



APPENDIX 2-1

**SCOPING AND TELECOMS
RESPONSES**

David Naughton

From: info@birdwatchireland.ie
Sent: Monday 17 August 2020 16:10
To: David Naughton
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Follow Up Flag: Follow up
Flag Status: Flagged

Hi David ,
We would like to acknowledge receipt of your email .This has been forwarded to our Policy officer .

Regards,
Michelle Kavanagh,
Membership Department.
BirdWatch Ireland
Unit 20 Block D | Bullford Business Campus | Kilcoole | Greystones | A63 RW83 | Co.Wicklow | Ireland
Tel: +353 (0)1 281 9878 email: mkavanagh@birdwatchireland.ie
Website: www.birdwatchireland.ie

'Please note that due to current Covid-19 restrictions most BirdWatch Ireland Staff will be working from their homes .Please be assured that your email will be answered as soon as possible.'

BirdWatch Ireland - protecting wild birds and their habitats

BirdWatch Ireland - protecting birds and biodiversity

Cairde Éanlaith Éireann - ag caomhnú éin agus bithéagsúlacht

To join as a member, make a donation, volunteer or shop online visit www.birdwatchireland.ie or call us on +353 (0)1 281 9878

From: David Naughton [mailto:dnaughton@mkoireland.ie]
Sent: Monday 17 August 2020 15:38
To: info@birdwatchireland.ie
Subject: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Dear Sir or Madam,

Please find attached a cover letter and Scoping Document for a proposed wind farm development in Cuilleenoolagh and adjacent townlands in Co. Roscommon.

As part of the scoping exercise for the proposed development, we would welcome any comments in relation to the proposed project.

If you have any queries, please do not hesitate to contact me.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie



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David Naughton

From: Roger Woods <rwoods@bai.ie>
Sent: Monday 15 June 2020 09:11
To: David Naughton
Cc: Órla Murphy
Subject: RE: 190907 - Proposed Seven Hills Development

Hi David

The BAI does not perform an in-depth analysis of the effect of wind turbines on FM networks. However, we are not aware of any issues from existing windfarms into existing FM networks. Also, the proposed windfarms are not located close to any existing or planned FM transmission sites.

Regards

Roger

Senior Executive Engineer
Broadcasting Authority of Ireland
2-5 Warrington Place
Dublin D02 XP29

Tel: 01 6441200
Fax: 01 6441299

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Tá an ríomhphost seo agus aon iatán a ghabhann leis rúnda agus is leis an duine sin amháin a bhfuil siad seolta chuige/chuici a bhaineann siad. Muna duitse an ríomhphost seo, ní ceart é a léamh ná a scaoileadh chuig aon tríú páirtí. Iarrtar ort teachtaireacht a sheoladh chuig an seoltóir nó chuig info@bai.ie, agus an ríomhphost seo a scrios.

From: David Naughton <dnaughton@mkoireland.ie>
Sent: Friday 12 June 2020 08:50
To: Roger Woods <rwoods@bai.ie>
Cc: Órla Murphy <omurphy@mkoireland.ie>
Subject: 190907 - Proposed Seven Hills Development

Hi Roger,

We are currently preparing an Environmental Impact Assessment Report Statement (EIAR) for a proposed Wind Farm Development in Cuilleenoolagh and adjacent townlands in Co. Roscommon. The site is located both northeast and southeast of the village of Dysart. As part of the EIA process, a Scoping Document is being prepared to provide further detail of the proposed project. It is envisaged that the proposed development will classify as Strategic Infrastructure Development (SID) as the project is anticipated to have a total generating capacity greater than 50MW.

We intend to send the scoping document on to relevant consultees, including the Broadcasting Authority of Ireland. If you could let me know whether BAI would rather receive the Scoping document via post or as a PDF in an email attachment, it would be much appreciated.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

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06/04/2021

MKO,
Tuam Road,
Galway,
H91 VW84

Re: E.I.A.R. Scoping Request for the proposed for development for Seven Hills Wind Farm at Cuilleenoolagh Co. Roscommon.

Dear Sir/Madam,

The following are the comments from this Division in relation to the proposed development:

If the proposed development will involve the felling or removal of any trees, the developer must obtain a Felling License from this Department before trees are felled or removed. A Felling Licence application form can be obtained from **Felling Section, Department of Agriculture, Food and the Marine, Johnstown Castle Estate, Co. Wexford**. Tel: 076-1064459, Web <https://www.agriculture.gov.ie/forests-service/tree-felling/tree-felling/>

A Felling Licence granted by the Minister for Agriculture, Food and the Marine provides authority under the Forestry Act 2014 to fell or otherwise remove a tree or trees and/or to thin a forest for silvicultural reasons. The Act prescribes the functions of the Minister and details the requirements, rights and obligations in relation to felling licences. The principal set of regulations giving further effect to the Forestry Act 2014 are the Forestry Regulations 2017 (S.I. No. 191 of 2017).

The developer should take note of the contents of **Felling and Reforestation Policy** document which provide a consolidated source of information on the legal and regulatory framework relating to tree felling; <https://www.agriculture.gov.ie/media/migration/forestry/tree-felling/FellingReforestationPolicy240517.pdf>. As this development is within forest lands, particular attention should be paid to deforestation, turbulence felling and the requirement to afforest alternative lands.

In order to ensure regulated forestry operations in Ireland accord with the principles of sustainable forest management (SFM), as well fulfilling the requirements of other relevant environmental protection laws, the Department (acting through its Forest Service division) must undertake particular consultations, and give certain matters full consideration during the assessment of individual Felling Licence applications. This includes consultation with

relevant bodies, the application of various protocols and procedures (e.g. Forest Service Appropriate Assessment Procedure), and the requirement for applicants on occasion to provide further information (e.g. a Natura Impact Statement).

Consequently, when the Forest Service is considering an application to fell trees, the following applies:

1. The interaction of these proposed works with the environment locally and more widely, in addition to potential direct and indirect impacts on designated sites and water, is assessed. Consultation with relevant environmental and planning authorities may be required where specific sensitivities arise (e.g. local authorities, National Parks & Wildlife Service, Inland Fisheries Ireland, and the National Monuments Service);
2. Where a tree Felling Licence application is received, the Department will publish a notice of the application before making a decision on the matter. The notice shall state that any person may make a submission to the Department within 30 days from the date of the notice. The notices for 2020 are published online at:
<https://www.agriculture.gov.ie/forests-service/publicconsultation/environmentalimpactassessment-eia-publicconsultation-for-afforestation-forest-road-construction-and-felling-licences-2020/>
3. Third parties that make a submission or observation will be informed of the decision to grant or refuse the licence, and on request, details of the conditions attached to the licence, the main reasons and considerations on which the decision to grant or refuse the licence was based, and where conditions are attached to any licence, the reasons for the conditions. Both third parties and applicants will be also informed of their right to appeal any decision within 28 days to the Forestry Appeals Committee. Felling Licence decisions for 2020 are published online at:
<https://www.agriculture.gov.ie/forests-service/publicconsultation/environmentalimpactassessment-2020-register-of-decisions/>

It is important to note that when applying to a **Local Authority**, or **An Bord Pleanála**, for planning permission where developments are:

- a) subject to an EIA procedure (including screening in the case of a sub-threshold development) and any resulting requirement to produce an EIAR; and/or
- b) subject to an Appropriate Assessment procedure (including screening) and any resulting requirement to a Natura Impact Statement (NIS); and

- c) the proposed development in its construction or operational phases, or any works ancillary thereto, would directly or indirectly involve the felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species,
1. that there is a requirement inter alia under the EIA Directive for an overall assessment of the effects of the project or the alteration thereof on the environment to be undertaken, including the direct and indirect environmental impact of the project;
- and
2. pursuant to Article 2(3) of the EIA Directive, the Department of Agriculture, Food and the Marine strongly recommends that, notwithstanding the fact that a parallel consent in the form of felling licence may also have to be applied for, any EIAR and/or NIS produced in connection with the application for planning permission to the Local Planning Authority or An Bord Pleanàla, should include an assessment of the impact of and measures, as appropriate, to prevent, mitigate or compensate for any significant adverse effects direct or indirect identified on the environment arising from such felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species.

Yours sincerely,

Tara Hendley

Tara Hendley

Felling Section

Department of Agriculture, Food and the Marine

Johnstown Castle

Co Wexford

David Naughton

From: David Naughton
Sent: Thursday 1 April 2021 17:27
To: PropertyManagementPlanning
Cc: Gareth OFlaherty; Don Watchorn
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Hi All,

I am just following up to see if the Department of Defence have any comments or recommendation to make on the scoping document sent last August.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

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From: PropertyManagementPlanning <PropertyManagementPlanning@defence.ie>
Sent: Tuesday 18 August 2020 15:47
To: David Naughton <dnaughton@mkoireland.ie>
Cc: Gareth OFlaherty <Gareth.OFlaherty@defence.ie>; Don Watchorn <Don.Watchorn@defence.ie>
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Hello David

I have forwarded to the appropriate authorities and will revert to you upon reply.

*Kind Regards,
Raymond*

Raymond Myles

Property Management Branch

An Roinn Cosanta

Department of Defence

Bóthar an Staisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 492036

raymond.myles@defence.ie

From: David Naughton <dnaughton@mkoireland.ie>

Sent: 17 August 2020 15:35

To: PropertyManagementPlanning <PropertyManagementPlanning@defence.ie>

Subject: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Dear Sir or Madam,

Please find attached a cover letter and Scoping Document for a proposed wind farm development in Cuilleenoolagh and adjacent townlands in Co. Roscommon.

As part of the scoping exercise for the proposed development, we would welcome any comments in relation to the proposed project.

If you have any queries, please do not hesitate to contact me.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

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chuig aon tríú páirtí gan cead roimh ré ón Roinn Cosanta.

Chun amharc ar an Chairt do Chustaiméirí, cliceáil ar

www.defence.ie/system/files/media/file-uploads/2018-06/customer-charter-2017-irish.pdf

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To view our Customer Charter, please click on

www.defence.ie/system/files/media/file-uploads/2018-06/customer-charter-2017.pdf



Your Ref: Seven Hills Wind Farm
Our Ref: **G Pre00159/2020**
(Please quote in all related correspondence)

23 September 2020

David Naughton
MKO
Tuam Road
Galway
H91 VW84
Via email

Re: Preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Seven Hills Wind Farm Development at in Cuilleenoolagh and adjacent townlands in Co. Roscommon. The site is located both northeast and southeast of the village of Dysart, approximately 1.5 kilometres away at its closest point and approximately 11 kilometres northwest/west of the town of Athlone, Co. Roscommon.

A chara

I refer to correspondence to the Department of Culture, Heritage and the Gaeltacht on (DATE) received in connection with the above.

Outlined below are heritage-related observations/recommendations of the Department under the stated heading(s).

Nature Conservation

The Department refers to your email dated 17th August 2020 and your request for observations on the preparation of the EIAR for the proposed Seven Hills Wind Farm, near Dysart, Co. Roscommon, on behalf of Gaeltech Energy Developments Ltd. And Energia Renewables Ltd.

This submission is made in the context of this Department's role in relation to nature conservation. The observations have been divided into:

1. Matters relating to the EIAR.
2. Matters relating to Appropriate Assessment.
3. Comments relating to the sites in question.

They are intended to assist you in relation to identifying potential impacts on European sites, other nature conservation sites, and biodiversity and environmental protection in general, in the context of the current proposal. Data collected and surveys carried out in connection with this proposed development may raise other issues that have not been considered here. The



observations are not exhaustive and are made without prejudice to any recommendation that may be made by this Department in the future. The Department notes that McCarthy Keville O'Sullivan Ltd. (MKO) have stated that the finalised layouts may be subject to amendment therefore the Department's comments should be viewed in the context of the information provided in the EIAR scoping report and the two map layouts supplied, Layout A and B. The Department reserves the right to comment further should there be significant amendments to the proposed layout.

The National Parks and Wildlife Service website has recently been updated and should be consulted with regard to the impact of planning and development on nature conservation. The following link gives extensive details on the standards and content NPWS expect from applications: <https://www.npws.ie/development%20consultations>.

1. Matters relating to the Environmental Impact Assessment Report (EIAR):

Ecological survey

With regard to scoping for an EIAR for a proposed development, in order to assess impacts on biodiversity, fauna, flora and habitats an ecological survey should be carried out of the proposed development site including the route of any access roads, pipelines or cables, connections to the grid etc. to survey the habitats and species present. Any improvement or reinforcement works required for access and transport anywhere along any proposed haul route(s) should be included in the EIAR and subjected to ecological impact assessment with the inclusion of mitigation measures, as appropriate. Where bridges require strengthening this may involve grouting of crevices which may function as bat roosts. Where ex-situ impacts are possible, survey work may be required, outside of the development sites. Such surveys should be carried out by suitably qualified persons at an appropriate time of the year, depending on the species being surveyed for. The EIAR should include the results of the surveys and detail the survey methodology and timing of such surveys including consistency in terms of timed vantage point surveys. It is expected by this Department that best practice will be adhered to with regard to survey methodology and if necessary non Irish methodology adapted for the Irish situation, noting specific gaps in relation to species and age of the data outlined in some guidance documents. The EIAR should cover the whole project, including construction, operation and, if applicable, restoration or decommissioning phases. Alternatives examined should also be included in the EIAR. Inland Fisheries Ireland should be consulted with regard to fish species, if applicable. For information on Geological and Geomorphological sites, the Geological Survey of Ireland, should be consulted.

Specific reference should be made to the National Biodiversity Action Plan. Any losses of biodiversity habitat associated with this proposed development (including access roads and cabling etc.) such as woodland, scrub, hedgerows and other habitats should be mitigated for. In addition, Annex 1 habitats which occur outside the Natura 2000 network are also important in terms of biodiversity conservation. The presence of any Annex I habitats outside the network should be given due consideration as part of the consideration of biodiversity



matters generally for the proposed development. The loss of Annex 1 habitats outside SACs should be avoided wherever possible.

In order to assess impacts it may be necessary to obtain hydrological and/or geological data. Any impact on water table levels or groundwater flows may impact on wetland sites some distance away. The EIAR should assess cumulative impacts with other plans or projects, if applicable. Where negative impacts are identified suitable mitigation measures should be detailed as appropriate.

Hedgerows and related habitats

Hedgerows and uncultivated vegetation should be maintained where possible, as they form wildlife corridors and provide areas for birds to nest in; hedgerow trees provide a habitat for woodland flora, roosting places for bats and Badger setts may also be present. The EIAR should provide an estimate of the length/area of any hedgerow/uncultivated vegetation that will be removed. Where it is proposed that trees or hedgerows and uncultivated vegetation will be removed there should be suitable planting of native species in mitigation incorporated into the EIAR. Where possible, hedgerows, uncultivated vegetation and trees should not be removed during the nesting season (i.e. March 1st to August 31st), noting the protection afforded under the Wildlife Act 1976-2018.

Watercourses and wetlands

Wetlands are important areas for biodiversity and ground and surface water quality should be protected during construction and operation of the proposed development. The EIAR should include a detailed assessment of the hydrological impacts on wetlands from the proposed development. Any watercourse or wetland which may be impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. For example, these species could include otters (*Lutra lutra*) which are protected under the Wildlife Acts and listed on Annexes II and IV of the Habitats Directive, salmon (*Salmo salar*) and Lamprey (three species in Ireland) listed on Annex II of the Habitats Directive, Freshwater Pearl Mussels (*Margaritifera* species) and White-clawed Crayfish (*Austropotamobius pallipes*) which are both protected under the Wildlife Act and listed on Annex II of the Habitats Directive, Frogs (*Rana temporaria*) and Newts (*Triturus vulgaris*) protected under the Wildlife Acts and Kingfishers (*Alcedo atthis*) protected under the Wildlife Acts and listed on Annex I of the Birds Directive (Council Directive 79/409 EEC).

One of the main threats identified in the threat response plan for otter is habitat destruction (see https://www.npws.ie/sites/default/files/publications/pdf/2009_Otter_TRP.pdf). A 10m riparian buffer on both banks of a waterway is considered to comprise part of the otter habitat. Therefore any proposed development should be located at least 10m away from a waterway and should consider movements between waterways and waterbodies by otters.

Flood plains



Flood plains, if present, should be identified in the EIAR and left undeveloped to allow for the protection of these valuable habitats and provide areas for flood water retention (green infrastructure). If applicable the EIAR should take account of the guidelines for Planning Authorities entitled "*The Planning System and Flood Risk Management*" published by the Department of the Environment, Heritage and Local Government In November 2009.

Bats

Bat roosts may be present in trees, buildings and bridges. All bat species are strictly protected under EC (Birds and Natural Habitats) Regulations, 2011 and listed on Annex IV of Habitats Directive. Bat roosts can only be disturbed and/or destroyed under licence issued under the Wildlife Act and a derogation under the EC (Birds and Natural Habitats) Regulations, 2011. An assessment of the impact of the proposed wind farm on bat species should be carried out noting recent guidance available, "*Bat and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019*" published jointly by Scottish Natural Heritage and Bat Conservation Trust and other stakeholders. The Department would like to highlight new survey research on patterns of bat activity in upland wind farms¹ which indicates it is more appropriate to use 30 day survey periods with static automated detectors, in each season, and in different weather conditions to reduce sampling bias and to accurately determine when the curtailment mitigation is required during the operational phase. This survey should include use of detectors at different heights. Any proposed migratory bat friendly lighting should be proven to be effective and follow up to date guidance.

Alien invasive species

The EIAR should also address the issue of invasive alien plant and animal species such as Japanese Knotweed or Crayfish plague, and detail the methods required to ensure they are not accidentally introduced or spread during survey and or construction. Information on alien Invasive species In Ireland can be found at <http://invasives.biodiversityireland.ie/> and at <http://invasivespeciesireland.com/>.

Bird surveys

Survey methodologies should follow best practice and if necessary be modified to reflect the Irish situation. Two full years of bird surveys is normally considered to be necessary. When survey results are being presented in an EIAR it is important that best practice is followed and that the full survey methodologies used, are detailed, including dates and times. Furthermore, it is expected that bird survey data should be presented in context and records should be supported by basic environmental data such as hourly estimates of visibility, glare arc's, cloud cover and precipitation during vantage point and walk over survey periods. Results for species need to be referenced back to the overall populations and their dynamics as, in some cases even a small risk to a population of a species could be considered significant. It is important that bird migration routes (day and night) are assessed as well as the flight lines (day and night) of bird species travelling between roosting and feeding areas. Limitations in guidance documentation, used in the analysis and discussion of results from

¹ <https://cieem.net/resource/cieem-webinar-patterns-of-bat-activity-at-upland-windfarms-implications-for-sampling-and-mitigation/>



any bird surveys, should be acknowledged, e.g. species that are covered by the guidance, data gaps and application to the Irish environment.

Impact assessment

The impact of the proposed development on the flora/ fauna and habitats present should be assessed with particular regard to:

Natura 2000 sites, i.e.:

- Special Areas of Conservation (SAC) designated under the EC Habitats Directive (Council Directive 92/43/EEC).
- Special Protection Areas (SPA) designated under the EC Birds Directive (Directive 2009/147 EC).

Other designated sites, or sites proposed for designation such as:

- Natural Heritage Areas.
- Proposed Natural Heritage Areas.
- Nature Reserves.
- Refuges for Fauna or Flora designated under the Wildlife Acts 1976 to 2012.
- Species protected under the Wildlife Acts including protected flora.

'Protected species and natural habitats', as defined in the Environmental Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008 including:

- Birds Directive - Annex I species and other regularly occurring migratory species, and their habitats (wherever they occur).
- Habitats Directive - Annex I habitats, Annex II species and their habitats.
- Annex IV species and their breeding sites and resting places (wherever they occur).
- important bird areas such as those identified by Birdlife International, features of the landscape which are of major importance for wild flora and fauna, such as those with a "stepping stone" and ecological corridors function, as referenced in Article 10 of the Habitats Directive.
- Other habitats of ecological value in a national to local context (such as those identified as locally important biodiversity areas within Local Biodiversity Action Plans and County Development Plans).
- Red data book species.
- Biodiversity in general.

Complete project details including Construction Management Plans (CMPs) need to be provided in order to allow an adequate EIAR and appropriate assessment to be undertaken. Applicants need to be able to demonstrate that CMPs and other such plans are adequate, mitigation is effective and supported by scientific information and analysis and that they are feasible within the physical constraints of the site. The positions, locations and sizes of construction infrastructure and mitigation such as settlement ponds, disposal sites and construction compounds may significantly affect European and other designated sites, habitats and species in their own right and could have an effect for example on drainage,



water quality, habitat loss, and disturbance. If these are undetermined at time of the assessment all potential effects of the development on the site are not being considered.

Construction Management Plans

Construction Management Plans should contain sufficient detail to avoid any post construction doubt with regard to the implementation of mitigation measures, timings and roles and responsibilities for same. There can be no doubts or lacunae regarding what is required for mitigation, pre-commencement surveys and or licencing requirements.

Construction work should not be allowed to impact on water quality and measures should be detailed in the EIAR to prevent sediment and/or fuel runoff from getting into watercourses which could adversely impact on aquatic species. See EIAR; Flood Plains for details with regard to flooding risk.

Inland Fisheries Ireland (IFI) should be consulted with regard to impacts on fish species and the applicant may find it useful to consult their publication entitled "Planning for watercourses in the urban environment" which can be downloaded from their web site.

If applicants are not in a position to state the exact location and details of cable routes at the time of application, then they need to consider the range of options that may be used within their assessment. Should the exact height and rotor diameter of the turbines not be known at EIAR stage then the assessment of impacts must be applicable to a variety of turbine heights and rotor diameters which could be used. This should be made clear in the EIAR.

It is important to note that unless post decision consultation with NPWS is specifically stated as a condition of planning, NPWS has no post consent role. However, regional staff are available for liaison regarding any associated licencing requirements and or new information arising for specific species of concern.

Cumulative and ex situ impacts

A rule of thumb often used is to include all European sites within a distance of 15km. It should be noted however that this will not always be appropriate. In some instances where there are hydrological connections a whole river catchment or a groundwater aquifer may need to be included. Similarly where bird flight paths are involved the impact may be on an SPA more than 15 kilometres away.

Other relevant Local Authorities should be consulted to determine if there are any projects or plans which, in combination with this proposed development, could impact on any European sites.

Post construction monitoring

This Department recognises the importance of pre and post construction monitoring, such as recommended in Drewitt et al. (2006), and Bat Conservation Ireland (2012). The applicant



should not use any proposed post construction monitoring as mitigation to supplement inadequate information in the assessment. Please refer to Circular Letter PD 2/07 and NPWS 1/07 on this issue. This can be downloaded from the Department's website <https://www.npws.ie/development-consultations>.

The EIAR process should identify any pre and post construction monitoring which should be carried out. The post construction monitoring should include bird and bat strikes/fatalities including the impact on any such results of the removal of carcasses by scavengers. Monitoring results should be made available to the competent authority and copied to this Department. A plan of action needs to be agreed at planning stage with the Planning Authority if the results in future show a significant mortality of birds and/or bat species. It is important to note again that unless post decision consultation with NPWS is specifically stated as a condition of planning, NPWS has no post consent role. However, regional staff are available for liaison regarding any associated licencing requirements and or new information arising for specific species of concern.

Note: any significant change to mitigation may require amendment and where a licence has expired; there will be a need for new licence applications for protected species.

Licenses

Where there are impacts on protected species and their habitats, resting or breeding places, licenses may be required under the Wildlife Act 1976-2018 or derogations under the EC (Birds and Natural Habitats) Regulations 2011, as amended. In particular, bats and otters are **strictly** protected under Annex IV of the Habitats Directive. A copy of Circular Letter NPWS 2/07 entitled "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences*" can be found on the Departmental web site at www.npws.ie/sites/default/files/general/circular-npws-02-07.pdf.

It should be noted that the Regulations of 1997 have since been superseded by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. Part 6 of those Regulations is now the relevant section dealing with the protection of flora and fauna. Reference to Regulation 23 in the circular letter should be taken to mean Regulation 51 in the current Regulations.

In addition, the EIAR should take account of species protected under sections 21, 22 and 23 of the Wildlife Acts if there are any impacts on other protected species or their resting or breeding places, such as on protected plants, badger setts or birds' nests. And will also need to be cognisant of article 5 (d) of the Birds Directive. For that reason uncultivated vegetation, including hedges and trees, should not be removed during the nesting season (i.e. March 1st to August 31st).

In order to apply for any such licenses or derogations as mentioned above the results of a survey should be submitted to the National Parks and Wildlife Service of this Department. Such surveys are to be carried out by appropriately qualified person/s at an appropriate time



of the year. Details of survey methodology should be provided. Should this survey work take place well before construction commences, it is recommended that an additional ecological survey of the development site should take place immediately prior to construction to ensure no significant change in the findings of the baseline ecological survey has occurred. If there has been any significant change mitigation, this may require amendment and where a licence has expired, there will be a need for new licence applications for the protected species.

Baseline data

Along with the standard NPWS data requests which is recommended, other sources of habitat and species information beyond those already identified include (but are not be limited to): the National Biodiversity Data Centre (www.biodiversityireland.ie), Inland Fisheries Ireland (www.fisheriesireland.ie), BirdWatch Ireland (www.birdwatchireland.ie), Irish Raptor Study Group, Golden Eagle Trust and Bat Conservation Ireland (www.batconservationireland.org). Data may also exist at a County level within the Planning Authority. Some guidance and reference documents are provided in the Appendix to this letter.

2. Matters relating to the Appropriate Assessment (AA):

In order to carry out the Appropriate Assessment screening, and/or prepare a Natura Impact Statement (NIS), information about the relevant European sites including their conservation objectives will need to be collected. Screening for appropriate assessment should focus on the likely significant effects of the proposed development and related activities on European sites noting that impacts to sites via air and water may occur over large distances. Details of designated sites and species and conservation objectives can be found on <http://www.npws.ie/>. Site-specific, as opposed to generic, conservation objectives are now available for many sites. Each conservation objective for a qualifying interest (QI) habitat or species is defined by a list of attributes and targets and is often supported by further documentation. Where these are not available for a site, an examination of the attributes that are used to define site-specific conservation objectives for the same QIs in other sites can be usefully used to ensure the full ecological implications of a proposal for a site's conservation objective and its integrity are assessed. It is advised, as per the notes and guidelines in the site-specific conservation objectives that any reports quoting conservation objectives should give the version number and date, so that it can be ensured and established that the most up-to-date versions including map boundaries² are used in the preparation of Natura Impact Statements and in undertaking appropriate assessments. In addition, the Article 12 and 17 reports under the Birds and Habitats Directives should be referenced <https://www.npws.ie/publications>.

The Departmental guidance document on Appropriate Assessment is available on the NPWS website at <https://www.npws.ie/development-consultations> and in EU Commission guidance entitled:

² <https://www.npws.ie/maps-and-data/designated-site-data>



- “Wind energy developments and Natura 2000”³
- "Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC"⁴;
- 2018 Commission notice "Managing Natura 2000 sites The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC"⁵

More recent CJEU and Irish case law has clarified some issues and should also be consulted.

3. Further to the above general comments please find below specific observations relating to the site in question:

The Department notes that the proposed development is in close proximity to a number of Natura 2000 sites, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs). The Department is concerned that the proposed development may significantly affect the integrity of a number of European sites. These concerns relate to potential impacts upon bird species (e.g. Greenland white-front Geese), both within and outside of the SPAs as well as impacts on Annex I habitats outside the designated sites (e.g. calcareous grassland) that support Qualifying Interests (QI) for the sites (e.g. Turloughs), Specifically, the Department notes that Annex I semi-natural grassland habitats have been recorded within/adjacent to the two linked development sites. The Irish Semi Natural Grassland Survey, IWM 78⁶ dataset should be referenced and the habitat survey within the proposed development sites should include an assessment of Annex I habitats; noting the loss of Annex I habitats outside designated areas, as outlined already, should be avoided wherever possible.

The Department highlights that the topography of the two linked development sites and potential constraints regarding the selection of vantage points, for ornithological surveys. Notwithstanding the above, the vantage point surveys should be undertaken in a manner that ensures sufficient data is collected to allow an assessment of the importance of all the flight paths into, out of and between sites.

Consequently, the Department recommends that technological solutions (e.g. Radar, telemetry based tracking studies) are considered in conjunction with VPs surveys to ensure

³ https://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf

⁴

http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

⁵

https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_6_nov_2018_en.pdf

⁶ O’Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.



sufficient data is compiled for assessment. This is because an appropriate assessment must contain complete, precise and definitive findings and conclusions with regard to the implications of a proposal for the conservation objectives and integrity of a European site(s). Furthermore, surveys should be designed to also include an assessment of improved agricultural lands. These types of intensified landscape features have the potential to provide feeding habitat and attract wintering wildfowl species (e.g. whooper swan and GWF Goose).

The proposed development is located in a limestone / karst landscape with all of the complex hydrological features and characteristics. The Department recommends a detailed hydrological assessment is carried out in terms of the potential impacts arising from the proposed development on Natura 2000, NHAs and pNHAs within the zone of influence; noting that designated sites at some distance can be intrinsically linked and supported by the surrounding habitats (e.g. agricultural fields) and hydrological processes.

The Department advise that pre – consent ground investigations, data gathering infrastructure or testing that take place in a location that may affect an ecological feature (e.g. NHAs/ pNHA's and European sites SACs and SPAs), may require consent (i.e. are not exempted development) from the planning authority and or the Ministers consent from NPWS/ DHPLG.

Finally, the Department also highlights the following (non- exhaustive) specific sites and their Qualifying Interest (QI); Special Conservation Interest (SCI) that should be assessed in the Natura Impact Statement and considered in the EIAR:

Lough Croan Turlough SAC (000610) & SPA (004139):

- Turloughs [3180]
- Shoveler (*Anas clypeata*) [A056]
- Golden Plover (*Pluvialis apricaria*) [A140]
- Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]
- Wetland and Waterbirds [A999]

River Suck Callows NHA (000222) & SPA (004097):

- Whooper Swan (*Cygnus cygnus*) [A038]
- Wigeon (*Anas penelope*) [A050]
- Golden Plover (*Pluvialis apricaria*) [A140]
- Lapwing (*Vanellus vanellus*) [A142]
- Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]
- Wetland and Waterbirds [A999]
- Peatlands [4]



- Birds [12]

Killeglan Grassland SAC (002214):

- Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210]

Four Roads Turlough SAC (001637) & SPA (004140):

- Turloughs [3180]
- Golden Plover (*Pluvialis apricaria*) [A140]
- Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]
- Wetland and Waterbirds [A999]

Ballynamona Bog and Corkip Lough SAC (002339):

- Turloughs [3180]
- Active raised bogs [7110]
- Degraded raised bogs still capable of natural regeneration [7120]
- Depressions on peat substrates of the *Rhynchosporion* [7150]
- Bog woodland [91D0]

Lough Ree SAC (000440) & SPA (004064)

Feacle Turlough pNHA (001634).

Appendix – Additional Guidance and References

1. The Departmental Wind Energy Planning Guidelines
2. Windfarms on Peatland (2008-2010) Mires and Peat volume 4.
3. Best Practice guidance for Habitat Survey and Mapping by George F Smith, Paul O'Donoghue, Katie O'Hora and Eamon Delaney, 2011. The Heritage Council.
4. Pearce-Higgins, James W., Stephen, Leigh, Langston, Rowena H. W., Bainbridge, Ian P. and Bullman. Rhys (2009). "The distribution of breeding birds around upland wind farms". *Journal of Applied Ecology*, 46, p1323-1331.
5. Johnson, Gregory D. and Arnett Edward 8. "A Bibliography of Bat Fatality Activity and Interactions with Wind Turbines" (June 2004 updated February 2010) Bat Conservation International.
6. Pearce-Higgins, James W., Stephen, Leigh, Douse, Andy, and Langston, Rowena H. W. (2012). "Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multisite and multi-species analysis". *Journal of Applied Ecology*. 49. p386-394.



7. Rodrigues, Let ai, (2014). "Guidelines for consideration of bats in wind farm projects". Eurobats Publication Series NO.6 UNEP and Eurobats.
8. The Departmental guidance document on Appropriate Assessment which is available on the NPWS web site at <https://www.npws.ie/protected-sites/guidance-appropriate-assessment-planning-authorities>
9. The EU Commission guidance entitled "Assessment of plans and projects significantly affecting Natura 2000 sites, Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC" which can be downloaded from http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm
10. Bat Conservation Ireland (2012) Wind Turbine/Wind Farm Development Bat Survey Guidelines. Version 2.8, December 2012.
11. Drewitt, Allan Land Longston Rowena H. W. (2006) "Assessing the impacts of wind farms on birds". Ibis 148. p29-42.
12. <https://cieem.net/resource/cieem-webinar-patterns-of-bat-activity-at-upland-windfarms-implications-for-sampling-and-mitigation/>
13. May R, Nygård T, Falkdalen U, Åström J, Hamre Ø, Stokke BG. Paint it black: Efficacy of increased wind turbine rotor blade visibility to reduce avian fatalities. Ecol Evol. 2020;00:1–9. <https://doi.org/10.1002/ece3.6592>

NPWS Circular Letters (available from www.npws.ie)

14. Circular Letter NPWS 2/07: *Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – Strict Protection of Certain Species/Derogation Licences.*
(It should be noted however that the Regulations of 1997 have since been revoked and that Part 6 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015 is now the relevant part dealing with the protection of flora and fauna. In particular reference to Regulation 23 in the circular letter should be taken to mean Regulation 51 in the current Regulations.)
15. Circular Letter PD 2/07 and NPWS 1/07: *Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites*
16. Circular NPWS 1/10 & PSSP 2/10: *Appropriate Assessment under Article 6 of the Habitats Directive: guidance for Planning Authorities*

You are requested to send further communications to the Development Applications Unit (DAU) manager.dau@chg.gov.ie, or to the following address:

The Manager
Development Applications Unit (DAU)
Government Offices



Newtown Road
Wexford
Y35 AP90

Is mise, le meas

A handwritten signature in blue ink, which appears to read 'Connor Rooney'. The signature is fluid and cursive, with a long horizontal stroke at the end.

Connor Rooney
Development Applications Unit

David Naughton

From: planning applications <planning.applications@failteireland.ie>
Sent: Wednesday 7 April 2021 10:40
To: David Naughton
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm
Attachments: Fáilte Ireland EIAR Guidelines.pdf

Hello David,

Thank you for your follow up email for the proposed Seven Hills Wind Farm, Co Roscommon.

Please see attached a copy of Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA, which you may find informative for the preparation of the Environmental Impact Assessment for the proposed development. The purpose of this report is to provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports (EIAR), or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.

Regards,

Yvonne

Yvonne Jackson

Product Development-Environment & Planning Support | Fáilte Ireland
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Please consider the environment before printing this email

From: David Naughton <dnaughton@mkoireland.ie>
Sent: Thursday 1 April 2021 17:33
To: planning applications <planning.applications@failteireland.ie>
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

[ATTENTION] This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear Sir or Madam,

I am just following up on the below email from last August to see if Failte Ireland have any comments ore recommendations to make upon review of the Scoping Document for the proposed wind farm development.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

MKO
Tuam Road, Galway
Ireland, H91 VW84
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From: David Naughton
Sent: Monday 17 August 2020 16:00
To: planning.applications@failteireland.ie
Subject: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Dear Sir or Madam,

Please find attached a cover letter and Scoping Document for a proposed wind farm development in Cuilleenoolagh and adjacent townlands in Co. Roscommon.

As part of the scoping exercise for the proposed development, we would welcome any comments in relation to the proposed project.

If you have any queries, please do not hesitate to contact me.

Kind regards,



David Naughton B.Sc. (Env.)
Environmental Scientist

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Fáilte Ireland
National Tourism Development Authority

EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects



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1. Introduction

Tourism is a growing sector and substantial part of the Irish Economy. It contributes to both urban and rural economies in every part of the country. The impact and interaction of tourism with the environment is complex and the assessment of environmental impacts is of utmost importance to creating a sustainable tourism economy and protecting the natural resources that are so often a tourism attraction.

The purpose of this report is to provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports (EIAR), or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.

This guidance document has been prepared by Cunnane Stratton Reynolds on behalf of Fáilte Ireland to update their EIA guidelines in line with changes in legislative requirements.

2. Background to this Document

Tourism is one of the largest and most important sectors of the economy, providing employment for approximately **260,000 people**, an economic contribution of **€8.4 billion**, and exchequer revenue of **€1.78 billion** in 2018, which helps fund other key public services.

In 2018 Ireland welcomed **10.6 million overseas visitors**.

Fáilte Ireland is the National Tourism Development Authority. Fáilte Irelands role is to support the tourism industry and work to sustain Ireland as a high-quality and competitive tourism destination. They provide a range of practical business supports to help tourism businesses better manage and market their products and services.

Fáilte Ireland also work with other state agencies and representative bodies, at local and national levels, to implement and champion positive and practical strategies that will benefit Irish tourism and the Irish economy.

Fáilte Ireland promotes Ireland as a holiday destination through a domestic marketing campaign (DiscoverIreland.ie) and manage a network of nationwide tourist information centres that provide help and advice for visitors to Ireland.

Tourism related projects cover a broad range of plans, programmes and developments, from the Wild Atlantic Way to a single hotel conversion. These guidelines apply to projects involving or impacting upon tourism. A tourism plan, strategy or programme where it is part of the statutory plan making process under the Planning and Development Acts (as amended), may be more appropriately assessed by a Strategic Environmental Assessment (SEA) as discussed in the next section.

It should be borne in mind that EIA is required where there is anticipated to be a significant impact on the environment, where tourism projects are of a prescribed type or meet thresholds identified below.

Where Natura 2000 Designated Sites are potentially affected by tourism development Appropriate Assessment must be carried out by the appropriate authority in accordance with Article 6(3) of the EU Habitats Directive.

3. Legislation and Statutory Guidance

Environmental Impact Assessment is a procedure that ensures that the environmental implications of decisions are taken into account before planning based decisions are made. The assessment results in a report, called an Environmental Impact Assessment Report (EIAR).

Legislation

These guidelines are produced under current EIAR legislative requirements, having regard to Directive 2011/92/EU (known as 'Environmental Impact Assessment' – EIA Directive), as amended by Directive EU 2014/52 which came into effect in May of 2017. These requirements were transposed into Irish Law on 1 September 2018 as most of the provisions of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) came into effect. The principle of both Directives is to ensure that plans, programmes and projects likely to have significant effects on the environment are made subject to an environmental assessment, prior to their approval or authorisation.

Statutory Guidance

In response to the changes to the EIAR requirements under Directive EU 2014/52, the Environmental Protection Agency (EPA) developed Draft guidelines on the information to be contained in Environmental Impact Assessment Reports in August 2017. At the time of this document the guidelines have not been adopted from draft.

In addition to the EPA statutory guidance, the Department of Housing has produced Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment in August 2018.

The process of EIA is set out in the EPA EIAR Guidelines, which this document should be read in conjunction with and used as supplementary guidance to. The process for ascertaining whether an EIAR is required is known as 'screening' and the process to determine the breadth and scope of an EIAR is known as 'scoping'. Guidance on this can be found in Section 3.2 of the EPA Guidelines.

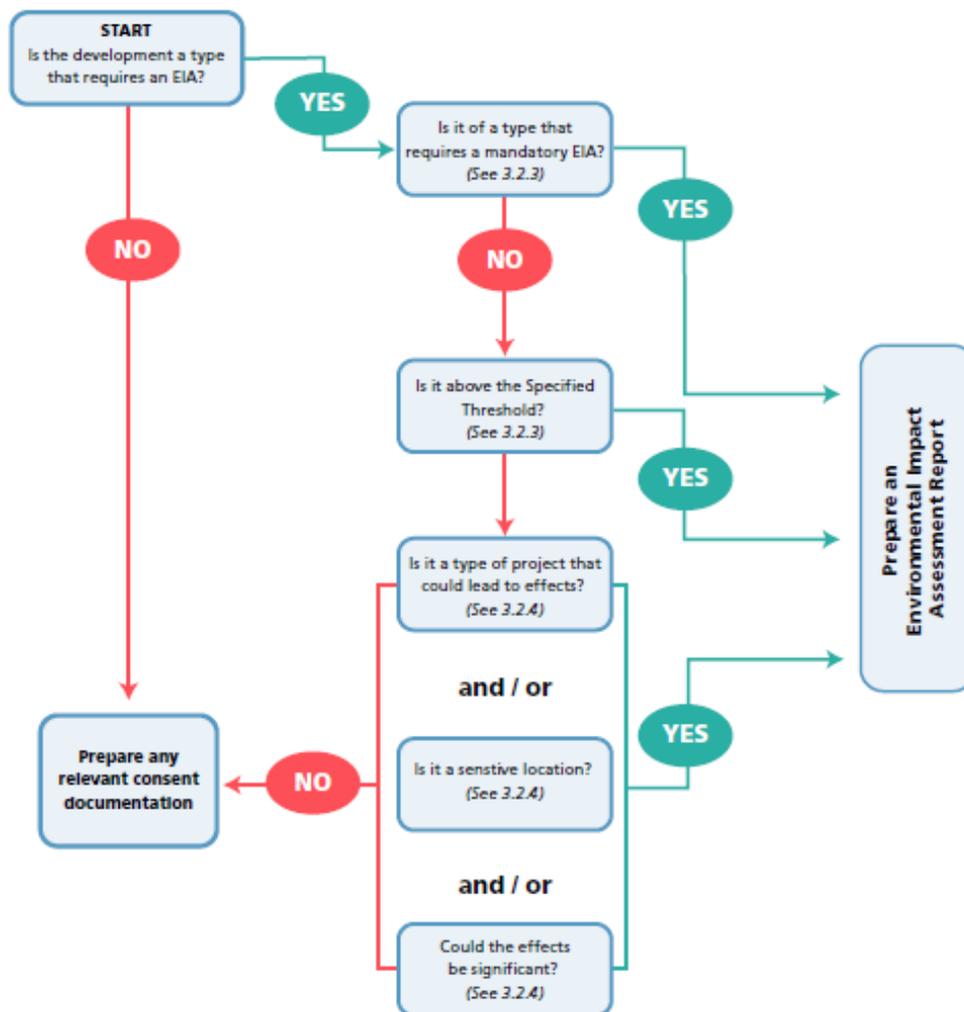
Screening

Through EIAR Screening, developments are either considered as requiring an EIAR due to the project type or because they exceed a threshold level. The screening process begins by establishing whether the proposal is a 'project' as understood by the Directive (as amended).

The prescribed development types and thresholds are set out in Annex I and II of the EIA Directive as transposed into Schedule 5 of the Planning and Development Regulations 2010-2018 (as amended). Development which do not exceed these thresholds but may require an EIAR are called sub threshold. Sub-Threshold considerations are outlined in Schedule 7 of European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) as transposed from Annex III of the Directive. The Guidelines on Environmental Impact Assessment Reports note that projects at first glance may not appear to come under the Schedule

but on closer examination when the process is further examined, they may do so because of the sensitivity or significance of the receiving environment etc. Sub threshold developments require an EIAR if they are likely to have significant environmental impacts and must undergo assessment for likely significant impacts through an EIAR screening report. The contents of a screening report for subthreshold development are contained in Annex III of the EIA Directive.

Figure 1: EIAR Screening Process



(Taken from Fig 3.2 of the EPA Guidelines)

Tourism locations should be identified as sensitive receptors in screening assessments for particular impacts, depending on scale and sensitivity, as they would in a full EIAR. Section 6 below can act as guidance for Screening Reports as well as for full EIAR.

The screening process for considering where an EIAR is necessary, is summarised below in Figure 1 (excerpted from Figure 3.2 of the EPA Guidelines).

Strategic Environmental Assessment (SEA) is a more strategic level of environmental assessment that examines plans, policies, objectives and programmes specifically rather than projects. For some tourism developments it may be more appropriate that they be examined through SEA, while individual projects or specific proposals are likely to be more assessed through EIAR. If a project is part of a plan, programme or policy/objective assessed by SEA there will still be a requirement for an EIAR for that development.

EIAR Scoping

Scoping an EIAR is an opportunity to look at the breadth of issues and ensure that any areas of possible significant impact are assessed. Identifying sensitivities and stakeholders should take account of tourism facilities and consider Fáilte Ireland in scoping requests where necessary.

4. Assessing Tourism

There is no legal definition of 'tourism' in Irish legislation. The UNWTO definition of sustainable tourism is "*Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities*". This is widely accepted as a key definition of tourism as we move to a more sustainable future.

Tourism assessments are frequently carried out by economic consultants and by specific tourism consultants. It is always advisable, particular for tourism projects, that suitably qualified and experienced personnel are used to determine the impact of tourism related projects or to assess the impact of more general proposals on a tourism asset identified in a particular location. There is a requirement for EIAR under current legislation to contain a statement of competency within all EIAR documents, including screening and scoping reports.

Projects which involve a tourism element

Tourism projects are wide ranging and diverse. While there are some projects which cater to tourism and are easily identified as such - Hotels, Museums, etc. there are other projects where tourism is a key service or element, but which may not be immediately obvious - forest trails, community facilities and others. EIAR conducted for developments containing tourist elements should be completed in accordance with the current guidance from the EPA.

Projects which include a tourism element have potential particular environmental effects which differ from a non-tourism development. These impacts can be intermittent, event related, inconsistent, dependent on weather, temporal, temporary or seasonal. This is considered within the prescribed environmental topics for EIAR outlined in Section 7 below.

Projects which may have an impact upon tourism

While tourism projects may be diverse, the projects which can impact tourism are considerably more wide ranging, from large infrastructural developments to local energy developments. Disruption to or suppression of a tourist resource or amenity can have very local or more strategic impacts, directly or indirectly- for example energy projects in a rural area can have both a negative and positive impact in different regards. There can be temporary, periodic or even seasonal impacts occurring during construction or operational periods.

According to the Fáilte Ireland Tourism Facts 2018 Report, the most important factors in determining the attractiveness of tourism destinations for visitors to Ireland are;

- Beautiful Scenery and Unspoiled Environment
- Hospitality
- Safety
- Nature, Wildlife and Natural Attractions
- History and Culture
- Pace of Life

These factors used for the promotion of tourism in Ireland are also barometers of sensitivity to change in tourism sensitive or dominant locations where development may have an impact upon the tourism asset. The potential for development to impact these sensitivities, and the environmental criteria under which they can be considered, are identified in section 7 of the guidelines.

5. Guiding Principles of EIAR

As outlined in the EPA Draft EIAR Guidelines, the fundamental principles to be followed when preparing an EIAR, including screening and scoping, are:

- Anticipating, avoiding and reducing significant effects
- Assessing and mitigating effects
- Maintaining objectivity
- Ensuring clarity and quality
- Providing relevant information to decision makers
- Facilitating better consultation.

Environmental assessment should be undertaken in accordance with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

6. Consideration of Competency and Qualifications

As per Section 2.5 of the EPA Guidelines, EIAR is required to be completed by 'competent experts'.

Contributors to the preparation of environmental impact assessment reports, including screening and scoping assessments, should be qualified and competent. Sufficient expertise, in the relevant field of the project concerned, is required for the purpose of its examination by the competent authorities in order to ensure that the information provided by the developer is complete and of a high level of quality so that a full and proper assessment can be undertaken.

For tourism related projects, or projects likely to affect tourism assets, competent experts in the area of tourism should be utilised in the environmental assessment.

The competency of all involved in the production of an EIAR or any related report (eg. Screening and scoping) is required to be stated at the beginning of the EIAR report with further details as necessary in each following chapter.

Where tourism projects involve for example heritage or cultural components, input from heritage consultants, conservation architects, or historians may be required.

7. EIAR Requirements

The following are the key requirements for an EIAR under the current guidance. This is not a definitive list and should be read in conjunction with regulations.

- project description;
- assessment of alternatives considered;

- baseline assessment;
- impact assessment;
- cumulative impact
- interaction of impacts
- mitigation.

Project Description

Project descriptions are required to describe the whole project including site, scale, design and key factors. It is important that the EIAR and design team have a consistent understanding of the development description in full. The key requirements are outlined in section 3.5 of the EPA Guidelines however they identify the following;

- the location of the project
- the physical characteristics of the whole project
- the main characteristics of the operational phase of the project
- an estimate, by type and quantity, of the expected residues and emissions

The location of the project should include identifying key sensitive receptors (including tourism receptors). In the operational phase of the project any tourism based, or potentially tourism related activity, should be identified.

Assessment of Alternatives

The assessment of alternatives is a requirement of EIAR

Where tourism projects are location dependent the assessment of alternatives should consider alternative methods and technologies, detail the key considerations culminating in the selection of the design, the reasoning for these and the environmental effect of these decisions. This is particularly important for tourism projects which are often location tied. The developer is expected to consider reasonable alternatives. What is considered reasonable may vary from case to case.

Baseline Assessment

Baseline descriptions are evidence based, current descriptions of environmental characteristics with consideration of likely changes to the baseline environment evidenced in planning histories, unimplemented permissions, and applications pending determination. Baseline assessments should identify any tourism sensitivities in the zone of influence of a development. This zone of influence of a development is highly dependant on its **Context, Character, Significance, and Sensitivity**, as outlined in the Draft Guidelines. These characteristics apply to both the development and the environment.

For example, in a tourism context;

The location of sensitive tourism resources that are likely to be directly affected should be highlighted, and other premises which although located elsewhere, may be the subject of in combination impacts such as alteration of traffic flows or increased urban development.

The character of an area from a tourism perspective should be described and the principal types of tourism in the area. Where relevant, the specific environmental resources or attributes in the existing environment which each group uses or values should be stated and where relevant, indicate the time, duration or seasonality of any of those activities.

The significance of the tourism assets or activities likely to be affected should be highlighted. Reference to any existing formal or published designation or

recognition of such significance should be. Where possible the value of the contribution of such tourism assets and activities to the local economy should be provided.

If there are any significant concerns or opposition to the development known to exist among tourism stakeholders and interest groups, this should be highlighted. Identify, where possible, the particular aspect of the development which is of concern, together with the part of the existing tourism resource which may be threatened or impacted.

In addition, the baseline should include any methodologies employed in the study to obtain information, if particular databases are used to locate sensitive receptors they should be acknowledged. In relation to tourism information, the suggested information sources at the end of this document are a non-exhaustive list which may be of assistance in identifying tourism receptors.

Impact Assessment

The topics for consideration of impact are prescribed in the EIA Directive and transcribed into Irish law by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018). Impact assessment should contain the likely significant effects of a development arising from both construction and operation of a development. Advice on describing the effects is contained within the Draft Guidelines and includes the **quality, significance, extent, probability, type** and **duration** of the effect, with particular descriptors for each. In describing effects upon tourism receptors these descriptors should take account of the particular aspects and sensitivities of tourism, for example a temporary annual effect from a development may have different impacts upon tourism if it falls at peak season rather than off-peak.

Impact assessment should be carried out as per EPA guidelines and the best practice for that prescribed topic. It may be considered appropriate to consider impact on tourism assets under the 'material assets' topic below.

Population and Human Health

The consideration of tourism projects within the Population and Human Health is extensive, with impacts ranging from rural employment population impacts of seasonal tourism, to the health impact of air pollution from increased traffic in urban areas.

The impact upon tourism can be considered within this section through the sensitivities of Hospitality, Safety and Pace of Life. Changes in population can impact the perception of pace of life or safety in a particular location. Impacts upon these issues in areas which rely heavily on tourism or have a particular sensitive tourism generator should be considered in this section.

Biodiversity

Particular tourist activities can have a significant impact upon biodiversity. Landscapes which are 'unspoiled' can be attractors of tourism. However, the disturbance to ecology must be managed to minimise impact. Biodiversity is also a tourism asset and should be protected as such from other development and should be provided for in proposals where possible.

Land, Soils and Geology

A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however particular activities or facilities which use geological features may have an impact upon soils and geology, such as mountain biking trails, recreational uses of old quarries etc. Indirect impacts such as material use for extensive landscaping and public realm should also be considered.

Water

Tourism uses can be water intense, depending on development type. Recreational use of a surface water feature, water-based leisure centres etc have different impacts to standard development.

Air Quality and Climate

Tourism impact upon air quality is dependent on activity proposed and sensitivity of the location.

Noise and Vibration

A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction adjoining hotels for example should consider the sensitivity of the development and ensure mitigation is in place.

Material Assets; Traffic and Transport

The different transport patterns associated with tourism activities is a key impact of tourism and should be considered especially for tourism projects. These produce temporal and seasonal changes on the norm and specialist consideration and interpretation should be given. Tourism proposals should, where possible, be well served by public transport and should be accessible by modes other than the car. The impact of traffic on tourism assets can be substantial and can vary in severity according to season, the weather, etc. The impact of construction traffic can be a particular concern in tourism sensitive areas in terms of noise pollution and visual impact. The construction programme of developments should work to avoid peak tourism periods in tourism areas and should consider planned or anticipated tourism events and festivals.

Cultural Heritage

Cultural heritage can be a key component of tourism projects and the impact of tourism on the maintenance of cultural heritage should be given the utmost consideration, whether positive or negative. As a tourism attraction, cultural heritage should be strongly considered in non-tourism developments and the impact upon tourism considered as a potential impact.

Archaeology

Archaeology can be of tourism interest and can be an attractive or key component of tourism projects. Archaeology can be a tourism attractor but is generally not kept in situ except in key cases which could also be considered under cultural heritage.

Material Assets; Waste Management

Tourism is a resource heavy activity and can impact waste streams and waste segregation. Impacts here should be considered strongly and with knowledge of the variation that arises from the particular tourist activity. Waste and Waste disposal issues can also impact the perception of an unspoiled environment, effecting tourism, which should be considered.

Material Assets

Material assets are utilities and infrastructure. Tourism itself could be considered a material asset as its impact upon the economy and the infrastructure in place to support it is a material consideration in assessing economic impact.

Landscape

The visual impact of a tourism development, especially in locations which are visually sensitive or renowned for their scenic or landscape beauty, should be considered carefully. A

development intended to utilise or enjoy a particular vista or environment should minimise impact upon that environment.

Major Accident and Natural Disaster

There is a requirement for tourist developments to describe expected significant effects on the environment of the proposed development's vulnerability to major accidents and/or natural disasters relevant to it. Where appropriate measures should be identified to prevent or mitigate the significant adverse effects of such accidents or disasters, including resulting from climate change, on the environment and detail the preparedness for the proposed response.

Interaction of Effects

Where two or more environmental impacts combine or interact they should be considered under the prescribed topics. It is best practice to provide a table of interactions within an EIAR or EIAR Screening Report.

Mitigation

Mitigation should follow the hierarchy of minimisation in descending order of preference- Avoid, Reduce, Remedy

Avoid sensitive tourism resources- such as views, access and amenity areas including habitats as well as historical or cultural sites and structures.

Reduce the exposure of sensitive resources to excessive environmental impact

Reduce the adverse effects to tourism land uses and patterns of activities, especially through interactions arising from significant changes in the intensity of use or contrasts of character or appearance.

Remedy any unavoidable significant residual adverse effects on tourism resources or activities.

Mitigation measures must be measurable and achievable within the bounds of the project.

Cumulative Impact

The cumulative impact is that of the project combined with any known likely project which will interact or compound an environmental impact.

Transboundary Impact

Transboundary impacts should be included in EIAR. In the case of tourism, especially international travel, the transboundary impacts may not be proximate to the EIAR site.

8. Sources of information on Tourism

Information available online

Fáilte Ireland

Fáilte Ireland offers detailed research analysis and insights into the Irish Tourism Industry. The National Tourism Development Authority has a portfolio of research across a number of areas including facts and figures, briefing papers and reports and visitor feedback. The Fáilte Ireland website has a dedicated research library which can be accessed [here](#)

Tourism Ireland

Tourism Ireland is responsible for marketing the island of Ireland overseas as a holiday and business tourism destination. Tourism Ireland publishes a range of research documents including; visitor facts and figures, seasonal updates and industry insights which are accessible [here](#)

Local Authorities

Local Authorities are an invaluable source of information. They produce tourism strategies and audits of tourism assets within their jurisdiction. Local authorities will also produce landscape and seascape studies. Protected views and prospects as well as the record of protected structures and other designated protected buildings are contained within the Statutory Development Plans.

Regional Authorities

Regional Authorities can also be consulted on high level strategic tourism and potential Regional Spatial and Economic Strategies (RSEs) should be consulted.

Central Statistics Office

The Central Statistics Office (CSO) is Ireland's national statistical office and their purpose is to impartially collect, analyse and make available statistics about Ireland's people, society and economy. The Tourism and Travel Section of the Central Statistics Office is the major source for tourism statistics in Ireland and is updated regularly.



David Naughton
MKO - Planning & Environmental Consultants
Tuam Rd
Galway
H91 VW84

08 September 2020

Re: EIA Scoping Document for the Proposed Seven Hills Wind Farm Development, in Cuilleenoolagh and adjacent townlands in Co. Roscommon

Your Ref: 190907

Our Ref: 20/197

Geological Survey Ireland is the national earth science agency and has datasets on Bedrock Geology, Quaternary Geology, Geological Heritage Sites, Mineral deposits, Groundwater Resources and the Irish Seabed. These comprise maps, reports and extensive databases that include mineral occurrences, bedrock/mineral exploration groundwater/site investigation boreholes, karst features, wells and springs. Please see our [website](#) for data availability and we recommend using these various data sets, when undergoing the EIAR, planning and scoping processes. Geological Survey Ireland should be referenced to as such and should any data or geological maps be used, they should be attributed correctly to Geological Survey Ireland.

Dear David,

With reference to your letter dated 17 August 2020, concerning the EIA Scoping Document for the Proposed Seven Hills Wind Farm Development, in Cuilleenoolagh and adjacent townlands in Co. Roscommon, Geological Survey Ireland (a division of Department of Communications, Climate Action and Environment) would like to make the following comments.

Geoheritage

Geological Survey Ireland is in partnership with the National Parks and Wildlife Service (NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs) to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Geoheritage Programme of Geological Survey Ireland, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGS), as adopted under the National Heritage Plan are now included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online [Map Viewer](#). The audit for Co. Roscommon was carried out in 2012. The full report details can be found at [The Geological Heritage of County Roscommon](#). **Our records show that there are CGSs in the area of the proposed wind farm development.**

Killeglan Karst Landscape, Co. Roscommon. (GR 187960, 242893), under IGH themes: IGH1 Karst, IGH7 Quaternary. Site Code: RO015. This site comprises an extensive area of bouldery terrain in southern Roscommon covering an area of 5 by 2 kilometers, and includes a number of low amplitude, hummocky ridges. This is the only such area of lowland, boulder-strewn, limestone glacial karst in the country. It is of national importance. Site Code: [RO015](#).



Castlesampson Esker, Co. Roscommon (GR 192104, 241567), under IGH theme: IGH7 Quaternary. This esker is an excellent example of a complex, multi-crested esker which is comprised of numerous beads. The esker system comprises ten individual segments, which stretch for a distance of just over six kilometers. The esker is one of Ireland's best examples of the 'long beaded' esker type. Site Code: [RO010](#).

With the current plan, there may be potential impacts on the integrity of current CGSs envisaged by the proposed development, should these sites not be assessed as constraints. Ideally, the sites should not be damaged or integrity impacted or reduced in any manner due to the proposed development. However, this is not always possible, and in this situation appropriate mitigation measures should be put in place to minimize or mitigate potential impacts. Where the integrity cannot be preserved we would ask that careful consideration be given in design to accommodating preservation of cuttings and access to the site during construction to record the exposures to strengthen our knowledge and datasets. We would also ask that the design of any future windfarms considers the use of information panels as appropriate to highlight the significance of the impacted CGS. Please contact Clare Glanville (Clare.Glanville@gsi.ie) for further information and possible mitigation measures if applicable.

Groundwater

Groundwater is important as a source of drinking water, and it supports river flows, lake levels and ecosystems. It contains natural substances dissolved from the soils and rocks that it flows through, and can also be contaminated by human actions on the land surface. As a clean, but vulnerable, resource, groundwater needs to be understood, managed and protected. Through our [Groundwater Programme](#), Geological Survey Ireland provides advice and maps to members of the public, consultancies and public bodies about groundwater quality, quantity and distribution. Geological Survey Ireland monitors groundwater nationwide by characterising aquifers, investigating karst landscapes and landforms and by helping to protect public and group scheme water supplies.

With regard to Flood Risk Management, there is a need to identify areas for integrated constructed wetlands. We recommend using the GSI's National Aquifer, Vulnerability and Recharge maps on our [Map viewer](#) to this end. **The proposed wind farm development is underlain by a 'Regionally Important Aquifer - Karstified (conduit)'. The Groundwater Vulnerability map indicates the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your EIAR.**

In the area there is a groundwater drinking water abstraction for which there is a zone of contribution/source protection area: Killeglan Public Water Supply - Tobermore Spring. Link to report [here](#). Key to groundwater protection in general, and protection of specific drinking water supplies, is preventing ingress of runoff to the aquifer. Design of the windfarm drainage will need to be cognizant of the public water scheme and the interactions between surface water and groundwater as well as run-off. Appropriate design should be undertaken by qualified and competent persons to include mitigation measures as necessary, such as SUDs or other drainage mitigation measures.

Also, any excavation/cuttings required should ensure that groundwater flow within the zones of contribution to the groundwater abstraction points is not disrupted, resulting in diminished yields. Note that there could be other groundwater abstractions in the locality for which Geological Survey Ireland has not undertaken studies, and a robust assessment should be undertaken by qualified and competent persons.

Given the Public Water Supply Scheme and numerous domestic wells, the effects of any potential contamination / dewatering as a result of the windfarm development would need to be assessed.

Our GWflood project is a groundwater flood monitoring and mapping programme aimed at addressing the knowledge gaps surrounding groundwater flooding in Ireland. The project is providing the data and analysis tools required by local and national authorities to make scientifically-informed decisions regarding groundwater flooding.



This is primarily focused on karst areas such as those located in Co. Roscommon, which will provide vital information to benefit the proposed wind farm development. Monitoring of karst groundwater flooding in areas of lowland karst in counties Galway, Clare, Mayo, Roscommon, Longford and Westmeath commenced in October 2016. The report produced describes the implementation of a turlough monitoring network and the methodology used to produce the historic and predictive groundwater flood maps. **The flood maps and their accompanying report are available [here](#). We recommend using our GWFlood tools found under our programme activities to this end.**

With regards to Climate Change, there is a need to improve the monitoring capacity of groundwater levels in Ireland so that the potential impacts of climate change can be monitored and assessed. In this context the GSI has established the GWClimate project in January 2020. GWClimate will 1) establish a long-term strategic groundwater level monitoring network and 2) develop modelling and analytical approaches for evaluating the impacts of Climate Change to Irish groundwater systems. **Further information can be found on the Groundwater flooding [page](#) of the Groundwater Programme.**

Geological Mapping

Geological Survey Ireland (GSI) maintains online datasets of bedrock and subsoils geological mapping that is reliable, accessible and meets the requirements of all users including depth to bedrock and physiographic maps. These datasets include depth to bedrock data and subsoil classifications. **We would encourage you to use these data which can be found [here](#), in your future assessments.**

Geohazards

Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides are the most prevalent of these hazards. **Landslides are common in areas of peat, areas which are found within the proposed area.** Geological Survey Ireland has information available on past landslides for viewing as a layer on our [Map Viewer](#). Geological Survey Ireland also engages in national projects such as Landslide Susceptibility Mapping and GWFlood Groundwater Flooding. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so. **We recommend that geohazards and particularly flooding be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so.**

Natural Resources (Minerals/Aggregates)

Geological Survey Ireland is of the view that the sustainable development of our natural resources should be an integral part of all development plans from a national to regional to local level to ensure that the materials required for our society are available when required. Geological Survey Ireland highlights the consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process. Geological Survey Ireland provides data, maps, interpretations and advice on matters related to minerals, their use and their development in our [Minerals section](#) of the website. The Active Quarries, Mineral Localities and the Aggregate Potential maps are available on our [Map Viewer](#). **We would recommend use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. In keeping with a sustainable approach we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed wind farm development are sustainably sourced from properly recognised and licensed facilities.**



Other Comments

Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. Should any significant bedrock cuttings be created, we would ask that they will be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints. In areas where natural exposures are few, or deeply weathered, this measure would permit on-going improvement of geological knowledge of the subsurface and could be included as additional sites of the geoheritage dataset, if appropriate. Alternatively, we ask that a digital photographic record of significant new excavations could be provided. Potential visits from Geological Survey Ireland to personally document exposures could also be arranged.

The data would be added to Geological Survey Ireland's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to Beatriz Mozo, Land Mapping Unit, at Beatriz.Mozo@gsi.ie, 01-678 2795.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me (Trish.Smullen@gsi.ie), or my colleague Clare Glanville (Clare.Glanville@gsi.ie).

Yours sincerely,

Trish Smullen
Geoheritage Programme
Geological Survey Ireland



David Naughton
MKO - Planning & Environmental Consultants
Tuam Rd
Galway H91 VW84

04 November 2020

Re: Additional response to the Proposed Seven Hills Wind Farm Development, in Co. Roscommon
Your Ref: 190907
Our Ref: 20/197

Dear David,

With reference to your email dated 19 October 2020, concerning potential mitigation measures for the Proposed Seven Hills Wind Farm Development, in Co. Roscommon, Geological Survey Ireland (a division of the Department of the Environment, Climate and Communications) would like to make the following additional comments regarding the proposed windfarm development and its potential effects on the County Geological Sites (CGS) and groundwater in the locality.

Geoheritage

Geological Survey Ireland's initial review and written response to the scoping document and draft layout map has indicated that two CGSs are located within the development area of the proposed windfarm: [Killeglan Karst Landscape](#) and [Castlesampson Esker](#).

Killeglan Karst Landscape

This site comprises an extensive area of karstic, limestone, bouldery terrain in southern Roscommon, covering an area of 5 by 2 kilometres, and includes several low amplitude, hummocky ridges that appear to be minor ribbed moraines. Three discrete areas of this topography are defined in close proximity to each other. Of the three areas, substantial portions of the draft layout windfarm development map are located within the Mid Section and Northeast Section of the Killeglan Karst Landscape, as shown by the delineated site boundaries in page three of the [CGS report](#).

This is the only such area of lowland, boulder-strewn, limestone glacial karst in the country. It is of national importance and has been recommended as a Geological NHA.

We wish to highlight the possible, potential impacts of the proposed windfarm on this landscape:

- Removal and damage of limestone boulders due to site clearance and haul and access road construction and modification.
- Potential use of boulders as aggregate for the windfarm development.
- Damage to the underlying karst bedrock and karst features such as swallow holes, enclosed depressions and turloughs resulting from heavy plant machinery traffic and turbine installation operations. Potential collapse of sinkholes and cavities due to weight and activity of overlying construction.
- Destruction of individual, distinctive, boulder strewn ribbed moraines due to construction. Consequent loss of landscape definition due to effect on topography and geomorphology.
- High overall loss of landscape integrity due to increased development and fragmentation of this rare and unique landscape.
- Loss of scientific potential for new discoveries and/or recognition of landscape features in both Quaternary science (glacial geomorphology) and karst geology



- Loss of a landscape that would be of particular value as an educational site, a public amenity and for geotourism

Castlesampson Esker

The Castlesampson Esker is an excellent example of a complex, multi-crested esker which is comprised of numerous beads (segments). The esker is formed on Lower Carboniferous limestone bedrock and is Quaternary in age, having been deposited at the base of the ice sheet moving northwest to southeast during early deglaciation at the end of the last Ice Age. The feature interfingers with many flanking fans and deltas, with a pronounced kame-kettle topography in places. **The esker is one of Ireland's best examples of the 'long beaded' esker type.**

It is already conserved for its grassland natural heritage as a SAC and as a proposed NHA (Site Number 001625). As part of Roscommon County Development Plan 2014 -2020, it has been noted in the [Landscape Character Assessment of Roscommon](#) report: "The importance of the site lies in its almost intact structure, something that is very rare in Irish eskers, in its relatively undisturbed state and in the presence of good quality, species-rich dry calcareous grassland of a type listed, with priority status, on Annex I of the EU Habitats Directive (Special Area of Conservation). It provides a good contrast to the more acidic eskers nearby."

This esker trends west-northwest to east-southeast in southern Roscommon, south of the R363 road. Sections of the esker lie within the south eastern portion of the draft layout windfarm development map.

We have identified a number of issues that may compromise the esker with regard to the proposed windfarm development:

- Damage to the intact esker and associated features, e.g fans and deltas, from traffic and from turbine installation and access and haul roads construction and modification
- Use of esker material (sand and gravel), as aggregate for the windfarm development construction
- Loss of scientific potential for new discoveries and/or recognition of landscape features in Quaternary science (glacial geomorphology and sedimentology)
- Loss of a landscape that would be of particular value as educational sites and a public amenity

In summary, both CGSs should not be damaged, or integrity impacted or reduced in any manner due to the proposed development. We would recommend compliance with the objectives and policies of the Roscommon County Development Plan (CDP) 2014 – 2020 and in particular:

- Policy 7.2 "Protect geological Natural Heritage Areas as they become proposed, designated and notified to Roscommon County Council during the lifetime of this plan."
- Objective 7.3, "Preserve and protect sites of county geological importance from inappropriate development where they comprise designated sites or national heritage areas."

The Geoheritage programme of Geological Survey Ireland endeavour to comply with and promote Policy 7.6 of the Roscommon CDP, to "Raise awareness of the importance of geological heritage and disseminate information on sites of geological importance in County Roscommon."

Proposed mitigation measures to be considered

We recommend that turbine locations are situated outside of the CGSs boundaries. Where this may not be feasible (all efforts of avoidance should be clearly demonstrated as having been considered), the turbines should then be located as close to the perimeter of the CGS margins as possible to minimize or mitigate potential impacts.



We understand that under the current proposed development there will be a requirement for access and service roads to cross the CGS. These should avoid the Esker in all instances. We strongly recommend that haul roads to be used for the delivery of wind turbines to their final installation locations should not cross the CGSs as we understand that these will need to be up to 5m in width, and this will have a negative impact on the integrity of the CGS. Where roads are required to cross the site, we would request that these be smaller service roads where possible and should be kept to the minimum width necessary for service purposes. We note from correspondence that the proposed final road width would be 5m, however we would hope that the developer would consider a smaller narrower road in areas crossing the CGS as we consider a 5m road width to be a considerable increase on the existing unpaved farm tracks that are already present and would have a negative impact on the integrity of the CGSs.

Groundwater

Following on from the original response, one of our hydrogeologists has reviewed the proposed site and would like to draw your attention to some specifics from a karst hydrogeological point of view.

Firstly, the most southern proposed windfarm area crosses into the source protection zone for Killeglan public water drinking supply. The source protection zone delineation and report were carried out as part of Ireland's National Groundwater Protection Schemes.

A Groundwater Protection Scheme provides guidelines for the planning and licensing authorities in carrying out their functions, and a framework to assist in decision-making on the location, nature and control of developments and activities in order to protect groundwater. Use of a scheme will help to ensure that within the planning and licensing processes, due regard is taken of the need to maintain the beneficial use of groundwater.

Killeglan spring is a public drinking water supply and serves a population of about 7,000 people. The catchment area to the spring has been delineated and encompasses an area of approximately 40 km².

The surface water regime in the catchment is closely interconnected with the groundwater regime. Karst landforms are abundant in the catchment, and beyond, with many areas draining into turloughs and subsequently entering the groundwater system in swallow holes as and when the turlough empty.

Tracer testing was undertaken at three different locations within the catchment indicating minimum groundwater velocities of between 70m/hr and 110 m/hr. It also clearly demonstrates the direct and rapid link between most of the catchment and the springs.

Due to these rapid flow rates the whole catchment is delineated as SI (Inner Protection Area). According to the National Groundwater Protection Scheme (DELG/EPA/GSI, 1999), delineation of an Inner Protection Area is required to protect the source from microbial and viral contamination and it is based on the 100 day time of travel to the supply. The velocities from the tracer tests show that groundwater can therefore reach the spring within 5 days from any point in the ZOC which is underlain by Visean Limestone.

The proposed southern windfarm area overlaps with this catchment and is also to be constructed directly on the catchment for Feacle Lough. Feacle Lough is a turlough (with many associated karst landforms), within the Killeglan SI (Inner Protection Zone) that was traced directly to the Killeglan supply. Any activity in the catchment zone of Feacle Lough could result in direct contamination of the public drinking water supply. The Killeglan Source Protection Zone and report can be found at:
https://secure.dcca.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/SPZ/RN_PWSS_SPZ_Killeglan_Tobermore_Spring_April_2003_GSI.pdf.

The northern section of the proposed windfarm is also in the catchment area for a number of turloughs and karst landforms. In fact, one of the proposed turbines and access roads runs along by the shore of the turlough itself and has the potential to be frequently flooded.



**Roinn Cumarsáide, Gníomhaithe
ar son na hAeráide & Comhshaoil**
Department of Communications,
Climate Action & Environment



Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Again, any activity carried out in the catchment area to these turlough has the potential to cause significant pollution to the turloughs themselves and the connected groundwater systems.

We would appreciate, if possible, copies of site investigation reports carried out during the design phase, such as geotechnical and geophysical surveys, and/or any other geological data generated over the course of this project. This data would permit on-going improvement of geological knowledge of the surface and subsurface of the County Geological Sites.

I hope that these additional comments are of assistance, and if we can provide any further help and/or information, please do not hesitate to contact me (Trish.Smullen@gsi.ie), or my colleague Clare Glanville (Clare.Glanville@gsi.ie).

Yours sincerely,

Trish Smullen
Geoheritage Programme
Geological Survey Ireland



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Environmental Health Service,
Health Service Executive,
Government Offices,
Convent Road,
Roscommon,
Co. Roscommon.
Phone: 090 6637890

MKO Planning & Environmental Consultants
Tuam Rd
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10th September 2020

Re: HSE SCOPING SUBMISSION REPORT

Dear Sir/Madam,

Please find enclosed the HSE consultation report in relation to the above proposal. The following HSE departments were notified of the consultation request for this development on 21st August 2020.

- Emergency Planning – Kay Kennington
- Estates – Helen Maher
- Assistant National Director for Health Protection – Kevin Kelleher / Laura Murphy
- CHO – Breda Crehan-Roche

This report only comments on Environmental Health impacts of the scoping request. If you have any queries regarding this report the contact is: John Hanily, Principal Environmental Health Officer, Government Buildings, Roscommon.

Yours sincerely,

A handwritten signature in red ink that reads "John Hanily".

Principal Environmental Health Officer



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

HSE EIS SCOPING REPORT
Environmental Health Service Consultation Report
(as a Statutory Consultee (Planning and Development Acts 2000,
& Regs made thereunder)).

<u>Date:</u>	16th September 2020
<u>Type of consultation:</u>	Scoping
<u>Planning Authority:</u>	An Bord Pleanála
<u>EHIS Reference:</u>	1335
<u>Applicant:</u>	Energia Renewables Ltd. and Galetch Energy Developments Ltd.
<u>Proposed Development:</u>	Proposal to develop the Seven Hills Wind Farm in the townland of Cuilleenoolagh and adjacent townlands, in Co. Roscommon. The Proposed Development will comprise of up to 21 no. turbines with a total generating capacity greater than 50MW thereby classifying it as a Strategic Infrastructure Development (SID).

This report only comments on Environmental Health impacts of the proposed development. We have made observations on the following specific areas:

Description of the Project:

The EIAR must fully describe the characteristics and construction of the project and the reasons for proposing same. It should also describe the existing physical environment and detail any potential impacts on the existing environment both during the construction and operational phase of the project. It is noted that the area is largely rural with the small villages of Dysart, Bridewell and Taughmaconnell on the outskirts of the proposed location sites. There are 3 primary schools in the vicinity of the site and a

nursing home is located to the east of the southern section of the site in Brideswell village. All sensitive receptors in the vicinity of the turbines should be identified. It is stated in the scoping report *“The number and layout of turbines will be refined during the upcoming project design stages.”* For accuracy it is the final agreed turbine size and location that should be included in any impact assessment.

Later Consents Required:

Information on possible future monitoring requirements for the operation of the wind farm should be included in the EIAR.

Consideration of Alternatives:

The EIAR should fully describe and consider any alternatives to this project. The applicant should outline a rationale for the site selection and the proposed individual turbine locations and design.

Public Consultation:

The scoping document should describe measures the applicant has already taken and shall take to inform the public about the project. Details of feedback from the public regarding the proposal should be included within the EIAR. Public consultation should be a two way process between the applicant and the public. The EIAR should clearly demonstrate how the legitimate concerns of the public have been assessed and evaluated and how the outcome of consultation with the public influenced decision making within the EIA.

Noise:

A full and thorough noise survey must be carried out to assess the impact of noise from the proposed turbines on the residents living in the vicinity. It is noted from site visits that there is a significant number of one off housing in the local area of both sections of the site.

It is essential that up to date baseline monitoring is carried out to establish the existing noise environment. All noise sensitive receptors in the vicinity of the turbines shall be identified. The selection of noise monitoring locations for background noise is of critical importance in the noise survey, therefore the rationale for choosing the number and the positioning of these should be provided by the applicant.

Once the existing noise environment has been established, the predicted increase in noise from the proposed turbines should then be quantified and assessed. It is this departments opinion that adherence to specified noise limit values does not always protect sensitive receptors from noise nuisance therefore the significance of the predicted change in the noise environment should be fully assessed. It is requested that this information is outlined and displayed clearly in the EIS.

The potential cumulative effects of other windfarms, industry, quarrying etc in the vicinity of the development should be assessed as part of the noise survey. Note: there

is an active sand and gravel quarry located to the south east of the site. All mitigation measures for the control of noise shall be described.

Shadow Flicker:

A shadow flicker assessment is to be carried out. All possible impacted dwellings and sensitive receptors shall be identified. The assessment should include identification of the room use in properties potentially impacted by shadow flicker. If reduction factors are applied as part of the shadow flicker assessment, the rationale for applying same shall be clearly outlined. Any mitigation measures for the control of shadow flicker shall be described. It is noted the exact model of turbine will not be finalised until the construction tender stage so the impact of all various turbine designs considered by the applicant should be modelled in the assessment.

Geological Impacts/Land Stability

A detailed assessment of the current ground stability of the site for the proposed wind farm development together with the necessary mitigation measures should be included in the EIAR. The assessment should include the impact construction work will have on the future stability of ground conditions taking into account extreme weather events, site drainage, and the possibility for soil erosion.

Water:

All drinking water sources, both surface and groundwater (including individual private wells) shall be identified. It is known that the main water supply in the area is the South Roscommon (Killeglan) Regional Water Supply Scheme sourced from Killeglan springs with a limited number of private water supplies also in the area. Any potential impacts to these drinking water sources shall be assessed. Details of bedrock, overburden, vulnerability, groundwater flows and gradients, inner and outer zones of protection and catchment areas should all be considered when assessing potential impacts and possible mitigation measures. The EHS would recommend that all information is gathered by means of a site survey as desktop studies do not always accurately reflect the current use of water resources.

Dust:

The impact of dust generation from construction should be assessed and a dust minimisation plan or similar mitigation measure that meets current national standards for construction sites should be addressed.

Construction:

A construction management plan should be provided with the EIAR. This should comprehensively outline working procedures and any necessary mitigation measures that will be provided. A site visit has identified narrow access roads that are currently unsuited for construction traffic and the delivery of oversized loads. The scoping document does state that temporary upgrade works and road widening is proposed. The impact of this work along with the impact of increased construction traffic on

residents in the vicinity should be assessed in the EIAR. Mitigation and traffic management measures should be outlined.

Complaints procedure:

The EIAR should include proposals for dealing with issues of nuisance from members of the public should they arise.

Ancillary Facilities

The EIAR should provide location details of any borrow pits, site office, construction yard(s), fuel storage depot, sanitary accommodation, canteen, 1st Aid, disposal of waste water and the provision of potable drinking water supply.

Cumulative Impacts:

In line with the EPA Guidelines on the information to be contained in Environmental Impact Statements (2002) and their Advice Notes on Current Practise in the preparation of Environmental Impact Statements (2003) the EIA should include the assessment of cumulative impacts of any other industrial or energy developments in the area e.g. other wind farms, forestry, peatcutting, intensive agriculture and quarrying etc. It is known that there is an active sand and gravel quarry located to the south east of the site.

Health Gain:

The Developer should explore the possibility for recreational facilities to be provided on the Wind Energy Development. Any potential for health gain from the development should be exploited.



Kathleen Lydon
Senior Environmental Health Officer



Lisa Maguire
Environmental Health Officer

All correspondence or any queries with regard to this report including acknowledgement of this report should be forwarded to:

**John Hanily
Principal Environmental Health Officer
HSE West
Government Offices
Covent Rd
Roscommon**

Órla Murphy

Subject: FW: Seven Hills Wind Farm

From: RAFFERTY Audrey <audrey.rafferty@iaa.ie>

Sent: Monday 7 September 2020 17:36

To: Ellen Costello <ecostello@mkoireland.ie>

Subject: Seven Hills Wind Farm

Dear Sir/Madam,

In general terms, the Authority has no specific requirements in relation to this request for information in relation to the development of an Environmental Impact Assessment for the proposed Seven Hills Wind Farm comprised of 21 Turbines at Cuilleenoolagh and adjacent townlands in Co. Roscommon. Based on the information provided,

During the formal planning process, the Safety Regulation Division – Aerodromes will likely make the following general observation:

In the event of planning consent being granted, the applicant should be conditioned to contact the Irish Aviation Authority to:

- (1) agree an aeronautical obstacle warning light scheme for the wind farm development,
- (2) provide as-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location

<i>Turbine No.</i>	<i>WGS-84 Co-ordinates</i>	<i>Ground elevation (Malin Head OD)</i>	<i>Blade tip elevation of turbine (Malin Head OD)</i>	<i>Height of turbine (height from ground level to blade tip)</i>	<i>Confirm if turbine has obstacle lighting.</i>
T1	53.346125, -6.258288	75m	225m	150m	No

- (3) notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.

Kind Regards

Audrey Rafferty

Irish Aviation Authority

The Times Building

11-12 Dolier Street

Dublin 2

Ph: (01) 603 1103

MKO,
Tuam Road,
Galway,
H91 VW84,
Ireland

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
D01 WA07
Éire

Irish Water
PO Box 6000
Dublin 1
D01 WA07
Ireland

T: +353 01 89 25000
T: +353 01 89 25001
www.water.ie

15 September 2020

Re: EIAR Scoping Request – Proposed Seven Hills Wind Farm Development, in Culleenoolagh and adjacent townlands in Co. Roscommon

Dear Mr. Naughton,

Irish Water (IW) acknowledges receipt of your request in respect of the Environmental Impact Assessment Report (EIAR) scoping for proposed wind farm development located at Culleenoolagh, Co. Roscommon.

Please see attached our suggested scope in relation to Water Services. On receipt of the planning referral, Irish Water will review the EIAR as part of the planning process.

Queries relating to the terms and observations above should be directed to planning@water.ie

Yours sincerely,

Signed on behalf of Irish Water:

Maria O'Dwyer
Connections and Development Services

Response to EIAR Scoping Report Requests

IW currently does not have the capacity to advise on scoping of individual projects. However, in general we would like the following aspects of Water Services to be considered in the scope of an EIAR where relevant;

- a) Impacts of the development on the capacity of water services (do existing water services have the capacity to cater for the new development if required). This is confirmed by IW in the form of a Confirmation of Feasibility (COF). If a development will require a connection to either a public water supply or sewage collection system the developer is advised to submit a Pre Connection Enquiry (PCE) enquiry to IW to determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available from <https://www.water.ie/connections/get-connected/>
- b) Any up-grading of water services infrastructure that would be required to accommodate the development.
- c) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an IW collection network
- d) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers
- e) Any physical impact on IW assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets
- f) If you are considering a development proposal, it is best practice to contact us in advance of designing your proposal to determine the location of public water services assets. Details, where known, can be obtained by emailing an Ordinance Survey map identifying the proposed location of your intended development to datarequests@water.ie. Other indicators or methodologies for identifying infrastructure located within your lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed site.
- g) Any potential impacts on the assimilative capacity of receiving waters in relation to IW discharge outfalls including changes in dispersion /circulation characterises
- h) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence/present a risk to the quality of the water abstracted by IW for public supply.
- i) Where a development proposes to connect to an IW network and that network either abstracts water from or discharges waste water to a “protected”/sensitive area, consideration as to whether the integrity of the site/conservation objectives of the site would be compromised.
- j) Mitigation measures in relation to any of the above

This is not an exhaustive list.

Please note

- The Confirmation of Feasibility from IW, to the applicant, should be issued prior to applying for planning permission.
- Irish Water will not accept new surface water discharges to combined sewer networks

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David Naughton

From: Nollaig Feeney <NFeeney@roscommoncoco.ie>
Sent: Wednesday 19 August 2020 15:58
To: David Naughton; Órla Murphy; Mary Grier
Subject: FW: 190907 - Scoping Document for Proposed Seven Hills Wind Farm - with smaller file size
Attachments: RO015_Killeglan_Karst_Landscape.pdf; RO010_Castlesampson_Esker.pdf; The Geological Heritage of Roscommon, excl site reports.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

David / Orla

Please see my

Nollaig Feeney, Heritage Officer

Roscommon County Council, Áras on Chontae, Roscommon, F42 VR98

090 6637135 www.roscommoncoco.ie

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email below. The Audit Report I attach now excludes the site reports, the full report including all site reports as was attached to my previous email does not appear to have been delivered to you,

Best regards

Nollaig

From: Nollaig Feeney
Sent: Wednesday 19 August 2020 15:43
To: dnaughton@mkoireland.ie; Mary Grier <mgrier@roscommoncoco.ie>; omurphy@mkoireland.ie
Subject: RE: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Dear David

Thanks you for your email and the EIAR Scoping Report for the Proposed Seven Hills Wind farm.

Some of the proposed development area overlaps with areas identified in 'The Geological Heritage of Roscommon - An audit of County Geological Sites in Roscommon' which was carried out for Roscommon County Council in 2012, copy attached. The geological sites identified in this audit can be viewed on <https://heritagemaps.ie/WebApps/HeritageMaps/index.html> - you go to the Geology dataset layer, then Geological Heritage Sites, then Roscommon.

I am concerned that the proposed development may impact on two identified sites of County Geological importance – Killeglan Karst Landscape and Castlesampson Esker. I attach the Geological Audit site reports for both these sites.

Note the observation on Killeglan Karst Landscape - This is the only such area of lowland, boulder-strewn, limestone glacial karst in the country. It is of national importance.

Note the observation on Castlesampson Esker - The esker is one of Ireland's best examples of the 'long beaded' esker type.

Page 9 of 'The Geological Heritage of Roscommon - An Audit of County Geological Sites in Roscommon' refers specifically to Killeglan Grasslands – *'However, sites such as Killeglan Karst Landscape exemplify the potential both for new discoveries or recognition of landscape features, and also the potential for their loss despite best planning practices. The bouldery limestone landscape here, which overlies karstified bedrock, is possibly unique in lowland Ireland, and requires detailed study and delineation. It is to be hoped that the windfarm development, recently granted Planning Permission within the boundaries of the Geological Heritage site, will not impact on the integrity of the geomorphological landscape. With some constructive thinking, and engagement by all concerned, the permitted development work may offer opportunity to fully characterise and understand this newly recognised important landscape'*

also
*'There are large contrasts in the management requirements for geological sites in comparison to biological sites. Most geology is actually quite robust and generally few restrictions are required in order to protect the scientific interest. In some cases, paradoxically, the geological interest may even be served better by a development exposing more rock. **The important thing is for the relevant planning department to be aware of the sites, and more generally, that consultation can take place if some development is proposed for a site.** In this way, geologists may get the opportunity to learn more about a site or area by recording and sample collection of temporary exposures, or influence the design so that access to exposures of rock is maintained for the future, or prevent completely inappropriate developments through a strong scientific case.*

Regarding management recommendations for both these significant sites, the site reports note:

Management/promotion issues for Killeglan Grasslands -

This is an excellent site in terms of macro-scale Quaternary geomorphology. The landscape is noteworthy and should be promoted as unique amongst landscape elements within the Roscommon County Development Plan and in Landscape Characterisation. The site should also be designated as an NHA owing to the uniqueness of the natural landscape character. The site boundary illustrated here delineates the area displaying this geology in 2004 when the aerial photographs of the locality were taken. As land management practices are constantly changing and may have impacted heavily on this vulnerable landscape, in order to delineate the exact remaining area of interest a detailed field survey is required. Further research and investigation is required to document and understand the full scientific story. Since a windfarm has been granted planning permission in 2012, it is hoped that scientific opportunity created by ground excavations for this will be used and not wasted.

Management/promotion issues for Castlesampson Esker

This report gives proper recognition to the geomorphological component of a site that is already conserved for its grassland natural heritage as SAC and proposed NHA (Site Number 001625).

Section 7.2 of the Roscommon County Development Plan addresses Geological Heritage. http://www.roscommoncoco.ie/en/Services/Planning/Roscommon-County-Council-Planning-Publications/Roscommon-County-Council-Planning-Publications/County_Development_Plan_2014_-_2020/County_Development-Plan-2014-2020/1e-Chapter-6-8.pdf

Objectives 7.3 relates to County Geological Sites where they comprise designated sites – having consulted the NPWS mapviewer, the areas proposed for this development do not appear to be within the designated parts of Killeglan Grasslands or Castlesampson Esker. However, Objective 7.4 states 'Refer all planning applications within County Geological Sites to the Geological Survey of Ireland for consultation and have regard to their recommendations'.

I note from your EIAR Scoping Report that you have consulted the Geological Survey of Ireland, however I am anxious that the sites identified as being of County Geological Importance are given due consideration in the EIA.

Please contact me if you have any queries about this,
Best regards

Nollaig

Nollaig Feeney, Heritage Officer
Roscommon County Council, Áras on Chontae, Roscommon, F42 VR98
090 6637135 www.roscommoncoco.ie

If you wish to be added to the **Heritage Office email mailing list** please reply with 'Mailing List' in the subject box. If you wish to be removed from the Heritage Office mailing list please reply with 'Remove' in the subject box.



From: David Naughton [<mailto:dnaughton@mkoireland.ie>]
Sent: Monday 17 August 2020 15:21
To: Mary Grier <MGrier@roscommoncoco.ie>
Cc: Órla Murphy <omurphy@mkoireland.ie>; Nollaig Feeney <NFeeney@roscommoncoco.ie>
Subject: 190907 - Scoping Document for Proposed Seven Hills Wind Farm

Hi Mary,

As discussed the last day in our pre-planning meeting over Microsoft teams, please find attached a Scoping Document for the proposed seven hills wind farm development in Cuilleenoolagh and adjacent townlands in Co. Roscommon. Also attached is individual cover letters for each department to be circulated along with the scoping document itself.

As part of the scoping exercise for the proposed development, we would welcome any comments in relation to the proposed project.

If you have any queries, please do not hesitate to contact me.

Kind regards,



David Naughton [B.Sc.](#) (Env.)
Environmental Scientist

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The Geological Heritage of Roscommon

An audit of County Geological Sites in Roscommon

By Matthew Parkes, Robert Meehan and Sophie Préteseille

October 2012



The Roscommon Geological Heritage Project was supported by

An Chomhairle Oidhreachta
The Heritage Council



This report is an action of the
County Roscommon Heritage Plan 2012 2016

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This report is an action of the
County Roscommon Heritage Plan 2012 – 2016

For the:
Irish Geological Heritage Programme
Geological Survey of Ireland
Beggars Bush
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Dublin 4
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Section 2 – Site Reports

IGH 1 Karst

Site Name

Brierfield Turlough

Castleplunkett Turlough

Carrowmurragh Mushroom Rocks

Killeglan Karst Landscape

Lough Funshinagh

Loughnaneane Turlough

Mewlaghmore Dolines

Moyvannon Mushroom Rocks

Mullygollan Turlough

Oweynagat

Pollnagran

Rockingham Spring

IGH 2 Precambrian to Devonian Palaeontology

Site Name

Not represented in Roscommon

IGH 3 Carboniferous to Pliocene Palaeontology

Site name

Not represented in Roscommon

IGH 4 Cambrian-Silurian

Site name

Not represented in Roscommon

IGH 5 Precambrian

Site name

Not represented in Roscommon

IGH 6 Mineralogy

Site Name

Not represented in Roscommon

IGH 7 Quaternary

Site Name

Ballinasloe-Split Hills-Clonmacnoise-Clara Esker System

Boyle Drumlins

Brierfield Turlough (see IGH1 Karst)

Castleplunkett Turlough (see IGH1 Karst)

Castlesampson Esker

Cloonburren Fan

Errit and Cloonagh Loughs Deltas

Garranlahan Esker

Killeglan Karst Landscape (see IGH1 Karst)

Lough Funshinagh (see IGH1 Karst)

Loughnaneane Turlough (see IGH1 Karst)

McKeon's Pit

Mid Roscommon Ribbed Moraines

Mullygollan Turlough (see IGH1 Karst)

IGH 8 Lower Carboniferous

Site Name

Castlemine Quarry

Keeloges Quarry

Largan Quarry

IGH 9 Upper Carboniferous and Permian

Site Name

Not represented in Roscommon

IGH 10 Devonian

Site Name

Boyle Road Cutting

IGH 11 Igneous intrusions

Site Name

Not represented in Roscommon

IGH 12 Mesozoic and Cenozoic

Site Name

Lecarrow Clay Pit

IGH 13 Coastal Geomorphology

Site Name

Not represented in Roscommon

IGH 14 Fluvial and lacustrine geomorphology

Site Name

Carrowmurragh Mushroom Rocks (see IGH1 Karst)

Moyvannon Mushroom Rocks (see IGH1 Karst)

River Shannon Callows

Suck River Callows

IGH 15 Economic Geology

Site Name

Altagowlan

Arigna Mining Experience

Lecarrow Clay Pit (see IGH12 Mesozoic and Cenozoic)

IGH 16 Hydrogeology

Site Name

Brierfield Turlough (see IGH1 Karst)

Castleplunkett Turlough (see IGH1 Karst)

Lough Funshinagh (see IGH1 Karst)

Loughnaneane Turlough (see IGH1 Karst)

Mullygollan Turlough (see IGH1 Karst)

Rockingham Spring (see IGH1 Karst)

Appendix 1

Geological heritage audits and the planning process

Appendix 2

Bibliography – Geology of County Roscommon

Appendix 3

Bibliography – Caves and karst of County Roscommon

Appendix 4

Bibliography – County Roscommon Quaternary References

Appendix 5

Rejected sites

Appendix 6

A detailed geological map of County Roscommon

Report Summary

County Roscommon is a geologically diverse place with many landscapes, areas and sites treasured by both natives and visitors. The bedrock foundation, with hundreds of millions of years in its formation and shaping, and the more recent history of geomorphological processes such as limestone solution and scouring by glaciers, are what has created that underlying geodiversity. Geological understanding and interpretation is best done on the ground at sites where the rocks and landforms are displayed. County Roscommon has a wealth of such natural and human-influenced sites, particularly of karstic and glacial types.

This report documents what are currently understood to be the most important geological sites within Roscommon by the Irish Geological Heritage Programme (IGH) of the Geological Survey of Ireland (GSI). It proposes them as County Geological Sites (CGS), for inclusion within the Roscommon County Development Plan (CDP). The audit provides a reliable study of sites to replace a provisional listing based on desk study which was adopted in a previous CDP.

County Geological Sites do not receive statutory protection like Natural Heritage Areas (NHA) but receive an effective protection from their inclusion in the planning system. However, many of the sites described in this report are considered to be of national importance as best representative examples of particular geological formations or features. They will be formally proposed by the Geological Survey of Ireland, for designation as NHAs by the National Parks and Wildlife Service after due survey and consultation with landowners. However, many of these sites fall within existing pNHAs and SACs where the ecological interest is founded upon the underlying geodiversity. The commission of this audit and adoption of the sites within the County Development Plan ensure that County Roscommon follows a now established and effective methodology for ensuring that geological heritage is not overlooked in the general absence of allocated resources for progress at national level. It keeps Roscommon at the forefront of geological conservation in Ireland.

This report is written in non-technical language (with a glossary for unavoidable geological terminology) as a working document for use by the Heritage Officer and the Planning department of Roscommon County Council. It will also be made available via the County Council website for the people of Roscommon. A chapter of the report includes recommendations on how to best present and promote the geological heritage of Roscommon to the people of the county. It will also inform the work of the IGH Programme and be made available through the GSI website.

The preliminary sections, summary geological history and accompanying map, timescale and stratigraphical column particularly may be used as they stand to preface a booklet or as website information in the development of this work, and for information as seen fit by the Heritage Officer. The contents also provide the essential ingredients for a public-oriented booklet on the geological heritage of Roscommon.

Roscommon in the context of Irish Geological Heritage

This report ensures Roscommon is active at the forefront of geological heritage within Ireland, as it is only the ninth county to commission such an audit within the scope of the county-based Heritage Plan. It will hopefully encourage other local authorities to follow what is now a tried and trusted methodology. In the absence of significant political and economic resources available to the relevant bodies for geological heritage conservation as Natural Heritage Areas (NHA) at a national level, it represents a significant level of progress in defining and safeguarding Ireland's geological heritage.

It also represents a significant commitment on the part of the Local Authority to fulfil its obligations to incorporate geology into the spectrum of responsibilities under the Heritage Act 1995, the Planning and Development Act 2000, Planning and Development Regulations 2001, and the Wildlife (Amendment) Act, 2000 and the National Heritage Plan (2002). The Geological Survey of Ireland (GSI) views partnerships with the local authorities, exemplified by this report, as a very important element of its strategy on geological heritage (see Appendix 1).

The Irish Geological Heritage Programme (IGH) in the Geological Survey of Ireland complements other nature conservation efforts of the last decade, by assessing Ireland's geodiversity, which is the foundation of the biodiversity addressed under European Directives on habitats and species by the designations of Special Areas of Conservation (SAC) and more recently on a national scale by the introduction of Natural Heritage Areas (NHA) as the national nature conservation method. As a targeted conservation measure to protect the very best of Irish geology and geomorphology it fills a void which has been there since the abandonment of the Areas of Scientific Interest scheme, listed by An Foras Forbartha in 1981.

The IGH Programme does this by identifying and selecting the most important geological sites nationally for designation as NHAs. It looks at the entire spectrum within Irish geology and geomorphology under 16 different themes:

IGH THEMES

1. Karst
2. Precambrian to Devonian Palaeontology
3. Carboniferous to Pliocene Palaeontology
4. Cambrian-Silurian
5. Precambrian
6. Mineralogy
7. Quaternary
8. Lower Carboniferous
9. Upper Carboniferous and Permian
10. Devonian
11. Igneous intrusions
12. Mesozoic and Cenozoic
13. Coastal geomorphology
14. Fluvial and lacustrine geomorphology
15. Economic geology
16. Hydrogeology

A fundamental approach is that only the minimum number of sites necessary to demonstrate the particular geological theme is selected. This means that our first criterion is to identify the best national representative example of each feature or major sequence, and

secondly any unique or exceptional sites. The third criterion, of any sites of International importance, is nearly always covered by the other two.

Designation of geological NHAs is by the GSI's partners in the Programme, the National Parks and Wildlife Service (NPWS) currently operating within the Department of Arts, Heritage and the Gaeltacht. Once designated any geological NHAs will be subject to normal statutory process within the Roscommon Planning Department and other relevant divisions. **However, management issues for geological sites are generally less, and somewhat different from many ecological designations. The following section considers these issues.**

From a national perspective, as a result of extensive comparison of similar sites to establish which are the best, there is now a good knowledge of many other sites, which are not the chosen best example, but may still be of national importance. Others may be of more local importance or of particular value as educational sites or as a public amenity. It is these various other important sites that are proposed for County Geological Site (CGS) listing in the County Development Plan, along with the clear NHA selections.

Currently, in 2012, a Master List of candidate CGS and NHA sites has been established in GSI with the help of Expert Panels for all the 16 IGH themes. For several themes, the entire process has been largely completed and detailed site reports and boundary surveys have been done along with a Theme Report. Due to various factors, they have not been formally designated yet, although only a very small number of sites (e.g. Moyvannan Mushroom Stones) were considered to be of national importance and to be put forward as Natural Heritage Areas (NHA). Therefore, inclusion of all sites as County Geological Sites (CGS) in Roscommon's planning system will ensure that they are not inadvertently damaged or destroyed through lack of awareness of them outside of the IGH Programme in GSI.

The sites proposed here as County Geological Sites (CGS) have been visited and assessed specifically for this project, and represent our current state of knowledge. It does not exclude other sites being identified later, or directly promoted by the Council itself, or by local communities wishing to draw attention to important sites for amenity or education with an intrinsic geological interest. New excavations, such as major road cuttings or new quarries for example, can themselves be significant and potential additions to this selection.

It was not possible within the scope of this study to identify landowners except in a few sites, but it is emphasised that listing here is not a statutory designation, and carries no specific implications or responsibilities for landowners. It is a primarily a planning tool, designed to record the scientific importance of specific features, and to provide awareness of them in any decision on any proposed development that might affect them. It thus also has an educational role for the wider public in raising awareness of this undervalued component of our shared natural heritage.

Geological conservation issues and site management

Since **geodiversity is the often forgotten foundation for much of the biodiversity** which has been identified for conservation through SAC or NHA designation, it is unsurprising that many of the most important geological sites are actually in the same areas. In these areas, the geological case enhances and cements the value of these sites for nature conservation, but requires no additional designation of actual land areas.

There tend to be two broad types of site identified by the IGH Programme. The first, which are the most common, are small and discrete sites. They may be old quarries, natural exposures on hilly ground, coastal cliff sections, or other natural cuttings into the subsurface, such as the mushroom stones at Moyvannon and Carrowmurragh, the old clay pits at Lecarrow or the old coal mines at Arigna and Altagowlan. They usually have a specific interest such as fossils, minerals or are a representative section of a particular stratigraphical sequence of rocks. **The other type of site tends to be larger areas that represent a geomorphological interest – landscapes that illustrate processes which formed them.** The Quaternary theme and the Karst theme include such sites. In Roscommon, the superb eskers are characteristic of the larger sites encompassed under the IGH 7 Quaternary Theme. Large areas of Roscommon's landscape are covered by drumlins or ribbed moraine, which can be problematic, as although unique and impressive, they can be too large to consider as 'sites'.

It is also important from a geological conservation perspective that planners understand the landscape importance of geomorphological features which may not in themselves warrant any formal site designation, but which are an integral part of the character of Roscommon. A lack of awareness in the past, has led to the loss of important geological sites and local character, throughout the country. In Roscommon a full Landscape Characterisation Assessment was completed in 2008. This provides a tool to help future planning decisions maintain the integrity of the County. However, sites such as Killeglan Karst Landscape exemplify the potential both for new discoveries or recognition of landscape features, and also the potential for their loss despite best planning practices. The bouldery limestone landscape here, which overlies karstified bedrock, is possibly unique in lowland Ireland, and requires detailed study and delineation. It is to be hoped that the windfarm development, recently granted Planning Permission within the boundaries of the Geological Heritage site, will not impact on the integrity of the geomorphological landscape. With some constructive thinking, and engagement by all concerned, the permitted development work may offer opportunity to fully characterise and understand this newly recognised important landscape.

There are large contrasts in the management requirements for geological sites in comparison to biological sites. Most geology is actually quite robust and generally few restrictions are required in order to protect the scientific interest. In some cases, paradoxically, the geological interest may even be served better by a development exposing more rock. **The important thing is for the relevant planning department to be aware of the sites, and more generally, that consultation can take place if some development is proposed for a site.** In this way, geologists may get the opportunity to learn more about a site or area by recording and sample collection of temporary exposures, or influence the design so that access to exposures of rock is maintained for the future, or prevent completely inappropriate developments through a strong scientific case.

In other counties, working quarries may have been listed simply because they are the best representative sections available of entire rock sequences, in areas where exposure is otherwise poor. No restriction would be sought on the legitimate operation of these quarries. However, maintenance of exposure after quarry closure would be sought with the operator and planning authority in such a case. At present, several working quarries are now included as County Geological Sites in Roscommon. These issues are briefly explored in a set of Geological Heritage Guidelines for the Extractive Industry, issued jointly by the GSI and the Irish Concrete Federation in 2008.

A new quarry may open a new window into the rocks below and reveal significant or particularly interesting features such as pockets of fossils or minerals, or perhaps a karstic depression or cave. Equally a quarry that has finished working may become more relevant as a geological heritage site at that stage in its life. It would possibly need regular maintenance to prevent overgrowth of vegetation obscuring the scientific interest.

Nationally, specific sites may require restrictions and a typical case might be at an important fossil locality or a rare mineral locality, where a permit system may be required for genuine research, but the general opportunity for collecting may need to be controlled. However, Roscommon's sites are not likely to require such an approach.

Waste dumping

An occasional problem throughout the country, including in County Roscommon, is the dumping of rubbish in the countryside. The dumping of waste is not only unsightly and messy, but when waste materials are dumped in area where rock is exposed, such as quarries or karstic depressions, they may leach into the groundwater table as they degrade. This can cause groundwater pollution and can affect nearby drinking water supplies in wells or springs. Groundwater Protection Schemes (DELG 1999) help to combat pollution risks to groundwater by zoning the entire land surface within counties into different levels of groundwater vulnerability. Such a scheme has been completed for Roscommon County Council by the Geological Survey of Ireland, thus ranking the county land surface into vulnerability categories of 'Extreme', 'High', 'Moderate' and 'Low', and helps planners in assessing which developments are suitable in some areas of Roscommon, and which are not. **Given the very high dependence of County Roscommon on groundwater supplies it is important that education about the threat of dumping is given serious attention.**

New exposures in development

One less obvious area where the Local Authority can play a key role in the promotion and protection of geology is in the case of new roads. **Wherever major new carriageways are built**, such as the bypass around Boyle town and through the Curlews, or in other major infrastructural work, it should be a policy within the Planning Department that **where new rock exposures are created, that they be left open and exposed** unless geotechnical safety issues occur (such as bedding dips prone to rock failure). The grading and grassing over of slopes in cuttings is largely a civil engineering convenience and a mindset which is difficult to change. However, it leads to sterile and uninteresting roads which look the same throughout the country. By leaving rock exposures along the routeway, where they are intersected, it provides an improvement in character and interest, reflecting the geology and landscape of the locality. Sympathetic tree or shrub planting can still be done, but leaving bare rocks, especially where they show interesting features, not only assists the geological profession, but creates new local landmarks to replace those removed in the construction of

the roadway. This can also potentially save money on the construction. The cutting through Devonian volcanic sediments north of Boyle town, on the climb over the Curlews is a good example of such a site, with groundwater seeps and tufa deposits adding to the interest of the rocks.

Geoparks

An extremely interesting development in geological heritage, not just in Europe but internationally, has been the rapid recent growth and adoption of the Geopark concept. A **Geopark is a territory** with a well defined management structure in place (such as Local Authority support), **where the geological heritage is used to develop sustainable tourism opportunities**. Initially it was largely a European Geoparks Network (EGN) but has now expanded worldwide as the Global Geoparks Network (GGN) since 2004 and is fully assisted by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) [see www.globalgeopark.org and www.europeangeoparks.org]. A fundamental theoretical basis of the Geopark is that it is driven from the bottom up – the communities in the Geopark are the drivers of the project and are the main beneficiaries. It therefore provides protection of the geological heritage resource so that the community can benefit from it.

In Ireland there are already three members of the Geoparks Network. One is the Copper Coast Geopark in Waterford [see www.coppercoastgeopark.com]. Another is the cross-border Marble Arch Caves Global Geopark in Fermanagh and Cavan [see www.marblearchcaves.net]. A recent addition has been the Burren and Cliffs of Moher in County Clare [see www.burrenconnect.ie/geopark]. In addition there are aspirant groups exploring the work and infrastructure required for applications in other areas such as Joyce's Country in Mayo and Galway, and the Mourne Mountains and Carlingford area. However, Roscommon has no aspirant communities, nor any obvious bedrock areas that have the coherent geological characteristics that would benefit from consideration as potential Geoparks. However, we consider that the Slieve Dart area and Cloonfad Eskers and associated topography are potentially worthy of an east Connaught esker-karst type geopark, including the Garranlahan system and the karstlands in between.

Proposals and ideas for promotion of geological heritage in Roscommon

The clear and significant inclusion of geological heritage in the County Roscommon Heritage Plan 2012-2016 is a most welcome and positive step, for a topic that is often undervalued and poorly known in the wider community. This section examines the existing points in the plan relating to geological heritage and provides specific suggestions of how these may be implemented, supported or enhanced by the audit of geological heritage sites in the county.

Objective 1 Collect and disseminate heritage information –‘Notice’. To facilitate the development of a comprehensive heritage database for the county, to make this information available to all.

Action 1.1 Identify gaps in knowledge and facilitate research studies as required to gather data on all aspects of heritage in the county.

Audit Action: This broad action will be partly fulfilled by the geological heritage audit, since geology is poorly understood and undervalued in comparison with many other elements of our heritage. The authors have aimed for a very broad perspective on geological heritage in the audit, including economic and industrial exploitation of Earth resources in Roscommon, and people’s interaction with geology over time.

Action 1.4 Carry out an inventory of geological heritage in the county and a literature review of relevant geological research. Publish the findings.

Audit Action: The audit will provide a robust and detailed report and dataset to achieve this objective in the Heritage Plan. However, ongoing review in future years for additional sites will be required. Some vigilance on the ground at sites will be required to ensure they are not damaged. The GSI should be consulted on any planning application that is potentially impacting upon an identified County Geological Site.

Action 1.5 Carry out baseline surveys and data gathering as necessary to inform the Roscommon County Development Plan. For example character assessments of architectural conservation areas, tree survey, habitat mapping, esker survey, turloughs survey, wetlands survey, bogs survey.

Audit Action: The audit will contribute to part of this objective, particularly in respect of turloughs and eskers, both of which are especially richly represented in the county. The audit provides a status report and imagery as of summer 2012 for selected sites, which is a subset of all of the eskers and turloughs in the county.

Action 1.8 Disseminate results of information gathered from heritage research in the county, for example archaeological research.

Audit Action: The audit will be made available to the public as well as to planners and County Council staff. The audit report will be supplemented by exhibition material that can be used as a physical exhibition, and as internet resources, all aiming to disseminate the audit results to a much wider audience. It is to be hoped that resources may be available in subsequent time to produce a ‘public-friendly’ book on the geological heritage of the county in a similar manner to Sligo, Meath, Fingal and Waterford.

Objective 2 Promote best practice in heritage conservation and management – ‘Care’. To promote and advise on best practice standards for heritage conservation and management within the county.

Action 2.1 Seek the provision of a designated county museum service for the county.

Audit Action: *Although the audit is not directly relevant to this action, it is to be noted that the contents may contribute to the inclusion of geology within a County Museum if the action is achieved.*

Action 2.4 Provide heritage training for community groups. Topics to include amongst others: Best practice in heritage conservation and management; Enhancement of biodiversity; and 'Heritage Audits' – how to identify sites of heritage interest and plan to conserve or enhance sites in your local area.

Audit Action: *The authors of this audit report could provide training in geological topics by arrangement with the Heritage Officer.*

Action 2.6 Provide heritage training for Roscommon County Council staff and elected members. Topics to include amongst others: Architecture.

Audit Action: *The authors of this audit report could provide training in geological topics by arrangement with the Heritage Officer.*

Objective 3 To raise awareness of our heritage – 'Enjoy'. To increase knowledge, awareness, understanding and enjoyment of Roscommon's heritage.

Action 3.10 Promote awareness of Roscommon's geological heritage, for example hosting a geology exhibition.

Audit Action: *This objective will be fulfilled by the inclusion of draft content for a panel based exhibition (provided as supplementary to tender specifications). Exhibition panels included as part of this audit project can be made available as a handy resource. In addition, the Geoschol 4 page leaflet on the geology of Roscommon, aimed at primary level, can be made available or through a link to it on the Geoschol website (www.geoschol.com).*

Other audit benefits:

1. Selected geological and speleological titles will be made available digitally to build the heritage data, from the authors' own connections (including Matthew Parkes being Speleological Union of Ireland Librarian) and resources.

2. The audit could serve as a basis for developing walking and cycling routes, and associated information leaflets and signage if required.

Specific ideas for projects

Leaflets

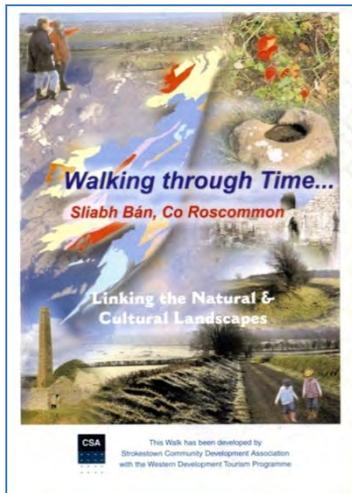
There are two excellent free leaflets produced by the County Council, one on bogs and one on turloughs. The addition of one on the geology of the county and one on the karst features of Roscommon could be derived easily from this audit. A separate leaflet could easily be produced on 'The Eskers of County Roscommon', 'The Drumlins of County Roscommon' or a combined 'The Glacial landforms of County Roscommon'.



We propose that leaflets on geological topics should be added to this series for free public distribution.

Guides

There are in reality no existing guides to the geology of County Roscommon. There is scope for guides at different levels of detail and accessibility to non-specialists. A wide range of leaflets, booklets, books and other media are all feasible, but the research and production of appropriate text and images is a difficult task to do well without appropriate experience, and adequate time and resources. **It is suggested that with only modest editing and reorganisation the content of this report would comprise a good general guide to the geological heritage of County Roscommon, in similar style to those books and booklets produced in Sligo, Meath, Fingal and Waterford, following audits.**



This guide to Slieve Bawn does briefly describe the geological history of the landscape in which cultural features are explored.

Signboards

Simple explanatory or interpretive signboards may be advisable at key geological heritage locations, but if these are considered, their locations and individual siting should be very selective, since a proliferation of different interest groups may provoke a 'rash' of panels all over the county. The Planning Section should clearly have a controlling input, in conjunction with the Heritage Office. It is most likely that a panel combining various heritage interests at a place is preferred to single interest panels. It is important to consult with potential partners in the planning stage so that duplication does not occur.

The subject of panels, and the integration of text and graphics are a fine art to complete successfully, and the IGH Programme can offer input if signs are planned for key visitor localities. The authors of this report are also able to write, review or provide content on geological heritage for any proposed panels.

Aside from the full public presentation of the Arigna Mining Experience, at present the only geological site known to the authors where some panel signs include an element of geology are at Loughaneane. This turlough area immediately west of Roscommon town has a castle and wildlife interest, and is managed by Roscommon County Council. Signboards about the turlough have a cursory explanation of the geological functioning of turloughs.

Museum exhibitions

As a result of the work to produce this report, the material for a panel based exhibition has been largely compiled. With some extra research covering human dependence on geology and resources, an interesting exhibition can be put together for display in the Roscommon Museum, Council offices or County Library branches. The model followed was that produced for Carlow and for Dun Laoghaire-Rathdown. Images of these can be seen on the geological heritage section of the GSI website [www.gsi.ie].

New media

There are increasing numbers of examples of new methods of promoting Earth Sciences, via mobile phone applications and other electronic media. Self guiding apps on specific sites would be one of these, such as those produced by Ingenious Ireland for Dublin city geology and for other sites. Plans for such products would require some considerable effort to produce and imaginative effort, with the sites being scattered across the county. Linking together turlough sites or eskers would seem the most likely targets for consideration.

Earth Science Ireland Group and magazine [www.earthscienceireland.org]

The group Earth Science Ireland is an all-Ireland group promoting awareness of earth sciences and supporting educational provision in the subject. A main vehicle for the efforts is the twice a year magazine *Earth Science Ireland* and this is distributed free to thousands of individuals, schools, museums, centres and organisations. The editors would welcome more material from the Republic of Ireland and on Roscommon's geological heritage.

Geoschol website [www.geoschol.com]

Geoschol is an educational project, now essentially represented by a website, which was largely aimed at producing educational materials on geology for primary schools. A four page **pdf** summarising the geology and some highlights of Roscommon is already part of the available material. If no material is available to add, then at least working links to

Roscommon County Council website Heritage section, and to other heritage websites should be established.

A summary of the Geology of Roscommon

1) Paragraph summary

The geology of Roscommon is dominated by 330 million years old limestones from the Carboniferous Period. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. The limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. Only in the north of the county around Lough Allen are there younger rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface was then emerged for nearly 300 million years and many of these rocks eroded down to their present level. The most significant force to shape the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets were covering the county and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, also with large fans of sand and gravel. Since then, the limestone bedrock under the glacial sediments has become markedly dissolved, a process known as karstification. Water solution of the rock formed some caves, and in some larger lakes formed unusual mushroom shaped stones. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Geological processes continue to modify the landscape such as with seasonal flooding of the Shannon and Suck River Callows.

2) Simple summary

The geology of Roscommon is absolutely dominated by 330 million years old limestones from the Carboniferous Period. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. These include two inliers (older rocks entirely surrounded by younger rocks) north-east of Strokestown and at Slieve Bawn. These rocks are of Ordovician age and are the remnants of a former ocean floor and the roots of a long since vanished mountain chain. They are related to rocks throughout Longford, Down, and into the Southern Uplands of Scotland, but as they occupy such a small area in Roscommon, their story is best told in detail elsewhere.

Surrounding them are some Devonian age rocks, sandstones and gravels laid down by flash floods in a poorly vegetated environment. Both Ordovician rocks and Devonian rocks are partly preserved because they have been lifted up on one side of the Strokestown Fault, which is a visible geological structure in the county, because the older, more resistant rocks form Slieve Bawn.

The Carboniferous limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. The uniform nature of these beds both across wide areas and

vertically in thickness makes it difficult to map different geological formations, and they are often simply considered as 'shelf' limestones, from an open, shallow sea.

Only in the north of the county around Lough Allen are there younger solid rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface then emerged for nearly 300 million years and many of these rocks were eroded down to their present level. Only small parts of the country now remain covered by these coalfield rocks, primarily the Castlecomer plateau in Kilkenny, the Arigna district in Leitrim and the northern tip of Roscommon.

The most significant force to shape the form of the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets covered the county for thousands of years and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, adjacent to large fans and deltas of sand and gravel. Eskers were formed by sub-glacial rivers, that is, they flowed in tunnels at the base of the ice sheets. Some eskers are small and local within Roscommon, but others form extended networks and cross several counties.

Some Ice Age features define the landscape character of large areas yet are so large they can almost only be seen when using satellite or air photo images. One example is a very fine discrete field of drumlins near Boyle. These whale back elongated ridges of glacial till were left by the ice sheets which covered the county. Even larger ribbed moraines, on a kilometre scale, are present across mid Roscommon, but these need a trained eye to discriminate them from remotely sensed images.

Since the Ice Age, the exposed limestone has developed into what is termed karstified bedrock. Water solution of the rock formed some caves, widespread collapse features and enclosed depressions called dolines. Where some larger, temporary lakes were formed when meltwater was prolific, unusual mushroom shaped stones were created by dissolution of the rock that was submerged. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon and Suck River Callows.

3) Extended summary

Although the geology of Roscommon is absolutely dominated by 330 million years old limestones from the Carboniferous Period, there are much older rocks extending back to nearer 500 million years ago, within the county. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. These include two inliers (older rocks entirely surrounded by younger rocks) north-east of Strokestown and at Slieve Bawn. These rocks are of Ordovician age and are the remnants of a former ocean floor and the roots of a long since vanished mountain chain. They are related to rocks throughout Longford, Down, and into the Southern Uplands of Scotland, but as they occupy such a small area in Roscommon, their story is best told in detail elsewhere.

Surrounding them are some Devonian age rocks, sandstones and gravels laid down by flash floods in a poorly vegetated environment. Both Ordovician rocks and Devonian rocks are partly preserved because they have been lifted up on the east side of a fault, and are now preserved as the more resistant hills known as Slieve Bawn. In the Curlew Mountains north of Boyle and westward through Sligo to Ballaghderreen is a faulted block of the Devonian rocks, uplifted in relation to the limestones either side of the block. The Devonian rocks are mostly sandstones and pebble conglomerates, but include some volcanoclastic rocks; rock material erupted by volcanos but then carried and deposited as sedimentary rocks like the sandstones. The Boyle Road Cutting is a good place to see these rocks.

The Carboniferous limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. The uniform nature of these beds both across wide areas and vertically in thickness makes it difficult to map different geological formations, and they are often simply considered as 'shelf' limestones, from an open, shallow sea. These limestone rocks are present below the surface of the largest part of Roscommon, but are actually rarely exposed. The veneer of glacial sediments hides them, so the few rock quarries such as Keeloges, Castlemine and Largan are important examples of what the subsurface is actually like.

Only in the north of the county around Lough Allen are there younger solid rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface then emerged for nearly 300 million years and many of these rocks eroded down to their present level. Only small parts of the country now remain covered by these coalfield rocks, primarily the Castlecomer plateau in Kilkenny, the Arigna district in Leitrim and the northern tip of Roscommon. Two County Geological Sites in Roscommon are representatives of this geology. The Arigna Mining Experience is a superb place to fully appreciate the underground geology of coal deposits and the mining heritage of the district. Altagowlan, which is Roscommon's portion of a wider upland area along the Sligo county boundary, exemplifies the place of coal in the energy supply of human society, now visibly met by windfarm turbines scattered through the old coal mine features.

The most significant force to shape the form of the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets covered the county for thousands of years and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, adjacent to large fans and deltas of sand and gravel, such as at Cloonburren Fan, McKeon's Pit and the Cloonagh and Errit Loughs Deltas. The fans and deltas now stand out as high ground with good grass amongst the boggy lake margins. Eskers were formed by sub-glacial rivers, that is, they flowed in tunnels at the base of the ice sheets. Some eskers are small and local within Roscommon, but others form extended networks and cross several counties. The Ballinasloe-Split Hills-Clonmacnoise-Clara Esker System is the most extensive of them, but the Garranlahan Esker is also large and complex. The Castlesampson Esker is smaller but equally valuable as an untouched example of the landform.

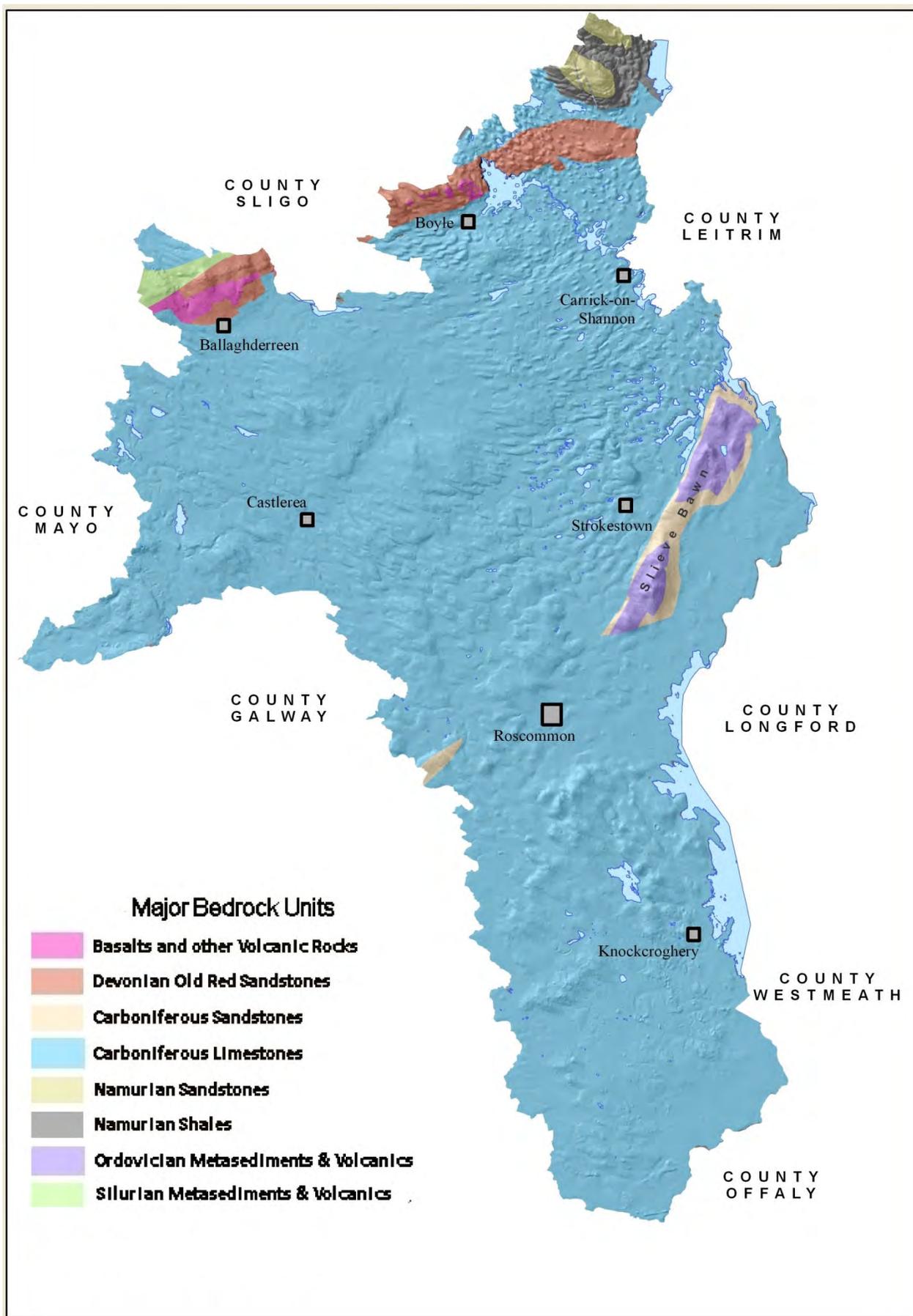
Some Ice Age features define the landscape character of large areas yet are so large they can almost only be seen when using satellite or air photo images. West of Boyle for example is a very fine discrete field of drumlins. These whale back elongated ridges of

glacial till were left by the ice sheets which covered the county. On the ground they form low relief, breaking up any long vistas, but from above or on a map with shaded relief they clearly show the sweeping passage of ice movements. Even larger ribbed moraines, on a kilometre scale, are present across mid Roscommon, but these need a trained eye to discriminate them from remotely sensed images.

Since the Ice Age, the exposed limestone has developed into what is termed karstified bedrock. Water solution of the rock formed some caves, widespread collapse features and enclosed depressions called dolines. Where some larger, temporary lakes were formed when meltwater was prolific, unusual mushroom shaped stones were created by dissolution of the rock that was submerged. Carrowmurragh and Moyvannan Mushroom Stones near the shores of Lough Ree demonstrate it previously once had a far greater extent. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Good geological examples of these include Brierfield, Loughnaneane, Mullygollan and Castleplunkett Turloughs. A special kind of turlough exists at Lough Funshinagh which is a disappearing lake. Rather than seasonal fluctuations it occasionally drains entirely as if someone had pulled the plug in the bath. A kind of pseudo karst landscape has been identified around Killeglan west of Athlone. This is a unique site with limestone boulder ridges formed as glacial deposits. Large parts are untouched and represent a pristine landscape of Roscommon before human intervention and land clearance and enclosures.

Geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon and Suck River Callows. Slow build-up of alluvial sediments and meandering of the river course can change a landscape scene in human lifespans. Collapses of limestone into cavities beneath are more sudden events and occur in some areas, but such holes are often quickly filled in by farmers and landowners. The most active but unseen geological process going on is the movement of groundwater. Since Roscommon has one of the highest percentages of water supply from groundwater, such as from Rockingham Spring, immense care is needed not to pollute the supply from badly maintained septic tanks or farm practices, as limestone areas are very vulnerable to such destruction of a valuable geological resource. Another geological resource, apart from limestone, coal and groundwater, which was formerly exploited, is the clay deposit at Lecarrow. The Knockcroghery clay pipe industry once supplied pipes for smoking tobacco to all of Ireland from this ancient clay preserved in a karstic doline.

AGE (Million Years Ago)	ERA	PERIOD	EVENTS IN ROSCOMMON	IF THIS TIMESCALE WERE A DAY LONG ...
2	Cenozoic	Quaternary	Several ice ages smothering Roscommon, followed in the last 10,000 years by the spread of vegetation, growth of bogs and arrival of humans. Deposition of ribbed moraines drumlins and eskers. Dissolution of limestone beneath Quaternary sediments.	The ice ages would begin 38 seconds before midnight
65		Tertiary	Erosion, especially of limestone. Caves, cavities and underground streams developing in mid-Roscommon. Potential deposition of clay at Lecarrow, near Lough Ree.	The Tertiary period begins at 11.40 pm
145	Mesozoic	<i>Cretaceous</i>	<i>Erosion. No record of rocks of this age in Roscommon.</i>	11.15 pm
205		<i>Jurassic</i>	<i>Uplift and erosion. No record of rocks of this age in Roscommon.</i>	The age of the dinosaurs, starting at 10.55 pm
250		<i>Triassic</i>	<i>Desert conditions on land.</i>	10.42 pm
290	Palaeozoic	<i>Permian</i>	<i>No record of rocks of this age in Roscommon.</i>	10.30 pm
355		Carboniferous	Land became submerged, limestones with some shales and sandstones deposited in tropical seas across much of Roscommon. Limestones remaining today are pure and unbedded in the majority, with smaller areas of muddier limestones at the edges. Shales and sandstones with coal seams deposited in Arigna district.	Much of Roscommon's current rocks (limestone, sandstone and shale) deposited around 10.10 pm
410		Devonian	Caledonian mountain building. Sandstones deposited in the Curlews and north of Ballaghderreen.	'Old Red' Sandstone deposited at 9.52 pm
444		Silurian	Shallow seas, following closure of the Iapetus Ocean. Greywacke and shales deposited at Bohalas in the northwest of the county.	Starts at 9.42 pm
488		Ordovician	Shales, slates, siltstones and volcanic rocks form across the Slieve Bawn ridge.	Begins at 9.28 pm
542	Proterozoic	Cambrian	Opening of the Iapetus Ocean. <i>No record of rocks of this age in Roscommon.</i>	Starts at 9.11 pm
2500		<i>Precambrian</i>	<i>Some of Ireland's oldest rocks deposited in Mayo and Sligo.</i>	Beginning 11.00 am
4000		Archaean	<i>Oldest known rocks on Earth.</i>	Beginning 3.00 am
4600	<i>Age of the Earth.</i>		Beginning 1 second after midnight	



A simplified geology map of Roscommon outlining the main geological units.

Geological heritage versus geological hazards

Ireland is generally considered to be a country with very low risk of major geological hazards: there are no active volcanoes, stable tectonic plates mean earthquakes are relatively rare and Ireland's broad human history is not peppered with disastrous landslides, mudflows or other geological hazards. Yet there are of course risks of one-off events, and this section briefly looks at the specific record and nature of geological hazards in Roscommon and the relationship of the County Geological Sites to those hazards.

The difference between human timescales and geological timescales can be difficult to comprehend but for many geological processes they can be suddenly active with major events, and quiet periods in between. Many of the sites in this audit represent evidence of past environments and geological processes, such as tropical coral seas, swampy deltas glacier erosion of the land surface and so on. However, some sites represent the active geomorphological or land-forming processes of today. These sites, generally coastal in many counties, but mainly karstic or rivers in Roscommon, are dynamic environments and can be subject to constant or intermittent change.

Landslides and bog flows

The Geological Survey of Ireland has been compiling national data on landslides in the past decade. Occasional landslides and bog slides are both recorded in Roscommon, in the Arigna area especially.

Flooding

There are two types of flooding which need consideration.

River flooding occurs inland when the rainfall exceeds the capacity of the ground to absorb moisture, and the river channels cannot adequately discharge it to the sea. The OPW website www.floods.ie can be consulted for details of individual flood events in County Roscommon. Some 239 events are recorded across the entire county. Many of these are predictable, seasonal events in the floodplains of the River Shannon and the River Suck. They are vital to the biodiversity of these floodplain areas, known as Callows. Both plant and birdlife is dependent on the wetland habitats along the river banks. As the flooding of the river floodplains is essentially an active geological environment, we have included some representative examples as County Geological Sites.

Karstic flooding can occur when underground passages are unable to absorb high rainfall events. The karst in Roscommon has few caves, yet the abundance of springs, swallow holes and dolines, as well as the karstification seen in some quarries such as Largan Quarry, indicates that the limestone is heavily karstified. In Largan Quarry, as well as the highly weathered epikarst zone nearest the surface, deep expanded joints and fissures are evident, although many have clay rich sediment fills.

There are numerous known turloughs in Roscommon, which are seasonal lakes where the water table intersects the land surface. The Ordnance Survey of Ireland six inch to the mile mapping records many areas as 'liable to flooding' in the karstic landscapes. However, the 1:50,000 Ordnance Survey of Ireland Discovery Series maps are drawn from aerial photographs and are very poor in accurately delimiting such turloughs. These turloughs indicate seasonal variation in the ground water table. The normal pattern is for them to be

lakes in winter and dry grassland in summer, although localised weather/rainfall patterns may mean they are wet in summer too.

Karstic collapse

This is a very real, but localised hazard in parts of Roscommon. In the county there is limestone often only a few metres or less beneath the land surface. The number of known caves in the limestone is very few, but in certain areas such as Mewlaghmore near Castlerea, there are hundreds of karstic features called dolines. These are enclosed depressions with no surface water drainage associated with them. Some form by slow dissolution of the underlying limestone rock, but others can be formed as rapid collapse events.

When they occur, they are often not reported and just filled in by farmers so we have little information on the frequency with which they happen. A record of one such area at Lissananny, north of Castlerea, indicated that collapses frequently occurred but were filled in as rapidly by the landowner. Similarly a verbal communication engaged in with the authors while compiling this report, of a new housing development at Lisacul, included an account of massive collapse openings which were then filled in with rock by the developer before the houses were built.

Groundwater pollution

Whilst not such an obvious hazard as physical collapses, flooding and landslides, the pollution of groundwater supplies carries a serious risk to human health. Roscommon is one of the counties most dependent on groundwater supplies, and therefore the risk is more serious than for most other counties. As the groundwater is largely contained within limestone, it should be noted that karstic springs are especially vulnerable to pollution since the flow is mainly within fissure conduits allowing rapid transmission of pollution from source to water supply. The opportunity for microbial attenuation of pollutants is far less in limestone fissures (as there are no natural barriers to stop pollutants) than it would be in granular deposits, which act as natural filters.

Glossary of geological terms

Geological term	Definition
Adit	a horizontal or only gently inclined mine tunnel dug to access coal or mineral ore, or to drain, ventilate or further develop a mine.
Alluvial Deposit	unconsolidated clay, silt, sand and gravel, deposited by a body of running water.
Alluvium	a term for unconsolidated clay, silt, sand and gravel, deposited by a body of running water.
Aquifer	a water saturated rock unit.
Bead (of an esker)	a segment of an esker.
Bedding Plane	the contact between individual beds of rock.
Bedrock	a general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
Biostratigraphy	using fossils to define the succession of rocks.
Blanket Bogs	bog covering a large, fairly horizontal area, which depends on high rainfall or high humidity, rather than local water sources for its supply of moisture.
Boulder Clay	unconsolidated, unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock or silt. Also known as till.
Brachiopods	a marine invertebrate of the phylum Brachiopoda - a type of shellfish. Ranging from Lower Cambrian to present.
Braided River	a river that consists of a network of small channels separated by small and often temporary islands.
Bryozoa	invertebrates belonging to the phylum Bryozoa, ranging from Ordovician to present, often found as frond-like, net-like or stick-like fossils.
Calcareous	containing significant calcium carbonate.
Calcite	a pale mineral composed of calcium carbonate, which reacts with dilute acid.
Callows	riverside meadows which dry in summer but flood in winter.
Carbonate	a rock (or mineral), most commonly limestone (calcite) and dolomite.
Cave	a natural underground space large enough for a human to enter, which is usually formed in either soluble limestone by karstic processes, or in exposed rock along the coastline, where the sea erodes natural rock fractures.
Chattermarks	crescent shaped marks on a rock surface made at the base of a glacier
Clast	an individual constituent, grain or fragment of a sediment or rock, usually produced by mechanical weathering (disintegration) of a larger rock mass.
Cleavage	a finely spaced, flat plane of breakage caused by compressive deformation of rocks. e.g. the splitting of slate.
Clint	tabular block of limestone in a limestone pavement.
Conglomerate	sedimentary rock comprising of large rounded fragments in a finer matrix.
Crinoid	a variety of sea-urchin, with a long flexible stem, usually anchored to the sea-floor and a body cup with arms which may be branching (a sea lily).
Cross-bedding	layering in sedimentary rocks at an inclined angle to bedding formed by current-ripples.
Crust	the outermost, solid, layer of the Earth.
Delta	a usually triangular alluvial deposit at the mouth of a river, or a similar deposit at the mouth of a tidal inlet, caused by tidal currents.
Dip/dipping	when sedimentary strata are not horizontal they are dipping in a direction and the angle between horizontal and the inclined plane is measured as

	the dip of the strata or beds.
Doline	circular/oval closed depression found in karst terrain.
Dolomite	calcium and magnesium bearing carbonate mineral; also a rock composed of the mineral.
Drumlin	a streamlined mound of glacial drift, rounded or elongated in the direction of the original flow of ice.
Epikarst	the shallow layer, near surface, of highly karstified rock, with many voids included.
Erratic	a rock fragment, often large, that has been transported, usually by ice, and deposited some distance from its source. It therefore generally differs from the underlying bedrock, the name "erratic" referring to the errant location of such boulders. Tracing their source can yield important information about glacial movements.
Esker	a long, narrow ridge of coarse gravel and sand deposited by a stream flowing in or under a decaying glacial ice sheet.
Facies	the character of the rock derived from its original sedimentary environment and process of deposition.
Fan	a usually triangular deposit of sand and gravel deposited by a glacial stream, either under a lake or under air.
Fault	planar fracture in rocks across which there has been some displacement or movement.
Fault Zone	a tabular volume containing many faults and fault rocks (rocks broken up by fault movement).
Fauna	collective term used to group all animal life.
Floodplain	a flat or nearly flat land area adjacent to a stream or river that experiences occasional or periodic flooding.
Flowstone	calcite or other minerals deposited as a surface crust by water flowing over cave or mine walls and floors.
Fluvial	pertaining to a river or stream.
Fold(ing)	flexure in layered rocks caused by compression.
Formation	a formal term for a sequence of related rock types differing significantly from adjacent sequences.
Fossiliferous	rich in fossils.
Fossils	any remains, trace or imprint of a plant or animal that has been preserved in the Earth's crust since some past geological or prehistorical time.
Glacial	of or relating to the presence and activities of ice or glaciers.
Grading	a sorting effect with the coarsest material at the base of the bed and finest grained material at the top.
Greywacke	an impure sandstone, characterised by poorly-sorted, angular grains in a muddy matrix, that was deposited rapidly by turbidity currents (submarine avalanches).
Grike	a solutionally widened vertical fracture separating clints on a limestone pavement.
Gully	a deep valley created by running water eroding sharply into bedrock or subsoil.
Haematite	a mineral form of iron oxide, which is the main ore mined as iron.
Horizon	may refer to a single layer of rock such as a coal seam, an ash layer, or other geological 'event'.
Head	weathered rock fragments accumulated on lower slopes from periglacial freezing and thawing action acting with gravity.
Hummock	a small hill or knoll in the landscape, which may be formed by many different processes.

Ice margin	the edge of an ice sheet or glacier.
Igneous	a rock or mineral that solidified from molten or partially molten material i.e. from a magma.
Interglacial	the time interval between glacial stages, or pertaining to this time.
Joint	a fracture in a rock, which shows no evidence of displacement.
Kame-kettle	an irregularly shaped hill or mound composed of sand, gravel and till that accumulates in a depression on a retreating glacier, and is then deposited on the land surface with further melting of the glacier. Kames are often associated with kettles, and this is referred to as <i>kame and kettle</i> topography.
Karst	general term used for landscapes formed by weathering of soluble rocks, usually limestone, by surface water and/or groundwater.
Kettle hole	a shallow, sediment-filled body of water formed by retreating glaciers or draining floodwaters.
Knoll	a small hill or hillock sticking up from generally flat terrain.
Laminated	the finest example of stratification or bedding, typically exhibited by shales and fine-grained sandstones.
Limestone	a sedimentary rock consisting chiefly of calcium carbonate (CaCO ₃), primarily in the form of the mineral calcite. It is mostly formed by the accumulation of calcareous shells, cemented by calcium carbonate precipitated from solution.
Lithification	the process of rock formation from unconsolidated sediment.
Lithology	the description of rocks on the basis of such characteristics as colour, composition and grain size.
Lodgement	process by which debris is released from the sliding base of a moving glacier/ice sheet and plastered or 'lodged' onto the glacier bed; also describes tills emplaced by this process (i.e. lodgement till).
Maze cave	a cave formed in an extensive grid pattern when slow moving water.
Melt-out	process by which glacial debris is very slowly released from ice that is not sliding or deforming internally; also describes tills emplaced by this process (i.e. melt-out till).
Metamorphic	referring to the process of metamorphism or to the resulting metamorphic rock, transformed by heat and pressure from an originally igneous or sedimentary rock.
Misfit stream	a stream which is too small to have eroded the valley in which it flows, as is often the case with streams now flowing in meltwater channels.
Moraine	any glacially formed accumulation of unconsolidated debris, in glaciated regions, such as during an ice age.
Mudmound	Waulsortian limestone of Carboniferous age is characterised by forming as massive mounds or ridges or sheets of carbonate mud on the seafloor of the time. Mudmound is a general term to describe the varieties of forms.
Mudstone	a very fine grained sedimentary rock, containing quartz and clay minerals. Similar to shale, but not as easily split along the plane of bedding.
Mushroom rock	a mushroom shaped rock, or undercut limestone rock, formed by dissolution of a rock partially submerged in a lake.
Ore	a mineral which is concentrated enough to be exploited by mining.
Orogeny	the creation of a mountain belt as a result of tectonic activity.
Outcrop	part of a geologic formation or structure that appears at the surface of the Earth.
P-form	plastically moulded, smooth-walled, linear depressions which may be straight, curved, or sometimes hairpin-shaped and measure tens of centimetres to metres in width and depth, formed under ice sheets.
Periglacial	very cold but non-glacial climatic conditions.
Phreatic	when a cave passage or void space in limestone rocks is filled with water it

is said to be phreatic or in the phreas. When later found without water in them such passages have a characteristic cylindrical shape from solution in all directions and are called phreatic tubes.

Phreatic Zone	the area below the water table, where the rock is completely saturated with water.
Plate Tectonics	a theory that states that the crust is divided up into a number of plates, whose pattern of horizontal movement is controlled by the interaction of these plates at their boundaries with one another.
Pyrite	iron sulphide, pale yellow/gold coloured mineral, commonly occurring as cubes and often called 'fool's gold'.
Sandstone	a fine to coarse sedimentary rock, deposited by water or wind, and composed of fragments of sand (quartz grains), cemented together by quartz or other minerals.
Sandur	a plain formed of glacial sediments deposited by meltwater outwash at the terminus of a glacier.
Sedimentary	a rock formed by the deposition of sediment, or pertaining to the process of sedimentation.
Shaft	a vertical hole dug in a mine for access, ventilation, for hauling ore out or for pumping water out.
Shale	a very fine-grained mudstone, containing quartz and clay minerals, that splits easily along the plane of bedding.
Siltstone	is similar to mudstone but with a predominance of silt-sized (slightly coarser) particles.
Sink	another name for a swallow hole, the point where a stream passes underground.
Sluggera	a tube-like collapse of the Earth's surface into an underground cavity, which has formed by the dissolution of limestone.
Slumping	the movement of a mass of unconsolidated sediment or rock layers down a slope, or pertaining to contorted sedimentary bedding features.
Solution pipe	a karstic feature of solution in a vertical narrow chimney or pipe shape.
Spring	the point where an underground stream reaches the surface.
Stratigraphy	the study of stratified (layered) sedimentary and volcanic rocks, especially their sequence in time and correlation between localities.
Sub-aerial	refers to processes occurring above ground level, such as the weathering of rocks.
Subduction	the sinking of one crustal plate beneath the edge of another through the process of plate tectonics.
Subsidence (zone)	the sudden sinking or gradual downward settling of the Earth's surface with little or no horizontal movement.
Swallow hole	the point where a stream passes underground, sinking below the ground surface.
Terrestrial	pertaining to the Earth's dry land.
Till	unconsolidated, unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock as sand, silt or clay also known as boulder clay.
Transgression	an incursion of the sea over land area.
Trilobites	extinct arthropods.
Turbidite	deposit of a turbidity current.
Turbidity Current	underwater density current carrying suspended sediment at high speed down a subaqueous slope. The resulting deposit is called a turbidite.
Turlough	a seasonal lake that fills and empties through springs and sinkholes.
Unconformable	a sedimentary rock that is not following in sequence from the one below but has a significant time gap present between them.

Unconformity	a buried erosion surface separating two rock masses or strata of different ages, indicating that sediment deposition was not continuous.
Vadose Zone	the area between the surface and the water table.
Vein quartz	white thin veins of quartz injected in rock fractures during episodes of stress. Also found as durable beach pebbles, once it has been eroded.
Volcanic Rock	any rock produced from volcanic material, e.g. ash, lava.
Volcaniclastic	rock material was derived from a volcanic eruption, but the rock was deposited as a sedimentary rock like a sandstone, as an aggregate of small particles.
Volcanism	the process by which magma and its associated gasses rise into the crust and are extruded onto the Earth's surface and into the atmosphere.
Volcano	a vent in the surface of the Earth through which magma and associated gasses and ash erupt.

Data sources on the geology of County Roscommon

This section is a brief summary of relevant GSI datasets, to assist any enquiry concerning geology and to target possible information easily. The GSI has very many datasets, accumulated since it began mapping Ireland's geology in 1845. A Document Management System (DMS) is freely available to any person at the GSI Customer Centre, into which about half a million documents and maps have been scanned. This means that any user can visit the GSI Customer Centre themselves and search on screen for data of relevance to them. High quality colour and black and white print-outs can be made or data supplied on CD, or via USB keys etc. **Data is available free of charge.** It is planned to make this resource available online but no date is yet set for when this may be achieved.

Key datasets include:

1:100,000 Map Report Series

All historical, modern and other mapping has been compiled into very useful maps and reports that describe the geology of the entire country. Parts of Sheets 7 and 15 include northern and southern Roscommon respectively but the majority of the county is on Sheet 12.

19th century 6 inch to the mile fieldsheets

These provide an important historical and current resource, with very detailed observations of the geology of the entire country.

19th century one inch maps and Memoirs

Information from the detailed 19th century mapping was distilled into one inch to the mile maps, of which parts of Sheets 65, 66, 67, 76, 77, 78, 86, 87, 88, 97, 98, 107 and 108 cover County Roscommon. Each sheet or several sheets were accompanied by a Memoir which described the geology of that area in some detail. These still provide valuable records of observations even though interpretations may have changed with better geological understanding. Memoirs are in the Customer Centre library and scanned on the DMS.

Historical geological mapping is now available via a website:
<http://www.geologicalmaps.net/irishhistmaps/history.cfm>

Open File Data

Each Mineral Prospecting Licence issued by the Exploration and Mining Division of the Department of Communications, Energy and Natural Resources (currently) carries an obligation on the exploration company to lodge records of the work undertaken, for the common good. These records are held by the Geological Survey and are available as Open File Data, once a period of time has expired. They may include geological interpretations, borehole logs, geophysical and geochemical surveys and so on.

MinLocs Data

The MinLocs Database records all known mineral occurrences, however small, from GSI records, such as 19th century fieldsheets and Open File data.

Historic Mine Records

Abandonment plans and varied other material exists for the various coal mining ventures in the county, particularly in the Arigna district.

Subsoils Mapping

Since a Groundwater Protection Scheme has been completed for County Roscommon by GSI, a recently completed map of the subsoil types and depths across Roscommon exists, as well as the previously completed bedrock mapping. This provides a significant resource in general terms as well as for groundwater protection. Customised output is possible. Further more detailed compilation of glacial geology datasets will provide more options in the near future.

Digital mapping of many different datasets is now available via the GSI website: www.gsi.ie

Shortlist of Key Geological References

This reference list includes a few **key** papers, books and articles on the geology and geomorphology of Roscommon that are recommended as access points to Roscommon's fabulous geological heritage.

DALY, D., DREW, D.P., DEAKIN, J., PARKES, M. and WRIGHT, J. 2001. *The Karst of Ireland; Limestone Landscapes, Caves and Groundwater Drainage Systems*. Karst Working Group Dublin, 37pp.

GATLEY, S., SOMERVILLE, I., MORRIS, J.H., SLEEMAN, A.G. and EMO, G. 2005. Geology of Galway-Offaly and adjacent parts of Westmeath, Tipperary, Laois, Clare and Roscommon: A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 15, Galway-Offaly. Geological Survey of Ireland. Vii + 90pp.

HOLLAND, C.H. (ed.). 2001. *The Geology of Ireland*. Dunedin Academic Press, Edinburgh.

MacDERMOT, C.V., LONG, C.B. and HARNEY, S.J. 1996. *Geology of Sligo-Leitrim*. Geological Survey of Ireland Bedrock Geology Sheet 7.

MITCHELL, G.F. and RYAN, M., 1997. *Reading the Irish Landscape*. Town House Press, 397 pp.

MORRIS, J.H., SOMERVILLE, I.D. and MacDERMOT, C.V. 2003. *Geology of Longford-Roscommon*. Geological Survey of Ireland Bedrock Geology Sheet 12.

Full Geological references

See Appendix 2 for the full reference list of all papers, books, articles and some unpublished reports etc relating to the geology and geomorphology of Roscommon that could be traced.

Caving References

The references in Appendix 3 relate significantly to caves and caving within the Roscommon area. They may only be brief reports or newsletter items. They are generally available within the Speleological Union of Ireland Library which is housed in the Geological Survey of Ireland and is managed by Matthew Parkes.

Mining heritage references

Appendix 2 includes some references specifically pertaining to the mining heritage of County Roscommon. Assistance with locating these references may be provided by the Mining Heritage Trust of Ireland if required.

Quaternary References

The references in Appendix 4 are all covering the Quaternary, or Ice Age, geology of Roscommon. They are split into the specific ones covering Roscommon sites or features and a section of national or regional papers with some Roscommon data included.

Further sources of information and contacts

Sarah Gatley of the Geological Survey of Ireland, who is the Head of the Geological Heritage and Planning Section, can be contacted in relation to any aspect of this report. Nollaig Feeney, the Heritage Officer of Roscommon County Council is the primary local contact for further information in relation to this report. Other contacts include the Conservation Rangers of the National Parks and Wildlife Service, currently in the Department of Arts, Heritage and the Gaeltacht. The names and phone numbers of current staff may be found in the phone book, or at www.npws.ie.

Web sites of interest

www.gsi.ie - for general geological resources

www.geology.ie – the website of the Irish Geological Association who run fieldtrips and lectures for members, including many amateur enthusiasts

www.earthscienceireland.org - for general geological information of wide interest [this website address is likely to change in 2012/2013. Suggestion search for 'Earth Science Ireland']

<http://www.iqua.ie> - for information, fieldtrips, lectures etc in relation to Ireland's Ice Age history

<http://www.cavingireland.org/> - for information on caves and safe caving

<http://www.progeo.se/> - for information about ProGEO the European Association for the Conservation of Geological Heritage

Acknowledgements

The authors would like to gratefully acknowledge the assistance of Nollaig Feeney, Heritage Officer from Roscommon County Council in the development of this project. Funding from the Heritage Council and Roscommon County Council is also acknowledged. We also acknowledge the many members of the IGH Programme Expert Panels who helped define the sites which were considered for County Geological Site status. Sarah Gatley in the Geological Heritage and Planning Section of GSI also provided invaluable support and guidance throughout the project.

Section 2 - Site Reports

Site reports – general points

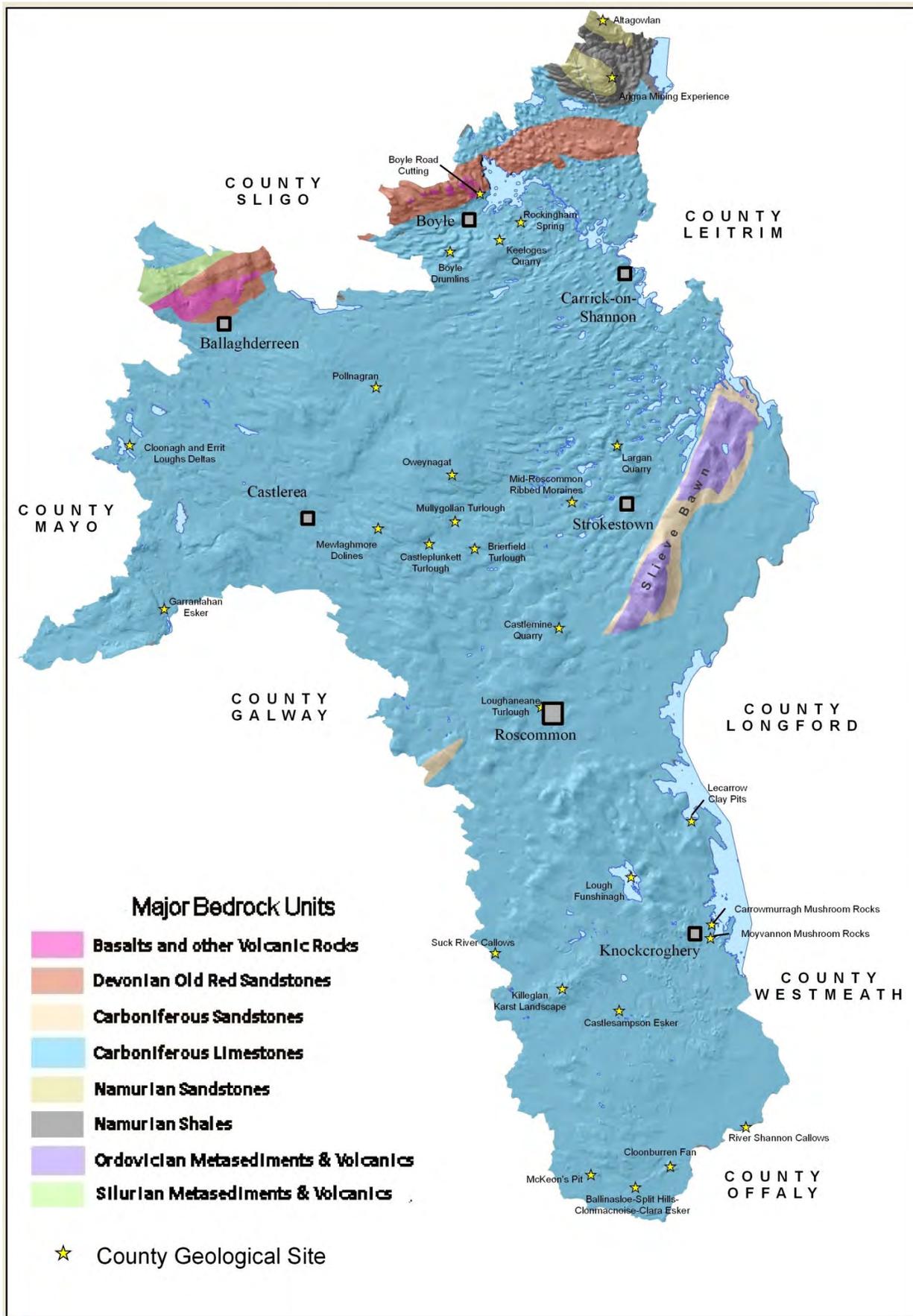
The following site reports are brief non-technical summaries of the proposed County Geological Sites for County Roscommon. These have been specially prepared for this Report in order to make the information accessible to planners and others without geological training. For most sites more detailed reports and information files are held in the IGH Section in the Geological Survey of Ireland. These are available for consultation if required. Further sites may become relevant as IGH Programme work develops.

Each site report has primary location information, a mention of the main rock types and their age, and a short description of the key aspects of scientific interest. A section outlining any particular management or other issues specific to the site is included, along with one or two low resolution photographs exemplifying the site. **A CD accompanying this report will include further pictures of most sites at higher resolution, should they be required for a glossy booklet or leaflet for the general public.** Grid references are given normally for a central point in the site, if the site is small, or two extreme points at opposite ends of the site if the site is extensive or linear. They are only indicative of the location, but the site extent is best shown on the included maps.

A series of maps are provided with an outline of the site boundary. It is important to note that no legal or definitive basis should be based on these boundaries. They are indicative only of the limits of exposure or of geological interest, and not based on detailed field and boundary surveys, which were outside the scope of this contract.

For sites that have been proposed or will be proposed for NHA designation detailed site boundary maps will become available to the Local Authority, through NPWS as the designation process is undertaken. Some areas may already be available if they are proposed NHAs (pNHA), under the Wildlife (Amendment) Act 2000. Areas which have been designated as Special Areas of Conservation (SAC) under European Habitats Directives will also have statutory boundaries already determined. The geological interest may be included within the wider area of nature conservation.

In terms of any geological heritage site designation as NHA, due process of site reporting, boundary survey and very importantly, consultation with landowners where they can be readily identified, will take place before GSI makes recommendations to NPWS on the most important sites to be designated. Any landowner within areas or sites identified in this report with concerns over any aspect of this project is encouraged to contact Sarah Gatley, Head of the Heritage and Planning Section, in the Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4. Phone 01-6782837. Email: sarah.gatley@gsi.ie



Simplified Geological Map of Roscommon with site locations indicated.

The Geological Heritage of Roscommon

An audit of County Geological Sites in Roscommon

By Matthew Parkes, Robert Meehan and Sophie Préteseille
October 2012



The Roscommon Geological Heritage Project was supported by

An Chomhairle Oidhreachta
The Heritage Council



This report is an action of the
County Roscommon Heritage Plan 2012-2016

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For the:
Irish Geological Heritage Programme
Geological Survey of Ireland
Beggars Bush
Haddington Road
Dublin 4
01-6782837 / 01-6782741

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Section 2 – Site Reports

IGH 1 Karst

Site Name

Brierfield Turlough

Castleplunkett Turlough

Carrowmurragh Mushroom Rocks

Killeglan Karst Landscape

Lough Funshinagh

Loughnaneane Turlough

Mewlaghmore Dolines

Moyvannon Mushroom Rocks

Mullygollan Turlough

Oweynagat

Pollnagran

Rockingham Spring

IGH 2 Precambrian to Devonian Palaeontology

Site Name

Not represented in Roscommon

IGH 3 Carboniferous to Pliocene Palaeontology

Site name

Not represented in Roscommon

IGH 4 Cambrian-Silurian

Site name

Not represented in Roscommon

IGH 5 Precambrian

Site name

Not represented in Roscommon

IGH 6 Mineralogy

Site Name

Not represented in Roscommon

IGH 7 Quaternary

Site Name

Ballinasloe-Split Hills-Clonmacnoise-Clara Esker System

Boyle Drumlins

Brierfield Turlough (see IGH1 Karst)

Castleplunkett Turlough (see IGH1 Karst)

Castlesampson Esker

Cloonburren Fan

Errit and Cloonagh Loughs Deltas

Garranlahan Esker

Killeglan Karst Landscape (see IGH1 Karst)

Lough Funshinagh (see IGH1 Karst)

Loughnaneane Turlough (see IGH1 Karst)

McKeon's Pit

Mid Roscommon Ribbed Moraines

Mullygollan Turlough (see IGH1 Karst)

IGH 8 Lower Carboniferous

Site Name

Castlemine Quarry

Keeloges Quarry

Largan Quarry

IGH 9 Upper Carboniferous and Permian

Site Name

Not represented in Roscommon

IGH 10 Devonian

Site Name

Boyle Road Cutting

IGH 11 Igneous intrusions

Site Name

Not represented in Roscommon

IGH 12 Mesozoic and Cenozoic

Site Name

Lecarrow Clay Pit

IGH 13 Coastal Geomorphology

Site Name

Not represented in Roscommon

IGH 14 Fluvial and lacustrine geomorphology

Site Name

Carrowmurragh Mushroom Rocks (see IGH1 Karst)
Moyvannon Mushroom Rocks (see IGH1 Karst)
River Shannon Callows
Suck River Callows

IGH 15 Economic Geology

Site Name

Altagowlan
Arigna Mining Experience
Lecarrow Clay Pit (see IGH12 Mesozoic and Cenozoic)

IGH 16 Hydrogeology

Site Name

Brierfield Turlough (see IGH1 Karst)
Castleplunkett Turlough (see IGH1 Karst)
Lough Funshinagh (see IGH1 Karst)
Loughnaneane Turlough (see IGH1 Karst)
Mullygollan Turlough (see IGH1 Karst)
Rockingham Spring (see IGH1 Karst)

Appendix 1

Geological heritage audits and the planning process

Appendix 2

Bibliography – Geology of County Roscommon

Appendix 3

Bibliography – Caves and karst of County Roscommon

Appendix 4

Bibliography – County Roscommon Quaternary References

Appendix 5

Rejected sites

Appendix 6

A detailed geological map of County Roscommon

Report Summary

County Roscommon is a geologically diverse place with many landscapes, areas and sites treasured by both natives and visitors. The bedrock foundation, with hundreds of millions of years in its formation and shaping, and the more recent history of geomorphological processes such as limestone solution and scouring by glaciers, are what has created that underlying geodiversity. Geological understanding and interpretation is best done on the ground at sites where the rocks and landforms are displayed. County Roscommon has a wealth of such natural and human-influenced sites, particularly of karstic and glacial types.

This report documents what are currently understood to be the most important geological sites within Roscommon by the Irish Geological Heritage Programme (IGH) of the Geological Survey of Ireland (GSI). It proposes them as County Geological Sites (CGS), for inclusion within the Roscommon County Development Plan (CDP). The audit provides a reliable study of sites to replace a provisional listing based on desk study which was adopted in a previous CDP.

County Geological Sites do not receive statutory protection like Natural Heritage Areas (NHA) but receive an effective protection from their inclusion in the planning system. However, many of the sites described in this report are considered to be of national importance as best representative examples of particular geological formations or features. They will be formally proposed by the Geological Survey of Ireland, for designation as NHAs by the National Parks and Wildlife Service after due survey and consultation with landowners. However, many of these sites fall within existing pNHAs and SACs where the ecological interest is founded upon the underlying geodiversity. The commission of this audit and adoption of the sites within the County Development Plan ensure that County Roscommon follows a now established and effective methodology for ensuring that geological heritage is not overlooked in the general absence of allocated resources for progress at national level. It keeps Roscommon at the forefront of geological conservation in Ireland.

This report is written in non-technical language (with a glossary for unavoidable geological terminology) as a working document for use by the Heritage Officer and the Planning department of Roscommon County Council. It will also be made available via the County Council website for the people of Roscommon. A chapter of the report includes recommendations on how to best present and promote the geological heritage of Roscommon to the people of the county. It will also inform the work of the IGH Programme and be made available through the GSI website.

The preliminary sections, summary geological history and accompanying map, timescale and stratigraphical column particularly may be used as they stand to preface a booklet or as website information in the development of this work, and for information as seen fit by the Heritage Officer. The contents also provide the essential ingredients for a public-oriented booklet on the geological heritage of Roscommon.

Roscommon in the context of Irish Geological Heritage

This report ensures Roscommon is active at the forefront of geological heritage within Ireland, as it is only the ninth county to commission such an audit within the scope of the county-based Heritage Plan. It will hopefully encourage other local authorities to follow what is now a tried and trusted methodology. In the absence of significant political and economic resources available to the relevant bodies for geological heritage conservation as Natural Heritage Areas (NHA) at a national level, it represents a significant level of progress in defining and safeguarding Ireland's geological heritage.

It also represents a significant commitment on the part of the Local Authority to fulfil its obligations to incorporate geology into the spectrum of responsibilities under the Heritage Act 1995, the Planning and Development Act 2000, Planning and Development Regulations 2001, and the Wildlife (Amendment) Act, 2000 and the National Heritage Plan (2002). The Geological Survey of Ireland (GSI) views partnerships with the local authorities, exemplified by this report, as a very important element of its strategy on geological heritage (see Appendix 1).

The Irish Geological Heritage Programme (IGH) in the Geological Survey of Ireland complements other nature conservation efforts of the last decade, by assessing Ireland's geodiversity, which is the foundation of the biodiversity addressed under European Directives on habitats and species by the designations of Special Areas of Conservation (SAC) and more recently on a national scale by the introduction of Natural Heritage Areas (NHA) as the national nature conservation method. As a targeted conservation measure to protect the very best of Irish geology and geomorphology it fills a void which has been there since the abandonment of the Areas of Scientific Interest scheme, listed by An Foras Forbartha in 1981.

The IGH Programme does this by identifying and selecting the most important geological sites nationally for designation as NHAs. It looks at the entire spectrum within Irish geology and geomorphology under 16 different themes:

IGH THEMES

1. Karst
2. Precambrian to Devonian Palaeontology
3. Carboniferous to Pliocene Palaeontology
4. Cambrian-Silurian
5. Precambrian
6. Mineralogy
7. Quaternary
8. Lower Carboniferous
9. Upper Carboniferous and Permian
10. Devonian
11. Igneous intrusions
12. Mesozoic and Cenozoic
13. Coastal geomorphology
14. Fluvial and lacustrine geomorphology
15. Economic geology
16. Hydrogeology

A fundamental approach is that only the minimum number of sites necessary to demonstrate the particular geological theme is selected. This means that our first criterion is to identify the best national representative example of each feature or major sequence, and

secondly any unique or exceptional sites. The third criterion, of any sites of International importance, is nearly always covered by the other two.

Designation of geological NHAs is by the GSI's partners in the Programme, the National Parks and Wildlife Service (NPWS) currently operating within the Department of Arts, Heritage and the Gaeltacht. Once designated any geological NHAs will be subject to normal statutory process within the Roscommon Planning Department and other relevant divisions. **However, management issues for geological sites are generally less, and somewhat different from many ecological designations. The following section considers these issues.**

From a national perspective, as a result of extensive comparison of similar sites to establish which are the best, there is now a good knowledge of many other sites, which are not the chosen best example, but may still be of national importance. Others may be of more local importance or of particular value as educational sites or as a public amenity. It is these various other important sites that are proposed for County Geological Site (CGS) listing in the County Development Plan, along with the clear NHA selections.

Currently, in 2012, a Master List of candidate CGS and NHA sites has been established in GSI with the help of Expert Panels for all the 16 IGH themes. For several themes, the entire process has been largely completed and detailed site reports and boundary surveys have been done along with a Theme Report. Due to various factors, they have not been formally designated yet, although only a very small number of sites (e.g. Moyvannan Mushroom Stones) were considered to be of national importance and to be put forward as Natural Heritage Areas (NHA). Therefore, inclusion of all sites as County Geological Sites (CGS) in Roscommon's planning system will ensure that they are not inadvertently damaged or destroyed through lack of awareness of them outside of the IGH Programme in GSI.

The sites proposed here as County Geological Sites (CGS) have been visited and assessed specifically for this project, and represent our current state of knowledge. It does not exclude other sites being identified later, or directly promoted by the Council itself, or by local communities wishing to draw attention to important sites for amenity or education with an intrinsic geological interest. New excavations, such as major road cuttings or new quarries for example, can themselves be significant and potential additions to this selection.

It was not possible within the scope of this study to identify landowners except in a few sites, but it is emphasised that listing here is not a statutory designation, and carries no specific implications or responsibilities for landowners. It is a primarily a planning tool, designed to record the scientific importance of specific features, and to provide awareness of them in any decision on any proposed development that might affect them. It thus also has an educational role for the wider public in raising awareness of this undervalued component of our shared natural heritage.

Geological conservation issues and site management

Since **geodiversity is the often forgotten foundation for much of the biodiversity** which has been identified for conservation through SAC or NHA designation, it is unsurprising that many of the most important geological sites are actually in the same areas. In these areas, the geological case enhances and cements the value of these sites for nature conservation, but requires no additional designation of actual land areas.

There tend to be two broad types of site identified by the IGH Programme. The first, which are the most common, are small and discrete sites. They may be old quarries, natural exposures on hilly ground, coastal cliff sections, or other natural cuttings into the subsurface, such as the mushroom stones at Moyvannon and Carrowmurragh, the old clay pits at Lecarrow or the old coal mines at Arigna and Altagowlan. They usually have a specific interest such as fossils, minerals or are a representative section of a particular stratigraphical sequence of rocks. **The other type of site tends to be larger areas that represent a geomorphological interest – landscapes that illustrate processes which formed them.** The Quaternary theme and the Karst theme include such sites. In Roscommon, the superb eskers are characteristic of the larger sites encompassed under the IGH 7 Quaternary Theme. Large areas of Roscommon's landscape are covered by drumlins or ribbed moraine, which can be problematic, as although unique and impressive, they can be too large to consider as 'sites'.

It is also important from a geological conservation perspective that planners understand the landscape importance of geomorphological features which may not in themselves warrant any formal site designation, but which are an integral part of the character of Roscommon. A lack of awareness in the past, has led to the loss of important geological sites and local character, throughout the country. In Roscommon a full Landscape Characterisation Assessment was completed in 2008. This provides a tool to help future planning decisions maintain the integrity of the County. However, sites such as Killeglan Karst Landscape exemplify the potential both for new discoveries or recognition of landscape features, and also the potential for their loss despite best planning practices. The bouldery limestone landscape here, which overlies karstified bedrock, is possibly unique in lowland Ireland, and requires detailed study and delineation. It is to be hoped that the windfarm development, recently granted Planning Permission within the boundaries of the Geological Heritage site, will not impact on the integrity of the geomorphological landscape. With some constructive thinking, and engagement by all concerned, the permitted development work may offer opportunity to fully characterise and understand this newly recognised important landscape.

There are large contrasts in the management requirements for geological sites in comparison to biological sites. Most geology is actually quite robust and generally few restrictions are required in order to protect the scientific interest. In some cases, paradoxically, the geological interest may even be served better by a development exposing more rock. **The important thing is for the relevant planning department to be aware of the sites, and more generally, that consultation can take place if some development is proposed for a site.** In this way, geologists may get the opportunity to learn more about a site or area by recording and sample collection of temporary exposures, or influence the design so that access to exposures of rock is maintained for the future, or prevent completely inappropriate developments through a strong scientific case.

In other counties, working quarries may have been listed simply because they are the best representative sections available of entire rock sequences, in areas where exposure is otherwise poor. No restriction would be sought on the legitimate operation of these quarries. However, maintenance of exposure after quarry closure would be sought with the operator and planning authority in such a case. At present, several working quarries are now included as County Geological Sites in Roscommon. These issues are briefly explored in a set of Geological Heritage Guidelines for the Extractive Industry, issued jointly by the GSI and the Irish Concrete Federation in 2008.

A new quarry may open a new window into the rocks below and reveal significant or particularly interesting features such as pockets of fossils or minerals, or perhaps a karstic depression or cave. Equally a quarry that has finished working may become more relevant as a geological heritage site at that stage in its life. It would possibly need regular maintenance to prevent overgrowth of vegetation obscuring the scientific interest.

Nationally, specific sites may require restrictions and a typical case might be at an important fossil locality or a rare mineral locality, where a permit system may be required for genuine research, but the general opportunity for collecting may need to be controlled. However, Roscommon's sites are not likely to require such an approach.

Waste dumping

An occasional problem throughout the country, including in County Roscommon, is the dumping of rubbish in the countryside. The dumping of waste is not only unsightly and messy, but when waste materials are dumped in area where rock is exposed, such as quarries or karstic depressions, they may leach into the groundwater table as they degrade. This can cause groundwater pollution and can affect nearby drinking water supplies in wells or springs. Groundwater Protection Schemes (DELG 1999) help to combat pollution risks to groundwater by zoning the entire land surface within counties into different levels of groundwater vulnerability. Such a scheme has been completed for Roscommon County Council by the Geological Survey of Ireland, thus ranking the county land surface into vulnerability categories of 'Extreme', 'High', 'Moderate' and 'Low', and helps planners in assessing which developments are suitable in some areas of Roscommon, and which are not. **Given the very high dependence of County Roscommon on groundwater supplies it is important that education about the threat of dumping is given serious attention.**

New exposures in development

One less obvious area where the Local Authority can play a key role in the promotion and protection of geology is in the case of new roads. **Wherever major new carriageways are built**, such as the bypass around Boyle town and through the Curlews, or in other major infrastructural work, it should be a policy within the Planning Department that **where new rock exposures are created, that they be left open and exposed** unless geotechnical safety issues occur (such as bedding dips prone to rock failure). The grading and grassing over of slopes in cuttings is largely a civil engineering convenience and a mindset which is difficult to change. However, it leads to sterile and uninteresting roads which look the same throughout the country. By leaving rock exposures along the routeway, where they are intersected, it provides an improvement in character and interest, reflecting the geology and landscape of the locality. Sympathetic tree or shrub planting can still be done, but leaving bare rocks, especially where they show interesting features, not only assists the geological profession, but creates new local landmarks to replace those removed in the construction of

the roadway. This can also potentially save money on the construction. The cutting through Devonian volcanic sediments north of Boyle town, on the climb over the Curlews is a good example of such a site, with groundwater seeps and tufa deposits adding to the interest of the rocks.

Geoparks

An extremely interesting development in geological heritage, not just in Europe but internationally, has been the rapid recent growth and adoption of the Geopark concept. A **Geopark is a territory** with a well defined management structure in place (such as Local Authority support), **where the geological heritage is used to develop sustainable tourism opportunities**. Initially it was largely a European Geoparks Network (EGN) but has now expanded worldwide as the Global Geoparks Network (GGN) since 2004 and is fully assisted by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) [see www.globalgeopark.org and www.europeangeoparks.org]. A fundamental theoretical basis of the Geopark is that it is driven from the bottom up – the communities in the Geopark are the drivers of the project and are the main beneficiaries. It therefore provides protection of the geological heritage resource so that the community can benefit from it.

In Ireland there are already three members of the Geoparks Network. One is the Copper Coast Geopark in Waterford [see www.coppercoastgeopark.com]. Another is the cross-border Marble Arch Caves Global Geopark in Fermanagh and Cavan [see www.marblearchcaves.net]. A recent addition has been the Burren and Cliffs of Moher in County Clare [see www.burrenconnect.ie/geopark]. In addition there are aspirant groups exploring the work and infrastructure required for applications in other areas such as Joyce's Country in Mayo and Galway, and the Mourne Mountains and Carlingford area. However, Roscommon has no aspirant communities, nor any obvious bedrock areas that have the coherent geological characteristics that would benefit from consideration as potential Geoparks. However, we consider that the Slieve Dart area and Cloonfad Eskers and associated topography are potentially worthy of an east Connaught esker-karst type geopark, including the Garranlahan system and the karstlands in between.

Proposals and ideas for promotion of geological heritage in Roscommon

The clear and significant inclusion of geological heritage in the County Roscommon Heritage Plan 2012-2016 is a most welcome and positive step, for a topic that is often undervalued and poorly known in the wider community. This section examines the existing points in the plan relating to geological heritage and provides specific suggestions of how these may be implemented, supported or enhanced by the audit of geological heritage sites in the county.

Objective 1 Collect and disseminate heritage information –‘Notice’. To facilitate the development of a comprehensive heritage database for the county, to make this information available to all.

Action 1.1 Identify gaps in knowledge and facilitate research studies as required to gather data on all aspects of heritage in the county.

Audit Action: *This broad action will be partly fulfilled by the geological heritage audit, since geology is poorly understood and undervalued in comparison with many other elements of our heritage. The authors have aimed for a very broad perspective on geological heritage in the audit, including economic and industrial exploitation of Earth resources in Roscommon, and people’s interaction with geology over time.*

Action 1.4 Carry out an inventory of geological heritage in the county and a literature review of relevant geological research. Publish the findings.

Audit Action: *The audit will provide a robust and detailed report and dataset to achieve this objective in the Heritage Plan. However, ongoing review in future years for additional sites will be required. Some vigilance on the ground at sites will be required to ensure they are not damaged. The GSI should be consulted on any planning application that is potentially impacting upon an identified County Geological Site.*

Action 1.5 Carry out baseline surveys and data gathering as necessary to inform the Roscommon County Development Plan. For example character assessments of architectural conservation areas, tree survey, habitat mapping, esker survey, turloughs survey, wetlands survey, bogs survey.

Audit Action: *The audit will contribute to part of this objective, particularly in respect of turloughs and eskers, both of which are especially richly represented in the county. The audit provides a status report and imagery as of summer 2012 for selected sites, which is a subset of all of the eskers and turloughs in the county.*

Action 1.8 Disseminate results of information gathered from heritage research in the county, for example archaeological research.

Audit Action: *The audit will be made available to the public as well as to planners and County Council staff. The audit report will be supplemented by exhibition material that can be used as a physical exhibition, and as internet resources, all aiming to disseminate the audit results to a much wider audience. It is to be hoped that resources may be available in subsequent time to produce a ‘public-friendly’ book on the geological heritage of the county in a similar manner to Sligo, Meath, Fingal and Waterford.*

Objective 2 Promote best practice in heritage conservation and management – ‘Care’. To promote and advise on best practice standards for heritage conservation and management within the county.

Action 2.1 Seek the provision of a designated county museum service for the county.

Audit Action: *Although the audit is not directly relevant to this action, it is to be noted that the contents may contribute to the inclusion of geology within a County Museum if the action is achieved.*

Action 2.4 Provide heritage training for community groups. Topics to include amongst others: Best practice in heritage conservation and management; Enhancement of biodiversity; and ‘Heritage Audits’ – how to identify sites of heritage interest and plan to conserve or enhance sites in your local area.

Audit Action: *The authors of this audit report could provide training in geological topics by arrangement with the Heritage Officer.*

Action 2.6 Provide heritage training for Roscommon County Council staff and elected members. Topics to include amongst others: Architecture.

Audit Action: *The authors of this audit report could provide training in geological topics by arrangement with the Heritage Officer.*

Objective 3 To raise awareness of our heritage – ‘Enjoy’. To increase knowledge, awareness, understanding and enjoyment of Roscommon’s heritage.

Action 3.10 Promote awareness of Roscommon’s geological heritage, for example hosting a geology exhibition.

Audit Action: *This objective will be fulfilled by the inclusion of draft content for a panel based exhibition (provided as supplementary to tender specifications). Exhibition panels included as part of this audit project can be made available as a handy resource. In addition, the Geoschol 4 page leaflet on the geology of Roscommon, aimed at primary level, can be made available or through a link to it on the Geoschol website (www.geoschol.com).*

Other audit benefits:

- 1. Selected geological and speleological titles will be made available digitally to build the heritage data, from the authors’ own connections (including Matthew Parkes being Speleological Union of Ireland Librarian) and resources.*
- 2. The audit could serve as a basis for developing walking and cycling routes, and associated information leaflets and signage if required.*

Specific ideas for projects

Leaflets

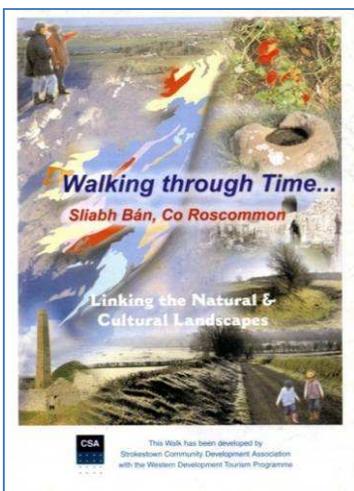
There are two excellent free leaflets produced by the County Council, one on bogs and one on turloughs. The addition of one on the geology of the county and one on the karst features of Roscommon could be derived easily from this audit. A separate leaflet could easily be produced on 'The Eskers of County Roscommon', 'The Drumlins of County Roscommon' or a combined 'The Glacial landforms of County Roscommon'.



We propose that leaflets on geological topics should be added to this series for free public distribution.

Guides

There are in reality no existing guides to the geology of County Roscommon. There is scope for guides at different levels of detail and accessibility to non-specialists. A wide range of leaflets, booklets, books and other media are all feasible, but the research and production of appropriate text and images is a difficult task to do well without appropriate experience, and adequate time and resources. **It is suggested that with only modest editing and reorganisation the content of this report would comprise a good general guide to the geological heritage of County Roscommon, in similar style to those books and booklets produced in Sligo, Meath, Fingal and Waterford, following audits.**



This guide to Slieve Bawn does briefly describe the geological history of the landscape in which cultural features are explored.

Signboards

Simple explanatory or interpretive signboards may be advisable at key geological heritage locations, but if these are considered, their locations and individual siting should be very selective, since a proliferation of different interest groups may provoke a 'rash' of panels all over the county. The Planning Section should clearly have a controlling input, in conjunction with the Heritage Office. It is most likely that a panel combining various heritage interests at a place is preferred to single interest panels. It is important to consult with potential partners in the planning stage so that duplication does not occur.

The subject of panels, and the integration of text and graphics are a fine art to complete successfully, and the IGH Programme can offer input if signs are planned for key visitor localities. The authors of this report are also able to write, review or provide content on geological heritage for any proposed panels.

Aside from the full public presentation of the Arigna Mining Experience, at present the only geological site known to the authors where some panel signs include an element of geology are at Loughaneane. This turlough area immediately west of Roscommon town has a castle and wildlife interest, and is managed by Roscommon County Council. Signboards about the turlough have a cursory explanation of the geological functioning of turloughs.

Museum exhibitions

As a result of the work to produce this report, the material for a panel based exhibition has been largely compiled. With some extra research covering human dependence on geology and resources, an interesting exhibition can be put together for display in the Roscommon Museum, Council offices or County Library branches. The model followed was that produced for Carlow and for Dun Laoghaire-Rathdown. Images of these can be seen on the geological heritage section of the GSI website [www.gsi.ie].

New media

There are increasing numbers of examples of new methods of promoting Earth Sciences, via mobile phone applications and other electronic media. Self guiding apps on specific sites would be one of these, such as those produced by Ingenious Ireland for Dublin city geology and for other sites. Plans for such products would require some considerable effort to produce and imaginative effort, with the sites being scattered across the county. Linking together turlough sites or eskers would seem the most likely targets for consideration.

Earth Science Ireland Group and magazine [www.earthscienceireland.org]

The group Earth Science Ireland is an all-Ireland group promoting awareness of earth sciences and supporting educational provision in the subject. A main vehicle for the efforts is the twice a year magazine *Earth Science Ireland* and this is distributed free to thousands of individuals, schools, museums, centres and organisations. The editors would welcome more material from the Republic of Ireland and on Roscommon's geological heritage.

Geoschol website [www.geoschol.com]

Geoschol is an educational project, now essentially represented by a website, which was largely aimed at producing educational materials on geology for primary schools. A four page **pdf** summarising the geology and some highlights of Roscommon is already part of the available material. If no material is available to add, then at least working links to Roscommon County Council website Heritage section, and to other heritage websites should be established.

A summary of the Geology of Roscommon

1) Paragraph summary

The geology of Roscommon is dominated by 330 million years old limestones from the Carboniferous Period. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. The limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. Only in the north of the county around Lough Allen are there younger rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface was then emerged for nearly 300 million years and many of these rocks eroded down to their present level. The most significant force to shape the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets were covering the county and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, also with large fans of sand and gravel. Since then, the limestone bedrock under the glacial sediments has become markedly dissolved, a process known as karstification. Water solution of the rock formed some caves, and in some larger lakes formed unusual mushroom shaped stones. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Geological processes continue to modify the landscape such as with seasonal flooding of the Shannon and Suck River Callows.

2) Simple summary

The geology of Roscommon is absolutely dominated by 330 million years old limestones from the Carboniferous Period. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. These include two inliers (older rocks entirely surrounded by younger rocks) north-east of Strokestown and at Slieve Bawn. These rocks are of Ordovician age and are the remnants of a former ocean floor and the roots of a long since vanished mountain chain. They are related to rocks throughout Longford, Down, and into the Southern Uplands of Scotland, but as they occupy such a small area in Roscommon, their story is best told in detail elsewhere.

Surrounding them are some Devonian age rocks, sandstones and gravels laid down by flash floods in a poorly vegetated environment. Both Ordovician rocks and Devonian rocks are partly preserved because they have been lifted up on one side of the Strokestown Fault, which is a visible geological structure in the county, because the older, more resistant rocks form Slieve Bawn.

The Carboniferous limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. The uniform nature of these beds both across wide areas and vertically in thickness makes it difficult to map different geological formations, and they are often simply considered as 'shelf' limestones, from an open, shallow sea.

Only in the north of the county around Lough Allen are there younger solid rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface then emerged for nearly 300 million years and many of these rocks were eroded down to their present level. Only small parts of the country now remain covered by these coalfield rocks, primarily the Castlecomer plateau in Kilkenny, the Arigna district in Leitrim and the northern tip of Roscommon.

The most significant force to shape the form of the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets covered the county for thousands of years and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, adjacent to large fans and deltas of sand and gravel. Eskers were formed by sub-glacial rivers, that is, they flowed in tunnels at the base of the ice sheets. Some eskers are small and local within Roscommon, but others form extended networks and cross several counties.

Some Ice Age features define the landscape character of large areas yet are so large they can almost only be seen when using satellite or air photo images. One example is a very fine discrete field of drumlins near Boyle. These whale back elongated ridges of glacial till were left by the ice sheets which covered the county. Even larger ribbed moraines, on a kilometre scale, are present across mid Roscommon, but these need a trained eye to discriminate them from remotely sensed images.

Since the Ice Age, the exposed limestone has developed into what is termed karstified bedrock. Water solution of the rock formed some caves, widespread collapse features and enclosed depressions called dolines. Where some larger, temporary lakes were formed when meltwater was prolific, unusual mushroom shaped stones were created by dissolution of the rock that was submerged. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon and Suck River Callows.

3) Extended summary

Although the geology of Roscommon is absolutely dominated by 330 million years old limestones from the Carboniferous Period, there are much older rocks extending back to nearer 500 million years ago, within the county. In Slieve Bawn, the Curlew Mountains north of Boyle and northwest of Ballaghderreen there are much older rocks exposed at the surface in small windows through the limestones. These include two inliers (older rocks entirely surrounded by younger rocks) north-east of Strokestown and at Slieve Bawn. These rocks are of Ordovician age and are the remnants of a former ocean floor and the roots of a long since vanished mountain chain. They are related to rocks throughout Longford, Down, and into the Southern Uplands of Scotland, but as they occupy such a small area in Roscommon, their story is best told in detail elsewhere.

Surrounding them are some Devonian age rocks, sandstones and gravels laid down by flash floods in a poorly vegetated environment. Both Ordovician rocks and Devonian rocks are partly preserved because they have been lifted up on the east side of a fault, and are

now preserved as the more resistant hills known as Slieve Bawn. In the Curlew Mountains north of Boyle and westward through Sligo to Ballaghderreen is a faulted block of the Devonian rocks, uplifted in relation to the limestones either side of the block. The Devonian rocks are mostly sandstones and pebble conglomerates, but include some volcanoclastic rocks; rock material erupted by volcanos but then carried and deposited as sedimentary rocks like the sandstones. The Boyle Road Cutting is a good place to see these rocks.

The Carboniferous limestones are dominantly well bedded, horizontal layers of a remarkably uniform nature. They were originally deposited in a shallow marine environment when Ireland was largely submerged under a warm tropical sea, and the presence of fossils such as corals reflects this. The uniform nature of these beds both across wide areas and vertically in thickness makes it difficult to map different geological formations, and they are often simply considered as 'shelf' limestones, from an open, shallow sea. These limestone rocks are present below the surface of the largest part of Roscommon, but are actually rarely exposed. The veneer of glacial sediments hides them, so the few rock quarries such as Keeloges, Castlemine and Largan are important examples of what the subsurface is actually like.

Only in the north of the county around Lough Allen are there younger solid rocks, recording a time when the shallow sea was filled with deltas and swamps. In these sandstone and shale rocks there are coal seams formed from ancient forests. The land surface then emerged for nearly 300 million years and many of these rocks eroded down to their present level. Only small parts of the country now remain covered by these coalfield rocks, primarily the Castlecomer plateau in Kilkenny, the Arigna district in Leitrim and the northern tip of Roscommon. Two County Geological Sites in Roscommon are representatives of this geology. The Arigna Mining Experience is a superb place to fully appreciate the underground geology of coal deposits and the mining heritage of the district. Altagowlan, which is Roscommon's portion of a wider upland area along the Sligo county boundary, exemplifies the place of coal in the energy supply of human society, now visibly met by windfarm turbines scattered through the old coal mine features.

The most significant force to shape the form of the county as we see it today was the Ice Age which ended about 10,000 years ago. Large ice sheets covered the county for thousands of years and eroded the rocks beneath. As the ice eventually melted away, the meltwaters reorganised the sediments into iconic landforms like eskers, adjacent to large fans and deltas of sand and gravel, such as at Cloonburren Fan, McKeon's Pit and the Cloonagh and Errit Loughs Deltas. The fans and deltas now stand out as high ground with good grass amongst the boggy lake margins. Eskers were formed by sub-glacial rivers, that is, they flowed in tunnels at the base of the ice sheets. Some eskers are small and local within Roscommon, but others form extended networks and cross several counties. The Ballinasloe–Split Hills–Clonmacnoise–Clara Esker System is the most extensive of them, but the Garranlahan Esker is also large and complex. The Castlesampson Esker is smaller but equally valuable as an untouched example of the landform.

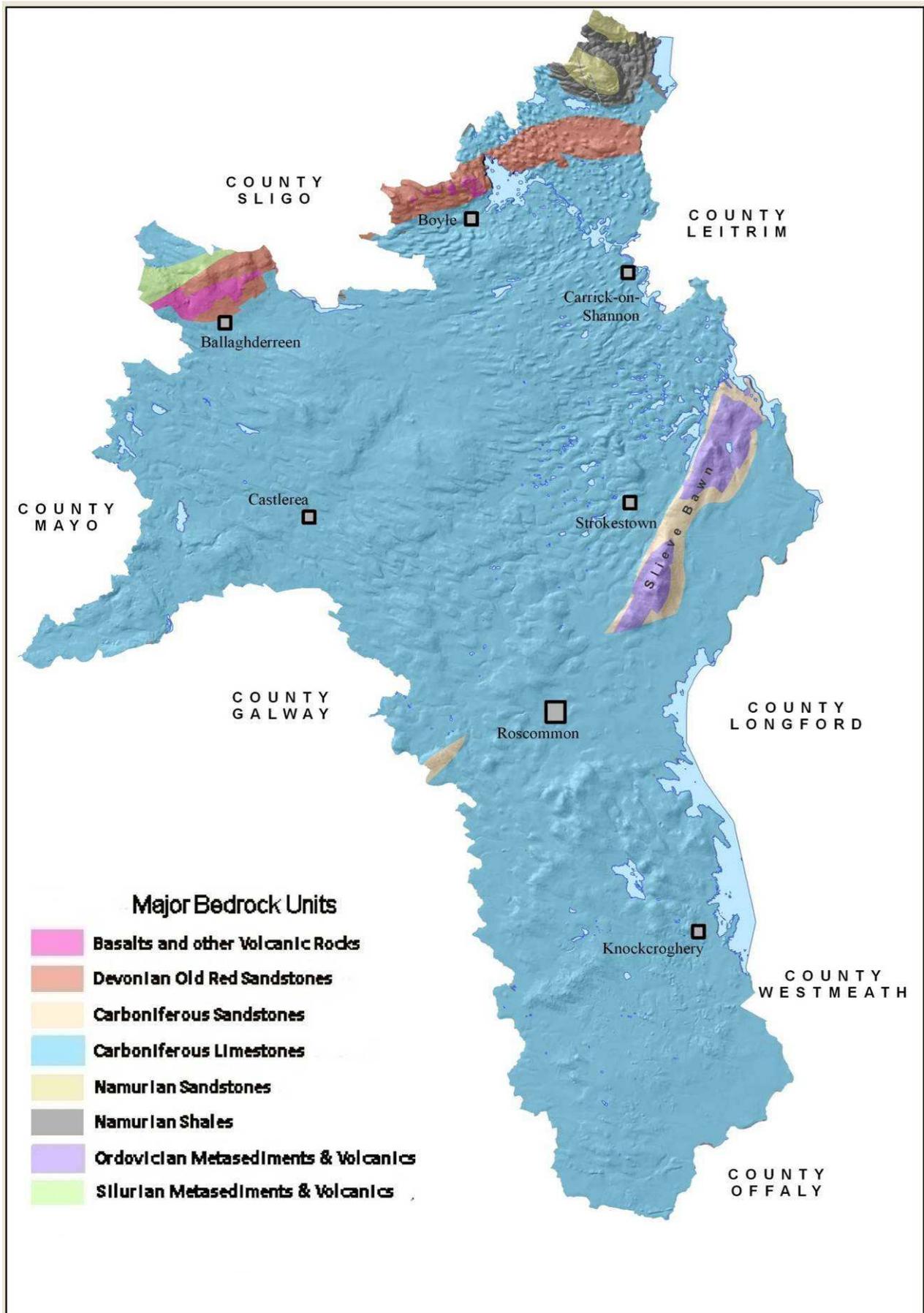
Some Ice Age features define the landscape character of large areas yet are so large they can almost only be seen when using satellite or air photo images. West of Boyle for example is a very fine discrete field of drumlins. These whale back elongated ridges of glacial till were left by the ice sheets which covered the county. On the ground they form low relief, breaking up any long vistas, but from above or on a map with shaded relief they clearly show the sweeping passage of ice movements. Even larger ribbed moraines, on a

kilometre scale, are present across mid Roscommon, but these need a trained eye to discriminate them from remotely sensed images.

Since the Ice Age, the exposed limestone has developed into what is termed karstified bedrock. Water solution of the rock formed some caves, widespread collapse features and enclosed depressions called dolines. Where some larger, temporary lakes were formed when meltwater was prolific, unusual mushroom shaped stones were created by dissolution of the rock that was submerged. Carrowmurragh and Moyvannan Mushroom Stones near the shores of Lough Ree demonstrate it previously once had a far greater extent. Roscommon also has a wealth of seasonal lakes called turloughs, where glacially scoured basins fill with groundwater in the winter and dry out in summer as the water table lowers. Good geological examples of these include Brierfield, Loughnaneane, Mullygollan and Castleplunkett Turloughs. A special kind of turlough exists at Lough Funshinagh which is a disappearing lake. Rather than seasonal fluctuations it occasionally drains entirely as if someone had pulled the plug in the bath. A kind of pseudo karst landscape has been identified around Killeglan west of Athlone. This is a unique site with limestone boulder ridges formed as glacial deposits. Large parts are untouched and represent a pristine landscape of Roscommon before human intervention and land clearance and enclosures.

Geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon and Suck River Callows. Slow build-up of alluvial sediments and meandering of the river course can change a landscape scene in human lifespans. Collapses of limestone into cavities beneath are more sudden events and occur in some areas, but such holes are often quickly filled in by farmers and landowners. The most active but unseen geological process going on is the movement of groundwater. Since Roscommon has one of the highest percentages of water supply from groundwater, such as from Rockingham Spring, immense care is needed not to pollute the supply from badly maintained septic tanks or farm practices, as limestone areas are very vulnerable to such destruction of a valuable geological resource. Another geological resource, apart from limestone, coal and groundwater, which was formerly exploited, is the clay deposit at Lecarrow. The Knockcroghery clay pipe industry once supplied pipes for smoking tobacco to all of Ireland from this ancient clay preserved in a karstic doline.

AGE (Million Years Ago)	ERA	PERIOD	EVENTS IN ROSCOMMON	IF THIS TIMESCALE WERE A DAY LONG ...
2	Cenozoic	Quaternary	Several ice ages smothering Roscommon, followed in the last 10,000 years by the spread of vegetation, growth of bogs and arrival of humans. Deposition of ribbed moraines drumlins and eskers. Dissolution of limestone beneath Quaternary sediments.	The ice ages would begin 38 seconds before midnight
65		Tertiary	Erosion, especially of limestone. Caves, cavities and underground streams developing in mid-Roscommon. Potential deposition of clay at Lecarrow, near Lough Ree.	The Tertiary period begins at 11.40 pm
145	Mesozoic	<i>Cretaceous</i>	<i>Erosion. No record of rocks of this age in Roscommon.</i>	11.15 pm
205		<i>Jurassic</i>	<i>Uplift and erosion. No record of rocks of this age in Roscommon.</i>	The age of the dinosaurs, starting at 10.55 pm
250		<i>Triassic</i>	<i>Desert conditions on land.</i>	10.42 pm
290	Palaeozoic	<i>Permian</i>	<i>No record of rocks of this age in Roscommon.</i>	10.30 pm
355		Carboniferous	Land became submerged, limestones with some shales and sandstones deposited in tropical seas across much of Roscommon. Limestones remaining today are pure and unbedded in the majority, with smaller areas of muddier limestones at the edges. Shales and sandstones with coal seams deposited in Arigna district.	Much of Roscommon's current rocks (limestone, sandstone and shale) deposited around 10.10 pm
410		Devonian	Caledonian mountain building. Sandstones deposited in the Curlews and north of Ballaghderreen.	'Old Red' Sandstone deposited at 9.52 pm
444		Silurian	Shallow seas, following closure of the Iapetus Ocean. Greywacke and shales deposited at Boholas in the northwest of the county.	Starts at 9.42 pm
488		Ordovician	Shales, slates, siltstones and volcanic rocks form across the Slieve Bawn ridge.	Begins at 9.28 pm
542		Cambrian	Opening of the Iapetus Ocean. <i>No record of rocks of this age in Roscommon.</i>	Starts at 9.11 pm
2500	Proterozoic	<i>Precambrian</i>	<i>Some of Ireland's oldest rocks deposited in Mayo and Sligo.</i>	Beginning 11.00 am
4000	Archaean		<i>Oldest known rocks on Earth.</i>	Beginning 3.00 am
4600			<i>Age of the Earth.</i>	Beginning 1 second after midnight



A simplified geology map of Roscommon outlining the main geological units.

Geological heritage versus geological hazards

Ireland is generally considered to be a country with very low risk of major geological hazards: there are no active volcanoes, stable tectonic plates mean earthquakes are relatively rare and Ireland's broad human history is not peppered with disastrous landslides, mudflows or other geological hazards. Yet there are of course risks of one-off events, and this section briefly looks at the specific record and nature of geological hazards in Roscommon and the relationship of the County Geological Sites to those hazards.

The difference between human timescales and geological timescales can be difficult to comprehend but for many geological processes they can be suddenly active with major events, and quiet periods in between. Many of the sites in this audit represent evidence of past environments and geological processes, such as tropical coral seas, swampy deltas glacier erosion of the land surface and so on. However, some sites represent the active geomorphological or land-forming processes of today. These sites, generally coastal in many counties, but mainly karstic or rivers in Roscommon, are dynamic environments and can be subject to constant or intermittent change.

Landslides and bog flows

The Geological Survey of Ireland has been compiling national data on landslides in the past decade. Occasional landslides and bog slides are both recorded in Roscommon, in the Arigna area especially.

Flooding

There are two types of flooding which need consideration.

River flooding occurs inland when the rainfall exceeds the capacity of the ground to absorb moisture, and the river channels cannot adequately discharge it to the sea. The OPW website www.floods.ie can be consulted for details of individual flood events in County Roscommon. Some 239 events are recorded across the entire county. Many of these are predictable, seasonal events in the floodplains of the River Shannon and the River Suck. They are vital to the biodiversity of these floodplain areas, known as Callows. Both plant and birdlife is dependent on the wetland habitats along the river banks. As the flooding of the river floodplains is essentially an active geological environment, we have included some representative examples as County Geological Sites.

Karstic flooding can occur when underground passages are unable to absorb high rainfall events. The karst in Roscommon has few caves, yet the abundance of springs, swallow holes and dolines, as well as the karstification seen in some quarries such as Largan Quarry, indicates that the limestone is heavily karstified. In Largan Quarry, as well as the highly weathered epikarst zone nearest the surface, deep expanded joints and fissures are evident, although many have clay rich sediment fills.

There are numerous known turloughs in Roscommon, which are seasonal lakes where the water table intersects the land surface. The Ordnance Survey of Ireland six inch to the mile mapping records many areas as 'liable to flooding' in the karstic landscapes. However, the 1:50,000 Ordnance Survey of Ireland Discovery Series maps are drawn from aerial photographs and are very poor in accurately delimiting such turloughs. These turloughs indicate seasonal variation in the ground water table. The normal pattern is for them to be

lakes in winter and dry grassland in summer, although localised weather/rainfall patterns may mean they are wet in summer too.

Karstic collapse

This is a very real, but localised hazard in parts of Roscommon. In the county there is limestone often only a few metres or less beneath the land surface. The number of known caves in the limestone is very few, but in certain areas such as Mewlaghmore near Castlerea, there are hundreds of karstic features called dolines. These are enclosed depressions with no surface water drainage associated with them. Some form by slow dissolution of the underlying limestone rock, but others can be formed as rapid collapse events.

When they occur, they are often not reported and just filled in by farmers so we have little information on the frequency with which they happen. A record of one such area at Lissananny, north of Castlerea, indicated that collapses frequently occurred but were filled in as rapidly by the landowner. Similarly a verbal communication engaged in with the authors while compiling this report, of a new housing development at Lisacul, included an account of massive collapse openings which were then filled in with rock by the developer before the houses were built.

Groundwater pollution

Whilst not such an obvious hazard as physical collapses, flooding and landslides, the pollution of groundwater supplies carries a serious risk to human health. Roscommon is one of the counties most dependent on groundwater supplies, and therefore the risk is more serious than for most other counties. As the groundwater is largely contained within limestone, it should be noted that karstic springs are especially vulnerable to pollution since the flow is mainly within fissure conduits allowing rapid transmission of pollution from source to water supply. The opportunity for microbial attenuation of pollutants is far less in limestone fissures (as there are no natural barriers to stop pollutants) than it would be in granular deposits, which act as natural filters.

Glossary of geological terms

Geological term	Definition
Adit	a horizontal or only gently inclined mine tunnel dug to access coal or mineral ore, or to drain, ventilate or further develop a mine.
Alluvial Deposit	unconsolidated clay, silt, sand and gravel, deposited by a body of running water.
Alluvium	a term for unconsolidated clay, silt, sand and gravel, deposited by a body of running water.
Aquifer	a water saturated rock unit.
Bead (of an esker)	a segment of an esker.
Bedding Plane	the contact between individual beds of rock.
Bedrock	a general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
Biostratigraphy	using fossils to define the succession of rocks.
Blanket Bogs	bog covering a large, fairly horizontal area, which depends on high rainfall or high humidity, rather than local water sources for its supply of moisture.
Boulder Clay	unconsolidated, unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock or silt. Also known as till.
Brachiopods	a marine invertebrate of the phylum Brachiopoda - a type of shellfish. Ranging from Lower Cambrian to present.
Braided River	a river that consists of a network of small channels separated by small and often temporary islands.
Bryozoa	invertebrates belonging to the phylum Bryozoa, ranging from Ordovician to present, often found as frond-like, net-like or stick-like fossils.
Calcareous	containing significant calcium carbonate.
Calcite	a pale mineral composed of calcium carbonate, which reacts with dilute acid.
Callows	riverside meadows which dry in summer but flood in winter.
Carbonate	a rock (or mineral), most commonly limestone (calcite) and dolomite.
Cave	a natural underground space large enough for a human to enter, which is usually formed in either soluble limestone by karstic processes, or in exposed rock along the coastline, where the sea erodes natural rock fractures.
Chattermarks	crescent shaped marks on a rock surface made at the base of a glacier
Clast	an individual constituent, grain or fragment of a sediment or rock, usually produced by mechanical weathering (disintegration) of a larger rock mass.
Cleavage	a finely spaced, flat plane of breakage caused by compressive deformation of rocks. e.g. the splitting of slate.
Clint	tabular block of limestone in a limestone pavement.
Conglomerate	sedimentary rock comprising of large rounded fragments in a finer matrix.
Crinoid	a variety of sea-urchin, with a long flexible stem, usually anchored to the sea-floor and a body cup with arms which may be branching (a sea lily).
Cross-bedding	layering in sedimentary rocks at an inclined angle to bedding formed by current-ripples.
Crust	the outermost, solid, layer of the Earth.
Delta	a usually triangular alluvial deposit at the mouth of a river, or a similar deposit at the mouth of a tidal inlet, caused by tidal currents.
Dip/dipping	when sedimentary strata are not horizontal they are dipping in a direction and the angle between horizontal and the inclined plane is measured as

	the dip of the strata or beds.
Doline	circular/oval closed depression found in karst terrain.
Dolomite	calcium and magnesium bearing carbonate mineral; also a rock composed of the mineral.
Drumlin	a streamlined mound of glacial drift, rounded or elongated in the direction of the original flow of ice.
Epikarst	the shallow layer, near surface, of highly karstified rock, with many voids included.
Erratic	a rock fragment, often large, that has been transported, usually by ice, and deposited some distance from its source. It therefore generally differs from the underlying bedrock, the name "erratic" referring to the errant location of such boulders. Tracing their source can yield important information about glacial movements.
Esker	a long, narrow ridge of coarse gravel and sand deposited by a stream flowing in or under a decaying glacial ice sheet.
Facies	the character of the rock derived from its original sedimentary environment and process of deposition.
Fan	a usually triangular deposit of sand and gravel deposited by a glacial stream, either under a lake or under air.
Fault	planar fracture in rocks across which there has been some displacement or movement.
Fault Zone	a tabular volume containing many faults and fault rocks (rocks broken up by fault movement).
Fauna	collective term used to group all animal life.
Floodplain	a flat or nearly flat land area adjacent to a stream or river that experiences occasional or periodic flooding.
Flowstone	calcite or other minerals deposited as a surface crust by water flowing over cave or mine walls and floors.
Fluvial	pertaining to a river or stream.
Fold(ing)	flexure in layered rocks caused by compression.
Formation	a formal term for a sequence of related rock types differing significantly from adjacent sequences.
Fossiliferous	rich in fossils.
Fossils	any remains, trace or imprint of a plant or animal that has been preserved in the Earth's crust since some past geological or prehistorical time.
Glacial	of or relating to the presence and activities of ice or glaciers.
Grading	a sorting effect with the coarsest material at the base of the bed and finest grained material at the top.
Greywacke	an impure sandstone, characterised by poorly-sorted, angular grains in a muddy matrix, that was deposited rapidly by turbidity currents (submarine avalanches).
Grike	a solutionally widened vertical fracture separating clints on a limestone pavement.
Gully	a deep valley created by running water eroding sharply into bedrock or subsoil.
Haematite	a mineral form of iron oxide, which is the main ore mined as iron.
Horizon	may refer to a single layer of rock such as a coal seam, an ash layer, or other geological 'event'.
Head	weathered rock fragments accumulated on lower slopes from periglacial freezing and thawing action acting with gravity.
Hummock	a small hill or knoll in the landscape, which may be formed by many different processes.

Ice margin	the edge of an ice sheet or glacier.
Igneous	a rock or mineral that solidified from molten or partially molten material i.e. from a magma.
Interglacial	the time interval between glacial stages, or pertaining to this time.
Joint	a fracture in a rock, which shows no evidence of displacement.
Kame-kettle	an irregularly shaped hill or mound composed of sand, gravel and till that accumulates in a depression on a retreating glacier, and is then deposited on the land surface with further melting of the glacier. Kames are often associated with kettles, and this is referred to as <i>kame and kettle</i> topography.
Karst	general term used for landscapes formed by weathering of soluble rocks, usually limestone, by surface water and/or groundwater.
Kettle hole	a shallow, sediment-filled body of water formed by retreating glaciers or draining floodwaters.
Knoll	a small hill or hillock sticking up from generally flat terrain.
Laminated	the finest example of stratification or bedding, typically exhibited by shales and fine-grained sandstones.
Limestone	a sedimentary rock consisting chiefly of calcium carbonate (CaCO ₃), primarily in the form of the mineral calcite. It is mostly formed by the accumulation of calcareous shells, cemented by calcium carbonate precipitated from solution.
Lithification	the process of rock formation from unconsolidated sediment.
Lithology	the description of rocks on the basis of such characteristics as colour, composition and grain size.
Lodgement	process by which debris is released from the sliding base of a moving glacier/ice sheet and plastered or 'lodged' onto the glacier bed; also describes tills emplaced by this process (i.e. lodgement till).
Maze cave	a cave formed in an extensive grid pattern when slow moving water.
Melt-out	process by which glacial debris is very slowly released from ice that is not sliding or deforming internally; also describes tills emplaced by this process (i.e. melt-out till).
Metamorphic	referring to the process of metamorphism or to the resulting metamorphic rock, transformed by heat and pressure from an originally igneous or sedimentary rock.
Misfit stream	a stream which is too small to have eroded the valley in which it flows, as is often the case with streams now flowing in meltwater channels.
Moraine	any glacially formed accumulation of unconsolidated debris, in glaciated regions, such as during an ice age.
Mudmound	Waulsortian limestone of Carboniferous age is characterised by forming as massive mounds or ridges or sheets of carbonate mud on the seafloor of the time. Mudmound is a general term to describe the varieties of forms.
Mudstone	a very fine grained sedimentary rock, containing quartz and clay minerals. Similar to shale, but not as easily split along the plane of bedding.
Mushroom rock	a mushroom shaped rock, or undercut limestone rock, formed by dissolution of a rock partially submerged in a lake.
Ore	a mineral which is concentrated enough to be exploited by mining.
Orogeny	the creation of a mountain belt as a result of tectonic activity.
Outcrop	part of a geologic formation or structure that appears at the surface of the Earth.
P-form	plastically moulded, smooth-walled, linear depressions which may be straight, curved, or sometimes hairpin-shaped and measure tens of centimetres to metres in width and depth, formed under ice sheets.
Periglacial	very cold but non-glacial climatic conditions.
Phreatic	when a cave passage or void space in limestone rocks is filled with water it

is said to be phreatic or in the phreas. When later found without water in them such passages have a characteristic cylindrical shape from solution in all directions and are called phreatic tubes.

Phreatic Zone	the area below the water table, where the rock is completely saturated with water.
Plate Tectonics	a theory that states that the crust is divided up into a number of plates, whose pattern of horizontal movement is controlled by the interaction of these plates at their boundaries with one another.
Pyrite	iron sulphide, pale yellow/gold coloured mineral, commonly occurring as cubes and often called 'fool's gold'.
Sandstone	a fine to coarse sedimentary rock, deposited by water or wind, and composed of fragments of sand (quartz grains), cemented together by quartz or other minerals.
Sandur	a plain formed of glacial sediments deposited by meltwater outwash at the terminus of a glacier.
Sedimentary	a rock formed by the deposition of sediment, or pertaining to the process of sedimentation.
Shaft	a vertical hole dug in a mine for access, ventilation, for hauling ore out or for pumping water out.
Shale	a very fine-grained mudstone, containing quartz and clay minerals, that splits easily along the plane of bedding.
Siltstone	is similar to mudstone but with a predominance of silt-sized (slightly coarser) particles.
Sink	another name for a swallow hole, the point where a stream passes underground.
Sluggera	a tube-like collapse of the Earth's surface into an underground cavity, which has formed by the dissolution of limestone.
Slumping	the movement of a mass of unconsolidated sediment or rock layers down a slope, or pertaining to contorted sedimentary bedding features.
Solution pipe	a karstic feature of solution in a vertical narrow chimney or pipe shape.
Spring	the point where an underground stream reaches the surface.
Stratigraphy	the study of stratified (layered) sedimentary and volcanic rocks, especially their sequence in time and correlation between localities.
Sub-aerial	refers to processes occurring above ground level, such as the weathering of rocks.
Subduction	the sinking of one crustal plate beneath the edge of another through the process of plate tectonics.
Subsidence (zone)	the sudden sinking or gradual downward settling of the Earth's surface with little or no horizontal movement.
Swallow hole	the point where a stream passes underground, sinking below the ground surface.
Terrestrial	pertaining to the Earth's dry land.
Till	unconsolidated, unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock as sand, silt or clay also known as boulder clay.
Transgression	an incursion of the sea over land area.
Trilobites	extinct arthropods.
Turbidite	deposit of a turbidity current.
Turbidity Current	underwater density current carrying suspended sediment at high speed down a subaqueous slope. The resulting deposit is called a turbidite.
Turlough	a seasonal lake that fills and empties through springs and sinkholes.
Unconformable	a sedimentary rock that is not following in sequence from the one below but has a significant time gap present between them.

Unconformity	a buried erosion surface separating two rock masses or strata of different ages, indicating that sediment deposition was not continuous.
Vadose Zone	the area between the surface and the water table.
Vein quartz	white thin veins of quartz injected in rock fractures during episodes of stress. Also found as durable beach pebbles, once it has been eroded.
Volcanic Rock	any rock produced from volcanic material, e.g. ash, lava.
Volcaniclastic	rock material was derived from a volcanic eruption, but the rock was deposited as a sedimentary rock like a sandstone, as an aggregate of small particles.
Volcanism	the process by which magma and its associated gasses rise into the crust and are extruded onto the Earth's surface and into the atmosphere.
Volcano	a vent in the surface of the Earth through which magma and associated gasses and ash erupt.

Data sources on the geology of County Roscommon

This section is a brief summary of relevant GSI datasets, to assist any enquiry concerning geology and to target possible information easily. The GSI has very many datasets, accumulated since it began mapping Ireland's geology in 1845. A Document Management System (DMS) is freely available to any person at the GSI Customer Centre, into which about half a million documents and maps have been scanned. This means that any user can visit the GSI Customer Centre themselves and search on screen for data of relevance to them. High quality colour and black and white print-outs can be made or data supplied on CD, or via USB keys etc. **Data is available free of charge.** It is planned to make this resource available online but no date is yet set for when this may be achieved.

Key datasets include:

1:100,000 Map Report Series

All historical, modern and other mapping has been compiled into very useful maps and reports that describe the geology of the entire country. Parts of Sheets 7 and 15 include northern and southern Roscommon respectively but the majority of the county is on Sheet 12.

19th century 6 inch to the mile fieldsheets

These provide an important historical and current resource, with very detailed observations of the geology of the entire country.

19th century one inch maps and Memoirs

Information from the detailed 19th century mapping was distilled into one inch to the mile maps, of which parts of Sheets 65, 66, 67, 76, 77, 78, 86, 87, 88, 97, 98, 107 and 108 cover County Roscommon. Each sheet or several sheets were accompanied by a Memoir which described the geology of that area in some detail. These still provide valuable records of observations even though interpretations may have changed with better geological understanding. Memoirs are in the Customer Centre library and scanned on the DMS.

Historical geological mapping is now available via a website:
<http://www.geologicalmaps.net/irishhistmaps/history.cfm>

Open File Data

Each Mineral Prospecting Licence issued by the Exploration and Mining Division of the Department of Communications, Energy and Natural Resources (currently) carries an obligation on the exploration company to lodge records of the work undertaken, for the common good. These records are held by the Geological Survey and are available as Open File Data, once a period of time has expired. They may include geological interpretations, borehole logs, geophysical and geochemical surveys and so on.

MinLocs Data

The MinLocs Database records all known mineral occurrences, however small, from GSI records, such as 19th century fieldsheets and Open File data.

Historic Mine Records

Abandonment plans and varied other material exists for the various coal mining ventures in the county, particularly in the Arigna district.

Subsoils Mapping

Since a Groundwater Protection Scheme has been completed for County Roscommon by GSI, a recently completed map of the subsoil types and depths across Roscommon exists, as well as the previously completed bedrock mapping. This provides a significant resource in general terms as well as for groundwater protection. Customised output is possible. Further more detailed compilation of glacial geology datasets will provide more options in the near future.

Digital mapping of many different datasets is now available via the GSI website: www.gsi.ie

Shortlist of Key Geological References

This reference list includes a few **key** papers, books and articles on the geology and geomorphology of Roscommon that are recommended as access points to Roscommon's fabulous geological heritage.

DALY, D., DREW, D.P., DEAKIN, J., PARKES, M. and WRIGHT, J. 2001. *The Karst of Ireland; Limestone Landscapes, Caves and Groundwater Drainage Systems*. Karst Working Group Dublin, 37pp.

GATLEY, S., SOMERVILLE, I., MORRIS, J.H., SLEEMAN, A.G. and EMO, G. 2005. Geology of Galway-Offaly and adjacent parts of Westmeath, Tipperary, Laois, Clare and Roscommon: A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 15, Galway-Offaly. Geological Survey of Ireland. Vii + 90pp.

HOLLAND, C.H. (ed.). 2001. *The Geology of Ireland*. Dunedin Academic Press, Edinburgh.

MacDERMOT, C.V., LONG, C.B. and HARNEY, S.J. 1996. *Geology of Sligo-Leitrim*. Geological Survey of Ireland Bedrock Geology Sheet 7.

MITCHELL, G.F. and RYAN, M., 1997. *Reading the Irish Landscape*. Town House Press, 397 pp.

MORRIS, J.H., SOMERVILLE, I.D. and MacDERMOT, C.V. 2003. *Geology of Longford-Roscommon*. Geological Survey of Ireland Bedrock Geology Sheet 12.

Full Geological references

See Appendix 2 for the full reference list of all papers, books, articles and some unpublished reports etc relating to the geology and geomorphology of Roscommon that could be traced.

Caving References

The references in Appendix 3 relate significantly to caves and caving within the Roscommon area. They may only be brief reports or newsletter items. They are generally available within the Speleological Union of Ireland Library which is housed in the Geological Survey of Ireland and is managed by Matthew Parkes.

Mining heritage references

Appendix 2 includes some references specifically pertaining to the mining heritage of County Roscommon. Assistance with locating these references may be provided by the Mining Heritage Trust of Ireland if required.

Quaternary References

The references in Appendix 4 are all covering the Quaternary, or Ice Age, geology of Roscommon. They are split into the specific ones covering Roscommon sites or features and a section of national or regional papers with some Roscommon data included.

Further sources of information and contacts

Sarah Gatley of the Geological Survey of Ireland, who is the Head of the Geological Heritage and Planning Section, can be contacted in relation to any aspect of this report. Nollaig Feeney, the Heritage Officer of Roscommon County Council is the primary local contact for further information in relation to this report. Other contacts include the Conservation Rangers of the National Parks and Wildlife Service, currently in the Department of Arts, Heritage and the Gaeltacht. The names and phone numbers of current staff may be found in the phone book, or at www.npws.ie.

Web sites of interest

www.gsi.ie - for general geological resources

www.geology.ie – the website of the Irish Geological Association who run fieldtrips and lectures for members, including many amateur enthusiasts

www.earthscienceireland.org - for general geological information of wide interest [this website address is likely to change in 2012/2013. Suggestion search for 'Earth Science Ireland']

<http://www.iqua.ie> - for information, fieldtrips, lectures etc in relation to Ireland's Ice Age history

<http://www.cavingireland.org/> - for information on caves and safe caving

<http://www.progeo.se/> - for information about ProGEO the European Association for the Conservation of Geological Heritage

Acknowledgements

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Section 2 - Site Reports

Site reports – general points

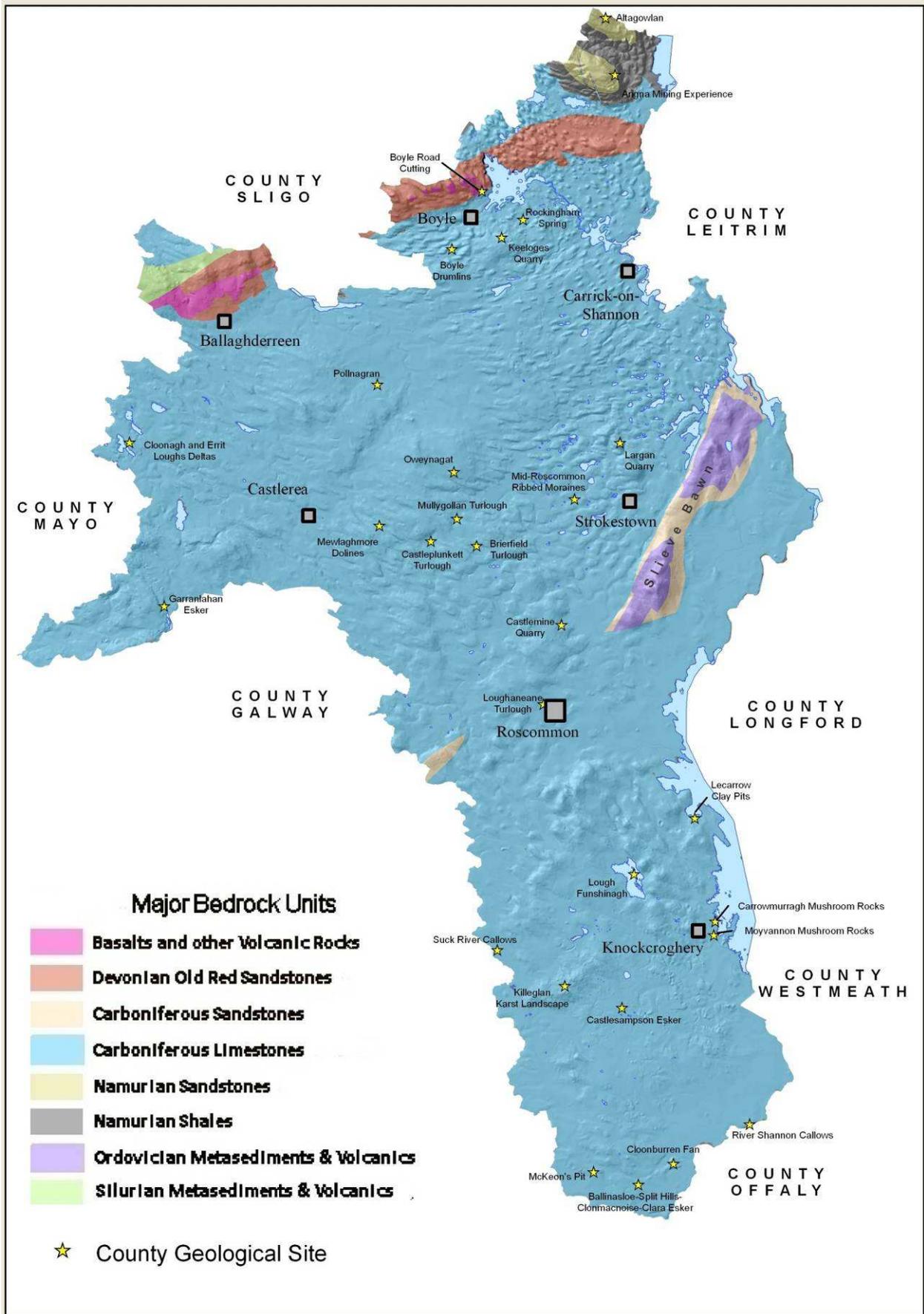
The following site reports are brief non-technical summaries of the proposed County Geological Sites for County Roscommon. These have been specially prepared for this Report in order to make the information accessible to planners and others without geological training. For most sites more detailed reports and information files are held in the IGH Section in the Geological Survey of Ireland. These are available for consultation if required. Further sites may become relevant as IGH Programme work develops.

Each site report has primary location information, a mention of the main rock types and their age, and a short description of the key aspects of scientific interest. A section outlining any particular management or other issues specific to the site is included, along with one or two low resolution photographs exemplifying the site. **A CD accompanying this report will include further pictures of most sites at higher resolution, should they be required for a glossy booklet or leaflet for the general public.** Grid references are given normally for a central point in the site, if the site is small, or two extreme points at opposite ends of the site if the site is extensive or linear. They are only indicative of the location, but the site extent is best shown on the included maps.

A series of maps are provided with an outline of the site boundary. It is important to note that no legal or definitive basis should be based on these boundaries. They are indicative only of the limits of exposure or of geological interest, and not based on detailed field and boundary surveys, which were outside the scope of this contract.

For sites that have been proposed or will be proposed for NHA designation detailed site boundary maps will become available to the Local Authority, through NPWS as the designation process is undertaken. Some areas may already be available if they are proposed NHAs (pNHA), under the Wildlife (Amendment) Act 2000. Areas which have been designated as Special Areas of Conservation (SAC) under European Habitats Directives will also have statutory boundaries already determined. The geological interest may be included within the wider area of nature conservation.

In terms of any geological heritage site designation as NHA, due process of site reporting, boundary survey and very importantly, consultation with landowners where they can be readily identified, will take place before GSI makes recommendations to NPWS on the most important sites to be designated. Any landowner within areas or sites identified in this report with concerns over any aspect of this project is encouraged to contact Sarah Gatley, Head of the Heritage and Planning Section, in the Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4. Phone 01-6782837. Email: sarah.gatley@gsi.ie



Simplified Geological Map of Roscommon with site locations indicated.

ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Brierfield Turlough
Other names used for site	
IGH THEME	IGH1 Karst, IGH7 Quaternary, IGH16 Hydrogeology
TOWNLAND(S)	Slevin, Lismurtagh, Ballaghabawbeg, Ballaghabawmore, Tonbaun, Brierfield, Carrowbaun
NEAREST TOWN	Tulsk
SIX INCH MAP NUMBER	28
NATIONAL GRID REFERENCE	181105 277550 (centre of turlough)
1:50,000 O.S. SHEET NUMBER	40 1/2 inch Sheet No. 12

Outline Site Description

Brierfield Turlough is located southeast of the R367 road, about halfway between Castleplunkett and Tulsk. It is in a noticeable basin, bordered by a rock outcrop to the northeast and southwest, and sloping fields underlain by till around the rest of the feature.

Geological System/Age and Primary Rock Type

The turlough has been formed by solution of the karstified Lower Carboniferous limestone which probably occurred in Tertiary times, while its current form is a result of the glaciers of the last Ice Age, which acted during the late Quaternary Period.

Main Geological or Geomorphological Interest

The turlough basin has a 'V' shape extending southwest and northeast. The southwestern arm is peaty and appears flat or slightly domed. The rest of the turlough floor is uneven, the valley in the northwest opening out into a hummocky zone around the swallow holes with shallow channels. A semi-permanent stream enters from the northwest, and water enters from a spring at the southwest. There is additional seepage into the turlough from the peaty areas at the eastern edge.

Site Importance – County Geological Site; may be recommended as Geological NHA

Brierfield Turlough was one of twenty-two turlough sites included in a project, funded by the National Parks and Wildlife Service and the Environmental Protection Agency, entitled Assessing the Conservation Status of turloughs. Twelve vegetation communities were mapped in Brierfield Turlough.

Management/promotion issues

The site is already a pNHA (site number 000594), but is an excellent site in terms of karst geomorphology as a well developed swallow hole occurs at the centre of the feature and unusual aspects such as algae paper occur at the base of the feature when freshly drained. The site should be promoted as potentially the best example of a karst turlough in County Roscommon.



The sinkholes of Brierfield Turlough exposed when the turlough was dry in September 2012.



Brierfield Turlough, dry in September 2012.

ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Castleplunkett Turlough
Other names used for site	
IGH THEME	IGH1 Karst, IGH7 Quaternary, IGH16 Hydrogeology
TOWNLAND(S)	Castleplunkett, Ardeevan
NEAREST TOWN	Tulsk
SIX INCH MAP NUMBER	27
NATIONAL GRID REFERENCE	177824 277700 (centre of turlough)
1:50,000 O.S. SHEET NUMBER	40 1/2 inch Sheet No. 12

Outline Site Description

Castleplunkett Turlough is located immediately southeast of the R367 road, at Castleplunkett Village. It is in a noticeable basin, bordered by a rock outcrop to the northeast and sloping fields underlain by till to the south.

Geological System/Age and Primary Rock Type

The turlough has been formed by solution of the karstified Lower Carboniferous limestone which probably occurred in Tertiary times, while its current form is a result of the glaciers of the last Ice Age, which acted during the late Quaternary Period.

Main Geological or Geomorphological Interest

The turlough is one of the best examples of a turlough feature, which are commonplace in mid-Roscommon. A semi-permanent stream enters from the northeast and flows towards ponds and a swallow hole in peat and rock, which occurs at the centre of the feature. The floor of the turlough retains a high water table, with ditches in summer and there has been a significant peat accumulation. Fen vegetation covers this peat and there is little formation of marl at present. The turlough has a very distinctive appearance in summer due to the presence of the black moss *Cinclidotus* on rocks in the basin floor.

Site Importance – County Geological Site

Castleplunkett is an important turlough because of its semi-natural condition, and its high degree of physical and vegetational diversity. The wetlands support national and wintering bird populations of conservation status.

Management/promotion issues

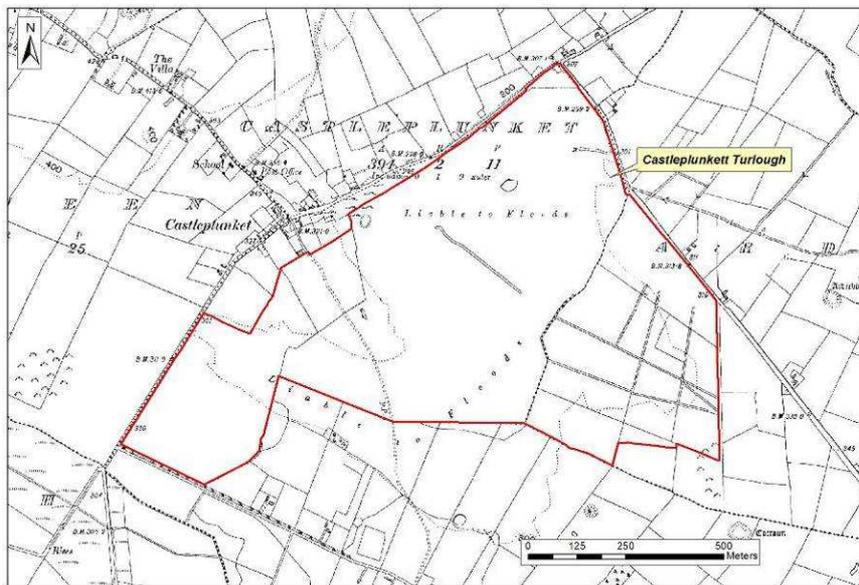
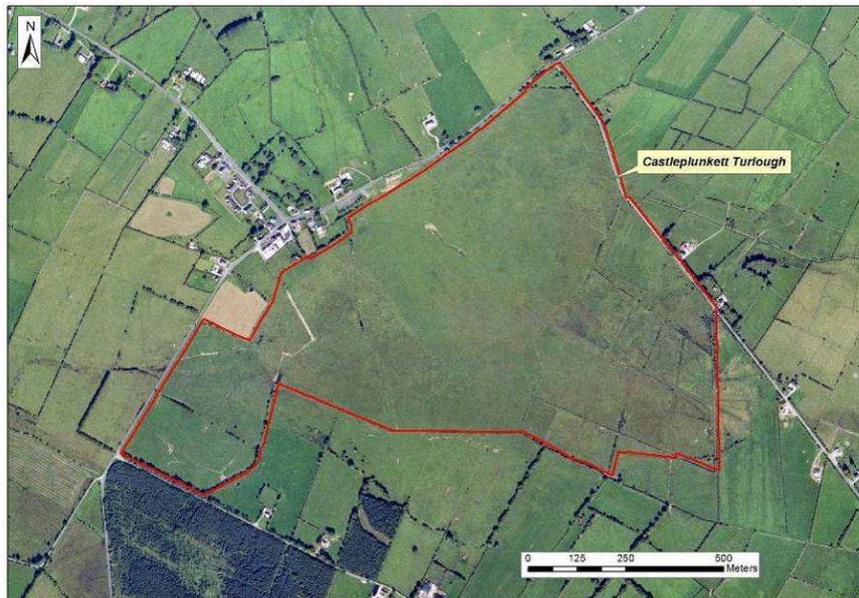
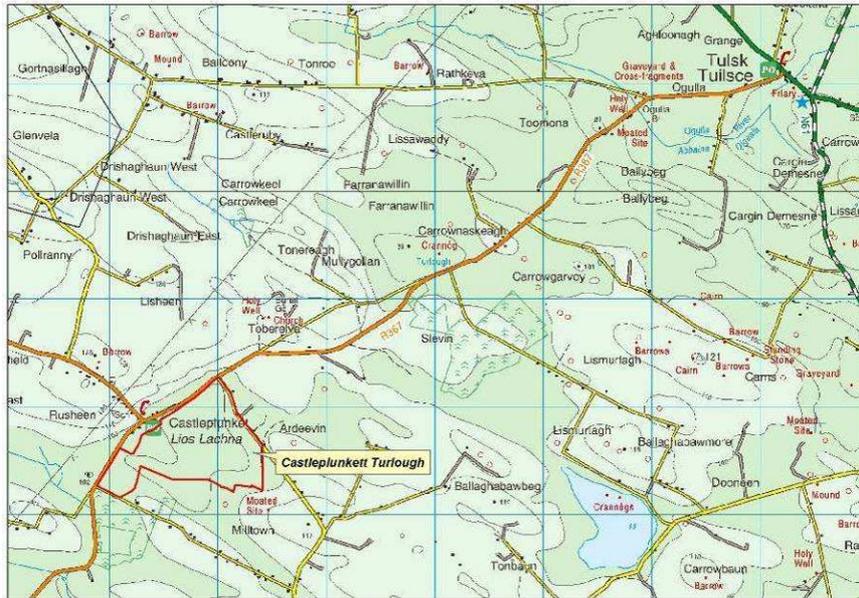
The site has been designated as a proposed NHA (site number 000598). Listing it as a County Geological Site gives recognition to the geological foundation of the biodiversity importance.



A view of Castleplunkett Turlough from the village.



A view of Castleplunkett Turlough from the southeast.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Carrowmurragh Mushroom rocks
Other names used for site	
IGH THEME	IGH1 Karst, IGH14 Fluvial and Lacustrine Geomorphology
TOWNLAND(S)	Carrowmurragh
NEAREST TOWN	Athlone
SIX INCH MAP NUMBER	49
NATIONAL GRID REFERENCE	199758 248115
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 12

Outline Site Description

The site comprises four different limestone rocks in close proximity, which exhibit a mushroom shape or which show dissolution with marked overhanging lips or shelves.

Geological System/Age and Primary Rock Type

These rocks are of Carboniferous limestone, but the solution is believed to be post-glacial (Holocene) from short lived submergence in temporary lakes or higher-level river floodplains than presently exist.

Main Geological or Geomorphological Interest

Throughout Ireland only around 70 of these mushroom stones are known, in several discrete areas. These stones and the associated cluster at Moyvannan in Cornaseer Townland a kilometre south are indicative of a much higher former level of Lough Ree. This prolonged exposure of the undercut portions of the stone probably took place in the period immediately after glaciation ended when there was both extensive meltwater and many temporary barriers of glacial sediment or remnant ice which dammed back water until new overflow channels and breaches were formed.

Site Importance – County Geological Site; may be recommended for Geological NHA

These are fine examples of mushroom stones and are of national importance since there are so few on a countrywide basis.

Management/promotion issues

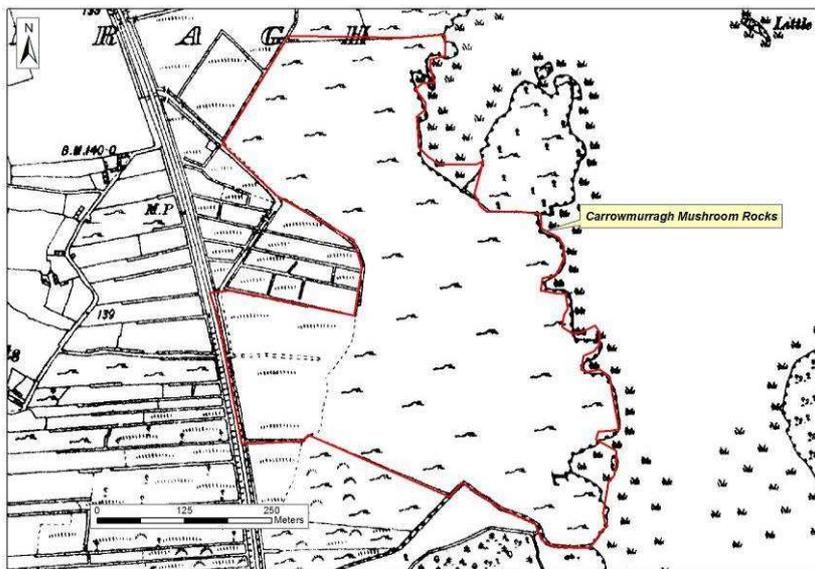
The rocks are inaccessible, very difficult to find and any kind of promotion of them as visitor sites would require some investment as well as landowner agreement and co-operation. It would be desirable to bring them into the public domain and make them accessible, with interpretation. They are also vulnerable to obscurity and damage from the growth of unwanted vegetation like ivy, gorse and brambles. If linked with Moyvannan stones they could make an excellent trail. They are currently within Lough Ree SAC and pNHA (Site Number 000440), and SPA (004064).



Carrowmurragh 1 mushroom stone.



Carrowmurragh 1 mushroom stone viewed from a different angle showing the pedestal and undercut.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Mullygollan Turlough
Other names used for site	Carrownaskeagh Turlough
IGH THEME	IGH1 Karst, IGH7 Quaternary, IGH16 Hydrogeology
TOWNLAND(S)	Mullygollan, Carrownaskeagh, Farranawillin, Slevin
NEAREST TOWN	Tulsk
SIX INCH MAP NUMBER	28
NATIONAL GRID REFERENCE	179900 279430 (centre of turlough)
1:50,000 O.S. SHEET NUMBER	40 1/2 inch Sheet No. 12

Outline Site Description

Mullygollan Turlough is located immediately northwest of the R367 road, about halfway between Castleplunkett and Tulsk. It is in a noticeable basin, bordered by a rock outcrop to the north and sloping fields underlain by till to the south.

Geological System/Age and Primary Rock Type

The turlough has been formed by solution of the karstified Lower Carboniferous limestone which probably occurred in Tertiary times, while its current form is a result of the glaciers of the last Ice Age, which acted during the late Quaternary Period.

Main Geological or Geomorphological Interest

The turlough is one of the best examples of a turlough feature, which are commonplace in mid-Roscommon. A semi-permanent stream enters from the west and flows towards ponds and a swallow hole in rock. The floor of the turlough retains a high water table, with ditches in summer and there has been a significant peat accumulation. Fen vegetation covers this peat and there is little formation of marl at present.

Site Importance – County Geological Site

Mullygollan is an important turlough because of its semi-natural condition, and its high degree of physical and vegetational diversity. The occurrence of the scarce Water Sedge (*Carex aquatilis*) and Lesser Water-parsnip (*Berula erecta*), the former in its only known turlough site are of interest. This, coupled with its birdlife, adds to its overall importance ecologically.

Management/promotion issues

The site has been designated an SAC and is a proposed NHA (Site No. 000612). 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 are designated to afford protection to the most vulnerable of them. Listing Mullygollan Turlough as a County Geological Site gives recognition to the geological foundation of the biodiversity importance.



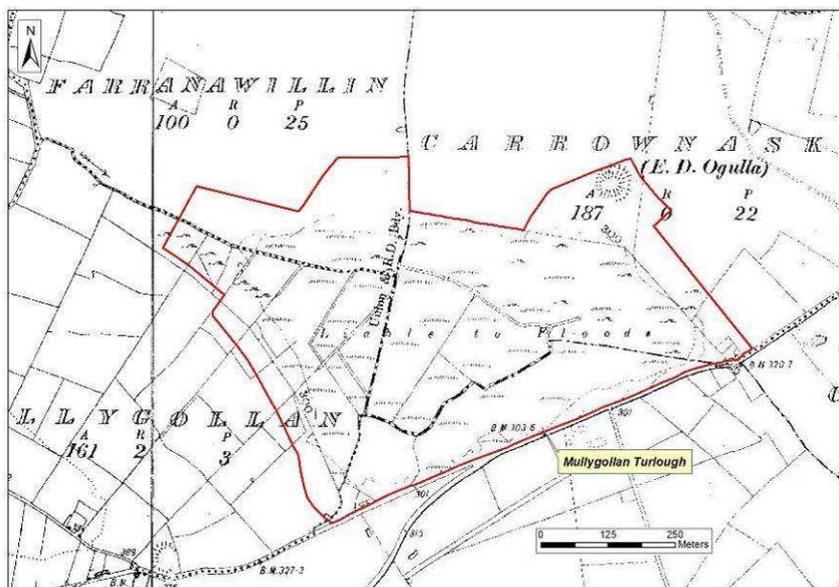
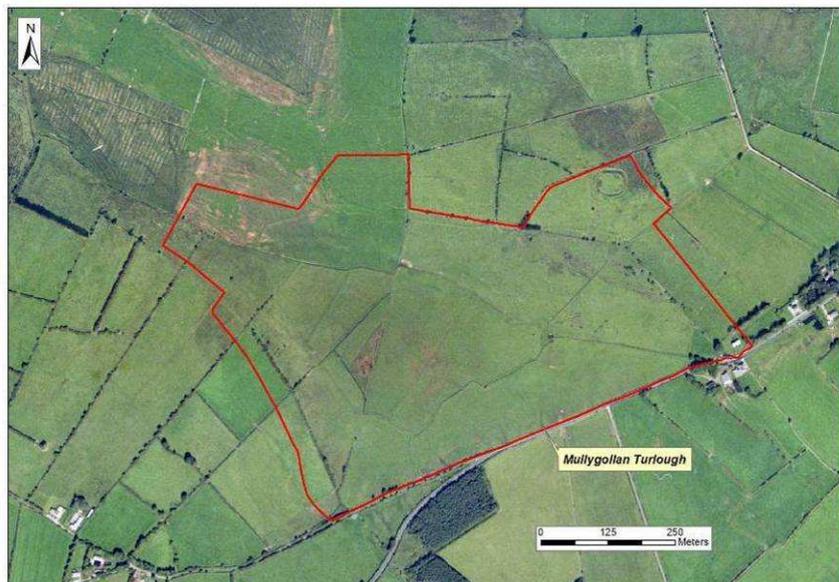
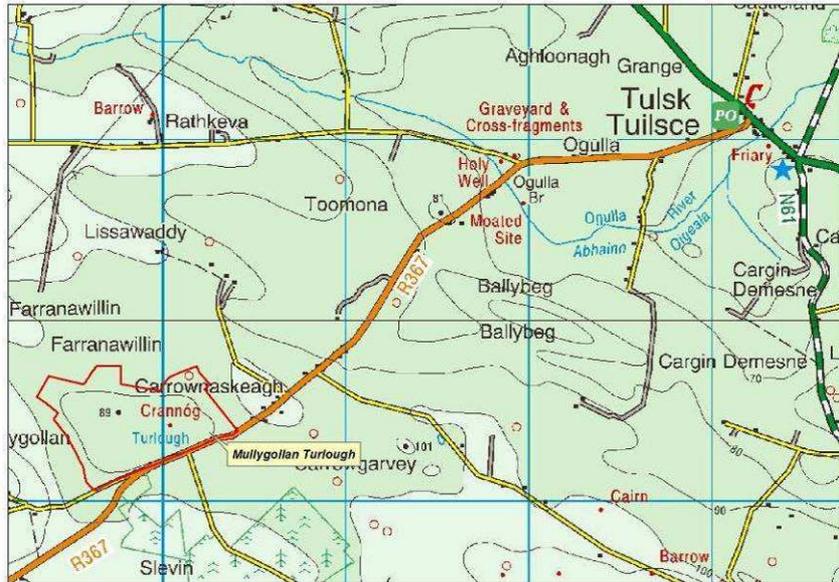
A panorama view of Mullygollan Turlough from higher ground to the southwest.



A panorama view northwest into the turlough from the R367 road.



A view of the centre of Mullygollan Turlough from the southwest.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Killeglan Karst Landscape
Other names used for site	
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Milltown, Cuilleenoolagh, Cloonacaltry, Skeavally, Boleyduff, Tobermacloughlin, Lugboy, Breeole, Porteen, Ballyglass
NEAREST TOWN	Ballyforan, Taghmaconnell
SIX INCH MAP NUMBER	47, 48, 50
NATIONAL GRID REFERENCE	188250 243150 (centre of area)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 12

Outline Site Description

This site comprises an extensive area of bouldery terrain in southern Roscommon, covering an area of 5 by 2 kilometres, and includes a number of low amplitude, hummocky ridges. Three discrete areas of this topography are defined in close proximity to each other.

Geological System/Age and Primary Rock Type

The landscape is formed on bedrock which is Lower Carboniferous limestone. The majority of the ridge features, as well as the boulders, are Quaternary in age, having been deposited at the base or edge of the ice sheet moving northwest to southeast during the maximum period of the last Ice Age.

Main Geological or Geomorphological Interest

This area is unique in lowland Ireland as it expresses what the entire lowland limestone landscape would have looked like before man modified the countrywide, by reclaiming land and building field boundaries.

The area comprises a number of low, quasi-linear and hummocky ridges, which are 2m-10m in amplitude and often long and sinuous. These seem to be minor ribbed moraines. All of these features have been covered by karstified limestone boulders strewn across the ground. The area looks just like an area of karstified bedrock outcrop in many respects, but little outcrop is seen. The abundance of limestone boulders gives the landscape an unusual and rustic feel. The entire area is dry, with no surface drainage features visible. The majority of the area comprises dry grassland or scrub.

Site Importance – County Geological Site; recommended for Geological NHA

This is the only such area of lowland, boulder-strewn, limestone glacial karst in the country. It is of national importance.

Management/promotion issues

This is an excellent site in terms of macro-scale Quaternary geomorphology. The landscape is noteworthy and should be promoted as unique amongst landscape elements within the Roscommon County Development Plan and in Landscape Characterisation. The site should also be designated as an NHA owing to the uniqueness of the natural landscape character.

The site boundary illustrated here delineates the area displaying this geology in 2004 when the aerial photographs of the locality were taken. As land management practices are constantly changing and may have impacted heavily on this vulnerable landscape, in order to delineate the exact remaining area of interest a detailed field survey is required.

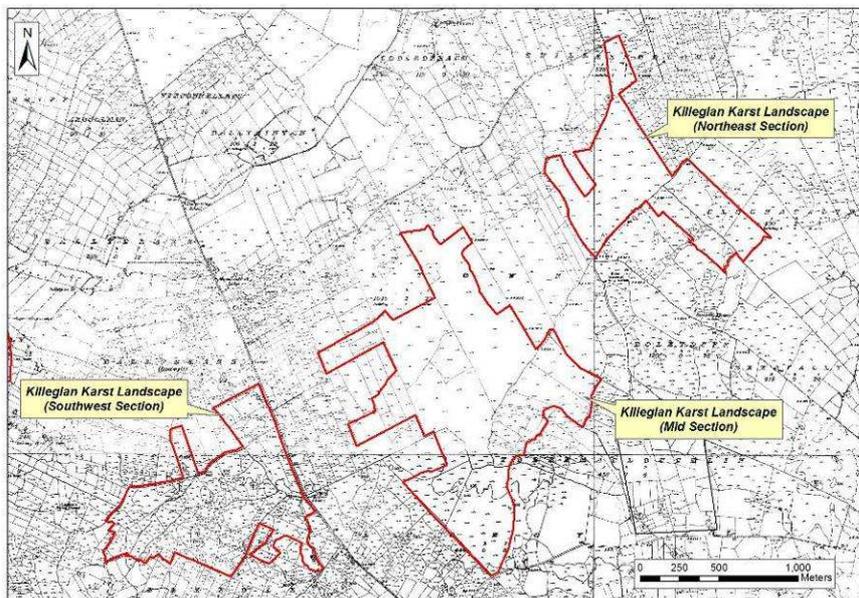
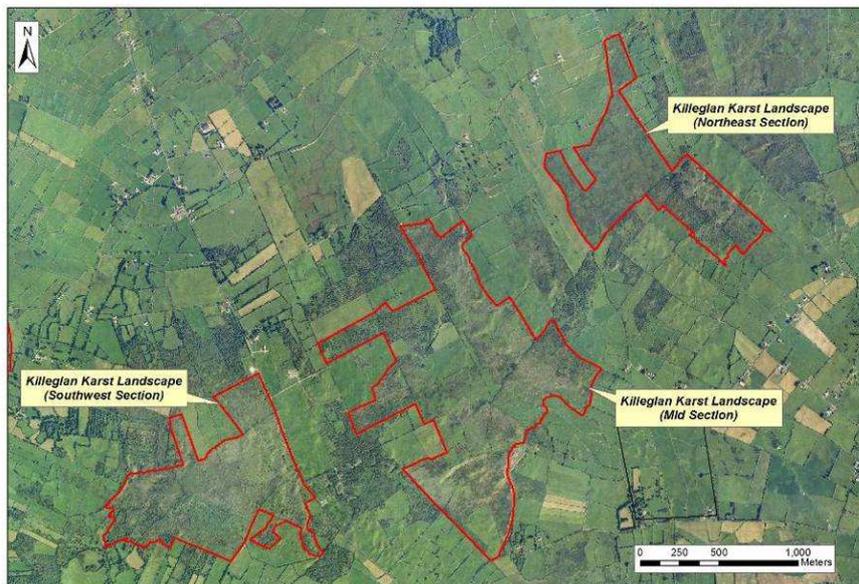
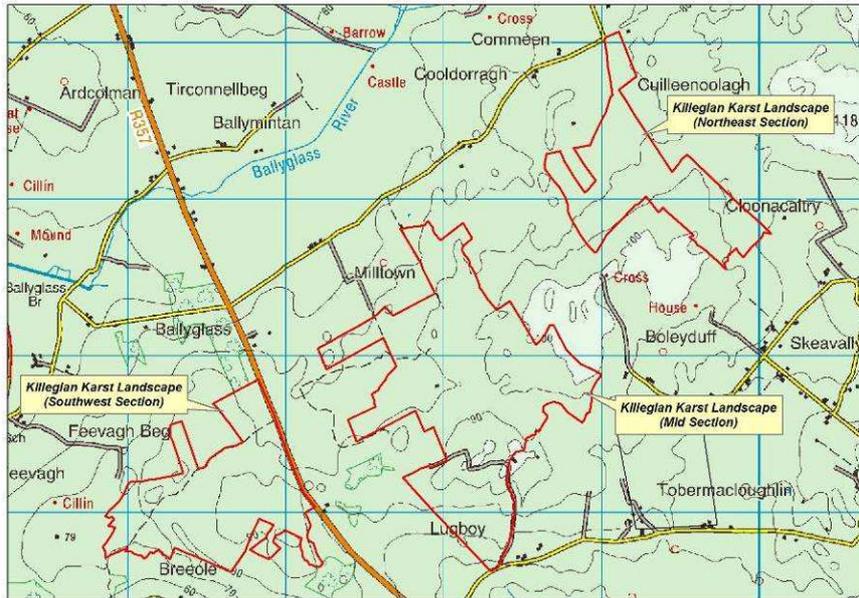
Further research and investigation is required to document and understand the full scientific story. Since a windfarm has been granted planning permission in 2012, it is hoped that scientific opportunity created by ground excavations for this will be used and not wasted.



The pristine landscape of limestone boulders on glacial moraine at Killeglan.



The pristine landscape of limestone boulders on glacial moraine at Killeglan, with karstic weathering imitating limestone bedrock.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE Lough Funshinagh
Other names used for site
IGH THEME IGH 1 Karst, IGH7 Quaternary, IGH16 Hydrogeology
TOWNLAND(S) Ballagh, Lahara, Lysterfield, Kildurney, Carrick,
Carrickbeg, Inchiroe and Gortfree, Lisfelim
NEAREST TOWN Athlone
SIX INCH MAP NUMBER 45
NATIONAL GRID REFERENCE 193470 251500

1:50,000 O.S. SHEET NUMBER 40, 47 1/2 inch Sheet No. 12

Outline Site Description

Lough Funshinagh is a large lake which is known to occasionally disappear rapidly.

Geological System/Age and Primary Rock Type

The lake is in a karstic terrain with Carboniferous limestone bedrock underlying it, although there may be thin clay or marl deposits underlying the lake bed.

Main Geological or Geomorphological Interest

Lough Funshinagh is not a true turlough, but rather it is a disappearing lake. This only happens occasionally, with the last rapid draining taking place in September 1996. It appears that there must be one or more swallow holes in the lake bed which are normally 'plugged' with an impermeable layer, such as clay. If the seal is broken, then the shallow lake may drain, leaving large expanses of dry lakebed. Gradual slumping inward of impermeable material may then reseal the swallow hole and allow the lake to fill gradually again.

Site Importance – County Geological Site; recommended for Geological NHA

The rarity of such disappearing lakes in Ireland means that this site has already been recommended by GSI for designation as a geological Natural Heritage Area by the NPWS.

Management/promotion issues

Access by road to the lake is fairly restricted and could be enhanced if council resources permitted. However, unless the lake has had a disappearing event, it presents no more specific interest to a visitor than any other lake in the county. If the event happens again, it would be very helpful if appropriate geological researchers could be alerted in order to access the site and make observations about processes and locations of importance. Photographs taken during this time, of the lake itself from both the surrounding land and air, would be especially useful.

Lough Funshinagh is already a proposed NHA and an SAC (site number 000611).



Lough Funshinagh from the roadside at the southern end looking north.



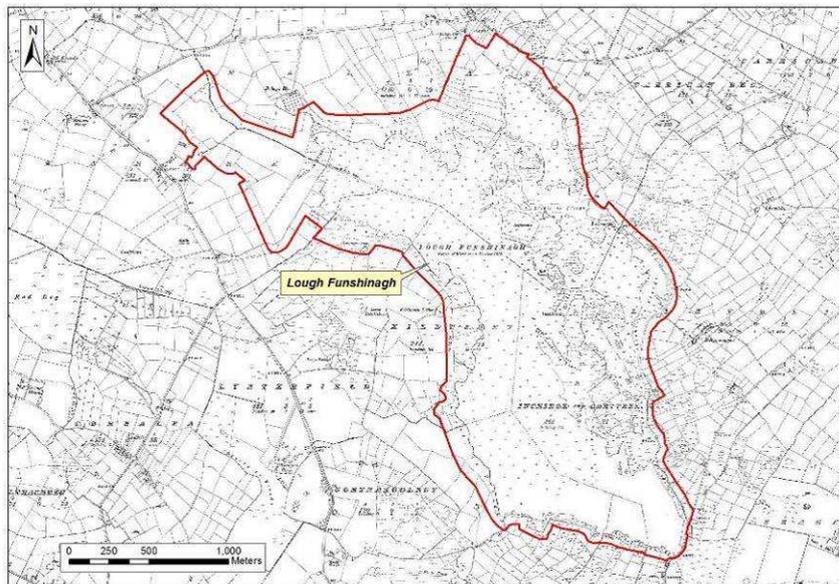
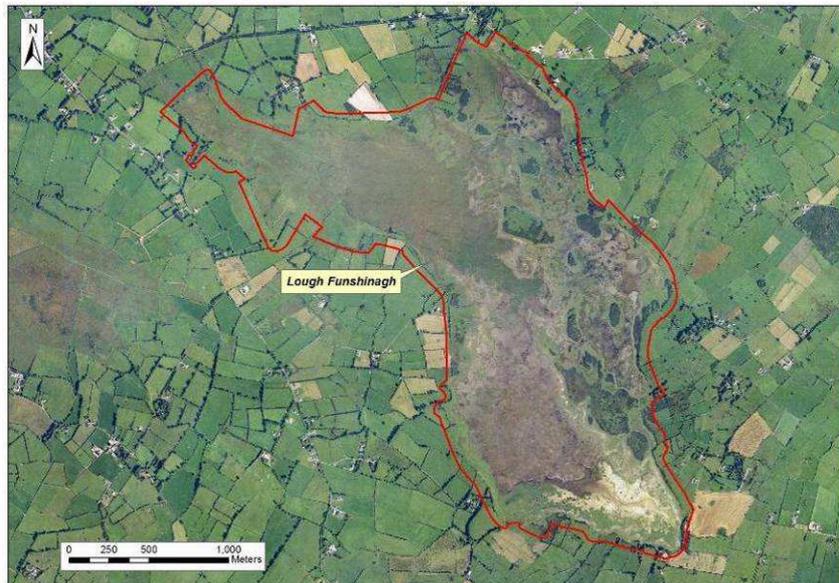
Lough Funshinagh viewed from the southwest side of Red Hill.



Lough Funshinagh, damp (left) and dry with algal paper covering (right) after a draining event in September 1996 (Photos: David Drew).



The main sink at Lough Funshinagh (Photo: David Drew)



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Loughnaneane Turlough
Other names used for site	Loughnaneane Park
IGH THEME	IGH1 Karst, IGH7 Quaternary, IGH16 Hydrogeology
TOWNLAND(S)	Loughnaneane, Ballyboughan
NEAREST TOWN	Roscommon
SIX INCH MAP NUMBER	39
NATIONAL GRID REFERENCE	186670 265000 (centre of feature)
1:50,000 O.S. SHEET NUMBER	40
	1/2 inch Sheet No. 12

Outline Site Description

This site comprises an expansive turlough adjacent to Roscommon town.

Geological System/Age and Primary Rock Type

The turlough is founded on Carboniferous Limestone bedrock, in a basin eroded largely by ice sheets during the Ice Age (Quaternary).

Main Geological or Geomorphological Interest

The turlough is a karstic basin which is sometimes inundated with water yet at other times is dry grassland, depending on the level of the water table. This turlough shows no obvious large springs to feed it, nor sinks that take water, as many turloughs have, so presumably water flow is via many smaller conduits in the bedrock.

Site Importance – County Geological Site

This turlough is a good example of a geomorphological feature which Roscommon has a large number of, but which are rare in Europe as a whole and largely represented only in Ireland. An arbitrary choice of larger than 10 hectares in size for SAC designation of turloughs means that some smaller ones such as Loughnaneane Turlough of significance are overlooked in nature conservation designations.

Management/promotion issues

This site has a pride of place in Roscommon town through Loughnaneane Park which is partly within the turlough and which already offers good opportunities for people to visit, view, learn about and enjoy the turlough and its wildlife, as the seasons change and water levels in the turlough also change.



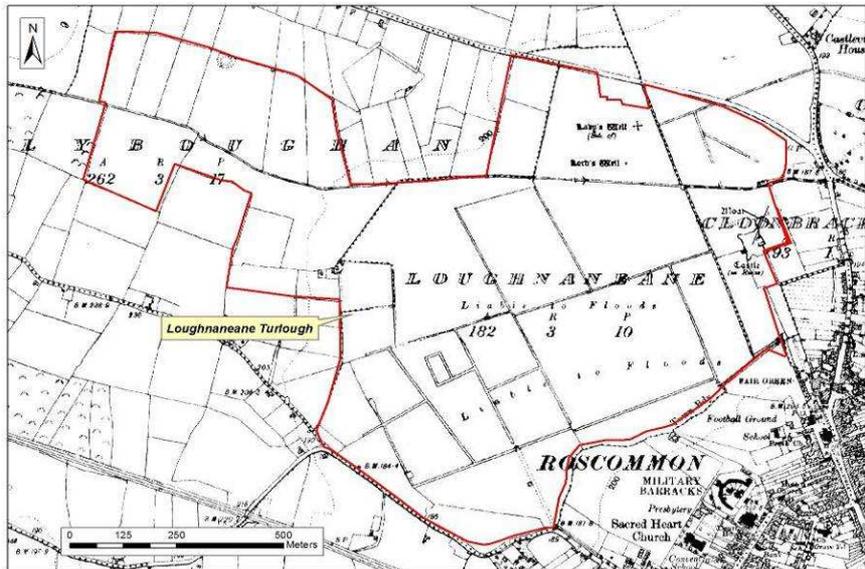
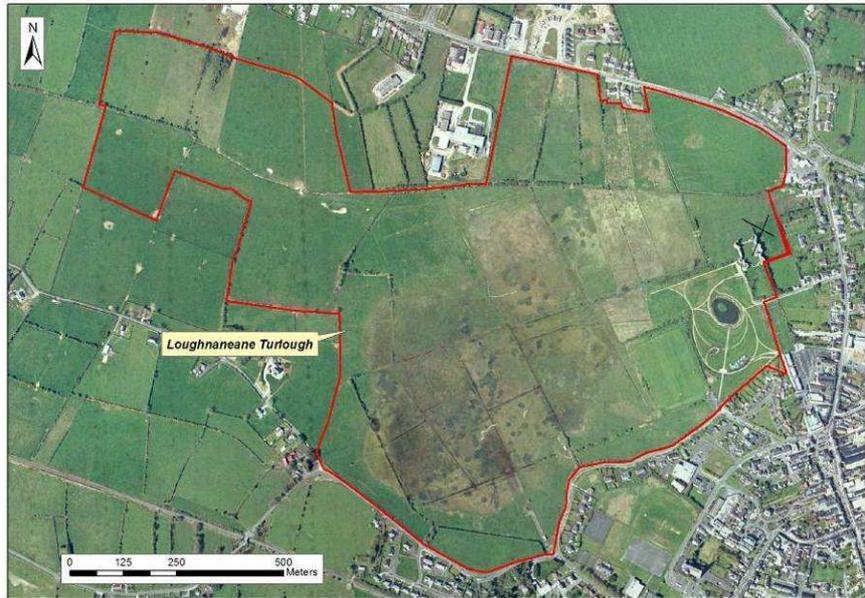
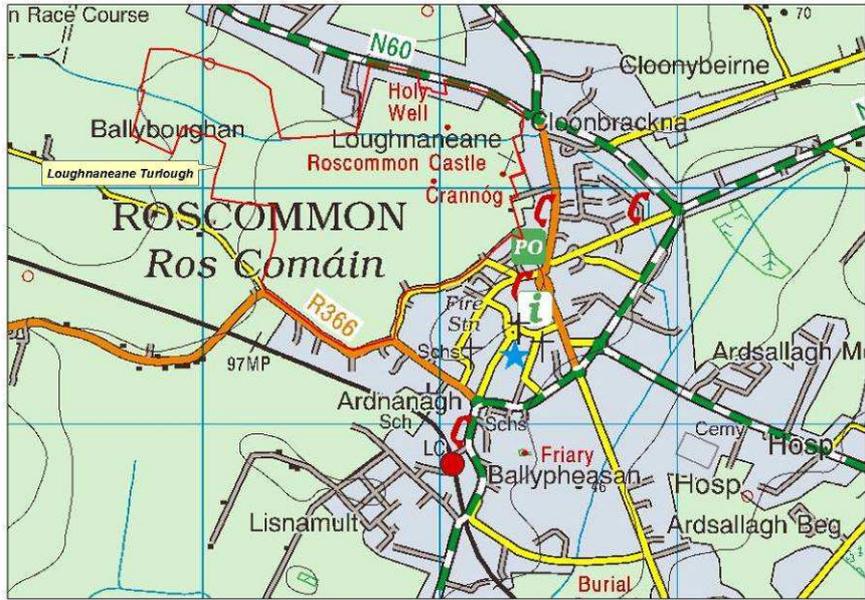
A view over the turlough in summer of 2012, from the road at the southeastern margin.



A sign for the park approaching the town. Horses grazing the drier slopes of the turlough.



A view from Roscommon Castle steps looking over the public park, to the left, and fields sloping down to the centre of the turlough basin, looking west.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Mewlaghmore Dolines
Other names used for site	
IGH THEME	IGH1 Karst
TOWNLAND(S)	Southpark Demesne, Lissalway, Mewlaghmore, Rathbarna, Knockalegan West
NEAREST TOWN	Castlerea
SIX INCH MAP NUMBER	27
NATIONAL GRID REFERENCE	173360 279100 (centre of features)
1:50,000 O.S. SHEET NUMBER	40 1/2 inch Sheet No. 12

Outline Site Description

The Mewlaghmore Dolines comprise a series of enclosed karstic depressions (or dolines) situated southwest of the R377 road, adjacent to Lissalway Crossroads. They are aligned in a northwest to southeast direction at the base of a shallow valley.

Geological System/Age and Primary Rock Type

The dolines have been formed by solution of the karstified Lower Carboniferous limestone during the late Quaternary Period.

Main Geological or Geomorphological Interest

The Mewlaghmore locality contains a large number of karst features (enclosed depressions and swallow holes) oriented along a linear plane. This is an excellent example of a high density of karst features along a dry valley. The field contains different types and forms of dolines, ranging from shallow, gentle-sided depressions to large, deep collapse dolines with vertical sides. The collapses follow a general line running northwest to southeast, which becomes increasingly more 'valley-like' to the west. Some of the features are dry, some hold ponded water and some are actually becoming swallow holes gradually as water is beginning to sink continually into them.

Site Importance – County Geological Site; recommended for Geological NHA

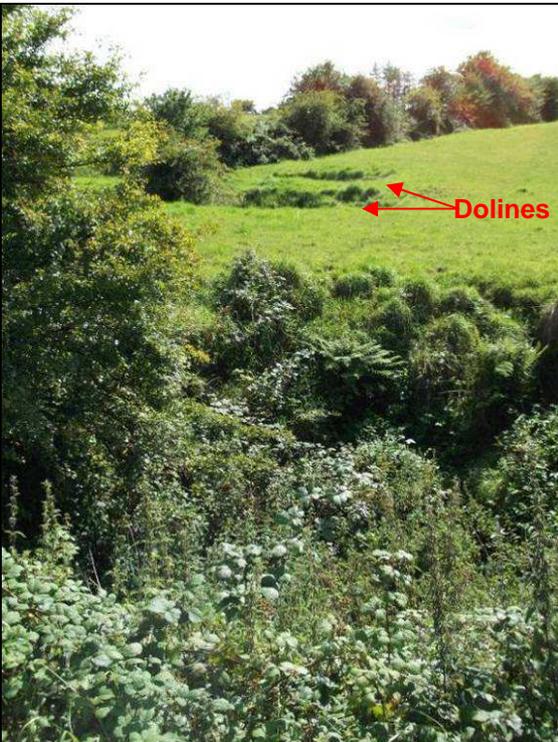
The field of collapse features is perhaps the finest in the country. It is rare to have such a high concentration of dolines, but the wide range of form within the features makes this locality an even more unique one. The site is proposed as a Geological NHA.

Management/promotion issues

This is an excellent site in terms of karst geomorphology. The site should be considered as potentially the best example of a field of collapse features in the country. The landowner should be identified if possible, to raise awareness of the scientific importance of these features. They are very vulnerable to misguided efforts at drainage or 'land improvement' for agricultural reasons.



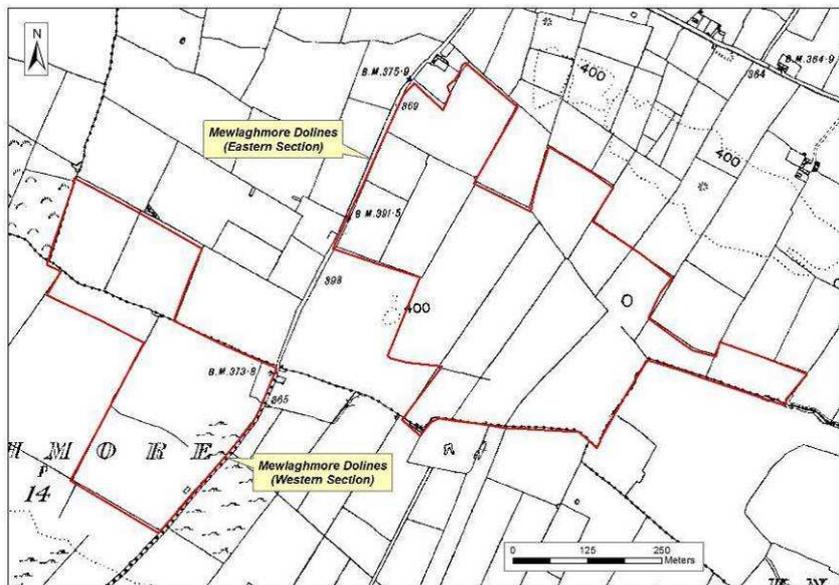
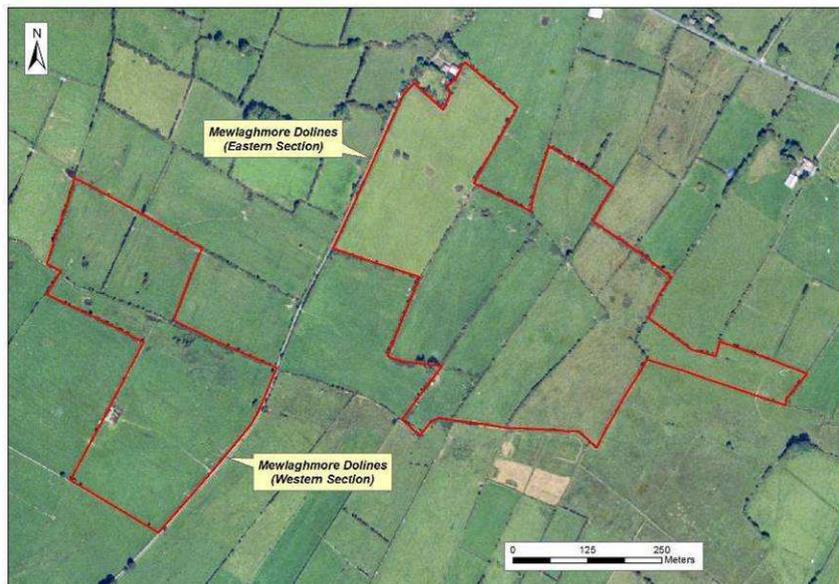
A view over the doline field, with many unseen shallow dolines present beyond the foreground example, with a small pond in it.



A sinkhole has developed in the foreground doline.



Two dolines: one flooded, one not.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Moyvannan Mushroom rocks
Other names used for site	Cornaseer mushroom stones
IGH THEME	IGH1 Karst, IGH14 Fluvial and lacustrine Geomorphology
TOWNLAND(S)	Cornaseer
NEAREST TOWN	Athlone
SIX INCH MAP NUMBER	49
NATIONAL GRID REFERENCE	199583 247136
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 12

Outline Site Description

This site comprises seven different limestone rocks in close proximity which exhibit a mushroom shape or which show dissolution with marked overhanging lips or shelves.

Geological System/Age and Primary Rock Type

These rocks are of Carboniferous limestone, but the solution is believed to be post-glacial (Holocene) from short lived submergence in temporary lakes or higher-level river floodplains than presently exist.

Main Geological or Geomorphological Interest

Throughout Ireland only around 70 of these mushroom stones are known, in several discrete areas. These stones and the associated cluster at Carrowmurragh a kilometre north are indicative of much higher former levels of Lough Ree. This prolonged exposure of the undercut portions of the stone probably took place in the period immediately after glaciation ended when there was both extensive meltwater and many temporary barriers of glacial sediment or remnant ice, which dammed back water until new overflow channels and breaches were formed.

The primary stone at Moyvannan is considered to be the classic form, with a full mushroom shape, and also with three lips on the underside indicating three separate former lake levels.

Site Importance – County Geological Site; recommended for Geological NHA

The primary stone is perhaps the 'best' example of a mushroom stone in the country and has been promoted by GSI for designation by NPWS as a geological NHA.

Management/promotion issues

The rocks are inaccessible and any kind of promotion of them as visitor sites would require some investment as well as landowner agreement and co-operation. It would be desirable to bring them into the public domain and make them accessible, with interpretation. They could be linked with the Carrowmurragh stones in some kind of trail. They are also vulnerable to obscurity and damage from the growth of unwanted vegetation like ivy, gorse and brambles. They are currently within Lough Ree SAC and pNHA (Site Number 000440), and SPA (004064).



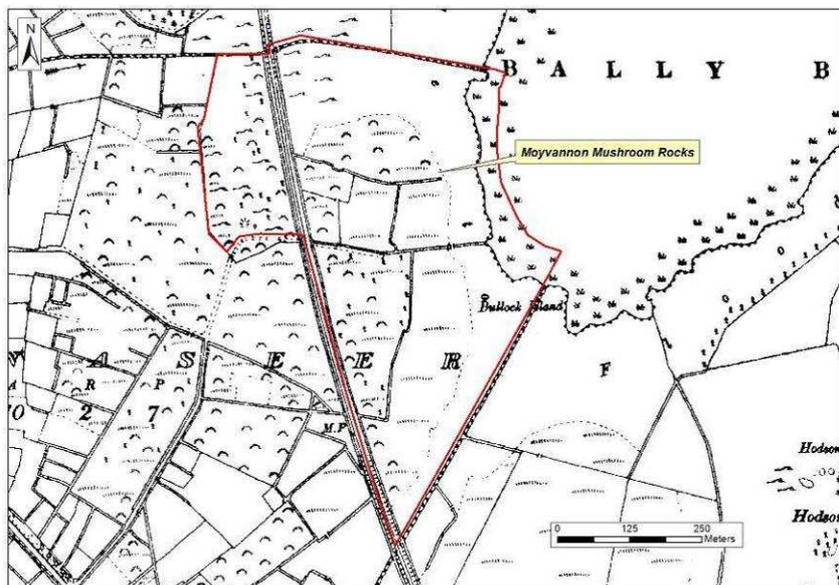
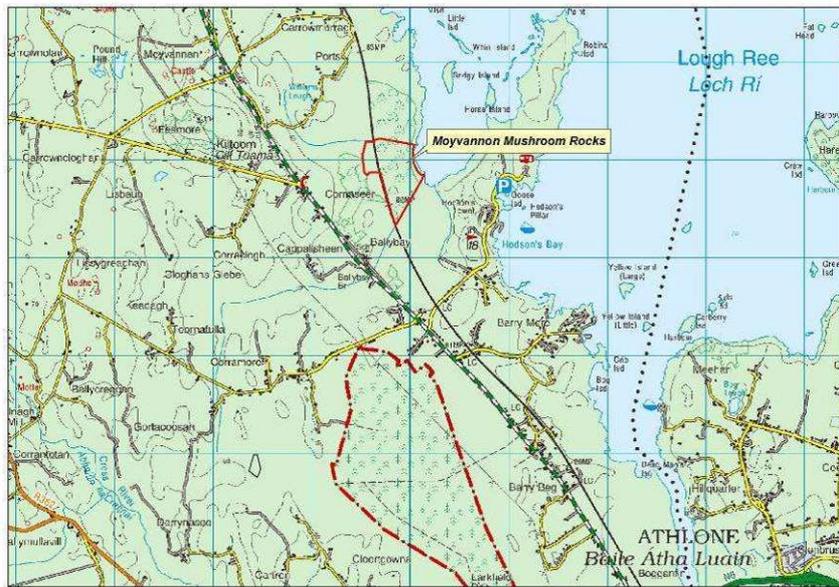
Stylised image of Moyvannan Mushroom rocks from Geological Survey of Ireland Memoir of 1865.



Moyvannan 1 mushroom rock.



Moyvannan 1 mushroom rock viewed from distance showing how vegetation is swallowing up the rock.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Oweynagat
Other names used for site	Uaigh nag Cat, Cave of the Cats, also possibly the Cave of Crúachu
IGH THEME	IGH1 Karst
TOWNLAND(S)	Glenballythomas
NEAREST TOWN	Tulsk
SIX INCH MAP NUMBER	22
NATIONAL GRID REFERENCE	179580 283110
1:50,000 O.S. SHEET NUMBER	33
	1/2 inch Sheet No. 12

Outline Site Description

Oweynagat is a linear rift cave entered via a souterrain.

Geological System/Age and Primary Rock Type

The cave is within Carboniferous limestone, but is likely to be post-glacial (Holocene) in age.

Main Geological or Geomorphological Interest

Aside from its archaeological and folklore interest, as a cave entered via a souterrain, and with an ogham stone built into the entrance roof, the cave is one of very few in County Roscommon and is in an extensive area of karstic terrain, with no other known caves. At Oweynagat there is 37m length of a straight rift passage, with its roof close to surface. Similar unroofed rifts are found within the same field towards the northwest.

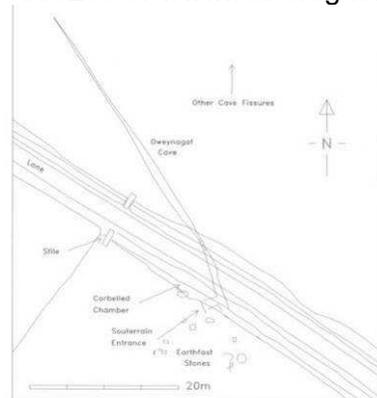
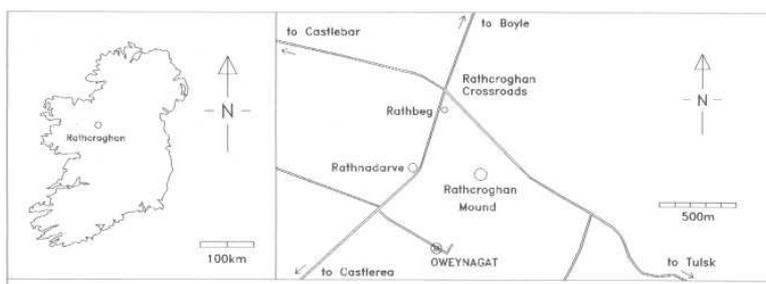
A thin veneer of glacial sediment covers most of the limestone terrain in the plateau area west of Tulsk. There may well be other similar caves nearby, masked by sediment cover. The cave has no active stream.

Site Importance – County Geological Site

Although not especially large or otherwise remarkable, the isolated location and rarity of this cave make it important enough to be a County Geological Site. Its place within the rich, undamaged archaeological landscape around Rathcroghan supports the geomorphological interest.

Management/promotion issues

The cave and the souterrain entrance are on private farmland and are not suitable for visiting or promotion other than by permission of the landowner. Although not long or complex, cave environments are both fragile and potentially dangerous and caves should only be visited in the company of experienced cavers. Public access may be available in guided tours on occasion, through the Rathcroghan Visitor Centre in Tulsk (contact 071-9639268 or www.rathcroghan.ie).





Inside the main rift section of the cave.



Unroofed cave passage near the cave.



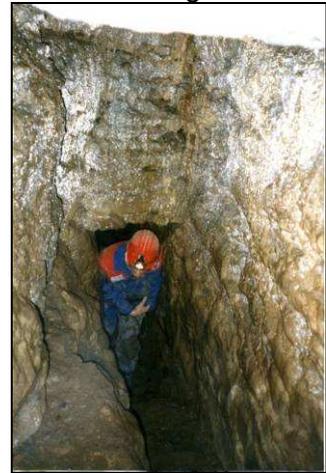
Inside the main cave rift passage.



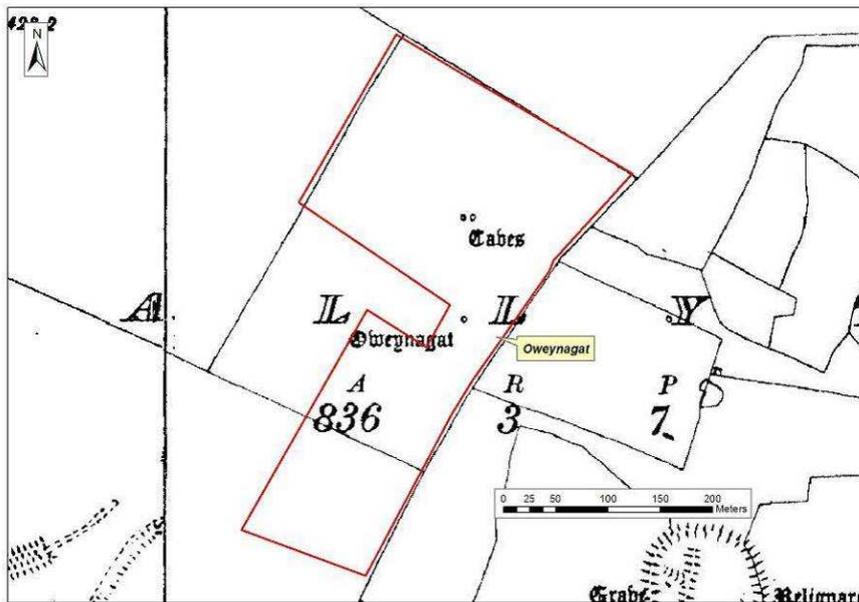
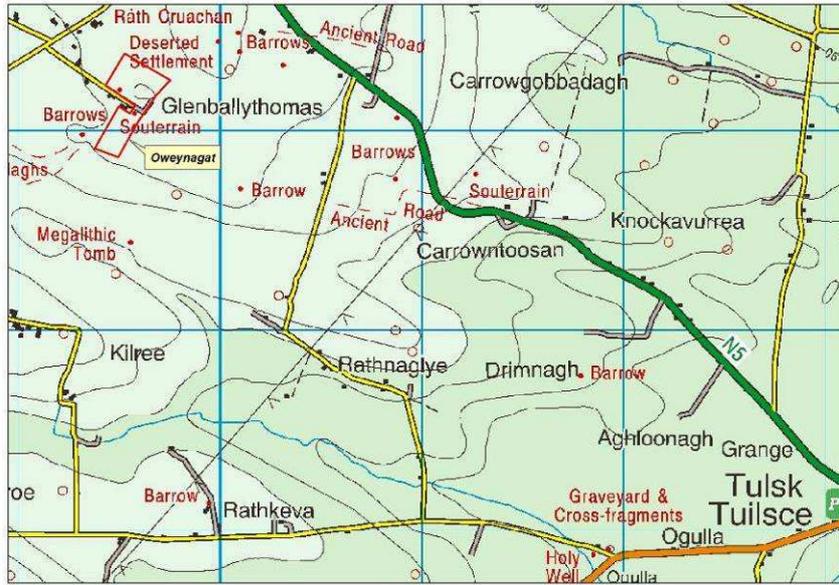
The stepped entrance looking outwards.



Outside the entrance to Oweynagat.



The stepped entrance looking inwards.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Pollnagran		
Other names used for site			
IGH THEME	IGH1 Karst		
TOWNLAND(S)	Leggatinty		
NEAREST TOWN	Frenchpark		
SIX INCH MAP NUMBER	15		
NATIONAL GRID REFERENCE	173510 289696		
1:50,000 O.S. SHEET NUMBER	33	1/2 inch Sheet No.	12

Outline Site Description

Pollnagran is a 750m long, active stream cave.

Geological System/Age and Primary Rock Type

The cave is post-glacial (Holocene) in age.

Main Geological or Geomorphological Interest

This is the only active stream cave in Roscommon, and at 750m long is not insignificant. It was discovered in 2003 by two scientific cavers exploring all known and potential cave sites in Roscommon.

The cave has an entrance in a shallow blind valley where a surface stream disappears underground, although a second stream combines with the first a short distance in. The cave is then a single linear passage trending northeast until it becomes impassable. It follows a single bedding plane down a very shallow dip of 2-3 degrees and is a vadose trench. This means there is water cutting down in a trench, but with air above.

Scalloping of the walls is of small size and indicates fast flowing water. There are zones with roof breakdown, and many deposits of cobbles, sand and silt from reworking of the glacial till on which the surface stream flows before sinking into the limestone. There are also some calcite deposits inside the cave, cementing the fill material as false floors. The cave is near the surface as there are zones of active collapse in the overlying fields.

Site Importance – County Geological Site

As a rare active stream cave, this site merits being a County Geological Site, and it is unusual in the context of the widespread karstic terrain in County Roscommon.

Management/promotion issues

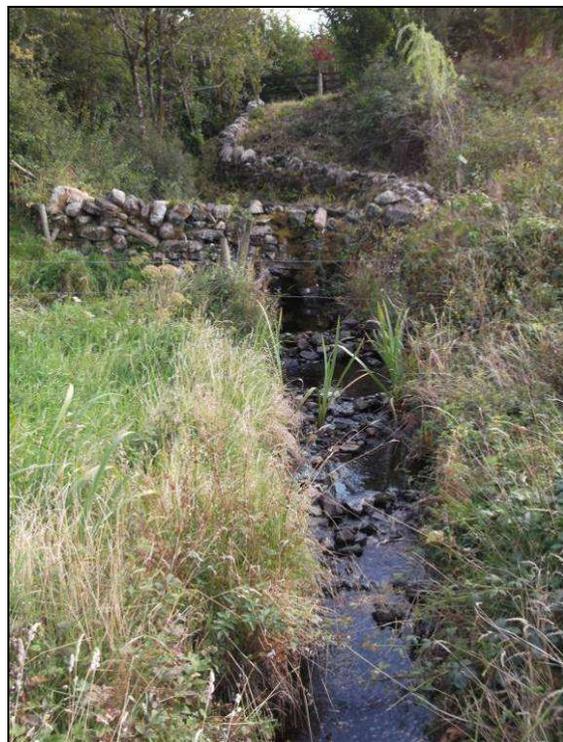
The cave has a very tight entrance providing its own restriction to all but small and determined cavers. It is on private land and is not suitable for promotion.



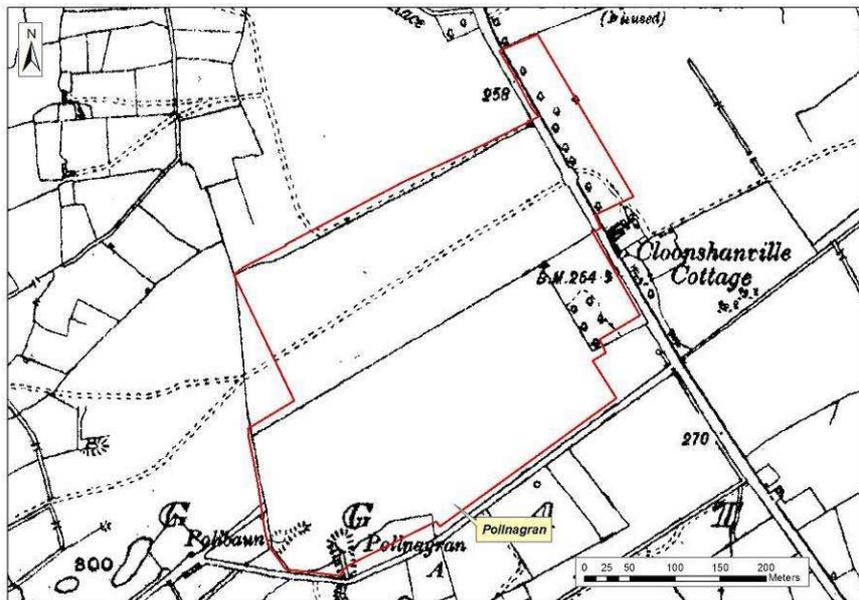
The cave entrance is at the end of the blind valley in the bramble vegetation.



The cave entrance.



The stream that forms the cave.



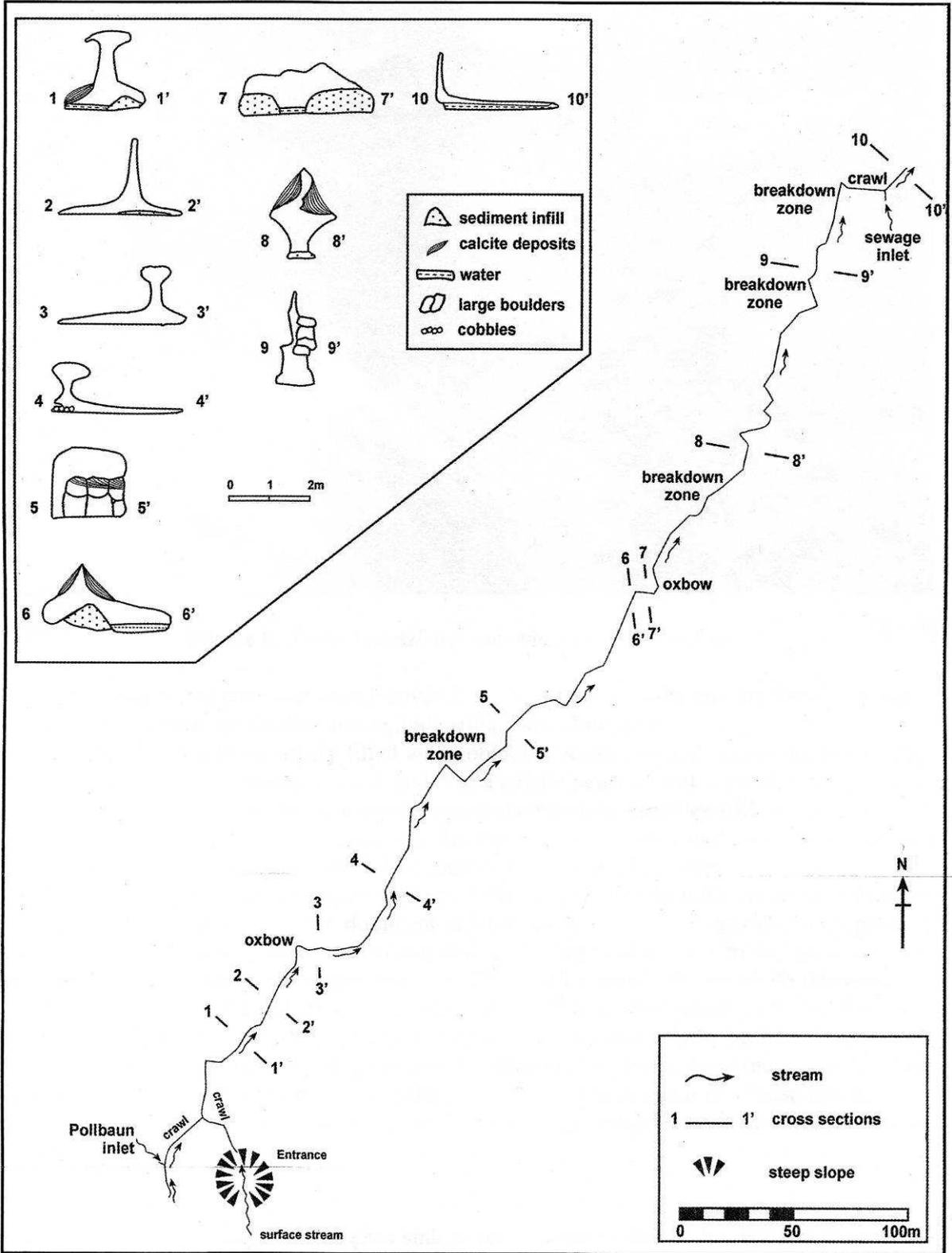


Figure 7. Plan survey of Pollnagran.

ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Rockingham Spring
Other names used for site	
IGH THEME	IGH1 Karst, IGH16 Hydrogeology
TOWNLAND(S)	Rockingham Demesne
NEAREST TOWN	Boyle
SIX INCH MAP NUMBER	6
NATIONAL GRID REFERENCE	184970 302880 (spring)
1:50,000 O.S. SHEET NUMBER	33 1/2 inch Sheet No. 7

Outline Site Description

The Rockingham Spring site comprises a disused spring sump and three production boreholes (PW-1, PW-2, PW-3). The spring overflows via two channels to meet the Ballykeevican stream, which then flows to Lough Key. A fourth, augmentation borehole is approximately 300 m north east of the spring, located in the adjacent field.

Geological System/Age and Primary Rock Type

The spring is of karstic origin, formed in pure bedded limestones of the Oakport Formation, which is of Lower Carboniferous age (359-320 million years ago).

Main Geological or Geomorphological Interest

The Oakport Limestone around Rockingham Demesne comprises well bedded, well-jointed, pale, clean, coarse grained rock, with thin shales. The boreholes drilled around the springs indicate fracture zones in the first 20 m. These fractures are likely to act as the major conduits for groundwater flow. The Oakport Limestone has evidence of significant karstification. Epikarst (clints and grikes) has been observed in the uppermost metres of quarry sections around the spring. Furthermore, there is a high density of karst features (dolines, swallow holes, springs and turloughs) located in the Oakport and Lower Ballymore Limestone.

Monitoring of daily abstraction and overflow was undertaken from July 1993 to April 1994. The spring overflows via two channels that meet the Ballykeevican stream. The first channel flows over the weir, via the front of the pond area. The second is a smaller stream flowing from the rear of the pond area. It is likely that the second channel also takes discharge from a fracture zone, which is adjacent to, or part of, that feeding the Rockingham Spring. These data indicate an annual discharge of approximately 5.9M m³/yr, which suggests a daily discharge of approximately 16,000 m³/d.

Site Importance – County Geological Site

Rockingham Spring is one of the largest springs in County Roscommon, with a contributing area of approximately 16 km². As the site is also a major water supply source it is also one of the most important hydrogeological sites within the county.

Management/promotion issues

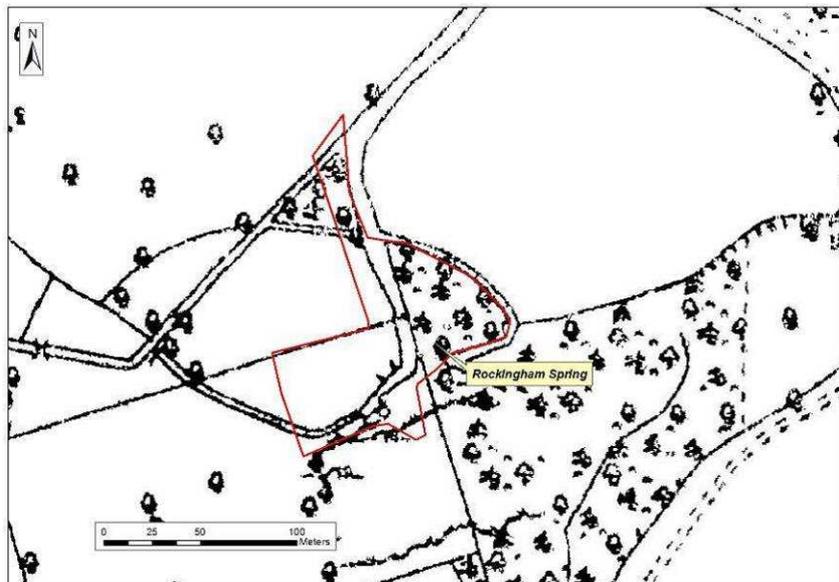
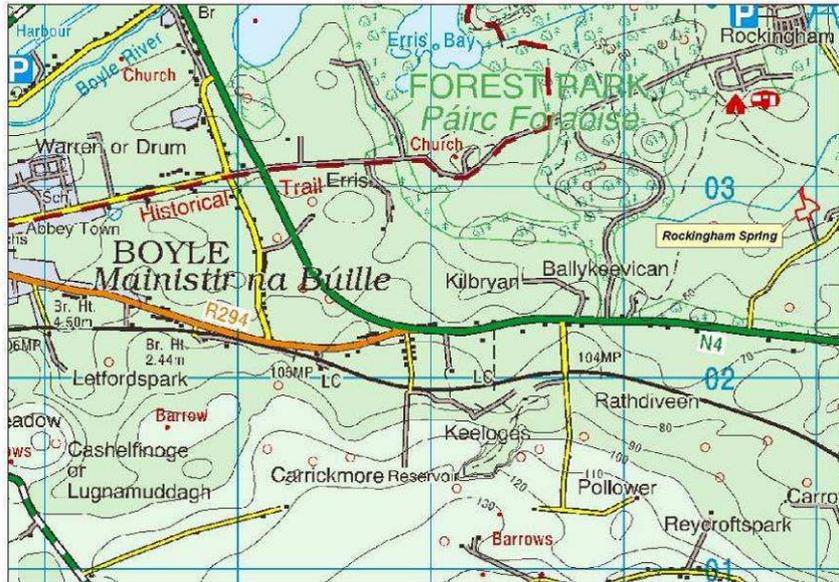
The site is securely fenced off within its own compound, and the boreholes are surrounded by concrete chambers. The spring is now completely covered over. Being a secure water supply vulnerable to contamination the general promotion of the locality is not recommended. General education about the vulnerability of karst groundwater supplies to pollution from septic tanks and agricultural slurry spills and bad spreading practices is highly advisable.



A view of Rockingham Spring with boreholes housed in adjacent buildings.



General view downstream over the spring pool at Rockingham Spring.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Boyle Drumlins
Other names used for site	
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Ross, Ardmoyle, Lecarrow, Coolnagranshy, Carrownurlaur, Ballylugnagon, Glebe, Ballytrasna, Kilbryan, Derrybeg, Ardlona, Lisgullaun, Breandrum, Harepark, Ballinphuill, Carrickmore, Rockingham, Derrymaquick, Knockadoo, Ballybaun, Knockadoobrusna, Carrownaun, Lisserdrea, Tinacarra, Lowparks, Greatmeadow, Rathtinaun, Ardgallin, Knocknacloy, Aghnagrange, Termon, Letfordspark, Bellspark, Drumanone, Ardsallagh, Copse, Ardcorcoran, Erris, Reask, Emlagh, Mocmoyne, Knocknashee, Ballykeevican, Rathtermon, Lisselough, Lismerraun, Ardmore, Knockavroe, Grange Beg, Cashelfinoge, Warren, Tawnytaskin
NEAREST TOWN	Boyle
SIX INCH MAP NUMBER	5, 6, 9, 10
NATIONAL GRID REFERENCE	177777 300500 (centre of features)
1:50,000 O.S. SHEET NUMBER	32, 33 1/2 inch Sheet No. 7, 12

Outline Site Description

This field of drumlins forms part of a small, discrete field of these features, south and southwest of Boyle town. It covers an area of 16 by 8 kilometres, and includes approx. 200 drumlin features. A number of the drumlins southwest of the town are superimposed on ribbed moraine features.

Geological System/Age and Primary Rock Type

The drumlins are formed on bedrock which is Lower Carboniferous limestone. The features themselves are Quaternary in age, having been deposited at the base of the ice sheet moving northeast to southwest during the maximum period of the last Ice Age.

Main Geological or Geomorphological Interest

The drumlin field is not only unusual in its small size and 'discreteness', but is unusual in that a marked upland area around the Plains of Boyle also contains high, superimposed drumlin features.

The features are generally 500m-1km long and 300m-400m or so wide. They attain a maximum height of about 30m and are usually 20m or so in elevation.

Site Importance – County Geological Site

This is one of the finest fields of discrete drumlins in the country.

Management/promotion issues

This is an excellent site in terms of macro-scale Quaternary subglacial geomorphology. The features as a whole are too large to define as a single site with a specific boundary, as would be required for NHA status. However the landscape itself is particularly noteworthy and should be mentioned as unique in landscape elements within the Roscommon County Development Plan. A colour leaflet on 'The Drumlins of County Roscommon' could be produced.



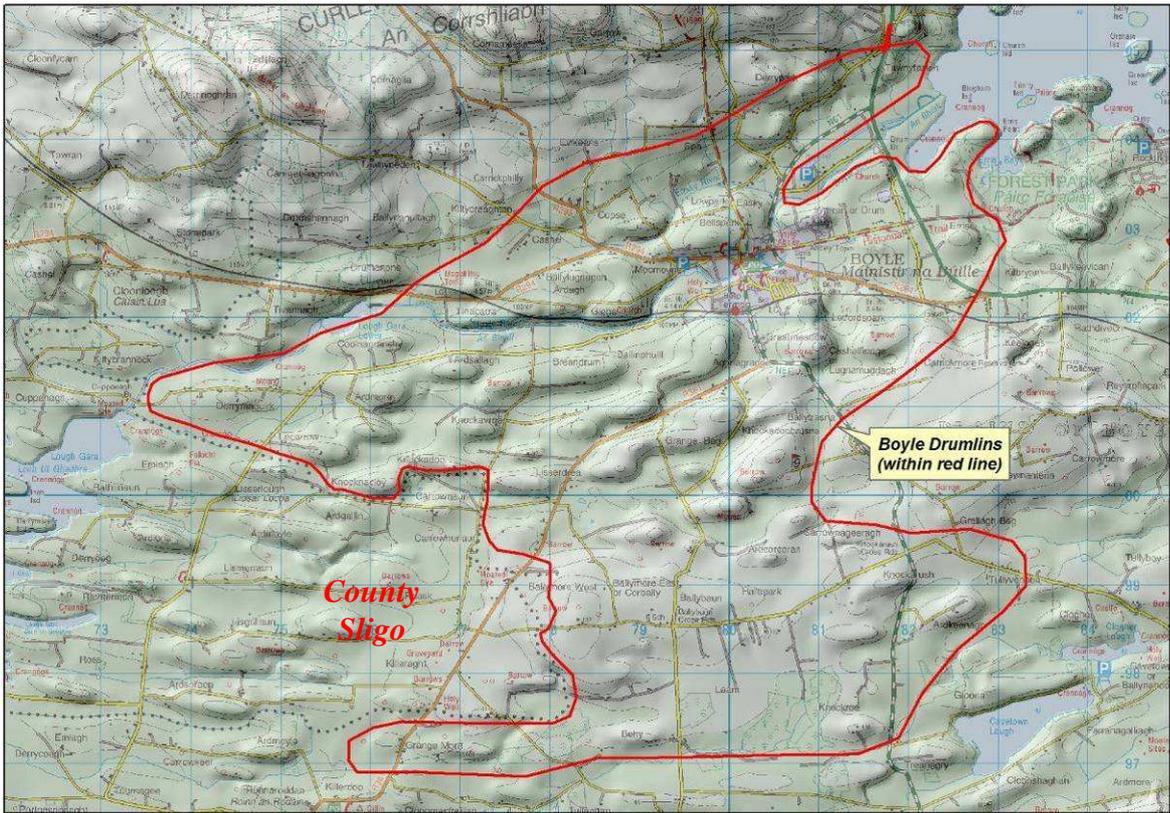
A view of Boyle drumlins, looking north, showing the east-west trend of the drumlins.



A view of Boyle drumlins, looking north, showing the east-west trend of the drumlins.



A view of Boyle drumlins, looking north, showing the east-west trend of the drumlins.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Castlesampson Esker
Other names used for site	Onagh Esker
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Tobermacloughlin, Onagh, Kilkenny, Castlesampson, Carrowkeeran, Eskerbeg
NEAREST TOWN	Athlone, Ballyforan
SIX INCH MAP NUMBER	48, 51
NATIONAL GRID REFERENCE	192000 241240 (centre of features)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

This esker trends west-northwest to east-southeast in south Roscommon, occurring south of the R363 road between Ballyforan and Athlone.

Geological System/Age and Primary Rock Type

The esker is formed on bedrock which is Lower Carboniferous limestone. The feature itself is Quaternary in age, having been deposited at the base of the ice sheet moving northwest to southeast during early deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The Castlesampson esker is an excellent example of a complex, multi-crested esker which is comprised of numerous beads. The esker system comprises ten individual segments, which stretch for a distance of just over six kilometres. The most complex portion of the longest bead (3.5km) has at least four crests. The esker has a very complex, generally sinuous morphology. The feature interfingers with many flanking fans and deltas, with a pronounced kame-kettle topography in places. Many of the kettle holes host lakes.

The esker was probably deposited as a series of fans, which formed at the mouth of a subglacial tunnel as the ice progressively retreated towards the northwest in this area of Roscommon. Several fans, deltas and kames flank the feature.

Site Importance – County Geological Site

The esker is one of Ireland's best examples of the 'long beaded' esker type.

Management/promotion issues

This report gives proper recognition to the geomorphological component of a site that is already conserved for its grassland natural heritage as SAC and proposed NHA (Site Number 001625).



Scrub vegetation on a bead of the Castlesampson esker system.



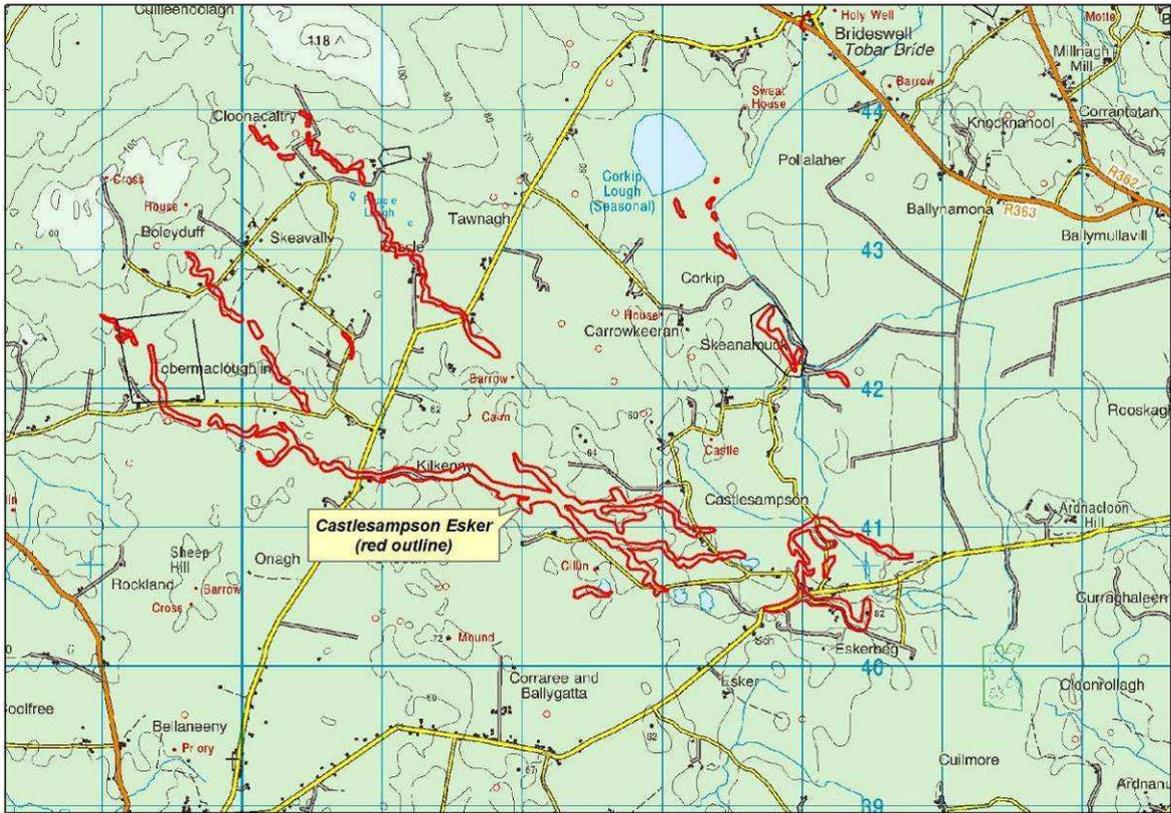
Reclaimed gravel pit within the Castlesampson esker system.



Bare gravels outcropping on the summit of the Castlesampson esker. See the sinuous nature of the feature as it winds away into the distance.



Two distinct beads of the Castlesampson esker system.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Cloonburren Fan
Other names used for site	The Pilgrims Road, The Eiscir Riada,
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Cornaveagh, Cloonburren
NEAREST TOWN	Shannonbridge
SIX INCH MAP NUMBER	56
NATIONAL GRID REFERENCE	196300 228570 (centre of feature)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

This is a wide, hummocky feature comprised of sand and gravel which partially smothers the Ballinasloe-Split Hill-Clonmacnoise-Clara Esker System at Cloonburren, in southernmost County Roscommon, adjacent to the Shannon River.

Geological System/Age and Primary Rock Type

The fan is formed on bedrock which is Lower Carboniferous limestone. The feature itself is Quaternary in age, having been deposited at the edge of the westward-retreating ice sheet during deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The fan feature is a fine example of the type of associated deglacial feature that often forms adjacent to eskers. The ridge may be comprised of several fans, which coalesce to form one large fan-shaped feature at Cloonburren.

The esker is comprised chiefly of limestone clasts which have been derived from the bedrock around the site within the Irish Midlands. These were carried by ice, released into the meltwater conduit on top of or within the ice, and then deposited at the ice margin as the river left the ice and flowed off eastwards subaerially.

An old quarry cut into the southern side of the feature exposes sand and pebble gravel cross-beds, which comprise the internal structure of the feature and record when the sediments were deposited by water flowing off the glacier as it retreated across the area.

Site Importance – County Geological Site

This fan is an excellent example of a deglacial, ice marginal, meltwater-deposited feature. This is a superb feature and it should be considered for inclusion within the boundary of the Geological NHA of the Ballinasloe-Split Hill-Clonmacnoise-Clara Esker System.

Management/promotion issues

Cloonburren Fan has the one disused quarry noted above which shows the sediments but no new quarrying should be permitted to preserve the integrity of the landforms.



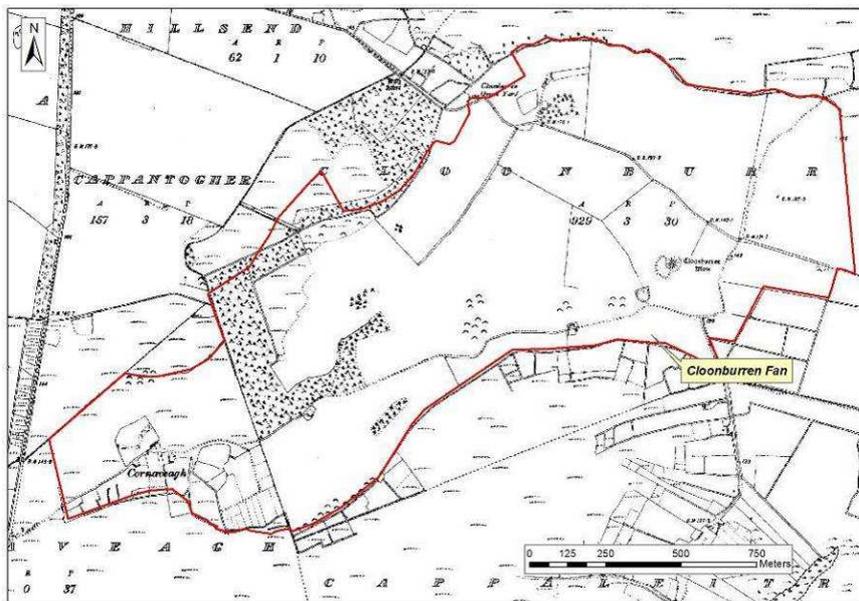
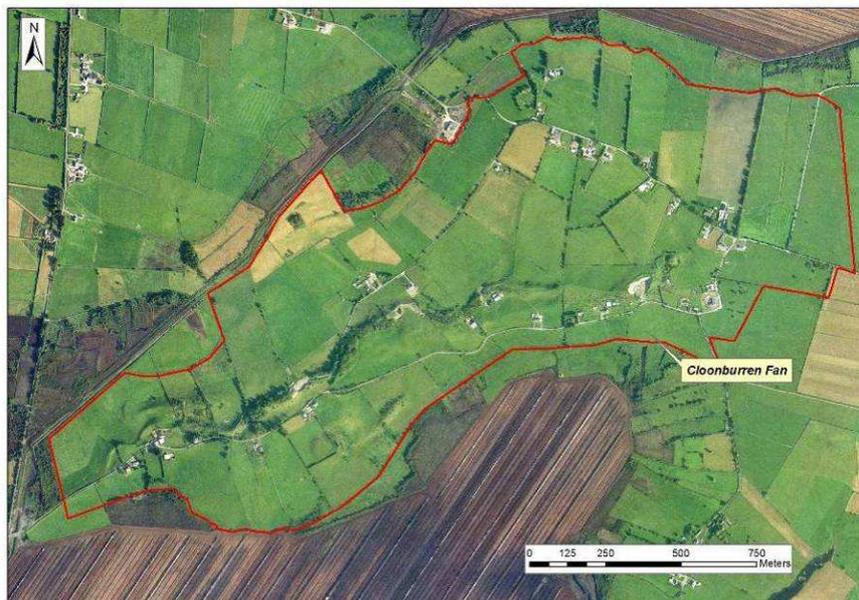
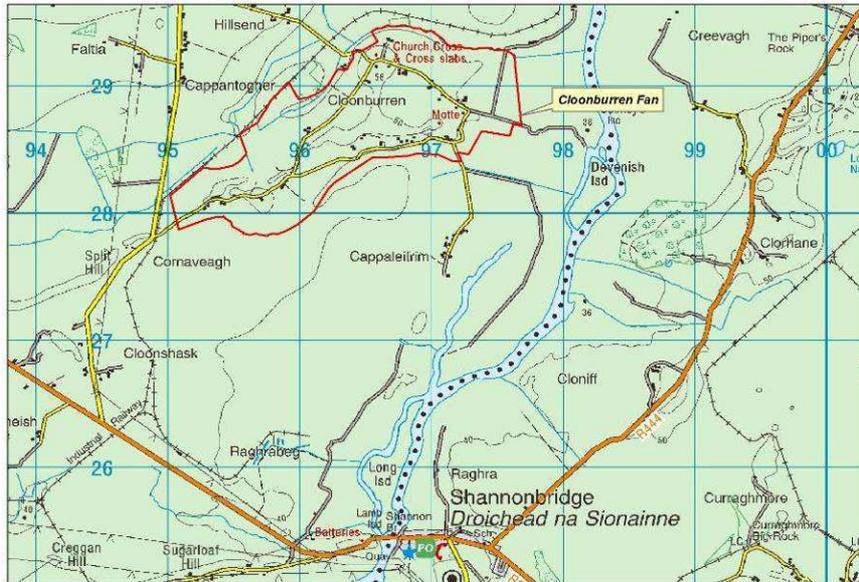
The face of the disused quarry in the south face of Cloonburren Fan.



The southern edge of Cloonburren Fan from the motte at the eastern end of the fan.



Close up detail of the sand and gravel beds in the disused pit.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Ballinasloe-Split Hills-Clonmacnoise-Clara Esker System
Other names used for site	Clonmacnoise esker, Split Hills esker, Clara esker, The Pilgrims Road, The Eiscir Riada
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Tulrush, Culliaghmore, Culliaghbeg, Cloonfad, Cornaveagh, Cloonburren
NEAREST TOWN	Ballinasloe, Shannonbridge
SIX INCH MAP NUMBER	53, 56
NATIONAL GRID REFERENCE	193210 227170 (centre of features)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

This is a long, beaded, often high, sinuous esker ridge system that traverses a lateral distance of just under 70 kilometres across the Central Midlands, including counties other than just Roscommon.

Geological System/Age and Primary Rock Type

The esker is formed on bedrock which is Lower Carboniferous limestone. The feature itself is Quaternary in age, having been deposited at the base of the ice sheet moving west to east during early deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The esker system is one of the finest examples of a long, wide tunnel-deposited esker in the country. The ridge also has many associated fan, delta, and sandur (a plain formed of glacial sediments deposited by meltwater outwash at the terminus of a glacier) features associated with it. This ridge is one of the three major conduit systems that subglacially drained the melting ice sheet in the Irish Midlands. It crosses Roscommon between the Suck and the Shannon Rivers and follows the R357 road for most of its course. It is generally oriented in an east-west direction and has many small and large pits, both currently in use and disused, cut into it. The feature interfingers with many flanking fans and deltas, with a pronounced kame-kettle topography in places.

The esker is comprised chiefly of limestone clasts which have been derived from the bedrock around the site within the Irish Midlands. These were carried by ice, released into the meltwater conduit at the base of the ice, and rounded in a subglacial river before being left upstanding as the esker when the ice melted.

Site Importance – County Geological Site; recommended for Geological NHA

The esker is probably Ireland's best example of a tunnel-deposited esker.

Management/promotion issues

This is a superb feature and should be designated as a geological NHA. It will be put forward by GSI for designation by National Parks and Wildlife Service in the future. Signage along the roadside along the R357 road, especially near the church at Oldtown, might help in the promotion of the feature. A colour leaflet on 'The Eskers of County Roscommon' could also be produced.



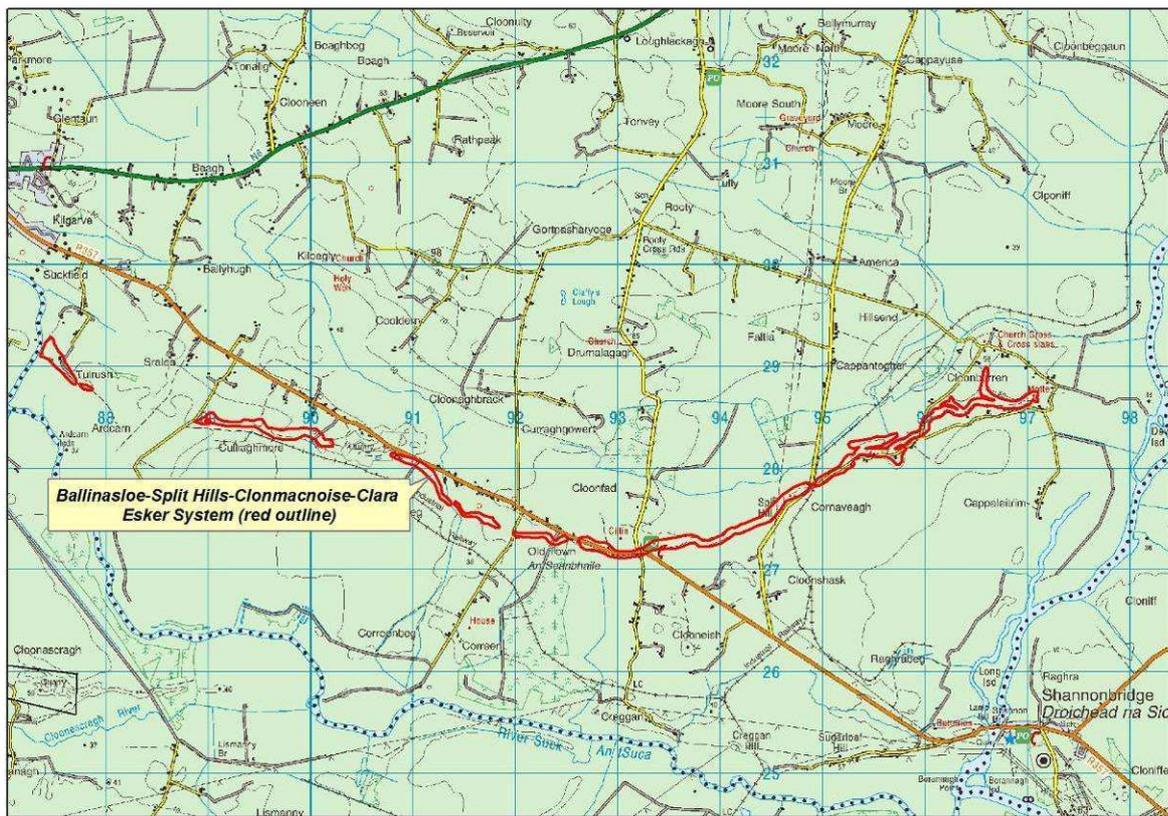
One of the esker beads in Cloonburren Townland.
See the steep sides on the ridge.



The esker, poking through bogland and viewed from the west, at Cloonburren.
The long, sinuous nature of the feature is clearly seen.



The esker winding east towards the west, also at Cloonburren.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Erritt and Cloonagh Loughs Deltas
Other names used for site	
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Errit, Gortaganny, Carrowbehy, Lecarrow, Derreenamackaun, Cloondart, Tully
NEAREST TOWN (Roscommon)	Ballyhaunis (Mayo), Loughglinn
SIX INCH MAP NUMBER	19
NATIONAL GRID REFERENCE	154250 285500 (centre of feature)
1:50,000 O.S. SHEET NUMBER	32 1/2 inch Sheet No.

Outline Site Description

These deltas comprise a number of wide, flat-topped ridges made up of sand and gravel, which stand proud above the surrounding peat bog, in northwesternmost County Roscommon.

Geological System/Age and Primary Rock Type

The deltas are formed on bedrock which is of Lower Carboniferous limestone. The features themselves are Quaternary in age, having been deposited at the edge of the northwestward-retreating ice sheet during deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The delta features are fine examples of the type of ice marginal, deglacial features that often form at the edge of glacial lakes. The ridges seem to be comprised of several individual deltas, which coalesce to form one large ice marginal standstill in the locality.

The deltas are chiefly made up of limestone clasts which have been derived from the bedrock around the site within the Irish Midlands. These were carried by ice, released into a meltwater conduit on top of or within the ice, and then deposited subaqueously at the ice margin as the river left the ice and flowed off southeastwards.

Site Importance – County Geological Site

These deltas are excellent examples of deglacial, ice marginal, meltwater-deposited features.

Management/promotion issues

This system comprises a number of superb features and should be listed as a County Geological Site. A signboard in Gortaganny (which means the 'sandy field') where the locals have a strong 'tidy village' initiative might help promote the features.



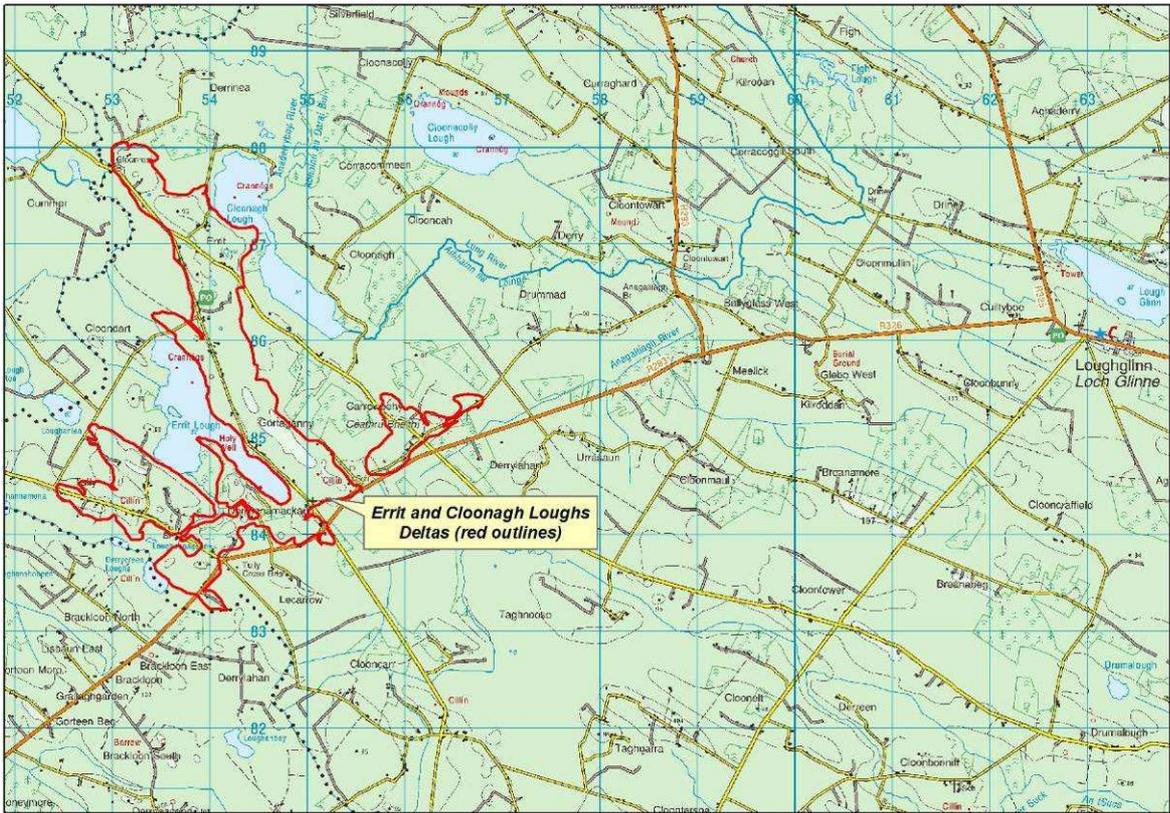
The main delta feature between Cloonagh and Errit Loughs (green fields) from the east.



See the flat-topped nature of the delta ridge, adjacent to Cloonagh Lough.



Bedded sands and gravels which were deposited in a glacial lake, exposed in a gravel pit.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Garranlahan Esker System
Other names used for site	Cloonfad Esker, Slieve Dart Esker
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Grange, Pollanea Upper, Pollanea Lower, Garraunlahan More, Ballybane Upper, Glenties, Moanvane, Stonepark South, Cloonfineen, Rathleena, Coolcam, Glenmore, Clogher Lower, Milltown, Ballybane, Coosaun, Meelick, Cloonlea, Coolatinny, Clydagh Lower, Cashel, Lisnagroob, Kiltullagh
NEAREST TOWN	Cloonfad
SIX INCH MAP NUMBER	25, 32
NATIONAL GRID REFERENCE	156350 273720 (centre of features)
1:50,000 O.S. SHEET NUMBER	39
	1/2 inch Sheet No. 11

Outline Site Description

This is a long, beaded, often high, sinuous esker ridge system that traverses a lateral distance of over 100 kilometres across the west Central Midlands, including the counties of Mayo, Galway and Roscommon.

Geological System/Age and Primary Rock Type

The esker is formed on bedrock which is Lower Carboniferous limestone. The feature itself is Quaternary in age, having been deposited at the base of the ice sheet moving northwest to southeast during early deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The esker system is one of the finest examples of a long, wide tunnel-deposited esker in the country. The ridge also has many associated fan, delta, and sandur features associated with it. This ridge is the westernmost of the three major conduit systems that subglacially drained the melting ice sheet in the Irish Midlands. It crosses Roscommon between the N69 at Scregg and the northeastern edge of Slieve Dart, and 'wraps itself' around Slieve Dart. It is generally oriented in a north-south direction and has many small and large pits, both currently in use and disused, cut into it. In interfingering with many flanking fans and deltas, the system has a pronounced kame-kettle topography in places.

The esker is comprised chiefly of limestone clasts which have been derived from the bedrock around the site within the Irish Midlands. These were carried by ice, released into the meltwater conduit at the base of the ice, and rounded in a subglacial river before being left upstanding as the esker when the ice melted.

Site Importance – County Geological Site; may be recommended for Geological NHA

The esker is one of Ireland's best examples of a tunnel-deposited esker.

Management/promotion issues

This is a superb feature and should be designated as a geological NHA. Signage along the roadside along the R69 and R327 roads, especially along the Slieve Dart ridge, might help in the

promotion of the feature. A colour leaflet on 'The Eskers of County Roscommon' could also be produced.



View along the steep-sided esker towards a disused gravel pit.



A small bead flanking the main esker ridge.

ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	McKeon's Pit		
Other names used for site			
IGH THEME	IGH7 Quaternary		
TOWNLAND(S)	Culliaghmore, Culliaghbeg		
NEAREST TOWN	Shannonbridge		
SIX INCH MAP NUMBER	56		
NATIONAL GRID REFERENCE	190500 228300		
1:50,000 O.S. SHEET NUMBER	47	1/2 inch Sheet No.	15

Outline Site Description

This is a gravel pit cut into a wide, hummocky feature comprised of sand and gravel which partially smothers the Ballinasloe-Split Hill-Clonmacnoise-Clara Esker System at Culliaghmore and Culliaghbeg, in southernmost County Roscommon.

Geological System/Age and Primary Rock Type

The pit is cut into a series of fan features which is formed on bedrock of Lower Carboniferous limestone. The features themselves are Quaternary in age, having been deposited at the edge of the westward-retreating ice sheet during deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The fan feature is a fine example of the type of associated deglacial feature that often forms adjacent to eskers. The pit seems to be comprised of several fans, which coalesce to form one large ridge feature at Culliaghmore and Culliaghbeg.

The esker is comprised chiefly of limestone clasts which have been derived from the bedrock around the site within the Irish Midlands. These were carried by ice, released into the meltwater conduit on top of or within the ice, and then deposited at the ice margin as the river left the ice and flowed off eastwards subaerially.

The gravel pit has been worked down to the top of bedrock and now limestone is being worked and crushed as well as gravel.

Site Importance – County Geological Site

This fan is an excellent example of a deglacial, ice marginal, meltwater-deposited feature. This pit is a nice cutting into a good example of a fan feature.

Management/promotion issues

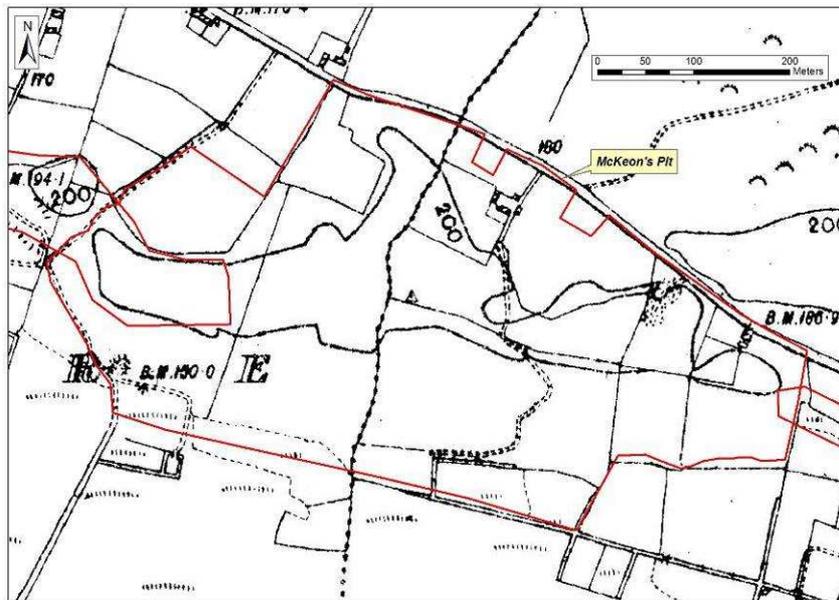
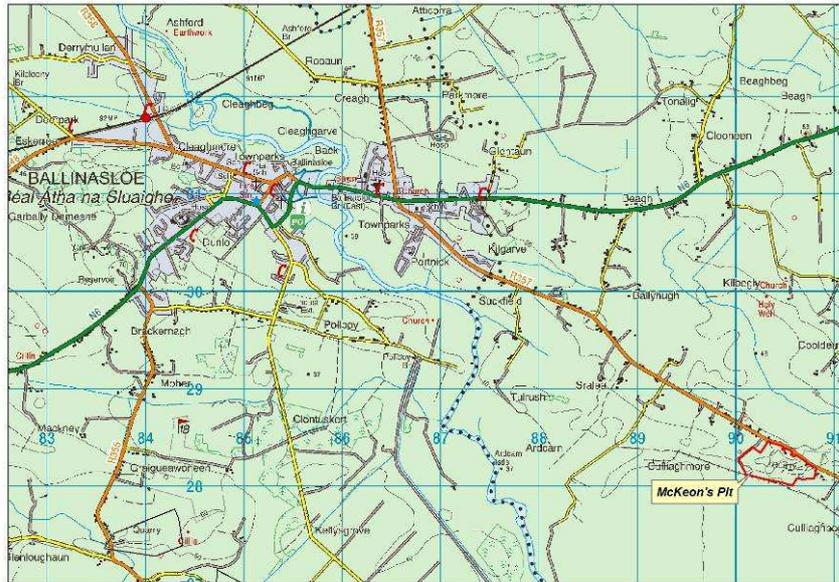
As a working gravel pit and rock quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It would be desirable to consider retaining representative rock faces for geological purposes during any final closure stages. However, maintaining faces of sand and gravel deposits is unrealistic as they quickly degrade and vegetate. The quarry is not suitable for any general promotion other than by express agreement and permission of the owners and operators, Roadstone Wood.



A view into McKeon's Pit showing flooded workings in bedrock limestone with the thick gravel fan deposit overlying.



The worked out gravel deposit on the southern side of the fan, with thick bog deposits adjacent.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Mid Roscommon Ribbed Moraines
Other names used for site	
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Too many to list ... the field covers over two hundred and thirty individual townlands, across an area of 200 km ²
NEAREST TOWN	Strokestown, Elphin, Tulsk
SIX INCH MAP NUMBER	16, 17, 22, 23, 28, 29, 36
NATIONAL GRID REFERENCE	190000 282000 (centre of features)
1:50,000 O.S. SHEET NUMBER	33, 40 1/2 inch Sheet No. 12

Outline Site Description

This field of ribbed moraine forms part of a small, discrete field of these features, west and northwest of Slieve Bawn. It covers an area of 10 by 20 kilometres, and includes approx. 100 ribbed moraine features.

Geological System/Age and Primary Rock Type

The ribbed moraines are formed on bedrock which is Lower Carboniferous limestone. The features themselves are Quaternary in age, having been deposited at the base of the ice sheet moving northwest to southeast during the maximum period of the last Ice Age.

Main Geological or Geomorphological Interest

These ribbed moraines each contain many superimposed drumlins on their crests, and the area has traditionally been known as the southwesternmost extreme of the 'Drumlin Belt'. The ribbed moraines can only be seen using digital elevation modelling (DEM) and satellite imagery owing to their size.

This ribbed moraine field is not only unusual in its small size and 'discreteness' (comparatively for these types of landform), but being interspersed with deep peat means the features are quite striking. It forms the perfect 'ribbed' topography.

The features are generally 6km-8km long and 1km or so wide, with individual superimposed drumlins being c. 1km long and 400m-500m wide. They attain a maximum height of about 35m and are usually 25m or so in elevation.

Site Importance – County Geological Site

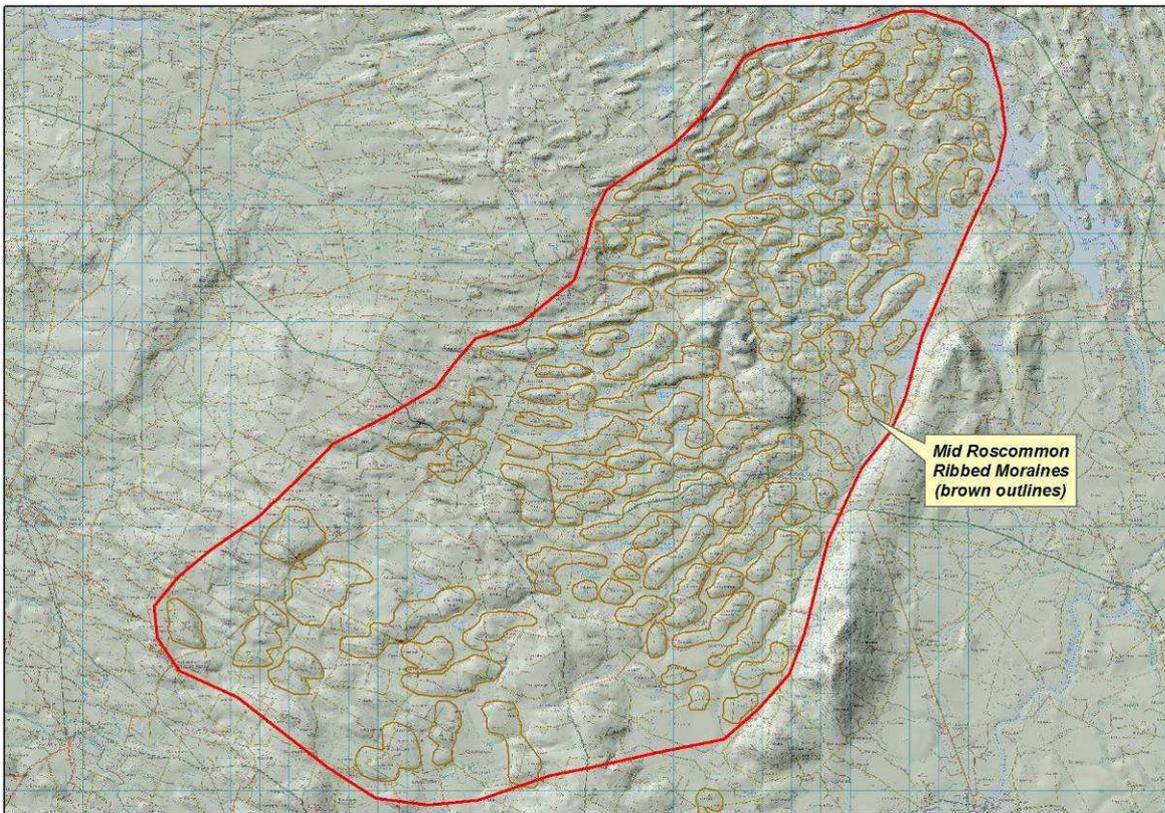
This is one of the finest fields of discrete ribbed moraines in the country.

Management/promotion issues

This is an excellent site in terms of macro-scale Quaternary subglacial geomorphology. The features are too large to undertake any conservation efforts on their part, but the landscape itself is noteworthy and should be promoted as unique amongst landscape elements within the Roscommon County Development Plan and in Landscape Characterisation.



A view across some of the mid Roscommon ribbed moraine from Lisduff, east of Elphin, looking north.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Boyle Road Cutting
Other names used for site	
IGH THEME	IGH10 Devonian
TOWNLAND(S)	Tawnytaskin
NEAREST TOWN	Boyle
SIX INCH MAP NUMBER	6
NATIONAL GRID REFERENCE	181763 305142 (centre of section)
1:50,000 O.S. SHEET NUMBER	33 1/2 inch Sheet No. 7

Outline Site Description

A low rock cliff on the west side of the N4 road northeast of Boyle town.

Geological System/Age and Primary Rock Type

The rocks are of Devonian age, and are principally made up of sandstones, which also contain some very hard volcanic sediments.

Main Geological or Geomorphological Interest

Devonian rocks in the Curlew Mountains are principally conglomerates and sandstones but they are poorly exposed. This site provides a good representative section of these Devonian rocks not often exposed elsewhere. Their general characteristics suggest they were deposited in various alluvial environments. In the Boyle road cutting they are classified as the Keadew Formation, but they are already badly weathered, degraded and vegetated in the time since the cutting was made and the road opened in 1999.

One section is accessible and visible because the rock is a local unit of volcanoclastic sediments, termed the Sheegorey Member. Volcanoclastic simply means that the rock material was derived from a volcanic eruption, but the rock was deposited as a sedimentary rock like a sandstone, as an aggregate of small particles. This is a hard, dark grey rock with a purple tinge. It forms well bedded layers which are cut back in a small cliff in the cutting. Localised seeps of lime rich water are forming tufa-like deposits along the cliff. As the rock does not weather and degrade as quickly as the surrounding sandstones it has not become vegetated as much.

Site Importance – County Geological Site

This is a good representative section for the Sheegorey Member of the Keadew Formation, and it is of County Geological Site importance.

Management/promotion issues

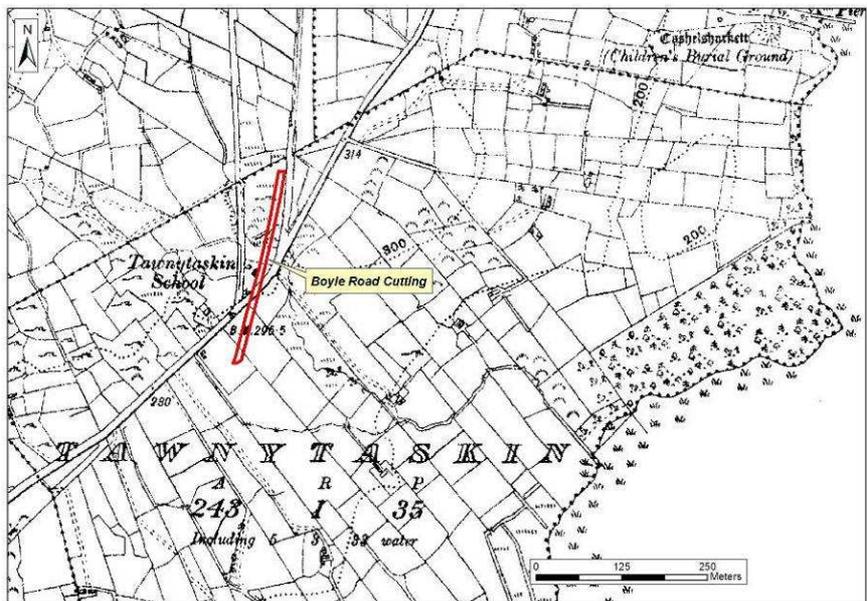
Vegetation is already covering the southern end of the section and some management of this would be required in the long term to maintain an open rock section in the sandstones.



The mid-section of the Boyle Road Cutting showing the wide verge and relatively unvegetated cliff.



The lime rich water seeping from bedding planes in the volcaniclastic rocks has formed a tufa-like deposit over parts of the face.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Castlemine Quarry
Other names used for site	
IGH THEME	IGH8 Lower Carboniferous
TOWNLAND(S)	Cashelmeehan
NEAREST TOWN	Roscommon
SIX INCH MAP NUMBER	35
NATIONAL GRID REFERENCE	187900 271000 (centre of quarry)
1:50,000 O.S. SHEET NUMBER	40
	1/2 inch Sheet No. 12

Outline Site Description

Castlemine Quarry is a large working quarry about 6km north of Roscommon town.

Geological System/Age and Primary Rock Type

The quarry is excavated in Carboniferous limestone, which dates from about 330 million years ago. The Geological Survey of Ireland maps the limestone in this locality as undifferentiated but these rocks may belong to the Ballymore Limestone Formation.

Main Geological or Geomorphological Interest

Over 22m thickness of horizontal limestone beds are seen throughout the quarry, which provides a window into the bedrock which is normally very rarely exposed in County Roscommon. Thick and massive beds are visible across the quarry. Some faces display some karstic solution, with occasional narrow solution pipes and brown calcite stained walls of narrow fissures.

Some beds are very rich in fossils of corals, crinoids, brachiopods and gastropods.

Site Importance – County Geological Site

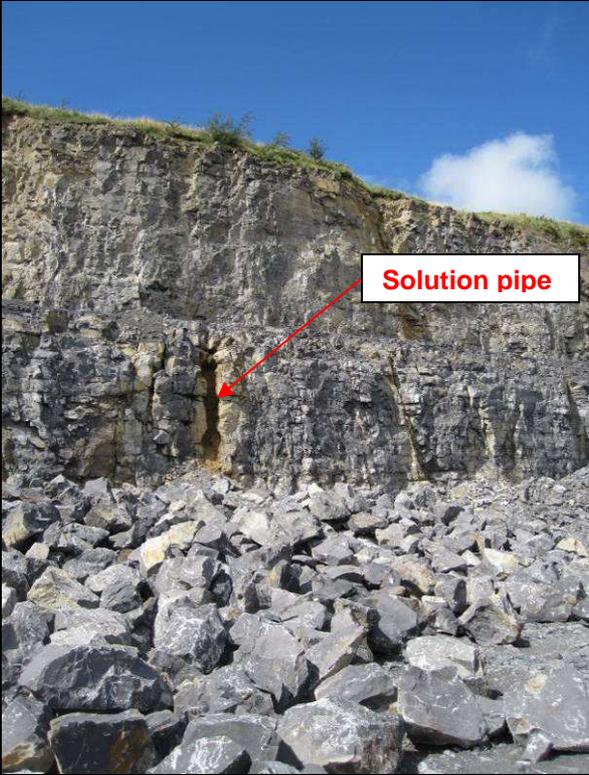
This is a good representative site displaying the Carboniferous limestone bedrock in central County Roscommon.

Management/promotion issues

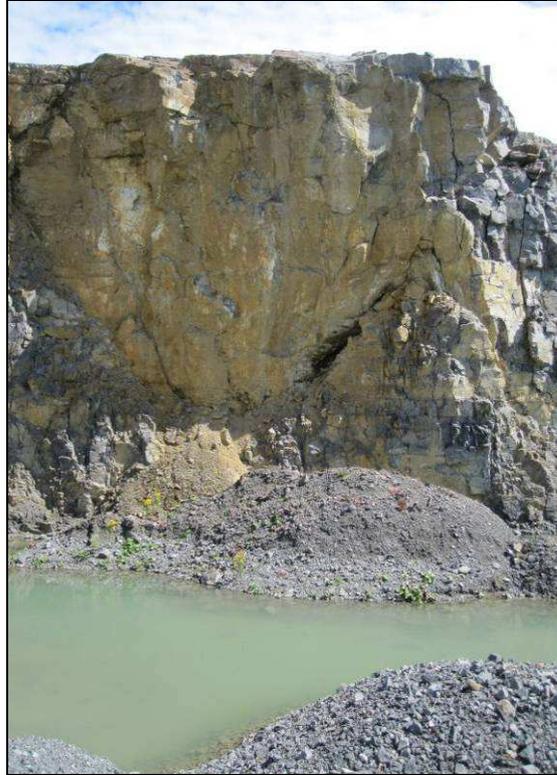
As a working quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It would be desirable to consider retaining representative faces for geological purposes during any final closure stages. The quarry is not suitable for any general promotion other than by express agreement and permission of the owners and operators, Roadstone Wood.



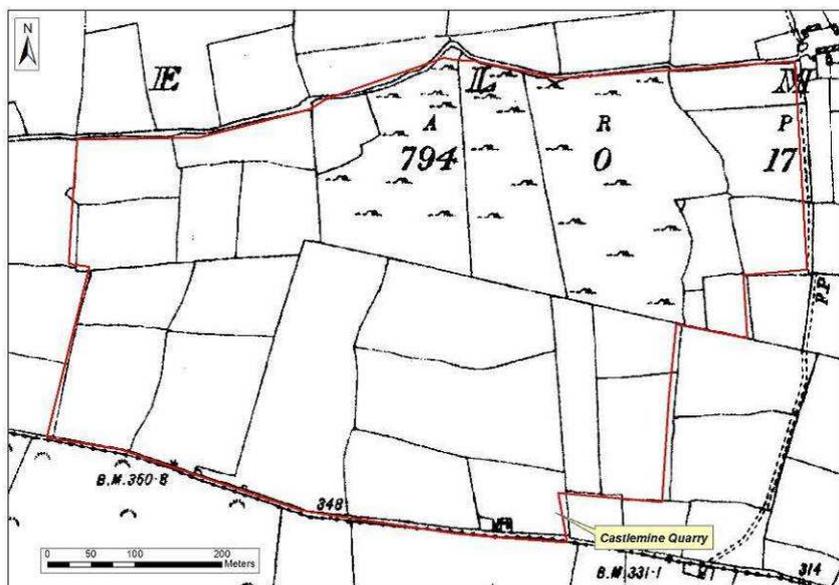
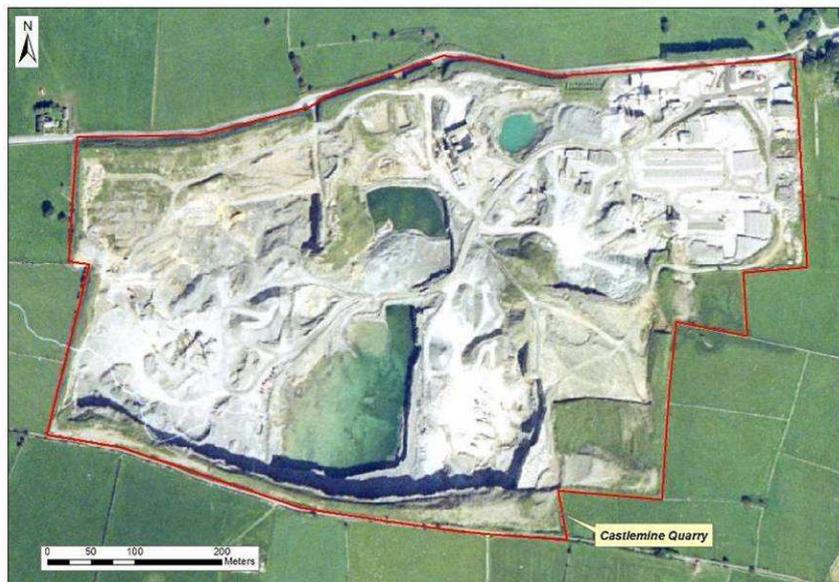
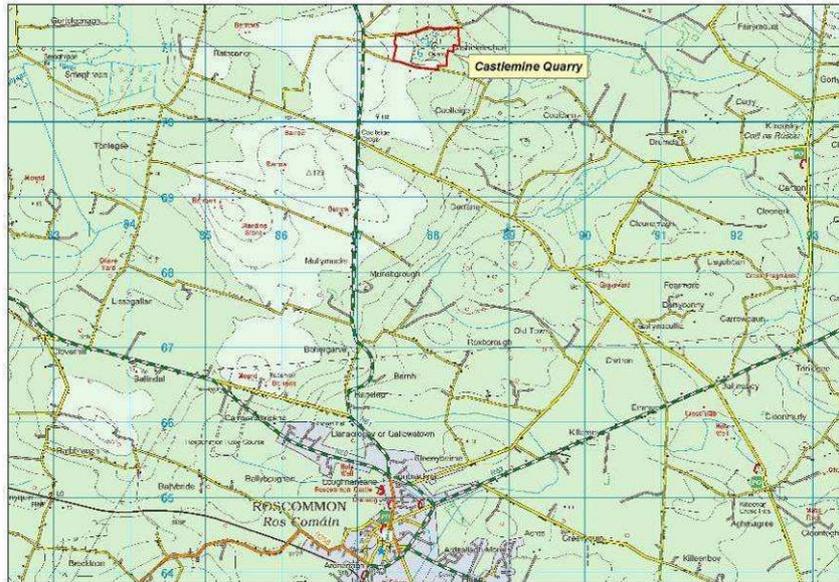
A general view of Castlemine Quarry from the quarry floor.



A karstic solution pipe visible in the face.



A calcite stained fissure in the quarry face.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Keeloges Quarry
Other names used for site	
IGH THEME	IGH8 Lower Carboniferous
TOWNLAND(S)	Carrickmore, Keeloges, Rathdiveen
NEAREST TOWN	Boyle
SIX INCH MAP NUMBER	6
NATIONAL GRID REFERENCE	183230 301500 (centre of quarry)
1:50,000 O.S. SHEET NUMBER	33 1/2 inch Sheet No. 7

Outline Site Description

A large, working limestone quarry, about 3km east of Boyle town.

Geological System/Age and Primary Rock Type

The quarry exposes bedrock of the Oakport Limestone Formation and the Ballymore Limestone Formation, both of Carboniferous age, which dates from about 330 million years ago.

Main Geological or Geomorphological Interest

This quarry provides superb representation and exposure of rock strata that are otherwise rarely exposed at surface and are often described and understood by geologists only from continuous borehole records drilled down into the bedrock. The limestones at Keeloges are very flat bedded. They are fossiliferous with many different types of fossils such as corals, crinoids, trace fossils and microfossils.

The two limestone formations are divided by a palaeokarstic surface in the quarry where the lower one was briefly exposed and slightly weathered before the overlying limestone was deposited on top of it. The horizontal beds show that this was a short-lived episode. There are features in the quarry showing karstification that has occurred mostly since the Ice Age, where water has dissolved the rock and left narrow voids as fissures, pipes and small caves, as well as at least one solution doline. Here an enclosed depression has been filled with sand and mud, coloured orange by iron minerals.

Site Importance – County Geological Site; may be recommended for Geological NHA

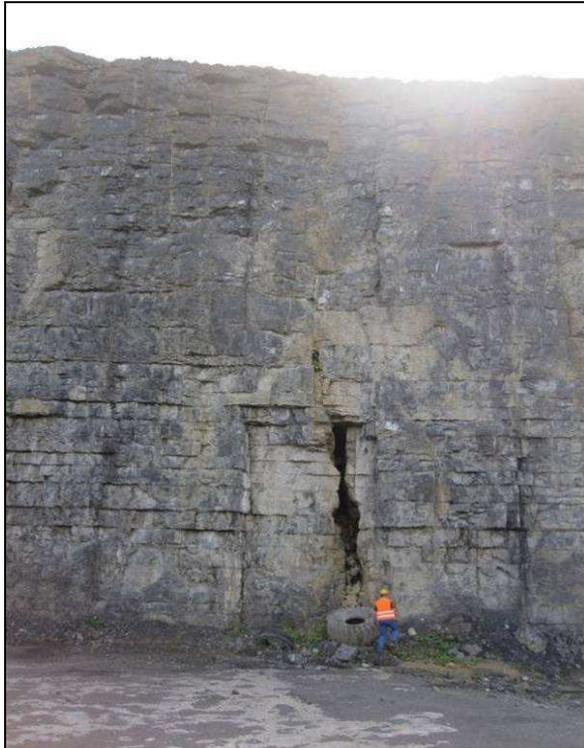
This is an important representative section of rock in the region and is likely to be viewed as having the required national interest for a geological NHA under the IGH8 Lower Carboniferous theme when further work is completed on that theme.

Management/promotion issues

As a working quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It would be desirable to consider retaining representative faces for geological purposes during any final closure stages. It is not suitable for any general promotion other than by express agreement and permission of the owners and operators, Roadstone Wood.



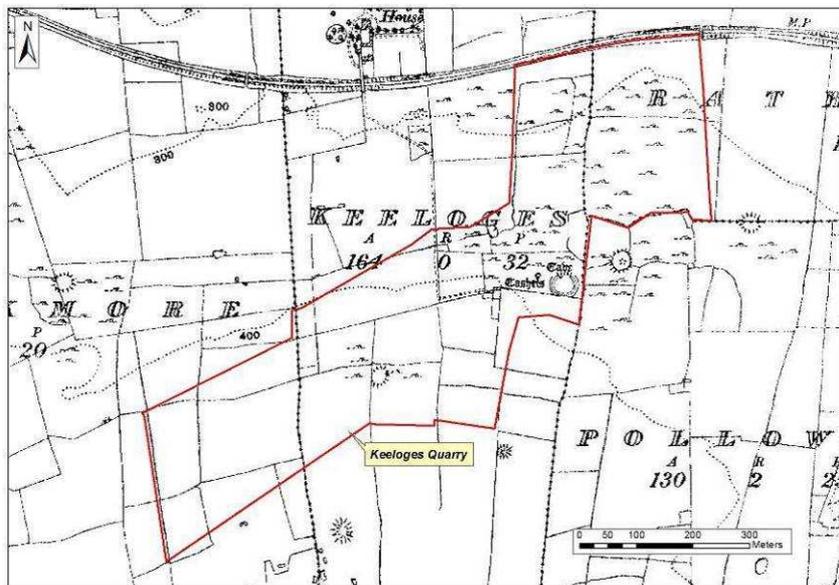
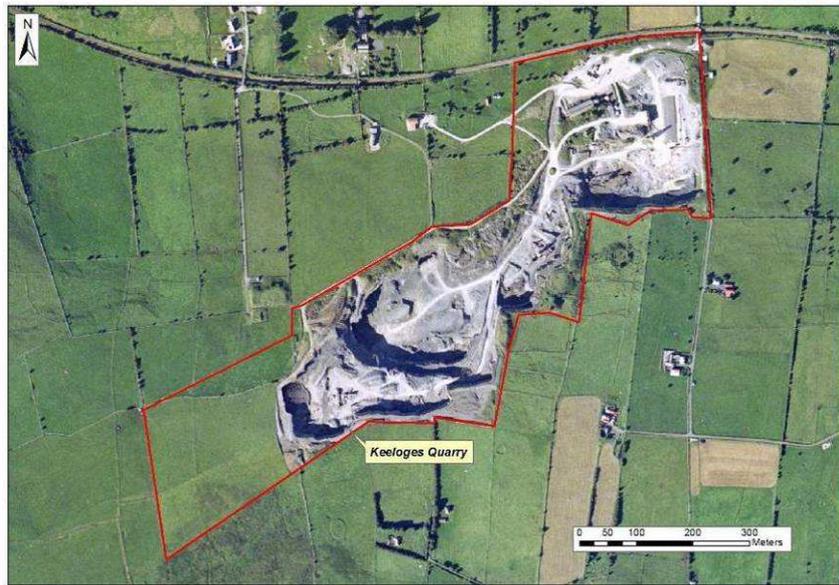
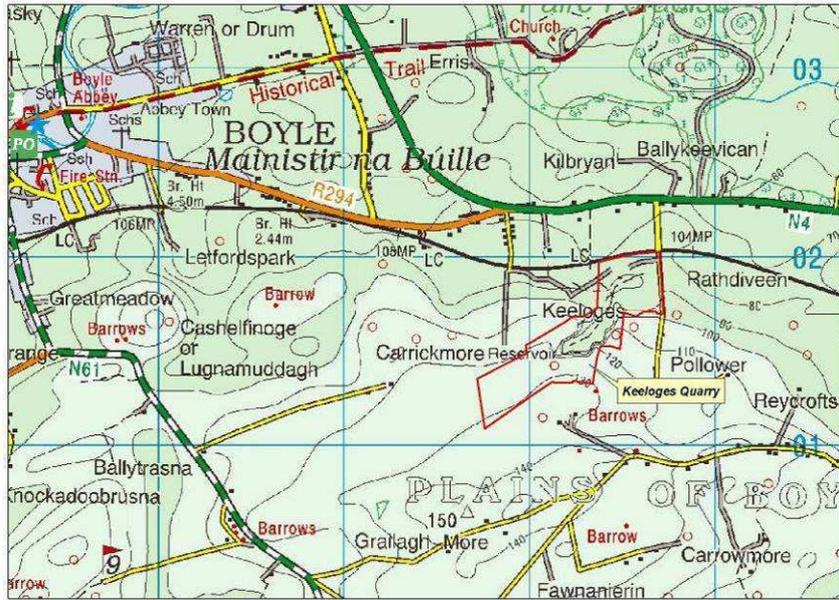
An overview of the south western end of the quarry, looking northeast.



A cross section through an enclosed depression or doline filled with unwanted sediment for the quarry operators (left). A small cave exposed in the quarry face (right).



A bench that has been drilled ready to place explosives in the pattern of holes to blast the rock apart in a highly controlled operation.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Largan Quarry		
Other names used for site			
IGH THEME	IGH8 Lower Carboniferous		
TOWNLAND(S)	Largan, Cuilrevagh		
NEAREST TOWN	Elphin		
SIX INCH MAP NUMBER	23		
NATIONAL GRID REFERENCE	192530 285400		
1:50,000 O.S. SHEET NUMBER	33	1/2 inch Sheet No.	12

Outline Site Description

Largan Quarry is a large working quarry in the northern side of Greywood Hill, north of Strokestown.

Geological System/Age and Primary Rock Type

The quarry is excavated in Carboniferous limestone, which dates from about 330 million years ago. The Geological Survey of Ireland maps the limestone as undifferentiated but these rocks may belong to the Ballymore Limestone Formation.

Main Geological or Geomorphological Interest

Near perfect horizontal limestone beds are seen throughout the quarry, which provides a window into the bedrock which is normally very rarely exposed in County Roscommon. Thick and massive beds are visible across the quarry. Some of the northern faces in particular, but also faces elsewhere in the quarry, display some karstic solution, with pipes and some clay filled cavities, as well as brown calcite stained walls of narrow fissures.

The hill was overtopped by ice sheets during the Ice Age, since there are thick glacial tills in a road cut up to the top of the hill at the south side of the quarry. In addition, freshly exposed rock surfaces (as in the summer of 2012) at the southern end of the quarry show streamlined bedrock forms known as 'P' forms, as well as striations and chattermarks.

Site Importance – County Geological Site

This is a good representative site displaying Carboniferous limestone bedrock in County Roscommon, with additional features of glacial and karstic interest.

Management/promotion issues

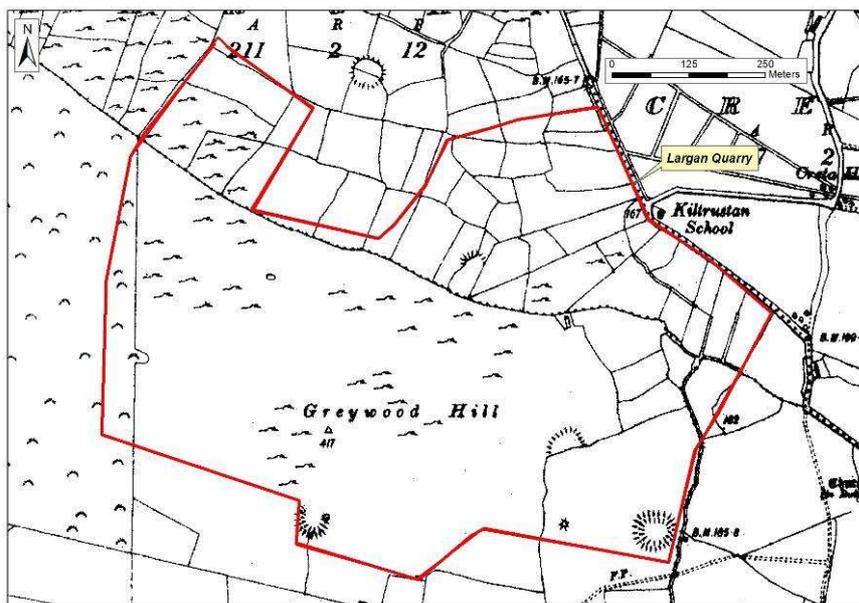
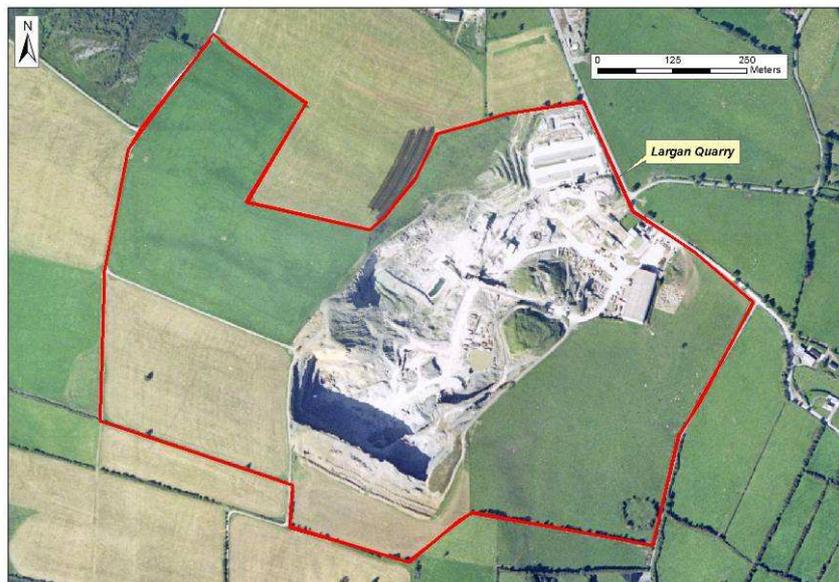
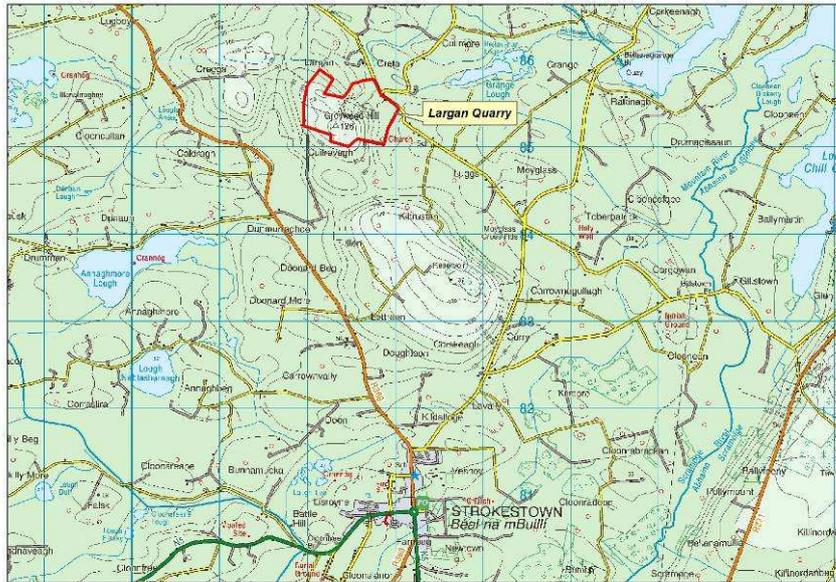
As a working quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It would be desirable to consider retaining representative faces for geological purposes during any final closure stages. The quarry is not suitable for any general promotion other than by express agreement and permission of the owners and operators, Hanly Brothers Limited.



A view of Largin Quarry, looking southwest from the eastern side.



Glacial striations freshly exposed from beneath glacial till on the hilltop (left).
Rounded edges to limestone beds near the summit are glacial features known as "P"-forms (right).



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	River Shannon Callows
Other names used for site	
IGH THEME	IGH14 Fluvial and Lacustrine Geomorphology
TOWNLAND(S)	Raghrabeg, Cappaleitrim, Cloonburren, Clooniff, Cloonbeggaun, Coolumber, Drumlosh, Curraghnaboll, Cregganabeaka, Callowbeg, Cloonown, Carrickynaghtan, Kilnamanagh, Bunaribba, Doovoge, Bellaugh
NEAREST TOWN	Athlone (North), Shannonbridge (South)
SIX INCH MAP NUMBER	52, 55, 56
NATIONAL GRID REFERENCE	203000 232150 (central portion of callows)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

The Shannon Callows is a long, flat site which includes the Shannon River floodplain, and which extends for approximately 20 km from the town of Athlone to the town of Shannonbridge. The site averages about 0.75 km in width though in places is up to 1.5 km wide.

Geological System/Age and Primary Rock Type

The floodplain is of Holocene (postglacial) age.

Main Geological or Geomorphological Interest

The site has extensive areas of callow, or seasonally flooded, semi-natural, lowland wet grassland, along both sides of the river. The callows are mainly too soft for intensive farming but are used for hay or silage or for summer grazing. Other habitats of smaller area which occur alongside the river include lowland dry grassland, freshwater marshes, reedbeds and wet woodland. Along most of its length the site is bordered by raised bogs, now mostly exploited for peat, with some hummocks and esker ridges, and knolls of limestone bedrock.

Site Importance – County Geological Site

The Shannon Callows has by far the largest area of lowland semi-natural grassland and associated aquatic habitats in Ireland and one in which there is least disturbance of natural wetland processes, which are ongoing. Botanically, it is extremely diverse. In winter the site is internationally important for the total numbers of birds (regularly exceed 20,000) and for Whooper Swan in particular. It also holds nationally important populations of a further five species.

Management/promotion issues

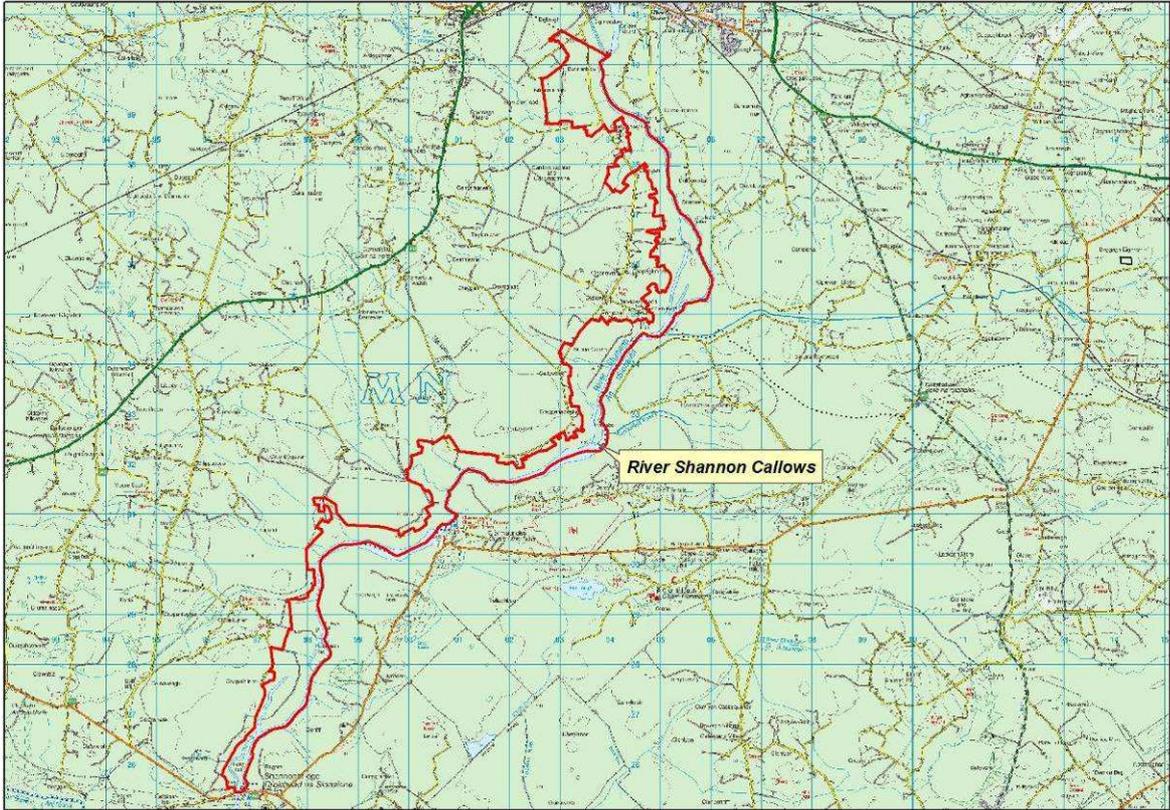
The site has been designated an SAC and proposed NHA (Site Number 000216) and SPA (Site Number 004096). The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. Listing it as a County Geological Site gives recognition to the geomorphological foundation of the biodiversity importance.



River Shannon Callows near Cloonburren, north of Shannonbridge.



River Shannon Callows near Cloonburren, north of Shannonbridge.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Suck River Callows
Other names used for site	
IGH THEME	IGH14 Fluvial and Lacustrine Geomorphology
TOWNLAND(S)	Ballyforan, Cloonagh, Carrowntarriff, Ballyglass, Cartronkilly, Feevagh Beg, Feevagh, Feevagh More, Derrycahill, Porteen and Ballyrevagh West, Breeole West, Cregganycarna, Cloonaddron, Clooncoran, Bellagill, Rooaun Bog and Meadow, Suckfield, Tulrush, Ardcar, Culliaghmore, Culliaghbeg, Correenbeg, Correen, Creggan, Raghrabeg
NEAREST TOWN	Ballyforan (North), Shannonbridge (South)
SIX INCH MAP NUMBER	47, 50, 53, 56
NATIONAL GRID REFERENCE	184530 236820 (central portion of callows)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

The Suck River Callows is a long, flat site which includes the Suck River floodplain, and which extends for approximately 70 km from the village of Castlecoote to the town of Shannonbridge. Only the representative section from Ballyforan to Shannonbridge is reported here, a length of approximately 38 km. The site averages about 0.5 km in width though in places is up to 1.5 km wide.

Geological System/Age and Primary Rock Type

The floodplain is of Holocene (postglacial) age.

Main Geological or Geomorphological Interest

The site has extensive areas of callow, or seasonally flooded, semi-natural, lowland wet grassland, along both sides of the river. The callows are mainly too soft for intensive farming but are used for hay or silage or for summer grazing. Other habitats of smaller area which occur alongside the river include lowland dry grassland, freshwater marshes, reedbeds and wet woodland. Along most of its length the site is bordered by raised bogs, now mostly exploited for peat, with some hummocks and esker ridges, and knolls of limestone bedrock. As with any geomorphological process based site, it must be remembered that these are dynamic environments and the flooding is a natural and unpredictable development.

Site Importance – County Geological Site

The Suck River Callows is an extensive area of lowland semi-natural grassland and associated aquatic habitats, despite much drainage works in recent years. This site is of considerable ornithological importance for the Greenland White-fronted Goose population which is of international importance. The Suck River Callows are also known to support nationally important populations of Whooper Swan, Wigeon and Lapwing.

Management/promotion issues

The site has been designated a proposed NHA (Site Number 000222) and SPA (Site No. 04097). 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. Listing it as a County Geological Site gives recognition to the geomorphological foundation of the biodiversity importance. As it is dynamic system, controlling flooding is neither easy nor advisable.



Suck River Callows near Carrowreagh Townland, north of Ballinasloe.



Suck River Callows near Carrowreagh Townland, north of Ballinasloe.



Suck River Callows near Carrowreagh Townland, north of Ballinasloe.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Altagowlan		
Other names used for site	Spion Kop		
IGH THEME	IGH15 Economic Geology		
TOWNLAND(S)	Altagowlan, Greaghnaglogh		
NEAREST TOWN	Arigna		
SIX INCH MAP NUMBER	2		
NATIONAL GRID REFERENCE	191023 318642 ('T' junction in road within site)		
1:50,000 O.S. SHEET NUMBER	26	1/2 inch Sheet No.	7

Outline Site Description

This site comprises old coal workings on open hillside.

Geological System/Age and Primary Rock Type

The coal seams are in Upper Carboniferous rocks of Westphalian age.

Main Geological or Geomorphological Interest

Coal mining has taken place for hundreds of years in north Roscommon, centred on Arigna. A portion of this locality covers the Altagowlan-Greaghnaglogh area, where mining has most recently ceased before 1990, and many of the surface features such as buildings, rail tracks and other infrastructure have either been salvaged, scrapped or fallen into decay. However many ancillary features remain, but the key interest is in the occurrence of coal seams and underground workings.

More recent stone extraction, in part to provide roadways for the erection of a large windfarm, has added fresh geological exposures to the Altagowlan site, providing evidence of the sedimentary environments that the coal seams were formed in.

Site Importance – County Geological Site

Whilst the Arigna Mining Experience portrays so many facets of the coal mining story in the district, Altagowlan provides a complementary untouched representation of the coal mining industry, not otherwise seen in Ireland except in parts of the Castlecomer and Slieveardagh coalfields.

Management/promotion issues

Parts of the full site of interest are in County Leitrim and any future audit of geological heritage sites in that county should include assessment of the adjoining area, which is mostly outside of Roscommon. Safety concerns with underground coal workings are such that no promotion of this site should be undertaken, and only experienced qualified personnel should be used in any more detailed assessments. However, both flooding and collapses that have already occurred have provided closure of most mine adits.



An adit, with adjacent concrete structures.



An adit visible in a surface cut.



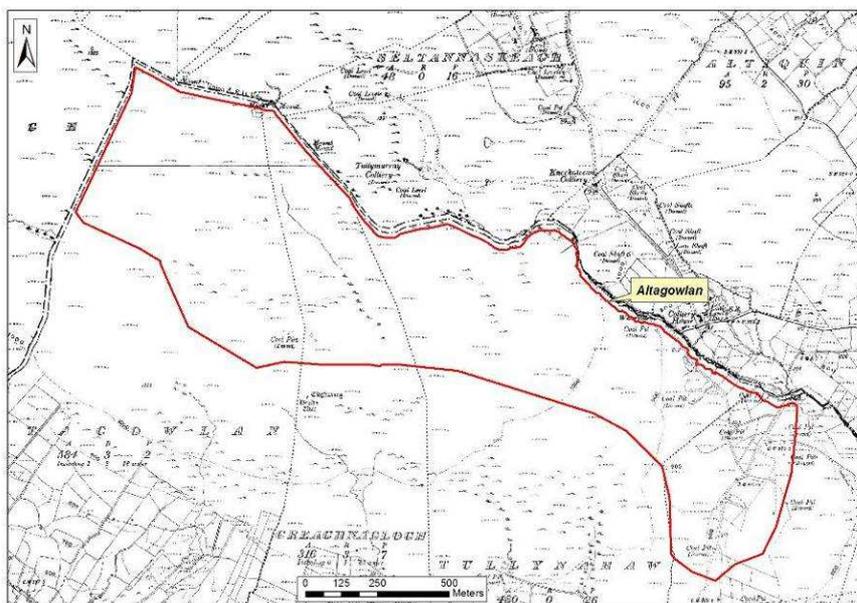
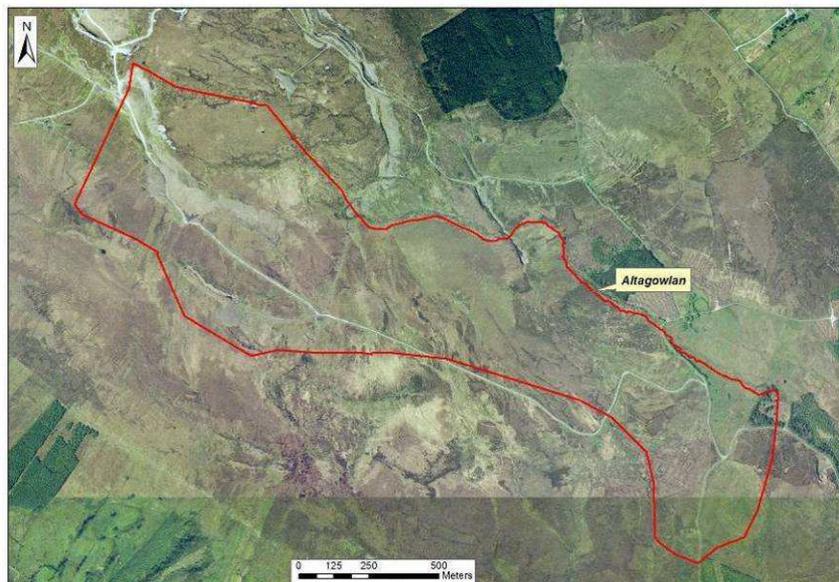
Rusting hutches for carrying coal on rails.



An abandoned adit, now flooded.



A rock quarry for supplying stone for wind turbine roads.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Arigna Mining Experience		
Other names used for site	Derreenavoggy		
IGH THEME	IGH15 Economic Geology		
TOWNLAND(S)	Derreenavoggy		
NEAREST TOWN	Arigna		
SIX INCH MAP NUMBER	2		
NATIONAL GRID REFERENCE	192155 314255		
1:50,000 O.S. SHEET NUMBER	26	1/2 inch Sheet No.	7

Outline Site Description

Disused coal mine and associated spoil heaps made accessible to the public as a visitor attraction, with full visitor centre and underground tour.

Geological System/Age and Primary Rock Type

The rocks are Upper Carboniferous in age, from the Westphalian Stage, informally known as the Coal Measures. They are a complex of sandstones, siltstones, mudstones and coal horizons formed in a deltaic environment.

Main Geological or Geomorphological Interest

Coal of Carboniferous age forms a main energy source throughout western Europe and America, and has given its name to the time period at around 320 million years ago when it formed. Ireland has several coalfield areas where rocks of this age survive, although they were formerly more widespread, and have been extensively mined. Arigna is one of the two largest deposits, as well as Castlecomer in Kilkenny, and this site very neatly includes nearly all aspects of interest with the rocks and the mines in a well-presented package.

The site has a visitor centre where audio-visual records of coal mining are shown along with physical equipment remains. The highlight is the underground tour in the company of a former miner who demonstrates the geology of the coal deposits and the practical issues involved in extracting it. On accessing the mine, a rock face is preserved under the roof labelled to show the sequence of rock strata. The tour very clearly demonstrates that the coal seams were relatively thin hereabouts, as the miners had to work by hand lying on their sides in a cavity only as thick as the seam. The limits of the site include one of the largest spoil heap areas in the district, demonstrating both the scale of mining that took place until 1990 and the degree of unwanted rock that had to be processed to extract the thin coal seams. Other more minor features of mining interest are included within the site boundary.

Site Importance – County Geological Site

As a preserved and presented site, this is very important in encapsulating the coal mining heritage of the Arigna district, whilst most other sites are significantly degraded since closure of the mines. As a tourist/visitor attraction it is of major importance in Roscommon and deserves to be supported and further enhanced.

Management/promotion issues

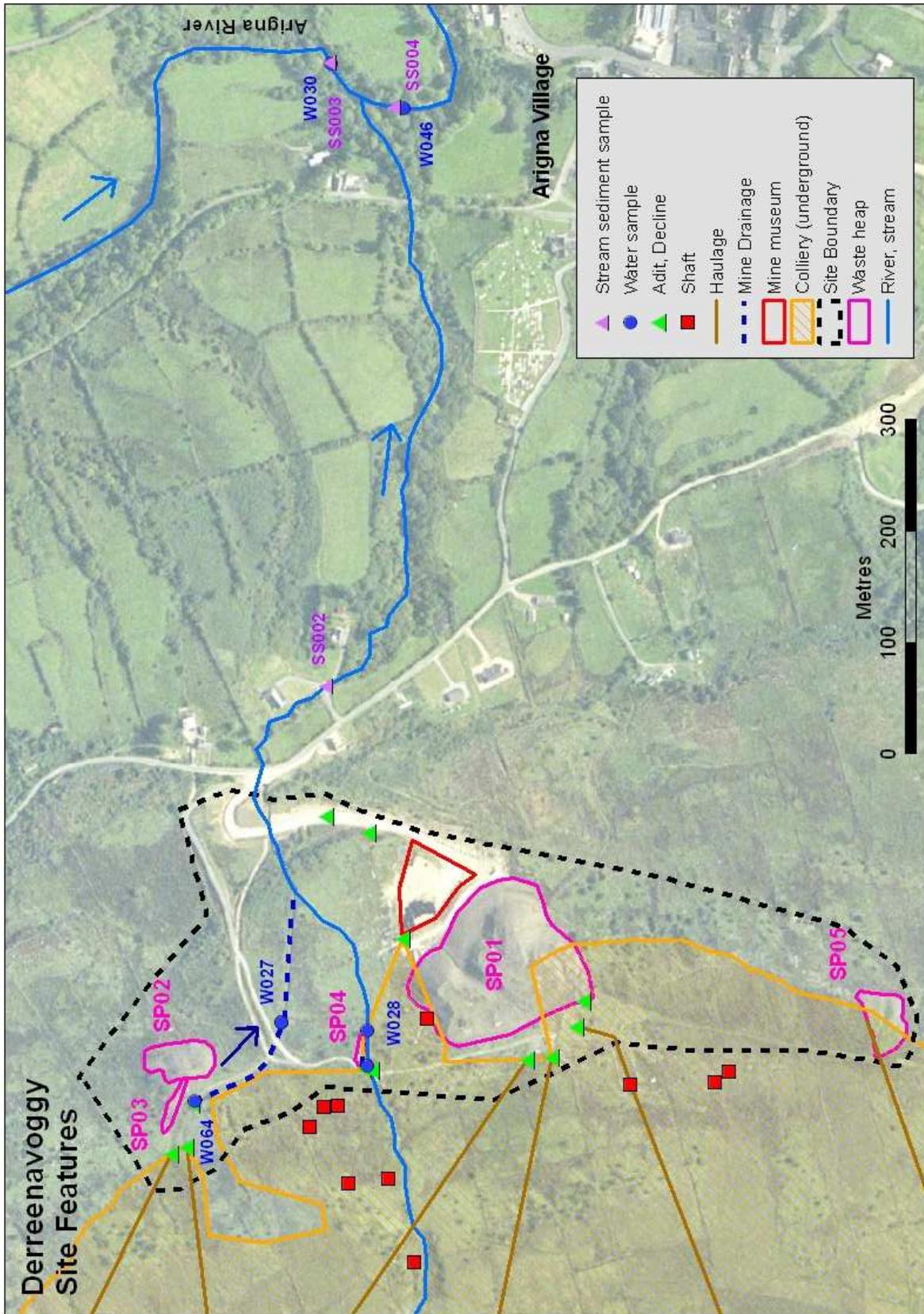
The Arigna Mining Experience is run by a limited company and has a range of financial supports as well as visitor income. The support of the County Council will be important into the future, since the level of tourist visitors across the NW region is relatively low, and the Arigna Mining Experience has to work very hard to achieve sustainable visitor numbers.



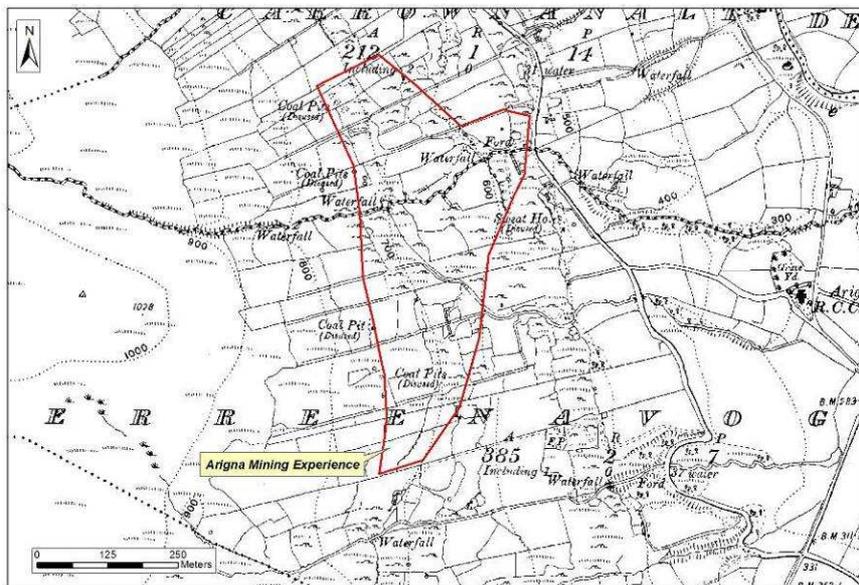
A view of the Arigna Mining Experience visitor centre and car park from the spoil heap above it at Derreenavoggy.



A view of the Arigna Mining Experience visitor centre and car park with the spoil heaps above it at Derreenavoggy.



This map of Derreenavoggy is used with permission, from the EPA-GSI Historic Mine Sites - Inventory and Risk Classification Volume 1, 2009 (see <http://www.epa.ie/downloads/pubs/land/mines/>).



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Lecarrow clay pit		
Other names used for site	Blackbrink Bay		
IGH THEME	IGH 12 Mesozoic/Cenozoic, IGH 15 Economic Geology		
TOWNLAND(S)	Carrownamaddy		
NEAREST TOWN	Roscommon		
SIX INCH MAP NUMBER	42		
NATIONAL GRID REFERENCE	197870 255920		
1:50,000 O.S. SHEET NUMBER	40	1/2 inch Sheet No.	12

Outline Site Description

A flooded, overgrown and disused clay pit near the shore of Blackbrink Bay in Lough Ree.

Geological System/Age and Primary Rock Type

The pit seems to be in a karstic solution pipe, of probable Tertiary age (from 2.5-60 million years ago), within Carboniferous age limestone, from about 330 million years ago. The exact age of the clay deposit is unknown but it is likely to be a Tertiary clay deposit rather than a younger, Ice Age (Quaternary) or post glacial (Holocene) deposit that many local brick clay pits are found in.

Main Geological or Geomorphological Interest

This clay deposit is known to be constrained to a narrow solution pipe within Carboniferous limestone, as a pionjar drilling programme in 1979 by the Geological Survey of Ireland found bedrock in close proximity to the old flooded pit. Such Tertiary deposits are rare in Ireland. There may have been some minor secondary deposits as the present landowner described some smaller pits as having been worked. These were possibly trial pits from the 1979 investigation.

Although it is not certain, and imported clay from Scotland or Wales was probably used at some periods, it seems likely that the clay pipe industry in Ireland, based in Knockcroghery, was founded on using the deposit at Carrownamaddy. An alternative use in pottery in Belleek is also suggested, but the focus of clay pipe making at Knockcroghery presumably resulted from the local supply of suitable clean clay at Lecarrow.

Site Importance – County Geological Site

Despite being effectively inaccessible at present the site merits being considered as a County Geological Site, due to its rarity as a Tertiary clay deposit protected in a karstic solution pipe or doline. The association with the clay pipe industry at Knockcroghery is significant, since it is understood that the clay pipe works supplied pipes to the entire island of Ireland from this one place, rather than there being dispersed production.

Management/promotion issues

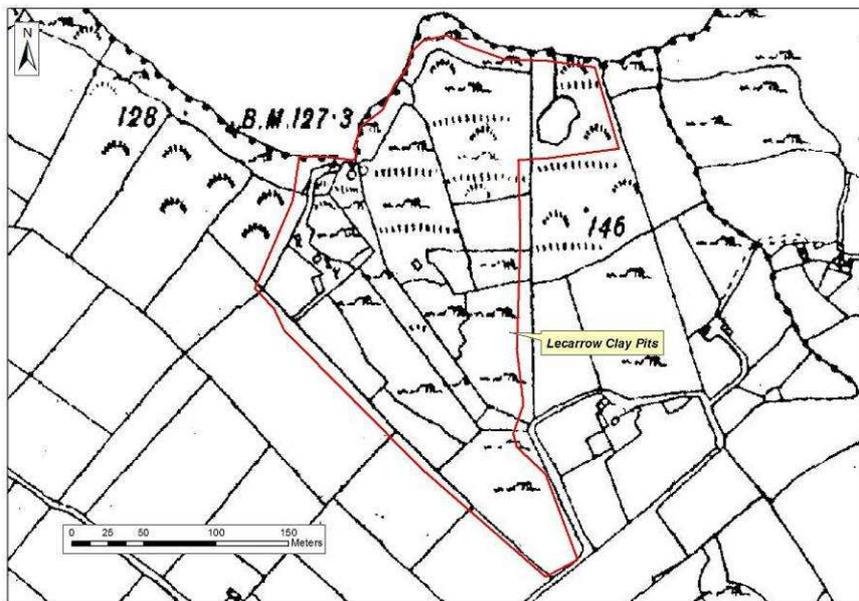
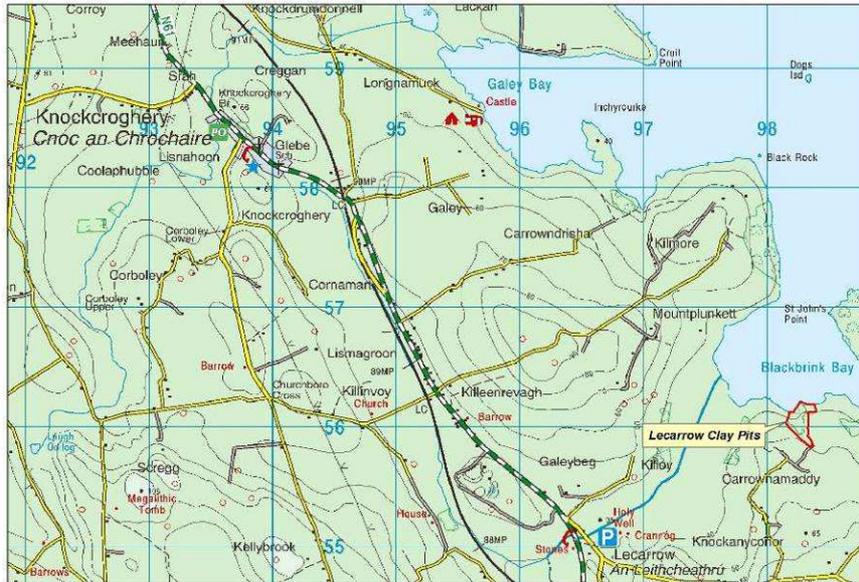
The association of the pit with the clay pipe industry at Knockcroghery is not something that can reasonably be promoted at present, and the flooded pit is likely to remain that way unless a major change of use was proposed such as reworking the deposit, which would require the pit to be pumped out. Any other alternative use is difficult to envisage. If older photographs of the pit in use could be sourced, a signboard could be put into the Clay Pipe Museum in Knockcroghery explaining the geological origins and significance of the deposit. The site falls within the area of Lough Ree proposed NHA (Site Number 000440).



The closest point from which the heavily overgrown and flooded pit could be viewed.



The flooded pit is situated within the wooded area of skyline trees close to the shore of Lough Ree.



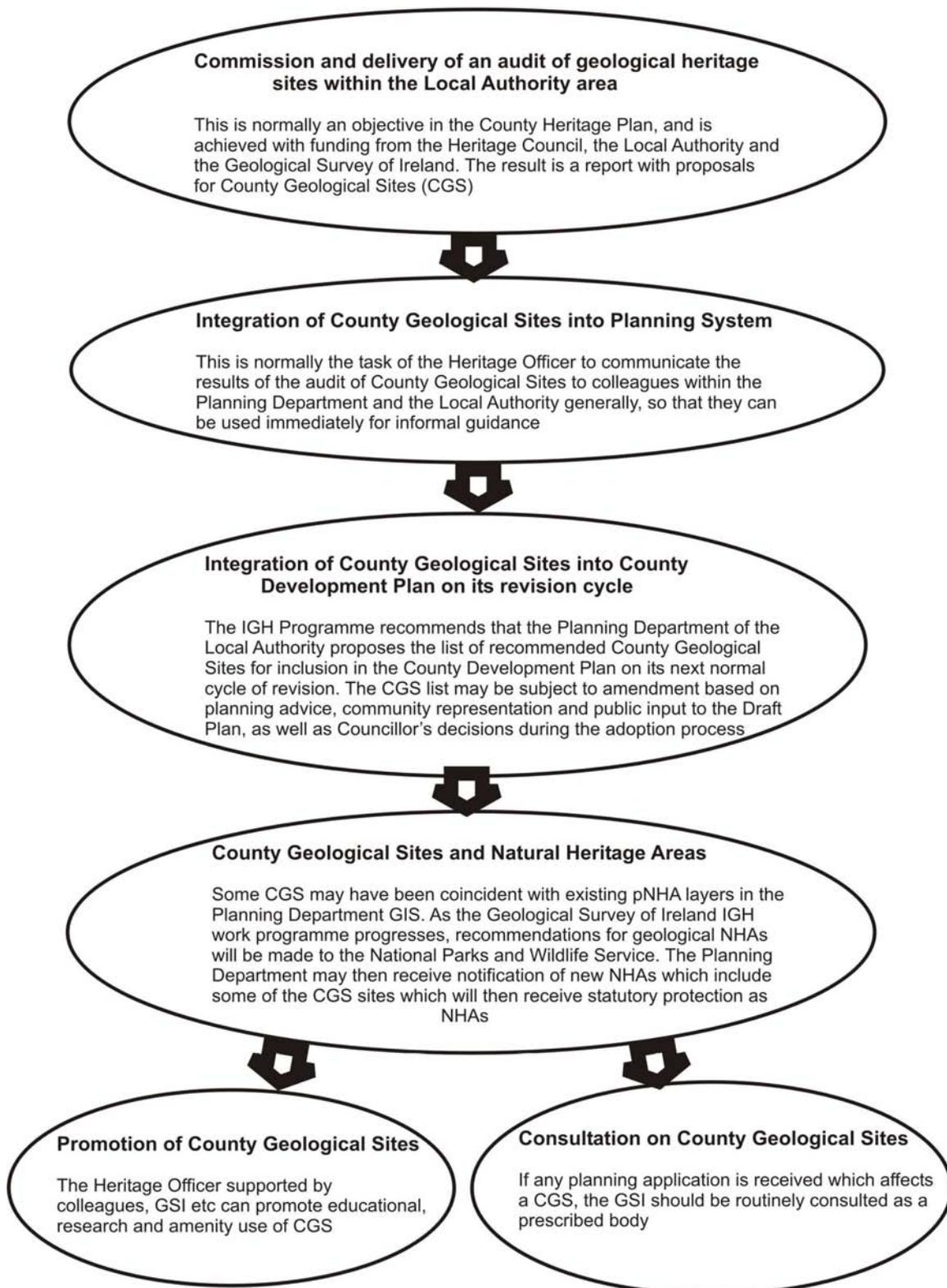
Appendix 1 – Geological heritage audits and the planning process

This appendix contains more detail on the legal framework behind geological heritage audits conducted by County Councils, and the process which operates as a partnership between the Geological Heritage and Planning Section of the GSI and the local authority Heritage Officer.

Geology is now recognised as an intrinsic component of natural heritage in three separate pieces of legislation or regulations, which empower and require various branches of Government, and statutory agencies, to consult and take due regard for conservation of geological heritage features: Planning and Development Act 2000 [e.g. Sections 212 (1)f; Part IV, 6; First Schedule Condition 21], Planning and Development Regulations 2001, Wildlife (Amendment) Act 2000 (enabling Natural Heritage Areas) and the Heritage Act 1995. The Planning and Development Act and the Planning Regulations in particular, place responsibility upon Local Authorities to ensure that geological heritage is protected. Implementation of the Heritage Act 1995, through Heritage Officers and Heritage Plans, and the National Heritage Plan 2002, allow County Geological Sites to be integrated into County Development Plans.

The chart below illustrates the essential process, established by the Irish Geological Heritage Programme in the GSI, over the course of eight other county audits since 2004.

County Geological Sites - a step by step guide



Appendix 2 – Bibliography – Geology of County Roscommon

This bibliography, and those following are quite comprehensive, but are certainly not claimed to be definitive. Any additional references (and preferably a copy of the publication) relating to the geology, geomorphology or hydrogeology of County Roscommon will be welcomed by the Heritage Officer.

References specifically about the caves and karst of Roscommon are included in Appendix 3. The references about the Quaternary (or Ice Age) geology of County Roscommon are included in Appendix 4.

This bibliography includes many books which are national in scope or of great historical importance, and of general value to any geological study in Roscommon. Many of the individual papers listed are perhaps concerned with adjacent or cross-county districts such as the Curlew Mountains, and may have only marginal reference to Roscommon, but geological boundaries do not follow human administration boundaries.

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Appendix 5 – Rejected sites

A range of sites had been previously flagged for consideration in the IGH Master site list, and some were assessed as unsuitable for County Geological Site status in this audit. Similarly a range of additional sites were assessed in the audit, based on the authors' expert knowledge of Roscommon's geology. It was known, for example, that karst features of county importance, rather than of national status, in Roscommon had not been adequately considered in the preparation of the IGH Master site list. Other sites were visited on spec during fieldwork, based on knowledge of Roscommon geology gained from projects undertaken in the years since the original county site list was first supplied to Roscommon's Heritage Officer and/or planning department. The various rejected sites are listed below with brief notes as to why they were assessed as unsuitable for inclusion as County Geological Sites.

Largan Cave

Although this is listed in the GSI's Karst features database, no cave is actually present on the ground. Within the accuracy of the grid reference for the cave there is an area of very wet soil with different vegetation from that expected from dry limestone grassland. It is believed that this may be made-ground filling in a former karstic hole or hollow where a cave may have existed or perhaps a collapse occurred.



The

patch of ground where Largan cave is supposed to be, with different soil and vegetation marked.

Lisduff Cave

Although this is listed in the GSI's Karst features database and noted on the Ordnance Survey of Ireland's six inch to the mile maps, no cave is actually present on the ground. The present day ground of grass fields is considerably different from the configuration on the historical maps where there were more walls and buildings in this locality. Whilst the field boundary has small outcrops of limestone rock underneath dense scrub, the cave appears to have been obliterated or buried. It is possible that it was never a natural cave and may have been a souterrain, since they are sometimes mapped as caves on historical OSI maps.



The wooded limestone bank with thick wood debris piled up in the possible site of the cave.

Castlerea Esker

The Castlerea Esker comprises a series of esker beads within an extensive peat bog northwest of Castlerea Town. The esker, though well-defined and intact, is a very low feature as surrounding peatland has enveloped it, and is no more than around 2m-3m high along the entirety of its length. As well as this, the feature is beaded and narrow compared to many of the other eskers in Roscommon.

As the feature is in no way of National Importance, the small size and subdued expression of the feature has merited its exclusion as even a County Geological Site.



Castlerea Esker is the low wooded ridge from which the photo is taken, curving round from left to right (with red highlight).

Moydow Pavement

The Moydow locality is an elevated area of karstified bedrock at or close to the surface, approximately 5 km south of Roscommon Town. During preparation for the field element of the audit, the area was noted as having a potentially extensive area of limestone pavement, from the bare and dry grassland vegetation cover observed in the locality. When visited in the field, the area does comprise some scrub and dry grassland, but there is no rock outcrop of any significance. Thus neither is there any limestone pavement as was initially expected following examination of the aerial photographs.



A view of the high ground at Moydow showing that although there is some bedrock close to surface, there is no significant limestone pavement.

Ballinloughquarter meltwater channel

At Ballinloughquarter just east of Ballinlough Village, a 1.5 km long, sinuous meltwater channel occurs and dissects a ridge. The channel was formed when glacial meltwater spilled from a lake, which was impounded to the north of the ridge during deglaciation in the area. When visited on the ground though, the channel exists and is lengthy, the channel is also wide and relatively shallow and its profile is not clearly seen on the ground. As well as this, much of the locality comprises high hedgerows and forestry, which further subdues the visual impressiveness of the feature. From this, its status as a site is diminished by its wide and shallow morphology, and the difficulty in viewing the profile of the feature clearly from the ground anywhere in the locality.



Ballinloughquarter meltwater channel viewed from the southwest, looking northwest.

Tobereeoige Spring

Tobereeoige Spring is a karstic spring used for water supply, and is located approximately 1.5 km north of Knockcroghery Village. The spring is housed in a pumphouse with an underground concrete chamber, and the water supply compound is secured with security fencing. From this, the spring is not easily accessible and is not clearly seen owing to the engineering of the structure housing it. As there are other water supply springs that can be seen more clearly and which discharge larger volumes of water than Tobereeoige, it has not been recognised as being of County Geological Site status.



Two views of Tobereoge Spring.

Silver Island Spring

Silver Island Spring is a karstic spring used for water supply, and is located approximately 2 km east of Castlerea Town. The spring is not readily visible and is surrounded by low-lying, wet grassland which subtracts from the impressiveness of the feature. As there are other water supply springs that can be seen more clearly and which discharge larger volumes of water than Silver Island Spring, it has not been recognised as being of County Geological Site status.

Lough Key Forest Park

Although the water levels were high during our fieldwork, we discussed the occurrence of rock exposures with boatmen and staff at the park and are of the view that those that do occur when the water is low are unsubstantial and do not merit inclusion as a County Geological Site. Given the substantial area of the park, there may be some rock exposures present, including within the woodlands. If any attempt at developing the geological interest of the property was considered, it would require detailed study and fieldwork to progress.



The general public access point to the lake.



The rock exposures just below water!

Estersnow Cave

Hickey and Drew (2003) describe this short cave near Cavetown cross roads as having a man-made entrance and being 9m long. It is shorter than this at present, probably due to past dumping of rubbish in the cave. The cave is of no great significance and does not merit being classed as a County Geological Site.



Outside and internal views of Estersnow Cave.

Pollnagollum cave and doline, Frenchpark

This site is very close to the centre of Frenchpark, in a wooded enclosure at the back of a garden. A small stream cave emerges in the side of a 4m deep oval doline. It is effectively a window into the epikarst. The cave stream is polluted by sewage and the water disappears quickly into the rock at the base of the doline. A large pipe that was probably overflow from a septic tank discharges into the doline from the adjacent house but this appears to be redundant, and there may now be proper sewage connections for the house.

Overall, despite the rarity of documented caves in Roscommon, this site does not merit inclusion as a County Geological Site. The pollution of groundwater in a karstic terrain is of some concern and could be investigated further.



Looking into the pothole of Pollnagollum at Frenchpark.

Curlew Mountains road cutting (in Devonian sandstones)

At the very western margin of the county in the bypass north of Boyle there are some sections of Devonian sandstone ("Old Red Sandstone") in the road cut. These were probably very fresh after road construction when they were put forward for inclusion in the IGH site list for the Devonian theme. However they are now poorly exposed due to weathering and degradation of the cutting and due to the encroachment of extensive vegetation cover. There is no merit in the inclusion of this site

as a County Geological Site. One short section on the southern slopes of the Curlews is listed as a County Geological Site (Boyle Road Cutting) since a good exposure of a volcanic rock within the sandstones is reasonably well exposed and accessible in a road cutting.

The GSI IGH record includes mention of a nearby quarry with raindrop pits. This quarry was examined and although there are rock faces exposed, the overall status of the faces is poor. The rock is the same volcanic sediment seen in the Boyle Road Cutting. There is almost no bedrock exposed on the quarry floor, with vegetation and standing water dominating this area. No raindrop impressions were seen. It is reported that such impressions were preserved on fine grained green units, such as thin mudstones or possible ash beds. There are indications of these mudstones as easily weathered broken fragments in a couple of places, but no thin greenish beds. They may have been present and recorded when the quarry was operational and exposures were fresh. However, there is insufficient geological interest remaining to consider this quarry as a County Geological Site. Some pieces of the raindrop prints in a very fine grained greenish rock, that may have been a volcanic ash, are collected and preserved in Trinity College Dublin Geological Museum.



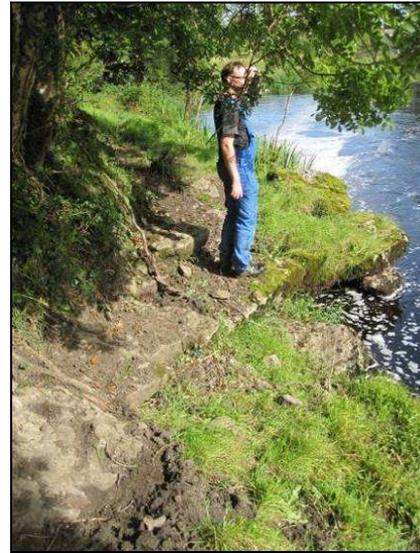
Degraded and overgrown Devonian sandstones in the road cut on the northern side of the Curlews, near the county boundary.



The quarry from which raindrop prints were recovered is not now in satisfactory condition for County Geological Site status.

Boyle River

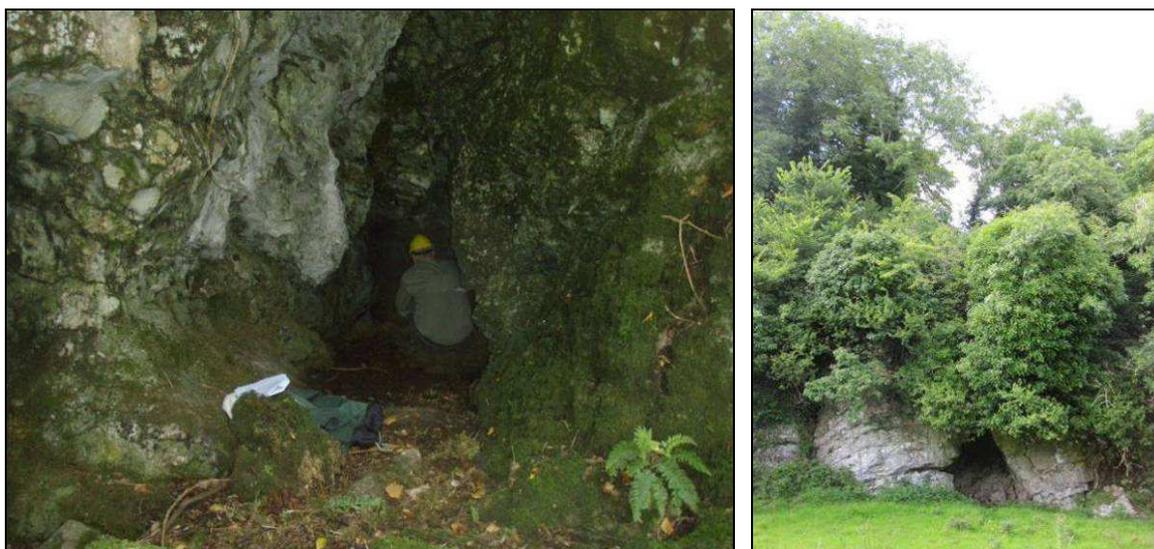
This site was originally listed as showing sections of Boyle Sandstone Formation and Kilbryan Limestone Formation. In fact there are some very minor bankside rock exposures at the minor rapids below Assylin Church graveyard (marked as 'waterfall' on the Ordnance Survey mapping), on the western side of town. There are no outcrops of any significance throughout the town to the northern side of Boyle Abbey, and some of it is channelized by buildings and walls. The exposures near the graveyard are inconsequential beyond allowing an exposure and potential contact between rock types to be drawn on a geological map. River conditions were apparently in high flow, but even so, the exposures in the short rapids would not materially differ from the bankside scraps, in times of low water flow.



Left: The rapids in the Boyle River where there is a small amount of rock exposure.
Right: The rock exposures are no better or larger than this riverbank.

Ballynahoogh or Cavetown Cave

This cave may be the one described in 1969 as Cavetown Cave (Devoy and Gilhuys 1969) but does not fully correspond to the description. The cave is located 5km southeast of Boyle in a limestone hillock just north of the road at NGR 184430 297680, in the townland of Cavetown or Ballynahoogh. The hillock has cliffs of limestone around the base with several arch like rifts which do not extend more than a metre or two. At the east end is a cave which has been surveyed and is a total of 24m long. It is currently very unpleasant due to the decay of a dead animal. Irrespective of this, the cave is of no great significance and does not merit being classed as a County Geological Site.



Left: Matthew Parkes looking into the entrance of Cavetown Cave.

Right: Blind cave in the same escarpment as Cavetown Cave.

Arigna area sites

Coal mining was once widespread across the hills centred on Arigna. Two sites (Arigna Mining Experience and Altagowlan) represent this important industry and its geological component. This area was previously noted in the IGH Master site list as having much potential interest for coal mining heritage under IGH 15, the Economic Geology Theme. For NHA status, the criteria for a site in this theme demanded scientific justification based on the geology of the economic deposit itself and could not include sites solely based on the subsequent mining heritage infrastructure of buildings, water power, pits or adits. As County Geological Sites all facets of the mining heritage could be encompassed in the selection of a site.

The Arigna area was appraised with a view to identifying the best examples of coal and possibly some older iron mining heritage in the district to include both the coal geology and any mining infrastructure. Sadly most areas now exhibit very little of their past with only lumps and bumps in the ground needing serious work to interpret their role, and no classic buildings such as are found in metal mining areas in Wicklow, west Cork, Silvermines and so on.

The public visitor facility, the Arigna Mining Experience (AME) does a superb job of capturing all the interest of the former industry and preserves and presents the underground aspects of coal geology and mining very well. The site boundary encompasses a range of spoil heaps and other minor remains. To represent the underground aspects of coal, the only other site in the region that should probably be considered as a geological NHA is on Bencroy in County Leitrim. Most of the adits in the Arigna coal mines have collapsed or are now made inaccessible for safety reasons.

Other former mines at Aghabehy and Carrownanalt, above the AME and along the flanks of Kilonan Mountain, are now of insufficient interest on the ground to include as County Geological Sites. These have been well documented in the EPA/GSI Historic Mine Site Characterisation Project, which looked at them principally as possible sources of environmental pollution. At Rockhill for example, the decline to the adit survives although the entrance is collapsed. Mine buildings of poor quality concrete also survive but some have been subsumed for farm buildings and the whole area has been disturbed in the course of building roads for access to wind turbines.



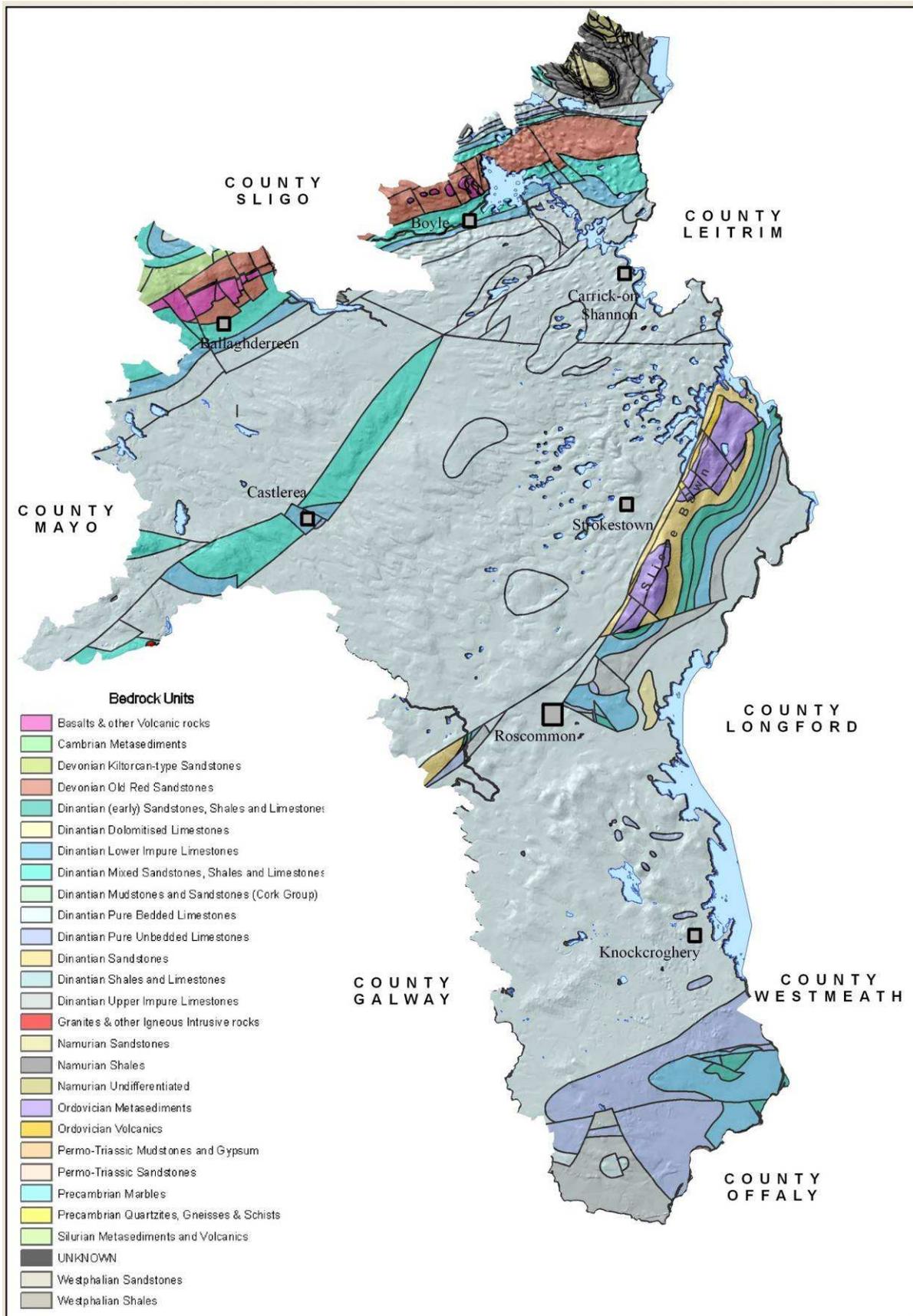
Left: The decline at Rockhill with the collapsed adit at the lower end behind the trees.
Right: Former mine buildings now shelter new inhabitants.

Pollawaddy

The cave is located some 7.5km southwest of Ballaghaderreen in the extreme northwest of Co. Roscommon and approximately 1.5km southwest of Lisacul village; NGR M 157317 289238, (50,000 map No. 32); Townland Carrownaknockaun; Altitude 94m O.D; Surveyed length is 45.5m. The entrance is located part way up the southern flank of an 11m high east-west ridge just north of the point at which a small stream sinks. The cave was explored and surveyed in September 2000 by David Drew and Caoimhe Hickey.

The original cave entrance was spacious - some 3m wide and 2m high but the farmer has walled in much of the opening and culverted the stream at the sink and entry is now via an easy squeeze and a 1m drop into a boulder-strewn chamber. Whilst interesting, it does not merit County Geological Site status.

Appendix 6 – Detailed geological map of County Roscommon



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Killeglan Karst Landscape
Other names used for site	
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Milltown, Cuilleenoolagh, Cloonacaltry, Skeavally, Boleyduff, Tobermacloughlin, Lugboy, Breeole, Porteen, Ballyglass
NEAREST TOWN	Ballyforan, Taghmaconnell
SIX INCH MAP NUMBER	47, 48, 50
NATIONAL GRID REFERENCE	188250 243150 (centre of area)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 12

Outline Site Description

This site comprises an extensive area of bouldery terrain in southern Roscommon, covering an area of 5 by 2 kilometres, and includes a number of low amplitude, hummocky ridges. Three discrete areas of this topography are defined in close proximity to each other.

Geological System/Age and Primary Rock Type

The landscape is formed on bedrock which is Lower Carboniferous limestone. The majority of the ridge features, as well as the boulders, are Quaternary in age, having been deposited at the base or edge of the ice sheet moving northwest to southeast during the maximum period of the last Ice Age.

Main Geological or Geomorphological Interest

This area is unique in lowland Ireland as it expresses what the entire lowland limestone landscape would have looked like before man modified the countryside, by reclaiming land and building field boundaries.

The area comprises a number of low, quasi-linear and hummocky ridges, which are 2m-10m in amplitude and often long and sinuous. These seem to be minor ribbed moraines. All of these features have been covered by karstified limestone boulders strewn across the ground. The area looks just like an area of karstified bedrock outcrop in many respects, but little outcrop is seen. The abundance of limestone boulders gives the landscape an unusual and rustic feel. The entire area is dry, with no surface drainage features visible. The majority of the area comprises dry grassland or scrub.

Site Importance – County Geological Site; recommended for Geological NHA

This is the only such area of lowland, boulder-strewn, limestone glacial karst in the country. It is of national importance.

Management/promotion issues

This is an excellent site in terms of macro-scale Quaternary geomorphology. The landscape is noteworthy and should be promoted as unique amongst landscape elements within the Roscommon County Development Plan and in Landscape Characterisation. The site should also be designated as an NHA owing to the uniqueness of the natural landscape character.

The site boundary illustrated here delineates the area displaying this geology in 2004 when the aerial photographs of the locality were taken. As land management practices are constantly changing and may have impacted heavily on this vulnerable landscape, in order to delineate the exact remaining area of interest a detailed field survey is required.

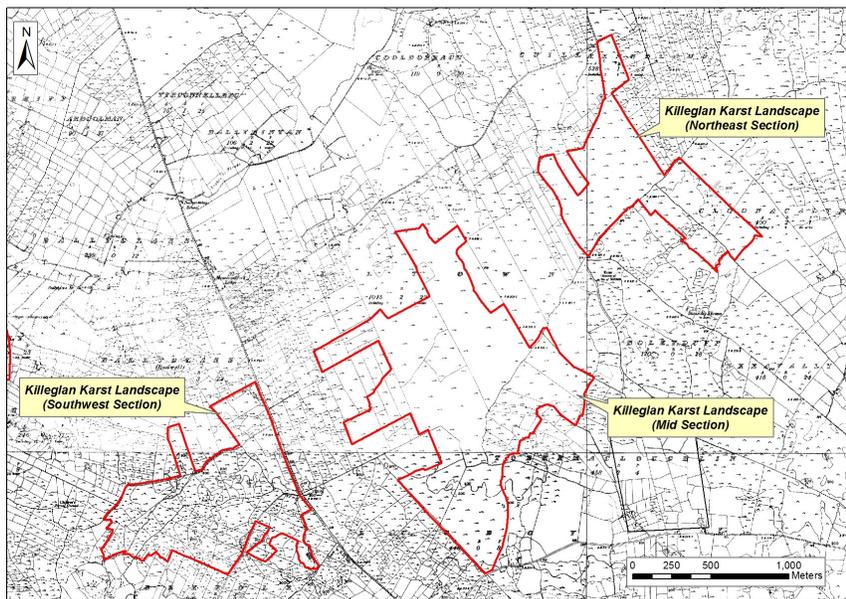
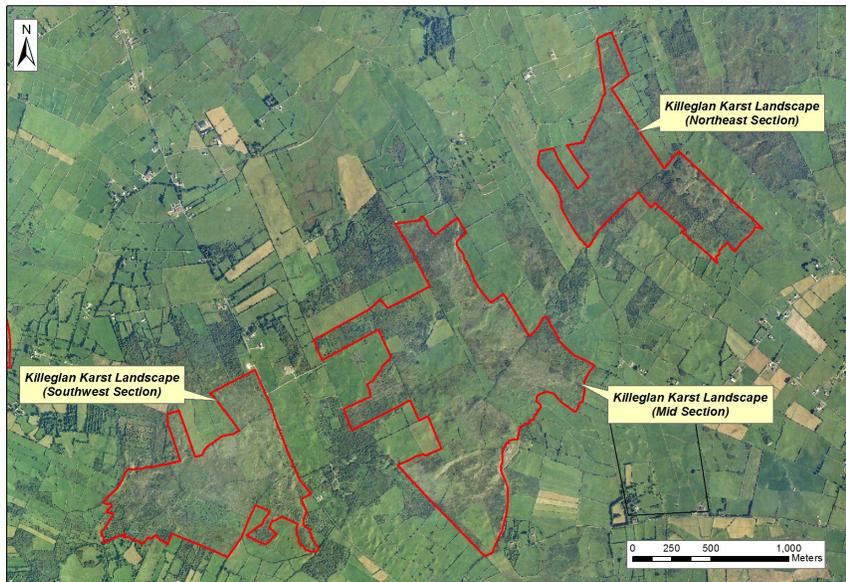
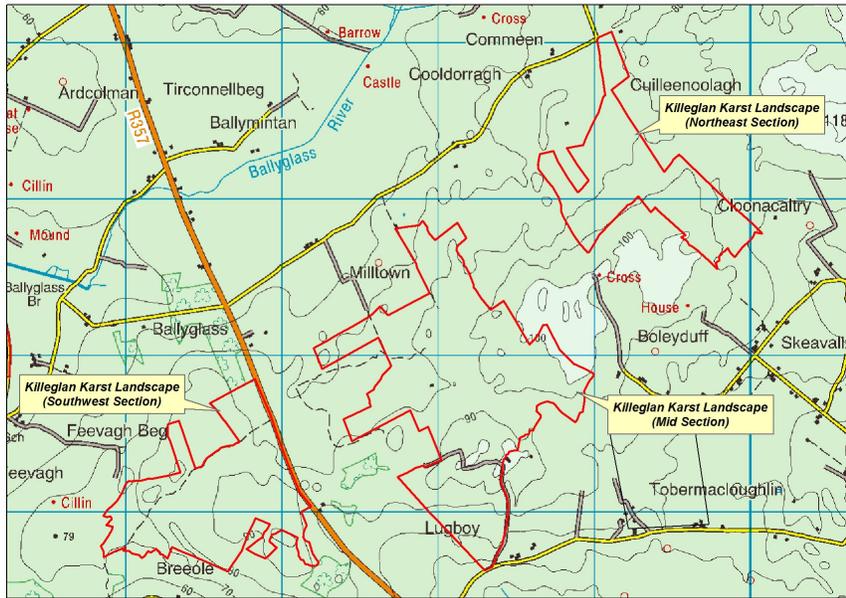
Further research and investigation is required to document and understand the full scientific story. Since a windfarm has been granted planning permission in 2012, it is hoped that scientific opportunity created by ground excavations for this will be used and not wasted.



The pristine landscape of limestone boulders on glacial moraine at Killeglan.



The pristine landscape of limestone boulders on glacial moraine at Killeglan, with karstic weathering imitating limestone bedrock.



ROSCOMMON - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Castlesampson Esker
Other names used for site	Onagh Esker
IGH THEME	IGH7 Quaternary
TOWNLAND(S)	Tobermacloughlin, Onagh, Kilkenny, Castlesampson, Carrowkeeran, Eskerbeg
NEAREST TOWN	Athlone, Ballyforan
SIX INCH MAP NUMBER	48, 51
NATIONAL GRID REFERENCE	192000 241240 (centre of features)
1:50,000 O.S. SHEET NUMBER	47 1/2 inch Sheet No. 15

Outline Site Description

This esker trends west-northwest to east-southeast in south Roscommon, occurring south of the R363 road between Ballyforan and Athlone.

Geological System/Age and Primary Rock Type

The esker is formed on bedrock which is Lower Carboniferous limestone. The feature itself is Quaternary in age, having been deposited at the base of the ice sheet moving northwest to southeast during early deglaciation after the last Ice Age.

Main Geological or Geomorphological Interest

The Castlesampson esker is an excellent example of a complex, multi-crested esker which is comprised of numerous beads. The esker system comprises ten individual segments, which stretch for a distance of just over six kilometres. The most complex portion of the longest bead (3.5km) has at least four crests. The esker has a very complex, generally sinuous morphology. The feature interfingers with many flanking fans and deltas, with a pronounced kame-kettle topography in places. Many of the kettle holes host lakes.

The esker was probably deposited as a series of fans, which formed at the mouth of a subglacial tunnel as the ice progressively retreated towards the northwest in this area of Roscommon. Several fans, deltas and kames flank the feature.

Site Importance – County Geological Site

The esker is one of Ireland's best examples of the 'long beaded' esker type.

Management/promotion issues

This report gives proper recognition to the geomorphological component of a site that is already conserved for its grassland natural heritage as SAC and proposed NHA (Site Number 001625).



Scrub vegetation on a bead of the Castlesampson esker system.



Reclaimed gravel pit within the Castlesampson esker system.



Bare gravels outcropping on the summit of the Castlesampson esker. See the sinuous nature of the feature as it winds away into the distance.



Two distinct beads of the Castlesampson esker system.

David Naughton

From: INFO <Information@tii.ie>
Sent: Friday 21 August 2020 08:55
To: David Naughton
Subject: Proposed Seven Hills Wind Farm Development, Cuilleenoolagh, Co. Roscommon - EIA Scoping. TII Ref: TII20-110502.

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Mr. Naughton,

Thank you for your email and attachments of 17 July 2020, regarding an EIA scoping for the proposed Seven Hills Wind Farm Development, Cuilleenoolagh, Co. Roscommon. The position in relation to your enquiry is as follows.

Transport Infrastructure Ireland (TII) wishes to advise that it is not in a position to engage directly with planning applicants in respect to proposed developments. TII will endeavour to consider and respond to planning applications referred to it, given its status and duties as a statutory consultee under the Planning Acts. The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidelines, as outlined in the Section 28 of 'Spatial Planning and National Roads. Guidelines for Planning Authorities' (DoECLG, 2012). Regard should also be had to other relevant guidance available at www.TII.ie.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals, following the examination of any valid planning application referred.

With respect to EIAR scoping issues, the recommendations indicated below provide only general guidance for the preparation of an EIAR, which may affect the National Roads Network.

The developer/scheme promoter should have regard, *inter alia*, to the following:

- Consultations should be had with the relevant Local Authority/National Roads Design Office, with regard to locations of existing and future national road schemes in the vicinity of the subject development site.
- TII would be specifically concerned as to potential significant impacts the development would have on the existing national road network (and junctions with national roads), in the proximity of the proposed development.
- The developer should assess visual impacts from existing national roads.
- The developer should have regard to any Environmental Impact Assessment and all conditions and/or modifications imposed by An Bord Pleanála, regarding road schemes in the areas concerned. The developer should, in particular, have regard to any potential cumulative impacts.
- The developer, in preparing EIAR, should have regard to TII Publications (formerly the 'NRA Design Manual for Roads and Bridges' and the 'NRA Manual of Contract Documents for Road Works').
- The developer, in preparing EIAR, should have regard to TII's environmental assessment and construction guidelines, including the 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes' (National Roads Authority, 2006).
- The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may

need to consider the incorporation of noise barriers to reduce noise impacts (see 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes' (1st Rev., National Roads Authority, 2004)).

- It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site, with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's 'Traffic and Transport Assessment (TTA) Guidelines' (2014) should be referred to in relation to proposed development, with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TTA Guidelines, which addresses requirements for sub-threshold TTA.
- The designers are asked to consult [TII Publications](#) to determine whether a Road Safety Audit is required.
- In the interests of maintaining the safety and standard of the national road network, the EIAR should identify the methods/techniques proposed for any works traversing/in proximity to, the national road network.
- In relation to haul route identification, the applicant/developer should clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route, including where temporary modification to the road network may be required. Consultation with relevant PPP Companies and MMarC Contractors may also be required. All structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed.
- In relation to cabling and electricity grid connection routing, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard the proposed road schemes. In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered, in the interests of safeguarding the investment in and the potential for future upgrade works to the national road network. The cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII. Any costs attributable shall be borne by the applicant/developer. Consultation with relevant PPP Companies and MMarC Contractors may also be required. The developer should also be aware that separate approvals may be required for works traversing the national road network and/or motorway network, where applicable.

Notwithstanding, any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practise.

I trust that the above comments are of assistance in your EIAR preparation.

Yours sincerely,

Michael McCormack
Senior Land Use Planner



Transport Infrastructure Ireland
Parkgate Business Centre

Parkgate Street
Dublin D08 DK10

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Órla Murphy

From: Peter O'Brien <peter.obrien@enet.ie>
Sent: Tuesday 18 February 2020 19:09
To: Órla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

This proposed development won't affect us,

Kind Regards,
Peter

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: Tuesday, February 18, 2020 5:38 PM
To: Peter O'Brien <peter.obrien@enet.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Peter,

See attached.

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie



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From: Peter O'Brien <peter.obrien@enet.ie>
Sent: Monday, February 17, 2020 12:00 PM
To: Órla Murphy <omurphy@mkoireland.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

Can you send the location in a Google Earth kml please?

Thanks,
Peter

From: Orla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday, February 12, 2020 10:18 AM
To: Peter O`Brien <peter.obrien@enet.ie>
Cc: GRennicks@airspeed.ie
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Peter,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Airspeed has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Orla Murphy

From: padraig.condon@bt.com
Sent: Wednesday 12 February 2020 11:04
To: Orla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,
Proposed development will have no impact on BT microwave network.

Regards

Padraig Condon
Core Network Operations

Tel: +353014326819
Mobile number: +353 86 604 0636
BT Meetme: + 353 1 6569053
E-mail padraig.condon@bt.com
<https://www.webjoin.com/>
Participant: 40342233#
Web: www.btireland.com



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From: Orla Murphy [mailto:omurphy@mkoireland.ie]
Sent: 12 February 2020 10:21
To: Condon,PG,Padraig,NQE32E R <padraig.condon@bt.com>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Padraig,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if BT has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Myles Redmond <myles.redmond2@esb.ie>
Sent: Monday 17 February 2020 10:14
To: Órla Murphy; Wilson Dalikeni; Dermot Hopkins
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla,

I have carried out an impact analysis of the proposed windfarm as outlined in your mail and there is no impact to ESB Networks Telecoms existing point to point and point to multipoint radio networks.

Regards,

Myles

From: Orla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 12 February 2020 10:22
To: Dalikeni. Wilson (ESB Networks) <Wilson.Dalikeni@esb.ie>; Hopkins. Dermot (Engineering and Major Projects) <dermot.hopkins@esbtelecoms.ie>; Redmond. Myles (ESB Networks) <myles.redmond2@esb.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

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Hi Wilson,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if ESB Telecoms has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

MKO
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+353 (0) 91 735611
www.mkoireland.ie



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An timpeallacht? - Smaoinigh air sula bpriontáileann tú an r-phost seo.
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* * * * *

Tá an t-eolas sa ríomhphost seo agus in aon chomhad a ghabhann leis rúnda agus ceaptha le haghaidh úsáide an té nó an aonáin ar seoladh chuige iad agus na húsáide sin amháin.
Is tuairimí nó dearcthaí an údair amháin aon tuairimí nó dearcthaí ann, agus ní gá gurb ionann iad agus tuairimí nó dearcthaí ESB.
Má bhfuair tú an ríomhphost seo trí earráid, ar mhiste leat é sin a chur in iúl don seoltóir.
Scanann ESB ríomhphoist agus ceangaltáin le haghaidh víreas, ach ní ráthaíonn sé go bhfuil ceachtar díobh saor ó víreas agus ní glacann dliteanas ar bith as aon damáiste de dhroim víreas.
<https://www.esb.ie/contact>

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* * * * *

Órla Murphy

From: John Bagnall <john.bagnall@eir.ie>
Sent: Monday 24 February 2020 13:51
To: Órla Murphy
Cc: Mobile Networks TXN
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

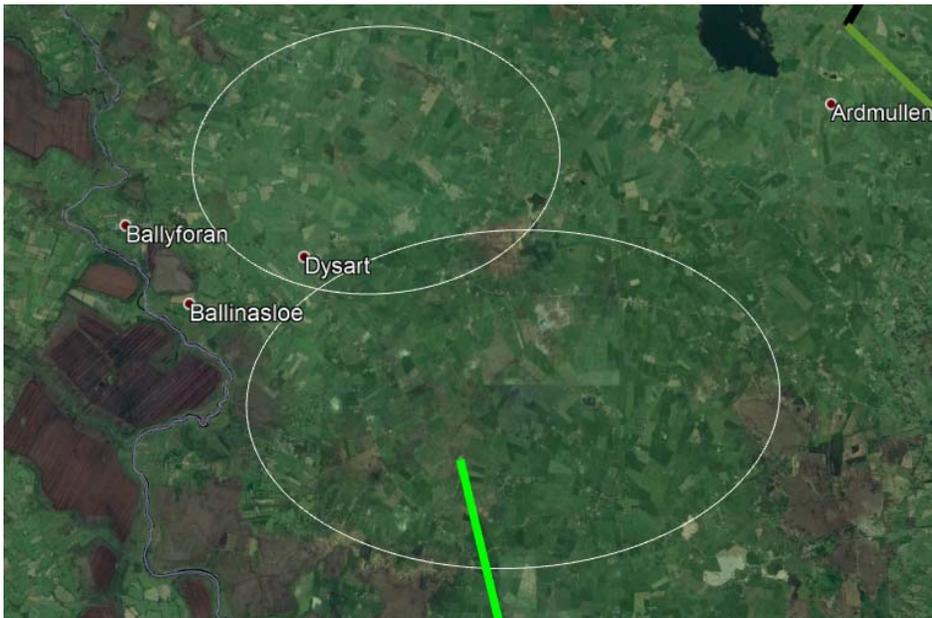
Follow Up Flag: Follow up
Flag Status: Flagged

Hi Orla,

We have one transmission link within the proposed area that could be at risk, the end points of the transmission link is below, for windfarm developments we would keep a buffer of 100meters radius away from this transmission path as always.

Link 1 – End point 1 - 53°25'51.45"N 8°10'27.61"W, End point 2 – 53°19'13.81"N 8° 7'32.08"W

Please keep sending future windfarm development analysis and large infrastructure project request to MobileNetworksTXN@eir.ie for Eir Mobile (formerly Meteor) network analysis.



Kind regards,



John Bagnall

Transmission Design & Engineering

M: +353 85 1053746

E: john.bagnall@eir.ie

Address: EirCode - D24 HX03

On Wed, 12 Feb 2020 at 10:23, Orla Murphy <omurphy@mkoireland.ie> wrote:

Hi John,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Eir has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Ali Tariq <ali.tariq@imaginegroup.ie>
Sent: Wednesday 4 March 2020 12:13
To: Órla Murphy; William Morgan; Ronnie O'Neill; Lorna Brennan
Cc: John Coleman
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

The proffered buffer for this link will be at least 50m.

Best regards
Ali

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: 04 March 2020 12:02
To: William Morgan <william.morgan@imaginegroup.ie>; Ronnie O'Neill <Ronnie.ONeill@imaginegroup.ie>
Cc: Ali Tariq <ali.tariq@imaginegroup.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi William,

Thanks for coming back to me. Is there a preferred buffer for this link?

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: William Morgan <william.morgan@imagegroup.ie>
Sent: Wednesday, February 12, 2020 12:24 PM
To: Orla Murphy <omurphy@mkoireland.ie>; Ronnie O'Neill <Ronnie.ONeill@imagegroup.ie>
Cc: Ali Tariq <ali.tariq@imagegroup.ie>
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla

The proposed wind-farm development at Seven Hills, Co. Roscommon will cause interference to one existing Imagine microwave link. Please see the requested information highlighted below,

MMC Mount Mary

- Latitude: 53.57113611
- Longitude: -8.38358056
- Azimuth: 118.81 degrees
- Height that the base of tower is above sea level: 150m.
- Height that the dish is placed on the tower: 25m.
- Frequency: 6GHz

ESB Athlone Town Centre

- Latitude: 53.424048
- Longitude: -7.935437
- Azimuth: 298.81 degrees
- Height that the base of tower is above sea level: 43m.
- Height that the dish is placed on the tower: 40m.
- Frequency: 6GHz

Kind Regards,
Will.

From: Orla Murphy <omurphy@mkoireland.ie>

Sent: 12 February 2020 10:27

To: Ronnie O'Neill <Ronnie.ONeill@imagegroup.ie>

Cc: William Morgan <william.morgan@imagegroup.ie>

Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Ronnie,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Imagine has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Órla Murphy
Sent: Friday 21 August 2020 11:16
To: Andrew Snowdon; Fergus Hickey; Network-Engineering
Cc: David Naughton
Subject: RE: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Andrew,

Just to confirm, we have been able to move the turbines a total of 121m away from the identified link.

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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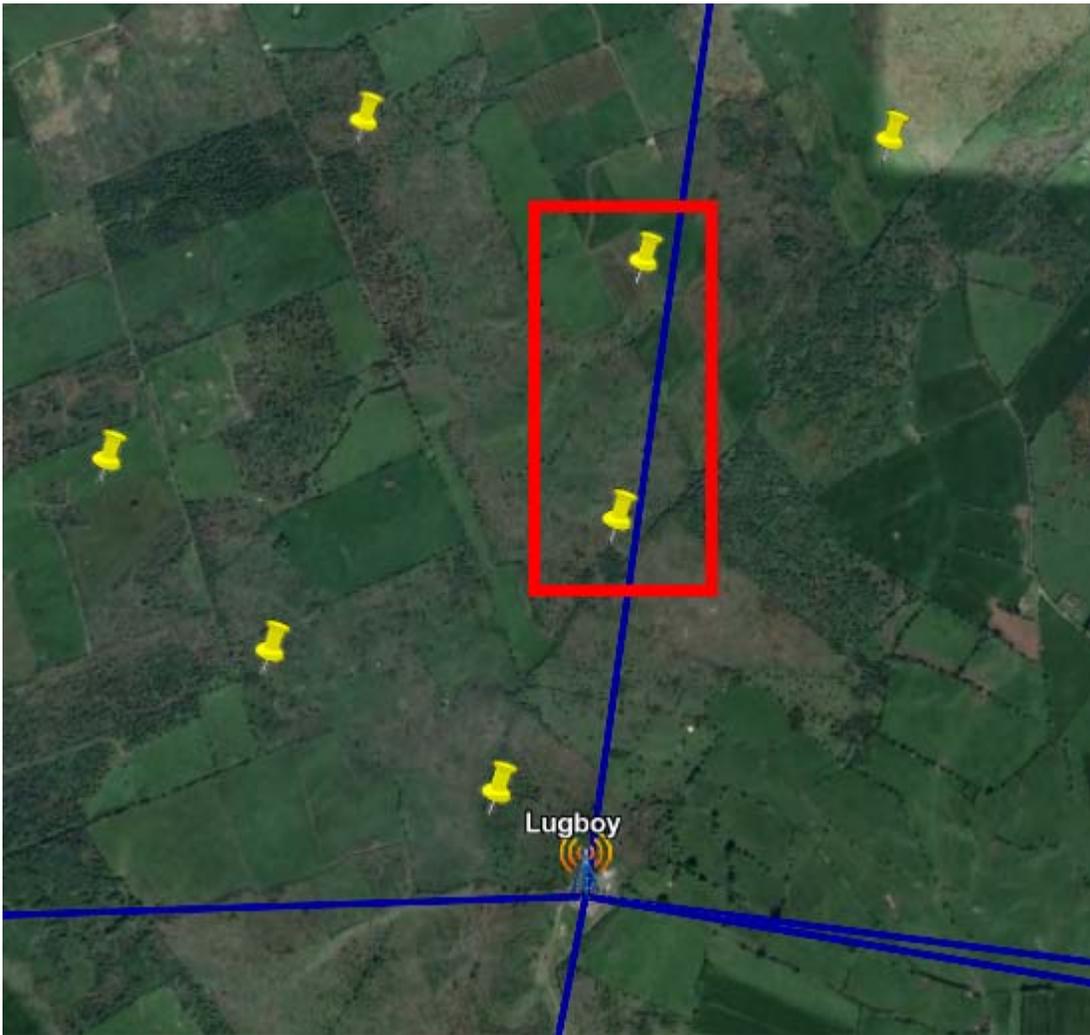
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From: Andrew Snowdon <andrew.snowdon@ripplecom.net>
Sent: Friday 24 July 2020 16:03
To: Órla Murphy <omurphy@mkoireland.ie>; Fergus Hickey <fergus.hickey@ripplecom.net>; Network-Engineering <network-engineering@ripplecom.net>
Cc: David Naughton <dnaughton@mkoireland.ie>
Subject: Re: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla,

40 meter's clearance from the blade's should suffice. If the the radius of the blade's is 81 meters and we add the required 40 meters clearance that mean's they need to be at least 121 meter's from the path of the link. So it's actually just these two that are the problem:



Best regards,

Andrew

On 24/07/2020 15:54, Órla Murphy wrote:

Hi Andrew,

Thanks for the detail.

So does 40m suffice then from those turbines or are you going to come back to me with the appropriate buffer? Turbine numbers are 1-21 at the minute (not sure why it has given those names in google!)

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Andrew Snowdon <andrew.snowdon@ripplecom.net>
Sent: Friday 24 July 2020 15:41
To: Órla Murphy <omurphy@mkoireland.ie>; Fergus Hickey <fergus.hickey@ripplecom.net>; Network-Engineering <network-engineering@ripplecom.net>
Cc: David Naughton <dnaughton@mkoireland.ie>
Subject: Re: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla,

Thanks for that. Understood.

Gortnabla is at 53.381713, -8.182275

Yeah, it looks like the Lugboy -> Mount Kelly link will be impacted by Turbine 17, 41 & 33.

Best regards,

Andrew

On 24/07/2020 15:24, Órla Murphy wrote:

Hi Andrew,

Thanks for this.

Just to confirm, the links you are noting are:

1. Lugboy water tower (53.431235 -8.174446) to Gortnabla (XX)
2. Lugboy water tower (53.431235 -8.174446) to Mount Hazel
3. River Village (Athlone Springs hotel, Athlone) (53.424268 -7.935312) and Lugboy water tower (53.431235 -8.174446)
4. Lugboy water tower and Mount Kelly mast site (53.575662 -8.16484).

Could you provide me with the above coordinates for Gortnabla? Just want to have a record on file for the connection.

Just having a look now, and the main link causing the issue is that between Lugboy Water Tower and Mount Kelly; and there are a few locations close to the link but outwith 40m. I have attached a kmz of the turbine layout at present. Could you check

this and let me know? As mentioned to Fergus, we will be using a maximum blade diameter of 162m.

Please note, I know a few of the locals around the proposed development have contacted yourselves, they are aware of the turbine layout but not specific coordinates. If you could keep this confidential.

Many thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Andrew Snowdon <andrew.snowdon@ripplecom.net>
Sent: Friday 24 July 2020 11:40
To: Fergus Hickey <fergus.hickey@ripplecom.net>; Órla Murphy <omurphy@mkoireland.ie>; Network-Engineering <network-engineering@ripplecom.net>
Cc: David Naughton <dnaughton@mkoireland.ie>; Fergus Hickey <fergus.hickey@ripplecom.net>
Subject: Re: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

We have several links traversing the polygons in the sent KMZ. I can't accurately calculate the clearance requirements without knowing proposed locations of turbines. The Fresnal zone of the link could be up to 40 meter's depending on link distance and frequency.



See attached KMZ.

Best regards,

Andrew

On 20/07/2020 12:08, Fergus Hickey wrote:

Thanks Orla

Thank you

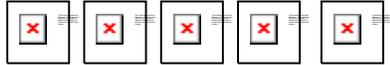
Best Regards

Fergus Hickey | Operations Coordinator

M: 087 2340041

E: fergus.hickey@ripplecom.net | W: ripplecom.net

Houston Hall, Raheen Business Park, Limerick, V94 PKF1



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From: Órla Murphy <omurphy@mkoireland.ie>

Sent: 20 July 2020 12:06

To: Fergus Hickey <fergus.hickey@ripplecom.net>; Network-Engineering <network-engineering@ripplecom.net>

Cc: David Naughton <dnaughton@mkoireland.ie>

Subject: RE: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Fergus,

We are looking at a maximum tip height of 180m and a maximum blade diameter of 162m

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Fergus Hickey <fergus.hickey@ripplecom.net>
Sent: Monday 20 July 2020 11:55
To: Órla Murphy <omurphy@mkoireland.ie>; Network-Engineering <network-engineering@ripplecom.net>
Cc: David Naughton <dnaughton@mkoireland.ie>
Subject: Re: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

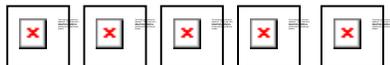
Hi Orla
Do you know how high the wind turbines are and the diameter of the blades and we can figure out if it will impact the frenzil zone of our Links?

Thank you

Best Regards

Fergus Hickey | Operations Coordinator

M: 087 2340041
E: fergus.hickey@ripplecom.net | **W:** ripplecom.net
Houston Hall, Raheen Business Park, Limerick, V94 PKF1





Please consider the environment before printing this email.

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: 20 July 2020 11:09
To: Fergus Hickey <fergus.hickey@ripplecom.net>; Network-Engineering <network-engineering@ripplecom.net>
Cc: David Naughton <dnaughton@mkoireland.ie>
Subject: RE: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Fergus,

Thanks for sending me on the detail.

Just to confirm, the links you are noting are:

5. Sheraton hotel, Athlone (53.424268 -7.935312) and Lugboy water tower (53.431235 -8.174446)
6. Lugboy water tower and Mount Kelly mast site (53.575662 - 8.16484).

Can you provide me with a buffer please for both links?

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Fergus Hickey <fergus.hickey@ripplecom.net>
Sent: Wednesday 15 July 2020 16:26
To: Órla Murphy <omurphy@mkoireland.ie>; Network-Engineering <network-engineering@ripplecom.net>
Subject: RE: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla

It looks like the proposed wind farm will seriously impact at least two of our main backhaul links between the Sheraton hotel, Athlone (53.424268 -7.935312) and Lugboy water tower (53.431235 -8.174446) and Mount Kelly mast site (53.575662 - 8.16484).

We do have dedicated links for business customers connected to these access points which will be affected by turbines also. If you require any further information please let me know..

Thank you

Best Regards

Fergus Hickey | Operations Coordinator

M: 087 2340041

E: fergus.hickey@ripplecom.net | **W:** ripplecom.net

Houston Hall, Raheen Business Park, Limerick, V94 PKF1



Órla Murphy

From: Fergus Hickey <fergus.hickey@ripplecom.net>
Sent: Friday 24 July 2020 11:08
To: Órla Murphy
Subject: Re: RE WindFarm

Thanks Orla

Thank you

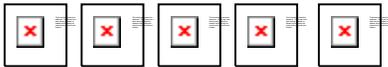
Best Regards

Fergus Hickey | Operations Coordinator

M: 087 2340041

E: fergus.hickey@ripplecom.net | **W:** ripplecom.net

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Please consider the environment before printing this email.

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: 24 July 2020 11:04
To: Fergus Hickey <fergus.hickey@ripplecom.net>
Subject: RE: RE WindFarm

Hi Fergus

See attached.

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Fergus Hickey <fergus.hickey@ripplecom.net>
Sent: Friday 24 July 2020 10:49
To: Órla Murphy <omurphy@mkoireland.ie>
Subject: RE WindFarm

Hi Orla

Can you send me on the KMZ file on google earth for the seven hills wind farm please? I seem to have deleted the original one.

Thank you

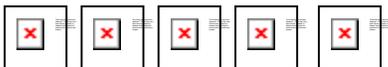
Best Regards

Fergus Hickey | Operations Coordinator

M: 087 2340041

E: fergus.hickey@ripplecom.net | **W:** ripplecom.net

Houston Hall, Raheen Business Park, Limerick, V94 PKF1



- Available
- Contactable
- Adaptable

Órla Murphy

From: Denis Herlihy <denis.herlihy@ripplecom.net>
Sent: Wednesday 15 July 2020 15:23
To: Órla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

I'll pass it on to another colleague Orla

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 15 July 2020 12:00
To: Denis Herlihy <denis.herlihy@ripplecom.net>
Subject: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Denis,

I had emailed Jarek in February in regards to a request for scoping on potential Ripplecom links in the area surrounding a proposed wind farm site in Roscommon. I was chasing those this morning and got a bounce back email.

On discussion within the team here, my colleague Eoin O'Sullivan said that you had communicated with him that Jarek had left the company. Would you be able to get someone else to deal with my request below please?

Any queries let me know

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Órla Murphy
Sent: Wednesday 15 July 2020 11:46
To: 'Jarek Frankiewicz' <jarek.frankiewicz@ripplecom.net>
Subject: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Jarek,

I am chasing up a few telecoms operators I haven't heard back from in regard to the proposed Seven Hills Wind Farm, Co. Roscommon

Would you be able to give me some feedback on whether Ripplecom have any links in this area?

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

MKO
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From: Orla Murphy

Sent: Wednesday 12 February 2020 10:29

To: Jarek Frankiewicz <jarek.frankiewicz@ripplecom.net>

Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Jarek,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Ripplecom has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Órla Murphy
Sent: Tuesday 21 April 2020 09:49
To: Matthew Craig
Cc: Johnny Evans; windfarms@rte.ie
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Thanks Matthew,

Just wanted to confirm there were no additional buffers required.

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Matthew Craig <matthew.craig@2rn.ie>
Sent: Tuesday 21 April 2020 09:41
To: Órla Murphy <omurphy@mkoireland.ie>
Cc: Johnny Evans <Johnny.Evans@2rn.ie>; windfarms@rte.ie
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla,

It would be great if you could do that.

Regards

Matthew Craig

Project Engineer
Projects and Coverage Planning
2RN
Block B, Cookstown Court, Old Belgard Road, Tallaght, Dublin 24, Ireland
D24 WK28
Phone: + 353 (0) 1 2082261

Mobile: + 353 (0) 87 7509955

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From: Órla Murphy <omurphy@mkoireland.ie>
Sent: 20 April 2020 18:56
To: Matthew Craig <matthew.craig@2rn.ie>
Cc: Johnny Evans <Johnny.Evans@2rn.ie>; windfarms@rte.ie
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Matthew

Just want to confirm, we are currently assessing a 180m tip turbine, are we okay to keep the proposed turbines outside the 1st Fresnel Zone as per the file you previously sent me?

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Matthew Craig <matthew.craig@2rn.ie>
Sent: Wednesday 12 February 2020 15:30
To: Órla Murphy <omurphy@mkoireland.ie>
Cc: Johnny Evans <Johnny.Evans@2rn.ie>; windfarms@rte.ie
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

The larger of the two shape files sits across one of our links between Cairn Hill and Maghera. I have attached a kmz file with the 1st Fresnel Zone and a turbine with a tip height of 185m. Here are the details of the sites:

Site Name	Location	Ant height AMSL	Frequency
-----------	----------	--------------------	-----------

CAIRN HILL	N53.80715 W07.71531	297	658MHz
MAGHERA	N52.96861 W08.71835	434	658MHz

Please let me know if you require any further information.

Regards

Matthew Craig

Project Engineer

Projects and Coverage Planning

2RN

Block B, Cookstown Court, Old Belgard Road, Tallaght, Dublin 24, Ireland

D24 WK28

Phone: + 353 (0) 1 2082261

Mobile: + 353 (0) 87 7509955

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From: Orla Murphy <omurphy@mkoireland.ie>

Sent: 12 February 2020 10:30

To: Matthew Craig <matthew.craig@2rn.ie>; Johnny Evans <Johnny.Evans@2rn.ie>

Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Matthew, Johnny,

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if 2rn has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Thomas Barry <Tom.Barry@TETRAIRELAND.IE>
Sent: Tuesday 18 February 2020 10:29
To: Órla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Orla,

We anticipate no impact from development at the proposed locations. Can you ensure the proposal is also reviewed by eir.

Regards,
Tom

From: Orla Murphy [mailto:omurphy@mkoireland.ie]
Sent: Wednesday 12 February 2020 10:31
To: Thomas Barry
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Tom

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Tetra has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Gerry Callan <Gerry.Callan@three.ie>
Sent: Wednesday 4 March 2020 11:41
To: Órla Murphy
Cc: Alan Hutchinson; DL Estates ROI; David Montgomery
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla,

To ensure stability of service we typically seek a 100m buffer, however once you have a proposed turbine layout we can assess the impact at that stage.

Could you provide us with the turbine layout in Irish Grid format in an Excel file which we can then import into our planning tool. At that point we can conduct a thorough analysis of the potential impact of each turbine.

Thanks and best wishes,



Gerry Callan
Transmission Engineer

086 3884246
gerry.callan@three.ie



Make it count.

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: 04 March 2020 11:30
To: Gerry Callan <Gerry.Callan@three.ie>
Cc: Alan Hutchinson <alan.hutchinson@three.ie>; DL Estates ROI <Estates@three.ie>; David Montgomery <David.Montgomery@three.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Gerry,

Thanks for the below, I have mapped all links and noted the two for decommissioning. Is there a buffer that should be applied to the second link for our constraints mapping?

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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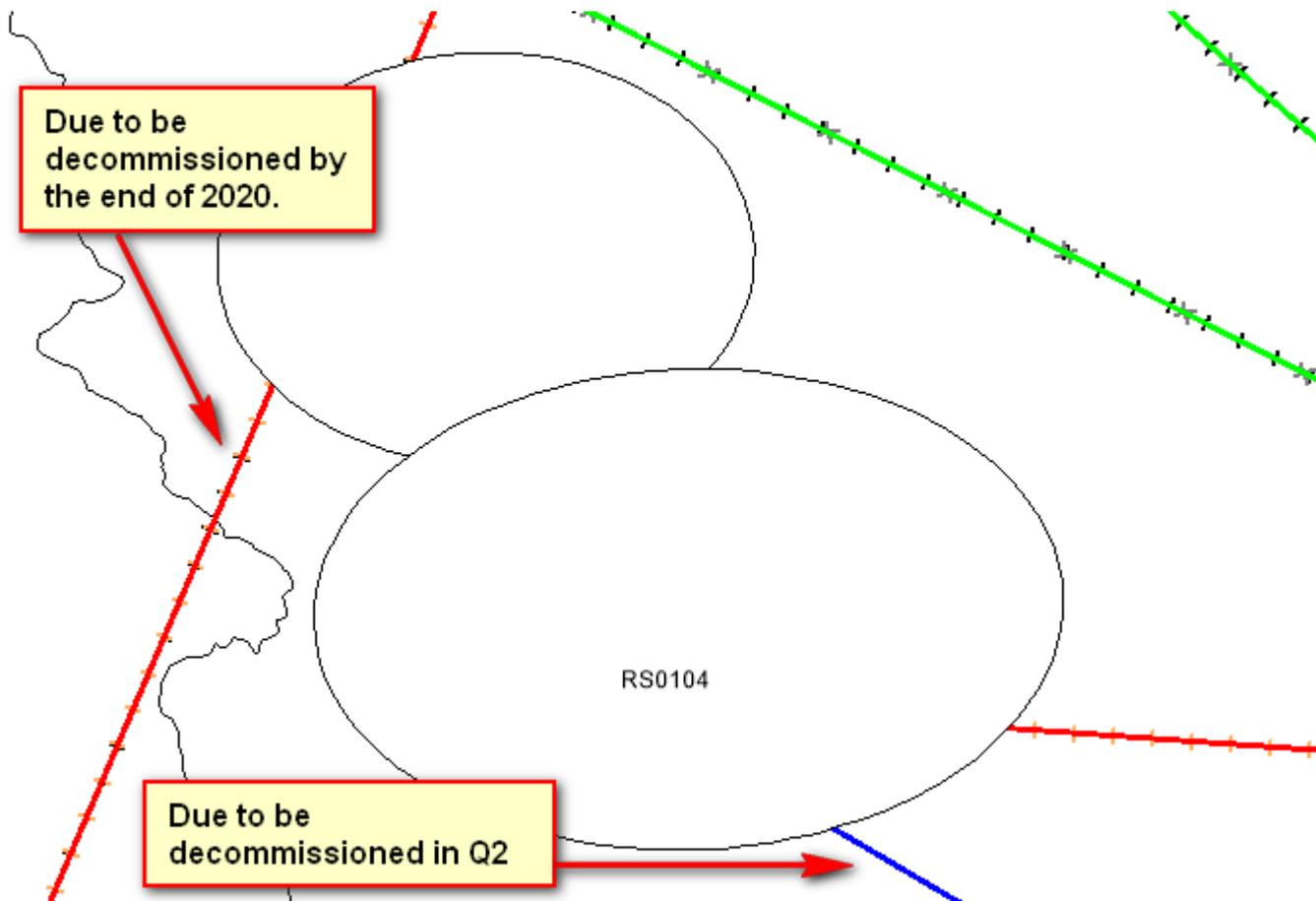
From: Gerry Callan <Gerry.Callan@three.ie>
Sent: Wednesday, February 12, 2020 1:12 PM
To: Órla Murphy <omurphy@mkoireland.ie>
Cc: Alan Hutchinson <alan.hutchinson@three.ie>; DL Estates ROI <Estates@three.ie>; David Montgomery <David.Montgomery@three.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

I've reviewed this proposed windfarm on behalf of the Three Transmission Network and can confirm that we have 3 links traversing the development area.

Site A	X	Y	Site B	X	Y	Band	Dish Height A	Dish Height B
Knockcroghery Cellcom	189113	258238	Castlegar	180912	239204	15	13.5	30
Athlone 110kv	201691	241381	Dysart Reservoir	188459	242323	18	30	30
Cornafulla	198841	236183	Dysart Reservoir	188459	242323	15	20	20

However, the first and third links above will be removed this year. The 2nd link will be remaining.



Please factor this into your constraints planning and when you have confirmed a finalised turbine layout, could you please let us have the coordinates (in Irish Grid format, preferably in an Excel file) and we'll import those to our planning tool and assess any potential impact.

Good luck with the development.

Best wishes,



Gerry Callan
Transmission Engineer

086 3884246
gerry.callan@three.ie



Make it count.

From: Orla Murphy <omurphy@mkoireland.ie>
Sent: 12 February 2020 10:33
To: Gerry Callan <Gerry.Callan@three.ie>
Cc: Alan Hutchinson <alan.hutchinson@three.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Gerry

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Three has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,



Órla Murphy B.Sc M.Sc
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Órla Murphy

From: Rachel Hennessy <RHennessy@towercom.ie>
Sent: Wednesday 11 March 2020 11:01
To: Órla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

From review of the proposed location of the wind farm detailed below, it would not appear have an impact on Towercom's sites.

However, in order to fully assess any impact it may have, we would require coordinates showing the proposed turbines locations.

Kind regards,
Rachel

Rachel Hennessy
Towercom
M: +353 (0)86 843 9587
E: rachel.hennessy@towercom.ie

From: Orla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 12 February 2020 10:34
To: Rachel Hennessy <RHennessy@towercom.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Rachel

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Towercom has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Orla Murphy

From: Liam Allister <Liam.Allister@virginmedia.ie>
Sent: Wednesday 12 February 2020 14:54
To: Orla Murphy; Cathal O'Donnell
Cc: Mark Nolan
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

Thanks for the notification. We do have Microwave links in the area but the nearest link path is over 8 Km from the site area as outlined on the map, so it would not be effected by the proposed development. Please inform Virgin Media if there is a change to the site area.

Regards,

Liam Allister | B2B Access Network Transmission Engineer,
Virgin Media | John F Connelly Road, Churchfield, Cork.
Liam.allister@virginmedia.ie

From: Orla Murphy [mailto:omurphy@mkoireland.ie]
Sent: 12 February 2020 10:35
To: Cathal O'Donnell <Cathal.ODonnell@virginmedia.ie>
Cc: Liam Allister <Liam.Allister@virginmedia.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Cathal

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Virgin Media has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Sent: Thursday 12 March 2020 10:58
To: Órla Murphy
Cc: Cassidy, Emma, Vodafone Ireland; Dennehy, Darragh, Vodafone Ireland; Murphy, Daragh, Vodafone Ireland
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Follow Up Flag: Follow up
Flag Status: Completed

Hi Orla,

Please use a buffer as follows:

Perpendicular distance of 1st Fresnel zone maximum radius +30m between Centre line of Fresnel zone and Rotor Edge

If you want us to assess the turbine locations, please feel free to send them to me.

Thanks

Gavin

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 4 March 2020 09:43
To: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Cc: Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; Dennehy, Darragh, Vodafone Ireland <darragh.dennehy@vodafone.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Gavin,

Can you let me know what buffer you would like us to apply for the below link that runs through the study area? I have noted the MPLS Trunk radio and we are avoiding that link entirely.

The Seven Hills Phase 2 project was never built so the developer is looking at the feasibility of the project again.

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Sent: Thursday, February 13, 2020 11:54 AM
To: Orla Murphy <omurphy@mkoireland.ie>
Cc: Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; Dennehy, Darragh, Vodafone Ireland <darragh.dennehy@vodafone.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Orla,

Please find attached Vodafone microwave links in this area. Note there is an MPLS trunk radio, between Roslevin and Slievemurry in this area, that should be avoided above all else. I have also noted there was an assessment completed in 2011 for Seven Hills Phase 2 development. Is this 2011 proposal for 19 turbines already built or is it now superseded by this new proposal?



Gavin Byrne

TX Planning & Design Engineer
TEC-Networks Converged Transmission
+353 87 6448159
gavin.byrne@vodafone.com

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From: Orla Murphy <omurphy@mkoireland.ie>

Sent: Wednesday 12 February 2020 10:36

To: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>

Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Gavin

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Vodafone has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc

Environmental Scientist

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Órla Murphy

From: Martin O Donoghue <Martin.ODonoghue@comreg.ie>
Sent: Wednesday 12 February 2020 15:29
To: Orla Murphy
Cc: Sinead French; Licensing
Subject: RE: [Confidential] 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site
Attachments: List Of Operators.xlsx

Hi Orla,

Please find attached the list of operators within 20km.

Kind Regards,

Martin O'Donoghue

Innealtóir Speictrim Raidió

Radio Spectrum Engineer

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

1 Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0.

One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0.

Teil | Tel +353 1 8049670

Rphost | Email martin.odonoghue@comreg.ie

Suíomh | Website www.comreg.ie

From: Orla Murphy [mailto:omurphy@mkoireland.ie]
Sent: 12 February 2020 10:39
To: Martin O Donoghue <Martin.ODonoghue@comreg.ie>
Cc: Sinead French <sinead.french@comreg.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Martin

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

We are consulting with all of the main telecoms operators, but would like to check if there are any other operators in these two areas – would it be possible to send this information on to me please?

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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GDPR information: we have updated our Privacy Notice, which explains what personal information we collect and use about individuals, what we do with it and why. Here is a link to our updated Privacy Notice:
<https://www.comreg.ie/privacy/>

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Faisnéis GDPR: tá nuashonrú déanta againn ar ár bhFógra Príobháideachta, a mhíníonn an fhaisnéis phearsanta a bhailímid agus a úsáideannimid faoi dhaoine aonair, an méid a dhéanaimid leis agus cén fáth. Seo nasc chuig ár bhFógra Príobháideachta nuashonraithe: <https://www.comreg.ie/privacy/>

Tá an ríomhphost seo, chomh maith le haon iatáin a bhaineann leis faoi rún agus d'fhéadfadh leis a bheith faoi phribhléid nó cosanta ó aon nochtadh. Is don seolaí(aithe) ainmnithe thuas amháin é. Níl sé ceadaithe go mbeidh rochtain ag éinne eile ar an ríomhphost seo. Más rud é nach tusa an faighteoir ainmnithe, ná cló amach, léigh, cóipeáil, nocht d'éinne nó bain úsáid as an eolas sa ríomhphost seo in aon tslí eile, le do thoil. Más rud é go bhfuair tú an ríomhphost seo trí earráid, dean teagmháil leis an seoltóir láithreach agus scríos an t-ábhar ina iomlán, bíodh sé i gcóip leictreonach nó chrua.

<u>User</u>	<u>Contact</u>	<u>Email</u>
Ajisko Ltd	Denis	denis.ahern@imedia.ie
Arden Broadband Limited	Barry	accounts@eurona.ie
Eircom Ltd	Seamus	seamus.okeeffe@openeir.ie
Electricity Supply Board	Dermot	dermot.hopkins@esbtelecoms.ie
Enet Telecommunications Netwo	Peter	peter.obrien@enet.ie
Imagine Networks Services	Ronnie	ronnie.oneill@imginegroup.ie
Lighthouse Networks Limited	Enda	enda.broderick@lightnet.ie
Meteor Mobile Communicati	Paul	Paul.Marron@eir.ie
Ripple Communications Ltd	Denis	denis.herlihy@ripplecom.net
RTE	Tracey	tracey.mahon@2rn.ie
Three Ireland (Hutchison)	Gerry	Gerry.Callan@three.ie
Viatel Ireland Ltd	Donna	Donna.Fairbrother@viatel.com
Virgin Media Ireland Ltd	Mark	Mark.Nolan@virginmedia.ie
Vodafone Ireland Ltd	Gavin	gavin.byrne@vodafone.com
Westmeath County Council		Secretar@westmeathcoco.ie

Órla Murphy

From: Dominic Crudden <dominic.crudden@emrsolutions.ie>
Sent: Wednesday 12 February 2020 15:49
To: Orla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Follow Up Flag: Follow up
Flag Status: Completed

Hi Orla,

We do not currently have any links in that area.

Regards,

Dominic Crudden
Business Development



Mobile: +353 (86) 7712819
DDI: +353 (1) 2552056
Office: +353 (1) 8013131
Fax: +353 (1) 8013166
Email: dominic.crudden@emrsolutions.ie
Website: <https://emr.ie/>



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From: Orla Murphy [mailto:omurphy@mkoireland.ie]
Sent: Wednesday 12 February 2020 10:42
To: Dominic Crudden <dominic.crudden@emrsolutions.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Dominic

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, in Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745,857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if EMR has any links in this area, and we will incorporate these into our constraints map?
We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Denis Ahern <denis.ahern@imedia.ie>
Sent: Thursday 13 February 2020 09:34
To: Orla Murphy
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Follow Up Flag: Follow up
Flag Status: Completed

Hi Orla,

Thank you for your email.

I can confirm that Ajisko do not have any links in this area.

Denis Ahern

COO
IMS

1st Floor Ashbourne Hall, Ashbourne Business Park,
Dock Road, Limerick, V94 NPE0, Ireland
www.imedia.ie

m: +353 87 8122298
t: +353 61 310752
e: denis.ahern@imedia.ie



From: Orla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 12 February 2020 18:27
To: Denis Ahern <denis.ahern@imedia.ie>
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Denis

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, in Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Ajisko has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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Órla Murphy

From: Órla Murphy <omurphy@mkoireland.ie>
Sent: Wednesday 29 July 2020 14:55
To: Enda Broderick
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

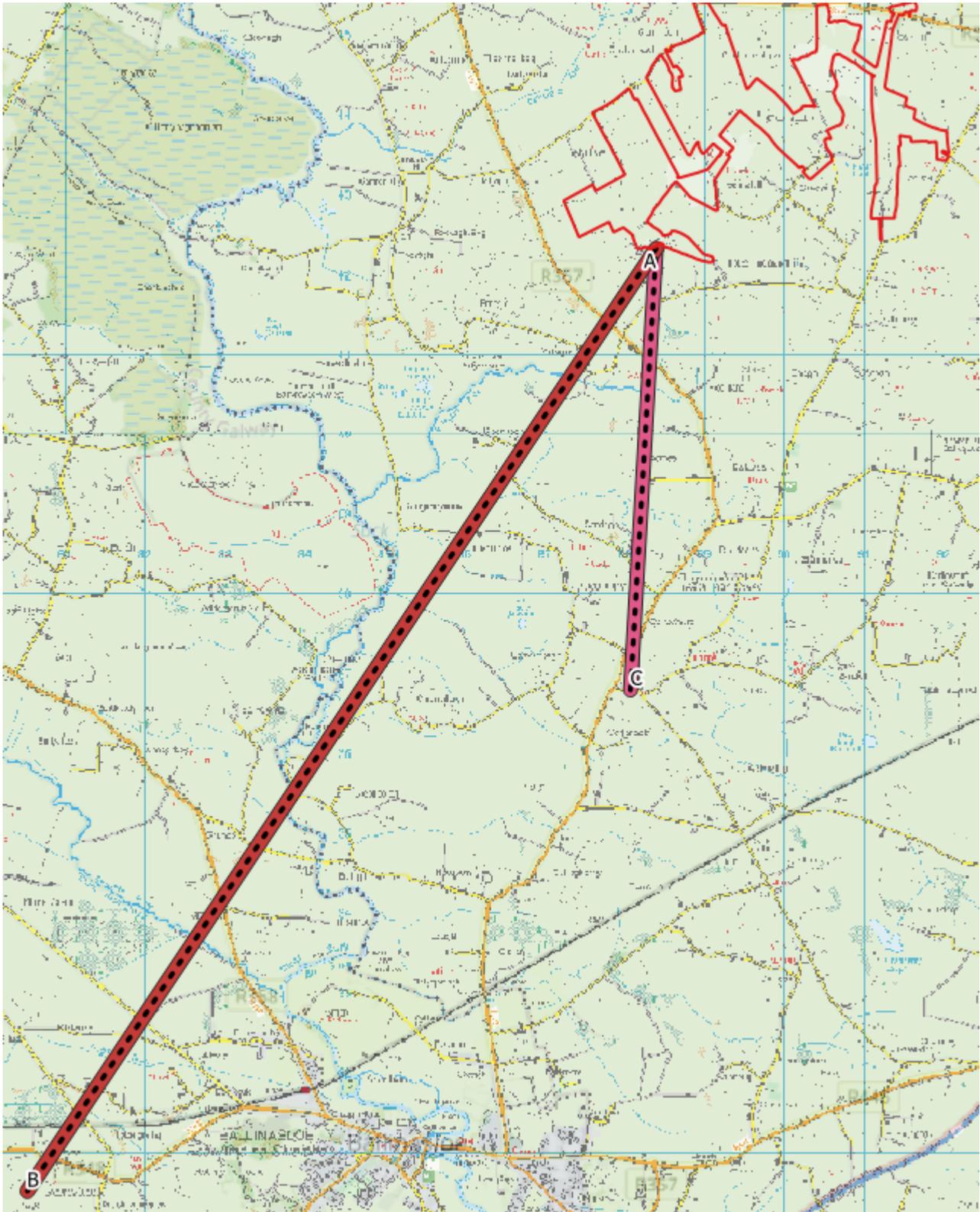
Hi Enda,

Thanks for this, see below map, does this seem correct on your end? The point you send me is slightly off the watertower which I assume is where the link begins? I have applied the fresnal zone buffer also (+ blade length). Because both links are travelling south, we will be able to avoid.

Generally, we receive links and appropriate buffers from yourselves which should allow for no interference to the network and therefore no impact on individual households. If, when the wind farm is operational, any issues arise, the developer will be required to find a solution for any individual.

Many thanks and any queries give me a call

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Enda Broderick <enda@lightnet.ie>
Sent: Monday 27 July 2020 17:43
To: Órla Murphy <omurphy@mkoireland.ie>
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla
The B ends for the two links are
53.32452, -8.292887 Fresnel Zone Radius (r) 30ft

53.38128, -8.179636 Fresnel Zone Radius (r) 16ft

Other than the two links are you mapping data for subscriber's in the area who are receiving a point to multipoint signal from this site and surrounding sites?

Regards
Enda

From: Enda Broderick <enda@lightnet.ie>
Date: Friday 24 July 2020 at 17:58
To: Órla Murphy <omurphy@mkoireland.ie>
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla
Sorry been busy trying to close off some projects all week before we break for the week.
I will try and respond later tonight.
Enda

From: Órla Murphy <omurphy@mkoireland.ie>
Date: Friday 24 July 2020 at 17:01
To: Enda Broderick <enda@lightnet.ie>
Subject: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Enda,

Are you able to come back to me on the below please? Just want to update the constraints map so any potential areas are avoided

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Órla Murphy
Sent: Monday 20 July 2020 16:12
To: Enda Broderick <enda@lightnet.ie>
Cc: Barry O'Donovan <barry@lightnet.ie>
Subject: RE: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Enda,

Thanks for coming back to me – I am back in the office but was away from the desk Wednesday afternoon, so you just missed me.

Are you able to send me the two end point coordinates for both links coming from the below transmitter site?

Could you also send me through an associated buffer for these?

Thanks

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Enda Broderick <enda@lightnet.ie>
Sent: Wednesday 15 July 2020 15:20
To: Órla Murphy <omurphy@mkoireland.ie>
Cc: Barry O'Donovan <barry@lightnet.ie>
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla
A correction our 1st bearing below should have been 183.18deg not 118.18.
Regards
Enda

From: Enda Broderick <enda@lightnet.ie>
Date: Wednesday 15 July 2020 at 14:42
To: Órla Murphy <omurphy@mkoireland.ie>
Cc: Barry O'Donovan <barry@lightnet.ie>
Subject: Re: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Órla
Sorry your 1st email had slipped though the mayhem at the time. I tried calling your office, but I suspect like many others your working from home.

We have a transmitter site serving the area at the following GPS location 53.43103, -8.175.
From there, we have two point to point links feeding the site on the following bearings
118.18deg
213.48deg

We would have quite a number of customers following the R357 from Taughmaconnell (Ballinasloe) to Dysart
And along the Taughmaconnell to Brideswell road (cant find a road number)

Kind regards,
Enda Broderick
Managing Director
Lighthouse Networks Ltd.



East Point Business Park
Loughrea - Co. Galway

Tel +353 (0) 91-395804
Mob +353 (0) 86-8676410
Web www.lightnet.ie

From: Órla Murphy <omurphy@mkoireland.ie>
Date: Wednesday 15 July 2020 at 12:24
To: Enda Broderick <enda@lightnet.ie>
Subject: FW: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Enda,

I am chasing up a few telecoms operators I haven't heard back from in regard to the proposed Seven Hills Wind Farm, Co. Roscommon. See below.

Would you be able to give me some feedback on whether Lighthouse Networks have any links in this area?

Regards

Órla



Órla Murphy B.Sc M.Sc
Project Environmental Scientist

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From: Orla Murphy
Sent: Wednesday 12 February 2020 18:33
To: enda.broderick@lightnet.ie
Subject: 190907 - Seven Hills, Co. Roscommon - Proposed Wind Farm Site

Hi Enda

We are working on a constraints study for a proposed wind farm site near Dysart, located approximately 14km northwest of Athlone, in Co. Roscommon. The Grid Ref coordinates for the site centre are ITM E588,097 N745857. A site location map and associated shapefile are attached showing the area of search.

Could you let me know please if Lighthouse Networks has any links in this area, and we will incorporate these into our constraints map? We don't have a turbine layout yet; this will be informed by the constraints study.

If you have any queries, please do not hesitate to contact me.

Regards,

Órla



Órla Murphy B.Sc M.Sc
Environmental Scientist

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