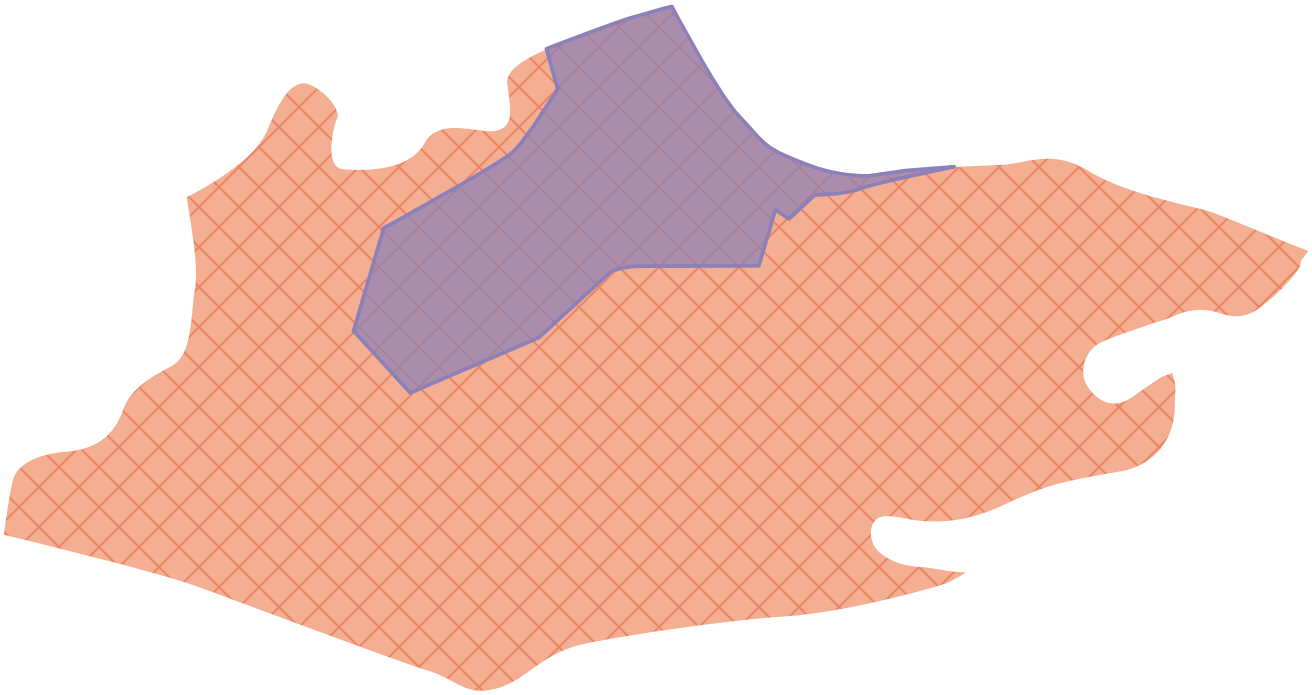
Radioactive Waste Management



London and the Thames Valley

SUBREGION 1

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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 a small part of this subregion, but the properties of the potential rock 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 and road cuttings, some deep boreholes and geophysical investigations give us an understanding of the rocks present and their distribution.

There are granites and similar strong rocks around Milton Keynes, in which we may be able to site a GDF. These rocks have only been found in a handful of boreholes and we would need to do more work to find out whether these rocks have suitable properties and thicknesses in the depth range of interest for a GDF.

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 part of the London and the Thames Valley region north of Thame, Luton, Stevenage and Royston but east of Oxford, Buckingham and Olney.

Rock type

Figure 1 shows where in the subregion there are likely to be Higher Strength Rocks (HSR) within the depth range of interest, there are no Lower Strength Sedimentary Rocks (LSSR) or Evaporites in the subregion. The depth range of interest in this subregion comprises basement rocks about which relatively little is known because only a handful of deep boreholes have been drilled. These have identified 2 broad categories of rocks:

- Igneous rocks – a granitic intrusion encountered at the base of a borehole near Bletchley to the south of Milton Keynes, and basic igneous intrusions (sills) in the Ordovician sedimentary rocks (approx. 445 to 485 million years old) at Calvert, 13km east of Bicester.
- Sedimentary rocks – mudstones with thin sandstones of early Ordovician age (465 to 485 million years ago) have been found in several boreholes between Bicester and Milton Keynes.

The BGS considers that these igneous rocks are potential HSR hosts, but that there is insufficient information available at present to know if the basement rocks of sedimentary origin would be suitable to host a GDF. They are not overlain by any LSSR rocks which might provide hydraulic separation between groundwater in potential HSR in the basement rocks and groundwater near the surface.

A summary of the geological attributes of the London and the Thames Valley 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 rocks in this subregion are not strongly folded and there are only a few major faults (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

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. The Lower Greensand Formation aquifer occurs at shallow depths in the east of the subregion but principal aquifers are otherwise absent. Given that basement rocks are not overlain by any clay-rich layers it is unlikely that there is significant hydraulic separation between groundwater in the basement rocks and groundwater near the surface. However there are no thermal springs in this subregion to suggest rapid flow of deep groundwater to the surface. Groundwater from depths greater than 400m is unlikely to be suitable as drinking water anywhere in the UK[2].

There is one very small area to the east of Kidlington, where deep exploration boreholes may influence the connectivity between shallow and deep groundwater which would need to be considered during the siting process (see Figure 3).

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.

[2] Water Framework Directive UK TAG. Defining and reporting on groundwater bodies, 2012.

Figure 1 The areas of the London and the Thames Valley subregion 1 where Higher Strength Rock Types of Interest are present between 200 and 1,000 m below NGS datum.

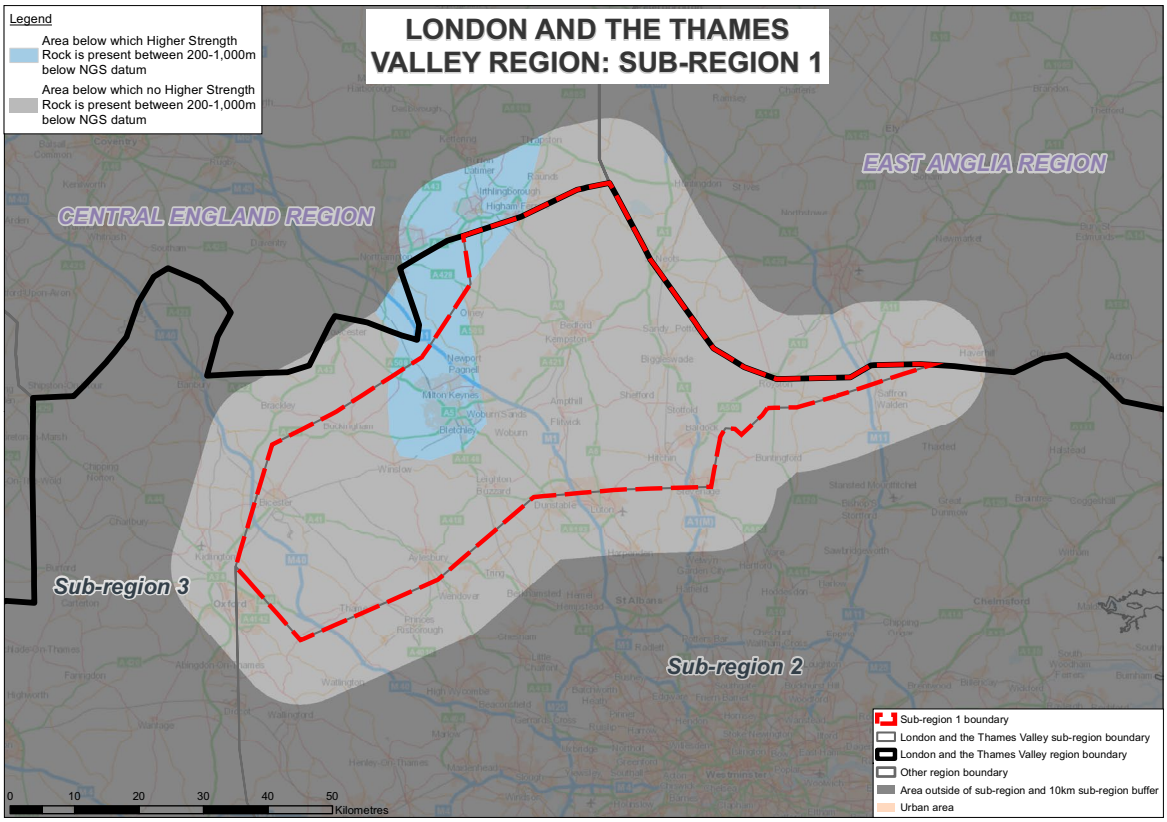


Figure 2 Location of major faults in the London and the Thames Valley subregion 1.

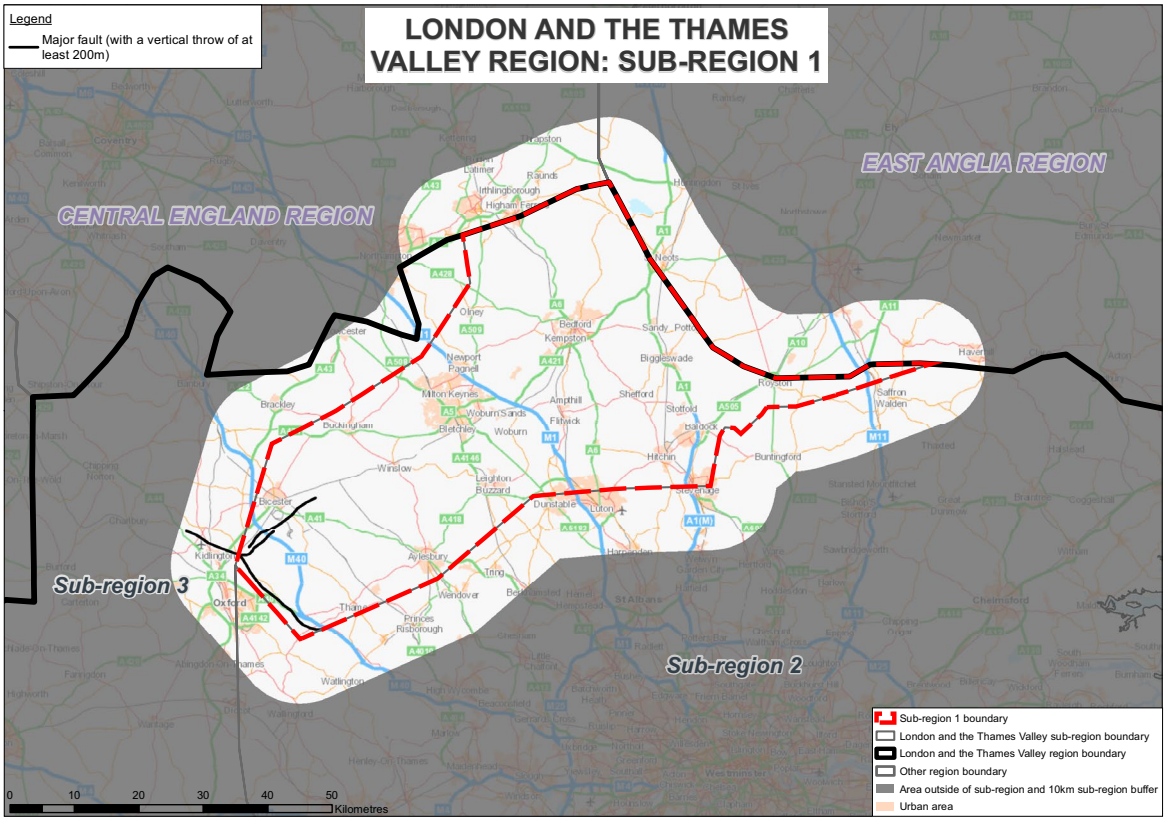
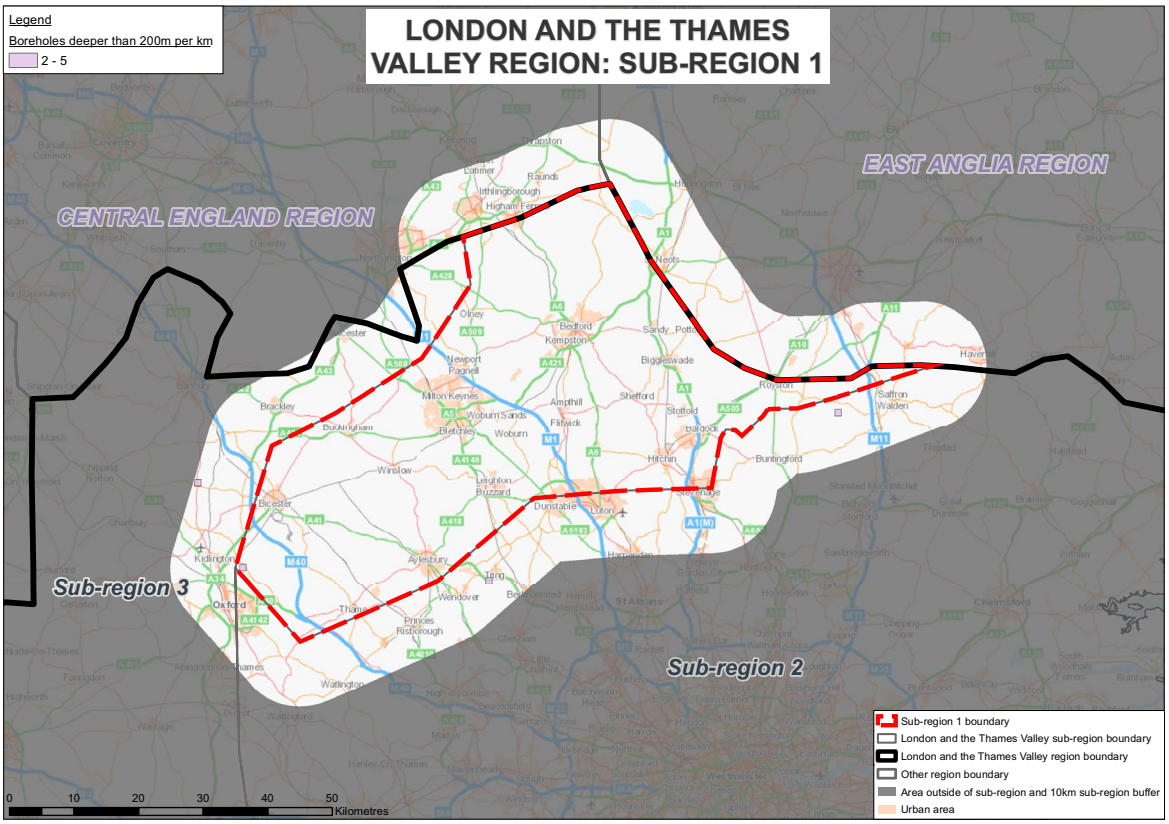


Figure 3 Areas in the London and the Thames Valley subregion 1 with concentrations of deep exploration boreholes.



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.

Igneous
One of three main rock types (the others being sedimentary and metamorphic), consisting of hard, dense rocks made up of interlocking crystals. They form due to cooling of magma deep within the crust beneath volcanoes, or as lavas erupted at the surface.

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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