Radioactive Waste Management

SEARCH AREA EVALUATION REPORT

Allerdale Search Area and the adjacent inshore area

PREPARED FOR: Allerdale GDF Working Group
SITE REFERENCE: Allerdale Search Area

Preface

This report has been developed by Radioactive Waste Management Ltd (RWM) as part of the process to identify a suitable site for a Geological Disposal Facility (GDF) within a willing host community.

Discussions with RWM were initiated by an Interested Party in the Borough of Allerdale. As part of these initial discussions, RWM undertook evaluation work to understand whether the area identified by the Interested Party had the potential to host a GDF.

This initial evaluation work, presented in RWM's Initial Evaluation Report [i], suggested that, based on the information considered, there was potential for a GDF to be hosted within the Borough of Allerdale.

A Working Group subsequently formed in the Borough of Allerdale as a consequence of the initial discussions with RWM and the initial evaluation work. In line with the UK Government's Working with Communities Policy [ii] the Allerdale Working Group has identified a Search Area - referred to and defined in this report as the 'Allerdale Search Area'.

This Search Area Evaluation report relates to the Allerdale Search Area and the inshore area adjacent to Allerdale Borough.

The Search Area is the geographical area within which RWM will seek to eventually identify potentially suitable sites to host a GDF. Defining the boundaries of the Search Area is important in order to identify appropriate membership for the Community Partnership. As RWM completes its investigations the Community Partnership will refine and review the Search Area.

As the Allerdale Search Area is different from the area that was considered as part of RWM's initial evaluation work in Allerdale Borough, a further high level evaluation of the Allerdale Search Area has been undertaken to confirm whether it has any potential to host a GDF.

This Search Area Evaluation Report has been developed to support RWM and the Allerdale Working Group and details this high level evaluation work, which focuses on the Search Area and the adjacent inshore area to Allerdale Borough.

This report is supported by information which has been collated from readily available sources such as the RWM National Geological Screening (NGS), Office for National Statistics, Natural England and Allerdale Borough Council. It is envisaged that if a Community Partnership were to form then a further review of available information will be conducted as part of RWM's investigation works.

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Executive Summary

The Allerdale Working Group (the 'Working Group') has been formed in accordance with the requirements set out in the UK Government's Working with Communities policy[1] (the 'Policy') and have begun to raise the awareness in Allerdale of the GDF Siting Process.

Radioactive Waste Management (RWM) has previously carried out an initial evaluation in the Borough of Allerdale and has determined that the area has potential to host a Geological Disposal Facility (GDF). As agreed with the Working Group, those areas of Allerdale Borough that are currently located within the boundary of the Lake District National Park are excluded from consideration to host a GDF.

The Working Group has identified a Search Area in accordance with the requirements set out in the Policy. The Search Area includes the 13 Allerdale Borough Council electoral wards of Aspatria, Broughton St Bridgets, Dalton, Ellen & Gilcrux, Flimby, Harrington & Salterbeck, Maryport North, Maryport South, Moorclose & Moss Bay, Seaton & Northside, St John's, St Michael's and Stainburn & Clifton (the 'Allerdale Search Area'). The inshore area adjacent to the Borough of Allerdale also remains under consideration[2].

This Search Area Evaluation Report follows the same approach as RWM's initial evaluation work, and focuses on the identified electoral wards which encompass the Allerdale Search Area and inshore area adjacent to Allerdale Borough.

The evaluation of the Allerdale Search Area has been based on the six 'siting factors' of Safety and Security, Community, Environment, Engineering Feasibility, Transport and Value for Money. More information on the siting factors can be found in RWM's published document 'Site Evaluation – how we will evaluate sites in England' [iii].

[1] *Implementing Geological Disposal - Working with Communities. An updated framework for the long-term management of higher-activity radioactive waste, HM Department for Business, Energy and Industrial Strategy, December 2018.*

[2] *The inshore region is defined as the UK Territorial Waters which extend up to 12 nautical miles (22.2 km) from the Mean Low Water Mark.*

Based upon work in the UK and overseas RWM has identified three broad types of potential host rock for a GDF. Existing geological Information, as compiled in the National Geological Screening (NGS) [iv], shows that all three generic rock types, Lower Strength Sedimentary Rocks (LSSR), Evaporite and Higher Strength Rocks (HSR) are present within the Allerdale Search Area and/or the adjacent inshore, within the depth range of interest[3] (200 – 1,000 metres below the NGS datum[4]). There are LSSR consisting of several clay-rich rock layers occurring within the depth range of interest within the inshore area off the coast of Allerdale and HSR, such as granites, are potentially suitable as host rocks for a GDF and are found onshore.

RWM has considered the safety and security relating to construction, operations and post-closure aspects of a GDF in the Allerdale Search Area and adjacent inshore and no fundamental constraints have been identified at this stage. A number of characteristics have been identified for early consideration and investigation including ground conditions, access to potential underground environments from possible locations for a surface facility, the presence of faults and aquifers and any impacts from historical mining and related activities.

A GDF is expected to bring substantial benefits to the community which hosts it and the wider area. As a major infrastructure project, a GDF is expected to generate hundreds of well-paid jobs each year for over 100 years in construction, engineering, administration, safety operations and project management. There is an opportunity for skills to be developed by people in the community and for the jobs to be undertaken by them.

RWM has considered the community aspects of delivering a GDF in the Search Area. There is considerable nuclear skill and expertise in the local workforce as well as a local community that is familiar with the nuclear industry, including those relating to the management of radioactive waste at the existing nuclear sites at Sellafield and the Low Level Waste Repository, both located in the adjacent Borough of Copeland. Sellafield Limited directly employs around 11,000 people and indirectly there are thousands more within the supply chain. Approximately 25% of Sellafield's workforce reside in Allerdale.

The Nuclear sector is a recognised priority at the regional level Cumbria Strategic Economic Plan 2014-2024 [v], with the aim of using the nuclear and the energy sector to diversify and grow the regional economy. Furthermore, the development of a GDF could be aligned with existing local plans and supported by a developed Community Partnership vision. In addition, the community would benefit from opportunities to use significant community investment funding for locally important priorities early in the siting process.

The visitor economy accounts for £2.9 billion (2017) worth of income to the Cumbria area, and it will be important to ensure that the natural, heritage and cultural features and assets that support and drive this economy are treated sensitively. The delivery of a GDF within the Allerdale Search Area could provide the local community with an opportunity to create a GDF scientific centre of excellence, which itself could become a tourism point of interest alongside the existing tourism destinations.

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[3] *The depth range of interest for a GDF is 200 metres to 1,000 metres below the NGS datum (see the NGS web page (**https://www.gov.uk/guidance/about-national-geological-screening-ngs**). Although screening has focused on the 200 to 1,000 metres depth range, which is consistent with Government Policy and the National Geological Screening Guidance, RWM recognises that some rock types may be suitable as host rocks where they occur at depths greater than 1,000 metres.*

[4] *NGS datum is a level that has been used to enable the production of maps showing the rock types of interests at depths of 200 metres to 1,000 metres below the surface. In flat lying areas the use of the lands surface is fine, however in mountainous and hilly areas this can be misleading. This is because there could be potentially suitable host rocks that appear to be more than 200 metres below the surface, but they are actually higher than, or level with, nearby valleys. To avoid this, a model was developed that consists of flat surfaces between the bases of valleys. This is to ensure that rocks identified as potentially suitable will be below nearby valleys.*

With respect to the environment siting factor, parts of the Allerdale Search Area and adjacent inshore area off the coast are designated due to their nature conservation and heritage interests. RWM understands and fully supports the priority given to respecting these protected areas. At this stage, with no specific sites for the surface facilities of a GDF identified, it is not possible to assess the specific potential impacts of delivering a GDF on the environment. If the Allerdale Search Area progresses through the siting process, RWM will work with the community and other relevant stakeholders to understand the natural environment in greater detail when considering the implications of delivering a GDF in Allerdale on protected areas and the natural environment.

With respect to engineering feasibility, there is likely to be flexibility in terms of where the surface facilities of a GDF could be located. RWM would work collaboratively to develop safe and secure designs of the surface facilities and identify a potential location for a GDF that responds to local priorities and the natural environment. Matters such as ground stability and associated engineering aspects would need to be considered in greater detail should the area progress to identifying specific sites and RWM would want to ensure sustainability and good design practices.

With respect to the transport siting factor, much of Allerdale Borough is remote from the national transport network and travelling through the area can take longer due to the topography, limited train services and the nature of the rural road network. To support the development of a GDF in the Allerdale Search Area, it is likely that there would be a need for improved transport infrastructure for movement of construction materials, personnel and the waste inventory. This could bring benefits for local communities, which are currently under-served by the existing road and rail networks in the wider region. This could provide the additional benefit of making the area more attractive for development and inward investment. The Local Enterprise Partnership highlights the need for improved infrastructure in the area and the delivery of a GDF could support these plans.

The Search Area has a coastline and it may be possible to transport freight to the area via sea. The option of sea transport via a dedicated sea facility could be explored further with the community as a potential benefit to address any adverse transport issues. Similarly, the use of existing facilities could be explored. If sea transport were to be utilised there could be additional benefits that could be realised as a consequence of infrastructure upgrades that may be required.

Given the early stage in the siting process, there are many uncertainties that would influence the overall programme cost and delivery schedule. It is recognised that the Sellafield nuclear site is relatively close to the Allerdale Search Area, and that a large proportion of the waste likely to be disposed of in a GDF is currently located there. At this early stage, nothing has been identified which suggests or indicates that a GDF could not be delivered in the Allerdale Search Area in a way which secures value for money. Further evaluation work would need to be undertaken at a later stage when additional information has informed the engineering design of the GDF and the safety cases for a GDF.

Having considered readily available information, relevant to each of the six Siting Factors, initial findings indicate that the Allerdale Search Area and the adjacent inshore area have the potential to host a GDF.

This evaluation work has not confirmed that the Allerdale Search Area and adjacent inshore area are suitable to host a GDF. Rather, it has developed an understanding of whether the area holds any potential to host a GDF, together with early identification of known constraints and uncertainties.

Should the Allerdale Search Area and adjacent inshore area be considered further in the siting process, then further analysis drawing on additional sources of information and data will be required to enhance the understanding of the implications of delivering a GDF in the area. RWM will work collaboratively with communities and stakeholders to understand what is important to them and feed this into assessments and evaluations relating to potential for areas and sites to host a GDF.

1. Introduction

This report has been developed by Radioactive Waste Management Ltd (RWM) as part of the process to identify a suitable site for a Geological Disposal Facility (GDF) within a willing host community.

Discussions with RWM were initiated by an Interested Party in the Borough of Allerdale. As part of these initial discussions, RWM undertook initial evaluation work to understand whether the area identified by the Interested Party had the potential to host a GDF. The initial evaluation work, presented in RWM's Initial Evaluation Report, suggested that, based on the information available, there was potential for a GDF to be hosted within the Borough of Allerdale.

These discussions resulted in the establishment of a Working Group to start initial engagement and the identification of a Search Area within Allerdale. If the area continues in the siting process, a Community Partnership will be set up as the main vehicle for dialogue with communities within the Allerdale Search Area and neighbouring communities.

In line with the UK Government's Working with Communities Policy (the 'Policy'), the Allerdale Working Group has identified a Search Area from the area first put forward for consideration.

This Search Area Evaluation Report relates to that area, which is referred to in this report as the 'Allerdale Search Area' and comprises the Allerdale Borough Council electoral wards of Aspatria, Broughton St Bridgets, Dalton, Ellen & Gilcrux, Flimby, Harrington & Salterbeck, Maryport North, Maryport South, Moorclose & Moss Bay, Seaton & Northside, St John's, St Michael's and Stainburn & Clifton (the 'Allerdale Search Area'). The inshore area adjacent to the Borough of Allerdale also remains under consideration and is within the scope of this report.

The Policy provides that the Search Area is the geographical area within which RWM will seek to eventually identify potentially suitable sites to host a GDF. Defining the boundaries of the Search Area is important in order to identify appropriate membership for the Community Partnership.

Paragraphs 6.21 and 6.22 of the Policy state that:

6.21. *"An early task for the Working Group will be to identify a Search Area. The Search Area is the geographical area within which RWM will seek to identify potentially suitable sites to host a GDF".*

6.22. *"The Search Area will be derived from the area first put forward for consideration by the interested party and will be defined using district or unitary council electoral ward boundaries, depending on the administrative arrangements in place for the particular area. The Search Area will, therefore, encompass all the electoral wards within which RWM will be able to consider potential sites. For areas which include potential for development under the sea bed, the Search Area will comprise only that area on land."*

The geographical boundaries of a Search Area are likely to change as the search for a potential location for the surface and underground facilities progresses and more is understood about the area. It is expected that the Allerdale Search Area will be refined over time by a future Community Partnership.

The Allerdale Search Area that has been identified is derived from within the area first put forward and considered as part of RWM's initial evaluation work. This further high level Search Area Evaluation Report is intended to support the conclusions of RWM's initial evaluation work to confirm whether the Search Area has potential to host a GDF, whilst maintaining a focus on the identified electoral wards which encompass the Search Area and adjacent inshore area.

This report is underpinned by information which has been collated from readily available sources such as the RWM National Geological Screening (NGS), Office for National Statistics, Natural England and Allerdale Borough Council. It is envisaged that if a Community Partnership were to form then a further review of available information will be conducted as part of RWM's investigation works.

The evaluation work is not designed to confirm whether or not the Allerdale Search Area is suitable to host a GDF but rather whether it has any potential. Identifying a suitable site will take several years due to the need to properly identify, investigate, and assess potential GDF host sites and ensure that communities involved in the siting process have a full understanding of how the GDF project may affect them.

2. Search Area

2.1 Search Area Purpose

The purpose of the Search Area is defined in the Policy. It is the geographical area on land (based on district or unitary electoral ward boundaries) within which RWM will seek to identify potentially suitable sites to host a GDF. Defining the boundaries of the Search Area is also important in order to identify appropriate membership for the Community Partnership.

The Search Area may evolve over time. If the Search Area progresses through the siting process, any Community Partnership that may form is likely to review and refine the Search Area as RWM completes its investigations. The Search Area will also change to reflect any future changes to electoral ward boundaries. The Community Partnership may consider, under some circumstances, to include electoral wards that have limited potential to host a GDF (e.g. due to geological constraints, environmental features, engineering design limitations, etc.) but which need to be included in the community dialogue, as they may be impacted by the development.

In some cases, to understand the implications of delivering a GDF, studies may need to be undertaken outside of the Search Area, for example, to assess any potential impact that the construction or operation of a GDF may have on the wider area.

2.2 Allerdale Search Area

The Allerdale Search Area was identified from within an area first put forward by Interested Party for consideration. The original Area of Consideration was the entire Borough of Allerdale, excluding the Lake District National Park.

The Allerdale Search Area that has been identified by the Working Group and the adjacent inshore area which are the focus of this report, is shown in Figure 1 below.

The Allerdale Search Area comprises the 13 Allerdale Borough electoral wards of Aspatria, Broughton St Bridgets, Dalton, Ellen & Gilcrux, Flimby, Harrington & Salterbeck, Maryport North, Maryport South, Moorclose & Moss Bay, Seaton & Northside, St John's, St Michael's and Stainburn & Clifton.

Within these 13 wards are 21 Parish Councils: Aspatria, Bothel & Threapland, Bridekirk, Brigham, Broughton, Broughton Moor, Camerton, Crosscanonby, Dean, Dearham, Gilcrux, Great Clifton, Greysouthen, Little Clifton, Maryport, Papcastle, Plumbland, Seaton, Westnewton, Winscales and Workington.

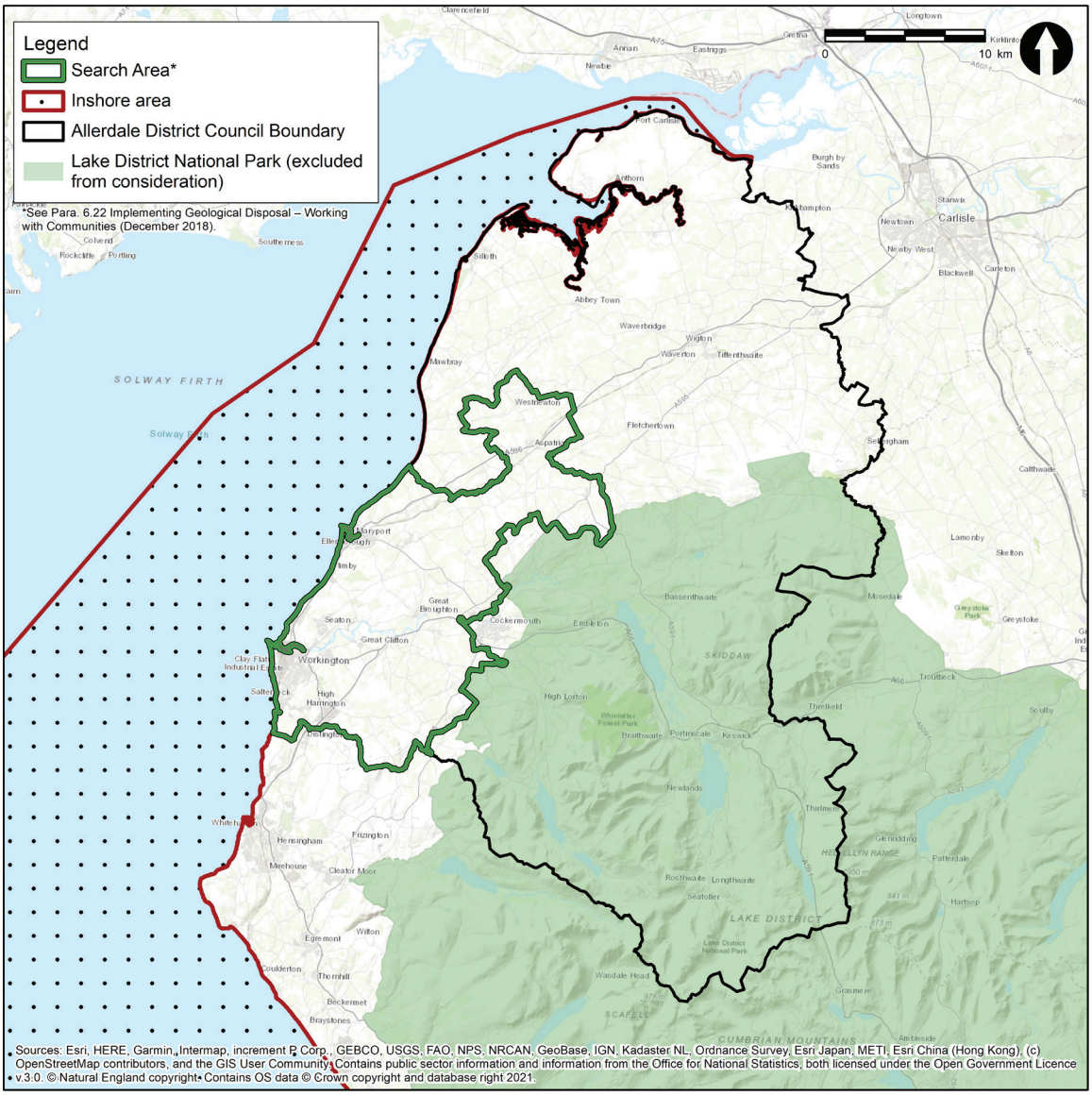
The Search Area considered in this report was identified by the Allerdale Working Group through a workshop where the geological attributes of the area were presented, discussed and considered, as well as surface features of the Borough of Allerdale. The matters considered included relevant environmental, community and other factors and included information on subjects such as landscape designations, heritage assets, ecological designations, transport and flooding.

The Working Group also considered feedback received during its early engagements with the public and a series of workshops with a group of stakeholders who shared information and their local insight. This included feedback relating to community factors, environmental and landscape impacts, community wellbeing, socio-economic data and safety. The Working Group was also mindful of the location of Areas of Outstanding Natural Beauty (AONB) and World Heritage Sites, as well as the commitment that had already been made to excluding the Lake District National Park from the area under consideration and the Search Area. The group also discussed the impact on a Search Area's community holistically, recognising that communities are not solely defined by wards boundaries or geographical areas. The cultures and needs of different areas were also considered.

During discussions with the Working Group, it was agreed that those areas of Allerdale Borough currently located within the boundary of the Lake District National Park should be excluded from any consideration to host a GDF. On this basis, the Allerdale Search Area does not include any land that is within the boundary of the Lake District National Park. The Lake District National Park abuts three of the wards included in the Allerdale Search Area (Aspatria, Broughton St Bridgets, and Dalton).

The Search Area lies within the administrative areas of Allerdale Borough Council and Cumbria County Council. There are plans to reorganise the County Council and the six District Councils into two new unitary councils. As the Policy defines the Search Area by district or unitary electoral wards, any changes to electoral ward boundaries will be reflected in the Search Area, which will be reviewed and refined by the Community Partnership.

Figure 1: Allerdale Search Area



The Policy set out the definition of a Search Area as the land encompassed by district or unitary electoral wards. These only cover areas on land, so the adjacent inshore area off the coast of Allerdale is outside of the formally defined boundary of the Allerdale Search Area. However, the geology below the adjacent inshore area may be accessible from a surface site on land. The Working Group has recommended further work to understand the potential for the subsurface elements of a GDF to be hosted deep beneath the seabed. Therefore, the inshore area adjacent to the Borough of Allerdale remains an area under consideration, which is reflected in this evaluation report.

3. RWM Evaluation Process

3.1 Evaluation Approach

RWM's approach to evaluation follows the principles set out in the Policy. There are many requirements derived from legislation, certain policy documents and guidance that RWM will need to satisfy to successfully investigate potential areas and sites, and to subsequently construct, operate and close a GDF. Equally there are many requirements that relate to the period after closure. These requirements are discussed in RWM's report '*Site Evaluation - How we will evaluate sites in England*' which describes the approach in more detail.

RWM looked at international GDF projects and UK infrastructure projects of similar size and complexity, to identify a series of Siting Factors. The six Siting Factors we have selected set out the broad topic areas that we will need to consider throughout the siting process as we assess and evaluate areas and sites. These Siting Factors are:

- Safety and Security
- Community
- Environment
- Engineering Feasibility
- Transport
- Value for Money

The Siting Factors are underpinned by 'Evaluation Considerations' which will be used to guide the evaluations and discussions with communities. These are presented in RWM's '*Site Evaluation - How we will evaluate sites in England*' published document with examples of typical matters that RWM assesses under each Evaluation Consideration provided in Annex B of the published Site Evaluation document.

A key focus of this Search Area Evaluation has been on the geological context of the Allerdale Search Area and to explore in further detail the conclusions reached in the initial evaluations in order to better understand the potential to host a GDF.

At this early stage in the siting process RWM has drawn upon existing readily available information to inform a desktop study by RWM's technical specialists.

4. Search Area Evaluation

4.1 Safety and Security

Based on the review of readily available information relating to the Safety and Security Siting Factor, RWM has concluded that the Allerdale Search Area and the adjacent inshore area have potential to host a GDF.

Safety after Closure – geological understanding

It is essential that a GDF remains safe, both during the period in which it is constructed and operated, and for hundreds of thousands of years after it has been closed and sealed. Safety after closure is often referred to as 'long-term safety' or 'post-closure safety'.

Safety is of paramount importance to RWM. The consent based, flexible approach to finding and identifying a suitable site for a GDF within a willing community is designed to ensure above all, that the site which is selected is safe and secure for people and the environment, now and in the future.

A GDF will use a multi-barrier system in which engineered barriers work together with natural barriers provided by the geology to isolate and contain waste for the time required for the radioactivity associated with them to naturally reduce, and to prevent any harmful levels of radioactivity returning to the surface. It is essential that a GDF is safe during the period in which it is constructed and operated, and in the future once it has been closed.

The geological environment makes an important contribution to safety after closure as man-made engineered barriers work together with the geology to provide this protection. Placing radioactive waste deep underground puts it far beyond people's reach, so that it is safe and secure.

Post-closure safety assessment requires detailed examination of the geological environment to understand if a GDF could be designed to provide the required high level of safety through the combined use of engineered barriers and the geological environment.

At this early stage, the geological information that has informed this evaluation work was obtained from the NGS exercise and also includes, but is not limited to, local borehole data, petroleum exploration boreholes within the adjacent inshore area, geophysical surveys, historical mining records and local geological information.

Key aspects of the geology that relate to safety after closure are the rock type, rock structure, groundwater, natural processes and resources. More detailed work that looks at and acquires additional sources of information and data would need to be undertaken in due course, if the Allerdale Search Area were to be considered further in the siting process.

Rock type

Based upon work in the UK and overseas RWM has identified three broad types of potential host rock for a GDF.

- Lower Strength Sedimentary Rocks (LSSR), like claystones and mudstones;
- Evaporites, such as rock salt; and
- Higher Strength Rocks (HSR), like granites and slates.

All three of these potential host rocks (LSSR, Evaporite and HSR) occur within the depth range of interest (200 to 1,000 metres below NGS datum) within the Allerdale Search Area and/or the adjacent inshore area.

There are well developed disposal concepts for all three of the potential host rock types (LSSR, Evaporites and HSR) found in the Allerdale Search Area and adjacent inshore. Based on its own work and similar work carried out overseas, RWM has confidence that a GDF design could be developed which would provide the required high level of safety. This would be presented in safety cases which would be assessed by the UK's independent regulators.

Lower Strength Sedimentary Rocks (LSSR)

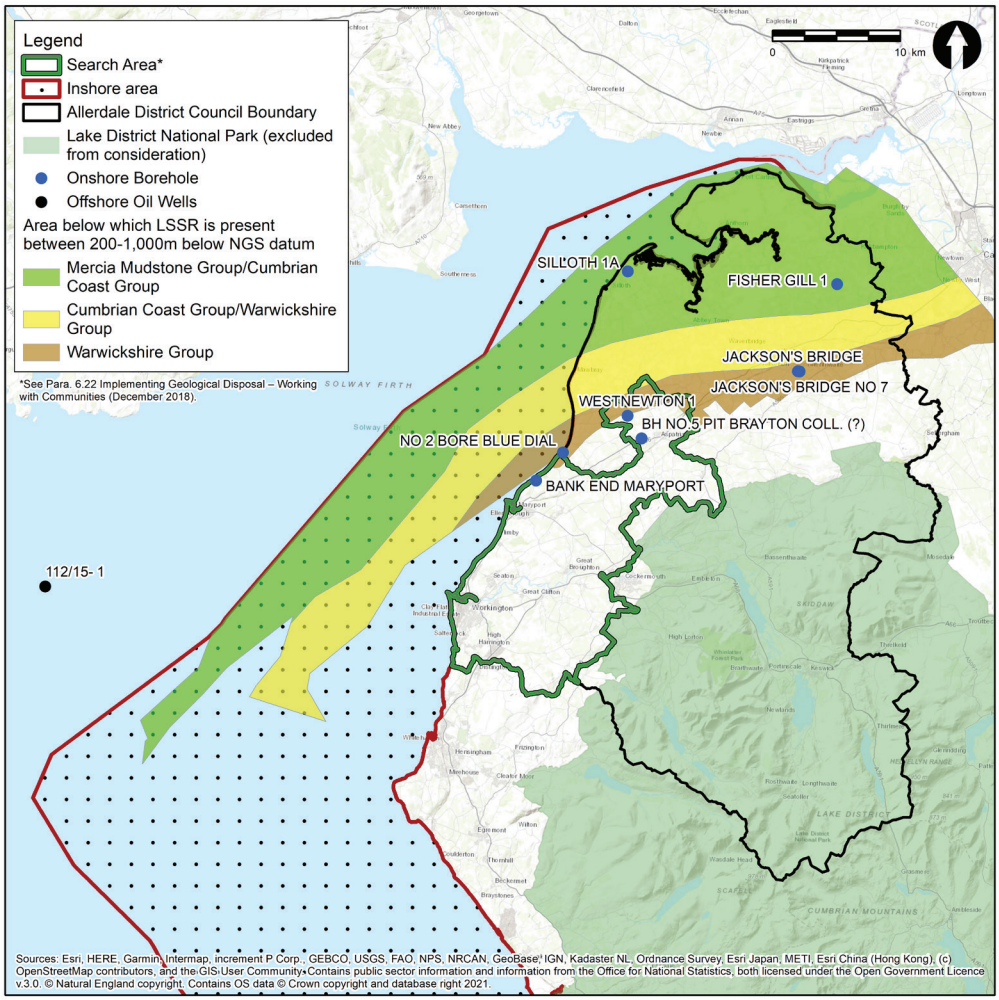
Much of the area off the coast, within the inshore area adjacent to Allerdale Borough is underlain by clay-rich rock layers and rock salt (halite) layers (**Figure 2**). The Triassic Mercia Mudstone Group is widespread off the coast and is dominated by mudstone. Mudstones have low permeability and where they are sufficiently thick, have potential to act as a LSSR host rock. The LSSR can be found immediately adjacent (less than 1 kilometre) to the shoreline in the north-west of the Allerdale Search Area, near Maryport. Clay-rich mudstone layers, forming part of the Mercia Mudstone Group, are understood to be up to 110 metres thick[5], close to the axis of the Solway basin. This location is further from the coast than is being considered, though represents the closest inshore/offshore borehole where the geology at depth beneath the seabed has been examined. While the Mercia Mudstone comprises predominately thick mudstones, it also contains units of variable thicknesses and composition, including silty and sandy intervals. This variability needs to be understood in greater detail if this area progresses.

The Cumbrian Coast Group in the region of Allerdale Borough is arranged in different layers and separated from the younger Mercia Mudstone Group by the Sherwood Sandstone Group, which is a thick section of sandstones with thin mudstone layers within them. In west Cumbria and the East Irish Sea, the Cumbrian Coast Group is composed of the St Bees Shale Formation, Barrowmouth Mudstone Formation and the underlying St Bees Evaporite Formation. Current data suggests that in the Allerdale region the St Bees Evaporite Formation is not present.

LSSR, or clay-rich rocks, are internationally recognised as potentially suitable for hosting a GDF. This is because these rocks are rich in very small clay particles, and only allow water to pass through them very slowly. In addition, the high clay content means that any cracks that form in these rocks are likely to reseal, particularly under the weight of hundreds of metres of overlying rock. As a result, there is often almost no groundwater movement through these rocks. These attributes, together with the engineered barrier system, would contribute to a situation where radionuclides and other non-radioactive materials are suitably contained for hundreds of thousands of years.

[5] *Recorded in borehole 112/15-1, approximately 32 kilometres west of Workington.*

Figure 2: Areas where LSSR are present



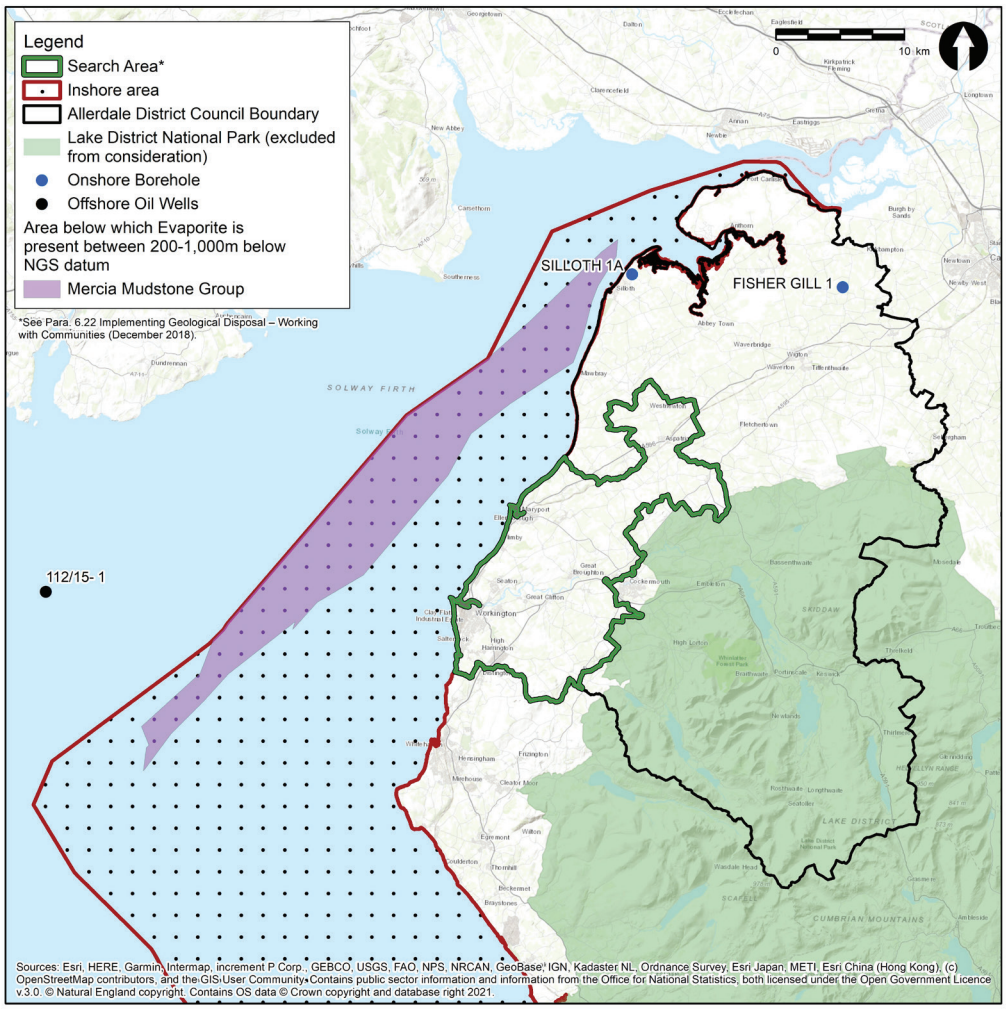
Evaporites

The Mercia Mudstone Group contains layers of halite that have the potential to be a suitable host rock for a GDF[6]. However, there is little direct evidence of the presence of thick halite intervals within the Mercia Mudstone Group within the immediate Allerdale area. Existing borehole data suggests that the halite layers are both thin (6 metres thick) and shallow (less than 200 metres deep) in the north of Allerdale Borough, near the coast at Silloth. The halite layers could be up to 80 metres thick within the depth range of interest, 32 kilometres to the west of Workington. Figure 3 shows where these halites may occur within the depth range of interest.

Rock salt has several properties that make it potentially well-suited for hosting a GDF. First, they are made of interlocking crystals of salt with very few gaps in between them. This makes it very difficult for water, gas and other fluids to pass through it, even over geological time scales. Secondly, rock salt environments are extremely dry making them particularly well suited for radioactive waste disposal. This dry state leads to low corrosion rates of waste packages, reduces gas generation rates and means little water is available to transport radionuclides away from a GDF. Thirdly, rock salt can be squeezed into different shapes under relatively low pressures and over short time scales. This means that cracks and fractures in rock salt, that might provide pathways for water and gases to flow, rapidly close up and 'seal' and therefore prevent movement of these fluids.

[6] *As part of the National Geological Screening exercise, the BGS identified layers of evaporites as potential host rocks. In this area it is only where there are significant thicknesses of halite, that these layers are likely to be suitable to host a GDF.*

Figure 3: Areas where Evaporite may be present



In a situation where the clay-rich and evaporite layers are not in themselves suitable to host a GDF because they may too thin, a combination of these units may provide a suitable thickness. Alternatively, they may support a combined disposal horizon, including within deeper Higher Strength Rocks (HSR), as they are likely to act as a barrier to groundwater flow. Geological properties which may influence the potential for gas to migrate away from a GDF will need further investigation if the Search Area progresses through the siting process.

Higher Strength Rocks (HSR)

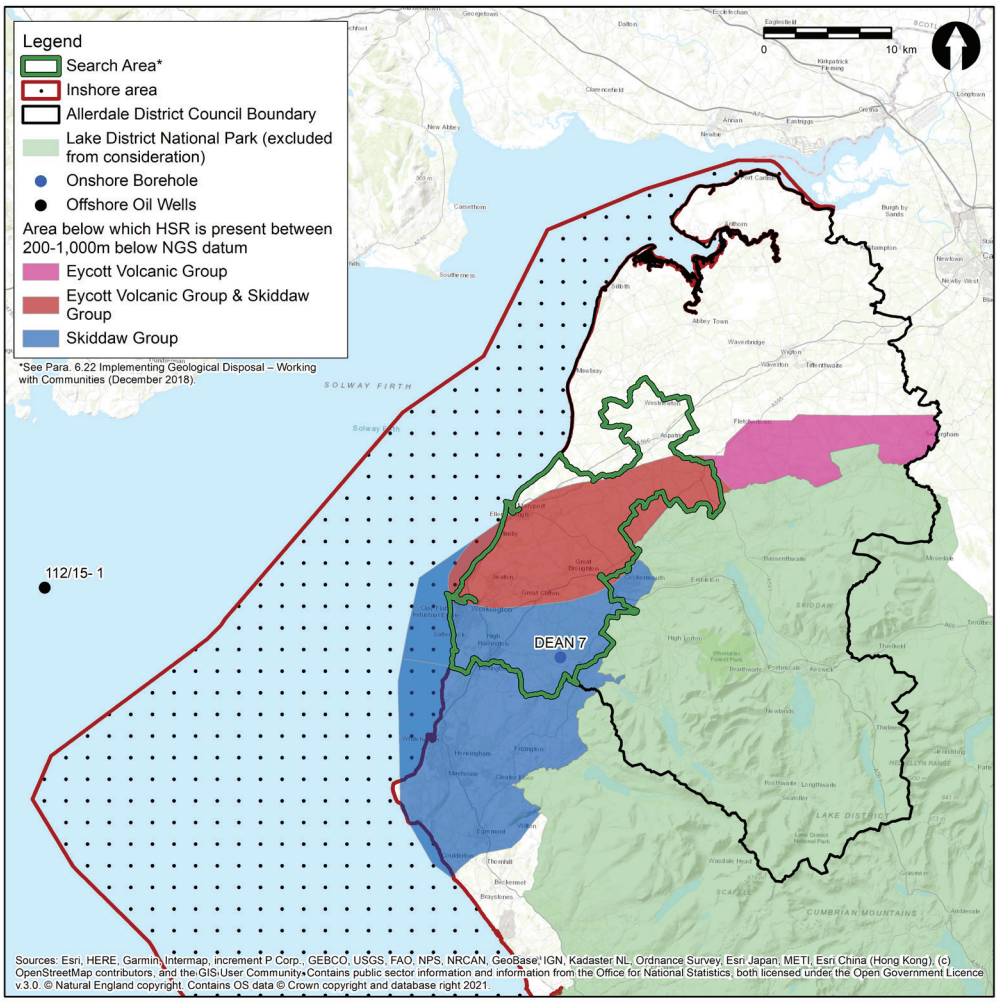
Most of the Allerdale Search Area is underlain by potential HSR. There are two main types of rock with potential to act as HSR hosts in the Allerdale Search Area: the Skiddaw Group slates and the Eycott Volcanic Group igneous rocks (Figure 4).

The Eycott Volcanic Group is present in the depth range of interest through the central part of Allerdale. It is found at the surface around Cockermouth and Whitrigg and may extend as far west as the coast north of Workington, where it is understood to exist at depth. The rocks that make up the group were formed from erupted ashes and lavas which have been metamorphosed into uniform volumes of rock and may have the potential to be HSR host rocks.

The Skiddaw Group is present in the depth range of interest from the edge of the Lake District National Park near Cockermouth, extending west to the coast. They were formed from a sequence of mudstones and sandstones which have been metamorphosed into slates and are therefore potential HSR host rocks.

HSR, such as granites and volcanics are potentially suitable host rocks because they are strong so they can easily support the tunnels and caverns that make up a GDF. These rocks typically have no gaps between the crystals and therefore groundwater flow is restricted to cracks or fractures. Depending on the nature of these cracks, the surrounding geology and groundwater, HSR could be suitable to host a GDF. The close proximity of these rocks to the Carboniferous limestone aquifer and the extensively mined coal measures to the west may be a challenge to their suitability that would need to be considered further if this area is taken forward to Community Partnership.

Figure 4: Areas where Higher Strength Rocks are present



A simplified column of the rock types present in the Borough of Allerdale is presented in Table 1. The oldest rocks are shown at the bottom of the table, with progressively younger rock units towards the top.

Table 1: Sequence of major rock types present based upon the BGS Regional geological visualisation models. Only rock units occurring in the depth range 200 to 1,000 metres below NGS datum are included.

	Geological Period (age in millions of years)	Geological Unit	Dominant Lithology	Rock Types of Interest		
				LSSR	HSR	Evaporite
Younger sedimentary rocks	Triassic (201.3 – 251.9)	Mercia Mudstone Group	mudstone with local siltstone, anhydrite, gypsum and halite	✓		✓
		Sherwood Sandstone Group including St Bees sandstone	sandstone, siltstone and minor amounts of mudstone			
	Permian (251.9 – 298.9)	Cumbrian Coast Group	mudstone and sandstone with anhydrite, gypsum and/or halite.	✓		
		Appleby Group	sandstone and conglomerate			
Older Sedimentary rocks	Carboniferous (298.9 – 358.9)	Warwickshire Group	sandstone and siltstone with mudstone	✓		
		Pennine Coal Measures Group	mudstone, siltstone, sandstone and coal			
		Millstone Grit, Yoredale and Border Groups	sandstone, siltstone, limestone and mudstone			
		Carboniferous Limestone Supergroup	limestone with mudstone, siltsone and conglomerate			
Basement	Devonian (358.9 – 419.2)	Lake District Batholith	granite			
	Silurian (419.2 – 443.8)	Windermere SuperGroup (including Kendal and Dent Groups)	weakly metamorphosed mudrock with siltstone and sandstone			
	Ordovician (443.8 – 485.4)	Lake District Batholith (in part)	granite			
		Borrowdale & Eycott Volcanic Groups	weakly metamorphosed lavas and pyroclastic rocks		✓	
		Skiddaw Group	weakly metamorphosed slates and sandstones		✓	

Rock structure

The term "rock structure" describes natural geological features that could affect the safety of a GDF or the ease with which a GDF could be constructed in a given geological environment. The present understanding of the Allerdale region indicates that there are a number of major faults both onshore and within the inshore area off the coast. These have the potential to impact the siting and construction of a GDF that will need further consideration. Faults may act as barriers to or pathways for groundwater movement, depending upon their characteristics. Understanding the rock structure and its complexity within an area is a highly important aspect and is required to characterise any potential site. It will inform the effect of long-term evolution on safety, and hence the design and constructability requirements of a GDF.

Onshore large-scale folding is less common in the area, while inshore in the younger sedimentary section, folding is likely to be associated with the faults. The older rocks in the region have experienced smaller scale folding and metamorphism. The current level of understanding of rock structure is limited and significant further study and characterisation would be required. This is particularly relevant to understanding the structural and related groundwater characteristics of potential HSR host rocks, as well as the overlying geology.

Groundwater

The term "groundwater" describes all types of subterranean water. Groundwater attributes relate to the movement and chemical composition of groundwater present in pores and fractures in rocks from surface to a depth of around 1,000 metres.

There is very little information on groundwater in the depth range of interest for a GDF, although there is information on groundwater in aquifers above 200 metres. The previous siting process for a GDF (carried out under the previous *Managing Radioactive Waste Safely* (MRWS)) policy framework process identified locations within the boundary of the Allerdale Search Area where it would be necessary to consider the presence of groundwater resources. In the north of Allerdale Borough, the Sherwood Sandstone Group is classed as a Principal Aquifer, and is used for public water supply. Secondary Carboniferous aquifers are also present in the north and west of Allerdale Borough.

There is extensive historical mining over 100 metres depth in Allerdale, including in the Allerdale Search Area, that is likely to have changed the original patterns of groundwater movement. Shallow groundwater may now circulate to greater depths within the depth range of interest than it did before mining took place.

Dense brines may be present within the potentially suitable rocks in the depth range of interest in the inshore area. Where dense brines are present it is likely that groundwater movement is very limited and has been isolated from shallower, fresher groundwater for significant periods of time.

More information would need to be sought about the groundwater chemistry and groundwater movement, including rock structure considerations. Similarly, further information will be required to understand the location and nature of aquifers in the region.

Natural processes

The term "natural processes" include earthquakes, glaciations and sea level changes. One of the benefits of geological disposal of radioactive waste is that the waste is isolated at depth and therefore protected from future natural processes which occur at the surface. Therefore, whilst a GDF would need to be sited and designed to take account of natural processes which may occur during its operational lifetime, there is no reason to suggest that the Allerdale Search Area and adjacent inshore should be excluded from the siting process on the basis of the area's susceptibility to natural processes alone.

Resources

In areas where there are licences for exploration or mining, or where there is a history of mining activity, it is considered more likely that future generations may inadvertently disturb a facility. Surface coal resources are present throughout the Allerdale Search Area. There are also Coal Authority Licence Areas off the coast of the Search Area, allowing companies to explore for coal. It is currently not known with any degree of certainty whether these licence areas will be exploited, however continual monitoring of potential exploration and development would be required. RWM would continue to monitor any potential exploration or related activities throughout the GDF siting process. Coal resources in the area, as well as historical mining practices, would need to be carefully considered in the context of design, construction, operation and eventual closure of a GDF.

Historical information

It is recognised that there is geological information available that relates to previous work in the wider Allerdale region. This was generated through historical surveys and studies that were commissioned to understand the area's potential for the geological disposal of radioactive waste in this locality. Similarly, there are operational and historic mining activities that will have resulted in the production of potentially relevant sub-surface surveys and studies. If the Allerdale Search Area progresses to a point where a Community Partnership is formed, RWM will review and revisit existing information that may be available. RWM would need to be mindful of the purposes of the historic surveys and studies, and legislative and regulatory changes that may have occurred in the intervening years, however this information could enhance RWM's understanding of the geological environment of the area.

As part of the work that was carried out under the West Cumbria Managing Radioactive Waste Safely Partnership, the British Geological Survey (BGS) undertook a high-level screening of Copeland and Allerdale Boroughs. This was a desk-based study that used existing information to rule out areas that could not host a facility due mostly to the known presence of natural resources, based on pre-determined criteria that formed part of that previous siting process. This work resulted in the exclusion of some parts of the area studied at that time. In addition, some volumes of rock were ruled out due to the presence of known aquifers. However, it was recognised that exploitable aquifer rock volumes do not extend throughout the whole depth range of interest (between 200 and 1,000 metres), and consequently it may be possible to construct a GDF in suitable rocks below aquifers. The presence of natural resources, whilst important to siting, may not automatically exclude an entire area from further consideration and would be evaluated in detail as part of a full site characterisation process.

Construction and Operational Safety

The initial findings of RWM as part of this evaluation work indicate that there are no fundamental constraints relating to construction and operational safety matters which would prevent the Allerdale Search Area and adjacent inshore from being considered further in the siting process. There are, however, a number of matters that have been identified that would need to be investigated further should the Allerdale Search Area progress through the siting process.

Some parts of the Allerdale Search Area are prone to flooding, with sources of flooding including rivers, the sea and flash flooding due to extreme rainfall. At some locations this may present challenges to the construction and consequent operation of a GDF and the drilling of deep boreholes to characterise the geological environment. Further work would need to be done to understand the potential impact of flood risk when considering locations for the surface facilities and accessways, including potential effects of climate change and coastal erosion.

RWM would look to work collaboratively with relevant stakeholders to consider locating the surface facilities of a GDF in locations that are more resilient to flood risk, taking into account the possible effects that climate change may have. RWM would also seek to investigate the possibility of introducing design features to mitigate the impact on the surface site, as well as opportunities to implement wider flood protection schemes that could benefit the area. This is an important matter that would need collaboration with relevant stakeholders, including the community, the Environment Agency and Lead Local Flood Authorities.

In parts of the Allerdale Search Area, coal mining has historically taken place. The presence of mine workings nearby could present geotechnical hazards during the construction and operation of a GDF. More information would be sought about the historic (and possible future) mining activities in the region if the Allerdale Search Area was to progress through the siting process.

The implications of having another nuclear site (i.e. a GDF) in the vicinity of the existing nuclear sites at Sellafield and the LLWR is a matter that would need to be considered in more detail in due course. This would be an important issue for discussion with the UK's independent regulators and other key stakeholders. Sellafield is the UK's most complex nuclear site, covering approximately six square kilometres with operations including decommissioning, spent nuclear fuel management and the safe management and storage of nuclear waste. Sellafield contains a significant proportion of the likely nuclear waste disposal inventory. Under the Radiation (Emergency Preparedness and Public Information) Regulations 2019, the Sellafield site has a detailed emergency planning zone and an outline planning zone, and plans which cover on-site and off-site emergencies. The Allerdale Search Area is located within the 50 kilometre radius of the outline planning zone. RWM would need to undertake further work, with Sellafield Ltd and other stakeholders, to understand any constraints that these emergency preparedness arrangements could have on the construction and operation of a GDF in the Allerdale Search Area.

There is one known Upper Tier and two known Lower Tier COMAH sites (major hazards establishments subject to the Control of Major Accident Hazards Regulations 2015) in the Allerdale Search Area. These sites would need to be considered further if this Allerdale Search Area progresses through the siting process.

There is a potential risk to the operability and availability of a facility if there are road or rail closures, or if the transport network capability changes for any reason. The existing rail line is at risk from sea level rise, storm surges and the possibility of flooding and erosion. The potential failure of the existing rail supply route may have implications for the safe transport of waste and also on emergency arrangements. RWM would need to undertake further work to understand any constraints and potential transportation network improvements that may be needed for construction and operational requirements.

It is recognised that Carlisle Lake District Airport (outside the Allerdale region) is located to the north-east of the City of Carlisle. RWM would need to understand any potential impacts of the flight paths and future development plans that the airport may have on the siting of a GDF. RWM would also need to consider the impact of military aircraft low flying areas and tactical training areas. RWM would engage with the relevant stakeholders and the wider community to understand the implications of such matters should the Search Area progress through the siting process.

Security

Many of the considerations highlighted above in the context of Safety apply equally in the context of Security, and RWM would need to consider these issues further should the Allerdale Search Area progress through the siting process.

RWM will need to meet expectations set from the Office of Nuclear Regulation in respect of safeguards, an important part of nuclear non-proliferation treaty compliance set by the International Atomic Energy Agency upon signatory member states. The purpose of such agreements is to ensure that nuclear materials acquired for peaceful purposes are not diverted for military purposes.

The initial work undertaken indicates that there are no fundamental constraints relating to security or safeguards which would prevent the Allerdale Search Area being considered further in the siting process for a GDF.

4.2 Community

Based on the review of readily available information relating to the Community Siting Factor, RWM has concluded that the Allerdale Search Area and the adjacent inshore area have potential to host a GDF.

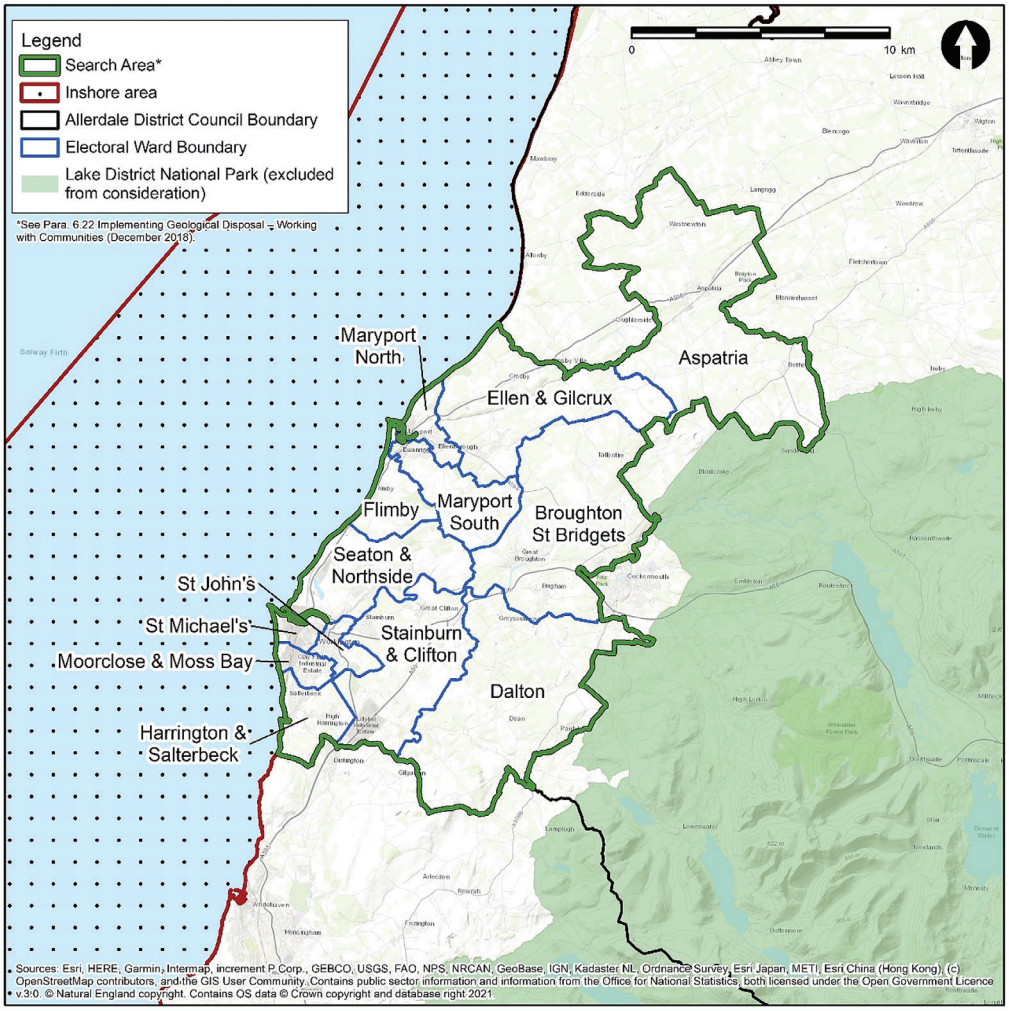
The community information that has informed this early evaluation work was obtained from public domain sources and local authority publications. Some of the gathered information is summarised here to explain the current view of RWM. Further work that looks at a progressively more detailed and wider suite of information would be undertaken in due course if the Allerdale Search Area progresses through the siting process.

In Cumbria, there are currently two tiers of local government consisting of Cumbria County Council and six District Councils. The Allerdale Search Area lies within the administrative areas of both Allerdale Borough Council and Cumbria County Council. Currently, the Allerdale Search Area (**Figure 5**) covers 13 electoral wards (Aspatria, Broughton St Bridgets, Dalton, Ellen & Gilcrux, Flimby, Harrington & Salterbeck, Maryport North, Maryport South, Moorclose & Moss Bay, Seaton & Northside, St John's, St Michael's and Stainburn & Clifton). Within these 13 wards there are 21 Parish Councils.

There are plans to reorganise the County Council and the six District Councils into two new unitary councils [vi]. As the Policy defines the Search Area by district or unitary electoral wards, any changes to electoral ward boundaries will be reflected in the Search Area.

The main settlements within the Allerdale Search Area are the towns of Workington and Maryport. The total population of the Allerdale Search Area contains approximately 59.5% of Allerdale Borough's total population. The Allerdale Search Area has a slightly higher working age population and younger demographic profile than the wider Allerdale Borough as a whole. Allerdale Borough also has a higher retired age population than England overall. As with the rest of Allerdale Borough, the Allerdale Search Area has a declining working age population, and that decline is forecast to continue by the Office for National Statistics.

Figure 5: Allerdale Search Area Electoral Wards



Economic Growth

There is significant synergy and cohesion between the strategies and plans operating in the region. Allerdale Borough Council has produced strategic documents which seek to deliver a vision of economic growth whilst securing its financial capability.

Allerdale Borough Council has published a 10-year strategy [vii] with a vision that communities will be sustainable, prosperous, safe, healthy and vibrant. The economy will be strong, diversified and well connected, with a growing and highly skilled population, with high employment, capitalising on skills and opportunities in the nuclear, energy and tourism sectors.

Allerdale Borough Council has set its focus on the following areas:

- making sure that the council is on a sound financial footing,
- ensuring high quality services are delivered,
- making sure neighbourhoods are clean and tidy as well as addressing wider environmental issues,
- supporting towns as key service centres for communities,
- taking action to ensure the right homes are in the right places,
- supporting communities to be healthy, active and engaged; and
- investing to support businesses so there are good employment opportunities to keep people in and attract people to Allerdale.

The Index of Multiple Deprivation (IMD) [viii] is a measure of relative deprivation in areas in England. It is comprised of the following seven domains: Income; Employment; Education; Skills and Training; Health and Disability; Crime; Barriers to Housing and Services; and Living Environment. Of the six districts in Cumbria, Allerdale is the third most deprived and between 2015 and 2019 the overall level of deprivation has worsened. Five of the communities (defined by Local Super Output Areas) in the Allerdale Search Area currently fall within the 10% most deprived in England.

The employment type in Allerdale Borough is largely dominated by manufacturing and construction, the public sector, retail and service sector (including hotel, leisure and tourism sectors). In the rural north of the borough, agriculture is still an important sector for employment and the economy. Those in professional jobs are often involved in occupations outside the borough related to the nuclear activities at Sellafield, which contributes about £60m (4.4%) to the Gross Value Added (GVA) of the borough. As of 2017, of the 9,944 Sellafield staff based on site and in the Whitehaven offices, 25.8 % live in Allerdale [ix].

It is recognised that Sellafield is currently undergoing a transformation in operations, with a move into full decommissioning. This could be a potential challenge for large scale employment in the future, both directly and through the supply chain.

A GDF would provide direct and indirect employment opportunities over a very long period of time. There would be hundreds of well-paid jobs every year for over a century with further opportunities for the local supply chain. Local projects could benefit from Community Investment Funding and public facilities and infrastructure could be improved over the long-term.

Irrespective of its location, a GDF will result in an increase in direct and indirect employees to the area which will require goods and services from local businesses. There may be an opportunity for RWM to ensure that the supply chain recruits and procures from the local workforce, where this is possible, to further enhance the benefits to the local area. However, it is recognised that RWM will need to work collaboratively with the existing community to avoid consequential detriment to other local businesses and supply chains.

Tourism

The tourism economy is of local importance and RWM recognises the need to treat the features and assets that support tourism sensitively. There may be an opportunity to create a local GDF scientific centre of excellence, which itself could become a tourism point of interest alongside existing tourism assets. For example, the French counterpart to RWM has developed an Environmental Observatory, an Environmental Specimen Bank and a Technological Exhibition Facility within the area in which they are intending to construct their GDF. These facilities in France attract over 10,000 visitors per year. Similarly, facilities constructed at Aspo in support of the Swedish spent fuel repository programme host 20,000 visitors per year.

Skills and Training

The existing supply chain in the region is highly attuned to the needs of the existing nuclear industry, with a heavy focus on engineering and technical activities, manufacturing, specialised construction and professional services. Likewise, training and development programmes from apprenticeships to higher level skills and research and development programmes are also attuned to the needs of the nuclear industry.

The delivery of a GDF within the Allerdale Search Area has the potential to provide a number of different opportunities to retain and develop skills within the local community, for example by delivering Science, Technology, Engineering & Maths (STEM) activities within schools, projects to increase aspiration, career mentoring and skills and training courses for local residents. A GDF could result in an increase in a wide range of opportunities through delivery of modern apprenticeships and skills training to develop the site-specific design, the construction and subsequent operation and management of this major piece of infrastructure.

Housing

There is considerable divergence in house prices across the Allerdale Search Area. The biggest difference is between Dalton, which has the highest median house price (£240,000), and Flimby, whose median house price is the lowest at £70,500. Flimby's low median price is likely driven by local conditions and opportunity, affecting the buoyancy of the market, with 100% of its residents living in the 30% most deprived Lower Layer Super Output Areas (LSOA) nationally, when considering income.

The delivery of a GDF could require additional housing for workers involved in the construction and operational phases over a long period of time. RWM would work closely with Allerdale Borough Council and other relevant stakeholders to agree a local worker housing strategy that complements the overarching housing strategy for the area.

The siting, investigation, construction and management of a GDF would be developed and delivered in partnership with communities, to ensure that it is sensitive to the local environment and the priorities of the local community. RWM would seek to work collaboratively though a Community Partnership, to ensure that local priorities and concerns are understood, considered and addressed.

Previous Siting Process

Allerdale Borough Council was a key member of the partnership that engaged with the previous siting process for a GDF. In 2008, following public consultation, the UK Government and devolved administrations of Wales and Northern Ireland published the White Paper *'Managing Radioactive Waste Safely (MRWS) – A Framework for Implementing Geological Disposal'* [x]. Three Cumbrian local authorities: Copeland Borough, Allerdale Borough and Cumbria County Council engaged with the MRWS process, covering the areas of Copeland and Allerdale only. The three councils formed and led their own West Cumbrian MRWS Partnership body, with broad membership from other neighbouring local authorities, business, farming, tourism and a range of other local groups.

There were three rounds of public and stakeholder engagement, and initial screening of the area's geology by the British Geological Survey. In the 2012 MRWS final report [xi], it was acknowledged that there was net support within Allerdale Borough for continuing the process of a search for a suitable site within Cumbria when it ended in 2013.

Allerdale Borough Council, Copeland Borough Council and Cumbria County Council subsequently made their decisions in January 2013 about whether or not to participate in stage 4 of the process. This would have allowed desk-based studies to address technical questions and further consultation to begin identifying potential sites, with an ongoing 'Right of Withdrawal'. Both Copeland and Allerdale Borough Councils decided to participate further in the siting process whilst Cumbria County Council decided to withdraw. As it had previously been agreed with UK Government Ministers that both tiers of local government would need to agree to participate in stage 4 of the process for either Allerdale or Copeland to proceed, this resulted in the end of that site selection process in west Cumbria.

RWM will work with the community to understand and share the lessons learnt from the previous siting process in order to aid the effectiveness of the current siting process.

4.3 Environment

Based on the review of readily available information relating to the Environment Siting Factor, RWM has concluded that, with appropriate mitigation, the Allerdale Search Area and adjacent inshore area have potential to host a GDF.

The environmental information that has informed the evaluation work was obtained from key documentation and national data sets which are publicly available. Some of the information gathered is summarised here to explain RWM's current view. More detailed work that looks at a wider suite of information would be undertaken in due course, if the Allerdale Search Area progresses in the siting process.

The delivery of a GDF, to safely and securely dispose of radioactive waste, would be one of the largest environmental infrastructure projects in the UK. However, all developments have the potential to generate both positive and negative impacts on the environment. At this stage, with no specific sites for the surface facilities of a GDF having been identified, it is not possible to assess the specific potential impacts on the environment of delivering a GDF at a particular location. That will come at a later stage in the process.

A number of key environmental constraints have nonetheless been identified in the Allerdale Search Area. Two categories are considered to be particularly noteworthy at this stage in the siting process, namely: the ecological designated sites and the landscape designations. These designations would influence the deliverability of a GDF in the Allerdale Search Area and would have particular implications for the location of surface infrastructure. If the Allerdale Search Area progresses through the siting process, RWM would look to work collaboratively with all relevant stakeholders to consider the environmental constraints and the implications of delivering a GDF at a specific site or sites within the area.

Landscape Designations

The coastal area in the west of the Allerdale Search Area is relatively low lying, with the major settlements of Workington and Maryport located at 21 metres Above Ordnance Datum (AOD) and 26 metres AOD respectively. The elevation of the Allerdale Search Area increases moving east, towards the boundary of the National Park, with Tallentire Hill representing the highest point, at 223 metres AOD. Beyond the larger settlements mentioned, the landscape is generally rural and interspersed with smaller villages and urban areas.

The Cumbria Landscape Character Guidance identifies 14 landscape subtypes in the Allerdale Search Area. The Allerdale Search Area is covered by three National Character Areas (NCA), the Cumbria Fells and Dales (NCA 8), the West Cumbria Coastal Plain (NCA 7) and the Solway Basin (NCA 6). The southern portion of the Allerdale Search Area is largely the West Cumbria Coastal Plain and the northern portion is predominately the Solway Basin NCA. A small portion of the north east and south east of the Allerdale Search Area falls within the Cumbria Fells and Dales (NCA 8).

The Lake District National Park (LDNP) is England's largest National Park and is designated as a UNESCO World Heritage Site. Legislation and planning policy provide a very high degree of protection to National Parks, and strict tests and requirements apply to any development proposals which could impact a National Park.

No part of the Allerdale Search Area is within the LDNP, though three of the electoral wards within the Allerdale Search Area abut the LDNP.

The LDNP is ecologically rich and diverse and is a key asset to the Cumbria and Allerdale economy in terms of tourism and outdoor recreation. The LDNP is considered to present a potentially substantial constraint on the siting of a GDF in the Allerdale Search Area, even though the GDF will not situated within the LDNP itself. This is due to potential indirect effects from both the built development itself (e.g. visual impact) and associated activities (e.g. traffic movement through the park), both of which are factors that would need to be considered in more detail if the Allerdale Search Area progresses in the siting process.

The Lake District National Park Authority is the planning authority for the land within the LDNP[7]. The Lake District National Park Local Plan [xii] contains a policy (Policy 29 'Waste Management'), which states that 'We will not support a geological disposal facility for radioactive waste in or under the Lake District National Park'.

Ecologically Designated Sites

Allerdale Borough hosts a large number of designated sites for nature conservation, including Ramsar sites, Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs).

There are over 2,500 species of flora and fauna across both designated and non-designated areas in the Allerdale Search Area. There are also a range of Priority Habitats located within the Allerdale Search Area, predominantly on the coast. Priority Habitats within the Allerdale Search Area include coastal sand dunes, maritime cliff and slope, purple moor grass and rush pasture and lowland fens.

There are a number of Biodiversity designations within the Allerdale Search Area. Many of the designations are overlapping or connected (e.g. SSSI, SAC, and SPA). The Solway Firth SPA occupies the Inshore Area of the Allerdale Search Area. The SPA is an internationally important site for seabirds and waterbirds (both breeding and non-breeding) including three Annex I species in the breeding season and six Annex I species in the non-breeding season.

There is one Special Area of Conservation (SAC) within the Allerdale Search Area, the River Derwent & Bassenthwaite Lake SAC. The Allerdale Search Area does not contain the lake component of the SAC, but the River Derwent flows east to west through the Allerdale Search Area, joined by the tributaries of the River Cocker and the River Marrow and drains into the sea at Workington. It has been designated as such for the presence of Annex II species including lampreys, Atlantic salmon, marsh fritillary butterflies, otters and aquatic plants. The Solway Firth SAC is located outside the Allerdale Search Area, three kilometres to the north west, and has been designated for its large, complex estuary system and sublittoral sandbanks.

There are no Ramsar sites located within the Allerdale Search Area, however, the Upper Solway Flats & Marshes is located just three kilometres north west of the area. It should therefore be an important consideration in the siting of a GDF due to its proximity and the risk of indirect effects on the site.

[7] *Allerdale Borough Council is the planning authority for the area outside the National Park and Cumbria County Council also has relevant planning functions, such as for minerals and waste planning.*

There is one Marine Conservation Zone (MCZ), which is Allonby Bay, in the inshore region adjacent to the north of the Allerdale Search Area. It has been designated due to the presence of a variety of features, including extensive living reefs formed of the honeycomb worm and mussels. These reefs form important habitat for a range of shore-dwelling species including snails, crabs, anemones and seaweeds.

There are four sites of special scientific interest (SSSI) in the Allerdale Search Area, including Siddick Pond, which provides excellent habitat for waterfowl and other birds. The majority of the SSSI in the Allerdale Search Area are designated due to biological interests, and one contains features of geological interest. There are also areas of ancient woodland scattered throughout the Allerdale Search Area.

DEFRA is funding five Local Nature Recovery Strategy (LNRS) 'Pilots' to inform national environment policy. The purpose of the LNRS is to restore and link up habitats so that species can thrive, and to reach consensus on the best places to help nature recover, plant trees and woodland, restore peatland, mitigate flood and fire risk, and create green spaces for local people to enjoy. In August 2020, the Government announced that Cumbria will be one of five Pilot areas trialling the development of a LNRS. The Cumbria LNRS Habitats Network identifies specific locations for a range of actions to help improve the ecological resilience for each of the habitats or habitat networks.

If the Allerdale Search Area progresses through the siting process, RWM would work with the local authorities, the community and other relevant stakeholders to understand and investigate the sensitivities of the natural environment in detail. Given the proximity of the inshore area to the boundary with Scotland, RWM will continue to engage with Scottish Government and any relevant public bodies in Scotland, for example NatureScot or Marine Scotland, to keep them informed and ensure any potential cross-border impacts or permitting requirements around marine survey work are properly addressed.

RWM would seek to establish whether the delivery of a GDF in the Allerdale Search Area could be aligned to relevant local environmental objectives and in a manner which conserves and enhances assets, in compliance with relevant legislation and policy. There may be opportunities to provide environmental improvements as part of the delivery of a GDF in the Allerdale Search Area through the provision of biodiversity enhancements, improving ecological networks or improving public access, if this was deemed appropriate.

The local tourism economy is influenced by the landscape, recreation opportunities and the broader wildlife interest, as well as cultural heritage assets within the wider area. RWM would seek to work collaboratively with stakeholders and to ensure that local priorities and concerns are understood and influence any work that may be undertaken.

Flood Risk and Coastal Change

Surface water flood risk from rivers and the sea is generally low across the Allerdale Search Area, with localised areas of high risk (Flood Zone 3) located along the rivers and at the coast. This is generally located away from main settlements and properties, largely along the River Ellen and River Derwent. Limited parts of settlements in the Allerdale Search Area are at particularly high risk of flooding, affecting a limited number of properties in Workington, Maryport, Flimby and Harrington.

In terms of coastal flooding, the area within Flood Zone 3 (and Flood Zone 2) largely does not extend to the properties within the settlements located on the coast, however some properties in Flimby and Maryport are likely to be affected. The Shoreline Management Plan strategy is predominantly Hold the Line, with some areas of No intervention.

The National Policy Statement for Geological Disposal Infrastructure (NPS) [xiii] notes that 'Development consent should not be granted for development where any part of the surface infrastructure of a geological disposal facility is located in Flood Zone 3b'[8]. The NPS further notes that 'Development consent should only be granted for development in respect of deep boreholes where those boreholes are located in whole or in part in Flood Zone 3b where there are no other reasonable alternative locations'[9], and that 'Whilst the surface facilities of a geological disposal facility should take account of Flood Zones, an applicant is not precluded from developing the underground parts of a geological disposal facility beneath Flood Zones'[10].

Because of its coastal location, the Allerdale Search Area is considered to be vulnerable to environmental changes brought about by climate change. Most of the population of Allerdale Borough live in towns and villages along coastal areas and some of these have a flood risk. Some of these areas already suffer from surface water flooding, and this risk will likely increase as the west of the UK becomes wetter and suffers more frequent and intense storm and rainfall events.

If the Allerdale Search Area progresses, RWM would look to work collaboratively with stakeholders (including environmental regulators) to understand the existing flooding related challenges in the area, the implications of future climate change and how this may influence the delivery of a GDF.

There could be opportunities to deliver flood and/or coastal protection mitigations as part of the delivery of a GDF that could benefit the wider area, protecting not only homes and businesses, but also protecting, and enhancing existing ecological habitats. There could be potential for the spoil that would be generated as part of the construction of a GDF to be used to support such benefits. This would be an area for further work and discussion later in the siting process, as RWM would need to consider the volume and type of spoil that may be generated and work collaboratively with stakeholders to understand the implications of reusing the material generated.

The Water Environment

Two Water Framework Directive (WFD) groundwater bodies are located within the Allerdale Search Area, namely the Eden Valley and Carlisle Basin Permo-Triassic Sandstone Aquifer, and the Derwent and Cumbria West Lower Palaeozoic and Carboniferous Aquifer. Both achieved 'good' quantitative status in 2019, however both were identified as having 'poor' chemical status. The RNAG status for the Derwent and Cumbria West Lower Palaeozoic and Carboniferous Aquifer was due to diffuse pollution from abandoned mines.

A review of DEFRA's Aquifer Designation Map indicates that the Allerdale Search Area is underlain by a 'Principal' aquifer on the north west shore. The majority of the Allerdale Search Area is underlain by a 'Secondary A' aquifer. While there are no Source Protection Zones (SPZ) located within the Allerdale Search Area itself, the northern boundary is abutted by the Total Catchment area of SPZ 3.

[8] *NPS para 5.8.20*

[9] *NPS para 5.8.20*

[10] *NPS para 5.8.20*

There are a cluster of points around Workington where the primary abstraction use is identified as being industrial, commercial and public services water supply. Other abstraction points include agricultural, environmental and amenity uses. There are no designated Sensitive Area for Nitrates, Eutrophic Rivers, Eutrophic Lakes or Coastal Areas, or Drinking Water Safeguard Zones within the Allerdale Search Area.

The Solway Outer South Coastal Water and Maryport and Derwent Transitional Water lie within the Allerdale Search Area. All waterbodies have a 'moderate' overall classification and a 'failed' chemical status. The Solway Outer South Coastal Water and Maryport Transitional Water have a 'moderate' ecological status and the Derwent has a 'good' ecological status.

There is no freely available groundwater flood mapping, so this may need to be sourced from the British Geological Society for future studies. The Strategic Flood Risk Assessment (SFRA) for Allerdale Borough Council states that there is high potential for emergence of groundwater at the surface in the towns of Maryport and Aspatria.

If this area progresses through the siting process consideration would need to be given to the potential impacts on water resources in the area, including on quantitative, ecological and chemical status.

Other Matters

Based on currently available data, there are no significant air quality or noise issues in the Allerdale Search Area or wider borough. A review of England's Noise and Air Quality Viewer (Extrium) indicates that there are eight Noise Important Areas (NIAs) located within the Allerdale Search Area. There are eight NIAs concentrated around the major settlements in the Allerdale Search Area. Specifically, there are two in Maryport, two in Flimby and four NIAs in Workington.

These matters would require further consideration if the Allerdale Search Area progresses in the siting process. In particular, the noise implications associated with the programme of site characterisation and construction of a GDF would need to be considered, both in terms of the impacts on noise sensitive premises and areas, and on designated sites and wildlife.

Much of the built heritage within Allerdale Borough is of significant historic interest. There are 33 Scheduled Monuments in the Allerdale Search Area. These range in age, but there are a number of Roman ruins, including the UNESCO World Heritage Site (WHS) 'Frontiers of the Roman Empire' (Hadrian's Wall).

If the Search Area progresses through the siting process, RWM would seek to establish whether the delivery of a GDF could be aligned to relevant objectives relating to the historic environment and consider the implications of delivering a GDF in the area for the cultural and heritage assets that should be conserved and enhanced, in compliance with relevant legislation and policy.

4.4 Engineering Feasibility

Based on the review of readily available information relating to the Engineering Feasibility Siting Factor, RWM has concluded that, with appropriate design measures, the Search Area and the adjacent inshore area have potential to host a GDF.

Design and Construction

A GDF would require a suitable location for both the surface and sub surface facilities, linked by a sloping tunnel and/or vertical shafts. Consideration has been given to whether the surface and sub surface environments in the Allerdale Search Area have the potential to host a GDF, together with the potential to link the surface facilities to the sub surface infrastructure.

A desktop review of key documentation has been completed. This evaluation has also been informed by national datasets which are publicly available. More detailed work that looks at a wider suite of information would be undertaken later in the siting process, if the Allerdale Search Area progresses through the siting process.

Based on the current geological understanding of the Allerdale Search Area, there are several units of potentially suitable host rocks under the Allerdale Search Area, including the adjacent inshore region. Current estimates of waste volumes suggest that there would be sufficient rock volume to dispose of the inventory. However, further work will be required to understand the depth, thickness and suitability of the potential host rocks in due course.

There are potential challenges with constructing accessways in mixed ground conditions such as those found in the Allerdale Search Area, including risks such as traversing through faults, aquifers and historical mines. Known major faults may constrain a GDF but may also provide a hydraulic barrier or pathway. While groundwater has been discussed in the report earlier, the hydrogeology of the Allerdale Search Area and the greater region remains an important consideration. No known complex hydrogeological environments, such as deep karst or thermal springs, have been identified in earlier studies including the MRWS initial screening.

Surface facilities

At this stage, when no specific surface sites for a GDF within the Allerdale Search Area have been identified, it is not possible to assess the precise implications of the surface facilities required as part of the delivery of a GDF. This would take place at a later stage in the siting process.

The GDF surface facilities would require in the region of one square kilometre of land, however the precise layout and land requirements will need to be determined in due course and will depend in large part on the characteristics of the site. The layout of GDF surface facilities would depend on the geography of a particular site, how much space is available, and the arrangement of existing infrastructure. Whilst no specific surface sites have been identified, based on the available information, there is no reason to suggest that it would not be possible to find a suitable location within the Allerdale Search Area.

Existing and historical land use, including potential contaminated land, will need to be considered if this area progresses. There are 15 brownfield land sites, 32 historic landfill sites and eight permitted waste sites located within the Allerdale Search Area. The Allerdale contaminated land public register acknowledges that there is one area of contaminated land, in Carr Wood, Aspatria, within the Allerdale Search Area. At present, none of these factors would preclude the construction of a GDF within the Allerdale Search Area, though during characterisation the quality and potential contamination of land at potential sites will require further investigation.

While one of the potential challenges that has been identified relates to flooding, the surface water flood risk from rivers and the sea is generally considered to be low across the Allerdale Search Area. RWM would need to work with the community, the district council, the county council (with respect to its role as the Lead Local Flood Authority), as well as the Environment Agency and other stakeholders, to ensure that the development of a GDF and any associated infrastructure would be sensitive to the issues relating to all sources of flooding and the effects of climate change on flood risk.

It would be important to ensure the delivery of sensitively and appropriately designed buildings and security arrangements that are sympathetic to the character of the local area. RWM would seek to work collaboratively with the community and regulators to ensure that their preferences and requirements are acknowledged.

The surface facilities may be split across more than one site if required in response to relevant surface constraints or local priorities. However, splitting the site also has the potential to increase the adverse impacts of a GDF. For example, it may increase vehicle movements or increase the visual envelope of development. The full implications of splitting the surface facilities would be considered if this approach were to be pursued.

Matters such as mixed ground conditions and associated engineering aspects would need to be considered in greater detail should the Allerdale Search Area progress to identifying specific sites. Mining below 100 metres has taken place for coal in the West Cumbrian Coalfield, which includes in the Allerdale Search Area and surrounding area. Consideration will need to be given to the historical mining and coal fields in the region, which may present engineering challenges.

The majority of the Allerdale Search Area has a low radon risk, apart from a band of higher risk in the east which is associated with the presence of Higher Strength Rocks. Where there are elevated levels, methods to limit exposure will need to be considered. An understanding of the impact on ventilation to the atmosphere may need to be developed.

The construction and continued operation of a GDF would result in the generation of excavated spoil. There could be opportunities to reuse the spoil locally, for instance in support of flood mitigation, habitat creation or enhancement, or as part of other infrastructure schemes. The potential opportunities would need to be considered further if the Allerdale Search Area progresses through the siting process as the potential for reuse would be dependent on the volume and type of spoil generated, as well as the construction schedule.

Sustainable Design

RWM will apply 'good design' to a GDF in order to meet the sustainable infrastructure objectives as described in Section 4.5 of the NPS, which confirms that applying 'good design' to geological disposal infrastructure projects should produce sustainable infrastructure that is sensitive to place, efficient in the use of natural resources and energy used in their construction and matched by an appearance that demonstrates good aesthetics as far as possible. It should also mitigate any existing adverse impacts wherever possible, for example, in relation to the environment.

A good design would also be one that sustains the improvements to operational efficiency for as many years as practicable, taking into account capital cost, economics and environmental impacts.

4.5 Transport

Based on the review of readily available information relating to the Transport Siting Factor RWM has concluded that the Search Area and the adjacent inshore area have potential to host a GDF.

Publicly available information regarding the transport infrastructure has been reviewed to understand the current transport links and any issues likely to affect the ability to carry out all potential transport operations safely and securely to inform this early evaluation work. More detailed work that looks at a wider suite of information would be undertaken later in the siting process if the Allerdale Search Area progresses through the siting process.

Although the surface location is currently unknown, transport links to and from a GDF will be vital throughout the lifetime of the facility. Transport will be required for the following:

- transportation of excavated material (this also includes backfill and spoil required for reuse as backfill or surface bunds);
- construction materials for underground and surface facilities and associated infrastructure;
- delivery of plant and equipment;
- transport of radioactive waste for disposal in the GDF; and
- personnel movements during site studies & characterisation, construction and operation.

During operations, the GDF would receive different types of radioactive waste packages from across England and Wales for emplacement at the facility. RWM has developed a range of transport containers that will be used to safely transport radioactive waste packages to a GDF. It is be noted that at present approximately 80% of the waste currently resides at Sellafield in west Cumbria.

Rail

The Allerdale Search Area is connected to the national rail network via the Cumbrian Coast Line (CCL). The CCL runs from Carlisle to Carnforth, Lancashire, through the Allerdale Search Area stations of Aspatria, Maryport, Flimby, Workington and Harrington, before continuing east to Carnforth, where it connects with the West Coast Main Line (WCML). As the use of rail in preference to road is a key part of the RWM Transport Safety Strategy[11], it would be preferable to connect a GDF to the existing rail network.

Lines such as the CCL are at the heart of the communities which they serve, often being the only form of public transport within rural areas. They play a critical role in providing connectivity both within and outside Cumbria through connecting people to educational facilities, key services and leisure and tourism opportunities. The rail line forms a vital transport artery supporting sustainable travel for the tourism economy and also links people with key employment sites along the line. The most significant of these currently being the Sellafield site, nearby in adjacent Copeland Borough. There are currently 11 daily freight train paths in one direction on this line. Current freight usage on the CCL includes:

[11] *https://rwm.nda.gov.uk/publication/geological-disposal-transport-safety-strategy/?download*

- transport of nuclear materials from nuclear licensed sites nationwide to Sellafield;
- movement of Low Level Waste (LLW) to the Low Level Waste Repository (LLWR);
- support to major construction activities on various nuclear licensed sites in Cumbria;
- freight movements to/from the ports of Workington and Barrow; and
- the operations of the oil terminal at Dalston.

It should be noted that the Sellafield site is accessible via the CCL, so if a GDF was to be located in the Allerdale Search Area, the line would likely provide a suitable option for movement of radioactive waste.

It is anticipated that the majority of rail transportation for a GDF will meet the existing Route Availability requirements on the rail network. Therefore, this area offers a rail network that is already considered to be largely suitable for use. Depending on location of a GDF in relation to the existing railway infrastructure, intermodal transfers may be required, or a dedicated branch line may need to be constructed.

If the Allerdale Search Area were to progress through the siting process, the effect of developing a GDF on the future usage of the CCL will need to be considered as the line is currently nearing capacity, noting that some upgrades are currently planned that would increase line speed and overall capacity. RWM would work with relevant stakeholders to understand the rail network, including improvements that are planned and schedules for their delivery.

It should be noted that the topography within the Allerdale Search Area may pose a challenge in providing rail access to potential GDF surface facilities. In general, potential sites adjacent to the existing rail corridor may be more suitable. Potential sites away from the existing rail corridor will need to be assessed on a site-by-site basis.

Road

The A66 Strategic Route runs from Junction 40 of the M6 at Penrith to Workington, passing east to west through the Allerdale Search Area. The A595 Strategic Route splits from the A66 east of Workington and heads south passing through Lillyhall to the south of the Allerdale Search Area, and on towards Sellafield.

Although there are sections of dual carriageway, most of the strategic roads are single carriageway. The transport situation is affected by the location of the Cumbrian Mountains and estuaries, which limit the road network that traverses from the M6 to the Allerdale Search Area. Additionally, visitors to the Lake District National Park (approximately 16.4 million visitors per year) also require access to these roads.

Away from the strategic road network, there are a number of non-strategic A-roads that traverse the Allerdale Search Area, most notably the A594, A595 (north of Cockermouth) and the A596. The north of the Allerdale Search Area is not serviced by any strategic roads. The Cumbria Local Enterprise Partnership (LEP) is committed to investing in infrastructure to support growth, with west of the M6 strategic connectivity being a priority.

It is acknowledged in the Allerdale Council Plan that improved infrastructure and connectivity across the borough is needed. The roads in the Allerdale Search Area would be sensitive to increased traffic requirements and therefore use and management of the road network should be investigated further with the Council. While there are existing strategic roads, further detailed consideration would be needed if extensive use of the road network is necessary.

As far as is reasonably practicable, it is preferable for developments generating freight movements to be located where there is easy access to the strategic road network. Discussions may be required with the local communities and councils regarding the use and possible upgrade of existing roads. Further consideration on the possible implications of delivering a GDF on the road network would be needed if extensive use of the road network is necessary, particularly on local roads.

In summary, the Allerdale Search Area is served with roads that are part of the Strategic Network, though the use of local roads may be required for access if a GDF is located away from Strategic Routes. It is also acknowledged that the region may be sensitive to increased traffic requirements.

Sea

The Allerdale Search Area offers good opportunities for the transport of excavated material, construction materials and radioactive waste packages by sea. The region has good access to three established ports at Barrow-in-Furness, Workington and Silloth.

Maryport Harbour serves as a marina with a tidal dock housing a fishing fleet, fronted by residential developments. Whitehaven has been a working port in the past but has since been converted into a marina. Given the urban setting and recreational use of these harbours they are not currently seen as viable options.

The Port of Silloth is located approximately 10 miles north of the Allerdale Search Area and is owned and operated by Associated British Ports. The new dock is a tidal dock accessed through a lock. This port has 7 berths with a total quay length of 590 metres. The Port of Silloth has no rail links and is serviced by the road network only. Onward transport from the port is facilitated by the B5301 and B5302, both of which connect to the A596.

The Port of Workington is located in the Allerdale Search Area and is owned and operated by Cumbria County Council. The main cargo handling area consists of an extensive quay frontage (773 metres) providing 7 berths plus a roll-on-roll-off facility. All berths are rail-connected, linking to the main rail line. The Port Authority also operates its own locomotives on the site's extensive internal rail system. The port could in principle accommodate the majority of the anticipated transport packages and construction requirements that RWM would require to deliver a GDF in the Allerdale Search Area.

Part of the Port of Barrow (approximately 40 miles to the south of the Allerdale Search Area) is owned and operated by Nuclear Transport Solutions. The quay has two berths for cargo operations and was designed as the home port for the spent fuel shipments to Sellafield. The berth is rail-connected and linked to the main line via Salthouse junction situated at Cavendish dock. This port has been used for the shipment of radioactive materials therefore it has all the security requirements for Category I nuclear materials and would be suitable to receive the radioactive waste transport packages that would be sent to a GDF.

There are three established ports at Silloth, Workington and Barrow-in-Furness, which are accessible from the Allerdale Search Area by road. Workington and Barrow-in-Furness are also accessible via rail. All of the ports would be able to handle the majority of expected radioactive transport packages and construction requirements. It should be noted that the majority of the radioactive waste to be sent to a GDF is currently at Sellafield, and so would not require transport by sea.

Transport Safety and Security

The existing transport network within the Allerdale Search Area is already routinely used for radioactive transports to and from the nuclear sites at Sellafield and the Low Level Waste Repository. Outside of the Search Area, the transport network connects to port facilities that have experience of handling radioactive transports, therefore it can be determined that there are adequate combinations of transport modes and routes necessary to ensure the safe and secure transport of radioactive waste.

4.6 Value for Money

Based on the review of readily available information relating to the Value for Money Siting Factor, RWM has concluded that the Allerdale Search Area and the adjacent inshore area have potential to host a GDF.

Given the early stage in the siting process, there are many uncertainties that would influence the overall programme cost and delivery schedule. RWM will keep these under close review should the Allerdale Search Area progress through the siting process.

It is recognised that the Sellafield nuclear site is relatively close to the Allerdale Search Area, and that a large proportion of the waste likely to be disposed of in a GDF is currently located there. The possibility of developing the surface facilities of a GDF in Allerdale has the potential to reduce the costs, environmental impact and transport-related safety and security risks associated with transporting the waste packages for disposal when compared with locations outside Cumbria.

If the subsurface elements of a GDF are located in the inshore area off the coast and some distance from the surface locations, then the additional length of the underground accessways will increase the initial construction cost and schedule duration, impacting the date of first waste emplacement. This potentially reduces the construction and disposal operations productivity and increases ongoing construction and operations costs. However, as no specific locations have been identified at this stage, this would require further consideration in due course.

There are some matters that could increase the initial GDF construction duration and costs, including aquifers near the surface, coastal and/or river flood risk mitigation measures and faulting or mixed ground conditions. The local utilities (electricity distribution, water and drainage) may require significant upgrades to service a GDF.

Further evaluation work would need to be undertaken at a later stage when additional information has informed the engineering design of the GDF and the safety cases for a GDF.

Notwithstanding the uncertainties highlighted above, nothing has been identified at this early stage in the siting process which suggests or indicates that a GDF could not be delivered in the Allerdale Search Area in a way which secures value for money, or that the cost of doing so would be particularly high relative to other locations that may be considered for hosting a GDF.

5. Conclusion

Having considered the readily available information, including the National Geological Screening outputs, RWM has concluded that the Allerdale Search Area and adjacent inshore area have potential to host a GDF.

This Search Area Evaluation Report expands on the Initial Evaluation work that has already been completed, using readily available information relevant to the identified Allerdale Search Area to further enhance RWM's understanding of the potential of the Allerdale Search Area, and adjacent inshore area, to host a GDF.

This Search Area Evaluation Report presents the findings of work to evaluate the potential of the Allerdale Search Area and adjacent inshore to host a GDF, considering the six identified Siting Factors set out in RWM's Site Evaluation document.

At this stage nothing has been identified which would prevent the development of a GDF in the Allerdale Search Area and adjacent inshore and therefore **RWM has concluded that the Allerdale Search Area and adjacent inshore area have the potential to host a GDF.**

It is important to note that these evaluations have not confirmed that the Allerdale Search Area and adjacent inshore area are suitable to host a GDF. Further work would be required to establish this.

6. Potential Future Work

If the Allerdale Search Area were to move forward in the siting process, RWM would work collaboratively with the local community and other relevant stakeholders on the following areas:

- RWM would work with the Community Partnership to identify initial study areas in which desk-based data gathering, and initial assessment work can be undertaken within the Allerdale Search Area. This may include a range of early feasibility studies, including geological and engineering assessments.
- Following stakeholder engagement and regulatory approvals, RWM would commission data gathering and initial assessment work within the adjacent inshore area (for example, seismic survey works).
- Existing and future aspirations for the area and how delivery of a GDF could be aligned to relevant local priorities.
- The sensitivities of the local natural environment and the potential implications of delivering a GDF in the Allerdale Search Area, whether there could be alignment with local environmental objectives, and the potential to deliver environmental enhancements to designated areas and sites.
- The existing transport related challenges of the area and the transport related implications of the development of a GDF in the Allerdale Search Area. This could include consideration of the potential to transport freight to the area via sea and how benefits could be realised as a consequence of any infrastructure upgrades that may be required.
- The existing flooding related challenges in the area, the implications of future climate change and how this may influence the delivery of a GDF in the Allerdale Search Area.
- How the delivery of a GDF in the Allerdale Search Area could affect existing residents and businesses and how RWM could support all people living in and around the area by adding real value through the whole siting process. Benefits could start to be realised in the near future including through the use of Community Investment Funding.
- How RWM could work collaboratively with all relevant stakeholders to develop safe and secure potential design solutions and identify potential locations for a GDF that are sensitive to local priorities and the legislative, policy and regulatory frameworks within which RWM must operate; and
- The implications of a GDF on Sellafield and the Low Level Waste Repository near to the village of Drigg and the potential for alignment. RWM will also need to consider the implications of these sites for the delivery of a GDF in the Allerdale Search Area.

Glossary

Community Guidance
Guidance that RWM has developed to provide information, help and advice in support of the policy frameworks that exist in England and Wales. It is for anyone who is interested in learning more about geological disposal and the process for identifying a site for a GDF.

Community Partnership
The partnership between the members of the community, at least one Relevant Principal Local Authority and RWM.

Disposal Concept
A high level description of the engineered and natural barriers required to ensure that the radioactivity in the wastes is sufficiently contained so that it will not be released back to the surface in unacceptable amounts that may cause harm to people and the environment.

Engineered Barrier System
The combination of the man-made engineered components of a disposal facility, including the waste packages / disposal containers, buffer, backfills and seals.

Geological Disposal Facility (GDF)
A geological disposal facility is a highly-engineered facility capable of isolating radioactive waste within multiple protective barriers, deep underground, to ensure that no harmful quantities of radioactivity ever reach the surface environment.

Host Rock
The rock in which a disposal facility is located.

Initial Discussions
Early contact with an Interested Party to help them to find out more about the Siting Process; to understand whether a site/area put forward has any potential to host a GDF; and to help them to decide whether they want to seek to form a Working Group and open up a wider discussion.

Interested Party
The group, organisation, or individual(s) who first started discussions with RWM.

Inshore Area
The inshore is defined as the UK Territorial Waters which extend up to 12 nautical miles (22.2 kilometres) from the Mean Low Water Mark.

Inventory for Disposal
The specific types of higher activity radioactive waste (and nuclear materials that could be declared as waste) which may need to be disposed of in a GDF.

National Geological Screening (NGS)
An exercise undertaken by RWM that brings together high level geological information from across the country relevant to the design of a GDF.

Nuclear Decommissioning Authority (NDA)
A non-departmental public body established by the Energy Act 2004 to ensure the safe and efficient cleanup of the UK's public sector, civil nuclear legacy. The NDA has statutory responsibility for decommissioning and cleaning-up 17 UK sites and the associated liabilities and assets.

It reports to the Department for Business Energy and Industrial Strategy (BEIS); for some aspects of its functions in Scotland, it is responsible to Scottish Ministers.

Policy – The Working with Communities Policy
'Implementing Geological Disposal – Working with Communities', An updated framework for the long- term management of higher activity radioactive waste, HM Department for Business, Energy and Industrial Strategy, (December 2018).

Potential Host Community
The Potential Host Community is the community within a geographical area that could potentially host a GDF.

Radioactive Waste Management Ltd (RWM)
A wholly-owned subsidiary of the Nuclear Decommissioning Authority, established in 2014 for the purpose of delivering geological disposal and providing solutions for the management of higher activity waste.

Relevant Principal Local Authorities
A principal local authority is a district, county or unitary authority. Relevant principal local authorities will be the principal local authorities that represent people in all or part of the area under consideration. The area under consideration will change during the course of the process. Initially it will be the area that is the subject of discussions between RWM and the interested party. Once the Working Group identifies the Search Area, it will be the Search Area; and once the Search Area is narrowed down to the Potential Host Community, it will be the Potential Host Community.

Search Area
The Search Area is the geographical area encompassing all the electoral wards within which RWM will be able to search for potential sites. For areas which include potential for development under the seabed, the Search Area will comprise only that area on land.

Working Group
The Working Group is formed in the early part of the GDF siting process in order to gather information about the community and provide information to the community about geological disposal before a Community Partnership is formed. It comprises the Interested Party, RWM, an independent facilitator, an independent chair and any relevant principal local authorities that wish to join.

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Mapping Data

Dataset	Source
Geology	National Geological Screening Guidance - RWM 2016 National Geological Screening - Northern England - Regional Geology - RWM 2018 National Geological Screening - Northern England Sub-regions 3, 4 and 5 - RWM 2018 National Geological Screening: Northern England - Minerals and Waste Programme Commissioned Report CR/17/097 - BGS 2018 British Geological Survey - Managing Radioactive Waste Safely: Initial Geological Unsuitability Screening of West Cumbria Commissioned Report CR/10/072
Boreholes	British Geological Survey GeoIndex Onshore - GeoIndex - British Geological Survey (bgs.ac.uk) (accessed 2021)
Hydrocarbon wells	Oil and Gas Authority, UK National Data Repository - https://ndr.ogauthority.co.uk/ (accessed 2021)
Unitary Authority Boundaries Ward Boundaries	OS Boundary Line Open Data (accessed 2021) Ordnance Survey data © Crown copyright and database right
Contour	OS Terrain® 50 Open Data (accessed 2021) Ordnance Survey data Open Government Licence
Ramsar sites Special Protection Areas Special Areas of Conservation Marine Conservation Zones Sites of Special Scientific Interest National Park National Character Area National Nature Reserves Heritage Coast Ancient Woodland	Natural England Open Data (accessed 2021) © Natural England copyright
Flood Zones and Flood Defences Main River	Environment Agency Open Data (accessed 2021) Contains Environment Agency information. Open Government Licence

Endnotes

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