

Appendix 'A'

Background Information on Unconventional hydrocarbons and hydraulic fracturing

This document sets out an overview of the current situation in the UK in relation to unconventional hydrocarbons. It is not a statement of the County Council's position on the subject and has been put together to inform members of the JAC considering the proposal to begin with as a Supplementary Planning Document (SPD).

Unconventional Reservoirs

In the UK, as elsewhere, hydrocarbons (gas and oil) are predominantly extracted from "conventional" hydrocarbon reservoirs in permeable rock formations such as sandstones. In these reservoirs gas or oil can flow through the structure of the rock and collect in a pocket where the upward migration of the hydrocarbon is stopped by a low permeability cap rock above it. These conventional reservoirs do not generally require hydraulic fracturing to stimulate the flow of gas.

Hydrocarbon reservoirs with low permeability (i.e. does not allow gas to flow) are described as 'unconventional', because hydrocarbon production in commercial quantities requires the rock structure to be fractured to provide permeability and thus stimulate the flow of hydrocarbons. These reservoirs are predominantly shale and coal seams. The process to achieve this is known as hydraulic fracturing.

Hydraulic fracturing ("fracking") is a generic term for various oilfield operations which aim to improve hydrocarbon flow rates in low permeability oil/gas reservoirs by increasing the natural fracturing in the rocks, or by creating artificial fractures. These operations vary in choice and volume of fluid injected, pressures and rates, depending on specific reservoir attributes.

The process is that fracking fluid is pumped into the shale to enlarge or create fractures. The fluid consists of water, fine sand particles and a combination of non-hazardous chemicals chosen relative to geology type to act as a proppant. As the pressure is released, pressurised fluid returns to the surface (flow back water) but leaving some within the shale, including the sand which resides within the fractures creating a migratory path way so that the gas can flow to the surface via the borehole. Vertical and horizontal drilling is often used with shale gas wells to enable the creation of a very large fracture network within the shale.

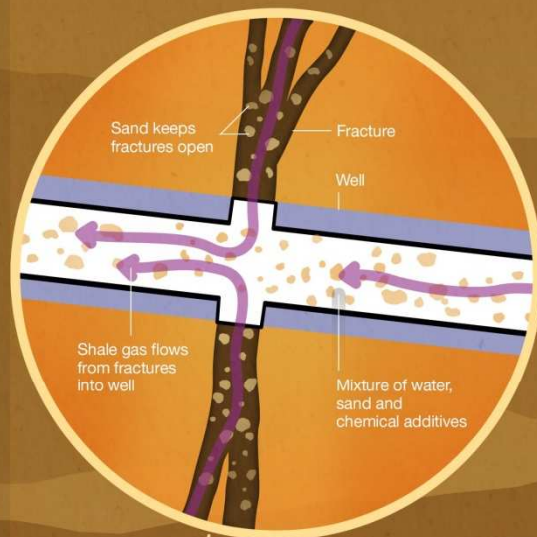
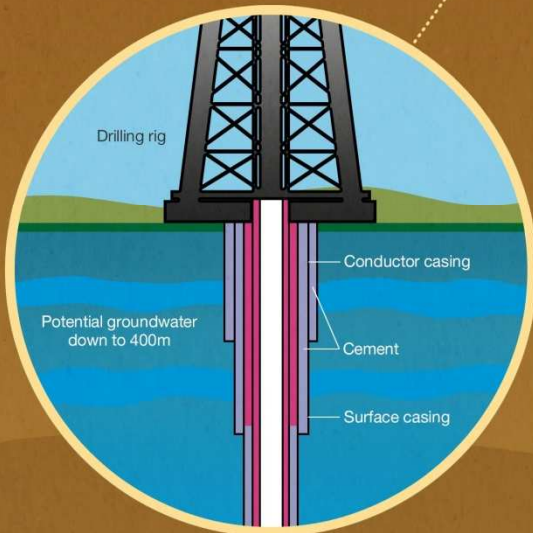
Operations of this type were conducted by Cuadrilla in Lancashire in April and May 2011, when approximately 2 million gallons of fluid were used.

The diagram below, provided by DECC, shows the mechanics of fracking.

What is shale gas and fracking?

Pad size is 2 hectares – 100*200m

Potential groundwater down to 400m



Intervening layers of rock stop fracking fluids / gas from escaping

Shale gas rock

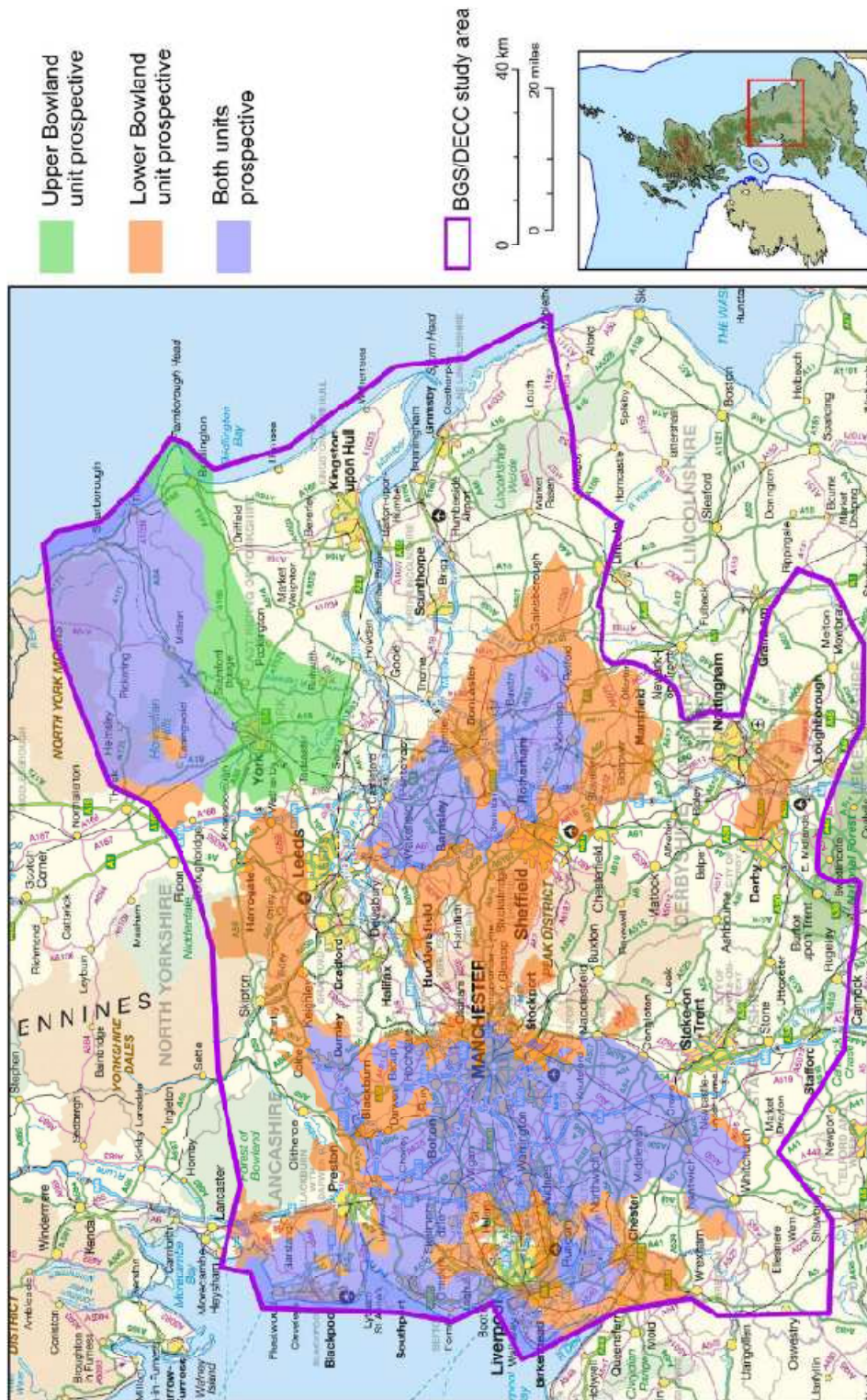
Shale rock in the UK is present at all depths, but gas only starts to be produced between 1500m-4200m and the rock can be up to 3000m thick in some areas.

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Source: DECC

Bowland Shale

The Lancashire Bowland Shales have been identified by the British Geological Survey as having potential to hold shale gas which could be exploited for commercial purposes. The extent of these Bowland Shales is illustrated below.



Source: Bowland shale gas report – media summary (BGS) (Contains Ordnance Survey data)

The Nature of Operations

Site development works and drilling activities are common for exploratory well sites and involve three main phases:

The construction of the drilling platform: stripping of top soils, some sub soil levelling and storing, the laying of an impervious and stabilising membrane followed by the construction of a sealed stoned working platform. The removed topsoil and subsoil is stored as bunds along the sides of each of the sites and which assist in providing temporary screening of plant and equipment during the drilling operations. The site preparation works take up to six weeks.

The drilling operations: a borehole is drilled to the depth of the target rock formation. Of the permissions that had been granted in Lancashire the variation in depth of the shale is between 2470 metres (8100 ft.) and 3505 metres (11500 ft.) below ordnance datum. The drilling operations are undertaken 24 hours per day, 7 days per week over a period of eight to twelve weeks or more. The drilling rig can be up to 36m high. The borehole is lined with steel tubing ("casing") to prevent the escape of drilling or fracking fluids and to control the flow of hydrocarbons if encountered.

Testing for the presence of hydrocarbons (gas): this is undertaken on completion of drilling operations and during normal daytime hours. To allow the gas to flow, the shale is fractured (see above), the gas will then flow from the fractured rock up the borehole to the surface where it is sampled, tested and managed by either flaring off, or closing, the borehole. This can take around twelve weeks.

If no gas is detected or not detected in commercially exploitable quantities the borehole will be plugged and the site restored over a period of up to six weeks. If testing is successful, the borehole will be temporarily sealed with a control valve and the rig and other temporary buildings removed. The land would not be restored immediately as further testing or production facilities may be required. However, further planning permission would be required for the retention of the platform and for any further testing or subsequent production facilities.

Current Activities in Lancashire

Cuadrilla has submitted a request for a scoping opinion to Lancashire County Council for proposals to explore for shale gas by drilling, hydraulically fracturing and testing the flow of gas at two sites:

- **Roseacre Wood - Roseacre, Fylde East.** The Roseacre Wood site is located to the south of the village of Roseacre.
- **Preston New Road – Little Plumpton, Fylde West.** The site is located north of Preston New Road (the A583), to the west of Little Plumpton.

Cuadrilla currently has sites for testing at the following locations in Lancashire:

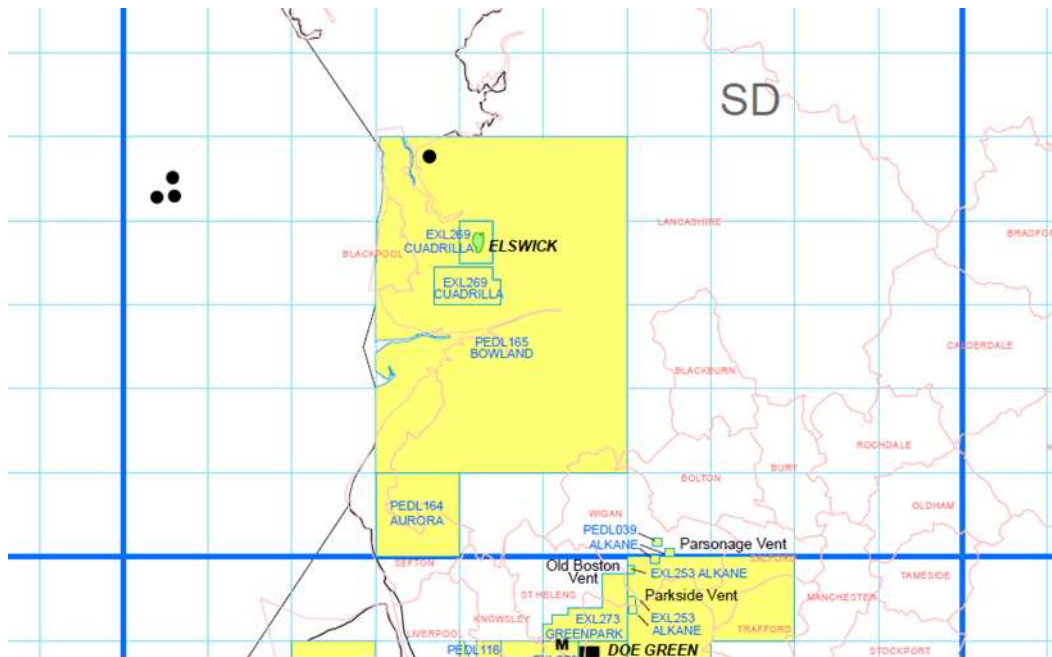
- Anna's Road, Westby
- Preese Hall, Weeton
- Grange Road, Singleton

- Banks Enclosed Marsh, Becconsall

Aurora Petroleum currently has sites for testing at the following locations in Lancashire:

- Norris Farm, Down Holland

In this current 13th round only two operators hold licenses for parts of Lancashire. Cuadrilla's PEDL165 and Aurora's PEDL164 are current 13th Round licences. At this moment we can only speculate what further interest there may be in the Bowland shale under the next round.



Source: Onshore Licensing 1 October 2013 (DECC) (Contains Ordnance Survey data. Crown copyright and database right 2013)

Current Activities Nationally

The Regulatory Road Map

The Government has published a regulatory roadmap for shale oil and gas developers. The "Regulatory Roadmap: Onshore oil and gas exploration in the UK regulation and best practice" (17 December 2013) is available at the following link: <https://www.gov.uk/government/publications/regulatory-roadmap-onshore-oil-and-gas-exploration-in-the-uk-regulation-and-best-practice>

The roadmap for shale gas sets out the series of permits and permissions developers need to obtain prior to drilling for onshore oil and gas. This is to provide certainty to investors and local communities about what the permitting process entails.

The Strategic Environment Assessment (SEA) for further onshore oil and gas licensing

DECC published for consultation *The Strategic Environment Assessment (SEA) for further onshore oil and gas licensing*. This is available from the following link:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/266330/environmental_report.pdf

The Strategic Environmental Assessment (SEA) report, produced by AMEC, sets out the potential economic and environmental effects of further oil and gas activity in Great Britain, including shale oil and gas production, comparing a 'low activity' and 'high activity' scenario. The assessment was carried out in preparation for the launch of the next round of licenses being made available for onshore oil and gas exploration and production. A consultation will run until March to consider the findings of the SEA and how this affects shale gas production in the UK.

Areas under consideration for the 14th onshore licensing round

Licensing is awarded by DECC and gives a developer exclusive rights to an area, but it should be noted that planning permission and permits will still be required before activity can take place. Further information on the extent of the Bowland shales, the current licensed areas and areas under consideration for the next round, can be found in the SEA report. The '*Bowland Shale Gas Study*', undertaken The British Geological Society, is also a useful source of information, particularly for its diagrams, and can be accessed at the following link: <https://www.bgs.ac.uk/shalegas/#ad-image-0>