SURFACE WATER MANAGEMENT PLAN

Revision 5

March 2023

APPROVAL LIST

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REVISION HISTORY

Revision	Reason for Revision	Date of Revision
Rev 0	Supersedes V1.4 of Envireau Water Surface Water Management Plan following construction of the West Newton A Wellsite.	01/04/2021
Rev 1	Inclusion of Appendix 3.	27/04/2022
Rev 2	Change of parameter suite testing. Appendix 3 now Appendix 2.	26/05/2022
Rev 3	Updated following Environment Agency Schedule 5 Notice.	24/08/2022
Rev 4	Updated following Environment Agency Schedule 5 Notice.	08/11/2022
Rev 5	Updated following Environment Agency Schedule 5 Notice.	23/03/2023

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1. INTRODUCTION

Rathlin Energy (UK) Limited (Rathlin) is a private company with its head office in Beverley, East Riding of Yorkshire. Rathlin Energy is a petroleum exploration, development and production company with operations in the United Kingdom. Rathlin Energy is the operator of PEDL 183.

The purpose of the Surface Water Management Plan is to outline the surface water management arrangements to be implemented at the West Newton A (WNA) Wellsite (the 'Site') during the long term production operations, which for clarity includes periodic drilling, workover and testing operations.

2. SCOPE

This Surface Water Management Plan is applicable to the WNA Wellsite and all operations permitted therein. It is applicable to Rathlin, its contractors and subcontractors and can be used in support of applications to the Environment Agency under EPR2016.

3. DEFINITIONS

µg/l:	Micrograms per litre
AOD:	Above Ordnance Datum
BGS:	British Geological Survey
BS:	British Standard
CIRIA:	Construction Industry Research and Information Association
EA:	Environment Agency
GRR:	Greenfield Runoff Rate
HDPE:	High Density Polyethylene
High Risk Activity(ies)	Onsite activities determined by the Operator as presenting a higher level of risk to surface water
l/s/ha:	Litres per second per hectare
Low Risk Activity(ies)	Onsite activities determined by the Operator as presenting a low level of risk to surface water
M:	Metres
mg/l:	Milligrams per litre
NGR:	National Grid Reference
PEDL:	Petroleum Exploration and Development Licence
PPG3:	Use and design of oil separators in surface water drainage systems
USEPA16:	Sixteen Poly Aromatic Hydrocarbons regulated by the U.S. Environmental Protection Agency (USEPA) based on their potential human and ecological health effects
UKAS:	The United Kingdom Accreditation Service

4. SITE DESCRIPTION

4.1 Site Location and Setting

The WNA Wellsite is located approximately 1.25km north of the village of West Newton and 12km northeast of Hull.

The site address is as follows:

West Newton A Wellsite
Rathlin Energy (UK) Limited
Fosham Road
Marton
Hull
HU11 5DA
National Grid Ref: TA 19268 39131

The site covers an area of approximately 3ha and is situated at an elevation of approximately 13m AOD.

4.2 Surface Water Containment System

The site has been designed so that any materials falling onto the site are contained prior to going off site. This allows for the containment of any hazardous substances and non-hazardous substances which could cause surface water pollution.

4.2.1 Drilling Area

The site shall be created by levelling the surface, constructing 1.1m deep ditches around the perimeter of the site and installing a HDPE membrane over the entirety of the site. The site surface shall be created, in the most part, from 300mm MOT type 1 aggregate. All but the Western side of the perimeter containment ditches shall have 300mm diameter twin walled perforated pipe installed and be back filled to surface with granular material, the western perimeter containment ditch shall remain open.

The drilling cellars shall create an impermeable containment area within which the wells will be drilled. The HDPE membrane shall be sealed to the edge of the cellars. Concrete slabs shall be installed around the cellars and drainage channels shall be installed where necessary to direct drilling fluids back to the cellars. Any fluids falling on the site (including rainfall) shall permeate through the surface aggregate and collect in the perimeter containment ditches.

4.2.2 Production Area

The production area shall be constructed in a similar fashion with 0.6m deep ditches around the perimeter of the site and an HDPE membrane across the whole site and topped with MOT type 1 for the surface. All of the perimeter containment ditches shall be piped and backfilled. Any fluids falling on the surface shall percolate through the aggregate and collect in the perimeter containment ditches. The perimeter containment ditches shall be sloped towards the outlet point.

The two separate areas shall be independent of each other with a raised concrete baton formed between the drilling area and production area to prevent cross contamination.

Bunds shall be formed where tanks containing hazardous substances are to be stored or transferred. Bunds and loading areas shall be constructed in accordance with the methodology detailed within CIRIA C736[1] (2014) Guidance [Ref. 1]. Any fluids falling on these areas will be contained within the areas.

4.3 Surface Water Discharge System

4.3.1 Class 1 SPEL Oil-water Separator

A Class 1 SPEL Oil-water Separator (herein referred to as an interceptor) shall be installed prior to the surface water discharge point from the site. Surface water from both the drilling area and production area shall flow into the interceptor. Isolation valves shall be installed within each containment system prior to the interceptor.

[1] Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises.

A hydrobrake shall be installed prior to the interceptor to ensure that the interceptor is not flooded and only the maximum allowable run off rate can be flowed through the discharge system.

4.3.2 Surface Water Discharge Point

Surface water is processed through the interceptor and discharged to a field drain located on the north west boundary of the site (Discharge Point (Outlet 1)). The Discharge Point (Outlet 1) discharges to a dry field drain present along the western boundary of the site at National Grid Reference (NGR): TA 19221 39198. The current field drainage system feeds to this point at the perimeter of the field so no additional rainwater shall be entering the system via the site discharge due to the construction of the site. The field drain flows towards the north and confluences with the Lambwath Stream approximately 350m north of the site. At this point, the Lambwath Stream is at an elevation of approximately 8mAOD and flows towards the west. The capacity of the field drain is not known. The rate of discharge to the field drain will be limited by the hydrobrake installed prior to the interceptor. The hydrobrake will limit the discharge to a rate no greater than the Greenfield runoff rate.

4.3.3 Surface Water Monitoring Sampling Points

Surface water monitoring sampling points have been identified within the site and their location, including National Grid Reference (NGR), are provided within Table 4.1.

Sample Point No.	Sampling Point	Location	NGR
#1	Holding Tank No. 1	Drilling Area – Western Boundary	TA 19242 39176
	Holding Tank No. 2	Drilling Area – Western Boundary	TA 19242 39172
#2	Drilling Area Perimeter Containment Ditch	Drilling Area – Western Boundary	TA 19236 39168
#3	Discharge Point (Outlet 1)	Outlet 1 – North West Boundary of site	TA 19238 39196
#4	Production Area Perimeter Containment Ditch	Production Area – North West boundary	TA 19363 39192

Table 4.1 Information of Surface Water Monitoring Sampling Points

Details of the sampling points are detailed below.

- #1 – Drilling Area Sample Point – Isolated water storage tanks.
- #2 – Drilling Area Sample Point – Drilling area surface water containment ditch.
- #3 – Outlet 1 Sample Point – Discharge point from site.
- #4 – Production Area Sample Point – Production area surface water containment ditch.

Surface water monitoring sampling points external to the site have been identified and their location, including National Grid Reference (NGR), are provided within Table 4.2.

Sample Point No.	Sampling Point	Location	NGR
#5	Lambwath Stream (Upstream)	~0.578Km Northeast of Site	TA 19545 39729
#6	Lambwath Stream (Downstream)	~0.568Km Northwest of Site	TA 18908 39670

Table 4.2 Information of Surface Water Monitoring Sampling Points

Details of the sampling points are detailed below.

- #5 – Upstream Sample Point (Zinc analysis only) – Public footpath that crosses Lambwath Stream.
- #6 – Downstream Sample Point (Zinc analysis only) – Public footpath that crosses Lambwath Stream.

For clarity, the external surface water monitoring sampling points are for quarterly sampling and analysis for Zinc only. These sampling points have been agreed with the Environment Agency to ensure that Zinc identified within off-site discharges is monitored to ensure that Zinc levels are diluted and do not impact on Lambwath Stream.

4.4 Attenuation Capacity

A drainage assessment concludes that the site well pad and oil production facility can contain a 1 in 100-year storm event with an allowance for climate change (+30%), without the need to discharge any surface water runoff. As such, the site will not increase the risk of off-site flooding and if necessary, can attenuate the volume of water generated from an extreme storm, which would then be discharged from the site or removed by road tanker.

4.4.1 Drilling Area

The design and construction of the well pad means that rainfall-runoff generated over the platform area (13,225m^2) and also the topsoil bund (1,188m^2, which could potentially contribute to runoff), can be contained either within the perimeter containment ditch or on the site platform up to the height of the containment berm.

As assessed in the Flood Risk Assessment, the Drilling Area is required to have an attenuation capacity of 2,283m^3 and at least 174mm bunding above the top of the surface stone to contain the volume of rainfall from a 7-day, 1 in 100-year storm event plus 30% climate change volume.

4.4.2 Production Area

The design and construction of the oil production facility means that rainfall-runoff generated over the area (11,483m^2) and also the topsoil bund (2,099m^2, which could potentially contribute to runoff), can be contained either within the perimeter containment ditch or on the facility platform up to the height of the containment berm.

As assessed in the Flood Risk Assessment, the Production Area is required to have an attenuation capacity of 2,151m^3 and at least 174mm bunding above the top of the surface stone to contain the volume of rainfall from a 7-day, 1 in 100-year storm event plus 30% climate change volume.

4.5 Secondary Containment Systems

Surface water from precipitation will accumulate within the secondary containment systems located within the wellsite. The surface water level within secondary containment system will be monitored to ensure bund overtop does not occur.

When required, surface water (includes surface water contaminated by the site inventory and/or fire-fighting water / cooling water) contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Treatment Facility via road tanker.

5. DISCHARGE TO SURFACE WATER

5.1 Greenfield Runoff Rate

Based on the Environment Agency guidance [Ref. 2] and SuDS manual C7532 [Ref. 3], the greenfield runoff rate to limit surface water discharge, based on a 1 in 1 year peak flow has been calculated using the HR Wallingford Greenfield runoff tool as 3.66l/s/ha. This equates to a maximum flow rate of 10.24l/s given the surface water drainage area.

5.2 Control of Discharges

Only the appointed person shall have access to the isolation valves and subsequently 'open' and 'close' the discharge operation as dictated by the site operations and the analysis results of any sampling undertaken as described in the sections below.

To facilitate any discharge, manually operated isolation valves will be opened. The keys for the isolation valves will be held in the Rathlin Energy Office and by the on-call operator (the appointed person). Each respective drainage pipe leading to the interceptor shall have a set of isolation valves leading to the interceptor and will be opened and shut accordingly as dictated by the phase of the development.

The discharge of surface water across both sections of the proposed site have been assessed to highlight the inherent risks associated with discharging. The residual risk, once mitigation measures have been implemented concludes that the risk is 'not significant'. The Discharge Risk Assessment has been presented in Appendix 1.

5.3 Drilling Area

5.3.1 High Risk Activities

During periods of high risk activities, such as drilling, testing, workover operations and well maintenance treatments, the interceptor shall remain isolated from the drilling area so as to prevent surface water (rainfall) on the site discharging into the surface water course. The interceptor shall remain open for the production area.

As there is an increased risk to surface water becoming contaminated within the drilling area, surface water will be pumped from the containment system into a separate holding tank installed within the site where it will be sampled in accordance with Section 6.4. The parameters for analysis are presented in Section 6.2 and consider potential pollutants present at the site as part of the high risk activities.

The two (2) 50,000 litre holding tanks will be installed within the site at the locations detailed within Table 5.1.

Equipment	Location	NGR
Holding Tank No.1	Drilling Area – Western Boundary	TA 19242 39176
Holding Tank No.2	Drilling Area – Western Boundary	TA 19242 39172

Table 5.1 Information of Holding Tanks within Drilling Area

Each holding tank will provide containment of a maximum 50,000 litres (50 m^3) with a combined capacity to hold 100,000 litres (100 m^3) of surface water.

Upon receipt of the sampling results, the surface water contained within the holding tank that has been sampled shall be discharged through the surface water discharge system given the water falls within the screening limits set out in Appendix 2. In the event that the results from the analysis indicate that the surface water has been contaminated and does not meet the screening limits set out in Appendix 2, arrangements will be made for the surface water to be removed from site via vacuum tanker to an Environment Agency approved Waste Facility for treatment and/or disposal.

By holding the fluids within the holding tank(s), this ensures that the fluids cannot be contaminated after the sample has been taken and prior to discharge.

For clarity, only one (1) sample will be taken of the fluids contained within the holding tank. Immediately following the sampling procedure, the holding tank will be isolated to ensure that no additional fluids are pumped in to the tank thus ensuring that the fluids contained within the holding tank remain a true representation of the sample analysis.

Following the conclusion of drilling, testing, workover operations, well maintenance treatments and high risk activities, a sample shall be taken from the perimeter containment ditch and a full suite of analysis shall be undertaken, the

parameters of which have been identified in Section 6.2. Once the sampling results have been received and comply with the screening limits set out in Appendix 2, the surface water shall be discharged through the interceptor to the field drain, with the interceptor being left open. Sampling and analysis shall then take place on a monthly basis.

5.3.2 Production Operations

During periods of production the interceptor shall remain 'open' so as to allow surface water (rainfall) on the site to discharge into the local surface water course, preventing the build-up of levels within the containment system and preventing flooding of the site.

Surface water will be discharged from the perimeter containment ditch to the Discharge Point (Outlet 1) located on the north west boundary of the site via the interceptor. The interceptor is designed, manufactured and tested in accordance with the European Standard BS EN 858-1 [Ref. 4].

The discharge arrangement means there is a negligible risk that free phase hydrocarbons would be present in the discharge; however, the interceptor does provide an additional level of environmental protection. The interceptor will be fitted with a high fluid level alarm system so as to warn the Operator to close the isolation valves and arrange for servicing of the interceptor preventing any potential hydrocarbons from being discharged to the surface water course.

The discharge equipment will be inspected on a regular basis and the condition recorded on the Rathlin Energy Testing and Maintenance Form (RE-05-FO-059). Any issues identified will be addressed. Records will be made available to the Environment Agency for inspection.

In the event of a spillage or leak occurring within the drilling area, the containment system will be isolated from the interceptor immediately with the spillage area remediated and the surface water sampled. Once the results confirm that the surface water has not been contaminated, the containment system will be opened to allow discharge operations to continue. In the event that the results from the analysis indicate that the surface water has been contaminated, arrangements will be made for the surface water to be removed from site via vacuum tanker to an Environment Agency approved Waste Facility for treatment and/or disposal.

5.4 Production Area

The activities taking place on the production area are limited in so far as either being in production or inactive. The production area has an independent containment system to that of the drilling area and therefore the management of surface water during the neighbouring drilling and/or testing operations can also be managed independently, namely being left open to enable the discharge of surface water from the production area only.

5.4.1 Production and Suspension Operations

During periods of production, or when the production area is inactive, the interceptor shall remain 'open' to allow surface water (rainfall) on the site to discharge into the surface water course, preventing the build-up of levels within the containment system and preventing flooding of the site.

Surface water will be discharged from the perimeter containment ditch to the Discharge Point (Outlet 1) located on the north west boundary of the site via the interceptor. The interceptor is designed, manufactured and tested in accordance with the European Standard BS EN 858-1 [Ref. 4].

The discharge arrangement means there is a negligible risk that free phase hydrocarbons would be present in the discharge; however, the interceptor does provide an additional level of environmental protection. The interceptor will be fitted with a high fluid level alarm system so as to warn the Operator to close the isolation valves and arrange for servicing of the interceptor preventing any potential hydrocarbons from being discharged to the surface water course.

Again, the discharge equipment will be inspected on a regular basis and the condition recorded on the Rathlin Energy Testing and Maintenance Form (RE-05-FO-059). Any issues identified will be addressed. Records will be made available to the Environment Agency for inspection.

In the event of a spillage or leak occurring within the production area, the containment system will be isolated from the interceptor immediately with the spillage area remediated and the surface water sampled. Once the results confirm that the surface water has not been contaminated, the containment system will be opened to allow discharge operations to continue. In the event that the results from the analysis indicate that the surface water has been contaminated, arrangements will be made for the surface water to be removed from site via vacuum tanker to an Environment Agency approved Waste Facility for treatment and/or disposal.

For clarity, surface water discharge will only be permitted in the event that the screening limits detailed within Table A1, Appendix 2 are met.

5.5 Discharge Process Map

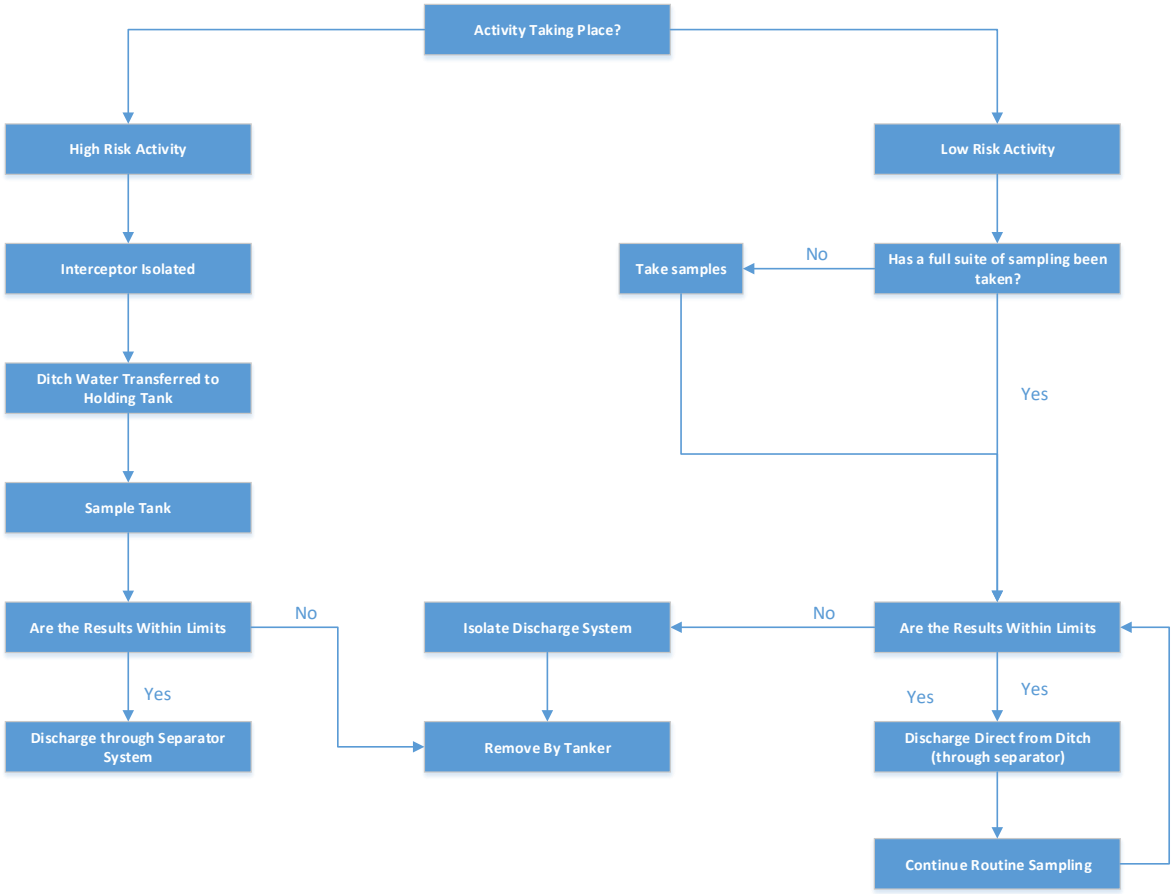

Figure 5.1: Discharge Process Map

6. SAMPLING AND ANALYSIS

6.1 Sampling Philosophy

The reason for sampling the surface water is two-fold. Firstly, there is a requirement to ensure that surface water being discharged from the site will not introduce contamination to the local surface water network. Therefore, limits shall be set on parameters for discharge to surface water which are consistent with Environmental Quality Standards [Ref. 5].

Secondly, the testing of the surface water is part of the site integrity management. The results from the surface water testing can be corroborated against the results of the groundwater testing to determine whether there is a leak pathway between the site surface and the groundwater.

Therefore, there will be two parameter sets to test at different intervals and from different sample points.

6.2 Drilling Area

The proposed drilling area will be subject of two (2) types of activities categorised by their perceived risk to surface water. As such there is a requirement to ensure that suitable sampling and analysis regimes are in place to manage the varying levels of risk. Details of 'High Risk' activities and 'Low Risk' activities and the sampling regimes are provided within Section 6.2.1 and 6.2.2.

6.2.1 High Risk Activities

High risk activities include activities where the risk of contamination within surface water is increased significantly by the potential for polluting substances to be introduced to the surface water discharge system. Potentially polluting substances includes both hazardous substances and non-hazardous substances which could cause surface water pollution.

High risk activities identified within the proposed drilling area include:

- Drilling Operations;
- Workover Operations;
- Well Maintenance Treatments;
- Well Test and Completion Operations;
- When potentially polluting substances are stored on site (with the exception of fuel stored as part of trailer mounted water sampling equipment and fuel stored to enable power supply to the site);
- When mining waste or fuels are stored on site (with the exception of fuel stored as part of trailer mounted water sampling equipment and fuel stored to enable power supply to the site);
- Servicing and maintenance operations of plant and equipment where breaking of containment occurs;
- Spillage of a hazardous substance and/or a non-hazardous substance which could cause surface water pollution;
- Unintentional leak from plant and equipment of a hazardous substance and/or a non-hazardous substance which could cause surface water pollution; and
- Well Abandonment Operations.

During 'high risk' activities surface water shall be contained within one (1) of two (2) holding tanks installed within the site where it will be sampled in accordance with Section 6.4. The surface water will be discharged through the surface water discharge system where analysis results meet the screening limits set out in Appendix 2.

Where analysis results do not meet parameters set out in Appendix 2, arrangements will be made for the surface water to be removed from site via vacuum tanker to an Environment Agency approved Waste Facility for treatment and/or disposal.

During 'High Risk' activities, isolation valves installed within the drilling area surface water discharge system shall be 'locked close' to ensure that there are no accidental / unauthorised discharges to surface.

Isolation valves shall be installed at the following points within the surface water discharge system:

- Each respective drainage pipe leading to the interceptor; and
- The discharge line from each individual Holding Tank to the separator.

During 'High Risk' activities where the isolation valves are closed, the surface water shall be sampled quarterly for a full suite of parameters as part of the site integrity checks.

The parameters, frequency and sampling locations for 'high risk' activities have been provided within Table 6.1.

Parameters[2] - High Risk Activities		
• pH • Electrical Conductivity • Total Suspended Solids • Turbidity • Alkalinity (Total Bicarbonate) • Hardness • Mercury (Total Hg) • Cadmium • Sulphate • Sulphur • Chloride • Sodium • Nitrate	• Calcium • Magnesium • Potassium • Aluminium • Iron • Manganese • Zinc • Benzene • Toluene • Ethyl Benzene • m/p Xylene • o Xylene • MTBE	• Total Petroleum Hydrocarbons - aromatic and aliphatic class and carbon banding C8 to C35 • Polyaromatic Hydrocarbons USEPA16 • Antimony • Arsenic • Boron • Total Chromium • Copper • Lead • Nickel • Selenium

Frequency	Sample Point
Prior to discharge during 'High Risk Activities'.	Holding Tank No.1 – Reduced Suite (Blue) (NGR: TA 19242 39176).
Prior to discharge during 'High Risk Activities'.	Holding Tank No. 2 – Reduced Suite (Blue) (NGR: TA 19242 39172).
Upon cessation of 'High Risk Activities'.	Perimeter Containment Ditch – Full Suite (NGR: TA 19236 39168).
Quarterly.	Perimeter Containment Ditch – Full Suite (NGR: TA 19236 39168).
Quarterly.	Outlet 1 – Reduced Suite (Blue) (NGR: TA 19221 39198).

Table 6.1 Sampling and Analysis Parameters for High Risk Activities

For clarity, surface water sampling undertaken within the site provides for two (2) separate methods of environmental monitoring.

The first methodology of environmental monitoring provides for suite of surface water sampling to be undertaken, which will either be taken from the Holding Tanks prior to discharge, or from the Outlet when discharging from the ditch. This sampling methodology is to monitor for contamination being released from the site to the surrounding surface water. The reduced suite of surface water sampling has been set in accordance with the Environmental Quality Standards [Ref. 5] and Drinking Water Standards [Ref. 6] and is identified in Blue within Table 6.1.

The second methodology of environmental monitoring provides for a full suite of surface water sampling within the drilling area to be undertaken:

- Following the cessation of 'High Risk Activities';
- A spillage / leak of a hazardous substance and/or a non-hazardous substance which could cause surface water pollution;
- Quarterly to provide a comparison between the surface water analysis results and the groundwater analysis results to identify any issues of integrity within the site containment systems.

The full suite of surface water sampling includes all parameters detailed within Table 6.1.

[2] Blue parameters analysed for prior to discharge.

Upon receipt of the sampling results, the surface water that has been sampled shall be discharged through the surface water discharge system given the water falls within the screening limits set out in Appendix 2. In the event that the results from the analysis indicate that the surface water has been contaminated and does not meet the screening limits set out in Appendix 2, arrangements will be made for the surface water to be removed from site via vacuum tanker to an Environment Agency approved Waste Facility for treatment and/or disposal.

The reduced suite (Blue) of sampling will be utilised to monitor for surface water contamination.

The full suite of sampling will be utilised to monitor for contamination from the site to groundwater.

6.2.2 Low Risk Activities

Low Risk Activities include activities where the site is inactive or in production as the potential for contamination is reduced significantly by hazardous substances and/or a non-hazardous substance which could cause surface water pollution not being stored within the area, and produced fluid (production only) being contained within pipework.

Low risk activities identified within the proposed drilling area include:

- Production Operations;
- When potentially polluting substances are not stored on site (with the exception of fuel stored to enable power supply to the site); and
- When mining waste or fuels are not stored on site (with the exception of fuel stored to enable power supply to the site).

During 'Low Risk' activities, isolation valves installed within the drilling area surface water discharge system shall be 'locked open' permitting continuous surface water discharges to surface.

During 'Low Risk' activities where the isolation valves are open, the surface water shall be sampled monthly for a reduced suite (Blue) of parameters as part of the site integrity checks.

The parameters, frequency and sampling location have been provided within Table 6.2.

Parameters[3] - Low Risk Activities		
• pH • Electrical Conductivity • Total Suspended Solids • Turbidity • Alkalinity (Total Bicarbonate) • Hardness • Mercury (Total Hg) • Cadmium • Sulphate • Sulphur	• Chloride • Sodium • Nitrate • Calcium • Magnesium • Potassium • Aluminium • Iron • Manganese • Zinc	• Benzene • Toluene • Ethyl Benzene • m/p Xylene • o Xylene • MTBE • Total Petroleum Hydrocarbons - aromatic and aliphatic class and carbon banding C8 to C35 • Polyaromatic Hydrocarbons USEPA16

Frequency	Sample Point
Following a leak / spillage of a hazardous substance and/or a non-hazardous substance which could cause surface water pollution.	Perimeter Containment Ditch – Full Suite (NGR: TA 19236 39168).
Monthly where isolation valves are 'open'.	Outlet 1 – Reduced Suite (Blue) (NGR: TA 19221 39198).
Quarterly.	Perimeter Containment Ditch – Full Suite (NGR: TA 19236 39168).

Table 6.2 Sampling and Analysis Parameters for Low Risk Activities

6.3 Production Area

The proposed production area will be the subject of 'Low Risk Activities' throughout its lifetime including periods of inactivity and production. Therefore, quarterly samples shall be taken from a sample point within the 'production area'

[3] Blue parameters analysed for prior to discharge.

containment as part of the site integrity checks and quarterly samples of a reduced suite shall be taken from the discharge point (Outlet 1).

For clarity, whilst hazardous and non-hazardous substances which could cause surface water pollution will be stored within the production area in high volumes, the storage vessels will be located within purpose-built containment bunds constructed in accordance with the methodology detailed within CIRIA C736[4] (2014) Guidance [Ref. 1].

The parameters, frequency and sampling location have been provided within Table 6.3.

Parameters[5] - Low Risk Activities		
• pH • Electrical Conductivity • Total Suspended Solids • Turbidity • Alkalinity (Total Bicarbonate) • Hardness • Mercury (Total Hg) • Cadmium • Sulphate • Sulphur • Chloride • Sodium • Nitrate	• Calcium • Magnesium • Potassium • Aluminium • Iron • Manganese • Zinc • Benzene • Toluene • Ethyl Benzene • m/p Xylene • o Xylene • MTBE	• Total Petroleum Hydrocarbons - aromatic and aliphatic class and carbon banding C8 to C35 • Polyaromatic Hydrocarbons USEPA16 • Antimony • Arsenic • Boron • Total Chromium • Copper • Lead • Nickel • Selenium

Frequency	Sample Point
Following a leak / spillage of a hazardous substance and/or a non-hazardous substance which could cause surface water pollution.	Perimeter Containment Ditch – Full Suite (NGR: TA 19363 39192).
Quarterly.	Perimeter Containment Ditch – Full Suite (NGR: TA 19363 39192).
Monthly.	Outlet 1 – Reduced Suite (Blue) (NGR: TA 19221 39198).

Table 6.3 Sampling and Analysis Parameters for Production Area Configuration

For clarity, surface water discharge will only be permitted in the event that the screening limits detailed within Table A1, Appendix 2 are met.

6.4 Lambwath Stream

Two (2) external surface water monitoring sampling points have been identified for quarterly sampling and analysis. The sampling points are for the sampling and analysis for Zinc only which is to ensure that Zinc identified within off-site discharges is monitored. This is to ensure that Zinc levels are diluted and do not impact on Lambwath Stream.

The parameters, frequency and sampling location for external surface water monitoring are provided within Table 6.4.

Parameters - External Monitoring	
• Zinc	
Frequency	**Sample Point**
Quarterly.	Lambwath Stream (Upstream – Zinc analysis only) (NGR: TA 19545 39729).
Quarterly.	Lambwath Stream (Downstream – Zinc analysis only) (NGR: TA 18908 39670).

Table 6.4 Sampling and Analysis Parameters for External Monitoring

[4] Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises.
[5] Blue parameters analysed for Surface Water Discharge.

6.5 Sampling Methodology

1. All sampling equipment shall be clean, sanitised and in working order prior to use.
2. Suitable sampling locations shall be identified, ideally fixed and marked as the sample spot for consistency.
3. Water shall be visually inspected and the following details shall be recorded:
   a) Depth of water;
   b) Signs of oil / grease;
   c) Date and time; and
   d) Weather Conditions;
4. Nitrile Gloves shall be applied and sample containers marked-up as necessary detailing the following:
   a) Client Name for Laboratory (Rathlin Energy UK Limited);
   b) Location (West Newton A Wellsite / Lambwath Stream (Upstream / Downstream);
   c) Sample Identification; and
   d) Date and time sample taken.
5. The sample shall be collected from the inspection chamber/perimeter containment ditch/holding tank (depending on phase of operation), below the surface layer. Caution must be taken when sampling in shallow water that debris from the bottom is not disturbed. If disturbance occurs, the sample should be disregarded and retaken.
6. Sample bottles shall be filled completely, so as to removed air when the top is screwed on, unless otherwise stated by the laboratory. Water bottles shall be filled on a flat clean surface.
7. Sample bottles shall be placed into the cool box provided.
8. Beakers shall be filled and hand probes used to measure field water chemistry parameters (pH, electrical conductivity, temperature).
9. Paperwork shall be completed and shall accompanying the samples to the laboratory which shall arrive within 48 hours of being taken. Storage of the samples shall be suitable and include a cool box to store samples at the necessary temperatures.

7. SURFACE WATER ANALYSIS AND DISCHARGE RECORDS

Records of all the surface water sampling and surface water discharge activities will be recorded within the Rathlin Energy Environmental Management System on Rathlin Energy Discharge to Surface Water Record (RE-05-FO-034). The records will include the date, time and all relevant results of monitoring and analysis undertaken.

Records will be made available to the Environment Agency for inspection.

7.1 Surface Water Monitoring Data

Surface water monitoring has been undertaken within the site since November 2015 following the determination by the Environment Agency of an application for a surface water activity permit (EPR/BB3001FT) [Ref. 7] permitting the '*discharge of surface water run off from the site during periods of inactivity*.'

In accordance with Table S4.1 of the West Newton A Environmental Permit (EPR/BB3001FT) [Ref. 7], surface water monitoring has been undertaken on a quarterly basis, with the analysis results of the surface water sampling documented on Rathlin Energy Surface Water Monitoring Report Form (RE-05-FO-051) and submitted to the Environment Agency via the Regulatory Officer.

Rathlin Energy Surface Water Monitoring Report Forms (RE-05-FO-051) covering a two (2) year period from July 2020 to July 2022 have been collated and are provided within Appendix 4.

8. TRAINING

All personnel involved in surface water discharge operations will be trained and competent and a record of training held within the Rathlin Energy Environmental Management System.

9. REFERENCES

Serial	Document Reference	Document Title
Ref. 1	CIRIA C736 (2014) Guidance	Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises.
Ref. 2	Environment Agency 2013 Report SC030216	Rainfall runoff management for developments.
Ref. 3	CIRIA C753 (2015) Guidance	The SuDS Manual.
Ref. 4	European Standard BS EN 858-1	Separator systems for light liquids (e.g. oil and petrol) Principles of product design, performance and testing, marking and quality control.
Ref. 5	Environmental Quality Standards	The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
Ref. 6	Drinking Water Standards	The Water Supply (Water Quality) Regulations .
Ref. 7	EPR/BB3001FT	West Newton Well Site Permit number EPR/BB3001FT.

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APPENDIX 1 - DISCHARGE RISK ASSESSMENT

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1. Abbreviations and Definitions

Definitions for the Environemntal Risk Assessment	
ID:	Identification number the hazard has been given to allow for easy referencing.
Activity / Event	The specific operating being undertaken relating to the proposed hazard and risk.
Potential Release Point	The point at which the pollutant / emission leaves its dedicated infrastructure and enters the environment.
Source	A source of pollutants from the activity taking place such as flaring. (Source can also be referred to as 'hazard').
Pathway	The pathway the pollutant is taking such as air or unsaturated zones.
Receptor	Although the likelihood of pollution is low it may have an adverse effect on surrounding residents, wildlife and habitats; these are known as the pollutants receptors.
Exposure Probability	The chance of the hazard occurring without taking into account mitigation measures.
Impact Severity	The impact of the hazard should it occur without taking into account mitigation measures.
Risk Magnitude	A hazard that has been assessed and has been given a risk rating level post mitigation measures i.e. not significant, low, medium, high very high etc.
Risk Management	Mitigation measures that will be put in place to control the risks so far as reasonably practicable.
Residual Risk	A hazard that has been assessed and has been given a risk rating level post mitigation measures i.e. not significant, low, medium, high very high etc.
Not Significant	The severity of risk together with the likelihood of the risk is not expected to cause harm to the environment.
Low	The severity of risk together with the likelihood of the risk is not expected to cause harm to the environment.
Medium	The severity of risk together with the likelihood of the risk has a moderate potential for causing harm to the environment.
High	The severity of risk together with the likelihood of the risk has a high potential for causing harm to the environment.
Other Definitions	
PEDL	Petroleum Exploration and Development Licence
WNA	West Newton A

Table 1.1: Definitions

2. Methodology

The structure of the Environmental Risk Assessment follows the Environment Agency guidance using a source pathway receptor model and includes:

- Identifying the surface water discharge risk from the site;
- Assessing risks and checking they are acceptable;
- Justifying appropriate measures to control the risk (if needed); and
- Presenting the risk assessment.

3. Scoring Criteria

In order to establish a risk rating for each Source-Pathway-Receptor (S-P-R) linkage both the Likelihood (Probability of Exposure) and Consequence have been issued a score. The score is used in conjunction with Table 4.3 to provide an overall risk rating of the activity. All scores and risk ratings are provided on the basis that the mitigation measure are in place.

Likelihood	Descriptor
Very Low	Rarely encountered, never reported or highly unlikely.
Low	Infrequent Occurrences.
Medium	Can be expected to occur several times per year.
High	Repeated Occurrences.

Table 2.1: Scoring System Likelihood

Consequence	Descriptor
Very Low	Slight environmental effect that does not exceed a regulatory standard.
Low	Minor environmental effect which may breach a regulatory standard but is localised to the point of release with no significant impact on the environment or human health.
Medium	Moderate, localised effect on people and the environment in the vicinity of the incident.
High	A major environmental incident resulting in significant damage to the environment and harm to human health.

Table 2.2: Scoring System Consequence

The risk matrix presented in Table 4.3 below derives a risk rating for each S-P-R linkage identified within this Environmental Risk Assessment.

Risk Rating		Consequence			
		Very Low	Low	Medium	High
Likelihood	Very Low	Not Significant	Not Significant	Low	Low
	Low	Not Significant	Low	Medium	Medium
	Medium	Low	Medium	Medium	High
	High	Low	Medium	High	High

Table 2.3: Risk Matrix

Environmental risks are assigned a Not Significant, Low, Medium or High risk rating and coded using a colour coded system. A description of each risk rating is presented in Table 4.4 below.

Consequence	Acceptable	Descriptor
Not Significant	Acceptable	Near-certain that an incident will not occur. If it did occur the consequences would not be significant.
Low	Acceptable	Unlikely an incident will occur or give rise to anything more than a minor consequence on the immediate area.
Medium	Tolerable	The activity can only take place provided that any impacts remain localised and risk remediation is readily available.
High	Unacceptable	The risk must be further reduced before the activity can commence.

Table 2.4 Risk Rating Definition

Receptors	Search Radius (km)	Name	Distance (km)	Direction from Site	Grid Reference (Edge)
RAMSAR	10	None	-	-	-
Special Areas of Conservation (SAC)	10	None	-	-	-
Special Protection Areas (SPA)	10	Hornsea Mere	6.93	North	TA 17983 46008
Marine Protection Areas (MPA)	10	Greater Wash	5.24	Northeast	TA 23650 42421
Sites of Special Scientific Interest (SSSI)	2	Lambwath Meadows	0.79	Northeast	TA 20100 39699
Scheduled Ancient Monuments (SAM)	2	Burton Constable medieval settlement and field system.	1.92	South	TA 18852 37191
National Nature Reserves	2	None	-	-	-
Local Nature Reserves	2	None	-	-	-
Local Wildlife Sites (LWS)	2	The Moors, Burton Constable	0.84	South	TA 18876 38359
		Wycliffe, North Plantation	0.92	South	TA 18676 38389
		Mill Avenue, Burton Constable	1.27	South	TA 19442 37093
		Sallymere Plantation	1.70	Southwest	TA 17778 38222
		Burton Constable Parkland	1.77	South	TA 19098 37311
Water Features (Closest in All Directions)	2	Field Drain - to Lambwath Stream	0.01	West	TA 19231 39097
		Field Drain	0.06	North	TA 19235 39265
		Pond at Black Bush Cottage	0.34	East	TA 19815 39298
		Field Drain	0.53	South	TA 19372 38533
		Field Drain	0.90	East	TA 20381 39178
Aquifers	2	Principal Aquifer - Bedrock	0.00	-	TA 19355 39413
Sensitive Receptors: Households / Businesses	2	Church House	0.53	Southwest	TA 18916 38673
		Old School House	0.58	Southwest	TA 18948 38593
		Wood End Farm	0.63	West	TA 18625 38977
		Black Bush Farm	0.40	East	TA 19892 39301
		Caley Cottage	0.46	East	TA 19947 39168
		High Fosham Cottage	0.52	East	TA 19991 39142
		Marton Farm	0.78	West	TA 18481 39216
		White House Farm	0.84	Southwest	TA 18618 38534
		Straits Farm (Withernwick)	0.92	North	TA 19571 40124
		Manor House	0.92	Northeast	TA 19804 40071
		Piper Garth	1.05	West	TA 18214 39235
		Wood House	1.15	South	TA 19077 37949
		West Newton Village	1.11	South	TA 19544 37955
		Heywood Farm	1.16	West	TA 18095 39261
		Treasure Cottage	1.30	West	TA 17952 39248
		Model Farm	1.32	Southeast	TA 19912 37803
		Hill Farm	1.52	West	TA 17710 39289
		Mount Pleasant	1.39	Southeast	TA 20163 37846
		Homer House	1.42	Northeast	TA 20285 40378
		Farm at Low Fosham	1.43	East	TA 20878 38786
		Old Farm Cottage	1.49	Southeast	TA 20352 37829
		Withernwick Hall	1.81	North	TA 19635 41070
		Longdykes Farm	1.91	Northwest	TA 18325 40764
		Northfield Cottage	1.99	North	TA 19463 41185

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
Current Wellsite Configuration - Inactive										
01	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Equipment Failure	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Personnel to shut interceptor if pollution event occurs during breaking. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Small fuel stores if present are the subject of bunding.	Not Significant
02	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Planned Breaking of Containment	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Low	Not Significant	Breaking of containment to be kept to a minimum on an as needs basis. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Dedicated Surface Water Management Plan Established. Drip trays utilised. Personnel inducted / trained on emergency response procedures. Personnel to shut interceptor if pollution event occurs during breaking. Scheme of monitoring being undertaken.	Not Significant
03	Ancillaries • Generators • Lighting Towers • Small Fuel Store	Handling and Transfer of Fuels	•Gas-Oil	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Low	Medium	Medium	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Drip trays utilised. Personnel inducted / trained on emergency response procedures. Personnel to shut interceptor if pollution event occurs. Scheme of monitoring being undertaken. Small fuel stores if present are the subject of bunding.	Not Significant
04	Well Equipment • Wellhead	Equipment Failure	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Suspension column in the well. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution.	Not Significant
05	Well Equipment • Wellhead	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Breaking of containment to be kept to a minimum on an as needs basis. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Personnel inducted / trained on emergency response procedures. Personnel to shut interceptor if pollution even occurs during breaking. Scheme of monitoring being undertaken. Suspension column in the well. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
Drilling Compound Configuration - Production / Inactive										
01	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Equipment Failure	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Small fuel stores if present are the subject of bunding.	Not Significant
02	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Planned Breaking of Containment	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Low	Not Significant	Breaking of containment to be kept to a minimum on an as needs basis. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Dedicated Surface Water Management Plan Established Drip trays utilised. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Scheme of monitoring being undertaken.	Not Significant
03	Ancillaries • Generators • Lighting Towers • Small Fuel Store	Handling and Transfer of Fuels	•Gas-Oil	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Low	Medium	Medium	Class 1 Separator installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Drip trays utilised. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Scheme of monitoring being undertaken. Small fuel stores if present are the subject of bunding.	Not Significant
04	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Equipment Failure	• Oil • Formation Water	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
05	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages.	Not Significant
									Breaking of containment to be kept to a minimum on an as needs basis.	
									Competent operators employed / contracted.	
									Dedicated Emergency Response Plan Established.	
									Dedicated Surface Water Management Plan Established.	
									Established and Tested Well Control Procedures.	
									Personnel inducted / trained on emergency response procedures.	
									Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs.	
									Plant and equipment installed, maintained and operated as dictated by manufacturer.	
									Scheme of monitoring being undertaken.	
									Suspension column in the well.	
									Wellhead installed and maintained as dictated by industry standards.	
									Wellhead placed within a cellar, capturing initial pollution.	
Drilling Compound Configuration - Drilling and Well Testing (High Risk Activities)										
01	Ancillaries • Generators • Lighting Towers • Large Fuel Store • Small Fuel Store • Welfare	Equipment Failure	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge.	Not Significant
									Competent operators employed / contracted.	
									Containment System locked off from interceptor to prevent discharge during high risk operations within the compound.	
									Containment water pumped to a holding tank pending testing.	
									Containment water unsuitable for discharge shall be tankered offsite.	
									Dedicated Emergency Response Plan Established.	
									Dedicated Leak Detection and Repair Plan Established.	
									Dedicated Surface Water Management Plan Established.	
									Personnel inducted / trained on emergency response procedures.	
									Plant and equipment installed, maintained and operated as dictated by manufacturer.	
									Scheme of monitoring being undertaken.	
									Site Manned 24/7 during operations.	
									Small and large fuel stores if present are the subject of bunding.	
02	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Planned Breaking of Containment	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Low	Not Significant	Breaking of containment to be kept to a minimum on an as needs basis.	Not Significant
									Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge.	
									Competent operators employed / contracted.	
									Containment System locked off from interceptor to prevent discharge during high risk operations within the compound.	
									Containment water pumped to a holding tank pending testing.	
									Containment water unsuitable for discharge shall be tankered offsite.	
									Dedicated Emergency Response Plan Established.	
									Dedicated Leak Detection and Repair Plan Established.	
									Dedicated Surface Water Management Plan Established.	
									Discharge from holding tank through interceptor should results indicate water is suitable for discharge.	
									Personnel inducted / trained on emergency response procedures.	
									Plant and equipment installed, maintained and operated as dictated by manufacturer.	
									Scheme of monitoring being undertaken.	
									Site Manned 24/7 during operations.	

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
03	Ancillaries • Generators • Lighting Towers • Small Fuel Store	Handling and Transfer of Fuels	•Gas-Oil	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Medium	Medium	Medium	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Containment System locked off from interceptor to prevent discharge during high risk operations within the compound. Containment water pumped to a holding tank pending testing. Containment water unsuitable for discharge shall be tankered offsite. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Discharge from holding tank through interceptor should results indicate water is suitable for discharge. Drip trays utilised. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site Manned 24/7 during operations.	Not Significant
04	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Equipment Failure	• Oil • Formation Water	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Containment System locked off from interceptor to prevent discharge during high risk operations within the compound. Containment water pumped to a holding tank pending testing. Containment water unsuitable for discharge shall be tankered offsite. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Discharge from holding tank through interceptor should results indicate water is suitable for discharge.	Not Significant
05	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Containment System locked off from interceptor to prevent discharge during high risk operations within the compound. Containment water pumped to a holding tank pending testing. Containment water unsuitable for discharge shall be tankered offsite. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Discharge from holding tank through interceptor should results indicate water is suitable for discharge. Drip trays utilised. Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site Manned 24/7 during operations. Wellhead encased within cellar and caged enclosure for security. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
06	Drilling and Testing Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages.	Not Significant
									Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge.	
									Competent operators employed / contracted.	
									Containment System locked off from interceptor to prevent discharge during high risk operations within the compound.	
									Containment water pumped to a holding tank pending testing.	
									Containment water unsuitable for discharge shall be tankered offsite.	
									Dedicated Emergency Response Plan Established.	
									Dedicated Leak Detection and Repair Plan Established.	
									Dedicated Surface Water Management Plan Established.	
									Discharge from holding tank through interceptor should results indicate water is suitable for discharge.	
									Drip trays utilised.	
									Established and Tested Well Control Procedures.	
									Personnel inducted / trained on emergency response procedures.	
									Plant and equipment installed, maintained and operated as dictated by manufacturer.	
									Scheme of monitoring being undertaken.	
									Site Manned 24/7 during operations.	
									Wellhead encased within cellar and caged enclosure for security.	
									Wellhead installed and maintained as dictated by industry standards.	
									Wellhead placed within a cellar, capturing initial pollution.	
Production Compound Configuration - Production / Inactive										
01	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Equipment Failure	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge.	Not Significant
									Competent operators employed / contracted.	
									Dedicated Emergency Response Plan Established	
									Dedicated Leak Detection and Repair Plan Established	
									Dedicated Surface Water Management Plan Established	
									Personnel inducted / trained on emergency response procedures.	
									Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs.	
									Plant and equipment installed, maintained and operated as dictated by manufacturer.	
									Scheme of monitoring being undertaken.	
									Site remotely monitored via CCTV system when unmanned.	
									Small fuel stores if present are the subject of bunding.	
02	Ancillaries • Generators • Lighting Towers • Small Fuel Store • Welfare	Planned Breaking of Containment	• Gas-Oil • Sewage	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Low	Not Significant	Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge.	Not Significant
									Competent operators employed / contracted.	
									Dedicated Emergency Response Plan Established	
									Dedicated Surface Water Management Plan Established	
									Drip trays utilised.	
									Personnel inducted / trained on emergency response procedures.	
									Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs.	
									Scheme of monitoring being undertaken.	

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
03	Ancillaries • Generators • Lighting Towers • Small Fuel Store	Handling and Transfer of Fuels	•Gas-Oil	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Breaking of containment to be kept to a minimum on an as needs basis. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Drip trays utilised. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Scheme of monitoring being undertaken. Small fuel stores if present are the subject of bunding.	Not Significant
04	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Equipment Failure	• Oil • Formation Water	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Dedicated Leak Detection and Repair Plan Established Dedicated Surface Water Management Plan Established Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution.	Not Significant
05	Site Production Equipment • Wellhead • Pumpjack • Bath Heater • Separator • Knock Out Pot • Pipeline	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	Medium	Low	Plant and equipment installed, maintained and operated as dictated by manufacturer. Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Competent operators employed / contracted. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Breaking of containment to be kept to a minimum on an as needs basis. Suspension column in the well. Wellhead installed and maintained as dictated by industry standards. Wellhead placed within a cellar, capturing initial pollution. Personnel lock off containment area from interceptor to prevent discharge if pollution event occurs. Established and Tested Well Control Procedures. Dedicated Emergency Response Plan Established Dedicated Surface Water Management Plan Established Dedicated Leak Detection and Repair Plan Established	Not Significant
06	Site Production Storage • Storage Vessels	Equipment Failure	• Oil • Formation Water	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automated alerts / notifications to the Operator in real time when site is unmanned, allowing sufficient time to attend site and contain the site where necessary. Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Dedicated Leak Detection and Repair Plan Established Dedicated Surface Water Management Plan Established Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Storage tanks shall be placed within CIRIA 736 compliant containment bunds.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
07	Site Production Storage • Storage Vessels	Planned Breaking of Containment	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automated alerts / notifications to the Operator in real time when site is unmanned, allowing sufficient time to attend site and contain the site where necessary. Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Breaking of containment to be kept to a minimum on an as needs basis. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established. Dedicated Surface Water Management Plan Established. Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Storage tanks shall be placed within CIRIA 736 compliant containment bunds.	Not Significant
08	Site Production Storage • Storage Vessels	Overfilling	• Oil • Formation Water • Suspension Brine	Discharge of Surface Water (Rainwater) collected from the 'Active Area' site foot print. Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Automated alerts / notifications to the Operator in real time when site is unmanned, allowing sufficient time to attend site and contain the site where necessary. Automatic ESD Devices installed on production equipment in the event of High Pressure / Low Pressure, preventing / limiting wellbore fluid spillages. Class 1 Separator (Interceptor) installed with High Level Alarm to removing any trace oils prior to discharge. Competent operators employed / contracted. Dedicated Emergency Response Plan Established Dedicated Surface Water Management Plan Established Established and Tested Well Control Procedures. Personnel inducted / trained on emergency response procedures. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Storage tanks shall be placed within CIRIA 736 compliant containment bunds.	Not Significant
Drilling Compound Configuration - Secondary Containment Systems										
01	Secondary Containment Systems • Well Cellars • Temporary Bunds	Loss of Containment (LOC) from Primary Containment Systems leading to Bund Over Top	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Competent operators employed / contracted. Periodic Thickness Testing of crude oil storage tanks undertaken. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
02	Secondary Containment Systems • Well Cellars • Temporary Bunds	Loss of Containment (LOC) from Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Secondary containment systems have been constructed / installed for containment of any unintended escape of material from that area where potentially polluting substances are stored / transferred. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water or remediation of spillages as required. Periodic checks to be undertaken of the secondary containment system to ensure that integrity is maintained Maintenance and servicing regimes implemented to minimise failure of secondary containment system. Competent operators employed / contracted. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant
03	Secondary Containment Systems • Well Cellars • Temporary Bunds	Addition and Release of Fire Water / Cooling Water from Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water • Fire Water / Cooling Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Secondary containment systems have been constructed / installed for containment of any unintended escape of material from that area where potentially polluting substances are stored / transferred. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water or remediation of spillages as required. Periodic checks to be undertaken of the secondary containment system to ensure that integrity is maintained Maintenance and servicing regimes implemented to minimise failure of secondary containment system. Competent operators employed / contracted. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant
04	Secondary Containment Systems • Well Cellars • Temporary Bunds	Accidental Discharge of Surface Water (Rainwater) collected from the Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water • Fire Water / Cooling Water	Discharge to surface water Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Management Controls should ensure that Accidental Discharge does not occur. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water as required. Dedicated Surface Water Management Plan Established. Dedicated Emergency Response Plan Established. Personnel inducted / trained on emergency response procedures. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Discharge Operations only undertaken by Trained Personnel.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
Production Compound Configuration - Secondary Containment Systems										
01	Secondary Containment Systems • Well Cellars • Tanker Loading Bay • Tanker Turning Area • Oil / Produced Water Storage Tank Area • Fluid Separation Area	Loss of Containment (LOC) from Primary Containment leading to Bund Over Top	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Competent operators employed / contracted. Periodic Thickness Testing of crude oil storage tanks undertaken. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Plant and equipment installed, maintained and operated as dictated by manufacturer. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant
02	Secondary Containment Systems • Well Cellars • Tanker Loading Bay • Tanker Turning Area • Oil / Produced Water Storage Tank Area • Fluid Separation Area	Loss of Containment (LOC) from Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Secondary containment systems have been constructed / installed for containment of any unintended escape of material from that area where potentially polluting substances are stored / transferred. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water or remediation of spillages as required. Periodic checks to be undertaken of the secondary containment system to ensure that integrity is maintained Maintenance and servicing regimes implemented to minimise failure of secondary containment system. Competent operators employed / contracted. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant

ID	Potential Release Point	Activity / Event Leading to Emission	S-P-R Linkage			Exposure Probability	Consequence	Risk Magnitude	*	Residual Risk
			Source	Pathway	Receptor					
03	Secondary Containment Systems • Well Cellars • Tanker Loading Bay • Tanker Turning Area • Oil / Produced Water Storage Tank Area • Fluid Separation Area	Addition and Release of Fire Water / Cooling Water from Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water • Fire Water / Cooling Water	Leakage and run-off to surface water Infiltration to groundwater through the base of the wellsite Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Secondary containment systems have been constructed / installed for containment of any unintended escape of material from that area where potentially polluting substances are stored / transferred. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water or remediation of spillages as required. Periodic checks to be undertaken of the secondary containment system to ensure that integrity is maintained Maintenance and servicing regimes implemented to minimise failure of secondary containment system. Competent operators employed / contracted. Site spillage kits to be readily available. Spillages to be remediated immediately. Dedicated Emergency Response Plan Established. Dedicated Leak Detection and Repair Plan Established. Dedicated Surface Water Management Plan Established. Personnel inducted / trained on emergency response procedures. Scheme of monitoring being undertaken. Site remotely monitored via CCTV system when unmanned. Surface water level within secondary containment system will be monitored to ensure Bund Overtop does not occur. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Tertiary Containment installed across the active area of the wellsite.	Not Significant
04	Secondary Containment Systems • Well Cellars • Tanker Loading Bay • Tanker Turning Area • Oil / Produced Water Storage Tank Area • Fluid Separation Area	Accidental Discharge of Surface Water (Rainwater) collected from the Secondary Containment Systems	• Oil • Gas Oil • Formation Water • Suspension Brine • Oil Based Drilling Products • Water Based Drilling Products • Cement Products • Well Treatment Products • Surface Run-off Water • Fire Water / Cooling Water	Discharge to surface water Field Drain and Downstream Confluence	• SPA • MPA • SSSI • SAM • Aquifers • Sensitive Receptors • Surface Water Features • Surrounding Environment	Very Low	High	Low	Management Controls should ensure that Accidental Discharge does not occur. Secondary containment system monitored and procedures in place to test and remove excess surface run–off water as required. Dedicated Surface Water Management Plan Established. Dedicated Emergency Response Plan Established. Personnel inducted / trained on emergency response procedures. Surface water contained within the secondary containment system will be monitored and transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Contaminated surface water / Fire-fighting water / Cooling water contained within the secondary containment system will be transferred offsite to an Environment Agency Licensed Waste Water Disposal / Waste Water Treatment Facility via road tanker. Discharge Operations only undertaken by Trained Personnel.	Not Significant

APPENDIX 2 – SURFACE WATER SCREENING LIMITS

West Newton A Laboratory Analysis Parameter Limits

Surface water parameters shall not be discharged if the screening limits provided within Table A1 are exceeded.

Parameter	LOD	Unit	Screening Limit
pH	0.01	pH Units	6.5 – 9.5
Electrical Conductivity	2	µS/cm	<2500
Total Suspended Solids	10	mg/l	<100
Benzene	0.0005	mg/l	<1
Toluene	0.005	mg/l	<5
Ethel Benzene	0.001	mg/l	<1
m/p Xylene	0.002	mg/l	<2
O Xylene	0.001	mg/l	<1
MTBE	0.0001	mg/l	<1
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C8 to C35	0.01	mg/l	<10
Polyaromatic Hydrocarbons USEPA16	0.173	mg/l	<0.173
Aluminium	0.0015	mg/l	<0.2
Antimony	0.002	mg/l	N/A
Arsenic	0.0009	mg/l	<0.05
Boron	0.012	mg/l	<2
Cadmium	0.00003	mg/l	<0.00015
Chloride	0.3	mg/l	<250
Chromium	0.0002	mg/l	<0.0034
Chromium (Total)	0.0015	mg/l	<0.0034
Copper	0.001	mg/l	<0.001
Iron	0.02	mg/l	<1
Lead	0.0004	mg/l	<0.0012
Manganese	0.0015	mg/l	<0.123
Mercury	0.00001	mg/l	<0.00007
Nickel	0.0002	mg/l	<0.004
Selenium	0.0012	mg/l	N/A
Sodium	0.1	mg/l	<200
Zinc	0.0015	mg/l	<0.093
Alkalinity (Total Bicarbonate)	0.2	mg/l	N/A
Hardness	1	mg/l	N/A
Sulphate	0.05	mg/l	<250

Parameter	LOD	Unit	Screening Limit
Sulphur	0.01	mg/l	N/A
Nitrate	0.2	mg/l	<50
Calcium	0.2	mg/l	<1,000
Magnesium	0.1	mg/l	<25
Potassium	0.1	mg/l	<250

Table A1 Surface Water Screening Limits

Screening limits have been selected based on baseline surface water monitoring and taking into account of freshwater Environmental Quality Standards [Ref. 5] and Drinking Water Standards [Ref. 6].

The surface water parameters shall be tested at regular intervals to allow for interpretation and comparison with the Groundwater monitoring. Surface water parameters to be tested are provided within Table A2.

• pH • Electrical Conductivity • Total Suspended Solids • Turbidity • Alkalinity (Total Bicarbonate) • Hardness • Mercury (Total Hg) • Cadmium • Sulphate • Sulphur • Chloride • Sodium • Nitrate	• Calcium • Magnesium • Potassium • Aluminium • Iron • Manganese • Zinc • Benzene • Toluene • Ethyl Benzene • Xylene • MTBE	• Total Petroleum Hydrocarbons - aromatic and aliphatic class and carbon banding C8 to C35 • Polyaromatic Hydrocarbons USEPA16 • Antimony • Arsenic • Boron • Total Chromium • Copper • Lead • Nickel • Selenium

Table A2 Surface Water Parameters

APPENDIX 3 – SURFACE WATER MONITORING – SAMPLING POINT LOCATION PLANS

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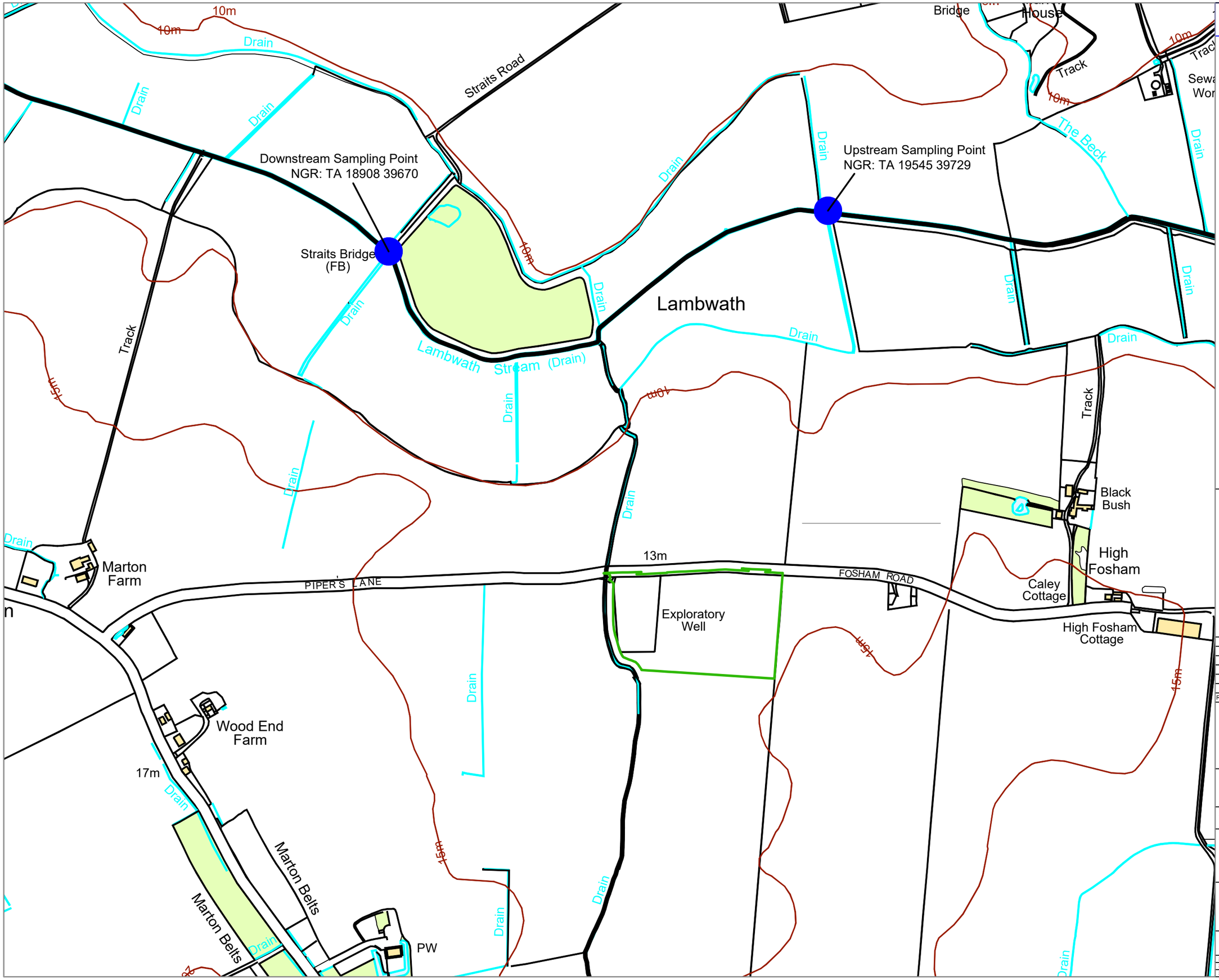


KEY:

- PERMIT BOUNDARY
- WATER FEATURES (PONDS / DRAINS)
- 5M CONTOUR LINES

0 50m 100m 200m

SCALE IN METRES 1:5,000

NOTES:

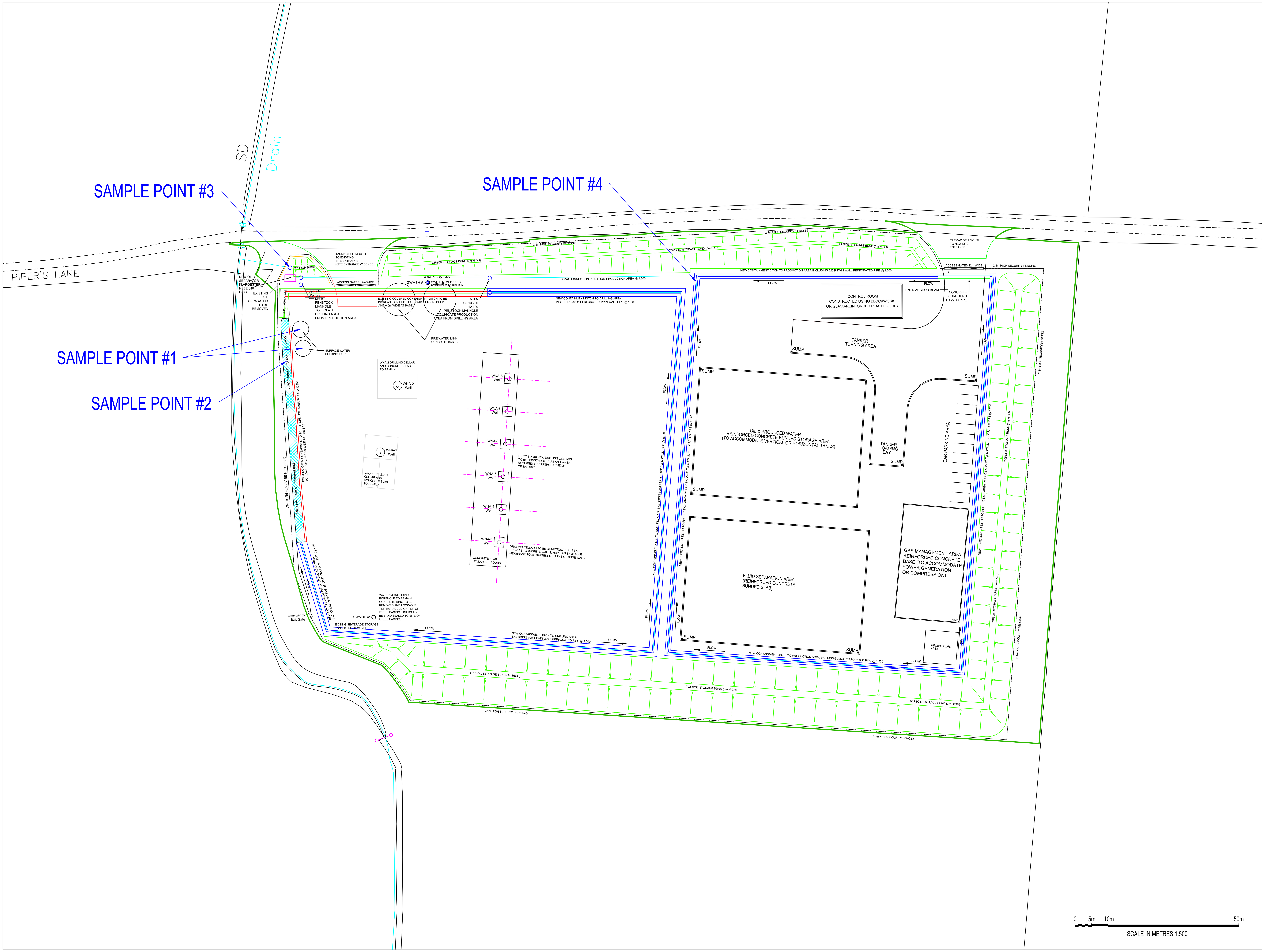
REVISION HISTORY				
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
0	MAR23	JF	ORIGINAL FOR ISSUE	JF
REV	DATE	BY	DETAILS	APR

ZETLAND GROUP
FROM CONCEPTION TO COMPLETION
ZETLAND GROUP LIMITED
THE INNOVATION CENTRE, KIRKLEATHAM BUSINESS PARK, REDCAR, TS10 5SH
T: +44(0)1642 777726 E: info@zetlandgroup.com W: www.zetlandgroup.com
Registered in England No. 05964499. Registered office: The Innovation Centre, Kirkleatham Business Park, Redcar, TS10 5SH

SITE:	WEST NEWTON A WELLSITE
PROJECT:	WEST NEWTON A WELLSITE EXTENSION FOR HYDROCARBON EXPLORATION, APPRAISAL & PRODUCTION
TITLE:	EXTERNAL SURFACE WATER MONITORING POINTS LOCATION PLAN
CLIENT:	RATHLIN ENERGY (UK) LIMITED

Scale:	1:5,000
Size:	A3
Sheet:	1 of 1

DWG. No: ZG-RE-WNAEXT-PROD-EPR-009



THE ORDNANCE SURVEY DATA ON THIS PLAN HAS BEEN REPRODUCED FROM ORDNANCE SURVEY ® BY PERMISSION OF ORDNANCE SURVEY ® ON BEHALF OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. © CROWN COPYRIGHT 2020. ALL RIGHTS RESERVED. LICENCE No. 100022432

KEY:

- PERMIT BOUNDARY
- WATER FEATURES (PONDS / DRAINS)
- GROUNDWATER QUALITY MONITORING BOREHOLES (GWMBH)
- PERIMETER CONTAINMENT RODDING/JETTING ACCESS
- PIPED & BACKFILLED PERIMETER CONTAINMENT DITCH
- OPEN PERIMETER CONTAINMENT DITCH
- WELL CENTRE

NOTES:

WNA-1 AND WNA-2 ARE EXISTING WELLS.

REVISION HISTORY

REV	DATE	BY	DETAILS	APR
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
1	NOV22	JF	RENUMBERING OF SAMPLING POINTS	JF
0	AUG22	JF	ORIGINAL FOR ISSUE	JF

ZETLAND GROUP

FROM CONCEPTION TO COMPLETION

ZETLAND GROUP LIMITED
THE INNOVATION CENTRE, KIRKLEATHAM BUSINESS PARK, REDCAR, TS10 5SH
T: +44(0)1642 777726 E: info@zetlandgroup.com W: www.zetlandgroup.com
Registered in England No. 05964499. Registered office: The Innovation Centre, Kirkleatham Business Park, Redcar, TS10 5SH

SITE: WEST NEWTON A WELLSITE

PROJECT: WEST NEWTON A WELLSITE EXTENSION FOR HYDROCARBON EXPLORATION, APPRAISAL & PRODUCTION

TITLE: SURFACE WATER MONITORING - SAMPLE POINT LOCATION PLAN

CLIENT: RATHLIN ENERGY (UK) LIMITED

Scale:	1:500	DWG. No: ZG-RE-WNAEXT-PROD-EA-S5-04
Size:	A1	
Sheet:	1 of 1	

APPENDIX 4 – SURFACE WATER MONITORING REPORT FORMS

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EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/04/2020 to 30/06/2020

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/06/2020 Surface water sample point (WNA SW1)	18/06/2020 Effluent sample point (WNA OL1)			
pH	7.94 pH Units	7.54 pH Units			
Electrical Conductivity	681 µS/cm	177 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	6 mg/l	1 mg/l			
Turbidity	5.8 NTU	4.7 NTU			
Alkalinity (Total, Bicarbonate)	77 mg/l	78 mg/l			
Hardness	184 mg/l	117 mg/l			
Mercury (Total Hg)	<1 µg/l	<1 µg/l			
Cadmium (Total Cd)	<0.5 µg/l	<0.5 µg/l			
Sulphate	60.20 mg/l	27.89 mg/l			
Sulphur	18.98 mg/l	9.95 mg/l			
Chloride	144.4 mg/l	29.2 mg/l			
Sodium	41.1 mg/l	10.9 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/06/2020 Surface water sample point (WNA SW1)	18/06/2020 Effluent sample point (WNA OL1)			
Nitrate	1.7 mg/l	4.7 mg/l			
Calcium	65.0 mg/l	41.7 mg/l			
Magnesium	5.1 mg/l	3.1 mg/l			
Potassium	21.7 mg/l	6.1 mg/l			
Aluminium	27 µg/l	<20 µg/l			
Iron	79 µg/l	<20 µg/l			
Manganese	19 µg/l	6 µg/l			
Zinc	17 µg/l	17 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/06/2020 Surface water sample point (WNA SW1)	18/06/2020 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/06/2020 Surface water sample point (WNA SW1)	18/06/2020 Effluent sample point (WNA OL1)			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……6th July 2020…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/07/2020 to 30/09/2020

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	10/09/2020 Surface water sample point (WNA SW1)	10/09/2020 Effluent sample point (WNA OL1)			
pH	8.57 pH Units	7.64 pH Units			
Electrical Conductivity	331 µS/cm	307 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	1 mg/l	<1 mg/l			
Turbidity	2.2 NTU	1.3 NTU			
Alkalinity (Total, Bicarbonate)	40 mg/l	68 mg/l			
Hardness	95 mg/l	104 mg/l			
Mercury (Total Hg)	<1 µg/l	<1 µg/l			
Cadmium (Total Cd)	<0.5 µg/l	<0.5 µg/l			
Sulphate	31.64 mg/l	31.53 mg/l			
Sulphur	10.85 mg/l	10.95 mg/l			
Chloride	32.9 mg/l	31.1 mg/l			
Sodium	10.0 mg/l	10.1 mg/l			
Nitrate	0.4 mg/l	1.4 mg/l			
Calcium	32.8 mg/l	36.4 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	10/09/2020 Surface water sample point (WNA SW1)	10/09/2020 Effluent sample point (WNA OL1)			
Magnesium	3.0 mg/l	3.1 mg/l			
Potassium	5.9 mg/l	6.6 mg/l			
Aluminium	29 µg/l	25 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	<2 µg/l	<2 µg/l			
Zinc	3 µg/l	5 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	10/09/2020 Surface water sample point (WNA SW1)	10/09/2020 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……16th October 2020…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/10/2020 to 31/12/2020

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	03/12/2020 Surface water sample point (WNA SW1)	03/12/2020 Effluent sample point (WNA OL1)			
pH	7.94 pH Units	7.84 pH Units			
Electrical Conductivity	686 µS/cm	605 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	<1 mg/l	<1 mg/l			
Turbidity	0.9 NTU	6.7 NTU			
Alkalinity (Total, Bicarbonate)	97 mg/l	114 mg/l			
Hardness	223 mg/l	212 mg/l			
Mercury (Total Hg)	1 µg/l	<1 µg/l			
Cadmium (Total Cd)	<0.5 µg/l	<0.5 µg/l			
Sulphate	80.79 mg/l	63.94 mg/l			
Sulphur	23.75 mg/l	18.99 mg/l			
Chloride	96.5 mg/l	73.6 mg/l			
Sodium	32.4 mg/l	24.8 mg/l			
Nitrate	1.4 mg/l	2.4 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	03/12/2020 Surface water sample point (WNA SW1)	03/12/2020 Effluent sample point (WNA OL1)			
Calcium	73.6 mg/l	71.7 mg/l			
Magnesium	9.2 mg/l	7.9 mg/l			
Potassium	14.8 mg/l	11.2 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	<2 µg/l	7 µg/l			
Zinc	36 µg/l	31 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	03/12/2020 Surface water sample point (WNA SW1)	03/12/2020 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……7th January 2021…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/01/2021 to 31/03/2021

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	02/02/2021 Surface water sample point (WNA SW1)	02/02/2021 Effluent sample point (WNA OL1)			
pH	6.82 pH Units	7.04 pH Units			
Electrical Conductivity	209 µS/cm	195 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	4 mg/l	1 mg/l			
Turbidity	4.8 NTU	2.2 NTU			
Alkalinity (Total, Bicarbonate)	83 mg/l	87 mg/l			
Hardness	82 mg/l	80 mg/l			
Mercury (Total Hg)	<0.5 µg/l	<0.5 µg/l			
Cadmium (Total Cd)	<0.03 µg/l	<0.03 µg/l			
Sulphate	14.37 mg/l	8.71 mg/l			
Sulphur	4.44 mg/l	2.87 mg/l			
Chloride	8.2 mg/l	4.7 mg/l			
Sodium	4.9 mg/l	4.0 mg/l			
Nitrate	<0.2 mg/l	0.3 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	02/02/2021 Surface water sample point (WNA SW1)	02/02/2021 Effluent sample point (WNA OL1)			
Calcium	29.1 mg/l	28.2 mg/l			
Magnesium	2.2 mg/l	2.2 mg/l			
Potassium	3.9 mg/l	2.7 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	<2 µg/l	<2 µg/l			
Zinc	18 µg/l	23 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	02/02/2021 Surface water sample point (WNA SW1)	02/02/2021 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……28th April 2021…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/04/2021 to 30/06/2021

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	17/05/2021 Surface water sample point (WNA SW1)	17/05/2021 Effluent sample point (WNA OL1)			
pH	8.68 pH Units	7.47 pH Units			
Electrical Conductivity	302 µS/cm	352 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	<1 mg/l	<1 mg/l			
Turbidity	1.6 NTU	4.7 NTU			
Alkalinity (Total, Bicarbonate)	62 mg/l	96 mg/l			
Hardness	108 mg/l	132 mg/l			
Mercury (Total Hg)	<0.5 µg/l	<0.5 µg/l			
Cadmium (Total Cd)	<0.03 µg/l	0.04 µg/l			
Sulphate	25.38 mg/l	21.19 mg/l			
Sulphur	9.13 mg/l	7.95 mg/l			
Chloride	24.9 mg/l	36.4 mg/l			
Sodium	9.6 mg/l	10.8 mg/l			
Nitrate	1.1 mg/l	1.5 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	17/05/2021 Surface water sample point (WNA SW1)	17/05/2021 Effluent sample point (WNA OL1)			
Calcium	37.0 mg/l	46.7 mg/l			
Magnesium	3.6 mg/l	3.7 mg/l			
Potassium	4.1 mg/l	4.8 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	46 µg/l			
Manganese	<2 µg/l	16 µg/l			
Zinc	12 µg/l	18 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethylbenzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	17/05/2021 Surface water sample point (WNA SW1)	17/05/2021 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……13th July 2021…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/07/2021 to 30/09/2021

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
pH	** No monitoring undertaken during this period due to operations being conducted**				
Electrical Conductivity					
Total Suspended Solids					
Biochemical Oxygen Demand					
Turbidity					
Alkalinity (Total, Bicarbonate)					
Hardness					
Mercury (Total Hg)					
Cadmium (Total Cd)					
Sulphate					
Sulphur					
Chloride					
Sodium					
Nitrate					
Calcium					
Magnesium					

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
Potassium					
Aluminium					
Iron					
Manganese					
Zinc					
Benzene					
Toluene					
Ethylbenzene					
p/m-Xylene					
o-Xylene					
MTBE					
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35					

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
Polyaromatic Hydrocarbons:					
Naphthalene					
Acenaphthylene					
Acenaphthene					
Fluorene					
Phenanthrene					
Anthracene					
Fluoranthene					
Pyrene					
Benzo[a]anthracene					
Chrysene					
Benzo[bk]fluoranthene					
Benzo[b]fluoranthene					
Benzo[k]fluoranthene					
Benzo[a]pyrene					
Indeno[1,2,3-cd]pyrene					
Dibenzo[a,h]anthracene					
Benzo[ghi]perylene					
Total (USEPA16) PAHs					

Signed…… …….. Date……8th November 2021…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/10/2021 to 31/12/2021

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/11/2021 Surface water sample point (WNA SW1)	14/12/2021 Effluent sample point (WNA OL1)			
pH	7.06 pH Units	7.98 pH Units			
Electrical Conductivity	945 µS/cm	1075 µS/cm			
Total Suspended Solids	19 mg/l	17 mg/l			
Biochemical Oxygen Demand	<1 mg/l	<1 mg/l			
Turbidity	72.3 NTU	22.0 NTU			
Alkalinity (Total, Bicarbonate)	84 mg/l	106 mg/l			
Hardness	306 mg/l	349 mg/l			
Mercury (Total Hg)	<0.5 µg/l	<0.5 µg/l			
Cadmium (Total Cd)	0.10 µg/l	0.07 µg/l			
Sulphate	19.34 mg/l	23.22 mg/l			
Sulphur	7.80 mg/l	75.89 mg/l			
Chloride	215.0 mg/l	239.2 mg/l			
Sodium	26.6 mg/l	30.8 mg/l			
Nitrate	1.5 mg/l	1.4 mg/l			
Calcium	109.7 mg/l	127.6 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/11/2021 Surface water sample point (WNA SW1)	14/12/2021 Effluent sample point (WNA OL1)			
Magnesium	7.5 mg/l	7.1 mg/l			
Potassium	7.1 mg/l	7.0 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	6 µg/l	37 µg/l			
Zinc	47 µg/l	139 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	01/11/2021 Surface water sample point (WNA SW1)	14/12/2021 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.01 µg/l	<0.01 µg/l			
Acenaphthene	<0.01 µg/l	<0.01 µg/l			
Fluorene	<0.01 µg/l	<0.01 µg/l			
Phenanthrene	<0.01 µg/l	<0.01 µg/l			
Anthracene	<0.01 µg/l	<0.01 µg/l			
Fluoranthene	<0.01 µg/l	<0.01 µg/l			
Pyrene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]anthracene	<0.01 µg/l	<0.01 µg/l			
Chrysene	<0.01 µg/l	<0.01 µg/l			
Benzo[bk]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[b]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[k]fluoranthene	<0.01 µg/l	<0.01 µg/l			
Benzo[a]pyrene	<0.01 µg/l	<0.01 µg/l			
Indeno[1,2,3-cd]pyrene	<0.01 µg/l	<0.01 µg/l			
Dibenzo[a,h]anthracene	<0.01 µg/l	<0.01 µg/l			
Benzo[ghi]perylene	<0.01 µg/l	<0.01 µg/l			
Total (USEPA16) PAHs	<0.1 µg/l	<0.1 µg/l			

Signed……. Date……5th January 2022…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/01/2022 to 31/03/2022

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	05/04/2022 Surface water sample point (WNA SW1)	05/04/2022 Effluent sample point (WNA OL1)			
pH	7.83 pH Units	8.04 pH Units			
Electrical Conductivity	362 µS/cm	382 µS/cm			
Total Suspended Solids	<10 mg/l	12 mg/l			
Biochemical Oxygen Demand	<1 mg/l	<1 mg/l			
Turbidity	1.0 NTU	2.5 NTU			
Alkalinity (Total, Bicarbonate)	92 mg/l	97 mg/l			
Hardness	138 mg/l	149 mg/l			
Mercury (Total Hg)	<0.5 µg/l	<0.5 µg/l			
Cadmium (Total Cd)	<0.03 µg/l	<0.03 µg/l			
Sulphate	21.79 mg/l	23.25 mg/l			
Sulphur	6.46 mg/l	7.11 mg/l			
Chloride	51.3 mg/l	55.3 mg/l			
Sodium	11.8 mg/l	11.3 mg/l			
Nitrate	1.5 mg/l	1.9 mg/l			
Calcium	49.3 mg/l	53.4 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	05/04/2022 Surface water sample point (WNA SW1)	05/04/2022 Effluent sample point (WNA OL1)			
Magnesium	3.5 mg/l	3.6 mg/l			
Potassium	3.7 mg/l	3.8 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	<2 µg/l	7 µg/l			
Zinc	29 µg/l	35 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	05/04/2022 Surface water sample point (WNA SW1)	05/04/2022 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.005 µg/l	<0.005 µg/l			
Acenaphthene	<0.005 µg/l	<0.005 µg/l			
Fluorene	<0.005 µg/l	<0.005 µg/l			
Phenanthrene	<0.005 µg/l	<0.005 µg/l			
Anthracene	<0.005 µg/l	<0.005 µg/l			
Fluoranthene	<0.005 µg/l	<0.005 µg/l			
Pyrene	<0.005 µg/l	<0.005 µg/l			
Benzo[a]anthracene	<0.005 µg/l	<0.005 µg/l			
Chrysene	<0.005 µg/l	<0.005 µg/l			
Benzo[bk]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[b]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[k]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[a]pyrene	<0.005 µg/l	<0.005 µg/l			
Indeno[1,2,3-cd]pyrene	<0.005 µg/l	<0.005 µg/l			
Dibenzo[a,h]anthracene	<0.005 µg/l	<0.005 µg/l			
Benzo[ghi]perylene	<0.005 µg/l	<0.005 µg/l			
Total (USEPA16) PAHs	<0.173 µg/l	<0.173 µg/l			

Signed……. Date……14th April 2022…….

(Authorised to sign as representative of Operator)

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Permit Number: EPR/BB3001FT **Operator:** Rathlin Energy (UK) Limited

Facility: West Newton A wellsite **Form Number:** Table S1.2 04/01/2016

Reporting of surface water monitoring for the period from 01/04/2022 to 30/06/2022

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	08/06/2022 Surface water sample point (WNA SW1)	08/06/2022 Effluent sample point (WNA OL1)			
pH	7.90 pH Units	7.47 pH Units			
Electrical Conductivity	988 µS/cm	286 µS/cm			
Total Suspended Solids	<10 mg/l	<10 mg/l			
Biochemical Oxygen Demand	<1 mg/l	<1 mg/l			
Turbidity	2.9 NTU	2.8 NTU			
Alkalinity (Total, Bicarbonate)	69 mg/l	66 mg/l			
Hardness	111 mg/l	109 mg/l			
Mercury (Total Hg)	<0.5 µg/l	<0.5 µg/l			
Cadmium (Total Cd)	<0.03 µg/l	<0.03 µg/l			
Sulphate	20.66 mg/l	21.72 mg/l			
Sulphur	7.73 mg/l	6.96 mg/l			
Chloride	32.3 mg/l	30.3 mg/l			
Sodium	7.2 mg/l	6.9 mg/l			
Nitrate	6.8 mg/l	6.1 mg/l			
Calcium	39.8 mg/l	39.4 mg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	08/06/2022 Surface water sample point (WNA SW1)	08/06/2022 Effluent sample point (WNA OL1)			
Magnesium	2.8 mg/l	2.5 mg/l			
Potassium	4.0 mg/l	3.9 mg/l			
Aluminium	<20 µg/l	<20 µg/l			
Iron	<20 µg/l	<20 µg/l			
Manganese	<2 µg/l	4 µg/l			
Zinc	10 µg/l	13 µg/l			
Benzene	<0.5 µg/l	<0.5 µg/l			
Toluene	<5 µg/l	<5 µg/l			
Ethel Benzene	<1 µg/l	<1 µg/l			
p/m-Xylene	<2 µg/l	<2 µg/l			
o-Xylene	<1 µg/l	<1 µg/l			
MTBE	<0.1 µg/l	<0.1 µg/l			
Total Petroleum Hydrocarbons – aromatic and aliphatic class and carbon banding C5 to C35	<10 µg/l	<10 µg/l			

EMS SUPPORTING DOCUMENTATION – SURFACE WATER MONITORING REPORT FORM – TABLE S1.2

Parameters as listed in Table S1.2 EPR/BB3001FT	Sample Date				Remarks
	08/06/2022 Surface water sample point (WNA SW1)	08/06/2022 Effluent sample point (WNA OL1)			
Polyaromatic Hydrocarbons:					
Naphthalene	<0.1 µg/l	<0.1 µg/l			
Acenaphthylene	<0.005 µg/l	<0.005 µg/l			
Acenaphthene	<0.005 µg/l	<0.005 µg/l			
Fluorene	<0.005 µg/l	<0.005 µg/l			
Phenanthrene	<0.005 µg/l	<0.005 µg/l			
Anthracene	<0.005 µg/l	<0.005 µg/l			
Fluoranthene	<0.005 µg/l	<0.005 µg/l			
Pyrene	<0.005 µg/l	<0.005 µg/l			
Benzo[a]anthracene	<0.005 µg/l	<0.005 µg/l			
Chrysene	<0.005 µg/l	<0.005 µg/l			
Benzo[bk]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[b]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[k]fluoranthene	<0.008 µg/l	<0.008 µg/l			
Benzo[a]pyrene	<0.005 µg/l	<0.005 µg/l			
Indeno[1,2,3-cd]pyrene	<0.005 µg/l	<0.005 µg/l			
Dibenzo[a,h]anthracene	<0.005 µg/l	<0.005 µg/l			
Benzo[ghi]perylene	<0.005 µg/l	<0.005 µg/l			
Total (USEPA16) PAHs	<0.173 µg/l	<0.173 µg/l			

Signed……. Date……11th July 2022…….

(Authorised to sign as representative of Operator)

Rathlin Energy

STATISTICAL REVIEW OF ZINC LEVELS IN SURFACE WATER

R1

March 2023

WNA Permit Variation Application

Review conducted to ascertain zinc limits for SW discharge

APPROVAL LIST

	Name	Title	Signature
Prepared By	Caroline Foster	Operations Engineer	
Reviewed By	Tony Fildes	HSE Advisor	
Approved By	Tom Selkirk	Country Manager	

Revision History

Revision	Reason for Revision	Date of Revision
Rev 0	Initial Draft	21/03/2023
Rev 1	Reviewed to issue	23/03/2023
Rev 2		

Table of Contents

1 Introduction

The results of surface water sampling from the WNA wellsite have shown that the quantity of dissolved zinc in the surface water regularly exceeds the limit of 13.8µg/l proposed as a limit on discharge from the site.

Rathlin has analysed the surface water analysis data to propose a limit which is consistent with known data from the surface water analysis conducted since 2016.

2 Summary

Rathlin is currently in the process of an application to vary the bespoke permit for WNA. With this, a review of the surface water management plan has been undertaken. Limit levels on certain compounds present within the surface waters are likely to be set to ensure that the discharge of surface water from the wellsite does not pollute the surrounding surface water.

Rathlin have been taking samples of surface water since December 2015 to analyse for various compounds within the water, including zinc.

A limit for zinc of 13.8µg/l has been proposed by the Environment Agency but the results from surface water analysis shows that the zinc levels are consistently higher than this within the surface water collected and discharged at the WNA wellsite.

Rathlin has collected, and had sampled by a third-party laboratory, over 80 samples from both the surface water contained within the perimeter ditch and at the outlet point where the surface water is discharged from the site.

The results of the surface water analysis show the amount of zinc found in the surface water samples has ranged from <3µg/l to 157µg/l.

Analysis shows that the high values of zinc are not linked to either seasonal patterns or following periods of activity on the site.

Following sampling of both surface water and stone from various places around the site it has been assumed that the imported limestone has higher levels of zinc than naturally found in the surrounding areas. As the surface water drains through the limestone before collecting in the perimeter containment ditch, it accumulates additional zinc dissolved into the water.

The samples from the outlet have been analysed to determine the maximum zinc levels for discharge of the surface water from the site.

The results show that the highest result of 81µg/l omits outlying anomalies which have been detected throughout the surface water sampling but that through statistical interpretation a maximum limit of 93µg/l should be set to allow discharge of surface water from the site.

3 Results of Surface Water Sampling

3.1 All Surface Water Samples

Figure 1 graphs all the results from the surface water sampling at the WNA site for both the containment ditch and the outlet sampling points. The zinc levels within these samples ranges from <3µg/l to 157µg/l. The highest zinc level recorded was in August 2016 from the Outlet sampling point. This was during a prolonged period of inactivity on site and is therefore assumed not to have been an increase due to a process contribution from the site.

Other results with higher readings (over 100 µg/l) of zinc were recorded in June, August, October and December and are therefore not assumed to be related to any seasonal changes.

70% of the samples analysed had zinc levels in the surface water over 13.8µg/l.

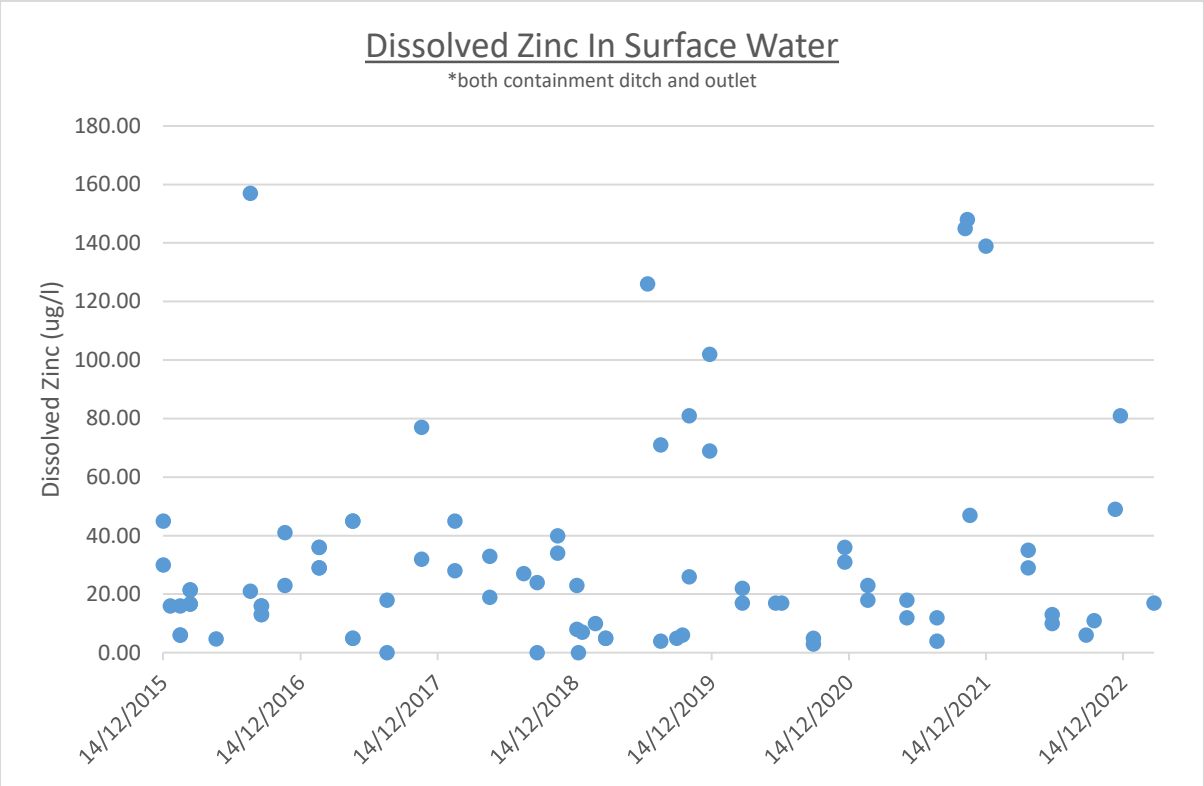

FIGURE 1 - RESULTS FROM ALL SURFACE WATER SAMPLES

3.2 Outlet Samples – Discharge Point from Site

Figure 2 shows the results from the sampling of the water from the outlet – the point at which the water is discharged from site. This sampling point has been chosen as it is the point from which samples have been analysed and submitted in accordance with the permit.

There have been a total of 35 samples taken from the outlet since December 2015. The maximum level of dissolved zinc recorded was 157µg/l on 02/08/2016. 77% of the results recorded were higher than 13.8µg/l zinc. Although the majority of samples are below 45µg/l there have been 6 samples (17%) with results of over 65µg/l and two much higher results of >100µg/l.

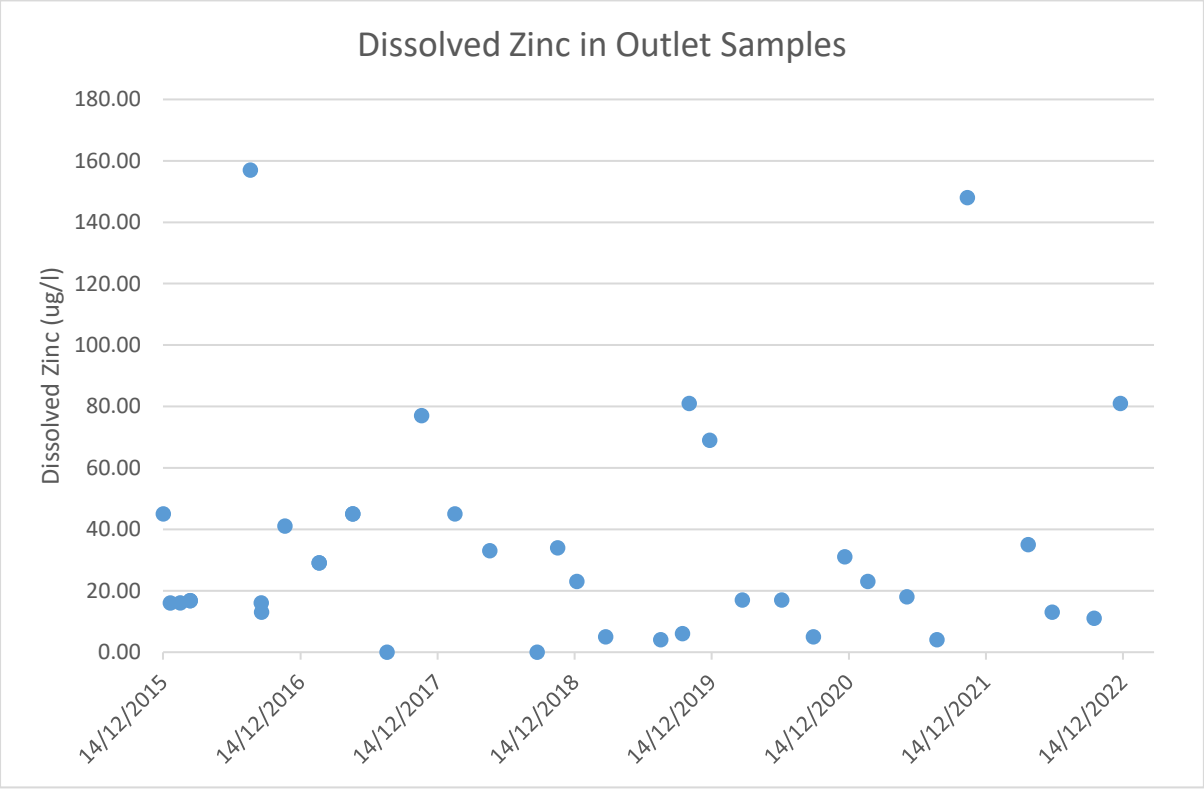

FIGURE 2 - RESULTS FROM OUTLET SAMPLES ONLY

4 Statistical Review to determine Outliers and Maximum Limit

The outliers and maximum limits have been determined using three statistical analyses: visual interpretation of zinc in outlet samples over time, box and whisker plots and analysis of interquartile ranges to determine anomalies within the dataset assuming a normal distribution.

4.1 Visual interpretation of data

Using the data distribution of the outlet sample results (same as figure 2) the outliers can be determined by how far away from the main data they fall. Figure 3 shows that most of the results fall below 45µg/l, there are 4 results (over 10%) which fall between 45µg/l and 81µg/l and two results which are in excess of 145µg/l. The two highest results are clearly outliers.

The results between 45µg/l and 81µg/l could be considered to be higher than the average range and classed as outliers. Given that the 90th percentile in the data falls at 79.4µg/l it is reasonable to assume that those results below 81µg/l are not outliers.

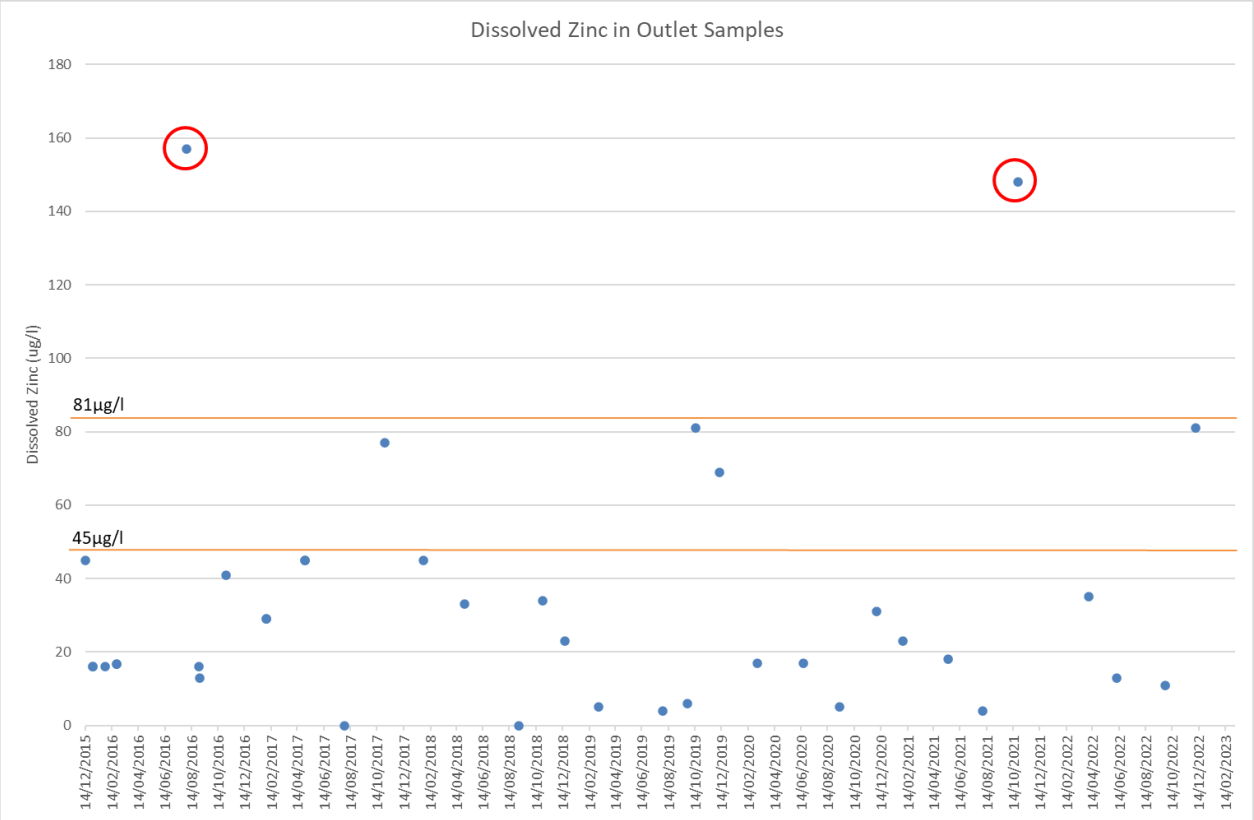

FIGURE 3 - VISUALISATION OF OUTLIERS

4.2 Box and Whisker Plots

Box and whisker plots are used to determine the first quartile, median and third quartile from a set of data, showing the minimum and maximum values and excluding any outliers.

Figure 4 shows that the data range, excluding any outliers, is <3-81µg/l. The mean value for the total dataset is 34.2µg/l (X in box). The median value is 23µg/l, the lower quartile is 13µg/l and the upper quartile is 45µg/l.

The maximum value, without the outliers, is 81µg/l.

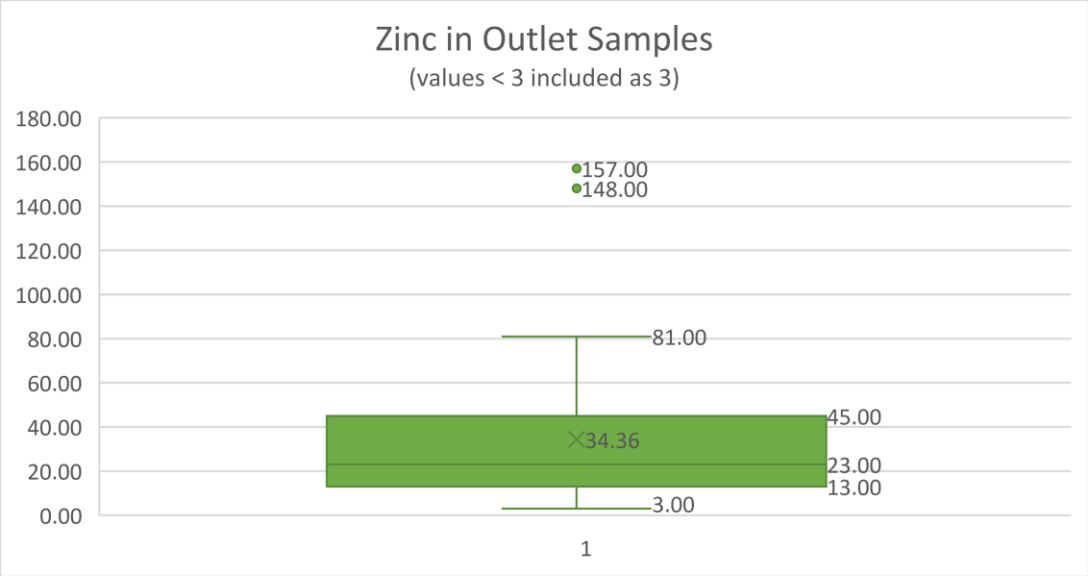

FIGURE 4 - BOX AND WHISKER PLOT OF OUTLET SAMPLE DATA

4.3 Interquartile Range Analysis

A statistical review of the data set to calculate the interquartile range (IQR) can then be used to determine the limits for any outliers. Firstly the 1st and 3rd quartile needs to be calculated – these are the 25th and 75th percentile of the data respectively.

Q1 = 13
Q3 = 45
IQR = Q3 – Q1 = 32

The high outliers can then be determined by using the calculation Q3 + 1.5 IQR. In this case the high outliers would be anything over 93µg/l.

It has been considered that lower values calculated by the lower anomaly number (Q1 - 1.5 IQR) should not be classed as anomalies to determine a lower value for discharge limits.

5 Conclusion

The three statistical analyses demonstrate that the results over 93µg/l can be assumed to be outliers in this dataset. The three different ways of analysing the maximum value within this data set shows that 81µg/l is the highest value (excluding outliers) using two methods (5.1 and 5.2) but that the maximum statistical value using IQR (5.3) is 93µg/l.

Therefore, it is proposed that the maximum level for zinc in the surface water is set at **93µg/l** to undertake discharge of surface water from the site.

6 Appendices

Sample ID	Sample Date	Dissolved Zinc
SW	14/12/2015	30.00
OL	14/12/2015	45.00
SW	28/01/2016	6.00
OL	28/01/2016	16.00
SW	24/02/2016	21.50
OL	24/02/2016	16.70
SW	02/08/2016	21.00
OL	02/08/2016	157.00
OL	01/09/2016	13.00
SW	01/09/2016	16.00
SW	02/11/2016	23.00
OL	02/11/2016	41.00
SW	01/02/2017	36.00
OL	01/02/2017	29.00
SW	02/05/2017	5.00
OL	02/05/2017	45.00
SW	28/01/2016	6.00
OL	02/01/2016	16.00
SW	24/02/2016	21.50
OL	24/02/2016	16.70
SW	03/05/2016	4.70
SW	31/08/2016	13.00

Sample ID	Sample Date	Dissolved Zinc
OL	31/08/2016	16.00
SW	01/02/2017	36.00
OL	01/02/2017	29.00
SW	02/05/2017	5.00
OL	02/05/2017	45.00
SW	01/08/2017	18.00
OL	01/08/2017	<3
SW	01/11/2017	32.00
OL	01/11/2017	77.00
SW	29/01/2018	28.00
OL	29/01/2018	45.00
SW	02/05/2018	19.00
OL	02/05/2018	33.00
SW	31/07/2018	27.00
SW	05/09/2018	24.00
OL	05/09/2018	<3
SW	30/10/2018	40.00
OL	30/10/2018	34.00
SW	20/12/2018	8.00
OL	20/12/2018	23.00
SW	24/12/2018	<3
SW	03/01/2019	7.00

Sample ID	Sample Date	Dissolved Zinc
SW	07/02/2019	10.00
SW	07/03/2019	5.00
OL	07/03/2019	5.00
SW	26/06/2019	126.00
SW	31/07/2019	71.00
OL	31/07/2019	4.00
SW	12/09/2019	5.00
OL	27/09/2019	6.00
SW	15/10/2019	26.00
OL	15/10/2019	81.00
SW	09/12/2019	102.00
OL	09/12/2019	69.00
SW	05/03/2020	22.00
OL	05/03/2020	17.00
SW	01/06/2020	17.00
OL	18/06/2020	17.00
SW	10/09/2020	3.00
OL	10/09/2020	5.00
SW	03/12/2020	36.00
OL	03/12/2020	31.00
SW	02/02/2021	18.00
OL	02/02/2021	23.00
SW	17/05/2021	12.00
OL	17/05/2021	18.00
SW	05/08/2021	12.00
OL	05/08/2021	4.00
SW	19/10/2021	145.00
OL	25/10/2021	148.00
SW	01/11/2021	47.00
SW	14/12/2021	139.00
SW	05/04/2022	29.00
OL	05/04/2022	35.00
SW	08/06/2022	10.00
OL	08/06/2022	13.00
SW	07/09/2022	6.00
OL	28/09/2022	11.00
SW	23/11/2022	49.00
OL	07/12/2022	81.00
SW	06/03/2023	17.00