Dave Salmon

From: < @ukogplc.com>
Sent: 09 March 2018 12:09
To: Well Notifications
Cc:
Subject: Horse Hill Developments Ltd - Horse Hill 1 Well - LR/24-4 - Notification of Rigless well Testing Operations
Attachments: Letter HSE Submission Well Testing Horse Hill.pdf; Rigless Intervention and Well Testing Programme Rev 0 100218.pdf

Good afternoon,

Please find attached the above mentioned notification.

Regards,

Drilling Advisor

For and on Behalf of:

UKOG
ENERGY FOR BRITAIN

Crossways House
28-30 High Street
Guildford
Surrey
GU1 3EL
United Kingdom

M:+44
E: @ukogplc.com

HORSE HILL
DEVELOPMENTS

9th March 2018

Health and Safety Executive,
Well Operations Administration,
Lord Cullen House,
Frazer Place,
Aberdeen.
AB25 3UB

Dear Sir / Madam,

Well Notification: Horse Hill-1 Well Testing Programme

Location: Surrey

PEDL: 137

OGA Well Number: LR/24-4

On behalf of Horse Hill Developments Ltd, please find attached the above mentioned notification to perform rig-less well testing operations at the Horse Hill well site, near Gatwick in Surrey.

The submission is formatted per the requirements of the Borehole Sites and Operations Regulations 1995.

The well testing operations are planned to start in early April 2018.

The well is a conventional oil and gas well drilled in 2014 and the well test will quantify the productivity and the extent of the hydrocarbon accumulations in the Portland Sandstone and Kimmeridge Limestones. This test programme follows the original shorter well test programme completed in 2016.

The programme is being reviewed by an independent well examiner and their comments will be closed out per the HHDL Well Examination Scheme. Note that the independent well examiner for this work is of Well Technical Services Limited.

For any communications, and if you need any further information, or clarification, please do not hesitate to contact the undersigned via the following;

- Mobile number; 0
- E mail; @mdc.co.uk

Yours sincerely,

Drilling Advisor

HORSE HILL
DEVELOPMENTS

Horse Hill Developments Ltd

Horse Hill-1

Rig-less Intervention and Well Testing Programme

HHDL Ref: HHDL-HH1-RIWTP-R0
Rev 0 February 2018

Field:	Horse Hill
Well:	Horse Hill-1
Rig Name:	Rig-less
Document Number:	HHDL-HH1-RIWTP-R0
Depths:	All depths are in feet MD RT, Marriott Rig 50 (25 ft. AGL) unless otherwise stated.

APPROVAL LIST

	Title	Name	Signature	Date
Prepared By	Drilling Advisor			10.02.18
Reviewed By	Reservoir Engineering Advisor			
Approved By	Reservoir Engineering Advisor			
Approved By	UKOG COO			
Approved By	UKOG Director			

REVISION RECORD

Version	Date	Description
Rev 0	10.02.2018	For submission to Well Examiner and HSE

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	Slickline Coordinator / Expro	1
	Well Test Coordinator / PW Well Test	1
Health and Safety Regulatory Authority	Health and Safety Executive	1
	Independent Well Examiner / Well Technical Services Ltd	1
Site Canteen	Horse Hill Site	1

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Table of Contents

1.0 GENERAL WELL SUMMARY

The Horse Hill 1 well is located in Petroleum Exploration & Development Licence (PEDL) 137 in Surrey, SE England. The licence lies within the central Weald Basin.

The Horse Hill 1 exploration well was spudded on 24th September 2014 and rig operations completed on 4th November 2014. Well testing operations took place in February and March 2016, when hydrocarbons were successfully produced to surface from three separate zones – the Portland Sandstone, the Kimmeridge Limestone 4 and the Kimmeridge Limestone 3. The well was suspended pending a planning application for an extended well test. The planning permission for the extended well test was granted on 18th October 2017.

The intent is to start rig-less extended well testing operations in early April 2018.

The HSEQ objectives are to perform intervention operations for the well test:

- Without incident or accident.
- Whilst protecting individuals, including site personnel and the general public.
- With minimal impact on the environment.
- Whilst adhering to all planning conditions.
- With full well integrity throughout.

The technical objectives are to confirm:

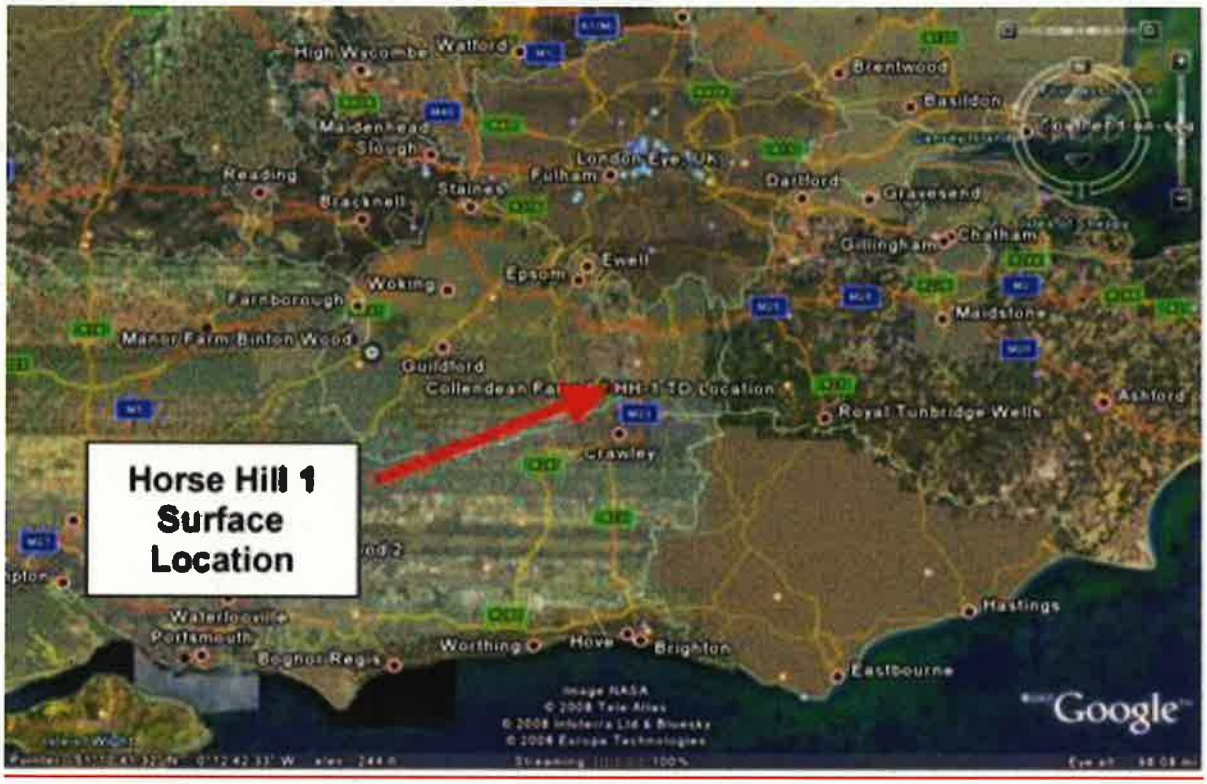
- Virgin reservoir pressure in each discrete reservoir zone
- Volume of hydrocarbons in place
- Maximum flow rates without risk to the reservoir
- Reservoir fluid composition

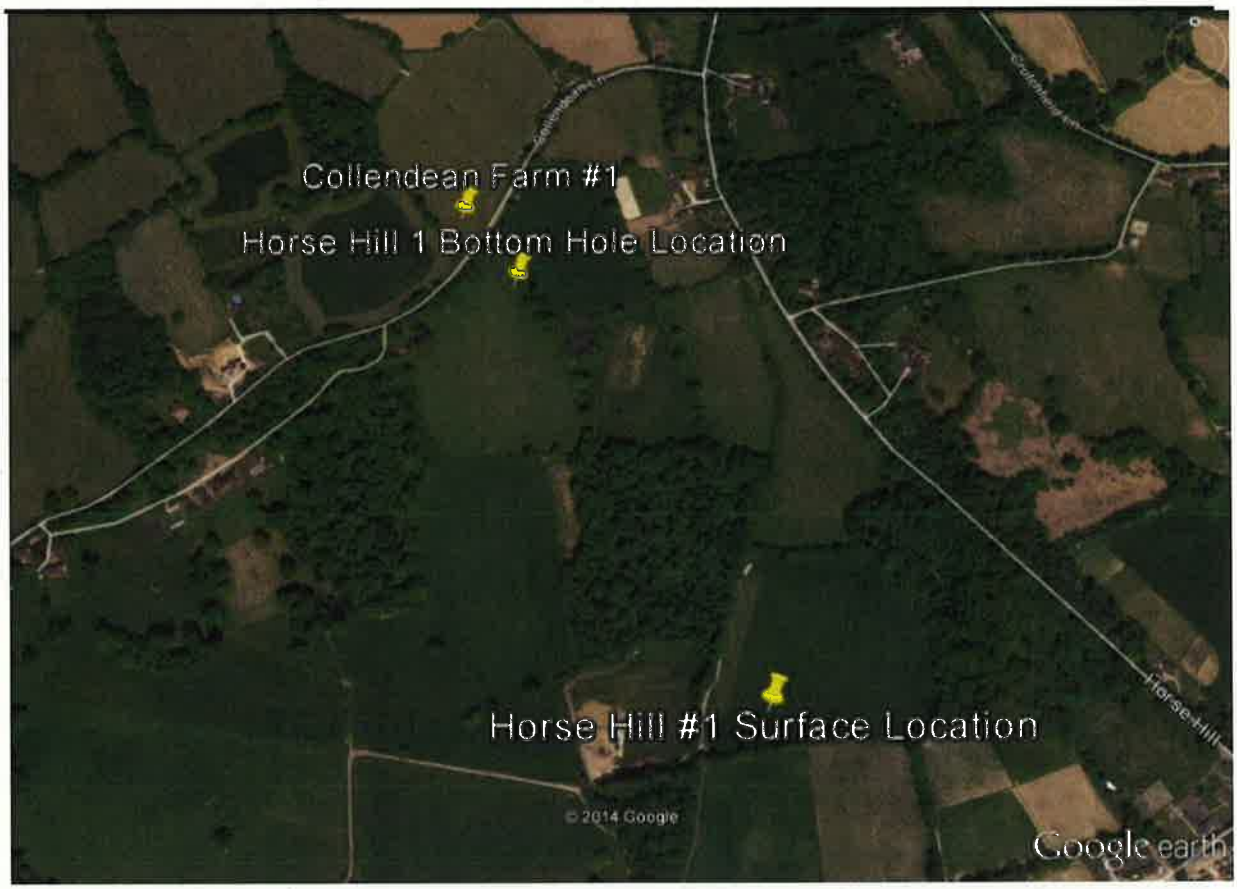
2.0 SITE LOCATION MAP

The site address is:

Horse Hill Site,
Horse Hill,
Hookwood,
Horley,
Surrey.
RH6 0HN

Access information can be found in the KOGL document 'Information for Contractors'.





The bottom hole location which is marked is at the TD of the original borehole at 8,815 ft MDBRT

3.0 WELL INFORMATION

3.1 BASIC WELL DATA

All depths in the programme are in ft. MD-BRT unless otherwise stated.

Operator For Licence	Horse Hill Developments Ltd Crossweys House, 28-30 High Street, Guildford, Surrey. GU1 3EL	
Well name	Horse Hill-1	
Well number	LR/24-4	
Well classification	Conventional oil exploration well	
Licence number	PEDL 137	
Field / basin	Weald Basin	
Region	Surrey, UK	
Drilling rig used	Marriott Rig 50	
Depth measurement units	Feet	
Rotary table to ground level	25 ft	
Ground level elevation	219 ft above MSL	
Well type	Oil producer	
Offset data	N/A	
Reservoirs	**Formation**	**Perforation Depths**
Portland Sandstone Kimmeridge Limestones (Reservoir hydrocarbon is medium GOR oil, no water)	Sandstones Limestones	2,044 – 2,143 ft Portland 2,827 – 2,930 ft KL4 3,102 – 3,185 ft KL3
Plugged Back TD (calculated top of cement plug)	4,126 ft MD-BRT, 3,737 ft TVD (44 deg at this depth)	

	Latitude	Longitude	Comments
Surface Coordinates (WGS84-UTM 30 N: Geodetic Coordinates)	51° 10' 38.5676 N	0° 12' 28.4182 W	After site build
	Northing mN	**Easting mE**	
	143600	525255	After site build
TD Coordinates at 8,815 ft MDBRT	**Latitude**	**Longitude**	
	51° 10' 55.9234" N	0° 12' 42.7343" W	From drilling surveys
	Northing mN	**Easting mE**	
	144130	524964	From drilling surveys

Casing and Mud			
Hole size	**Casing size**	**Depth (ft. MD-BRT)**	**Mud type**
N/A	20"	45	N/A
17 ½"	13 ⅜"	1,787	KCl / polymer water based mud
12 ¼"	9 ⅝"	6,602	Low toxicity oil based mud

Estimated duration	180 days
Estimated start date	Early April 2018
Partners	N/A
Completion status	2 ⅞" kill string inside 9 5/8" production casing

3.2 WELL OPERATIONS SUMMARY

There is only one well and well cellar on site. The site has only welfare equipment (offices, WCs, kitchen and meeting facilities) at the start of the operations. The site has 24/7 security.

Prior to operations commencing;

1. Pressure test tubing head ring joint void (inc. upper and lower tubing hanger seals) to 250 psi / 5 mins and 2,000 psi / 10 mins
2. Confirm A and B annulus and tubing pressure. Bleed off and top up as required. Confirm fluids or gas bled off
3. Pressure test wellhead annulus valves to 250 psi / 5 mins and 2,000 psi / 10 mins
4. Pressure test H2 BPV to 250 psi / 5 mins and 2,000 psi / 10 mins

Well testing operations;

1. Move on well test package and rig up
2. Move on rig less well intervention package and rig up
3. Check annulus pressures are reading zero. Flow check the well. Remove tubing head adaptor and valves
4. Nipple up 11" BOPs and pressure test
5. Pull the H2 back pressure valve
6. Retract the hanger tie down bolts. Pull and lay down the tubing hanger
7. Pull the 2 7/8" kill string
8. Run the wear bushing
9. RIH tubing work string
10. Latch the Weatherford WRP retrievable bridge plug. POOH
11. Pull the wear bushing
12. Run the 3 ½" Portland Zone 3 test string
13. Land the tubing hanger. Set the packer
14. Install the H2 back pressure valve and pressure test
15. Nipple down the BOPs
16. Nipple up the tubing head adaptor and production tree. Pressure test
17. Pull the H2 BPV
18. Open the sliding sleeve
19. Run downhole pump and rods
20. Rig up linear rod pump (LRP)
21. **Flow test Portland Zone 3**
22. Rig down LRP
23. Kill the well
24. Pull rods and pump
25. Close the sliding sleeve
26. Set the deep plug and prong
27. Install the H2 BPV
28. Nipple down the production tree
29. Nipple up the BOPs and pressure test
30. Remove the H2 BPV
31. Pull the deep prong and plug

32. Unseat the packer
33. POOH the test string
34. Run the wear bushing
35. RIH tubing work string. Circulate
36. Latch the Weatherford WRP retrievable bridge plug. POOH
37. RIH the motor milling assembly on the work string
38. Mill out the EZSV bridge plug and push to bottom
39. POOH work string
40. Pull wear bushing
41. Run three zone selective completion on 3 ½" tubing
42. Land the tubing hanger. Set the packers
43. Install the H2 back pressure valve and pressure test
44. Nipple down the BOPs
45. Nipple up the tubing head adaptor and production tree. Pressure test
46. Pull the H2 BPV
47. **Flow test KL4 Zone 2/2a and KL3 Zone 1**
48. Suspend well

Depending on the results of the flow tests, a decision will be made on whether to run a dedicated suspension string.

Additional works may include;

1. Re-perforating with 7" tubing conveyed guns
2. Acid treatment

3.3 PROCEDURE FOR RIG-LESS INTERVENTION OPERATIONS

Rig-less intervention operations will take place during the well testing operations to allow access to different reservoir zones. The programmes of work will be performed in conjunction, and as required, with one another.

Rig-less tubing running and pulling operations are performed utilising a crane with personnel working off a work platform. The work string weight is landed off on top of the wellhead through the BOPs and spacer spools and a slip bowl and slips.

Hydraulic power tongs are used to make and break tubing.

Shear release downhole packers are released by using a 100 MT capacity hydraulic jacking table which is supported off the top of the BOPs. Once the packers are sheared, the tubing hanger is landed down on its seat and the crane is utilised to pull the tubing.

Typically, slickline services are on site to open and close sliding sleeves for reverse circulation and well kill.

The test zones may be pumped, utilising a downhole plunger rod pump. HHDL have access to a linear rod pump (LRP) which provides reciprocation of the rod string at surface, replacing the conventional beam pump.

A kill pump and kill fluids will be maintained on site whenever performing well operations with the BOPs in place.

4.0 SAFETY MANAGEMENT AND SAFETY CRITICAL OPERATIONS

All HHDL operations are carried out in accordance with the Company's Health, Safety & Environmental Management System (HSE MS), which exists to ensure a systematic and consistent approach to compliance with applicable legislation and the management of health and safety risk.

In accordance with the HHDL HSE MS, a site specific HSE and security document has been produced for the Horse Hill well test operation, which sets out the arrangement for health and safety and provides evidence to support the risk to persons on the borehole site having been assessed in accordance with Regulation 3 of the Management of Health and Safety at Work Regulations and that adequate control measures have been implemented. The document references all other components of the HSE MS, including the following;

- Health, Safety and Environmental Policy Documents
- Contractor HSEQ Evaluation
- Management of Change
- Identification of Health and Safety Risks
- Incident Investigation and Reporting
- Work Programme, Attachments and formal changes
- Risk Assessments

Lifting operations with the crane, to insert and remove tubing from the well, will be planned and supervised by competent personnel from the chosen crane provider. Operational procedures and risk assessments will form part of the HHDL documentation listed above.

The well test contractor selected by HHDL for the Horse Hill well test operation is PW Well Test Limited (PW), who will undertake its operations in accordance with their Integrated Management System (IMS) which is accredited to ISO 9001:2015 (Quality), ISO 1400:2015 (Environment) and OHSAS 18001:2007 (Occupational Health and Safety), which includes but is not limited to the following documentation:

- Health and Safety (PWWT-01-001)
- Environmental Policy (PWWT-01-002)
- IMS Policy Manual (PWWT-02-002)
- Well Test Design Report (PWWT-02-003)
- Hazardous Identification Study (HAZID) (PWWT-04-002)
- Standard Operating Procedures and Risk Assessments
- Planned Maintenance System (PMS)
- Competency Assurance System (CAS)
- Daily Work Instructions
- Pre-Task Risk Assessments (PTRA) and Safety Observation Cards (SOCs)

The Company's HSE MS and the well test contractor's IMS have been bridged under a separate document HH-PR-Q03, which provides a quick reference to the integration of both HSE MS's and sets out the accountabilities and responsibilities for HSE during the Horse Hill well test operation.

The HHDL Rig-less Intervention and Well Testing Programme (this document) is the principle document for the well test rig-less operations design and implementation on the Horse Hill 1 borehole.

Any amendments to the work programme shall be compulsorily subject to review by the HHDL Drilling Advisor, who in turn will liaise with HHDL's Chief Operating Officer (COO) and, if material, will also be subject to Independent Well Examiner review. Only when the required change has been formally authorised by HHDL's COO can the required change be implemented.

Any changes to the well test programme established by HHDL, to an operational procedure or to a work instruction which could significantly impact the level of risk to the persons, the environment or the operation, shall be managed in accordance with the HHDL Management of Change procedure. Risk assessments will be carried out where applicable.

Any changes to PW's equipment, to a PW operational procedure, or to a PW work instruction issued, which could significantly impact the level of risk to the persons, the environment or the operation, shall be managed in accordance with the PW Management of Change procedure. Risk assessments will be carried out where applicable.

Exceptionally, where circumstances require immediate action to ensure the site and personnel safety, the HHDL Site Supervisor, in conjunction with the PW Supervisor, is permitted to implement the necessary changes to the work programme. He/she must contact the HHDL Drilling Advisor as soon as reasonably practicable to confirm his/her validation. An additional clause (amendment) to the work programme shall be issued at the latest on the next working day following the change implementation.

In accordance with Schedule 2 (2) of the Borehole Sites and Operations Regulations, the Horse Hill 1 well operations will be supervised by the HHDL Site Supervisor, who has been formally appointed by HHDL to exercise immediate supervision of the borehole operation. The HHDL Site Supervisor also represents the provision of a competent person under Schedule 2 (3) of the Borehole Sites and Operations Regulation and has well control to IWCF supervisor level 4.

Operations will take place on a 24 hr per day basis. Control of the site will be provided by 24 hr security cover. Welfare facilities including change and washing facilities, canteen, WCs, etc. will be provided for the onsite personnel.

The service provider personnel will be accommodated together in a local hotel, where possible. The HHDL Site Supervisor will have living accommodation provided on site.

5.0 WELL INFORMATION

5.1 WELL DESIGN AND STATUS

During well test operations in March 2016;

- Fluid above Upper Weatherford WRP retrievable bridge plug is 8.8 ppg inhibited brine
- Upper Weatherford WRP retrievable bridge plug pressure tested to 3,200 psi
- Upper Weatherford WRP retrievable bridge plug inflow tested to 760 psi
- Lower Weatherford WRP retrievable bridge plug pressure tested to 3,200 psi
- EZSV pressure tested to 3,500 psi
- Tubing hanger body seals pressure tested to 3,500 psi
- H2 back pressure valve in tubing hanger pressure tested to 3,500 psi
- Tubing hanger neck seals pressure tested to 2,000 psi

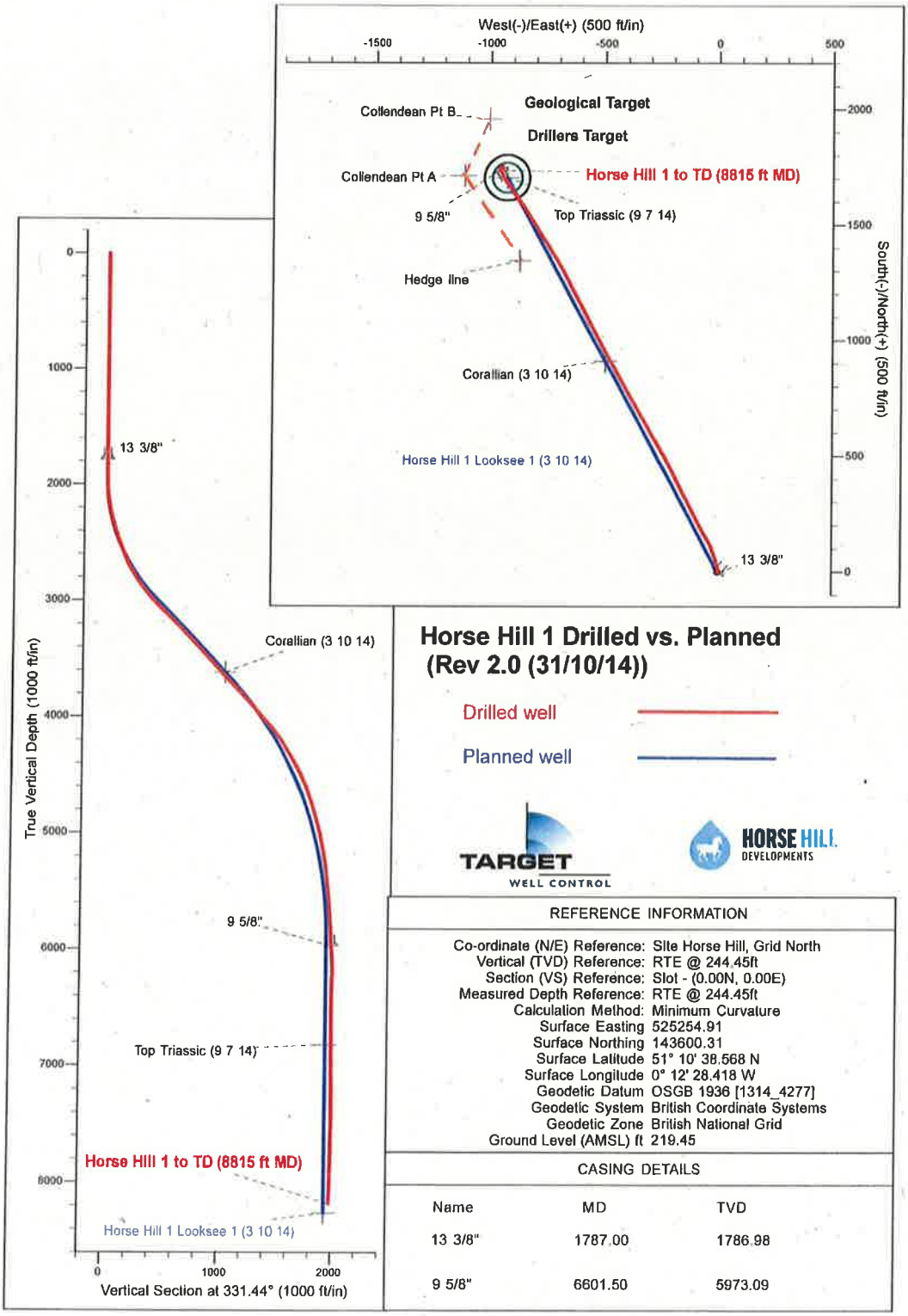
5.2 FLUID SPECIFICATIONS

Formation	Test Zone	Bubble Point psia	Temperature degF	Gravity API	GOR scf/stb	Sample Depth ft MDBRT
Portland	3	705	82	36	~140	NA
KL4	2/2a	755	95	40.6	~230	2,790
KL3	1	715	97	40.5	~225	2,800

5.3 CASING SPECIFICATIONS

Size (")	Weight (lb/ft)	Grade	Connection	Burst (psi)	Collapse (psi)	Tensile (k lb)
9 5/8	47	L80	Vam Top	6,870	4,760	1,086

5.4 DIRECTIONAL PROFILE



REFERENCE INFORMATION	
Co-ordinate (N/E) Reference:	Site Horse Hill, Grid North
Vertical (TVD) Reference:	RTE @ 244.45ft
Section (VS) Reference:	Slot - (0.00N, 0.00E)
Measured Depth Reference:	RTE @ 244.45ft
Calculation Method:	Minimum Curvature
Surface Easting	525254.91
Surface Northing	143600.31
Surface Latitude	51° 10' 38.568 N
Surface Longitude	0° 12' 28.418 W
Geodetic Datum	OSGB 1936 [1314_4277]
Geodetic System	British Coordinate Systems
Geodetic Zone	British National Grid
Ground Level (AMSL) ft	219.45

CASING DETAILS

Name	MD	TVD
13 3/8"	1787.00	1786.98
9 5/8"	6601.50	5973.09

5.5 COMPLETION / WORK STRING

Completion String

Size (in)	Weight (lb/ft)	ID (in)	Drift (in)	Grade	Range	Coupling OD (in)	Thread Connection	Tensile Yield (k lb)	Yield Pressure (psi)
3 ½	9.3	2.992	2.867	L80	2	4.500	3 ½" EUE	207	10,160
2 7/8	6.5	2.441	2.347	L80	2	3.668	2 7/8" EUE	145	10,570

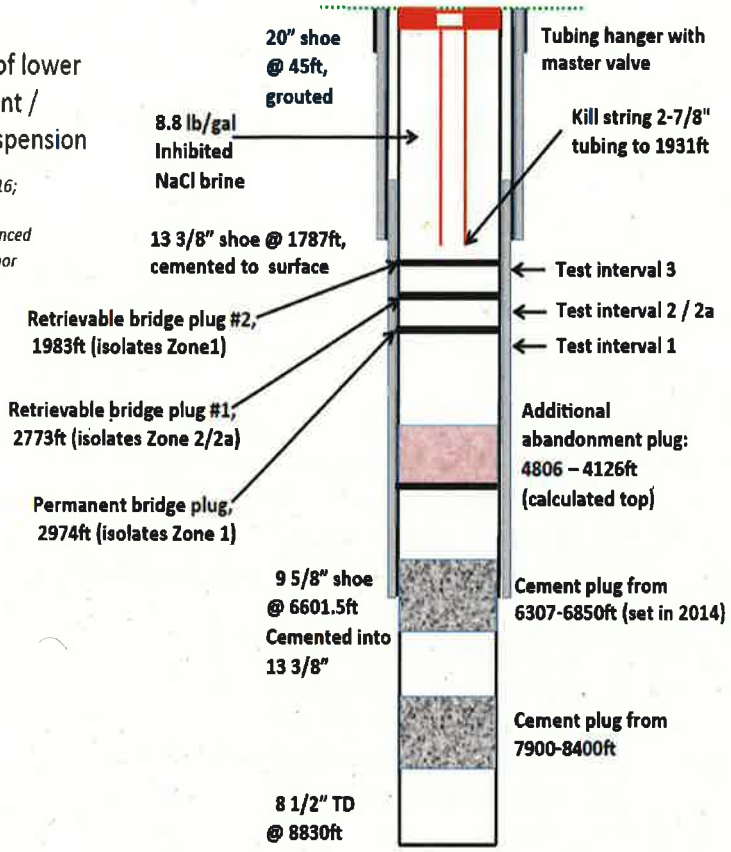
Work String

Size (in)	Weight (lb/ft)	ID (in)	Drift (in)	Grade	Range	Coupling OD (in)	Thread Connection	Tensile Yield (k lb)	Yield Pressure (psi)
3 ½	9.3	2.992	2.867	L80	2	4.500	3 ½" EUE	207	10,160
2 7/8	6.5	2.441	2.347	L80	2	3.668	2 7/8" EUE	145	10,570

5.6 CURRENT WELL SCHEMATIC

Horse Hill-1
Schematic of lower abandonment / Portland suspension

As at 18 Mar 2016;
Not to scale;
All depths referenced To HH-220 rig floor



Upper Tunbridge Wells SST: 520 – 580ft
Lower Tunbridge Wells: 770 – 805ft

Ashdown Beds: 978 – 1302ft

Purbeck Anhydrite: sealing, 1984 – 2032ft

Test Zone 3: 2044 – 2143ft

Test Zone 2 / 2a: 2827 – 2930FT

Test Zone 1: 3102 - 3185ft

Kimmeridge Clay

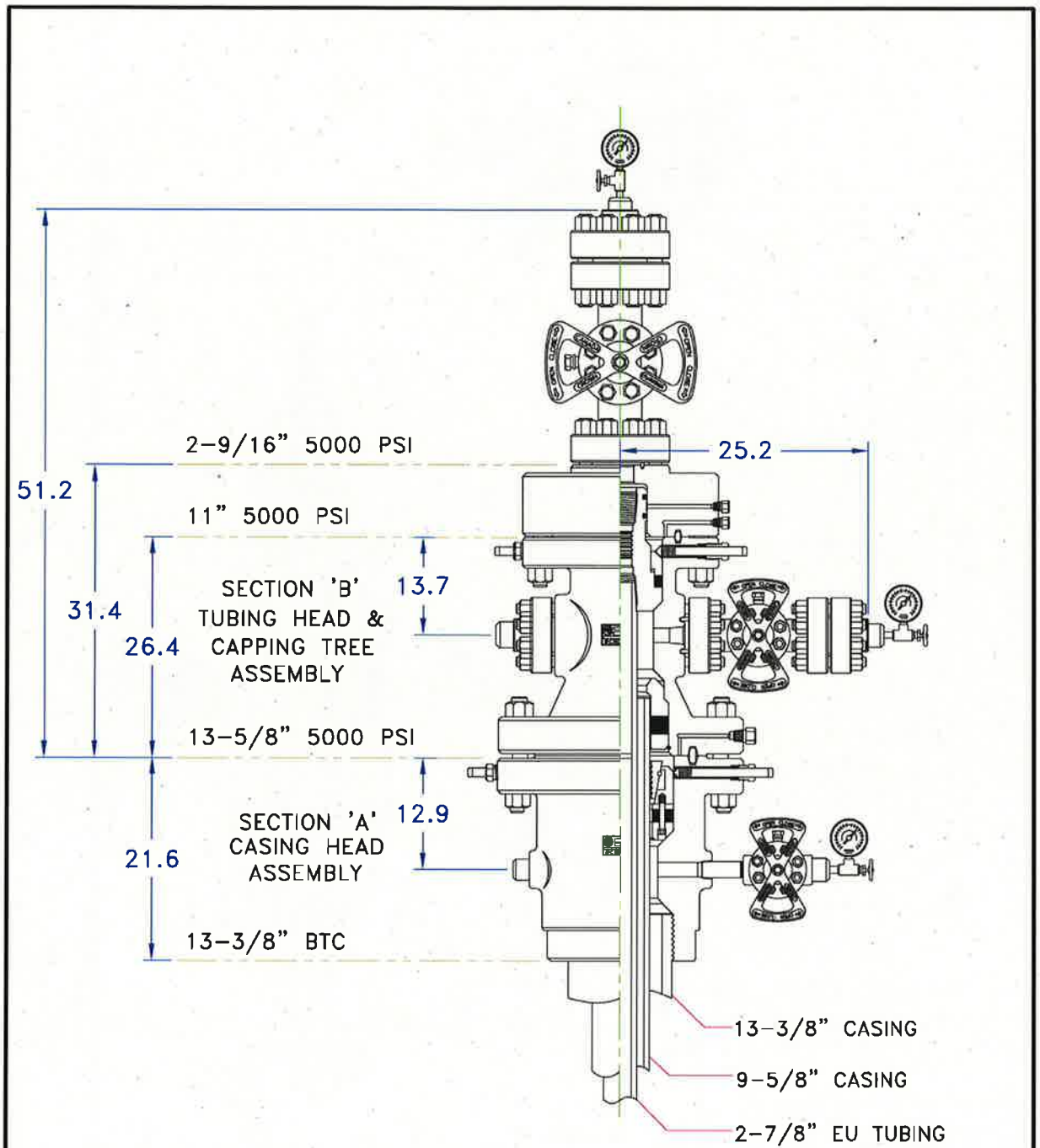
Corallian SST: 4459 – 4520ft (NVP)

Corallian LMST: 4999 – 5050ft (NVP)
Oxford Clay
Kellaway Beds/Gr. Oolite: 5517 - 5685ft
Inferior Oolite: 5799 – 6370ft
Lias Claystone

Depths are measured depths
NVP = no visible porosity

5.7 WELLHEAD

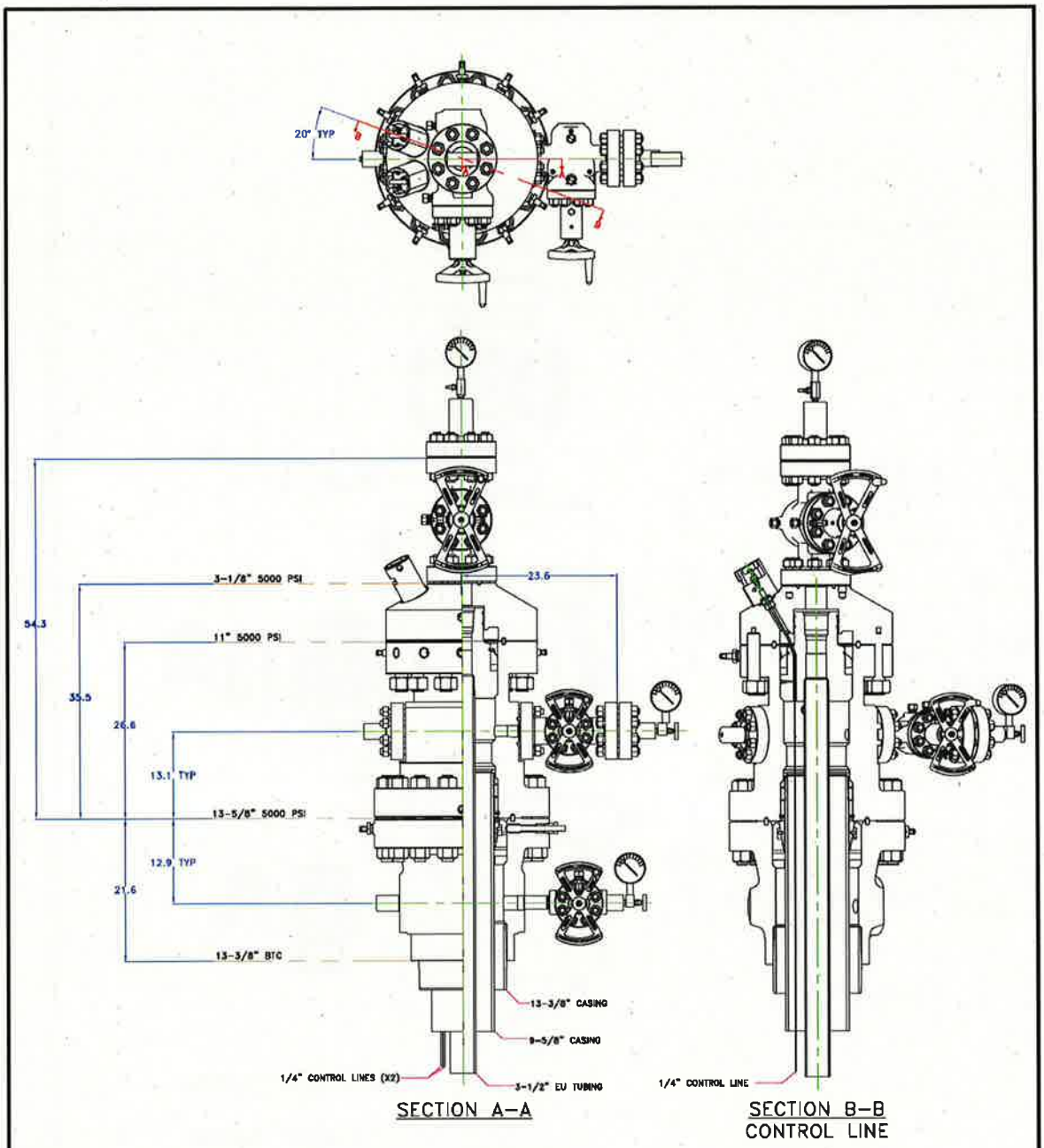
Manufacturer	StreamFlo Industries Ltd
Type	Spool system
Wellhead housing and spools	13 ⅝" 5K Buttress box casing head 13 ⅝" 5K x 11" 5K casing spool
Tubing head adaptor	11" 5K x 2 9/16" 5K – **current** 11" 5K x 3 1/8" 5K – **to be installed**
Tubing hanger	11" x 2 7/8" EUE top and bottom with 2 ½" BPV profile - **current** 11" x 3 ½" EUE top and bottom with 3" BPV profile, two control line exits (for down hole gauges) – **to be installed**
Rating	5,000 psi
Size	13 ⅜" x 9 ⅝" x 2 7/8" / 3 ½" tubing
Material Specification (includes associated annulus valves)	Section A, Casing head: AA Section B, Tubing spool: A Tubing hanger: DD-NL Section C, Tubing head adaptor: DD-NL Production tree: DD-NL
Production Specification Level	Section A, Casing head: PSL-1 Section B, Tubing spool: PSL-1 Tubing hanger: PSL-2 Section C, Tubing head adaptor: PSL-2 Production tree: PSL-2
Performance Requirements	PR 2
Temperature Rating	Section A, Casing head: U Section B, Tubing spool: U Tubing hanger: L Section D, Tubing head adaptor: L Production tree: P-U/L-U



NOTE:
1. DIMENSIONS ARE IN INCHES AND MAY VARY ± 1/2" DUE TO FORGING TOLERANCES.

NORTHERN PETROLEUM (GB) LTD/MAGELLAN PETROLEUM (NT) PTY LTD	DWN.	ND	07-04-14	EDMONTON, AB. CANADA	DRAWING No. WH-8057 REV. 1
	CHK.	VN	07-04-14		
	APPR.				
		BY:	DATE		

Current wellhead arrangement with 2 7/8" tubing hanger



NOTE:
1. DIMENSIONS ARE IN INCHES AND ARE SUBJECT TO CHANGE (ESTIMATED ONLY).

HORSE HILLS DEVELOPMENT LTD. 13-3/8" X 9-5/8" X 3-1/2"	DWN.	MCG	02-08-18	DRAWING No. WH-17878 REV. 0
	CHK.	SEB	02-08-18	
	APPR.			
		BY:	DATE	

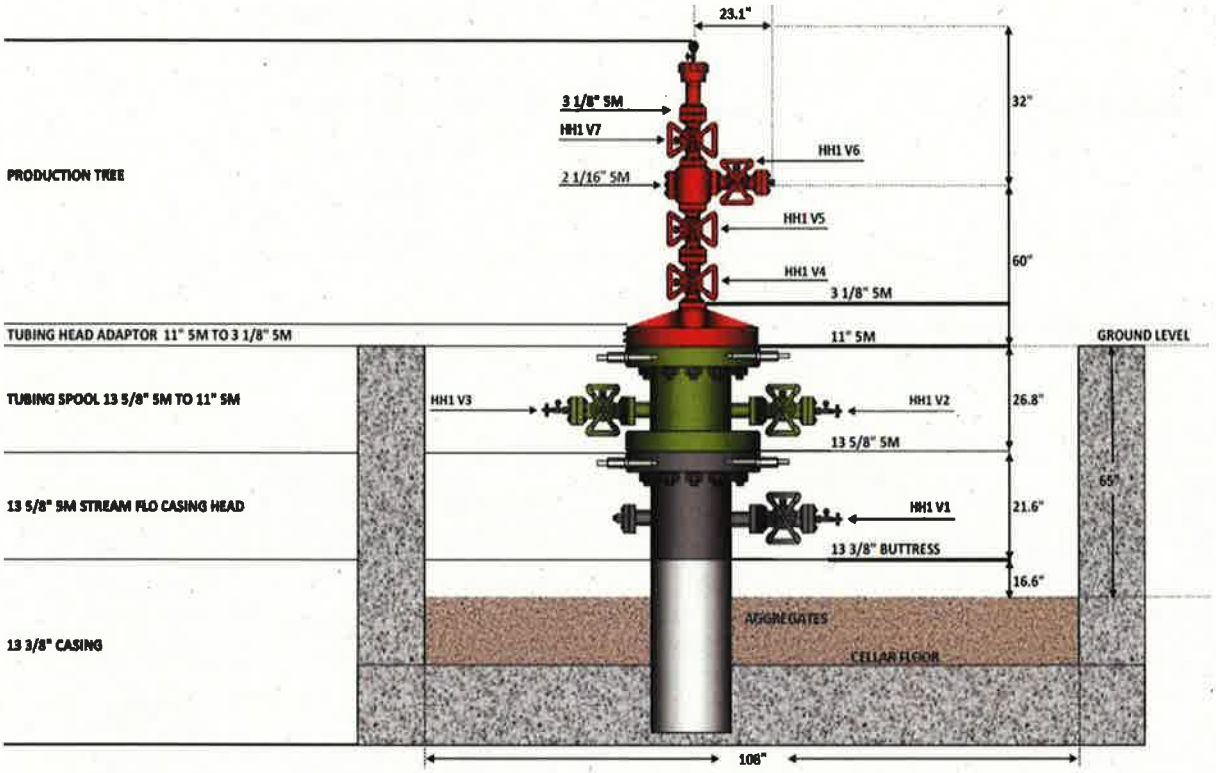
Stream Flo — Worldwide Expertise - Global Strength

REFERENCE:WH-8057 PROJECT #6273

Proposed wellhead arrangement with 3 ½" tubing hanger

5.8 SITE STACK-UP

SCALE: NTS
REV: 13/02/2018



The production tree has an OTIS 5"- 4 ACME cap.

6.0 WELL CONTROL

Work Scope	BOP Configuration
▪ Crane operations	11" x 5 M Double Ram • 3 ½" pipe ram (upper) • blind ram (lower)
▪ Slickline operations	5" x 5 M Triple Ram • Wire ram • Blind ram • Shear ram

Stack up drawings for the well control equipment are included in the Appendices.

Horse Hill 1 Well Test
Barriers During Well Operations

Operation	Tubing			Annulus		
	Primary Barrier	Secondary Barrier	Tertiary Barrier	Primary Barrier	Secondary Barrier	Tertiary Barrier
Tubular tripping operations	Brine with minimum 50 psi overbalance	Stab in valve	Circulation of heavy brine via the kill pump	Brine with minimum 50 psi overbalance	Ram BOPs dressed with correct sized tubing rams	Circulation of heavy brine via the kill pump
Slickline during overbalance operations - production tree installed	Brine with minimum 50 psi overbalance	Production tree body, BOP body, lubricator, stuffing box	BOP rams (wire and shear)	Brine with minimum 50 psi overbalance	9 5/8" production packer	9 5/8" production casing, wellhead annulus valves on tubing spool, tubing hanger body seals
Slickline during underbalance operations - production tree installed	Production tree body, BOP body, lubricator, stuffing box	BOP rams (wire and shear)	None	Brine with minimum 50 psi overbalance	9 5/8" production packer	9 5/8" production casing, wellhead annulus valves on tubing spool, tubing hanger body seals
Well flow during well testing	Production tree body,flow line to ESD valve	Master valves on production tree	None	Brine with minimum 50 psi overbalance	9 5/8" production packer	9 5/8" production casing, wellhead annulus valves on tubing spool, tubing hanger body seals
Running and pulling downhole pump and rods	Brine with minimum 50 psi overbalance	Production tree body, rod BOP, flow line to ESD	None	9 5/8" production casing, wellhead annulus valves on tubing spool, tubing hanger body seals	13 3/8" casing, wellhead annulus valves on casing head, 11" flange on ring joint between tubing spool and tubing head adaptor, tubing hanger neck seals, companion flanges and block and bleed valves on tubing spool annulus valves	None
Rod pumping operations	Production tree body, rod BOP, flow line to ESD	Rod stuffing box, flapper on stuffing box if polished rod fails	None	9 5/8" production casing, wellhead annulus valves on tubing spool, tubing hanger body seals	13 3/8" casing, wellhead annulus valves on casing head, 11" flange on ring joint between tubing spool and tubing head adaptor, tubing hanger neck seals, companion flanges and block and bleed valves on tubing spool annulus valves	None

7.0 FORMATION INFORMATION

7.1 FORMATION PORE PRESSURE

The following information is from well testing operations carried out on the same three zones in 2016.

Formation / Test Zone	Minimum Formation Pressure psia	Maximum Formation Pressure psia	Depth ft TVDBRT (at 25 ft AGL)	Depth ft TVDBGL	Formation Gradient to Ground Level (psi/ft)	Equivalent Mud Weight (ppg)
Portland / 3	844	N/A	1,903	1,878	0.449	8.64
	846	855	1,898	1,873	0.452	8.68
	965	N/A	2,154	2,129	0.453	8.72
	969	N/A	2,154	2,129	0.455	8.75
KL4 / 2 and 2a	1,203		2,694	2,669	0.451	8.67
		1,230			0.461	8.86
KL3 / 1	1,289		2,886	2,861	0.451	8.66
		1,306			0.456	8.78

7.2 TEMPERATURE AND PVT ANALYSIS

The following information is from well testing operations carried out on the same three zones in 2016.

Formation / Test Zone	Bubble Point psia	Temperature deg F	Gravity API	GOR scf/stb	Sample Depth ft MDBRT
Portland / 3	705	82	36	~140	NA
KL4 / 2 and 2a	755	95	40.6	~230	2,790
KL3 / 1	715	97	40.5	~225	2,800

The PVT values should be viewed as indicative i.e. providing a range with potentially a +/-20% error bar.

7.3 FORMATION INTEGRITY TESTS

A formation integrity test of 12.1 ppg EMW was observed at the 13 3/8" shoe at 1,787 ft TVDBRT.

7.4 CASING PRESSURE TESTS

The 9 5/8" casing has been pressure tested to 3,500 psi above the EZSV bridge plug at 2,974 ft MDBRT.

7.5 PRIMARY WELL CONTROL – KILL FLUID WEIGHT

Primary well control is provided by the kill weight brine when the well is dead.

The kill weight brine will be targeted to provide a minimum 50 psi over pressure on the formation pressure and will be at 8.8 - 9.3 ppg. Previous well testing operations suggest that downhole fluid losses may become unmanageable above that level of overbalance due to the highly fractured nature of the Limestone zones. Calcium Carbonate LCM will be available to reduce downhole fluid losses to the formation.

7.6 SECONDARY WELL CONTROL – BOPS, LUBRICATOR, STUFFING BOX

Secondary well control will be provided by BOPs, lubricator and stuffing box, as appropriate to the operation. The BOPs will be rated to a minimum of 3,000 psi and be suitable for H_2S service (but H_2S presence is not anticipated).

The well head system and production tree exposed during the operations are rated to a working pressure of 5,000 psi.

8.0 WORK PROGRAMME

A Rig-less Intervention Well Test on Paper meeting will be held with all service provider management represented.

A site 'pre-operations meeting' will be held with all site-based personnel in attendance prior to intervention operations commencing.

A site inspection and acceptance audit will be performed after rig-up, by the HHDL HSE Advisor, HHDL Site Supervisor and service provider supervisors. Actions will be prioritised for close out and progress tracked.

Rules of The Work Programme

- All pressure testing to be to 250 psi / 5 mins and 2,000 psi / 10 mins on temporarily installed equipment
- Two passive pressure tested barriers are to be activated at all times (i.e. two valves closed) when breaking out the slickline lubricator
- The slickline lubricator is to be pressure tested each time containment has been broken. A quick test sub is included in the lubricator.
- Two closed barriers must be maintained on the well when breaking any surface connections.

8.1 PRE INTERVENTION WELLHEAD OPERATIONS

The objective is to ensure that the wellhead is suitable for intervention operations, with no failed barriers.

1. Check for A and B annulus pressure. Bleed off pressure and top up the annuli as required
2. Stab the H2 check valve in the tubing hanger. Check for pressure in the tubing and bleed off pressure as required. Top up the tubing. Pressure test the H2 BPV to 250 psi / 5 mins and 2,000 psi / 10 mins
3. Pressure test the upper and lower tubing hanger seals through the test port on the ring joint void to 250 psi / 5 mins and 2,000 psi / 10 mins
4. Pressure test the 9 5/8" slip seal and the seal bushing seals to 250 psi / 5 mins and 2,000 psi / 10 mins
5. Pressure test the A annulus valves to 250 psi / 5 mins and 2,000 psi / 10 mins. Ensure two barrier isolations on each A annulus outlet
6. Pressure test the B annulus valves to 250 psi / 5 mins and 2,000 psi / 10 mins. Ensure two barrier isolations on each A annulus outlet

8.2 INSTALL AND PRESSURE TEST BOPS

The objective is to install and pressure test passive barriers on the well to pull the kill string and run and pull test strings into and out of the well.

1. Remove the tubing head adaptor and master valve from the wellhead
2. Install the 11" double ram BOPs, choke and kill line and choke manifold. Ensure certification for recent pressure tests for all pressure control equipment is provided. Ensure the tubing hanger neck does not foul the blind rams when the rams are closed.
3. Connect the accumulator closing unit to the BOPs
4. Close the blind rams. Pressure test the blind rams against the H2 BPV in the tubing hanger. Open the blind rams
5. Install the 3 ½" drilled pup joint into the tubing hanger (crossover to 2 7/8" required on the bottom of the pup joint)
6. Close the pipe rams and pressure test. Open the pipe rams
7. Perform a BOP accumulator test. The accumulator pump should be isolated. All BOPs should be functioned closed, open, closed and the accumulator pressure should remain above 1,200 psi. The pipe rams can be functioned twice in lieu of the blind rams for this test
8. Remove the landing joint
9. Pressure test the choke and kill lines and choke manifold as required out with the testing already included in the testing sequence above

8.3 POOH THE KILL STRING

The objective is to pull out the kill string and lay out.

1. Retrieve the H2 BPV from the tubing hanger
2. Install the 2 7/8" landing joint with full opening safety valve installed. Rig up LP return line
3. Rig up HP lines to the A annulus and pressure test
4. Reverse circulate the well to 8.8 ppg brine. Rig down lines
5. Retract the tubing hanger tie down bolts and confirm fully retracted
6. Unseat the tubing hanger and pick up with the crane
7. Pull the tubing hanger. Break out at the pup joint connection below the tubing hanger and lay out the tubing hanger
8. POOH the kill string, laying out in singles. Monitor hole fill on the trip tank

8.4 PULL THE WEATHERFORD UPPER RETRIEVABLE BRIDGE PLUG

The objective is to latch the upper retrievable bridge plug, unset and pull out of hole.

The upper Weatherford WRP retrievable bridge plug is an auto j latch retrieval with a straight pull to release.

1. Pick up and RIH the wear bushing. Lock down
2. Make up the Weatherford J latch retrieval tool and RIH with 3 x 4 ¾" DC and the 3 ½" tubing work string. Make up a closed Kelly cock on the last joint of tubing
3. Pass over the fishing neck on the bridge plug and latch. Confirmed latched with 5 k lb overpull
4. Slack off 5 k lb to open the equalising ports in the plug. Open the Kelly cock and check for flow in the tubing string. Assuming no flow;
5. Rig up the jacking table. Pick up 10 – 15 k lb to release the bridge plug. Pull up 6 ft to ensure full travel of the slips on the mandrel

6. Wait for 30 mins for the elements to relax whilst rigging down the jacking table
7. POOH the bridge plug laying out in singles
8. Release the tie down bolts and pull the wear bushing

8.5 RUN THE PORTLAND (TEST ZONE 3) TEST STRING

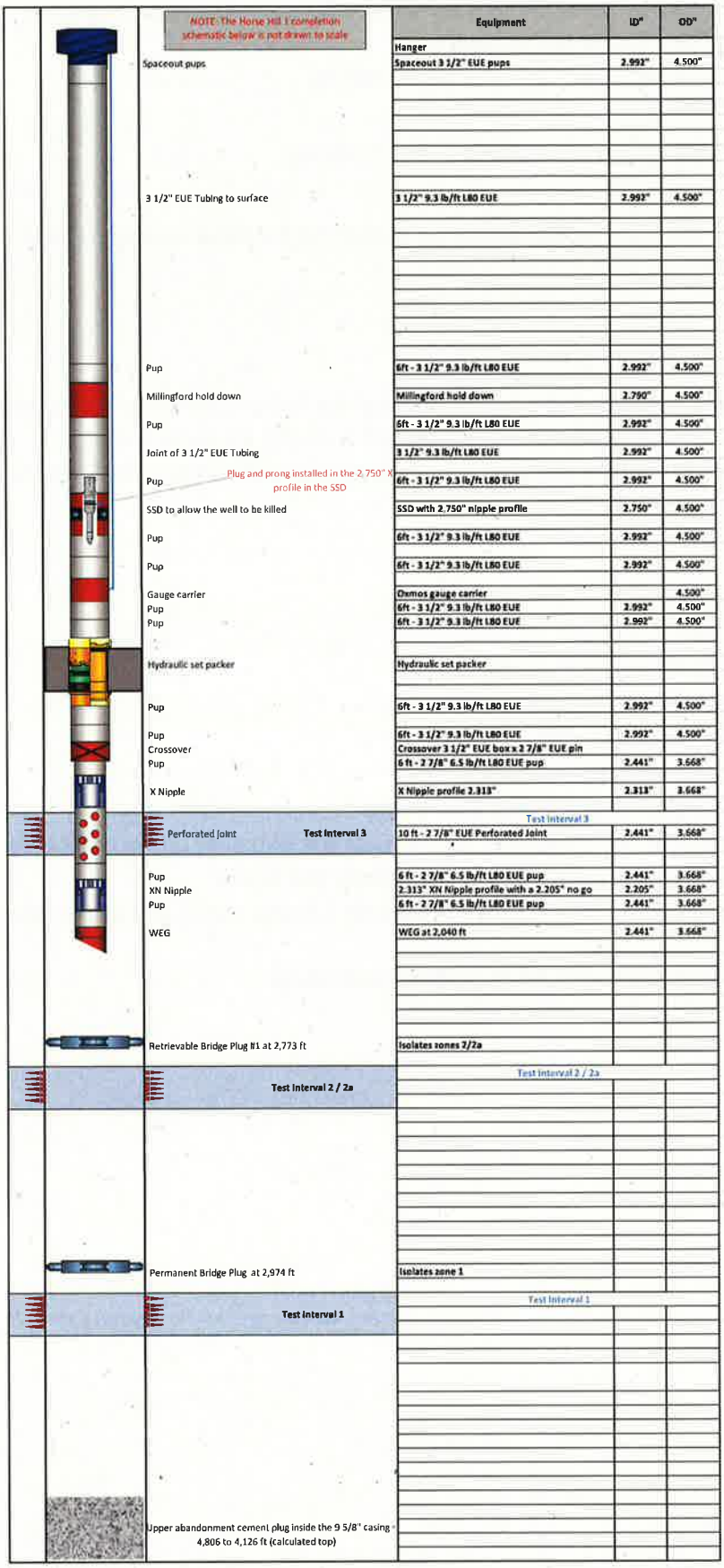
The objective is to run a pressure tested test string to test the Portland sandstone zone with a downhole plunger pump.

Note;

- all connections are EUE
- to shut in the well, the data cable will be cut and the string lowered so that there is plain tubing across the pipe rams. Ensure a cable cutting tool is on the work platform
- the well test package will be installed, commissioned and function tested before, or during, the following well operations

1. Pick up the
2. test string as follows;

- 2 7/8" WEG with 6 ft pup joint above
- 2.313" XN nipple with 6 ft pup joint above
- Perforated 2 7/8" pup joint 10 ft
- 2.313" X nipple with 6 ft pup joint above
- 3 ½" x 2 7/8" crossover with 6 ft pup joint above
- 9 5/8" x 3 ½" hydraulic set retrievable packer with 6 ft pup joint above and below
- 3 ½" Oxmos gauge carrier with 6 ft pup joint above and below
- 3 ½" sliding sleeve with 2.75" X nipple profile with 6 ft pup above and below, **plug and prong installed**
- 3 ½" API pump hold down with 6ft pup above and below



Equipment	ID"	OD"
Hanger		
Spaceout 3 1/2" EUE pups	2.992"	4.500"
3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Millingford hold down	2.790"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
SSD with 2.750" nipple profile	2.750"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Oxmos gauge carrier		4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Hydraulic set packer		
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Crossover 3 1/2" EUE box x 2 7/8" EUE pin		
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
X Nipple profile 2.313"	2.313"	3.668"
Test Interval 3		
10 ft - 2 7/8" EUE Perforated Joint	2.441"	3.668"
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
2.313" XN Nipple profile with a 2.205" no go	2.205"	3.668"
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
WEG at 2,040 ft	2.441"	3.668"
Isolates zones 2/2a		
Test Interval 2 / 2a		
Isolates zone 1		
Test Interval 1		

3. RIH on 3 ½" tubing with cable protection clamps installed across each tool joint. Fill the pipe on the way in the hole.
4. Space out to land the test string on the tubing hanger with the WEG +/- 4 ft above the top open perforation
5. Pick up the tubing hanger, make up the Kelly cock on the landing joint and make up HP test lines
6. Pressure test the HP lines to 2,750 psi against the closed Kelly cock. Open the Kelly cock
7. Pressure test the tubing to 250 psi / 5 mins and 2,500 psi / 10 mins. Bleed off pressure and rig down
8. Terminate the Oxmos cable through the tubing hanger. Land the tubing hanger and energise the tie down bolts
9. Rig up slickline open hole with a Kelly cock on the tubing
10. Pull the prong and plug from the 2.75" SSD
11. Run the plug and prong into the 2.313" nipple below the packer
12. Rig down slickline. Rig up HP lines to the Kelly cock
13. Pressure test the HP lines to 2,750 psi against the closed Kelly cock. Open the Kelly cock
14. Pressure up the tubing to 2,500 psi observing packer set. Hold pressure for 10 mins. Bleed off pressure and rig down
15. Rig up HP lines to the annulus and pressure test to 2,500 psi. Open the annulus valve and pressure test the 9 5/8" x 3 ½" annulus to 2,000 psi /10 mins. Bleed off pressure
16. Remove the 3 ½" landing joint
17. Install the 3" H2 BPV in the tubing hanger and pressure test against the blind rams
18. Nipple down the BOPs
19. Nipple up the tubing head adaptor, terminating the Oxmos cable through it. Nipple up the production tree
20. Pressure test the tubing head adaptor ring joint void
21. Perform a production tree body pressure test against the BPV. Note that the production tree valves will have been pressure tested prior to tree installation
22. Install the flow line to the well test package and pressure test. Function the ESD system from all site locations
23. Retrieve the BPV
24. Rig up slickline open hole
25. Pull the prong and plug from the 2.313" nipple
26. Open the 2.75" SSD
27. Run the downhole plunger pump
28. Install the rod BOP on the production tree. Note that the rod BOP is dressed for 7/8" rods and so a crossover will be required from ¾" rods to 7/8" rods for well control
29. Run the plunger pump on rods per the rod design
30. Space out. Install the polished rod with stuffing box. Make up the stuffing box to the rod BOP
31. Install the liner rod pump (LRP) stand and pump
32. Stabilise the LRP as required for continuous pumping operations
33. Attach hydraulic hoses to the LRP. Run up the hydraulic power unit. Function the LRP
34. **Perform flow test on Portland zone 3 per Test Engineers instructions. An indicative programme is included in the Appendices**

8.6 RODDING OPERATIONS

The objective is to remove the rods and downhole pump to allow the completion to be pulled out of hole.

1. Close the rod BOP
2. Hydraulically disconnect the LRP on the wellhead
3. Disconnect and rig down the LRP and lay down
4. Latch onto the polished rod with the crane. Open the rod BOP and pick up and unseat the downhole pump
5. Flow check the well
6. POOH and lay down the polished rod
7. Close the rod BOP. Reverse circulate the well to kill weight brine
8. Open the rod BOP
9. POOH and lay down the remainder of the rod string in triples and the downhole pump, topping up the tubing as required
10. Once the equipment is clear of the production tree, close the production tree valves to provide double valve isolation

8.7 POOH TEST STRING

The objective is to remove the test string to access deeper test zones.

1. Install the H2 BPV in the tubing hanger. Pressure test
2. Nipple down the production tree. Install the seal on the end of the Oxmos data cable
3. Install and pressure test the BOPs per section 8.2 above
4. Install the hydraulic jacking table
5. Check for pressure in the production annulus
6. Release the hanger tie down bolts
7. Release the packer with straight pick up with the jacking table
8. Land the tubing hanger into the bowl. Rig down the jacking table whilst allowing the packer elements to relax for 30 mins
9. Flow check the well on the tubing and annulus
10. POOH the test string, laying out the tubing in singles and spooling the Oxmos cable

8.8 PULL THE WEATHERFORD LOWER RETRIEVABLE BRIDGE PLUG

The objective is to latch the lower retrievable bridge plug, unset and pull out of hole.

The lower Weatherford WRP retrievable bridge plug is an auto j latch retrieval with a straight pull to release.

1. Pull the lower retrievable bridge plug per section 8.4 above. Leave the wear bushing in place

8.9 MILL OUT THE HALLIBURTON EZSV BRIDGE PLUG

The objective is to mill out the bridge plug and push the remains to below the KL3 Test Zone 1 perforations.

1. Pick up the following drilling assembly;

- 8 ½" mill (pre made up to)
- 6 ¾" mud motor (with float installed)
- 4 x 4 ¾" DC
- 3 ½" IF pin x 3 ½" EUE box crossover

2. RIH on 3 ½" EUE tubing
3. Gently tag the EZSV bridge plug. Pull back
4. Space out with pup joints and a crossover. Pick up the square Kelly joint with Kelly cock on top, crossover and chicksan swivel and HP hose attached
5. Circulate bottoms up to ensure brine weights are in equilibrium
6. Install the reactive torque plate in two parts and bolt to the top of the uppermost flange on the BOPs
7. Start circulation and establish up and down weights
8. RIH slowly and tag the bridge plug
9. Mill out the bridge plug with up to 5 k lb weight and 6 bbl/min flow rate. It is not intended to circulate the milled cuttings out of the well, rather re-grind them until the bridge plug is milled through
10. Once through the bridge plug, flow check the well
11. RIH to 3,500 ft pushing the bridge plug debris to bottom
12. Circulate bottoms up
13. Flow check
14. POOH laying out drill collars and mud motor
15. Pick up 9 5/8" scraper assembly with 8 ½" bit below
16. RIH on work string and scrape the 9 5/8" casing down to 3,450 ft
17. Circulate bottoms up
18. Flow check
19. POOH laying out the casing scraper
20. Pull the wear bushing

8.10 RUN THE KL4/3 (TEST ZONE 2/2A AND 1) TEST STRING

The objective is to run a pressure tested test string to selectively test the KL4/3 limestone zones on free flow. There will be the option to revert to testing the Portland test zone 3 with a downhole plunger pump and LRP.

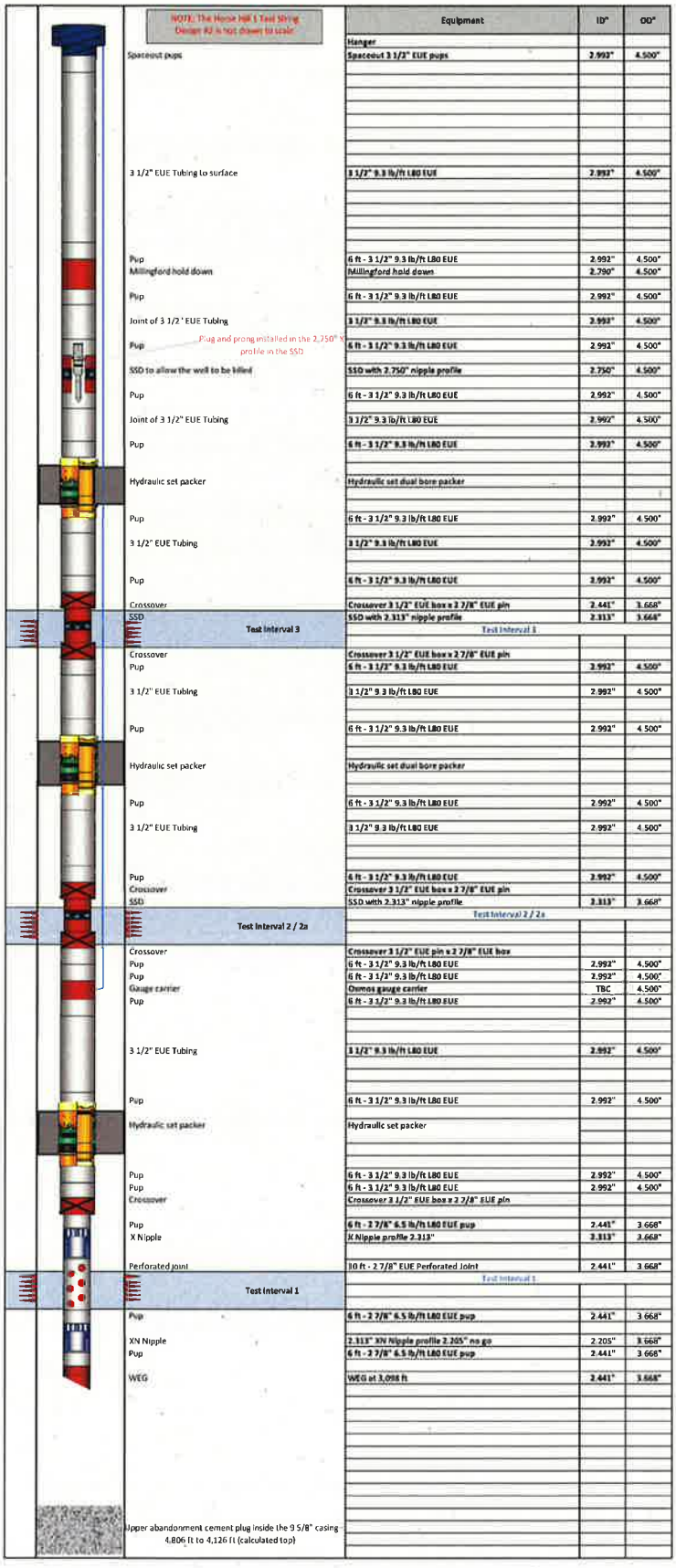
Note;

- all connections are EUE
- to shut in the well, the data cable will be cut and the string lowered so that there is plain tubing across the pipe rams. Ensure a cable cutting tool is on the work platform

- the Oxmos cable will need to be threaded through the two upper packers and termination connectors before terminating the gauge

1. Pick up the test string as follows;

- 2 7/8" WEG with 6 ft pup joint above
- 2.313" XN nipple with 6 ft pup joint above
- Perforated 2 7/8" pup joint 10 ft
- 2.313" X nipple with 6 ft pup joint above
- 3 ½" x 2 7/8" crossover with 6 ft pup joint above
- 9 5/8" x 3 ½" hydraulic set retrievable packer with 6 ft pup joint above and below
- Space out tubing
- 2 7/8" sliding sleeve with 2.313" X nipple, 3 ½" x 2 7/8" crossovers and 6 ft pup joint above and below
- 3 ½" Oxmos gauge carrier with 6 ft pup joint above and below
- Space out tubing
- 9 5/8" x 3 ½" hydraulic set retrievable packer with cable penetration and 6 ft pup joint above and below
- Space out tubing
- 2 7/8" sliding sleeve with 2.313" X nipple, 3 ½" x 2 7/8" crossovers and 6 ft pup joint above and below
- Space out tubing
- 9 5/8" x 3 ½" hydraulic set retrievable packer with cable penetration and 6 ft pup joint above and below
- 3 ½" sliding sleeve with 2.75" X nipple profile with 6 ft pup above and below, **plug and prong installed**
- 3 ½" API pump hold down with 6ft pup above and below



NOTE: The Horse Hill 1 Test String Design #2 is not drawn to scale

	Equipment	ID"	OD"
	Hanger		
Spaceout pups	Spaceout 3 1/2" EUE pups	2.992"	4.500"
3 1/2" EUE Tubing to surface	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Millingford hold down	Millingford hold down	2.790"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Joint of 3 1/2 " EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup (Plug and prong installed in the 2.750" X profile in the SSD)	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
SSD to allow the well to be killed	SSD with 2.750" nipple profile	2.750"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Joint of 3 1/2" EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Hydraulic set packer	Hydraulic set dual bore packer		
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Crossover	Crossover 3 1/2" EUE box x 2 7/8" EUE pin	2.441"	3.668"
SSD	SSD with 2.313" nipple profile	2.313"	3.668"
Test Interval 3	Test Interval 3		
Crossover	Crossover 3 1/2" EUE box x 2 7/8" EUE pin		
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Hydraulic set packer	Hydraulic set dual bore packer		
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Crossover	Crossover 3 1/2" EUE box x 2 7/8" EUE pin		
SSD	SSD with 2.313" nipple profile	2.313"	3.668"
Test Interval 2 / 2a	Test Interval 2 / 2a		
Crossover	Crossover 3 1/2" EUE pin x 2 7/8" EUE box		
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Gauge carrier	Omnes gauge carrier	TBC	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" EUE Tubing	3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Hydraulic set packer	Hydraulic set packer		
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Pup	6 ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Crossover	Crossover 3 1/2" EUE box x 2 7/8" EUE pin		
Pup	6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
X Nipple	X Nipple profile 2.313"	2.313"	3.668"
Perforated joint	10 ft - 2 7/8" EUE Perforated Joint	2.441"	3.668"
Test Interval 1	Test Interval 1		
Pup	6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
XN Nipple	2.313" XN Nipple profile 2.205" no go	2.205"	3.668"
Pup	6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
WEG	WEG at 3,098 ft	2.441"	3.668"
Upper abandonment cement plug inside the 9 5/8" casing 4,806 ft to 4,126 ft (calculated top)			

2. RIH on 3 ½" tubing with cable protection clamps installed across each tool joint. Fill the pipe on the way in the hole.
3. Space out to land the test string on the tubing hanger with the WEG +/- 4 ft above the top KL 3 open perforation
4. Pick up the tubing hanger, make up the Kelly cock on the landing joint and make up HP test lines
5. Pressure test the HP lines to 2,750 psi against the closed Kelly cock. Open the Kelly cock
6. Pressure test the tubing to 250 psi / 5 mins and 2,500 psi / 10 mins. Bleed off pressure and rig down
7. Terminate the Oxmos cable through the tubing hanger. Land the tubing hanger and energise the tie down bolts
8. Rig up slickline open hole with a Kelly cock on the tubing
9. Pull the prong and plug from the 2.75" SSD
10. Run the plug and prong into the 2.313" nipple below the lowest packer
11. Rig down slickline. Rig up HP lines to the Kelly cock
12. Pressure test the HP lines to 2,750 psi against the closed Kelly cock. Open the Kelly cock
13. Pressure up the tubing to 2,500 psi observing packers setting. Hold pressure for 10 mins. Bleed off pressure and rig down
14. Rig up HP lines to the annulus and pressure test to 2,500 psi. Open the annulus valve and pressure test the 9 5/8" x 3 ½" annulus to 2,000 psi /10 mins. Bleed off pressure
15. Remove the 3 ½" landing joint
16. Install the 3" H2 BPV in the tubing hanger and pressure test against the blind rams
17. Nipple down the BOPs
18. Nipple up the tubing head adaptor, terminating the Oxmos cable through it. Nipple up the production tree
19. Pressure test the tubing head adaptor ring joint void
20. Perform a production tree body pressure test against the BPV. Note that the production tree valves will have been pressure tested prior to tree installation
21. Install the flow line to the well test package and pressure test. Function the ESD system from all site locations
22. Retrieve the BPV
23. Rig up slickline open hole
24. Pull the prong and plug from the 2.313" nipple

Perform flow test on KL 3, test zone 1 per Test Engineers instructions. An indicative programme is included in the Appendices.

Flow testing of KL 4, test zone 2/2A, can take place after flow testing of test zone 1 by utilising slickline with pressure control equipment to set plugs and prongs and open sliding sleeves.

Similarly, comingled flow from chosen zones can be initiated in the same way.

8.11 SUSPENSION

1. It is intended that the well will be suspended with the test string in the well. This will provide a selective completion for future production operations if required
2. A deep set plug and prong will be installed and pressure tested and a BPV will be installed in the tubing hanger and pressure tested

3. The production tree will remain installed and all production tree valves will be locked closed. A security cage will be installed around the wellhead.
4. Should the test string need to be POOH, the lower test zones will be killed by bull heading the tubing contents to kill weight fluid. The sliding sleeve above the upper packer will be opened to circulate and hydrostatically balance the annulus and tubing fluids prior to unseating the packers
5. Any new suspension string design will be advised when appropriate

8.12 ACID TREATMENT

Acid treatment is not anticipated but is a contingency operation.

15% HCl will be used with 3% corrosion inhibitor and 0.7% Iron inhibitor – all Chemiphase product.

Acid of higher concentration will be delivered to site and diluted in a mix tank.

Acid will be circulated down the tubing to depth by displacing tubing contents out through the open sliding sleeve above the packer. The sliding sleeve will then be closed to allow injection of the acid to the formation.

Injection pressures will be maintained below formation fracture pressures.

The procedure will be repeated as required.

8.13 TUBING CONVEYED PERFORATING

Tubing conveyed perforating (TCP) is not anticipated but is a contingency operation.

The service provider will be Halliburton.

7" guns will be used in the 9 5/8" casing.

A drop bar detonation system will be utilised.

Perforation will be performed underbalance by injecting Nitrogen from quads into the tubing and displacing tubing contents through an open sliding sleeve. The sliding sleeve will be shut before the detonation bar is dropped.

The procedure will be repeated as required.

9.0 APPENDICES

9.1 INDICATIVE TESTING PROGRAMME

PORTLAND

Rate - bopd	Duration - hours	Cum. Production - bbo	
100	2	8	We may shorten this to 1 hour (and will shorten the shut-in to 12 hours) - to get clear Initial pressure.
0	24	0	See above...
150	40	250	If Oxmos / SRO used rate may be varied to assess maximum rate at this stage. Potential PVT sampling
0	50	250	Buildup to check reservoir parameters
150	960	6,250	Extended production to prove up 8 -12 mmstb. This flow period will likely include a maximum rate above Bubble Point Test.
0	100	6,250	
Cumulative hours	1,176		
Cumulative Days	49		

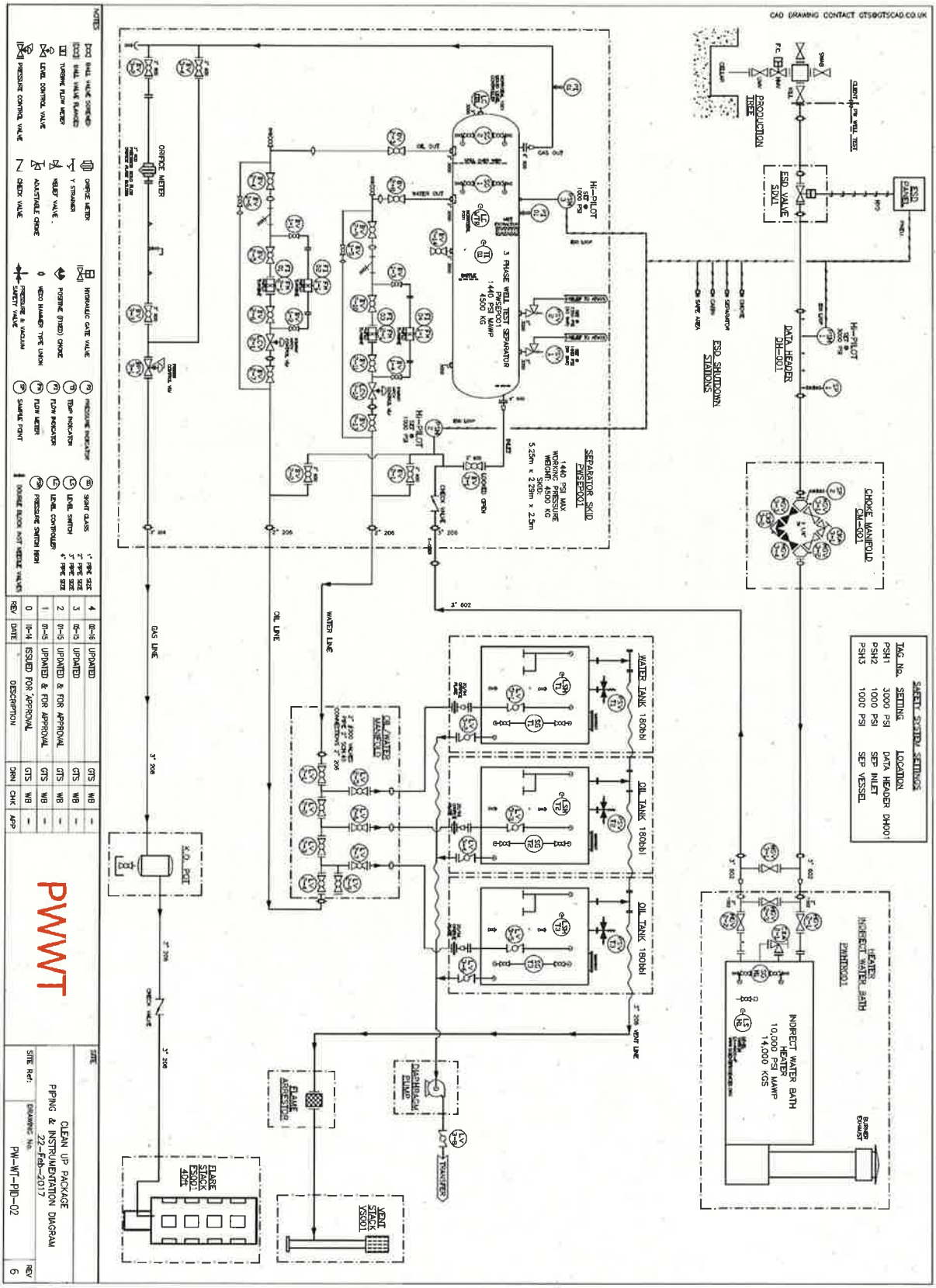
KL4/3 (PER ZONE)

Plus Potential Additional Co-mingled Flow

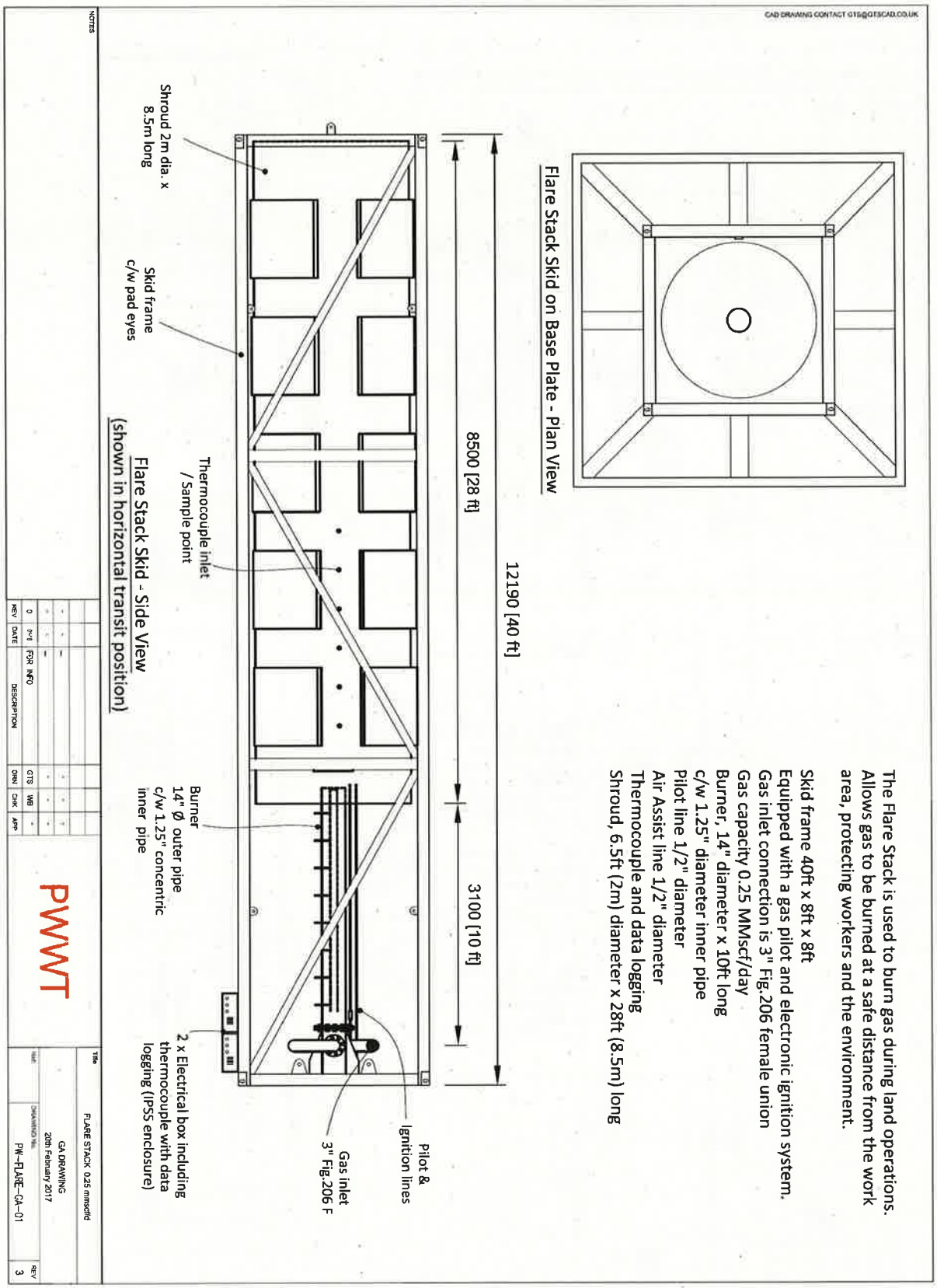
Rate - bopd	Duration - hours	Cum. Production - bbo	
200	2	17	Get initial pressure
0	24	0	See above....
350	40	583	If Oxmos / SRO used rate may be varied to assess maximum rate at this stage. Potential PVT sampling. Potential MPLT on Co-mingled Zone Test.
0	50	583	Buildup to check reservoir parameters
350	400	6,417	Extended production to generate pressure drop // infer range of connected volumes. This flow period will likely include a maximum rate above Bubble Point Test.
0	100	6,417	
Cumuative hours	616		
Cumulative Days	26		

Considerations:
Actual rate will be a function of the calculated PI's of the zones so as to avoid going below bubble point (Pb).
Pb will be being estimated from GOR behaviour and quality of oil / PVT sampling.

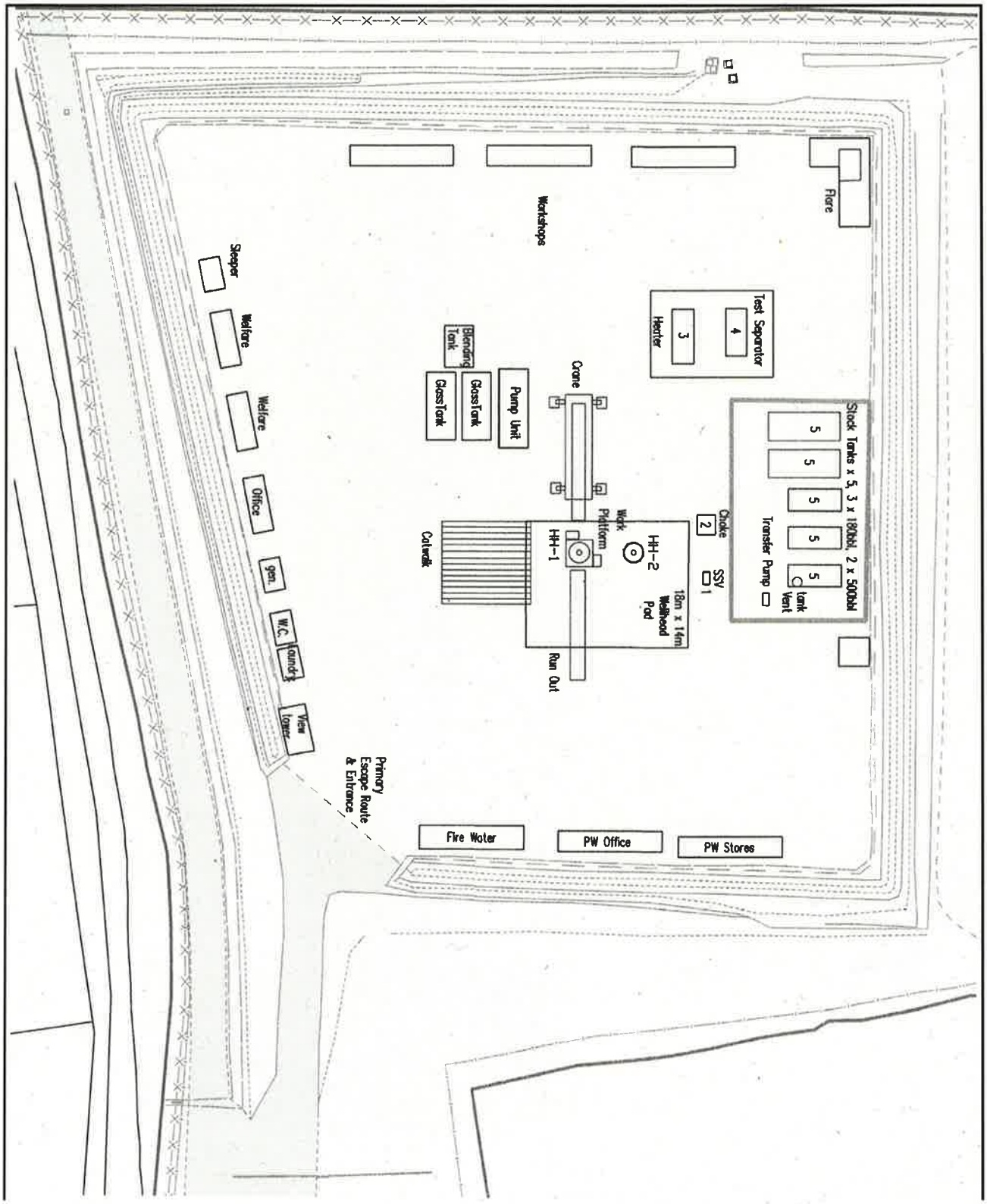
9.2 WELL TESTING PACKAGE P&ID



9.3 FLARE SCHEMATIC



9.4 SITE ARRANGEMENT



9.5 EXPRO SLICKLINE PCE STACK UP

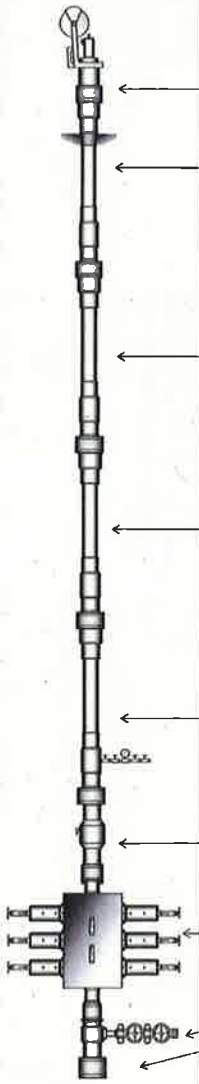
EXPRO

Pressure Control Equipment

Rig Up Drawing

Doc no. INS-003679
Rev no. 2.0
Issued Date: 03/Nov/2016

Location		Well Number		Tree Connection Size & Type	
Job Description		Date		Tree Maximum Working Pressure	



PCE Item Description	Minimum Inside Diameter (Inches)	PCE Item Working Pressure (PSI)	PCE Item Length Decimal Feet	PCE Item Weight Pounds	Expro WLS Number
5" Otis Stuffing Box	0.125	5k PSI	3.20		
5" Otis Lubricator	3"	5k PSI	8.00		
5" Otis Lubricator	3"	5k PSI	8.00		
5" Otis Lubricator	3"	5k PSI	8.00		
5" Otis Lubricator	3"	5k PSI	8.00		
5" Otis Insit U test Sub	3"	5K PSI	2.00		
5" Otis Tripple Wireline Valve, Blind Rams Bottom set Shear Rams	3"	5K PSI	4.00		
2" 1502 Plug Valves		10k PSI			
5" Otis Pump In Sub	5"	5K PSI	2.00		
	Total Available PCE Riser & Lubricator Length (Decimal Feet)		49.20	0.00	Total Riser & Lubricator Weight (Pounds)
	Enter Maximum Toolstring Length (Decimal Feet)		27.00	1000 Kilograms (KG's) = 1 Tonne 1 Tonne = 2204 lbs 1 Metre = 39.36 Inches 1 Metre = 3.2803 Decimal Feet 12 Inches = 1 Foot	
	Safety Gap =		16.20		

Client Supervisor		Expro Senior Representative	
Print		Print	
Sign		Sign	
Has the PCE been cross checked for compatibility with the Toolstring document INS-003678		Signature	

9.6 BOP ARRANGEMENT

To be inserted after supplier is chosen

9.7 WELL SURVEY DATA

HH-1 Provisional definitive survey (Rev 2.0) 31/10/14							
Directions Referenced To Grid North							
Permanent Datum is Mean Sea Level							
Ground Level Elevation 219.45ft AMSL							
Depths Relative To RTE @ 244.45ft AMSL / 25 ft AGL							
Vertical Section Azimuth 331.44° from N0.00 E0.00				Geodetic Datum : OSGB 1936			
Geodetic System : British Coordinate Systems				Geodetic Zone : British National Grid			
MD	INC	AZIMUTH	TVD	N(+)	E(+)	VS	DOGLEG
ft	deg	deg	ft	ft	ft	ft	°/100ft
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
875.00	0.25	105.00	875.00	-0.49	1.84	-1.32	0.03
1185.00	0.25	5.00	1185.00	0.00	2.56	-1.22	0.12
1500.00	0.50	60.00	1499.99	1.38	3.81	-0.61	0.13
1780.00	1.00	215.00	1779.98	-0.01	3.46	-1.67	0.52
1787	13-3/8" casing shoe						
1816.90	0.85	25.35	1816.88	-0.03	3.40	-1.65	5.00
1861.90	0.85	20.41	1861.87	0.58	3.65	-1.23	0.16
1906.40	0.81	18.93	1906.37	1.19	3.87	-0.81	0.10
1945.40	1.07	9.77	1945.36	1.81	4.02	-0.33	0.77
1991.40	3.04	359.78	1991.33	3.45	4.09	1.08	4.34
2035.80	5.12	353.20	2035.62	6.60	3.85	3.95	4.79
2081.00	6.90	351.36	2080.57	11.29	3.21	8.38	3.96
2125.20	7.95	353.47	2124.40	16.95	2.46	13.71	2.45
2169.40	9.33	345.15	2168.10	23.45	1.19	20.02	4.20
2214.00	10.78	342.03	2212.01	30.91	-1.02	27.64	3.47
2257.70	12.46	340.10	2254.81	39.23	-3.89	36.32	3.95
2302.00	14.34	340.41	2297.91	48.89	-7.35	46.46	4.25
2346.80	15.90	339.52	2341.15	59.87	-11.36	58.02	3.52
2390.70	17.23	340.00	2383.23	71.61	-15.69	70.40	3.05
2434.00	18.64	339.11	2424.43	84.11	-20.35	83.60	3.32
2478.30	19.59	339.09	2466.28	97.66	-25.52	97.98	2.14
2525.40	20.21	336.21	2510.57	112.48	-31.62	113.91	2.46
2566.50	20.74	331.66	2549.08	125.38	-37.94	128.26	4.08
2610.70	21.71	328.59	2590.28	139.25	-45.92	144.26	3.34
2659.40	23.55	328.80	2635.23	155.26	-55.65	162.97	3.78
2703.40	25.72	330.57	2675.22	171.09	-64.90	181.30	5.21
2748.20	28.25	330.85	2715.14	188.82	-74.84	201.63	5.65
2792.10	30.74	331.44	2753.35	207.75	-85.27	223.24	5.71
2835.20	33.09	331.82	2789.93	227.80	-96.09	246.02	5.47
2879.00	35.25	332.28	2826.17	249.53	-107.62	270.62	4.97
2922.80	37.03	331.58	2861.53	272.32	-119.78	296.45	4.17
2968.00	38.22	331.70	2897.33	296.60	-132.88	324.04	2.64
3011.70	39.63	331.90	2931.33	320.80	-145.86	351.50	3.24
3053.90	40.71	332.77	2963.58	344.91	-158.49	378.71	2.88
3101.60	42.73	333.00	2999.18	373.16	-172.96	410.44	4.25
3145.50	44.94	333.30	3030.84	400.29	-186.69	440.83	5.06
3188.40	45.02	333.31	3061.19	427.38	-200.31	471.14	0.19
3234.40	44.98	331.59	3093.72	456.22	-215.36	503.66	2.65
3277.70	44.76	331.76	3124.40	483.11	-229.85	534.21	0.58
3324.40	44.31	331.21	3157.69	511.89	-245.48	566.96	1.27
3368.60	44.84	329.79	3189.18	538.89	-260.76	597.98	2.55

3413.40	44.46	329.70	3221.05	566.08	-276.62	629.45	0.86
3457.40	44.11	329.53	3252.55	592.58	-292.16	660.15	0.84
3501.80	44.04	329.69	3284.45	619.23	-307.79	691.02	0.30
3546.80	43.57	329.55	3316.92	646.10	-323.54	722.16	1.07
3589.80	43.20	329.50	3348.17	671.55	-338.52	751.68	0.86
3633.60	42.87	329.61	3380.19	697.32	-353.67	781.55	0.77
3679.30	42.53	329.60	3413.77	724.06	-369.35	812.53	0.74
3725.10	43.60	330.85	3447.23	751.20	-384.87	843.79	2.99
3769.40	43.95	331.15	3479.22	778.01	-399.73	874.44	0.92
3812.60	43.62	331.09	3510.41	804.18	-414.17	904.33	0.77
3857.20	42.98	331.07	3542.87	830.95	-428.96	934.92	1.44
3902.10	42.77	331.16	3575.77	857.70	-443.72	965.47	0.49
3947.30	43.32	330.48	3608.81	884.64	-458.76	996.32	1.59
3989.60	43.57	330.54	3639.52	909.96	-473.08	1025.40	0.60
4034.40	44.70	331.55	3671.67	937.26	-488.18	1056.60	2.97
4077.70	44.61	332.16	3702.47	964.09	-502.53	1087.03	1.01
4123.40	44.04	332.15	3735.16	992.32	-517.45	1118.96	1.25
4168.20	43.65	332.59	3767.47	1019.82	-531.84	1149.99	1.10
4212.70	43.36	332.47	3799.75	1047.00	-545.97	1180.61	0.68
4257.20	43.16	332.74	3832.16	1074.07	-560.01	1211.10	0.61
4301.80	42.71	332.87	3864.81	1101.10	-573.89	1241.48	1.03
4345.40	42.30	332.84	3896.95	1127.31	-587.33	1270.93	0.94
4390.40	41.94	332.96	3930.33	1154.18	-601.08	1301.10	0.82
4435.30	40.52	332.16	3964.10	1180.44	-614.71	1330.68	3.37
4479.80	40.44	331.90	3997.95	1205.95	-628.26	1359.57	0.42
4524.90	40.55	331.94	4032.24	1231.79	-642.05	1388.86	0.25
4567.40	40.35	332.10	4064.59	1256.14	-654.98	1416.43	0.53
4611.90	39.70	331.62	4098.66	1281.38	-668.48	1445.04	1.62
4657.00	39.21	330.97	4133.49	1306.52	-682.24	1473.70	1.42
4701.20	37.41	329.73	4168.17	1330.33	-695.79	1501.10	4.43
4790.80	33.26	327.47	4241.25	1374.57	-722.74	1552.84	4.86
4835.90	32.68	327.31	4279.08	1395.25	-735.96	1577.32	1.30
4880.80	32.20	327.19	4316.98	1415.51	-748.99	1601.34	1.08
4923.90	31.45	327.19	4353.60	1434.61	-761.31	1624.01	1.74
4968.40	30.36	327.11	4391.78	1453.81	-773.71	1646.80	2.45
5058.60	25.91	327.46	4471.30	1489.58	-796.70	1689.21	4.94
5102.00	24.37	327.62	4510.59	1505.14	-806.59	1707.60	3.55
5146.80	24.04	327.87	4551.45	1520.67	-816.39	1725.93	0.77
5190.80	23.38	327.78	4591.74	1535.65	-825.82	1743.59	1.50
5234.60	21.98	327.46	4632.15	1549.91	-834.86	1760.44	3.21
5279.40	20.75	326.64	4673.87	1563.61	-843.73	1776.71	2.83
5324.70	20.03	326.41	4716.33	1576.77	-852.44	1792.44	1.60
5369.50	18.91	326.14	4758.57	1589.19	-860.73	1807.31	2.51
5414.40	17.85	325.10	4801.18	1600.88	-868.72	1821.39	2.47
5455.80	16.93	324.31	4840.68	1610.98	-875.87	1833.68	2.29
5502.30	16.30	324.19	4885.24	1621.77	-883.63	1846.87	1.36
5546.30	15.32	324.01	4927.58	1631.48	-890.66	1858.76	2.23
5589.60	14.12	324.15	4969.46	1640.39	-897.12	1869.67	2.77
5634.50	12.99	324.12	5013.10	1648.92	-903.28	1880.11	2.52
5678.40	11.99	324.35	5055.96	1656.62	-908.83	1889.53	2.28
5721.90	10.77	324.09	5098.61	1663.58	-913.85	1898.05	2.81
5766.90	10.55	324.65	5142.83	1670.35	-918.70	1906.31	0.54

9.8 9 5/8" CASING TALLY

To be inserted

9.9 CRANE LIFT PLAN

To be inserted following award of crane services contract

9.10 TECHNICAL RISK ASSESSMENT

Draft Technical Risk Assessment

Discipline:	Horse Hill 1 Crane operations								**Risk Assessment Ref:**		
Assessment Team:	Richard Sands								**Date of Assessment:**		07/03/2018
Activity/Element	**Potential Hazards**	**Preliminary Risk Rating**			**Action to be Taken to Control and Mitigate Risk**	**Residual Risk Rating**			**Residual Risks**	**Comments**	
		L	C	R		L	C	R			
Competent contractors and wells team	Inability to perform to expected standards Unsuitable equipment specification Inexperienced operators Low standard of equipment Familiarity with tools and workspace Unfamiliar with operating onshore UK	2	4	8	Tendering process to select competent contractors based on HSE, experience, technical ability and quality Pre-contract supplier engagement meetings to identify weaknesses Approved well programme which defines equipment specification and requirements Personnel CVs provided upfront by service provider to identify suitable site operators and reviewed Wells team with experience of crane operations on deep wells Specialist equipment developed and provided for crane operations Use of bona fide suppliers of rental equipment with quality assurance systems in place, industry experience, longevity of supply and certified equipment Certification of equipment to be checked on delivery to site (or before) before use	1	2	2			
Well preparation	HSE delay Specification and condition of production casing and wellhead equipment Well flow whilst BOPs being installed Unsuitable finished wellhead height Wellhead not installed with level flange Dropped objects Damage to equipment Seal area damage	4	3	12	Work programme submitted to HSE by KOGL in a timely manner Well was constructed in 2017 with all new materials Leak in 7" production casing is understood and will be investiagted as part ofthe well work programme Tubing plug will be installed in the tubing and BPV will be installed in the tubing hanger and pressure tested prior to production tree removal Site Supervisor trained in well control to IWCF level 4 Wellhead height is understood and the programme of works is developed with this understanding Wellhead flange is level and 13 3/8" casing is near vertical Hole cover used wherever possible Lifts over well planned and executed by competent personnel with certified lifting equipment and supervision Good practice for lifting operations followed	1	3	3			
Site	Poor ground conditions Insufficient ground loading capability Inability to operate effectively Pollution due to spillage on site Inability to perform tasks due to site size/layout Existing facilities and services Standing surface water Lack of cellar integrity	4	4	16	Site constructed in 2015 and provided a stable platform for drilling and well testing operations Ground loading tests completed and acceptable for crane operations Site investigation report carried out prior to site design and engineeres site design Appointed Person (AP) to visit site and confirmed crane position acceptable for chosen cranes and loads Site layout drawing developed for this operational phase Input from service providers on site layout AP to specify crane mat requirements Site has been shown to exhibit good drainage properties Equipment containing fuel to be bunded or temporary bunds installed beneath Bunds/drip trays available for mobile equipment and IBCs of fluids Spill kit available on site COSHH stores on site Potential for minor brine spills possible but considered acceptable Control of site adopted by KOGL Site Supervisor Cellar integrity has been proven in 2017	1	4	4			
Control of site	Stolen equipment Public interference with site operations Third party interference with site operations Non-permitted operations Non-adherence to traffic management Planning restrictions Planning permission Poor communication Uninformed workforce SIMOPS	3	3	9	Security controling access 24/7 Secure store for small items Out of hours emergency number for reporting of issues by members of public Fencing around site with signage KOGL liaison committee with locals Daily site permitting defined in Site Safety Document KOGL TMP in place TMP formally advised to service providers and transport companies Site planning permission in place and restrictions well understood Permit to work system in place Banksman to guide all trucks onsite All ignition sourcesleft at site gates Roles and responsibilities defined within work programme, with clear lines of reporting	1	3	3			
	Personnel onsite unaware of procedures and hazards Damage to equipment 3rd Party equipment arrival not in a timely manner Insufficient lifting capability for rigging up Incompatibility between interfaces Incorrect/unsuitable equipment for interfaces Weather Deliveries Insufficient resource Equipment shortage Insurances				All personnel to be inducted prior to commencing work onsite. All operations to be covered in a pre job briefing, capturing all personnel Lifts planned by AP and carried out by lifting Banksman Input from Site Supervisor to prevent damage to equipment Lifting Banksman to be identified by wearing of different coloured hi vis vest and not to be involved in any physical handling of loads Keep clear of tag lines when in use Tools correct for application No lifting over live equipment or people Relevant lifting certificates to be supplied by 3rd party All load weights to be made available to crane company for lift plan implementation Permit to work required for all tasks - issued by permit controller Agree site layout drawing before operations commence Traffic movement onto site to be controlled by site security and directed to a suitable holding point and only authorised personnel allowed access Equipment to be unloaded with cranes and telehandler if load is suitable and stable for telehandler to lift in a controlled manner Procedure for access to back of trailer to be followed using dedicated steps						
Mobilise and rig up equipment / Demobilise and rig down		4	4	16	Cargo summary sheet provided, confirming equipment is correctly loaded out when sent from service company Lifting equipment certified and within inspection period. Checked prior to use Interfaces checked and pre-operations meeting held to go through programme with supervisors Load out list generated from a detailed programme of works Detailed work programme Crane and lighting towers earthed in case of lightning Weather forecast checked on a regular basis Traffic management plan in place for access to site Correct manual handling procedure and trained personnel Central logistics focus for project Light vehicle parking area at site Single vehicle for travel to/from site per service provider Pre-operations meeting held to discuss resource Daily operational conference call to discuss ongoing resource requirement Crane fitted with anemometer Segregate work areas - pedestrian barriers Equipment provided by bona fide providers equipment function tested or checked by service operators prior to use Certification pack provided by service providers Insurances to be checked for logistic companies to ensure suitable cover	2	3	6			

	Installation and pressure testing of BOPs	Damage to wellhead Incompatible BOP fittings Dropped objects Working at height Equipment incompatible with wellhead Crane operations Equipment not certified for required pressure BOPs do not operate Insufficient access Equipment configuration Failure of testing equipment Failure of test Stored energy	3	3	9	All lifting mitigations in place as per mob/demob Single source BOP and operating system Hole cover used when possible Platform to be installed over cellar if required for access during nippling up of BOPs Detailed work programme reviewed and signed off All pressure equipment procured from third party suppliers with adequate QA systems for pressure certification and functionality All certification to be checked on delivery to site BOP and Koomey system to be function tested after installation 3 1/2" landing joint available on site for pressure test Equipment connections torqued correctly New or fully inspected equipment with certification (if applicable) Spare ring gaskets available on site Blind rams pre-tested before delivery to site if no BOP outlet below blind rams All HP line connections to be whip checked Site Supervisor to witness and sign off all pressure tests Calibrated chart recorder to be used	1	3	3		
	Installation of jacking table	Dropped objects Insufficient support for jacking table on BOPs Insufficient stroke on jacking unit Insufficient lift capacity on the jacking table Jacking table not certified for load Clash of jacking table with working platform Personnel unfamiliar with jacking table and operating pump Over pressurisation of jacking table hydraulic system	3	4	12	Certified lifting equipment Utilise crane and Appointed Person to plan the lift 7 1/16" x 13 5/8" DSA to be installed on top of BOPs to to provide a 26" 'table' for the jacking table to sit on. Jacking table designed to sit on this circular support Travel of hydraulic jacks designed to provide acceptable stroke (10") in relation to an overall pragmatic height for the table Jacking table designed for 200 k lb jacking capability. Expected packer release is +/- 120 k lb Jacking table certified after manufacture with load test Jacking table will sit above work platform Personnel will be trained in operation of jacking table and HP hydraulic pump Jacking table hydraulic system and jacks raled to 5,000 psi. Pressure dump valve required to ensure pressure does not exceed this value	1	4	4		
	Puling and running tubing	Ability to run tubulars without rig Stuck BHA Casing damage Wellhead damage Damage to wear bushing and tie down bolts Unsuitable handling equipment and tong Incorrect make up Inadvertant operation of blind rams Damage to tubing threads	4	3	12	Certified and inspected tubular handling equipment Procedures and risk assessments understood by all personnel Correct running techniques used including safety clamp where required Operators with comparable experience utilised for rigless operations Drilling Advisor with experience of riglesk operations Handling equipment checked on site for compatibility prior to running string Detailed work programme and pre-job brief for all personnel Assemblies made up off-site if required Minimise size of tubulars and number of make ups Check pick up/set down weights at start and periodically throughout operations Detailed pipe tally checked by Site Supervisor plus one other ODs of equipment callipered Wear bushing installed Length of tie down bolts understood for both engaged and retracted positions Handling equipment checked on site for compatibility prior to running string All lifting and crane mitigations as per mob/demob Blind rams locked out during casing running operations Tubing thread protectors installed on tubing threads whilst lifting to work floor TRS contractor to utilise own racking equipment New or inspected casing to be used with certification	2	2	4		
	Pressure testing 7" casing for locating leak	Failure of test Pump failure Overpressure Uncalibrated chart recorder Packer not set correctly HP Lines	4	3	12	New certified premium connection casing, torque turned and visually inspected prior to installation Certified pump, lines and fittings Detailed work programme, pre-job brief and DWOP Pump to be maintained as per manufacturers requirements Mechanical packer can be un-set and re-set as often as required All HP lines to be whip checked Chart recorder to be calibrated	1	3	3		
	Wireline operations	Unable to get tools to bottom Well control Stuck tool	1	3	3	Wireline run in newly installed 7" casing with no history of damage issues 7" casing is clean, with only clean fluids introduced Overbalanced fluid in the well Wireline tools run through the BOPs Wire cutter available if the wire has to be cut and the blind rams closed Wireline fishing tools to be available on wireline truck	1	3	3		
	Squeeze cementing operations	Incorrect placement procedure Cement quality Pump failure Water supply Cement traces in well Water source unsuitable Bottom hole temperature Brine / Slurry contamination Unable to manage returns at surface	4	4	16	Modelling performed by service provider that defines rheology and injection rates for spacer and cement Specific cementing procedure issued to site Contractor supervised by Site Supervisor Pump spacer ahead to clean perforation tunnels and behind to clean drill string Perform contamination test between brine and cement slurry Cement samples taken Cement lab test utilised actual cement powder and additives to be used Site Supervisor confirms mix water recipe mixed on site Competent and specialist service provider with relevant experience Volumes are small and pump failure on such a short operation is unlikely Lab testing of thickening time and slurry contamination confirms slurry pumpable for duration of operations Chloride testing onsite of freshwater Low temperatures - 30 - 40 deg C Use of spacer to separate brine and slurry Returns to be contained as per line drawing	1	4	4		
	Clean out after squeeze cementing operations	Handling mud motor Reactive torque in tubing Suitable hole cleaning	4	3	12	Mud motor made up to bit and crossover back to tubing prior to transport to site Reactive torque transmitted up the tubing reduced due to hole angle and depth Back up tong installed on tubing whilst drilling and anchored with suitable snubbing line Suitable pump to provide sufficient flow rate to clean hole with non viscous fluid	2	2	4		
	General	HSE Issues	5	4	20	**Refer to Site Safety Document.**	2	2	4		

10.0 GLOSSARY OF TERMS

ABANDON: When production is stopped from a well that is depleted and no longer capable of producing profitably. A wildcat well may also be abandoned after it has been determined that it will not produce.

ACIDISING: Treatment of oil-bearing limestone or carbonate formations with a solution of diluted (15% planned) hydrochloric acid and other chemicals to clean up the well and the near well bore. Otherwise knows as an acid wash. The acid enters the formation at low pressure, where it enlarges the flow channels near to the well bore by dissolving the limestone.

BIT: The cutting or boring element used in drilling oil and gas wells.

BLOWOUT: Uncontrolled flow of gas, oil, or other well fluids from a well during drilling due to formation pressure exceeding the pressure exerted by the column of drilling mud.

BLOWOUT PREVENTER (BOP): Hydraulically or mechanically actuated high pressure valve installed at the wellhead to control pressure within the well.

BRING IN A WELL: Act of completing and brining a well into production.

CAP ROCK: Impermeable rock overlying an oil or gas reservoir that tends to prevent migration of the reservoir fluids from the reservoir.

CAPPED WELL: A well capable of production but lacking wellhead installations and a pipeline connection.

CASING: Steel pipe threaded together and cemented into a well as drilling progresses to prevent the wall of the hole from caving in during drilling and to provide a means of extracting oil/gas if the well is productive.

CASING HEAD: Heavy steel fitting that connects the first string of casing and provides a housing for the slips and packing assemblies by which subsequent strings of casing are suspended and the annulus sealed off.

CASING STRING: Total feet of casing run in a well.

CATWALK: Steel platform immediately in front of the derrick substructure on which joints of drill pipe are stored prior to being lifted to the derrick floor by the catline.

CENTRALIZERS: Spring steel guides attached to the casing which help keep it centred in the hole and thus provide for a uniform cement sheath around the casing pipe.

CHRISTMAS TREE: Valves, pipes, and fittings assembled at the top of a completed well used to control the flow of oil and gas.

CIRCULATE: Cycling of the drilling fluid through the drill string and wellbore while drilling is temporarily suspended. This is done to condition the drilling fluid and wellbore before drilling proceeds.

CLOSE IN: To shut in (temporarily) a well that is capable of production.

COMPLETE A WELL: Finish the work on a well and bring it to a productive state.

CONDENSATE: Mixture of pentanes and heavier hydrocarbons that may be contaminated with sulphur compounds and is recovered or recoverable form an underground reservoir. It is gaseous in its virgin state but is liquid under the conditions at which its volume is measured.

CORE: Cylindrical sample taken from a formation for the purpose of examination or analysis.

CUTTINGS: Fragments of rock dislodged by the bit and brought to the surface in the drilling mud.

DERRICK: Load-bearing tower like framework over an oil/gas well which holds the hoisting and lowering equipment.

DERRICKHAND: Crew member whose work station is in the derrick while pipe is being hoisted or lowered into the hole. He is usually next in line of authority under the driller.

DEVELOPMENT WELL: Well drilled for oil and gas within a proven field or area for the purpose of completing the desired pattern of production.
DIRECTIONAL DRILLING: Controlled drilling at a specified angle from the vertical.
DISCOVERY WELL: Exploratory well which discovers a new oil/gas field (see WILDCAT).
DOGHOUSE: Small house located on the rig floor or nearby that is used as an office for the driller and as a storage place for small tools.
DOG LEG: A sharp change of direction in the wellbore or an elbow caused by such a change in direction.
DOWNTIME: When rig operations are temporarily suspended because of repairs or maintenance.
DRAWWORKS: Hoisting mechanism on a drilling rig which spools off or takes in the drilling line and thus raises or lowers the drill string and bit.
DRILL PIPE: Steel pipe, in approximately 30-foot (9-metres) lengths, screwed together to form a continuous pipe extending from the drilling rig to the drilling bit at the bottom of the hole. Rotation of the drill pipe and bit causes the bit to bore through the rock.
DRILL STEM TEST (DST): Conventional method of testing a formation to determine its potential productivity before installing production casing in a well. A testing tool is attached to the bottom of the drill pipe and placed opposite the formation to be tested which has been isolated by placing packers above and below the formation. Fluids in the formation are allowed to flow up through the drill pipe by establishing an open connection between the
formation and the surface.
DRILL STRING: String of individual joints of pipe that extends from the bit to the kelly and carries the mud down to, and rotates, the bit.
DRILLING FLUIDS: While a mixture of clay and water is the most common drilling fluid, wells can also be drilled with air, natural gas, oil, or plain water as the drilling fluid.
DRY HOLE: Generally, refers to any well that does not produce oil or gas in commercial quantities.
DUAL COMPLETION: Completion of a well in which two separate formations may be produced at the same time. Production from each zone is segregated by running two tubing strings with packers, or running one tubing string with a packer and producing the other zone through the annulus.
ELEVATOR: Clamp which grips a stand or column of casing, tubing, drill pipe, or sucker rods so that it can be raised or lowered into the hole.
EXPLORATION WELL: Well drilled in unproven territory (See WILDCAT).
FAULT: Geological term denoting a break in the subsurface strata.
FISH: Any undesirable object accidentally lost in the wellbore which must be removed before drilling can continue.
FISHING: Encompasses both the special equipment and the special equipment and the special procedures required to remove undesirable objects from the wellbore.
FLOORHAND: Crew member whose work station is primarily about the rig floor. There are normally tow floor hands on each drilling crews.
FLOWING PRESSURE: Pressure registered at the wellhead of a flowing well.
FORMATION: Sedimentary bed or deposit composed substantially of the same minerals throughout and distinctive enough to be a unit.

GAS CAP: Free gas, separate from, but overlying an oil zone that occurs within the same producing formation as oil. Since gas is lighter, it occupies the upper part of the reservoir.
GEOLOGIST: Scientist whose duties consist of obtaining and interpreting data dealing with the earth's history and its life, especially as recorded in rocks.

GEOLOGRAPH: Patented apparatus which automatically records the rate of penetration and depth during drilling operations.
HORIZON: Distinct layer or group of layers of rock.
HYDROCARBONS: Organic chemical compounds of hydrogen and carbon whose densities, boiling points, and freezing points increase as their molecular weights increase. The molecular structure of the most common petroleum hydrocarbon compounds varies from the simplest - methane, a constituent of natural gas - to the very heavy and complex.
JET BIT: Bit having nozzles of various sizes through which the drilling fluid is directed to achieve a desired fluid velocity.
JOINT: One length of drill pipe or casing.
JUNK: Debris lost in the hole.
KELLY: Square or hexagonal steel pipe about 43 feet (13 metres) long which transmits torque from the rotary table to drill string, thus rotating the string and bit.
KILLING A WELL: The act of bringing a well under control which has blown out or is threatening to blow out; also, applies to the procedure of circulating water and mud into a completed well before starting well service operations.
LATCH ON: Attaching elevators to a section of pipe.
LAYING DOWN PIPE: The operation of pulling drill pipe or tubing from the hole and laying it down on the pipe rack.
LEDGE: An irregular wellbore caused by penetration of alternating layers of hard and soft formations where the soft formation has washed out and caused a change of diametrical size.
LOST CIRCULATOIN: Loss quantities of whole mud to a formation, usually cavernous, fissured, or coarsely permeable beds. It is indicated by the complete or partial loss of drilling mud returns. Until the zone in which the drilling fluid has been lost is sealed off, drilling cannot be resumed in most cases.
MAKE A CONNECTION: Act of screwing a single joint of drill pipe into the drilling string suspended in the wellbore. The addition of this joint of pipe permits deepening of the hole the length of the joint added, or about 30 feet (9 meters).
MAKING A TRIP: Hoisting of the drill string out of, and returning it into, the wellbore. This is done for the purpose of changing bits, preparing to take a core, etc.
MAKING UP A JOINT: Act of screwing a joint into another section of pipe.
MAST: Portable derrick capable of being erected as a unit, as opposed to a standard derrick, which cannot be raised to a working position as a unit, since it is of bolted construction and must be assembled part by part.
MIGRATION: Natural movement of oil or gas within or out of a formation.
MIXING MUD: Preparation of drilling fluids from a mixture of water and other fluids and one or more of the various dry mud-making materials such as clay, chemical, etc.
MONKEY BOARD: Platform on which the derrick hand works during the time the crew is making a trip.
MOUSE HOLE: Hole drilled under the derrick floor and temporarily cased in which a single joint of pipe is placed awaiting connection to the drill string.

MUD: Usually colloidal suspensions of clays in water with chemical additives that are circulated through the wellbore during rotary drilling and workover operations. Can use oil as the main medium.
MULTIPLE-ZONE WELL COMPLETION: Completion of a well in such a way that production is obtained from several different formations.
OFFSET WELL: Well location adjoining another well site.
OILFIELD: Loosely defined term referring to an area where oil is found. May also include the oil reservoir, the surface and wells, and production equipment.
OPEN HOLE: Uncased part of a well.

PENETRATION, RATE OF: Rate at which the drill bit proceeds in the deepening of the wellbore and usually expressed as feet (meters) per hour.
PERFORATE: To pierce holes through well casing within an oil or gas-bearing formation by means of a perforating gun lowered down the hole and fired electrically from the surface. The perforations permit production from a formation which has been cased off.
PERMEABILITY: Capacity of a porous rock formation to allow fluid to flow within the interconnecting pore network.
PIPE: Oilfield tubular goods such as casing, drill pipe, tubing, or pipeline.
PLUG: Object or device that serves to block a hole or passageway such as a cement plug in a borehole.
PLUG AND ABANDON: Act of placing cement plugs in a hole to prevent unwanted vertical migration in an abandoned well.
POROSITY: Volume of pore spaces between mineral grains expressed as a percentage of the total rock volume. Thus, porosity measures the capacity of the rock to hold oil, gas, or water.
POTENTIAL: Actual or maximum volume of oil and/or gas that a well is capable of producing.
PRODUCTION: The operation of bringing the well fluids to the surface and separating them, and storing, gauging, and otherwise preparing product for the pipeline. Also, refers to the amount of oil or gas produced over a given period.
RATHOLE: Shallow bore under the derrick substructure in which the Kelly joint is temporarily set while making a connection.
RESERVOIR: Porous, permeable sedimentary rock structure or trap containing oil and/or gas. A reservoir can contain more than one pool.
RIGGING UP: Act of getting a rig assembled and ready to start drilling.
ROTARY DRILLING: Method of drilling in which the drill pipe is rotated to rotate a bit.
ROTARY TABLE: Equipment over the wellbore which transfers power from the engines to produce a rotary motion. Via bushings and gears the rotary motion is transferred to the kelly and through to the drill string.
SANDFRAC: Method of fracturing subsurface rock formations by injection of fluid and sand under high pressure to increase permeability. Fractures induced in the rock by the hydraulic pressure are kept open by the grains of sand.
SEISMOGRAPH: Apparatus used to measure and record vibrations in the earth. It is used to detect possible oil-bearing structures.
SET CASING: Installation of steel pipe or casing in a wellbore, normally cemented in place by surrounding it with a wall of cement.
SIDE TRACKING: Drilling past an obstruction in the hole, usually done using a special tool known as a whipstock.

SINGLE: One joint of drill pipe.
SLIM HOLE DRILLING: Drilling in which the hole size is smaller than the conventional hole diameter, enabling the operator to run smaller casing, thereby decreasing the cost of completion.
SPECIFIC GRAVITY: Ratio of weight of any substance to weight of equal volume of another substance, usually water as the standard for solids and liquid.
SPUD OR SPUDDING IN: Commencement of actual drilling of well.
STABILIZER: A centralizer installed in the drill string to centre the string in the hole and to stiffen the string to resist bending and deviation.
STEP-OUT WELL: Well drilled adjacent or near to proven well to ascertain the limits of the reservoir.
STRATIGRAPHIC TRAP: Subsurface formation created by sedimentation that might trap an accumulation of oil and/or gas.
STRING: The entire length of casing, tubing, or drill pipe.

STRUCTURE: Subsurface geological feature capable of acting as a reservoir for oil and/or gas.
STUCK PIPE: Drill pipe, casing, or tubing that cannot be worked in or out of the hole as desired.
SUBSTRUCTURE: Foundation on which the derrick and engines sit. Contains space for storage and well control equipment.
SURFACE CASING: First string of casing set in well.
SWABBING: Operation using a swab to bring well fluids to the surface when the well does not flow naturally.
TIGHT HOLE: Drilling a well in which the information obtained is restricted and passed only to those authorized to receive it.
TOOLPUSHER: Foreman in charge of the drilling rig operations and crew members.
TOTAL DEPTH (TD): Maximum depth reached in a well.
TRAP: Any geological structure which precludes the migration of oil and gas through subsurface rocks, causing the hydrocarbons to accumulate into pools.
TRIPPING: Making a trip; operation of hoisting pipe out of, and returning it to, the wellbore.
TURNING TO THE RIGHT: Slang term referring to actual drilling time as opposed to repair time, trip time, etc.
TURNKEY CONTRACT: Contract under which contractor carries out and completes his assignment for a fixed fee, as opposed to working on per diem basis.
TWIST-OFF: To fracture a joint of drill pipe in two, necessitating a recovery or fishing operation.
WAITING ON CEMENT (W.O.C.): Time period that drilling is suspended while the cement used to hold casing in the wellbore hardens.
WELLBORE: The hole made by a drilling bit.
WELL COMPLETION: See COMPLETE A WELL.
WELL LOGGING: Recording information about subsurface geologic formations; methods include records kept by the driller, mud and cutting analysis, core analysis, drill stem tests, electric and radioactivity procedures.
WHIPSTOCK: Long steel wedge used to deflect the bit from the original borehole at a slight angle for controlled directional drilling, for straightening crooked holes, and for side tracking in or to bypass an irretrievable fish.
WORKOVER: To carry out remedial operations on a producing well with the intention of restoring or increasing production.

11.0 ABBREVIATIONS

ACF – Annular Capacity Factor
AV – Annular Velocity
BF – Buoyancy Factor
BHA – Bottom Hole Assembly
BHP – Bottom Hole Pressure
BOP – Blow Out Preventer
CP – Casing Pressure
DC – Drill Collar
DP – Drill Pipe
ECD – Equivalent Circulating Density
ESP – Estimated Stuck Point or Electrical Submersible Pump

FCP – Final Circulating Pressure
FD – Fluid Density
FIT – Formation integrity test
FP – Formation Pressure
FV – Funnel Viscosity
GPM – Gallons Per Minute
HHP – Hydraulic Horse Power
HP – Hydrostatic Pressure
IBOP – Inside Blow Out Preventer
ICP – Initial Circulating Pressure
ISICP – Initial Shut-in Casing Pressure
KMW – Kill Mud Weight
KOP – Kick Off Point
LC – Lost Circulation
LCM – Lost Circulation Material
LOT – Leak Off Test
LTOBM – Low Toxicity Oil Based Mud
MAASP – Maximum Allowable Annular Surface Pressure
MASP – Maximum Anticipated Surface Pressure
MD – Measured Depth
MISICP – Maximum Initial Shut-in Casing Pressure
MW – Mud Weight in ppg
NP – Neutral Point
OBM – Oil Based Mud
OMW – Original Mud Weight
PG – Pressure Gradient
POOH – Pull Out of Hole
PP – Pore Pressure
PPG – Pounds Per Gallon
RIH – Run In Hole
RPM – Rounds Per Minute
RSS- Rotary Steerable System

SCR – Slow Circulating Rate
SG – Specific Gravity
SICP – Shut-in Casing Pressure
SIDPP – Shut-in Drill Pipe Pressure
SOBM – Synthetic Oil Based Mud
SPP – Stand Pipe Pressure
SPM – Strokes Per Minute
SPR – Slow Pump Rate
TDS – Top Drive System
TOC – Top Of Cement
TOF – Top Of Fish
TOL – Top Of Liner
TVD – True Vertical Depth
TVDSS – True Vertical Depth Sub Sea
WBM – Water Based Mud

WOB – Weight On Bit
WOC – Wait On Cement
YP – Yield Point

Dave Salmon

From: @ukogplc.com>
Sent: 23 March 2018 05:56
To:
Cc:
Subject: RE: Well Notification for well LR/24-4

Good morning

Please find the answers embedded below in red.

Please let me know if you need anything further.

Regards,

Drilling Advisor

For and on Behalf of:

UKOG
ENERGY FOR BRITAIN

Crossweys House
28-30 High Street
Guildford
Surrey
GU1 3EL
United Kingdom

M:+44 (
ogplc.com

From: @hse.gov.uk <f @hse.gov.uk>
Sent: 20 March 2018 11:53
To: @ukogplc.com>
Cc: hse.gov.uk
Subject: Well Notification for well LR/24-4

Good mornir

I am currently inspecting the above notification of well operation on behalf and will appreciate your response to the following queries to enable me complete my inspection.

1. I note that this operation will be conducted rig-less utilizing a crane. I also note that the permanent bridge plug will be milled. Please provide information about how this milling of the plug will be achieved? A mud motor is used with a mill on the bottom. The reactive torque in the work string is taken out with a Kelly type tubular through the BOPs and a plate bolted on the top of the BOPs with the Kelly shape internally

2. I note that PW well test is your well test contractor. Please provide information describing the process used to ensure that the well test package provided is suitable and fit for purpose? A tender exercise was performed in 2017 where all the specifications and certifications of the equipment were requested for the

work scope, and provided. The same equipment has been used at Broadford Bridge well site for 6 months by Kimmeridge Oil and Gas which is an associated company to Horse Hill Developments. Performance has been good. The exception is that a new flare stack will be provided for the Horse Hill testing which is being trialled currently at Albury with IGas

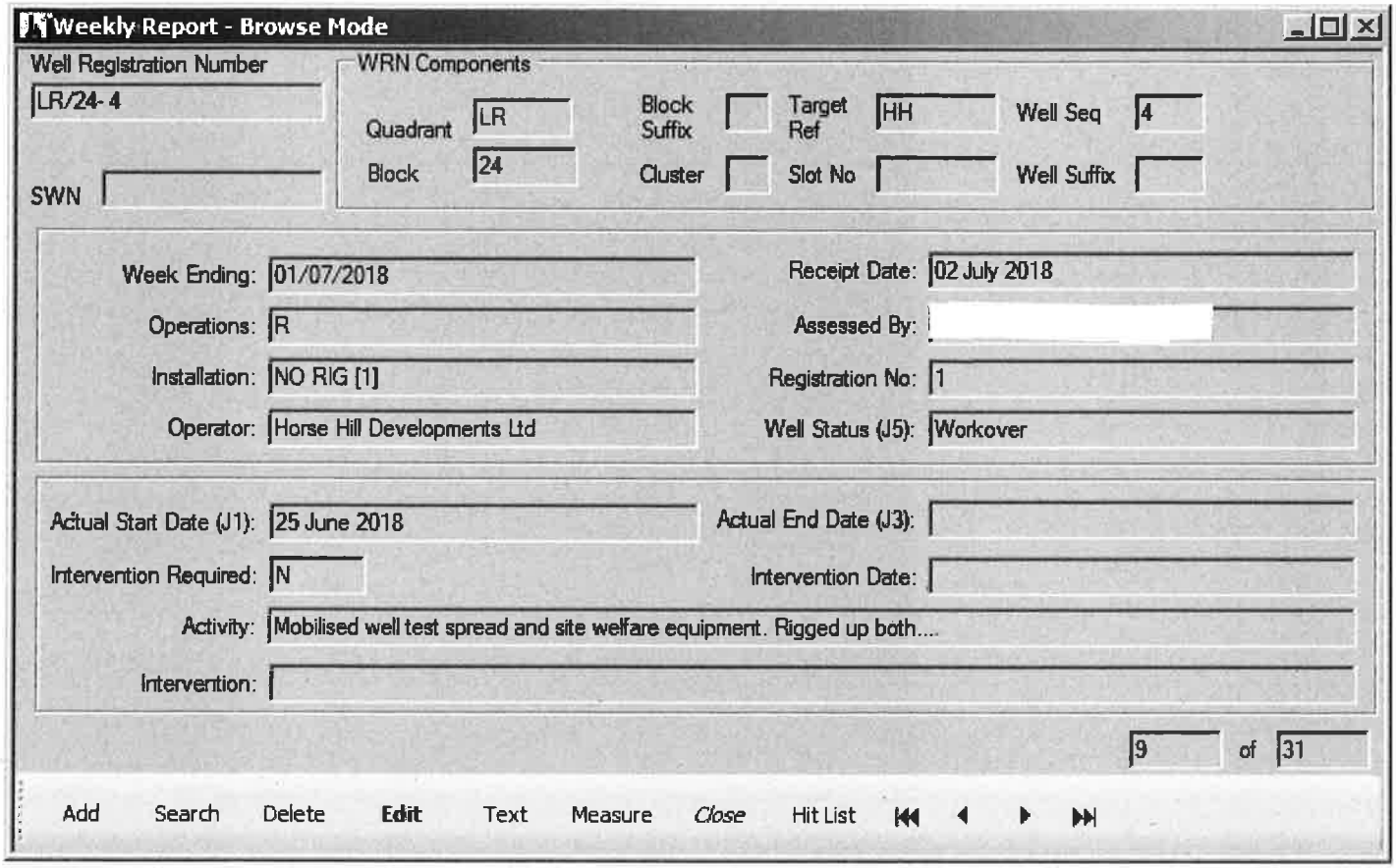
3. I note on page 41 of the submitted notification that the Well test P&ID is titled 'clean up package'. Please clarify? This is a typo and will be addressed

4. I note from the risk assessment that 'squeeze cementing operation' is listed as an activity / element considered as part of the risk assessment. Please confirm if cementing operation is planned? Squeeze cementing is a contingency operation. If the well test shows connectivity between formations, squeeze cementing may be performed, however, it is not expected

5. I note that nitrogen will be used to create an underbalance in the case of conducting tubing conveyed perforation. Please provide information about the controls that will be in place for nitrogen handling. Nitrogen is delivered in 'quads'. A calibrated pressure regulator is used to deliver Nitrogen to the well through a small bore hose. The hose assembly is pressure tested before Nitrogen injection into the well. There is a non return valve at the wellhead which would prevent material Nitrogen release should the hose fail in service

Regards,

HM Inspector of Health & Safety
Well Engineering & Operations
HID Energy Division 6 - Offshore
Lord Cullen House
Fraser Place
Aberdeen, AB25 3UB
Tel: 02030281
Mobile:

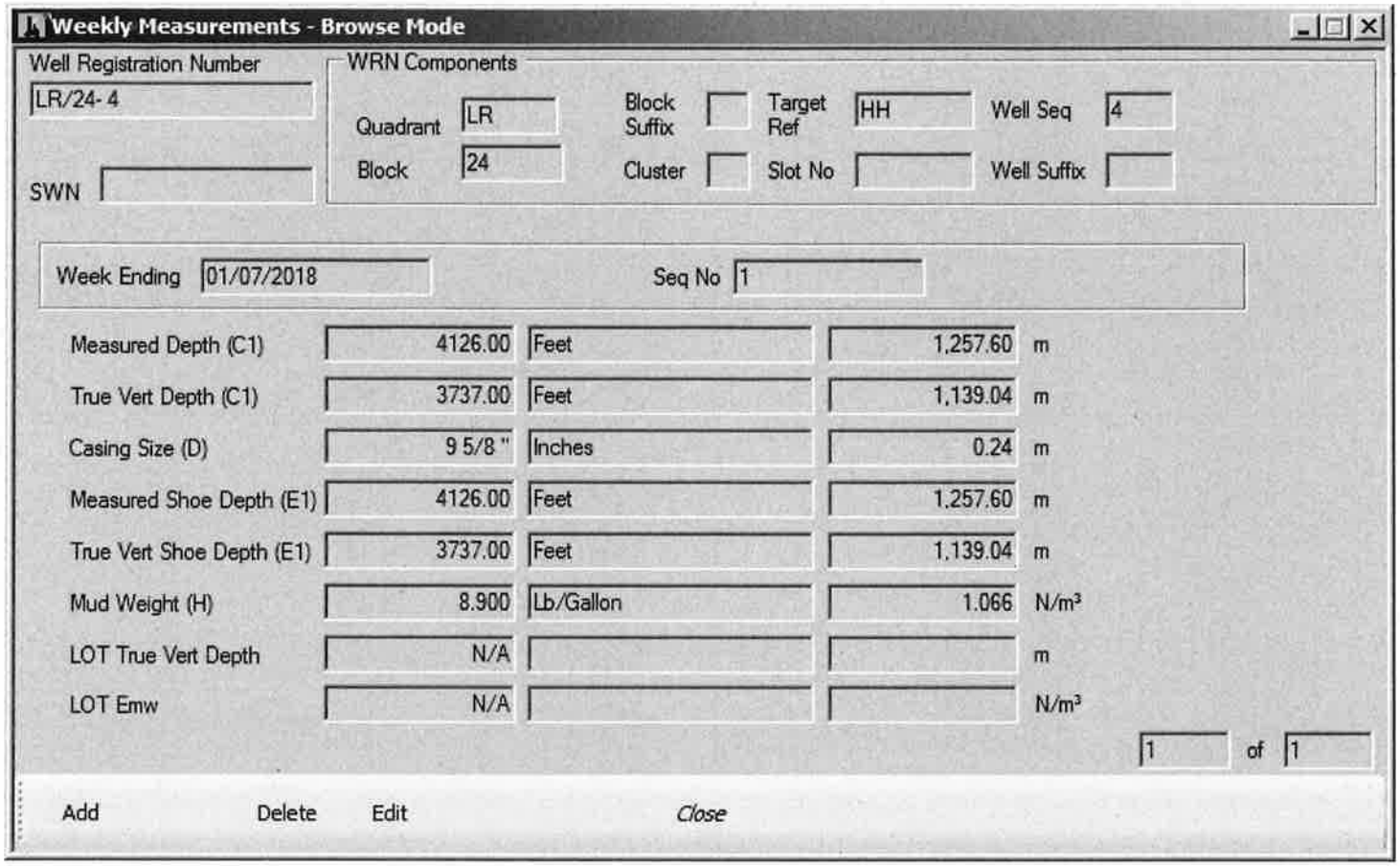

Weekly Report - Browse Mode
Well Registration Number
LR/24- 4
SWN
WRN Components
Quadrant
LR
Block
24
Block Suffix
Cluster
Target Ref
HH
Slot No
Well Seq
4
Well Suffix
Week Ending:
01/07/2018
Operations:
R
Installation:
NO RIG [1]
Operator:
Horse Hill Developments Ltd
Receipt Date:
02 July 2018
Assessed By:
Registration No:
1
Well Status (J5):
Workover
Actual Start Date (J1):
25 June 2018
Intervention Required:
N
Activity:
Mobilised well test spread and site welfare equipment. Rigged up both....
Intervention:
Actual End Date (J3):
Intervention Date:
9
of
31
Add
Search
Delete
Edit
Text
Measure
Close
Hit List

Weekly Report. Week Ending: 01/07/2018 for Well LR/24- 4

Activity Text:

Mobilised well test spread and site welfare equipment. Rigged up both. Pressure tested well test spread. Rigged up kill pump and mixing system. Held testing well on paper meeting on site. Installed and pressure tested BPV. Removed tubing bonnet. Installed BOPs. Pressure tested BOPs, choke and choke line and kill line to 500 / 2,000 psi. Performed accumulator test. Performed site evacuation drill.

Intervention Summary:


Weekly Measurements - Browse Mode
Well Registration Number
LR/24- 4
SWN
WRN Components
Quadrant
LR
Block
24
Block Suffix
Cluster
Target Ref
HH
Slot No
Well Seq
4
Well Suffix
Week Ending
01/07/2018
Seq No
1
Measured Depth (C1) 4126.00 Feet 1,257.60 m
True Vert Depth (C1) 3737.00 Feet 1,139.04 m
Casing Size (D) 9 5/8 " Inches 0.24 m
Measured Shoe Depth (E1) 4126.00 Feet 1,257.60 m
True Vert Shoe Depth (E1) 3737.00 Feet 1,139.04 m
Mud Weight (H) 8.900 Lb/Gallon 1.066 N/m³
LOT True Vert Depth N/A m
LOT Emw N/A N/m³
1 of 1
Add
Delete
Edit
Close

Weekly Report - Browse Mode

Well Registration Number: LR/24- 4

SWN:

WRN Components

Quadrant: LR | Block Suffix: | Target Ref: HH | Well Seq: 4

Block: 24 | Cluster: | Slot No: | Well Suffix:

Week Ending: 08/07/2018 | Receipt Date: 09 July 2018

Operations: R | Assessed By: [redacted]

Installation: NO RIG [1] | Registration No: 1

Operator: Horse Hill Developments Ltd | Well Status (J5): Workover

Actual Start Date (J1): 25 June 2018 | Actual End Date (J3):

Intervention Required: N | Intervention Date:

Activity: Pulled BPV. Unseated tubing hanger. POOH 2 7/8" kill string. RIH with bridge...

Intervention:

8 of 31

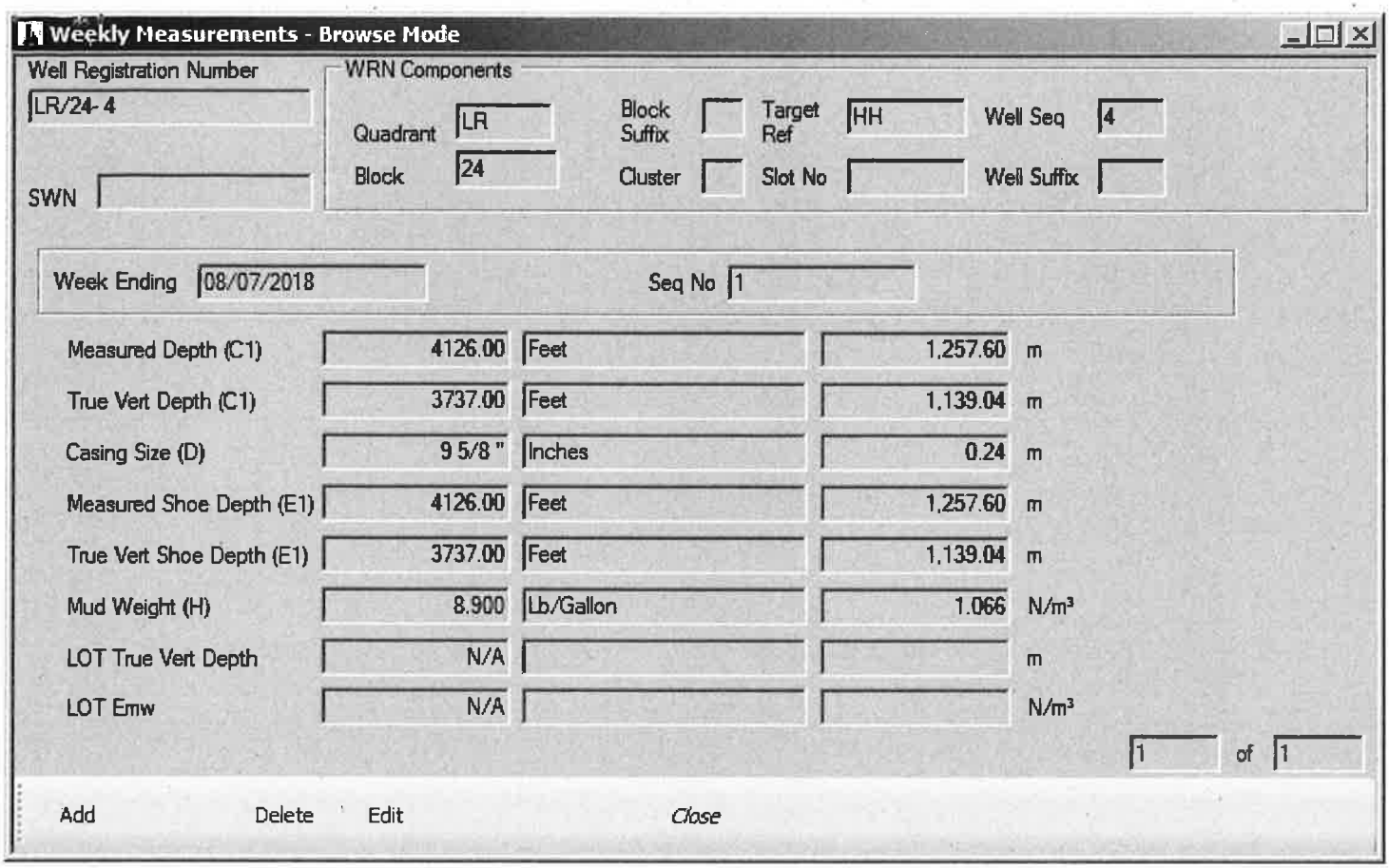
Add Search Delete **Edit** Text Measure *Close* Hit List

Weekly Report. Week Ending: 08/07/2018 for Well LR/24- 4

Activity Text:

Pulled BPV. Unseated tubing hanger. POOH 2 7/8" kill string. RIH with bridge plug retrieval tool on 3 ½" tubing. Released bridge plug. POOH and laid out same. Ran 3 ½" completion. Pressure tested tubing 2,500 psi. Unable to run slickline plug through crossover in tubing. POOH 3 ½" completion. Changed out crossover. Ran 3 ½" completion. Pressure tested tubing 2,500 psi. Set packer. Pressure tested annulus to 2,000 psi. Installed and tested BPV. Removed BOPs. Installed production tree and flow line to well test. Pressure tested to 2,000 psi. Pulled BPV. Recovered downhole plug on slickline. Ran gauges and set in lowermost nipple. Prepared to run downhole pump on rods. Performed site evacuation drill.

Intervention Summary:


Weekly Measurements - Browse Mode
Well Registration Number
LR/24- 4
SWN
WRN Components
Quadrant
LR
Block
24
Block Suffix
Cluster
Target Ref
HH
Slot No
Well Seq
4
Well Suffix
Week Ending
08/07/2018
Seq No
1
Measured Depth (C1) 4126.00 Feet 1,257.60 m
True Vert Depth (C1) 3737.00 Feet 1,139.04 m
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Measured Shoe Depth (E1) 4126.00 Feet 1,257.60 m
True Vert Shoe Depth (E1) 3737.00 Feet 1,139.04 m
Mud Weight (H) 8.900 Lb/Gallon 1.066 N/m³
LOT True Vert Depth N/A m
LOT Emw N/A N/m³
1 of 1
Add
Delete
Edit
Close

Dave Salmon

From: < ukogplc.com>
Sent: 13 July 2018 10:48
To:
Cc: @mdc.co.uk';
Subject: Re: Earthquakes in Surrey.

Thanks for your email below. Please be advised that no earthquakes have been felt at any of UKOG/HHDL's well sites: Horse Hill, Broadford Bridge and Markwells Wood.

As we discussed in our recent meeting and per UKOG's recent press release, HHDL's well testing is now again underway at Horse Hill. The site is now fully manned and we are pressure testing the well and test completion per our well test programme. All pressure tests have been fine.

Broadford Bridge remains manned by a small security team with the BB-1z well safely suspended. The Markwells Wood site remains manned with the well safely suspended.

As we further discussed, UKOG and HHDL are initiating well integrity schemes and well examination training.

Regards,

UK Oil & Gas Investments PLC

+44

ukogplc.com

From: @hse.gov.uk" < @hse.gov.uk>
Date: Wednesday, 11 July 2018 at 10:13
To: :@ukogplc.com>
Cc @mdc.co.uk" < @mdc.co.uk>
Subject: Earthquakes in Surrey.

Good mornin
I hope this email finds you well. In response the recent series of earthquakes that occurred in Surrey (see below link) it is expected that well operators conduct checks on well integrity of the wells in the region. Please provide information on the checks you have made / intend to carry out and the results of those checks.
https://earthquakes.bgs.ac.uk/earthquakes/recent_events/20180705105300.html#page=summary

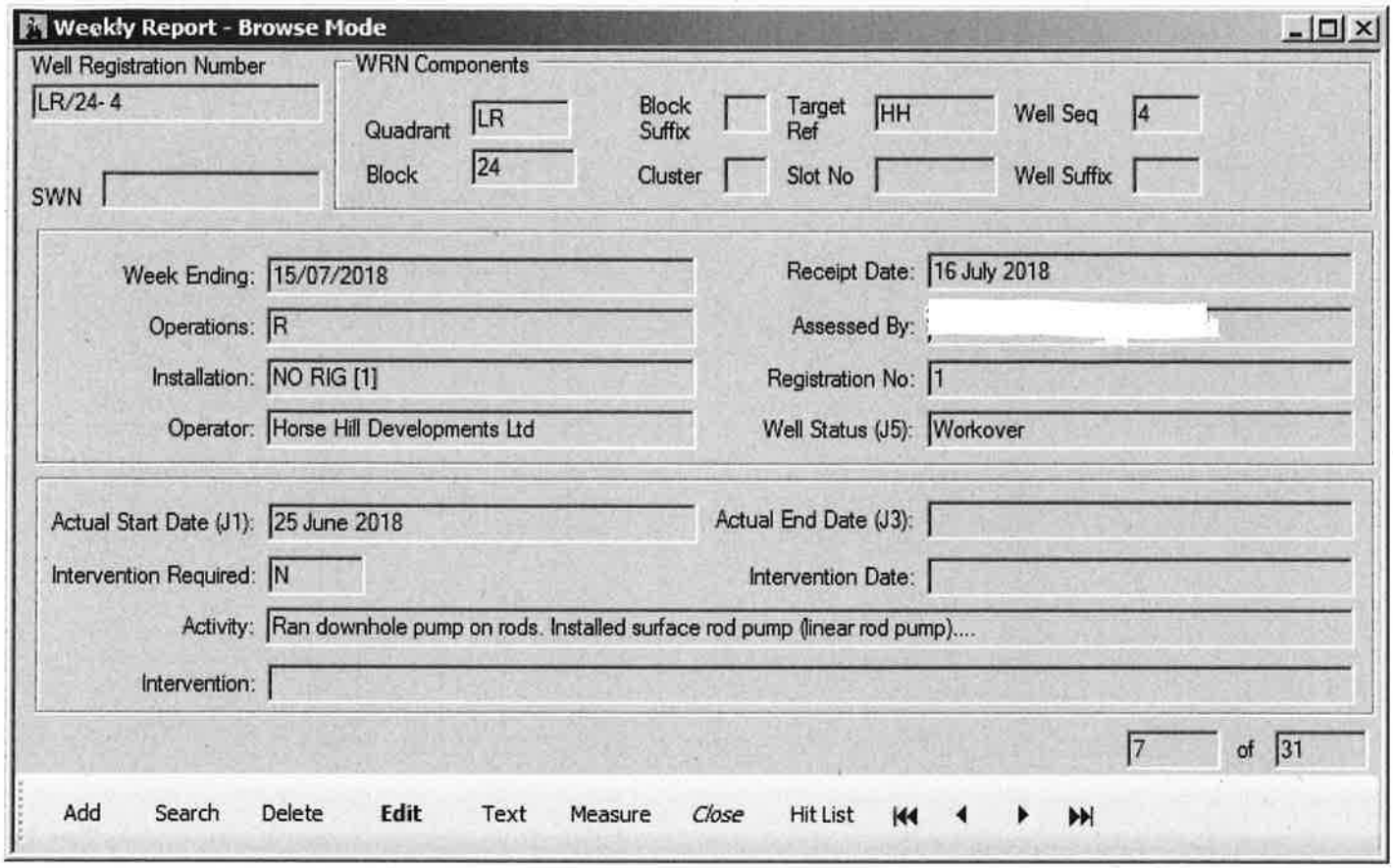
Kind Regards

HM Inspector of Well Engineering & Operations | Energy Division - Offshore
Health & Safety Executive| HID Energy Division, ED 6, Lord Cullen House, Fraser Place, Aberdeen, AB25 3UB |☎:
Direct Line +44 (20) 30 / Mob. | ✉: @hse.gov.uk

****

Please visit the HSE website at the following address to keep yourself up to date

www.hse.gov.uk

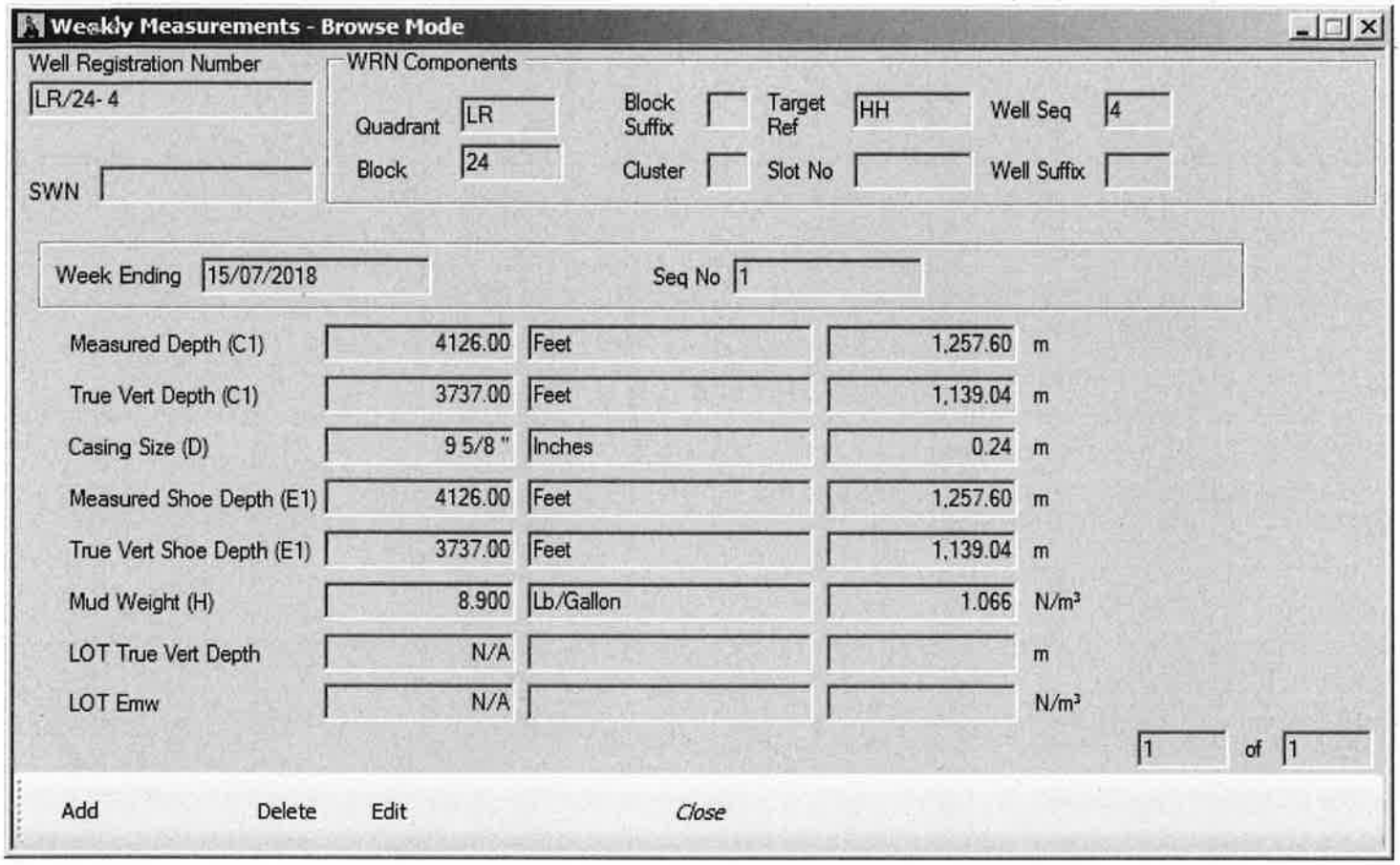

Weekly Report - Browse Mode
Well Registration Number
LR/24- 4
SWN
WRN Components
Quadrant
LR
Block
24
Block Suffix
Cluster
Target Ref
HH
Slot No
Well Seq
4
Well Suffix
Week Ending:
15/07/2018
Receipt Date:
16 July 2018
Operations:
R
Assessed By:
Installation:
NO RIG [1]
Registration No:
1
Operator:
Horse Hill Developments Ltd
Well Status (J5):
Workover
Actual Start Date (J1):
25 June 2018
Actual End Date (J3):
Intervention Required:
N
Intervention Date:
Activity:
Ran downhole pump on rods. Installed surface rod pump (linear rod pump)....
Intervention:
7
of
31
Add
Search
Delete
Edit
Text
Measure
Close
Hit List

Weekly Report. Week Ending: 15/07/2018 for Well LR/24- 4

Activity Text:

Ran downhole pump on rods. Installed surface rod pump (linear rod pump). Pumped and free flowed the well.

Intervention Summary: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Well Registration Number
LR/24- 4
SWN
WRN Components
Quadrant
LR
Block
24
Block Suffix
Cluster
Target Ref
HH
Slot No
Well Seq
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Well Suffix
Week Ending
15/07/2018
Seq No
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True Vert Depth (C1) 3737.00 Feet 1,139.04 m
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True Vert Shoe Depth (E1) 3737.00 Feet 1,139.04 m
Mud Weight (H) 8.900 Lb/Gallon 1.066 N/m³
LOT True Vert Depth N/A m
LOT Emw N/A N/m³
1 of 1
Add
Delete
Edit
Close

Dave Salmon

From: @Horsehilldevelopments.co.uk>
Sent: 09 August 2018 14:19
To: Well Notifications
Cc:
Subject: Horse Hill Developments Limited - Horse Hill 1 Well - Well Number LR/24-4 - Programme Supplement No. 1
Attachments: Horse Hill 1 Portland Reperforation Programme Supplement no. 1.pdf

Good afternoon,

Please find attached a programme supplement for the previously notified rigless testing operations at Horse Hill.

It is intended to re-perforate the well with TCP guns. This was included as a contingency in the original notification. However, the attached programme supplement provides greater detail.

Regards,

Drilling Advisor

For and on Behalf of:

HORSE HILL DEVELOPMENTS

1, Farnham Road
Guildford
Surrey
GU2 4RG
United Kingdom

M:+44 (0
E @horsehilldevelopments.co.uk

HORSE HILL DEVELOPMENTS

Horse Hill 1

Programme Supplement no. 1

Re-perforation of the Portland Sandstone

The Portland Sandstone well testing has confirmed a high skin on the formation, which is affecting production potential.

The technical objective of this work programme is to re-perforate the Portland Sandstone in underbalanced conditions with tubing conveyed perforating guns (TCP). GeoDynamics are the chosen service provider.

Work Programme

1. Mix 8.9 ppg kill fluid with 3% KCl content, remainder NaCl
2. Rig down the LRP
3. Pick up and unseat the pump
4. Tighten the stuffing box
5. Rig up HP pump lines to the 9 5/8" x 3 ½" annulus. Pressure test to 1,000 psi x 5 mins
6. Reverse circulate kill fluid back to the well test package and kill the well
7. Flow check on the annulus and tubing – 10 min
8. Lay out the polished rod and stuffing box
9. POOH the rods and pump, laying out on the bunding material
10. Flow check the well on annulus and tubing – 10 min
11. Install the BPV in the tubing hanger. Pressure test to 1,000 psi x 10 min
12. Rig down the well test flow line and production tree
13. Nipple up the 11" 5M BOPs and choke line
14. Close the blind rams. Pressure test the blind rams to 300 psi x 5 min and 2,000 psi x 10 min
15. Install the landing joint. Pressure test the variable pipe rams to 300 psi x 5 min and 2,000 psi x 10 min
16. Retrieve the landing joint
17. Check the annulus for pressure
18. Pull the BPV
19. Re-install the landing joint
20. Install the spacer spool, DSA and jacking table
21. Back out the hanger tie down bolts. **Ensure the gland nuts are tightened back up**
22. Jack the packer until it unseats. Maximum pull 100 k lb
23. Land the hanger
24. Flow check the tubing and annulus 10 min
25. Lay out the jacking table, DSA and spacer spool
26. Pull and lay out completion with bunding material below pipe racks
27. Pick up the TCP BHA per GeoDynamics procedures and instructions (see Appendix 2)

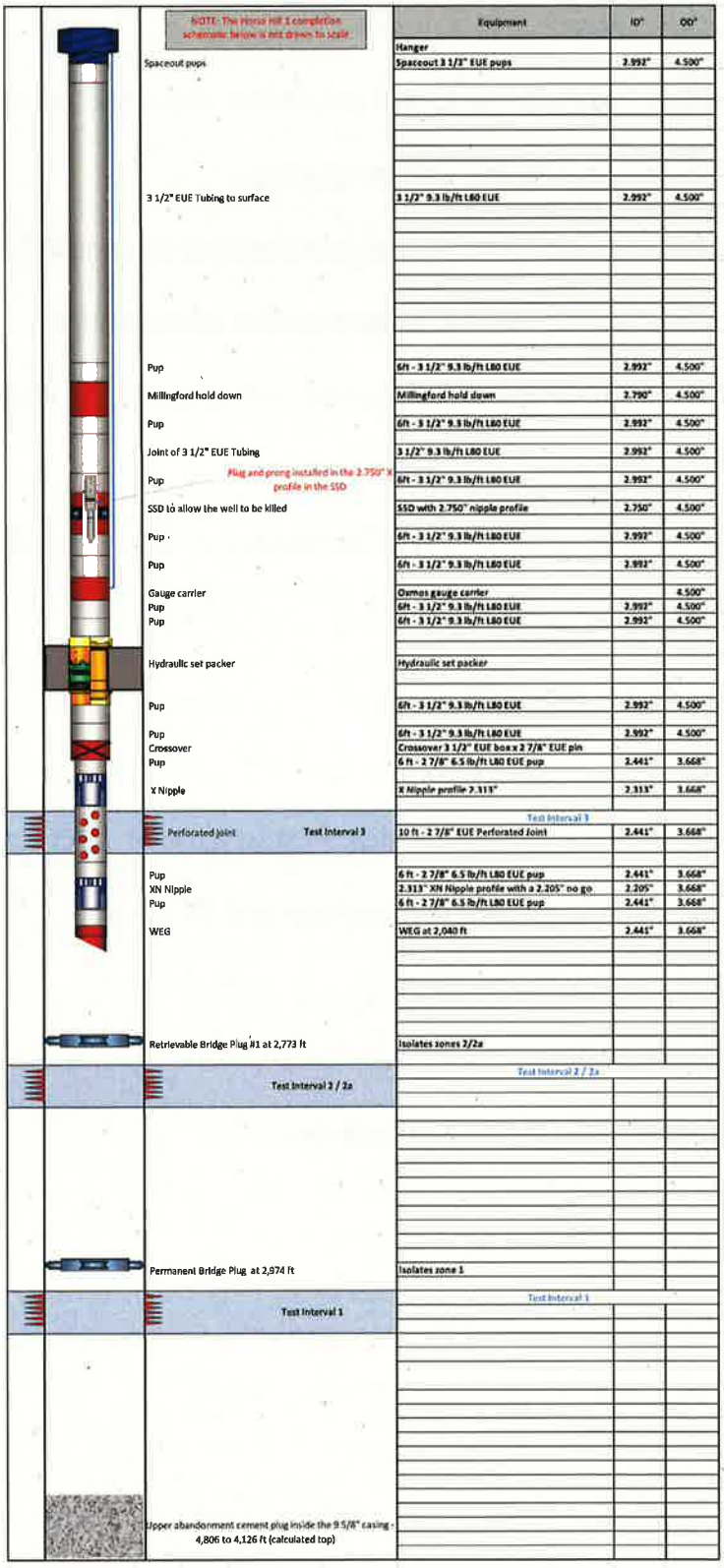
28. Pick up the remainder of the BHA incorporating;
    - 2 7/8" pup joints (as required)
    - 2.313" XN nipple
    - 2 7/8" pup joint
    - 2.313" SSD
    - 2 7/8" pup joint x 2
    - 2 7/8" x 3 ½" crossover
    - 3 ½" pup joint
    - 9 5/8" x 3 ½" packer – **with 6 shear set screws and 12 shear release screws**
    - 3 ½" pup joint x 2
    - Oxmos gauge carrier
    - 3 ½" pup joint x 2
    - 2.75" SSD
    - 3 ½" pup joint x 2
    - 2.79" Millingford pump hold down
    - 3 ½" pup joint
    - 3 ½" tubing to surface
29. RIH to packer setting depth
30. Rig up slickline – open hole through the 4 ½" kelly cock is acceptable
31. Perform GR correlation run on slickline
32. Space out. Make up tubing hanger. Terminate Oxmos cable
33. Land tubing hanger. Tie down. **Ensure gland nuts are tight**
34. Close variable bore rams. Pressure test tubing hanger seals to 300 psi x 5 min and 2,000 psi x 10 min
35. Run tubing plug and prong open hole through the 4 ½" kelly cock and set in 2.75" nipple above packer
36. Rig up HP lines to tubing. Pressure test lines to 300 psi x 5 min and 3,000 psi x 10 min
37. Pressure test tubing 300 psi x 5 min and 3,000 psi x 10 min
38. Rig down lines
39. POOH prong and plug open hole through the 4 ½" kelly cock
40. RIH and set the plug and prong in the 2.313" nipple in the SSD
41. Rig up HP lines to tubing. Pressure test lines to 300 psi x 5 min and 3,000 psi x 10 min
42. Pressure up on tubing and set packer 3,000 psi x 10 min
43. Rig up HP lines to annulus. Pressure test lines to 300 psi x 5 min and 2,500 psi x 10 min
44. Pressure test annulus 300 psi x 5 min and 2,000 psi x 10 min
45. Set BPV in tubing hanger. Pressure test 300 psi x 5 min and 2,000 psi x 10 min
46. Nipple down BOPs
47. Nipple up production tree and flow line. Pressure test connection to wellhead and choke line to 300 psi x 5 min and 2,000 psi x 10 min
48. Pull BPV

49. Rig up slickline PCE onto the production tree and pressure test 300 psi x 5 min and 2,000 psi x 10 min (and each time the lubricator is split)
50. RIH and pull prong and plug from 2.313" X nipple
51. RIH and open 2.75" SSD
52. Rig up HP lines to annulus. Pressure test to 300 psi x 5 min and 2,000 psi x 10 min
53. Reverse circulate well to dead oil into the well test package
54. Isolate the annulus and well test package
55. Rig up HP Nitrogen lines to tubing. Pressure test to 300 psi x 5 min and 2,000 psi x 10 min
56. Displace tubing contents to provide **200 psi underbalance on reservoir pressure**
57. RIH slickline and close 2.75" SSD. Bleed down tubing surface pressure. Rig down slickline
58. Prepare surface lines for perforating
59. Hold TBT
60. Drop bar and perforate, allowing well to flow per instructions of the Petroleum Engineer
61. At a convenient time, shut in the well
62. RIH slickline and recover drop bar
63. Run gauges and land in 2.313" XN nipple
64. Open 2.313" SSD
65. Open 2.75" SSD
66. Rig down slickline
67. Rig up HP pump lines to the 9 5/8" x 3 ½" annulus. Pressure test to 1,000 psi x 5 mins
68. Reverse circulate kill fluid back to the well test package and kill the well
69. Flow check on the annulus and tubing – 10 min
70. Install rod BOPs
71. Run pump and rods. Space out
72. Install polished rod and stuffing box
73. Install LRP and function test
74. Pump well per requirements of the Petroleum Engineer

Written by;

7th August 2018

Appendix 1 – Current Test String Schematic



Equipment	ID"	OD"
Hanger		
Spaceout 3 1/2" EUE pups	2.992"	4.500"
3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Millingford hold down	2.790"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
SSD with 2.750" nipple profile	2.750"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Gamos gauge carrier		4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Hydraulic set packer		
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
6ft - 3 1/2" 9.3 lb/ft L80 EUE	2.992"	4.500"
Crossover 3 1/2" EUE box x 2 7/8" EUE pin		
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
X Nipple profile 2.313"	2.313"	3.668"
Test Interval 3		
10 ft - 2 7/8" EUE Perforated Joint	2.441"	3.668"
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
2.313" XN Nipple profile with a 2.205" no go	2.205"	3.668"
6 ft - 2 7/8" 6.5 lb/ft L80 EUE pup	2.441"	3.668"
WEG at 2,040 ft	2.441"	3.668"
Isolates zones 2/2a		
Test Interval 2 / 2a		
Isolates zone 1		
Test Interval 1		

HORSE HILL DEVELOPMENTS

Appendix 2 – TCP Gun Schematic Below Packer

GEODynamics TCP Bottom Hole Assembly

Customer:	Horse Hill Developments		**Size"**	**Type**	**Weigth PPF**	**ID"**		**Liner Top:**	N/A
Region:	United Kingdom	**Production Casing Specifications:**	9.625	L-80	47.00	8.681		**PBTD:**	2,773.00
Well No.:	No. 1	**Work String Specifications:**	3.500	L-80	9.30	2.991		**Max Deviation :**	5.12
Field:		**Minimum ID:**	2.205					**Fluid Type (SG):**	
Customer Rep:								**Fluid Weight (PPG):**	8.8
GEO Rep:								**BHP (PSI):**	915
Rig Name:	TBA	**Date:**	09/08/2018	**Revision:**	Draft			**BHT (F):**	80

No.	BHA	Tool Description	Supplied By	Top Connection	Bottom Connection	I.D."	O.D."	Length	Depth
24		Tubing to Surface	Horse Hill	3 1/2" EUE Box	3 1/2" EUE Pin	2.992	4.500	1,916.984	
23		Packer Center to Top	Horse Hill	3 1/2" EUE Box		2.441	TBA	3.000	1,901.984
22		Packer Bottom to Center	Horse Hill		3 1/2" EUE Pin	2.441	TBA	2.000	1,904.984
21		Pup Joint	Horse Hill	3 1/2" EUE Box	3 1/2" EUE Pin	2.992	4.500	10.000	1,906.984
20		Crossover, 3 1/2" EUE Box - 2 7/8" EUE Pin	Horse Hill	3 1/2" EUE Box	2 7/8" EUE Pin	2.441	5.000	1.000	1,916.984
19		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	10.00	1,917.984
18		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	10.00	1,927.984
17		SSD	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.313	3.668	3.00	1,937.984
16		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	10.00	1,940.984
15		XN Nipple	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.313	3.668	1.00	1,950.984
14		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	6.00	1,951.984
13		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	6.00	1,957.984
12		Underbalance Sub	GEO	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	1.00	1,963.984
11		Pup Joint	Horse Hill	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	10.00	1,964.984
10		Ported Debris Sub	GEO	2 7/8" EUE Box	2 7/8" EUE Pin	2.440	3.660	1.000	1,974.984
9		Tubing Joint Containing the Surface Safe Bar Drop Firing Head	GEO/HHDL	2 7/8" EUE Box	2 7/8" EUE Pin	2.441	3.668	30.000	1,975.984
8	Gun 7	7" Gun Safety Spacer	GEO	2 7/8" EUE Box	ACME Box	N/A	7.000	20.289	2,005.984
		7" Gun Safety Spacer	GEO	ACME Pin	ACME Box	N/A	7.000	7.627	2,026.273
7	Gun 6	Top Shot - 7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000	113.200	2,033.900
6	Gun 5	7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000		
5	Gun 4	7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000		
4	Gun 3	7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000		
3	Gun 2	7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000		
2	Gun 1	Bottom Shot - 7" 6 spf ConneX Gun System	GEO	ACME Pin	ACME Box	N/A	7.000		2,147.100
1		Gun Guide (Non Ballistic)	GEO	ACME Pin		N/A	7.000	0.250	2,147.100
								Bottom of Assembly	2,147.350

Relevant Depths:

A.	RA Marker Sub must be at the this depth for Top Shot to be on Depth	N/A
B.	Distance from Top Shot to RA Marker is	N/A
C.	Center of Packer when on depth will be at	N/A
D.	Fish length after Automatic Gun Release is Activated	N/A
E.	Tubing end depth after Release is Activated	N/A
F.	Fish length if Mechanical Tubing Release is Activated	N/A
G.	Bottom of assembly when Top Shot is on Depth	2,147.35

Notes:
1. All ID's, OD's & lengths are estimated and need to be confirmed at the well site.
2. ID's & OD's are in inches, lengths & depths are in meters.
3. All depths are to top depth
4. Gun system can be shot in fluid only.

Dave Salmon

From: , < @Horsehilldevelopments.co.uk>
Sent: 13 August 2018 12:54
To:
Cc: HHDLsitesupervisor
Subject: RE: Material change #1 to well testing notification of Horse Hill -1
Attachments: 20180813_HH Jacking Unit Stack Up.pdf

Good afternoon

1. Please find attached a stack up of the BOPs and jacking table as rigged up on the well. The spool on top of the BOPs is installed to take the jacking table to a working height for the work platform. The DSA allows us to bolt the jacking table to the spacer spool and therefore indirectly to the BOPs. The jacking table is pull tested to 100 MT for certification purposes and will be on site during your visit next week to give you better clarity.
2. The flow check on the annulus is done via the pump truck. There is a Weco valve installed on the outside of the 'A annulus' valve providing double valve isolation to the annulus. The flow check on the tubing side is done via the well test header access

If you need any further information, please let me know.

Regards,

Drilling Advisor

For and on Behalf of:

HORSE HILL DEVELOPMENTS

1, Farnham Road
Guildford
Surrey
GU2 4RG
United Kingdom

M:+44
E: @horsehilldevelopments.co.uk

From i@hse.gov.uk @hse.gov.uk>
Sent: 10 August 2018 11:00
To: ;@Horsehilldevelopments.co.uk>
Cc: @Horsehilldevelopments.co.uk>
Subject: Material change #1 to well testing notification of Horse Hill -1

Good morning
I am reviewing the above material change and I have the following questions/ clarifications:

1- Please provide the following:
   - a schematic of the BOP stack planned to be used.
   - A schematic of the jacking table as rigged up on top of the well

2- I noticed that the THS has one side outlet valves, through which the reverse circulation will be performed, presumably. Please provide more details of how the flow check of the annulus and the tubing sides will be performed after the well has been killed. This may include schematics (P&ID) of the surface equipment.

Kind Regards

| **HM Inspector of Well Engineering & Operations | Energy Division - Offshore**
Health & Safety Executive | HID Energy Division, ED 6, Lord Cullen House, Fraser Place, Aberdeen, AB25 3UB | ☎:
Direct Line **+44 (20) 3028** / Mob. **+44(0)** ; | ✉: i@hse.gov.uk

SCALE: NTS
REV: 13/08/2018