Wressle Wellsite

Waste Management Plan

Environmental Permitting (England and Wales) Regulations 2016

- Application to Vary Mining Waste Operation
- Application to Vary Water Discharge Activity
- Application to Vary Groundwater Activity
- Application for a New Installation for Gas Refining Activity

ISSUE No.	Description
240321	Draft for Client Review
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1. PURPOSE AND CONTEXT

This Waste Management Plan forms part of an application to the Environment Agency to authorise the undertaking of specific 'permitted activities' at the Wressle Wellsite. In the context of onshore oil and gas operations, an activity that produces extractive waste is classified as a 'mining waste operation'.

A 'mining waste operation' is considered a 'regulated facility' under The Environmental Permitting (England and Wales) Regulations 2016, as amended (EPR2016) [Ref.1]. Throughout the life of the wellsite this Waste Management Plan shall be considered a live 'operating technique' and must be complied with as it forms part of the environmental permit.

The Waste Management Plan sets out the necessary measures to ensure that extractive waste is managed in a controlled manner without endangering human health or harming the environment. The purpose of the Waste Management Plan is to demonstrate how Egdon Resources U.K. Limited (herein referred to as the 'Operator') will minimise, treat, recover and dispose of extractive waste whilst taking into account the principle of sustainable development.

The Waste Management Plan has been produced in accordance with EPR2016 which has been transposed, in part, from the Mining Waste Directive (MWD) [Ref.2]. This Waste Management Plan has also been compiled based on the requirements and guidance from the Environment Agency's How to comply with your environmental permit guidance 6.14 [Ref.3].

For clarity, domestic legislation derived from European Union legislation such as the MWD and the Waste Framework Directive (WFD) [Ref.4] continues to have an effect in domestic law following the UK's withdrawal from the European Union in accordance with the European Union (Withdrawal) Act 2018 [Ref.5]. The MWD and WFD are therefore still applicable to this Waste Management Plan and activities performed by the 'Operator'.

The primary purpose of the Waste Management Plan is to demonstrate that the 'mining waste operation' will meet the requirements of EPR2016 and, in turn, the MWD and WFD.

All figures included in this document, for example volumes, tonnages, formation depth represent best estimates at the time of document production, and may change, as operations develop.

2. SCOPE

This Waste Management Plan is applicable to the Wressle Wellsite and all operations conducted therein. It is applicable to the 'Operator', its contractors and subcontractors and may be used in support of an application to the Environment Agency for an environmental permit under EPR2016.

In addition to the management of extractive waste, a 'regulated facility' may require an environmental permit that facilitates the deposit or accumulation of extractive waste in a 'mining waste facility'. The definition of a 'mining waste facility' is based on the site having a designated area for the accumulation or deposit of waste that are subject to certain timescales, depending on the nature and source of the waste.

The Wressle Wellsite is considered a 'mining waste facility' as waste was previously accumulated and deposited within the specified time periods laid out within Article 3 (15) of the MWD. The 'mining waste facility' was approved by the Environment Agency to facilitate the permanent deposit of proppant carrier fluid. This operation has since been concluded however the designation of 'mining waste facility' remains as the wellsite is still permitted under EPR2016.

Furthermore, it was confirmed by the Environment Agency following the issue of the previous permit that the 'mining waste facility' was not designated a Category A facility as the criteria under Annex III of the MWD was not met.

This Waste Management Plan will supersede all previous Waste Management Plans relating to the Wressle Wellsite once both approved by the Environment Agency and upon the commencement of the operations. This Waste Management Plan is the principle document for the management of all extractive wastes associated with the Wressle Development.

3. ABBREVIATIONS AND DEFINITIONS

":	Inch – A unit of linear measure equal to one twelfth of a foot (2.54 centimetres)
%:	Percentage – A rate, number, or amount in each hundred.
BAT:	Best Available Technique
BOP:	Blowout Preventer
BREF:	BAT reference documents which cover specific agro-industrial activities
BSOR1995:	The Borehole Sites and Operations Regulations 1995
CCTV:	Closed Circuit Television
DCR1996:	The Offshore Installations and Wells (Design & Construction, etc) Regulations 1996
DNO:	District Network Operator
EGMBE:	Ethylene Glycol Monobutyle Ether
EPR2016:	The Environmental Permitting (England and Wales) Regulations 2016, as amended
EWC:	European Waste Catalogue also referred to as LoW (List of Waste)
EWT:	Extended Well Test
FIT:	Formation Integrity Test
GEU:	Grid Entry Unit
g/l:	Grams per Litre
Groundwater Activity:	Has the meaning given within Regulation 2 of EPR2016
HCl:	Hydrochloric Acid
HDPE:	High-density polyethylene
HSE:	Health, Safety and Environmental
IED:	The Industrial Emissions Directive aims to prevent and reduce harmful industrial emissions, while promoting the use of techniques that reduce pollutant emissions and that are energy and resource efficient.
Installation Activity:	Has the meaning given within Regulation 2 of EPR2016
JAGDAG:	Joint Agencies Groundwater Directive Advisory Group
Kg:	Kilogram equal to 1,000 grams
LOT:	Leak-off Test
m:	Metre – A unit of measurement of length equal to one hundred centimetres
m^3:	Cubic metre – An SI unit of volume with a length, height, and width of one metre, with 1,000 litres of space.

MCP:	Medium Combustion Plant
MCPD:	Medium Combustion Plant Directive
MCPSG:	Medium Combustion Plant - Specified Generator
MD:	Measured Depth
MDRT:	Measured Depth below Rotary Table
Medium Combustion Plant:	Has the meaning given within Regulation 2 of EPR2016
Mining Waste Facility:	Has the meaning given within Regulation 2 of EPR2016
Mining Waste Operation:	Has the meaning given within Regulation 2 of EPR2016
mm:	Millimetre – equal to one thousandth of a metre
MWD:	The Mining Waste Directive – Directive 2006/21/EC of the European Parliament and the Council on the management of waste from extractive industries.
NORM:	Naturally Occurring Radioactive Material
OGUK:	Oil & Gas UK
Operating Technique:	Documents approved by the regulator to ensure compliance with the issued permit
Operator:	Has the meaning given within Regulation 7 of EPR2016
Permitted Activities:	Any activity or operation defined within Schedule 1 to 29 of EPR2016
psi:	Pound per square inch
Radioactive Substances Activity:	Has the meaning given within Regulation 2 of EPR2016
Regulated Facility:	Has the meaning given within Regulation 8 of EPR2016
Specified Generator:	Has the meaning given within Regulation 2 of EPR2016
SR2015 No.1:	The Environment Agency's Standard Rules for 'The management of extractive waste not including a waste facility, generated from onshore oil and gas prospecting activities.
TVD:	True Vertical Depth
UK:	United Kingdom
Water Discharge Activity:	Has the meaning given within Regulation 2 of EPR2016
WCU:	Well Clean Up
WFD:	European Community (EC) Directive 2006/12/EC
WM3:	The Environment Agency's Technical Guidance WM3: Waste Classification - Guidance on the classification and assessment of waste
WR2011:	The Waste (England and Wales) Regulations 2011

Table 1: Abbreviations and Definitions

4. ENVIRONMENTAL PERMITTING (ENGLAND AND WALES) REGULATIONS 2016

The Wressle Wellsite has historically been the subject of a number of permit applications and variations. Table 2 provides a summary of the 'permitted activities' currently permitted at the wellsite.

Permitted Activities				
Permit	Ref.	Description	Activity	EPR2016
EPR/AB3609XX	A1	Loading, unloading, handling or storage of crude oil.	Installation	Schedule 1
	A2	Non-hazardous mining waste operation	Mining Waste	Schedule 20
	A3	Non-hazardous mining waste facility		
	A4	Groundwater activity for a single injection.	Groundwater	Schedule 22
	A5	Discharge of rainfall run off water to Ella Beck	Water Discharge	Schedule 21
	A6	Operate a Medium Combustion Plant.	MCP and SG	Schedule 25
EPR/HB3295DH	A1	Accumulation of radioactive waste on the premises.	Radioactive Substances	Schedule 23
	A2	Disposal of radioactive waste on or from the premises.		

Table 2: List of Activities Currently Permitted

4.1 Current Operational Status (Pre-Application)

The Wressle Wellsite is currently producing oil and gas from a single well. The wellsite is in its infancy with regards to production and as such, Activity A6 has yet to commence.

The site is currently producing and storing crude oil in accordance with Activity A1 of permit EPR/AB3609XX, whereby the volume of oil is less than 500 tonnes. This activity is considered an 'installation activity'.

As the Wressle Wellsite is in a phase of production, it is currently operating as a 'mining waste operation' (Activity A2 of EPR/AB3609XX), due to the production of extractive waste which will include formation water, spent acid and proppant throughout the lifetime of the development. The wellsite also holds the necessary permission to operate a 'mining waste facility' (Activity A3) which for clarity is not located at the wellsite itself but within the target formation where proppant fluid remains following previous proppant squeeze operations.

A proppant squeeze operation was previously undertaken at the wellsite. The 'groundwater activity' permit was obtained to enable the discharge of a pollutant in circumstances that might lead to an indirect input of that pollutant to groundwater. The residual proppant fluid and proppant remains in the formation from which hydrocarbons are produced.

Due to the wellsite incorporating an impermeable membrane to capture any potential spills or leaks, the site regularly collects rainwater. To negate the need for a road tanker to remove the water from site a 'water discharge activity' was permitted at the site to enable the discharge of clean rainwater to the adjacent Ella Beck surface watercourse via an oil-water separator. During low risk operations i.e. production and suspension operations the outlet remains open. Where workovers and similar operations are being undertaken, the outlet is closed.

Due to the production of associated gas at the wellsite, a 'medium combustion plant activity' (which is also considered a specified generator) was obtained as a means to harness the gas, produce electricity for site use, and potentially export. This activity has yet to commence at the wellsite due to no suitable gas engines being identified for the small volume of electricity needed for the site. Only when exportation is available, or the site power requirements increase significantly can a suitable gas engine be installed. The waste natural gas is currently harnessed as much as possible via micro-turbines to meet the sites electrical supply with remaining gas being incinerated in a flare unit, consented under the 'mining waste operation' as the volumes of incineration are below 10 tonnes per day. For clarity, the use of

the micro-turbines do not fall under EPR2016 due to the aggregated thermal input parameters not meeting the threshold limit detailed within the Medium Combustion Plant Directive [Ref.6] and is therefore not considered a 'permitted activity'.

Production of hydrocarbons together with associated water and natural gas has the potential to produce naturally occurring radioactive material (NORM). At the time of this application, produced water is materialising and initial analysis indicates that NORM is evident. A Radioactive Substances Permit (EPR/HB3295DH) [Ref.7] is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas. This is considered a 'radioactive substances activity'.

Table 3 outlines the operations that are permitted under the existing environmental permitting consents.

Permitted Operations derived from Permitted Activity.		
Permit		**Description**
EPR/AB3609XX	A1	Allows for the storage and handling of crude oil that arise from oil production activities.
	A2	Allows for the management of extractive wastes from side-track drilling, radial drilling and near well-bore treatments (acid-squeeze, hot oil wash, solvent treatment, nitrogen injection) and hydraulic fracturing for conventional oil which will be done only once. An enclosed ground flare will be used to incinerate less than 10 tonnes of waste gas per day.
	A3	Allows for a mining waste facility for the disposal and management of non-hazardous extractive waste and permanent deposit in-situ of fracturing fluids.
	A4	Allows for the discharge (injection) of fracturing fluid into the target formation that might lead to an indirect input of a pollutant to groundwater.
	A5	Allows for the discharge of rainfall runoff treated site surface water to the Ella Beck.
	A6	A medium combustion plant comprising of a natural gas fired engine.
EPR/HB3295DH	A1	Accumulation of radioactive waste including both aqueous and solid material containing NORM on the premises
	A2	Disposal of radioactive waste on or from the premises to an EA permitted facility for treatment and onward disposal.

Table 3: Permitted Operations Derived from the Permitted Activities

4.2 Proposed Activities and Permitted Activities

The 'Operator' is proposing to undertake 5 phases of development, which will include:

1. Phase 1 – Construction of the proposed Wellsite extension.
2. Phase 2 – Drilling of Wressle-2 and Wressle-3 Wells.
3. Phase 3 – Production testing of Wressle-2 and Wressle-3 Wells.
4. Phase 4 – Production.
5. Phase 5 – Well decommissioning and site restoration.

Phase 1

To facilitate the additional wells at the site the Wressle Wellsite will be extended from the southern boundary. As such, the 'regulated facility' will need to be increased and updated on any future permit.

Phase 2

The second phase of the development will include the drilling of two new boreholes from the existing/extended Wressle Wellsite. The second and third boreholes shall be known as the Wressle-2 Well and the Wressle-3 Well respectively and will be drilled with the intention of further evaluating the zones of interest identified by the 'Operator' during the drilling of the Wressle-1 Well.

It may be necessary to undertake a proppant squeeze, should it be deemed necessary to enhance production rates. The proppant squeeze has been designed such that it will be confined to the saturated formations, which contain hydrocarbons. The proppant squeeze is a 'groundwater activity', namely the injection of any substance into groundwater to increase the flow of fluids or gas to a well or borehole in connection with the extraction or use of any energy source.

Phase 3

The third phase of the development will include production testing of the Wressle-2 Well and the Wressle-3 Well.

Phase 4

If production testing of the Wressle-2 Well and/or the production testing of the Wressle-3 Well is successful, the wells will be put in to production. Natural gas will be exported via pipeline to the District Network Operator (DNO).

Phase 5

Following production operations, the wells will be decommissioned and the wellsite restored.

4.2.1 Mining Waste Operation including a Mining Waste Facility

In order to drill, test and undertake well treatments from the proposed Wressle-2 Well and Wressle-3 Well it is necessary to apply for a variation to the mining waste operation (which includes a flare, mining waste facility and a small fracture operation). The variation to the 'mining waste operation' will consider the additional extractive waste volumes and waste streams created as a result of both the drilling process and any subsequent testing, production and well treatment operations. In addition, the 'Operator' is proposing to undertake a proppant squeeze, which will also require a variation to the 'mining waste facility' which permits the permanent storage of waste at the wellsite, which in the case of the proposed development is the permanent disposal of proppant carrier fluid into the target formation.

4.2.2 Incineration of Natural Gas

Schedule 1, Part 2 of EPR2016 transposes the requirements of the Industrial Emissions Directive, which requires an environmental permit to authorise an installation operation for the incineration and coincineration of waste, as detailed within Section 5.1.

Part A(1)

(a) The incineration of hazardous waste in a waste incineration plant or waste co-incineration plant with a capacity exceeding 10 tonnes per day;

The proposed short-term production testing phase may involve the incineration of natural gas exceeding 10 tonnes per day and therefore Environmental Permit EPR/AB3609XX is being varied to include the Well Clean up (WCU) and Extended Well Test (EWT) activities.

4.2.3 Groundwater Activity

An activity that could involve the discharge of pollutants into groundwater must be notified to the Environment Agency, together with the nature of these pollutants, under EPR2016. The Environment Agency will then determine whether the groundwater activity needs to be permitted.

During the life of the well, as with the current Wressle-1 Well, it may be necessary to undertake near wellbore treatments, including an acid squeeze and solvent treatment, all of which fall within the definition of a 'groundwater activity under Schedule 22 of EPR2016.

Schedule 22 3 (3) of EPR2016 provides that the '*The regulator may determine that a discharge, or an activity that might lead to a discharge, is not a groundwater activity if the input of the pollutant…*

(b) is or would be of a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater.

To assist the regulator in determining whether the proposed activities are/are not considered groundwater activities a description of the operations, together with a technical justification as to why the 'Operator' believes these can be excluded under Schedule 22 paragraph 3 (3) of EPR2016, is included within the Waste Management Plan.

It may be necessary to undertake a proppant squeeze, should it be deemed necessary to enhance production rates. This activity falls within the definition of a 'groundwater activity under Schedule 22 of EPR2016. The proppant squeeze has been designed such that will be confined to the saturated formations, which contain hydrocarbons. The proppant squeeze is a 'groundwater activity', namely the injection of any substance into groundwater to increase the flow of fluids or gas to a well or borehole in connection with the extraction or use of any energy source.

4.2.4 Water Discharge Activity

To enable the drilling of up to two additional wells it is necessary to increase the area of the 'regulated facility'. As such, the containment system (HDPE Impermeable membrane) will also need to be extended to cover the additional site area. The containment ditches on the east and west side of the Wressle Wellsite will be extended further south, with a new southern perimeter ditch also being installed of the same design. The current southern containment ditch will either remain and connect to the eastern and western ditches via a T-Piece connection or be removed and infilled depending on the final configuration of the site design.

The rate of discharge will not alter from the existing permit boundary, nor will the maximum volume of daily discharge. The discharge conditions shall also remain the same and the surface water will be the subject of the same monitoring regime, with surface water only being discharged during production operations or during periods of site inactivity where the likelihood of contamination is far lower. The interceptor and surface water outlet is locked off during any well operations or wellsite construction operations.

4.2.5 Installation Activity - Refining of Natural Gas

The 'Operator' is proposing to add an additional 'installation activity' to its existing permit (EPR/AB3609XX) to permit the refining of natural gas. The refining of natural gas is considered under the IED and transposed into domestic legislation under EPR2016. The specific 'installation activity' to be applied for under EPR2016 is Schedule 1, Part 2, Chapter 1, Section 1.2 Part A(1)(a) which states:

"Refining gas where this is likely to involve the use of 1,000 or more tonnes of gas in any 12-month period."

In the absence of a specific definition for 'refining' under EPR2016, BREF for the Refining of Mineral Oil and Gas [Ref.8] States: "*the purpose of refining is to convert natural raw materials such as crude oil and natural gas into useful saleable products*". In this instance, the dehydration of the natural gas would be considered an installation activity.

The purpose of refining the gas is to ensure that it complies with both the requirements of the Gas Safety (Management) Regulations 1996 [Ref.9] and the entry requirements of the District Network Operator (DNO). It is proposed by the 'Operator' to refine the gas within the existing boundary of the 'regulated facility' before being exported.

It is the view of the 'Operator' that the pipeline shall be considered a Directly Associated Activity to the 'installation activity'. Where the pipeline leaves the boundary of the 'regulated facility' it will be formally adopted by the DNO.

In the context of the export of gas to the DNO, a Grid Entry Unit (GEU) is required to enrich (where required), analyse, meter and odorise natural gas entering the grid. Odorants are added to natural gas for reasons of public safety to alert members of the public to leaks of gas within the system. The current odorant employed by DNOs in the UK for natural gas is Odorant NB, a blend of t-butyl mercaptan and dimethyl sulphide.

Whilst the addition of an odorant to the natural gas is a permitted activity under ERP2016, the activity would not be undertaken by the 'Operator' should the gas be exported to the DNO. The GEU (which also includes a remotely operable valve and a remote telemetry unit) will be adopted by the DNO for monitoring, controlling and odourising the flow to its network. This activity will be undertaken and operated by the DNO and not the 'Operator'.

5. OBJECTIVES OF THE WASTE MANAGEMENT PLAN

The objectives of the Waste Management Plan are derived from Article 5 of the MWD and are detailed as follows:

- *To prevent or reduce waste production and its harmfulness, in particular, by considering:*
  - *Waste management in the design phase and in the choice of method used for mineral extraction and treatment;*
  - *The changes that the extractive waste may undergo in relation to an increase in surface area and exposure to conditions above ground;*
  - *Placing extractive waste back into the excavation void after extraction of the mineral, as far as is technically and economically feasible and environmentally sound in accordance with existing environmental standards at the community level and with the requirements of the directive, where relevant;*
  - *Putting topsoil back in place after the closure of the mining waste facility or if this is not practically feasible, reusing topsoil elsewhere; and*
  - *Using less dangerous substances for the treatment of mineral resources.*

With regards to the prevention and reduction of waste production, the location of the Wressle-1 well was determined by the target formation and geology. The location was also determined by other considerations such as planning constraints, access agreements etc. The design of the Wressle-2 and Wressle-3 wells was informed by all of these factors and as such the minimisation of waste from a design basis is constrained by the selection of hole sizes that would achieve the planned targets.

Extractive waste will be stored at surface in dedicated areas within the 'regulated facility'. Extractive waste will have minimal contact with above ground conditions, as they will be confined to enclosed / partially enclosed tanks with exception of natural gas.

Placing extractive waste back into the extraction void is not feasible as the well is cased, cemented and then tested for oil and/or gas. In short, the extraction voids need to remain in order to produce from the well.

The Wressle Wellsite was constructed by excavating top soil and sub soil and stored at the site in a bund acting as both a storage bund and screening against any visible impact from neighbouring properties. The soils will be laid back from whence it came, restoring the site to its pre-development condition and negating any waste.

Where practicable, dangerous substances will be substituted with less dangerous substances for the treatment of mineral resources. However, the substances must be able to fulfil the same function and to the same standard.

- *To encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste, where this is environmentally sound in accordance with existing environmental standards at Community level and with the requirements of the Directive where relevant.*

Associated natural gas has been encountered from the Wressle-1 well and as a result has been used to generate electricity for internal use within the wellsite. Any associated natural gas encountered from the Wressle-2 and Wressle-3 wells, will be harnessed in some capacity either exporting it via pipeline, or using it to generate electricity for internal use and export.

- *To ensure short and long term safe disposal of the extractive waste, in particular by considering, during the design phase, management during the operation and after-closure of a mining waste facility and by choosing a design which:*
  - Requires minimal and, if possible, ultimately no monitoring, control and management of the closed mining waste facility;
  - Prevents or at least minimises any long term negative effects for example attributable to migration of airborne or aquatic pollutants from the mining waste facility; and
  - Ensures the long-term geotechnical stability of any dams or heaps rising above the pre-existing ground surface.

With regards to the mining waste operation, no extractive waste shall remain at the wellsite indefinitely. Upon closure of the site, it will be restored to its natural state with the removal of all site surface equipment. The wellhead will be mechanically cut off below the surface (after the required monitoring period). All extractive waste shall be treated / disposed in accordance with the receiving facilities environmental permit.

6. WASTE MANAGEMENT ARRANGEMENTS

6.1 Waste Definition

A waste is defined in Article 3(1) of the MWD by reference to Article 3(1) of the WFD. The definition is; *'waste' shall mean any substance or object which the holder discards or intends or is required to discard.*

The wastes are defined in Article 3 of the Directive as inert, non-hazardous or hazardous and are as follows:

Hazardous Waste: A hazardous waste is defined as a waste that has one or more of the fifteen specified hazardous properties listed in Annex III to the WFD. The application of this is determined by the List of Wastes Decision [Ref.10].

Non Hazardous Waste: A waste, which is neither classed as inert or hazardous.

Inert Waste: Waste which does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant and in particular not endanger the quality of surface water and/or groundwater.

6.2 Waste Classification

A list of waste streams, together with their respective European Waste Catalogue (EWC) codes has been provided within Table 5 to 12. To ensure that the Waste Management Plan remains suitable and sufficient in the event of contamination, both Hazardous and Non-Hazardous EWC codes have been applied to the waste stream. Such an example includes circulation fluid (brine) which ordinarily would be assessed as EWC code '01 05 08' but may be assessed onsite as EWC code '01 05 06*' should it be contaminated with a hazardous substance above a certain threshold i.e. oil based mud or hydrocarbons.

The 'Operator' is required to assess and classify its waste (both extractive and non-extractive) by using the correct code from the Environment Agency's Waste Classification Technical Guidance WM3 [Ref.11].

6.3 Hierarchy of Waste Management

The 'Operator' and its contractors follow The Waste (England and Wales) Regulations 2011 (WR2011) [Ref.12], which lays out a hierarchy of waste management, derived from the WFD. This hierarchy has been outlined in Figure 1.

	Most Preferred	
Prevention		Using less materials in design and manufacture. Keeping products for longer i.e. re-use. Longer-term waste prevention includes gas distribution to national transmission system if feasible.
Preparing for Re-Use		Checking, cleaning, repairing, refurbishing, whole items or spare parts.
Recycle		Turning waste into a new substance or product. This can include gas to grid concepts.
Other Recovery		Incineration with energy recovery, gasification and pyrolysis, which produce energy and materials from waste.
Disposal		Landfill and incineration without energy recovery.
	Least Preferred	

Figure 1: Waste Hierarchy

The Wellsite Supervisor is appointed by the 'Operator' to exercise overall control of the wellsite operations, in accordance with The Borehole Sites and Operations Regulations 1995 (BSOR1995) [Ref.13]. In addition, the 'Operator's' Production & HSE Manager will be the person responsible for waste management.

The management of waste onsite will include:

- Waste management in accordance with WR2011, waste hierarchy;
- Monitoring of all waste storage vessels;
- Liaison with third party waste advisors with respect to waste sampling, analysis and classification;
- Compiling and keeping records of all waste transfer notes where this is not undertaken by the waste carrier; and
- Managing the collection and offsite disposal of all waste streams.

The 'Operator' will appoint competent waste brokers, dealers and carriers where necessary who shall be responsible for the transportation of all waste streams to the relevant Environment Agency permitted waste treatment facility. Waste brokers, dealers and carriers will hold relevant certificates issued by the Environment Agency, which shall be inspected prior to being appointed.

The Production and HSE Manager shall at all times, together with all employees and contractors:

- Promote awareness of the Waste Management Plan and its effectiveness; and
- Monitor, assess, record and report on waste generation, segregation, treatment and disposal.

7. WASTE GENERATING ACTIVITIES

The following section describes the various 'extractive wastes' arising from the Wressle development, together with their waste classification and estimated quantities. Non-extractive waste is not subject to an environmental permit under the MWD, and as such has not been included in detail.

7.1 Activities Already Permitted Under EPR/AB3609XX

The following activities have previously been permitted by the Environment Agency:

1. A1: An Industrial Emission activity as defined by the Industrial Emissions Directive and Part 2 Section 1.2 of the Environmental Permitting (England and Wales) Regulations 2016, as amended, relating to the loading, unloading, handling and storage of crude oil. Activity A1 allows for storage and handling of crude oil that arise from oil production activities.
2. A2: A Mining Waste Operation, as defined by the Mining Waste Directive and Schedule 20 of the Environmental Permitting (England and Wales) Regulations 2016, as amended, relating to the management of extractive waste. The Waste Management Plan 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 acid-squeeze, hot oil wash, solvent treatment, nitrogen injection; and hydraulic fracturing for conventional oil which will be done only once. An enclosed ground flare will be used to incinerate less than 10 tonnes of waste gas per day that cannot be used.
3. A3: A Mining Waste Facility, as defined by the Mining Waste Directive and Schedule 20 of the Environmental Permitting (England and Wales) Regulations 2016, as amended, for the disposal of hydraulic fracturing fluid retained with 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 fracturing fluids and will not require financial provision to be set aside.
4. A4: A groundwater activity, as defined by the Groundwater Directive and Schedule 22 of the Environmental Permitting (England and Wales) Regulations 2016, as amended, for the discharge, injection of fracturing fluid into the target formation that might lead to an indirect input of a pollutant to groundwater.
5. A5: Water discharge activity, the discharge arises from rainfall related runoff from areas of the Wressle 1 wellsite not requiring secondary containment. During rainfall events, water is collected via the perimeter drainage system and is treated via a Class 1 (oil-water separator) interceptor before being discharged to the environment. The treated water is discharged via an outfall to the Ella Beck. The discharge flow is limited to 5 litres per second with a maximum daily discharge volume of up to 432 cubic metres. The discharge shall only take place in times of normal operation which includes production or suspension and shall not discharge to the environment during times of nonstandard operations.

7.2 Hydrocarbon Production

The Wressle Wellsite is currently in a stage of hydrocarbon production which has the potential to generate extractive waste in the form of formation water, spent wellbore treatment fluids and/or flowback water. Depending on the characteristics of the well(s), 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 or export, it will be considered extractive waste and disposed of safely by way of an enclosed ground flare.

Produced fluids (oil, formation water, spent wellbore treatment fluids and/or flowback water) will continue to free flow to the surface naturally until such time artificial lifting techniques (i.e. pump jack) are required. For clarity, a permit subject to EPR2016 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 should not be a consideration under the MWD.

At surface, produced fluids and associated natural gas will continue to be diverted by pipework through various plant such as a bath heater, a separator(s), and any other as deemed necessary. Preheating the fluid aids in the three-phase separation process, which will separate out oil, water (if present) and associated natural gas.

Oil is diverted via pipework to dedicated storage tanks onsite for subsequent offsite removal to a refinery.

Water (if present) will be diverted via pipework to dedicated storage tanks onsite for subsequent offsite disposal, or where practicable, used as a product i.e. pressure support.

7.3 Extractive Wastes

Currently at the time of writing this Waste Management Plan, natural gas and produced water are the only extractive wastes being produced.

7.3.1 Natural Gas

Natural gas is currently being incinerated by an enclosed flare in accordance with the identified Best Available Technique (BAT). Gas harnessing techniques have also been considered with three microturbines being delivered to the wellsite with a view to harnessing the gas to supply the wellsite with electricity.

7.3.2 Produced Water

An initial analysis of the produced water indicates that NORM is evident. A Radioactive Substances Permit (EPR/HB3295DH) is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas. The produced water is transferred offsite to a local Wellsite for production support.

7.4 Well Abandonment and Partial Well Abandonment

Upon cessation of hydrocarbon production, the Wressle-1 Well will be abandoned in accordance with Oil & Gas UK Guidelines [Ref.14], 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, the well abandonment will be undertaken in accordance with BSOR1995 and DCR1996.

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.

Based on a borehole construction, which complies with Oil & Gas UK guidance for the suspension and abandonment of wells, the internal section of last cemented casing string will be subject to well abandonment. The 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.

Following abandonment, the casing strings will be mechanically cut off at 1.5 m below original ground level and a steel plate welded on top. The pre-cast concrete cellar would then be removed and the site restored to its former use.

7.5 Activities Already Permitted Under EPR/HB3295DH

7.5.1 Produced Water

At the time of this application, produced water is materialising and initial analysis indicates that NORM is evident. A Radioactive Substances Permit (EPR/HB3295DH) is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas. This is considered a ‘radioactive substances activity’.

7.6 Proposed Activities - Not Yet Permitted

The ‘Operator’ is proposing to drill two new boreholes, Wressle-2 and Wressle-3, from the Wressle Wellsite.

7.6.1 Drilling of the Wressle-2 Well and the Wressle-3 Well

The Wressle-2 Well and the Wressle-3 Well shall be drilled in sections with an appropriate drilling rig. The exact well design shall be agreed with the Environment Agency by way of WR11 application prior to drilling of the wells. An indicative well design for each well has been provided within the Chemical Inventory, which shows the structure of each well, the formations being drilled, the drilling mud being proposed.

The specific casing depth will not rely on the estimate provided within this application but will be determined by the actual formation tops, as determined by sample and log evaluation during drilling of the Wressle-2 Well.

Drilling fluid additives shall be the subject of approval by the Environment Agency prior to the undertaking of any drilling activities. The 'Operator' is proposing to use a number of drilling additives which have been the subject of approval within previous applications to the Environment Agency as well as including the use of oil-based mud in the lower section of the well.

Details of the drilling additives have been provided within the Chemical Inventory together with the location on where these additives shall be used within the well. Any oil based mud system will be comparable with the requirements of SR2015 No.1 permit, i.e. will be low toxicity. For clarity, an SR2015 No.1 permit is not being applied for.

The anticipated extractive wastes during this phase includes:

- Water Based Rock Cuttings;
- Water Based Drilling Fluid;
- Oil Based Rock Cuttings; and
- Oil Based Drilling Fluid.

7.6.2 Indicative Well Design

The exact well design will be contingent on the actual conditions encountered during drilling, however an indication of how the well will be constructed is summarised in Table 5.

Hole Section (")	Depth (m)		Mud System	Casing (")	Cement
	MD	TVD			
24	70	70	Water Based	18 5/8	Section depth to surface
16	510	450	Water Based	13 3/8	Section depth to surface
12 1/4	1,190	854	Salt Saturated Water Based	9 5/8	Section depth to within 13 3/8 casing
8 1/2	2,630	1,858	Oil Based	7	Section depth to within 9 5/8 casing

Table 4: Wressle-2 Well Construction Summary (Not Final)

Hole Section (")	Depth (m)		Mud System	Casing (")	Cement
	MD	TVD			
24	70	70	Water Based	18 5/8	Section depth to surface
16	505	450	Water Based	13 3/8	Section depth to surface
12 1/4	1,090	851	Salt Saturated Water Based	9 5/8	Section depth to within 13 3/8 casing
8 1/2	2,410	1,800	Oil Based	7	Section depth to within 9 5/8 casing

Table 5: Wressle-3 Well Construction Summary (Not Final)

7.6.3 Logging

Geological logging is undertaken during well construction to determine whether formations encountered during drilling may contain petroleum. The borehole logs assist Rathlin in determining specific zones, which justify subsequent testing. Coring may also be undertaken.

7.6.4 Perforation

In order to establish communication between the formation(s) being tested and the wellbore the casing must be perforated.

The perforating operation, in particular the use of explosive charges, is regulated by the Police Authority and the Health and Safety Executive. Perforating may be undertaken several times as deemed necessary by the 'Operator'.

Once the casing has been perforated, the fired perforating guns will be recovered at a time determined within the operation. The perforation process may be repeated a number of times.

The anticipated extractive wastes during this phase includes:

- Circulation Fluid / Suspension Brine; and
- Metal Debris.

7.6.5 Well Integrity

Regulation 13 of The Offshore installations and Wells (Design and Construction, etc) Regulations 1996 requires that well-operators ensure that a well is designed, constructed and controlled (throughout its lifecycle) so there can be no escape of fluids from the well and that the risks to strata to which it is connected are as low as reasonably practicable. This is done by (Regulation 14) taking into account the geological strata and formations, and fluids within them and any hazard which such strata and formations may contain at pre-design stage and (Regulation 16) ensuring that every part of a well is composed of material suitable to achieving these purposes.

The design and well activities must be independently reviewed (Regulation 18) and submitted to the Health and Safety Executive prior to constructing the well.

As per the OGUK Well Life Cycle Integrity Guidelines, integrity tests shall be undertaken during the construction of the well. These shall include pressure testing of the casing once cemented and the BOP installed, prior to drilling out the cement shot, to a higher pressure than the maximum potential pressure the casing will be subjected, and then the cement seal around the shoe will be tested by a LOT of FIT.

By following these regulations and guidelines to ensure integrity of the well, this should limit the risk of contamination to the environment.

7.6.6 Near Wellbore Treatments for Wressle-2 Well and Wressle-3 Well

It is proposed to undertake, where necessary, the same wellbore treatments on the Wressle-2 and Wressle-3 Wells as those currently consented for the Wressle-1 Well as described within Section 7.1.3. The description of those activities will not change and the chemicals associated with the treatments will remain the same as those already consented, but have been included for assessment for use on the Wressle-2 Well and the Wressle-3 Well for completeness.

Near Wellbore Treatment Table		
Treatment	**Description**	**Chemicals used**
Acid Squeeze	Acid is applied to the formation to aid the flow of hydrocarbons to the surface by cleaning out the near wellbore formation, removing debris and induced damage resulting from the initial drilling operation. An acid squeeze involves injecting the treatment and low pump rates and controlled pressure to treat the area in the vicinity of the casing perforations.	Hydrochloric Acid and Hydrofluoric Acid solution.
Hot Washing	Hot oil and/or hot water is applied to the formation with the aim to remove solid hydrocarbons such as paraffin's from the near wellbore formation.	Hot oil and/or hot water
Solvent Treatment	Solvent is applied to the formation in oil bearing formations to remove solid hydrocarbons near the wellbore. Solvents only dissolve with hydrocarbons and do not react with the formation.	EGMBE. Well Wash with organic surfactants.
Nitrogen Lift	To aid the initial flow of hydrocarbon, 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 atmosphere.	Nitrogen.

Table 6: Near Wellbore Treatment Table

7.6.7 Well Testing

Upon completion, the well(s) will be the subject to subsequent, clean up and testing. The purpose of the well test is to evaluate the commercial viability of the hydrocarbon reservoir, if encountered. The test will be conducted in two (2) parts consisting of a Well Clean Up (WCU) and an Extended Well Test (EWT).

During the well test, hydrocarbons will be produced. A Waste Gas Management Plan has been developed for the purpose of demonstrating Best Available Technique (BAT) for the management of waste gas as a result of each well testing phase and the production phase.

The testing of the Wressle-2 Well and the Wressle-3 Well is anticipated to last no more than six (6) months, start to finish

The anticipated extractive wastes during this phase include:

- Natural Gas
- Circulation Fluid / Suspension Brine; and
- Formation Water.

7.6.7.1 Well Clean Up

A well clean up is conducted when trying to bring the reservoir fluids to surface for the first time following a drilling campaign, after a maintenance shutdown, or after a period of non-operation. The aim of the well clean up is to get the reservoir fluids to surface and flowing at a consistent rate for onward extended well testing.

A well clean up will involve the use of a well testing spread, typically consisting of at least a choke manifold, surface safety valve, three-phase separator, a heater unit, fluid storage tanks, a vent line and a combustion unit.

Once at surface, gas and produced fluids will be diverted by temporary pipework to a separator, which will separate out the produced fluids and gas. The mixed fluids (oil and water), will be diverted via temporary pipework to dedicated storage tanks onsite for subsequent storage prior to offsite removal.

Oil will be removed offsite to a local refinery and formation water will be transported via a licenced haulier to either:

1. 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; or
2. To a bespoke permitted waste treatment facility for treatment and disposal in accordance with BAT.

Waste gas produced as a result of the well clean-up operations shall be managed in accordance with the approved Best Available Technique (BAT) as demonstrated by the Waste Gas Management Plan.

It is considered that using an enclosed ground flare unit is considered BAT. Extended Well Testing

Should the well clean up phase indicate that hydrocarbons are present, then testing operations will continue with the extended well testing stage. An extended well testing stage is a longer duration test, which is carried out to assess the commercial viability of the well and establish detailed gas and oil composition.

Once at surface, gas and produced fluids will be diverted by temporary pipework via a separator, which will separate out the produced fluids and gas, to onsite storage tanks

Oil will be removed offsite to a local refinery and formation water will be transported via a licenced haulier to either:

1. 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; or
2. To a bespoke permitted waste treatment facility for treatment and disposal in accordance with BAT; or
3. Transferred offsite to a local Wellsite for production support.

Waste gas produced as a result of the well clean-up operations shall be managed in accordance with the approved Best Available Technique (BAT) as demonstrated by the Waste Gas Management Plan.

The purpose of an extended well test is to analyse the flow characteristics of a formation over an extended period.

Disposal of produced natural gas by incineration will employ a Uniflare UF10 flare stack.

7.6.8 Proppant Squeeze

In order to increase the permeability within the target formations of the Wressle-2 and Wressle-3 wells, it may be necessary to undertake a proppant squeeze, which is designed to create channels of communication through near wellbore formation, having potentially been blocked as a result of the initial drilling and completion operation.

A proppant squeeze involves a slurry of proppant (resin-coated ceramic) and gelled water being pumped through the perforations into the target formation at a pressure exceeding the fracture propagation pressure of the formation. Injecting pressure and pump rates high enough to propagate a fracture in the formation creates channels of

communication through near wellbore formation damage. When the pressure is released, the proppant remains in situ propping open the small fractures, through which hydrocarbons can flow at enhanced rates. Unlike hydraulic fracturing, a proppant squeeze requires the use of only a small volume of proppant and carrier fluid as it seeks to only bypass the formation damage rather than specifically to enhance the natural permeability of the formation.

A pre-treatment injectivity test will first be undertaken using approximately $15m^3$ – $25m^3$ 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.

The main proppant treatment will consist of approximately 20 to 30 tonnes of resin-coated ceramic beads and approximately $80m^3$ to $120m^3$ 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 proppant squeeze is designed to extend circa 40m in a lateral direction and 20m in a vertical direction, above and below the perforation.

This is a small scale operation, which was undertaken on the Wressle 1 Well where there were tight formations of sandstone reservoirs, and/or where there were formation damage issues preventing full flow potential.

A full disclosure of the proposed proppant fluid is provided within the Chemical Inventory.

7.6.8.1 Flowback Water and Disposal

A percentage of the proppant fluid will be returned to surface (flowback water) 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. The percentage returned is expected to be circa 30% with a maximum of 50%, based upon previous proppant squeeze operations undertaken by the 'Operator' and the industry.

Flowback water has the potential to contain low levels of Naturally Occurring Radioactive Material (NORM), which predominantly relate to the isotopes of radium (and associated progeny), which find their way into the water due to their chemical solubility. Elevated concentrations of radium-226 and radium-228 progeny may also be present due to dissolved Rn-222 (radon) and to a lesser extent, Rn-220 (thoron) gas. Samples of flowback water shall be sent to a laboratory holding the appropriate accreditations for radionuclide analysis.

A Radioactive Substances Permit (EPR/HB3295DH) is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas. The produced water is transferred offsite to a local Wellsite for production support.

7.6.8.2 Retained Fluid within the Target Formation

The remaining 50% to 70% of proppant fluid will be retained within the target formation, having been adsorbed on the charged, high surface area minerals within the target formation. The majority of the constituents within the proppant fluid are non-hazardous, having been assessed using the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) assessment methodology. The assessment concluded that the majority of constituents assessed for use in the Wressle-1 proppant squeeze are classified as non-hazardous to groundwater. A copy of the JAGDAG substances assessment has been provided previously to the Environment Agency.

Three (3) constituents have been classified as hazardous, however, due to the extremely low quantity and concentration expected to be used within the target formation, the use of such constituents is considered de-minimis in accordance with Schedule 22 3 (3) of EPR 2016, as the quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater.

The target formation within which the fluid is retained is expected to be classified by the Environment Agency as a Non-Hazardous Mining Waste Facility, the extent of which will be determined through fracture height and growth modelling.

An indicative well path design has been provided within the Site Plans, which shows the indicative well paths of the Wressle-2 Well and the Wressle-3 Well.

As a result of the retention of proppant fluid with the target 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 options considered as part of the BAT assessment include:

- Recovery of all proppant carrier fluid over prolonged flowback 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 target formation.

The BAT assessment identified that both the prolonged flowback periods and artificial lift are unlikely to result in a 100% recovery of proppant fluid from the target 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 circa 1,576m TVD, 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 target formation unviable.

As it is not feasible to retrieve 100% flowback, either by a prolonged flowback period or by artificial lift and the removal of proppant fluid by excavation is not feasible, retention within the target 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 target 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.

7.6.9 Hydrocarbon Production

Following a successful drilling and testing campaign of the Wressle-2 Well and Wressle-3 Well, they will each be individually brought into production and operate alongside the currently producing Wressle-1 Well. The ‘extractive waste’ streams will be the same as those currently consented.

7.6.10 Well Abandonment and Partial Well Abandonment

Upon cessation of hydrocarbon production, the Wressle-2 Well and Wressle-3 Well will be abandoned in accordance with all applicable guidance and legislation as described within Section 7.1.6, the same as the Wressle-1 Well. The ‘extractive waste’ streams will be the same as those currently consented.

7.7 Extractive Waste Management

An assessment of the potential ‘extractive waste’ arising from both the permitted activities and the proposed permitted activities has been undertaken.

The activities, which result in the production of extractive waste, are as follows:

- Drilling activities including the drilling of the Wressle-2 and Wressle-3 Wells
- Near wellbore treatments including acidisation, solvent treatment, hot oil washing and nitrogen lifting.
- Well clean up and extended well testing.
- Proppant squeeze of the Wressle-2 Well and the Wressle-3 Well and residual waste from the Wressle-1 Well.
- Hydrocarbon production across both wells.
- Well abandonment and/or partial well abandonment.

Well Suspension Brine				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 05 08
	Potential Classification:	Hazardous	EWC Code:	01 05 06*
	Estimated Quantity:	25 Tonnes	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	<2 Weeks
Operation / Activity	The wells throughout their lifespan will be the subject of a period of suspension, which is undertaken using brine. In addition, brine is also used as circulation fluid following well treatments to recover spent treatment additives such as acid. Following suspension or circulation operations, the brine will be circulated out of the well to an onsite storage tank. Brine remaining within the well during suspension operations is not considered a waste as it is serving a 'well control' function.			
Prevention and Minimisation	The suspension brine will be stored onsite for subsequent reuse if required at a later date if the well will need to be suspended again.			
Treatment and Disposal	Once the suspension fluid has fully served its purpose, it 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.			
Remaining in the Formation	None. Suspension brine is circulated out prior to production, formation testing and proppant operations.			
Monitoring	An inspection of the storage tanks that contain the suspension fluid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 7: Waste Table – Well Suspension Brine

Water Based Drilling Fluids (Fresh Water)				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 05 04
	Potential Classification:	Hazardous	EWC Code:	01 05 06*
	Estimated Quantity:	150 Tonnes	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	<2 Weeks
Operation / Activity	Drilling fluids are used to aid the drilling process by lubricating the drill bit, circulating rock cuttings to surface and by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of natural gas or formation pressure.			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the drilling fluid in a closed loop system, sustained by filtering out any rock cuttings and/or finer particles of rock. The rock cuttings tank is a fluid separator tank (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 drilling fluid system.			
Treatment and Disposal	Drilling fluid becomes a waste when it is no longer required in the operation and will be transferred from the circulating mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all drilling fluid shall be circulated out.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the water based drilling fluid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 8: Waste Table – Water Based Drilling Fluids (Fresh Water)

Waste Clays and Sand				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 04 09
	Potential Classification:	Hazardous	EWC Code:	01 05 06*
	Estimated Quantity:	130 Tonnes	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Storage Container	Storage Duration:	<2 Weeks
Operation / Activity	The drilling of the borehole will commence with the drilling and installation of a casing string known as a surface conductor. The near surface clays and sands within which the surface conductor casing will be set will be removed. The clay and sand will be circulated out of the well using either an auger or water-based drilling fluids and return to the surface where it is transferred to an open tank.			
Prevention and Minimisation	The ability to prevent or minimise clay and sand is limited given that the formation needs to be removed to allow the conductor casing to be installed.			
Treatment and Disposal	The clay and sand will be transported offsite via licenced haulier to a permitted facility for treatment and reuse.			
Remaining in the Formation	None, all clay and sand shall be removed to allow the conductor casing to be installed.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the waste clay and sand shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 9: Waste Table – Water Clays and Sand

Water Based Drilling Fluid (Salt Saturated)				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 05 08
	Potential Classification:	Hazardous	EWC Code:	01 05 06*
	Estimated Quantity:	620 Tonnes	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	<2 Weeks
Operation / Activity	Drilling fluids are used to aid the drilling process by lubricating the drill bit, circulating rock cuttings to surface and by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of natural gas or formation pressure.			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the drilling fluid in a closed loop system, sustained by filtering out any rock cuttings and/or finer particles of rock. The rock cuttings tank is a fluid separator tank (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 drilling fluid system.			
Treatment and Disposal	Drilling fluid becomes a waste when it is no longer required in the operation and will be transferred from the circulating mud system on the drilling rig to a vacuum tanker for removal offsite via licenced haulier to a permitted facility for treatment.			
Remaining in the Formation	None, all drilling fluid shall be circulated out.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the water based drilling fluid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 10: Waste Table – Water Based Drilling Fluid (Salt Saturated)

Water Based Rock Cuttings (Salt Saturated)				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	680 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Storage Container	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling muds 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.			
Prevention and Minimisation	The ability to prevent or minimise rock cuttings recovery 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 hole size required to install each string of casing which in turn keeps the waste recovery to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.			
Treatment and Disposal	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. Rock cuttings are transported offsite via a licenced haulier to an Environment Agency permitted composting facility where it is blended into compost after the compost has been sanitised.			
Remaining in the Formation	None. Extractive process only.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the rock cuttings shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 11: Water Based Mud (Salt Saturated) Waste Table

Oil Based Drilling Fluid				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	01 05 05*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	150 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling fluids are used to aid the drilling process by lubricating the drill bit, circulating rock cuttings to surface and by maintaining a prescribed hydrostatic pressure within the well to prevent the uncontrolled release of natural gas or formation pressure.			
Prevention and Minimisation	Drilling fluid waste is minimised by continually reusing the oil based drilling fluid in a closed loop system, sustained by filtering out any rock cuttings and/or finer particles of rock. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows oil based 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. When oil-based drilling fluid exceeds the prescribed mud weight, due to finer particles of rock cuttings in the oil based drilling fluid, the finer particles of rock cuttings are removed via a centrifugal process undertaken onsite.			
Treatment and Disposal	Low toxicity oil-based drilling fluids at the end of their usage are returned to the supplier for treatment and reuse. A small volume of low toxicity oil based drilling fluid, contaminated with clean up fluids during the rig, tank and equipment cleaning process, will be transferred to a vacuum tanker for removal offsite via a licenced haulier to an Environment Agency permitted facility.			
Remaining in the Formation	None, all mud shall be circulated out.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the oil based drilling fluid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 12: Oil Based Mud Waste Table

Oil Based Rock Cuttings				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	01 05 05*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	320 Tonnes	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Storage Container	**Storage Duration:**	<2 Weeks
Operation / Activity	Drilling muds 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.			
Prevention and Minimisation	The ability to prevent or minimise rock cuttings recovery 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 hole size required to install each string of casing which in turn keeps the waste recovery to a minimum. The rock cuttings tank is a fluid separator tank (perforated false floor), which allows drilling mud coating the rock cuttings to percolate down through the false floor where it is collected and pumped back into the closed loop mud system.			
Treatment and Disposal	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. Rock cuttings are transported offsite via a licenced haulier to an Environment Agency permitted composting facility where it is blended into compost after the compost has been sanitised.			
Remaining in the Formation	None. Extractive process only.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved drilling programme. An inspection of the storage tanks that contain the rock cuttings shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 13: Oil Based Rock Cuttings Waste Table

Cement				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	17-01-01
	Potential Classification:	N/A	**EWC Code:**	N/A
	Estimated Quantity:	5 m^3	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Skips	**Storage Duration:**	<2 Weeks
Operation / Activity	On completion of hydrocarbon production from the well, it is plugged and abandoned. Cement returns from the casing of the well may result in waste cement. In addition, not all cement made at site may be used and therefore some may be surplus.			
Prevention and Minimisation	Careful planning will be taken prior to any cement operation being undertaking to calculate the amount of cement required thus preventing or minimising cement waste. The cement will be batched 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.			
Treatment and Disposal	Excess returns to surface will be transferred to a number of open top builder's skips onsite for subsequent removal and disposal to an Environment Agency permitted waste facility where it recycled as building rubble for use within the building industry.			
Remaining in the Formation	None. Cement remaining within the formation, between the casing and formation (wellbore annulus) and within the casing is a critical component of the well construction and remains so throughout the life cycle of the well. It is not considered a waste.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved cementing programme. An inspection of the open top builder's skips that contain the cement waste shall be carried out prior to being used and will be subject to regular visual inspections checks.			

Table 14: Cement Waste Table

Near Wellbore Treatment – Spent Acid				
Classification, Quantity and Storage	**Default Classification:**	Non-Hazardous	**EWC Code:**	01 05 08
	Potential Classification:	Hazardous	**EWC Code:**	01 05 06*
	Estimated Quantity:	5 m^3	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Acid is used to remove production-resisting completion-induced formation matrix damage. As the acid reacts with minerals within the formation, the chemical reaction produces a near neutral solution, 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.			
Prevention and Minimisation	The acid will be used in stages to ensure its use is minimised. The reaction of the acid with minerals produces a near neutral solution. This reaction, and in turn the waste generated, is unavoidable. Careful planning will be taken prior to any acid squeeze being undertaking to ensure the 'Operator' minimises the amount of acid used, which in turn reduces the amount of waste generated by the operation.			
Treatment and Disposal	The spent acid 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.			
Remaining in the Formation	None. The reaction of the acid with the minerals produces chlorides, which are classified as non-hazardous. The chloride solution will be lifted out of the formation and collected at surface.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved acid treatment programme. An inspection of the storage tanks that contain the spent acid shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 15: Spent Acid Waste Table

Near Wellbore Treatment – Solvent				
Classification, Quantity and Storage	**Default Classification:**	Hazardous	**EWC Code:**	14 06 03*
	Potential Classification:	-	**EWC Code:**	-
	Estimated Quantity:	15 m^3	**Dust / Odour Potential:**	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	**Storage Duration:**	<2 Weeks
Operation / Activity	Solvent is used to promote clean up and fluid recovery. Solvents also strip oil and sludge layers from acid soluble materials and the prevention of emulsions forming within the wellbore. The solvent 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 disposal facility where it is processed, treated and incinerated in accordance with the permitted controls of the waste treatment facility.			
Prevention and Minimisation	The solvent will be used in stages to ensure its use is minimised. Careful planning will be taken prior to any solvent operations being undertaking to ensure the 'Operator' minimises the amount of solvent used, which in turn reduces the amount of waste generated by the operation.			
Treatment and Disposal	The solvent 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 disposal facility where it is processed, treated and incinerated in accordance with the permitted controls of the waste treatment facility.			
Remaining in the Formation	None. The solvent will be lifted out of the formation and collected at surface.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved solvent treatment programme. An inspection of the storage tanks that contain the solvent shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 16: Solvent Waste Table

Nitrogen				
Classification, Quantity and Storage	Default Classification:	Inert	EWC Code:	N/A
	Potential Classification:	N/A	EWC Code:	N/A
	Estimated Quantity:	Unknown	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	N/A	Storage Duration:	N/A
Operation / Activity	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.			
Prevention and Minimisation	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.			
Treatment and Disposal	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.			
Remaining in the Formation	None. Nitrogen injected into the well to aid the initial lifting of wellbore fluids will flow to surface.			
Monitoring	The volumes of Nitrogen will be monitored both in and out of the well.			

Table 17: Nitrogen Waste Table

Proppant Carrier Fluid (Retained in the Formation)				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 01 02
	Potential Classification:	N/A	EWC Code:	N/A
	Estimated Quantity:	105 m^3	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	N/A	Storage Duration:	N/A
Operation / Activity	The technique is used to undertake low volume hydraulic fracturing of the formation and prop open the fractures using proppant. This in turn provides permeability, allowing natural gas and oil from within the formation to flow into the wellbore and up to surface.			
Prevention and Minimisation	It is anticipated that up 50% of proppant fluid will return to surface. The remaining fluid will be retained within the target formation and, as such, is classified as a Non-Hazardous Mining Waste Facility.			
Treatment and Disposal	Not Applicable.			
Remaining in the Formation	No less than 50% of the proppant fluid will be retained within the Millstone Grit Group.			
Monitoring	None.			

Table 18: Proppant Carrier Fluid (Retained in the Formation) Waste Table

Proppant Carrier Fluid (Flowback)				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 01 02
	Potential Classification:	N/A	EWC Code:	N/A
	Estimated Quantity:	75 m^3	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	N/A
Operation / Activity	The technique is used to undertake low volume hydraulic fracturing of the formation and prop open the fractures using proppant. This in turn provides permeability, allowing natural gas and oil from within the formation to flow up into the wellbore and up to surface.			
Prevention and Minimisation	Due to the nature of the Millstone Grit Group, it is anticipated that up 50% of proppant fluid will unavoidably return to surface.			
Treatment and Disposal	Flowback fluid will be transported via a licenced haulier to either 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, or to a bespoke RSR permitted waste treatment facility for treatment and disposal in accordance with the Best Available Technique (BAT).			
Remaining in the Formation	Not Applicable.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved solvent treatment programme. An inspection of the storage tanks that contain the proppant carrier fluid (flowback) shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 19: Proppant Carrier Fluid (Flowback) Waste Table

Proppant				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	01 04 09
	Potential Classification:	N/A	EWC Code:	N/A
	Estimated Quantity:	30 Tonnes	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	N/A
Operation / Activity	Flowback water will contain proppant (resin-coated ceramic) which is removed at surface.			
Prevention and Minimisation	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.			
Treatment and Disposal	The proppant will be transported offsite via licenced haulier to an Environment Agency permitted composting facility, where it is blended into compost after compost has been sanitised.			
Remaining in the Formation	Not Applicable.			
Monitoring	The 'Operator' provides onsite competent supervision to ensure the operation be carried out in accordance with an approved proppant squeeze programme. An inspection of the storage tanks that contain the proppant carrier fluid (flowback) shall be carried out prior to being used and will be subject to regular visual inspections and annual thickness checks.			

Table 20: Proppant Waste Table

Formation Water / Produced Water				
Classification, Quantity and Storage	Default Classification:	Non-Hazardous	EWC Code:	16 10 02
	Potential Classification:	Hazardous	EWC Code:	16 10 01
	Estimated Quantity:	75 m^3	Dust / Odour Potential:	Limited Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	N/A
Operation / Activity	Formation water may be produced together with petroleum. Formation water is separated from the petroleum on surface using fluid separation equipment and transferred to cylindrical storage tanks located onsite for offsite removal. The formation water has the potential to contain low levels of Naturally Occurring Radioactive Material (NORM). Samples of formation water will be sent to a laboratory holding the appropriate accreditations for radionuclides analysis by gamma spectrum.			
Prevention and Minimisation	The ability to prevent or minimise recovery of formation water is extremely limited. Formation water cannot be reused onsite due to unknown components within the formation water and high salinity.			
Treatment and Disposal	Depending on the outcome of radionuclides analysis formation water will be transported via a licenced haulier to either an Environment Agency permitted waste water treatment works facility or a bespoke RSR permitted waste treatment facility where it is processed, treated and discharged in accordance with the permitted controls of the treatment facility.			
Remaining in the Formation	None. Formation water naturally occurs within the formation and is only considered as a waste when produced from the well.			
Monitoring	A contamination monitoring programme will be devised and include the wellhead, separator equipment and storage tanks. Consignment of formation water will be screened externally for contamination prior to leaving site. An inspection of the fluid tanks that contain the formation water shall be carried out prior to being used and will be subject to visual weekly inspections and annual thickness checks.			

Table 21: Formation Water / Produced Water

Natural Gas				
Classification, Quantity and Storage	Default Classification:	Hazardous	EWC Code:	16 05 04*
	Potential Classification:	N/A	EWC Code:	N/A
	Estimated Quantity:	30 Tonnes	Dust / Odour Potential:	Some Potential
	Onsite Storage:	Enclosed / Partially Enclosed Storage Tank	Storage Duration:	N/A
Operation / Activity	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 for the determination on whether or not the reservoir is capable of producing commercial quantities of natural gas.			
Prevention and Minimisation	The ability to prevent or minimise natural gas is extremely limited during this operation, as it is required 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). It is proposed that an electrical generator could be used to harness the natural gas and reduce any waste volumes, or to export the gas via pipeline.			
Treatment and Disposal	Natural gas is separated from produced fluids at surface and diverted via pipework to the identified BAT i.e. flare / generator / pipeline export.			
Remaining in the Formation	None. Natural gas naturally occurs within certain hydrocarbon bearing formations and is only considered as a waste when produced from the well.			
Monitoring	An inspection of the relevant plant shall be carried out prior to being used and will be subject to regular inspections and maintained in accordance with manufacturers recommendations.			

Table 22: Natural Gas Waste Table

Drilling mud may require treatment within the site boundary. An assessment of the potential waste treatment processes confirms that an 'installation activity' would not be required, as the treatment plant will not include a capacity exceeding:

- 50 tonnes per day for non-hazardous waste for disposal - using chemical, biological or physical treatment;
- 75 tonnes per day for non-hazardous waste for recovery - using biological treatment; or
- 10 tonnes per day for hazardous waste.

Drilling mud will form part of a closed loop system with treatment of the mud being limited to physical treatment to filter our cuttings to prolong the use of the mud and reduce overall waste mud volumes. The treatment is not for disposal purposes but rather ongoing recovery.

7.8 Management of Non-Extractive Waste

Throughout the operations, non-extractive wastes will be generated onsite, which may include, but is not limited to:

- Surface run-off water;
- Waste water and sewage;
- Waste engine, gear and lubricating oils;
- Waste hydraulic oils;
- Oil rags and absorbents;
- Waste oil filters;
- Paper and cardboard;
- Canteen waste;
- Wood; and
- Metal.

7.9 Treatment of Non-Extractive Waste

Non-extractive wastes will not be treated at the wellsite. They will be segregated and stored according to their EWC Code pending collection by a licenced waste carrier for onward treatment and/or disposal.

7.10 Management of Naturally Occurring Radioactive Material

A Radioactive Substances Permit (EPR/HB3295DH) is in place for the accumulation and disposal of radioactive waste from NORM resulting from the production of oil and gas.

A competent Radiation Protection Supervisor and/or Radioactive Waste Advisor has been appointed to ensure that NORM is managed correctly.

8. RISK POSED TO THE ENVIRONMENT AND HUMAN HEALTH

The risks posed by the 'mining waste operation' has been addressed within an Environmental Risk Assessment which forms part of any application to the Environment Agency and is considered an 'operating technique'. The Environmental Risk Assessment (which is qualitative) considers activities, which have the potential to cause harm to the environment and human health (pollution damage).

The Environmental Risk Assessment has concluded that the risk to the Environment and Human Health is 'insignificant' not least due to the type of activities being undertaken, the nature of the waste and the mitigation measures adopted by the 'Operator'.

The Environmental Risk Assessment follows the Environment Agency's source-pathway-receptor' model and includes the risks posed from the site operations in relation to:

- Accidents and incidents;
- Air emissions;
- Dust;
- Global warming potential;
- Noise;
- Odour;
- Release to water; and
- Waste.

9. POINT SOURCE EMISSIONS

There are a number of point source emissions registered at the Wressle Wellsite comprising of emissions to air, surface water and groundwater.

9.1 Point Source Emissions to Groundwater

Previously the Wressle-1 well was the subject of a proppant squeeze, which required the consenting of an indirect discharge to groundwater. Whilst this indirect discharge is unlikely to have taken place as the retained proppant carrier fluid is likely residing within the target formation, to ensure the operation was regulated beyond doubt the relevant 'groundwater activity' was obtained. It is proposed that a second and a third emission to groundwater will take place from the proposed Wressle-2 Well and Wressle-3 Well respectively.

9.2 Point Source Emissions to Surface Water

Surface water (rain water) captured on the Wressle Wellsite runs to the perimeter containment ditch and is subsequently discharged via a Class 1 separator to the nearby watercourse (Ella Beck). During periods of production or well suspension when the wellsite is undertaking normal operations, the site surface water continues to discharge to this watercourse. Groundwater monitoring and surface water monitoring is undertaken to ensure the discharge does not have an adverse effect on the water quality and that the mitigation measures such as the Class 1 separator is working correctly.

9.3 Point Source Emissions to Air

There are a number of point source emissions to air at the Wressle Wellsite. The primary emission point is the flare unit used to incinerate waste gas. Additional emission points include the oil storage tank conjoined vent line and the medium combustion plant unit, the latter is not yet in use but is a registered emission point under the permit.

10. WELLSITE MANAGEMENT

10.1 Foul Water and Sewage

The proposed development does not require nor does it propose the installation of a permanent connection to the existing sewerage system. During hydrocarbon production, a welfare unit is provided onsite, which has its own independent under-unit sewage tank. During short duration well operations, such as drilling, and proppant squeeze operations, when a number of personnel will be onsite will be at its greatest, temporary welfare facilities will be provided onsite, each facility having an independent under-unit sewage tank. The temporary welfare facilities will remain onsite during the lifetime of the wellsite, with any replacement welfare cabins (if necessary) also being of a temporary nature. Foul sewage will continue to be directed into contained systems, which are emptied periodically and transported offsite via a licenced haulier to an Environment Agency permitted waste treatment facility. For clarity, no sewage will be directed to Ella Beck or any other watercourse.

Sewage will be collected routinely throughout the periods when the wellsite is manned and removed by licenced waste carrier to an Environment Agency permitted waste water treatment works for subsequent treatment and/or disposal. The criteria for determining whether waste will be recycled or disposed of will be determined by the receiving waste treatment facility upon receipt of the waste at the treatment facility. The waste will be tested by the waste treatment facility, the results of which will determine the treatment and/or disposal method to be used. Such treatment and/or disposal method will be in accordance with the waste treatment facility's environmental permits.

10.2 Wellsite Monitoring

The 'Operator' is responsible for the day to day monitoring of the Wressle Wellsite during hydrocarbon production. When production has stabilised, and if conditions allow, the wellsite may revert to daytime manning only, with a nominated Production Supervisor onsite. The 'Operator' will identify potential leaks and emissions from permanent site equipment and materials stored within the site and ensure that any action required to remediate such leaks or emissions is undertaken as soon as they are identified, thus preventing potential impact on the environment.

During short duration well operations, such as drilling, and proppant squeeze, the supervision of the Wressle Wellsite will be delegated to the Wellsite Supervisor, appointed by the 'Operator' to exercise overall control of the wellsite operations, in accordance with the BSOR1995 and WR2011.

The Wellsite Supervisor will be responsible for monitoring the wellsite and temporary well operations equipment and will identify potential leaks and emissions from such temporary equipment and temporary materials stored within the site and ensure that any action required to remediate such leaks or emissions is undertaken as soon as they are identified, thus preventing potential impact on the environment.

During short duration well operations, a written record of monitoring (Environmental Checklist) will be completed as part of the monitoring schedule by the Wellsite Supervisor. Copies of the Environmental Checklist will be held onsite and will be made available for review by the Environment Agency.

10.3 Contractor Performance

The 'Operator' is ultimately responsible for any waste generated onsite during the hydrocarbon production and short duration well operations and will not delegate its responsibilities or accountabilities as 'Operator' to a contractor. Contractors, who are involved in the generating of waste and subsequent reuse, recycle or disposal will first have been selected in accordance with the Safety and Environmental Management System.

10.4 Security

Security of the wellsite is provided in the form of a 2m high 138.5 m by 80.5 m security fence and lockable access gates. The positioning of, both permanent and temporary equipment, including the groundwater quality monitoring boreholes, will be within the confines of the security fence. The wellsite is fitted with an intruder alarm system. CCTV system is also installed.

Manned security control access and egress to the wellsite and play a key role in the control of personnel in the event of an emergency situation, in accordance with the Site Safety Document, a requirement of BSOR1995.

10.5 Complaints

In the event that a complaint is received from stakeholders, including neighbours, the complaint shall be recorded and investigated in accordance with the Safety and Environmental Management System.

Complaints relating to the environment will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident initiating the complaint and/or permit conditions. In some cases, permit conditions may require notification the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

10.6 Fire Response

Whilst a fire is associated more so with the health and safety of the personnel onsite, a fire does have the potential to lead to an environmental incident. It is imperative, therefore, that any potential for a fire and subsequent emergency response is identified and included in the operational planning. The Site Safety Document, which is a requirement under Regulation 7 of BSOR1995, specifies the arrangements for identification and mitigation in the event of a fire, including consultation with the local Fire & Rescue Service.

Containment of any firefighting fluid is provided for in three ways: -

1. By the secondary bunding installed for key process areas.
2. By the raised perimeter bund, that provides significant fluid containment for the site area.
3. By the impermeable membrane incorporated in to the design of the wellsite.

Additional water is available onsite and should be used to keep the areas adjacent to the fire cool to avoid any damage being sustained to the impermeable membrane.

10.7 Incident Reporting and Investigation

All incidents, no matter how minor, are reported in accordance with the Safety and Environmental Management System. A procedure therein provides for the investigation of all incidents to ensure lessons are captured and actions implemented to avoid reoccurrence.

In addition, the procedure provides for the notification to the relevant Regulatory Authority in the event of an incident, which extends beyond the containment of the wellsite.

Environmental incidents will be reported to the Environment Agency within the required timescales, as determined by the severity and environmental impact of the incident and/or permit conditions. In some cases, permit conditions may require notification to the Environment Agency within 24 hours or without delay for a potentially polluting incident.

Following notification, measures to prevent reoccurrence will be agreed with the Environment Agency, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

11. PROPOSED PLAN FOR CLOSURE AND SITE AFTERCARE

Prior to site closure, abandonment of the well and restoration of the wellsite, a Site Closure Plan will be developed by the 'Operator' and submitted to the Environment Agency for approval.

As a minimum, the Site Closure Plan will consider both the decommissioning and abandonment of the well(s) and the restoration and aftercare of the wellsite.

11.1 Well Abandonment and Decommissioning

Upon cessation of activities the well will be abandoned in accordance with industry guidance, in force at the time of well decommissioning. Current industry guidance 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.

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.

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.

Once the well is abandoned, the casing strings will be mechanically cut off at 1.5 m 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.

In addition to industry guidance the well abandonment(s) will be undertaken in accordance with BSOR1995 and DCR1996 and all other applicable industry guidance and standards and reviewed by independent well +examiner.

11.2 Restoration and Aftercare

All extractive waste shall be removed from the wellsite prior to restoration.

All surface equipment will be purged clean, dismantled and removed from the wellsite. Buildings and structures will be demolished and removed. The containment systems and associated management of surface water will continue to be implemented until all equipment has been removed from the site.

Plant and structures shall be removed from the site; the site surface will be inspected for contaminants and placed within skips pending collection. Any material which shows evidence of contamination shall be segregated and collected independently of its uncontaminated counterparts.

Samples will be obtained throughout the restoration process to demonstrate that there has been no deterioration to the environment. Samples taken will include surface water, groundwater and soil analysis.

The results of the monitoring will form part of the Site Condition Report, which will be issued to the Environment Agency upon surrender of the environmental permit.

Upon completion of the restoration phase, the site will be the subject of an aftercare programme to ensure the condition of the land is comparable with adjacent land and its pre-development condition.

12. REFERENCES

1. The Environmental Permitting (England and Wales) Regulations 2016

   Available at: https://www.legislation.gov.uk/uksi/2016/1154/contents/made

2. Council Directive 2006/21/EC on the management of waste from extractive industries and amending Directive 2004/35/EC

   Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02006L0021-20090807&from=EN

3. Environment Agency. (2011). *EPR 6.14 How to comply with you environmental permit. [Additional guidance for: mining waste operations.* Version 2.0].

   Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296493/LIT_8451_eb68e4.pdf

4. Council Directive 2008/98/EC on waste and repealing certain Directives.

   Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008L0098-20180705&from=EN

5. European Union (Withdrawal) Act 2018.

   Available at: https://www.legislation.gov.uk/ukpga/2018/16/contents/enacted

6. Council Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

   Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32015L2193

7. Radioactive Substances Permit (EPR/HB3295DH)

8. BREF Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas.

   Available at: https://eippcb.jrc.ec.europa.eu/reference/refining-mineral-oil-and-gas-0

9. The Gas Safety (Management) Regulations 1996.

   Available at: https://www.legislation.gov.uk/uksi/1996/551/contents/made

10. Commission Decision (2000/532/EC) replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste.

    Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000D0532&from=EN

11. Environment Agency Technical Guidance WM3: Waste Classification – Guidance on the classification and assessment of waste.

    Available at: https:// https://www.gov.uk/government/publications/waste-classification-technical-guidance

12. The Waste (England and Wales) Regulations 2011.

    Available at: https://www.legislation.gov.uk/uksi/2011/988/contents/made

13. The Borehole Sites and Operations Regulations 1995.

    Available at: https://www.legislation.gov.uk/uksi/1995/2038/contents/made

14. Radioactive Substances Permit (EPR/HB3295DH)

15. Environment Agency, Onshore Oil and Gas Sector Guidance.

    Available at: https://www.gov.uk/guidance/onshore-oil-and-gas-sector-guidance