Economic Valuation of BGS' National Geological Repository

Final Summary Report

18 July 2025

Human Economics

To what extent has the National Geological Repository delivered value for UK society? How could further investment help to secure and enhance this value?

Human Economics

Version control

Project J1067 BGS Economic Value of the National Geological Repository

Report Final Summary Report

Client British Geological Survey

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Abbreviations

BCR	Benefit Cost Ratio
BGS	British Geological Survey
bn	Billion
CBA	Cost Benefit Analysis
CAES	Compressed Air Energy Storage
CCS	Carbon capture and storage
DESNZ	Department for Energy Security and Net Zero
GDF	Geological Disposal Facility
GDP	Gross Domestic Product
HMT	HM Treasury
HLW	High-level radioactive waste
ILW	Intermediate-level radioactive waste
km	Kilometre
LLW	Low-level radioactive waste
m	metres
NERC	Natural Environment Research Council
NDA	Nuclear Decommissioning Authority
NGR	National Geological Repository
NGS	National Geological Screening
NIREX	Nuclear Industry Radioactive Waste Executive
NPV	Net Present Value
NWS	Nuclear Waste Services
OBR	Office of Budget Responsibility
RoI	Return on Investment
RWM	Radioactive Waste Management
UKRI	UK Research and Innovation
VfM	Value for Money

Contents

> **"The BGS' core facility (the National Geological Repository) is invaluable in enabling researchers to use legacy geological materials and data for new purposes in the transition to low-carbon energy."**
>
> **— Gary Hampson, Professor of Sedimentary Geology, Imperial College London**

> **"The collection of physical material (core), part of the NGR, serves as a key national asset that supports ongoing and new research projects, often reusing data collected from previously studied boreholes. This facility enables scientific observations to be revisited, expanded upon, and applied in new contexts. The preservation of this material ensures that the UK scientific record remains robust and accessible for future generations."**
>
> **— Nick Terrell, Industry Co-Chair, Subsurface Task Force**

> **"As the centre for long-term curation of UK cores, the National Geological Repository is a hugely valuable national asset. Representing billions of pounds of investment, core materials appreciate in scientific value as our technologies advance. These cores have the potential to benefit society fundamentally, providing unique sources of information on the subsurface for uses that are only dimly perceived at present."**
>
> **— Stephen P. Hesselbo, Professor of Geology, University of Exeter**

> **"The National Geological Repository offers the most comprehensive and readily accessible subsurface dataset in the UK."**
>
> **— Equinor Representative**

Executive Summary

Introduction

The British Geological Survey (BGS) is the UK's national geological survey and one of the oldest institutions of its kind globally. Founded in 1835, BGS now operates as a mission-led research centre within UK Research and Innovation (UKRI), under the Natural Environment Research Council (NERC). Its work focuses on improving the UK's understanding of its subsurface environment – and enabling the best use of this environment to support key policy initiatives, the energy transition, infrastructure delivery and economic development – through systematic geological surveying, long-term monitoring, data curation and applied research.

At the heart of BGS' work is the National Geological Repository (NGR) — the UK's principal archive of physical geological samples and subsurface data. Located at BGS' headquarters in Nottinghamshire, the NGR houses over 16 million geological samples and specimens, including over 600km of drill core (cylindrical sections of subsurface rock, 30-150mm in diameter and 1-3m in length) collected from UK boreholes and wells. These collections are a critical national asset, providing data and insight into the geology of the UK and its Continental Shelf, that can be analysed and examined to inform the nation's energy transition, management of its natural resources, and resilience to environmental hazards.

This study focuses on the NGR – rather than the work of BGS more broadly – and assesses the value that the NGR has delivered to date for the UK. In doing so it also sets out the key strategic arguments for why further investment in the NGR — particularly in digitisation and expanded storage capacity — is necessary to unleash the potential of its collections as nationally enabling infrastructure. This study was commissioned by BGS, in recognition of the challenges facing the NGR, and was delivered by Human Economics, supported by Ipsos.

Approach

The uses of the NGR are vast and varied. Its collections are, and have been, used by BGS and other key stakeholders to inform policy decisions, regulatory activity, private sector investment and community consensus-building across many of the most strategically important infrastructure projects and resource and energy questions facing the UK – from oil and gas exploration to offshore wind development, ground water management, and major net zero initiatives. Given this wide breadth of uses, this study adopted a case-study approach, focussing on how the NGR has supported four high-value, high-profile activities:

1. UK shale gas exploration, policy development and moratorium,
2. The long-term geological disposal of the UK's radioactive waste,
3. The development of the UK's carbon capture and storage (CCS) industry,
4. The development of the UK's geological energy storage industry.

Case studies were developed that showed the role of the NGR in supporting each of these sectors, based on primary consultation with key stakeholders from government, regulators, industry and academia, a literature review and desk-based assessments. Key findings were combined with data from BGS to develop monetary estimates of the potential cost savings arising from use of the NGR for three of the four case studies (estimation for the geological energy storage case study was not possible). These savings were compared against the costs of running the NGR over the same period to generate benefit cost ratios, as per HM Treasury

Green Book guidance. The results provide a lower-bound estimate of the value generated by the NGR for each sector, noting that the estimates consider direct time and cost savings only, rather than any wider environmental or downstream economic impacts, and that these case studies reflect just a small subset of the NGR's many historical, ongoing and potential future applications. The overall magnitude of value generated by the NGR would likely be many times greater if all its potential uses could be considered.

Key findings

Across the four case studies, this report shows the NGR has consistently:

- Enabled faster, lower-cost, and better-informed decision-making,
- Reduced the need for duplicative and expensive new subsurface investigation,
- Supported transparent, evidence-based regulatory analysis,
- Facilitated open and accessible community engagement based on trusted data and analysis,
- Ensured the long-term preservation of critical geological records that continue to deliver value across successive policy cycles.

The value of the NGR lies not only in its collections, but in how these collections are used to support geological research, accelerate infrastructure development, and enable evidence-based public policy and regulatory decision making – as per BGS' strategy to deliver applied, mission-led geoscience in the public interest.

Economic value delivered to date

The economic analysis found that:

- The NGR has already delivered value to each case study far exceeding its costs:
  - For UK shale gas (onshore), use of the NGR generated **benefits of £5-£8 for every £1 spent** on NGR operations,
  - For radioactive waste disposal and CCS (offshore), this rises to **benefits of £31-£40 for every £1 spent**.
- These returns are not surprising given the high costs of drilling new boreholes, especially offshore, that can be avoided through re-examination of the drillcores already held in the NGR – especially at early investigation and pre-feasibility study stages. For example, it costs less to run the NGR for a whole year than it does to drill one new onshore borehole; and drilling new offshore boreholes cost some twenty times more.[1]

Beyond direct cost savings, the NGR also enables a wide range of other economic, social and environmental outcomes – including greater regulatory efficiency, science-led policymaking, increased energy security, strengthened public trust and greater resilience to climate change.

Potential future value at risk

Despite this, this report also highlights a series of emerging constraints that now risk limiting the NGR's ability to deliver future public value:

- The NGR is now effectively full, meaning expansion is required to accommodate further core acquisitions going forward.

[1] Costs are averages, calculated based on ranged data provided by BGS.

- Less than 5% of physical holdings have been digitised to date,[2] limiting the NGR's ability to serve industrial, scientific, regulatory and government demand for remote, rapid, interoperable and reusable data.
- Public funding for the NGR has declined steadily over time, placing pressure on the access model that has historically underpinned the NGR's wide public availability.

Without intervention, these limits risk eroding the NGR's role as an enabling national infrastructure — leading to lost data, reduced access, and missed opportunities for scientific, regulatory and economic value creation.

The case for targeted investment

This study identifies clear strategic priorities for targeted investment that would secure and enhance the NGR's long-term national value:

1. **Physical storage expansion** is essential to ensure the NGR can continue accessioning, curating and preserving new core materials from future infrastructure and energy developments.
2. **Targeted, mission-led digitisation** would unlock the unique geological data currently held within each core, enabling its use for modelling and analysis at site-specific, regional and national scales, as well as enabling the integration of such datasets into national scientific and industrial analyses.

Of these, digitisation is the game-changer, but expansion is also necessary to ensure valuable geological data is not lost and to provide space for digitisation to proceed. Current digitisation levels permit discovery of the NGR's collections – i.e., stakeholders can identify whether the NGR holds a core they might be interested in – but often little more. The data and insight that each core holds about an area's geology currently remains locked-away within that core, necessitating in-person re-examination each time to be unlocked. Targeted, mission-led digitisation – i.e., scientific scanning, photography and data curation on the cores that BGS already know will be key to addressing the UK's long-term needs around energy, resource security and infrastructure development – would create the large-scale datasets necessary to turbo-charge sector development and facilitate timely regulatory, industrial, and environmental decision-making.

Conclusion

This report demonstrates the NGR's role as a critical enabler of national geoscientific capability, supporting evidence-based decision making for key questions around energy security, resource management, infrastructure delivery and climate change mitigation. The NGR provides the physical and data infrastructure required to assess the feasibility, safety, and optimisation of subsurface uses – delivering billions in public value. With targeted investment in storage and digitisation, the NGR is well positioned to play a central, enabling role in the UK's transition to net zero, environmental resilience and digital innovation.

Acknowledgements

The Human Economics team would like to place on record our gratitude to Emma Bee, Dan Condon, Steve Thorpe and the wider staff at BGS, and Fiona Goff at NERC, for their support and guidance through this study. We would also like to thank the many stakeholders from industry, academia and government who contributed time and insight through interviews.

[2] Although digitisation levels are currently low, over 50% of the core collection has been photographed to date (including c.95% of the offshore core collection and c.10% of the onshore core collection).

The strategic value of the National Geological Repository (NGR)

A national archive of subsurface data delivering extraordinary returns across energy, infrastructure, and environmental protection

Extraordinary value for money over 20 years

£1.5bn

in avoided drilling and analysis costs for major energy and infrastructure projects through re-examination of cores held in the NGR

x36

RETURN ON INVESTMENT
Based on the costs of maintaining the NGR

£1.2bn
saved in siting research for carbon capture and storage (CCS), supporting £21bn in investment

£319m
saved in siting research for radioactive waste disposal

£71m
saved on shale gas exploration by reusing core data

British Geological Survey

200 years of geological knowledge

The UK's most comprehensive archive of geological samples and records, which have cost £200bn+ to collect

- **16 million** specimens
- **Over 600km** of drillcore from boreholes across the UK
- **Over 1 million** physical rock, sediment, and soil samples
- **Over 3 million** fossil specimens
- Detailed borehole logs, site reports, field notebooks, and geological maps

Infrastructure enabler

Trusted by government, regulators and industry for faster, better-informed decisions

- **3+ year time-savings** per project through access to legacy core samples
- Supporting the UK's clean energy infrastructure projects (GDF, CCS, Geothermal)

Strategic impact

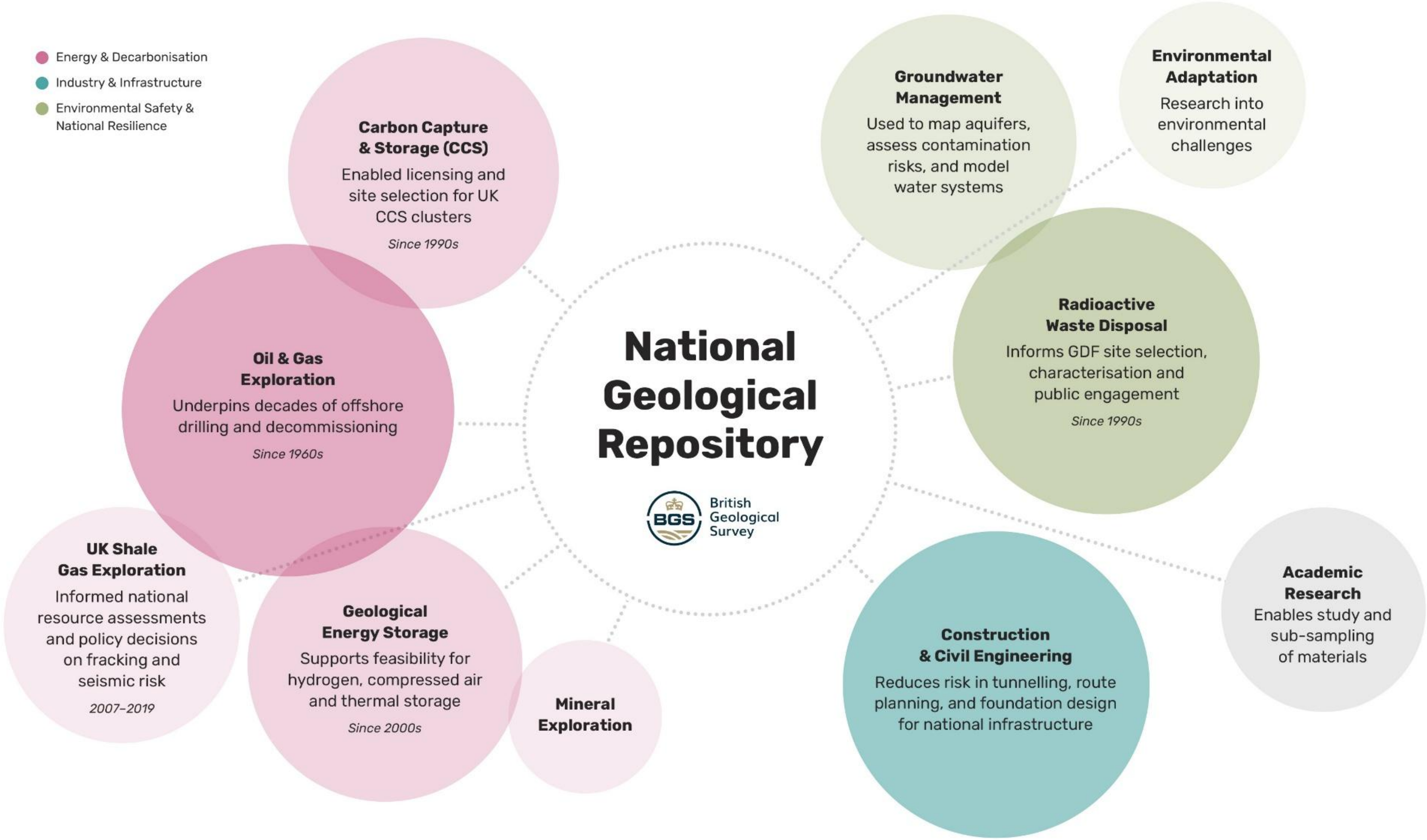
Independent, science-based data that builds confidence in national decisions

- Enables **net zero, energy security** and **climate resilience**
- Used by policymakers, regulators, industry, academia and the wider geoscience community
- Strengthens public trust through evidence-based decision-making

BGS is part of UK Research and Innovation (UKRI) and a research centre under the Natural Environment Research Council (NERC)

The NGR powering progress across UK sectors

Saving cost, reducing risk and accelerating project timelines



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1 Introduction, scope and approach

1.1 Introduction and purpose

The British Geological Survey (BGS) has been at the forefront of the UK's geoscientific capability for nearly two centuries. Central to this capability is the National Geological Repository (NGR), the UK's principal archive of physical geological samples and subsurface data, housed at BGS' headquarters in Keyworth, Nottinghamshire.

The purpose of this study is to assesses the economic value generated by the NGR to date for the UK. In doing so, this report also sets out the key strategic arguments for why future investment — for example in targeted digitisation and expanded storage capacity – is necessary to unleash the full value of the NGR to support the UK's energy transition and key strategic initiatives.

1.2 Study scope

This study focuses on the value generated by the NGR specifically, rather than of BGS more broadly. Within this, we have focused on the value generated by the physical drill core samples and associated subsurface data housed within the NGR, which BGS consider to be the most economically and strategically significant parts of the archive. The value of other important components of the NGR – for example, the rocks, fossils and extensive collection of paper records – has not been considered but would only add to the values estimated in this study.

Given the wide range of uses of the NGR over its history, we have adopted a case study approach, focusing on how the drill cores held within the NGR have been used – and continue to be used – to support the development of key national activities. The results therefore provide indicative estimates of the value delivered by the NGR in each area. The aggregate scale of these impacts would be many times greater if it were possible to include all the different uses of the NGR within this study's scope.[3]

1.3 Approach and methodology

The analysis followed a four-stage methodology designed to reflect the mission-led, policy-relevant character of the BGS, and to provide robust, real-world evidence on economic value. The four stages comprised:

1. **Case study development:** Working with BGS, we agreed and developed four structured case studies that illustrated the breadth, duration, significance and scale of the NGR's role in supporting high-value national activities. Each case study considered how the NGR's role developed over time, together with counterfactual scenarios and estimated time/cost savings.
2. **Stakeholder consultation:** We undertook structured interviews with ten representative industry experts, researchers and regulatory bodies. We used these interviews to understand the role of the NGR from a user perspective, as well as to collect data, validate assumptions, test impact pathways and strengthen the credibility of the valuation estimates.
3. **Cost benefit analysis (CBA):** In line with HM Treasury Green Book guidance, cost and time savings enabled by the NGR were compared against its annual operating costs. Costs and benefits were compared in present value terms, allowing indicative benefit-cost ratios (BCRs) to be calculated. Where

[3] See Section 2.2.3 for more detail on the range of work the NGR has been involved with.

data did not permit full monetisation, we reviewed non-monetised impacts including regulatory confidence, environmental stewardship and strategic enablement of future technologies.

4. **Literature review and benchmarking:** We then supplemented the core CBA work with additional analysis from published research to contextualise and benchmark our findings.

Further detail on our approach and methodology can be found in the accompanying technical report, including extended case study write-ups, our approach to the CBA, key valuation assumptions and evidence sources.

1.4 Structure of this report

The remainder of this report is structured as follows:

- **Section 2** introduces BGS and the NGR, including their history, functions, uses, users, and constraints.
- **Section 3** sets out the four case studies that illustrate the role of the NGR across key sectors,
- **Section 4** presents the results of the quantitative and qualitative economic assessment,
- **Section 5** makes the strategic case for targeted investment in the future of the NGR,
- **Section 6** offers conclusions and recommendations, including opportunities for enhancing impact and improving measurement.

A glossary of technical terms, including all geological terms used in this report, is available at Annex A. Annex B lists the stakeholders we consulted as part of this study.

2 Overview of BGS and the NGR

2.1 Introduction to the British Geological Survey

BGS is the UK's national geological survey and one of the oldest institutions of its kind globally. Founded in 1835, BGS now operates as a mission-led research centre within UK Research and Innovation (UKRI), under the Natural Environment Research Council (NERC).

BGS' work focuses on enhancing understanding of the UK's subsurface environment through systematic surveying, long-term monitoring, data curation and applied research. It plays a critical role in supporting evidence-based public policy, infrastructure delivery, and industrial development — particularly in the context of net zero, natural resource management and resilience to environmental hazards.

BGS employs over 600 staff, around 70% of whom are scientists, and operates across two primary sites:

- Keyworth, Nottinghamshire – BGS headquarters and home to the NGR
- The Lyell Centre, Edinburgh – Joint venture with Heriot-Watt University

With a current annual operating budget of around £56 million,[4] BGS provides independent geoscientific advice, analysis and research services to government, regulators, industry, and academia.

2.2 The National Geological Repository

2.2.1 History of the NGR

Since its inception, BGS has been curating geological samples and subsurface data – including drill core, rocks and fossils – to support geological mapping and research activities. As this collection grew, so grew the need to catalogue and store these materials systematically, leading to the formation of an internal archive. Throughout the 19th and 20th centuries, this archive grew rapidly – as a result of both BGS' surveys and legislation (dating back to 1926) requiring industry to provide records and samples whenever they drilled their own boreholes as part of mineral and then oil and gas exploration (see Figure 2–1).

Originally stored across various BGS sites in Leeds, Edinburgh and London, the national archive began its journey to becoming a centralised repository in 1976 with core storage across England being consolidated at BGS' newly formed headquarters in Keyworth. With the closure of the Gilmerton and Loanhead stores in

What is drill core?

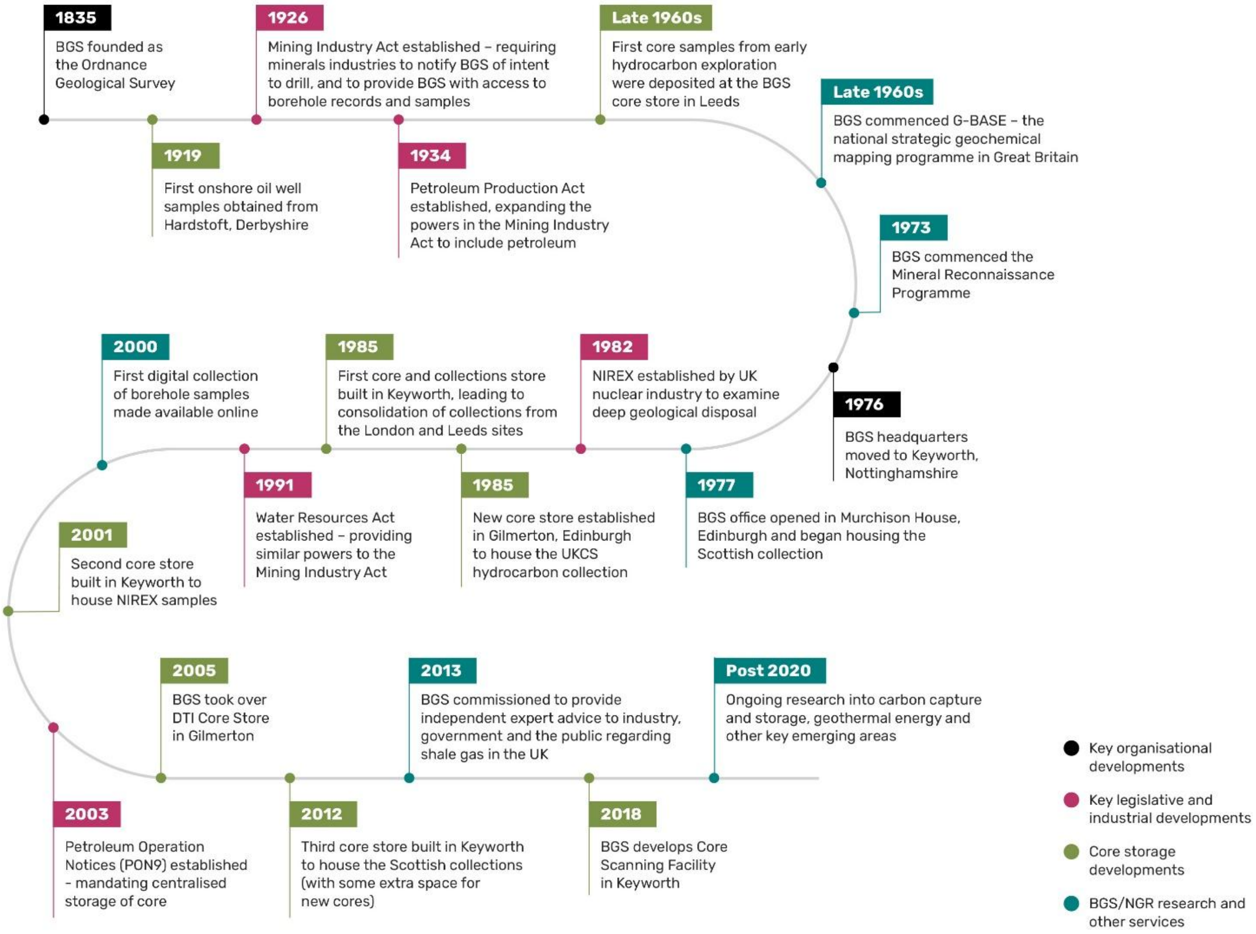
Drill core – or 'core' for short – is the primary focus of this study. It is a section of rock extracted from the ground during the drilling of a well or borehole. Cores are usually cylindrical in shape, with diameters typically ranging from 30mm to 150mm. Whilst stored in lengths between 1m and 3m, combined they can cover over a kilometre of record below the Earth's surface. Cores are the only means of directly observing and characterising the subsurface and, as such, are critical to a broad range of geoscientific disciplines.

[4] BGS Annual Report, 2023-2024. Available here.

Scotland, and investment for further core storage at Keyworth, what is now known as the NGR became a centralised national repository at the BGS headquarters.

Figure 2–1: Timeline of key events in the history of the BGS and NGR

Source: Graphic by Human Economics



2.2.2 Scope of the NGR's collections

Today, the NGR holds the largest working collection of British geological samples – used for research – in existence. Its collections contain:

- Over 600km of drill core - the prime focus of this study – comprising over 1 million registered cores from more than 23,000 boreholes[5] and wells[6] across the UK,
- The UK's most extensive collection of British fossil specimens and records (3 million+)[7],
- A systematic national rock collection (~1 million samples; 250,000 thin sections),
- Extensive soil and stream sediment[8] archives,

[5] Boreholes: holes drilled into the ground, often using specialised machinery, to collect samples and data on subsurface geology – for a variety of purposes including oil, gas and water extraction.

[6] Wells: holes dug in the ground by hand, or with simpler tools, and primarily used for extracting groundwater.

[7] Fossils: the preserved remains or traces of dead organisms (i.e., plants and animals) which were buried in sediments, such as sand or mud.

[8] Stream sediments: particles of sand, clay and organic matter that accumulate in streams due to erosion and weathering processes.

- The UK's largest geoscience records archive (including over 1.4 million well and borehole logs, site investigation reports, and field records and maps).

> **"The collection of physical material (core), part of the NGR, serves as a key national asset… The preservation of this material ensures that the UK scientific record remains robust and accessible for future generations."**
>
> **— Nick Terrell, Industry Co-Chair, Subsurface Task Force**

2.2.3 Uses and users

The NGR is foundational to BGS' role as the UK's national authority on subsurface knowledge. Its holdings are, and have been, used by BGS and other key stakeholders to inform policy decisions, regulatory activity, private sector investment and community consensus-building across many of the most strategically important infrastructure projects and resource and energy questions facing the UK, for example:

- **Safe disposal of the UK's radioactive waste:** The collections in the NGR have been critical to supporting the national need to develop a geological disposal facility, both through regional assessments and detailed process-based studies. One of the NGR's three stores was developed in the 1990s as part of an earlier iteration of this programme and any government plans for a geological disposal facility in the future will be heavily informed by analyses of the NGR's collections.
- **Carbon capture and storage (CCS):** The need to reduce carbon emissions has led to the development of a variety carbon capture and storage methods. One of the main storage options is to repurpose oil and gas fields such as those in the North Sea, where the geology is suitable for storage and retention of CO_2, and some infrastructure already exists. This has seen stakeholders revisiting the cores held in the NGR – that were previously used to understand oil and gas systems – with new questions about the behaviour of CO_2 in these storage volumes to reduce risk in operational CCS.
- **Oil and gas exploration:** The NGR holds geological materials relating to the UK's subsurface and continental shelf, which have been obtained by industry and accumulated in the NGR through deposits made over several decades. For 50+ years, these have been accessed to understand the regional nature of oil and gas seams in the UK continental shelf, to aid and reduce risk during exploration.
- **Mineral exploration:** This has a long history in the UK and the NGR contains a range of records and materials from regions that have been exploited in the past, as well as those with future potential. Analyses of these materials and records can help provide information about UK hosted resources, and insights into the processes that drive the development of mineral resources.
- **Geological energy storage:** The geological storage of energy – in the form of hydrogen, heated or cooled water, or as compressed air – could help address the intermittent nature of renewable energy sources such as wind and solar. NGR collections are being used to underpin regional geological assessments, as well as provide unique materials for experiments to understand how these storage volumes will respond to these new uses.
- **UK shale gas exploration and policy:** National energy policy in the 2010s resulted in a focused interest in shale gas as a potential UK-based energy source. Understanding the feasibility of the UK shale gas industry required rapid research into the nature of this resource across the UK. Analysis of the NGR's materials informed national policy, which ultimately resulted in the UK not pursuing this energy resource.
- **Groundwater management:** Understanding the nature of the aquifers, and the geology that surrounds them, impacts how this dynamic subsurface resource is managed and is of critical

importance as pressure on groundwater increases. The NGR contains valuable materials, including records and rock core, that enable this insight into the UK's major and minor aquifers.

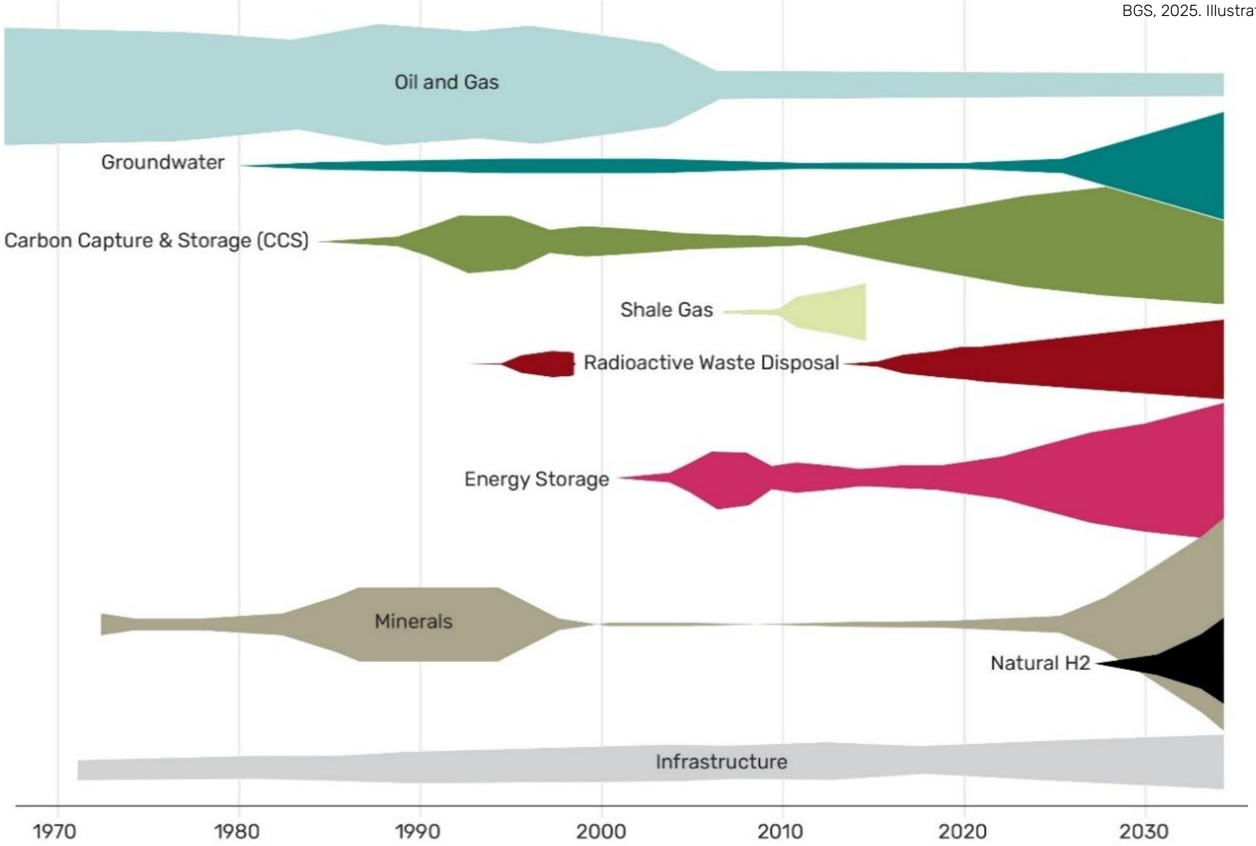
- **Construction and civil engineering:** This sector is dependent upon knowledge of the subsurface to design and build long-lasting infrastructure with minimal risk. Materials in the NGR are used to develop geological models for areas where major construction is being undertaken – from major rail network developments to the construction of nuclear power stations.
- **Offshore wind development:** The cores held in the NGR from oil and gas exploration are now being used to understand which areas are most suitable for the development of offshore windfarms, accelerating the development of this renewable technology and reducing risk.
- **Academic research:** The NGR contains a wealth of materials that record the evolution of the Earth System, from the Proterozoic (~2 billion years ago) through to the Anthropocene, and these collections are used by academics across the UK and internationally to understand how the planet operates. Historical records, including those from Charles Darwin, underpin history of science studies.

Use of the NGR, and demand for access to its collections, has been consistently high over the past 50+ years, since the start of large-scale oil and gas exploration in the UK. However, key use-cases have varied over time, reflective of changing national priorities. This can be seen in the above list and is illustrated below in Figure 2–2, which shows conceptually how demand for access to support different use-cases has waxed and waned over time. While oil and gas exploration was the major use-case for the NGR up to the around 2005, today the major use-cases are CCS, energy storage, minerals and radioactive waste disposal. The NGR's materials are also expected to support additional use-cases in the near future, such as natural hydrogen exploration.

What is important to note is that the NGR's collections are not tied to specific uses. Rather, the drill core held in the NGR holds data on the geology at specific locations – and different geologies can often have multiple possible uses. The clearest example of this is how many of the cores collected and used to support oil and gas exploration in the past are now being used to support sectors and technologies ranging from CCS to offshore wind and the disposal of radioactive waste. The figure highlights the varied uses of the NGR – past, present and into the future – and its particular importance at times of energy transition, as the focus of policy makers and key stakeholders shifts from one use-case to another.

Figure 2–2: Evolution of demand for access to the NGR's collections

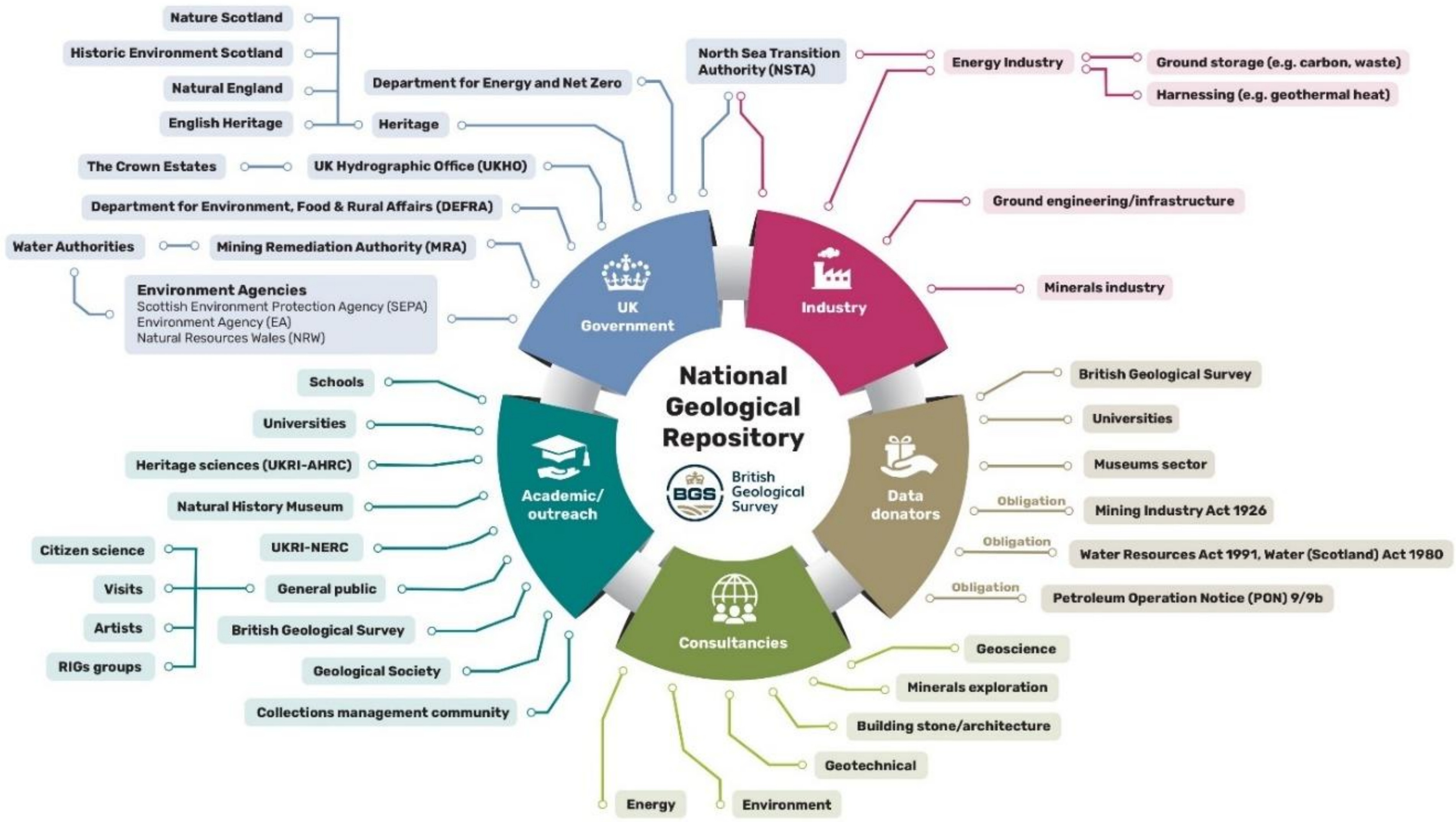
Source:
BGS, 2025. Illustrative, not to scale.



The diversity of the NGR's uses is further illustrated in the scale and breadth of stakeholders that use the NGR, as shown below. This range or users identified below reflects BGS' strategic commitment to delivering applied geoscience that supports public good and long-term national capability.

Figure 2-3: NGR stakeholder map

Source: BGS, 2025



These stakeholders include:

- **Industry and private businesses:** The samples and data held within the NGR are used by public and private organisations to inform natural resource exploration, infrastructure projects, and other industrial activities, across a wide range of sectors, e.g., oil and gas, minerals, nuclear, construction, civil engineering and groundwater management.
- **Government and related parties:** The data contained within the NGR enables BGS and other academic users to provide impartial and independent geoscientific advice to government departments, agencies and regulatory bodies, enabling evidence-based policymaking.
- **Data and sample donators:** Legislation requires that operators give BGS prior notification of their intention to drill holes greater than 30m in depth (or 15m if drilled for water). If BGS considers the resulting drill core to be important to its national survey, it can request to view logs and visit and take subsamples for onshore drill core; for offshore drill core, North Sea Transition Authority (NSTA) samples guidance requires operators to offer drill core samples to the NGR prior to disposal. This allows the NGR to serve as both a scientific resource and a regulatory tool, whilst also enabling wider access to the collection for the nation.
- **Academia:** The NGR's collections and specialised facilities are used extensively by academics (including international researchers) and students conducting research, providing them with the resources needed to develop understanding and publish repeatable results. A number of UK universities also use the NGR for practical teaching and training in earth sciences.
- **BGS and the wider geoscience community:** As with external users, the NGR provides BGS staff with access to subsurface samples and data which are essential for the Survey's own research, analysis and other activities, which in turn underpin regional knowledge, planning, policy and geoscience implementation. In doing so, it also contributes to the wider aims and objectives of NERC and UKRI, and helps to promote the interests of the broader UK and international geoscience community.
- **The general public:** Geoscience matters affect the daily lives of the public, including groundwater flooding, landslides, sinkholes, and the development of energy and mineral resources. In this regard, the NGR plays a key role in providing information and resources that support the public engagement activities of BGS (including open days).

2.2.4 Collections and use-case lifecycles

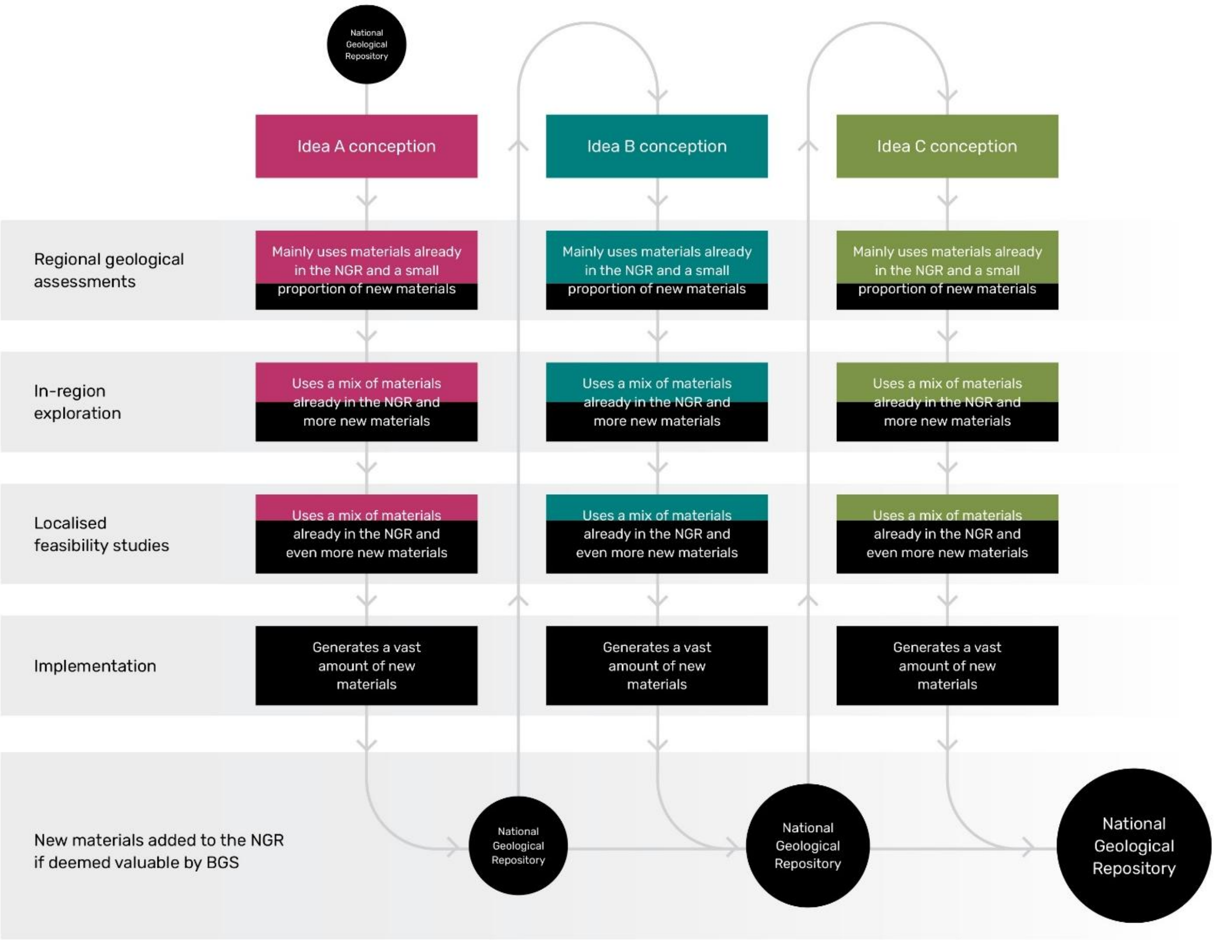
The uses underpinned by the NGR's collections tend to be long-term, multi-decadal endeavours. Moreover, they tend to follow a broadly similar data collection and analysis lifecycle (see Figure 2–4 below):

- At the initial stages of a new idea, BGS and other interested stakeholders will explore the idea's high-level feasibility using the NGR's collections where possible to determine technical requirements and assess the potential geological suitability of different areas for the new use.
- Once technical feasibility has been demonstrated, the next stage will see particular regions being targeted for more detailed exploration. Where possible this will still involve testing existing materials held in the NGR, but may also involve the targeted drilling of new cores, which may end up being deposited in the NGR over time. This adds to the NGR's collections, boosting the available evidence for regulatory and policy development.
- As – and if – the idea approaches commercial deployment, more and more targeted investigation becomes required, which will often require a greater proportion of new boreholes being drilled. This exploration will usually be undertaken by the private sector, resulting in further notifications and potentially more data and samples being requested to support the NGR's nationally important scientific working collection.

This process shows how the volume of drill core held in the NGR grows with each new idea that is explored. It also shows how the NGR's collections can be re-used for purposes not foreseen at the time of collection, given that geologies previously favoured for one purpose can be reused for another.

Figure 2–4: Generalised stages of NGR use in UK subsurface exploration and development

Source: Graphic by Human Economics



The NGR's holdings are thus the result of over a century of systematic surveying, industrial exploration and collaborative science. Its collections have grown through decades of work in sectors such as oil and gas, minerals exploration, construction and civil engineering, groundwater management, nuclear waste siting, and, more recently, low-carbon energy systems.

2.3 Funding arrangements

It currently costs about £1 million per year to operate the core facilities within the NGR, comprising staff costs and overheads but excluding ongoing necessary capital investment in the building, equipment and systems.[9] This cost is covered by a mix of central government funding – primarily through NERC/UKRI – plus access charges on commercial organisations and grant-funded researchers. Access for private individuals and researchers without grant funding has typically been free of charge, providing the work they are doing is not for commercial gain.

[9] BGS' financial data show NGR operating costs of £935k in 2024/25.

Income from commercial access charges varies year on year, depending on policy drivers and economic conditions. Income from these sources peaked at nearly £250,000 p.a. between 2010-2015 but then fell following the moratorium on shale gas exploration and the restrictions imposed during the pandemic. Although commercial income has risen again since, it remains significantly below the levels achieved in the early/mid 2010s, at about £140,000 in 2024/25.

At the same time, the public funding that has enabled the NGR to provide free access to date has steadily reduced over time, requiring BGS to introduce new charging structures in 2025/26 for commercial organisations and grant-funded researchers. Together with growing demand for access to drill core (i.e., to support CCS, geological disposal and other emerging use cases), this is expected to increase the share of NGR revenue generated through commercial charges.

2.4 Operating challenges

Drill core samples are housed in the NGR's 'Core Store'. The Core Store comprises three warehouses, constructed in 1985, 2001, and 2010. Collectively, these facilities hold up to 20,000 pallets of drill core, and over 80,000 trays of samples, weighing up to 10,000 tonnes.

However, the Core Store now faces multiple challenges, primarily due to space constraints:

- **The Core Store is now full:** Capacity in the Core Store has been an issue for some time but the significant increase in accessions rates in recent years means the store is now effectively full.[10] Although BGS has begun a rationalisation programme to review and prioritise the drill cores held in the Core Store, this process can only prolong the inevitable and available capacity is expected to be exhausted within 3-5 years. At the same time, new boreholes continue to be drilled: BGS has received around 1,200 notifications of new borehole drilling activity over the past three years alone. Whilst BGS might not request that all these cores be deposited in the NGR, many will be deemed valuable to underpin and improve the UK's knowledge of its subsurface environment
- **The existing examination areas are unable to accommodate further increases in visitor numbers:** This could jeopardise the NGR's effectiveness in supporting modern research and development needs, as well as its long-term financial sustainability.
- **Logistical and operational challenges in handling collections:** Given the scale of the collection and the size and weight of each specimen, retrieving specific materials can be time-consuming and labour-intensive, as it requires NGR staff to find, lay out and return them on a regular basis. Repeatedly doing this for large physical samples is operationally inefficient, given the configuration of the Core Store and visitor access spaces (e.g., viewing labs are located within the working area for NGR staff). It also carries safety risks for both staff and visitors, as well as the risk of materials being damaged or misplaced.
- **Lack of space and infrastructure for digitisation:** Whilst BGS has been able to invest in laboratories for the analysis of samples, the NGR lacks dedicated space and capabilities for the systematic digitisation of its collections, beyond photography for discovery. Just 5% of drill core held in the NGR has been digitised (i.e., scanned to a level beyond simple photography). Digitisation at the point of accession, or when materials are being examined, would be most efficient but is not possible within the current NGR configuration.

Without strategic investment in additional storage capacity and enabling infrastructure, the NGR risks reaching a point where it can no longer fulfil its role as a place of deposit and the national custodian of subsurface data — constraining future research, policy delivery, and industrial innovation.

[10] The volume of new materials being accessioned into the Core Store per annum has increased by c.80% since 2020 - driven largely by an influx of samples from the oil and gas sectors where North Sea operators are decommissioning fields and reviewing their legacy holdings.

3 The four case studies

3.1 Introduction

As set out in Section 2.2.3, the NGR's collections have supported, and continue to support, a wide range of geological uses. A full assessment of the NGR's contribution to each of these was not possible within the constraints of this study, so a case study approach was used to demonstrate the breadth of the NGR's support across a variety of nationally important sectors and programmes. These case studies illustrate the enabling role that the NGR plays in supporting national value and delivering BGS' mission: to provide trusted subsurface evidence that informs national infrastructure, supports environmental stewardship, and accelerates the UK's transition to net zero.

Four case studies were chosen:

1. UK shale gas exploration and policy,
2. Geological disposal of radioactive waste,
3. Carbon capture and storage (CCS),
4. Geological energy storage.

The case studies were selected by BGS based on:

- The profile of these programmes and their alignment with current or recent UK policy priorities,
- The extent to which drill core held within the NGR was re-examined to support relevant activity,
- The visibility of the NGR's contribution to the decision-making process,
- Their coverage of both onshore and offshore uses of the subsurface,
- They way each example demonstrates the central role of the NGR as the common source of scientific knowledge for government, industry and academia.

Each case study is summarised below, setting out the context, the role of the NGR and the key benefits arising. The economic assessment of each case study is then set out in Section 4.

3.2 Case Study 1: Shale gas exploration

3.2.1 Overview

Between 2007 and 2019, the UK explored the viability of developing a domestic shale gas industry in response to considerations around security of energy supply. The NGR was central to this process, enabling interested parties to develop early estimates of the UK's potential shale reserves and locations, to model and assess potential safety implications, and develop appropriate public policy. This case study demonstrates the importance of having trusted, independent subsurface data and records to guide policy, manage environmental risk, and inform and facilitate much-needed public debate.

3.2.2 The role of the NGR

The NGR enabled the BGS to act as a neutral data broker and scientific adviser to both government and industry on shale gas. BGS provided data and assessments to the then Department of Energy and Climate Change (now the Department for Energy Security and Net Zero, DESNZ); to major industry operators such as Cuadrilla, INEOS, and IGAS, as well as to a cohort of smaller sector start-ups; and later to the Oil and Gas Authority. The NGR played a key facilitation role across each of the four phases of the shale gas programme:

1. Regional Screening and Desk-Based Assessments (2007–2010)

At the start of the shale gas programme, the borehole logs and seismic records held in the NGR enabled BGS and other parties to develop regional geological models that enabled prospective shale formations across the UK to be identified rapidly. This had the following benefits:

- Access to pre-existing data gave early investors' confidence
- It also helped focus exploration on the most promising areas.

2. Subsurface Characterisation and Core Analysis (2010–2013)

As interest grew, companies and regulators required more subsurface information on the porosity, organic content and mineralogy of the geology in the identified areas. This could be done quickly and cheaply by analysing the drill cores of historical hydrocarbon wells that were held in the NGR.

- Analysis of these drill cores provided early insights into the main areas of shale potential (Bowland, Weald, and Midland Valley, Scotland).
- Re-examination of these drill cores avoided the need to drill new exploratory wells, saving stakeholders millions of pounds per well and shortening analysis timelines by several years.

3. National Resource Assessment (2013–2017)

As the shale gas programme advanced, the government commissioned BGS to develop regional resource estimates. These studies were underpinned by new analysis of the drill core samples and subsurface data held in the NGR, which provided more detailed evidence on the geology of prospective basins, such as Bowland Shale in northern England.

- By drawing on these existing records, BGS was able to assess resource potential, characterise subsurface properties, and produce authoritative national assessments without the need for additional field campaigns.
- The availability of this historical material confirmed shale's potential and allowed prospective sites to be appraised quickly and with greater confidence, while minimising further environmental disturbance.
- Analysis of core materials also generated datasets that underpinned a large cohort (~25) of shale-related PhD and post-doctoral students.
- As well as making legacy material available, BGS also curated and accessioned over 300m of core material into the NGR from active shale exploration sites, thus building its collection of targeted geological records for future analysis by operators and academic researchers.

4. Seismic Risk Assessment and Moratorium (2018–2019)

When fracking-induced earthquakes occurred in Lancashire, BGS used historical seismic records and geological models from the NGR to assess risk.

- This evidence informed the Government's 2019 moratorium on fracking.

- The availability of trusted, independent geological data played a key role in public communication and regulatory response.

3.2.3 Broader benefits

Use of the data held in the NGR's collections also enabled and increased:

- **Regulatory transparency,** based on a shared, evidence-based platform for decision-making.
- **Public confidence,** via independent analysis that informed public debates on fracking risks.
- **Science-led policy,** by ensuring that decisions about industry expansion and cessation were grounded in UK-specific geological evidence.

3.2.4 Conclusion

The shale gas case study highlights how use of the NGR as a national archive of geological data reduced duplication of effort, facilitated science-based regulation, and avoided hundreds of millions of pounds in drilling expenditure.

Although the UK's shale gas industry did not proceed to commercial scale, the role of the NGR in supporting evidence-based exploration was decisive. By the time the shale gas programme was indefinitely paused in 2019, the NGR had significantly reduced the costs, risks, and timelines associated with assessing the UK's shale gas potential. It also enabled BGS to serve as a trusted intermediary in public debates around fracking, seismicity, and geological safety, thus helping the government respond credibly to public concerns.

The NGR's use in the development and ultimate suspension of the UK shale industry illustrates the NGR's function as a national knowledge asset: a resource that reduces risk, enhances transparency, and enables rapid science-led responses in areas of high political and environmental sensitivity.

3.3 Case Study 2: Geological disposal of radioactive waste

3.3.1 Overview

Over the past 70 years, the UK has accumulated approximately 773,000 cubic metres of radioactive waste from nuclear power generation, defence, medical, industrial, and research activities[11]. Most of this is low-level waste (LLW), which can be disposed of at near-surface facilities. However, around 46,000 cubic metres of intermediate-level waste (ILW) – comprising reactor components, contaminated plant equipment, and chemical sludges – and approximately 1,500 cubic metres of high-level waste (HLW) – primarily vitrified liquid waste from spent fuel reprocessing – will require permanent isolation.

The long-term solution adopted internationally for such wastes — and in development in the UK — is a Geological Disposal Facility (GDF): a purpose-built underground repository, designed to contain the highest levels of long-life radioactivity and heat generation.

Such a repository would require stable geological conditions. Since the 1990s, the NGR has supported the UK's GDF programme by providing the foundational data to identify and characterise potential sites that could meet these conditions, and support community engagement. By drawing on drill core samples, borehole records, and seismic data, the NGR has enabled early-stage decision-making, reduced project risk, and built regulatory and public confidence. This case study shows how the NGR has supported a multi-decade public infrastructure programme — providing strategic continuity, technical assurance, and transparent engagement, in line with BGS' commitment to responsible subsurface stewardship.

[11] Nuclear Waste Services. 2025.

3.3.2 The role of the NGR

The development of a GDF relies on having a detailed understanding of subsurface geology, hydrogeology, and geomechanics. The NGR has supported the GDF programme across its three major phases to date:

1. Early Feasibility Studies under NIREX (1990s–2006)

During the first generation of geological disposal investigations, led by the then Nuclear Industry Radioactive Waste Executive (NIREX), the NGR played a key role by providing access to existing seismic surveys, deep borehole data, and national geological mapping.

- These data sources allowed NIREX to evaluate a range of potential host rock formations without commissioning new, large-scale fieldwork.
- Although NIREX's siting proposals were ultimately discontinued in the early 2000s, the subsurface data gathered during that period was preserved in the NGR and remains critical to the current programme.

2. National Geological Screening (2010s)

Following the UK Government's 2014 White Paper,[12] responsibility for the GDF programme was transferred to Radioactive Waste Management (RWM), a subsidiary of the Nuclear Decommissioning Authority (NDA). RWM commissioned BGS to conduct an independent National Geological Screening (NGS) exercise, which systematically compiled all existing and publicly available geological information for England, Wales, and Northern Ireland to assess potential geological suitability.

- BGS were able to use the borehole records, seismic profiles, and stratigraphic models stored in the NGR to develop the regional-scale assessments, without the need for new drilling.

3. Community Partnership Formation (2020s)

Following completion of the NGS, BGS produced 13 regional geological reports summarising the suitability of different geological settings across England, Wales and Northern Ireland. These reports were made publicly available and used by Nuclear Waste Services (NWS, formerly RWM) to support national public engagement activities. While the reports did not identify specific disposal sites, they provided potential host communities with clear, scientifically-grounded information about the types of geology present in their area and whether such geology could, in principle, support a GDF.

This information formed the basis for community engagement under the UK's volunteer-based siting process. Interested local authorities and community groups were invited to explore participation after reviewing the findings relevant to their region. As volunteer communities came forward, the NGR provided detailed access to supporting data — including seismic records, borehole logs, and historical geological surveys — which enabled preliminary desk-based site assessments without the need for extensive new drilling or fieldwork.

- Publicly available NGR records have been directly incorporated into consultations with stakeholders, local authorities, and community partnerships to build trust and promote transparency.
- Without the NGR's archival data, government and developers would likely have been forced to commission large-scale new geological investigations and outreach materials, at an estimated cost of £100 million and delays of several years.

[12] Department of Energy & Climate Change, 2014, Implementing Geological Disposal – A framework for the long-term management of higher activity radioactive waste (link)

> **"The NGR has proven itself to be an invaluable national asset that has underpinned geological characterisation for radioactive waste disposal in the UK. Access to legacy records and borehole information has helped increase understanding of relevant geology and provide value for money."**
>
> **— David Schofield, Chief Geologist, Nuclear Waste Services**

3.3.3 Broader benefits

Use of the data held in the NGR's collections also enabled and increased:

- **Policy continuity,** by supporting the UK's long-term commitment to safe radioactive waste disposal.
- **Public trust,** by facilitating science-based engagement with local communities.
- **Strategic alignment** with the UK's net zero goals by supporting the future role of nuclear energy in the UK's energy mix.

3.3.4 Conclusion

The NGR has supported, and continues to support, the UK's efforts to develop a GDF — one of the most technically challenging and politically sensitive infrastructure projects in recent history. Its records have enabled a science-led, cost-effective approach to site screening and characterisation, while also providing the transparency needed to support public and regulatory confidence. In doing so, the NGR exemplifies the role of national scientific infrastructure in delivering long-term societal value.

3.4 Case Study 3: Carbon capture and storage (CCS)

3.4.1 Overview

CCS is a critical component of the UK's strategy to achieve net zero by 2050. The process involves capturing CO_2 emissions from large industrial emitters in otherwise hard-to-abate sectors such as cement, fertiliser, and petrochemical production; gas-fired power; clean hydrogen production; and energy-from-waste. Captured CO_2 is then transported and permanently stored offshore in deep geological formations beneath the UK Continental Shelf, primarily using depleted oil and gas reservoirs and saline aquifers.

The viability of CCS depends on the availability of reliable geological data to identify, characterise, and license offshore storage sites. The NGR has provided this. The drill core samples, borehole logs, and seismic records held in the NGR – gathered on the back of decades of North Sea oil and gas exploration – have been key in allowing researchers, developers, and regulators to screen, evaluate, and license UK CCS projects.

This case study demonstrates how the NGR has de-risked early CCS investment, accelerated the pace of regulatory approvals, and enabled the development of a UK CCS industry that, by 2050, is expected to capture and store 75-180 million tonnes of CO_2 per year[13] – or up to one third of the current UK emission baseline — and boost the UK economy by £5bn a year.[14]

3.4.2 The role of the NGR

CCS has proceeded in stages, from regional screening to site-specific assessment, followed by licensing and deployment. The NGR has supported each of these phases:

[13] North Sea Transition Authority – The Move to Net Zero

[14] Department for Energy Security and Net Zero (2023) Carbon Capture, Usage and Storage: A Vision to Establish a Competitive Market. Available here.

1. Regional Screening and Feasibility (1990s–2010s)

During the early screening and feasibility stage, the well logs, seismic records and drill core data held in the NGR were used by researchers to identify potential sedimentary basins suitable for CO_2 storage.

- Re-examination of the materials held in the NGR enabled this work to be done without the need for new, large-scale offshore surveys, which are especially expensive and time-consuming.
- The research into geochemical and geomechanical processes conducted at this stage established the scientific case for permanent containment.
- The early feasibility studies and scientific research provided the evidence base for emerging CCS policy.

2. Site-Specific Assessments and Licensing (2010s–2020s)

As attention shifted to specific potential sites, the NGR's holdings allowed developers and regulators to assess the key geological parameters of these sites — such as porosity, permeability, and caprock integrity — using existing physical samples and records.

- This supported timely technical assessments, reduced the requirement for new drilling,
- It allowed licensing processes to move forward on a robust, data-driven basis.

3. Deployment and Regulatory Confidence (2020s–Present)

With the UK government committed to large-scale CCS deployment, licensing decisions and investor confidence depend on trustworthy geological information. As of summer 2025, the North Sea Transition Authority has granted 28 offshore CO_2 storage licences covering sites across the UK Continental Shelf.[15]

- BGS, drawing on the NGR's collections, has contributed data and expert input to every awarded licence to date — both through its regional geological models and direct involvement in licence assessments.
- In the absence of the NGR, new deep borehole drilling and independent characterisation studies would have been needed much earlier, delaying project timelines by several years.

> **"Not having access to this world-class database of already acquired data could result in CCS players requiring appraisal drilling to reduce uncertainty and risk. This increases the chance of failure in already economically-challenging environments and is likely to lead to a marked reduction in CCS projects being sanctioned in the UK."**
>
> **— Storegga Representative**

3.4.3 Broader benefits

Use of the data held in the NGR's collections also enabled and increased:

- **Climate mitigation:** CCS is essential for reducing the UK's emissions from hard-to-abate sectors such as steel, cement, fertiliser and chemicals.
- **Economic development:** CCS clusters are expected to create thousands of jobs and stimulate regional investment, particularly in industrial clusters in the north of England and in Scotland. Economic impacts will be amplified as the successfully development of the technology in the UK should enable it to store CO_2 captured in Europe.

[15] North Sea Transition Authority, Carbon Storage Public Register.

- **International leadership:** The UK is among the most advanced CCS nations globally — a position made possible in part by its access to historical geological records and the research that supports.

3.4.4 Conclusion

The NGR has been central to the UK's CCS ambitions. From site identification to regulatory licensing, use of its collections has accelerated timelines, lowered costs, and underpinned safe, scientifically-grounded CO_2 storage across the UK Continental Shelf. Today, the UK CCS sector is already backed by £20bn of public funding,[16] with more than 20 offshore storage licences awarded and billions in private capital committed across early clusters. As this market grows, continued investment in the NGR will be essential to scaling these climate mitigation technologies while maintaining public trust in the long-term integrity of offshore storage.

3.5 Case Study 4: Geological energy storage

3.5.1 Overview

As the UK increases its reliance on renewable energy sources such as offshore wind and solar, the need for large-scale, long-duration energy storage solutions that can smooth-out fluctuations in daily, weekly and seasonal energy output, will be essential to balancing demand and supply. Without this capability, grid stability and energy security will become increasingly exposed as back-up fossil fuel plants are phased out.

Geological energy storage offers one of the few existing, scalable solutions to this challenge. It involves injecting energy carriers – such as hydrogen gas, compressed air, or heat – into suitable subsurface formations, where they can be safely stored and retrieved when needed. These energy carriers act as mediums for storing excess electricity (produced during periods of surplus renewable generation) in a form that can be converted back into power or used directly for industrial processes, heating, or transport fuels. However, how such carriers interact with their host geological formations is a key area of uncertainty affecting efficient operations. This case study shows how use of the NGR is enabling emerging technologies that are central to the UK's future energy system, and why investment in its capacity and digitisation is essential for supporting the next generation of low-carbon infrastructure.

High-quality geological data is critical for identifying, characterising, and prioritising potential storage sites. The NGR provides that data. Its extensive archive of drill core, borehole records, and well logs is being used to support the development of geological storage solutions, exemplifying the NGR's role as a critical enabler of the UK's future energy security and net zero transition.

3.5.2 The role of the NGR

The development of geological energy storage has proceeded in stages, with the NGR supporting each one.

1. Regional Screening and Feasibility Studies (2000s–2015)

During the early 2000s, BGS used the NGR's collections to develop geological models and seismic interpretations that identified potentially suitable sites for different types of geological energy storage. This analysis fed into multiple government-commissioned studies, including for DESNZ, and cross-industry research through UKRI and the Energy Systems Catapult. The collections used, and the resulting models and interpretations, were made available by BGS to government departments, regulators, infrastructure developers, and commercial operators in the emerging hydrogen, gas storage, and energy system integration sectors.

Through this analysis, BGS identified:

[16] In the March 2023 Budget, HM Treasury announced up to £20 billion to support the initial development of CCS.

- Over 30 salt formations across the UK Continental Shelf and onshore basins that could potentially be used for hydrogen and compressed air storage (notably in Cheshire, East Yorkshire, and the Irish Sea Basin).
- Multiple regional sandstone aquifers and porous formations that could be considered for thermal and gas storage, including in the Triassic Sherwood Sandstone and Cretaceous Lower Greensand formations.
- Extensive depleted oil and gas reservoirs across the UK Continental Shelf, many of which are now under licence or consideration for repurposing as CO_2 or hydrogen storage sites.

2. Site Characterisation and Resource Assessment (2015–2025)

As the industry progressed from national screening to pre-commercial development at specific sites, detailed geological characterisation has become critical to investment decisions and regulatory approval. Developers and regulators have used the NGR's drill core samples, well records, and petrophysical datasets, to evaluate key storage parameters, including rock integrity, porosity, sealing capacity, and pressure thresholds—without the need to initiate new drilling campaigns.

NGR data has thus been central to pre-feasibility and feasibility studies supporting multiple projects to date, including:

- HyNet North West Hydrogen Storage (using salt caverns in Cheshire),
- East Coast Cluster storage assessments for hydrogen and CO_2 in depleted gas fields,
- Potential compressed air energy storage feasibility studies in East Yorkshire,
- Early-stage assessments for thermal energy storage options in the North West England, the home counties and London.

3. Commercial Deployment and Regulatory Approvals (2025–)

As hydrogen storage moves towards commercial scale, project sponsors and regulators need fast, reliable access to trusted data.

- The NGR data is already being used to support risk assessments, environmental impact studies, and site licensing applications.
- Without access to this data, developers would face significant delays and costs related to new field investigations and permitting processes.

3.5.3 Broader benefits

Use of the data held in the NGR's collections thus enabled and increased:

- **Energy security:** Geological storage enables flexible, on-demand dispatch of low-carbon energy.
- **Renewable integration:** Supports balancing of wind and solar generation across time and geography.
- **Net zero infrastructure:** Enables clean hydrogen deployment and seasonal energy storage — both core elements of the UK's energy transition strategy.

3.5.4 Conclusion

Although still an emerging field, geological energy storage is poised to become a foundational element of the UK's future energy system. The NGR has played a key role in the enabling technology's early progress to date, particularly by reducing the cost and risk of identifying potential storage sites. As commercial projects scale up, continued access to historical geological records – and investment in digitisation – will be critical to unlocking long-duration, low-carbon energy storage at scale.

3.6 Summary of how the NGR impacts the development cycle

The four case studies demonstrate the role of the NGR as a key strategic enabler of national capability. Its value lies not only in its collections, but in how these collections are used to support geological research, accelerate infrastructure development, and enable evidence-based public policy and regulatory decision making – as per BGS' strategy to deliver applied, mission-led geoscience in the public interest. Across each case study's development cycle — from early feasibility screening, regulation development, through to licensing and permitting, into operational delivery and long-term environmental stewardship — the NGR has provided:

- **Cost-efficient access to trusted geological data:** enabling early-stage site screening, desk-based assessments, and feasibility studies across multiple sectors,
- **Direct substitution for exploratory drilling:** avoiding expensive and time-consuming new borehole drilling campaigns, saving hundreds of millions of pounds across the different case studies,
- **More sustainable exploration:** re-using materials already collected (at considerable financial and environmental expense), rather than collecting new, costly samples each time,
- **Evidence for planning and regulation:** supporting site identification, environmental risk assessment, planning conditions, and licensing decisions,
- **Transparency for public engagement:** ensuring all parties (government, regulators, developers and communities) are working from the same, shared dataset to arrive at more informed and inclusive policy decisions,
- **Institutional continuity:** preserving decades of subsurface data that continue to be repurposed for each new idea, and serving as a long-term national memory for the UK subsurface.

The case studies demonstrate how the NGR has provided foundational evidence for major national policy decisions, derisked private investment, accelerated public infrastructure development, and enabled ongoing innovation. As the UK navigates increasingly complex challenges — from climate resilience to energy transition — the enabling role of the NGR will grow. Ensuring its long-term capacity, accessibility, and digital interoperability is essential to maintaining the UK's leadership in applied geoscience, and to realising BGS' vision of delivering national and global good through trusted subsurface knowledge.

4 Economic value generated by the NGR

4.1 Introduction

This section provides an economic assessment of the value that the NGR has generated to date with respect to the case studies presented in Section 3. The assessment comprises:

- A quantitative assessment that compares monetised estimates of the benefits and costs arising from the NGR's role in the case studies; and
- A qualitative assessment of wider economic, social and environmental impacts that fall outside the scope of this report.

The quantitative assessment focuses on three of the four case studies discussed in this report (i.e., shale gas, radioactive waste disposal, and CCS). Impacts associated with the fourth case study, geological energy storage, are considered in qualitative terms only given that this is still a nascent field, and the NGR's role in supporting geological energy storage has been relatively limited to date.

The quantitative assessment uses a cost benefit analysis (CBA) methodology that follows HM Treasury Green Book guidance, drawing on publicly available evaluations, stakeholder consultations, and primary data provided by BGS.

4.2 Monetised economic assessment

4.2.1 Monetised economic benefits

The monetised economic assessment focuses on two key benefits:

- **Avoided drilling costs** – the financial savings arising from being able to re-examine historical drill core samples held in the NGR rather than launching new borehole drilling campaigns.
- **Avoided project delays and labour costs** – the labour cost savings arising from being able to re-examine existing cores rather than drill and analyse new ones.

The calculated benefits comprise savings to both public and private sector organisations. It should be noted that the avoided drilling costs refer to avoided financial costs only; the environmental costs of drilling new boreholes are also considerable, but we have not been able to estimate these within the scope of this study.

Drilling cost estimates were sourced from internal BGS data, with different estimates used for the cost of onshore versus offshore drilling. Upper and lower-bound cost ranges were estimated for each, resulting in average costs of £1.3 million per onshore borehole and £24.8 million per offshore borehole (both in 2024/25 prices). Estimates of the number of onshore and offshore boreholes that would otherwise have needed to be drilled, and when, were developed with BGS.

Labour costs reflect the additional time that would have been spent by technicians and geologists in scoping, identifying, accessing, compiling and reporting on drill core samples, if primary investigations had been required. Costs were calculated based on average BGS day rates for technicians and geologists, multiplied by the number of working days per year and the estimated number of years that using the NGR saved each of the three case studies (each estimated at 2.8 years[17]), informed by consultations with BGS and key NGR users.

The gross benefit estimates were then adjusted for deadweight (30-50%), uncertainty (5-10%), and residual optimism bias (5-25%). As shown below, the result is **an estimated cost saving of £1.4bn - £1.7bn** to date (in 2024/25 price terms), based on just the three case studies considered.

Table 4-1: Monetised cost savings to date

Source:
Human Economics analysis

Case study	Analysis period[18]	Low estimate of avoided drilling and labour costs	High estimate of avoided drilling and labour costs	Avoided project delay
UK shale gas exploration	2007-2017	£57m	£84m	2.8 years
Radioactive waste disposal	2020-2025	£281m	£356m	2.8 years
Carbon capture and storage	2010-2025	£1,035m	£1,275m	2.8 years
Total		**£1,373m**	**£1,715m**	

The figures presented above are conservative estimates based only on the three monetised case studies. Overall impacts would likely be many times greater if the full range of use cases were included in the analysis.

4.2.2 Monetised economic costs

The monetised economic benefits were compared against the economic costs of running the NGR, comprising both operating and capital costs, provided by BGS. Data over the same period (stretching back to 2007, when the NGR was first used to look at shale gas in the UK) was not available, so the following assumptions were used:

- NGR operating costs for 2024/25 (totalling £935k – see Section 2.3) were assumed to be broadly representative of operating costs in previous years.
- Capital costs covering one-off investments to keep the NGR operational were provided for the period 2017 to 2025. Costs over this period were averaged, with this average then applied to the full period.

All cost data were provided in nominal prices, so were converted to 2024/25 real prices by applying the Office of Budget Responsibility's (OBR) Gross Domestic Product (GDP) deflator index where required.[19] All costs were converted to present values using reverse discounting at the social discount rate of 3.5% (per Green Book guidance).

4.2.3 Results of the monetised economic assessment

Table 4-2 below shows the overall results of this assessment. The results show that:

- Each case study individually generates returns far exceeding the costs of running the NGR:
  - For UK shale gas, the NGR generated **benefits of £5-£8 for every £1 spent** in operating costs,
  - For radioactive waste disposal and CCS, this rises to **benefits of £31-£40 for every £1 spent**.

[17] Based on our assessment of time saved by NGR users in the drilling, analysis, reporting and decision-making process as a result of access to the NGR and its materials, compared to the counterfactual of having to obtain the material through primary investigations or other sources.

[18] Although the NGR's involvement in some of these case studies spans across several decades, the analysis periods used for this assessment reflect shorter timeframes where the most direct involvement (and greatest impact) of the NGR took place.

[19] HM Treasury - GDP deflators at market prices, and money GDP December 2024 (Quarterly National Accounts)

- The benefit cost ratio (BCR) is especially high when significant offshore drilling is involved – given the much higher cost and longer timeframes involved in offshore versus onshore drilling – which is the case for radioactive waste disposal and CCS.

The results show that any one of these case studies alone would have more than paid for the existence and use of the NGR over the analysis period. The fact that these case studies reflect just three of many concurrent uses of the NGR – including for geohazard assessment, climate adaptation, groundwater management, and public engagement as set out in Section 2.2.3 – highlights the much-greater overall scale and wide-ranging nature of the value that the NGR provides for the UK.

Table 4-2: Monetised economic assessment results

Source: Human Economics analysis

Case study	Analysis period	Total NGR costs over the analysis period	Avoided drilling and labour costs – range estimate	BCR – range estimate	Avoided project delay
UK shale gas exploration	2007-2017	£11.0m	£57m – £84m	5.2 – 7.7	2.8 years
Radioactive waste disposal	2020-2025	£9.2m	£281m – £356m	30.6 – 38.8	2.8 years
Carbon capture and storage	2010-2025	£21.2m	£1,035m – £1,275m	38.7 – 40.0	2.8 years
Total			**£1,373m – £1,715m**		

4.2.4 Discussion

The BCR estimates are high but are considered reasonable given the very high costs that can be avoided by re-examining cores already held in the NGR rather than drilling new boreholes (i.e., tens to hundreds of £millions per drilling campaign). For example:

- It costs less to run the NGR for a whole year than it does to drill one new onshore bore hole.
- It costs less to run the NGR for more than twenty years than it does to drill one new offshore bore hole.

For benchmarking, a 2008 BGS study examined the contribution of the geosciences to national economies and estimated BCRs of between 100:1 and 1000:1.[20] However, in contrast to our approach, the 2008 study compared the cost of geological infrastructure to the value of economic output (rather than cost savings) enabled by this infrastructure. Moreover, the study ultimately recognised the difficulty in making a direct connection between these inputs and outputs, given the long-time lags, other economic variables and political factors.

We have also considered how our results compare to previous international evaluations. For example, in 2019 Geoscience Australia commissioned a study to quantify the social returns from its Exploring for the Future (EFTF) Programme – a four-year AU$100m programme that investigated the mineral, energy and groundwater resource potential across Northern Australia.[21] The evaluation focused on three case study projects and estimated BCRs ranging from 7-30 for the lowest impact project, to 38-194 for the highest impact project. The lower end of these BCRs is within a similar range to our estimates, but the higher end is significantly greater since the EFTF case studies had reached full maturity by the time of the evaluation. This meant that downstream impacts (such as job creation and economic growth) could be readily monetised and were included in the BCRs. By contrast, the case studies considered in our study are either still early in their development stages (i.e., radioactive waste disposal and CCS) or have ceased altogether (i.e., shale gas exploration), such that these downstream economic impacts are yet to materialise. **This implies overall BCRs could be expected to be many times greater once impacts over a project's full lifecycle are included.**

[20] Ovadia, D., 2008. Geology as a contributor to national economies and their development. British Geological Survey. Available here.

[21] ACIL Allen Consulting. 2020. Exploring for the Future Program: Return on Investment Analysis. Geoscience Australia. Available here.

The US Geological Survey (USGS) recently published an economic analysis of geological mapping conducted across the United States from 1994 to 2019.[22] This analysis is similar to ours in that the maps have been expensive to produce, are the result of many years of surveying and analysis, and are used by a wide range of stakeholders and sectors that are similar to those that the NGR supports. USGS' analysis conservatively estimated that these maps generated economic value equivalent to 7-10 times the cost of their production, with maximum value estimates of 23-35 times the cost.

4.2.5 Limitations and caveats

The findings in this section should be interpreted in light of a few important caveats:

- **Attribution:** In most case studies, the NGR is one of several inputs into project success. While stakeholders affirmed its critical role, exact attribution of outcomes remains challenging.
- **Data availability:** Systematic tracking of NGR usage and impact is limited. In some areas, we relied on stakeholder insight and triangulated estimates rather than hard usage data.
- **Valuation scope:** This study did not attempt to quantify or value the full breadth of economic, social and environmental benefits delivered through the NGR, which are likely substantial.

Despite these caveats, the findings provide clear evidence that the NGR delivers exceptional value for money.

4.3 Qualitative assessment

Given that the benefits considered in the monetised assessment were limited to direct cost and time savings, we have also sought to analyse, in qualitative terms, the broader economic, social and environmental impacts generated by the NGR across the four case studies. The assessment drew on stakeholder feedback and desk-based research to assess the potential magnitude of the other impacts identified in each of the case study write-ups in Section 3.

The output of this assessment is summarised below and shows that impacts across 25 categories to diverse stakeholder groups. The majority of these (i.e., 18) were found to be economic impacts, followed by environmental and social impacts. These wider impacts reflect the NGR's function as a critical enabler of systems-level transitions, in line with BGS' commitment to providing integrated geoscientific responses to climate, energy, and environmental challenges.

Source:
Human Economics analysis

Table 4-3: Qualitative assessment of identified impacts

Case study	Impact description	Economic impact	Social impact	Environmental impact
UK shale gas exploration and policy	**Avoided drilling and surveying**	**High**		**High**
	Acceleration of exploratory research	**High**		
	Regulatory efficiency	Medium		
	Science-led policymaking	Medium		
	Increased public confidence		Medium	
	Contribution to net zero agenda			Medium
	Avoided drilling and surveying	**High**		**High**

[22] Berg, R.C. and Faulds, J.E., 2025. Economic analysis of the costs and benefits of geological mapping in the United States of America from 1994 to 2019. American Geosciences Institute. Available here.

Case study	Impact description	Economic impact	Social impact	Environmental impact
Geological disposal of radioactive waste	**Acceleration of programme timeline**	**High**		
	Improved evidence base to support site selection, regulatory engagement and community dialogue	High		
	Policy continuity on geological disposal	Medium		
	Increased public trust		Medium	
	Contribution to net zero agenda			Medium
Carbon capture and storage	**Avoided drilling and surveying**	**High**		**High**
	Acceleration of sector development	**High**		
	Climate change adaptation and resilience			Medium
	Economic development	Medium		
	International leadership in CCS	High		
	Contribution to net zero agenda			Medium
Geological energy storage	Avoided drilling and surveying	High		High
	Acceleration of project timelines	High		
	Improved evidence base to support site selection and risk mitigation	High		
	Increased investor confidence	Medium		
	Increased energy security	Medium		
	Renewable integration	Low		
	Contribution to net zero agenda			Medium

Note: the impacts that we have been able to quantify are shown in ***Bold****.*

4.4 Potential future value

The preceding sections demonstrate that the NGR has enabled substantial public value across multiple sectors and over many decades. The NGR is a national data asset for the subsurface of the UK, and supports the evolving demands the nation places on this resource: from oil and gas exploration in the last century through to current and future challenges around the energy transition, infrastructure development and key resources such as groundwater. The ability of researchers, scientists and both public and private sector geologists to return to the NGR to re-examine the materials housed there will continue to provide considerable value to the UK going forward by enabling these current and future uses to proceed at lower risk, lower cost and faster speeds than would otherwise be the case. Cost savings in-line with those realised to date can be expected, with wider benefits expected as per the qualitative assessment above.

However, the ability of the NGR to deliver additional value, over and above the value that re-examination of its current materials provides, depends on future investment. As noted in Section 2.4, the NGR currently faces a series of challenges that constrain its ability to do more. These issues are the focus of Section 5, below, which sets out the strategic case for investment in the NGR as a key enabling infrastructure for the UK.

5 Securing the future of the NGR – a strategic case for investment

> **"These cores were acquired at significant expense (often multiple hundreds of thousands of pounds per core) from offshore wells, specifically targeting areas of fundamental uncertainty in subsurface geology. Their preservation offers substantial economic and environmental value, as the cost of re-sampling or drilling new cores is prohibitively high. Moreover, the carbon footprint associated with new drilling can be significantly reduced by utilising these existing core samples for further research and decision-making, aligning with sustainability and Net Zero ambitions."**
>
> **— Nick Terrell, Industry Co-Chair, Subsurface Task Force**

5.1 Introduction

The preceding sections of this report have demonstrated the NGR's value as an active national infrastructure asset that enables faster, lower-cost and scientifically-grounded decision making. From supporting policy on radioactive waste disposal to enabling the UK's CCS and energy storage sectors, the NGR has delivered billions of pounds of public value to date.

However, the NGR is now approaching a critical juncture. Physical challenges, limited digital assets and funding constraints pose a direct risk to the NGR's ability to continue supporting future UK subsurface investigation and development. The UK now faces a clear choice: let this enabling infrastructure stagnate or invest in securing and enhancing its long-term value. This section sets out the key arguments for why investment is necessary, both to sustain the NGR's role as a national physical infrastructure and to unlock the enormous value its collections hold.

5.2 Strategic risks to the NGR's future

The NGR is at risk of losing its capacity to meet the growing demand for trusted, high-quality geological data. Three principal constraints must be addressed:

- **Physical storage is at capacity:** Without new investment, the NGR will be unable to accept critical new core material. In the next decade, many hundreds of millions of pounds are expected to be spent on new government-backed programmes to support radioactive waste disposal and the energy transition. Without space in the NGR to accession, curate and preserve these samples, these drill cores – and the opportunity to re-use and re-examine them again in the future for future uses – will be lost.
- **Digital capability is underdeveloped:** Less than 5% of physical holdings have been digitised and only first order discovery is possible for most of the collections. This limits how the stakeholder community can exploit the information locked within the physical collections, and limits the role that the collections

in the NGR can play in supporting real-time access, remote analysis, digital modelling, and participation in emerging national research infrastructures.

- **Public funding has declined:** The traditional access model, based on wide public availability and grant-funded usage, is increasingly difficult to sustain. Reduced funding risks weakening the NGR's mission-led mandate.

Together, these challenges constrain the NGR's role as a science-based enabler of national infrastructure and public policy.

5.3 Investment priorities

To protect the NGR's ongoing value and unlock its potential future impact, investment is needed to expand the core store's physical capacity and digitise key collections at pace. Each is considered in more detail below.

5.3.1 Expand physical capacity

The NGR must have the ability to accept and curate new geological material. This is essential not only for maintaining scientific continuity but also for ensuring that the UK does not forfeit future value by failing to preserve the country's subsurface knowledge. Expansion is not simply about logistics; it is about future-proofing national geoscientific capability by providing much-needed, fit-for-purpose spaces for storage, materials handling, examination, analysis and digitisation.

5.3.2 Advance mission-led digitisation

The country faces a series of known, long-term challenges around energy, resource security and infrastructure development. Use cases to address each challenge can be mapped against the NGR's collections to develop targeted, mission-led digitisation programmes (i.e., scientific scanning and data curation beyond simple photography) of drill core that would prioritise cores with direct relevance to regulatory, industrial, and environmental decision-making. This would unlock the data and insight that each core holds - but that is currently locked-away within that core, necessitating in-person re-examination each time to be unlocked. Delivered at scale, such digitisation would create the large-scale datasets necessary to turbo-charge sector development, infrastructure delivery and the energy transition.

Digitisation must move beyond ad-hoc, project-based pilots. A national infrastructure approach would enable the NGR to:

- Provide remote, real-time access for researchers, developers, regulators and the government,
- Enable integration with AI tools, simulation environments, new insights from large and complex datasets, and national digital twins,
- Support regulatory licensing and public consultation with transparent, accessible data,
- Maximise value from investments like DiSSCo UK, the National Data Library, and UKRI's Digital Research Infrastructure strategy.

Large-scale digitisation could also enable the creation and curation of industry or area-specific datasets that would be of commercial value to the private sector. Appropriately priced, these could help mitigate the loss of public funding support and put the NGR on a more sustainable financial footing.

5.4 A national infrastructure for a net zero UK

The value and importance of the NGR to the UK is set to grow as the UK accelerates its transition to net zero and the country tackles related issues around climate mitigation. Subsurface knowledge will underpin:

- The expansion of CCS and hydrogen storage,
- Siting of geological disposal facilities and new nuclear power,
- Development of deep geothermal and seasonal energy storage,
- Groundwater security through improved aquifer characterisation,
- Large-scale infrastructure resilience and risk management.
- Minerals for use in industry, including critical minerals,
- Exploration of new frontiers in energy and resources, such as natural hydrogen (H_2).

Each of these will require fast access to large-scale, trusted geological data. Without investment in the NGR's capacity and digital interoperability, the UK risks delays, duplication, and reduced policy responsiveness. Maximising the UK's investment in major compute capabilities and national digital data libraries will require our analogue data collections to be available in digital form. Strategic investment would reinforce the NGR's role as the UK's national subsurface knowledge base.

5.5 The case for action

Stakeholder consultations have made clear the widespread demand for improved access, digitisation, and long-term capacity at the NGR.

Without investment:

- Valuable new materials will be lost or remain inaccessible,
- Critical infrastructure projects would face delays and increased costs,

With investment:

- The NGR will retain and extend its enabling role across infrastructure, regulation, and environmental protection,
- The UK will gain a 21st-century subsurface infrastructure, capable of supporting its most urgent national priorities.

6 Conclusions and recommendations

6.1 Conclusions

This study has demonstrated the value of the NGR as a vital national infrastructure that actively supports public policy delivery, regulatory decision-making, infrastructure development, and environmental resilience.

Across the four case studies examined — shale gas, radioactive waste disposal, CCS, and geological energy storage — the NGR has consistently enabled more timely, efficient, and scientifically-robust outcomes. By reducing the need for expensive, time-consuming and duplicative drilling and subsurface investigation, this study has shown how the NGR has delivered billions of pounds of savings for UK society.

However, the NGR now faces a pivotal moment. Three intersecting challenges threaten its ability to sustain this enabling role:

- **Physical storage is at capacity**, risking the loss of new geological material from nationally significant programmes,
- **Digitisation remains limited,** with less than 5% of holdings having been digitised to date,
- **Funding pressures** have begun to erode the open-access model that has historically underpinned the NGR's public mission.

These constraints jeopardise the NGR's ability to serve future infrastructure, energy and environmental needs. By contrast, a dual-track investment in physical storage and mission-led digitisation would:

- Secure the long-term accessibility of both legacy and future core material,
- Enable real-time digital workflows for regulators, developers, researchers and the government,
- Position the NGR as a national hub within UKRI's digital infrastructure strategy and the wider net zero transition.

This is a strategic choice — not just about preserving a collection, but about future-proofing the UK's ability to deliver safe, science-led infrastructure in a complex and uncertain world. With timely investment, the NGR can become a model of 21st-century public infrastructure: deeply physical, fully digital, and strategically aligned with national goals.

6.2 Opportunities to improve impact measurement

A strategic priority for BGS is to demonstrate public value through transparent, evidence-based performance. Strengthening impact measurement at the NGR would support this ambition and improve return-on-investment modelling. Areas where better data and analysis could support more robust and ongoing valuation of the NGR's impact include:

- **Improved user tracking and analytics:** Establishing a system to record who accesses the NGR's collections (physically and digitally), for what purpose, and with what outcomes, while maintaining user privacy and open access.
- **More granular cost attribution:** Developing a breakdown of how operational and capital budgets for the NGR are allocated across functions and sectors, to support better Value for Money (VfM) modelling.

- **More project-specific valuation:** Developing longer-term, longitudinal case studies around individual infrastructure or energy projects where the NGR was used, enabling a wider range of benefits and impacts to be tracked and analysed across the full project lifecycle.
- **Stakeholder valuation tools:** Use of stated preference / contingent valuation methods to quantify user-perceived value across sectors, including regulatory, academic, and industrial users.

6.3 Recommendations for enhancing future value

The NGR's ability to deliver public value is cumulative and enduring — built upon decades of collected data, reused in new scientific, industrial, and policy contexts. However, its future value depends on action taken now to address critical constraints in capacity, access, and digital capability.

Based on the findings of this study, we recommend targeted action in five strategic areas:

1. Expand physical storage capacity to protect future collections

Build additional storage space to accommodate valuable new materials from the UK's major, ongoing – and expected - infrastructure, decommissioning, and energy programmes. Expansion is not simply a matter of logistics — it is essential to ensure future generations retain access to subsurface knowledge that underpins regulatory science, environmental risk management, and infrastructure planning.

2. Establish sustained, mission-led digitisation as national infrastructure

Digitisation should be viewed as a strategic necessity, not an operational add-on. Establishing a permanent Geological Materials Digitisation Hub at BGS Keyworth would enable systematic, high-quality, mission-led digitisation of the UK's geology, aligning the NGR with UKRI's Digital Research Infrastructure strategy and initiatives like DiSSCo UK. Collections most likely to inform net zero infrastructure, licensing, and risk assessment should be prioritised, with data needs and workflows designed in partnership with regulators, government, and industry.

3. Embed the NGR within cross-government infrastructure and policy delivery frameworks

Unlike discovery-focused research infrastructures, the NGR directly supports statutory functions, policy development and major infrastructure delivery. Future investment and governance should explicitly recognise its role in delivering key UK priorities — including net zero, energy security, environmental resilience, and nuclear decommissioning. Aligning the NGR with these frameworks will help secure long-cycle funding and embed its role in national strategy.

4. Strengthen data systems for tracking usage and public value

While this study has evidenced clear public benefits, future investment decisions would benefit from stronger impact measurement systems. Investment is required to enable BGS to implement a structured framework to track usage of the NGR across physical and digital platforms — including user types, regulatory and project applications, and downstream outcomes. This would enable more encompassing estimates of value to be generate, strengthening the NGR's strategic narrative and supporting stronger policy engagement.

5. Reinforce BGS' institutional role as the UK's national subsurface data authority

The NGR is a public-good infrastructure asset that delivers broad societal and environmental value. BGS' role as an impartial, scientifically-rigorous custodian of the UK's subsurface data should be explicitly recognised within UKRI governance and cross-government research and infrastructure policy. Investment in BGS as the national authority for subsurface assessment and knowledge is essential to sustaining the UK's leadership in geoscience and environmental stewardship.

Annexes

Human Economics

A Glossary of key terms

B

Benefit-cost ratio: A measure used in cost-benefit analysis that compares the total benefits of a project or intervention with its total costs. A BCR greater than 1.0 indicates that benefits outweigh costs.

Biostratigraphy: The study of ages of rocks using fossils.

Boreholes: Holes drilled into the ground, often using specialised machinery, to collect samples and data on subsurface geology – for a variety of purposes including oil, gas, mineral and water extraction.

C

Carbon capture and storage: A set of technologies designed to capture CO_2 emissions from industrial sources or power generation and store them underground in deep geological formations to prevent release into the atmosphere.

Core samples / drill core: Cylindrical sections of rock extracted from the subsurface during drilling operations. Used to analyse the geological structure, composition, and properties of subsurface formations.

Cost-benefit analysis: An economic evaluation method that compares the expected benefits and costs of a project or intervention to determine its net value or feasibility.

D

Decommissioning: The process of safely retiring and dismantling infrastructure such as oil and gas platforms or nuclear facilities, often involving the repurposing or recording of geological data and assets.

Digitisation: The process of converting physical geological records or samples (e.g., maps, core photos, borehole logs) into digital formats to facilitate remote access, analysis, and preservation.

Drill core: See 'core samples', above.

F

Fossils: The preserved remains or traces of dead organisms (i.e., plants and animals) which were buried in sediments, such as sand or mud.

G

Geoscience: The study of composition, structure, processes and other physical aspects of the Earth.

H

Hydrocarbon: An organic compound consisting entirely of hydrogen and carbon.

Hydrocarbon prospectivity: The likelihood or potential of a geological formation to contain extractable oil or gas resources.

I

Industrial clusters: Geographically concentrated areas of industry (e.g. Teesside, Humber) targeted for decarbonisation through coordinated deployment of low-carbon technologies such as CCS and hydrogen.

M

Minerals: Naturally occurring substances with distinctive chemical and physical properties, composition and atomic structure. Mineral resources are critical for modern agriculture and industry.

N

Net present value: A measure of the total value of a project over time, accounting for future benefits and costs discounted to their present value. A positive NPV indicates that a project is expected to deliver net benefits.

Net zero: A target to reduce greenhouse gas emissions to as close to zero as possible, with remaining emissions offset by removals (e.g., via carbon sinks or CCS). The UK has a statutory target to achieve net zero by 2050.

O

Offshore: Situated at sea, some distance from the shore / coast.

Onshore: Situated on land.

OpenGeoscience: An online platform developed by BGS offering free access to scanned maps, geological data, borehole records, and visual materials from the NGR.

R

Rocks: A solid collection of minerals. There are three main types of rock, classified by how they are sourced and formed: sedimentary, igneous and metamorphic.

S

Seismic records: Data collected from seismic surveys or monitoring that capture ground vibrations caused by natural or anthropogenic sources. Used to study subsurface structures and monitor geohazards.

Small modular reactor: A new class of nuclear reactor being developed for low-carbon electricity generation. SMRs require detailed geological assessments for siting, which may use NGR records.

Stream sediments: Particles of sand, clay and organic matter that accumulate in streams due to erosion and weathering processes.

T

Thin sections: Microscopic slices of rock or sediment prepared for analysis under a polarised light microscope, used to study mineral composition and structure.

V

Value for money: An assessment of whether a project or investment delivers the best possible outcome for the resources spent, typically evaluated through measures like cost-effectiveness, efficiency, and strategic fit.

W

Wells: Holes dug in the ground by hand, or with simpler tools, and primarily used for extracting groundwater.

B List of stakeholders consulted

Stakeholder Group	Organisations	Individuals
Government	BGS	Ed Hough Dave McCarthy Jan Hennisen Michelle Bentham Jonathan Pierce Jim White
Government / Industry	Nuclear Waste Services	Chris Eldred David Schofield
Academia	University of Exeter	Prof. Stephen Hesselbo
Consultant	Core Specialist Services	Craig Lindsay

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