



**Decision document – Egdon Resources U.K. Limited at  
Wressle 1 Well Site, Lodge Farm**

**Environment Agency Permitting Decisions - Variation**

**Decision document recording our decision making  
process**

The permit number is:	EPR/AB3609XX
The Applicant / Operator is	Egdon Resources U.K. Limited
The site is located at	Wressle 1 Well Site Lodge Farm, Clapp Gate Broughton and Appleby Scunthorpe DN15 0DB
Duly made	15 <sup>th</sup> June 2016
First consultation commenced on	30 <sup>th</sup> June 2016
First consultation ended on	28 <sup>th</sup> July 2016
Minded to consultation commenced on	16 <sup>th</sup> March 2017

Minded to consultation  
ends on

13<sup>th</sup> April 2017

Variation determined

17<sup>th</sup> MAY 2017

## **Purpose of this document**

This is a decision document which accompanies a permit variation notice.

It explains how we have considered the Applicant's application, and why we have included the specific conditions in the draft permit variation we are proposing to grant to the Applicant. It is our record of our decision-making process, to show how we have taken into account all relevant factors in reaching our position. Unless the document explains otherwise, we have accepted the Applicant's proposals.

We have made our final decision only after carefully taking into account any relevant matters raised in responses we received.

## **Structure of this document**

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## Preliminary Information

The application we received contained proposals to vary the existing permit to allow activities at the site to progress from exploratory activities to include full scale oil production and oil storage. The application contained proposals for permitted activities involving a mining waste operation, a mining waste facility, an installation for oil storage and a groundwater activity. The permitted site is being increased in area. In addition the permitted flare is being changed to an enclosed ground flare but will still be restricted to the present flaring capacity.

The site for the proposed activities is located at Wressle 1 Well Site, Lodge Farm, Clapp Gate, Broughton and Appleby, DN15 0DB. The national grid reference for the centre of the site is SE96772 11102.

The Application was duly made on 15<sup>th</sup> June 2016.

We gave the Application the reference number EPR/AB3609XX/V003. We refer to the Application as “the **Application**” in this document in order to be consistent.

The number we have given to the permit is EPR/AB3609XX. We refer to the permit as “the **Permit**” in this document.

## Use of terms

The Applicant is Egdon Resources U.K. Limited. We refer to Egdon Resources U.K. Limited as “the **Applicant**” in this document. Where we are talking about what would happen after the Permit is granted, we call Egdon Resources U.K. Limited “the **Operator**”.

### *Additive*

Chemical or chemicals manually added to clean water, or to flow-back fluid and clean water, to assist with the hydraulic fracturing process.

### *Conditioning spacer/spacer fluid*

Conditioning spacer/spacer fluid is a fluid used to separate drilling muds and cement and is used to displace drilling muds from the borehole prior to cement being applied.

### *Conventional and unconventional oil and gas*

The term ‘unconventional gas’ refers to natural gas which is tightly trapped within underground rocks, such as shale rock or coal beds and which is hard to extract. ‘Conventional’ hydrocarbon fields are usually situated in natural reservoirs caused by overlying impermeable layers containing hydrocarbons which have risen through strata below.

Until recently unconventional gas reserves have not been exploited because the cost was too high or that the technology was not available. Technological advances mean it could now be economically viable to extract methane from these sources.

Unconventional gas can be shale gas, coal bed methane or underground coal gasification. The different sources of unconventional gas mean the type of gases extracted will vary. Shale gas and coal bed gas are mainly methane, like conventional natural gas. Underground coal gasification produces a mix that can include hydrogen, carbon monoxide and methane.

The proposed activities at Wressle 1 well site are for conventional oil production and not unconventional oil production as shale formations were not targeted in the Wressle area.

#### *Drilling muds*

Drilling muds are fluids used to lubricate the drilling bit while drilling.

#### *Drill cuttings*

Drill cuttings are broken bits of solid material naturally occurring underground and removed from a borehole as part of the drilling process into underground formations.

#### *Exploration*

Activities carried out to provide information about geological structures and the presence or absence of hydrocarbons together with assessments to determine whether the reservoir development is economically feasible.

#### *Extractive waste*

Extractive waste is waste directly resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries.

#### *Flaring*

Flaring is a technique used where quantities of flammable waste gas are burnt in a controlled manner. The gas flow is ignited under controlled conditions.

#### *Flow-back fluid*

A mixture of hydraulic fracturing fluid, which may include mobilised natural gas and formation water which returns to the surface following the hydraulic fracturing process.

#### *Hydraulic fracturing*

Hydraulic fracturing or “fracking” is a technique that uses fluid, usually water, pumped at high pressure into the rock to create narrow fractures which provide paths for the tight gas to flow into the well bore and to surface. Once the fractures have been created, small particles, usually of sand, are pumped into them; these particles keep the fractures open when the water is flowed back up the well. The water normally contains small quantities of other substances to improve the efficiency of the process, e.g. to reduce friction.

The differences between hydraulic fracturing in conventional oil and gas sites and unconventional oil and gas sites is that in many instances, hydraulic fracturing for unconventional oil and gas takes place at a deeper level than those for conventional oil and gas. Generally it requires more water and chemicals and involves drilling at higher pressures than is common for conventional activities.

The proposed proppant squeeze at Wressle 1 is a small scale hydraulic fracturing activity for conventional oil similar to those activities that have previously been carried out in UK to enhance the productivity of conventional oil wells.

#### *Hydraulic fracturing fluid*

The fluid injected into the formation under pressure, and which consists predominantly of clean water, or flow-back fluid and clean water, together with a proppant and a friction reducer.

#### *HSE*

Health and Safety Executive

#### *JAGDAG*

Joint Agencies Groundwater Directive Advisory Group

#### *Prospecting*

Waste Directive defines this as ‘the search for mineral deposits of economic value, including sampling, bulk sampling, drilling and trenching, but excluding any works required for the development of such deposits, and any activities directly associated with an existing extractive operation’.

#### *Regulated facility*

This is the term used in the Environmental Permitting (England and Wales) Regulations 2016. Those Regulations provide that any regulated facility must be operated only under and in accordance with an environmental permit. The term is defined in the Regulations so as to include a “mining waste operation, a “groundwater activity” and an “installation”, which in this case includes a facility for the loading, unloading, handling or storage of, or the physical, chemical or thermal treatment of crude oil or stabilised crude petroleum as an activity listed in Schedule 1 section 1.2 Part A (1) (e) to the Environmental Permitting (England and Wales) Regulations 2016). A “mining waste operation” is further defined so as to include the management of extractive waste, whether or not it involves a waste facility.

#### *Reservoir*

The rock formation in which the hydrocarbon being targeted is held. In this case this is the Ashover Grit and Chatsworth Grit units in the Millstone Grit Formation.

*Surface conductor*

The first string of casing run, designed to prevent surface losses and/or washouts below the cellar base, in addition to isolating aquifers. The cellar is the concrete casing surrounding the wellhead and the initial part of the wellbore at the surface.

*Target formation*

When used in reference to drilling activities, this is the geological formation specifically being targeted by the exploration activities to assess whether hydrocarbons are present, their extent and the potential future well performance. When used in connection with production of hydrocarbons, this is the geological formation specifically being targeted for extraction. For the purpose of this Application, the target formation is the Ashover Grit and Chatsworth Grit in the Millstone Grit Formation.

*Wellbore*

The engineered construction through which the hydrocarbon is to be extracted.

# KEY ISSUES OF THE DECISION

## 1. Summary of the application

The original permit was for the management of extractive mining waste resulting from the drilling of an exploratory borehole at the Wressle 1 well site. This permit was varied to allow the operator to carry out production tests. The results of the production tests indicated that there are viable deposits of oil which can commercially be extracted. The operator now wishes to produce oil from the site. The application is to vary the permit to allow the operator to carry out activities associated with production of oil at the site.

The variation will involve adding the following permitted activities:

- I. Increasing permitted site area by 0.12 hectares.
- II. A Mining Waste Operation, as defined by the Mining Waste Directive and Schedule 20 of the Environmental Permitting (England and Wales) Regulations 2016, relating to the management of extractive waste.

The Waste Management Plan (WMP) is being varied to include management of extractive mining wastes from side-track drilling, radial drilling and near well-bore treatments. The near well-bore treatments will include an acid-squeeze, hot oil wash, solvent treatment, nitrogen injection; and a proppant squeeze. Waste gas will be flared through an enclosed ground flare, at low volumes well below the 10 tonnes per day Industrial Emissions Directive threshold.

- III. A Mining Waste Facility, as defined by the Mining Waste Directive and Schedule 20 of the Environmental Permitting (England and Wales) Regulations 2016, for the disposal of hydraulic fracturing fluid retained within the formation.

The permit is being varied to include a mining waste facility for management of non hazardous extractive waste and permanent deposit in-situ of proppants and hydraulic fluid and will not require financial provision to be set aside.

- IV. An Industrial Emission activity as defined by the Industrial Emissions Directive and Part 2 Schedule 1.2 of the Environmental Permitting (England and Wales) Regulations 2016, relating to the loading, unloading, handling and storage of crude oil.

The variation allows for storage and handling of crude oil that will arise from oil production activities.

- V. A groundwater activity, as defined by the Groundwater Directive and Schedule 22 of the Environmental Permitting (England and Wales) Regulations 2016, for the discharge, injection of fracturing fluid into the target formation that might lead to an indirect input of a pollutant to groundwater;

A slurry of proppant and gelled water will be pumped through existing well perforations into the Ashover Grit and Chatsworth Grit, which is part of the Millstone Grit Formation at a pressure greater than the fracture propagation pressure of the formation. The target formation is the Ashover Grit located at approximately 1580m true vertical depth. The activity will therefore create fractures in the formation and enhance the permeability of the formation. The 'proppant squeeze' constitutes a groundwater activity in accordance with the definition in paragraph 3 of Schedule 22 to the Environmental Permitting (England and Wales) Regulations 2016 (EPR) because of the potential for an indirect discharge to groundwater in the Ashover Grit and Chatsworth Grit.

A number of activities which do not require a permit will be conducted at the Wressle well site during hydrocarbon production and short duration well operations, including but not limited to:

- Discharge of clean surface water through an interceptor when the proposed drilling operations have ceased. The amount of discharge of clean surface water is estimated to be less than 20m<sup>3</sup> per day and is exempt from permitting.
- Production of hydrocarbons, including oil and associated natural gas used to generate electricity. For clarity a permit subject to the Mining Waste Directive covers the management of extracted waste and not the extraction process.
- Well maintenance and surveys not generating extractive wastes;
- Installation of groundwater monitoring boreholes;
- Well monitoring;
- Equipment maintenance and repairs; and
- Storage and disposal of non-hazardous and hazardous waste not directly associated with the permitted activities.

If the Applicant wishes to carry out different or additional activities not covered by this permit, a further variation of the permit will be required. Any such variation application would be determined on its merits and would be subject to our normal consultation process. Any further application to vary operations to manage mining waste will require an amended waste management plan to be submitted.

Except where a permit condition imposes a different requirement, the permit requires the Operator to comply with the techniques in the waste management plan (WMP) and limits the activities to those stated unless otherwise agreed in writing by the Environment Agency. We will authorize only minor amendments to the WMP without the need to vary the Permit.

## 2. Summary of our decision

We have decided to grant the Permit variation to the Applicant.

This will allow the Operator to operate the mining waste operation for the management of extractive waste arising from the proposed activities as set out in their WMP, subject to conditions in the permit. The varied permit will also allow for the storage and handling of crude oil arising from onshore oil and gas exploration and production activities. The varied permit will also allow flaring of less than 10 tonnes per day of waste gas using an enclosed ground flare as set out in the WMP and subject to any conditions in the permit. In addition the varied permit will also allow a groundwater activity, for a discharge that might lead to an indirect input of pollutants to groundwater. Permit conditions relating to groundwater require measures to be taken to limit the input of non-hazardous pollutants to groundwater. The varied permit also allow the Operator to increase the size of the permitted site.

We consider that, in reaching that decision we have taken into account all relevant considerations and legal requirements, and are satisfied that the permit will ensure that a high level of protection is provided for the environment and human health.

The Permit includes conditions taken from our standard environmental permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations, Mining Waste Directive, Industrial Emissions Directive, Groundwater Directive, Water Framework Directive and other relevant legislation.

This document does not therefore include an explanation for these standard conditions. Where they are included in the permit, we have considered the Application and accepted that the details are sufficient and satisfactory to make the standard conditions appropriate.

We have tried to explain our decisions as accurately, comprehensively and as plainly as possible, although given the nature of the Application it is inevitable that this document contains a significant amount of technical and specialist language.

### 3. How we took our decision

The Application was duly made on 15<sup>th</sup> June 2016. This means that we considered it was in the correct form and contained sufficient information for us to begin our determination.

We carried our consultation on the Application taking into account the Environmental Permitting (England and Wales) Regulations 2016 and our statutory Public Participation Statement. We advertised the Application by a notice placed on the GOV.UK website, which contained all the information required by the Regulations, including telling people where and when they could see a copy of the Application.

We also placed an advert in the Scunthorpe Telegraph's edition published on 30/06/2016. We contacted local MPs, local authorities and Parish Councils to notify them of the consultation.

We placed a paper copy of the Application and all other documents relevant to our determination on our Public Register at the local Environment Agency Offices at Waterside House, Waterside North, and Lincoln, LN2 5HA.

We also sent a copy of the Application to Broughton Jubilee Library, 59 High Street, Broughton, North Lincolnshire DN20 0JX

We sent copies of the Application to the following bodies, including those with whom we have "Working Together Agreements":

- Local Planning Authority, North Lincolnshire Council
- Mineral Planning Authority, North Lincolnshire Council
- Health and Safety Executive
- Public Health England
- Director of Public Health
- Natural England

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly.

We held a public meeting on the 13 July 2016 at Broughton Village Hall to raise local awareness of the permit variation application submitted by Egdon Resources for Wressle Well Site. Residents were able to discuss any concerns with the Environment Agency and partner organisations who were also in attendance, namely: Health & Safety Executive, Oil and Gas Authority, Public Health England and North Lincolnshire Council – Planning Authority.

Although the application contained sufficient information for us to begin our determination we asked the Applicant to provide additional information through three formal requests under Schedule 5 to the Environmental Permitting (England and Wales) Regulations 2016.

We have also made publicly available information provided by the Applicant in the form of responses to our Schedule 5 notices for additional information; and information received subsequent to those responses. This information, which is stated in the status log section within the introductory part of the permit, was required to determine the application. It was placed on our Public Register and we felt it was appropriate that it was made more widely available for interested parties to view.

As with the initial application the new information was made available at the minded to consultation stage and could be viewed at our public register offices, at the libraries and council addresses listed above and on the .gov.uk website for permit application consultations. i.e. <https://www.gov.uk/government/collections/environmental-permitting-notices-of-applications-made>. We contacted local stakeholders and those that contacted us during the consultation to notify them of the additional information.

Further details, along with a summary of consultation comments and our response to the representations we received, can be found in Annex 1 to this Decision Document. We have carefully considered all representations and have taken into account any relevant points in reaching our determination.

We carried out a Minded to consultation on our draft decisions taking into account the Environmental Permitting (England and Wales) regulations 2016 and our statutory Public Participation Statement. We advertised the Application by a notice placed on our website, which contained all the information required by the Regulations, including telling people where and when they could see a copy of the Application. As with the initial application, we also placed an advert in the Scunthorpe Telegraph's edition published on 16<sup>th</sup> March 2017.

### **Amendments made to the permit following the minded to consultation**

We have made some changes to the permit conditions listed below. We consider that these conditions provide an enhanced level of protection and are not significant enough to require further consultation.

- Condition 3.5.1. has been amended to include subsection 3.5.1.e. that will require the operator to monitor the volume of produced water arising from the production process.
- In Schedule 1 table S1.4 we have include pre-operational condition PO5 requiring the operator to provide for approval a method for monitoring volumes of produced waters arising during the production process and location details for the point from where produced water will be monitored, prior to commencement of groundwater activities.

- In Schedule 3, we have added Tables S3.7 which specify produced water monitoring requirements.
- In Schedule 4, we have amended Table S4.1 to include parameters for reporting on produced water.

### **Amendments made to the Decision Document following minded to consultation**

This document has been updated to reflect that this is now a final and not a draft decision, to address the consultation comments received and some minor changes have been made for clarity which do not significantly change the nature or sense of what was said previously.

The minded to consultation responses and how we have taken these into consideration in the determination and an explanation can be found in Annex 1 section D

## **4. Brief outline of proposed process**

The site was constructed in 2014 using a geosynthetic clay liner protected by a structural membrane. There is an existing well at the Wressle site that was drilled in 2014 down to 1855 m (true vertical depth) into the Carboniferous Limestone Group. The planned operations include drilling of a side-track well; radial drilling operations; near wellbore treatment; a one off hydraulic fracturing for conventional oil; production of hydrocarbons; storage of crude oil arising from the production process and extension of the permitted site by 0.12 hectares.

We regulate the management of the extractive wastes arising from these activities, including the flaring of natural gas. We do not regulate the hydraulic fracturing process, although we do regulate any discharge of hydraulic fracturing fluid that might lead to an indirect input of pollutants to groundwater.

### **4.1 Drilling of Side-track well and radial drilling operations**

One 25m side-track well starting above the Ashover Grit to be the base of the grit is proposed to be drilled using oil based drilling fluids. Radial drilling of two holes 51mm in diameter and up to 100m in length with oil based drilling fluids is also proposed using a high velocity fluid jet which drills out through the existing 4 1/2" casing at 2,010 m measured depth below rotary table (m MDRT) in the Ashover Grit. The objective of the drain holes is to improve oil production efficiency by extending the reach and contact beyond the borehole.

### **4.2 Near Wellbore Treatments**

The Operator may also undertake one or more near wellbore treatments within the Millstone Grit Formation during the lifetime of hydrocarbon production from the well, the details of which are described below. The purpose of near wellbore treatments is to reinstate or improve the permeability of the formation, having potentially been blocked as a result of the initial drilling and completion operations.

All near wellbore treatments will be applied to the Millstone Grit Formation and other formations at pressures and pump rates lower than those that would be required to fracture the formation. Initially, an injectivity test is first undertaken. This test is an engineering test, which will apply increased pressure to the formation until it reaches a point at which injectivity starts to occur. This, in turn, will determine the maximum pressure that can be used for a near-wellbore treatment. The applied pressure is controlled by the injection rate (i.e. the pump rate) which is typically very low, in the order of 1 barrel (159 litres) per minute.

The fluid used to undertake the injectivity test will be hydrochloric acid (HCl), at 10-15% concentration with water (i.e. 150kg of HCl with 850kg of water).

#### **4.2.1 Acid Squeeze**

To improve the flow of hydrocarbons within the Ashover Grit Unit, an acid, hydrochloric acid (HCl) at 10-15% concentration with water (i.e. 150kg of HCl with 850kg of water) plus hydrofluoric acid generating formulation, may be applied to the formation through the existing perforations within the wellbore. An acid squeeze is applying the acid to the formation at pressures and rates determined by the injectivity test, resulting in the acid being squeezed into the near wellbore formation matrix and increasing the near wellbore permeability.

A pre-flush of 10m<sup>3</sup> 10-15% HCl containing surface-tension reducing additives and corrosion inhibitor is pumped into the formation. This is then immediately followed by the main treatment of 20m<sup>3</sup> ammonium bi-fluoride, again with corrosion inhibitor, and is pushed into the formation past the damage zone using up to 20m<sup>3</sup> 3-5% ammonium chloride solution containing typically 10% ethylene glycol monobutyl ether (EGMBE) and poly-quarternary amine clay stabilizer. The treatment may then be further displaced with a low toxicity based oil, which may replace some or all of the ammonium chloride. The entire treatment is typically energised with nitrogen and following full displacement into the formation is then flowed back in a controlled manner, through standard production related equipment for collection and disposal.

The acid reacts with minerals within the formation, the chemical reaction produces a neutral solution if fully reacted i.e. neither alkali or acidic, though in practise the flow-back fluid usually remains slightly acidic. The solution produced as part of the reaction with the formation will be flowed back and removed from the Wressle-1 well.

Deeper aquifers within the Jurassic, Triassic and Permian are high saline and mineralised groundwater. Whilst the injection of acid and the displacement of acid using a low toxicity based oil is a 'groundwater activity', the quantity and concentration used within the deep saline water bearing formation is such that the activity is considered de minimis and can be excluded under Schedule 22 3 (3)(b) of EPR 2016.

The acid squeeze within the Millstone Grit Formation does not, therefore, require a groundwater activity permit.

#### **4.2.2 Hot Oil Wash**

Crude oil generally contains dissolved waxes that can precipitate within the natural fractures of the formation, restricting the flow of hydrocarbons to the well. Paraffin is one such wax, primarily consisting of long chain, saturated hydrocarbons.

Hot oil washing is a process of removing the build-up of paraffin precipitates within the production tubing. Hot oil, previously produced from the formation, is pumped from storage tanks onsite, via a mobile hot oil pump, which heats the oil prior to circulating down the well. Hot oil is pumped down the tubing to immediately above the perforations and circulated back to surface, dissolving or dislodging paraffin precipitates.

Paraffin precipitates dissolved or dislodged within the hot oil are diverted from the well at surface back to the onsite oil storage tanks where it is comingled with the produced oil. Produced oil is subsequently transferred to road tankers and removed from site by a licenced haulier to a permitted refinery for sale.

No hot oil is pumped into the formation and no waste is generated, therefore, a groundwater activity permit is not required nor does the activity constitute a mining waste activity.

#### **4.2.3 Solvent Treatment**

Similar to hot oil washing, a solvent treatment is a process of removing the build-up of paraffin precipitates within the near wellbore formation and production tubing. Solvent is pumped down the well and squeezed into the formation and dissolves the paraffin precipitates, re-establishing the flow of hydrocarbons. The spent treatment and the dissolved paraffin precipitates return to surface and diverted from the well at surface back to the onsite oil storage tanks where it is comingled with the produced oil. Produced oil is subsequently transferred to road tankers and removed from site by a licenced haulier to a permitted refinery for sale.

Whilst the injection of solvent treatment is a 'groundwater activity', the quantity and concentration used within the deep saline water bearing formation and the recovery of all treatment fluids is such that the activity is considered de minimis and can be excluded under Schedule 22 3 (3) of EPR 2016.

The use of solvent treatment within the Millstone Grit Formation does not, therefore, require a groundwater permit.

#### **4.2.4 Nitrogen**

To aid the initial flow of hydrocarbons from the formation, nitrogen may be injected into the wellbore to displace wellbore fluids, reducing its hydrostatic weight. Nitrogen is classified as an inert waste and venting of such considered a closed loop system, insofar as nitrogen is extracted from the atmosphere and is vented back to atmosphere. No nitrogen would remain in the formation.

### **4.3 Hydraulic fracturing for conventional oil**

The Applicant has proposed to undertake a 'proppant squeeze' and inject a slurry of proppant and gelled water through existing well perforations into the Ashover Grit, which is part of the Millstone Grit Formation at a pressure greater than the fracture propagation pressure of the formation.

A pre-treatment injectivity test will first be undertaken using approximately 15m<sup>3</sup> – 25m<sup>3</sup> of gelled liquid. The purpose of the injectivity test is to determine the breakdown pressure, propagation pressure and carrier fluid leak-off rate, which in turn will inform the main proppant treatment. Should the pre-treatment injectivity test indicate that the main proppant treatment may extend further than the design, the fluid volumes and pressures will be adjusted accordingly, to ensure the design objective is achieved. This calibration process, comparing data obtained during the pre-treatment injectivity test with the original design parameters and adjusting the main proppant treatment accordingly, will be documented within the Hydraulic Fracturing Plan, which must be submitted to Oil and Gas Authority and the Environment Agency for approval prior to commencement of the hydraulic fracturing process.

The process involves a slurry of proppant (resin-coated ceramic) and gelled water being pumped through the perforations into the Millstone Grit Formation at a pressure exceeding the fracture propagation pressure of the formation.

The main proppant treatment will consist of approximately 20 to 30 tonnes of resin-coated ceramic beads and approximately 80m<sup>3</sup> to 120m<sup>3</sup> of gelled liquid. The fluid mix is injected at a surface pressure of 9,000psi for 1 to 2 hours, then flowed back through the production facilities in a controlled manner.

The fractures create channels through near wellbore formation which would have been blocked as a result of the initial drilling and completion operations. The proppant squeeze is designed to extend to about 40m in a lateral direction and 20m in a vertical direction, above and below the perforations. The target formation for injection is the Ashover Grit at approximately 1580m true vertical depth and the fractures will extend into the Chatsworth Grit. The activity will therefore create fractures in the formation and enhance the permeability of the formation.

The proposed “proppant squeeze” is a small scale hydraulic fracturing process which has historically taken place in conventional oilfields in Lincolnshire, where oil is extracted from tight formations of sandstone reservoirs, or where the geological formations are prone to damage during the drilling process, resulting in impeded oil flows. The hydraulic fracturing at Wressle will be a single activity that will be done in order to stimulate the flow of oil within the Ashover Grit and Chatsworth Grit in the Millstone Grit Group.

The ‘proppant squeeze’ constitutes a groundwater activity in accordance with the definition in paragraph 3 of Schedule 22 to the Environmental Permitting (England and Wales) Regulations 2016 (EPR) because of the potential for an indirect discharge to groundwater in the Ashover Grit.

The sandstones and grits of the Millstone Grit Group will contain groundwater. The Millstone Grit will have a relatively low permeability due to depth of burial, the water content is considered to meet the definition of groundwater as defined in EPR. The Millstone Grit Group is classed as a Secondary A aquifer under the Environment Agency's Groundwater Protection, Principles and Practice (GP3). The Millstone Grit Group is not abstracted in the Wressle area because it is located between 1530m true vertical depth and 1792m true vertical depth.

The applicant has provided a list of chemicals proposed for use in the fracture fluid in Appendix 3 of the Waste Management Plan. The corresponding Material Safety Data Sheets have been included in the Wellbore Fluids – Production, Near Wellbore Treatments and Proppant Squeeze Operations Document. All chemical components of the fracture fluid have been assessed based on the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) Methodology for the determination of hazardous substances for the purposes of the Groundwater directive (2006/118/EC).

The chemicals on the applicants list have been assessed as non-hazardous in terms of persistence, bioaccumulation, and toxicity in line with this JAGDAG methodology.

A hazardous substance is any substance or group of substances that are toxic, persistent and liable to bio-accumulate. A non-hazardous pollutant is any pollutant other than a hazardous substance.

We satisfied that chemicals proposed for use in the fracture fluid have been correctly classified as non-hazardous to groundwater. The operator is not permitted to use any other chemical that is not on the list in the Waste Management Plan.

#### **4.3.1 Flow-back fluid and Disposal**

Based on estimations from previous conventional hydraulic fracturing operations within the industry, it is estimated that between 30 to 50 percent of the proppants injected will be returned to surface as flow-back fluid via the production facilities and stored onsite for subsequent offsite transfer to an Environment Agency approved waste treatment facility for disposal in accordance with the receiving waste treatment facility's environmental permits.

A radioactive substances activities permit (ref: EPR/HB3295DH) was issued for the Wressle well site on the 6<sup>th</sup> October 2014. That permit covers the accumulation and disposal of Naturally Occurring Radioactive Material (NORM) contained within formation water where such NORM is classified as radioactive waste. The activity limits set within the existing radioactive substances activities permit are deemed suitable for the proposed production activity.

### 4.3.2 Retained Fluid within the Formation

It is estimated that between 50% to 70% of proppant fluid injected during the fracturing process will be retained within the formation, having been adsorbed on the ion-charged, high surface area minerals within the formation.

We have classified the formation within which the fluid is retained as a Non-Hazardous Mining Waste Facility, the extent of which will be determined through fracture height and growth modelling.

As a result of the retention of proppant fluid within the Ashover Grit and Chatsworth Grit in the Millstone Grit Formation being classified as a Mining Waste Facility, there is a requirement, through assessment, to establish Best Available Technique (BAT) for the management of the retained proppant fluid. The options considered as part of the BAT assessment include:

- Recovery of all proppant carrier fluid over prolonged flow-back periods during hydrocarbon production;
- Increased recovery of proppant fluid using artificial lifting (submersible pumps);
- Recovery of proppant fluid by excavation; and
- Retention of proppant fluid within the formation.

The BAT assessment identified that both the prolonged flow-back periods and artificial lift are unlikely to result in a 100% recovery of proppant fluid from the formation.

Recovery by excavation is not feasible due to the depth of formation within which the fluid is retained. Such methods of excavation would have a significant environmental impact. This would involve the development of a mineshaft considerably wider than the original Wressle-1 borehole to a depth of approximately 1,576mTVD, sufficiently large enough to accommodate structural supports for safety against collapse and of entry of necessary personnel, machinery and supplies. The development of a mine would create significant extractive waste, the volume of which would far exceed the volume of waste the development seeks to retrieve from the target formation. This option offers no environmental benefit and would cause significant local amenity impacts and disruption to the local community. Economically, the development of a mine would render the exploration and subsequent production of hydrocarbons from the Millstone Grit Formation unviable.

As it is not feasible to retrieve 100% flow-back, either by a prolonged flow-back period or by artificial lift and the removal of proppant fluid by excavation is not feasible, retention within the formation is considered BAT. The alternative options are unrealistic and/or theoretical in nature. Injected proppant fluid, retained at depth, does not present an environmental risk. Proppant retained within the formation prevents the fractures from closing and provides the permeability for hydrocarbons to flow. As the proppant fulfils a purpose, it is not considered a waste.

We have assessed all the chemicals to be used using the determination under new Groundwater Directive 2006/118/E which is followed by JAGDAG. We have permitted the use of only those proppants that have been assessed to be non-hazardous.

An indication of the aerial extent of the Non-Hazardous Mining Waste Facility for the proppant fluid is included within document ER-EPRA-W1-SP-004 and is based on the maximum anticipated fracture length. The base of the well is approximately 1,140m southwest of the surface location, which for clarity, is the top of the borehole within the Wressle well site.

#### **4.4 Hydrocarbon Production from Wressle 1 Well**

Drilling of the Wressle-1 borehole was completed during third quarter 2014 followed by successful well testing operations during 2015. The Waste Management Plan (ER-EPRA-W1-WMP-005) has been produced to consider the management of extracted waste from hydrocarbon production from the Ashover Grit and Chatsworth Grit in the Millstone Grit Formation and, near wellbore treatments and proppant squeeze, as may be required.

Hydrocarbon production has the potential to generate extractive waste in the form of formation water, spent wellbore treatment fluids and/or flow-back fluid. It is anticipated that a mixture of oil and natural gas will be produced with the associated extractive wastes. Depending on the volumes of natural gas encountered, should the volume be insufficient for power generation, it will be considered extractive waste and disposed of safely by way of an enclosed ground flare. However, if the gas is of sufficient quantities, it may be used for electricity generation.

##### **4.4.1 Oil Production**

Produced fluids (oil, formation water, spent wellbore treatment fluids and/or flow-back fluid) will either flow to the surface naturally or with the aid of a surface pump that will artificially lift fluids to surface. For clarity, a permit subject to the Mining Waste Directive covers the management of extracted waste and not the extraction process, therefore, the method by which oil, natural gas and associated fluids come to surface is not a material consideration of the Waste Management Plan (ER-EPRA-W1-WMP-005) and associated environmental permits.

At surface, produced fluids and associated natural gas will be diverted by pipework to a bath heater (if water is present), preheating the fluid to aid in the three phase separation process, which will separate out oil, water (if present) and associated natural gas. Oil, which for clarity is not a waste, will be diverted via pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to a permitted refinery for sale.

Water, if present, will be diverted via pipework to dedicated storage tanks onsite for subsequent offsite removal by a licenced haulier to either an Environment Agency permitted water reinjection facility for reinjection or an Environment Agency permitted water treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

If natural gas is produced along with the oil, then gas will be managed in accordance with Section 4.4.2.

#### **4.4.2 Associated Natural Gas**

The primary objective of the Wressle-1 well is to produce oil from the Millstone Grit Formation, however, previous well testing operations indicate that natural gas may also be present.

Regardless of the quantity of natural gas present with the oil, an enclosed ground flare will be installed onsite as the method of safely disposing of natural gas, in the case of routine maintenance or an emergency, where the requirement to blow down the gas within the surface production equipment exists, once the well is shut in.

During the initial stages of hydrocarbon production, natural gas will be disposed of via the enclosed ground flare located onsite. This will also aid in the establishment of flow rates and pressures, which in turn will inform the decision as to whether the natural gas is sufficient in quantity and flow rate to sustain electricity generation by way of a gas engine to power the site, with any remaining electricity being exported to the national grid, up to the capacity limit of the receiving electricity distribution system.

At this early stage in the development of the Wressle 1 well site, it is difficult to predict the volumes, flow rates and longevity of associated natural gas production from the Wressle-1 well. Likewise, the cost and timescales associated with the installation of electricity generating equipment and connection to the national grid contribute to whether the use of associated natural gas, in accordance with Article 5 (2) of the Mining Waste Directive, is commercially viable.

The criteria for determining the management of associated natural gas production from the Wressle-1 well is detailed below.

##### **4.4.2.a) Low Gas Volumes**

Generally, the lower threshold limit for the combustion of natural gas via an enclosed ground flare is approximately 18,000 standard cubic feet per day (scufd), which equates to approximately 750scf per hour.

If the production of natural gas is below this threshold limit, it may not be feasible to combust the natural gas without the introduction of support gas, such as propane. Notwithstanding the lower threshold limit, natural gas production above 18,000scfd but below 50,000scfd is not likely to be sufficient to enable generation of electricity and export to the national grid.

It may be possible, however, to generate small quantities of electricity via a gas engine and use locally by either heat or feed into the site distribution system, or “dump” the electrically generated load via a load bank. If none of these options are technically or

commercially feasible, the proposal would be to safely dispose of the natural gas via an enclosed flare, assuming the volumes are sufficient to maintain combustion.

#### **4.4.2.b) Medium to high gas volumes**

If volumes are sufficient and it is deemed commercially viable, natural gas will be used to generate electricity and export to the national grid.

A ground flare will still be required onsite if medium to high gas volumes are sustainable to combust any residual gas that cannot be used (i.e. flow rates exceeds the maximum capacity of the gas engine and/or to act as a relief flare in the event of equipment or operational failure/malfunction).

If gas volumes are such that electricity generation is above the capacity of the export connection, it may be that a gas storage system is used to harness the additional natural gas rather than sending excess gas to the flare system.

### **4.5 Well Abandonment and Partial Well Abandonment**

Upon cessation of hydrocarbon production, the well will be abandoned in accordance with Oil & Gas *UK Guidelines for the suspension and abandonment of wells*, which requires all distinct permeable zones penetrated by the well to be isolated from each other and from surface by a minimum of one permanent barrier. If any permeable zone penetrated by the well is hydrocarbon-bearing or over-pressured and water-bearing then the requirement is for two permanent barriers from surface, the second barrier being a back-up to the first.

In addition to the Oil & Gas *UK Guidelines for the suspension and abandonment of wells*, the well abandonment(s) will be undertaken in accordance with the following regulations:

- The Borehole Sites and Operations Regulations 1995; and
- Offshore Installations and Wells (Design & Construction, etc.) Regulations 1996

The initial design and construction of the well takes into consideration the permeable zones encountered during the drilling operation and whether any of these zones are hydrocarbon-bearing or over-pressured and water-bearing. Construction of the borehole has provided adequate sealing of these zones when cementing in the various steel casing strings, ensuring compliance with the Oil & Gas UK guidance.

The well abandonment operation involves the setting of cement barriers, extended above and below the permeable zone(s). Retainers are positioned within the internal casing string immediately below the required cement depth, which prevents the cement from moving or slumping during setting. Once the well is abandoned, the casing strings will be mechanically cut off at 1.5m below original ground level and a steel plate welded over the top. The pre-cast concrete drilling cellar would then be removed and the site restored to its former use.

Plugging and decommissioning requires isolating different zones of the borehole (e.g. surface geology, hydrocarbon bearing geology and permeable geology) by permanent

barriers. A series of cement plugs will be used to isolate sections of the well, plugs will also be used higher up in the vertical wellbore. During the isolation the cement plug will be tagged, touching the top of the cement plug with a drill pipe, to verify its position and confirm that the cement has set. The sealing capability of the plug / barrier will be verified further by a pressure test, for example the magnitude of which should be a minimum of 500 psi above the injection pressure below the barrier but not exceed the casing strength.

Once the borehole has been plugged and decommissioned no further maintenance is required. However, to verify barrier construction, monitoring of the well pressure will be conducted in agreement with the Agency and HSE at the time of decommissioning. This process will follow the Oil & Gas UK and UK Onshore Operators Group guidelines, and is reviewed by an independent well examiner and the HSE.

The Applicant will produce a closure plan that covers all the required measures detailed in our prevailing guidance. This current guidance is provided in section 3.4 of our guidance *“EPR 6.14 How to comply with your environmental permit. Additional guidance for: mining waste operations”* as part of any application to surrender the environmental permit.

This closure plan will cross-reference the updated Site Condition Report and take into account any changes in site conditions. It will include a commitment to post-well decommissioning monitoring in line with the historical operation of the site and in accordance with regulatory/industry guidance at the time of plugging and abandonment of the well. The closure plan will also cover the reinstatement of the site to its previous use (agricultural land) as required by the planning permission.

The Environment Agency has the power to impose further conditions if we think that they are reasonable and necessary to ensure that we are satisfied that the well can be decommissioned and that there will be no risk of pollution and the permit can be safely surrendered. The Permit will remain in force until it is surrendered.

Routine ground-gas and groundwater monitoring will be required to continue post decommissioning as considered appropriate given the site history and site condition report. The frequency of monitoring will be determined based upon the information gathered throughout the operations and the requirements of the site condition report.

The decommissioning stage is sometimes referred to as well abandonment; the use of the term well abandonment at this stage is distinct to any application to surrender the permit. The permit itself cannot simply be abandoned and the obligations under it will remain until we accept that the permit can be surrendered.

## **5. The Legal Framework**

The mining and management of the extractive waste are regulated under different regimes. An Operator will need planning permission from the local Minerals Planning Authority, and a Petroleum Exploration and Development Licence (PEDL) from the Oil and Gas Authority.

### **5.1. Planning permission**

Decisions on whether to grant or refuse planning application are made separately to decisions on whether to grant or refuse an environmental permit.

Planning permission for a temporary well site for drilling of an exploratory borehole was granted by North Lincolnshire Council on 18 June 2013. Planning Reference: MIN/2013/0281. On 13<sup>th</sup> January 2017 North Lincolnshire Council refused to grant the relevant planning permission by the Applicant for the retention of the existing Wressle 1 Well Site and access road for long term production of hydrocarbons. The Planning Reference number for this application is MIN/2016/810. However, on the same date they granted planning permission, reference number PA/2016/808 which allowed the Applicant to install 4 groundwater monitoring boreholes at the Wressle 1 site. The boreholes would be used to monitor the effects that the permitted groundwater activities and associated subsurface operations might have on the quality of groundwater.

The Permit is granted under regulation 13 of the Environmental Permitting (England and Wales) Regulations 2016, which regulates facilities whose activities involve water discharges and groundwater activities, radioactive substances, waste, mining waste, or which involve activities listed in Schedule 1 to the 2016 Regulations. The Environmental Permitting Regime is the regulatory framework which requires the Environment Agency to deliver the obligations imposed by national policy and various EU directives.

### **5.2. Mining Waste Directive**

The regulated facility in question is within the scope of the Mining Waste Directive, because it involves the management of extractive waste.

We consider that the environmental permit will ensure that the operation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

### **5.3. Water Framework Directive**

The regulated facility in question is also in scope of the Water Framework Directive because it involves injecting fluids into the ground which might pose a risk to groundwater.

The Water Framework Directive requires that the proposed activities are regulated to reduce the risk of accident, and special boreholes are drilled and monitored, so that any pollution can be detected early.

We consider that the environmental permit will ensure that the operation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

## **6. Description of the site**

### **6.1 Site setting, layout and history**

The site is called Wressle 1 Well Site and is in a field located approximately 350 metres east of Lodge Farm, Clapp Gate, Broughton and Appleby, Scunthorpe, DN15 0DB.

The following receptors are located nearby:

- Residential properties are located at the Lodge Farm which is 350 metres to the west of the site; at Decoy Cottage which is 500 metres to the south east of the site and at Broughton cottages which are 650 metres to the south of the site.
- The site is located within a nitrate vulnerable zone, where there are some restrictions on the application of fertilisers and other nitrates to the land.
- The nearest surface watercourse is Ella Beck located to the north, adjacent to the well site and also approximately 65 metres to the west of the site. An unnamed land/field drain is also located approximately 45 metres east of the site.
- Broughton Far Wood Site of Special Scientific Interest (SSSI) is located approximately 650 metres to the west of the site.
- Broughton Alder Wood Site of Special Scientific Interest is located 1.3 kilometres south west of the site.
- Spring Wood Ancient woodland is located 1.3 kilometres west of the site.
- There are no national or local nature reserves, within a 2 kilometre radius of the site.

- There are no Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites within 10 kilometres of the site. The Humber Estuary Ramsar/SAC/SPA lies just over 10 kilometres to the North of the site.
- The site has a perimeter fence that is 9m away from Ella Beck so any works inside this boundary would not require a permit for flood risk activities.
- The site is approximately 1450m away from the River Ancholme and is located in an area where the likelihood of flooding from rivers, the sea and surface water has been assessed as less than 0.1% (1 in 1,000) chance of occurring in any given year, therefore the likelihood of flooding is estimated as 'very low'.

## **6.2 Site condition report**

The Operator submitted a site condition report detailing the condition of the site as part of the Application. We use the information on a site condition report to establish a baseline for the condition of the site prior to the permitted activity starting. This baseline will be used as a comparison, to establish whether there has been any deterioration of the land as a result of the permitted activities, when the Operator applies to surrender their permit.

The Operator must keep accurate records throughout the lifetime of their permit to clearly demonstrate that their activity has not adversely affected the site. This record will be used, in conjunction with the baseline data described above, to support any surrender application.

## **6.3 Pollution prevention measures**

We have considered the location of the site, actual and potential emissions, the sensitivity of receptors and the nature of the activity to decide what appropriate pollution prevention measures need to be in place.

As part of our assessment of the application we have carefully considered the risk assessment and all associated documents provided by the Applicant. We consider that these cover all the potential risks and sets out appropriate measures by way of mitigation.

## **6.4 Soil and Surface water management**

The site was constructed on a geosynthetic clay liner membrane protected by geotextiles, with a surface of 300-350mm stone and sand. The membrane extends over the entire site and underneath a drain which surrounds the site. The drain comprises a trench inlaid with a porous pipe and backfilled with coarse material. The site is constructed as a sealed site, designed to contain volumes of surface water generated by a 1 in a 100 year storm event. The geosynthetic clay liner provides containment for any spilled liquid. The storage of drilling muds, cuttings skips in separate containers will be located within the impermeable membrane.

An integral part of the well design is the well cellar. The cellar comprises a reinforced concrete chamber sunk and cemented into the ground with the top surface, level with the main site platform. This provides containment for any overspill of returned fluids, cement and surface water run-off from the well pad area.

The site is built into the existing land to the northern and eastern aspect, and soil and subsoil bunds to the southern aspect to provide screening and containment.

## **6.5 Storage arrangements**

Storage of the extractive wastes will take place on an impermeable membrane. This consists of a base of suitably designed geosynthetic clay liner, surface water impoundments and secondary containment. The membrane is self-sealing if punctured, with high climatic and chemical resistance. The geotextile membranes are then covered with a 300-350 mm layer of compacted material.

Three tanks, each with a capacity of 52 m<sup>3</sup> will be used to store the fluids. Of these tanks, one tank will be used to store produced fluids, another will be used for storing separated oil and the other for storing separated water. A fourth tank may be brought onto site if additional storage volume is required. The produced water will flow from the well via a high pressure pipe to a steel tank. Although the storage tanks can hold 52 m<sup>3</sup>, they will be filled to only 90% of capacity. Produced fluids would be moved between storage tanks, and to export tankers, via small transfer/export pumps situated within the bunded area.

The permit limits the storage of extractive wastes produced during the production testing phase to a maximum of three months.

## **6.6. Emissions to air**

During the determination of this application, we carefully considered emissions to air that will arise from the incineration of natural gas. Natural gas is separated from hydrocarbon liquids, produced water and oil fluids at surface and diverted via pipe work to an enclosed ground flare located onsite for incineration.

There is a requirement to prevent or minimise the generation of wastes. Due to the absence of infrastructure that would be necessary to allow for storage or utilisation of gas, it is necessary for the gas to be flared initially. Natural gas is considered to be a waste at the point of incineration.

The gas flows will be monitored initially, and if the quantities of gas are considered to be of sufficient quantity a gas engine will be installed to produce electricity for use on site and sell to the national grid. In section 4.4.2. above, we have explained further steps that will be taken by the Operator to amend their management systems to allow them to utilise gas.

The Operator has provided environmental risk assessments, updated the WMP and associated documents to include the flaring operation which includes monitoring.

An air quality assessment has been carried out using our H1 risk assessment tool to determine the impact of incinerating gas and we are satisfied that the contribution of emissions from the proposed flaring at locations closest to the well sites is considered to be insignificant.

The flare operation will be established with a permanent pilot flame using propane as a fuel to maintain the operation of the pilot light. When there is a gas flow from the well it will be directed through a separator before being ignited and combusted. We have reviewed the information submitted and we are satisfied that the design of the flare is appropriate. We are satisfied that the combustion of this natural gas will not result in pollution or harm to human health and that it is not necessary to set emission limits as the operating controls will ensure effective combustion.

We have amended condition 2.1.1 as read with table S1.1 of the permit to impose limits on the total amount of gas that can be flared per day to a maximum of 10 tonnes per day.

The Operator will be required to monitor emissions from incineration activities which will be released into the air. We are satisfied that these measures to minimise the risk of fugitive emissions, together with condition 3.5.1 (c) provide acceptable controls.

## **6.7 Description of the facility and related issues**

As required by the Mining Waste Directive, the Applicant has provided in section 5.4.2. of the Waste Management Plan a justification of the classification of mining waste operations at the site. The proposed operation authorised by the permit involves four classes of “regulated facility” as defined in the Environmental Permitting (England and Wales) Regulations 2016 (EPR). By virtue of the 2016 Regulations, an environmental permit is required for the operation of a regulated facility. These regulated activities are:

- **Non hazardous Mining Waste Operation**

A mining waste operation is defined in Schedule 20 paragraph 2 (1) of Environmental Permitting (England and Wales) Regulations 2016 as 'the management of extractive waste, whether or not involving, a mining waste facility.

The operator has classified the hydrocarbon production, near wellbore treatments and proppant squeeze operation as a Non-Hazardous Mining Waste Operation for the management of extraction waste, whether or not involving a mining waste facility. Non-hazardous extractive waste will be produced during hydrocarbon production, near wellbore treatments and proppant squeeze operations. A permit subject to the Mining Waste Directive covers the management of extracted waste and not the extraction process.

- **Non hazardous Mining Waste Facility**

The regulations define a waste facility as 'any area designated for the accumulation or deposit of extractive waste, whether in a solid or liquid state or in solution or suspension for a period of more than one year for facilities for non-hazardous non-inert waste. The accumulation of proppant carrier fluid which will not return to the surface and will remain within the formation being stimulated is a Non-Hazardous Mining Waste Facility

- An Industrial Emission activity relating to the loading, unloading, handling and storage of crude oil as listed in Schedule 1 section 1.2 Part A(1)(e) to the Environmental Permitting (England and Wales) Regulations 2016.
- A groundwater activity for a single discharge of hydraulic fracturing fluid into the target formation that might lead to an indirect input of pollutants to groundwater. The groundwater activity is defined by the Groundwater Directive and Schedule 22 of the Environmental Permitting (England and Wales) Regulations 2016,

### **6.7.2 Proposed Waste management activities**

The wastes that will or may need to be managed on site are:

#### Well suspension brine

- Chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06 (01 05 08) Non Hazardous
- Estimated Quantity: 25m<sup>3</sup>
- Onsite Storage: 1 x 60m<sup>3</sup> Horizontal Cylindrical Closed Tank
- Storage Duration: Maximum 7 Days

#### Side-track and radial drilling operation: Oil based rock cuttings

- Oil-containing drilling muds and wastes (01 05 05\*) Hazardous
- Estimated Quantity: Side-track = 0.4m<sup>3</sup> Radial = 0.20m<sup>3</sup> per radial drill
- Onsite Storage: 1 x 31m<sup>3</sup> Open Top Fluid Separator Tank (Drill Cuttings) and 1 x 20m<sup>3</sup> Open Top Tank (Centrifuge)
- Storage Duration: Maximum 7 Days

#### Side-track drilling and radial drilling operation: oil based drilling fluid

- Oil-containing drilling muds and wastes (01 05 05\*) - Hazardous
- Estimated Quantity: Side-track = 5m<sup>3</sup> Radial = 1m<sup>3</sup> per radial drill
- Onsite Storage: 1 x 60m<sup>3</sup> Horizontal Cylindrical Closed Tank
- Storage Duration: Maximum 7 Days

#### Cement (Plugging and cementation)

- Concrete (17 01 01) – Non hazardous
- Estimated Quantity: 5m<sup>3</sup>
- Onsite Storage: 6m<sup>3</sup> Open Top Builder's Skip
- Storage Duration: Maximum 7 Days

#### Near wellbore treatment – Spent acid

- 16 10 02 aqueous liquid wastes other than those mentioned in 16 10 01 Non Hazardous
- Estimated Quantity: 50m<sup>3</sup>
- Onsite Storage: 1 x 60m<sup>3</sup> Closed Tank
- Storage Duration: Maximum 7 Days

#### Nitrogen

- Classification: Inert
- EWC Code: Not Applicable
- Estimated Quantity: Not Known at this Time
- Onsite Storage: None – Comingled with the Natural Gas
- Storage Duration: Not Applicable

#### Proppant carrier fluid (retained in formation)

- Wastes from mineral non metalliferous excavation (01 01 02) – Non hazardous
- Wastes from mineral non metalliferous excavation (01 01 02) – Non hazardous
- Estimated Quantity: 180m<sup>3</sup>
- Onsite Storage: Not Applicable
- Storage Duration: Indefinitely

#### Proppant carrier fluid

- Wastes from mineral non metalliferous excavation (01 01 02) – Non hazardous
- Wastes from mineral non metalliferous excavation (01 01 02) – Non Hazardous
- Estimated Quantity: 180m<sup>3</sup>
- Onsite Storage: 1 x Silo

- Storage Duration: Maximum 28 Days

#### Proppant

- Wastes from mineral non metalliferous excavation (01 01 02) – Non hazardous
- Wastes from mineral non metalliferous excavation (01 01 02) – Non Hazardous
- EWC Code: 01 04 09
- Estimated Quantity: 30 Tonnes
- Onsite Storage: 15 x 70m<sup>3</sup> Horizontal Closed Tank
- Storage Duration: Maximum 28 Days

#### Natural gas

- Gases in pressure containers (including halogens) containing dangerous substances. Hazardous (16 05 04\*)
- Estimated Quantity: <14,000m<sup>3</sup> per day
- Onsite Storage: None – Incineration by Ground Flare
- Storage Duration: Not Applicable

We are satisfied that extractive waste has been properly characterised in accordance with Annex II of the Mining Waste Directive.

### **6.8 The following text is a description of how the wastes arise and what will happen to them.**

#### **6.8.1 Well Suspension Brine**

The Wressle 1 well is the subject of a period of suspension using suspension brine and mechanical plugs. Following suspension, any further operations will require the suspension brine to be circulated out of the well to an onsite storage tank via surface pipework. The suspension brine will be stored onsite for subsequent reuse if required for the Wressle-1 well at a later date if the well will need to be suspended again. Once the suspension fluid has fully served its purpose at the well site, the suspension brine will be removed from site via a licenced haulier to an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

#### **6.8.2 Side-track & Radial Drilling Operation: Oil Based Rock Cuttings**

Drilling fluids are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers) into an open top tank, which is also a fluid separator tank. Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well. The ability to prevent or minimise rock cuttings is limited given that the formation needs to be removed to allow the casing to be installed.

The selection of the drilling bit will be such that it minimises the hole size required to install

each string of casing which, in turn, keeps the recovered volumes to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud that coats the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.

Rock cuttings will be transferred from the rock cuttings tank to a sealed road bulker by a hydraulic grab arm fitted to the rock cuttings tank and transported offsite via licenced haulier to a permitted composting facility where it is blended into compost after compost has been sanitised.

### **6.8.3 Side-track & Radial Drilling Operation: Oil Based Drilling Fluid**

Drilling fluids are used to aid in the drilling process by lubricating the drill bit, circulating to surface the rock cuttings from the drilling process and for well control by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of natural gas or formation pressure.

Drilling fluids are used in a closed loop system, within which the rock cuttings are circulated to surface and removed by vibrating screens (shakers). Finer particles of rock cuttings are then extracted from the drilling mud by a centrifuge and the drilling mud is circulated back down the well. Drilling fluid waste is minimised by continually reusing the mud in a closed loop system and sustained by way of filtering out rock cuttings and finer particles of rock.

The rock cuttings tank is a fluid separator tank with a perforated false floor which allows drilling fluid that coats the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system. Whenever the low toxicity oil based drilling mud weight exceeds the prescribed mud weight, due to finer particles of rock cuttings in the mud, the drilling mud needs to be centrifuged, which is performed onsite.

Drilling fluids are used in a closed loop system onsite. Low toxicity oil based drilling fluids do not become a waste when no longer required for use in the operation, as they are returned to the supplier for reuse. Only a small volume of low toxicity oil based mud, contaminated with clean up fluid results from rig tank and equipment cleaning, which is transferred to a vacuum tanker for removal offsite via licenced haulier to a permitted disposal facility.

### **6.8.4 Cement (Plugging and Abandonment Cementation)**

On completion of hydrocarbon production from the well, it is plugged and abandoned. Careful planning will be taken prior to commencement of any cementing operation, allowing the Operator to calculate the amount of cement required thus preventing or minimising cement waste.

The cement will be batch mixed to allow control of quantities being used, which further prevents and/or minimises cement waste. The cement operation will be undertaken by a competent contractor to reduce the amount of potential wastes produced from the returns

to surface. The amount of waste cement expected is to be minimal.

Excess returns to surface will be transferred to a number of open top builders' skips onsite for subsequent removal and disposal to an Environment Agency permitted waste facility where it is recycled as building rubble for reuse within the building industry.

### **6.8.5 Near Wellbore Treatment – Spent Acid**

Acid is used for near well bore treatments to remove production-resisting completion-induced formation matrix damage as described in section 4.2.1 above. As the acid reacts with minerals within the formation the chemical reaction produces a near neutral solution which is generally mildly acidic.

The solution produced as part of the reaction with the minerals will be lifted out of the wellbore into a closed tank and stored onsite for subsequent removal via a licenced haulier to an Environment Agency permitted waste water treatment works facility where it is processed, treated and discharged in accordance with the permitted controls of the water treatment facility.

The acid will be used in stages to ensure its use is minimised. The reaction of the acid with minerals produces a generally mildly acidic solution. This reaction, and in turn the waste generated, is unavoidable. Careful planning will be taken prior to any acid squeeze being undertaken to ensure the Operator minimises the amount of acid used, which in turn reduces the amount of waste generated by the operation.

### **6.8.6 Nitrogen**

Nitrogen is injected into the well to aid the initial lifting of wellbore fluids, thus reducing the hydrostatic pressure and allowing hydrocarbons to flow to surface. The use of nitrogen can be classified as a closed loop system, having first been extracted from the atmosphere during its manufacturing process and subsequently released to atmosphere. The quantities of nitrogen required are small and a detailed measurement cannot be provided at this stage. As an inert gas, nitrogen that has been extracted from the atmosphere will be comingled with any natural gas that flows to surface, where it will be combusted. Unburnt nitrogen will be released to atmosphere during the natural gas combustion process.

### **6.8.7 Proppant Carrier Fluid Retained in Formation**

It is anticipated that up to 50% of proppant fluid will return to surface as flow back fluid during the conventional fracturing process. The remaining fluid will be retained within the Millstone Grit Formation and, as such, these have been classified as a Non-Hazardous Mining Waste Facility. We consider these predictions to be accurate.

The Applicant provided a site plan ER-EPRA-W1-SP-004 which indicates the aerial extent of the Non-Hazardous Mining Waste Facility. We have imposed condition 2.2.2. that restricts the location of the facility to the proposed location and is based on the maximum

anticipated fracture length. The base of the well is approximately 1,140m southwest of the surface location, which for clarity, is the top of the borehole within the Wressle 1 well site.

The amount of fracturing fluid used (and therefore the proportion left behind) for each fracturing event will be affected by the geological and physical characteristics of the target formation and will be limited to 120m<sup>3</sup>.

When the injected fluid left behind no longer serves a useful purpose it will become extractive waste. Retained fluid will be made up of a mixture of the injected proppant fluids and formation water. The Applicant has provided full details of the components of the proppant fluid and we are satisfied that it will be non-hazardous. We are therefore satisfied that the fluid that will be retained underground is properly classified for the purpose of the Mining Waste Directive as non-hazardous and is correctly assigned an absolute non-hazardous List of Waste code. However, given the general level of interest in this activity we have also considered in detail the composition of the fluid.

Formation water will contain dissolved salts and methane. We are satisfied that retained fluid will not have any of the properties that would render it hazardous under the Waste Framework Directive. Over time, the retained fluid will become indistinguishable from the formation water already in the target formation.

As a result of the retention of proppant fluid within the Millstone Grit Formation being classified as a Mining Waste Facility, there is a requirement, through assessment, to establish BAT for the management of the retained proppant fluid. The Applicant has provided a BAT justification in section 5.3.4.2 of the Waste Management Plan. The options considered as part of the BAT assessment include:

- Recovery of all proppant carrier fluid over prolonged flow back periods during hydrocarbon production;
- Increased recovery of proppant fluid using artificial lifting (submersible pumps);
- Recovery of proppant fluid by excavation; and
- Retention of proppant fluid within the formation.

The BAT assessment identified that both the prolonged flow back periods and artificial lift are unlikely to result in a 100% recovery of proppant fluid from the formation.

The development of a mine would create significant extractive waste, the volume of which would far exceed the volume of waste the development seeks to retrieve from the target formation. This option offers no environmental benefit and would cause significant local amenity impacts and disruption to the local community. Economically, the development of a mine would render the exploration and subsequent production of hydrocarbons from the Ashover Grit unit unviable.

As it is not feasible to retrieve 100% flow back, either by a prolonged flow back period or by artificial lift and the removal of proppant fluid by excavation is not feasible, retention within the formation is considered BAT. The alternative options are unrealistic and/or theoretical in nature. Injected proppant fluid, retained at depth, does not present a credible environmental risk.

Proppant retained within the formation prevents the fractures from closing and provides the permeability for hydrocarbons to flow. As the proppant fulfils a purpose, it is not considered a waste.

Recovery by excavation is not feasible due to the depth of formation within which the fluid is retained. Such methods of excavation would have a significant environmental impact. This would involve the development of a mineshaft considerably wider than the original Wressle-1 borehole to a depth of circa 1,576mTVD, sufficiently large enough to accommodate structural supports for safety against collapse and of entry of necessary personnel, machinery and supplies.

We have reviewed the justification for disposing of this waste by permanent deposit within the target formation (section 5.3.4.2 of the Waste Management Plan).

We are therefore satisfied that leaving the retained fluid in situ within the formation is the Best Available Technique. We have carefully considered the protection of groundwater, which is dealt with in section 8.5 below.

As required by the Mining Waste Directive, the Applicant has provided in section 4.2.2 of the Waste Management Plan, a justification of why this Mining Waste Facility will not be classified as a Category A Mining Waste Facility in accordance with the criteria in Annex III of the Mining Waste Directive.

Annex III provides that a waste facility shall be classified under Category A if:

- a) a failure or incorrect operation, e.g. the collapse of a heap or the bursting of a dam, could give rise to a major accident, on the basis of a risk assessment taking into account factors such as the present or future size, the location and the environmental impact of the waste facility; or
- b) it contains waste classified as hazardous under Directive 91/689/EEC above a certain threshold; or
- c) it contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold.

In relation to point a, loss of structural integrity/incorrect operation, the Applicant has assessed the non-hazardous mining waste facility against the effects resulting from loss of structural integrity or incorrect operation of the non-hazardous mining waste facility (the deposit of retained fluid within the target formation).

The Applicant has concluded, and we agree, that there is no risk of a major accident, i.e. involving significant loss of life, serious danger to human health or serious danger to the environment based on the fact that the Mining Waste Facility is to be located more than a kilometre underground and will not be accessible to people, and there is no relevant source-pathway-receptor chain.

Additionally, well construction will form a barrier to prevent escape of waste retained fluids

via the wellbore from the Mining Waste Facility.

Well integrity is assured through compliance with the well examination regime and regulation by the Health and Safety Executive, and further through conformance to Oil & Gas UK and UK Onshore Operators' Group good practice guidelines for well design and construction. A hydraulic fracturing plan will be submitted to Oil and Gas Authority (OGA) and the Environment Agency for approval prior to commencement of the hydraulic fracturing operation.

The potential for fractures that are propagated by hydraulic fracturing to extend beyond the target formation has been assessed to be very low and the extent of fractures resulting from the fracturing stage will be assessed with the aid of calibrated geomechanical modelling using the result of the injectivity test.

Only substances approved by the Environment Agency as non-hazardous to groundwater will be used as fracturing fluid additives. If they wish to use any other additive, this will need our prior written approval.

The detailed consideration of the subsurface geology that has been undertaken as part of the Waste Management Plan and the Site Condition Report has assessed the potential for retained fluids within the Millstone Grit Formation to migrate upwards into contact with any groundwater bearing formations. This outcome has been assessed as very low and with no plausible pathway (Site Condition Report, Appendix 2 Hydrogeological Risk Assessment).

In relation to point b, hazardous waste above the threshold, the waste fluids present in the Mining Waste Facility at closure of the Mining Waste Operation at the site may contain naturally occurring radioactive materials and other dissolved minerals salts. With regard to the threshold referred to in the second indent of Annex III of Directive 2006/21/EC, Commission Decision 2009/337/EC provides that it is calculated as the ratio of the weight on a dry matter basis of:

- (a) all waste classified as hazardous in accordance with Directive 91/689/EEC and expected to be present in the facility at the end of the planned period of operation; and
- (b) waste expected to be present in the facility at the end of the planned period of operation.

We are satisfied that the waste has been properly characterised as non-hazardous waste. In relation to point 3, dangerous Substances, a waste facility is required to be classified as Category A if it contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold. We have assessed all proppants to be used as non-hazardous and not dangerous and have concluded that no dangerous substances above the thresholds contained in Directives 67/548/EEC or 1999/45/EC are likely to be present.

We are therefore satisfied that this justification is appropriate and in accordance with the

Mining Waste Directive.

#### **6.8.8 Proppant Carrier Fluid Retrieved as Flow-back fluid**

Due to the nature of the Millstone Grit Formation, it is anticipated that approximately up to 50% of the injected fluid for each proppant squeeze is predicted to return as flow-back fluid to the surface. We consider these predictions to be accurate.

We are satisfied with the Applicant's proposals to minimise the overall quantity of waste arising from this process.

The permit requires that any fracturing fluid that is injected, must not cause pollution of groundwater. We would not approve the use of any hazardous additive.

The permit includes a requirement for the Operator to monitor the composition of the hydraulic fracturing fluid (which may include flow-back fluid), in particular to demonstrate that no hazardous additives have been used. The monitoring results will be made available to the Environment Agency and will be available on the Public Register.

There is a prohibition on injecting flowback fluids for disposal purposes. Flow-back fluid will be sent to an appropriately permitted waste facility for treatment or disposal.

#### **6.8.9 Proppant**

Flow-back fluid will contain proppant (resin-coated ceramic) which is removed at surface. The quantity of proppant used is determined by the required composition of the proppant fluid. Proppant retained within the formation is not classified as a waste as it serves the purpose of 'propping' fractures within the formation.

The proppant will be transported offsite via licensed haulier to an Environment Agency permitted composting facility, where it is blended into compost after compost has been sanitised. When the injected fluid left behind no longer serves a useful purpose it will be treated as extractive waste. Retained fluid will be made up of a mixture of the injected proppant fluid and formation water.

The Applicant has provided full details of the components of the hydraulic fluid and we are satisfied that it will be non-hazardous. We are therefore satisfied that the fluid that will be retained underground is properly classified for the purpose of the Mining Waste Directive as non-hazardous and is correctly assigned an absolute non-hazardous List of Waste code. However, given the general level of interest in this activity we have also considered in detail the composition of the fluid.

### **6.8.10 Natural Gas**

During production operations there is a likelihood of natural gas being produced from the formation and flowed at different rates to determine the characteristics of the formation, allowing the Operator to determine whether or not the reservoir is capable of producing commercial quantities of natural gas. The ability to prevent or minimise natural gas is extremely limited during this operation as it is required to allow the Operator to determine the condition and state of the reservoir. Given that the operation involves production, consideration has been given to the longer term, where there are a number of options in terms of management of associated or produced gas, which depend on the volumes of gas, the cost and timescale options if volumes are significant, and longevity (i.e. for how long gas would last). Natural gas is separated from produced fluids at surface and diverted via pipework to an enclosed ground flare located onsite for incineration.

The ground flare will be fitted with a pilot and an electrical ignition system. The flare will also be continuously propane fed to allow for a continuous flame. If natural gas is produced at commercially viable quantities incineration of natural gas will only occur as a safety precaution or if residual gas is present which cannot be used.

There is a requirement to prevent or minimise the generation of waste. We are satisfied that it would not be feasible to use the gas on site or by way of connection to the national grid during the initial production phases when the Operator is evaluating the quantities of gas that can be flowed. The enclosed ground flare proposed for use at the site meets our recommended BAT.

### **6.8.11 Scale**

Scale that may accumulate in equipment used for production will be regarded as radioactive waste and managed in accordance with the existing radioactive substances activities permit (Ref: EPR/HB3295DH) issued on 6th October 2014

### **6.8.12 Description of Groundwater Activity**

The permit includes the authorisation of a groundwater activity, namely the discharge of fracturing fluid into the target formation, which might lead to an indirect input of pollutants to groundwater. In section 8.5 we explain our consideration of groundwater issues.

## **7. General Issues**

### **7.1 Administrative issues**

We are satisfied that the Applicant is the person who will have control over the operation of the facility after we issue the permit variation in line with our Regulatory Guidance Note RGN 1: *Understanding the meaning of Operator (version 4.0)*; and that the Applicant will be able to operate the regulated facility in compliance with the conditions included in the permit.

### **7.2 Management**

Having considered the information submitted in the Application, we are satisfied that appropriate management systems and management structures will be in place.

### **7.3 Financial competence and relevant convictions**

We are satisfied that sufficient financial resources are available to the Operator to ensure compliance with the permit conditions.

The Operator does not have any relevant convictions.

### **7.4 External Emergency Plan**

As the activity does not involve a hazardous waste facility, there is no requirement for an External Emergency Plan.

### **7.5 Site security**

Having considered the information submitted in the Application, we are satisfied that appropriate infrastructure and procedures will be in place to ensure that the site remains secure. This is part of the written management system for the permit, condition 1.1.1 a.

### **7.6 Accident management**

Having considered the information submitted in the application, we are satisfied that appropriate measures will be in place to ensure that environmental accidents that may cause pollution are prevented but that, if they should occur, their consequences are minimised. This is part of the written management system for the permit, required by condition 1.1.1 a.

## **7.7 Surrender of the permit**

When the Operator wants to surrender their permit, they have to satisfy us that the necessary measures have been taken to:

- Avoid any on-going pollution risk resulting from operation of the facility; and
- To return the site to a satisfactory state, having regard to the state of the site before the activity was put into operation.

We will not grant any application for surrender unless and until we are satisfied that these requirements have been complied with.

## **8. Environmental Issues and their control**

This section of the document explains how we have approached the critical issue of assessing the likely impact of the operation on human health and the environment. It also details the measures we require to ensure a high level of protection. The principal potential emissions are those to air, water and land.

The key issues arising in relation to human health and the environment during this determination were:

- Protection of groundwater;
- Emissions to air;
- Odour;
- Noise;
- Contamination of land;
- Water quality.

The detail in this section relates to how we determined these issues.

### **8.1 Assessment of environmental impacts**

We are satisfied that the Operator has properly assessed the risk posed by the proposed activity. The risks identified are detailed in the Operator's risk assessment. This covers assessments of risks to surface, ground and air. We have reviewed the Operator's assessments of the environmental risk from the operations. The Operator's risk assessments are satisfactory and we are satisfied that proper mitigation measures will be in place to comply with the requirements of this Permit...

### **8.2. Scope of consideration**

#### **8.2.1. Nature Conservation**

##### **Protected areas**

We have considered the location of the site, the activity taking place and the materials likely to be present within the extractive waste in order to set suitable conditions and limits in the permit.

The well site is within the relevant screening distance criteria for a Site of Special Scientific Interest, (SSSI); Broughton Far Wood is located approximately 650 metres to the west of the site. Broughton Far Wood SSSI is part of an extensive block of mixed deciduous commercial woodland and calcareous grassland.

There is a woodland, a road and farmland separating the site and the SSSI referred to above. Given that none of the proposed activities will be carried in or near the SSSI, the proposed activities are unlikely to damage the features of special interest for the SSSI.

Due to the distance from the site's operations and the pollution prevention measures in place, including an impermeable membrane that extends over the entire fenced working area and underlies the perimeter drains, we consider that the management of the solid and liquid wastes will not affect the protected species and habitats and will not damage the special features of the SSSI.

We consulted Natural England on our assessment and they agreed with our conclusion that the proposed activities should not have significant impact on the designated interest features of Humber Estuary SAC/SPA/Ramsar, Broughton Alder Wood SSSI or Broughton Far Wood SSSI.

### **Protected species**

The Ella Beck is known to be a migratory route for European eel (*Anguilla Anguilla*) Only clean surface water which would have been treated through an interceptor would be discharged only during the rainy periods when there are ongoing operations at the site. We are satisfied that there won't be any adverse impact to the Ella Beck from any discharge of clean surface water through an oil interceptor. Surface water during drilling and the groundwater activity is being collected and disposed off site.

### **8.3. Waste Management Plan**

Under the Mining Waste Directive (Article 5) an Operator of a mining waste operation must draw up a waste management plan (**WMP**) for the minimisation, treatment, recovery and disposal of extractive waste. We have assessed the Applicant's waste management plan. The waste management plan references other documents which together fulfil requirements of Article 5 of the MWD and ensure that the requirements in Article 4 are also met. We have approved the plan as whole, subject to conditions in the permit. We are satisfied the permit requirements including the WMP will protect the environment and that Article 4 and 5 of the MWD are met.

Wastes arising from the activities will be recovered where possible. It also characterises each waste type. We are satisfied that waste is correctly characterised taking into account the definition in Article 3 of the Waste Framework Directive.

The WMP including any associated documents are incorporated into the permit by means of condition 2.3.1 and table S1.2. The WMP needs to be reviewed every 5 years but in the unlikely event that the activities give rise to pollution, condition 2.3.1 enables us to require a revision of the plan to be submitted to us for approval and thereafter implemented. Condition 2.3.2 is a standard condition and refers to an extended time period. The mining waste operation is expected to last for at least a 15 year period.

## 8.4. Setting permit conditions

We have set conditions in the permit in accordance with our Regulatory Guidance Series, RGN Number 4 – *Setting standards for environmental protection (version 3.0)*. This guidance note explains how we determine the requirements that should apply to a particular activity. Permit conditions specify certain key measures for that type of activity to protect the environment. Other measures may be required through outcome-based conditions. Outcome based conditions specify what we want the Operator to achieve, but do not tell them how to achieve it.

We have used the relevant generic conditions from our bespoke permit template along with other, activity-specific conditions to ensure that the permit provides the appropriate standards of environmental protection.

Our generic conditions allow us to deal with common regulatory issues in a consistent way and help us to be consistent across the different types of regulated facility. We have included our generic conditions on fugitive emissions, odour and noise/ vibration to control emissions from the facility.

## 8.5 Protection of groundwater

We have reviewed the Environmental Risk Assessment and the Site Condition Report, against our information and conceptual understanding of the location. We are satisfied that the potential risks to groundwater have been adequately identified and addressed through mitigation measures in the permit.

Groundwater is defined in the Environmental Permitting Regulations 2016 (EPR 2016) as all water that is below the surface of the ground in the saturation zone and in contact with the ground or subsoil (Regulation 2(1)). There are no restrictions on the quality of the groundwater or the depth of the geological formation that contains that groundwater.

The Environment Agency has determined that the Millstone Grit formation will contain groundwater, and although the formation will have a relatively low permeability due to the depth of burial, the water content is considered to meet the definition of groundwater as defined in the EPR 2016.

We have evaluated whether a Groundwater Activity Permit is required for any of the proposed activities using the definition of groundwater activity set out in paragraph (3)(1) of Schedule 22 to the EPR 2016. A groundwater activity is:

- a) The discharge of a pollutant that results in the direct input of that pollutant to groundwater
- b) A discharge of a pollutant that results in or might lead to a direct or indirect input to groundwater;

- c) any other discharge that might lead to a direct or indirect input of a pollutant to groundwater;
- d) an activity in respect of which a notice under Schedule 22 has taken effect;
- e) an activity that might lead to a discharge mentioned above where that activity is carried on as part of the operation of a regulated facility of another class.

We have determined that a Groundwater Activity Permit is required for the hydraulic fracture of the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation and we are satisfied that the necessary investigations have been properly carried out. This Permit sets out control measures that will control the way non-hazardous pollutants are discharged into the Ashover Grit and Chatsworth Grit units during the fracture process. The control measures will ensure that the non-hazardous pollutants are contained in the Ashover Grit and Chatsworth Grit units in the Millstone Grit Formation.

At this location, the geological structure of the rocks is an elongate dome structure known as a structural trap. The structural trap consists of coarser grained and more permeable sandstones and grits (Brigg Sandstone, Chatsworth Grit, Ashover Grit and the Raventhorpe Sandstone) separated by fine grained low permeability clay stone, mudstone and siltstones. These all form the Millstone Grit Formation. The existing Wressle 1 well penetrates the Millstone Grit Formation and is located between 1530m true vertical depth and 1792m true vertical depth.

The sandstones and grits of the Millstone Grit Formation will contain groundwater. The Millstone Grit will have a relatively low permeability due to depth of burial, the water content is considered to meet the definition of groundwater as defined in EPR. The Millstone Grit Group is classed as a Secondary A aquifer under the Environment Agency's Groundwater Protection, Principles and Practice (GP3). The Millstone Grit Formation is not abstracted in the Wressle area because it is located between 1530m true vertical depth and 1792m true vertical depth.

The Millstone Grit will contain fluid, however it is likely to be of very poor quality as it has been trapped for thousands of years and is isolated from the fresh hydrological cycle at the surface. The fluids will be highly saline because of the significant time period to dissolve minerals from the rock matrix as there is no inflow and no discharge area from these rocks to circulate. The fluids will also have a significant hydrocarbon content having been associated with the oil within.

Petrophysical logging and well testing undertaken by the operator in 2015 confirm the permeable units in the Millstone Grit Formation penetrated by the Wressle 1 well contain oil and no groundwater was produced from well testing. Therefore at this location and for the extent of the area that the activity is proposed to cover, the Ashover Grit and the Chatsworth Grit do not contain groundwater.

Figure 5.4 of the WMP shows the 'proppant squeeze' is proposed to extend 40m laterally from the wellbore into the Ashover Grit. The 'proppant squeeze' is also predicted to extend 20m vertically above and below the perforations in the Ashover Grit. The fracture

will therefore extend vertically above the Ashover Grit and through the overlying low permeability clay stones, siltstones and mudstones into the Chatsworth Grit.

The closest point at which groundwater is expected to be present in the Ashover Grit is at the base of the syncline referred to as the structural spill point in the WMP and SCR. Based on Figure 5.2 of the WMP and SCR this is a minimum distance of approximately 330m from the wellbore. The fracturing fluid will therefore be contained in the oil bearing parts of the Ashover Grit and Chatsworth Grit and the interbedded clay stones, siltstones and mudstones in between that do not contain groundwater.

The chemicals proposed for the groundwater activity are listed in Appendix 3 of the Waste Management Plan. The corresponding Material Safety Data Sheets have been included in the Wellbore Fluids – Production, Near Wellbore Treatments and Proppant Squeeze Operations Document. All chemical components of the stimulation fluid have been assessed as non-hazardous to groundwater in accordance with the JAGDAG methodology

### **8.5.1. Groundwater Activity Conditions**

The Groundwater Activity Permit conditions are designed to ensure that the activities are controlled to limit the discharge of non-hazardous pollutants to groundwater in the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation.

The Permit contains conditions which are protective of the water environment as a whole:

- the hydraulic fracturing fluid will only contain additives that have been assessed by us as non-hazardous. We have imposed a pre-operational condition which requires the operator to establish baseline groundwater quality.
- We have also imposed condition 3.51 (a) and (b) to monitor groundwater and surface water during and after operations on site, at specific points as listed in tables S3.1 and 3.2 in the Permit.
- The Wressle 1 well will be integrity tested prior to the hydraulic fracture commencing to ensure the well is fit for purpose.
- The Applicant will be required to submit a Hydraulic Fracture Plan which will need to be approved by the Oil and Gas Authority and the Environment Agency. The Hydraulic Fracture Plan will include, but not limited to:
  - a map showing faults near the well and along the well path, with a summary assessment of faulting and formation stresses in the area and the risk that the operations could reactivate existing faults ;
  - information on the historical seismicity and assessment of the risk of induced seismicity;
  - summary of the planned operations, including stages, pumping pressures and volumes
  - the processes and procedures that will be put in place before or during hydraulic fracturing to identify the vertical and horizontal extents of the fractures within the target formation and ensure that they are not near the permitted boundary;

- in the event that the fractures extend beyond the permit boundary, the steps that would be taken to assess and if necessary mitigate the effect and limit further propagation outside the target rocks;
- a comparison of proposed activity to any previous operations and relationship to historical seismicity;
- proposed measures to monitor local seismicity during the operations;
- proposed reporting during hydraulic fracturing and proposals for post fracturing reporting of the location, orientation and extent of the induced fractures to demonstrate that the permit has been complied with.

In addition to the above, the Hydraulic Fracture Plan will include, details of the geomechanical modelling used to predict the extent of the proposed proppant squeeze fracture. The details are to include a statement of all the parameters and their values that affect the modelled fracture extent, and the sources of those values. These will include values for in-situ stresses, rock strengths, injection pressures and volumes, and injection fluid viscosity.

The Hydraulic Fracture Plan will also show how new values for model parameters discovered during testing of the well will be incorporated in the model, and how proppant squeeze injection parameters will be adjusted to maintain the actual fracture extent to be within that originally proposed. Details of these parameters are to be made available to the Environment Agency when finalized.

### **8.5.2. Drilling**

We have reviewed the drilling additives to be used in drilling the sidetrack and are satisfied that they do not present a risk to the groundwater quality in any of the formations.

The drilling of the sidetrack and will be done from the existing Wressle 1 well within the Ashover Grit unit.

One 25m side-track well starting above the Ashover Grit to be the base of the grit is proposed to be drilled using oil based drilling fluids. Radial drilling of two holes 51mm in diameter and up to 100m in length with oil based drilling fluids is also proposed using a high velocity fluid jet which drills out through the existing 4<sup>1/2</sup>" casing at 2,010 m measured depth below rotary table (m MDRT) in the Ashover Grit.

Only those additives that have been identified in the approved operating techniques referred to in condition 2.3 and Schedule 1, table S1.2 of the permit can be used, and any deviation from this list will require prior approval from us.

We have evaluated the use of low toxicity oil based muds (LTOBM). We would consider that the use of oil based drilling muds, in this site specific instance, to comply with the groundwater activity exclusion under the EPR (paragraph 3(3) (b) of Schedule 22) in that any discharge to groundwater that may occur would be of a quantity and concentration so

small as to obviate any present or future danger of deterioration in the quality of any receiving groundwater and that a permit will not be required.

We have determined that a Groundwater Activity Permit is required for the hydraulic fracture of the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation and we are satisfied that the necessary investigations have been properly carried out. This Permit sets out control measures that will control the way non-hazardous pollutants are discharged into the Ashover Grit and Chatsworth Grit units during the fracture process. The control measures will ensure that the non-hazardous pollutants are contained in the Ashover Grit and Chatsworth Grit units in the Millstone Grit Formation.

### **8.5.3. Acid Squeeze**

The chemicals that are proposed to be used in the acid squeeze have been provided in the Wellbore Fluids - Production, Near Wellbore Treatments and Proppant Squeeze Operations Document. It is proposed to apply the acid to the near wellbore formation matrix at a pressure not exceeding the fracture pressure of the formation. The purpose of the acid squeeze is to break down debris in the near wellbore area caused from the original drilling operation and recover it increasing the near hole permeability.

The acid squeeze will use dilute 10 – 15% hydrochloric acid, 20 m<sup>3</sup> of hydrofluoric acid solution with corrosion inhibitor and 20 m<sup>3</sup> of 3 – 5% of ammonium chloride containing up to 10% ethylene glycol monobutyl ether.

Ammonium chloride, ammonium bifluoride and ethylene glycol monobutyl ether have been assessed as non-hazardous to groundwater. The corrosion inhibitor has been assessed as a hazardous substance. The acid may be further displaced with a low toxicity based oil which replaces the ammonium chloride.

The acid reacts with the minerals in the Ashover Grit and produces a near neutral solution. The solution will be fully recovered and returned to the surface.

We would consider that the acid squeeze, in this site specific instance, to comply with the groundwater activity exclusion under the EPR (paragraph 3(3) (b) of Schedule 22) in that any discharge to groundwater that may occur would be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of any receiving groundwater and that a permit will not be required.

#### **8.5.4. Solvent Treatment**

The solvent treatment will consist of a maximum of 20 m<sup>3</sup> of ethylene glycol monobutyl ether being pumped down the well and into the near wellbore formation to dissolve wax precipitates in this area and the production tubing. The chemicals proposed for the solvent treatment have been included in the Wellbore Fluids Document ER-EPRA-W1-009. Ethylene glycol monobutyl ether, the blend of non-ionic surfactants, dispersants and corrosion inhibitors blended with organic acids, Citric Acid and D-limonene have been assessed as non-hazardous pollutants.

We would consider any movement of the solvent into the formation to be trivial and the quantity and concentration of the treatment would be so small that the discharge would meet the exclusion qualifying criteria detailed in paragraph 3(3) (b) of Schedule 22 to EPR. The solvent treatment therefore does not require a groundwater activity permit.

#### **8.5.5 Hot Oil Wash**

Heated oil originally from the formation would be injected down the well, and circulated to dissolve paraffin precipitates. All hot oil will be recovered and none will be discharged into the reservoir formation. We would consider this not to pose a significant risk to groundwater. This would not be a groundwater activity.

#### **8.5.6 Nitrogen Lift**

Nitrogen may be injected into the wellbore to displace wellbore fluids reducing the hydrostatic weight allowing hydrocarbons to flow to the surface. The volume of nitrogen used is monitored and no nitrogen remains in the formation.

#### **8.5.8. Impact of side track drilling on nearby water supplies**

The oil well at the permitted site was constructed in summer 2014 and tested between January and March 2015. A side-track borehole will be drilled from the existing wellbore, just above the Ashover Grit unit to beyond the reservoir at 2,025mMRDT. The objective of the side-track would be to intersect the hydrocarbon bearing formation that may have formation damage present, and would be a short drilled length out of the existing casing of approximately 25m in length by a 3 ¾" diameter, extending out of the existing 4 ½" steel liner.

The Environment Agency has assessed the risk of drilling the proposed side-track. Under Section 199 of the Water Resources Act 1991 (as amended by the Water Act 2003), a notice of the intention to construct or extend a boring for the purpose of searching for or extracting minerals must be submitted to the Environment Agency using form WR11. The WR11 requires that a method statement, including drilling and casing design, together with storage and use of chemicals and drilling fluids, accompanies the WR11 application form.

The Wressle1 well was the subject of a WR11 application prior to the drilling of the wellbore

in 2014. In addition, a second WR11 application will be made to the Environment Agency in due course as and when it is the intention of Egdon Resources to undertake a sidetrack drilling operation from the existing Wressle 1 well.

We have noted that there are British Steel abstraction boreholes at Clap Gate Pump House approximately 380 to 400 m east of the oil well. The oil well is located outside of the SPZ assigned to the boreholes at Clap Gate Pump house. The SPZ is designed to protect certain types of groundwater abstractions from potential sources of contamination.

The construction of the oil well site includes a geosynthetic clay liner beneath the surface mounted infrastructure. This is designed to prevent the ingress rainfall and any potential contaminants beneath the site.

The existing well was constructed in accordance with the DCR Regulations and Borehole Sites and Operations Regulations 1995. The drilling of the side-track is subject to scrutiny by the HSE, who were consulted over this application.

The HSE are responsible for ensuring that the oil well has been constructed appropriately and confirming the details of how the well is isolated from the near surface aquifers that are for their groundwater abstraction. The side-track borehole will also be constructed in accordance with the requirements of the HSE and the Petroleum Exploration and Development Licence and will be designed in accordance with industry best practice and in compliance with the Installation and Wells (Design and Construction) Regulations 1996 (DCR). DCR requires the design of the well to be such that no unplanned escape of fluids can occur.

A requirement for this oil well to go into production is that there should be shallow and deep monitoring of groundwater quality. The deeper monitoring is proposed to take place from the Lincolnshire Limestone which is the principal aquifer from which groundwater is abstracted in the area.

We have imposed permit conditions which require the operator to implement a groundwater monitoring plan. We have imposed conditions 3.1.3, 3.5.1 and 3.5.7 which requires the Operator to implement the approved groundwater monitoring plan. This plan requires them to monitor ground water quality so as to ensure that there is no deterioration in groundwater quality. The Operator can only use additives that have been assessed and approved by the Environment Agency or equivalent alternatives subsequently approved. Assessment and approval is also required prior to the use of any other additive during the activities if the Operator needs to use different additives for operational reasons.

The Operator's own monitoring will include the monitoring of any loss or gain of fluids within the mud system throughout drilling, and appropriate actions to be taken.

### **8.5.9 Groundwater Monitoring**

The Applicant has provided a plan for monitoring ground water quality. We have imposed conditions 3.1.3, 3.5.1 and 3.5.7 which requires the Operator to implement the approved groundwater monitoring plan. We have put a condition requiring the Operator to carry out a baseline survey of groundwater quality at least three months before the commencement of the hydraulic fracturing activity and submit the results to the Environment Agency. The Applicant will continue to monitor groundwater quality at the same locations that the baseline measurements were taken.

Groundwater monitoring will be carried out monthly prior to the activities commencing, weekly during active operations (drilling and fracturing) and then monthly thereafter.

The Operator will keep records of the data collected, which will be submitted to the Environment Agency on a regular basis.

### **8.6 Fugitive aerial emissions**

We have considered emissions to air during the determination of the application. Fugitive emissions associated with the proposed activities will be at insignificant levels which are unlikely to cause negative impact on nearby receptors. The operator proposes to use an enclosed ground flare to incinerate any waste gas that may arise. We consider an enclosed ground flare as meeting our standards for BAT.

In the long term, should there be a stable flow of gas that can sustain power generation, the applicant intends to install an engine to generate electricity and feed it onto the national grid. In the interim, the operator will flare any gas arising and will assess the level of gas flows so as to determine the possibility of using the gas to produce electricity. The Operator has provided environmental risk assessments and consideration in the WMP for the management of waste gas and we have found these to be satisfactory.

### **8.7 Dust and particulate emissions**

The flare activity does not generate dust or particulates which may affect any of the sensitive receptors close to the site. No further assessment of PM10 was necessary.

### **8.8. Odour**

We have considered potential odour emissions from the activity during our determination. We do not consider that the activity will give rise to significant levels of odour. The use of the proposed BAT compliant enclosed ground flare, with automatic control of combustion temperature provides satisfactory mechanisms to prevent odour emissions. Condition 3.3.1 in the permit requires that emissions from the activities shall be free from odour at levels likely to cause pollution outside the site.

We are satisfied that appropriate measures will be in place to manage odour. However, we have included condition 3.3.2 in the permit. This condition enables us to require the

Operator to submit a specific odour management plan, should odour become a problem. If a plan be required in the future, once we have assessed this plan as suitable, it will form part of the permit and the Operator must carry out the activity in accordance with the approved techniques.

### **8.9. Noise and vibration**

We have considered emissions from noise and vibration during our determination. Condition 3.4 in the permit requires that emissions from the activities shall be free of noise and vibration at levels likely to cause pollution outside the site.

We have included condition 3.4.2 in the permit. This condition enables us to require the Operator to submit a specific noise and vibration management plan, should noise and vibration become a problem. If a plan be required in the future, once we have assessed this plan as suitable, it will form part of the permit and the Operator must carry out the activity in accordance with the approved techniques.

### **8.10 Surface and groundwater monitoring**

The applicant has provided a site management and monitoring plan and in order to demonstrate that the activities are not causing pollution, we have included this monitoring in the permit.

During operations all the discharges from site will be contained and prevented from entering the nearby Ella Beck. The nearest WFD water body is Ancholme from Bishop Bridge to the Humber (GB104029067520) as no discharges are to be made during operation the WFD status should remain unaffected from surface water sources. When drilling has ceased surface water will be discharged through an interceptor. We would not have expected this surface water discharge to impact upon the WFD status of the nearest water body or cause any deterioration of the Ella Beck.

### **8.11 Air emission monitoring:**

Acidification and Toxic Contamination could occur from the potential release of SO<sub>2</sub> and NO<sub>x</sub> into the atmosphere during flaring.

Monitoring of the point source emissions involves continuous measurement of the gas flow through the flare, the combustion temperature, and the gas composition. From this data the emissions from the flare can be derived, i.e. oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), volatile organic compounds (VOCs). The permit requires the Operator to monitor emissions from the flare.

Condition 3.5 of the permit requires the operator to monitor the input to the flare and assess by calculation the emissions to air. The Operator is required to continuously monitor the feed gas flow rate and analyse periodic samples of the feed gas to determine its composition, which includes at a minimum methane, low molecular weight organic suite, BTEX and hydrogen sulphide.

The flare efficiency is known from technical specification provided by the flare supplier. It is not possible to directly monitor combustion efficiency, but combustion temperature will be used as a surrogate indicator and also as a control parameter to ensure that the efficiency is maintained at its design value.

Using the parameters above, the operator is required to assess point source emissions which will be released into the air from incineration of gas. The Operator will keep records of the data collected, which must be submitted to the Environment Agency on a regular basis.

## **8.12 Ambient Air Monitoring:**

When the permit was originally granted, conditions of the permit required the Operator to monitor air quality periodically and submit reports on air quality. The results of monitoring have been submitted and are appended to the site condition report. The activities must not result in a deterioration of the air quality.

Condition 3.5 of the permit requires the operator to continue monitoring air quality in the same locations from where measurements were taken from during the exploration phase. This level of assessment will demonstrate whether the combustion is working at the correct level of efficiency to minimise harmful emissions.

## **General considerations**

### **8.13 Site stability**

The management of waste is limited to waste generated from the proposed drilling operations and well stimulation activities. Although the proppant squeeze does involve the injection of approximately 80 to 120m<sup>3</sup> of fluid under pressure of up to 9000psi for up to 2 hours to create fractures in the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation, this process is a single activity that will be done at a depth of between 1,500 to 1700 metres below ground. In addition, the fractures created by this process are small, which at up to 40 metres in extent, are at the lowest end of hydraulic fracturing spectrum and are most unlikely to affect the stability of the site.

The management of waste is limited to waste generated from prospecting without well stimulation. Any waste stored on site will be limited to extractive waste, temporarily stored in secure containment pending collection as part of the process of being transported off site or alternatively the flaring of gas. There will be no issues about the stability of the waste.

### 8.13. Seismicity

We have also considered the risk from induced seismicity on well integrity. The proposed activities are at the lowest end of the pressure spectrum associated with conventional hydraulic fracturing and are therefore unlikely to induce any seismic movements in the area. The permit requires the Operator to submit for approval the Hydraulic Fracture Plan as outlined in section 8.5.1.

Amongst other things, the hydraulic fracturing plan will contain information on:

- the historical seismicity and assessment of the risk of induced seismicity;
- summary of the planned operations, including stages, pumping pressures and volumes
- an assessment of the anticipated extent of fracturing resulting from injection and proposed method for confirming the validity of the model
- a comparison of proposed activity to any previous operations and relationship to historical seismicity;
- proposed measures to monitor local seismicity during the operations; and
- proposed methods for limiting fracture height.

For high volume hydraulic fracturing, the Operator is also required by OGA to monitor seismic activity during and after the conventional fracturing process and follow a “traffic light” system that controls whether injection can proceed or not, based on these checks. Any hydraulic fracturing must stop when tremors higher than the threshold agreed in the approved hydraulic fracturing plan are detected, and ground motions monitored. . However OGA’s guidance states that less information may be required for a small volume hydraulic stimulation of a conventional target.

The details of the monitoring of seismic activity are part of the hydraulic fracturing plan that the Operator is required to provide for Environment Agency approval as part of the pre-operational conditions in the permit prior to any hydraulic fracturing starting. The approved plan must be implemented unless otherwise agreed in writing.

## **9. Other Legal Requirements**

### **9.1 Mining Waste Directive 2006/21/EC**

In this section we explain how we have addressed other relevant legal requirements under the Mining Waste Directive, to the extent that we have not addressed them elsewhere in this document.

#### **9.1.1 Article 4 – General requirements**

Article 4 sets out requirements for the protection of the environment and human health which apply to the management of extractive waste. Under the Environmental Permitting (England and Wales) Regulations 2016 an environmental permit is required for a mining waste operation, which is defined as the management of waste whether or not it involves a waste facility. It is through the permit and the conditions imposed that we are satisfied that the provisions of Article 4 will be met.

#### **9.1.2 Article 5 - Waste management plan**

This includes the requirement for the Operator to provide a waste management plan and the information required within this. The waste management plan, including associated documents, has been assessed in accordance with these requirements and is approved subject to conditions. Condition 2.3.1 ensures that the operations are limited to those described in the WMP and in table S1.2. It also ensures that the Operator follows the techniques set out and that any deviation will require our written approval. Any significant changes will require a formal variation of the permit. Where a condition imposes a specific requirement that will take precedence over anything in the plan.

#### **9.1.3 Article 6 – Major accident prevention**

We are satisfied that the proposed activities do not involve a Mining Waste Facility which should be classified as a Category A facility.

#### **9.1.4 Article 7 – Application for a permit**

The permit covers the management of extractive waste and includes a Mining Waste Facility as defined in the MWD. The Application contained all necessary elements in Article 7(2) relevant to this site. We are satisfied that the requirements in Article 7(3) are met.

### **9.1.5 Article 8 – Public participation**

Through our consultation procedure we are satisfied that the public have been informed as required by Article 8 and that we have made available the information set out in Article 8(2). We have provided the public with the ability to express comments and opinions to us before a decision has been taken and the results of the consultation will be taken into account in deciding whether to grant this permit.

### **9.1.6 Article 9 – Classification system for waste facilities**

We are satisfied that there is no waste facility that should be classified as a category A facility. Although the waste facility in respect of the on-site storage of waste will contain hazardous waste during the operational phase, no waste is expected to be present at the end of the planned period of operation.

### **9.1.7 Article 10 - Excavation voids**

There is a requirement under this Article for the Operator to take appropriate measures in order to secure the stability of the extractive waste, prevent the pollution of soil, surface water and groundwater and ensure the monitoring of the extractive waste and the excavation void when placing extractive waste into excavation voids.

We are satisfied that the Operator will comply with the relevant requirements based on the information provided and the conditions in the permit.

### **9.1.8 Article 11- Construction and management of facilities**

This outlines a requirement for the facility to be suitably constructed, managed and maintained to ensure its physical stability and to prevent pollution and contamination of soil, air, surface water and groundwater. Under this article there is a requirement for suitable plans and arrangements for regular monitoring and inspection of the facility by competent persons.

We are satisfied that the operator will comply with these requirements, based on the information provided and the conditions in the permit.

### **9.1.9. Article 13 - Prevention of water status deterioration, air and soil pollution**

We are required, as the competent authority, to be satisfied that the Operator has taken the necessary measures in order to meet environmental standards, particularly to prevent deterioration of current water status.

We are satisfied that the Operator will comply with these requirements based on the information provided and the conditions in the permit.

#### **9.1.10 Article 14 - Financial Guarantee**

Article 14 requires the provision of a financial guarantee, in respect of a waste facility, to ensure funds are available to meet the obligations of the permit and to rehabilitate the site when operations finish. We will require a financial guarantee to be provided in respect of the area designated for the accumulation or deposit of hazardous waste stored at the surface before any permit is issued to satisfy this requirement.

In respect of the waste facility relating to waste fluid left in the formation, we are satisfied that this waste is properly characterised as non hazardous waste. By virtue of paragraph 9(3) of Schedule 20 to the Environmental Permitting (England and Wales) Regulations 2016 the requirements mentioned in Article 2(3) of the MWD are waived. These requirements include the need for a financial guarantee for non hazardous waste, unless deposited in a Category A facility. So no financial guarantee can be required in respect of the fluid left in the target formation.

## **Further legislation**

### **9.2. Industrial Emissions Directive (IED)**

We have addressed the requirements of the IED in the body of this document above. The specific requirements of Chapter IV only apply to waste incineration plant burning solid or liquid waste and so do not apply here where the waste is gaseous.

There is one requirement not addressed above, which is that contained in Article 5(3) IED. Article 5(3) requires that “In the case of a new installation or a substantial change where Article 4 of Directive 85/337/EC (the EIA Directive) applies, any relevant information obtained or conclusion arrived at pursuant to articles 5, 6 and 7 of that Directive shall be examined and used for the purposes of granting the permit.”

**9.2.1. Article 5** of EIA Directive relates to the obligation on developers to supply the information set out in Annex IV of the Directive when making an application for development consent.

**9.2.2. Article 6(1)** requires Member States to ensure that the authorities likely to be concerned by a development by reason of their specific environmental responsibilities are consulted on the Environmental Statement and the request for development consent.

**9.2.3 Article 6(2)-6(6)** makes provision for public consultation on applications for Development consent.

**9.2.4 Article 7** relates to projects with transboundary effects and consequential obligations to consult with affected Member States.

The grant or refusal of development consent is a matter for the relevant local minerals planning authority. The Environment Agency's obligation is therefore to examine and use any relevant information obtained or conclusion arrived at by the local planning authorities pursuant to those EIA Directive articles.

In determining the Application we have considered the Environmental Statement submitted with the planning application to which the Environment Agency were consulted on. The response of the Environment Agency to the local planning authority was made in its role as consultee to the planning process.

We have complied with our obligation under Article 9(2). From consideration of the Environmental Statement and our response as consultee to the planning process we are satisfied that no additional or different permit conditions are necessary.

The Environment Agency has also carried out its own consultation on the Environmental Permitting Application. The results of our consultation are described elsewhere in this decision document.

### **9.3. Schedule 22 to the EPR 2016 – Water Framework and Groundwater Daughter Directives**

To the extent that it might lead to a discharge of pollutants to groundwater (a “groundwater activity” under the EPR 2016), the Permit is subject to the requirements of Schedule 22, which delivers the requirements of EU Directives relating to pollution of groundwater. The Permit will require the taking of all necessary measures to prevent the input of any hazardous substances to groundwater, and to limit the input of non- hazardous pollutants into groundwater so as to ensure such pollutants do not cause pollution, and satisfy the requirements of paragraph 6 of Schedule 22 and Article 6(1) Groundwater Daughter Directive.

### **9.4 Directive 2003/35/EC – The Public Participation Directive**

Regulation 59 of the EPR 2016 requires the Environment Agency to prepare and publish a statement of its policies for complying with its public participation duties. We have published our public participation statement.

This Application is being consulted upon, in line with that statement, as well as with our guidance RGS6 on Sites of High Public Interest, which addresses specifically extended consultation arrangements for determinations where public interest is particularly high. This satisfies the requirements of the Public Participation Directive.

Our draft decision in this case has been reached following a programme of extended public consultation, both on the original application and later, separately, on this draft permit and a draft decision document. The way in which this has been done is set out in Section 2. A summary of the responses received to our consultations and our consideration of them is set out in Annex 1.

## **9.5 Section 4 Environment Act 1995 ( pursuit of sustainable development)**

We are required to contribute towards achieving sustainable development, as considered appropriate by Ministers and set out in guidance issued to us. The Secretary of State for Environment, Food and Rural Affairs has issued *The Environment Agency's Objectives and Contribution to Sustainable Development: Statutory Guidance (December 2002)*. That document:

*“provides guidance to the Environment Agency on such matters as the formulation of approaches that the Environment Agency should take to its work, decisions about priorities for the Environment Agency and the allocation of our resources. It is not directly applicable to individual regulatory decisions of the Environment Agency.”*

The guidance contains objectives in relation to the Environment Agency's operational functions and corporate strategy. Some of these objectives relate to the Environment Agency's wider role in waste management and strategy. In respect of the management of extractive waste, the guidance notes state that the Environment Agency should pursue the following objective:

*“to prevent or reduce as far as possible any adverse effects on the environment as well as any resultant risk to human health from the management of waste from the quarrying and mineral extraction industries.”*

In respect of water quality, the Environment Agency is required to: *‘protect, enhance and restore the environmental quality of inland and coastal surface water and groundwater, and in particular:*

- *To address both point source and diffuse pollution;*
- *To implement the EC Water Framework Directive; and to ensure that all relevant quality standards are met.’*

In respect of regulation of industrial pollution through the EPR, the Guidance refers in particular to the objective of setting permit conditions *“in a consistent and proportionate fashion based on Best Available Techniques and taking into account all relevant matters...”*.

The Environment Agency considers that it has pursued the objectives set out in the Government's guidance, where relevant, and that there are no additional conditions that should be included in this Permit to take account of the Section 4 duty

## **9.6 Section 5 Environment Act 1995 (preventing or minimising effects of pollution to the environment)**

We are satisfied that our pollution control powers have been exercised for the purpose of preventing or minimising, or remedying or mitigating the effects of pollution of the environment in accordance with section 5 of the Environment Act 1995.

Section 6 Environment Act 1995 (conservation duties with regard to water)

Consideration has been given to our duty to promote the conservation and enhancement of the natural beauty and amenity of inland waters and the land associated with such waters, and the conservation of flora and fauna which are dependent on an aquatic environment.

We do not consider that any conditions additional to those in the permit are required.

## **9.7 Section 7 Environment Act 1995 (pursuit of conservation interests)**

Section 7(1)(c) of the Environment Act 1995 places a duty on us, when considering any proposal relating to our functions, to have regard amongst others to any effect which the proposals would have on the beauty and amenity of any urban or rural area.

We do not consider that any conditions additional to those in the permit are required to meet this duty. The structures that could affect visual amenity will be the drilling rig and the flare. The drilling rig is temporary in nature. Any visual impact will be limited. In addition, this issue will be addressed through the planning process, for which we are statutory consultees.

## **9.8 Section 81 Environment Act 1995**

The site is not within a designated Air Quality Management Area.

We consider that we have taken our decision in compliance with the National Air Quality Strategy and that there are no additional or different conditions that should be included in this permit.

## **9.9 Section 40 Natural Environment and Rural Communities Act 2006**

Section 40 places a duty on us to have regard, so far as it is consistent with the proper exercise of our functions, to conserving biodiversity. 'Conserving biodiversity' includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat. We have done so and consider that no conditions additional or different to those in the permit are required.

### **9.10 Section 23 of the Local Democracy, Economic Development and Construction Act 2009**

Section 23 requires us, where we consider it appropriate, to take such steps as we consider appropriate to secure the involvement of interested persons in the exercise of our functions by providing them with information, consulting them or involving them in any other way. Section 24 requires us to have regard to any Secretary of State guidance as to how we should do that.

The way in which the Environment Agency has consulted with the public and other interested parties is set out in this document. The way in which we have taken account of the representations we have received is set out in annex 1. Our public consultation duties are also set out in the Environmental Permitting (England and Wales) Regulations 2016, and our statutory Public Participation Statement, which implement the requirements of the Public Participation Directive. In addition to meeting our consultation responsibilities, we have also taken account of our guidance in Environment Agency Guidance Note RGS6 and the Environment Agency's Building Trust with Communities toolkit.

### **9.11 Water Environment (Water Framework Directive) (England and Wales) Regulations 2003**

Consideration has been given to whether any additional requirements should be imposed in terms of the Environment Agency's duty under regulation 3 to secure compliance with the requirements of the Water Framework Directive through (inter alia) environmental permits, but we consider that existing conditions are sufficient in this regard, and no other appropriate requirements have been identified.

### **9.12 Human Rights Act 1998**

We have considered any potential interference with rights under the European Convention on Human Rights in reaching our decision and consider that our decision is compatible with our duties under the Human Rights Act 1998. In particular, we have considered the right to life (Article 2), the right to a fair trial (Article 6), the right to respect for private and family life (Article 8) and the right to protection of property (Article 1, First Protocol). We do not believe that Convention rights are engaged in relation to this determination and to the extent that they may be, any interference with those rights is justified.

### **9.13 Countryside and Rights of Way Act 2000 (CROW 2000)**

Section 85 of this Act imposes a duty on Environment Agency to have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty (AONB). There is no AONB which could be affected by the mining waste operation, groundwater activity or gas incineration activity.

## 9.14 Wildlife and Countryside Act 1981

Under section 28G of the Wildlife and Countryside Act 1981 the Environment Agency has a duty to take reasonable steps to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which a site is of special scientific interest. Under section 28I the Environment Agency has a duty to consult Natural England in relation to any permit that is likely to damage SSSIs.

We have assessed the application and concluded that there will be no likely damage to any SSSIs - see section 7.2 and 7.6 of this document.

The Conservation of Habitats and Species Regulations 2016

We have assessed the Application in accordance with guidance agreed jointly with Natural England and concluded that there will be no likely significant effect on any European Site.

We acknowledge that there could be a potential impact on air quality from the incineration of the waste gas and this impact has been fully assessed and is detailed in section 7.6 of this document. Following our assessment we are satisfied that there will be no likely significant effect on the statutory conservation sites (SPA/Ramsars/SSSI) from air emissions. We presented our assessment and conclusion to Natural England on an Appendix 11 form (Habitats Directive: Form for recording likely significant effect) for information. Natural England responded, agreeing with our conclusions.

## 10. Improvement and Pre-operational conditions:

The draft permit contains 1 improvement condition and 3 pre-operational conditions that require the Operator to carry out works, gather data and provide reports prior to certain activities starting. The Operator must have written approval from the Environment Agency prior to the specified activities starting and must implement the approved measures/procedures once they have been agreed.

The following tables lists all of the improvement and pre-operational conditions and explains why we have imposed them:

<b>Table S1.3 Improvement conditions</b>	
<b>Reference</b>	<b>Pre-operational measures</b>
IP 1	i) Within 2 months of the approval of this variation notice, the operator shall submit to the Environment Agency for approval a written Site Shut Down procedure to be adopted in case of emergency and obtain the Environment Agency's written approval to it.

**Table S1.4 Pre-operational measures**

<p><b>PO1</b></p>	<p>At least 2 months prior to commencement of activities referenced A4 in Table S1.1 the Operator shall submit to the Environment Agency for approval a written Hydraulic Fracturing Plan and obtain the Environment Agency's written approval to it. The plan must include :</p> <ol style="list-style-type: none"> <li>1) a map showing faults near the well and along the well path, with a summary assessment of faulting and formation stresses in the area and the risk that the operations could reactivate existing faults ;</li> <li>2) information on the historical seismicity and assessment of the risk of induced seismicity;</li> <li>3) summary of the planned operations, including stages, pumping pressures and volumes;</li> <li>4) the processes and procedures that will be put in place before or during hydraulic fracturing to identify the vertical and horizontal extents of the fractures within the target formation and ensure that they are not near the permitted boundary;</li> <li>5) in the event that the fractures extend beyond the permit boundary, the steps that would be taken to assess and if necessary mitigate the effect and limit further propagation outside the target rocks;</li> <li>6) a comparison of proposed activity to any previous operations and relationship to historical seismicity;</li> <li>7) proposed measures to monitor local seismicity during the operations;</li> <li>8) proposed reporting during hydraulic fracturing and your proposals for post fracturing reporting of the location, orientation and extent of the induced fractures to demonstrate that the permit has been complied with.</li> </ol>	
<p><b>PO2</b></p>	<p>The Operator shall undertake baseline monitoring for groundwater from each monitoring borehole monthly for a period of at least 3 months. The sampling for this baseline monitoring must include the parameters listed below, as a minimum. The results of the groundwater monitoring shall be submitted to the Environment Agency prior to the commencement of groundwater activities referenced A3 and A4 in Table S1.1 of Schedule 1</p>	
	<p><b>Parameters to be monitored</b></p>	
	<p><b>Earth metals</b></p> <p>Calcium, Magnesium, Potassium, Sodium</p>	<p><b>TPH</b></p> <p>(Aliphatics C5-6,&gt;6-8,&gt;8-10,&gt;10-12,&gt;12-16,&gt;16-21,&gt;21-35, 35 - 44) (aromatics &gt;C5-7,&gt;7-8,&gt;8-10,&gt;10-12,&gt;12-16,&gt;16-21,&gt;21-35, 35-44) including Benzene, Toluene, Ethylbenzene, Xylenes/MTBE</p>
	<p><b>Metals</b></p> <p>Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Boron, Aluminium, Barium, Cobalt, Iron, Molybdenum, Manganese, Lead, Antimony, Vanadium, Beryllium, Titanium</p>	
	<p>Chloride</p>	<p>Dissolved methane</p>
	<p>Nitrate as NO3</p>	<p>Bicarbonate Alkalinity</p>
	<p>Nitrite as NO2</p>	<p>Electrical Conductivity</p>
	<p>Ammoniacal Nitrogen as N</p>	<p>pH</p>

**Table S1.4 Pre-operational measures**

	Salinity	Sulphate
	Temperature (°C)	Groundwater Level
	<b>Alcohols</b> Ethyl acetate, i-propyl acetate, methyl acetate, n-butyl acetate, n-propyl acetate, ethyl alcohol(ethanol), i-propyl alcohol(IPA), methyl alcohol(methanol), n-butyl alcohol, n-heptyl alcohol, n-hexyl alcohol, n-propyl alcohol, n-pentyl alcohol	
	<b>Volatile Organic compounds</b>	

**Table S1.4 Pre-operational measures**

<p>Dichlorodifluoromethane</p> <p>1,1,2,2-Tetrachloroethane, Methyl Tertiary Butyl Ether Bromobenzene Chloromethane</p> <p>1,2,3-Trichloropropane,</p> <p>Vinyl Chloride, Propylbenzene, Bromomethane 2-Chlorotoluene, Chloroethane</p> <p>1,3,5-Trimethylbenzene</p> <p>Trichlorofluoromethane</p> <p>4-Chlorotoluene,</p> <p>1,1-Dichloroethene (DCE),</p> <p>tert-Butylbenzene,</p> <p>Dichloromethane (DCM)</p> <p>1,2,4-Trimethylbenzene,</p> <p>trans-1-2-Dichloroethene,</p> <p>sec-Butylbenzene</p> <p>1,1-Dichloroethane</p> <p>4-Isopropyltoluene</p> <p>cis-1-2-Dichloroethene</p> <p>1,3-Dichlorobenzene</p> <p>2,2-Dichloropropane</p> <p>1,4-Dichlorobenzene</p>	<p>1,2-Dibromo-3-chloropropane</p> <p>1,1-Dichloropropene</p> <p>1,2,4-Trichlorobenzene</p> <p>Carbon tetrachloride</p> <p>Hexachlorobutadiene</p> <p>1,2-Dichloroethane</p> <p>Naphthalene, Benzene</p> <p>1,2,3-Trichlorobenzene</p> <p>Trichloroethene (TCE)</p> <p>1,3-Dichloropropane</p> <p>1,2-Dichloropropane</p> <p>Dibromochloromethane</p> <p>Dibromomethane</p> <p>1,2-Dibromoethane</p> <p>Bromodichloromethane</p> <p>Chlorobenzene</p> <p>cis-1-3-Dichloropropene</p> <p>1,1,1,2-Tetrachloroethane</p> <p>Toluene, Ethylbenzene</p> <p>trans-1-3-Dichloropropene</p>
<p><b>Semi-Volatile Organic Compounds</b></p> <p>2-Chlorophenol, 2-Methylphenol</p> <p>2-Nitrophenol,</p> <p>2,4-Dichlorophenol</p> <p>2,4-Dimethylphenol</p> <p>2,4,5-Trichlorophenol</p> <p>2,4,6-Trichlorophenol</p>	<p>Diethyl phthalate</p> <p>Dimethyl phthalate</p> <p>1,2-Dichlorobenzene</p> <p>1,2,4-Trichlorobenzene</p> <p>1,3-Dichlorobenzene</p> <p>1,4-Dichlorobenzene</p>

**Table S1.4 Pre-operational measures**

	<p>4-Chloro-3-methylphenol</p> <p>4-Methylphenol, 4-Nitrophenol</p> <p>Pentachlorophenol, Phenol</p> <p>2-Chloronaphthalene</p> <p>2-Methylnaphthalene</p> <p>Acenaphthene, Acenaphthylene</p> <p>Anthracene, Benzo(a)anthracene</p> <p>Benzo(a)pyrene</p> <p>Benzo(bk)fluoranthene</p> <p>Benzo(ghi)perylene, Chrysene</p> <p>Dibenzo(a,h)anthracene</p> <p>Fluoranthene, Fluorene</p> <p>Indeno(1,2,3-cd)pyrene</p> <p>Naphthalene, Phenanthrene</p>	<p>2-Nitroaniline, 2,4-Dinitrotoluene</p> <p>2,6-Dinitrotoluene, 3-Nitroaniline</p> <p>4-Bromophenylphenylether</p> <p>4-Chloroaniline,</p> <p>4-Chlorophenylphenylether</p> <p>4-Nitroaniline, Azobenzene</p> <p>Bis(2-chloroethoxy)methane</p> <p>Bis(2-chloroethyl)ether</p> <p>Carbazole, Dibenzofuran</p> <p>Hexachlorobenzene</p> <p>Hexachlorobutadiene</p> <p>Hexachlorocyclopentadiene</p> <p>Hexachloroethane</p> <p>Isophorone, N-nitrosodi-n-propylamine,</p>
PO3	The Operator shall provide for approval a method for calculating the emissions from the flare as required by condition 3.5.6 and obtain the Environment Agency's written approval for the method	
PO4	Prior to the commencement of groundwater activity the Operator shall conduct a well integrity test on the existing borehole. The operator shall submit a written report to the Environment Agency including the results of the integrity test carried out, which should include, but is not limited to any comments provided by the Health and Safety executive.	
PO5	Prior to commencement of production, the operator shall provide for approval a method for monitoring volumes of produced waters arising during the production process and location details for the point from where produced water will be monitored.	

# ANNEX 1

## CONSULTATION AND WEB PUBLICISING

**Summary of responses to consultation and web publication and the way in which we have taken these into account in the determination process.**

### **Advertising and consultation on the Application**

The Application has been advertised and consulted upon in accordance with the Environment Agency's Public Participation Statement. The way in which this has been carried out along with the results of our consultation and how we have taken consultation responses into account in reaching our decision is summarised in this Annex. Copies of all consultation responses have been placed on the Environment Agency public registers.

The Application was advertised on GOV.UK website at <https://www.gov.uk/government/publications/dn15-0db-egdon-resources-uk-limited-environmental-permit-application-advertisement/dn15-0db-egdon-resources-uk-limited-environmental-permit-application-advertisement> from 30/06/2016 to 28/07/2016. The advert contained all the information required by the Regulations, including telling people where and when they could see a copy of the Application.

We also placed an advert in the Scunthorpe Telegraph in the edition published on 30/06/2016. We contacted local MPs, local authorities and Parish Councils to notify them of the consultation.

We placed a paper copy of the Application and all other documents relevant to our determination on our Public Register at the local Environment Agency Offices at Waterside House, Waterside North, Lincoln, LN2 5HA.

We also sent a copy of the Application to Broughton Jubilee Library, 59 High Street, Broughton, North Lincolnshire DN20 0JX

We sent copies of the Application to the following bodies, including those with whom we have "Working Together Agreements":

- Local Planning Authority, North Lincolnshire Council
- Mineral Planning Authority, North Lincolnshire Council
- Health and Safety Executive (HSE)
- Public Health England (PHE)
- Director of Public Health

- Natural England

We also liaised with the Oil and Gas Authority on some aspects of the application

These are bodies whose expertise, democratic accountability and/or local knowledge make it appropriate for us to seek their views directly.

We held a public meeting on the 13 July 2016 at Broughton Village Hall to raise local awareness of the permit variation application submitted by Egdon Resources for Wressle Well Site. Residents were able to discuss any concerns with the Environment Agency and partner organisations who were also in attendance, namely: Health & Safety Executive, Oil and Gas Authority, Public Health England and North Lincolnshire Council – Planning Authority.

## **A. Consultation Responses from Statutory and Non-Statutory Bodies**

No objections were received from North Lincolnshire Council who are the Local Planning Authority and Mineral Planning Authority, Health and Safety Executive and Director of Public Health.

### **1) Response received from Natural England, 16/08/2016**

We consulted Natural England on the conclusions that the proposed activities were unlikely to cause adverse impacts on Special Areas of Conservation, Special Protection Areas and Ramsar sites that were within a 10 kilometre radius from the site and Sites of Special Scientific Interest that were within one kilometre of the site.

Natural England concluded that the proposed activities, if permitted were not likely to damage any of the flora, fauna or geological or physiological features which are of special interest to Broughton Alder Wood and Broughton Far Wood Sites of Special Scientific Interest and the Humber Estuary Special Area of Conservation, Humber Estuary Special Protection Area and Humber Estuary Ramsar site. There is no mechanism, hazards or pathways for the features of these designated sites to be affected due to the distance between the permitted site and these sites.

Natural England agreed with our assessment that the proposed activities were not likely to have a significant effect on the Humber Estuary SAC/SPA/Ramsar, Broughton Alder Wood SSSI or Broughton Far Wood SSSI or any designated features of conservation interest for these sites.

**Response received from Public Health England (PHE), 21/07/2016 Summary of issues raised : Monitoring of emissions**

PHE reviewed the application taking into account the evidence drawn from ["A Review of the Potential Public Health Impacts of Exposures and Radioactive Pollutants as a Result of Shale gas Extraction process"](#). This report concludes that "An Assessment of the currently available evidence indicates that the potential risks to public health from exposure to the emissions associated with shale gas extraction will be low if the operations are properly run and regulated. PHE recommended that there be adequate monitoring of emissions to ensure these do not impact upon public health

**Summary of action taken/How this has been addressed**

The proposal is not for shale gas extraction. However we took note of PHE's comments.

We have assessed the potential emissions from the proposed site. We are satisfied that the combustion of the natural gas will not result in pollution or harm to human health and that it is not necessary to set emission limits as the operating controls will ensure effective combustion. We have detailed our consideration of potential emissions in sections 4.5.2., 5.8.3, 5.8.10, 6.6, 6.7, 6.11 and 6.12 to this report. We are satisfied that the appropriate controls are in place and that activities will be properly regulated and not cause pollution or harm to human health. On the permit, we have imposed condition 3.5 which require the operator to monitor and submit monitoring reports on groundwater quality, surface water quality, point source emissions and process emissions. The permit conditions allow us to take regulatory action if we note that the activities are causing environmental pollution.

**Summary of issues raised : Assessment of chemicals**

PHE noted that the target formation for hydrocarbon recovery is significantly below and hydraulically isolated from drinking water aquifers and as such, does not pose a direct pathway to human-health receptors. PHE recommended that all the chemicals to be used for the hydraulic fracturing process to be used be publicly disclosed and risk assessed prior to use. They noted that any potential risk to public health and the environment from hydraulic fracturing chemicals will be dependent on the route of exposure, total amount and concentration, and eventual fate of any such chemicals. It is expected that these aspects will be considered as part of the regulatory environmental permitting process

**Summary of action taken/How this has been addressed**

The approved chemicals are disclosed in Appendix 3 of the approved Waste management plan which contains safety data sheets of proppant carrier fluid. The approved Waste Management Plan is available on our public register. We requested the applicant to provide information on the degradation, bioaccumulation and toxicity to aquatic life and human health for all chemicals proposed for use. We have reviewed the Environmental Risk Assessment. We assessed all the information provided and we have approved the use of only chemicals that are non-hazardous. The operator has been granted planning permission to install 4 monitoring boreholes that will be used to monitor the quality of groundwater. We are satisfied that the potential risks to groundwater have been adequately identified and addressed through mitigation measures and monitoring conditions specified in the permit. See Section 7.5 for more details

**Summary of issues raised : reinjection of water**

PHE noted that the variation application made reference to the possibility to investigate the disposal of waste well water by reinjection into aquifers but no specific details were provided within the application. PHE pointed that evidence from the US suggests that the maintenance of well integrity, including post-operations, and appropriate storage and management of hydraulic fracturing fluids and wastes are important factors in controlling risks and appropriate regulatory control is needed

**Summary of action taken/How this has been addressed**

The variation does not include re-injection of produced waste water as a permitted activity at this site. Any water produced will be stored onsite in storage tanks for later disposal to an EA permitted waste facility. As part of the permit conditions, we have specified in Schedule 1 Table S1.1 on permitted activities that there will be no reinjection of produced water at Wressle 1 well.

**Summary of issues raised : Naturally Occurring Radioactive Materials (NORM)**

PHE recommended that a characterisation of potentially mobilised natural contaminants, including NORM and dissolved minerals was required.

**Summary of action taken/How this has been addressed**

The Operator already has an existing radioactive substances activities permit (Ref: EPR/HB3295DH) issued on 6<sup>th</sup> October 2014 which authorises the Operator to accumulate and dispose of NORM classified as radioactive waste.

## **Consultation responses from Non Governmental Organisations, members of the public and community organisations**

A total of 23 responses were received, of which 4 responses were made by Non Governmental Organisations comprising Lincolnshire Wildlife Trust, Friends of the Earth and Frack Free Lincolnshire Groups. The latter was a grouping of Frack Free Isle of Axholme, Frack Free Kirton-in-Lindsey, Frack Free Lincs and Frack Free Scunthorpe and they made two joint responses.

Although the consultation ended on 28/07/2016, any comments that have been received after the close of the consultation and prior to issue of our minded to position were taken into consideration as part of our determination process.

We can only consider comments which are relevant to the management of the extractive waste arising from the exploration and production for oil and gas, including hydraulic fracturing, groundwater protection as part of a Groundwater Activity Permit, flaring of gas and the storage and handling of crude oil which is what the Application relates to. For consultation comments that relate to matters beyond our regulatory control see section 3 below.

Summaries of the consultation responses and how we have addressed them are as follows:

## **B. CONSULTATION RESPONSES FROM NON GOVERNMENTAL ORGANISATIONS**

### **3. Response from Lincolnshire Wildlife Trust**

#### **Summary of issues raised : Impact on designated nature conservation sites**

The Lincolnshire Wildlife Trust raised concerns that the proposed hydraulic fracturing activities would adversely affect the nearby designated nature conservation sites which included Broughton Far Wood Site of Special Scientific Interest (SSSI), Rowland Plantation Local Wildlife Site (LWS) and BROUGHTON East Wood LWS.

The Trust also recommended that should the Environment Agency be minded to grant a permit it should impose adequate monitoring conditions to ensure any adverse impacts on the environment are recorded and appropriately mitigated.

#### **Summary of action taken/How this has been addressed**

In section 8.2.1 above, we have outlined how we considered the likely impacts of the proposed activities on designated interest features Broughton Far Wood SSSI. Given that none of the proposed activities will be carried out in or near the SSSI, the proposed activities are unlikely to damage the features of special interest for the SSSI.

Due to the distance from the site's operations and the pollution prevention measures in place, including an impermeable membrane that extends over the entire fenced working area and underlies the perimeter drains, we consider that the management of the solid and liquid wastes will not affect the protected species and habitats and will not damage the special features of the SSSI.

We consulted Natural England on our assessment and they agreed with our conclusion that the proposed activities should not have significant impact on the designated interest features of Humber Estuary SAC/SPA/Ramsar, Broughton Alder Wood SSSI or Broughton Far Wood SSSI.

As part of the permit conditions, we have imposed monitoring conditions 3.5 which require the operator to monitor surface water quality, groundwater quality, point source emissions and monitoring emissions. In section 4.2 we have imposed a condition which requires the operator to submit monitoring reports at specified frequencies, which enables us to assess trends and detect deterioration in monitored parameters.

Where we suspect that the permitted activities are giving rise to pollution outside the permitted areas, we have imposed conditions in section 3 that allow us to require the operator to implement an approved plan that mitigate and prevent further deterioration of the environment. In addition we have imposed condition 3.5.4 which require to maintain permanent access to any monitoring points that we may use should it become necessary to carry our own assessments to validate the any results presented to us.

### **4. Friends of the Earth, East Midlands**

### Summary of issues raised

Friends of the Earth objected to the proposed permit variation, citing the following concerns:

- lack of an Environmental Impact Assessment,
- inadequate consideration of the precautionary principle,
- risks to groundwater,
- issues associated with monitoring and liability,
- characterisation of drilling muds and use of acid;
- impacts of flooding and impacts on air quality.

### Summary of action taken/How this has been addressed

We have addressed concerns from this initial response in sections below as part of actions and considerations which we made to responses by other members of the public.

## 5. Frack Free Lincolnshire Groups

### First submission

#### Summary of issues raised

Frack Free Lincolnshire Groups made an initial response and raised concerns on the following issues:

- concerns on lack of clarity on whether the operations involved fracking
- lack of clarity on formation being targeted for exploration as the extent of the fractures which, at estimated length of 40 metres exceeded the width of the Ashover Grit formation, which was the target formation.
- inadequate financial provision being set aside to fund operations to redress any environmental incidents,
- inadequacy of the hydrological risk assessment as it did not assess associated flood risk issues,
- lack of trust of the operator,
- concerns on impacts of repeated well stimulation,
- concerns on water re-injection and disposal,
- lack of water to use, concerns on the use of hydrofluoric acid,
- lack of alarm systems on containment tanks,
- inadequate Environmental Impact Assessment,
- pollution of watercourses,
- deterioration of air quality,

#### Summary of action taken/How this has been addressed

We have addressed concerns from this initial response in sections below as part of actions and considerations which we made to responses by other members of the public.

## **Second submission**

### **Summary of issues raised Inadequate information to assess risks to groundwater**

Frack Free Lincolnshire groups made a second response where they raised concerns that arose in light of information related to the relevant planning permission MIN/2016/810. They contended that when the Environment Agency responded to the planning application consultation and when they consulted the public, the public were not informed of the location of the proposed side-track drilling or where the proppant squeeze and acidisation would take place. Frack Free Lincolnshire Groups stated that the deviated path of the well intersected the eastern edge of the principal aquifer and that the bottom of the well was not hydraulically separated from the nearby geological fault. They were concerned that because of the location of the designated non-hazardous mining waste facility where the proposed well stimulation activities may be carried out over multiple times, there was a risk of the principal aquifer being contaminated by hydrocarbons or wellbore fluids should that could escape via natural or induced fractures and / or a defective or damaged well casing. Frack Free Lincolnshire Groups noted that the Environment Agency and Portsmouth Water have previously objected to a proposal to drill a similar well at Markwells Wood because of concerns about pollution of the overlying aquifer. Frack Free Lincolnshire Groups requested that the Environment Agency either revisit its initial response to North Lincolnshire Council's consultation on the application, or take into account the locations of the site of proposed activities when making a determination of the permit.

### **Summary of action taken/How this has been addressed**

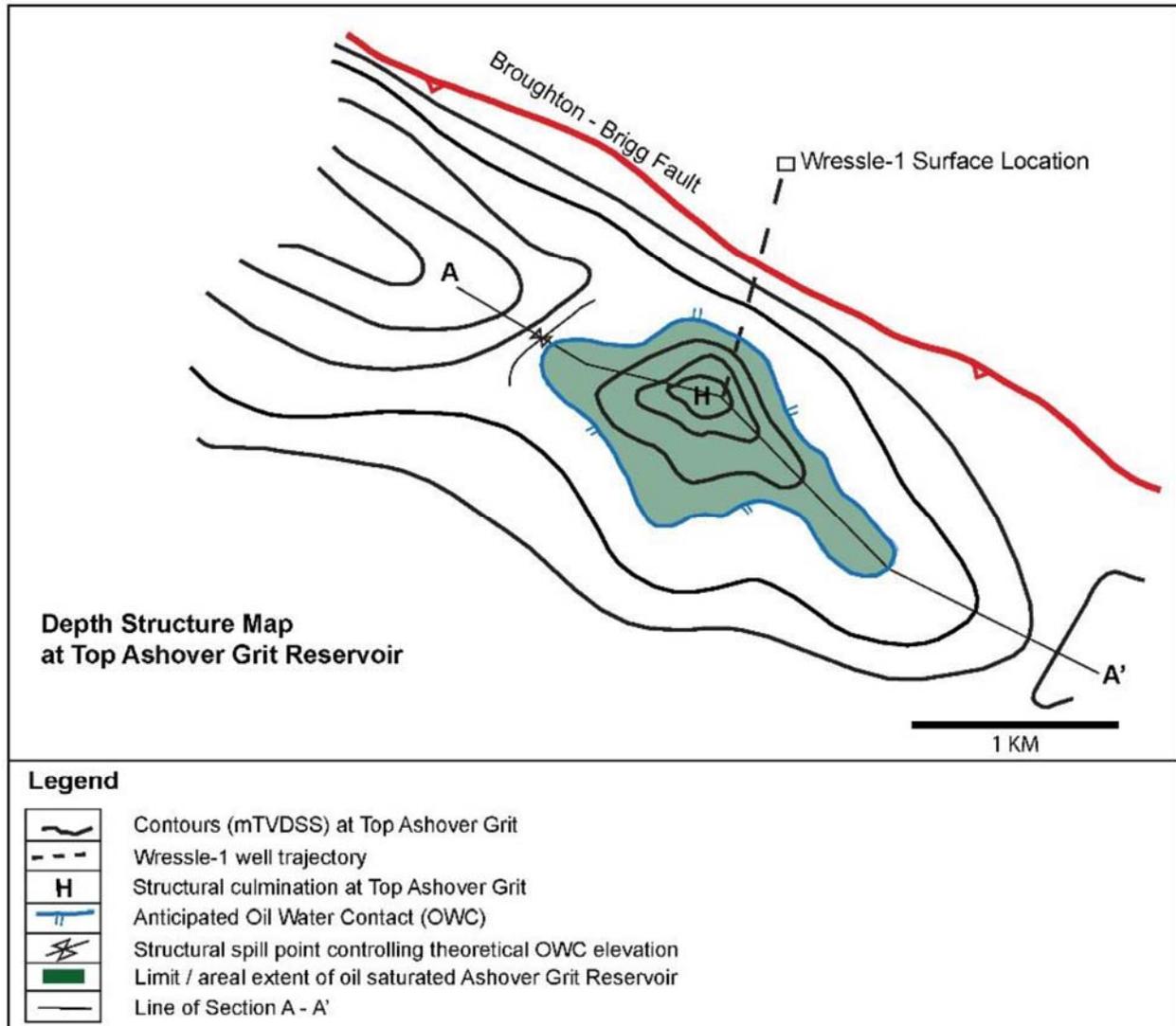
#### **Specification of site location**

When the Environment Agency consulted the public on the permit application, it advertised the application as detailed in section 3 above on "How we took our decision". As part of the consultation we advertised and placed on public register all the supporting documents which included the site plan ER-EPRA-W1-SP-004. The drawing and maps provided in this site plan clearly show the site where all surface and sub-surface operations, including the direction of side track drilling will take place.

The base of the well is approximately 1,140m southwest of the surface location, which for clarity, is the top of the borehole at the Wressle 1 well site marked in green as described above. The location of this non-Hazardous Mining Waste Facility is shown on the site plan ER-EPRA-W1-SP-004 and is marked in red as "Extent of subsurface Mining Waste Facility."

Further clarification of the location where the proposed hydraulic fracturing activities and extent of fractures will take place has been provided in section 5.5.1 of the site condition report ER-EPRA-W1-SCR-006 Rev2. The Wressle-1 well targets a structural hydrocarbon trap formed by an anticline within the Millstone Grit formation at a depth of approximately 1580m true vertical depth (TVD). The hydrocarbon trap at Wressle 1 is a simple four (4) way dip closure forming an elongate dome, running sub-parallel to the Broughton – Brigg fault.

**Map 1. Depth Structure Map at Top non-hazardous mining facility location**



We are satisfied that adequate information on structural geology that can be corroborated with available evidence has been provided for us to describe and define the site where the permitted activities will take place. We did not have any reason to change our advice to the Planning Authority as we had given them adequate information based on available evidence. However we advised the Planning Authority to seek further clarification on proposed activities from the Oil and Gas Authority (OGA). OGA is the strategic body that

licences each drilling and development activity and is also responsible for managing any earthquake risks as well as granting permission to companies to undertake hydraulic fracturing. No exploration or production activity can start without this consent.

We have imposed condition 2 which defines the site plan and specifies the location and formations where the surface and subsurface operations, including the Non-Hazardous Mining Waste Facility, will take place.

We have designated the location where the proppant squeeze will take place as a non-Hazardous Mining Waste Facility as explained in section 5.9. above. An indication of the aerial extent of the Non-Hazardous Mining Waste Facility for the proppant fluid is included within document ER-EPRA-W1-SP-004 and is based on the maximum anticipated fracture length.

### **Assessment of risks to groundwater**

Section 5 of the Waste management plan details how the well was constructed so as to avoid cross contamination between aquifers. The Wressle-1 well targets a structural trap formed by an anticline within the Millstone Grit Formation at a depth of approximately 1580m true vertical depth (TVD). The structural trap comprises a number of permeable formations, including the Brigg Sandstone, Chatsworth Grit, Ashover Grit and the Raventhorpe Sandstone. These permeable formations are separated by a conformable sequences of low permeability interbedded mudstones and siltstones. Petrophysical logging and subsequent testing of the Wressle-1 well conducted by Egdon Resources have demonstrated that all the permeable formations within this structural trap contain hydrocarbons (oil). The main well has been cemented and cased in zones that contain groundwater. The drilling in these areas was done using water based drilling muds.

The principal aquifers are in formations above 500metres whilst the proposed near well bore treatments will be at depths below 1500 metres. The target formation is separated from the principal aquifers by over 1000 metres. The well stimulation activity will be done only once in accordance with conditions of the permit issued. We are satisfied that the proposed one-off proppant squeeze and near well bore treatments, coupled with the cement casing in the water bearing formation, will not cause a risk of cross contamination to the principal aquifers due to the target formations being separated from the principal aquifers. The diagram 1 below illustrates possible areas of contact between hydrocabons and groundwater in relation to the location where proppant squeeze will take place.

In sections below, we have outlined how we took into consideration concerns raised relating to well integrity.

### **Comparison to Markwells Wood**

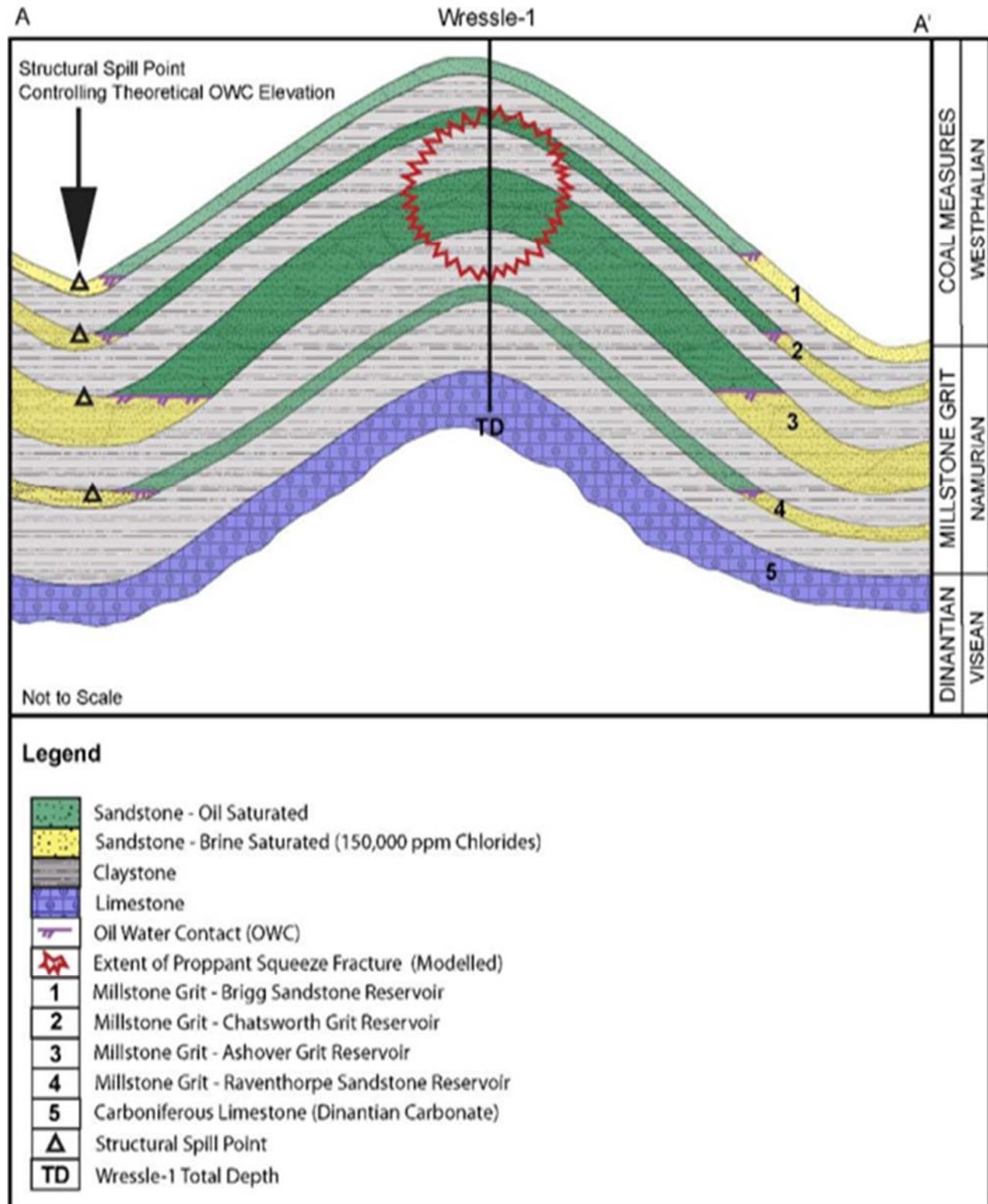
The environmental risk assessment completed for this permit application is specific to the Wressle 1 well site and it takes into account the geology as detailed in the Site Condition Report and the Hydrogeological Risk Assessment. As detailed above, we are satisfied that the risks to groundwater have adequately been assessed and we are satisfied that the Ashover Grit and Chatsworth Grit in the Millstone Grit Formation which is the target geological formation into which the hydraulic fracturing will be carried is adequately buffered from the overlying aquifers. The Millstone Grit Formation which extends from 1,530m TVD GL to 1,792m TVD GL is separated from the overlying aquifers by a depth of over 1000 metres.

### **Precautionary conditions**

In section 7.5 above we have outlined further considerations that we have given in regard to ensuring that there is adequate protection to ground water.

As a precaution we have imposed condition 3.5 requiring the operator to monitor ground water so as to detect any trends that may show a deterioration in water quality. On 13 January 2017, the Operator was granted full planning permission to install four ground water monitoring boreholes at the existing Wressle 1 well site. These boreholes will enable the Operator to comply with our conditions of monitoring the subsurface groundwater activities at the site.

**Diagram 1 : Cross section through hydrocarbon bearing Millstone Grit sequence**



## **C. Consultation responses from the Public and Community Organisations**

### **i) Inadequate flood risk assessment**

Concerns were raised on the level of flood risk assessment that had been carried out as it did not take into consideration information from the recent flood events of 2013. Some respondents noted that the land upstream drains in to the New River Ancholme and after heavy rain the river can rise rather alarmingly until it is appropriate for the gates to be opened at South Ferriby. Concerns were raised that high river levels on River Ancholme, coupled with tidal surges in the Humber estuary and heavy rains upstream could result in devastating flooding of the permitted site, which could result in a spillage of the chemicals and materials that could cause pollution downstream.

We made an assessment as to whether the proposed activities constitute a hazard that could increase flood risk in the area and whether a flood defence permit was required. Environmental permits or exemptions for flood risk activities are required for any proposed works or structures close to (normally within 8m), in, under or over a 'main river'. More information can be found at <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>. The perimeter fence of the site was originally erected when the site was established prior to the grant of the original permit. Any works inside this proposed boundary would not require a permit for flood risk activities. None of the activities proposed will be carried out within the nearby Ella Beck.

We also assessed the risk of flooding to the site based on the latest information that we have. There are instances where a situation called "Tide Lock" could occur when flows in Ancholme River increase after a period of heavy rain which coincide with high tides. In such instances, the gates at South Ferriby may well remain closed as the fluvial flows cannot be discharged as they would be normally. This could then cause Main River flows to back up and could cause localised flooding as a result, as has been noted from concerns raised.

The permitted site is approximately 1450m away from River Ancholme and is located in an area where the likelihood of flooding from rivers, the sea and surface water has been assessed as less than 0.1% (1 in 1,000) chance of occurring in any given year. The likelihood of flooding within the permitted site at lodge farm is estimated as "very low". We are satisfied that the activities covered by the permit variation will not result in an increase in flood risk to the area.

**ii) Lack of clarity on whether the proppant squeeze operations were hydraulic fracturing activities**

Hydraulic fracturing or “fracking” is a technique that uses fluid, usually water, pumped at high pressure into the rock to create narrow fractures which provide paths for the gas to flow into the well bore and to surface. Once the fractures have been created, small particles, usually of sand, are pumped into them; these particles keep the fractures open when the water is flowed back up the well. The water normally contains small quantities of other substances to improve the efficiency of the process, e.g. to reduce friction.

The differences between hydraulic fracturing in conventional oil and gas sites and unconventional oil and gas sites is that in many instances, hydraulic fracturing for unconventional oil and gas takes place at a deeper level than those for conventional oil and gas. Generally it requires more water and chemicals and involves drilling at higher pressures than is common for conventional activities.

The proposed proppant squeeze at Wressle 1 is a small scale hydraulic fracturing at the lowest range of the fracturing spectrum that will be done only once to enhance the productivity of the conventional oil well drilled at Wressle. The process involves pumping a slurry of proppant (resin-coated ceramic) and gelled water through the perforations into the Ashover grit formation of the Millstone Grit Group Formation at a pressure exceeding the fracture propagation pressure of the formation. The fractures will extend from the Ashover Grit into the Chatsworth Grit. The main proppant treatment will consist of approximately 20 to 30 tonnes of resin-coated ceramic beads and approximately 80m<sup>3</sup> to 120m<sup>3</sup> of gelled liquid. The fluid mix is injected at a surface pressure of 9,000psi for 1 to 2 hours, then flowed back through the production facilities in a controlled manner. The fractures create channels through near wellbore formation which would have been blocked as a result of the initial drilling and completion operations.

The proppant squeeze is designed to extend to about 40m in a lateral direction and 20m in a vertical direction, above and below the perforations in the well.

**iii) Fracking for shale gas**

Most respondents raised objections to fracturing for hydrocarbons in shale deposits. One respondent noted that the only and safe responsible thing to do with shale gas is to leave it in the ground. The respondent further noted that Wressle 1 was not part of the “desolate North” which some politicians have stated as being the area suitable for fracking.

The Wressle 1 site is not a shale gas exploration site. It is a conventional oil and gas site. The term ‘unconventional gas’ refers to natural gas which is trapped in deep underground rock formations which are hard to reach, such as shale rock or coal beds. ‘Conventional’ oil fields such as those at Wressle 1 are usually situated in easier to reach layers of rock.

Until recently unconventional gas reserves haven't been exploited because the cost was too high or the technology wasn't available. Technological advances mean it could now be economically viable to extract methane from these sources.

Both conventional and unconventional gases are formed over geological time by thermal conversion of organic material which was trapped in sediment and buried by newer deposits. Over time the sediment turns to rock and the organic material turns to oil and gas.

Conventional oil or gas is found in defined structural or stratigraphic traps into which hydrocarbons have migrated from source rocks. These "reservoirs" into which the gas migrates are usually sandstone or limestone, for instance the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation which is the "reservoir" at Wressle 1.

In contrast shale gas is produced directly from the source rock in which organic matter was deposited which, through the action of heat and pressure; becomes hydrocarbons. These unconventional source rocks tend to be shales or clays. The techniques used to extract hydrocarbons either from source rocks or reservoirs are essentially the same but as the gas flows much less freely through shales than sandstones or limestones the techniques have to be applied in a different way. In particular the shales have to be systematically fractured to enable the gas to flow.

#### **iv) Impacts on Gainsborough trough Bowland Hodder basin shales**

One respondent raised a concern that the proposed activities at Wressle would pollute the Gainsborough Trough Bowland Hodder basin shales.

The permitted site is not within the Gainsborough Trough Bowland Hodder basin shales. We have defined the permitted site where the proposed activities will take place in section 2.2 of the permit. We have also imposed condition 3.2. that prohibits the Operator from emitting substances that cause pollution. The permit empowers the Environment Agency to take regulatory action where pollution incidents arise.

#### **v) Adequacy of the Waste Management Plan and management of spent drilling muds**

Concerns have been raised that the options outlined in the Waste Management Plan for the disposal of spent drilling muds and radioactive waste through a composting facility could result in contamination of land beyond the permitted site.

The accumulation and disposal of radioactive waste has to be carried out in accordance with the conditions of the existing radioactive substances activities permit (Ref: EPR/HB3295DH) issued on 6<sup>th</sup> October 2014. This does not permit the use of a composting facility

#### **vi) Radioactive waste**

Several comments raised concerns on how the radioactive substances generated from the activity will be managed. Any NORM classified as radioactive waste will be managed in accordance with the existing radioactive substances activities permit (Ref: EPR/HB3295DH) issued on 6<sup>th</sup> October 2014.

**vii) Inadequacy of the Waste Management Plan and inadequate controls for flow back fluid**

Concerns have been raised that the Waste Management Plan does not contain an adequate level of information addressing the potential risks associated with chemicals generated from the proposed activities and that there is not enough treatment capacity available to deal with flow back fluid that will be produced from the proposed activities. We have assessed the Waste Management Plan and we are satisfied that the generation of waste will be minimised. Our approval of the Waste Management Plan is subject to conditions, the requirements of any conditions in the permit will override any conflicting details in the Waste Management Plan.

We have assessed the Application and we are satisfied that the waste can safely be dealt with. Capacity is primarily an issue for the Applicant and if an appropriately permitted outlet for the waste cannot be found, the operations will have to stop.

**viii) Reinjection of flow back fluid**

Concerns were raised that some of the flow-back fluid would be disposed of by re-injecting it back into the underground strata, which may eventually cause pollution. Some respondents noted that the Applicant intends to recycle flow back fluid wherever possible. Concerns raised were that the recycling without treatment only enhances the potential for toxic build-up below ground. Flow back fluid is fluid which returns from hydraulic fracturing operations where fresh water has been injected into the formation to create fractures, together with formation water. It is not a naturally occurring fluid, however the minerals that are returned are naturally occurring within the target formation.

The operator is restricted to activities described in the waste management plan, which do not include the reinjection of waste hydraulic fracturing fluid or flow-back fluid to land for disposal.

We have also included a permit condition that prohibits injection of any component of flow back fluid for the purpose of disposal.

## **ix) Nature of chemicals used**

Concerns were raised that the Applicant had not declared fully the nature of some chemicals proposed for use and that we have not fully assessed the proposed chemicals.

The Applicant has not made any claims of confidentiality and has made a full disclosure of the proposed proppant fluid, which is provided in document ER-EPRA-W1-WF-009. In section 4 above we have described how these additives will be used. We have assessed all the chemicals to be used using the determination under new Groundwater Directive 2006/118/E which is followed by JAGDAG. The fluids will be non-hazardous to groundwater and the permit will limit the composition of the fluids to those disclosed in the Waste Management Plan and approved by the Environment Agency. We do not consider that the approved chemicals will cause any environmental harm at the rates and levels of use proposed.

## **x) Potential impact of activity on surface water and groundwater**

There were several concerns that surface water and groundwater may be contaminated by the proposed hydraulic fracturing activities.

We have reviewed the Environmental Risk Assessment and the Hydrogeological Risk Assessment provided by the applicant against our information and conceptual understanding of the location. We are satisfied that the method of well construction, including drilling additives and hydraulic fracturing activities, which are controlled by this permit, will not pose a risk to groundwater or surface water given the mitigation measures required. We are satisfied that drinking water supplies are not at risk.

Source Protection Zones (SPZs) are used as a general level of protection for all drinking water sources, identifying those areas where the risk associated with groundwater contamination is greatest. The well site does not lie within a defined SPZ. However, there are two SPZs relating to the licensed groundwater abstraction at Clap Gate Pumping Station about 400 metres to the east and Birdhouse Clough pumping station to the southeast of the well site.

The Waste Management Plan (WMP) and the Environmental Risk Assessment specify the pollution prevention measures that will ensure that surface water and groundwater will be protected. The Waste Management Plan sets out the nature of the fluids to be used in each process of the proposal, their expected volumes and their treatment or disposal, where applicable. These measures are required through conditions in the permit. The Wressle-1 well targets a structural trap formed by an anticline within the Millstone Grit Formation at a depth of approximately 1580m true vertical depth (TVD). The Millstone Grit Formation, which extends from 1,530m TVD GL to 1,792m TVD GL.

This permit variation does not allow reinjection of water at the site. All produced and flow back water will be transported offsite to an Environment Agency licensed disposal site.

The fluid used for hydraulic fracturing will contain only additives that have been assessed as non-hazardous to groundwater, this limitation applies at all times and is enforced through a condition in the permit. The proposed fracturing will be a one off activity.

We are satisfied that measures can be taken to ensure that the fracturing fluids do not migrate from the target formation. We have included a pre-operational condition that provides that hydraulic fracturing shall not commence until we have approved, in writing, the hydraulic fracturing plan, which is referred to in section 2.3.1 of the waste management plan. A stepped approach will allow the geo-mechanical properties of the reservoir to be understood and the hydraulic fracturing programme to be tailored accordingly.

We have included a condition in the permit that provides that the hydraulic fracturing process must be designed and implemented to ensure that any fracturing fluid remains in the target formation, namely the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation, which extends from 1,530m TVD GL to 1,792m TVD GL. The HFP will set out the methodology of a phased approach starting with a low-volume injectivity test, followed by a single injection of 120 m<sup>3</sup>.

The operations will be continually monitored, reviewed and modified to ensure that the programme is carried out in the safest and most effective way. This will include ensuring that the fractures stay within the target formation, as any fractures leaving the target represent a waste of energy and reduce the efficiency of the operation.

It is unlikely that the fracturing fluids, which remain in the ground after the operations are complete, could migrate any distance from the fractures created by the hydraulic fracturing process within the target formation. In order for fluids to move in the rock a driving head would be required to produce a gradient to cause fluid movement. Once the hydraulic fracturing stage is complete the pressure is released to allow the fluid and gas to return to the extraction well and the pressure gradient will be from the rock towards the well. It is expected that up to 50% of the injected fracturing fluid will return to the surface as part of the flow back fluid. Fracturing fluid left behind will have nothing to 'push' it further into the formation. There would be limited potential for fluids to migrate further into the rocks. The sandstones are capable of absorbing some of the fracturing fluid, allowing it to migrate away from the fractures, however the distance over which that migration could occur is small due to the inherent low permeability of the sandstones.

When the wells come to the end of their useful life they will be either suspended or plugged and decommissioned; this process ensures that there is no pressure gradient remaining that could continue to push fluid away from the well locations.

We have assessed the proposed hydraulic fracturing activities and we have concluded that the Applicant requires a groundwater activity permit, see section 8.5 of the decision document above. An assessment of the impacts on groundwater has been reviewed as part of the decision on whether or not a groundwater activity permit should be issued. The decision document outlines how we have made our decision: see section 8.5 Protection of Groundwater.

Protection of surface water is addressed in details in section 8.10 of the decision document.

The operator will be carrying out groundwater monitoring to confirm that there is no pollution of groundwater, as well as monitoring the propagation of the hydraulic fractures they induce to ensure that they remain within the target formation. We are satisfied that both the Waste Management Plan and Environmental Risk Assessment submitted for this application adequately define the risks to groundwater in this location from both the drilling and hydraulic fracturing and that the appropriate mitigation measures to protect the groundwater have been imposed through the permit. See Potential impact of activity on surface water and groundwater section above for more details.

We are satisfied that we have fully assessed the risk to surface water and groundwater and that there will be no unacceptable impact or risk of pollution.

#### **xi) Potential impact on demineralisation plant at British Steelworks**

There were concerns that the proposed activities posed a serious risk that chemicals used in the oil production process could result in the release of hydrocarbons and other contaminants to the ground water. This could have the potential of contaminating groundwater supply to Clap Gate Pumping Station which provided water to the demineralisation plant operated by British Steelworks. There were concerns that the contaminated water could affect supply of pure water to the integrated steelworks, thereby compromising the operations at British Steelworks.

There were also concerns that there is a serious risk that the construction of any oil exploration and/or production borehole at Lodge Farm, Wressle could result in reduction to the water yield at our Clap Gate Pumping station, which will cause an insufficient supply of raw water to British Steelworks. It was feared that a shortage of raw water supply can potentially compromise the viability of the British Steelworks plant nearby.

We have reviewed the environmental risk assessment and site condition report provided, and we are satisfied that the current and proposed activities are not a risk to the operations at British Steelworks. The oil well at Wressle 1 well site was constructed in summer 2014 and tested between January and March 2015. Based on the Environment Agency's own mapping, the British Steelworks abstraction boreholes are approximately 400m east of the existing oil well. The oil well is located outside of the source protection zone (SPZ) assigned to the boreholes at Clap Gate Pumping Station. SPZs are designed to protect certain types of groundwater abstractions from potential sources of contamination.

It should be noted that the construction of the oil well site includes an impermeable membrane beneath the surface-mounted infrastructure. This is designed to prevent the ingress of rainfall and any potential contaminants to beneath the site.

The construction and testing of the oil well itself is subject to scrutiny by the Health and Safety Executive (HSE). HSE can be consulted to provide a determination on whether the well has been constructed appropriately and to confirm the means by which the well is isolated from the near surface aquifer, which British Steel rely on for their groundwater abstraction.

Prior to the well being constructed, the Environment Agency reviewed the proposed construction of the oil well in relation to groundwater protection as part of the determination of the original environmental permit application and under our Water Resources Act duties. As part of our decision on the initial permit application we considered that the well was constructed appropriately to protect groundwater bodies such as the Lincolnshire Limestone which supplies the boreholes in question.

We have imposed condition 3.5.1 which requires the Operator to carry out shallow and deep monitoring of groundwater quality. The deeper monitoring is to take place from the Lincolnshire Limestone, which is the principal aquifer from which groundwater is abstracted in the area. The Operator was granted full planning permission PA/2016/808 on 13/01/2017 which allows them to install 4 boreholes to monitor trends in groundwater quality at the locations specified in approved monitoring plan.

We do not expect a reduction to the water yield at Clap Gate Pumping Station because of the different depths of the strata involved and the isolation measures referred to above.

#### **xii) Overuse of groundwater**

Concerns have been raised that the permitted activity will use large quantities of local groundwater and that this is not a sustainable approach.

The application does not include a proposal to abstract water. Up to only 120m<sup>3</sup> of water will be used for the one-off proppant squeeze. If the applicant wishes to abstract groundwater they will need to apply to the Environment Agency for an abstraction licence and this will be assessed to ensure that any abstraction would not have a detrimental impact on the water environment before a licence could be granted.

#### **xiii) Monitoring (surface water/groundwater/air)**

Concerns were raised as to how the activities will be monitored and what mechanisms will be put in place to ensure that hydraulic fracturing fluids will remain in the target formation and not migrate to other formations.

Conditions of the current permit require the Operator to monitor surface water. The Operator has provided reports of the results of the monitoring that have been carried on site. The varied permit will require the operator to continue monitoring surface water at designated points on Ella Beck.

The Waste Management Plan details the monitoring that the Operator will be carrying out before, during and after the permitted activities are taking place. The permit will limit hydraulic fracturing activities to specific geological formations (Ashover formation in the Ashover Grit and Chatsworth Grit of the Millstone Grit formation). The permit will require groundwater monitoring boreholes to be constructed to monitor the quality of the groundwater beneath the site. The on-going monitoring data will be compared to the baseline data. In the unlikely event that changes in quality are detected that can be attributed to any activities on the site, then action will be required to remediate any impact.

The mechanisms to ensure that hydraulic fracturing fluid remain in the target formation are discussed in detail in section 8.5 of the decision document. The operator is also required to monitor the quality of hydraulic fracturing fluid entering the well. The results of the hydraulic fracture fluid quality, groundwater and surface water monitoring are to be reported to us on a quarterly basis so that we can assess any impact on the surrounding groundwater and surface water quality. Results will also be held on site for inspection at any time.

We have also specified monitoring requirements in the permit. The permit will require groundwater monitoring boreholes to be constructed to monitor the quality of the groundwater beneath the site. The Operator has been granted relevant full planning permission, reference PA/2016/808, which allows the installation of 4 groundwater monitoring boreholes at the existing Wressle well site. The on-going monitoring data will be compared to the baseline data that would be collected prior to commencement of the proppant squeeze operation. In the unlikely event that changes in quality are detected that can be attributed to any activities on the site, then action will be required to remediate any impact. The results of this monitoring will be made available on our public register.

#### **xiv) Suitability of the Risk Assessment**

Concerns have been raised about the adequacy and impartiality of the Applicant's Risk Assessment and whether it identified all the risks and categorised them correctly.

We have reviewed the assessment, and we are satisfied that it complies with our relevant guidance and that it identifies and covers all appropriate risks and that measures are in place to address them.

We have placed the risk assessment on our citizen space consultation portal for people to view and comment on it.

#### **xv) Environmental Impact Assessment**

A number of comments have asked why an Environmental Impact Assessment (EIA) has not been carried out to support the permit application.

An EIA for the proposed activities is not obligatory. An EIA is only required where the planning authority decide the development is likely to have significant effects on the environment which they have not in this case. In any event, we are satisfied that we have sufficient information to determine the application.

#### **xvi) Emergency planning**

A number of comments were made regarding the lack of emergency planning in case of a severe accident on site or health impacts on the local community.

This facility does not meet the criteria for a Category A mining waste facility as detailed in the Mining Waste Directive; as such an emergency plan is not required. However the permit requires the Operator to have an appropriate management system, and we will be checking that they comply with their permit conditions as part of our compliance work. This management plan will include avoidance of accidents, the management of potential accidents and the minimisation of their consequences.

The Health and Safety Executive and Public Health England have been consulted and have not raised any concerns relating to emergency planning.

#### **xvii) Pollution incident plan**

Concerns have been raised that the pollution incident plan has not been made available for the public to comment on.

We have assessed the pollution mitigation measures in the Waste Management Plan and Risk Assessment and we are satisfied that they are appropriate.

However the applicant recognises the need to have internal procedures in place in case of pollution and these will form part of the management system required under condition 1.1.1 of the permit. We check the adequacy of these as part of our compliance work.

We are satisfied we have sufficient information to determine the application.

#### **xviii) Spillages and alarmed storage tanks**

Concerns were raised that the risk from potential spillages had not been adequately addressed by the Applicant in their risk assessment. It was highlighted that there was no commitment by the operator to ensure that there was an alarm system that would be triggered when there was an overflow in storage tanks. Concerns were also raised about potential spillages off-site during transport of the waste waters. The risk assessment includes details of how risks from potential spillages are going to be minimised. The

proposals include the lining of the site with an impermeable membrane to protect the underlying soils and groundwater. The extractive waste transfer and storage activities will take place on an impermeable surface with sealed drainage and containment. All chemicals for use on site during the short duration well operations, including the proppant squeeze, will be stored in temporary secondary containment and located within the existing site, which has been built with an impermeable membrane (bentomat) and containment ditch system. The temporary secondary containment may be formed by means of a bund area created with sleepers and an impermeable membrane liner.

The storage tank system, located within the permanent containment bunding, will be fitted with high fluid level control switches, interlinked to valve systems, which will automatically shut down site operations in the event that the high level control switch is triggered. There will not be an alarm system on the bund itself.

Spillages during transport outside the permitted site boundary are outside the scope of the permit, but are, for waste, subject to other regulatory controls (Duty of Care).

#### **xix) Impact on wildlife**

Concerns were raised that the proposed activities did not give any consideration to wildlife.

We have assessed the risk from the proposed activities as part of our determination and we are satisfied that the activities will not pose a risk to local wildlife populations or to any local wildlife sites or nationally or internationally designated wildlife sites.

We assessed the potential likelihood of the proposed activities to impact on designated nature conservation sites, protected wildlife and habitats and we have outlined our conclusions of these assessments in response to concerns raised by the Lincolnshire Wildlife Trust and section 8.2.1 above.

#### **xx) Human health impacts, including stress**

A number of comments have raised concerns that the activities will cause stress to the local community.

See above in relation to Public Health England comments. Public Health England have raised no objection and we are satisfied that the activities we are permitting will not give rise to any significant pollution or any emissions that will cause harm to human health, and as such there is no objective reason for anyone to be stressed.

## **xxi) Air emissions of gas/fugitive emissions**

Concerns have been raised on how fugitive methane emissions and point source emissions from the flare would be controlled. There were also concerns raised on the effect of the emissions on human health.

Further to the original proposal the Applicant revised their proposal for a flare from that originally permitted and will now use an enclosed ground flare which meets our standards for Best Available Technique. Gas will be flared if it is encountered during the initial well clean-up phase immediately after the well treatments. Gas will also be flared once it starts to flow during production. The permit limits the amount of gas to be flared to less than 10 tonnes per day. As the natural gas flows to surface, the Operator will monitor and record flow rate and pressure, giving them a greater understanding of the likely volume of natural gas in place within the formation.

We recognise that the flaring of gas needs to be controlled and we have included monitoring conditions 3.5.1 and 3.5.6. in the permit requiring the Operator to monitor temperature and feed gas flow rate, and calculate the quantities of oxides of nitrogen, carbon monoxide, and total volatile organic compounds emitted. The operator is required to provide monthly reports of the results.

## **xxii) Light pollution**

Concerns have been raised that the flare will create light pollution which may impact on both local residents and wildlife.

The flare is of an enclosed design and will minimise light emissions; we are satisfied that the use of the flare will not result in light pollution. The use of artificial lights on site is controlled by the planning permission and falls outside of the remit of this permit.

## **xxiii) Noise pollution**

Concerns have been raised that the activities will cause noise pollution.

We are satisfied that the activities, if carried out in accordance with the permit, will not cause noise pollution.

See above for our response to the consultation response from Environmental Health on noise pollution for more details.

Condition 3.4 of the permit controls noise and vibration and requires that such emissions are minimised and, in the unlikely event that the activities give rise to pollution due to noise or vibration outside the site, a noise and vibration management plan can be requested and will have to be submitted to the Environment Agency for approval prior to being implemented.

#### **xxiv) Odour pollution**

Concerns have been raised that the activities will cause odour pollution.

We have carefully considered all the permitted activities and are satisfied that they are unlikely to give rise to any significant odour. In particular, the flaring of the gas is unlikely to give rise to odour due to the origin of the gas and its predicted composition.

Condition 3.3 of the permit controls odour and requires that emissions are minimised and, in the unlikely event the activities give rise to pollution due to odour outside the site, an odour management plan can be requested and will have to be submitted to the Environment Agency for approval and, once approved, be implemented.

#### **xxv) Inadequate consultation**

Some comments have raised concerns that the consultation has been inadequate due to lack of public awareness and a shorter time period to assess complex information provided as part of the application. Concerns were also raised that adequate consultation was inhibited by lack of clarity on whether or not the proposed proppant was hydraulic fracturing.

We carried out an extended consultation on the Application taking into account the Environmental Permitting Regulations and our statutory Public Participation Statement and the requirements of Article 8 of the Mining Waste Directive (MWD).

We advertised the Application by a notice placed on the .gov.uk website, and in the local newspaper which contained all the information required by the regulations, including telling people where and when they could see a copy of the Application.

We placed a paper copy of the Application and all other documents relevant to our determination on our Public Register. Anyone wishing to see these documents could do so and arrange for copies to be made. In addition copies of the relevant documents were made available at a library in the local area. The Applicant also made all the Application documents available on their website.

At the time of initial consultation, we had not started determination of the application, and we could not provide adequate answers to all queries. We have included a pre-operational condition that provides that the proppant squeeze operation shall not commence until we have approved, in writing, the Hydraulic Fracturing Plan which is referred to in section 5.3.4 of the waste management plan.

## **xxvi) Further consultation required**

One respondent requested that should the Environment Agency decided to grant the permit variation despite the risks posed by the proposed activities, they should afford the public a chance to review the conditions attached to the permit.

We are minded to grant the permit variation. We have published the draft permit and a draft decision document that explains how we have considered the Applicant's application and all the information made available to us in by all interested persons, and why we have included the specific conditions in the draft permit variation we are proposing to grant to the Applicant.

The permit and the decision documents are in draft at this stage, because we have yet to make a final decision. Before we make this decision we want to explain our current thinking to the public and other interested parties, to give them a chance to understand that thinking and, if they wish, to make relevant representations to us. We will make our final decision only after carefully taking into account any relevant matter raised in the responses we receive. Our mind remains open at this stage: although we believe we have covered all the relevant issues and reached a reasonable conclusion, our ultimate decision could yet be affected by any information that is relevant to the issues we have to consider. However, unless we receive information that leads us to alter the conditions in the draft permit, or to reject the Application altogether, we will grant the permit in its current form.

In this document we frequently say "we have decided". That gives the impression that our mind is already made up; but as we have explained above, we have not yet done so. The language we use enables this document to become the final decision document in due course with no more re-drafting than is absolutely necessary.

## **xxvii) Operator competence**

A number of concerns have been raised about the Operator and their competence to run the operations on site.

We have to assess the application made to us and we have no reason to consider that the applicant will not operate in accordance with the permit. The permit conditions require the Operator to have an appropriate management system in place that includes details of staff capability, roles and responsibilities, experience and training records to demonstrate technical competence. We will assess the operator's activities and we will be checking they comply with their permit conditions as part of our compliance work.

We have carefully considered operator competence and we have no reason to think that they would not comply with permit requirements and conditions.

### **xxviii) Lack of trust in the Operator**

Concerns were also raised that the operator was not transparent in their dealings with the public. Some respondents noted that it was disingenuous for the Applicant to state that “our operations at Wressle will not, either now, or in future, involve the process of hydraulic fracturing (fracking) for shale gas or oil. This part of Lincolnshire does not have the specific rock formations that contain shale gas or oil”.

It is quite common for Operators to conduct their own outreach programmes. Although we offer guidance to Operators, we are not involved in directing how the Operators conduct their public relations exercises.

In section 4 above, we have described our understanding of the proposed operations at the Wressle 1 site. We have considered all relevant factors and have determined that there is no reason to consider that the applicant will not operate in accordance with the permit.

### **xxix) Assessment of financial provision**

Comments were made which raised concerns regarding on the absence of monetary provision that could be set aside and which could be used for any remedial work required in the event of a pollution incident. One respondent queried why Egdon Resources has been allowed to transfer its operating arm into a limited company which can easily go out of business.

The requirement in the MWD for financial guarantee does not apply for the proposed activities as these do not involve a waste facility for hazardous waste.

In section 7 above, we have outlined how we have considered the administrative issues relating to this application. The applicant is a legal entity who is entitled to make an application for an environmental permit. We have no reason to believe that the Applicant does not have adequate financial resources to comply with conditions of the permit. The process of registering companies is outside the scope of this permit.

### **xxx) Impact of property value**

A number of comments have been made that the proposed activities will have a negative impact on property values in the local area.

Any negative impact of property values in the local area is not relevant to the determination for environmental permit applications.

### **xxxii) Proposed exploratory activities are unsustainable**

Concerns were raised that the type of exploratory work that was being proposed was unsustainable.

In section 4 and 6.8 above, we have comprehensively described the activities proposed by the operator. It is only wastes that arise from these sources that can be managed. We do not directly regulate the mining activity, we regulate the waste that is generated from mining. The permit is for the management of extractive waste from prospecting for mineral resources, including the flaring of gas. In determining the permit we need to be satisfied that the waste is managed in accordance with the regulations.

However the operator is limited to managing waste, including by flaring gas, from the specified activities set out in the permit and waste management plan. In other words, they cannot go beyond the activities that we have described in section 4 above. Should the operator wish to proceed to using further prospecting, and/or extraction techniques, they will need to apply for a variation of the permit which will be considered in the usual way.

### **xxxiii) Earth tremors/Seismic activity**

Concerns were raised that hydraulic fracturing could cause earthquakes. Some of the respondents pointed to previous earth tremors that were experienced on the Fylde coast in the Blackpool area as a result of hydraulic fracturing. Concerns were also raised that the operator was planning to drill straight through a fault and hydraulically fracture close to it.

We have considered the risk of seismicity in relation to the potential impact on the permitted activities, including the integrity of the wells, and we are satisfied that appropriate measures will be in place to ensure that seismicity will not result in pollution or harm to human health from the permitted activities.

Precautions against seismic activity are addressed by conditions on permissions for hydraulic fracturing that are granted by the Oil and Gas Authority (OGA). OGA oversee the implementation of precautions to prevent the occurrence of earth tremors as a result of hydraulic fracturing.

The extent of the proposed fracture will be more than 330 metres from the 'regional faults' which have been defined by the British Geological Survey and presented on the 1:50,000 scale geological maps. They have carried out 3D seismic mapping that has shown where the faults are and these have been illustrated in diagram 1 above. The proposed mitigation measures are built into the hydraulic fracturing plan which the Operator is required to provide for approval to the Environment Agency prior to undertaking any hydraulic fracturing associated with the proppant squeeze operation.

The Royal Society and the Royal Academy of Engineering conducted an independent review of the scientific and engineering evidence on the risks associated with hydraulic fracturing for shale gas. Its report, published in June 2012, concluded that the environmental (and health and safety) risks can be managed effectively in the UK, provided that “operational best practices are implemented and enforced through regulation”. The Government has accepted all of the recommendations from the report. The proposed activities at Wressle 1 are not for fracturing in shale nor are they high volume fracturing process. The proposed hydraulic fracturing at Wressle 1 is at the lower end of the hydraulic fracturing spectrum and are not new to the UK.

We are satisfied that measures can be taken to ensure that the fracturing fluids remain in the target formation. We have included a pre-operational condition that provides that hydraulic fracturing shall not commence until we have approved, in writing, the hydraulic fracturing plan which is referred to as proppant squeeze plan in section 5.3.4 of the waste management plan. A stepped approach will allow the geomechanical properties of the reservoir to be understood and the hydraulic fracturing programme to be tailored accordingly.

The fracturing plan will include:

- Information on the historical seismicity and assessment of the risk of induced seismicity;
- summary of the planned operations, including stages, pumping pressures and volumes
- an assessment of the anticipated extent of fracturing resulting from injection and proposed method for confirming the validity of the model
- a comparison of proposed activity to any previous operations and relationship to historical seismicity;
- proposed measures to monitor local seismicity during the operations; and
- proposed methods for limiting fracture height.

In addition, we have included a condition in the permit that provides that the hydraulic fracturing process must be designed and implemented to ensure any fracturing fluid remains in the target formation, namely the Ashover Grit and Chatsworth Grit units of the Millstone Grit Formation.

### **xxxiii) Well integrity**

Concerns were raised that there was no certainty that the exploratory boreholes to be drilled were safe and structurally adequate to prevent leakages that could cause pollution. Concerns were also raised that the Environment Agency is dependent on the designs approved by HSE, but that the HSE did not enforce their designs nor were they involved in carrying out checks at the permitted sites. As there were no regulations that enforced long term monitoring, leaks of abandoned wells could result in irreversible environmental damage.

The borehole at Wressle 1 was constructed in accordance with the requirements of the HSE and the Petroleum Exploration and Development Licence. It was also designed in accordance with industry best practice and in compliance with the Installation and Wells (Design and Construction) Regulations 1996 (DCR). The DCR requires the well design to be such that no unplanned escape of fluids can occur. The Environment Agency has assessed the risk of drilling boreholes at this location and considers that the design of the borehole drilled and the proposed side-track meets the requirement to prevent any release of liquids in to the water environment. The borehole was constructed in accordance with notifications under Section 199 of the Water Resources Act 1991. The proposed side-track will also be drilled in accordance with Section 199 of Water Resources Act and confirmation of completed drilling construction and integrity testing will be required.

At the point when the wells are no longer productive and the operator wishes to decommission them they will have to carry out any necessary works to make the well safe and prevent any leakage that could cause environmental damage. The Health and Safety Executive have detailed legal requirements relating to this stage of the well life, which the operator will have to comply with. The Environment Agency will be involved in this process to ensure that any groundwater is protected during the abandonment process and for the future. The operator will have to provide sufficient evidence to satisfy the Environment Agency that the decommissioned well will not cause any on-going or future impact on the environment before surrender of the permit would be accepted. Monitoring at the site will continue into the post decommissioning period and will have to demonstrate that no impact has occurred and that there are no on-going environmental issues.

#### **xxxiv) Additional Correspondence**

In addition, we have received certain correspondence and representations submitted to the Local Planning Authority in response to the planning application. Although this has not been directly submitted to us as part of our consultation, we have carefully considered any issues raised in those representations that are relevant to determination of this permit application, and taken them into account for the purposes of our draft decision.

**3 Other matters outside the scope of this permit Application that the public have commented on which may be more relevant to Applications for other permissions.**

**a) Hydraulic fracturing (“hydraulic fracturing”)**

Concerns were raised that hydraulic fracturing is an extremely dangerous process. The permitted activities include the management of waste from hydraulic fracturing. OGA issues consent that authorises hydraulic fracturing.

However, we do regulate activities associated with hydraulic fracturing as outlined in the body of this document. We have addressed the risks of those activities and how we have dealt with them.

**b) Location of the site, industrialization of the countryside, and devaluation of property prices**

Decisions over land use are matters for the planning system. North Lincolnshire Council is responsible for determining whether or not the proposed development is appropriate in this location, having regard to relevant policies within the adopted local plan and the National Planning Policy Framework. The location of the site is a relevant consideration for Environmental Permitting, but only in so far as affects the potential for the site to have an adverse environmental impact on communities or sensitive environmental receptors. The environmental impact is assessed as part of the determination process and has been reported upon in the decision document.

**c) Vehicle access to the site and traffic movements**

These are relevant considerations for the grant of planning permission, but do not form part of the Environmental Permit decision making process except where there are established high background concentrations of pollutants contributing to poor air quality and the increased level of traffic might be significant in these limited circumstances. This is not the case for this location.

**d) Climate change policy**

Policy is made by the Government and the policy on exploitation of Shale Gas is no different to that of any other fossil fuel. The policy states “We aim to maximise the economic recovery of oil and gas from the UK’s oil and gas reserves, taking full account of environmental, social and economic objectives”.

**e) Industry Self Regulation**

Where an environmental permit is issued, we have a responsibility and a duty to ensure that it is complied with. Concerns about industry self-regulation are not relevant to our permit determination or the subsequent regulation of any permit.

The industry is not new and has been in the UK producing oil and gas for many decades; as regulators of the refineries and combustion plants using this resource, we have extensive relevant experience.

We recognise that Hydraulic Fracturing is a relatively new activity, however the proposed activities are well regulated by legislation enforced by the Environment Agency, the Health and Safety Executive, the Local Planning Authority and OGA.

The waste management activities proposed for this site in terms of storage and processes for recovery and disposal, are well established and the risk management measures in place are commonly used across a variety of industries

The regulatory system that manages this industry and others has also been developed over many decades through global experience. Many of the regulations controlling this sector have been introduced in the last decade and are continually under review both in the UK and EU. What is new is the technique of high volume hydraulic fracturing, about which we have gathered regulatory information from around the world and particularly the US. This is the nature of industry as it develops new methods and techniques. To date there has only been one hydraulic fracturing event in the UK that has helped inform the requirement for permits to carry out all such exploratory activities. However the activities at Wressle 1 are not for high volume hydraulic fracturing.

We have stated from the outset that we will take a conservative approach and will require operators to fully risk assess their activities and demonstrate how risks will be managed and mitigated when applying for any permits. We have taken the same position in considering the permit conditions to include in this permit.

#### **D) ADVERTISING AND CONSULTATION ON THE DRAFT DECISION**

This section reports on consultation on our draft decision carried out between 16<sup>th</sup> March 2017 and 13<sup>th</sup> April 2017.

A total of 23 responses were received. Of these 4 came from Non Governmental Organisations, 1 came from Broughton Town Council and the remainder came from members of the public.

In most of the cases the issues raised in the consultation were the same as those raised previously and already reported in sections B and C of this Annex. Where this is the case, the Environment Agency response provided in sections B and c of this Annex has not necessarily been repeated and reference should therefore be made to sections B and C in addition to any response below.

Also some of the consultation responses received were on matters which are outside the scope of the Environment Agency's powers under the Environmental Permitting (England and Wales) Regulations 2016. Our position on these matters is as described previously.

<b>Response received from Broughton Town Council</b>	
<b>Brief summary of issues raised</b>	<b>Summary of action taken/how this has been covered</b>
Broughton Town Council expressed concerns about the granting of the permit until the Energy Security and Innovation Observing System for Subsurface (ESIOS) project has been completed.	<p>ESIOS project is a long term research project which aims to facilitate critical research that underpins the safe and environmentally sustainable development of subsurface energy systems. The project is not being designed to stop any oil exploration and production activities. It is a project that is still at a conceptual and developmental stage and is not likely to be concluded imminently. The permitted site is not earmarked for the project. It is not reasonable for the Environment Agency to withhold its determination indefinitely on the basis of a project that is still at a developmental stage.</p> <p>Any outcomes from the project will augment findings from other ongoing projects.</p>

<b>Response Received from Friends of Earth, and Friends of Earth Midlands Chapter</b>	
<b>Brief summary of issues raised</b>	<b>Summary of action taken/how this has been covered</b>
Friends of the Earth reiterated concerns they had raised during the first round of consultation. They drew comparisons with objections that had been made to the Markwell's Wood Site	We have considered and addressed concerns raised by Friends of the Earth section B subsection 4 and 5 of this Schedule.
Friends of Earth wanted the Environment Agency to give assurances that the operating company will be held more financially accountable for possible outcomes if this activity were to proceed.	<p>The permit holder is responsible for meeting all obligations for the conditions of the permit being issued. The permitted activities are not for Category A mining waste facility and therefore does not require the setting up of financial provision.</p> <p>The issue of financial provision has been addressed in section B, subsection XXIX of this Annex. The permit is for scheduled permitted activities that do not require the setting aside of financial provision.</p>
Friends of the Earth also queried if there has been an Environmental Impact Assessments of assessment of impacts on air quality arising from	In section 8 we have outlined how we have considered all environmental risks that may arise from the proposed activities. In section B subsection XVI of this Annex, we have explained

<p>the proposed activities.</p>	<p>the reasons why an Environmental Impact Assessment was not provided. We are satisfied with the Operator's Environmental Risk Assessment.</p> <p>We recognise that the flaring of gas needs to be controlled and we have included monitoring conditions 3.5.1 and 3.5.6. in the permit requiring the Operator to monitor temperature and feed gas flow rate, and calculate the quantities of oxides of nitrogen, carbon monoxide, and total volatile organic compounds emitted. The operator is required to provide monthly reports of the monitoring results. In section b subsection XXI of this Annex, we have explained how we have considered a previous concern related to impact on air quality.</p>
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<b>Responses received from Frack Free Lincolnshire Groups and Frack Free Kirton Lindsey</b>	
<b>Brief summary of issues raised</b>	<b>Summary of action taken/how this has been covered</b>
<p>Frack Free Lincolnshire Groups submitted a response which raised similar issues that had been raised in their first submission</p>	<p>In section B subsection 5 above, we have fully outlined how we have addressed issues raised by Frack free Lincolnshire Groups</p>
<p>Frack Free Lincolnshire Groups expressed concerns of repeated well stimulation techniques</p>	<p>In Table S1.1 we have specified that the groundwater activity shall be for a single injection of hydraulic fracturing fluid for extraction of hydrocarbons to ground via Wressle 1 well. The Operator has not applied for repeated well stimulations and any additional stimulation beyond the ones authorised in the permit and approved Waste Management Plan would require a permit variation.</p>
<p>Frack Free Lincolnshire Groups stated that the ESIOS project endorsed their concerns and requested that we object to granting the variation</p>	<p>The ESIOS project is a long term research project which has not yet published any findings from its proposed research. The project has stated its research aims, but has not yet drawn any conclusions. We will review the results of the project once they are published.</p>

## **E. Response to points raised by members of the public in the minded to consultation that were also raised in the initial consultation as set out in Section A**

### **Impact on British steel Works**

One respondent raised concerns on the impact of the proposed activities on British Steel Works.

British Steel Works were advised of our minded to issue decision. They did not formally submit any responses or raise concerns related to the grant of this permit. In section C subsection XI of this permit, we have outlined our assessment of the risks of the proposed activities to the British Steel Works.

### **Tidal surge and flood risk**

Concerns were raised that the permitted site was in an area liable to flooding.

We have assessed the risk of flooding to the site based on the latest information that we have. There are instances where a situation called “Tide Lock” could occur when flows in Ancholme River increase after a period of heavy rain which coincide with high tides. In such instances, the gates at South Ferriby may well remain closed as the fluvial flows cannot be discharged as they would be normally. This could then cause Main River flows to back up and could cause localised flooding as a result, as has been noted from concerns raised.

The permitted site is approximately 1450m away from River Ancholme and is located in an area where the likelihood of flooding from rivers, the sea and surface water has been assessed as less than 0.1% (1 in 1,000) chance of occurring in any given year. The likelihood of flooding within the permitted site at lodge farm is estimated as “very low”. We are satisfied that the permit variation will not result in an increase in flood risk to the area. In section C subsection I, we have fully explained how we have assessed flood risks hazards of the proposed activity.

### **Pollution of water sources**

Concerns were raised that the proposed activities will impact on quality of ground water and surface water sources.

In section C subsection X of this Annex, we have explained how we have assessed risks to groundwater and surface water.