Report on Drainage Strategy in Support of Application WSCC/063/13/BA

Site Location: Lower Stumble Hydrocarbon Exploration Site, Off London Road, Balcombe, West Sussex, RH17 6JH

Contents

1.0 Purpose of Strategy Report

This report has been prepared following a request from the West Sussex County Council for additional information on drainage and flood risk in association with a planning application for a revision of the current planning consent for exploratory operations providing details of a new flare stack (WSCC/063/13/BA).

The details of the additional information sought have been set out in a "Design Check Report" received from the West Sussex County Council dated 30th July 2013 (see Appendix 1).

This strategy report confirms the studies undertaken by the applicant in association with Method Statement and HSE requirements (see Appendix 2) and further that liaison has taken place with the Environment Agency concerning site preparation, drainage and flood risk matters relevant to the proposed site operations. It also provides an assessment of the site specific flood risk and surface water drainge conditions.

The total site area for the pad, including all lay down areas, administration areas and car parking, occupies approximately 0.55 hectares with the site access roadway extending to approximately 0.1 hectares. This is shown verged red on the application "Red Line Plan" which accompanied the planning application.

2.0 Flood Risk Assessment

An assessment of the site specific flood risk has been made and this is based on a review of the Environment Agency flood risk maps and the Strategic Flood Risk Assessment (SFRA) for West Sussex County Council (January 2010). These data sources have been supplemented by information obtained during a walk over survey and the site specific topographical survey.

There is no known history of flooding within the area and the SFRA for the area also has no historical record of flooding at, or within the immediate vicinity of, the site.

2.1 Flooding to the site

The site of the pad and the access track from London Road are located within the Environment Agency Flood Zone 1. This is the low risk flood zone considered to have a less than 1 in 1000 year (i.e. a probability of less than 0.1%) chance of flooding from rivers or streams and/or from tidal flooding.

The pad site is located within an area considered by the SFRA (see Map L) to have a Low to Medium risk of flooding from **surface water** flows (pluvial flooding). As the site is on locally raised ground with levels falling gently to the south, and given the presence of the railway line on a raised embankment to the north forming an effective control on flows from higher ground, the site is concluded to be at a low risk from surface water flooding.

The site is located within an area that is considered to be potentially at medium risk of flooding from **ground water** (SFRA, Flood map G). As the site is on ground that is locally elevated above the valley floor and outside of the fluvial floodplain (considered indicative of potentially worst case groundwater flooding potential), it is concluded to be at low risk from this source.

There are no records of historical **sewer flooding** in the area (see SFRA map S) and given the rural location of the site, with a lack of sewer infrastructure considered to be present, it is concluded that the site is at low risk of flooding from this potential source of flooding.

The only potential **artificial source** of flooding in the area is the Ardingly Reservoir which is located some 1.5km to the east of the site (see SFRA map R). The reservoir is in the neighbouring catchment to that of the site and separated from it by significantly higher ground that forms the watershed. The site is concluded to be at negligible risk from this source of potential flood risk.

It is concluded that the site and the access track are at **low risk of flooding** from all sources.

It is recognised that the Environment Agency flood maps indicate that a small length of London Road to the southwest of the site as being within Flood Zone 3 (High Risk). However, given the small change in elevation along the section of the road indicated as being at risk, it is concluded that flood depths will be shallow and safe access/egress could be maintained at all times.

The proposed scheme is not specifically categorised under the 'Flood Risk Vulnerability Classification' in the National Planning Policy Framework *(NPPF)*. However, based on a review of the other uses listed within the classes provided, this proposal is considered to best fit within the 'less vulnerable' category.

The 'Flood Risk Vulnerability and Flood Zone Compatibility' matrix (*NPPF*) indicates that 'less vulnerable' development is appropriate in Flood Zone 1.

2.2 Flooding from the site

The proposed works involve a change (increase) in the existing impermeable area and therefore may detrimentally impact on surface water generation. The area that is proposed to be lined and bunded to form the pad (see Figure 1 and Section 3.0 below) will effectively represent a new impermeable area of 0.11hectares which will increase the amount of surface run off from the site.

The proposals are to drain all surface water from this new imperemable pad to a 3m x 3m cellar and for all water collected to be and be disposed of off-site via a suction tanker to a waste water treatment works. As any increased runoff resulting from this area is to be contained and recycled (rather than drained from the site), there is no anticipated increase in runoff and therefore no detrimental impact on surface water flow generation as a result of the proposed works.

3.0 Site Set Up/ Impermeable Membrane

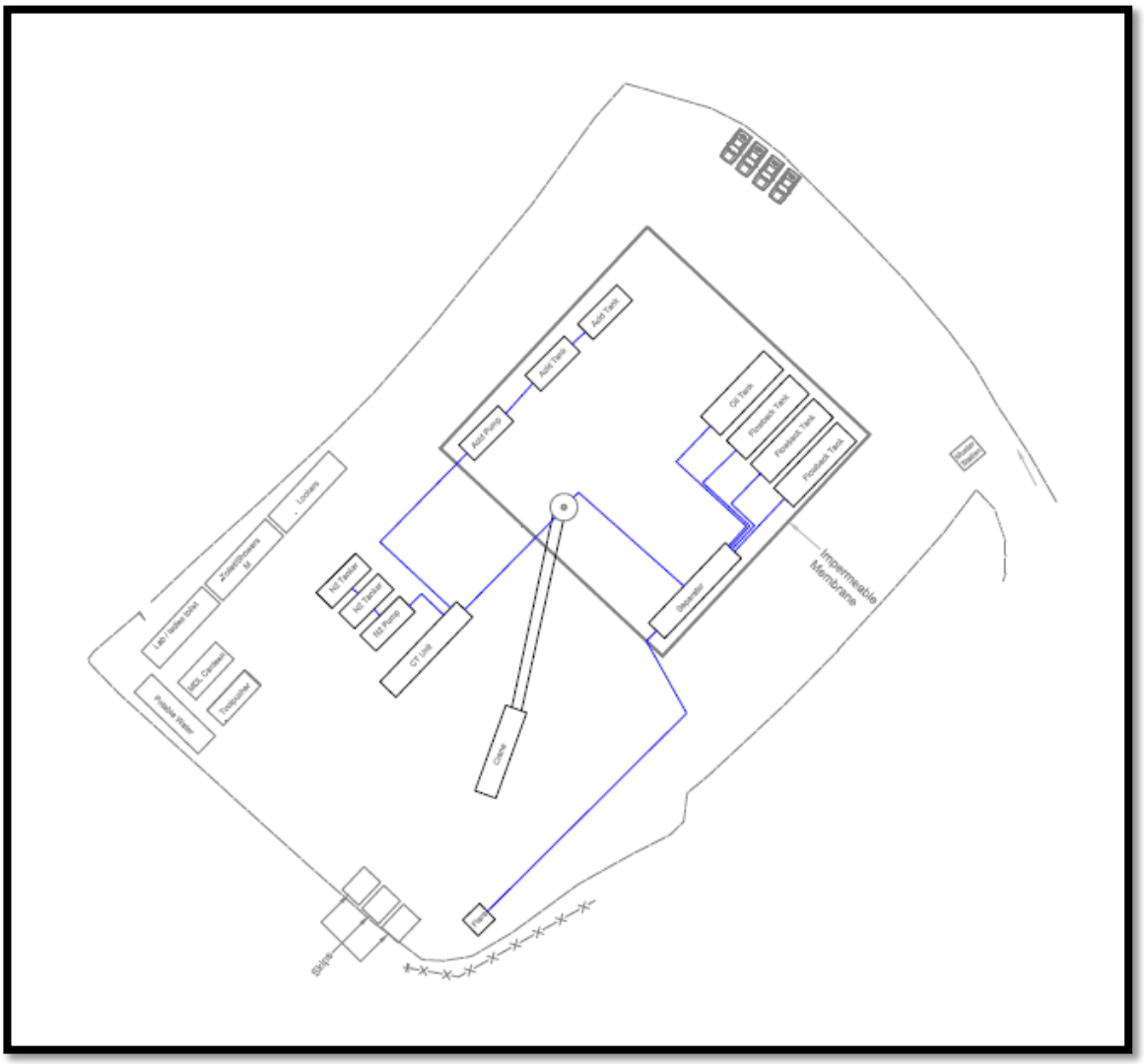
A topographic view of the proposed well testing site set up is shown in figure 1 below. The blue line indicates the area where an impermeable membrane has been installed prior to mobilisation on site.

The site membrane has been constructed in a central area of the site of approx. 0.11 hectares (33.5m x 33.5m). The method of installation has included a contractor tidying the existing site area and re rolling to a flat surface. A perimeter bund from used railway sleepers has been laid and protective geotextile has been laid on top of the stone surface area within the bund. A fully welded 1.0mm textured HDPE membrane has been installed to the geotextile area, sealed to concrete slab edge with metal battening and fixed to the top of sleepers. The HDPE membrane is textured to prevent slippage. A further 500g/m2 protective geotextile over HDPE area has been fixed to the perimeter sleepers. A nominal "pump sump" approx. 2m x 2m x 0.3m deep in the corner of the lined area nearest to existing oil interceptor has been established to pump off liquids contained within the bunded area. An access ramp in/out of the area in timber/stone has been installed. To protect the HDPE membrane further, 70mm thick rig mats (5m x 1m) have been provided to the entire area excluding 3m x 3m for the cellar.

The fuel tank is double skinned (secondary containment) in line with the oil storage regulations. Chemicals are stored in containers containing drip trays. Refuelling activity will be in accordance with the details set out in section 6.2. Any oils, diesels, chemicals in use shall be stored on drip trays.

The concrete slab has Aco drains flowing into the cellar forming a sealed impermeable area. The surface water from the pad will be directed into the cellar and be disposed of off-site via a suction tanker to a waste water treatment works.

Figure 1: Balcombe Flow Test Site Plan



4.0 General Environmental Management

The exploratory site at Balcombe received planning permission from West Sussex County Council in April 2010 (WSCC/027/10/BA). In response to the conditions from the planning permission and the statutory consultee responses,(e.g. Environment Agency, Natural England), the method statement at Appendix 2 has been developed to demonstrate compliance with the planning permission conditions. Surface waters will be contained within the site and removed as necessary by tanker. No discharge to local watercourses will take place and no silting will arise as a result of the on-site exploratory operations. All wastes will be contained and removed from site by appropriate tankers and no discharge of any kind will be made to local sewers/drains. Once the site has been fully developed, and all site exploration operations completed, the all mobile operation equipment will be removed. No drainage features will be offered for adoption as these will be linked directly to an on-site containment system. When the site is restored all such drainage will be removed.

The site is wholly located within flood risk zone 1 (low risk in relation to either tidal or fluvial flooding). In addition, given the site setting within the local topography of the surrounding land, the site is not considered to be at risk from groundwater, surface water (overland flows), or flooding from artificial sources. The site is therefore considered to be at low risk from all potential sources of flooding.

Details of the site water management and associated monitoring, as well as measures to ensure no detrimental impact on flood risk from the site operation, are set out in the followings sections of this report.

4.1 Health and Safety Executive (HSE) Monitoring & Reporting

Cuadrilla's approach to setting high site environmental standards includes a combination of written documentation and setting the right culture. As part of the site HSE organisational structure, a Site HSE Advisor has been assigned to the project for the duration of operations. The Site HSE Advisor will be supported by the HSSE Director, Environmental Engineer and Behavioural Safety Advisor. The Site HSE Advisor is responsible for the method statement communication and continued support. Operations are accountable for complying with the method statement, with the / Site Supervisor taking the lead for day to day accountability. As a minimum, daily tool box talks/morning briefings are held with operational personnel to communicate daily activities, HSE risks, reported incidents, near misses and other key information.

The HSSE Director, Environmental Engineer and Behavioural Safety Advisor will conduct inspections and provide coaching and further support to the Site HSE Advisor; ensuring compliance with environmental best practice is reviewed, achieved or improved upon. Documented inspections, audits and reporting of incidents and near misses via the company Behavioural Safety programme, STAR (Stop Think Act Report), are fundamental to learning lessons and continually improving Cuadrilla's approach to environmental management.

A programme of senior management site inspections will ensure compliance with Cuadrilla's HSE Policies and HSE Risk Management Framework whilst demonstrating the safety leadership culture of the business.

A monthly environmental report shall be shared with the Environment Agency summarising results from monitoring activities. This shall include but not limited to:

1. Operations update
2. Groundwater report
3. Surface water report
4. Air quality report

4.2 Baseline Information

As a baseline, the following activities have been carried out to inform Cuadrilla's approach to site environmental management:

1. An updated ecological study by Environmental Project Consulting Group, April 2013, identified no ecological concerns.
2. Ground Gas Solutions Ltd (GGS) baseline assessment of groundwater.
3. Data from the Conoco well drilled in 1986 Balcombe 1 well identifies that the Ashdown Beds groundwater has relatively high gas readings Methane 54,000ppm Ethane 1,335ppm[4]
4. Notification from the Environment Agency states there are no licensed groundwater (abstraction above 20m3/day) or surface water abstractions within a 2km radius of the site at Stumble Wood, Balcombe
5. The Environment Agency and Local Authority have advised that there are no protected rights (abstraction of water below 20m^3/day) within 2km radius of the site
6. The water supply for households and industry etc. in the area is supplied from abstractions taken from Ardingly reservoir and the River Ouse
7. Baseline soil report from Envirochem 28th June 2010
8. Baseline surface water quality sampling sent to Alcontrol laboratory for analysis for "Totals" and benchmarked against Environment Agency EQS standard[5]
9. Radiological Monitoring, Counts Per Second
10. Baseline Air Quality Monitoring which includes the following determinants: Methane, Hydrogen Sulphide, BTEX, VOC's, Nitrogen Dioxide, Sulphur Dioxide
11. Seismic monitoring

The site is secured by G4S on a 24 hour basis with a perimeter fence line. All activity will be conducted within the site perimeter fence line.

5.0 Well Integrity & Groundwater Protection

5.1 Groundwater Protection

The groundwater in the vicinity of the well is not used for domestic or industrial water supply. Results from a Conoco well drilled in 1986 identify that high levels of Methane and Ethane are already present in groundwater.

Notwithstanding this any groundwater is protected from the contents of the well during drilling and production operations by a combination of steel casing and cement sheaths, and other mechanical isolation devices installed as a part of the well construction process. The construction of the well is entirely directed to prevent the migration or transport of fluids between subsurface layers of impermeable rock formations that lie between the hydrocarbon producing formations and the groundwater, which themselves have isolated the groundwater over millions of years.

The primary method used for protecting groundwater during drilling operations consists of installing a steel pipe, called casing, immediately after drilling and cementing this steel pipe into place. The cement is pumped in slurry form down the inside of the casing and rises up through the annular space between the drilled hole and the casing, and once in place sets hard. The steel casing protects the zones from material inside the wellbore during drilling operations and, in combination with other steel casing and cement sheaths that are subsequently installed, protects the groundwater with multiple layers of protection for the life of the well.

Details of the method of casing together with a schematic of the steel casings run and cemented in the wellbore is shown in Figure 3 of the Method Statement at Appendix 2.

5.2 Groundwater Monitoring

From the Conoco well drilled in 1986 Methane and Ethane have been identified to be already present in the Ashdown Beds indicating a good seal from the Wadhurst clay with gas levels decreasing rapidly with depth. Ground-gas and groundwater monitoring will be undertaken before, during and after exploratory activities. Monitoring will be undertaken within a monitoring well, recently constructed within a newly drilled borehole specifically for ground-gas and groundwater monitoring. The monitoring well response zone has been installed within the Ashdown Beds (approx. 50mts) in order to monitor groundwater quality within the aquifer.

The monitoring well is situated in the South of the site as this is the predicted direction of groundwater flow in the area of the site. The available geological mapping indicates that the dip of the strata below the site is likely to be between 3-4 degrees to the south.

The well has been drilled and installed using standard rotary drilling techniques. Due to the short term programme of exploration and well testing a single monitoring well is deemed a balanced approach for the programme.

Further groundwater sampling will be undertaken to monitor the quality of groundwater. The determinants selected to monitor groundwater quality are set out within the Method Statement at Appendix 2.

Water sampling of the borehole will be completed using a bladder pump system in order to reduce the chance of ‘de-gassing’ of the water sample. As a minimum 3 samples have be taken before drilling to establish a pre-drilled baseline and further sampling will continue during drilling/ well testing and after drilling/ well testing.

6.0 Pollution Prevention & Drainage

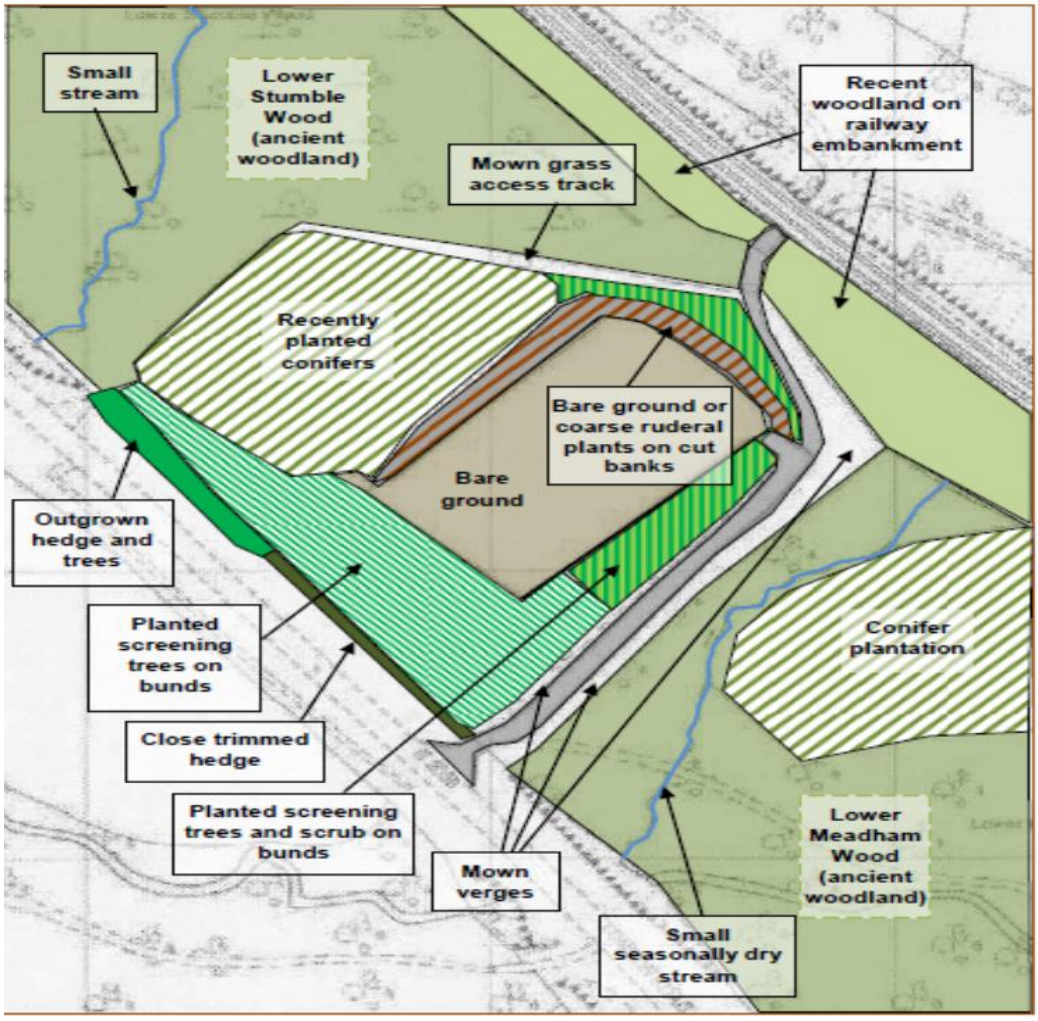
The management of site activities will be conducted in line with pollution prevention guidelines to prevent and manage spillages or other incidents and protect environmental receptors.

6.1 Surface Water Management

Cuadrilla have constructed a self-contained impermeable membrane for the rig area/well testing area which will contain all surface water falling onto the pad. No surface water from the pad will be allowed to enter peripheral surface watercourses. Neither will infiltration of the pad surface or direct discharge to local sewers take place. No silting of local watercourses will occur as no site discharge will be made. As such the site will not have any detrimental impact on surface water runoff rates or volumes.

The site review has identified two surface water streams (both unnamed) located in the Lower Stumble woodland and Lower Beanham woodland respectively. The Lower Stumble woodland stream is located approximately 100 meters to the north-west of the site. The Lower Beanham woodland stream is located approximately 30 meters to the south of the site. The Lower Beanham woodland stream is understood to be seasonally dry, (see Figure 2). Both streams flow in approximately a southerly direction where they enter a larger water course (unnamed) which generally flows in a south-easterly direction towards the River Ouse. This larger water course is located approximately 125m south of the site. The two smaller streams join the larger water course in close proximity to the main road between Balcombe and Cuckfield.

Figure 2 - Surrounding Site Receptors



The sampling strategy has established a baseline of water quality. As a minimum 3 samples have been taken from locations 1, 2, 3, 4 and 5 before drilling. An independent sample shall also be taken by GGS during this period.

Sampling will continue during the well testing programme. A minimum of weekly samples shall be taken during well testing and an independent sample shall be taken by GGS.

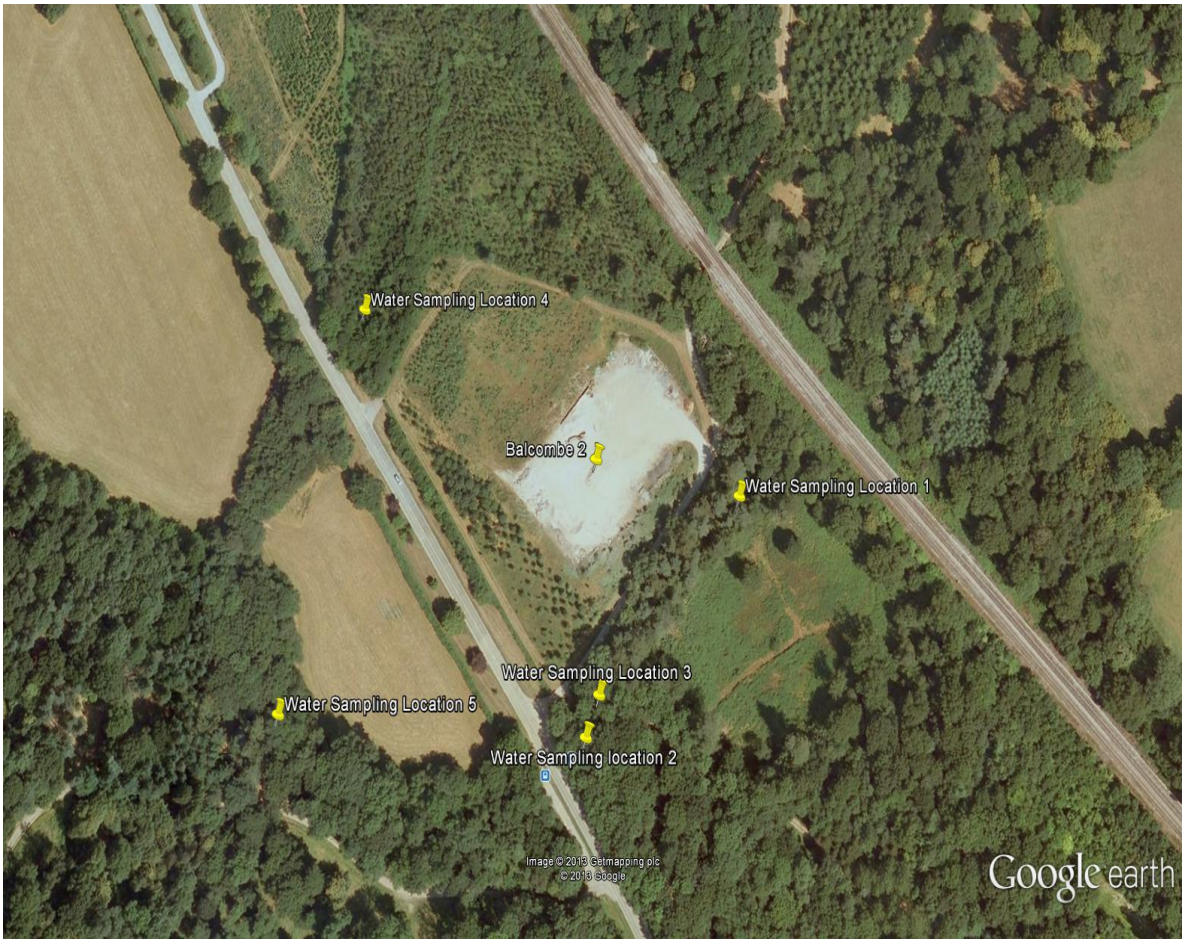
Once the site is demobilised 2 further samples shall be taken from the 5 sampling locations. GGS will also carry out an independent sample.

A daily visual inspection shall be conducted by the Site HSE Advisor to identify any changes in water quality (if flowing) at all of the five location points. In the event of a spill on the site access and egress road there is an emergency response procedure to deal with this, see section 6. To reduce the likelihood of a collision along the access and egress route there will be a strict speed limit of 15mph.

A site walkover indicated no land drains within the vicinity of the site. The original submitted site drainage plan has a French drain running along the perimeter site. An oil interceptor has been built into the drainage system along with a sump. A 150mm butterfly valve system is in place to prevent discharge from the site.

The valve is accessible from a manhole cover situated adjacent to the oil interceptor. The valve will be shut during the operational phase of work. The Site HSE Advisor will visually inspect the butterfly valve on a daily basis during drilling and well testing. No discharges are allowed from the oil interceptor at any time.

Figure 3 - Water Sampling Locations



6.2 Diesel, Chemical Storage & Refuelling

Storage of chemicals will be located on bunds/ drip trays with associated suppliers' Material Safety Data Sheets (MSDS). Each container shall be labelled and stored in accordance with the suppliers' requirements and identified on the Pollution Incident Plan.

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Diesel for the work over rig is stored in compliance with the Control of Pollution (Oil Storage) Regulations 2001, double skinned container. The oil storage containers are labelled with contents and capacity. Inspection of the diesel storage container shall form part of the daily HSE inspection tour.

Refuelling activities from the delivery tanker to the main diesel container shall be a supervised operation to prevent overfilling, poor connections and to respond to leaks in a timely manner. To prevent a pathway for diesel spills or leaks, secondary containment shall be located underneath connections and pipes to capture drips or leaks. The site layout shall be constructed to minimise the length of refuelling pipe from the tanker to the container$_8$. In the event of a spill, see section 7 emergency response.

There is no underground storage of liquids or fuels within the pad.

6.3 Foul Water Storage and Removal

Storage of foul water from the site administration and mess facilities, including the on-site toilets, is by way of integrated storage tanks built into the mess containers and toilet unit. These containers are monitored on a daily basis and emptied, as necessary, by road tankers which remove the waste to approved disposal locations. There are no direct connections into the local sewage system.

7.0 Emergency Preparedness & Response

In the unlikely event of an emergency on site, the Site Supervisor will be the coordinating mind from a site perspective. The emergency response/pollution incident plan shall be tested within the first week of operations.

7.1 Fire Fighter Water

The use of fire fighter water will initially be contained in the rig containment area. A 24 hour spill response contractor (Mantank) shall be contacted and deployed to support the containment of fire fighter water. Contact details of Mantank shall be located on the Pollution Incident Plan. Mantank shall also be briefed on the site Pollution Incident Plan.

The Site Supervisor is responsible for coordinating the site response to any fire in line with the site emergency response plan. The first priority is the health and safety of personnel. The Site Supervisor, or an employee with the delegated authority, shall report the incident to Cuadrilla Senior Management who will in turn notify the authorities (e.g. Environment Agency, Local Authority) of the incident, as required.

7.2 Spill Management

The use and transfer of liquids, e.g. chemicals, oils, fuels, shall be carried out with secondary containment, e.g. drip trays. The site has a minimum of three 200 litre spill kits located around the site to provide easy response to spillages. Before the start of operations, all personnel shall be briefed in the use and location of spill kits.

Each spill shall be cleaned up immediately and reported via Cuadrilla's incident reporting system, regardless of size. As part of the weekly HSE tour, each spill kit shall be examined to ensure it is still fit for purpose.

In the unlikely event of a large scale spill the impermeable membrane shall provide the principal source of containment. In the unlikely event of further support required the Site Supervisor shall coordinate the spill response, which includes notifying the 24 hour spill response contractor (Mantank), to support the clean-up of the spill. Details of the spill response contractor will be located on the Pollution Incident Plan. When contacting the spill response contractor, key information will include: estimated quantity and contents (oil, muds, chemicals). Cuadrilla senior management team shall contact the Environment Agency as outlined in the Method Statement at Appendix 2.

In the unlikely event of a large scale spill which requires the deployment of a spill response contractor, sampling of the local surface water shall be carried out for a minimum of 1 week after the spill or until agreed with the Environment Agency.

7.3 Spill on Access or Egress Road/Off Site

As a minimum, all liquid transfer of fuels, wastes or chemicals are expected to be transferred with spill kits. The 24 hour spill response contractor (Mantank) will be available to manage spillages off site as well as on site.

The Site HSE Advisor will carry out recorded spot checks on vehicles entering and leaving the site for spill kits.

DESIGN CHECK REPORT

Project: Flood Risk & Drainage Strategy Review – Lower Stumble Exploration Site, Balcombe

Reference: WSCC/063/13/BA
Revision: 1
Date: 30th July 2013

1 General Comments

1.1 I can confirm that **insufficient information** has been supplied to the scheme with regards to the flood risk and drainage proposals.

1.2 Please refer to section 4 for my conclusions and recommendations.

2 Surface Water Appraisal

Flood Risk:

2.1 The site is located partially within Flood Zone 1 as defined on The Environment Agency mapping. (local view mapping is out of date)

2.2 The developable site area is not defined clearly in the application; the scale of development edged in RED however suggests the site is of the order of 1-5ha.

2.3 The post development classification is compatible to flood zones 1.

2.4 Owing to the pollution risk The Environment Agency must be consulted with regards to the potential impacts.

2.5 A site specific FRA (Flood Risk Assessment) is mandatory given the size of the site.

Ultimate Outfall:

2.6 The application does not address any private and/or public surface water drainage strategies. For example the site falls towards London Road (Public highway), what preventative measures to mitigate run-off are proposed?

2.7 The existing site is likely to discharge rainfall directly to the natural ground via infiltration and/or to the existing ditch/watercourse network in vicinity. At this location these watercourses are classified as 'ordinary watercourses' and therefore governed by WSCC. Any direct/indirect connection to the said watercourses shall require land drainage consent.

2.8 The proposals are for a hydrocarbon exploration site thus there is concerns over contaminating the groundwater table and pollutions control measures. There is no evidence to confirm the depth of the natural groundwater level, seasonal variance and future impacts. How will this be managed?

Surface Water Catchment:

2.9 It is likely that permeable surfaces will be introduced for haulage purposes thus there could be an increase in run-off rates and volumes. Furthermore this may pose a pollution issue with particular in conjunction with the groundwater.

2.10 The application does not address existing/proposed hard paved areas, An assessment of pre-development and post-development area shall be undertaken to determine the impacts to existing drainage infrastructure and/or natural flow paths.

2.11 Where materials and/or plant are to be stored on site these locations will need to be reviewed in conjunction with natural flows paths which may impact on site run-off to 3rd party areas.

2.12 A drainage strategy is required to explore the above items.

3 Foul Water Appraisal

Flood Risk:

3.1 There are no records of foul sewer problems.

3.2 There is no evidence of the Local Water Authority being consulted.

Ultimate Outfall:

3.3 The application does not advise any foul sewerage proposals. This needs to be confirmed.

Foul Water Catchment:

3.4 Not applicable (see 3.3).

4 Conclusions & Recommendations

4.1 We note that the previous application/permit was approved in 2010 (WSCC/027/10/BA) whereby 'groundwater protection/drainage' conditions 16, 17 & 18 were previously met. This review follows current guidance and therefore may impose additional evidence to that which was previously submitted.

4.2 A drainage strategy statement and/or report should be a mandatory requirement for all applications and shall be reviewed prior to planning approval being granted/conditioned. (For some schemes this could also be incorporated on a drawing)

4.3 The drainage strategy shall consider the following requirements:

4.3.1 Clarify the flood risk and impacts within the application site i.e. sterilised areas.

4.3.2 Clarify selection of the surface water discharge method i.e. a) infiltration, b) watercourse/ditch, c) sewer/drain (or combination).

4.3.3 Clarify Greenfield rates and/or baseline discharge rates otherwise agreed together with design return period, storage provision and climate change considerations.

4.3.4 Where infiltration is utilised the applicant shall undertake reasonable ground investigation to determine suitability.

4.3.5 Where existing drains are utilised, investigations shall be undertaken to determine the network condition and suitability for re-use. The downstream connectivity and/or outfall shall also be confirmed.

4.3.6 Where existing sewers are utilised, the Local Water Authority shall be consulted to determine capacity and/or off-site impacts.

4.3.7 Clarify the pollution control strategy.

4.3.8 Clarify the siltation control strategy.

4.3.9 Clarify selection of the foul water discharge method i.e. a) infiltration, b) watercourse/ditch, c) sewer/drain d) local tanked storage (or combination).

4.3.10 Clarify of the drainage maintenance strategy.

4.3.11 Clarify if any drainage features will be offered for adoption.

4.4 In summary we will require the following:

4.4.1 Evidence of The Environment Agency being consulted with regards to flood risk, groundwater and pollution issues.

4.4.2 A Drainage Strategy as per 4.2.

Balcombe Environmental Method Statement			
Management System:	**HSE**	**File Name:**	HSE-Method-BAL-001
Accountable:	**HSSE Director**	**Version No:**	**Issue 1.0**
Responsible:	**Environmental Engineer**	**Date of Issue:**	**30th June 2013**
Author:	**Environmental Engineer**		

Version	Section	Revision Information	Date	Reviser
1.0		**Published Summary**	**30th June 13**	**Environmental Engineer**

Procedures are reviewed at least annually, or sooner if a significant change to the operation has taken place, to ensure relevance to the systems and process that they define.

Loction: Lower Stumble Hydrocarbon Exploration Site, Off London Road, Balcombe, West Sussex, RH17 6JH

Prepared By: Environment Engineer Cuadrilla

Date Valid from: 15th June 2013

Date Valid To: 30th October 2013

Briefing: To be completed by the Environmental Engineer prior to any drilling activity on site.

Post	Date Received Briefing	Name/ Signature
Tool Pushers		
Site HSE Advisor		
Waste Contractor		
Night Tool Pusher s		
Fluid Engineers		
Drilling Supervisors		
HSSE Director		
Other:		

Contents

1.0 Method

Balcombe-2 in PEDL-244 is planned as essentially a re-evaluation of the upper section of the Balcombe-1 well, drilled some 10m away on the same site in 1986. Balcombe-1 was drilled to a total depth of 5560ft into the Upper Lias, and was plugged and abandoned. The plan now is to drill a vertical pilot hole termed 'Balcombe-2' followed by a planned sidetrack to horizontal for non-hydraulically fractured completion and production testing. The sidetrack will be called Balcombe-2Z (See figure 2 for potential lateral direction and schematic in the Mining Waste Permit Application). The operation from 'spud' to installation of the completion is estimated to take 39 days and will involve a Schramm R1-TXD compact drilling unit and various connected well construction services including mud logging, coring, wireline logging, casing running, cementing and directional drilling. Well production testing will be conducted separately after the drilling unit has been demobilised.

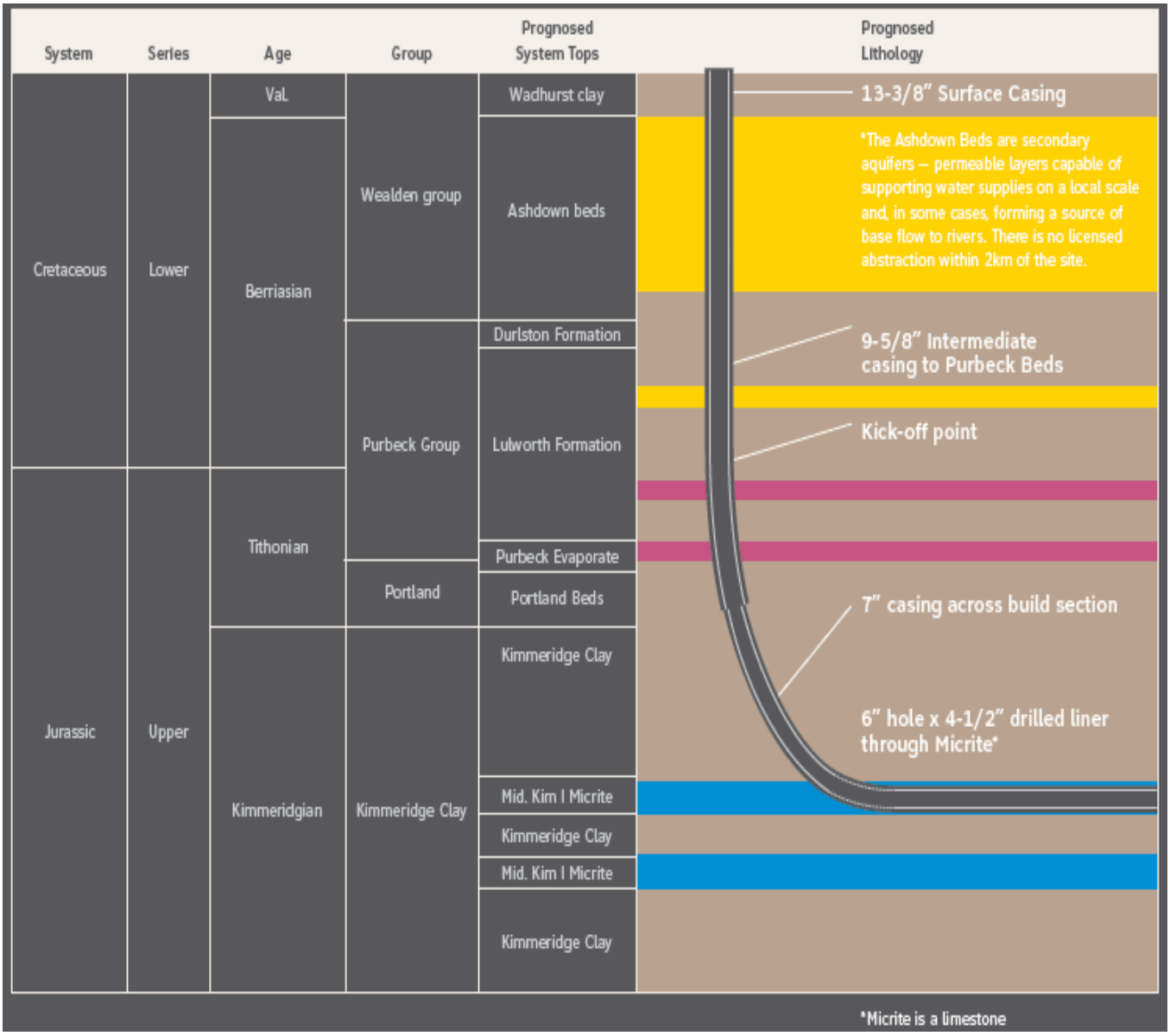
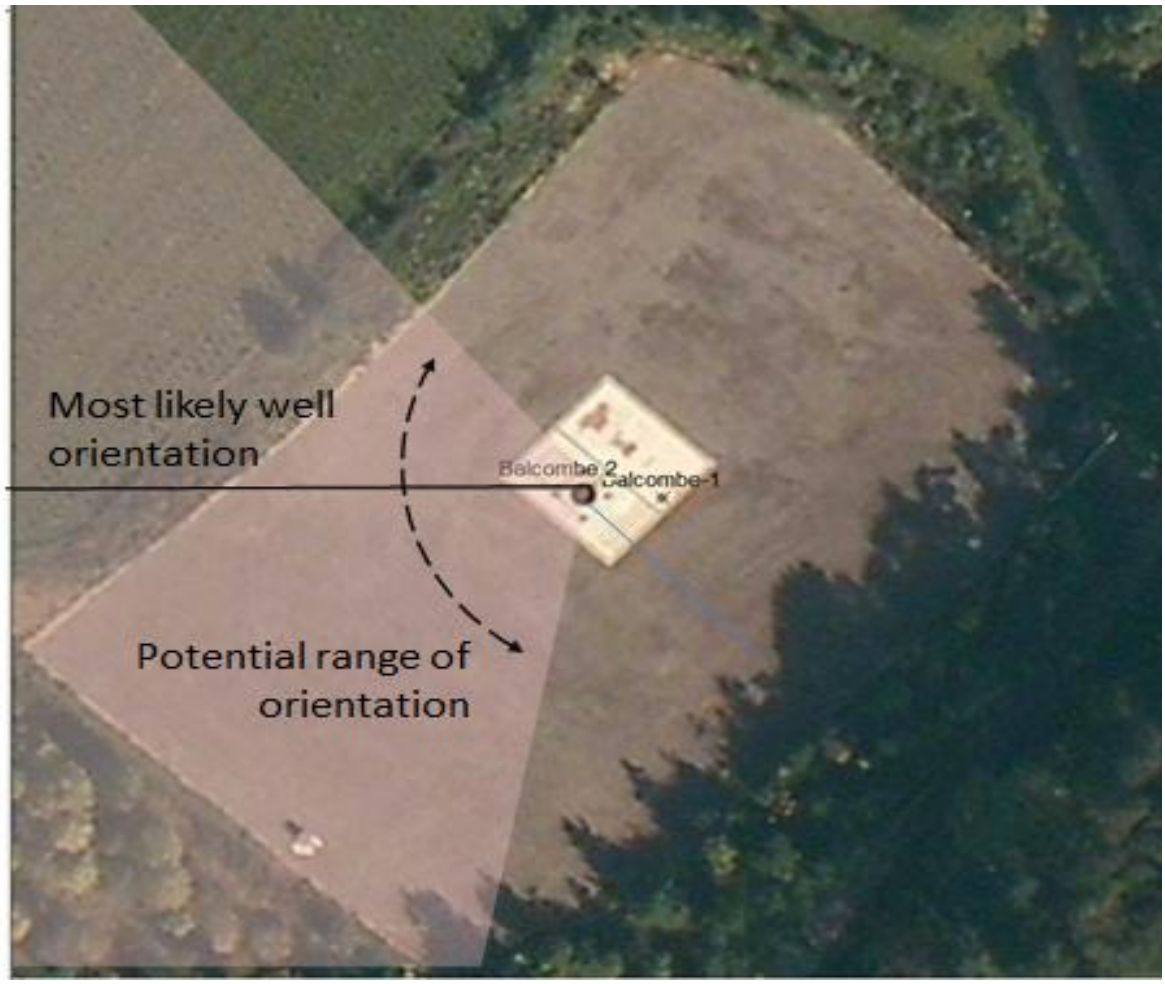


Figure 1 General schematic of planned well.

In principle the well testing will involve the circulation via coil tubing of approximately 20m³ of diluted hydrochloric acid (maximum. 10% HCl concentrate) to clean the well bore area under breakdown pressure of the rock matrix. The well testing programme will last approximately 3 to 7 days followed by 10-20 days shutting in of the well. This will provide data to understand the well conditions and potential production rates. Potential flaring will also be conducted during the well testing in an enclosed flare with air inlets. Any produced oil will be stored on site temporarily and subsequently sent to a refinery.

Unless otherwise agreed in advance and in writing by the county planning authority, construction, drilling rig mobilisation and restoration phases of the development work at the site shall only be undertaken between the hours of 0730 and 1830 Mondays to Fridays and 0800 to 1300 on Saturdays. No work shall occur on Sundays, Bank holidays and public holidays. This condition does not relate to operations necessary for the 24 hours drilling operation. The rig unit, mud pumps and all generators are enclosed in acoustic enclosures mitigating noise levels.

Figure 2 Later Well: Westerly Direction



2.0 Site Set Up/ Impermeable Membrane

A drawing of the proposed drilling site set up and membrane (blue square) is shown in Appendix A.

The membrane will be constructed in area approx. 33.5m x 33.5m. The method of installation will include a contractor tidying the existing site area and re roll to a flat surface. A perimeter bund from used railway sleepers nominally 130mm high will be laid. A 300g/m2 protective geotextile will then by lay on top of the stone surface area within bund. A fully welded 1.0mm textured HDPE membrane shall be installed to geotextile area, seal to concrete slab edge with metal battening and fix perimeter to top of sleepers with timber lats. The HDPE membrane is textured to prevent slippage. A further 500g/m2 protective geotextile over HDPE area shall be fixed to the perimeter sleepers with timber lats. A nominal "pump sump" approx. 2m x 2m x 0.3m deep in corner of lined area nearest to existing oil interceptor shall be established to pump off liquids contained within the bunded area. The water will be tankered off site for disposal or recycled into the drilling muds. An access ramp in/out of area in timber/stone shall be installed. To protect the HDPE membrane further, 70mm thick rig mats (5m x 1m) to entire area excluding 3m x 3m for the drilling cellar.

The fuel tank located outside of the containment area is double skinned (secondary containment) in line with the oil storage regulations. Chemicals are stored in containers containing drip trays. Refuelling activity will be in accordance of section 7.2. Any oils, diesels, chemicals in use shall be stored on drip trays.

The concrete slab has Aco drains flowing into the cellar forming a sealed impermeable area. The surface water will be directed into the cellar and can be either recycled into the drilling muds or disposed of off-site via a suction tanker to an authorised waste disposal facility.

During the well testing phase all liquid containers shall be located on top of the existing impermeable membrane.

3.0 General Environmental Management

The exploratory drilling site at Balcombe received planning permission from West Sussex County Council in 2010_1. In response to the conditions from the planning permission and the statutory consultee responses, Environment Agency$_2$, Natural England$_3$, the method statement has been developed to demonstrate compliance with legislation.

3.1 HSE Monitoring & Reporting

Cuadrilla's approach to setting high site environmental standards includes a combination of written documentation and setting the right culture. As part of the site HSE organisational structure, a Cuadrilla Site HSE Advisor will be assigned to the project for the duration of operations. The Site HSE Advisor will be supported by the HSSE Director, Environmental Engineer and Behavioural Safety Advisor. The Site HSE Advisor is responsible for the method statement communication and continued support. Operations are accountable for complying with the method statement, with the Drilling Supervisors/ Site Supervisor taking the lead for day to day accountability. As a minimum, daily tool box talks/morning briefings are held with operational personnel to communicate daily activities, HSE risks, reported incidents, near misses and other key information.

The HSSE Director, Environmental Engineer and Behavioural Safety Advisor shall conduct inspections and provide coaching and further support to the Site HSE Advisor; ensuring compliance with environmental best practice is reviewed, achieved or improved upon. Documented inspections, audits and reporting of incidents and near misses via the company Behavioural programme, STAR (Stop Think Act Report), are fundamental to learning lessons and continually improving Cuadrilla's approach to environmental management.

A programme of senior management site inspections will ensure compliance with Cuadrilla's HSE Policies and HSE Risk Management Framework whilst demonstrating the HSE leadership culture of the business.

A formal monthly environmental report shall be shared with the Environment Agency summarising results from monitoring activities. This shall include but not limited to:

1. Operations update
2. Groundwater report
3. Surface water report
4. Air quality report

As an interim, data will be shared with the Environment Agency as soon as practical to provide updates in between the formal monthly report.

3.2 Baseline Information

As a baseline, the following activities have been carried out to inform Cuadrilla's approach to site environmental management:

1. Ground Gas Solutions Ltd (GGS) baseline assessment of groundwater
2. **Data from the Conoco well drilled in 1986 Balcombe 1 well identifies that the Ashdown Beds groundwater has relatively high gas readings Methane 54,000ppm Ethane 1,335ppm**[4]
3. Notification from the Environment Agency states there are no licensed groundwater (abstraction above 20m3/day) or surface water abstractions within a 2km radius of the site at Stumble Wood, Balcombe
4. The Environment Agency and Local Authority has advised that there are no protected right (abstraction of water below 20m3/day) within 2km radius of the site
5. The water supply for households and industry etc. in the area is supplied from abstractions taken from Ardingly reservoir and the River Ouse
6. Baseline soil report from Envirochem 28th June 2010 (See Mining Waste Permit application).
7. Baseline surface water quality sampling sent to Alcontrol laboratory for analysis for "Totals" and benchmarked against Environment Agency EQS standard[5]
8. Radiological Monitoring,
9. Baseline Air Quality Monitoring which includes the following determinants: Methane, Hydrogen Sulphide, BTEX, VOC's, Nitrogen Dioxide, Sulphur Dioxide

The site is secured by G4S on a 24 hour basis with a perimeter fence line. All activity will be conducted within the site perimeter fence line.

4.0 Well Integrity & Groundwater Protection

4.1 Drilling & Groundwater Protection

The groundwater in the vicinity of the well is not used for domestic or industrial water supply. Results from the Conoco well drilled in 1986 identify **that the Ashdown Beds groundwater has relatively high gas readings Methane 54,000ppm Ethane 1,335ppm**.

Notwithstanding this any groundwater is protected from the contents of the well during drilling and production operations by a combination of steel casing and cement sheaths, and other mechanical isolation devices installed as a part of the well construction process. The construction of the well is entirely directed to prevent the migration or transport of fluids between subsurface layers of impermeable rock formations that lie between the hydrocarbon producing formations and the groundwater, which themselves have isolated the groundwater over millions of years.

The primary method used for protecting groundwater during drilling operations consists of installing a steel pipe, called casing, immediately after drilling through the groundwater and cementing this steel pipe into place. The cement is pumped in slurry form down the inside of the casing and rises up through the annular space between the drilled hole and the casing, and once in place sets hard. The steel casing protects the

zones from material inside the wellbore during subsequent drilling operations and, in combination with other steel casing and cement sheaths that are subsequently installed, protects the groundwater with multiple layers of protection for the life of the well.

A schematic of the steel casings run and cemented in the wellbore is shown in Figure 3. Comparing to this figure 5, for Balcombe-2 / 2Z.

The conductor casing has already been set, and was only required to extend 3ft below the base of the cellar in which the wellhead will be installed. This provides a conduit from below the ground surface up to the drilling rig's mud processing system while the first hole section is drilled.

The surface casing is 13-3/8" in diameter and will be set at approximately 140ft as measured from the drill floor (called "measured depth" or MD). It is set in a hole drilled through the Wadhurst Clay (no aquifer) with a 17-1/2" bit to just above the top of the Ashdown Bed. It is then cemented into place, with cement extending to surface. The wellhead is then installed on the top of the 13-3/8" casing, and this then support's the drilling rig's blow-out preventers (BOP) throughout the further drilling. The BOP is only ever for secondary well control in these operations; primary well control is provided by overbalancing the subsurface pressures by the hydrostatic pressure of the drilling fluid (or "mud") used to drill the well.

The intermediate casing is 9-5/8" in diameter and will be set at approximately 1300ft MD, through the Ashdown Beds and into the Purbeck Beds. It is set in a 12-1/4" drilled hole and cemented into place. Following the setting of the cement, an 8-1/2" diameter drill bit is used to drill out of the bottom of this casing, and a Formation Integrity Test is conducted. This test applies hydraulic pressure to the formation exposed below the casing shoe, and confirms that a hydraulic seal has been achieved from the casing shoe upwards. During the cementing operation, records are kept of all materials used, volumes pumped into the well and volumes returned from the well, in addition to a continuous recording of rates and pump pressures. Once this intermediate casing has been set and cemented, the aquifers within the Ashdown Beds in the vicinity of the well are isolated from further drilling and production operations.

The 8-1/2" "pilot hole" is then drilled vertically to a depth of approximately 3,050ft for the purpose of acquiring geological information by way of cuttings samples, continuous gas measurements while drilling, cutting cores (cylinders of rock), and running electric logging sondes on wireline.

Following data acquisition into the Mid-Kimmeridge Clay, the pilot hole will be plugged back with cement. A schematic of the plugging back is shown in Figure 4.

The well is then sidetracked to drill at increasing inclination to a point of about 80° inclination just above the chosen target reservoir (anticipated to be the Micrite I but subject to the results from the pilot hole). The 7" diameter production casing is then run to a point just above the reservoir, and cemented into place. This cement is intentionally brought only close to surface, rather than completely to surface, in order to leave a void at the top between the intermediate and the production casing, to facilitate the long-term monitoring for any pressure build-up or fluid movement. The 7" production casing isolates the reservoir below from the upper formations essentially as a secondary barrier since all near-surface permeable layers are already isolated by the 9-5/8" intermediate casing.

Finally, a 6" borehole is drilled out of the bottom of the 7" casing, building up to horizontal through the target reservoir. The Formation Integrity Test is repeated at the 7" casing shoe prior to entering the reservoir. Should this hydraulic test fail to provide a complete seal then criteria for the possible rate of fluid injection are used to select the remedial action. Such action includes injecting ("squeezing") cement slurry or other thinner sealant into the shoe area until a tight pressure seal is obtained. A schematic of the lateral borehole is shown in Figure 5. Once this has been completed a "Cement Bond Log" (or CBL) will be run along the length of the 7" casing to provide a record of the cement bonding at the end of well construction.

The cementing programme is designed as Cuadrilla's standard approach to providing life-of-well barriers, according to the Oil & Gas UK Well Integrity Guidelines[14]. In this well the primary requirement is for a successful hydraulic seal to be obtained at the shoe (set above the top of the reservoir) since that is where

the seal to the impermeable formation is required in order to isolate the overlying strata. The CBL is nonetheless taken over the production casing as a record for consideration in the planning of any future operations, including eventual full well abandonment.

After the drilling has reached the final depth, expected to be between 4,800ft and 5,000ft, the well is “completed”. This involves the installation of an uncemented inner steel tubing that isolates the production casing from production testing, from a true vertical depth of approximately 2000ft. This forms the third barrier to the Ashdown Beds.

Any loss of formation fluids shall be monitored using a Pit Volume Totaliser (PVT) utilising a paddle sensor measuring rate pumped in and rate coming out. This shall be monitored throughout drilling. In the event of formation loss being identified in the PVT, maintaining borehole stability and controlling fluid leak-off to permeable formations is achieved with fluid loss control additives which include drilling starch and ground marble (graded calcium carbonate) as a bridging agent.

Figure 3

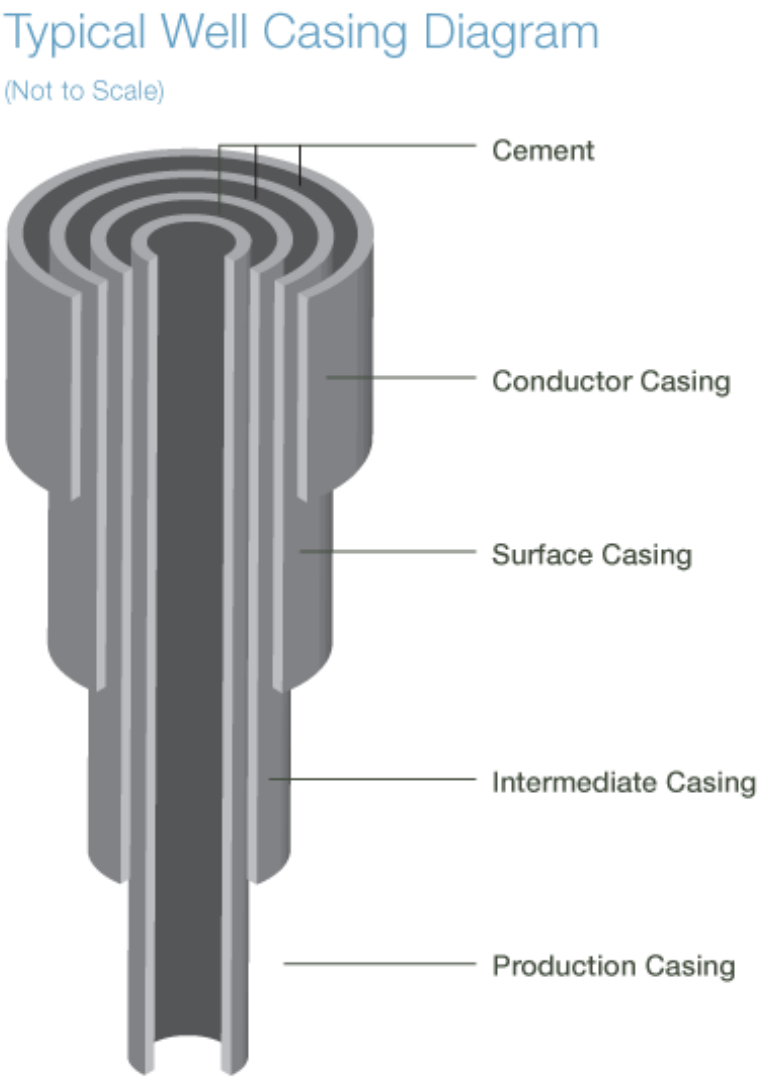

Typical Well Casing Diagram
(Not to Scale)
Cement
Conductor Casing
Surface Casing
Intermediate Casing
Production Casing

Figure 4: Abandonment of Pilot Hole Following Evaluation (Schematic)

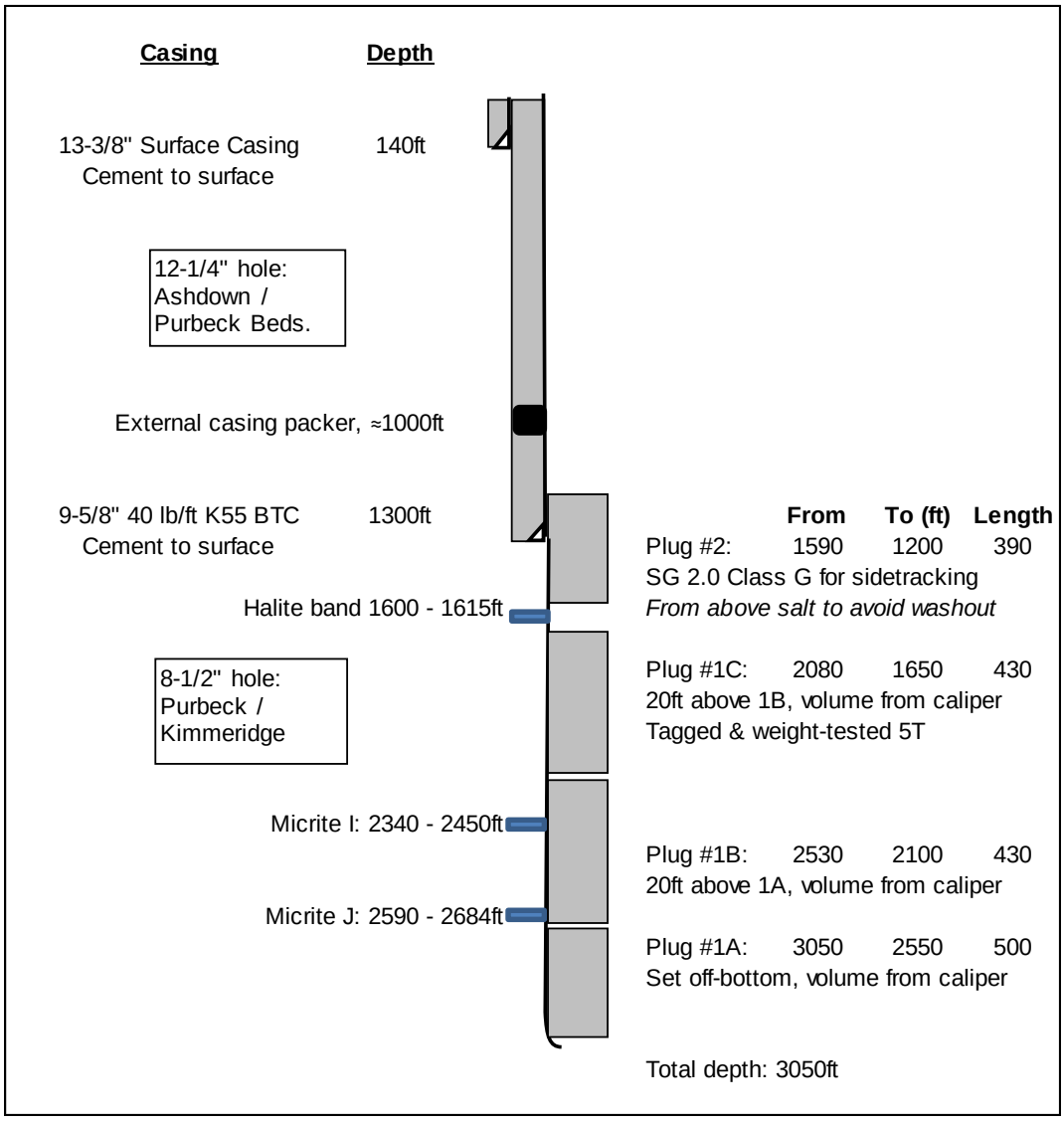
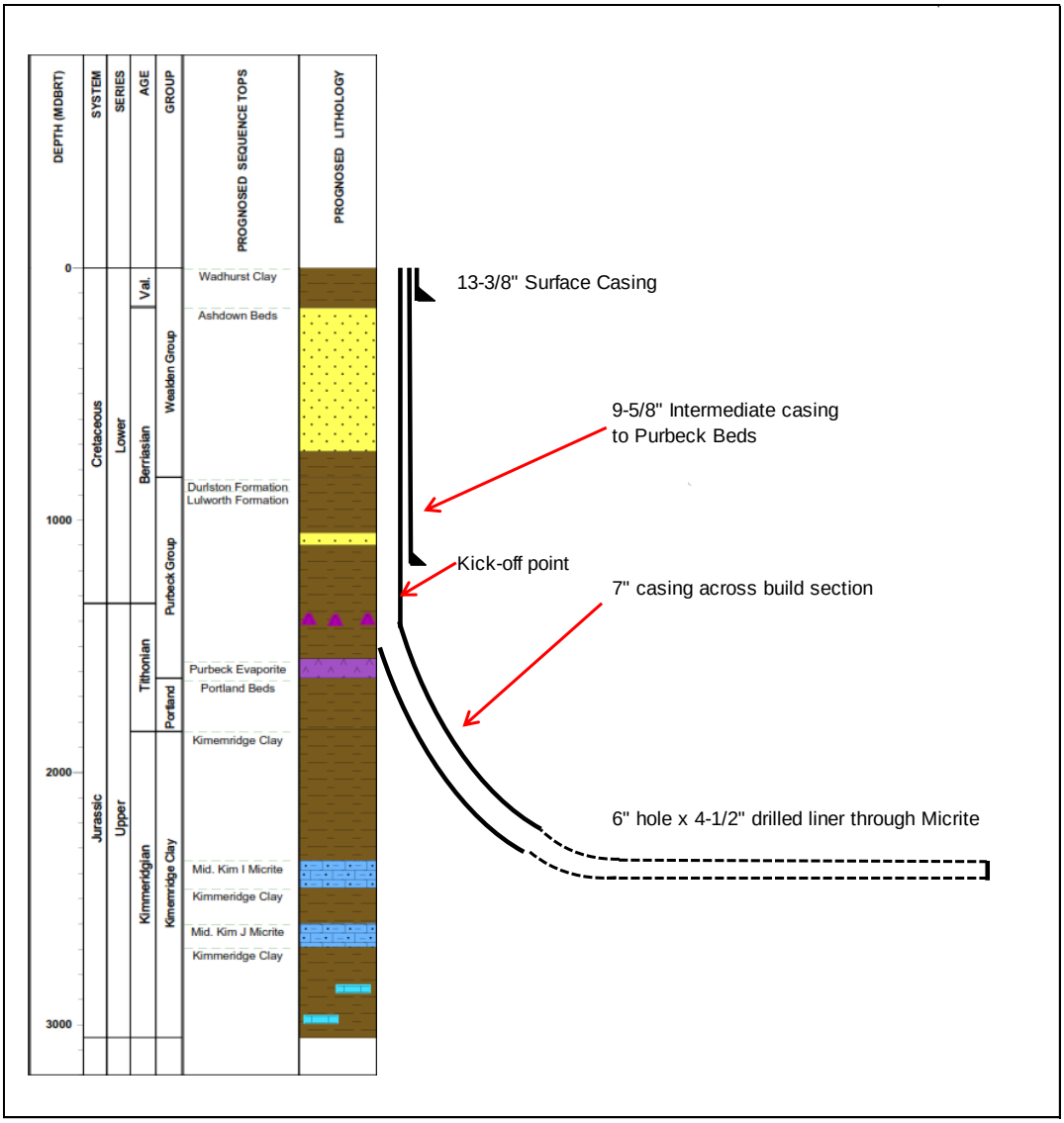


Figure 5: Balcombe-2Z Sidetrack to Horizontal (Schematic – without Completion)



The Balcombe-2 and 2Z drilling fluids programme is shown in Table 1. The selection of drilling fluids is based directly on results from Balcombe-1 and the requirements for meeting the objectives of the current well. The purposes of the drilling fluid include the following:

a) Maintaining primary well control by overbalancing the native formation pressures, and this is achieved by adjustment of the drilling fluid density;

b) Lifting the drill cuttings from the bit out of the hole and thereby keeping the hole clean which is achieved by viscosifying the drilling fluid via the main component of the drilling fluid which is xanthan gum;

c) Maintaining borehole stability and controlling fluid leak-off to permeable formations, and this is achieved with fluid loss control additives which include drilling starch and ground marble (graded calcium carbonate) as a bridging agent.

While drilling above and through the Ashdown Beds, fresh water will be used as the base fluid to make up the drilling fluid, together with the components indicated above. Once the intermediate casing has been set and cemented to protect the Ashdown Beds, sodium chloride (common salt) will be added to the same mud system, due to the presence of a halite bed at approximately 1,600ft. If not drilled with a salt-saturated mud, halite beds wash out massively and can cause borehole problems for subsequent drilling and wireline logging.

After the pilot hole has been completed, the sidetrack down to the 7" casing setting point will be drilled with the same salt-based mud system. After the 7" casing has been set and cemented, the drilling fluid system is changed out entirely to a 3-5% potassium chloride “drill-in fluid” for drilling the reservoir. It’s main components are again xanthan gum, ground marble and drilling starch. All components in the drill-in fluid are selected to be soluble in dilute hydrochloric acid (and many other common acids such as vinegar) so that the reservoir section can be fully cleaned up of the drill-in fluid residues in order to minimise productivity impairment, during the subsequent well flow test.

Other properties such as pH and lubricity require control. The lists of components of the drilling muds have been assessed to be non-hazardous to groundwater by the supplier. The drilling fluid composition shall be shared with the Environment Agency, including the MSDS sheets. Drilling muds are stored at the rig site in above-ground steel tanks. The drilling rig layout and the position of the mud tanks are shown in Appendix A.

Table 1: Drilling Fluids Summary

End Depth TVD /MD (ft)	Hole Size (inches)	Drilling Fluid*	Density lb/gal	Pore Pres. Gradient lb/gal	Formation Fluid
140	17 ½	Xanthan-based fresh water mud	9 – 9.3	8.32	Water (brine)
1,300	12 ¼		9 – 9.3	8.75	Water (brine)
3,050 - pilot hole	8 ½	Previous mud with salt added	10.3 (salt-sat)	7.5 (0.39 psi/ft)	Tight oil Expected
2,850 - sidetrack	8 ½		10.3 (salt-sat)	8.75	Water (brine)
4,850 horizontal	6	Potassium Chloride / CaCO3 drill-in fluid	8.65	7.5 (0.39 psi/ft)	Tight oil Expected
Completion	7" casing x 6" openhole	3% Potassium Chloride in fresh water	8.45	7.5	Tight oil Expected

*Drilling fluid has been assessed by the supplier to be non-hazardous to the groundwater under the EU Groundwater Directive

4.2 Post-Drilling Wellbore Clean-up and Testing

The objectives of the well testing to be conducted after the drilling unit has been removed from the site are as follows:

(1) To measure initial production rates for oil and natural gas

(2) Determine the Gas / Oil Ratio (GOR)

(3) Collect oil samples and run Pressure-Volume-Temperature analysis to characterise the oil

(4) Collect and analyse a water sample

(5) Estimate the “skin factor” (a mathematical indication of production impairment), permeability and reservoir pressure

(6) Use all acquired data to calculate the commercial viability of production.

The overall duration of the testing phase is approximately 3 to 7 days of flow, followed by 10 to 20 days of shut-in.

The general completion and well testing plan is as follows:

1. The last well construction operations with the drilling rig leave the well with a 4-1/2" liner with drilled holes, extending from just above the shoe of the 7" casing to the toe of the horizontal well. This ensures the borehole remains open and stable, and is in fact option if the borehole proves to be naturally stable. Above the 4-1/2" liner, the “production tubing” and “production packer” are installed which provides the inner conduit from the reservoir to the surface, and keeps the production casing isolated from reservoir fluids during testing, as described in the section above. The tubing and packer form the well’s “completion”.
2. To suspend the well for rig release, mechanical plugs are run into the production tubing. These provide for both deep and shallow barriers, the plugs being run on thin steel wireline and set in profiles fitted at specific depths in the production tubing. The shallow barrier is set in the tubing hanger directly at the wellhead.
3. Following rig demobilisation, coiled tubing and the well test / flow back equipment is mobilised and rigged up. The horizontal production borehole is circulated with 10% (max) diluted hydrochloric acid, from the toe to the heel using a rotating jet nozzle. The coiled tubing is a long spool of continuous steel tubing, generally 1.75” to 2” in diameter, which is spooled onto a large reel which is controlled with hydraulic motors. The coiled tubing provides a clean, accurate conduit for circulating the diluted acid wash to the wellbore.
4. After circulating the diluted acid wash the well is lifted with nitrogen from the toe to ensure it is entirely flushed out. A minimum clean-out of 24 hours is planned. Coiled tubing is pulled once oil has been lifted to surface and all spent diluted hydrochloric acid and completion brine is out of the well. All fluids returned from the wellbore pass through the well test system for separation and storage for removal from site via a licensed waste contractor to an authorised waste disposal facility
5. Pressure gauges are run on wireline and set in the profiles in the production tubing. Swab-assisted flow testing commences, using the wireline. Coiled tubing is demobilised once it has been confirmed that the well is responding to swabbing. If swabbing is not effective then the option is to run in with coiled tubing and lift again with nitrogen from the toe.
6. Once flow testing is complete, a plug is run into the tubing profile to shut the well in for pressure build-up. This pressure build-up provides vital data for analysing the reservoir properties.

The volume of maximum dilution 10% hydrochloric acid (HCl) is a non-hazardous pollutant to groundwater is expected to be in the order of 20m^3. The diluted hydrochloric acid reacts primarily with carbonate solids to produce carbon dioxide and water. The wellbore is planned to be drilled through the Micrite which is an argillaceous carbonate. The Argillaceous material is unaffected by HCl. The purpose of a "diluted acid wash" is to clean the immediate wellbore area. Typical radial penetration from the wellbore is less than 6 inches, and can only be to natural permeability (in this case in the form of natural fractures). No fractures are induced hydraulically during this treatment.

The returning produced water and natural gas are managed as per waste management plan submitted for the mining waste permit application.

Any oil returning to site is temporarily stored in non-permanent steel tanks. The oil will be taken off site to a refinery a.s.a.p. Due to the nature of exploration it is difficult to conclude how much oil will return to the surface. Estimates have put a range between 300-500bopd (Barrels of Oil per Day).

An impermeable membrane shall be located on site providing secondary containment for the storage of oil and produced waste water at the surface. Appendix B provides a drawing of the well testing site set up.

4.3 Groundwater Risk Assessment & Monitoring

The risk assessment (Appendix C), provides a three dimensional approach to identifying risk to groundwater (Source, Pathway, Receptor) based on DEFRA Greenleaves III guidance[15]. The conceptual model identifies that in the unlikely event of spills, leaks from the site activities the pathway direction is to receptors south of the site. Groundwater monitoring is in place to monitor changes in water quality and natural gas levels as well as surface water monitoring.

From the Conoco well drilled in 1986 Methane and Ethane have been identified to be already present in the Ashdown Beds indicating a good seal from the Wadhurst clay with gas levels decreasing rapidly with depth. Ground-gas and groundwater monitoring will be undertaken before, during and after exploratory activities. Monitoring will be undertaken within a monitoring well, constructed within a newly drilled borehole specifically for ground-gas and groundwater monitoring. The monitoring well response zone will be installed within the Ashdown Beds (approx. 50mts) in order to monitor groundwater quality within the aquifer.

The monitoring well will be situated in the South of the site due to the predicted flow of groundwater from site. The available geological mapping indicates that the dip of the strata below the site is likely to be between 3-4 degrees to the south.

A single monitoring well will be drilled and installed either using a standard cable percussive and/or rotary drilling techniques for the exploration phase. Due to the short term programme of exploration and well testing a single monitoring is deemed a balanced approach for the programme.

Cuadrilla's contractors, GGS, will install both a GasClam® and a water quality down-hole probe into the monitoring well. See figure 6 for schematic of the installed GasClam®.

The purpose of the GasClam® is to monitor methane, carbon dioxide and oxygen concentrations within the Ashdown Beds.

The following determinants will be monitored: groundwater level, specific electrical conductivity and temperature. Routine ground-gas and groundwater samples will be taken from the monitoring well on a weekly basis before and during the exploratory drilling.

As indicated above, the presence of methane alone does not provide evidence of its source. It is therefore necessary to carry out a suitable level of gas-sampling and laboratory analyses to fully characterise the provenance of any methane or associated gases identified.

It is proposed that the following two stage gas sampling and testing approach be adopted to provide a baseline dataset. Additional testing may be required dependant on findings.

- Stage 1 Gas Analysis:

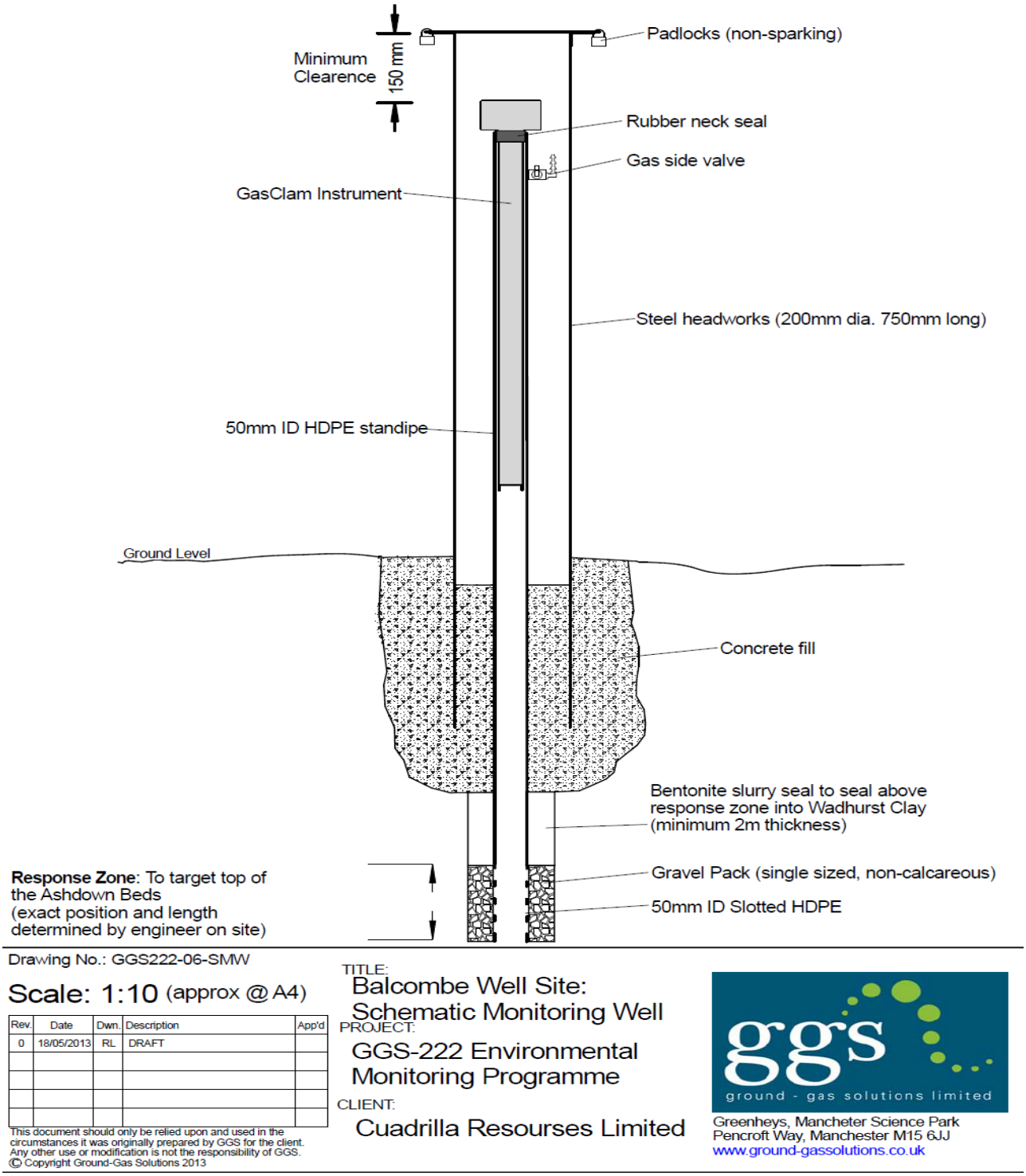
Gas samples will be taken from each borehole and scheduled for laboratory analysis for presence and concentration of selected bulk gases and trace compounds.

Determinant	Justification for Analysis
Methane	Key target gas
Carbon Dioxide	Tracer gas for methane & potential constituent of on-site and off-site source gas
Oxygen	Potential constituent of on-site and off-site source gases
Nitrogen	Potential constituent of on-site and off-site source gases
Ethane	Higher chain hydrocarbons – identifier for thermogenic provenance
Propane	Higher chain hydrocarbons – identifier for thermogenic provenance
Butane	Higher chain hydrocarbons – identifier for thermogenic provenance

- Stage 2 Gas Analysis:

Where sufficient concentrations of methane and/or carbon dioxide are detected, these will be scheduled for C12/C13 isotopic analysis to provide evidence of the gases' age and provenance.

Figure 6 Drawing of GasClam®



Gas sampling methods will typically comprise the use of Tedlar bags and/or Gresham tubes. As a minimum 3 samples shall be taken before drilling to establish a pre-drilled baseline and further sampling will continue during drilling/ well testing and after drilling/ well testing..

Further groundwater sampling shall be undertaken to monitor the quality of groundwater. The following determinants have been selected to monitor groundwater quality.

Determinant	Justification for Analysis
$\delta^{13}C\text{-}CH_4$	Dissolved methane provenance
$\delta^{13}C\text{-}CO_2$	Dissolved carbon dioxide provenance
Carbon Dioxide	Natural soils / potential as indicator of methane gas
Heavy Metals (dissolved)	Indicative of formation water ingress into aquifers
Strontium (dissolved)	Indicative of formation water ingress into aquifers
Earth Metals (dissolved)	Indicative of formation water ingress into aquifers
Dissolved Methane	Key target gas
Dissolved Ethane	Higher chain hydrocarbon – indicator of thermogenic gas
Dissolved Propane	Higher chain hydrocarbon – indicator of thermogenic gas
Dissolved Butane	Higher chain hydrocarbon – indicator of thermogenic gas
Ammoniacal Nitrogen, Nitrite & Nitrate	Indicative of groundwater quality
Bromide & Chloride	Indicative of formation water ingress into aquifers
Biological Oxygen Demand (BOD) & Chemical Oxygen Demand (COD)	Indicative of groundwater quality
pH	Indicator of change in geochemistry – ingress of stimulation fluids or formation waters
Salinity	Indicative of formation water ingress into aquifers above
Total Dissolved Solids	Indicative of formation water ingress into aquifers above
Total Petroleum Hydrocarbons – Criteria Working Group split	Indictor of fuels and oils used on site
Total Suspended Solids	Measure turbidity of groundwater

Water sampling of the boreholes will be completed using a bladder pump system in order to reduce the chance of 'de-gassing' of the water sample. As a minimum 3 samples shall be taken before drilling to establish a pre-drilled baseline and further sampling will continue during drilling/ well testing and after drilling/ well testing.

5.0 Naturally Occurring Radioactive Materials (NORM)

Please see future Radioactive Substances Regulation permit application submission to the Environment Agency.

6.0 Waste Management

Please see Mining Waste permit application to the Environment Agency.

7.0 Pollution Prevention & Drainage

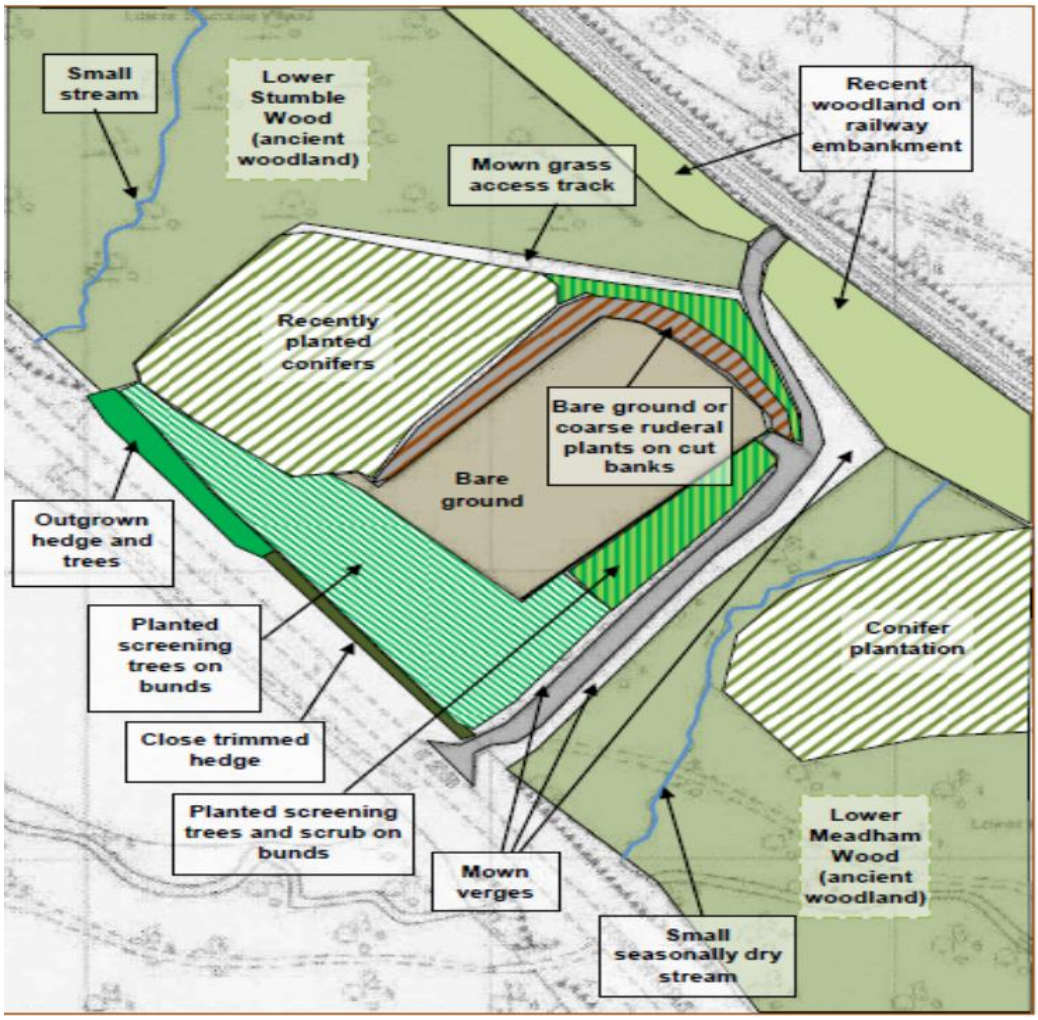
The management of site activities shall be conducted in line with pollution prevention guidelines to prevent and manage spillages or other incidents and protect environmental receptors.

7.1 Surface Water Management

Cuadrilla will construct a self-contained impermeable membrane for the rig area/ well testing area.

The site review has identified two surface water streams (both unnamed) located in the Lower Stumble woodland and Lower Beanham woodland respectively. The Lower Stumble woodland stream is located approximately 100 meters to the north-west of the site. The Lower Beanham woodland stream is located approximately 30 meters to the south of the site. The Lower Beanham woodland stream is understood to be seasonally dry, (see Figure 7). Both streams flow in approximately a southerly direction where they enter a larger water course (unnamed) which generally flows in a south-easterly direction towards the River Ouse. This larger water course is located approximately 125m south of the site. The two smaller streams join the larger water course in close proximity to the main road between Balcombe and Cuckfield.

Figure 7 - Surrounding Site Receptors



To establish a baseline of the local surface water quality, samples shall be taken from five locations, identified in Figure 8, and benchmarked against the Environment Quality Standards. Further testing shall be conducted during and after operations at all five locations. The five locations have been identified based on proximity to the site, the direction of stream flow and the direction of potential runoff from the site in a southern down gradient. Sample location 1 and 3 are located in the Lower Beadham woodland which is seasonally dry.

As part of the water sampling testing regime further independent testing shall be taken by Ground Gas Solutions before, during and after the operations. They will conduct the analysis against an independent suite.

The water quality testing suite has been established to capture a range of determinants. The following determinants are to be tested at the surface water locations.

Determinants
Water Samples “Totals”.
Ammoniacal Nitrogen
Arsenic
Barium
Boron
Cadmium
Calcium
Chloride
Total Chromium
Copper
Lead
Magnesium
Mercury
Nickel
Potassium
Selenium
Sodium
Zinc
pH
PAH
EPH
GRO (BTEX)
COD
TDS
Electrical Conductivity
$CACO_3$

The sampling strategy is to establish a baseline of water quality. As a minimum 3 samples shall be taken from locations 1, 2, 3, 4 and 5 before drilling. An independent sample shall also be taken by GGS during this period. Sampling will also be conducted with the Environment Agency.

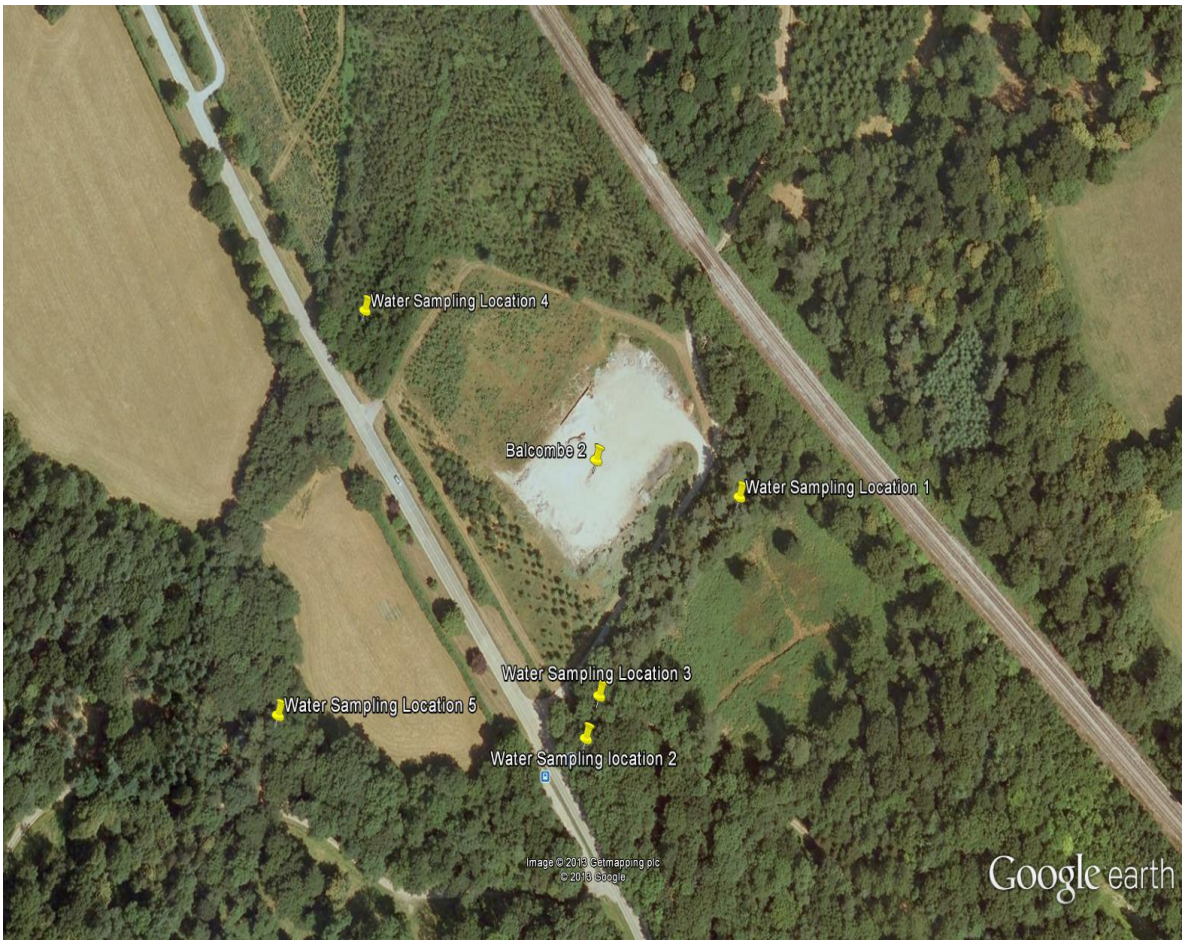
Sampling will continue during the drilling of the well and well testing programme. A minimum of weekly samples shall be taken during drilling/well testing and an independent sample shall be taken by GGS and with the Environment Agency.

Once the site is demobilised 2 further samples shall be taken from the 5 sampling locations. GGS will also carry out an independent sample.

A daily visual inspection shall be conducted by the Site HSE Advisor to identify any changes in water quality (if flowing) at all of the five location points. In the event of a spill on the site access and egress road, see section 6 for response.

A site walkover indicated no land drains within the vicinity of the site. The original submitted site drainage plan has a French drain running along the perimeter site. An oil interceptor has been built into the drainage system along with a sump. A 150mm butterfly valve system is in place to prevent discharge from the site. The valve is accessible from a manhole cover situated adjacent to the oil interceptor. The valve will be shut during the operational phase of work. The Site HSE Advisor shall visually inspect the butterfly valve on a daily basis during drilling and well testing. No discharges are allowed from the oil interceptor at any time.

Figure 8 - Water Sampling Locations



7.2 Oil, Diesel, Chemical Storage & Refuelling

Storage of chemicals will be located on bunds/ drip trays with associated suppliers' Material Safety Data Sheets (MSDS). Each container shall be labelled and stored in accordance with the suppliers' requirements and identified on the Pollution Incident Plan.

The rig is supplied by two 415 litre double skinned fuel tanks supported by double skinned diesel storage of 30,000 litres. The 30,000 litre storage tank is contained in a double skinned bund providing secondary containment. All liquids outside the containment area shall be stored as a minimum in drips trays or secondary containment.

Diesel for the rig generator shall be stored in compliance with the Control of Pollution (Oil Storage) Regulations 2001, double skinned container. The oil storage containers shall be labelled with contents and capacity. Inspection of the diesel storage container shall form part of the daily HSE inspection tour. The diesel rig fuel tank is an approximately 30,000 litres, bunded tank with a transfer pump and supply manifold with an automatic feed system to pumps, rig and rig generator.

Returning oil during the well testing phase shall be temporarily stored in top of the impermeable membrane providing secondary containment.

Refuelling activities from the delivery tanker to the main diesel container shall be a supervised operation to prevent overfilling, poor connections and to respond to leaks in a timely manner. To prevent a pathway for diesel spills or leaks, secondary containment shall be located underneath connections and pipes to capture drips or leaks. The site layout shall be constructed to minimise the length of refuelling pipe from the tanker to the container[8]. In the event of a spill the operations shall respond as per Pollution Incident Plan.

There is no underground storage of liquids or fuels within the pad.

8.0 Air Quality

Assessment of air quality shall be conducted by GGS monitoring the following parameters:

- Methane
- Hydrogen Sulphide
- Nitrogen Dioxide
- Sulphur Dioxide
- BTEX
- VOC's

The assessment shall be taken up wind and downwind before, during and after operations and assessed against background levels and Air Quality Standards Regulations 2010.

9.0 Emergency Preparedness & Response

In the unlikely event of an emergency on site, the Drilling Supervisor/ Site Supervisor will be the coordinating mind from a site perspective following the Pollution Incident Plan. The Pollution Incident Plan shall be tested within the first week of operations.

9.1 Fire Fighter Water

The use of fire fighter water will initially be contained in the rig containment area. A 24 hour spill response contractor (Mantank) shall be contacted and deployed to support the containment of fire fighter water. Contact details of Mantank shall be located on the Pollution Incident Plan. Mantank shall also be briefed on the site Pollution Incident Plan.

The Drilling Supervisor is responsible for coordinating the site response to any fire in line with the site emergency response plan. The first priority is the health and safety of personnel. The Drilling Supervisor/ Site Supervisor, or an employee with the delegated authority, shall report the incident to Cuadrilla Senior Management who will in turn notify the authorities (Environment Agency, Local Authority) of the incident, if required[10].

9.2 Spill Management

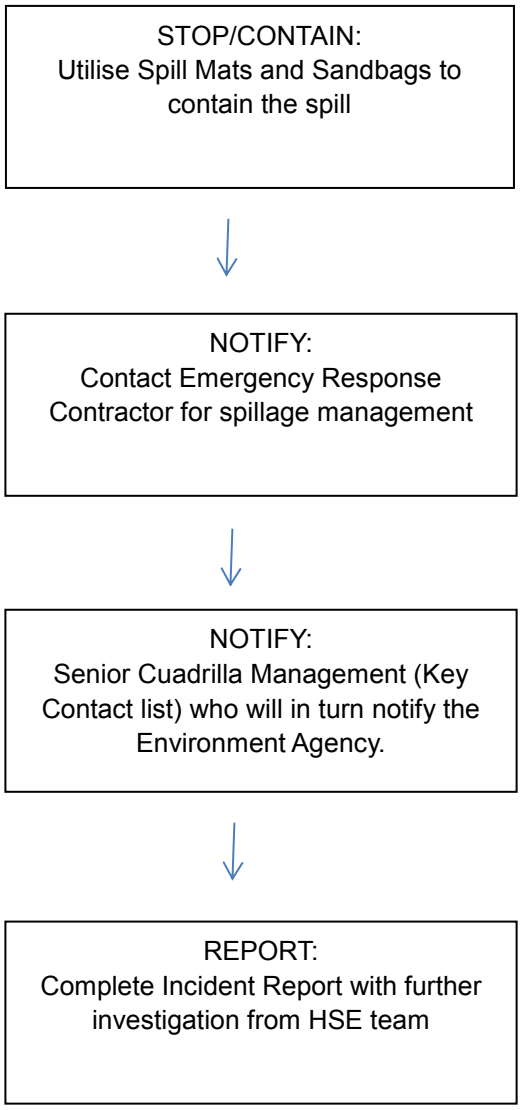
The use and transfer of liquids, e.g. chemicals, oils, fuels, shall be carried out with secondary containment, e.g. drip trays. The site has a minimum of three 200 litre spill kits located around the site to provide easy

response to spillages. Before the start of operations, all personnel shall be briefed in the use and location of spill kits. [11].

Each spill shall be cleaned up immediately and reported via Cuadrilla's incident reporting system, regardless of size. As part of the daily HSE tour, each spill kit shall be examined to ensure it is still fit for purpose.

In the unlikely event of a large scale spill the impermeable membrane shall provide the principal source of containment. In the unlikely event of further support required the Drilling Supervisor shall coordinate the spill response, which includes notifying the 24 hour spill response contractor (Mantank), to support the clean-up of the spill. Details of the spill response contractor will be located on the Pollution Incident Plan. When contacting the spill response contractor, key information will include: estimated quantity and contents (oil, muds, chemicals). Cuadrilla senior management team shall contact the Environment Agency as per figure 9.

Figure 9 – Spillage Response



In the unlikely event of a large scale spill which requires the deployment of a spill response contractor, sampling of the local surface water shall be carried out for a minimum of 1 week after the spill or until agreed with the Environment Agency.

9.3 Spill on Access or Egress Road/Off Site

As a minimum, all liquid transfer of fuels, wastes or chemicals are expected to be transferred with spill kits. The 24 hour spill response contractor (Mantank) will be available to manage spillages off site as well as on site. Mantak also has the capability of supplying and utilising booms for use on land and water.

The Site HSE Advisor will carry out recorded spot checks on vehicles entering and leaving the site for spill kits.

10.0 References

[1] West Sussex Planning Permission WSCC/027/10/BA 23rd April 2010

[2] Environment Agency, Consultation Response HA/2010/109145/01-L01 25th February 2010

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[5] Alcontrol Water Testing Suites April 2013

[6] Environment Agency Evidence Document, Review of assessment procedures for shale gas well casing installation, October 2012

[7] Environment Agency, Groundwater Protection: Principles and Practice (GP3) November 2012, Version 1

[8] Environment Agency, Pollution Prevention Guidelines PPG 1, General Guide to the Prevention of Pollution, May 2001

[9] Environment Agency, Pollution Prevention Guidelines PPG 7, Refuelling Facilities; Good Practice Guidelines, July 2011

[10] Environment Agency, Pollution Prevention Guidelines PPG 18, Managing Fire Water and Major Spillages, June 2000

[11] Environment Agency, Pollution Prevention Guidelines PPG 21, Pollution Incident Response Planning, March 2009

[12] Radiation Protection Supervisor Certificate, Radsmart Ltd, 16th November 2012

[13] UK Onshore Shale Gas Well Guidelines, Exploration and appraisal phase, Issue 1 February 2

[14] UK Onshore Shale Gas Well Guidelines, UKOOG, section 4.1, 1st February 2013,

[15] DEFRA Guidelines for Environmental Risk Assessment and Management - Green Leaves III, November 2011

11.0 Appendix

11.1 Appendix A: Drilling Site Set Up

11.2 Appendix B: Well testing Site Set Up

11.3 Appendix C: Environment Risk Assessment (Conceptual Model)