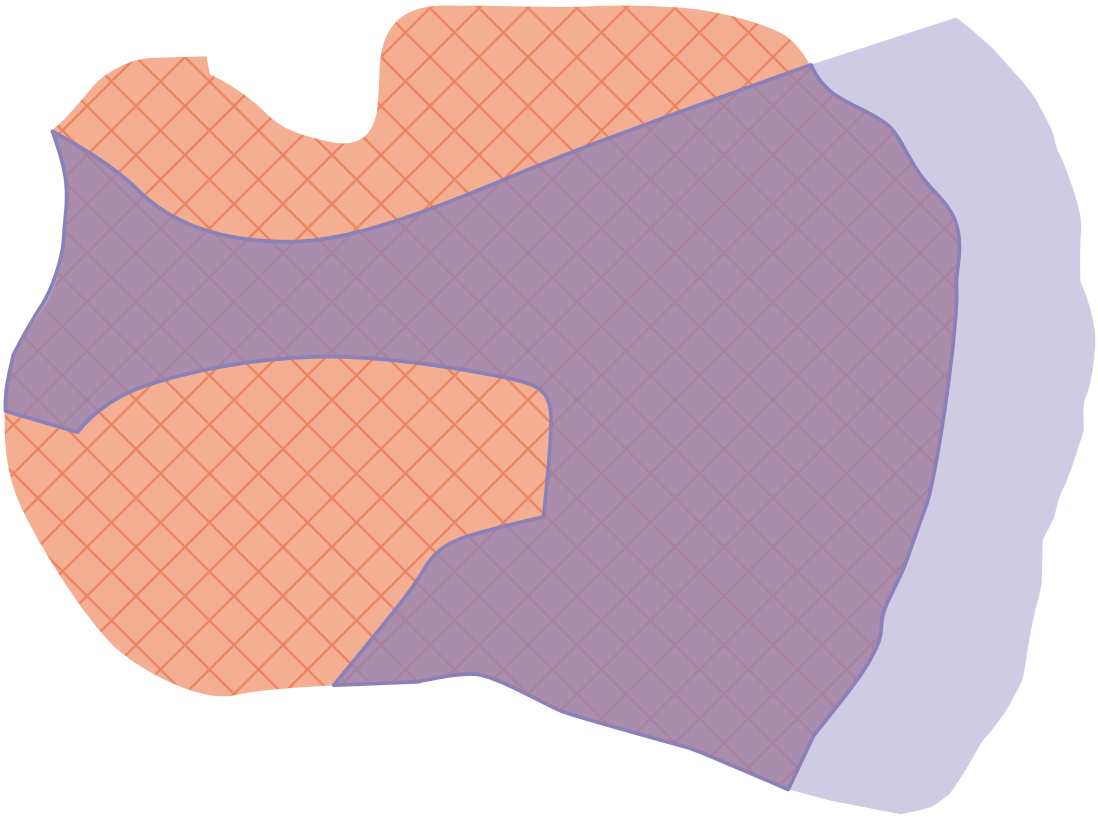
Radioactive Waste Management



East Anglia

SUBREGION 2

Contents

Clicking on words in green, such as sedimentary or lava will take the reader to a brief non-technical explanation of that word in the Glossary section. By clicking on the highlighted word in the Glossary, the reader will be taken back to the page they were on.

Clicking on words in blue, such as Higher Strength Rock or groundwater will take the reader to a brief talking head video or animation providing a non-technical explanation.

For the purposes of this work the BGS only used data which was publicly available at the end of February 2016. The one exception to this was the extent of Oil and Gas Authority licensing which was updated to include data to the end of June 2018.

Our work shows that we may find a suitable geological setting for a GDF in most of this subregion, but the thickness and properties of the potential host rocks present may not be suitable.

Although rock cannot generally be seen at the surface in this subregion except in man-made excavations such as quarries or road cuttings, some deep boreholes and geophysical investigations give us an understanding of the rocks present and their distribution.

There are clay-rich rock layers under the whole subregion in which we may be able to site a GDF. Very little is known about the rocks underneath these clay-rich layers. We would need to do more work to find out whether these rocks have suitable properties and thicknesses.

Even where individual clay-rich rock layers are found not to be thick enough to host a GDF they may support the siting of a GDF in deeper rocks as they could act as a barrier to groundwater flow from depth. This is important because movement of groundwater is one of the ways in which radioactive material could be carried back to the surface.

There are no known coal, oil, gas or metal resources in this subregion which means that it is unlikely that future generations may disturb a facility.

Introduction

This subregion comprises the largest part of the East Anglia region including the central area from Peterborough to Norwich, most of Suffolk and the adjacent inshore area which extends to 20km.

Rock type

Figure 1 shows where in the subregion there are likely to be Lower Strength Sedimentary Rocks (LSSR) within the depth range of interest, there are no Higher Strength Rocks (HSR) or Evaporites in the subregion. The depth range of interest in this subregion is occupied by a well-known sequence of sedimentary rocks overlying relatively poorly understood basement rocks. They include the Cretaceous Gault Clay Formation in the east and the Oxford and Kimmeridge Clay Formations and Lias and Mercia Mudstone Groups in the west. Whilst these clay-rich units may provide effective hydraulic separation between deep and shallow groundwater systems, they are generally less than 30m thick and thus may not be suitable as LSSR host rocks.

A few deep boreholes have been drilled into the basement rocks underneath the sedimentary rocks in this area. They encountered a range of mudstones, siltstones, sandstones and limestones of Silurian to Cambrian age (approx. 420 to 540 million years old). Because these rocks are unlikely to have been affected by folding to form slates, the BGS have not identified them as potential HSR host rocks. However there is very little information available on these rocks and volcanic ashes were encountered in a borehole just west of Peterborough, in the adjacent region, which would be considered as potential HSR host rocks if they were present in this subregion.

A summary of the geological attributes of the East Anglia region can be found here, including a simplified rock column showing the oldest and deepest rocks at the bottom, with progressively younger rock units towards the top.

Rock structure

The sedimentary rocks in this subregion have not been significantly affected by folding and there are only 2 major faults identified in the west of the region (see Figure 2). Faults may act as barriers to or pathways for groundwater movement, depending upon their characteristics, and these would need to be considered during the siting of a GDF [1].

Groundwater

The Chalk Group is a principal aquifer across the east of the subregion attaining thicknesses of more than 300m at the coast. Aquifers of the Great and Inferior Oolite Groups are also present in the west of the subregion. There is very little information on groundwater in the depth range of interest for a GDF, 200 to 1,000m below NGS datum, although there is information on groundwater in aquifers above 200m. Collectively the LSSR layers are likely to provide effective hydraulic separation between deep and shallow groundwater even where they are not thick enough to host a GDF: the Gault Clay Formation isolating the Chalk aquifer in the east; and the Jurassic mudstones and Mercia Mudstone Group isolating the limestone aquifers in the west.

Figure 3 shows a small area (approximately 1km^2) near Stowmarket where the presence of several deep exploration boreholes may influence the connectivity between shallow and deep groundwater and would need to be considered during the siting process.
There are no thermal springs in this subregion to suggest rapid flow of deep groundwater to the surface.

Resources

There are no known resources in this subregion and therefore the likelihood of future human intrusion is considered to be low.

Natural processes

Earthquakes and glaciations are unlikely to significantly affect the long-term safety of a GDF in the UK. Therefore, whilst a GDF would need to be sited and designed to take account of natural processes which may occur during its lifetime, they are not considered further as part of this screening exercise.

[1] Faults occur on a diverse range of scales, from centimetres to kilometres, and the subsurface is criss-crossed by networks of numerous individual faults. However our work includes only those faults identified by the BGS with throws (vertical offset) of 200m or more. This is because the data available to the BGS are not able to resolve all faults consistently, across all thirteen regions, with throws less than 200m. We recognize the potential importance of smaller scale faults to the integrity of a GDF and will need to survey them in detail as part of the site evaluation process.

Figure 1 The areas of the East Anglia subregion 2 where Lower Strength Sedimentary Rock Types of Interest are present between 200 and 1,000 m below NGS datum.

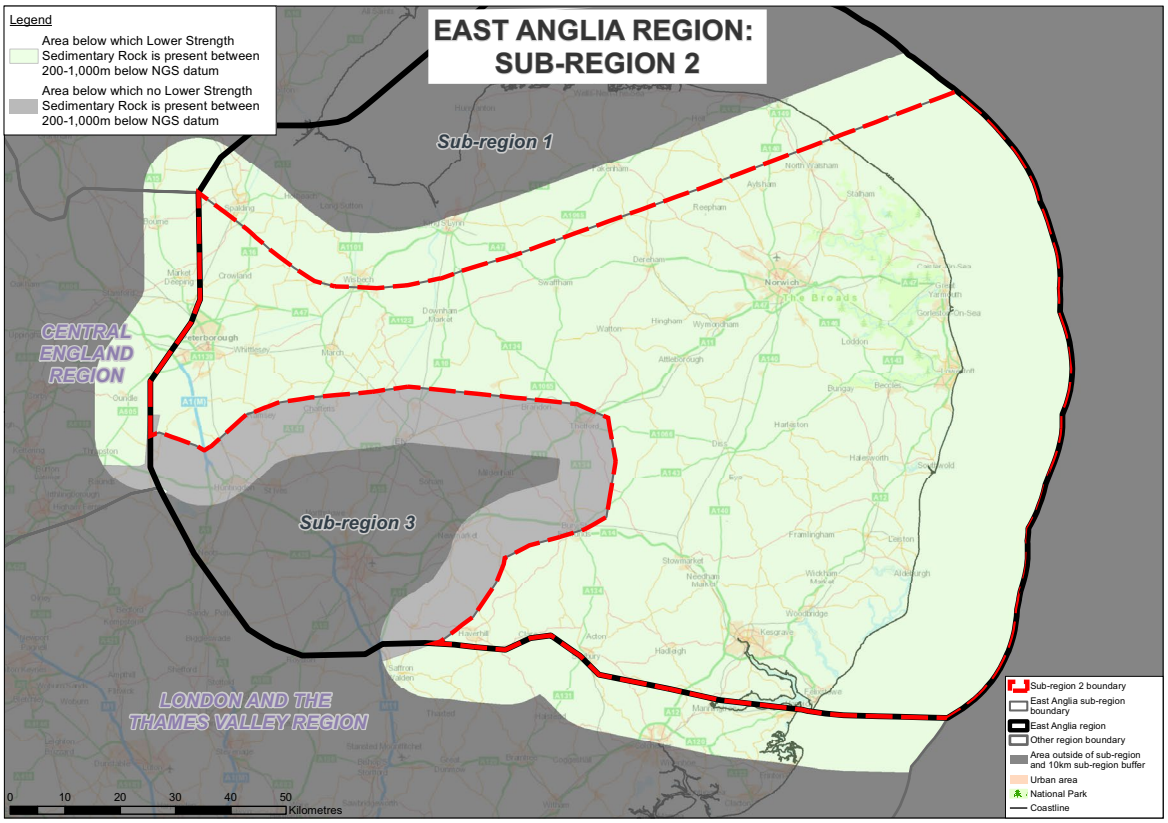


Figure 2 Location of major faults in East Anglia subregion 2.

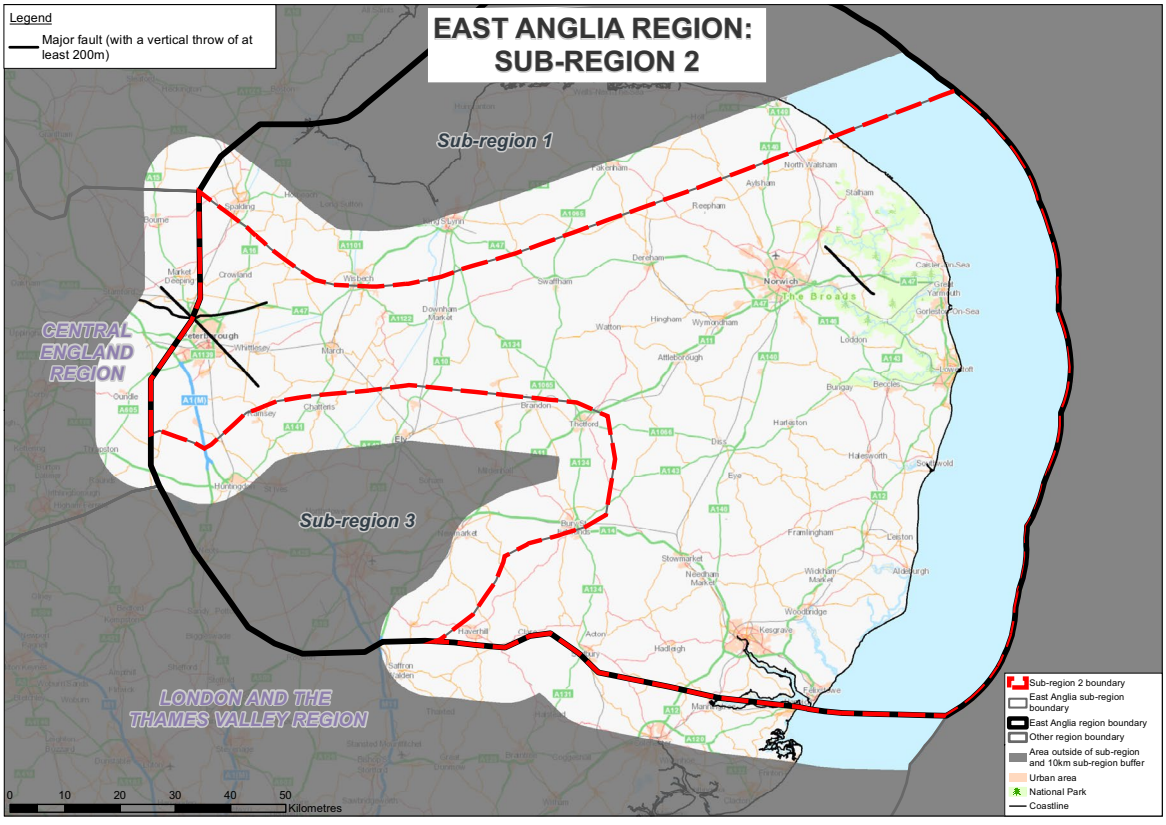
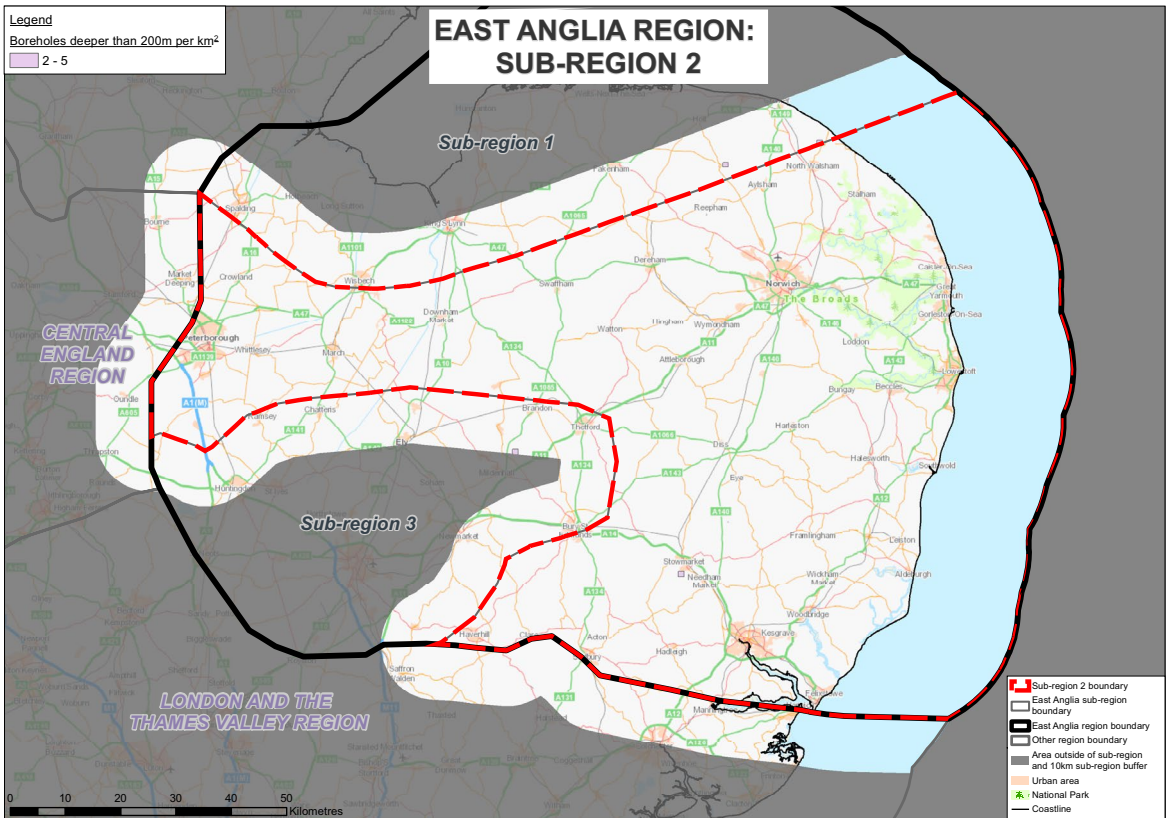


Figure 3 Areas in East Anglia subregion 2 with concentrations of deep exploration boreholes.



Glossary

Aquifers

Aquifers are rocks that contain freshwater in pores and/or fractures and whose porosity and permeability are sufficiently high to make the extraction of groundwater possible.

Principal aquifers

An aquifer classified by the Environment Agency as: “rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage.” They represent the most important aquifers in terms of water supply or base flow.

Sedimentary

A type of rock resulting from the consolidation of material that has accumulated in layers to form gravel, sandstone, mudstone and limestone. The layers may be built up by movement from erosion (e.g. by rivers, the sea or wind) or by chemical precipitation. Generally, the material that accumulates has originated from the weathering of other rocks. Sedimentary rocks constitute one of the three main classes of rocks identified by geologists, the others being igneous and metamorphic.

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