The Geological Heritage of County Longford

An audit of County Geological Sites in County Longford

by Ronan Hennessy, Robert Meehan, Matthew Parkes and Sarah Gatley

2015

An Chomhairle Oidhreachta
The Heritage Council

Longphort Uí Fhiaich
Dúnsean agus Dílis

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Suirbhéireacht Gheolaíochta Éireann
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Daingean agus Dílis

This report is a contribution to the programme of work in the County Longford Heritage Plan 2004 – 2009

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Report Summary

Since it is one of the smallest of Irish counties, and because bedrock is generally not well exposed, County Longford is not widely known for its geological heritage. However, it has some fine but underappreciated geological sites. The County Council's support for this audit is critical in raising the profile of geological heritage in County Longford and for maximising its potential, since some of the sites may be otherwise overlooked.

This report documents what are currently understood by the Irish Geological Heritage Programme (IGH) of the Geological Survey of Ireland (GSI) to be the most important geological sites within County Longford. It proposes them as County Geological Sites (CGS), for inclusion within the 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 the current 2015-2021 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. One of the sites described in this report (Glen Lodge Stream) is considered to be of national importance as a best representative example of a particular geological formation or feature. It has been provisionally notified to the National Parks and Wildlife Service (NPWS) by the GSI for designation as a Natural Heritage Area (NHA) once due survey and consultation with landowners is complete. In other counties, many of the sites fall within existing pNHAs and SACs where the ecological interest is actually founded upon the underlying geodiversity. In Longford, one CGS lies within a SAC/pNHA: Lough Kinale whilst Mullawornia CGS is situated beside the Royal Canal pNHA (002103).

The commission of this audit and adoption of the sites within the CDP ensure that County Longford 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 includes County Longford 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 County Longford Council. It should also be made available via the Council website for the people of County Longford. A chapter of the report includes recommendations on how to best present and promote the geological heritage of County Longford 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 book or other publications on the geological heritage of County Longford, if the funding can be found to produce them.

County Longford in the context of Irish Geological Heritage

This report ensures County Longford remains active at the forefront of geological heritage within Ireland, as more than half of the counties have now commissioned such an audit within the scope of the county-based Heritage Plan. By providing reliable data in a very cost-effective manner, it will hopefully encourage the remaining local authorities to follow what is now a tried and trusted methodology. In the absence of significant political and economic resources available at a national level to the relevant bodies for conservation of geological heritage as Natural Heritage Areas (NHA), it represents a significant level of progress in defining and safeguarding Ireland's geological heritage. In essence, County Geological Site audits are the only effective geological conservation at present, but only with advisory capacity (within the context of County Development Plans) and no real statutory protection where it is required.

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). 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 GSI complements other nature conservation efforts of the last decade, by assessing Ireland's geodiversity. Geodiversity 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 the IGH Programme fills a void which has existed 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 the first criterion is to identify the best national representative example of each feature or major sequence, and the second is to identify any unique or exceptional sites. The third criterion, identifying any sites of International importance, is nearly always covered by the other two.

Designation of geological NHAs will be by the GSI's partners in the Programme, the National Parks and Wildlife Service (NPWS). Once designated, any geological NHAs will be subject to normal statutory process within the County Longford Planning Department and other relevant divisions. **However, compared to many ecological sites, management issues for geological sites are generally fewer and somewhat different in nature. The subsequent section considers these issues**.

From a national perspective, as a result of extensive comparison of similar sites to establish the best among them, there is now a good knowledge of many other sites, which are not the chosen best example, but which 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. All these various important sites are proposed for County Geological Site (CGS) listing in the County Development Plan.

Currently, in 2015, a Master List of candidate CGS and NHA sites is being used in GSI, originally compiled 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, none have yet been formally designated. In County Longford, only Glen Lodge Stream was so far considered to be of national importance and has been put forward as a Natural Heritage Area (NHA) for the IGH2 Precambrian to Devonian Palaeontology Theme. Therefore, inclusion of all sites as County Geological Sites (CGS) in County Longford'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, 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 CGS listing here is not a statutory designation, and carries no specific implications or responsibilities for landowners. It is 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 often 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 as SAC and NHA sites. In these areas, the geological heritage enhances and cements the value of these sites for nature conservation, and requires no additional designation of actual land areas, other than citation of the geological interest.

Broadly speaking, there are two types of site identified by the IGH Programme. The first, and most common, includes small and discrete sites. These may be old quarries, natural exposures on hilly ground, coastal cliff sections, or other natural cuttings into the subsurface, such as stream sections. They typically have a feature or features of specific interest such as fossils or minerals or they are a representative section of a particular stratigraphical sequence of rocks. **The second type of site is a larger area of geomorphological interest, i.e. a landscape that incorporates features that illustrates the processes that formed it**. The Quaternary theme and the Karst theme often include such sites. In County Longford, with a high proportion of land area under grassland, the only such site is the Cloghchurnel Esker and Fan.

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 County Longford. A lack of awareness in the past, has led to the loss of important geological sites and local character throughout the country. In County Longford a Landscape Characterisation Assessment was completed and incorporated into the County Development Plan 2009-2015. This provides a tool for planners to help maintain the character of the County. An action in the Heritage Plan is to expand on the Assessment. The Strategic Environmental Assessment within the County Development Plan also provides tools. In addition, the now routine pattern of consultations with GSI, either by the planning department or by consultants carrying out Environmental Impact Assessment, plus strategic environmental assessment (SEA), has greatly improved the situation.

There are large differences in the management requirements for geological sites in comparison to biological sites. Geological features are typically 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 that the relevant planning department is 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 to influence the design so that access to exposures of rock is maintained for the future, or occasionally to prevent a completely inappropriate development through presentation of a strong scientific case.

In many counties, working quarries may have been listed because they are the best representative sections available of specific rock sequences, in areas where exposure is otherwise poor. No restriction is sought on the legitimate operation of these quarries. However, maintenance of exposure after quarry closure is generally sought in agreement

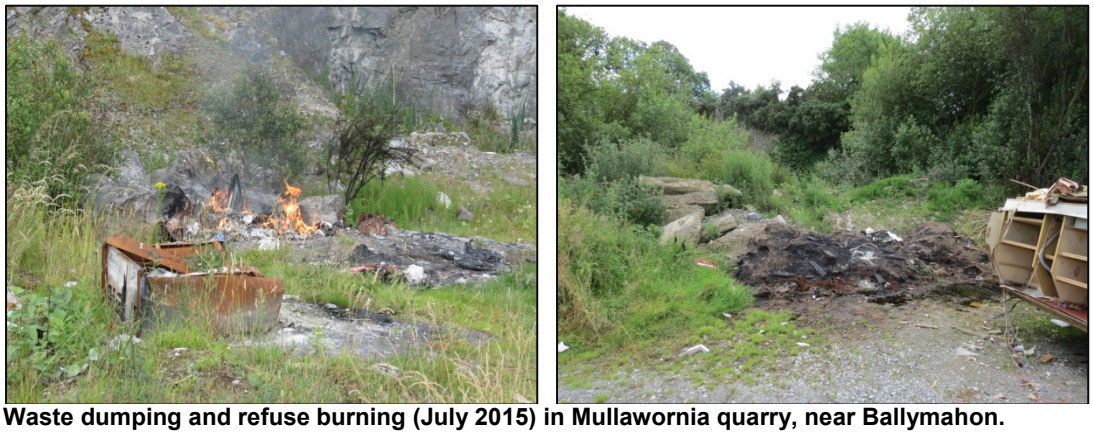
with the operator and planning authority in such a case. At present, working quarries like Killoe Quarry and Drumlish Quarry are now included as County Geological Sites in County Longford. These issues are briefly explored in a set of Geological Heritage Guidelines for the Extractive Industry, published jointly by the GSI and the Irish Concrete Federation in 2008.

A new quarry may open up a 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 may need occasional maintenance to prevent overgrowth of vegetation obscuring the scientific interest, or may be promoted to the public by means of a viewing platform and information panel.

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 opportunity for general collecting may need to be controlled. However, County Longford's sites are not likely to require such an approach.

Waste dumping

An occasional problem throughout the country, including in County Longford, 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 areas where rock is exposed, such as in quarries or disused gravel pits, 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. County Longford was included in a national scheme for Groundwater Protection in 2012, thus ranking the county land surface into vulnerability categories of 'Extreme', 'High', 'Moderate' and 'Low', and helping planners to assess which developments are suitable or not in some areas of County Longford.



Waste dumping and refuse burning (July 2015) in Mullawornia quarry, near Ballymahon.

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 to be built,** or in other major infrastructural work, it should be a policy within the Planning Department, that **where new rock exposures are created, they be left open and exposed** unless geotechnical safety issues arise (such as where bedding dips are 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 that look the same throughout the country. Leaving rock outcrops exposed where they are intersected along the road, improves the character and interest of the route, by 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 costs. It may also contribute to road safety by providing diversity of surroundings to maintain drivers' attention.

In Longford, because of the relatively subdued terrain, the opportunity for such rock road cuttings has been limited. The improvements on the N4 and around Longford Town itself, over recent years, have not really been deep enough to require cuttings. Other roads in the county are less likely to be significantly upgraded but the option should be borne in mind for all future road improvements.

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 of outstanding significance and is used to develop sustainable tourism opportunities**. Initially it was largely a European Geoparks Network (EGN) but since 2004 has expanded worldwide as the Global Geoparks Network (GGN) 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. The Geopark branding therefore helps promote the geological heritage resource so that the community can benefit from it.

In Ireland there are three members of the Geoparks Network. One is the cross-border Marble Arch Caves Global Geopark in Fermanagh and Cavan [see www.marblearchcaves.net and www.cavancoco.ie/marble-arch-caves-global-geopark]. The Copper Coast Geopark in Waterford also joined the Network in 2001 [see www.coppercoastgeopark.com]. A now well established addition has been the Burren and Cliffs of Moher in County Clare [see www.burrengeopark.ie]. In addition there are aspirant groups exploring the work and infrastructure required for applications in other areas such as Joyce Country in Mayo and Galway, and the cross-border Mourne-Cooley-Gullion area. At present, we do not consider the geodiversity in the county as likely to meet the criteria for a Geopark application.

Proposals and ideas for promotion of geological heritage in County Longford

The County Longford Heritage Plan 2004-2009 did not include specific reference to geological heritage but the decision by the Heritage Officer to commission an audit of geological heritage sites in the county, in conjunction with the Geological Survey of Ireland in 2015, 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 objectives in the draft County Longford Heritage Plan (of June 2015) relating to geological heritage and provides specific suggestions as to how these may be implemented, supported or enhanced by the audit of geological heritage sites in the county.

OBJECTIVES OF THE COUNTY LONGFORD HERITAGE PLAN

Objective 1: Implement key Strategic Actions over the lifetime of the Heritage Plan to achieve greater awareness and protection of all aspects of the heritage of County Longford

1.1 Develop and implement the Heritage-related policies within current and future County Longford Development Plans and Local Area Plans.

Audit Action: The audit will contribute a well-researched and reliable dataset on geological heritage to the County Development Plan, thus ensuring that geological heritage is not overlooked or ignored in Longford.

1.3 Produce paper- and web-based publications on Longford's key heritage sites and features, and foster proposals for appropriate access to same.

Audit Action: The audit will provide the base information to support this action for geological heritage, including content for a bespoke small exhibition, and the option of a county based geological heritage book.

1.4 Improve accessibility to heritage information through the Heritage Office website and emerging technologies, including the *Explore Longford* app.

Audit Action: The audit data may be used in website or app presentations of Longford's heritage, integrated with other information.

1.5 Coordinate and develop Heritage Week events in partnership with heritage organisations and community groups.

Audit Action: The audit may provide stimulus for groups like the Mining Heritage Trust of Ireland or the Irish Geological Association to develop events in Longford.

1.7 Support and assist innovations driving research and awareness of our cultural and natural heritage.

Audit Action: The audit may contribute to this objective by bringing Longford into the company of other counties who have already completed a county audit of geological heritage sites. The actual implementation of it within the CDP and day-to-day planning will raise geological heritage awareness in Longford, but also contribute to improvement of the national standard.

1.9 Seek to provide appropriate access to key heritage sites within County Longford, in partnership with stakeholders and landowners.

Audit Action: The audit may provide base information on landowners and stakeholders in the County

Geological Sites of Longford, where this information can reasonably be obtained in the course of the audit

1.10 Cultivate and promote education of best practice models in heritage protection and heritage management.

Audit Action: This audit report outlines some ideas for promotion of the geological heritage of Longford, based on best practice in Ireland, and informed by our collective knowledge of best practice across the international arena of geoconservation, Earth Science education and geosite management. The individual site reports specify management issues and potential tools and solutions for the site.

Objective 2: To develop knowledge, appreciation and access to Longford's heritage through research and innovation.

2.2 Support the County Library & Archives Service and collections.

Audit Action: The bibliography contained in this report will provide a simple access point to a fairly arcane and sparse geological literature relating to Longford. Some key references will be provided as pdfs or in hard copy to the Heritage Officer.

2.3 Develop exhibitions on aspects of Longford's heritage.

Audit Action: As a supplementary bonus to the actual audit the authors will provide a panel based exhibition which could be displayed in the County Library, or other venue, or presented on the Longford library heritage web pages.

2.6 Contribute heritage information to the creation and promotion of tourism and amenity trails within the region.

Audit Action: Distilled geological heritage information from the audit report, such as the geological history of the county, could be presented on the Longford tourism web pages.

2.11 Develop information and directional signage for publicly-accessible heritage sites, in partnership with key stakeholders.

Audit Action: Signage could be included detailing the nearby Cleenrah Mine Site, in Aghnacliff Heritage Park, as well as relating to the hydrogeological aspects of peat formation at the Corlea trackway.

2.12 Identify knowledge gaps in relation to Longford's heritage and undertake projects to bridge those gaps.

Audit Action: The audit perfectly fulfils this objective in bridging the gap for a very poorly known aspect of heritage.

2.14 Undertake surveys of Longford's built and industrial heritage.

Audit Action: A limited element of Longford's mining heritage is illuminated by the audit of Keel and Garrycam mine sites.

2.15 Research and promote Longford's ecclesiastical heritage.

Audit Action: A limited but highly important element of Longford's ecclesiastical heritage is illuminated by the audit of St. Mel's Cathedral.

Objective 3 - Promote the protection and best practice in heritage management within the county

3.1 Promote the implementation of heritage policy for Longford County Council through their statutory documents, including Local Area Plans and corporate plans.

Audit Action: The audit will contribute a well-researched and reliable dataset on geological heritage to the County Development Plan, thus ensuring that geological heritage is not overlooked or ignored in Longford.

3.2 Engage with sections throughout Longford County Council to achieve joint aims and objects with regard to cultural, built and natural heritage awareness and protection.

Audit Action: The audit will contribute a well-researched and reliable dataset on geological heritage to the County Development Plan, thus ensuring that geological heritage is not overlooked or ignored in Longford.

Objective 4 - Promote heritage education and awareness

4.1 Support and promote the educational work undertaken by officers of Longford County Council and Heritage Forum partners.

Audit Action: The audit will contribute information on geological heritage to the Heritage Officer.

4.2 Promote the use of heritage resources in education, in particular the *Heritage in Schools Scheme*, the National Monuments Services archaeological education packs, and local heritage-education packs.

Audit Action: The audit will contribute information on geological heritage to the Heritage Officer for use in educational packs. It can be made widely available to be used in many ways. The Geoschol website material on Longford can be promoted more effectively.

4.3 Continue to develop schools education packs on aspects of Longford's history, cultural heritage, and architectural heritage.

Audit Action: The audit will contribute information on geological heritage to the Heritage Officer which can provide foundation information for other aspects of heritage in the county.

4.8 Support education programmes for farmers and landowners on best practice heritage maintenance, including national monuments, hedge laying and conserving traditional farm buildings.

Audit Action: The audit will contribute information on geological heritage which can used by the Heritage Officer as a component of an integrated natural and cultural heritage perspective in many programmes. The GSI/ICF Guidelines on geological heritage for the quarrying industry can also be promoted in this style.

Objective 5 - Support the sustainable enjoyment of Longford's countryside, waterways and heritage

5.2 Engage in projects to foster awareness, appreciation and protection of Longford's heritage including: cultural and literary heritage; industrial & transport heritage; history, oral history, folklore, archaeological and built heritage.

Audit Action: As a supplementary bonus to the actual audit the authors will provide a panel based exhibition which could be displayed in the County Library, or other venue, and which would allow geology not to be overlooked amongst better known aspects of our heritage.

5.3 Host seminars and talks on aspects of heritage for community and local heritage groups.

Audit Action: The audit report authors are willing to provide a seminar or a talk or guided walk relating to the audit or the geological heritage of Longford.

5.4 Provide guidance and support to community and local heritage organisations on heritage projects.

Audit Action: The authors are willing to do this if there is a strong geological component, or to support the GSI in such provision.

5.6 Engage with neighbouring Heritage Offices, Local Authorities, Regional Assembly and national agencies in projects to foster awareness and/or protection of the heritage of the Irish Midlands.

Audit Action: Since geological features and bedrock know no human boundaries, potential co-operation with adjoining counties offers many benefits for geological heritage promotion and protection. Eskers, for example, can cross several counties in one original integrated sub-glacial drainage system.

6.0 Objective 6 - Implementation of the County Longford Biodiversity Action Plan.

See County Longford Biodiversity Action Plan.

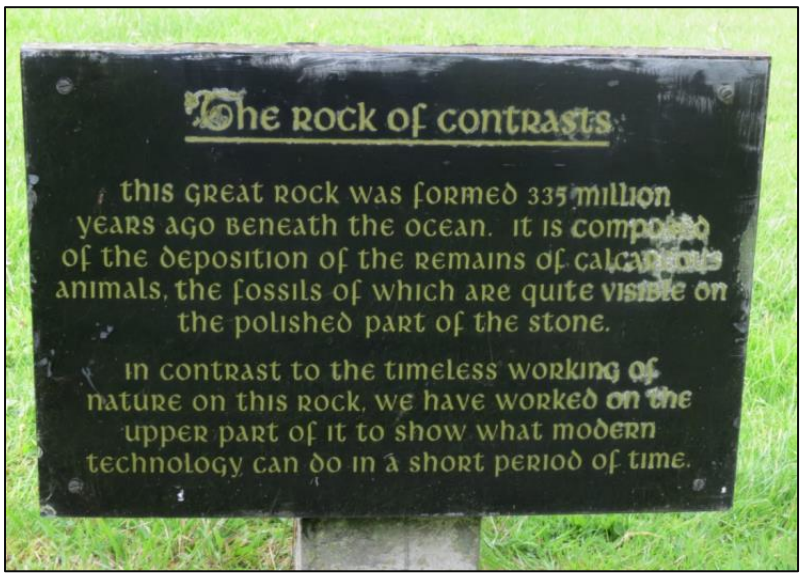
Audit Action: The proponents of Biodiversity measures often forget that geodiversity is often the foundation upon which biodiversity is made. It is crucial not to forget this fact, and the audit may help in providing base information and a reminder that geodiversity is a very important element of our entire natural heritage.

It is apparent from reading the draft Heritage Plan, that in response to times of austerity in recent years, much of the plan comprises aspirational objectives, rather than concrete actions, and is designed to allow a nimble and opportunistic responsive approach as and when funding to deliver specific projects becomes available. The audit project itself is symptomatic of this reality, as it did not appear in the previous plan as an action, nor is it specifically mentioned in this draft plan, but in partnership with the Geological Survey of Ireland, it became a reality. The fulfilment of the audit will contribute to the success of the new Heritage Plan, in ways suggested above, and possibly in many other unforeseen ways.

Specific ideas for projects

Quarry Park, Newtowncashel
The development of the old limestone quarry at Newtowncashel is a wonderful example of how a disused quarry site in a village setting can be reclaimed for community use as both an educational and amenity space and a location to celebrate the industrial and quarrying heritage of the village of Newtowncashel. Quarry Park is owned by a local family in Newtowncashel, and Newtowncashel Tidy Towns. The park makes good use of natural rock formations (natural quarry faces, water moulded karst boulders) and rock sculptures and rock carvings to exhibit aspects of cultural and industrial heritage, as well as folklore and literature.

The plaque accompanying the “Rock of Contrasts” describes the age of the limestone and the origin. Some further information on the origin and geological history of the region would be well situated on a notice board at the park (car parking area, or in the park).



Leaflets
No existing leaflets on the geological heritage of County Longford are known, other than the Geoschol one included as an appendix here. There is some scope for other and different leaflets. Any leaflets produced could simply be made available as pdf downloads on the Council's website to avoid large costs of printing.

Guides
There are no known guides to the geology of County Longford, apart from some mentions in geological and mineral exploration literature. The 1:100,000 GSI map report for Sheet 12 covers County Longford and is an essential resource.

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 main content of this report would distil into a good general short guide to the geological heritage of County Longford**, in a broadly similar style to those books produced for Sligo, Meath, Fingal, Waterford, Roscommon and Clare following audits in those counties.

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 successful integration of text and graphics on information panels is a fine art, 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.

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 Longford Council Offices, County Library branches or other venues. The model followed was that used for Carlow, Dun Laoghaire-Rathdown and Waterford. Images of those and other similar ones can be seen on the Geological Heritage/Exhibitions 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 the app for tourists in the Burren and Cliffs of Moher Geopark. Plans for such products would require some considerable effort to produce and imaginative effort, to link sites in any coherent ways, other than by their county.

Information on the heritage sites of County Longford can already be found on the 'Explore Longford' App available to download for both Android and Apple Devices: Android Store: http://bit.ly/1gMKZYY Apple Store: http://bit.ly/1n104Kk. It is to be hoped that in due course these apps can be updated to include suitable geological heritage information arising from the audit.

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 County Longford's geological heritage. It is anticipated by the authors of this report that they will soon contribute a summary article distilled from the audit report, but probably involving several counties, rather than Longford-specific.

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 County Longford is already part of the available material (see Appendix 6). Working links to the Heritage section of County Longford Council's website, as well as to other heritage websites, should be established.

Geological Heritage Research Archive
If the Heritage Officer wanted to do something similar to that produced in the Burren and Cliffs of Moher Geopark, with downloadable (or links to) free access papers, then a lot of groundwork is already provided by the reference lists in this audit. Making available technical references of direct relevance to County Longford geology and geomorphology will assist many users and researchers into the future. However, the relatively sparse literature is such that a geological heritage section with a bibliography pdf on the Heritage web pages for Longford would suffice for most users.

Maps
It is hoped that geological heritage sites as a data layer might be adopted by the Ordnance Survey of Ireland in their future map editions of the 1:50,000 Discovery Series, for all counties where an audit has been completed (similar to the East West maps of Wicklow which include such data from GSI).

A summary of the Geology of County Longford

1) Paragraph summary

The geology of much of the southern portion of County Longford is dominated by 330 million years old limestones from the Carboniferous Period. In the northern third of the county there are much older, partly volcanic, rocks exposed, from the Silurian and Ordovician Periods. 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. 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. In the last 10,000 years, the growth of peat has been important across the lower ground of the county. Geological processes continue to modify the landscape such as with seasonal flooding of the Shannon.

AGE (Million Years Ago)	ERA	PERIOD	EVENTS IN LONGFORD	IF THIS TIMESCALE WAS A DAY LONG ...
2.58	Cenozoic	Quaternary	Several ice ages smothering Longford, followed in the last 10,000 years by the spread of vegetation, growth of bogs and arrival of humans. Deposition of crag-and-tails, drumlins and eskers. Dissolution of limestone beneath Quaternary sediments.	The ice ages would begin 38 seconds before midnight
66		Tertiary	Erosion, especially of limestone. Caves, cavities and underground streams developing in south Longford.	The Tertiary period begins at 11.40 pm
145	Mezozoic	*Cretaceous*	*Erosion.* *No record of rocks of this age in Longford.*	11.15 pm
201		*Jurassic*	*Uplift and erosion.* *No record of rocks of this age in Longford.*	The age of the dinosaurs, starting at 10.55 pm
252		*Triassic*	*Desert conditions on land.* *No record of rocks of this age in Longford.*	10.42 pm
299	Palaeozoic	*Permian*		10.30 pm
359		Carboniferous	Land became submerged, limestones with some shales and sandstones deposited in tropical seas across the southern two-thirds of Longford. Limestones remaining today are pure and unbedded in the west of the county, with areas of muddier limestones in the east.	Much of Longford's current rocks (limestone, sandstone and shale) deposited around 10.10 pm
419		*Devonian*	*Caledonian mountain building.* *No record of rocks of this age in Longford.*	'Old Red' Sandstone deposited at 9.52 pm
443		Silurian	Shallow seas, following closure of the Iapetus Ocean. Greywackes, sandstones and shales deposited at in the northeast of the county, north of Granard.	Starts at 9.42 pm
485		Ordovician	Shales, slates, siltstones and volcanic rocks form across the higher, northern portion of the county, north of Newtownforbes.	Begins at 9.28 pm
541		*Cambrian*	Opening of the Iapetus Ocean. *No record of rocks of this age in Longford.*	Starts at 9.11 pm
2500	Proterozoic	*Precambrian*	*Some of Irelands oldest rocks deposited in Mayo and Sligo.*	Beginning 11.00 am
4000	Archaean		*Oldest known rocks on Earth.*	Beginning 3.00 am
4600			*Age of the Earth.*	Beginning 1 second after midnight

The Geological Timescale and County Longford

2) Simple summary

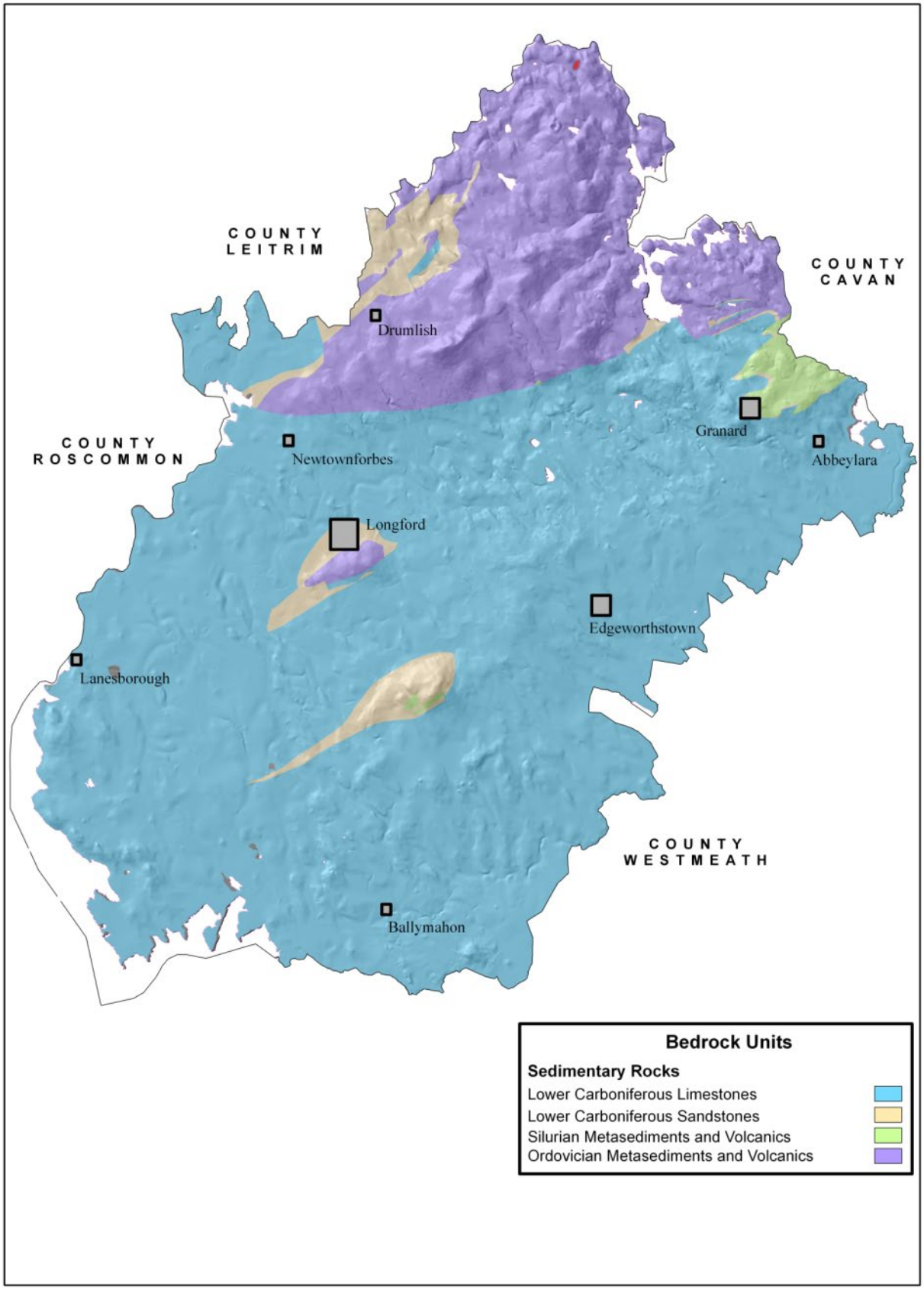
The geology of the southern two-thirds of Longford is dominated by 330 million years old limestones from the Carboniferous Period. On the higher ground north of Longford Town there are much older rocks exposed at the surface. These include the southwestern portion of the Longford-Down Massif, an area surrounded by younger rocks at the north, west and south. 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, including some volcanic rocks. They are related to rocks in the Southern Uplands of Scotland.

To the southeast of these, near Granard, some Silurian age rocks occur, sandstones, siltstones and shales laid down in a poorly vegetated environment.

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.

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 east Longford.

Since the Ice Age, the exposed limestone has developed into what is termed karstified bedrock. As well as this, extensive peatlands have grown within the waterlogged, lower portions of the landscape. Geological processes continue to modify the landscape today, such as with seasonal flooding of the Shannon.



A simplified geology map of County Longford 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, Ireland's location on stable tectonic plates mean earthquakes are relatively rare and its recorded human history is not peppered with disastrous landslides, mudflows or other geological catastrophes. There are of course risks of one-off events, and this section briefly looks at the specific record and nature of geological hazards in County Longford 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, there are periods of sudden activity encompassing major events, and then quiet periods in between. The sites in this audit represent evidence of past geological environments and processes, such as the building of high mountain chains, ice sheets covering the land surface and so on. However, in County Longford there are few sites representing the active geomorphological or land-forming processes of today.

Landslides and bog flows
The Geological Survey of Ireland has been compiling national data on landslides in the past decade. There were only 3 events recorded in Longford, two 1800's bog slides and one event in 2009. See http://www.gsi.ie/Programmes/Quaternary+Geotechnical/Landslides/

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 Longford. Karstic flooding can occur when underground passages are unable to absorb high rainfall events. The Carboniferous limestone bedrock in County Longford is not known to become heavily karstified, like upland limestone areas such as the Burren or the Bricklieves.

Radon
Radioactive minerals and gases at higher concentrations can be carcinogenic. Radon can seep into homes and workplaces and can be carried in water supplies. A map showing the areas predicted to be at particular risk from radon in Ireland, called High Radon Areas, can be seen on the EPA website at http://www.epa.ie/radiation/#.VRu9OVROPcs. The Radiological Protection Institute of Ireland was formerly responsible for this but has been merged with the EPA.

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. Longford is a county quite 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
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.
Basin	low areas in the Earth's crust, of tectonic origin, in which sediments have accumulated.
Bedrock	a general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
Bioclast	fragment of a shell or fossil forming part of a sedimentary rock.
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.
Breccia	igneous or sedimentary rock comprising of large angular fragments within finer grained material.
Bryozoa	invertebrates belonging to the phylum Bryozoa, ranging from Ordovician to present, often found as frond-like fossils.
Calcite	a pale mineral composed of calcium carbonate, which reacts with dilute hydrochloric acid.
Calp	dark grey, fine-grained, muddy limestone.
Channel	a landform consisting of the outline of a path of relatively shallow and narrow body of fluid, most commonly the confine of a river, river delta or strait.
Chert	a sedimentary rock comprising of very fine-grained quartz.
Chironomid	a family of flies, similar in size and form to mosquitoes.
Coleopteran	a family of moths which are sensitive indicators of climatic changes during the last ice age.
Crag and tail	a steep resistant rock mass (crag), with sloping softer sediments (tail) protected from glacial erosion or deposited as glacial debris on the crag's 'downstream' side.
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).
Diatom	a major group of algae, among the most common types of phytoplankton.
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.
Echinoderm	marine organisms with interlocking plates (skeletal) covered by spines.
Erratic	a large rock fragment 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	an elongated ridge of stratified sand and gravel which was deposited in a subglacial channel by meltwaters. Eskers are frequently several kilometers in length.

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.
Floodplain	a flat or nearly flat land area adjacent to a stream or river that experiences occasional or periodic flooding.
Flute (glacial)	smooth gutter-like channels or furrows made by the abrasive underside of a glacier moving across a rock face.
Fluvial	pertaining to a river or stream.
Geopetal indicator	way-up indicators determine the original top and bottom or orientation of a sedimentary layer.
Glacial	of or relating to the presence and activities of ice or glaciers.
Glacial striae	markings left on the surface of pebbles / boulders / bedrock by moving ice sheets.
Glaciofluvial	pertaining to the meltwater streams flowing from wasting glacier ice and especially to the deposits and landforms produced by such streams.
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).
Haematite (Hematite)	a mineral form of iron oxide, which is the main ore mined as iron.
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.
Inlier	area of older bedrock completely surrounded by younger bedrock.
Interglacial	the time interval between glacial stages, or pertaining to this time.
Irish Sea Till	clay-rich till found along the eastern seaboard of Ireland, and occurring as much as 12km inland, which was deposited by an ice stream which occupied the Irish Sea Basin during the last glaciation.
Joint	a fracture in a rock, which shows no evidence of displacement.
Lava	magma extruded onto the Earth's surface, or the rock solidified from it.
Limestone	a sedimentary rock consisting chiefly of calcium carbonate (CaCO3), primarily in the form of the mineral calcite.
Lithology	the description of rocks on the basis of such characteristics as colour, composition and grain size.
Meander	a bend in a sinuous watercourse or river which forms when moving water in a stream erodes the outer banks and widens its valley, and the inner part of the river has less energy and deposits fine sediment.
Meltwater	water from melted snow or ice.
Meltwater channel	a channel cut by glacial meltwater, either under, along or in front of an ice margin.
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.
Metasediments	metamorphosed sediments.
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.
Nautiloid	marine cephalopods (molluscs) with an external shell – and are still alive today.
Ore	a mineral which is concentrated enough to be exploited by mining.
Outcrop	part of a geologic formation or structure that appears at the surface of the Earth.
Pillow lava	a lava that forms from an underwater eruption and is characterized by pillow-shaped masses.
Raised Bogs	an area of acid, peaty soil, in which the centre is relatively higher than the margins.
Shaft	a vertical or inclined hole dug in a mine for access, ventilation, for hauling ore out or for pumping water out.
Shale	A fine-grained sedimentary rock, formed by the compaction and lithification of clay, silt, or mud. It has a finely laminated (composed of layers) structure that gives it a fissility, or tendency to split along bedding planes.
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.
Stromatactis	a sedimentary structure characterized by a nearly flat bottom, and a convex-upward upper surface, consisting of sparry-calcite cement, usually in the central part of a reef
Testate amoebae	microscopic, unicellular, shelled animals which are sensitive indicators of hydrological conditions in peatlands, primarily the depth of the water table.
Terrace	terraces are remnants of the former floodplain of a stream of river, formed by the downcutting of a river or stream channel into and the abandonment and lateral erosion of its former floodplain.
Till	unconsolidated, unsorted glacial deposits consisting of boulders and cobbles mixed with very finely ground-up rock as sand, silt or clay.
Volcaniclastic	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.
Volcanic Rock	any rock produced from volcanic material, e.g. ash, lava.
Waulsortian	Lower Carboniferous age limestones consisting of skeletal debris and carbonate mud. The sediments commonly form individual and coalesced mounds with depositional dips of 20-40 degrees. Named after rocks in Belgium.

Data sources on the geology of County Longford

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 (called GOLDMINE) is now (in 2015) freely available online, into which about half a million documents and maps have been scanned. This means that any user can search on screen for data of relevance to them. **Data is available free of charge**.

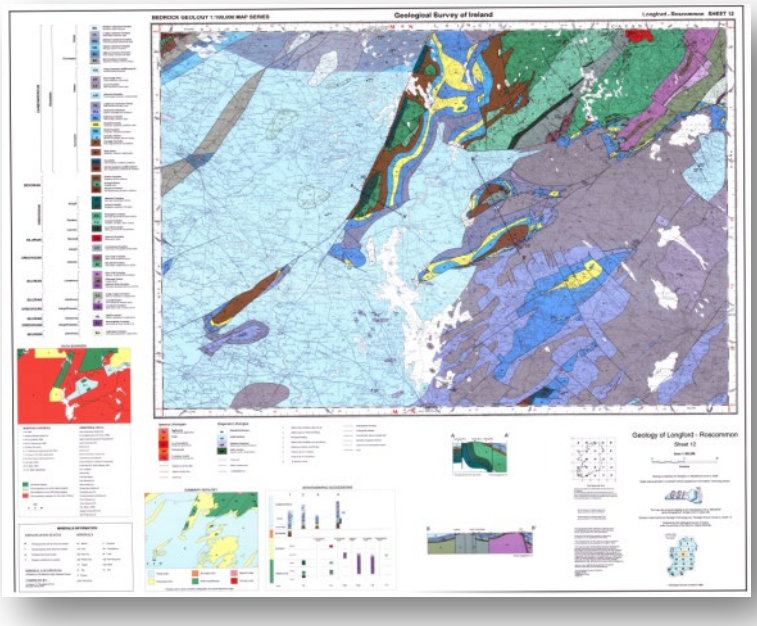
Key datasets include:

GOLDMINE (**G**SI **O**n**L**ine **D**ocument, **M**aps and **I**nformatio**N** **E**xplorer). The GSI online digital archive enables visitors to search the Geological Survey of Ireland online data archive database and download full-size resampled pdfs and/or original high resolution TIFF image files. The data consists of: Scanned Capture of 450,000 pages and maps, including all of GSI principal datasets, (Mineral Exploration Reports-Open File, Geotechnical Reports, boreholes & tests, Historic 6":1 mile and 1":1 mile Geological Maps, GSI Publications, Bulletins, Published and Unpublished Reports, Groundwater Well Hydrographs, Marine Maps, Airborne Geophysical Maps, Mineral Locality Reports and Mine Record Reports and Maps). The database runs on Oracle© and the stored imagery is currently 1.4TB in size.

https://secure.dcenr.gov.ie/goldmine/index.html

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. Sheet 12 covers all of County Longford.



Longford – Roscommon 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 78, 79, 88, 89, 98 and 99 cover County Longford. 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 GSI's Customer Centre library and scanned on GOLDMINE.

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 (EMD), currently of the Department of Communications, Energy and Natural Resources, 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. Licences relate to numbered prospecting areas, and these are available on a map from EMD. See also www.mineralsireland.ie

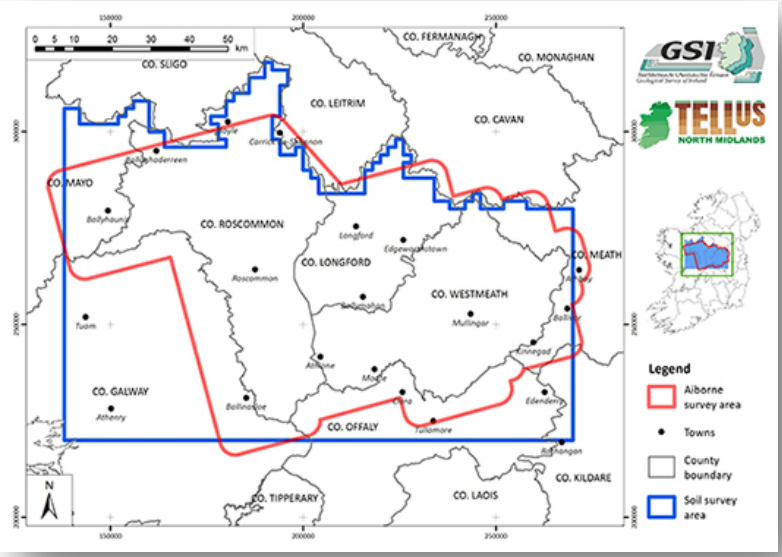
MinLocs Data
The MinLocs Database records all known mineral occurrences, however small, from GSI records, such as 19th century field sheets and Open File data.

Subsoils Mapping
Since a Groundwater Protection Scheme has been completed by GSI (2012) for the whole country, a modern map of the subsoil types and depths across County Longford 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. Furthermore, detailed compilation of glacial geology datasets, including a revision published by GSI in late 2014, now provides more data.

Digital mapping of many different datasets is now available via an easy to use public viewer on the GSI website: www.gsi.ie

Tellus Mapping
Tellus is a regional mapping project, combining airborne geophysical and geochemical surveys to provide geoscientific information for the island of Ireland. Since 2007, over 25,000 km^2 of the island of Ireland has been surveyed through the Tellus surveys which support mineral exploration, environmental management, agriculture and research activity.

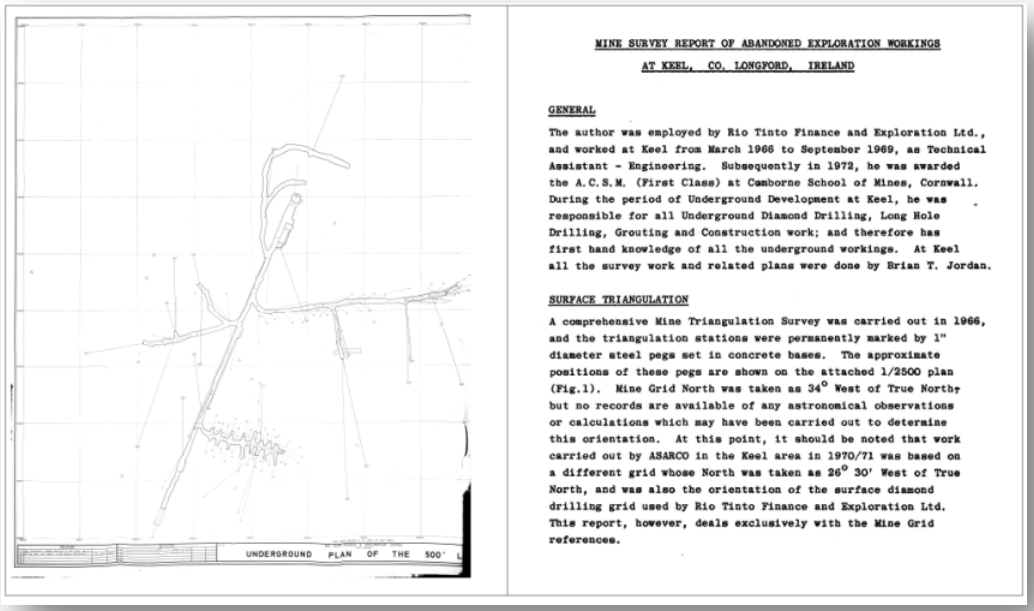
The Geological Survey of Ireland aims to complete Tellus surveying in 50% of the country by end 2017, with the view to completing the country in subsequent phases. The Tellus North Midlands phase of the national survey was carried out in 2014-2015. Data will be freely available from end 2015. For more information see www.tellus.ie/



Tellus North Midlands Survey Area

Historic Mine Records

Abandonment plans and varied other material exists for the various mining ventures in the country.



MINE SURVEY REPORT OF ABANDONED EXPLORATION WORKINGS

AT KEEL, CO. LONGFORD, IRELAND

GENERAL

The author was employed by Rio Tinto Finance and Exploration Ltd., and worked at Keel from March 1966 to September 1969, as Technical Assistant - Engineering. Subsequently in 1972, he was awarded the A.C.S.M. (First Class) at Camborne School of Mines, Cornwall. During the period of Underground Development at Keel, he was responsible for all Underground Diamond Drilling, Long Hole Drilling, Grouting and Construction work; and therefore has first hand knowledge of all the underground workings. At Keel all the survey work and related plans were done by Brian T. Jordan.

SURFACE TRIANGULATION

A comprehensive Mine Triangulation Survey was carried out in 1966, and the triangulation stations were permanently marked by 1" diameter steel pegs set in concrete bases. The approximate positions of these pegs are shown on the attached 1/2500 plan (Fig.1). Mine Grid North was taken as 34° West of True North, but no records are available of any astronomical observations or calculations which may have been carried out to determine this orientation. At this point, it should be noted that work carried out by ASARCO in the Keel area in 1970/71 was based on a different grid whose North was taken as 26° 30' West of True North, and was also the orientation of the surface diamond drilling grid used by Rio Tinto Finance and Exploration Ltd. This report, however, deals exclusively with the Mine Grid references.

Keel Mine Abandonment Report

Shortlist of Key Geological References
This reference list includes a few **key** papers, books and articles on the geology and geomorphology of County Longford that are recommended as access points to County Longford's geological heritage.

McARDLE, P. 2008. *Rock around Ireland*. A guide to Irish Geology. Science Spin Discovery 2. Albertine Kennedy Publishing. 112pp.

MORRIS, J.H., SOMERVILLE, I. and MacDERMOT, C.V. 2003. Geology of Longford-Roscommon. Bedrock Geology 1:100,000 Map Series, Sheet 12, Longford-Roscommon. Geological Survey of Ireland.

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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 County Longford that could be traced. Many papers that refer to the Midlands area in general, may or may not be specifically relevant to County Longford. Similarly there are many papers addressing the geology and wider development of the Longford-Down geological inlier (older rocks surrounded by younger ones). Many of these may have no significant detail on the rocks of Longford itself.

Quaternary References
The references in Appendix 3 all cover the Quaternary, or Ice Age, geology of County Longford. They are split into references specifically covering sites or features in County Longford, and a section of national or regional papers which have some data from or on County Longford 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 Programme, can be contacted in relation to any aspect of this report. Máiréad Ní Chonghaile, the Heritage Officer of Longford 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
http://www.iqua.ie - for information, fieldtrips, lectures etc in relation to Ireland's Ice Age history
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 Máiréad Ní Chonghaile, Heritage Officer from Longford County Council in the development of this project. Funding from the Heritage Council and Longford 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. Niall Blessington and Rhyne Rock Ltd are thanked for providing access to Killoe Quarry and Drumlish Quarry for the purposes of the audit. George Sevastopulo is thanked for information on several sites. Mary Forbes, Head Guide, and Tom Moore, OPW Area Manager, are thanked for their assistance in the audit visit to Corlea Trackway, along with Noel Carbery and Breda Mullaghan at the Trackway Centre.

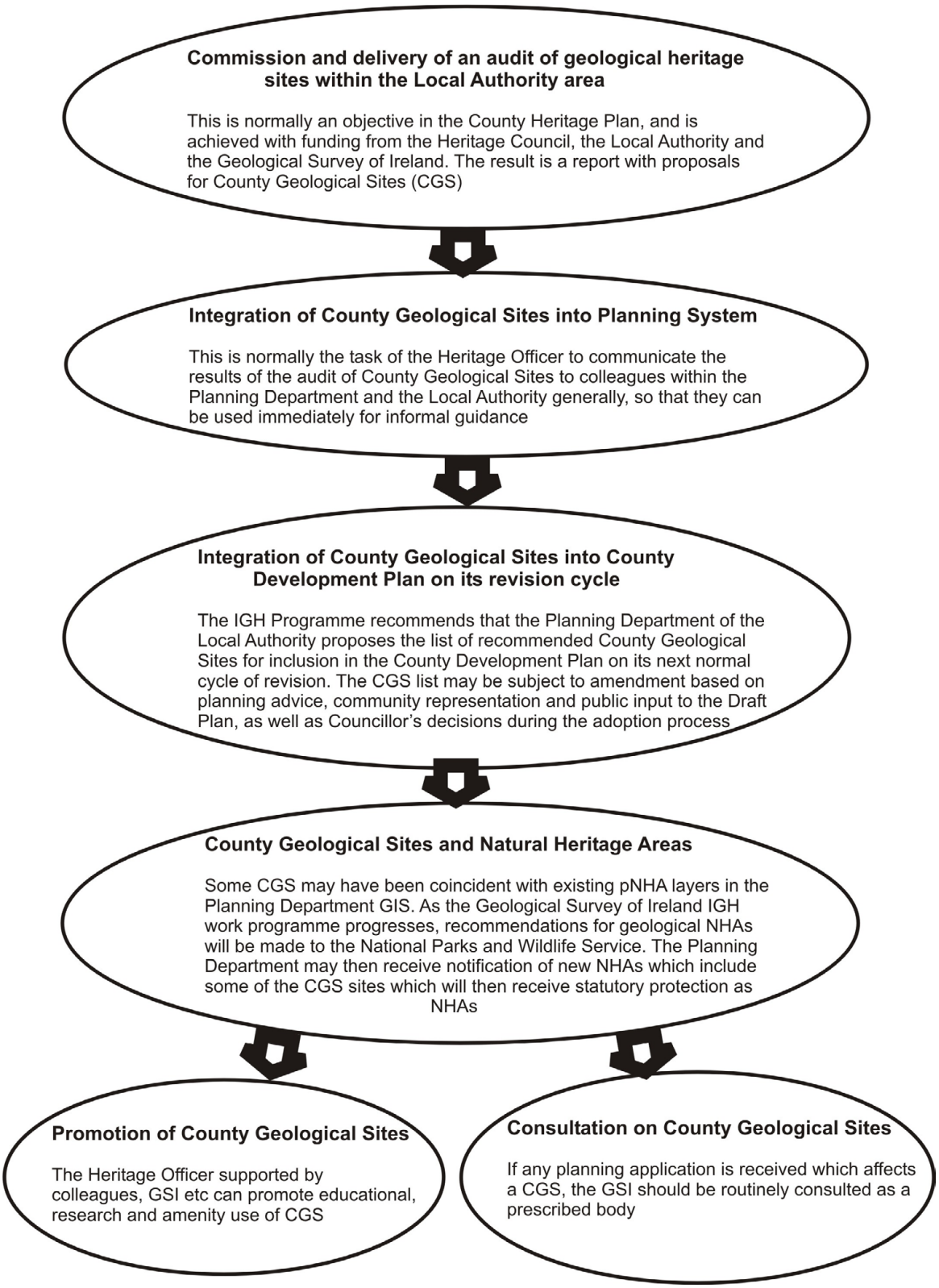
Appendix 1 – Geological heritage audits and the planning process

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 Programme 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: the Planning and Development Act 2000 [e.g. Sections 212 (1)f; Part IV, 6; First Schedule Condition 21], the Planning and Development Regulations 2001, the Wildlife (Amendment) Act 2000 (enabling Natural Heritage Areas) and the Heritage Act 1995. The Planning and Development Act 2000 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 GSI, over the course of numerous county audits since 2004.

County Geological Sites - a step by step guide



Appendix 2 - Bibliography – Geology of County Longford

GEOLOGICAL REFERENCES WITH DIRECT REFERENCE TO LONGFORD

CROWE, R.W.A. 1986. The stratigraphic and structural setting of Zn-Ba-Pb mineralization at Newtown Cashel, County Longford. *In: Geology and Genesis of Mineral Deposits in Ireland* (eds Andrew, C.J., Crowe, R.W.A., Finlay, S., Pennell, W.M. and Pyne, J.F.). Irish Association for Economic Geology, Dublin, 331 -340.

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Appendix 4 – 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 County Longford's geology, and especially for Quaternary landscape sites. Other sites were visited on spec during fieldwork. The rejected sites are listed below with brief notes as to why they were assessed as unsuitable for inclusion.

Ardnacassagh Quarry

This site was originally listed as a representative example of the Stackallan Member of the Meath Formation, within the IGH8 Lower Carboniferous Theme. The construction of the Longford By-pass road probably fuelled a reuse of small quarries in Ardnacassagh Townland, which are seen on both side of the present roadway on Ordnance Survey of Ireland historical maps. The Geological Survey Map Report for Sheet 12 – Geology of Longford-Roscommon (Morris *et al.* 2003) illustrates the quarry (Plate 7, page 49), and noted then that most of the 11m section had already been backfilled. In 2015 the quarry is entirely backfilled and no trace remains except in the poorer quality of grass growing on the fill than in adjacent fields. The 2005 air photos on the Ordnance Survey of Ireland map viewer indicate that the quarry was filled by that time as no trace remains.

Ballinamuck unconformity

The Geological Survey Map Report for Sheet 12 – Geology of Longford-Roscommon (Morris *et al.* 2003) has a photograph (Plate 1) of an unconformity near Ballinamuck in the 'simple explanation of some geological concepts' section. It was considered by the authors that this feature could make a good CGS in Longford, primarily for its educational and demonstrative value. Despite having a grid reference and extensive fieldwalking over numerous outcrops in the right vicinity with the landowner, no outcrop matching the photo could be identified. The original photo, taken in 1977, was in black and white, so the most likely explanation is that it is now very overgrown in an area fenced off under REPS for biodiversity. The landowner, and his father before him, had not undertaken any field clearance or other work that could have destroyed the unconformity exposure. John Morris who studied the exposure originally was currently unable to access his original fieldsheets

and it must remain off the list, with a proviso that it could be added if suitable, once it can be traced in the future.

The Geological Survey Map Report for Sheet 12 – Geology of Longford-Roscommon (Morris et al. 2003) (Plate 1)

Carrickateane Quarry

Carrickateane Quarry is listed in the 'Key Localities' of the Geological Survey Map Report for Sheet 12 – Geology of Longford-Roscommon (Morris *et al.* 2003) as the type locality for the Carrickateane Formation. Whilst it was undoubtedly of past value in the regional mapping and definition of poorly exposed rocks, it is not included as a CGS because it is now inactive as a quarry and the faces are degrading or partially obscured by stockpiles of aggregate, and the overall interest is low.

Coolcor Quarry

This site is listed as a working quarry in the 2014 Quarry Directory published by the GSI. It was being worked for limestone for building and walling and paving etc. The operator has since retired and no longer works the quarry as a subsidiary to farm activity. The quarry

was small anyway but has since become poorly accessible due to vegetation and primarily, the ponded water in front of the face.

Enaghan, near Arva

The site at Enaghan is a historic iron mine, worked for iron ore from the 1700's to 1870's. Nowadays the site is no more than a few small depressions in the landscape, where the entrances to mine shafts once occurred. The site is therefore rejected as a CGS as the site has completely degraded since closure, and no surface expression of any elements of the mine exists. The overall interest is therefore very low at the site.

Esker North townland

The Esker North Townland site is an exposure into a truncated slump fold that was described in some detail in the geological literature in the 1970s. The description from that time was of a 'small quarry on the eastern bank of a stream, 200m south of a farmyard at the end of an entrance lane'. Nowadays, the site locality is completely covered by mature coniferous forestry, and even the outcrop of rock itself cannot be seen. Therefore, as the fold itself is invisible at surface, the site has been rejected.

Garrycam

Garrycam was originally listed on the IGH Master Site List because of its association with Keel Mine, itself listed for IGH6 Mineralogy and IGH15 Economic Geology interest. Closer examination of available literature and field based study indicates that whilst a working mine existed at Keel, the mineralisation at Garrycam, which is closely linked to Keel, was only ever located through mineral exploration boreholes and no surface evidence exists. The Garrycam deposit represents the most significant stratiform baryte discovery in Ireland since the Ballynoe deposit which was mined near Silvermines in Tipperary. It is of significant scientific interest, although not presently a commercial deposit. However, in the absence of any surface expression no site can be defined as a County Geological Site and the listing is rejected.

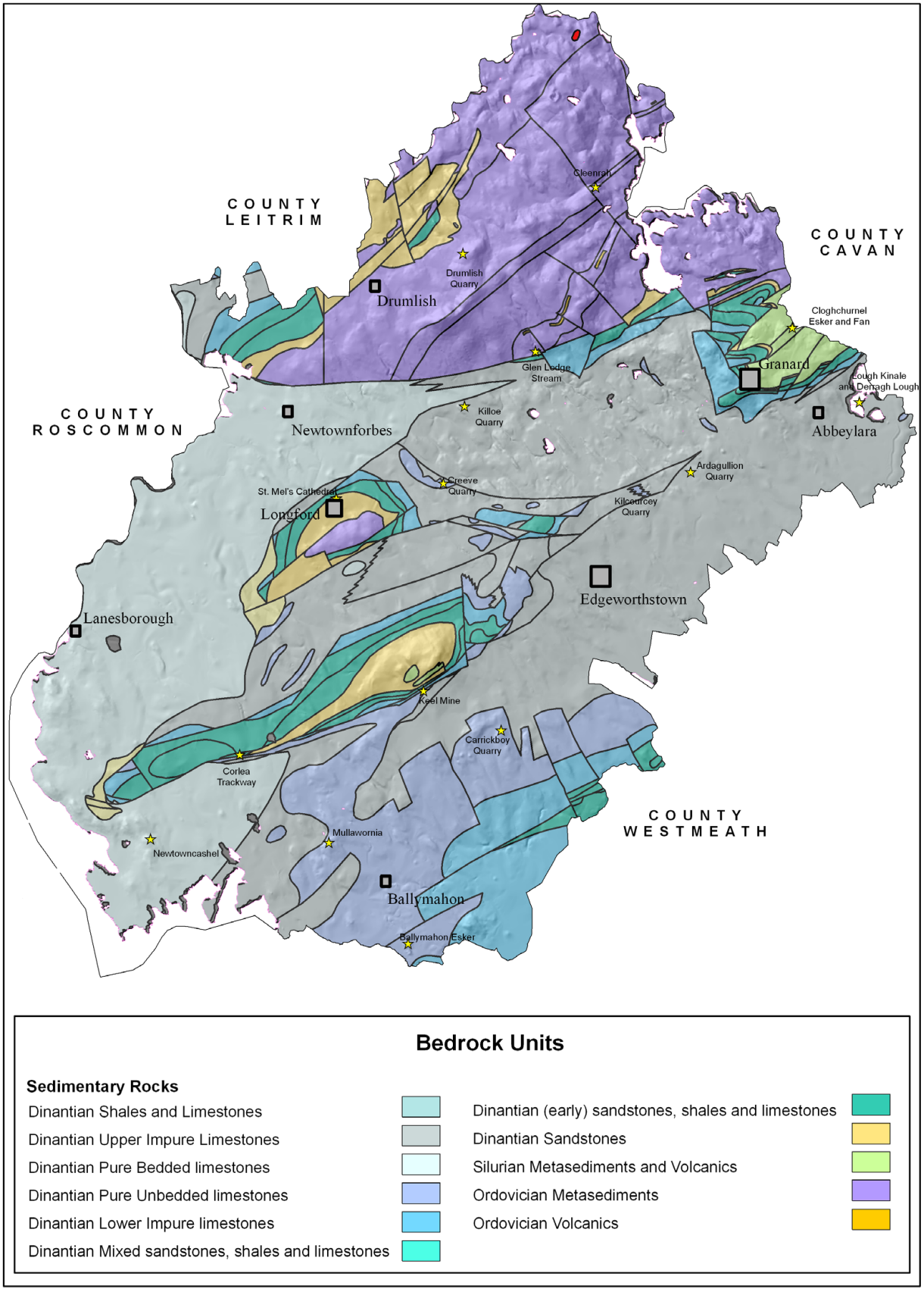
Kilcourcey Quarry

Kilcourvey Quarry was listed on the IGH Master Site List because of reports of atypical coral fauna (associated with post-Waulsortian mudmounds) in an unpublished undergraduate student report. The location of the quarry was not identified in the field on two separate survey visits. The location of old quarries on historic OSI maps led to the identification of one potential site. This site is now occupied by farm buildings/yards and the exposed carbonates are poorly exposed and degrading. Another potential quarry site (on OSI maps) could not be located and has possibly been filled in and grassed over. The site is not included as a CGS as no suitable site of interest could be identified.

Terlicken

Terlicken was added to the IGH Master Site List having been worked for building stone. The original six-storey Mill in Ballymahon was constructed in 1839 using limestone from the nearby Terlicken Quarry. Lewis's Topographical Dictionary of Ireland (1837) describes 'flag-stones of very good quality' at Terlicken. On the first edition OSI 6" scale maps, two small quarries are illustrated along the Royal Canal (east bank) in the Terlickeen townland. Over 150 years on, these quarries completely vegetated over, and therefore of no CGS significance.

Appendix 5



A detailed geological map of County Longford.

Appendix 6 - Geoschol leaflet on the geology of County Longford

LONGFORD

AREA OF COUNTY: 1,091 square kilometres or 421 square miles

COUNTY TOWN: Longford

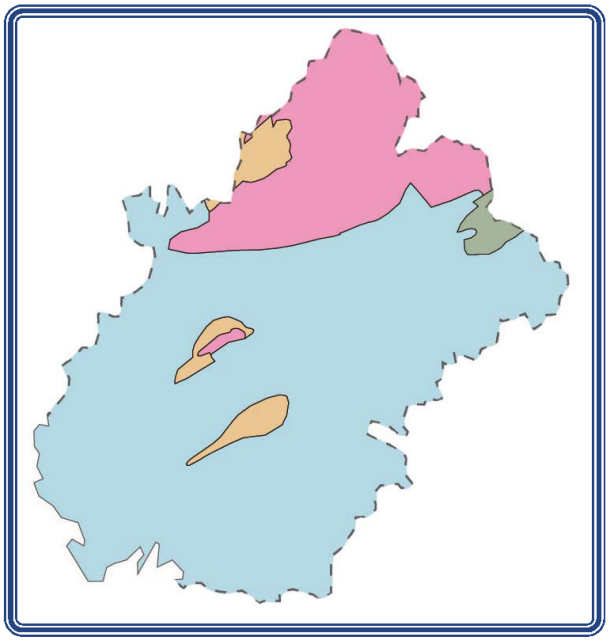
OTHER TOWNS: Abbeyshrule, Edgeworthstown, Granard

GEOLOGY HIGHLIGHTS: Lower Carboniferous Limestone, Glacial deposits

AGE OF ROCKS: Ordovician to Carboniferous

Royal Canal near Cloonard

The bridge over the canal from where the picture is taken is constructed of locally-quarried Lower Carboniferous grey limestone.



Geological Map of County Longford

Pink: Ordovician; Grey: Ordovician & Silurian; Beige: Devonian sandstones and conglomerates; Light blue: Lower Carboniferous limestone.

Geological history

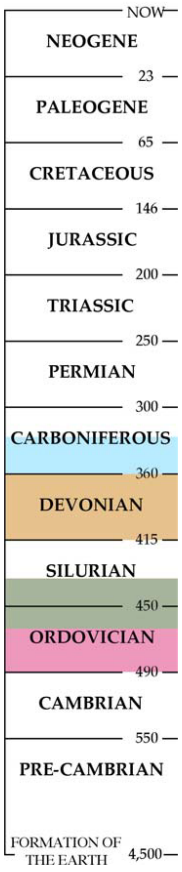
The oldest rocks in Co. Longford are those in the north of the county where Ordovician rocks comprise a succession of sandstones and shales. Towards the end of the Ordovician a different group of sediments (coloured grey on the map) were deposited in a deepish ocean, the Iapetus Ocean, that was fed with sands and muds by rivers flowing off the ever-nearing continental margins. This later suite of Ordovician and Silurian sediments are grouped together. These make up an inlier, the Longford-Down Inlier, where older rocks are surround by younger rocks, and this extends northeastwards. Only the western part of the inlier is exposed in the county near Granard between Lough Gowna and Lough Kinale.

Some small patches of Devonian sandstones and conglomerates are found near Drumlish and make up Corn Hill nearby. These rocks are the products of sedimentation in a semi-arid environment, meandering through which were temporary rivers which filled during flash floods. These waters

Carboniferous cephalopods (squids). These are either coiled (far left) or straight (centre). Internally they contain gas filled chambers (seen in cut specimen on right) which keep the animal from sinking.

carried coarse cobbles and pebbles, as well as sands southwards and these make up the Old Red Sandstone with its characteristic purple to rust colour.

At the end of the Devonian marine conditions returned to Ireland as it was slowly flooded by an ocean whose shoreline migrated northwards over many millions of years. In this ocean limestone was deposited and it is possible to find the fossilised remains of the many beautiful and diverse life-forms that lived in it. Two types of limestone were formed. Shelf limestones formed horizontal bands or beds of grey stone, while mudmound limestones form upstanding 'knolls' or bumps on the seafloor or in today's landscape. The mudmounds are much like modern-day reefs, except that there are few corals to bind the lime muds together. They are thought to have been held together with a sticky mass of algae which survived long enough to allow the stone to form. Recently a study of fossil cephalopods (pictured above), a type of squid closely related to the modern *Nautilus*, has shown that the mudmounds at Mullaghwornia in Longford formed in water depths of between 50 and 200 metres.



Geological timescale showing age of rocks in Longford.

Rocks younger than Lower Carboniferous do not occur in the county, and much of the underlying bedrock is obscured by a generous covering of glacial till or boulder clay. This was deposited in a number of events during the last Ice Age. It is thought that ice developed at least four times in Ireland in the last 2 million years and much of the county would have been smothered under several kilometres of ice. As it moved over Ireland the ice was able to gouge and erode the rock surface and the material was pulverised into small pieces.

When the climate became milder the ice melted and the rocks crushed up in the ice were dumped. Over the last 10,000 years soils developed on the glacial tills and as they contain a high proportion of limestone the soils are generally good for agricultural use.

Mining, the Mine that never was & Building Stones

Some small iron-ore mines were opened at Cleenragh and Enaghan, near Lough Gowna as long ago as the 1700s, and small-scale extraction continued off and on until the 1870s.

A deposit of metallic minerals was discovered at Keel in the early 1960s seven miles south of Longford town. In 1965 a shaft was dug and 1,500 metres of underground workings opened. This was done to access the commercial viability of the ore body which was found to contain Sphalerite (right) a zinc mineral. Unfortunately the grade (% of metal in the rock) was not high enough to begin wholesale extraction of the material, and the operation was suspended in 1968.

Limestone has always been an important material for building and for agriculture. Lime was produced for use as a fertiliser by burning limestone in a lime kiln and many small quarries were opened in the past to supply the kilns. Limestone was quarried for use as a dimension stone and blocks were extracted from a number of locations for use in the building of the Royal Canal that crosses the county. Today limestone is used for road materials, and for the making of concrete blocks and cement. A number of the mudmounds were removed by quarrying for such purposes.

In the middle of the nineteenth century an enterprising person started a brick and tile works in Longford that exploited some of the clays found in the glacial deposits. The bricks and tiles were sent by canal and rail to Dublin but because the Royal Canal was allowed to eventually fall into disrepair the factory failed and production ceased.

Map adapted with permission from Geological Survey of Ireland 1:1,000,000 map 2003.
Image credits: Kieran Campbell 1 (licensed for reuse under the Creative Commons Licence); Kathleen Histon 3; Geological Museum, Trinity College, Dublin 4.

Text by Patrick Wyse Jackson

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 Longford. 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 Programme 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 several 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 for a central point in the site generated from the GIS mapping (a shapefile) of the site boundary. They are only indicative of the location, but the site extent is best shown on the included maps.

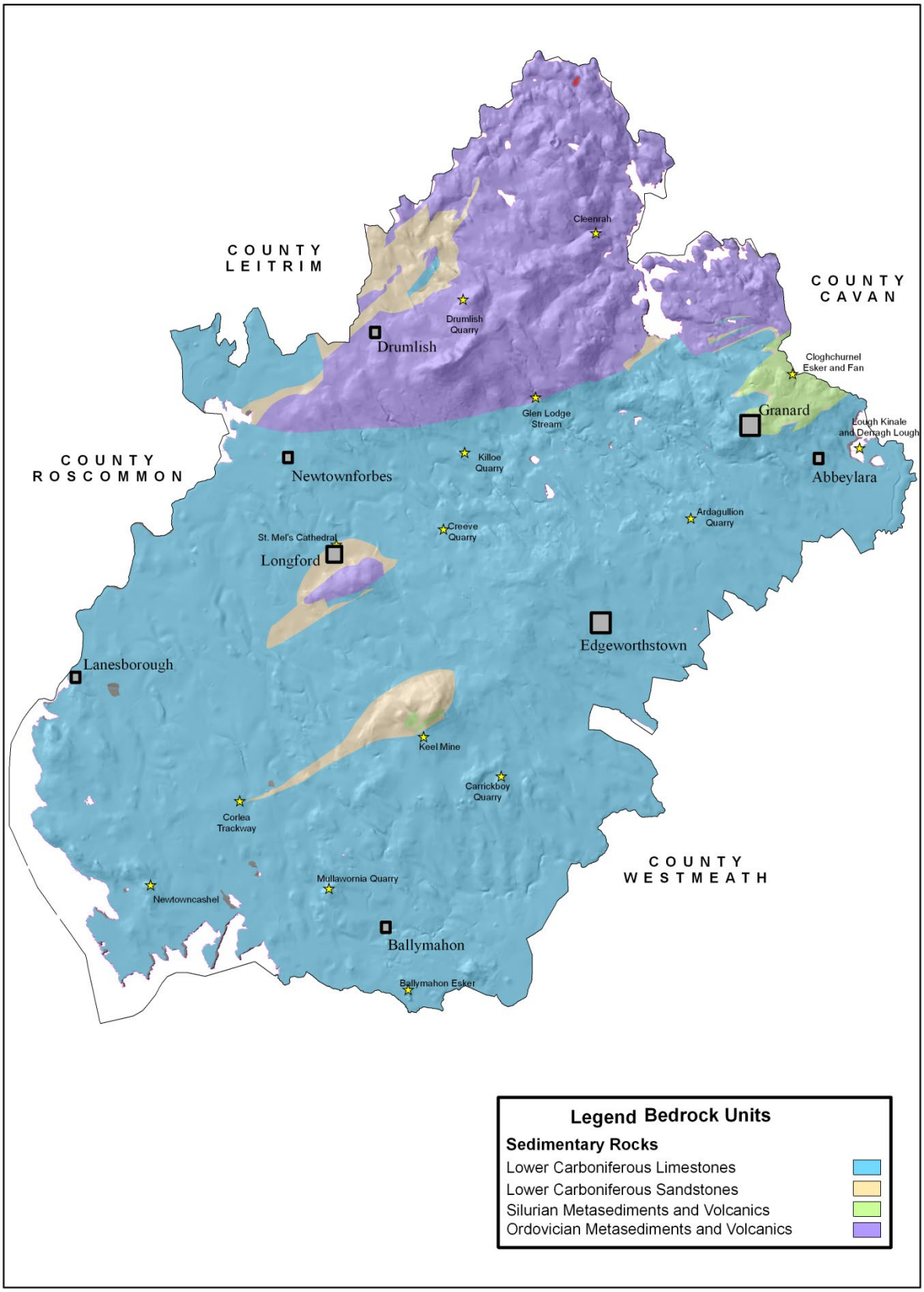
Coordinate Projection System – IRENET95 ITM
Irish Transverse Mercator (ITM) is the geographic projection co-ordinate system now in use for Ireland, and has been applied to all site localities in the site reports. It is the standard co-ordinate system for OSi maps, including the new Discovery map series, but a coordinate conversion tool is available on the OSi website at:
http://www.osi.ie/calculators/converter_index.asp?alias=/services/gps-services/co-ordinate-converter#results.

A series of maps are provided with an outline of the site boundary. It is important to note that these boundaries have no legal or definitive basis. 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. Boundaries are drawn to include the geological or geomorphological interest of the site, but are extended to the nearest mappable boundary, such as a field boundary, stream, road or edge of forestry. On a few sites, such as in open mountain terrain, it is impractical to find a boundary within a reasonable distance and an arbitrary line may be defined. County Geological Sites are non-statutory and so this is not problematic. If any such site is fully assessed for NHA status in the future, such a boundary may require small revisions.

For sites that have been recommended or which will be recommended 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 these wider areas 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 finalises recommendations with 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 Programme, in the Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4. Phone 01-6782837. Email: sarah.gatley@gsi.ie



Simplified Geological Map of County Longford with site locations indicated.

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Ardagullion Quarry**
Other names used for site	
IGH THEME	**IGH8 Lower Carboniferous, IGH3 Carboniferous - Pliocene Palaeontology**
TOWNLAND(S)	**Ardagullion**
NEAREST TOWN/VILLAGE	**Granard**
SIX INCH MAP NUMBER	**15**
NATIONAL GRID REFERENCE	**630480E 776730N**
1:50,000 O.S. SHEET NUMBER	**41 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
A long disused quarry.

Geological System/Age and Primary Rock Type
The Carboniferous Limestone strata here are classified as a part of the Lucan Formation (also known as Calp). Microfossils indicate a Viséan age.

Main Geological or Geomorphological Interest
This disused quarry exposes over 17m thickness of dark grey thinly-bedded cherty, laminated limestones and thick beds of laminated limestone, some of which show slumping. Recorded details of the detailed sedimentology of these beds indicate they were formed on the margin of the deep sea basin that existed eastward. This basin was filled in the Dublin region by the Lucan Formation limestones, which extended this far west. There are microfossils found here that indicate the limestone beds are of an early-mid Viséan age from the Arundian, of the Irish Carboniferous stratigraphy.

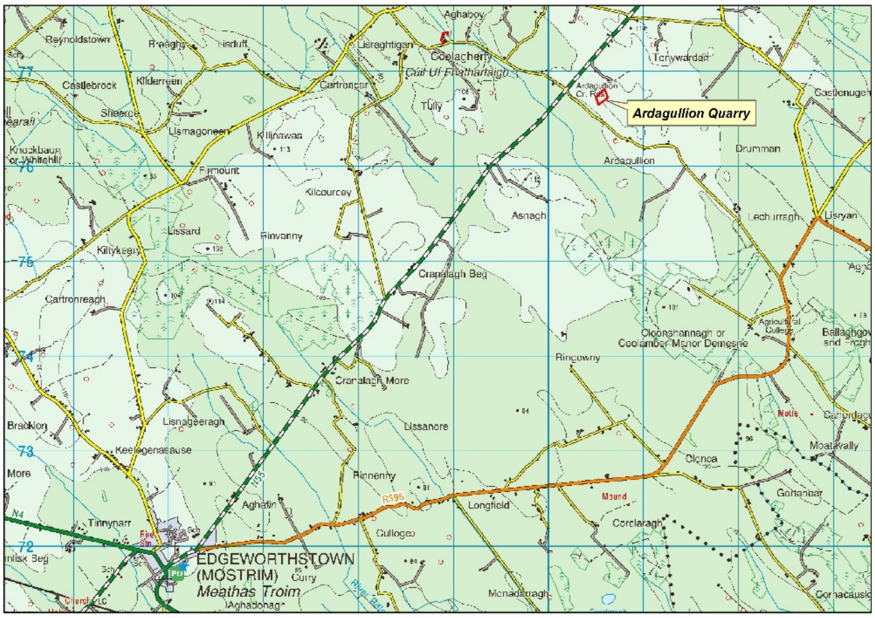
Site Importance – County Geological Site
The site provides a good representative section of the local Carboniferous Limestone in an area where it is generally poorly exposed.

Management/promotion issues
The quarry is partly wooded and is connected to agricultural grass fields for grazing or silage. No particular threats are evident, but the faces are quite overgrown and at risk of being obscured.

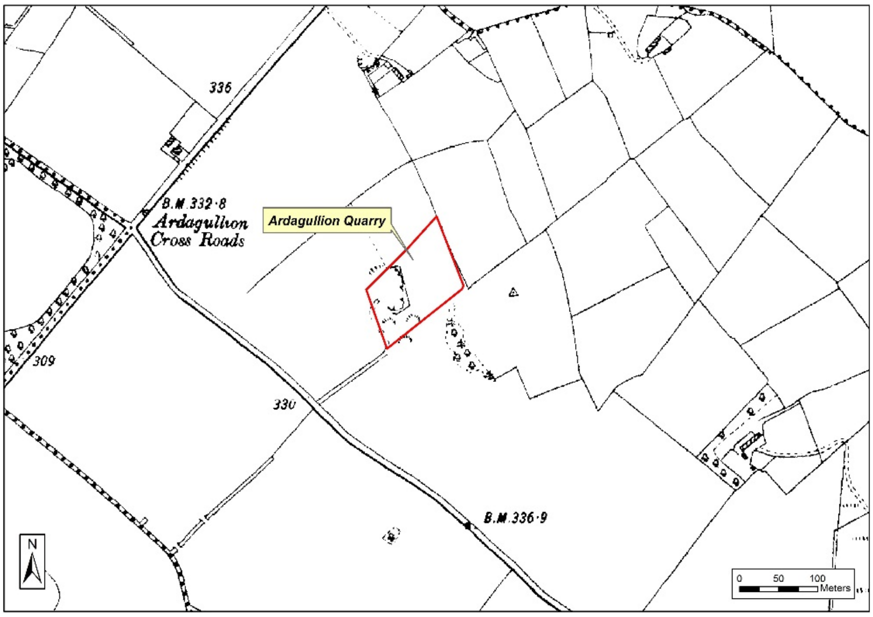
The view into the quarry from the outer area.


The view of the quarry face from the inner area.

The view of the quarry from the adjacent roadway, showing how it is essentially obscured by trees.


Ardagullion Quarry
Reynoldstown
Castlebrock
Kilderreen
Coolacherty
Cúil Ui Fhlatharta
Tully
Corrywardan
Castlenugent
Lismagoneen
Killinawas
Ardagullion
Drumman
Firmount
Kilcourcey
Asnagh
Lechurragh
Lisryan
Lissard
Rinvanny
Killykeegan
Cranalagh Beg
Cartronreagh
Cloonshannagh or
Coolamber Manor Demesne
Rincowny
Cranalagh More
Lissanore
Bracklon
Lisnageeragh
Keelogenasause
Clonca
Moatavally
Rinnenny
Longfield
Tinnynarr
Aghafin
Cullogo
Cordaragh
EDGEWORTHSTOWN
(MOSTRIM)
Meathas Troim
Aghadonagh
Curry
Mound
Motte
R395
N4
77
76
75
74
73
72


Ardagullion Quarry
N
0
50
100
Meters


336
B.M. 332·8
Ardagullion
Cross Roads
Ardagullion Quarry
309
330
B.M. 336·9
N
0
50
100
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Ballymahon Esker**
Other names used for site	
IGH THEME	**IGH7 Quaternary**
TOWNLAND(S)	**Keel, Calliaghstown, Carricknagower, Milltown, Harrystown, Dungolman, Ballynacorra**
NEAREST TOWN/VILLAGE	**Ballymahon**
SIX INCH MAP NUMBER	**22, 26**
NATIONAL GRID REFERENCE	**617770E 752410N (centre of feature)**
1:50,000 O.S. SHEET NUMBER	**40 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
An elongated ridge of sands and gravels deposited under the ice sheet at the end of the last Ice Age, Ballymahon Esker extends from Ballymahon town to Dungolman, Co. Westmeath. The crest of the esker carries a road along much of its length.

Geological System/Age and Primary Rock Type
An esker ridge formed on Lower Carboniferous bedrock. The feature is Quaternary in age and formed during deglaciation of the ice sheet towards the end of the Ice Age, between 22,000 and 14,000 years ago (Devensian).

Main Geological or Geomorphological Interest
Ballymahon esker is one of a series of north-south oriented eskers that lie just north of the east-west oriented central Irish Midlands esker system. Ballymahon esker comprises 12 kilometres of ridge segments (beads); each a narrow, sharp-crested ridge of coarse-grained sediments which trends southeast (down-ice direction) from Ballymahon town, and gently uphill, terminating in a wide, flat-topped, fan-shaped area. The esker runs east of and parallel to the Dungolman River.

The esker formed from meltwater deposits that were laid down within an ice-walled channel in a slowly receding ice sheet, which had occasional stillstands, at the end of the last deglaciation (22,000 to 14,000 years ago). The sediments within the esker segments indicate sequential deposition as the ice margin retreated.

The esker lies along the western edge of a hummocky moraine that spreads over 10 km east-northeast from Lough Ree.

Site Importance – County Geological Site
The sand and gravel ridge, standing proud of the surrounding low-lying landscape, is a fine example of a beaded esker. The landform lends important evidence to the understanding of the nature of the deglaciation of the Irish and British ice sheet – suggesting a gradual recession rather than a widespread collapse of the ice sheet.

Management/promotion issues
As with many eskers on the Irish landscape, the ridge carries a road across otherwise low-lying land, and the route is most likely a very ancient track-way.

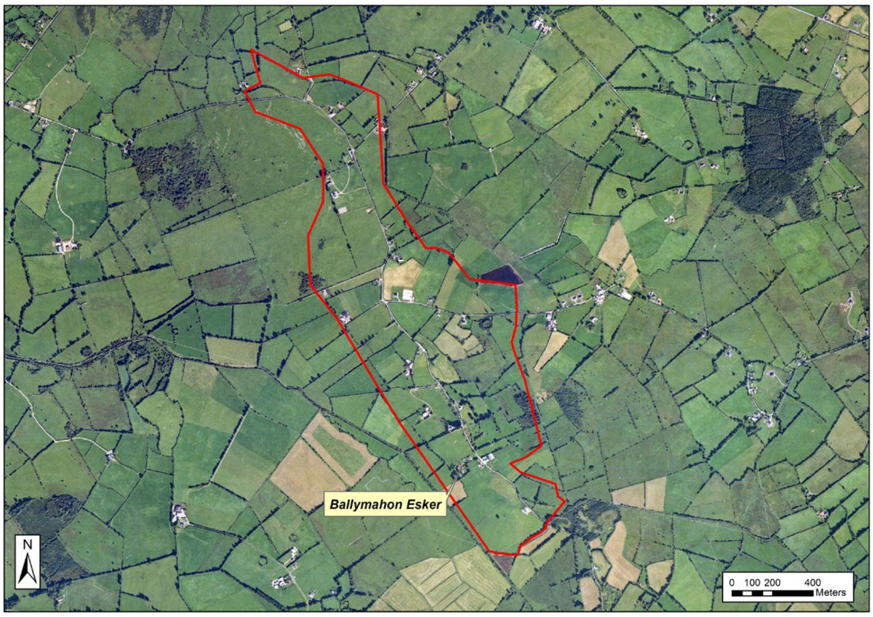
Ballymahon Esker at Keel (road along ridge top, by telephone poles) looking south.

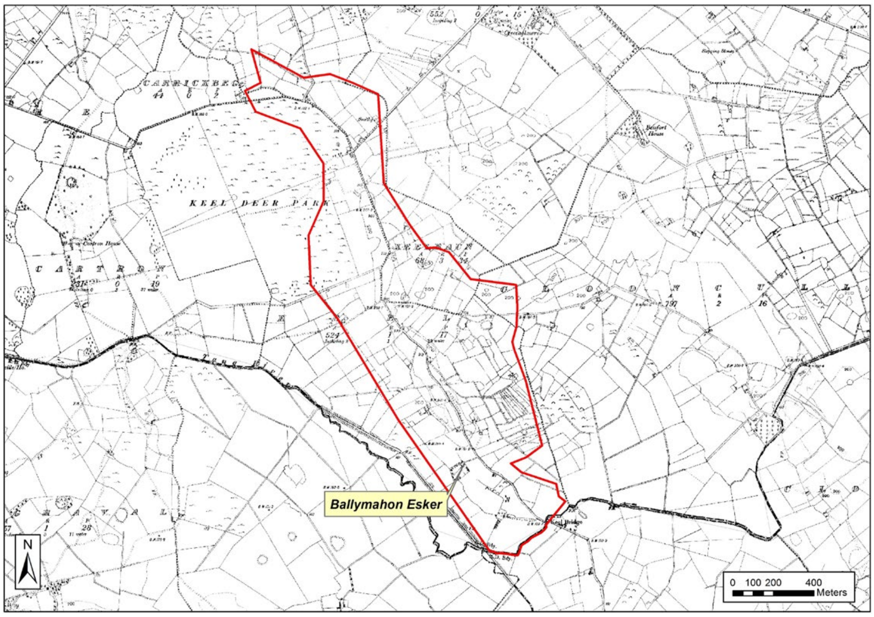
Rounded boulders from esker in stone wall along the ridge road.

Sand and pebble sediments in quarry along the side of esker.

Ballymahon esker (ITM 618590 751100) looking south. Road along ridge hidden by hedges.


Ballymahon Esker
BALLYMAHON
Baile Uí Mhatháin
Moneytad
Cartronbeg
Drinan
Ballybranigan
Moygh
Castlecore
Daroge
Gorteen Upper
Glebe
Garrynagh
Shrule
Barnacor
Rathmore
Creevagh Beg
Creevaghmore
Carrickbeg
Ballymulvey
Cloonkeen
Pallas More
Cloghan
Newcastle
Cloncallow
Kildordan
Rath
Hill of Forgney
Forgney
Holy Well
Church
Graveyard
Cartron
Keel
Keelbaun
Clooncullen
Cloncullen
Tang
An Teanga
Clogher
Corbrack
Noughaval
Ardnacrany North
Creggy
Coolvin
Lecade
Inny River
Tang River
Rath River
R392
N55


Ballymahon Esker
N
0 100 200 400
Meters


CARRICKBEG
KEEL DEER PARK
Ballymahon Esker
N
0 100 200 400
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Carrickboy Quarry**
Other names used for site	Thompson's locality
IGH THEME	**IGH8 Lower Carboniferous, IGH3 Carboniferous - Pliocene Palaeontology**
TOWNLAND(S)	**Carrickboy, Tennalough**
NEAREST TOWN/VILLAGE	**Carrickboy**
SIX INCH MAP NUMBER	**19, 23**
NATIONAL GRID REFERENCE	**621350E 764400N (new quarry)** **620555E 764920N (old quarry)**
1:50,000 O.S. SHEET NUMBER	**41 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
Two disused limestone quarries (old and new) situated on an elevated area near the crossroads at Carrickboy.

Geological System/Age and Primary Rock Type
Bedrock comprises massive and bedded Waulsortian limestone and shale. The fossiliferous deepwater limestones and shales formed topographic highs (reefs) on the Carboniferous seafloor around 340 million years ago.

Main Geological or Geomorphological Interest
The northeast face of the new quarry exhibits two dolines, which would have been plugged with glacial till. Much of the unconsolidated debris has since collapsed into the quarry and quarry lake-floor as the doline walls were removed.

Three main banks of rocks have been described in the old quarry (ITM 620555 764920). The lower reef rock here is dark, calcite mudstone, with bryozoan fossils, and is overlain by thin bedded dark limestone and blackish shales, overlain again by more calcite mudstones. Fossils are relatively abundant throughout, with several limestone beds are rich in crinoid fossils. Blastoids, an extinct type of stemmed echinoderm (*Ellipticoblastus ellipticus*) occur in shales near the top of the reef exposed at the older Carrickboy Quarry. The type specimen of an extinct genus of mollusc, *Conocardium inflatum*, was described at the old quarry at Carrickboy. Fossil fauna associated with the reefs in the Dublin Basin are late Courceyan-early Chadian in age.

Site Importance – County Geological Site
This is an important area for research conducted on tabular-form Waulsortian banks and knoll-reefs and Carboniferous palaeobiogeography. The old quarry, to the northwest of the Carrickboy crossroads is listed in the 1972 Report on Areas of Scientific Interest in Longford. The stratigraphy at the old quarry site was described in detail in 1964.

The new quarry provides good exposure of the inclined Lower Carboniferous strata, but the quarry faces are not accessible owing to the quarry floor being flooded.

Management/promotion issues
The new quarry at Tennalough was operated by Carrickboy Quarries Ltd between 2002 and 2009. This site is now flooded and no longer quarried (2015). The old disused quarry is fenced off by the landowner, and is not observable from the R393 road, even though the quarry face is only 100 metres from the road, being well hidden by hedges and trees. It is of interest primarily to geologists.

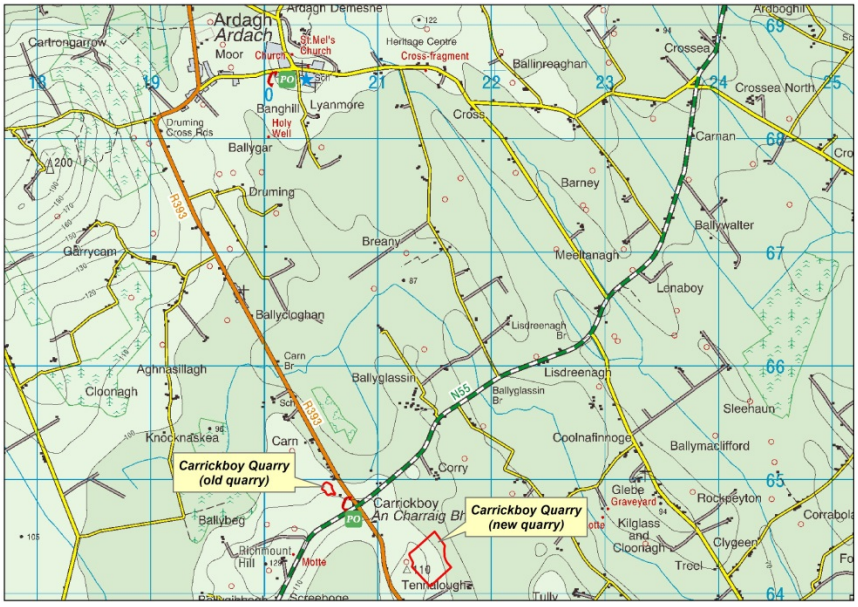
The flooded “new” quarry, viewed from the quarry service road, looking east.

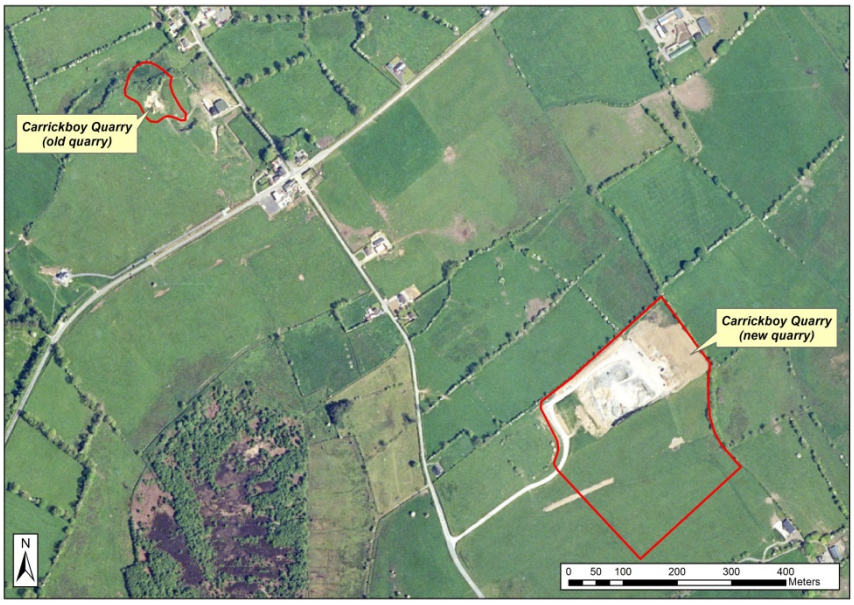
Trigonometrical (Trig) pillar sited on the rath enclosure just west of the “new” quarry.

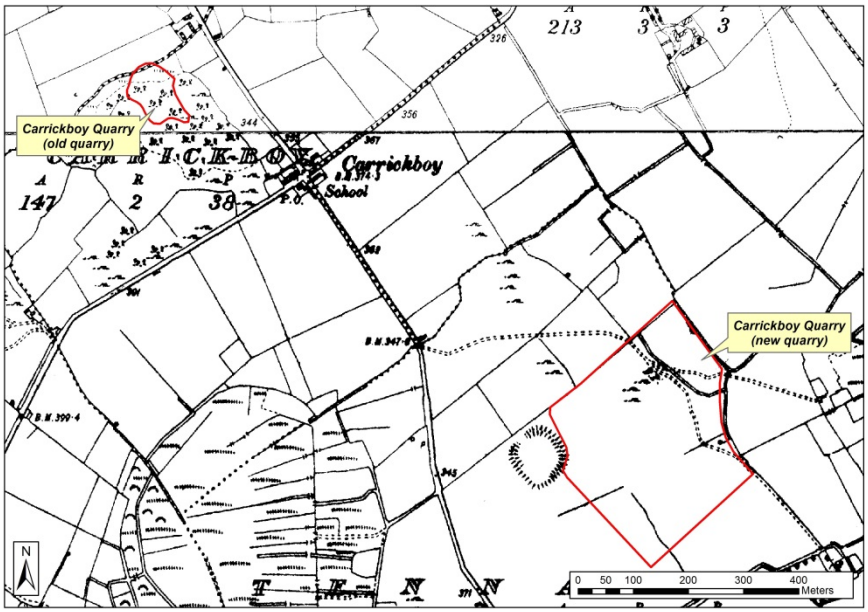
Syncline exposed in west side of “new” quarry adjacent to two dolines.

Glacially smoothed and striated limestone boulder at south side of “new” quarry.

Massive limestone exposed in northwest face of “new” quarry.


Ardagh
Ardagh Demesne
Cartrongarrow
Moor
St Mel's Church
Heritage Centre
Cross-fragment
Ballinreaghan
Crossea
Ardboghill
Crossea North
Banghill
Lyanmore
Cross
Druming Cross Rds
Holy Well
Ballygar
Carnan
Druming
Barney
Ballywalter
Breany
Meeltanagh
Garrycam
Lenaboy
Ballycloghan
Lisdreenagh Br
Carn Br
Aghnasillagh
Ballyglassin
Lisdreenagh
Cloonagh
Ballyglassin Br
Sleehaun
Knocknaskea
Carn
Coolnafinnoge
Ballymaclifford
Carrickboy Quarry (old quarry)
Corry
Glebe
Graveyard
Rockpeyton
Carrickboy
An Charraig Bh
Carrickboy Quarry (new quarry)
Kilglass and Cloonagh
Ballybeg
Clygeen
Richmount Hill
Motte
Trool
Tennelough
Tully
R393
N55


Carrickboy Quarry (old quarry)
Carrickboy Quarry (new quarry)
N
0 50 100 200 300 400
Meters


Carrickboy Quarry (old quarry)
Carrickboy School
Carrickboy Quarry (new quarry)
N
0 50 100 200 300 400
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Cleenrah**
Other names used for site	Cleenrah Mine
IGH THEME	**IGH15 Economic Geology**
TOWNLAND(S)	**Cleenrah**
NEAREST TOWN/VILLAGE	**Aghnacliff**
SIX INCH MAP NUMBER	**6**
NATIONAL GRID REFERENCE	**625600E 790550N (shaft entrance)**
1:50,000 O.S. SHEET NUMBER	**34 GSI BEDROCK 1:100,000 SHEET NO. 12**

Outline Site Description
The site is located in farmland surrounded by drumlins and crag-and-tails. The land is almost exclusively grassland to the west, south and east, but forestry has recently been planted to the north of the site.

Geological System/Age and Primary Rock Type
The area is underlain by shales, greywackes and volcaniclastics of the Ordovician Corn Hill Formation, part of the Lower Palaeozoic Longford-Down Inlier.

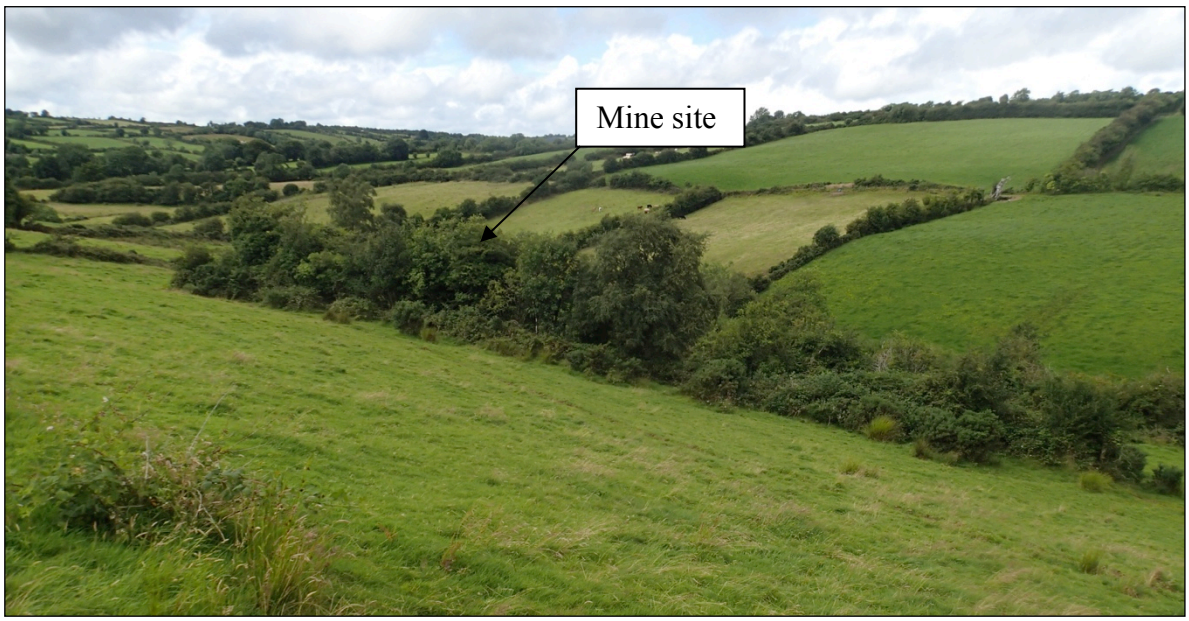
Main Geological or Geomorphological Interest
Cleenrah Mine was apparently operated from the early 16th century up to the 1870s, when haematitic-manganese shale associated with mafic volcanics was mined. The Geological Survey Memoir of the mid-nineteenth century describes the site as having 'three wide beds of a good dark brown haematite'. The mine had been worked before that time by a 'Dr. Ritchie', who would initially cart the ore to Crossdoney Station, but when that was found to be too costly, it was carted only to Lough Gowna and then transported by boat to the main Cavan-Dublin railway at the east of the lake.

It is not known how extensive the underground workings are, but a large, 10m deep chasm has been cut out of the steep hillside leading into the main mine area. This can be seen both today in the field and on the historical six-inch maps. The chasm appears to follow the line of a fault. Traces of mineralisation observed in boulders in field walls include haematite and manganese-dominated shale. There are a few spoil heaps around the site which are almost entirely vegetated over.

The area around the site now consists of pasture, and is accessed via a long, cul-de-sac laneway. Cottages on the way into the site may be old mine buildings/offices.

Site Importance – County Geological Site
The main interest in the site, apart from the deep chasm in the landscape where the entrance to the mine lies, is the geotechnical issue of potential subsidence along the line of old mine workings. The mine itself is probably one of the oldest mines in the north Midlands region. For this reason, it is worth designation as a CGS.

Management/promotion issues
There is the possibility of erecting a signboard in the vicinity to mark the site (potentially in Aghnacliff Village, where there is a small heritage park), given its historical importance.

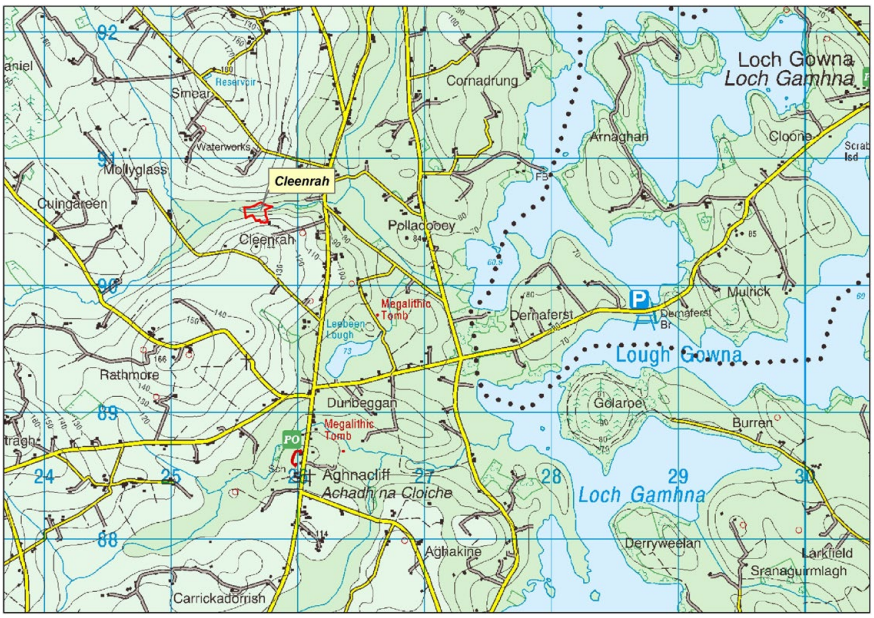


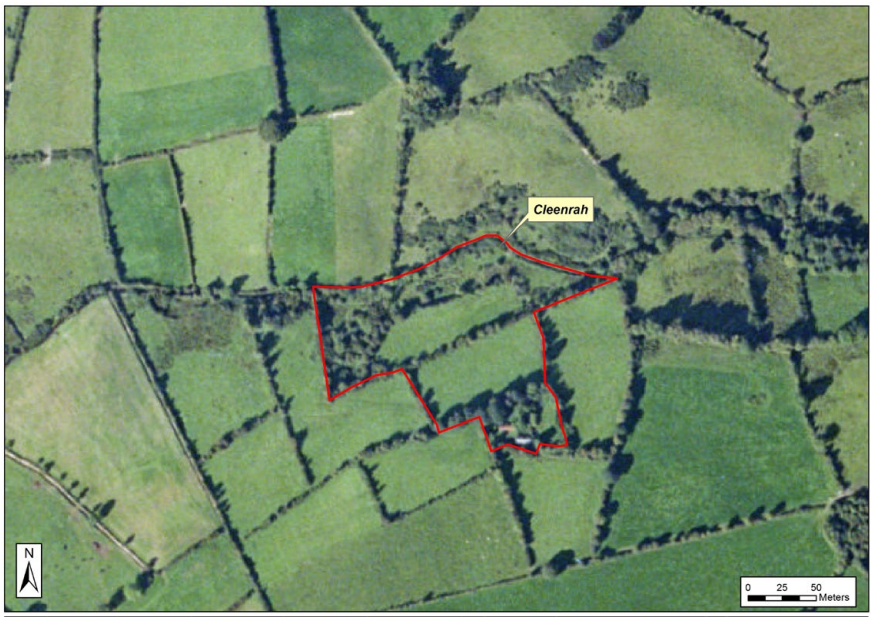
The Cleenrah Mine site, looking northwest.

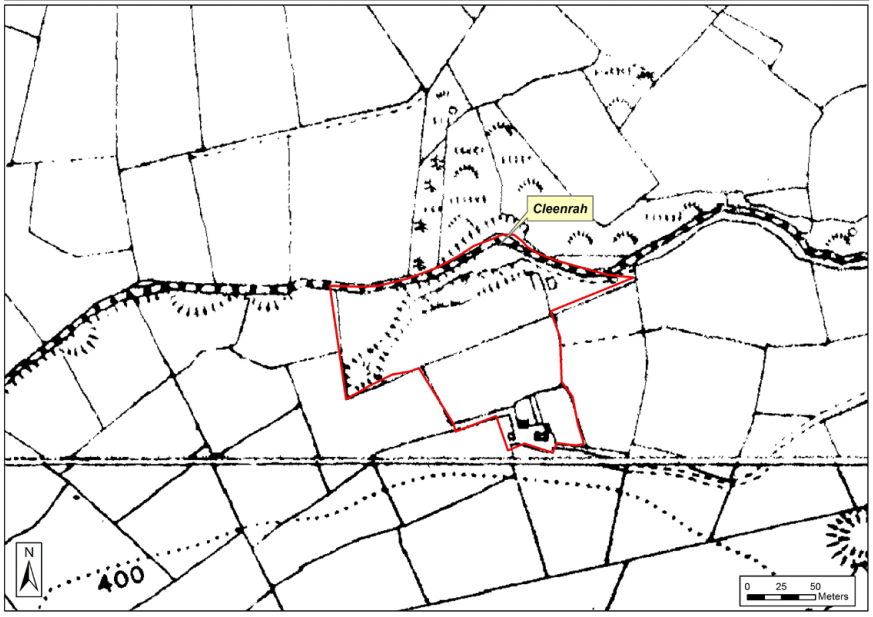
Looking south-southwestwards along the deep chasm cut into the hillside, where the mine entrance lies.

Haematite boulders can be seen throughout the site; here in the stream exiting the main mine cavity.

The cottages along the entrance are of unusual construction, and may be old mine buildings or offices.


Loch Gowna
Loch Gamhna
Cornadrung
Arnaghan
Cloone
Waterworks
Reservoir
Smear
Mollyglass
Cleenrah
Culingareen
Cleenrah
Pollacobbey
Megalithic Tomb
Lesbeen Lough
Dernaferst
Mulrick
Derrynafeest Br
Lough Gowna
Rathmore
Dunbeggan
Megalithic Tomb
Golaroe
Burren
Aghnacliff
Achadh na Cloiche
Loch Gamhna
Aghakine
Derryweelan
Larkfield
Sranagurmlagh
Carrickadorrish


Cleenrah
N
0 25 50
Meters


Cleenrah
N
400
0 25 50
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Cloghchurnel Esker and Fan**
Other names used for site	Ballywillin Esker
IGH THEME	**IGH7 Quaternary**
TOWNLAND(S)	**Cloonbeen, Cloghchurnel, Ballywillin**
NEAREST TOWN/VILLAGE	**Granard**
SIX INCH MAP NUMBER	**7, 11**
NATIONAL GRID REFERENCE	**634640E 784280N (centre of feature)**
1:50,000 O.S. SHEET NUMBER	**34 GSI BEDROCK 1:100,000 SHEET NO. 12**

Outline Site Description
The Cloghchurnel Esker and fan includes a large accumulation of sands and gravels deposited both under the ice sheet and at its margin as the ice withdrew northwestwards across north Longford at the end of the last Ice Age.

Geological System/Age and Primary Rock Type
The Cloghchurnel Esker and Fan are formed within an area dominated by bedrock of Silurian Metasediments and Volcanics, with some Lower Carboniferous limestone bedrock at the southeastern end of the feature. The esker itself is Quaternary in age, having been deposited either under or at the edge of the northwestward-retreating ice sheet during deglaciation, approximately 14,000 years ago.

Main Geological or Geomorphological Interest
Where present, the esker ridge is a striking feature, standing proud of the flat landscape of till (boulder clay) upon which it was deposited. Intact portions along the main R194 road northeast of Granard, and within Cloghchurnel Townland, are especially impressive. In both localities the esker is comprised of a raised, elevated ridge of sands and gravels.

The esker feature is important in that it records faithfully the ice movement across this area of northeast Longford which is along its orientation, *i.e*. northwest to southeast. Associated sands and gravels in Cloghchurnel and Ballywillin Townlands, flanking the esker, are probably part of an associated ice marginal fan. The sands and gravels within the feature are comprised chiefly of shale and sandstone clasts.

Site Importance – County Geological Site
What remains of the feature is still a high, striking example of a dry sand and gravel ridge, which stands proud of the surrounding landscape. This esker and the associated sands and gravels in the locality are a good example of a deglacial, meltwater-deposited complex, with portions deposited under the ice, and portions at the ice margin.

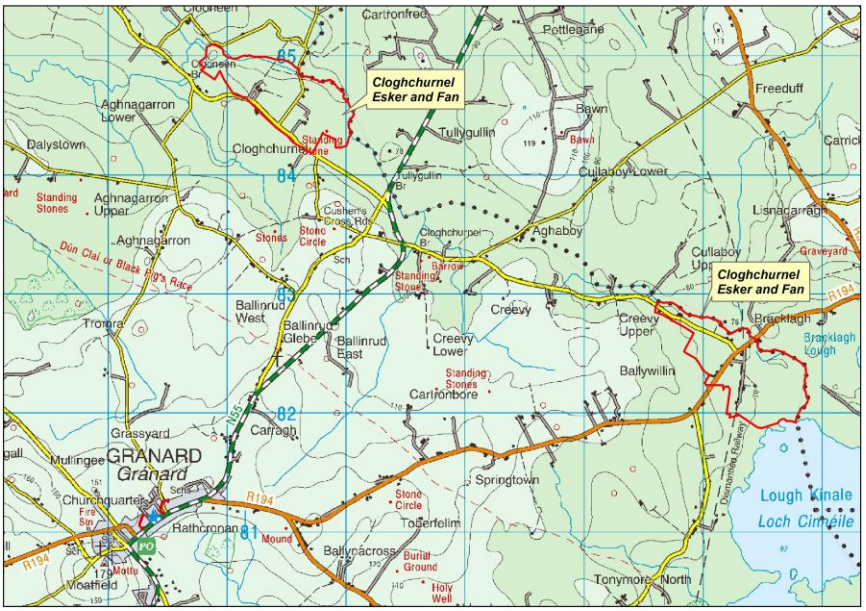
Management/promotion issues
This system comprises a well-defined landform sequence and should be listed as a County Geological Site. A signboard along the R194 road, where the feature can be well seen, might help promote the feature.

The Cloghchurnel Esker, looking southeast. See the high, elevated nature of the ridge.

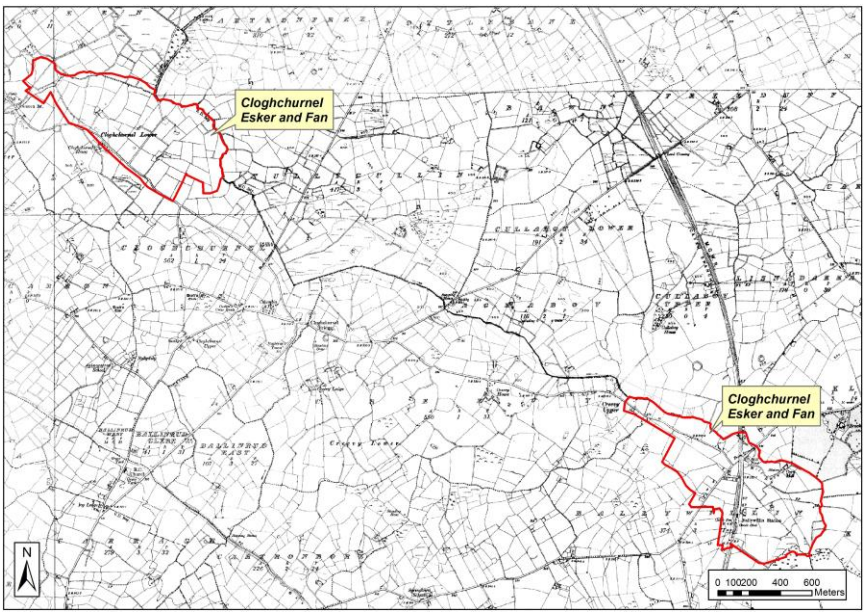
Looking northwestwards from Cloghchurnel Townland along the esker ridge.

Some of the hummocky terrain where the esker and fan meet.

A portion of the (well drained) fan sands and gravels ‘rising out’ of flat, poorly drained alluvium.


Cloghchurnel
Esker and Fan
Cartronfree
Pottlegane
Freeduff
Aghnagarron
Lower
Dalystown
Tullygullin
Bawn
Cullaboy Lower
Aghnagarron
Upper
Standing
Stones
Stone
Circle
Aghaboy
Lisnagarragh
Graveyard
Cullaboy
Upper
Brocklagh
Brocklagh
Lough
Ballinrud
West
Ballinrud
Glebe
Ballinrud
East
Creevy
Creevy
Lower
Creevy
Upper
Ballywilin
Carrontbore
Tromra
Grassyard
GRANARD
Granard
Mullingee
Carragh
Springtown
Churchquarter
Rathcronan
Toberfelim
Ballynacross
Burial
Ground
Holy
Well
Moatfield
Tonymore North
Lough Kinale
Loch Cinnéile
Dismantled Railway
N55
R194
PO
82
81


Cloghchurnel
Esker and Fan
Cloghchurnel
Esker and Fan
N
0 100200 400 600
Meters


Cloghchurnel
Esker and Fan
Cloghchurnel
Esker and Fan
N
0 100200 400 600
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Corlea Trackway**
Other names used for site	*Bóthar Chorr Liath, the Danes' Road*
IGH THEME	**IGH7 Quaternary, IGH15 Economic Geology, IGH16 Hydrogeology**
TOWNLAND(S)	**Cloonbreaney**
NEAREST TOWN/VILLAGE	**Keenagh**
SIX INCH MAP NUMBER	**22**
IRISH GRID REFERENCE	**610205E 762540N (trackway in visitor centre)**
1:50,000 O.S. SHEET NUMBER	**40 GSI BEDROCK 1:100,000 SHEET NO. 12**

Outline Site Description
The Corlea Trackway is an Iron Age trackway, or *togher*, near the village of Keenagh, which was constructed from oak planks in 148–147 BC.

Geological System/Age and Primary Rock Type
The Corlea Trackway is situated within an area dominated by bedrock of Lower Carboniferous limestone. The trackway itself is set in peat which is Quaternary in age, having formed as an extensive envelope of the landscape in the area since deglaciation, and mostly approximately 7,000-10,000 years ago.

Main Geological or Geomorphological Interest
The trackway is situated in an area harvested for peat on an industrial-scale by Bord na Móna, principally to supply the peat-fired power stations of the ESB. While today a generally flat and open landscape, the locality was covered by bog, marsh, quicksand, and ponds in the Iron Age, and surrounded by dense woodlands of birch, willow, hazel and alder. Higher ground was underlain by mineral soil, some distance away, and was covered by oak and ash. The terrain was dangerous and impassible for much of the year.

In 1984, timbers recovered from Corlea were radiocarbon dated to the Iron Age (rather than the Bronze Age as had been expected), and an archaeological project was established under Professor Barry Raftery of UCD to investigate the site before it was destroyed by peat-digging. Excavations to 1991 revealed 59 *toghers* in an area of around 125 hectares, and further work has raised the total to 108 with a further 76 in the nearby Derryoghil bog. Dating has shown that the Corlea Trackway was itself constructed in a single year.

The Corlea Trackway was approximately 1 kilometre long and ended on a small island, from which a second trackway connected to dry land on the far side of the bog. The purpose of the trackway is uncertain, but may have served to get to or into the bog, perhaps for ritual purposes, rather than merely to cross it. Whatever its purpose, the roadway was usable for only a few years. This disappearance of the feature gives the site its geological interest, as it was gradually covered by the rising bog, and sank under its own weight into it within a decade.

The site has a visitor centre where audio-visual records of the trackway and its archaeological excavation process are shown, along with an actual preserved section of the trackway. Other features of peat interest are included within the site boundary, such as intact and drained peat, industrially-cutover peat, peat cut by locals, wetlands, and recovering peat.

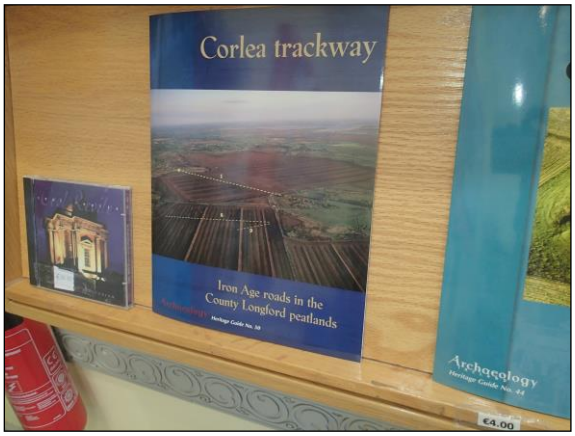
Site Importance – County Geological Site
As the various forms of peat are all accessible within a small locality, and as the trackway (and its visitor centre) exists due to the geological and hydrogeological process of peat growth, the locality is ranked as a County Geological Site.

Management/promotion issues
The Corlea Trackway Visitor Centre is run by the Office of Public Works. The geological aspects of the feature could be highlighted more in some of the promotional material.

The preserved portion of trackway inside the visitor centre.

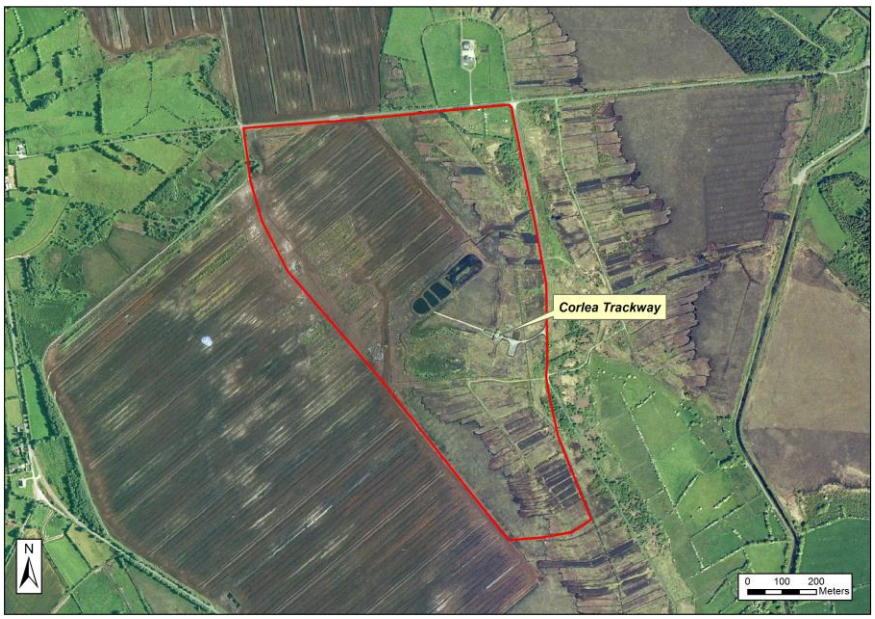
Recovering peat in wetlands adjacent to the centre.

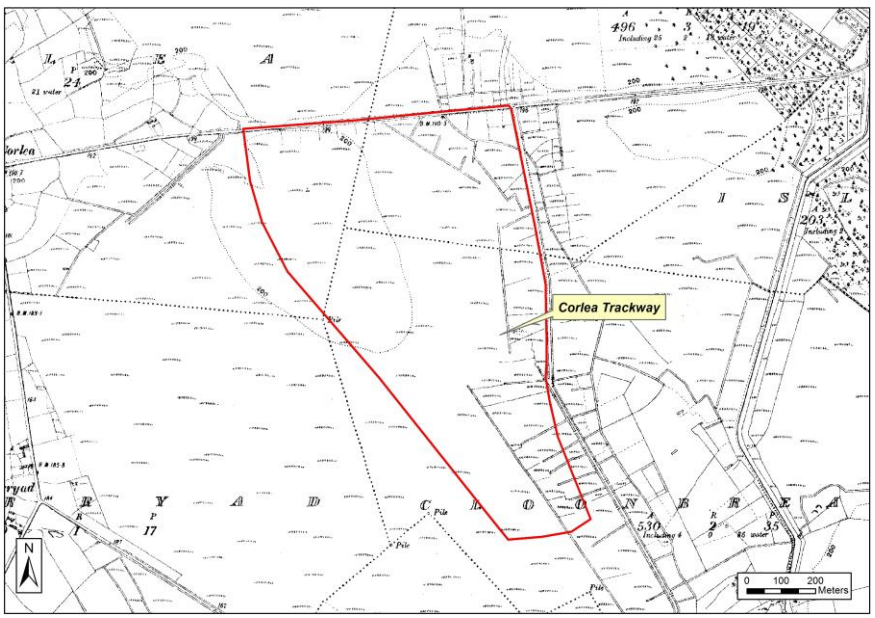
Stacked peat on plots harvested by locals.



Some of the promotional material on the trackway on sale inside the visitor centre.


Derrynaskea
Coolnahinch
Coolnahinch Br
Shrubborough
Stonepark
Well
Mosstown
Aghnacranagh
Cartrons
Sch
Mosstown
PO
Mosstown
Keenagh
Caonach
Island Br
Corlea
Keenagh
R397
Island
Corlea Trackway
Visitor's Centre
Croagh
Laughil
Derryad
Cloonbreany
Laughil
Cloonbreany Br
Kilcommock Glebe
Church
Cart
Kilcommock Glebe
Derryveagh


Corlea Trackway
N
0 100 200
Meters


Corlea Trackway
N
0 100 200
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Creeve Quarry**
Other names used for site	
IGH THEME	**IGH8 Lower Carboniferous**
TOWNLAND(S)	**Creeve**
NEAREST TOWN/VILLAGE	**Longford**
SIX INCH MAP NUMBER	**14**
NATIONAL GRID REFERENCE	**618270E 776200N**
1:50,000 O.S. SHEET NUMBER	**41 GSI Bedrock 1:100,000 Sheet No. 12**

Outline Site Description
A long disused quarry with adjacent wooded knoll of exposed rock.

Geological System/Age and Primary Rock Type
The quarry and the adjacent natural knoll show a section of Lower Carboniferous (Viséan) limestone rocks extending upwards from the upper part of the Tober Colleen Formation (basal Calp limestone) into thicker beds of the Lucan Formation, with the basal contact of an overlying Waulsortian mudmound also included.

Main Geological or Geomorphological Interest
The quarry and the adjacent natural knoll show a section of Lower Carboniferous (Viséan) limestone rocks. At the base of the quarry face the upper part of the Tober Colleen Formation (basal Calp limestone) is exposed, going up into thicker beds of the Lucan Formation, with a thin yellowish-grey volcanic ash band also recorded in the middle of the stratigraphical section.

The basal contact of an overlying Waulsortian mudmound is also included. This is seen in an isolated knoll about 100m north of the quarry, with a face of up to 4m of crinoidal limestone.

Site Importance – County Geological Site
This is a good representative exposure of the Lower Carboniferous rocks in Longford, with a variety of rock types which were formed in different settings, and is useful in a county where rocks are generally poorly exposed.

Management/promotion issues
The quarry is fenced off by the landowner from the adjacent fields used by cattle. It is quite wooded in the floor and has a ponded section adjacent to the road, but well hidden by hedges and trees, and all fenced off. It is of interest primarily to geologists.

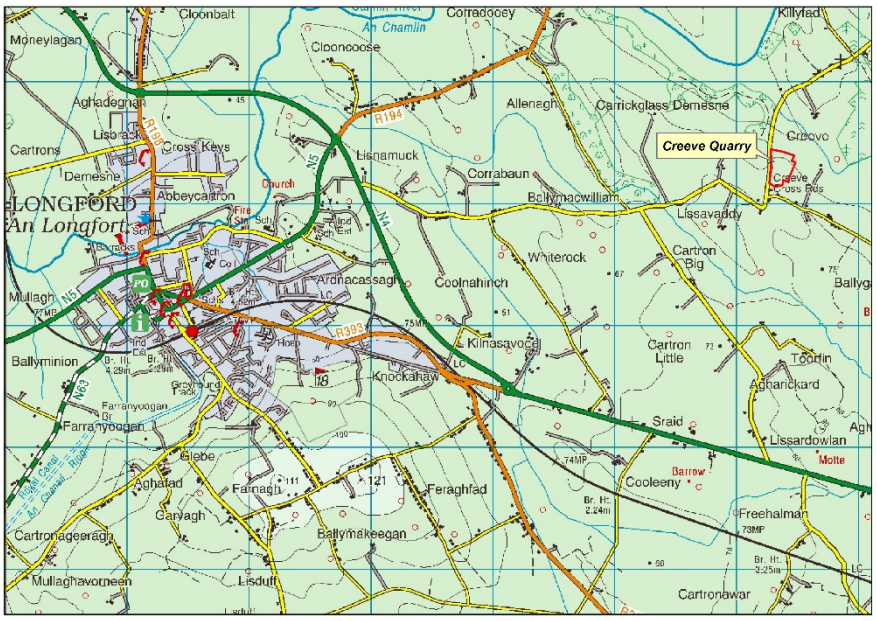
To the northeast (618490E 776400N) of the defined site there is a further section of a disused quarry which was not visited nor indicated in discussion with the landowner, and which appears to be quite shallow from the aerial photos.

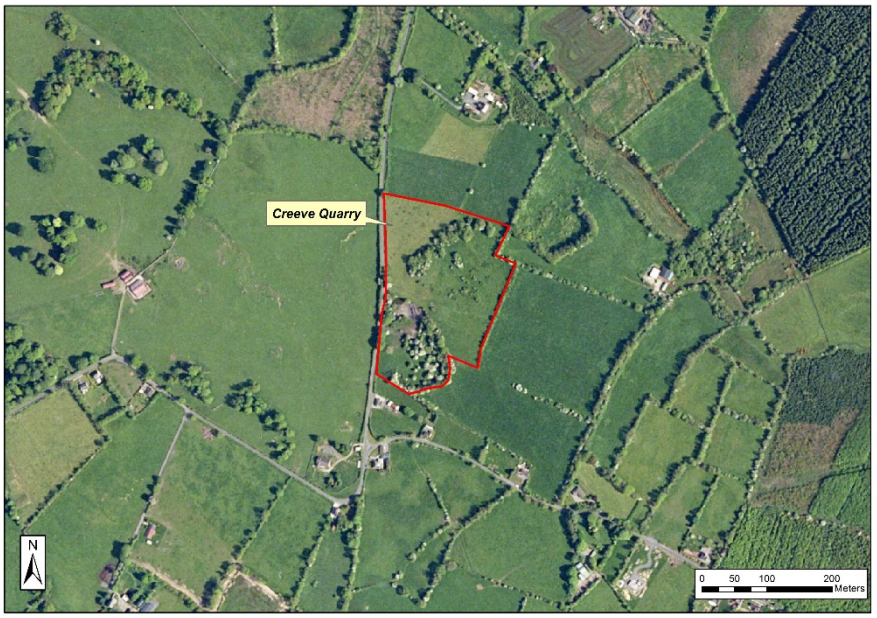
The Waulsortian mudmound exposed in the rocky knoll to the north of the quarry at Creeve.

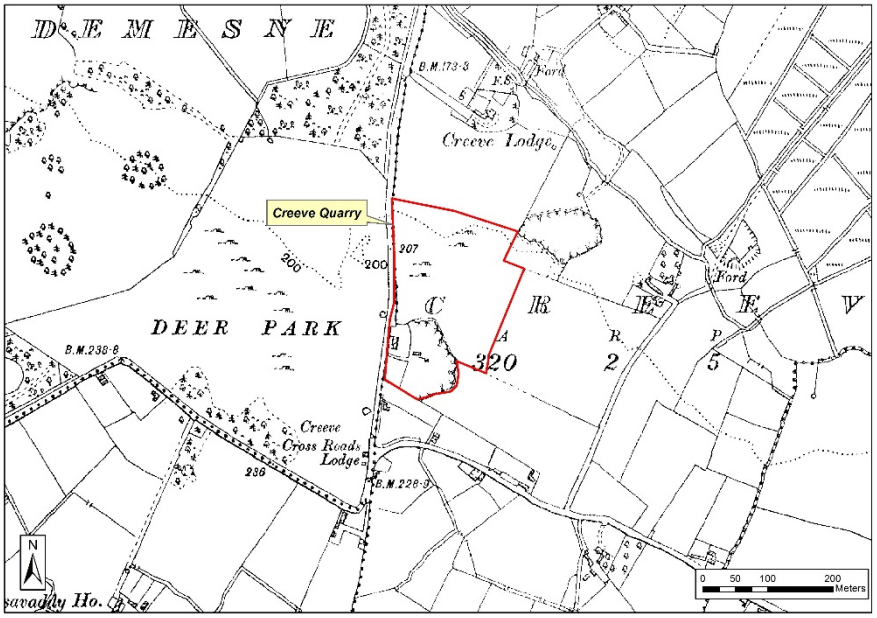
The main quarry face exposed in the quarry at Creeve, looking north.

The wooded knoll with Waulsortian mudmound north of the quarry at Creeve.

The main quarry face exposed in the quarry at Creeve, looking south.


Creeve Quarry
LONGFORD
An Longfort
Cloonbalt
Moneylagan
An Chamlin
Corradooey
Killyfad
Cloonoose
Aghadegnan
Allenagh
Carrickglass Demesne
R194
Lisnacreg
Cross Keys
Cartrons
Demesne
Lisnamuck
Creeve
Abbeycartron
Church
Corrabaun
Ballymacwilliam
Lissavaddy
Whiterock
Cartron Big
Ardnacassagh
Coolnahinch
Mullagh
R393
Kilnasavoca
Cartron Little
Ballyminion
Knockahaw
Toortin
Agharickard
Farranyoogan
Sraid
Lissardowlan
Glebe
Motte
Barrow
Cooleeny
Aghafad
Farnagh
Feraghfad
Freehalman
Garragh
Ballymakeegan
Cartronageeragh
Mullaghavorneen
Lisduff
Cartronawar


Creeve Quarry
N
0 50 100 200
Meters


DEMESNE
Creeve Lodge
Creeve Quarry
DEER PARK
B.M.238·8
Creeve Cross Roads Lodge
B.M.228·9
320
N
0 50 100 200
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE **Drumlish Quarry**
Other names used for site
IGH THEME **IGH4 Cambrian-Silurian**
TOWNLAND(S) **Lettergullion, Lettergeeragh**
NEAREST TOWN/VILLAGE **Drumlish**
SIX INCH MAP NUMBER
NATIONAL GRID REFERENCE
1:50,000 O.S. SHEET NUMBER **34** **GSI Bedrock 1:100,000 Sheet No.** **12**

Outline Site Description
An intermittently active quarry.

Geological System/Age and Primary Rock Type
The rock here is greywacke of the Coronea Formation, of Ordovician age.

Main Geological or Geomorphological Interest
This is a good representative site for the Ordovician greywacke rocks comprising the south western end of the Longford-Down inlier. Structurally this is a part of the Northern Belt, the most northerly of three main belts of ocean floor rocks that have been steeply tilted and stacked together on a very large scale. The rocks form part of the story of the closure of the Iapetus Ocean through the Ordovician and Silurian Periods and the joining of the two ‘halves’ of Ireland.

The greywacke rocks are all sedimentary rocks eroded off the land and deposited in the ocean basin as turbidites (mass flows from shallow to deep water), and hence are mixed compositions of sand and different types of rock fragments, with associated red mudstones and cherts.

Site Importance – County Geological Site
This is a good representative site for rocks that are not well exposed despite being relatively resistant to erosion and underlying some of the higher ground in the county.

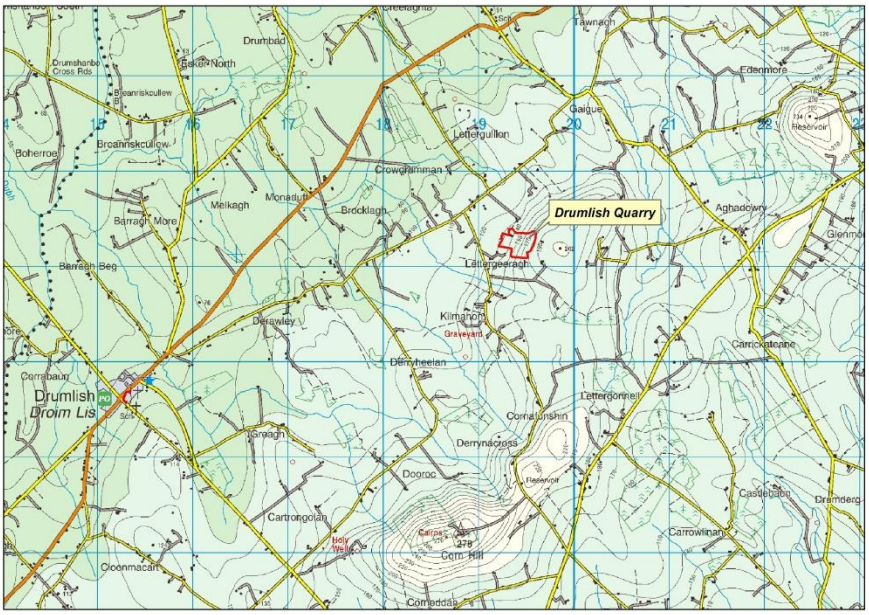
Management/promotion issues
The quarry is not operated consistently but used when demand for product requires it. The mixed nature of the rock means that it is mostly used as aggregate for concrete or as hardcore and fill for roadmaking. As a private business premises it is unsuitable for general visits or promotion.

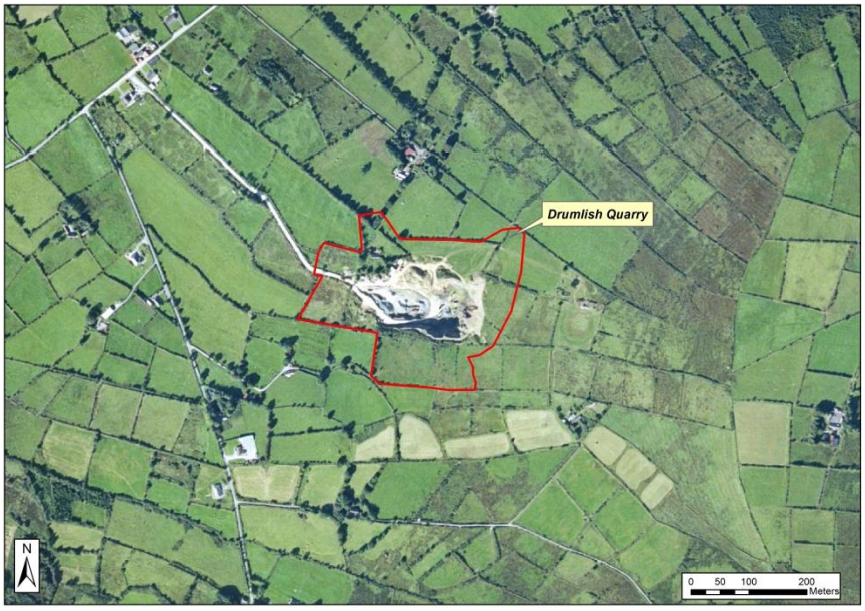
Drumlish Quarry overview.

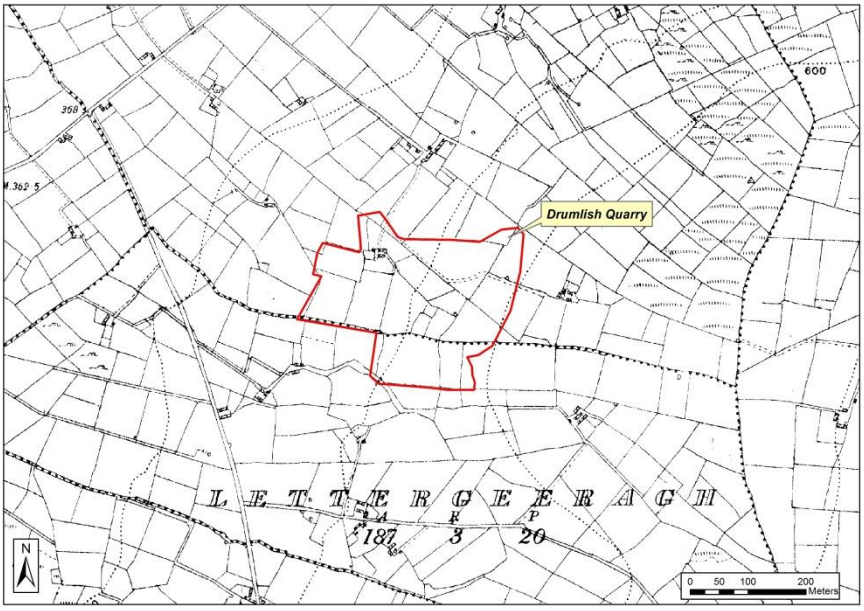
Left: Drumlish Quarry displays many red mudstone and cherty beds as well as the green coloured greywackes.

Right: The south wall of the quarry displays thin bedded turbiditic greywackes, steeply dipping and folded.

The Drumlish Quarry seen from the roadway to the northwest.


Drumlish Quarry
Drumlish
Droim Lis
Drumbad
Tawnagh
Edenmore
Gaigue
Letterguillon
Crowhammin
Monadurk
Melkagh
Brocklagh
Barragh More
Barragh Beg
Lettergeeragh
Aghadowry
Glenmore
Kilmahon
Graveyard
Derrywiley
Carricksteane
Derrybeelan
Corrabaun
Lettergonnel
Connalumshin
Derrynacross
Dooroc
Castlebaun
Dromderg
Cartrongolan
Carrowinane
Gem Hill
Cloonmacan
Comeddan


Drumlish Quarry
N
0 50 100 200
Meters


Drumlish Quarry
600
L E T T E R G E E R A G H
A 187 R 3 P 20
N
0 50 100 200
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Glen Lodge Stream**
Other names used for site	The Glen
IGH THEME	**IGH2 Precambrian to Devonian Palaeontology, IGH4 Cambrian-Silurian**
TOWNLAND(S)	**Kiltyclogh, Aghaward**
NEAREST TOWN/VILLAGE	**Granard**
SIX INCH MAP NUMBER	**9**
NATIONAL GRID REFERENCE	**622940E 782310N**
1:50,000 O.S. SHEET NUMBER	**34 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
Streambank exposures in a deep glen or gorge.

Geological System/Age and Primary Rock Type
The rocks are classified as the Glen Lodge Formation, within the Gowna Group and are of Ordovician age. They are mostly black-grey slaty rocks with some greywacke (a mixed type of sandstone with rock fragments and clay). There are also some volcanic lava and pillow lava breccia rock types. Of special interest is a small exposure of an unusual rock type which has yielded microfossils indicating that it is of Silurian (Ludlow) age.

Main Geological or Geomorphological Interest
This site is unique in Ireland as it is the sole exposure of late Silurian age sedimentary rocks in the Longford-Down zone of rocks. A fault bound section of rocks in the stream section bounding Kiltyclogh Townland has yielded an assemblage of microfossils which provides definite evidence of some of the youngest Silurian rocks in Ireland and certainly the youngest known in the Longford-Down succession. These rocks represent slivers of the ocean floor stacked together in fault bound blocks, exposed from Longford through County Down and through the Southern Uplands of Scotland. They tell part of the story of the closure of the Iapetus Ocean in the Ordovician and Silurian Periods and the amalgamation of two ‘halves’ of Ireland. The microfossils were of several different types but the spores were diagnostic of age, being comparable to Ludlow age ones from Wales.

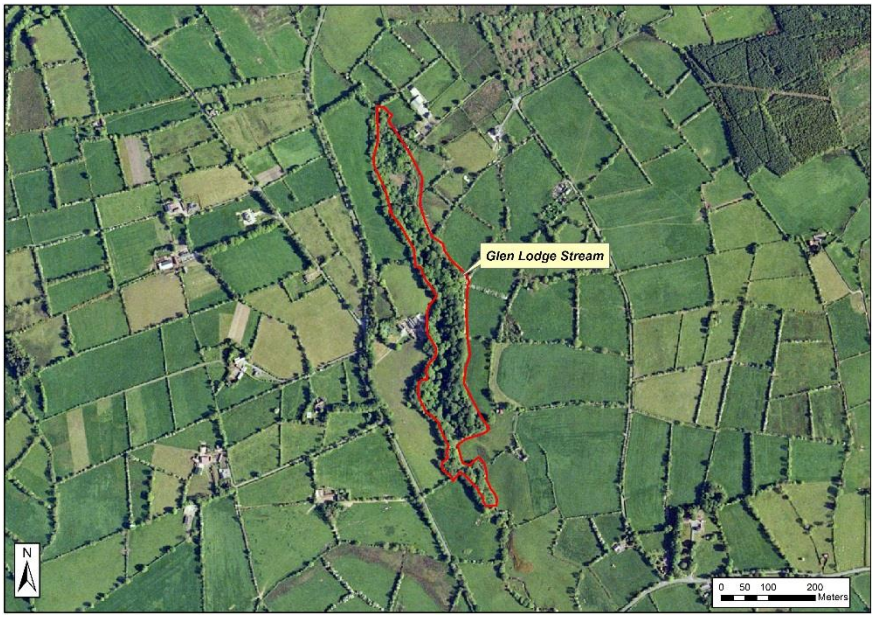
Site Importance – County Geological Site; recommended for Geological NHA
This site has already been recommended to NPWS for designation as a geological NHA. The boundary drawn here is a revised, slightly smaller version to that defined in a 2005 survey by GSI.

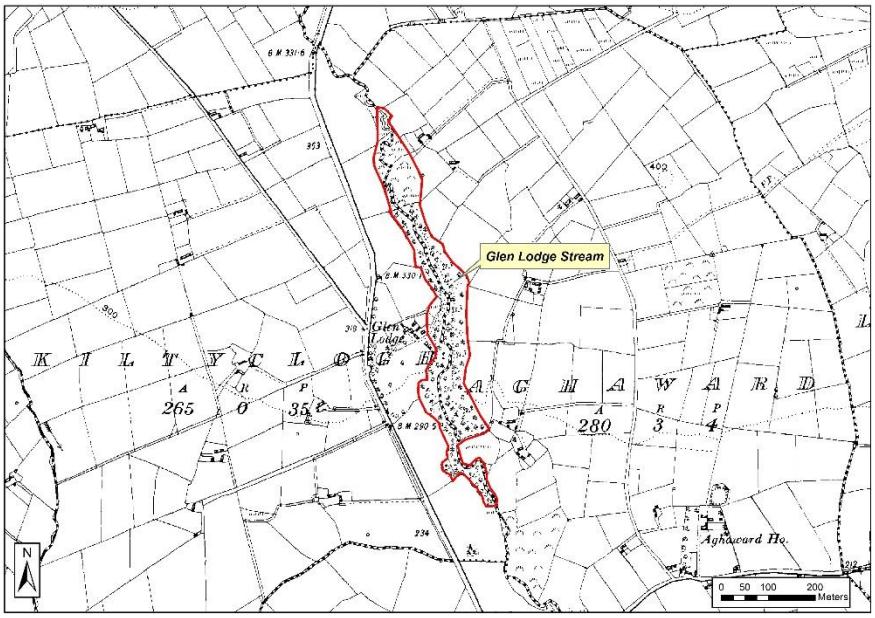
Management/promotion issues
The landowner is very proud of the Glen and would like to see the biological interest of the wooded gorge and its geological importance preserved through SAC or NHA designation. It is not under any threat from a change in land use. Access to rock exposures where fallen trees block the stream is not a significant problem, but could be incorporated into any management plan. Whilst it is of scientific interest and important, it is private woodland, and is also not suitable for general promotion due to the wild and adventurous nature of the gorge.

The gorge is variable in steepness of the sides and the amount of rock exposed in the streambed and cliffs, and some parts are much less accessible than in this image.

The exposure of Ludlow age rocks is only a few metres long, exposed in the lower section of the gorge in the site.


Glen Lodge Stream
Aghagreagh
Galshagh
Aghaward
Kilty
Lislea
Hill Town
Aghagreagh Lower
Soran
Drumnahara
Aghnashannagh
Derryncol
Kilshrulley
Knockmoody
Ballinalee
Leitrim
Camlin River
An Chamlinn
Ballinalee or Saintjohnstown
Clonbroney
School Land
Ballyreaghan
Cavan
Ballinalee
Béal Átha na Lao
Clooncoose
Currycahill
Gorteenrevagh
Tullyhaun
Kilnacarrow
Acres
Ederland
Listraghee
R194


Glen Lodge Stream
N
0 50 100 200
Meters


Glen Lodge Stream
KILTYCLOGH
Glen Lodge
265
35
AGHAWARD
280
3
4
Aghaward Ho.
N
0 50 100 200
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Keel Mine**
Other names used for site	
IGH THEME	**IGH6 Mineralogy, IGH15 Economic Geology**
TOWNLAND(S)	**Keel**
NEAREST TOWN/VILLAGE	**Longford**
SIX INCH MAP NUMBER	**19**
NATIONAL GRID REFERENCE	**617540E 766380N**
1:50,000 O.S. SHEET NUMBER	**41 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
An abandoned 1960's exploratory mine site with a capped shaft, numerous mine buildings and coresheds with discarded drill core.

Geological System/Age and Primary Rock Type
The ore body is of similar age and style to other 'Irish style' lead-zinc deposits, and was formed as a mineral deposit by mineral rich fluids within a large fault structure and perhaps penetrating into shallow sea floor sediments. This would have occurred contemporaneously with the deposition of sediments at the beginning of the Carboniferous Period, approximately 350 million years ago.

Main Geological or Geomorphological Interest
This mineral deposit was explored by boreholes and then by a shaft sunk in the mid-1960s to 585 feet depth with three exploratory levels at 200 feet, 400 feet and 500 feet depth. The deposit was proven, but at 1.85 million tons at 7.71% zinc it was too small for economic production compared to Silvermines in Tipperary and Tara Mine in Meath which were beginning around the same time. So no production of ore really took place at Keel, and in 1968 Rio Tinto closed it down,

The mineralogy is of honey coloured sphalerite (zinc sulphide) primarily within a pebble conglomerate, but other minerals such as lead, silver (as the mineral jalpaite) and cadmium occur also. Some examples can be found in the small amounts of spoil heap or abandoned drill core on the site.

Site Importance – County Geological Site
This is not a major centre of mine heritage value, but is an interesting example of a mine site that never was in full production, and worth recognition as a CGS in Longford.

Management/promotion issues
The State owns the mineral rights here, having acquired them in 1963, and through the Exploration and Mining Division has responsibility for the safety of the shaft. It was concrete lined and is capped. The State does not own the site, and the landowner is unknown. Several different owners may be involved since a dwelling has been built very close to the capped shaft and some former mine buildings are now used as garages or farm sheds. Others are derelict and fenced off. Forestry has been planted over much of the site surrounding the core buildings. A portable jaw crusher was located close by but is now lost, presumably in the forestry. The site is not suitable for promotion to or access by the public as it is private land.

The abandonment plans, as required by law, were lodged with the Geological Survey of Ireland. They are now freely accessible, along with a large archive of maps and documents about Keel Mine, on the following website: https://secure.dcenr.gov.ie/goldmine/. Using the search terms 'Keel Mine Longford' will find the material which includes a photographic record of the site.

The former hoist house with the capped shaft in the foreground.

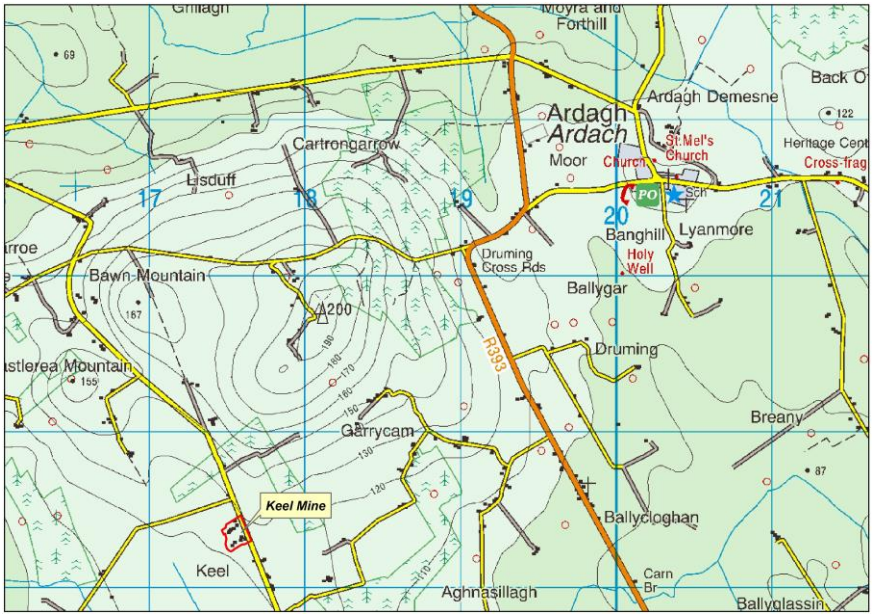

Long abandoned drill core inside a shed is now just a reminder.

The former Administration Block is now derelict.

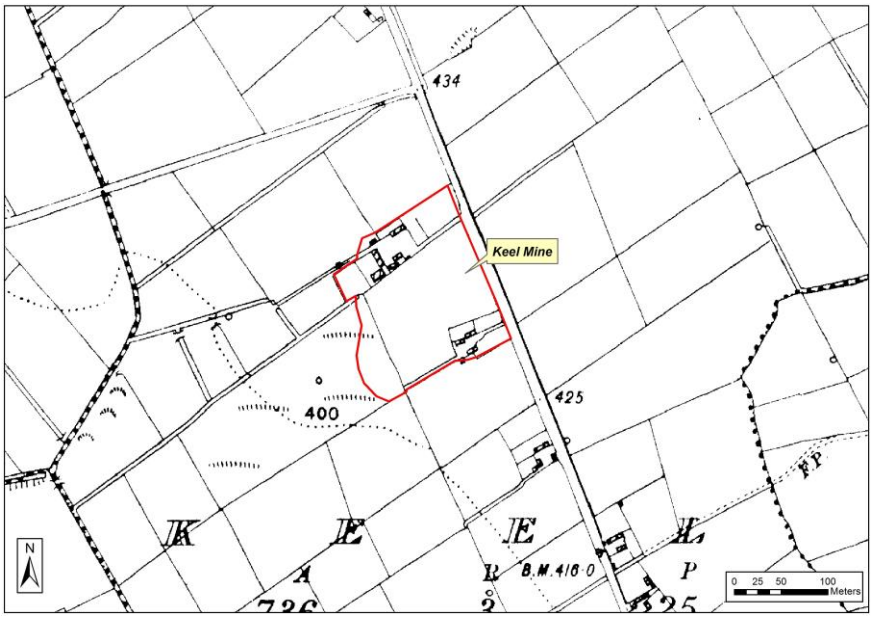
From the roadside alongside the Keel Mine site, mine workshops are now farm buildings.

Workshops and a crude timber wall and platform for loading onto lorries.

A new dwelling house is built in the centre of the site close to the shaft.

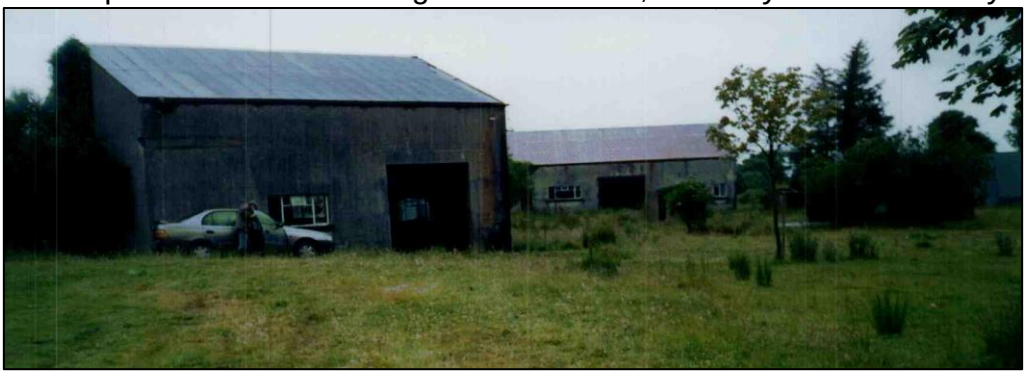

Keel Mine
Ardagh
Ardach
Ardagh Demesne
Cartrongarrow
Lisduff
Bawn Mountain
Banghill
Lyanmore
Ballygar
Druming
Garrycam
Breany
Ballycloghan
Keel
Aghnasillagh
Ballyglassin
Moor
Church
Holy Well
Druming Cross Rds
R393
Carn
Br
17
18
19
20
21
200


Keel Mine
N
0 25 50 100
Meters


Keel Mine
434
425
400
N
0 25 50 100
Meters

Historical pictures of Keel Mine site reproduced from the Historic Mine Records of the Geological Survey of Ireland, and in Lally, P. 2002. Salvaging minesites – the case of Keel. *Journal of the Mining Heritage Trust of Ireland* **2**, 3-7.

Aerial photo of the site during the late 1960s, taken by Charles Morley.



The winding house and mechanical workshop beyond taken in 2002.

The portable jaw crusher taken in 2002, now in the forestry.

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Killoe Quarry**
Other names used for site	Rhyne Rock Ltd.
IGH THEME	**IGH8 Lower Carboniferous**
TOWNLAND(S)	**Rhine**
NEAREST TOWN/VILLAGE	**Longford**
SIX INCH MAP NUMBER	**9**
NATIONAL GRID REFERENCE	**619500E 780000N**
1:50,000 O.S. SHEET NUMBER	**41 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
A large working quarry.

Geological System/Age and Primary Rock Type
The quarry is in the Lucan Formation, of Viséan (Lower Carboniferous) age.

Main Geological or Geomorphological Interest
This quarry is a very large one, exposing the Lucan Formation at the western fringes of the basin that extended across to Dublin at the time it was deposited. The beds are relatively thin but there is less shale between the beds than in other parts of the basin. The strata are sub horizontal and little disturbed. Although not easily accessible, the depth of the quarry shows the great thickness of limestone beds. There is very little karstification here with no dolines or significant infilled cave passages apparent. However, on the southeastern side of the quarry there is very thick overburden and the limestone is therefore much deeper below the surface than expected, which curtailed expansion of the quarry in that direction.

Production of limestone from here is mostly used as aggregate for concrete, hardcore, roadmaking, fill and similar uses.

Site Importance – County Geological Site
This is a good representative site for the Lower Carboniferous limestone rocks in Longford, which are poorly exposed in the county other than in quarries.

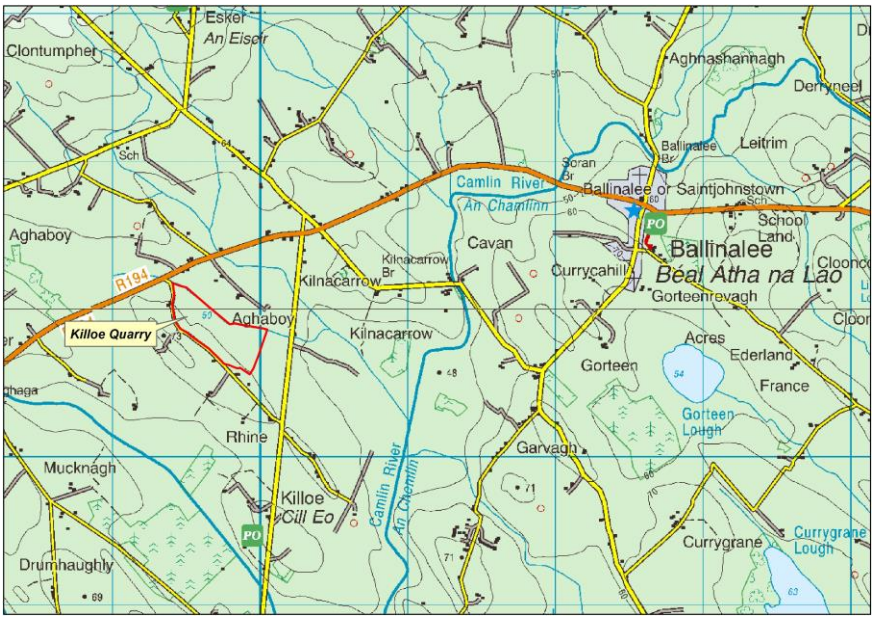
Management/promotion issues
The quarry is a working environment with its inherent dangers and is unsuitable for general promotion or visits, without the permission of the owners and operators.

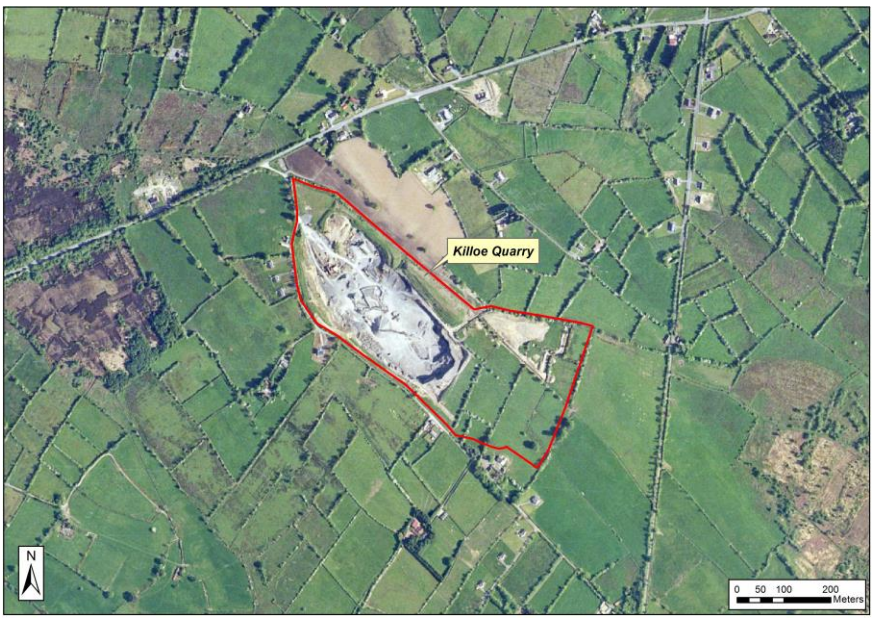
Panorama view of Killoe Quarry from the southeast end looking northwest.

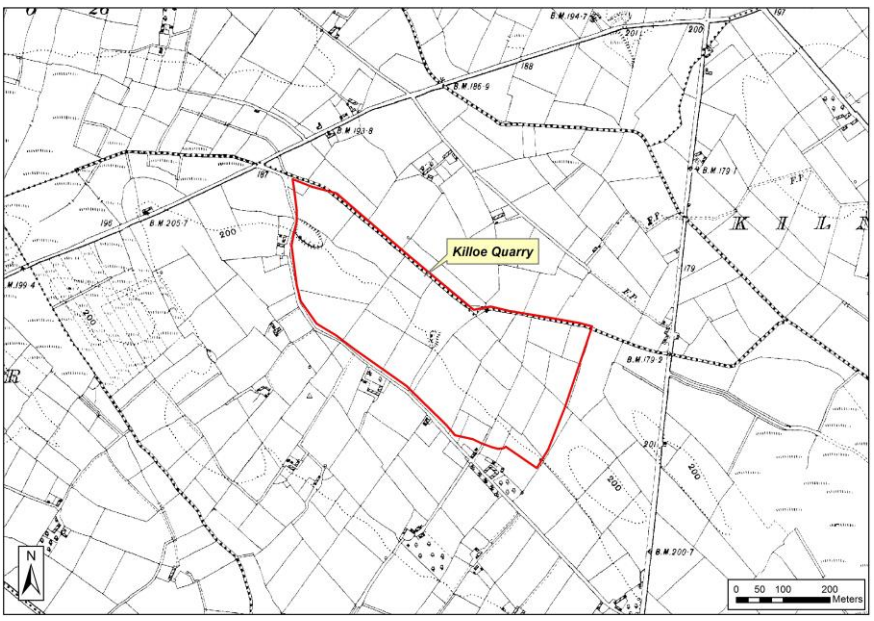
Panorama view of Killoe Quarry from the northwest end looking southeast.

Panorama view of the Killoe Quarry looking east to the thick overburden on the SE margin.

View of the Killoe Quarry looking into the deepest working face.


Esker
An Eiscir
Clontumpher
Aghnashannagh
Derryneel
Leitrim
Ballinalee Br
Soran Br
Camlin River
An Chamlinn
Ballinalee or Saintjohnstown
School Land
PO
Ballinalee
Béal Átha na Lao
Aghaboy
Cavan
Kilnacarrow Br
Kilnacarrow
Currycahill
Gorteenrevagh
R194
Killoe Quarry
Aghaboy
Kilnacarrow
Acres
Ederland
Gorteen
France
Gorteen Lough
Rhine
Garvagh
Mucknagh
Killoe
Cill Eo
Camlin River
An Chamlinn
Currygrane
Currygrane Lough
Drumhaughly


Killoe Quarry
N
0 50 100 200
Meters


Killoe Quarry
N
0 50 100 200
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Lough Kinale and Derragh Lough**
Other names used for site	
IGH THEME	**IGH7 Quaternary, IGH14 Fluvial and Lacustrine Geomorphology**
TOWNLAND(S)	**Ballywillin, Springtown, Tonymore North, Tonymore South, Derragh (Longford), Finnea, Kilgolagh (Westmeath)**
NEAREST TOWN/VILLAGE	**Abbeylara (Longford), Finnea (Westmeath)**
SIX INCH MAP NUMBER	**11**
IRISH GRID REFERENCE	**638900E 781200N (centre of feature)**
1:50,000 O.S. SHEET NUMBER	**34, 41 GSI BEDROCK 1:100,000 SHEET NO. 12**

Outline Site Description
Lough Kinale is a lake covering 250 hectares of open water, with two main basins, almost separated by swamp formations. Derragh Lough is a smaller (35 ha) companion lough to the southeast. They are separated by a peninsular area of well drained land, known as 'Derragh Island'.

Geological System/Age and Primary Rock Type
The lakes lie in a trough of Lower Carboniferous limestone bedrock. The lake themselves are Quaternary in age, having been scoured out of the bedrock and pre-existing sediment by ice during the last Ice Age, approximately 20,000 years ago.

Main Geological or Geomorphological Interest
Lough Kinale and Derragh Lough were studied extensively by the Lake Settlement Project of the Discovery Programme, which is funded by the Heritage Council, in the early 2000's, as they are soft-bed lakes that were likely to provide good environmental information. Lough Kinale had previously been shown to have Mesolithic remains, and the lake has three fine crannogs within.

Detailed analyses completed on stratigraphy and geomorphology, as well as pollen, plant macrofossil, diatom, chironomid, testate amoebae and coleopteran analyses, have provided detailed information about the regional and local environmental history of the Lough Kinale-Derragh Lough area since the early Mesolithic. A rise in lake levels during the Mesolithic has been seen from the stratigraphic work, showing that the lake(s) were much more extensive than today. Water levels then fell during the Neolithic, and the retreat of the lakes allowed the development of fen and subsequently moss peat.

This multi-stranded approach therefore provides a very comprehensive picture of environmental change.

Site Importance – County Geological Site
The multi-stranded nature of this study has shown the advantage of using a range of techniques in combination to provide a comprehensive database with few complications in terms of interpretation. On this basis, and as much of the work was stratigraphical and geomorphological, the site is recommended as a County Geological Site.

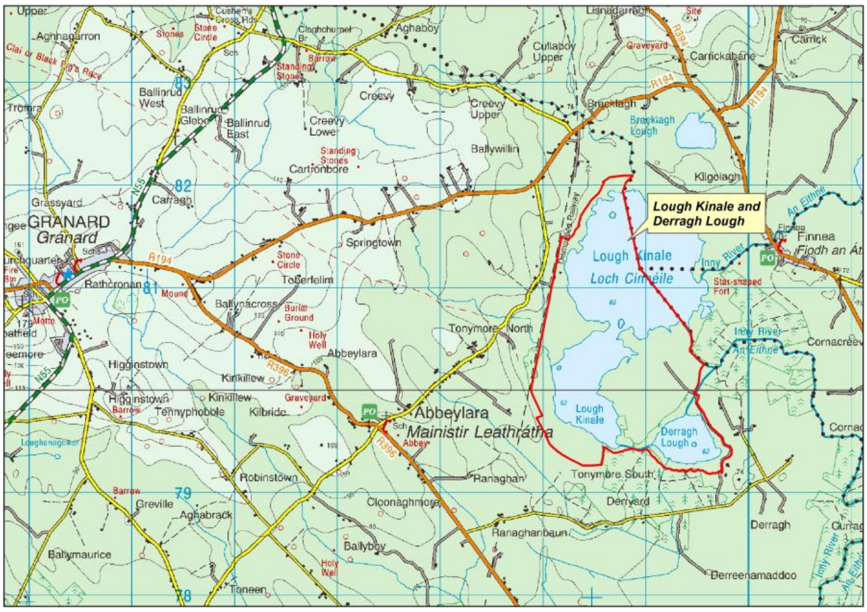
Management/promotion issues
A signboard at the lakes, which are popular with fishermen, which highlights the environmental significance of the studies conducted into the locality, might help promote the features.

Lough Kinale, looking east from ‘Derragh Island’.

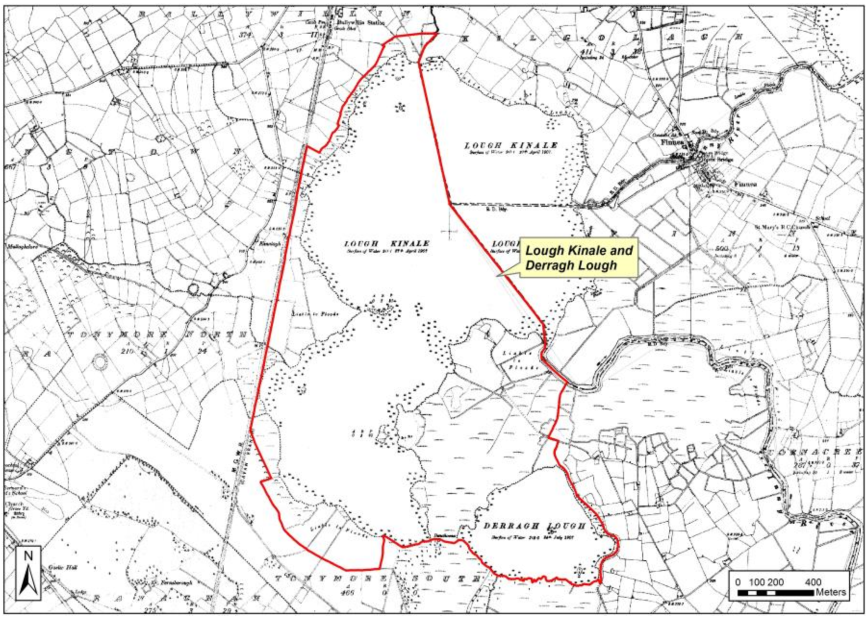
The ridge that forms ‘Derragh Island’ between Lough Kinale and Derragh Lough.

Some of the raised peat between the two lakes.

Layers of peat interspersed with lake clays, from a peat core into the lake (2005).


Lough Kinale and Derragh Lough
GRANARD
Granard
Abbeylara
Mainistir Leathratha
Lough Kinale
Loch Cimeile
Derragh Lough
Finnea
Fiodh an Átha
Inny River
An Eithne
Bracklagh Lough
Tonymore North
Tonymore South
Springtown
Rathcronan
Ballynacross
Kinkillew
Higginstown
Robinstown
Cloonaghmore
Ranaghan
Ranaghanbaun
Derryerd
Derragh
Derreenamaddoo
Ballyboy
Toneen
Greville
Aghabrack
Ballymaurice
Ballywillin
Kilgolagh
Bracklagh
Creevy
Creevy Upper
Creevy Lower
Cartronbore
Carragh
Grassyard
Ballinrud West
Ballinrud East
Aghnagarron
Aghaboy
Cullaboy Upper
Carrickabane
Carrick
Cornacreeve
Lisnadarragh
Tromra
Toberfelim
Kilbride
Tennyphobble
Stone Circle
Standing Stones
Burial Ground
Holy Well
Graveyard
Abbey
Mound
Motte
Barrow
Star-shaped Fort
R194
R396
N55
PO


Lough Kinale and Derragh Lough
N
0 100 200 400
Meters


Lough Kinale and Derragh Lough
LOUGH KINALE
DERRAGH LOUGH
TONYMORE NORTH
TONYMORE SOUTH
Finnea
N
0 100 200 400
Meters

LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Mullawornia Quarry**
Other names used for site	Terlickeen, Tirlickeen
IGH THEME	**IGH8 Lower Carboniferous, IGH3 Carboniferous - Pliocene Palaeontology**
TOWNLAND(S)	**Mullawornia**
NEAREST TOWN/VILLAGE	**Ballymahon**
SIX INCH MAP NUMBER	**22, 26**
NATIONAL GRID REFERENCE	**613000E 759040N**
1:50,000 O.S. SHEET NUMBER	**41 GSI Bedrock 1:100,000 Sheet No. 12**

Outline Site Description
A disused limestone quarry adjacent to the Royal Canal and the Ballymahon-Lanesborough road.

Geological System/Age and Primary Rock Type
Massive and bedded limestone of Waulsortian carbonate, fossiliferous mudmounds that formed on the seafloor around 340 million years ago (Ma). These Waulsortian facies rocks are part of the Cruicetown Group of Lower Carboniferous age.

Main Geological or Geomorphological Interest
Waulsortian carbonate mud banks occupied large areas of Ireland in the Lower Carboniferous (358-323 Ma). These mudmounds formed by the accretion of carbonate muds in bank beds of up to 1 metre or more in thickness and up to hundreds of metres in lateral extent. The quarry is excavated in a large, elongate, knoll-form bank. A range of depositional dips have been recorded at Mullawornia (*c*. 20° up to 45°), which is consistent with average slopes of knoll-form banks in Ireland of around 20° - 25°.

Mud-rich/calcite-rich layers identified in the quarry faces exhibit way-up structures (geopetal indicators) that indicate the depositional slopes on the bank margins. Stromatactid cavities and sheet spars are well represented in the quarry rocks.

Fossilised nautiloids (molluscs) identified in the quarry rocks at Mullawornia have provided an independent means of accessing the bathymetry and depth of formation of carbonate mudmounds, compared to conventional sedimentological studies. The results of these palaeontological studies indicate sea water depths of 65m-170m at the time the mounds were formed.

Solid bitumens, the residues of migrating hydrocarbons, have also been identified in calcite veins at the quarry.

Site Importance – County Geological Site
This is an important site for the research conducted on the depth of Waulsortian carbonate mudmounds.

Management/promotion issues
The quarry is disused. Old quarry sheds are now used to store bales of hay. Dumping and the burning of waste is a persistent problem on the quarry floor. The fossils that make the site so important are not easily identifiable in the exposed quarry face. Coupled with the issue of dumping in the quarry, the site is presently not suitable for public promotion. However, access should be maintained if at all possible for scientific study. The Record of Monuments and Places (SMR) lists an ‘enclosure’ (LF022-047) in the site of the quarry, which was also the location of a Trig point (307 feet). A report in 1976 (SMR file) recorded a raised oval area around 15 metres diameter enclosed by a bank of earth and stone. These features are no longer present due to quarrying.

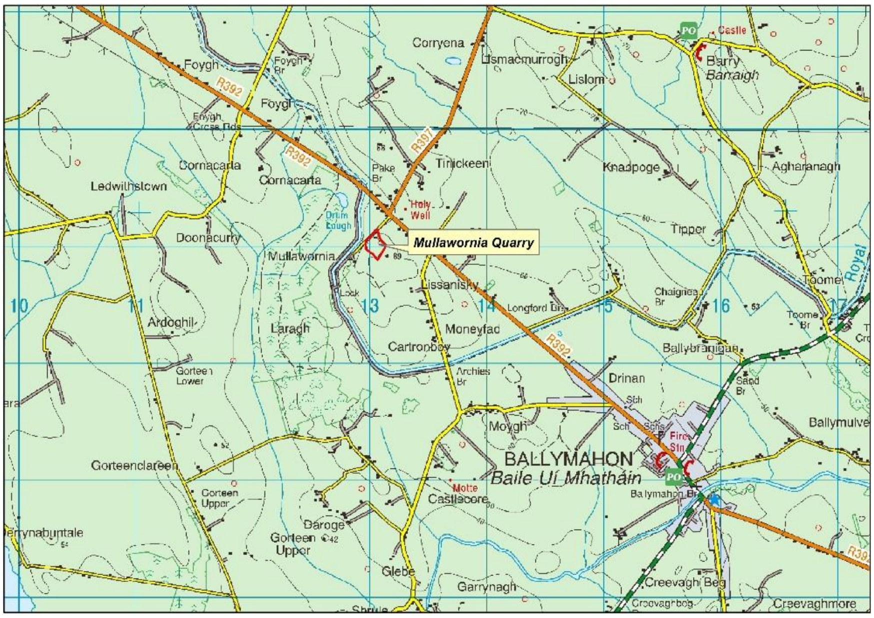
Mullawornia quarry viewed from road looking south.

Bull rushes in ponded area on quarry floor.

Mullawornia quarry viewed from road.

Rubbish burning on quarry floor (15/07/2015).

Carbonate mudbank rocks on east quarry face.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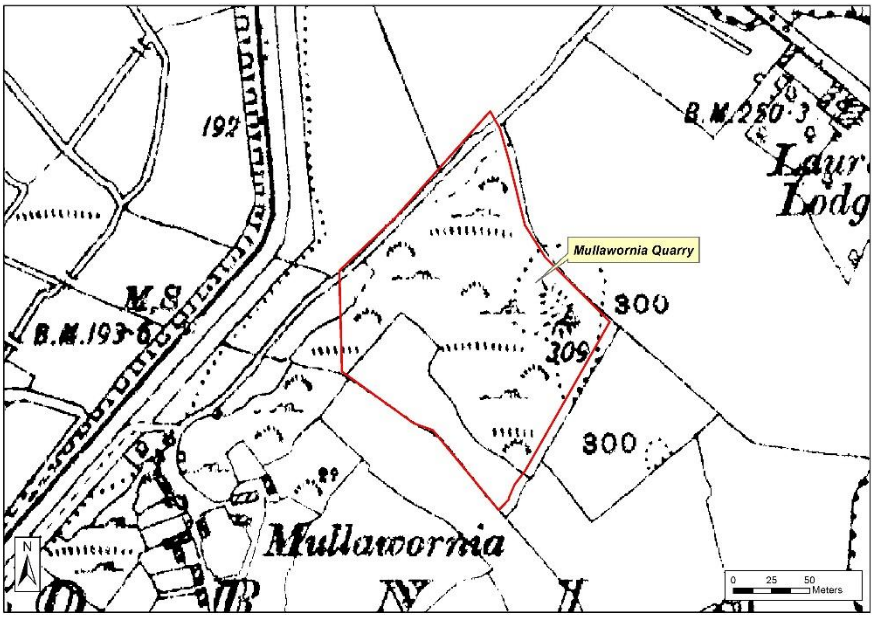
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LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**Newtowncashel**
Other names used for site	Ballyreevagh Quarry, Ballyreeve, Ballyrevagh, Quarry Park
IGH THEME	**IGH8 Lower Carboniferous**
TOWNLAND(S)	**Ballyrevagh**
NEAREST TOWN/VILLAGE	**Newtowncashel**
SIX INCH MAP NUMBER	**25**
NATIONAL GRID REFERENCE	**604280E 759350N**
1:50,000 O.S. SHEET NUMBER	**40 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
A disused limestone quarry rehabilitated to a community park after the year 2000, now celebrating the quarry's heritage in sculpture and rock carvings.

Geological System/Age and Primary Rock Type
Thickly bedded Lower Carboniferous limestone and varying amounts of dolomite.

Main Geological or Geomorphological Interest
The limestone quarry face exposures extend to a height of 15 metres. Bedrock comprises thickly bedded bioclastic limestones, generally dipping less than 5° to the west. Solutionally enhanced joints are visible in the upper strata, near the top of the quarry face. Thick bedding is clearly visible in the disused quarry to the north of Quarry Park.

The old quarry (Quarry Park) was operated from the mid-1800's, when the Knight and Farrell families from Lanesborough quarried stone here for the building of St. Mel's Cathedral in Longford, and for general construction in the local area, providing stone for e.g. window sill lintels and gravestones.

The original columns supporting the roof of St. Mel's Cathedral were quarried at Newtowncashel. The columns were quarried horizontally, and then were laid/set vertically upon each other (face bedded) as the columns in the cathedral. Stone for St. Mel's Cathedral was quarried here from January 1845 until 1846, and is a likely source of stone when rebuilding began after 1856.

With the intense heat of the fire of December 25th 2009, the columns shattered easily (frost and ice action in the immediate aftermath of the fire also contributed to the disintegration of the columns). The columns were replaced by 28 solid blue-coloured columns sourced from 10,000 tons of limestone at Old Leighlin quarry, Co. Carlow.

Site Importance – County Geological Site
This site is an important County Geological Site as it was the source of stone for buildings in the county including St. Mel's Cathedral, Longford Town. The quarry to the north of Quarry Park exhibits good exposure of the Lower Carboniferous rocks in this part of Longford.

Management/promotion issues
The development of the old Ballyreeve quarry into a community park, Quarry Park, with old machinery, sculptures and stone features that acknowledge the quarry workers of the past and the geology of the bedrock, is of great interest, and is an excellent example of how derelict quarries can be reclaimed as sites of public amenity. The stone carvings on the quarry face represent an interesting example of how industrial heritage, rock-art and folklore can be merged. This is an excellent example of geological heritage promotion in a local community. The park is a popular site for school visits.

Quarry Park at Newtowncashel, with quarry face, pond, sculptures and stone features.

“The Rock Breaker”: by Brian Ganley, Tom Feeney and Michael Casey.

“The Stonebreaker”: 1940s quarry machinery at Quarry Park roadside parking area.

Disused quarry immediately north of Quarry Park.


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Loch Rí
Effect Bay
St John's Bay
Newtown Cashel
Baile Nua an Chaisil
Ballyrevagh
Newtownflanigan
Carrow Dog
Cornagillagh
Ballina
Culnagore
Carrowrory
Derrydarragh
Lismagawley
Lismagawley Bog
Portanure Bog
Lismagawley Meadow
Portanure
Cloraun
Pollagh
Claras
Lugguir
Tipper
Corool
Saints Island
Forthill
Caltragh More
Clogher
Carrow More
Cornamowagh
Ballymahon
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Derrynagran
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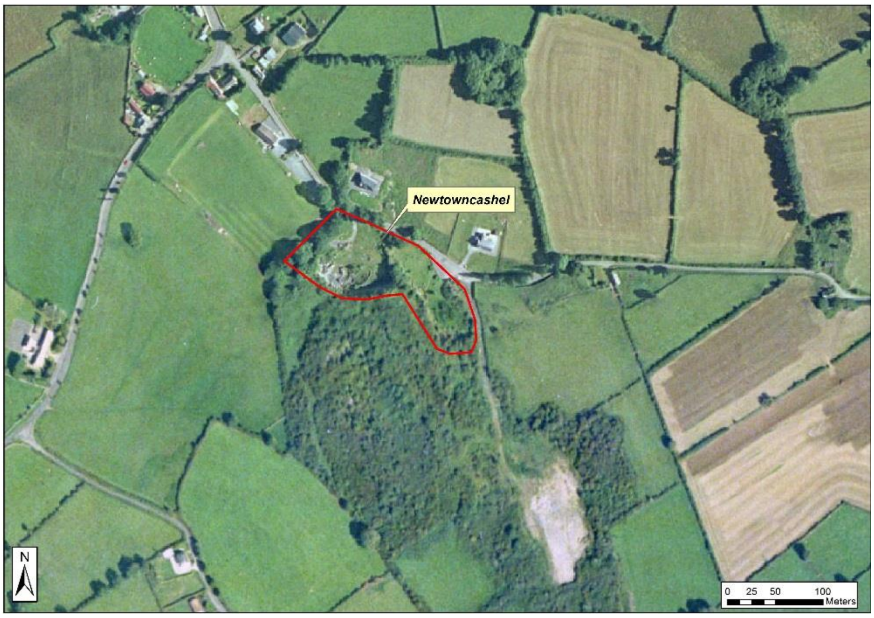
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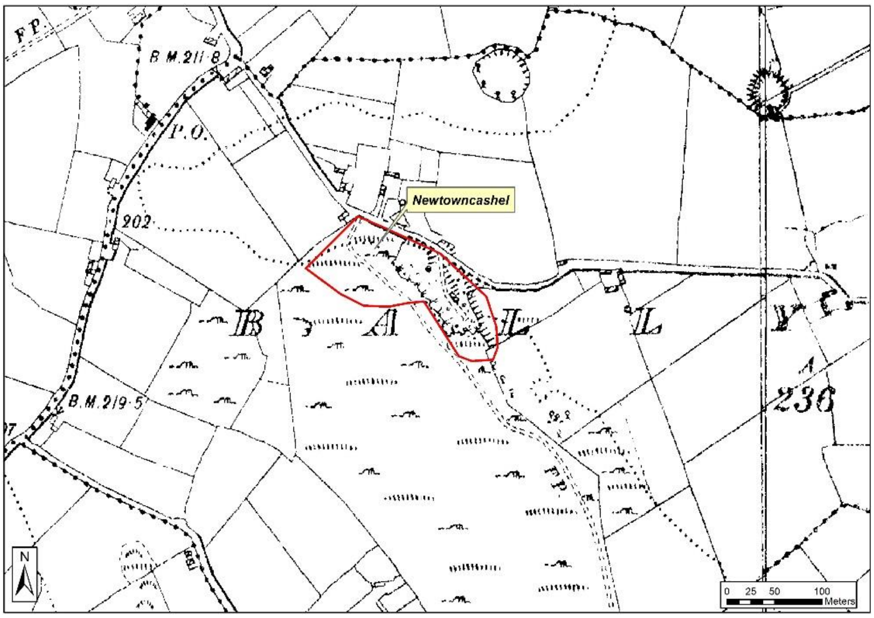
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LONGFORD - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	**St. Mel's Cathedral**
Other names used for site	
IGH THEME	**IGH15 Economic Geology**
TOWNLAND(S)	**Townparks**
NEAREST TOWN/VILLAGE	**Longford**
SIX INCH MAP NUMBER	**13**
NATIONAL GRID REFERENCE	**613440E 775300N**
1:50,000 O.S. SHEET NUMBER	**41 GSI BEDROCK 1:100,000 Sheet No. 12**

Outline Site Description
The site is an historical Cathedral building and its immediate paved surrounds.

Geological System/Age and Primary Rock Type
The Cathedral is built mainly from Carboniferous Limestone rock from around 340 million years ago, and was constructed from 1840 onwards. Extensive restoration work was completed between 2010 and 2014.

Main Geological or Geomorphological Interest
This landmark building is proposed as a County Geological Site for its excellent display of rock used as a building material, both in the original edifice and in its recent restoration after a catastrophic fire in 2009. The original building commenced in 1840, and in 1846 the walls and pillars were in place. Famine and the death of Bishop O'Higgins intervened and it was Bishop Kilduff who saw a new design for the roof and campanile completed. The Cathedral opened in 1856 for worship but both interior and exterior additions continued for decades after, and the building was finally consecrated as St. Mel's Cathedral in 1893. Detailed history survives of the construction and local sources of stone and building materials at different times in the 1840s and 1850s, including Newtowncashel.

At Christmas 2009 a fire devastated the building, destroying the roof and the floor and generating such heat that much of the stonework including the main pillars were irreparably damaged. A massive restoration project, costing around €30m, was commenced which replaced significant parts of the building, and required both traditional and modern building skills and innovative work practices to complete the work by Christmas 2014. Whilst many of the elements of great public interest are the religious iconography, artworks and artists involved, the geological elements are also very significant. In particular the total replacement of 28 massive columns of limestone with stone quarried from Old Leighlin in Carlow is most notable.

The high altar is composed of Carrera marble. The portico of great limestone columns from Knockcroghery in Roscommon was only commenced in 1891, and greatly enhances the building's grand façade. The statuary on the tympanum of the façade is in Portland Stone. The copper roof was destroyed in the fire but has been replaced by Bangor Slates, as first built, with stone from the original quarry source. Other chapels and elements inside the Cathedral use a variety of rocks and minerals in the decoration or construction.

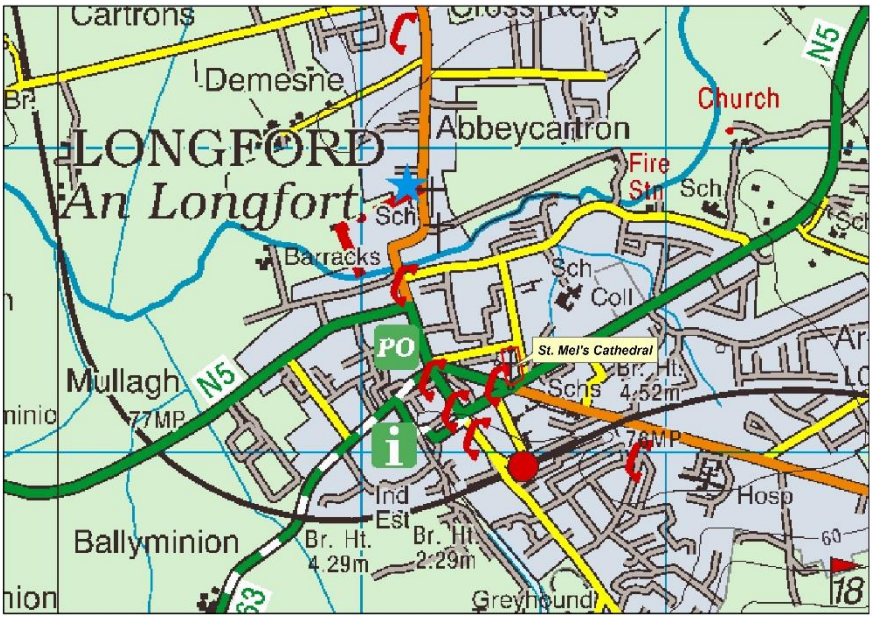
Site Importance – County Geological Site
This is a landmark building with a national profile, whose restoration has been reported upon extensively in national media. It is one of the finest neo-classical style churches in Ireland.

Management/promotion issues
The continued life of St. Mel's Cathedral is in the good hands of the Parish and the Diocese. The Parish website has an extensive photo archive of the restoration:
www.longfordparish.com

The exterior façade of St. Mel's Cathedral, Longford.


The interior of St. Mel's Cathedral.

Left: Column in sections alongside the cathedral. Middle and Right: Paving with brachiopod shells (L) and colonial corals (R).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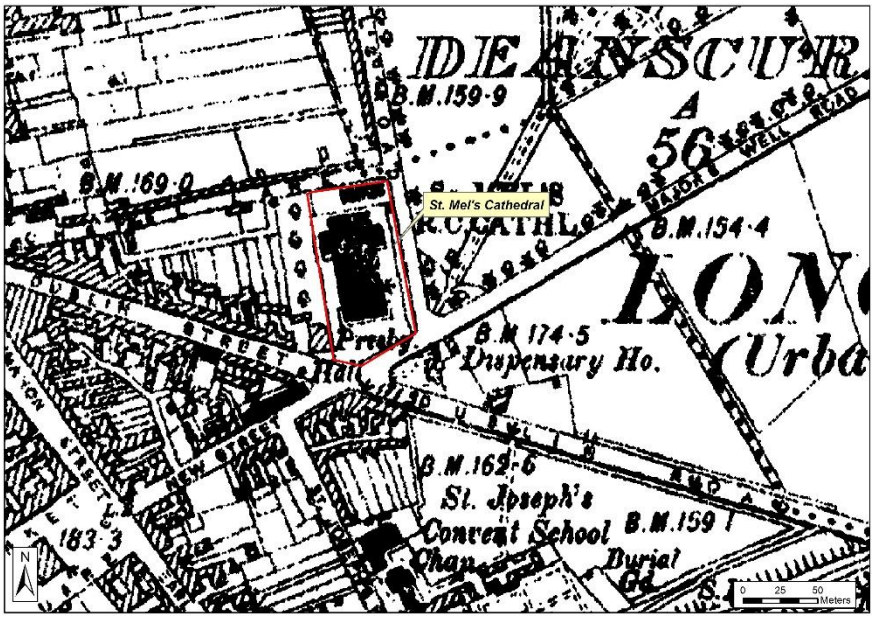
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