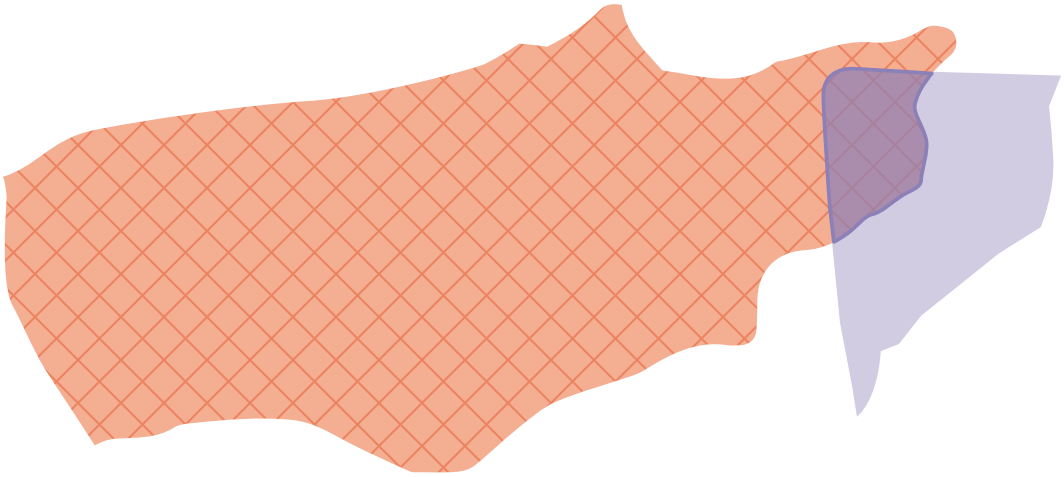
Radioactive Waste Management



Wealden District

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 region, but the thickness and properties of the potential host rocks present may not be suitable.

Given that the south and east of this subregion are the inshore, which extends to 20km from the coast, rock can only be seen at the surface in the sea cliffs and man-made excavations such as quarries or road cuttings. Combined with numerous deep boreholes and geophysical investigations, this gives us an understanding of the rocks present and their distribution.

There are clay-rich rock layers under the whole of the subregion in which we may be able to site a GDF. There are also slates and similar strong rocks, to the south of Folkestone under the English Channel, in which we may be able to site a facility. 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.

Some of the subregion has been mined for coal resources to depths below 100m, around Hersden, Aylesham, Elvington and Deal. In these areas the mining is likely to have affected the way in which water moves through the rock. Also possible exploration in the future in these areas means that it is more likely that future generations may disturb a facility.

The onshore parts of the subregion are Coal Authority Licence Areas allowing companies to explore for coal. It is not known whether coal in these licence areas will be exploited. RWM will continue to monitor how this exploration programme progresses.

Introduction

This subregion comprises the easternmost part of the Wealden District region, east of Folkestone and south of Ramsgate including the Kent Coalfield and the adjacent inshore area which extends to 20km from the coast.

Rock type

Figures 1a to 1c show where in the subregion there are likely to be Rock Types of Interest for the development of a GDF within the depth range of interest. The geology of this subregion comprises a well-known and predictable sequence of younger sedimentary rocks overlying older sedimentary rocks in the depth range of interest. Several Lower Strength Sedimentary Rock (LSSR) layers, including mudstones of the Wealden Group, Kimmeridge and Oxford Clay Formations and Lias and Mercia Mudstone Groups, occur in the depth range of interest. However, in this subregion none of these LSSR layers are particularly thick with boreholes around Dover indicating only 20m of Wealden Group, 13m of Kimmeridge Clay Formation, 40m of Oxford Clay Formation and 7m of Lias Group in boreholes. It is unlikely that any of these layers are thick enough to host a GDF but further information would be needed to confirm this.

The underlying older sedimentary rocks within the depth range of interest are predominantly the South Wales Coal Measures and Warwickshire Groups. They comprise interbedded mudstones, siltstones, sandstones and coals and are not considered likely to be potential host rocks in this region.

There is also an area of potential Higher Strength Rocks (HSRs) within the older sedimentary and basement rocks in the inshore part of this subregion south of Folkestone. These are discussed in more detail under subregion 2 of this region.

A summary of the geological attributes of the Wealden District 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

There is no major faulting or folding within the depth range of interest in this subregion [1].

[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.

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. Two principal aquifers are present within 400m of the surface in this subregion; the Chalk Group and Lower Greensand Formation. The Chalk Group is the most important groundwater source in the subregion and vitally important to public water supplies. Consequently it is relatively well understood with studies showing the main groundwater flow to be concentrated near the top of the Chalk Group, with little flow deeper than 50m below the water table. Some parts of the shallow Chalk aquifer have formed karst, where concentrated flow of mildly acidic groundwater has enlarged fractures by dissolution to form a network of major fissures, resulting in fast movement of groundwater near the surface. Even though they are unlikely to be thick enough to host a GDF, the layers of LSSR beneath the Chalk Group are likely to act as barriers to vertical flow from groundwater at depth.

The Great Oolite Group is a principal aquifer where it occurs at shallow depths in other regions, but in this subregion it occurs deeper than 400m and is not used for water supply. Groundwater from depths greater than 400m is unlikely to be suitable as drinking water anywhere in the UK [2].

Recent mining activity is likely to have changed patterns of groundwater movement in this subregion and shallow groundwater may circulate to much greater depths than it did before mining.

For a large part of this subregion deep exploration boreholes may influence the connectivity between shallow and deep groundwater which would need to be considered during the siting process (see Figure 2). There are no thermal springs in this subregion to suggest rapid flow of deep groundwater to the surface.

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

Resources

Coal has been mined from the Coal Measures at depths greater than 100m below NGS datum in east Kent (see Figure 3). The coal is concealed entirely beneath a cover of younger rocks and occurs at depths between 300 to 1,500m extending eastwards under the English Channel. All exploitation of the coalfield has now ceased, although coal was mined from collieries at Tilmanstone (closed 1986), Betteshanger (closed 1989), Snowdon (closed 1988), Chislet (closed 1969) and Shakespeare Cliff (closed 1915). In these areas the mining is likely to have affected the way in which water moves through the rock. Also possible exploration in the future in these areas means that it is more likely that future generations may disturb a facility. These known resources would be taken into account in the siting of a GDF. East of Folkestone and Canterbury and extending eastwards under the English Channel, parts of the coalfield have not been exploited with coal seams remaining in situ at depths less than 500m. These areas would also need to be considered in the siting of a GDF.

The Kent Coalfield shows generally very low methane yields and there are no current licences for coal bed methane, coal mine methane, abandoned mine methane or coal gasification. However there are Coal Authority Licence Areas in this area. It is not known whether coal in these licence areas will be exploited but they would need to be considered in the siting of a GDF (Figure 3).

There are no other known mineral, hydrocarbon or geothermal resources in the subregion.

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.

Figure 1a The areas of Wealden District subregion 2 where any of the 3 Rock Types of Interest are present between 200 and 1,000 m below NGS datum.

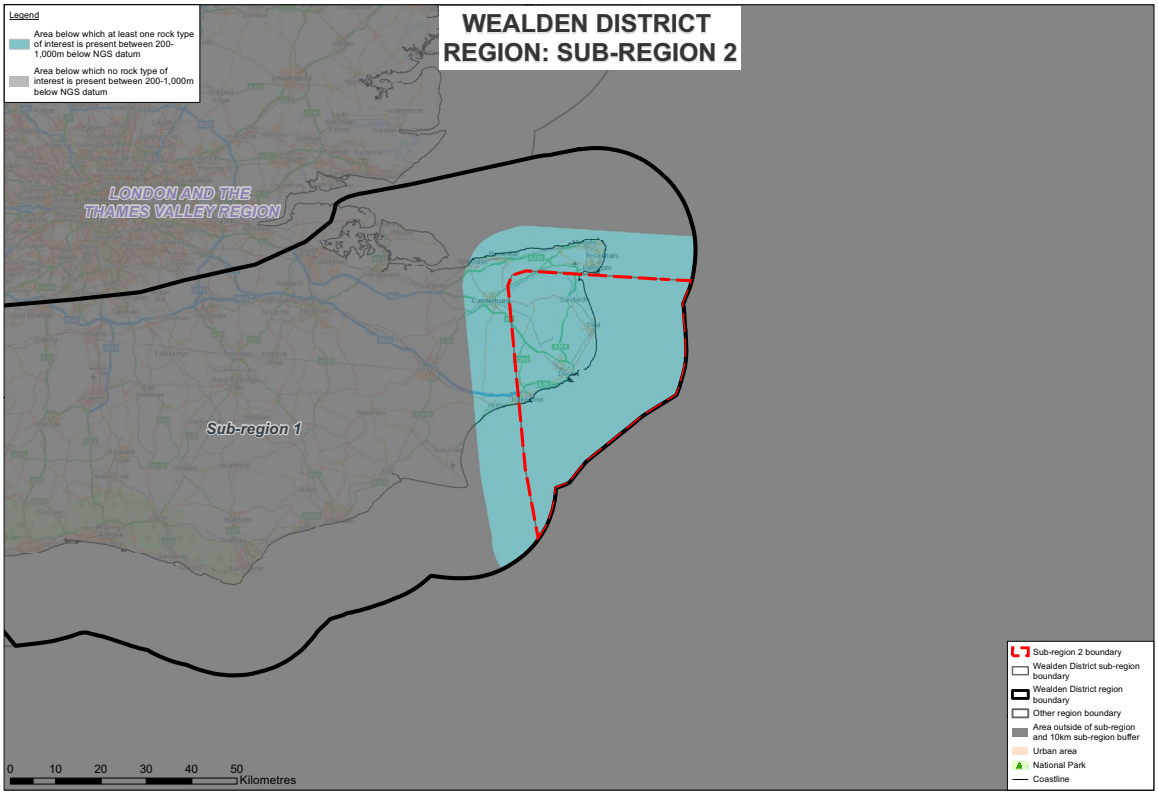


Figure 1b The areas of Wealden District subregion 2 where Lower Strength Sedimentary Rock Types of Interest are present between 200 and 1,000 m below NGS datum.

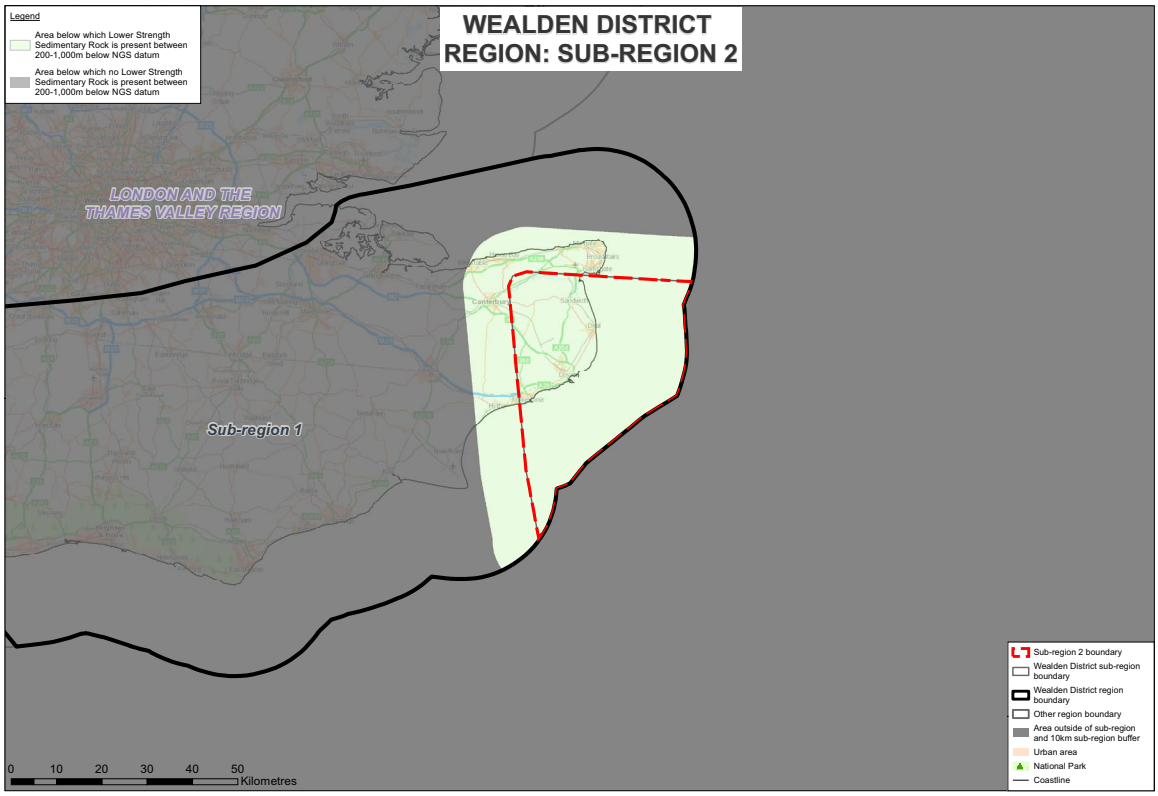


Figure 1c The areas of Wealden District subregion 2 where Higher Strength Rock Types of Interest are present between 200 and 1,000 m below NGS datum.

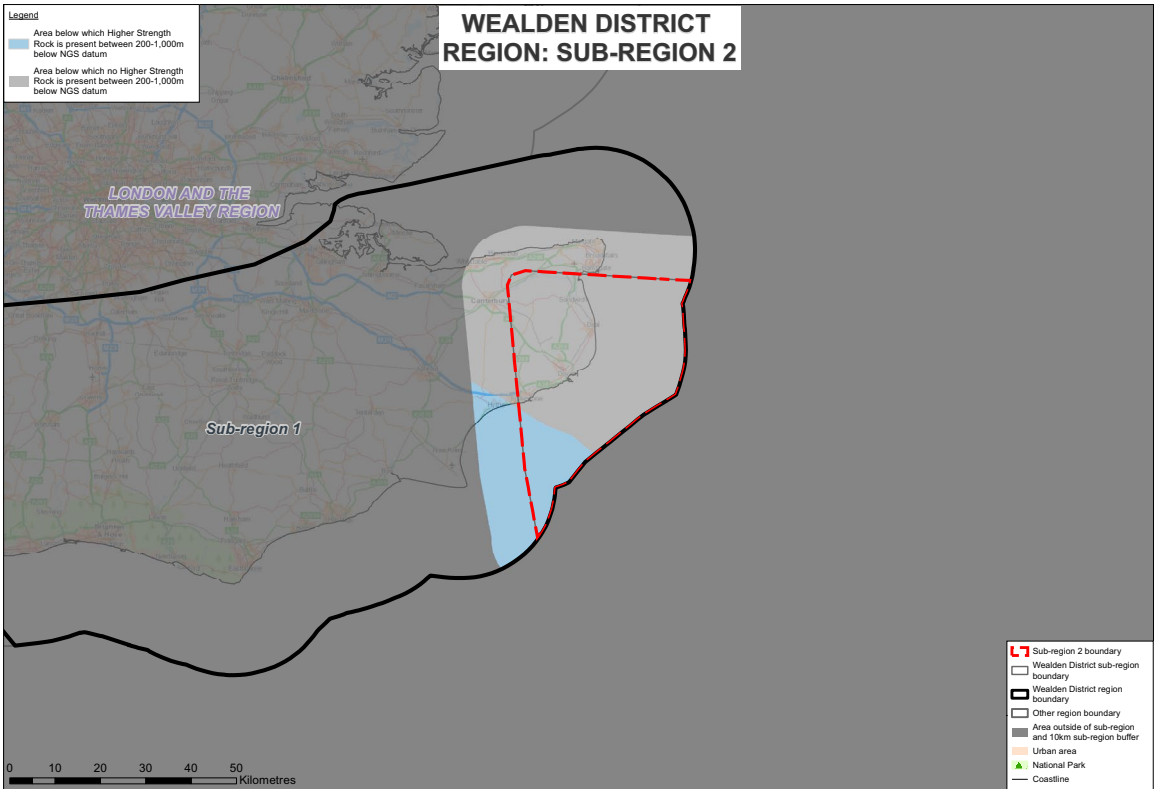


Figure 2 Location of intensely drilled areas in Wealden District subregion 2.

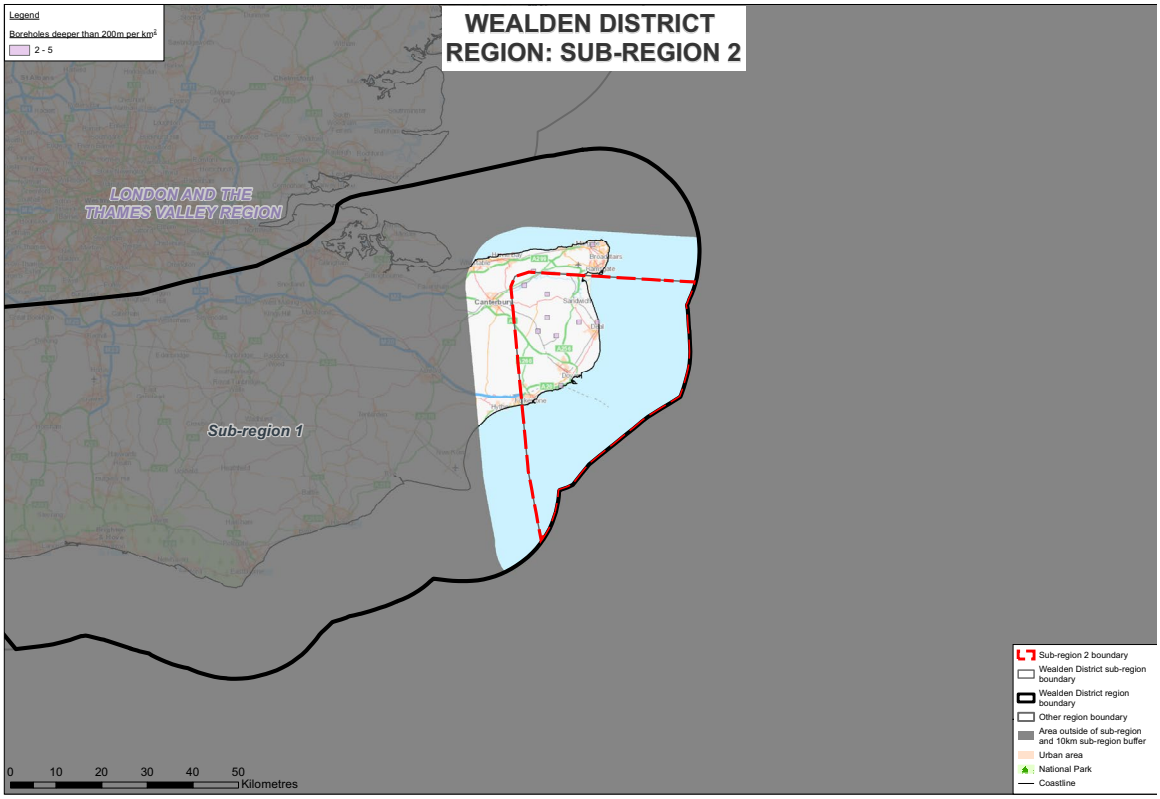
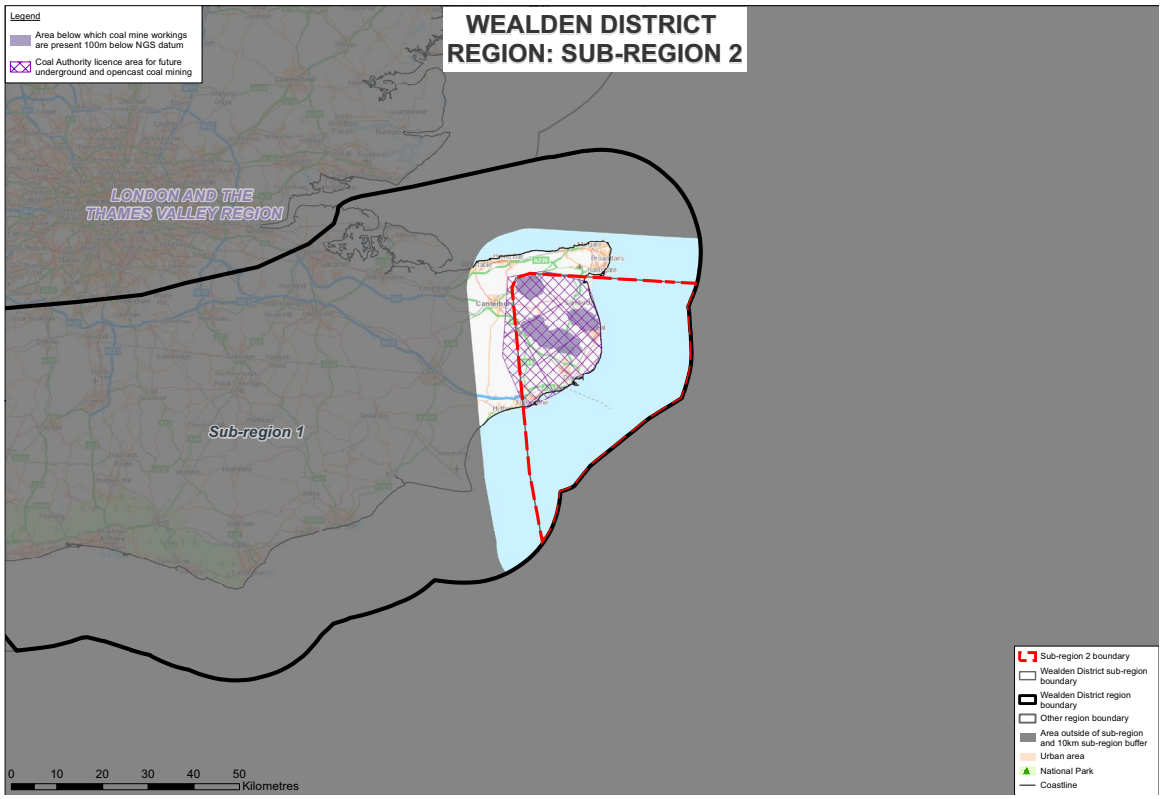


Figure 3 Areas of Wealden District subregion 2 with coal mines present below 100m and Coal Authority Licence Areas.



Glossary

Abandoned mine methane

Methane gas is naturally produced in coal mines. Even after abandoning a coal mine, methane gas continues to be released underground. This gas can be collected and use for heating or electricity generation

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.

Coal bed gasification

Coal bed gasification is an industrial process which uses a controlled combustion technique to turn underground coal into a synthetic gas that is then extracted and processed to provide fuel for power generation or heating.

Coal bed methane

Natural gas trapped in underground coal seams and extracted using boreholes without the need for a coal mine.

Coal mine methane

Methane gas naturally produced from coal seams within coal mines. This gas can be collected and used for heating or electricity generation.

Fractures

A crack in rock. Fractures can provide a pathway for fluids, such as groundwater or gas, to move in otherwise impermeable rock.

Hydrocarbon

A compound of hydrogen and carbon. Hydrocarbons are the chief components of oil and natural gas.

Karst

A distinctive type of landscape consisting of deep cracks and caves in limestones. Karst forms due to the action of mildly acidic groundwater dissolving the limestone.

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.

Radioactive Waste Management

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