Department for the Economy
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GSNI Geological Survey of Northern Ireland
www.bgs.ac.uk/gsni

Geological Survey of Northern Ireland Annual Report 2020–2021

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FOREWORD

I am pleased to set the scene for the Geological Survey of Northern Ireland's (GSNI) 2020/21FY Annual Report for the Department for Economy (DfE). It is my sixth year as Director of the survey and this report is for a whole financial year entirely affected by the COVID-19 pandemic. This report summarises how GSNI performed and the benefits its work have for Northern Ireland's economy, infrastructure, environment, tourism, health and education sectors.

All GSNI staff have done a remarkable job this year, especially in unprecedented times. They have sustained periods of working remotely since 13th March 2020 and have had to adapt whilst supporting one another. I am happy to say they sustained their delivery of excellent professional geoscientific services to the Northern Ireland government, the public, our stakeholders and clients without a hiatus.

The pandemic has also brought many benefits to our work including improved video conferencing, work mobility, computing and data access, access to online training, lower carbon footprint, international collaboration, work programme efficiencies and work-life balance. GSNI has had another very productive year of deliverables and outputs despite COVID-19.

Some of the most significant pieces of work this year include GSNI's contribution to the heat policy, specifically on the geothermal aspect of DfE's draft Energy Strategy. This included co-hosting an online geothermal conference in December together with Queen's University Belfast which attracted over 300 delegates, and a new monthly webinar series. Together with its strategic partner, the Geological Survey Ireland, GSNI's engagement and input into the EU's PEACE PLUS draft programme has resulted in the inclusion of a £20M geothermal theme.

GSNI provides a 24/7 emergency response service for DfE in the case of abandoned mine collapse; this involves recording all incidents, securing the site and carrying out site investigations. This year GSNI managed five such incidents, one of which required a family to vacate their home to allow drilling investigations onsite.

GSNI has a role as statutory consultee in the Department for Infrastructure's Planning System and we responded to 90% of all consultations within the required time-frame. We published new guidance for planners and developers on working in areas with abandoned mines. GSNI also responded to 554 enquiries, the majority of which were focussed on abandoned mine risks and data requests for infrastructure development projects.

As well as delivering on our geoscience work programme for the DfE, GSNI also worked on service level agreements for the NI Environment Agency, NI Water, Newry, Mourne and Down District Council, and Armagh, Banbridge and Craigavon District Council. GSNI is also a project partner on two EU INTERREG projects; AGEO on landslide risk and Catchment Care on groundwater quality.

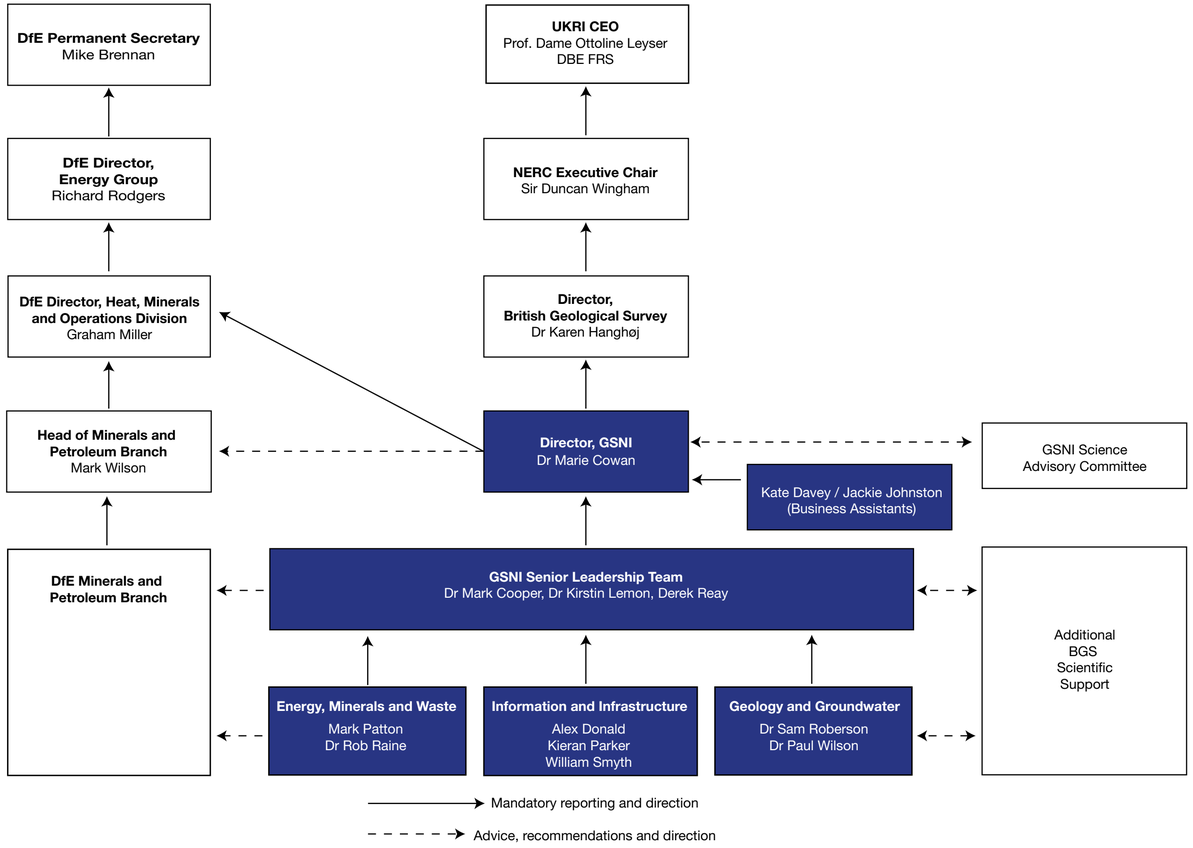
We look forward to next financial year, based on the positive feedback from our Science Advisory Committee (SAC) to GSNI's draft Science Strategy, marrying together with parallel policy research led by DfE, inviting comments from officials in departments across the NI Civil Service and working on securing and attracting the resources to deliver it.

Dr Marie Therese Cowan PGeo, MIoD MRIA
Director, Geological Survey of Northern Ireland

Front cover photo: © Tourism Ireland

CORPORATE GOVERNANCE

The Geological Survey of Northern Ireland (GSNI) is an office of the Department for the Economy (DfE) in Northern Ireland staffed by scientists of the British Geological Survey (BGS) based in Dundonald House, Belfast. GSNI sits within the Energy Group of the DfE.



The policies and processes framework for the operation and administration of GSNI are documented in the GSNI Procedures Manual, a key reference in any audit of GSNI. To provide an effective assurance mechanism, DfE reviews progress on its service-level agreement (SLA) with GSNI at quarterly SLA review meetings.

The SLA review meetings are chaired by the DfE Head of Heat, Minerals and Operations. It is attended by the GSNI Director and the Head of Minerals and Petroleum Branch. The purpose of the meeting is to review GSNI's SLA performance dashboards, monitor spend against budget, risk register information, and action points from previous meetings.

The GSNI Director chairs monthly meetings of the GSNI Senior leadership where monthly reports are reviewed, issues and opportunities are considered, risks are escalated and health and safety is managed. These meetings are minuted and saved to NICS Information Management system.

THE GSNI SCIENCE ADVISORY COMMITTEE

The role of the GSNI Science Advisory Committee (SAC) is to advise the GSNI Director and senior leadership team on the development and delivery of the GSNI public role and science strategy.

The role and responsibilities of the SAC include:

- support the GSNI in developing and delivering a science strategy that reflects Northern Ireland's needs and the challenges facing the environmental sciences, through appropriate funding streams
- advise GSNI on ways to ensure that the impact of its science is demonstrated and maximised, in particular how it contributes to addressing key science challenges of socio-economic importance
- advise on ways to enhance public engagement in GSNI science, and advise on the communication of science to ensure target audiences receive impartial and factual information
- advise on the development and implementation of a process for evaluating the quality of GSNI's research, and report to the GSNI Director and senior leadership team on this
- advise the GSNI on maintaining the quality of its core store and research infrastructure
- advise on the strategic direction of GSNI science, alerting the GSNI Director to changes in the needs of the user community or in the current status of the geosciences

- advise on creating and developing partnerships with the research community, government and private sector in NI, UK, RoI and internationally, and on the strategic development of commercial activities
- advise GSNI in its approach to identifying skills gaps through targeted recruitment and staff development
- provide other ad-hoc advice and support to GSNI in the development of its science.

MEMBERSHIP OF THE GSNI SAC 2020/21

Following a call to over twenty organisations from across government, academia, industry and the third sector for nominations to the SAC, the composition of the committee is:

- Professor Paul Dunlop, Research Director, Geography & Environmental Sciences, University of Ulster (Chair 19 Sept 2019)
- Gordon Best, Director, Mineral Products Association Northern Ireland
- Professor Maeve Boland, Senior Geoscience and Policy Specialist, University College Dublin
- Dr Alistair Carson, Chief Science Advisor, DAERA
- Dr Donal Daly, President, International Association of Hydrogeologists, Ireland
- Mairead Glennon PGeo, President, Institute of Geologists of Ireland
- Angus Kerr, Chief Planner and Director of Regional Planning, Department for Infrastructure
- Dr Duygu Kiyan, Schrödinger Fellow, Dublin Institute of Advanced Studies
- Sam Knox, Business Development Executive and Technical Advisor, Invest NI
- Elaine Lennox, Education Manager, Council for Curriculum, Examinations and Assessment
- Craig McGuicken, Chief Executive Officer, Northern Ireland Environmental Link
- Professor Jennifer McKinley, School of Natural and Built Environment, Queens University Belfast (Chair 23 March 2020)
- James Orr, Director, Friends of the Earth, Northern Ireland
- Dr Tracy Shimmield, Director, The Lyell Centre, Heriott Watt University
- Karen Smyth, Head of Policy and Governance, Northern Ireland Local Government Association
- Ken Stewart, Deputy Director, Ordnance Survey Northern Ireland
- Koen Verbruggen MRIA, Director, Geological Survey of Ireland

The GSNI SAC met on one occasion in March 2021. The position of Chair rotates each meeting amongst the university representatives.

GOVERNANCE AND ADMINISTRATION

The GSNI Director, supported by two business assistants, is responsible for the governance and administration of the organisation, including strategic direction, leadership, finance, stakeholder engagement and partnerships, health, safety and well-being, continued professional development of all staff and monitoring and reporting on performance. GSNI's research programme is delivered by three teams as outlined below.

ENERGY, MINERALS AND WASTE

The Energy, Minerals and Waste (EMW) team provides advice and support to DfE on resources and energy-related issues including oil and gas exploration, geothermal energy, underground energy storage and carbon capture and storage. The EMW team also provides geoscientific advice and support on the economic development of natural resources and assists Minerals and Petroleum Branch of DfE with minerals licensing. The team contributes to policy development for minerals and energy through the provision of scientific advice and data.

INFORMATION AND INFRASTRUCTURE

The Information and Infrastructure (II) team provides geological information through the enquiries service to external customers and stakeholders, ensures that GSNI's data is collated, managed and distributed effectively, and responds to planning consultations through the local council and regional planning process. They are also responsible for the monitoring of Northern Ireland's abandoned mines many of which are vested in DfE, and contribute to the development of geological tourism and education resources.

GEOLOGY AND GROUNDWATER

The Geology and Groundwater (GG) team provides information on the extent, thickness and properties of geological materials, primarily in the form of bedrock and superficial geological mapping. The GG team also provides information and advice on groundwater resources in Northern Ireland and contributes to groundwater monitoring.

COVID-19: NEW WAYS OF WORKING

Management of COVID-19 risk has been the overriding health and safety issue this year. GSNI took part in the BGS COVID-19 task-force which met twice weekly and has communicated key messages and offered both practical and well-being support to staff.

With COVID-19, staff worked from home for the majority of this year; regular surveying of abandoned mines and emergency response continued as before albeit with extra safe systems of work and risk assessments. Fieldwork, drilling and core store visits resumed during the summer period but not at pre-pandemic levels of activity.

Strong management control remains in place and all fieldwork continues to require authorisation at Senior Management level against assessment of both COVID-19. Zero COVID-19 cases were reported by GSNI staff during this financial year.

The risk assessment and safe systems of work were kept under constant review and amended to take account of evolving government guidance. GSNI also considered the risk assessments undertaken by DAERA and DfE to ensure that the messages were communicated clearly. Trade Union representatives were consulted about COVID-19 management measures.

The pandemic has also brought many benefits to our work including improved video conferencing, work mobility, computing and data access, access to online training, lower carbon footprint, international collaboration, work programme efficiencies and work-life balance. GSNI has had another very productive year progress on deliverables and outputs despite COVID-19.

Developing a sustainable economy

CONTRIBUTION TO NI ENERGY STRATEGY

In June 2019 the UK became the first major economy to commit to a 100 per cent reduction in greenhouse gas emissions by 2050. This ‘net zero’ target represents a significant step-change in the commitment to addressing the climate crisis.

The Department has begun the process of developing a new Energy Strategy to decarbonise the Northern Ireland energy sector by 2050 at least cost to the consumer. The first step in the on-going public engagement process to inform and shape development of the strategy was a call for evidence issued by DfE in December 2019. GSNI provided much data and published reports to the call for evidence.

Following on from the information provided through the Call for Evidence, DfE produced a series of potential policy options structured around the proposed principles of the Energy Strategy and accompanied by consultation questions.

NORTHERN IRELAND HEAT WORKING GROUP

As part of the ongoing development of the Energy Strategy for Northern Ireland, the future policy options for decarbonising heat are being considered. This is being done by taking a holistic view of energy in terms of energy efficiency, power, heat and transport, whilst also considering the impact on society as a whole, and consumers individually.

Five working groups including officials and stakeholders have been set up to consider these areas. GSNI has participated in the work of the

Photo: Courtesy Tourism Northern Ireland @Christopher Heaney

Heat Working Group to develop policy options for consultation, as well as the potential role of district heating and geothermal.

The approach in this area will form a key part of the future Energy Strategy, as producing heat accounts for approximately half of our total energy consumption in Northern Ireland. The four work streams that have been agreed in this area are:

- The future of oil and solid fuels
- The future of the gas network, and decarbonising gas
- Renewable heat technologies
- Local heat solutions

Decarbonising the heat sector will require a combination of reducing heat demand through energy efficiency investment, and reducing the carbon intensity of the remaining heat. The future Energy Strategy will set out a pathway and timeline for decarbonising heat, and the most effective way to measure progress between now and 2030, and subsequently to 2050.

NORTHERN IRELAND MINERAL POTENTIAL BASELINE OVERVIEW

The minerals industry provides the raw materials for every aspect of modern life. Sustainable management of our natural resources is essential to ensure these resources are not so depleted or rendered inaccessible by our actions that future generations cannot maintain the same quality of life that we do. Part of this management is identifying the resources that we have and where they occur.

Northern Ireland has had over 50 year of modern mineral exploration, underpinned by a mining industry that goes back hundreds of years. The development of new analysis techniques and the ability to detect lower concentrations of minerals contained underground has resulted in an ongoing exploration landscape. This landscape is evolving with improving technology and there is the potential that mineral deposits occur in Northern Ireland that may yet be identified.

GSNI has begun a review of data that aims to establish a new mineral potential baseline and research into the potential for base metals and minerals that are now considered critical to the green economy. GSNI aims to highlight areas where these critical minerals might be found. The results will provide useful information to policy makers as they consider the future development of our natural mineral resources.

UNDERSTANDING THE IMPACT OF FUTURE PETROLEUM DEVELOPMENT

The Department commissioned research into the economic, societal and environmental benefits and disbenefits of future onshore petroleum development (including exploration, extraction and decommissioning) and its application to Northern Ireland across a range of pre-identified scenarios. The project covers both conventional and unconventional oil and gas.

The research used relevant studies from other parts of the UK and Ireland, available data from Northern Ireland, and carried out stakeholder engagement to inform and test conclusions. The assessment included a review of policy, analysis of the resource position and reviews of economic, environmental and social impact evidence. The study then explored a range of impact and development scenarios.

GSNI has been involved through the Steering Group for the project and has provided data and scientific material to the researchers and contributed to the technical review of the research. Additionally, to supplement the research study, GSNI along with BGS produced a report for the researchers that reviewed available data on induced seismicity risk in Northern Ireland.

The results of the petroleum research will be used by policy makers to formulate evidence-based policy options and provide Northern Ireland Executive with the information needed to make fully informed decisions about future petroleum development.

Underpinning infrastructure

GEOSCIENCE INFORMATION FOR INFRASTRUCTURE DEVELOPMENT

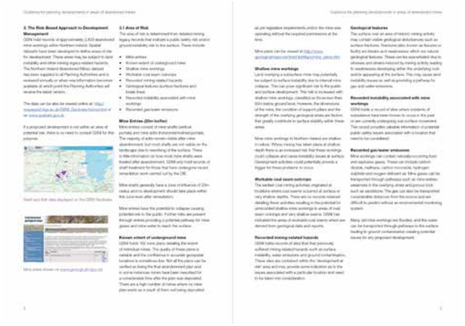
GSNI, through DfE, is a statutory consultee for planning applications in the development management process for all mineral applications and for all applications for hydrocarbon exploration or extraction. In addition, GSNI is a non-statutory consultee for planning applications that may be impacted upon by geological issues including but not limited to abandoned mines, compressible ground, and geological hazards.

In 2020/21, GSNI responded to 145 consultation requests, with 54% of these deemed to be statutory. One of the key requirements of statutory consultees is that they must provide a substantive response to all requests within the specific time-frame (usually 21 calendar days). In 2020/2021, GSNI responded to 90% within the statutory time-frame, up from 81% in the previous financial year.

The role that GSNI plays in the development management process is vital for underpinning Northern Ireland's infrastructure. GSNI provides information to support all types of infrastructure development including transport, energy, telecommunications, water and wastewater, all of which have a vital role to play in our economic development. This is especially true for planning applications that are of a major and regional significance. However, GSNI also provides information to assist with infrastructure development through the GSNI enquiries service, by providing geoscientific information to central and local government, and to commercial customers.

Photo: © Tourism Ireland photographed by Stefan Schnebelt

In 2020/21 GSNI responded to a total of 129 enquiries related to infrastructure development. These included flood alleviation schemes, power stations, water storage and sustainable transport schemes. In total 67% of these enquiries were commercial in nature, 20% were local government, 12% were central government, and the remaining 1% was for research or from the public.

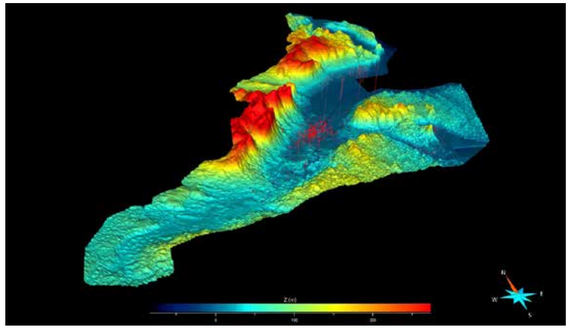


ABANDONED MINES GUIDANCE FOR PLANNERS

Developing on land that could be impacted by historic mining activity presents a number of challenges to public safety and can threaten safe sustainable development. As part of the development management process outlined in the previous section, GSNI works with planning officers in relevant local councils and developers when proposing developments located in areas of abandoned mines. To assist with this, GSNI published its ‘Guidance for planning developments in areas of abandoned mines’.

The document details a risk-based approach to development management that includes identifying areas with abandoned mines and potential hazards, and provides guidance on carrying out mine risk assessment as well as sources of further information. It is also designed to provide information on steps that need to be taken at an early stage of any development proposal. This will enable planning officers to have all the relevant information to provide recommendations for planning permission and will also allow developers to consider all mining legacy issues when designing their proposal.

To accompany the guidance document, new updated spatial layers have been developed to inform planners and developers on the location of land zones where a mine risk assessment will be required.



BELFAST 3D GEOLOGICAL MODEL

The new version of the Belfast 3D geological model continues to develop. Data from the original GSI3D model have been successfully exported into GOCAD, while existing data from the GStrat database have also been incorporated. Much time has been dedicated to ensuring data quality and the avoidance of duplication, as well as writing routines for the automation of stratigraphic coding from borehole descriptions. To date, 7498 boreholes have been incorporated. Of these, 2521 reach bedrock, while over 7000 stratigraphic layers have been coded, using both manual and automated methods.

A stakeholder event was held in March 2020, and was attended by 12 people from a range of sectors including industry (civil engineering & geothermal), central and local government, and academia. Stakeholders were asked how they would like to use the model in the future, in what format and at what stage they would like to use the model during their work flow. Demands were multi-scale, depending on the application, with those from geothermal requiring broad scale, but deep, while geotechnical professionals required high resolution data for site investigations. There was an overwhelming demand for 2D horizons of bedrock, till and sleech (estuarine deposits), as well as a high demand for a re-release of the Belfast Engineering Map.

NORTHERN IRELAND FLOOD RISK MANAGEMENT PLANS

In December 2020, Department for Infrastructure (DfI) Minister Nicola Mallon MLA announced a consultation on the second cycle of flood risk management plans for Northern Ireland’s three river basins.

This builds upon DfI’s work in 2018, the first NI Flood Risk Assessment identified that the main sources of flooding in NI as rivers, the sea and overland surface water flow.

The Second Cycle draft Northern Ireland Flood Risk Management Plan 2021-2027 was an interdepartmental collaboration including DAERA, DfE and NI Water. GSNI scientists provided all the geological and superficial summaries and maps in the document for the twelve Areas of Potential Significant Flood Risk.

Monitoring the environment

PROGRESS WITH CATCHMENTCARE

CatchmentCARE is an EU-funded project that aims to improve freshwater quality within the North Western and Neagh Bann international river basins. The project is focussed across three cross-border catchments, the Arney, Blackwater and Finn. The aims will be achieved through development of water quality improvement projects and installation of groundwater monitoring stations across the region.

Our ability to accurately monitor the health of our groundwater resources in Northern Ireland is limited by the lack of suitable monitoring points. The CatchmentCARE project is doing something about this by drilling 50 groundwater monitoring boreholes in Northern Ireland and the border counties. Nine new boreholes were installed at three station sites in the Derg Catchment working in partnership with the Source to Tap project and NI Water.

Their construction was designed, managed and supervised by GSNI to ensure they were of a high standard and to monitor the correct groundwater horizons. The results from this work has already proved very useful for enhancing our data holdings and understanding of the groundwater in Dalradian bedrock and in sand and gravel deposits.

A new sampling system, designed by GSNI is also being piloted in partnership with the Agri-Food and Biosciences Institute (AFBI) to acquire high resolution data on herbicide occurrences in groundwater. The results of this could support measures to improve water supply quality to consumers in the north-west of Northern Ireland.

BUILDING CAPACITY IN EARTH OBSERVATION

Earth Observation (EO) through the use of data acquired from the vast array of satellites in space is becoming an increasingly vital tool for monitoring and assessing our environment and land changes.

Throughout the year, GSNI continued to use data obtained from EO and also in building our capacity in incorporating the information into its strategic projects and goals. GSNI staff completed training with the University of Luxembourg in using the EU-derived Copernicus data service and are currently using this, and other EO data in the AGEO project to assess geological hazards at the Giant's Causeway and Carrick-a-rede, and assessing its input to a wide variety of projects including coastal change monitoring.

In 2021, a Northern Ireland Earth Observation Steering Group (NI-EOSG) and Northern Ireland Earth Observation User Group (NI-EOUG) was established. The groups bring together expertise from across the Northern Ireland public sector to provide strategic direction to increase the awareness of, enable access to, and accelerate the use of, EO data, services and applications. In doing so, EO data and associated technologies will become vital enabling resources to help inform policy developments, deliver strategic goals, provide value for money through operational cost-savings, and achieve better outcomes that benefit the economy, society and environment of Northern Ireland. Led by the Ordnance Survey NI, GSNI is represented on both groups with the objectives set to progress through the 2021/22 FY.

QUALITY ASSURANCE SCHEME FOR GROUNDWATER DATA

The Northern Ireland Groundwater Data Repository has been in development since 2014. It is a central database of information on the groundwater resources of Northern Ireland and is of great value to sustainably using and protecting them in the future. However, a challenge with the data on groundwater properties and chemistry is that they come from a variety of sources and therefore their reliability is not always comparable. Therefore, to enhance the reliability of a national analysis of groundwater properties and chemistry, a quality assurance rating scheme was developed along with a transparent and robust procedure for rating each groundwater sample and hydraulic test. This scheme was developed using common practise adopted within the BGS when analysing groundwater data but had never formally been written up.

There is currently no such comparable rating scheme in formal use in any other region of the UK or Ireland. To formalise the scheme so it can be used when adding new data to the database and to allow the scheme to be referred to when others are developed in other regions or countries, the quality assurance rating scheme was written up as a BGS commissioned report. This went through a robust internal science review within the BGS and was published as open access on the NERC Open Research Archive (NORA).

Photo: © Tourism Ireland photographed by Stefan Schnebelt

KNOWLEDGE EXCHANGE IN COASTAL CHANGE MONITORING

Northern Ireland's coastline is an important asset making an important contribution to the economy, society and the environment. However, the coastline is changing with erosion being a major and increasing risk, with incidents increasing annually as a result of climate change.

Over the past year, GSNI has contributed to the DAERA and DfI led Coastal Forum Working Group (CFWG) together with nominated representatives from Central Government, Local Government and the National Trust. The CFWG has identified that there is an absence of adequate information on which to base coastal decision-making and GSNI is working with DAERA to produce updated coastal geology datasets.

GSNI has been developing its understanding and research capabilities in the field of coastal change monitoring. This is in preparation for the creation of a new coastal geology work programme as an element within the new GSNI Science Strategy. This will contribute to an inter-governmental strategic approach to shoreline management that will help to reduce coastal degradation and loss of value.

Enhancing tourism

NATIONAL SUPPORT FOR UNESCO GLOBAL GEOPARKS

GSNI currently chairs both the UK Committee for UNESCO Global Geoparks and the Irish UNESCO Global Geoparks Committee. Both of these committees act as national points of contact for UNESCO Global Geoparks in the UK and Ireland, as liaison between the UNESCO Global Geoparks and the UNESCO National Commission, coordinate joint activities, provide advice and guidance on how to become a UNESCO Global Geopark and offer mentoring for areas that are aspiring UNESCO Global Geoparks.

GSNI has worked extensively with the UK National Commission for UNESCO (UKNC) by contributing to and promoting its seminal report on the National Value of UNESCO to the UK. We have also, in conjunction with the UKNC, contributed to the UNESCO Medium-Term Strategy, provided comments on the UNESCO Recommendations on Open Science, and also provided input for the development of new assessment procedures for UNESCO Global Geoparks.

In 2020/2021 there was a significant increase in the number of areas interested in becoming UNESCO Global Geoparks. In Northern Ireland GSNI is currently working with both the Mourne Gullion Strangford Aspiring UNESCO Global Geoparks and the Antrim Geopark Project. In the rest of the UK, GSNI has also provided mentoring to Arran Geopark, Kent Downs AONB Geopark Project and the Charnwood Forest Geopark Project. In addition, we have also provided guidance to areas that have expressed an interest in UNESCO Global Geoparks

Photo: © Tourism Ireland photographed by Tony Pleavin

including the Sperrins (Northern Ireland), North Somerset (England), and North Yorkshire (England).

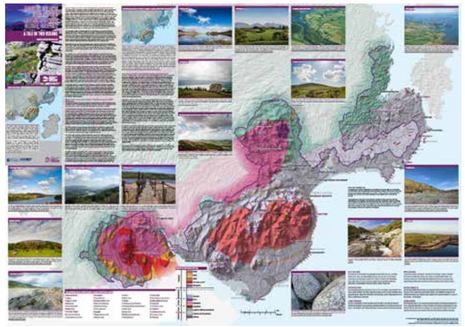
CUILCAGH LAKELANDS GEOPARK

REIMAGINING THE MARBLE ARCH CAVES UNESCO GLOBAL GEOPARK

GSNI has worked with the Marble Arch Caves UNESCO Global Geopark for over 20 years and it has undergone many changes in that time. In the past few years, the Geopark has undergone a significant governance and structural review that has included the production of a new development plan that GSNI has contributed to.

One of the recommendations of the development plan was to change the name of the Geopark to more accurately reflect the communities within the area and provide a better representation of the geographic range. GSNI attended workshops to inform the re-branding of the Geopark and provided information on the diverse geology and landscapes of the area which were important factors to be considered.

Another recommendation from the development plan was to amend the boundary of the Geopark, that would allow for better management of both financial and human resources, and provide a better focus for tourism activities. GSNI provided advice and guidance on the new boundary and produced maps to aid stakeholder engagement. GSNI attended all of the workshops and provided support for Geopark staff on the reasons for the new boundary and the benefits that it would have for local communities.

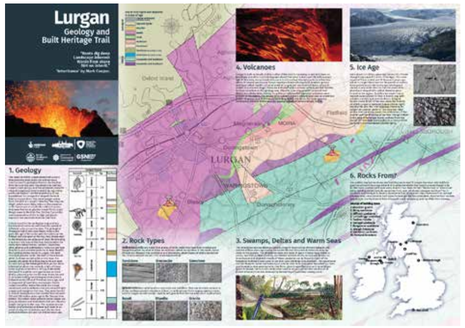


MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK MAP

GSNI has continued its work with Newry Mourne and Down District Council in the development of the aspiring UNESCO Global Geopark. Work has focused mainly on the preparation for an evaluation visit from UNESCO which was postponed due to the ongoing Covid-19 pandemic.

One of the major outputs was a popular geological map for the area. This map includes the entire area of the Geopark and presents the geology in a way that is easy to understand, making it accessible for a wide variety of audiences. It also includes photographs and short descriptions of sites of geological interest that are open to the public to encourage tourism.

The map forms a suite of publications that have been produced jointly between Newry Mourne and Down District Council and GSNI that will support the aspiring UNESCO Global Geopark. These have included suites of education resources for both primary and post-primary school children, information on the natural and cultural heritage and how it links with geological heritage, and information on the conservation of geological sites.



LURGAN GEOLOGY AND BUILT HERITAGE TRAIL

GSNI has been working closely with Armagh City, Banbridge and Craigavon Borough Council to deliver elements of its Lurgan Townscape Heritage Project. This project is partially funded through The National Lottery Heritage Fund's Townscape Heritage scheme that is aimed at regenerating historic urban environments across the UK.

Beginning in 2018, this 5-year project has three main elements, one of which is to deliver community-based activity and education programmes that raise awareness of Lurgan's rich history and heritage. It is under this element that the Lurgan Geology and Built Heritage Trail was produced.

Lurgan, like most other settlements in Northern Ireland, has been greatly influenced by the underlying rocks and landscapes on which it was built. However, it also has a rich industrial past which saw the use of local and imported stone from across the UK and Ireland as well as further afield. All of these elements were considered and included within the Lurgan Geology and Built Heritage Trail.

The trail takes the form of a foldable map that first of all outlines the geological history of the area in and around Lurgan, including a geological map, descriptions of the main rock types encountered and a summary of how they were formed. The main element of the trail provides a guide to the main building stone types used in 12 of Lurgan's most historic buildings, that display a remarkable diversity of geology within a very small geographical area.

Follow-up activities to accompany the publication are planned so that the geological diversity of the area as well as that of its most important historical buildings can be shared with the community and local schools.

Protecting human and animal health

RESPONDING TO ABANDONED MINE COLLAPSES

As part of its abandoned mines management programme, GSNI responds to incidents that occur as a result of disused mines. As part of this process, GSNI staff provide a 24/7 emergency call out service that involves recording of all incidents, securing the site and carrying out associated site assessments. After the initial incident response, further work is conducted including assessing relevant geological and mine data held by GSNI and necessary intrusive & non-intrusive surveys before actions are taken to remediate the sites.

In total, five incidents occurred during the year. These ranged from the discovery of open shafts, localised mine collapses and subsidence, as well as safety issues associated with access to abandoned mine sites.

The incidents that occurred were as follows:

- A mine shaft was uncovered at Ballycastle during archaeological investigations. This work was being overseen by GSNI staff due to its proximity to old coal workings. Investigations were carried out and mitigation works initiated to provide safe closure of the shaft and also a nearby open horizontal entrance driven into the hillside. Works were safely completed in December 2020.
- A collapse at an abandoned shallow iron ore mine was reported in Mid-Antrim. Site evaluations were carried out including an internal CCTV survey to determine the condition of the mine roof, water flow and extent of the mine roadway. Remediation is currently underway to make the area safe.

- During routine monitoring carried out by GSNI, a public safety issue was identified at an old mine site in Carrickfergus. The site is currently undergoing active subsidence and is monitored frequently. Due to the high risk, the site is fenced off and secure to ensure public safety within the area. Damage to the fence barriers, caused by flood waters, was remediated once identified.
- Subsidence occurred within the grounds of a residential development at Coalisland, an area with a high-density historic coal mining. GSNI carried out a site evaluation that was followed up with geophysical surveys and a review of historic mine data to determine the cause of the subsidence. A programme of works was put in place to carry out intrusive investigations to ascertain the cause, extent and make the area safe.
- As a result of a highly publicised livestock rescue from an open mine shaft at Rathkenny, Co. Antrim, GSNI responded to the incident and carried out a site assessment. The drainage shaft was previously sealed with a concrete cap and had become damaged, revealing an opening within a field. Investigations are ongoing so that the shaft can be closed off safely.

RISKS FROM INDUCED SEISMICITY ASSOCIATED WITH PETROLEUM DEVELOPMENT

The Minerals & Petroleum Branch (MAPB) of DfE, the body responsible for administering petroleum licensing onshore in Northern Ireland, asked GSNI to carry out a review on the potential risks of induced seismicity from high volume hydraulic fracturing (HVHF) for shale gas or oil, with respect to Northern Ireland.

The purpose of the review was to set out the scientific evidence relating to High Volume Hydraulic Fracture-related induced seismicity in order to inform the evolving DfE policy on licensing of petroleum exploration and production in Northern Ireland. The potential risk of induced seismicity is only one of many factors that will be taken into consideration by DfE in consideration of this policy.

“Proximity to critically stressed faults, fault maturity, high overpressures and tectonic strain have all been cited as causes for seismicity induced by HF operations. In a small number of cases, HF operations have triggered earthquakes large enough to cause potentially damaging ground motions. Such earthquakes cannot be confidently predicted in advance of operations. These observations suggest that the risk from induced seismicity during HF operations is not negligible”.

The report’s authors concluded that higher resolution geophysical data is needed to image detailed structure within the (NI) basins, identify faults and depth to basement in order to mitigate risk of induced seismicity from hydraulic fracturing of unconventional reservoirs.

PLATFORM FOR ATLANTIC GEOHAZARD RISK MANAGEMENT

The Platform for Atlantic Geohazards Risk Management (AGEO) is funded under the Interreg VB Atlantic Area programme and is for a total of €2.5 million between 2019 and 2022. AGEO is being led by the University of Lisbon, with GSNI being one of 12 other partners involved in the project that will see the launch of seven Citizens’ Observatory pilot sites across France, Portugal, Spain, Ireland and UK. The aim is to encourage local communities to actively participate in geohazard monitoring, and to enhance local capacity in risk management.

GSNI is working closely with the National Trust to develop the Giant’s Causeway and Carrick-a-rede as their pilot site for a Citizens Observatory. Both locations are impacted upon by landslides and the project will help to better understand the processes that cause these, and contribute to better risk management.

The project has been impacted upon by Covid-19 as restricted fieldwork has led to reduced ability to establish the Citizens Observatory. However, there has been significant progress despite the challenges presented:

- As part of the project, data captured by the Copernicus satellite constellation has been processed. This will help build a series of indicators to monitor the components of systemic vulnerability (hazards, impact, management) at the site. This will lead to a source of data to inform decisions on monitoring areas of increased impact and future development.
- A core component of AGEO is to promote engagement between civil society and local authorities to evaluate risk management systems in place across the pilot sites. This includes risk management for geohazards at a local and national scale. Over the past year, we have evaluated the current procedures and practices in place which will then be assessed against the outputs of the pilot observatories and best practice across the Atlantic region.
- Data has been acquired from both terrestrial and earth observation to the geological hazards at each of the pilot sites. Work is continuing to assess how these can be combined to develop better risk management for areas impacted by geohazards. It will also contribute to public education and community empowerment, and allow for stakeholder input through citizen science for their respective areas.

SAFEGUARDING GROUNDWATER PRIVATE WATER SUPPLIES

Under new regulations, all private water supplies must have a risk assessment carried out to assess how likely they are to be affected by contamination. As 99.4% of all private water supplies are sourced from groundwater, this is a complicated exercise that should involve the delineation of the zone of ground through which the water that is taken from each source recharges. The activities in that zone can then be assessed to determine if they present a risk of contamination.

To assist with these assessments, the GSNI produced a set of 20 bespoke reports containing relevant and useful geological information for newly registered private water supplies. The information contained within the reports will assist environmental health officers with carrying out initial risk assessments which will ultimately lead to improvements in water supply and public health.

Geological survey and mapping

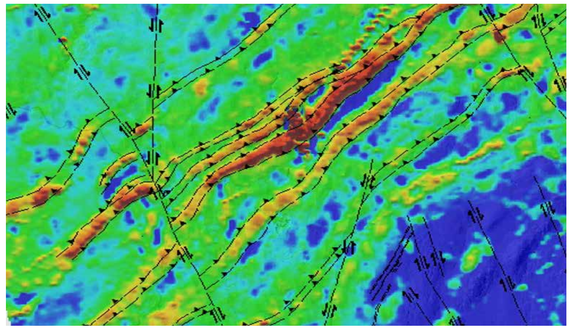
DESK-BASED INTERPRETATION OF SUPERFICIAL DEPOSITS

Geological surveying and mapping continue to be an important part of GSNI's work with the resulting geological maps producing vital information for various aspects of land-use planning, help to locate essential resources and identify potential hazards.

Work has continued on mapping the area known as the 'Newry sheet', stretching from Newcastle in the northeast, to Greencastle in the southwest, encompassing the Mourne Mountains and Mourne Plain. In 2020, desk-based interpretation of the superficial geology and geomorphology was extended across 80% of the sheet area. This area is composed primarily of upland regions dominated by till, bedrock, and peat, with lowland regions characterised by glaciofluvial outwash, till incised by meltwater channels and terminal moraine complexes. At the coast, these lowland deposits are incised by onlapping raised beaches, with modern beach deposits at lower elevations. The distribution of raised beach deposits is indicative of the extent of former marine-terminating glaciers, corroborated by adjacent bathymetry.

Field checking was limited due to Covid-19 restrictions, but a total of eight quarter sheets were covered.

Photo courtesy of Tourism Northern Ireland



IMPROVING THE GEOLOGICAL UNDERSTANDING OF LONGFORD-DOWN

A new GSNI technical report called ‘Structural, stratigraphical and biostratigraphical mapping of the Ordovician-Silurian bedrock geology of the Longford-Down Terrane, Northern Ireland’ was produced. It provides a review of the Northern Ireland stratigraphy of the Longford-Down area and of that established in County Monaghan by Geological Survey Ireland and has delivered a much greater understanding of the bedrock geology in this area.

Work completed by GSNI has involved the interpretation of existing Tellus geophysical and other datasets, followed by targeted fieldwork. A total of 17 quarries were surveyed during field truthing and have provided a wealth of fault related structural data. A major outcome of this work is a revised structural bedrock map of the region, providing valuable knowledge of key fault sets and their relationships with magmatism, mineralization and groundwater.

The report also presents the results of stratigraphical and biostratigraphical work carried out on 25 new graptolite bearing sites discovered during field work that provides evidence to support the tentative correlations made between the County Monaghan stratigraphy and that in Counties Down and Armagh.

QUATERNARY DOMAINS MAP FOR NORTHERN IRELAND

GSNI has been working with BGS on both the BGS TopRock and Quaternary Domains project to characterise, on a broad scale, the range of landscapes created during the Quaternary period in Northern Ireland. This is not dictated by just the sediment types present, but also their geomorphology, small-scale relief, and other landscape features imposed by the underlying bedrock.

Within each non-contiguous domain, subdomains were delineated, and a description of their individual characteristics given. In addition to these data, the map also draws upon the findings of the Lough Neagh Sand and Gravel Resource Survey that GSNI contributed to in 2016, and on work done by Royal Holloway University of London (RHUL) as part of a dissertation on Upper and Lower Lough Erne, in collaboration with GSNI.

Through this work, five different domain types have been identified in Northern Ireland: Coastal and Estuary domain (e.g. Strangford Lough, Belfast Lough), Montane and Valley domain (e.g. The Sperrin Mountains, the Mourne Mountains), Plateau and Valley domain (e.g. the Antrim Plateau), Lowland Basin domain (e.g. Lough Neagh, Lough Erne) and Till Dominant domain (e.g. Lower Bann Valley, Co. Down and Armagh).

This provides for the first time, complete coverage of Northern Ireland Quaternary sediment, as well as an entirely new Quaternary Domains data set. This will provide vital information to better understand the Quaternary systems in Northern Ireland, which being our youngest geological deposits most often found at surface play an essential role in many of our economic activities including agriculture and forestry.

REVISED PALAEOGENE STRATIGRAPHY

As part of a study by BGS NERC Isotope Geoscience Laboratory (NIGL) and GSNI, a report called ‘New U-Pb geochronological constraints and revised Palaeogene stratigraphy for the Northern Ireland—north of Ireland sector of the North Atlantic Igneous Province’ has been produced.

The project has brought together NIGL geochronological and GSNI geological expertise progress the regional and international understanding of the Palaeogene geology of Northern Ireland in the context of the North Atlantic Igneous Province (NAIP). The report documents 11 newly acquired U-Pb zircon age constraints and explores some implications of the new dating, and other recent advances, to the mapped geology and understanding of relationships between the Antrim Lava Group, dyke swarms, plugs, sills and central complexes. It presents a revised chronostratigraphy for the Palaeogene of Northern Ireland and compares it to other parts of the NAIP.

This work is important because the Northern Ireland Palaeogene is part of the much larger NAIP Large Igneous Province (LIP) and so this new information can help geologists to understand how LIPs behave globally. It also has implications for the study of historical climate change, mineralization, basin history, hydrocarbon reservoirs, geothermal energy, subsurface storage and groundwater resources.

Data, enquiries and facilities

GSNI DATA DELIVERY AND DATA TRANSFORMATION

To accompany the development of the GSNI Science Strategy a survey was carried out among customers and stakeholders to help inform our data delivery and digital transformation.

The survey was designed to gather feedback on our data and services including:

- the discovery, access and use of our data,
- the GeoIndex,
- our data on Spatial NI and Open Data NI, and,
- digital transformation of our archives.

Responses from the survey represented a cross-section of geoscience sectors, the majority of whom already used our data and indicated that our data plays an important role in undertaking their work.

While 90% of respondents used GIS in some form the responses indicated that online viewers, such as the GeoIndex and Spatial NI, play an important role in providing access to much of our data.

Improving discoverability of our data and services is highlighted as well as the need to provide additional data downloads in order for users to be able to integrate our data within their own systems.

The digital transformation section of the survey has identified key datasets that customers and stakeholders would like better online access to including published maps and reports, hydrogeological data and site investigation data.

The survey responses are already informing the GSNI work programme with the development of a new metadata portal and webservices.

ENQUIRIES

GSNI responded to 554 enquiries. The sector represented and enquiry type have been collated from the enquiries database and are shown in the tables below.

Sector	Number of enquiries
Commercial	212
Local Government	170
Public	67
Education / Research	67
Central Government	35
NGO	3

Category	Number of enquiries
Abandoned Mines	158
Infrastructure	129
General Geology	47
Hydrogeology - resources	41
Research / Education	35
Minerals	35
Geohazards (ex. abandoned mines)	28
Environment	26
Quarries	23
Other	32

CORE STORE

The core store remained largely closed to researchers during much of the year as the working from home recommendations were extended due to the ongoing Covid-19 pandemic.

Some access for a postgraduate research project carrying out core description and sampling was able to take place in November. The PhD research project looking at the stratigraphy and emplacement of the Antrim Lava Group. These samples will complement a series of field samples and data from across the Antrim Plateau gathered by the student.

Other research projects that required access to the core archive, particularly where travel to Northern Ireland was an issue for the researchers, sampling was done on their behalf by GSNI. This included a research project at Trinity College Dublin on Hyperspectral Analysis of the Mourne Mountains, which used the GSNI Silent Valley Geothermal borehole core along with samples from the Slieve Binnian Tunnel, which reduced the need for fieldwork during restrictions on movement and provided fresh samples of granite from the collection covering different units of the Mourne Granite. Sampling was also carried out of the Triassic Mercia Mudstone Group for palaeoclimate studies at Durham University.

Some ongoing remediation of the core collections and pest management was also carried out during this time.

Raising awareness of geoscience

OUR ENGAGEMENT

Engagement is an important aspect of GSNI's work programme. Not only does it highlight the relevance of the public good science that we do, but it helps us to be open and transparent about what we are spending public money on, building trust and mutual understanding through two-way engagement.

The Covid-19 pandemic has meant that GSNI has had to rethink the way that our engagement takes place, moving away from in-person events and relying more on digital communication platforms. Despite the difficulties that this has presented, GSNI has risen to the challenge, resulting in some of our most successful engagement to date.

A summary of lectures, conferences and invited talks is provided in the table below.

Event	Quantity
Lunchtme lectures	4
Conference keynote speaker	3
Invited talks	8

ENGAGEMENT HIGHLIGHT 1

IGI Minerals Factsheets

The Institute of Geologists of Ireland (IGI) provides professional accreditation for geoscientists on the island of Ireland and promotes the interest of its members in Ireland and internationally.

In April 2020, the IGI set up a Minerals Information Working Group with the goal of addressing misinformation and public perception problems surrounding mineral exploration and mining on the island of Ireland, activities directly linked to members' professional interests. Geoscientists from private companies, public bodies, consultants and GSNI and Geological Survey Ireland met to address the issues. Following the initial meeting five subgroups were established to consider:

- Mining and Our Green Future
- Mine Planning and Environmental Oversight
- Lifetime Value of a Mine
- Mineral Exploration in Ireland
- Mining through the Ages

Over the course of the next 12 months the subgroups met online to discuss the topics and in March 2021 five factsheets were published online. The factsheets will ensure that members of the public have access to facts on the critical role of mineral exploration and mining for our sustainable future.

ENGAGEMENT HIGHLIGHT 2

Geothermal conference and webinars

In December 2020, together with the Centre for Sustainability, Equality and Climate Action (SECA) at Queen's University Belfast, we jointly hosted a conference on the future of geothermal energy for Northern Ireland. The purpose was to highlight the future potential that geothermal technologies can play in Northern Ireland in building back our economy in a better, fairer, greener and more sustainable way after the Covid-19 pandemic. Within the context of the ongoing development of an Energy Strategy by DfE, interest in geothermal potential and associated research in Northern Ireland has grown in recent years.

Highlighting the significant interest in the topic, over 300 delegates from across industry, academia, government, charities and investors attended online. This international event saw attendees not only from the UK and Ireland, but also from mainland Europe and other parts of the world including Canada, USA, Venezuela, Peru, South Korea, Pakistan and Indonesia.

Speakers from a range of sectors presented aspects of geothermal, relevant to Northern Ireland. Topics included resource distribution and current geothermal research along with examples from other areas of geothermal business models, public engagement, policy and the performance of heat networks for decarbonising heat, and the most effective way to measure progress between now and 2030, and subsequently to 2050.

ENGAGEMENT HIGHLIGHT 3

Northern Ireland's Geodiversity Charter

Together with the Northern Ireland Environment Agency (NIEA), GSNI produced the second edition of Northern Ireland's Geodiversity Charter.

The Charter encourages promotion and management of Northern Ireland's geodiversity and its integration into policy and decision-making. By creating a greater awareness and understanding of our geodiversity it will lead to better protection of our geological heritage and the ability to sustainably manage our natural resources, so that we can enjoy the full range of economic, social and environmental benefits it provides.

Each of the proposed outcomes is demonstrated by a variety of case studies from all across Northern Ireland which help to emphasise the increasing understanding of geodiversity related issues.

The second edition of the Charter differs from the first by this time being aligned to the outcomes of the Northern Ireland Programme for Government. This approach means that is much more relevant for stakeholders including central government departments, local councils, NGOs, industry and academia.

ENGAGEMENT HIGHLIGHT 4

Enhancing awareness of groundwater

Being out of sight, groundwater resources are often out of mind. It is therefore up to those with a knowledge and understanding of groundwater to raise awareness of their existence and function, for the purpose of protecting this valuable resource. Only by doing so can it be used sustainably, when it is appropriate and for the benefit of Northern Ireland.

The Northern Ireland Groundwater Resources Working Group (GRWG) is Chaired and facilitated by GSNI and brings together those in Northern Ireland government and academia that have a role to play in groundwater resources. The aim of the group is to identify what gaps exist in the sustainable use and management of groundwater resources in Northern Ireland and one of those gaps was a poor awareness of groundwater amongst the general public.

The lack of understanding and awareness of groundwater amongst the public is an issue that needs to be addressed on an ongoing basis and the GRWG is best placed to do this. Led by the NIEA, a publication highlighting what groundwater is, where it can be found, as well as why it is important for Northern Ireland was produced, with significant contribution from GSNI.

ENGAGEMENT HIGHLIGHT 5

NIEA Training

In response to the ongoing Covid-19 pandemic, three GSNI training courses were adapted for online delivery to the NIEA: these were an ‘Introduction to Geology and Hydrogeology’; ‘Geology and Hydrogeology of Karst’, and ‘Geology and Hydrogeology and the Sherwood Sandstone’.

For GSNI, the Sherwood Sandstone course is a new addition, and has been put together to highlight the importance of this aquifer and reservoir to groundwater, geothermal energy and subsurface storage. A total of 52 NIEA staff completed the courses in 2020–21, which made use of field and rock photographs, videos and 3D models, and gave demonstrations of the GSNI GeoIndex and National scale bedrock 3D model in order to demonstrate the geology and hydrogeology of the region.

Since GSNI started offering training to NIEA in 2018, a total of 170 attendees have come from the Natural Environment Division (NED) and Resource Efficiency Division (RED), and include participants from the following groups: Biodiversity & Conservation Science; Conservation, Designations and Protection; Countryside, Coasts and Landscapes; Planning Response Team; Regional Operations; Land Management Team and the Water Management Unit.

ENGAGEMENT HIGHLIGHT 6

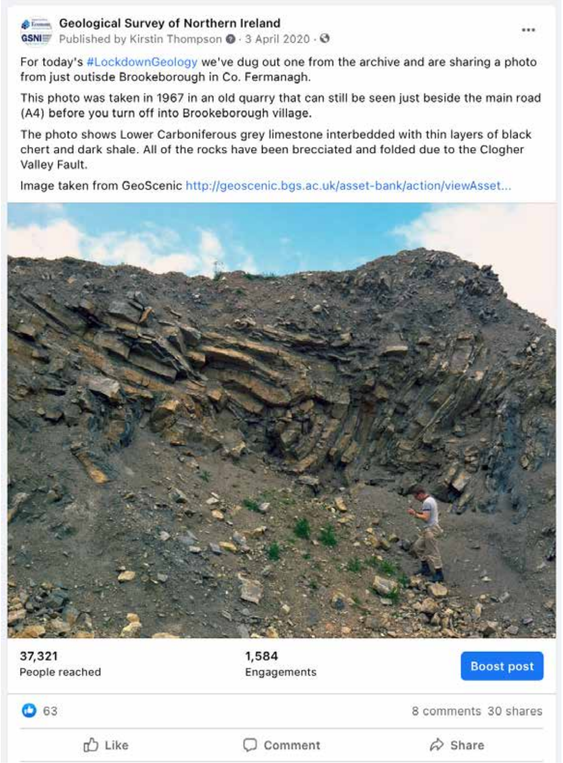
Loughareema on BBC’s The One Show

Opportunities to promote geoscience to a wide audience come along infrequently, therefore when they do, the GSNI makes the most of it. In February 2021, the One Show aired a segment about the ‘Vanishing Lake’ at Loughareema near Ballycastle. They combined the mythical stories associated with the site along with the scientific facts about how the lake comes to be there, and what causes it to vanish and reappear. The GSNI have been studying Loughareema since 2014, including monitoring the lake levels and surveying the area.

GSNI supported the production team with the planning and scripting of the segment. In addition, GSNI appeared on-camera to explain how a karstic sink hole in the Ulster White Limestone at the bottom of the lake acts as a plughole to take all the water on an underground journey making the lake appear like it vanishes.

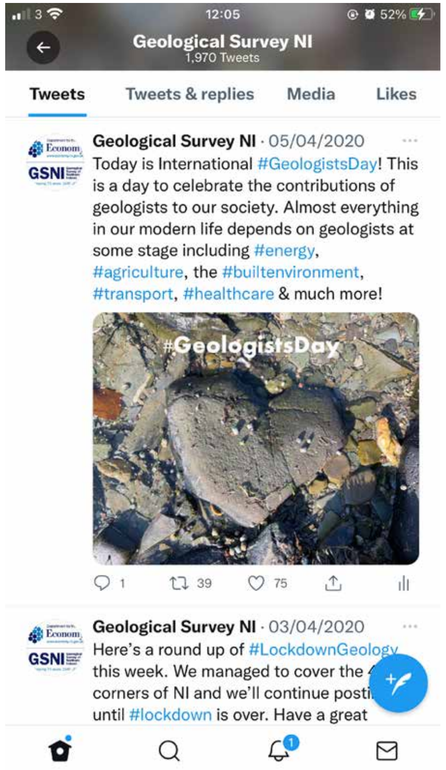
The show has a typical audience of 5 million across the UK and was an excellent opportunity to showcase the wonderful geology and geoscience capability we have in Northern Ireland.

SOCIAL MEDIA



FACEBOOK
Followers
67%

Most popular Facebook post was #LockdownGeology Brookeborough Fault with a reach of 37.3K

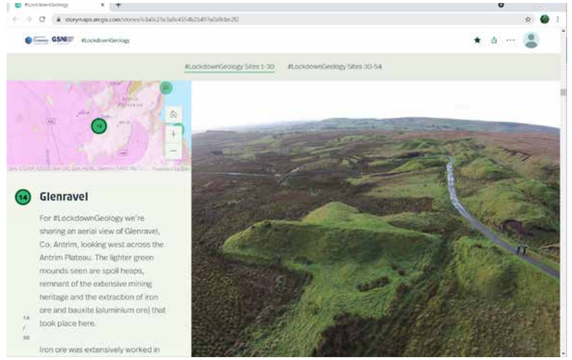


TWITTER
Followers
16%

Most popular Tweet was international Geology Day in April with a reach of 103K

INSTAGRAM
Followers
109%

Instagram followers up 109% from previous year



#LOCKDOWNGEOLOGY

In response to the stay at home message advised by the Northern Ireland Executive, GSNI embarked upon an extensive social media campaign to highlight geological sites.

The purpose of this was not only to raise awareness of our impressive geological diversity but to provide a window to the outdoors when most people were restricted to their homes.

#LockdownGeology had a total of 54 posts across each channel featuring geological sites across all six counties that were complied into an interactive storymap on ArcGIS online as a result of numerous requests from social media users.

There were a number of special themes such as geology and archaeology, geology and infrastructure with the most popular being a series on mining heritage. This series reached 27.3K people on Facebook alone over five days.

HOW WE PERFORMED

GOVERNANCE

Under the Minerals (Miscellaneous Provisions) Act (Northern Ireland) 1959, a Service Level Agreement (SLA) to undertake a research programme exists between DfE, Northern Ireland and the UK Research Institute (UKRI) represented by the BGS and carried out by the GSNI. The GSNI Director reports monthly, quarterly and annually to the DfE on the delivery of this research programme. The governance of GSNI and the performance of its work programme is also audited and reviewed as required by DfE. In addition, as a science Director at BGS, the GSNI Director reports to the BGS Senior Management Board.

PROCEDURES MANUAL

All aspects of GSNI governance is detailed in its Procedures Manual, an internal organisational document, which is updated as required, reviewed and signed by all staff annually and is also audited cyclically by DfE.

Date	Amendment/Additions
22/06/2020	Document restructure Update information re BCP Information re lone working FOI / EIR Requests
28/07/2020	BGS Mandatory Training Return
14/09/2020	Updated fire procedures for Dundonald House
18/11/2020	Site Access form for Dundonald House
27/01/2021	Move Mandatory Training information to end of Section 1 Insert Appendix 4 – Gift & Hospitality flow chart

HEALTH, SAFETY AND WELL-BEING

With all GSNI staff working from home from March 2020, health, safety and well-being has been a high priority with a robust work-from-home procedure adopted within weeks of the initiative of home-working.

Risk assessment and Covid Safe Systems of Work were required for all sites visits and visits to the office, when permissible according to Government guidance. In total, there were 34 risk assessments and 30 Covid Safe Systems of Work completed.

Mental health has been a primary concern and measures have been put in place to encourage good mental health, and to reduce the impact of working from home. In addition, two staff have undergone training in Mental Health First Aid, ensuring that it is given the same importance as physical first aid.

PUBLICATIONS AND ENQUIRIES

Type	Qty	Description
Papers	14	Peer-reviewed publications
Reports	2	Internal and external reports
Conference abstracts	3	Abstracts submitted as part of an academic conference
Magazine articles	4	Articles submitted for publication in a magazine
Other publications	6	Maps, leaflets and guidance documents
Enquiries	554	Requests for information dealt with through the enquiry system
Responses to planning consultations	151	Responses to consultations via the NI Planning Portal
Conssultation responses	8	Responses to consulations and Council Local Development Plans

DFE RESEARCH PROGRAMME

A summary of the research programme delivered as part of the DfE SLA is provided below.

Energy, Minerals and Waste		
Objective No.	**Objective**	**Targets Achieved in 20/21**
1	To support the regulatory and administrative functions of DfE MAPB for mineral exploration development and enhance the knowledge and understanding surrounding mineral resources in NI	Yes
2	To support the regulatory and administrative functions of DfE MAPB for petroleum exploration and development	Yes
3	To increase the knowledge, awareness and use of low carbon Earth energy resources	Yes
4	To increase knowledge and awareness of potential for geological storage of energy and carbon	Yes
5	To curate and promote the GSNI core archive	Only partially due to Covid
6	To carry out data collection, analysis and baseline monitoring to maintain & enhance EMW science capability	Only partially due to Covid

Information and Infrastructure		
Objective No.	**Objective**	**Targets Achieved in 20/21**
1	Provide DfE with advice on abandoned mines and reduce the associated risks	Yes
2	Increase the understanding of and increase resilience to geological hazards to minimise their impact on the NI economy	Yes
3	Provide advice and data to a diverse range of stakeholders and customers to underpin and support DfE interests	Yes
4	Realise the full potential of sustainable geological tourism and the benefit that it has for the NI economy	Yes
5	To maintain and develop the underpinning digital infrastructure and datasets that are essential for the delivery of all GSNI tasks	Yes
6	To increase the understanding of geoscience and its impact on the economy and the public of NI	Yes

Geology and Groundwater		
Objective No.	**Objective**	**Targets Achieved in 20/21**
1	Undertake baseline geological survey of prescribed areas of Northern Ireland and provided digital outputs to support DfE and stakeholder functions	Yes
2	Advance 3D geological models and their uptake by stakeholders at national and city scales, to allow visualization and assessment of the subsurface volume	Yes
3	Identify and undertake collaborative, high impact research and funding bids to support DfE and stakeholder needs	Yes
4	To maintain and develop Northern Ireland's hydrogeological datasets, knowledge and understanding in support of the sustainable use and protection of groundwater resources	Yes
5	To develop and inform a close and effective network of stakeholders in the sustainable development of groundwater resources	Yes

For further detail on actions completed see appendix 1.

OTHER RESEARCH PROGRAMMES

A summary of the research programmes delivered as part of non-DfE SLAs is provided below.

NIEA

GSNI has been operating under an SLA with the NIEA to deliver key actions under the Water Management Unit and Natural Heritage Directorates within NIEA.

The current SLA is renewed annually with a work programme being established to deliver a number of keys tasks as outlined below:

- Project management & provision of geoscientific advice
- Delivery of the NI Geodiversity Charter 2020-2024
- Earth Science Training for NIEA staff
- Supporting geoscientific information for the designation of NE County Antrim Karst identified under the Earth Science Conservation Review (ESCR)
- Sand Dunes Groundwater Level Monitoring
- Sand Dunes Groundwater Sampling and Analysis
- Sand Dune Hydrogeology Report

NEWRY MOURNE AND DOWN DISTRICT COUNCIL

GSNI has been operating under an SLA with Newry Mourne and Down District Council to deliver key actions to obtain UNESCO Global Geopark status for the region.

The current SLA is for a three-year period from 2020 to 2023, during which time there are a number of key deliverables including the ongoing preparation for the evaluation visit from UNESCO and the organisation and delivery of said visit. There is also work planned to continue with UNESCO Global Geopark maintenance specifically providing geological advice, attending meetings, and contributing to events.

In 20/21 a number of key outputs were delivered:

- Geopark primary and post-primary education resources
- Geopark geology map and geology booklet
- Contribution to new Geopark signage and interpretation
- Contribution to Geopark Development Plan
- Design of UNESCO Global Geopark Assessment visit
- Contribution to delivery of Geopark education and public events
- Attendance and contribution to Geopark Steering Group meetings

NI WATER

GSNI has been operating under an SLA with NI Water to provide hydrogeological oversight for the development of groundwater resources to supplement the NI drinking water supply.

GSNI's main role is to scope relevant work required from external hydrogeological consultants, as well as the assessment and review of such work, and to present this internally to NI Water.

OUR STAFF

LEARNING & DEVELOPMENT

Learning and Development (L&D) is primarily managed by the L&D team at BGS who provide and support training in leadership and management, behavioural / soft skills, IT, science, Health and Safety, bespoke coaching, mentoring and other training opportunities as they arise.

The table below highlights the courses that were taken by GSNI staff in 20/21.

Course Type	No. Courses	Total no. of courses delivered
Leadership and Management	3	4
Behavioural / Soft Skills	7	8
Technical	2	3
Health and Safety	1	2
IT (including Cyber Security)	2	4

All staff completed BGS mandatory training on:

- Anti-slavery and human trafficking
- GDPR
- Display Screen Equipment
- Driving for Work
- Fire Safety Awareness
- Taking Security Home: working remotely
- Kevin Mitnick Security Awareness Training
- Cyber and Data Protection Awareness
- Equality and Diversity – an overview
- Unconscious Bias

All staff completed NICS mandatory training on:

- Display Screen Equipment
- Fire Safety Awareness
- Responsible for Information

CONTINUING PROFESSIONAL DEVELOPMENT (CPD)

Continuing Professional Development is encouraged and supported at all levels. The CPD highlights for 2020–2021 are as follows:

- One staff member has been successful in achieving a Personal Promotion through BGS and has moved from being a Band 7 to a Band 6 scientist.
- One staff member is currently undertaking a MSc in Climate Change and Development with the University of London.
- One staff member has been awarded a Public Appointment as a member of the Management Committee for Armagh Observatory and Planetarium, selected by the Minister for the Department for Communities.
- Three staff members are working towards Chartership and/or PGeo from either the Geological Society of London or the Institute of Geologists of Ireland.

VOLUNTARY EXIT SCHEME

Our parent organisation received £1.8 million from UK Research and Innovation towards a voluntary exit scheme to enable a review of its workforce; three members of GSNI staff took this opportunity to retire and will leave the organisation in June 2021.

OUR COLLABORATIONS

GSNI collaborates with numerous stakeholders to deliver a number of strategic objectives. A list of the main collaborations is provided below:

	Stakeholder	Description
International	GSI, EMD, InvestNI, Geoscience Ireland, Enterprise Ireland	Support DfE in maintaining the profile of the Northern Ireland minerals industry on the virtual global stage at PDAC, Toronto.
	UNESCO	Work with the UNESCO Global Geoparks Council and UNESCO Secretriat to maintain and develop UNESCO Global Geoparks internationally and to raise profile of NI.
	North-East Atlantic Geological Surveys	Partnership of 10 Geological Surveys within the Northeast Atlantic area exploring geological themes where there is a significant overlap in interest.
	Royal Irish Academy	Geosciences and Geographical Sciences Committee
	BGS, GSI and GSNI Directors	Memorandum of Understanding between three geological surveys in the UK and Ireland
Research	Leeds University	Ongoing visits from staff and students and the development of research projects on ore deposits in NI
	Queen's University, Belfast	GSNI and QUB led an international conference on geothermal energy and are delivering a follow-on series of monthly webinars
	University of Wollongong, Australia	Collaborative research project on Mourne Mountains glaciation
	Durham University	Triassic palaeoclimates and geochemistry
	Birmingham University / Ulster Museum	Jurassic Triassic boundary across Northern Ireland
	iCRAG	Member of the iCRAG Governance Board
Central Government	DfI	Leading on the development of the Minerals Working Group
	DoJ / Emergency Services	Liaison with DoJ, emergency services and local resilience groups to maintain the Abandoned Mine Emergency Response Plan
	DAERA / NI Water	Leading on the development of the Groundwater Resources Working Group
	DfE / DfI	Representation on UK Minerals Forum together with GB government, industry, professional bodies and NGOs
	DAERA / DfI	Representation on the Coastal Forum Working Group
	DfI / DAERA / HSENI / NI Water / NIHE / Airports	Representation on the NI Planning Forum together with other Statutory Consultees
	OSNI / DAERA / DfI	Representation on the NI Earth Observation Steering Group

RESEARCH SUPERVISION

GSNI currently has responsibility for research supervision in collaboration with the following Universities:

Institution	Description
Sheffield University	PhD - Northern Ireland esker mapping and formation
Royal Holloway, University of London	MSc - Retreat moraines and evolution of Lough Erne
Leeds University	PhD - Northern Ireland orogenic gold formation
Queen's University Belfast	PhD - Geothermal policy
Birmingham University	PhD - Stratigraphy and emplacement of the Antrim Lava Group
Royal Holloway, University of London	PhD - Antrim Plateau glaciation
University of Aberdeen	PhD - The low enthalpy geothermal potential of shallow aquifer in Northern Ireland

POTENTIAL FUTURE COLLABORATIONS

A number of discussions have taken place with stakeholders in 2021/2022 that are likely to lead to key collaborations with GSNI. A list of these potential future collaborations is provided below:

Stakeholder Type	Stakeholder	Description
Research	Queen's University, Belfast	Exploring the possibility of research into human-landscape interactions during the Holocene.
	Portsmouth University (together with HSENI)	Exploring the possibility of research into geological hazards in basalt quarries in Co. Antrim
	BGS, DfE, DIAS	Space Weather and Natural Seismic Monitoring Station installation
	Ulster University / iCRAG	Exploring the potential for using NI Marine Data to support the development of offshore wind energy
	Ulster University	Exploring the possibility of coastal geology and geomorphology research to support GSNI's new Science Strategy
Central Government	DAERA	Assessment of historical shoreline change and development of improved coastal geology datasets through the Coastal Forum Working Group
	DAERA	Collaboration to better assess and respond to Peat Slide Risk Assessments as part of the NI development planning process
	DAERA / DfI	Assessment of NI Coastal Vulnerability and adaptation to climate change as part of potential PeacePlus EU-funding bid
	GSNI/GSI and others	PeacePlus geothermal bid
	DfE and others	Geothermal Advisory Committee
	LPS / OSNI	Potential to help in expanding gravity base station network in NI in conjunction with BGS.
	OSNI / DAERA / DfI	Representation on the newly-established NI Earth Observation Steering Group

FINANCE

2020–2021FY Projects	Amounts*	%
NI Public Service Level Agreements	£ 809,593.76	85%
Research	£ 14,088.41	1%
BGS Teams	£ 70,628.41	7%
Professional Development (UKRI)	£ 37,818.48	4%
Covid-19	£ 17,286.58	2%
	£ 949,415.64	100%

*excludes overheads

NORTHERN IRELAND PUBLIC SCIENCE

GSNI predominantly provides public science research services to government departments and NI councils, primarily for DfE as part of its three-year recurrent work programme managed under a service level agreement (SLA), for DAERA under an annual SLA, and for Newry, Mourne and Down District Council (NMDDC) on its UNESCO Global Geopark bid.

BGS TEAMS

GSNI also has funding from UK Research and Innovation (UKRI) via BGS and EU programmes. GSNI-based staff work on BGS Teams (UKRI) either on external research or internal ‘national-capability’ or operational projects.

PROFESSIONAL DEVELOPMENT

As GSNI staff are UKRI employees, BGS (UKRI) pays for their continuing professional development (CPD), mandatory training including health and safety.

COVID 19

BGS permitted staff time for home schooling and caring for dependants during the pandemic.

FORWARD LOOK

GSNI 10-YEAR SCIENCE STRATEGY

GSNI produced its draft Science Strategy for Northern Ireland 2021–2022 ("*Geoscience for a brighter future*") at the end of last financial year; an inaugural and ambitious blueprint for driving the geoscience agenda across government and utilising our expert resource to improve the economy, protect the environment and enhance the lives of people in Northern Ireland.

The Strategy is a result of substantial feedback from almost 600 respondents to an online survey, 120 stakeholders who gave input face-to-face at bespoke events and meetings with major data users and policy-makers. It sets out a challenging plan which, when delivered, will see a seismic change in the level of contribution of GSNI to Northern Ireland's public services and an enhanced appreciation of the role of geoscience in society.

The draft Strategy was presented to GSNI's Science Advisory Committee on 23 March 2020 for member's feedback; it was warmly received and supported pending minor edits and some presentational changes.

GSNI's four key strategic objectives are focused on:

- UN Sustainable Development Goals
- Unlocking the value of our data
- Partners and customers
- People and assets

The strategic objectives will be delivered through four science and innovation programmes;

1. Natural resources and energy transition

GSNI will carry out research and provide expertise to facilitate the transition to a low-carbon economy through the sustainable use of natural resources including critical raw materials, geothermal energy, and groundwater.

2. Environmental change and geohazards

GSNI will fortify its understanding of geoenvironmental change and geohazards to determine the risks and potential impacts on wider economic, societal, and environmental systems.

3. Science for Society

GSNI will enhance public understanding and engagement with geoscience by informing policy development and implementation, involving stakeholders, supporting sustainable geological tourism, and developing geoscience education.

4. Digital transformation

GSNI will unlock the vast information held within its archives, invest in data delivery mechanisms and new data products and services, and encourage and support its use to underpin evidence-based, decision-making.

Relevant and bi-laterally, DfE procured research into the economic, societal and environmental impacts of future onshore petroleum exploration and production, including Unconventional Oil and Gas (UOG), in Northern Ireland in October 2020.

Furthermore in February 2021, DfE carried out a similar exercise for a new research study into the potential economic, societal and environmental impacts of mineral exploration and mining in Northern Ireland. The outcomes of both pieces of work will dovetail with, and impact upon, GSNI's draft Strategy.

The next steps are to await the findings and outcomes of the minerals and petroleum research contracts, factor into the draft strategy as required, and then consult NICS departments on an updated draft strategy in September 2021.

HYBRID WORKING

Looking forward to next financial year, GSNI has fully embraced the recovery ethos from the impacts of COVID-19 on our work and service delivery. COVID-19 has provided space for GSNI to review and think differently about how it works, requirements for digital investment and the importance of investing in our people, both in terms of skills and well-being. GSNI will continue to be supported by BGS as it maintains its own COVID-19 taskforce throughout 2021/22.

GSNI will continue to follow Government guidance and process with a consistent but cautious approach. In parallel, we will implement our hybrid ways of working model through the UKRI and NICS evaluation phases. We will also seek to renew the focus on staff-support tools and activities, e.g. Action for Happiness, the Employee Assistance Programme and occupational health services.

GSNI will formulate and develop a new work programme for the next three-year SLA cycle, with supporting business case for additional resources to deliver its new science strategy.

Based on the 2021 BGS Staff Engagement Survey and, as a result, BGS (and GSNI) will focus on three areas:

- leadership change management
- career and skills development
- stress management

EU PEACE PLUS PROGRAMME

GSNI together with its strategic partner GSI, will continue with work to advice and inform the policy context, draft programme, strategic objectives and indicators in order to form a geothermal theme of the €1BN EU PEACE PLUS Programme. We will hold discussions with key stakeholders in central and local government and non-departmental public bodies, and also academic experts, and non-government organisations.

The development of the 2021-27 PEACE PLUS programme has been taking place since Autumn 2019. A public consultation for the draft programme was launched on 10 March 2021 and will conclude on 12 May 2021; further refinement of the cooperation document will take place to reflect the stakeholder input received. The draft PEACE PLUS programme must then be approved by both NI and RoI Administrations.

The EC and the Irish Government have jointly committed €206m to the Programme with the British Government providing at least €560m (£500m). The NI Executive €150m (£134m) and

Irish Government €52m providing additional match funding, it is expected that the PEACE PLUS Programme budget will be approximately €1bn. The draft programme must also submitted to the EC for approval with the first call expected in early 2022.

If the final draft EU PEACE PLUS Programme features a Geothermal Theme, this provides an ideal opportunity to demonstrate a geothermal project on either side of the Irish border. To date GSNI and GSI's geothermal proposal has been supported by officials in DfE and DoF in NI, and DECC and DPER in Ireland and listed in their respective parent departments' strategic priorities.

GEOTHERMAL

Next Financial year, GSNI will have a major focus on informing and enabling geothermal heat policy development process. This work will include establishing a new Geothermal Advisory Committee for Northern Ireland, publishing a Geothermal Prospectivity Report for Northern Ireland, hosting another Geothermal conference in spring 2022 with policy-led roundtables and stakeholder fringe events and begin to scope and plan geothermal pioneer capitals projects.

COASTAL GEOLOGY DATASETS

GSNI, together with other with representatives from Central Government, Local Government and The National Trust sit on the Coastal Forum Working Group (CFWG). Much of the identified work programme of the CFWG is a result of the Baseline Study and Gap Analysis of Coastal Erosion Risk Management NI, prepared by Amey Consulting with HR Wallingford for DfI and DAERA.

This seminal report identified significant shortfalls in the knowledge base around coastal erosion in Northern Ireland. It acknowledged that a comprehensive collation of relevant data sets would be essential to inform coastal erosion risk management and contribute to an effective Coastal Erosion Risk Management strategy.

GSNI has been working with DAERA to develop a SLA that will enable us help to address elements of that knowledge gap through the provision of coastal geology datasets with assistance from colleagues from the wider BGS. The main outputs of this SLA will be to produce a coastal bedrock geology dataset for the Northern Ireland, and to carry out a pilot study to define the methodology to produce a coastal superficial geology dataset.

PUBLICATIONS

GSNI produces numerous publications each year in the form of peer-reviewed papers, reports, conference abstracts, magazine articles, and various online publications. A list of all those produced in 2020/2021 are listed below:

PEER-REVIEWED PAPERS

Boomer, I., Azmi, A., Copestake, P. & **Raine, R.** (2020). Lower Jurassic (Hettangian–Pliensbachian) microfossil biostratigraphy of the Ballinlea-1 well, Rathlin Basin, Northern Ireland, United Kingdom. *Proceedings of the Geologists' Association*. https://doi.org/10.1016/j.pgeola.2020.06.002

Boomer, I., Copestake, P., **Raine, R.**, Azmi, A., Fenton, J.P.G., Page, K.N. & O'Callaghan, M. (2020). Stratigraphy, palaeoenvironments and geochemistry across the Triassic–Jurassic boundary transition at Carnduff, County Antrim, Northern Ireland. *Proceedings of the Geologists' Association.* https://doi.org/10.1016/j.pgeola.2020.05.004

Elío, J., Crowley, Q., Scanlon, R., Hodgson, J., Long, S., **Cooper, M.R.**, & Gallagher, V. (2020). Application of airborne radiometric surveys for large-scale geogenic radon potential classification. *Journal of the European Radon Association*, 1. https://doi.org/10.35815/radon.v1.4358

Franklin, J., Tyrrell, S., O'Sullivan, G., Nauton-Fourteu, M. & **Raine, R.** (2020). Provenance of Triassic sandstones in the basins of Northern Ireland—Implications for NW European Triassic palaeodrainage. *Geological Journal*, 55 (7). 5432-5450. https://doi.org/10.1002/gj.3697

Fyfe, L.-J.C., Schofield, N., Holford, S.P., Heafford, A. & **Raine, R.** (2020). Geology and petroleum prospectivity of the Larne and Portpatrick basins, North Channel, offshore SW Scotland and Northern Ireland. *Petroleum Geoscience*, 26 (2). 272-302. https://doi.org/10.1144/petgeo2019-134

Kirkwood, C., **Cooper, M.**, Ferreira, A., & Beamish, D. (2020). Unmixing and mapping components of Northern Ireland's geochemical composition using FastICA and random forests. *EarthArXiv.* May 7. https://eartharxiv.org/8k3f7/

Laborde-Casadaban, M., Homberg, C., Schnyder, J., Borderie, S. & **Raine, R.** (2021). Do soft sediment deformations in the Late Triassic and Early Jurassic of the UK record seismic activity during the break-up of Pangea? *Proceedings of the Geologists' Association*. https://doi.org/10.1016/j.pgeola.2021.02.007 (In Press)

Raine, R., Copestake, P., Simms, M.J. & Boomer, I. (2020). Uppermost Triassic to Lower Jurassic sediments of the island of Ireland and its surrounding basins. *Proceedings of the Geologists' Association*. https://doi.org/10.1016/j.pgeola.2020.04.001

Russell, A., McDermott, F., McGrory, E., **Cooper, M.**, Henry, T., & Morrison, L. (2021). As-1 Co-Ni sulfarsenides in Palaeogene basaltic cone sheets as sources of groundwater arsenic contamination in Co. Louth, Ireland. *Applied Geochemistry*, 127, 104914. https://doi.org/10.1016/j.apgeochem.2021.104914

Stoker, B., Livingstone, S., Barr, I. Ruffell, A., Storrar, R. & **Roberson, S.L.** (2021). Variations in esker morphology and internal architecture record time-transgressive deposition during ice margin retreat in Northern Ireland. *Proceedings of the Geologists' Association*. https://doi.org/10.1016/j.pgeola.2021.03.002

Wilson, P., O Dochartaigh, B. & **Cooper, M.** (2020) Conceptual models for Northern Ireland's Cretaceous and Carboniferous aquifers. In: *Characterisation and Management of Groundwater in Limestones, Online*, 19-20 Oct 2020. International Association of Hydrogeologists, 51-58.

Zhang, L., McKinley, J.M., **Cooper, M.**, Peng, M., Wang, Q., Song, Y. & Cheng H. (2020). A regional soil and river sediment geochemical study in Baoshan area, Yunnan province, southwest China. *Journal of Geochemical Exploration*, 217, 106557. https://doi.org/10.1016/j.gexplo.2020.106557

Zhang, L., McKinley, J.M., **Cooper, M.**, Han, W., Liu, F., Song, Y., Peng, M., Liu, X., Yang, W. & Cheng, H. (2020). Transfer processes of potential toxic elements (PTE) between rock-soil systems and soil risk evaluation in the Baoshan area, Yunnan Province, Southwest China. *Applied Geochemistry*, 121, 104712. https://doi.org/10.1016/j.apgeochem.2020.104712

Zheng,W., Liu, B., McKinley, J.M., **Cooper, M.** & Wang, L. (2021). Geology and geochemistry-based metallogenic exploration model for the eastern Tethys Himalayan metallogenic belt. *Tibetan Journal of Geochemical Exploration*, 224, 106743. https://doi.org/10.1016.gexplo.2021.106743

CONFERENCE ABSTRACTS

Cooper, M., Tapster, S. & Condon, D. (2020). Feeling the pulse? New high-resolution U-Pb zircon geochronological constraints for the Northern Ireland sector of the North Atlantic Igneous Province. *EGU General Assembly 2020, Online, 4–8 May 2020*, 2020EGUGA..22.8464C

Ortega Rodriguez, A., Carrilho Gomes, R., Telmo Jeremias, F., Santamarta Cerezal, J. C., Quental, L., Galindo Jiménez, I., Correia, V., Narciso Pinto, C., Le Dantec, N., Gouveia, F., **Lemon, K.**, Hénaff, A., & O'Hare, G. (2020). AGEO – Natural hazard prevention and awareness raising through citizen observatories. *EGU General Assembly 2020, Online, 4–8 May 2020,* EGU2020-13519. https://doi.org/10.5194/egusphere-egu2020-13519.

Smillie, Z., Demyanov, C., McKinley, J. & **Cooper, M.** (2020). Can radiometric data improve lithology mapping and geological understanding through unsupervised classification? *13th International Conference on Geostatistics for Environmental Applications 2020*

REPORTS

Cooper, M. (2021). Longford Down Technical Report. Nottingham, UK, British Geological Survey

O'Dochartaigh, B., & **Wilson, P.** (2021). Quality assurance procedures for aquifer property and chemistry data in the Northern Ireland Groundwater Data Repository. Nottingham, UK, British Geological Survey, 19pp. (CR/21/002N) (Unpublished)

MAGAZINE ARTICLES

Lemon, K. (2020). Geology and sustainable tourism: the benefits of UNESCO in Northern Ireland. AgendaNI, September 2020. https://www.agendani.com/geology-and-sustainable-tourism-the-benefits-of-unesco-in-northern-ireland/

Lemon, K. & **Parker, K.** (2020). Delivering an emergency response for abandoned mines: a multi-agency approach to reducing public risk. IMQS Annual Review, 2020. https://www.imqs.ie/wp-content/uploads/dlm_uploads/2020/12/imqs-2020-annual-review.pdf

Raine, R. (2020). Using science to produce clean heat, create jobs and warm homes. AgendaNI, December 2020. https://www.agendani.com/using-science-to-produce-clean-heat-create-jobs-and-warm-homes/

Parker, K., & **Lemon, K.** (2020) Coalisland Coalfield. Northern mine Research Society Newsletter, July 2020

OTHER PUBLICATIONS

IGI (2021). Minerals and mining on the island of Ireland: factsheets. IGI Minerals Information Working Group.

Cooper, M., **Donald, A., & Lemon, K.** (2021). Lurgan Geology and Heritage Trail. Armagh, Banbridge and Craigavon District Council.

Lemon, K., **Cooper, M.** & **Roberson, S.L.** (2021). A guide to the geodiversity of Mourne Gullion and Strangford. Newry Mourne and Down District Council.

Lemon, K., **Cooper, M.**, **Roberson, S.L.** & **Donald, A.** (2021). Mourne Gullion Strangford. Exploring the landscapes of the Mourne Gullion Strangford Aspiring UNESCO Global Geopark. Newry Mourne and Down District Council.

Lemon, K., **Roberson, S.L.** & Dempster, M. (2021). Northern Ireland's Geodiversity Charter. Belfast, Geological Survey of Northern Ireland.

Parker, K. & **Lemon, K.** (2021). Guidance for planning developments in areas of abandoned mines. Belfast, Geological Survey of Northern Ireland.

APPENDIX 1 - DFE SLA RESEARCH PROGRAMME

GOVERNANCE AND ADMINISTRATION

OBJECTIVE & TARGET	NO	ACTIONS	COMPLETE	COMMENT
Ensure compliance on all aspects of corporate governance at GSNI	1a	Participate in monthly DfE SLT and BGS SMB meetings (and covid19) meetings as required		
	1b	Update GSNI Procedures manual as required; annual review and signature by all GSNI staff		
	1c	Quarterly invoice verification and budget monitoring		
	1d	Carry out all financial transactions and reconciliation incl. sales, stock management, procurement, purchases and travel according to NICS and UKSBS policies.		
	1e	Ensure Health, safety and wellbeing of all GSNI staff and self		
Monitor and report on DfE contract deliverables and finance	2a	Chair monthly GSNI Senior Leadership Team meeting and file SLT(s) reports		
	2b	Produce quarterly SLA report and report to DfE at SLA review meetings		
	2c	Publish 2019-2020 FY Annual report		
Work with DfE and stakeholders to define future GSNI public tasks	3a	Engage, collaborate and communicate with NI gov depts, NDPBs, councils, universities, NGOs etc.		
	3b	Nurture and develop BGS/GSI/GSNI MoU		
	3c	Participate in Bi-annual NAG meetings and strategic projects		
	3d	Participate in RIA Geosciences and Geographical Sciences Cttee meetings		
	3e	Collaborate with Institute of Geologists of Ireland		
	3f	Participate in NIA All Party Group STEM meetings, NI Science Festival and Science in Stormont event		
Work with DfE and stakeholders to define future public science tasks of GSNI	4a	Consult and produce GSNI Science Strategy with GSNI's SAC and		
	4b	Bi-annual Science Advisory Committee (SAC) meetings		
Lead a NI/ RoI geothermal demonstrator €20M EU PEACE PLUS bid with key partners	5a	Develop project bid with partners adhering to DfE/SEUPB timelines for each project milestone.		
Build capacity and resources at GSNI	6a	Support and advise on the continued strategic development of all GSNI staff		

ENERGY, MINERALS AND WASTE

OBJECTIVE & TARGET	NO	ACTIONS	COMPLETE	COMMENT
To support the regulatory and administrative functions of DfE Minerals & Petroleum Branch	1a	Minerals exploration and development.		
	1b	To carry out research into the resource potential for metallic and non-metallic minerals in Northern Ireland		
	1c	To establish accurate information on quarry commodities and resources to augment the Annual Mineral Statement.		
To support the regulatory and administrative functions of DfE Minerals & Petroleum Branch for petroleum exploration and development.	2a	Research and review technical & other issues associated with petroleum exploration & production		
	2b	Provide advice on technical aspects of PL applications		
	2c	To provide scientific evidence & advice in support of policy development		No requirement from DfE
To increase knowledge, awareness and use of low C Earth energy resources	3a	Research, review and publicise potential use of geothermal energy		
	3b	To provide scientific and technical support to underpin evidence-based policy development		
	3c	To work towards application for geothermal energy demonstrator project to EU PEACE PLUS funding		
To increase knowledge and awareness of potential for geological storage of energy and carbon	4a	To review current research on underground energy storage in porous media and salt caverns		
To curate and promote the GSNI core archive	5a	To improve the core and rock archive and to increase its profile and use as a valuable scientific and teaching resource		Not completed due to Covid-19 restrictions
To carry out data collection, analysis and baseline monitoring to maintain & enhance EMW science capability	6a	Baseline seismicity monitoring		No planned progress due to Covid-19 restrictions
	6b	Baseline space weather monitoring		No planned progress due to Covid-19 restrictions
	6c	Characterisation of bedrock & superficial sediments		Not completed due to Covid-19 restrictions

Complete

Not complete

Not required / no planned progress due to Covid-19

INFORMATION AND INFRASTRUCTURE

OBJECTIVE & TARGET	NO	ACTIONS	COMPLETE	COMMENT
Provide DfE with advice on abandoned mines and reduce the associated risks	1a	Monitor and manage NI abandoned mines prioritising emerging issues, and ensure that overall mine risk is mitigated, and report to NIMOC as required.		
	1b	Fulfil emergency response responsibilities as required.		
Increase the understanding of and increase resilience to geological hazards to minimise their impact on the NI economy	2a	Expand the knowledge base around geological hazards by recording all known events in this FY, exploring one opportunity for research funding and complete 1st stage of MSC climate change dissertation.		
	2b	Increase the potential of geological hazard monitoring through researching the use of satellite observation, initiating a geological hazard monitoring programme and hosting a geological hazard stakeholder workshop.		
Provide advice and data to a diverse range of stakeholders and customers to underpin and support DfE interests	3a	Provide an efficient and high-quality enquiry service by responding to 90% of all enquiries within 21 calendar days.		84% completed within 21 day time frame. Predominantly due to complex enquiries from large infrastructure projects.
	3b	Provide accurate and timely information for Planners and developers by responding to 90% of planning consultations within the statutory deadline and 90% of all major and regional planning consultations and LDP responses within the DfE timeline.		
Realise the full potential of sustainable geological tourism and the benefit that it has for the NI economy	4a	Ensure that Newry Mourne and Down District Council achieve UNESCO Global Geopark (UGGp) status and the Arch Caves UGGp maintain their status by providing advice at Steering Group and Management Team meetings, contributing to at least 6 outputs and by assisting with UNESCO evaluation and revalidation missions		
	4b	Improve the sustainable tourism potential of the Giant's Causeway by attending quarterly Management Meetings, contributing to at least 3 outputs and developing a road map for UGGp status.		
	4c	Raise the profile of NI's UNESCO sites and develop future opportunities for sustainable geological tourism by attending UK and Irish UGGp committee meetings, participating in EGN meetings and carrying out evaluation and revalidation missions for UNESCO.		
	4d	Develop sustainable geological tourism opportunities with local councils by participating in the Whitespots Leadership Group meetings with Ards and North Down Council.		No requirements from ANDC.
To maintain and develop the underpinning digital infrastructure and datasets that are essential for the delivery of all GSNI tasks	5a	Ensure effective IT systems are in place by managing the GSNI server, installing relevant scientific software and troubleshooting 95% of related issues within 14 days.		
	5b	Maximize the potential impact of GSNI data by compiling a Data Survey to inform development, compiling a roadmap for delivery of online data and assets, and explore new technologies for data collection and delivery.		
	5c	Support all GSNI teams with identified GIS data processing and ensure long-term viability by developing a road map for future GIS infrastructure.		
	5d	Produce a consistent and high quality graphic design and publication service across all GSNI teams to assist in the delivery of the DfE SLA		
To increase the understanding of geoscience and its impact on the economy and the public of NI	6a	Increase the public awareness of geosciences and GSNI by working with DfE on a programme of stakeholder and public engagement, increasing reach of GSNI social media by 5%, and organising at least one event as part of NI Science Festival with a satisfaction rating of 90% or higher		
	6b	Increase the understanding of the subsurface in schools by developing a geoscience education roadmap, producing a suite of online resources to complement the NI curriculum and delivering two schools-based events with an 90% satisfaction rate		No schools events possible due to Covid-19 restrictions.

GEOLOGY AND GROUNDWATER

OBJECTIVE & TARGET	NO	ACTIONS	COMPLETE	COMMENT
Undertake baseline geological survey of prescribed areas of Northern Ireland and provided digital outputs to support DfE and stakeholder functions	1a	Complete desk-based interpretation of Superficial Deposits and Artificial layers for the whole Newry DigMap tile. BGS support from Leanne Hughes will be sought if budget allows (ii, iii, iv & v).		Not complete due to Covid-19 restrictions
	1b	Complete a draft technical report to accompany Longford-Down bedrock map.		
Advance 3D geological models and their uptake by stakeholders at national and city scales, to allow visualization and assessment of the subsurface volume.	2a	Align GSNI national scale modelling with BGS Deep Earth UK National Geological Model.		
	2b	Align GSNI national scale modelling with BGS Shallow Earth UK National Geological Model. (BGS Budget code)		Not complete due to Covid-19 restrictions
	2c	Belfast Urban Model (Be3D).		Not complete due to software complexities
Identify and undertake collaborative, high impact research and funding bids to support DfE and stakeholder needs.	3a	Continued support of existing research commitments. Identify strategic research areas for future collaboration.		
To maintain and develop Northern Ireland's hydrogeological datasets, knowledge and understanding in support of the sustainable use and protection of groundwater resources	4a	An improved Groundwater Data Repository (GDR) that is used to inform policy and decisions on the sustainable use and protection of groundwater resources		
	4b	Publish and launch the 'Northern Ireland Aquifer's' publication		Not complete due to BGS staff illness associated with Covid-19
	4c	Release the new Northern Ireland Groundwater Map on the GeoIndex		
	4d	Establish and develop a research platform for addressing the hydrogeological knowledge gaps in Northern Ireland that will enhance the effective sustainable use and protection of groundwater resources		
To develop and inform a close and effective network of stakeholders in the sustainable development of groundwater resources	5a	Increase the understanding of sustainable development of groundwater resources amongst government, industrial and academic stakeholders as well as the general public		
	5b	For a digital platform that enables hydrogeologists practising within Northern Ireland to share knowledge and for the dissemination of new data releases and groundwater related information to be functioning by the end of the year		

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www.economy-ni.gov.uk

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