



## **END OF WELL REPORT**

**Woodside Energy Ltd.**

**Somerset-1**

**19 October – 11 November 2009**

**by**

**BAKER HUGHES INTEQ**

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## **Woodside Energy Ltd**

### **Somerset-1**

### **End of Well Report**

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## **SECTION 1**

### **WELL SUMMARY**

## 1.1 Well and Rig Information

Well Name:	Somerset-1	
Well Type:	Vertical Exploration	
Operator:	Woodside Energy Ltd.	
Location:	Otway Basin	
Block:	T/34P	
Final Coordinates:	Latitude	039 deg 20' 36.757"S
	Longitude	142 deg 44' 56.144"E
	Datum	GDA94 Zone 54
UTM Coordinates:	Easting	650712.40m
	Northing	5643640.36m
Rig:	Ocean Patriot	
Type:	Semi-submersible	
Rig Floor - Seabed:	524.5m	
Rig Floor - Sea level	21.5m	
Spud Date:	19 October 2009	
Total Depth:	2912.0 mMDRT	
Drilling Completion Date:	27 October 2009	
Status:	Plug and abandon	
Baker Hughes INTEQ:	Data Engineers: Shaharizad Shahadan, Gokula Krishnan Ramanathan.	
	Logging Geologists: Raman Dhanda, James Bladen, Prashant Kadam, Sara Turnbull.	

## 1.2 Introduction

Baker Hughes INTEQ Surface Logging Services Unit 573 monitored drilling parameters from the spud of the well and provided formation evaluation, drill monitoring and pressure evaluation services for Somerset-1, whilst drilling the 914mm (36"), 444mm (17-1/2") and 311mm (12-1/4") hole sections to the well's TD at 2912.0 mMDRT (2911.73mTVDRT). All depths given in this report are metres Measured Depth below the Rotary Table (mMDRT), referenced to the Lowest Astronomical Tide (LAT), unless otherwise specified. Data obtained was processed and stored using the ADVANTAGE V.2.10U3 software.

The Somerset-1 well was designed as a vertical exploration well.

Ocean Patriot reached the well location on 18 October 2009.

The well was spudded on 19 October 2009 using a 660mm (26") bit combined with a 914mm (36") hole opener. The spud depth was 524.5 mMDRT and drilling continued to TD of the section at 572.5mMDRT, using seawater and Pre-hydrated gel (PHG) / Guar Gum Hi vis. The 762mm (30") conductor and Permanent Guide Base (PGB) was jetted from 524.5 mMDRT to a shoe depth of 569.4 mMDRT – which was then cemented.

The 444mm (17-1/2") hole was drilled from 572.5 mMDRT to the section TD depth of 1284.0 mMDRT. This section was drilled riser-less using seawater. Pre-hydrated gel (PHG) was pumped intermittently to clean the hole. The 340mm (13-3/8") casing was run and the shoe was set at 1278.6 mMDRT.

The BOPs were run on marine risers, landed and were pressure tested as per the requirements. A 311mm (12-1/4") bit and BHA were made up and ran in the hole. After drilling out the cement and shoe track, the well was then displaced to 1.25 sg Ultra Drill WBM. Drilling the shoe track, shoe and 5.0m of new formation was then carried out to 1289.0 mMDRT. A Leak off test (LOT) was performed with 1.25sg mud giving an EMW of 1.70sg. The well was then drilled from 1289.0 to 2912.0mMDRT. The well had been observed to be not taking the correct amount of mud; the active pit was showing a gain in volume. The well was flow checked – this was conducted using the trip tank to measure any discrepancy. The trip tank was shown to be gaining 9bbls in 15 minutes, so the well had kicked. The well was shut in; followed by well control procedures. Eventually, the well was killed with a 1.7sg EMW. The string was then pumped out of the hole. Major losses occurred at the interval of 1329.0 to 1300.0 mMDRT. The pumping out of the string was then continued after the losses had been controlled. The BHA and bit were then laid down and the bit graded.

The well then was then plugged and abandoned.

## **SECTION 2**

### **DRILLING & ENGINEERING**

## 2.1 Bit Run Summaries

### Somerset-1 660mm (26") x 914mm (36") Hole Section 19 October 2009

#### Bit Run No. 1 Summary

Bit Number	NB1
Bit Size	660mm (26") x 914mm (36")
Bit Type	Varel Mill Tooth
S/N	766R1
Jets 1/32 <sup>nd</sup> inch / TFA	3x20 / 0.9204
Depth In, mMDRT	524.5
Depth Out, mMDRT	572.5
Meters Drilled, m	48.0
Drilling Hours	3.0
TBR, krevs	103.71
Circulating Hours	5.2
Average ROP, m/hr	16.0
API Condition	1-1-0-0-0-0-0-TD










#### Drilling Parameters

WOB, klbf	1.4 – 17.9
RPM, surf/bit	24 -70 / 24 – 70
Torque, kft.lb	0 – 7.9
Pump Pressure, psi	45 – 1294
Flow In, gpm	537 – 946

#### Mud System

Seawater / Hi-Vis PHG	1.04sg
/ Guar Gum Sweeps	

#### BHA No. 1 BHA Length: 175.95m

127mm (5") DP to Surface	
12 x 127mm (5") HWDP	
210mm (8-1/4") Cross Over	
3 x 203mm (8")DC	
241mm (9-1/2") Cross Over1	
3 x 241mm (9-1/2") DC1	
241mm (9-1/2") Float Sub/Solid Float	
914mm (36") Bit 2.16m	
660mm (26") Bit 0.56m Varel 766 R1 Jets: 3x20	

**Somerset-1**  
**444mm (17-1/2") Hole Section**  
**20 - 21 October 2009**

**Bit Run No. 2 Summary**

Bit Number	NB2
Bit Size	444mm (17-1/2")
Bit Type	Smith Mill Tooth
S/N	PM6863
Jets 1/32 <sup>nd</sup> inch / TFA	3 x 16, 3 x 12 / 0.9204
Depth In, mMDRT	572.5
Depth Out, mMDRT	1284.0
Meters Drilled, m	711.5
Drilling Hours	8.2
TBR, krevs	104.52
Circulating Hours	12.5
Average ROP, m/hr	86.8
API Condition	1-1-WT-A-E-I-PN-TD

**Drilling Parameters**

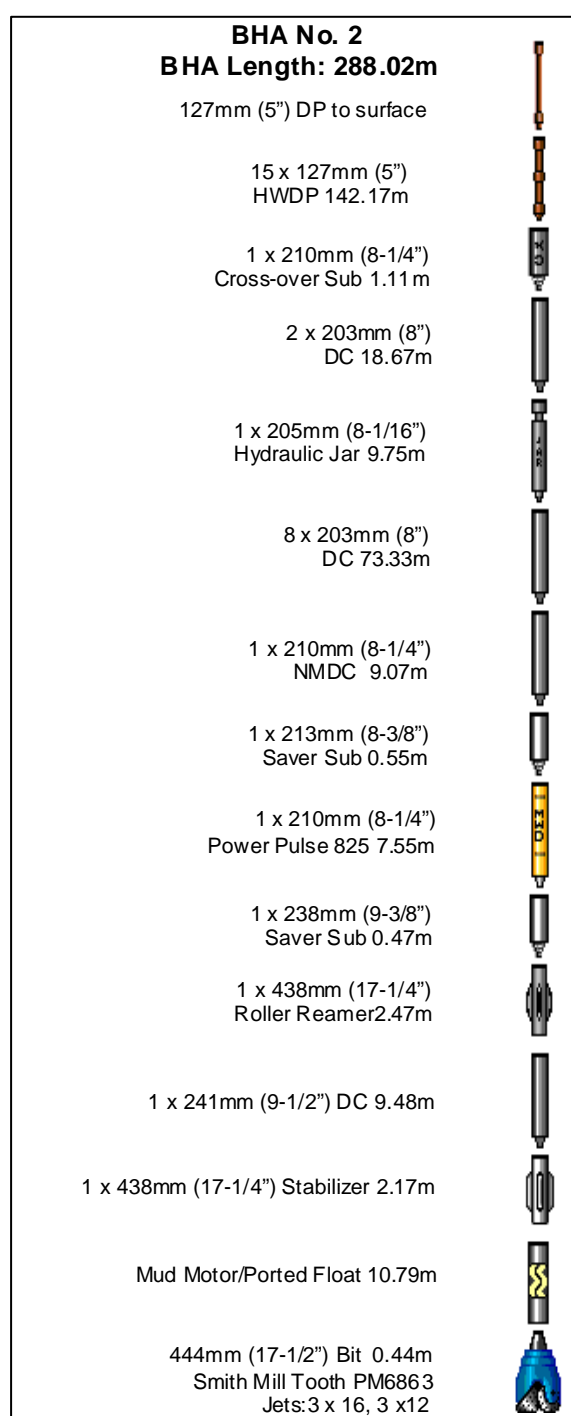
WOB, kbf	2.01 – 61.87
RPM, surf/bit	24-89/ 123-214
Torque, kft.lb	1.06 – 11.93
Pump Pressure, psi	1373 – 4428
Flow In, gpm	766 – 1270

**Mud System**

Seawater / Hi-Vis PHG	1.04sg
/ Guar Gum Sweeps	

**Lithology**

Returns to seabed





**Somerset-1**  
**311mm (12-1/4") Hole Section**  
**24 October - 02 November 2009**

**Bit Run No. 3 Summary**

Bit Number	NB3
Bit Size	311mm (12-1/4")
Bit Type	Smith MDi716LHBPX
S/N	JD0772
Jets 1/32 <sup>nd</sup> inch / TFA	10x12 / 1.1045
Depth In, mMDRT	1284.0
Depth Out, mMDRT	2912.0
Meters Drilled, m	1628.0
Drilling Hours	42.4
TBR, krevs	414.31
Circulating Hours	126.6
Average ROP, m/hr	38.4
API Condition	1-2-WT-S-X-I-CT-HP

**Drilling Parameters**

WOB, klf	4 – 40
RPM, surf/bit	15-165 / 15-165
Torque, kft.lb	1– 14
Pump Pressure, psi	1827 – 4618
Flow In, gpm	690 – 1126

**Mud System**

ULTRA DRILL WBM	1.25 - 1.31sg(Drilling mud)
	1.50 – 1.70sg (Kill mud)

**Lithology**

Argillaceous Calcisiltite, Argillaceous Calcilutite, Calcilutite, Claystone, Silty Claystone.

<b>BHA No. 3</b>	
<b>BHA Length: 265.72m</b>	
127mm (5") DP to surface	
15 x 127mm (5") HWDP 142.17m	
1 x 210mm (8-1/4") Cross Over 1.11m	
2 x 203mm (8") DC 18.65m	
1 x 205mm (8-1/16") Jar 9.75m	
6 x 203mm (8") DC 54.68m	
1 x 232mm (9-1/8") Saver Sub Cross-over 3.92m	
1 x 308mm (12-1/8") AND 6.37m	
1 x 211mm (8-5/16") Saver Sub 0.32m	
1 x 230mm (9-1/16") Sonic Vision 6.88m	
1 x 308mm (12-1/8") Stabilizer 0.98m	
1 x 213mm (8-3/8") Saver Sub 0.38m	
1 x 210mm (8-1/4") Telescope 825 7.68m	
1 x 308mm (12-1/8") In Line STR 0.91m	
1 x 229mm (9") ARC-8 5.44m	
1 x 210mm (8-1/4") Saver Sub 0.38m	
1 x 311mm (12-1/4") Stabilizer 1.75m	
1 x 203mm (8") Pony NMDC 2.90m	
1 x 311mm (12-1/4") NB Stabilizer/Ported Float 2.56m	
311mm (12-1/4") Bit 0.33 Smith MDSi716LHBPX Jets: 10x12	



## 2.2 Casing & Cementing Summary

### Somerset-1 762mm (30") Conductor 20 October 2009

#### 762mm (30") Conductor

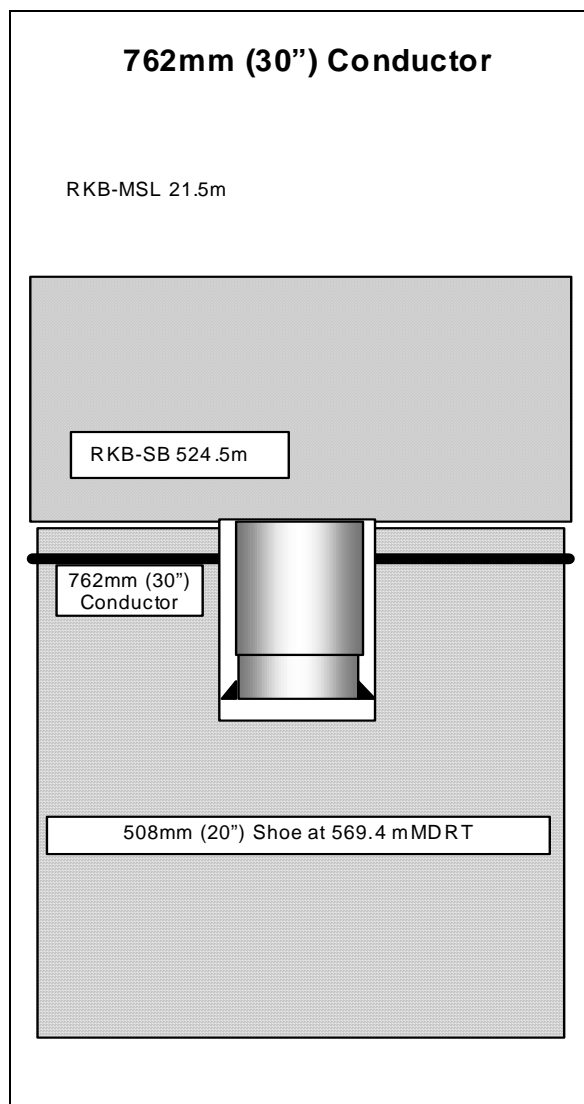
Hole Size 914mm (36")  
Depth 572.5 mMDRT

Casing 1 x 762mm (30") x 508mm (20")  
Float Shoe Joint  
1 x 762mm (30") Intermediate  
Joint  
1 x 762mm (30") Cross-over Joint  
1 x 762mm (30") Lower Wellhead  
Housing Joint  
1 x 762mm (30") Upper Wellhead  
Housing Joint

Weight 236 lb/ft  
Grade X-52  
Shoe Depth 570.6 mMDRT

#### Cement Details:

Cement (40.0MT)  
Type Class "G" with 1%CaCl  
Mixwater 5.194gal/sx  
Drillwater 0.00gal/sx  
Additives 0.01gal/sx D047  
0.12gal/sx D0185  
Weight 1.90sg (15.86ppg)  
Yield 1.19ft<sup>3</sup>/sx  
Volume 200.0bbl



**Somerset-1**  
**340mm (13-3/8") Casing**  
**21 October 2009**

**340mm (13-3/8")**

Hole Size 444mm (17-1/2")  
 Depth 1284.0 mMDRT

Casing 1 x Shoe Joint A  
 1 x Intermediate Joint A  
 1 x Float Joint A  
 56 x 340mm (13-3/8") Casing

ID 314mm (12.347") nominal  
 Weight 72 lb/ft  
 Grade NT80HE BTC  
 Shoe Depth 1278.6 mMDRT

**Cement Details:**

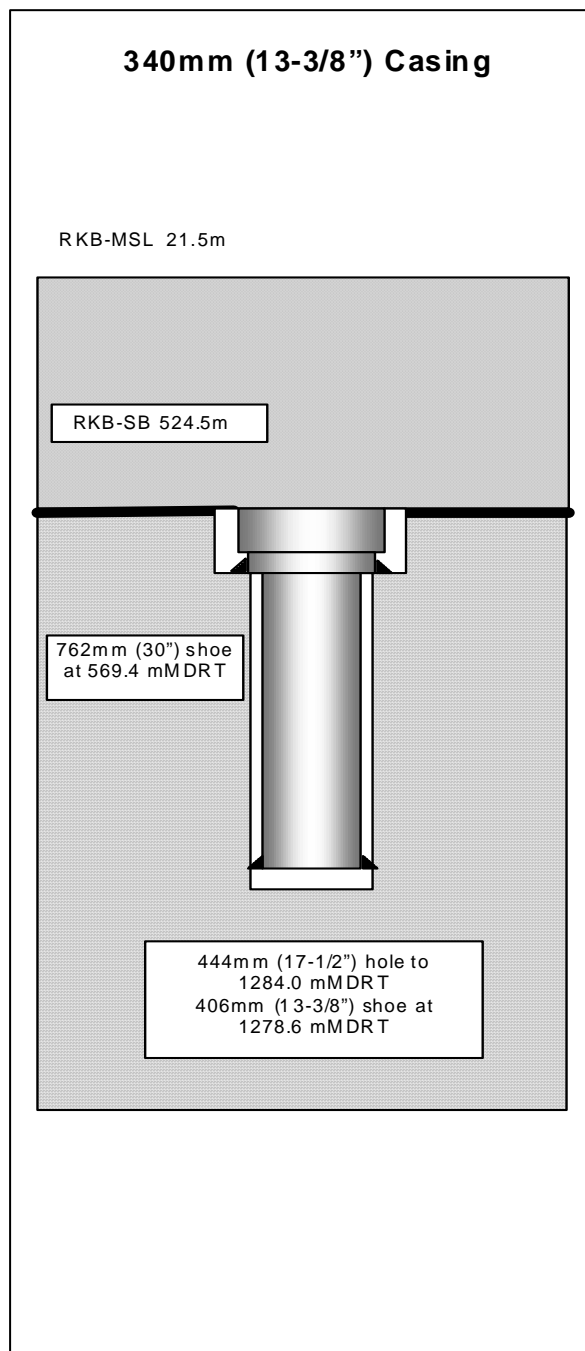
**Lead Slurry**

Cement -  
 Type -  
 Mixwater -  
 Drillwater -  
 Additives -

Weight -  
 Yield -  
 Volume -

**Tail Slurry**

Cement 40.0 MT  
 Type Class "G" with 1%CaCl  
 Mixwater 5.094 gal/sx  
 Drillwater 0 gal/sx  
 Additives 0.01 gal/sx D047  
 0.20 gal/sx D193  
 0.05 gal/sx D145A  
 Weight 1.90 sg (15.8 ppg)  
 Yield 1.19 ft<sup>3</sup>/sx  
 Volume 196.0bbl



**Somerset-1**  
**Barite & Cement Plug**  
**08 – 10 November 2009**

Hole Size: 311mm (12-1/4")  
 Depth: 2912.0 mMDRT

**Barite details**

Barite plug 1to4 ;  
 Weight: 1.98sg (16.5ppg)  
 Slurry Vol: 3.18 m<sup>3</sup> (20bbl)

**Cement Details**

**CEMENT PLUG # 1:**

Type: Class "G"  
 Weight: 1.89sg (15.8ppg)  
 Slurry Vol: 15.26m<sup>3</sup> (96bbl)

**CEMENT PLUG # 2:**

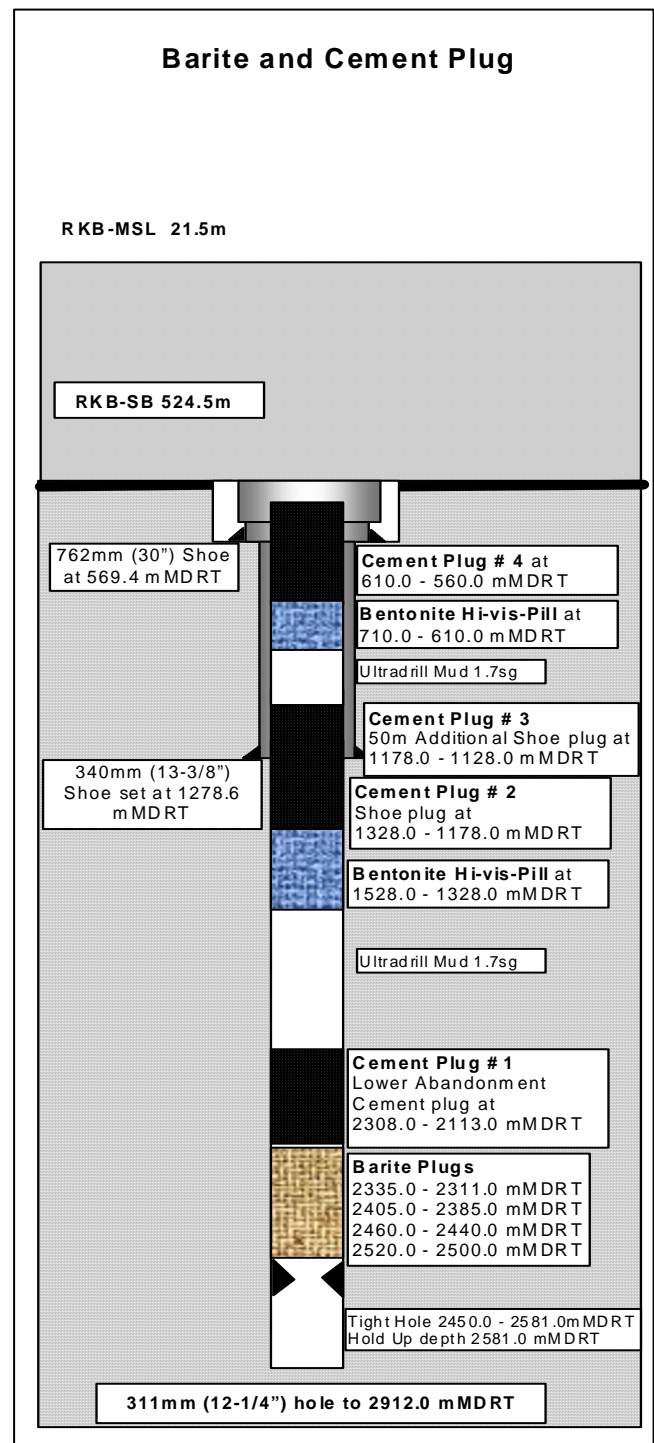
Type: Class "G"  
 Weight: 1.94sg (16.2ppg)  
 Slurry Vol: 15.26m<sup>3</sup> (96bbl)

**CEMENT PLUG # 3:**

Type: Class "G"  
 Weight: 1.94sg (16.2ppg)  
 Slurry Vol: 3.86m<sup>3</sup> (24.3bbl)

**CEMENT PLUG # 4:**

Type: Class "G"  
 Weight: 1.89sg (15.8ppg)  
 Slurry Vol: 15.26m<sup>3</sup> (96bbl)



## **SECTION 3**

### **GEOLOGY & SHOWS**

## Somerset-1

### 3.1 ROP, Gas and Shows

Geological logging for Somerset-1 commenced at 1284.0 mMDRT, below the 340mm (13-3/8") casing shoe at 1278.6 mMDRT, to a total depth of 2912.0 mMDRT. (All depths given in this section are measured from the Rotary Table, unless otherwise specified).

During the course of the well, all gas equipment were checked and calibrated regularly, and spot samples were taken during drilling breaks and other changes in drilling parameters to better assess lithological change. Drilled gas, trip gas, connection gas, re-circulated gas and swab gas levels were monitored.

The Lithology of Somerset-1 is described in detail in the Formation Evaluation Log, Enclosure 1, of this report.

A summary of ROP, Total Gas and Gas Chromatograph readings is tabulated below;

#### Gas and ROP Readings for 311mm (12-1/4") Hole Section

Interval (mMDRT)	Total Gas range min-max (%)	Total Gas Average (%)	ROP Range (m/h)	ROP Average (m/h)
1060.0 – 1330.0	0.00 – 0.01	0.01	5 – 175	60
1330.0 – 1602.0	0.01 – 0.05	0.03	10 – 100	48
1602.0 – 1680.0	0.02 – 0.12	0.05	13 – 80	45
1680.0 – 1732.0	0.03 – 0.12	0.08	11 – 79	49
1732.0 – 2140.0	0.01 – 0.13	0.06	12 – 90	47
2140.0 – 2817.0	0.00 – 0.19	0.11	11 – 82	42
2817.0 – 2912.0	0.04 – 2.62	0.94	8 – 68	31

Depth Interval (mMDRT)	Total Gas (%)	Depth Max Gas (mMDRT)	C1 Range (%)	C2 Range (%)	C3 Range (%)	iC4 Range (%)	nC4 Range (%)	iC5 Range (%)	nC5 Range (%)
<b>311mm (12-1/4") Hole Section</b>									
1060.0 – 1330.0	0.0043 – 0.010	1330.0	0.0003 – 0.003	Nil	Nil	Nil	Nil	Nil	Nil
1330.0 – 1602.0	0.0098 – 0.0463	1545.5	0.0021 – 0.0273	0.0 – 0.0002	0.0 – 0.0002	Nil	Nil	Nil	Nil
1602.0 – 1680.0	0.0196 – 0.122	1671.5	0.0024 – 0.075	0.0 – 0.0002	0.0 – 0.0002	Nil	Nil	Nil	Nil
1680.0 – 1732.0	0.0341 – 0.1245	1692.0	0.0006 – 0.0861	0.0 – 0.0003	0.0 – 0.0001	Nil	Nil	Nil	Nil
1732.0 – 2140.0	0.0104 – 0.1303	1747.0	0.0026 – 0.0879	0.0 – 0.0038	0.0 – 0.0002	0.0 – 0.0001	Nil	Nil	Nil
2140.0 – 2817.0	0.0001 – 0.1909	2526.5	0.0015 – 0.1323	0.0 – 0.0043	0.0 – 0.0024	0.0 – 0.0004	0.0 – 0.0003	0.0 – 0.0001	0.0 – 0.0001
2817.0 – 2912.0	0.0376 – 2.6176	2855.0	0.0215 – 2.5637	0.0004 – 0.058	0.0 – 0.0216	0.0 – 0.0019	0.0 – 0.0024	0.0 – 0.0007	0.0 – 0.0005

## 3.2 Sampling Summary

### Somerset-1

Ditch Cuttings Samples were collected at the following intervals:

#### DITCH CUTTING SAMPLING INTERVAL

#### 311mm (12-1/4") hole section

Depth (mMDRT)	Sample interval (m)	Sample Type
1284.0 – 1290.0	6	normal
1290.0 – 2810.0	10	normal
2810.0 – 2875.0	5	normal
2875.0 – 2878.0	3	normal

#### LIST OF ALL MISSED/UNDERWEIGHT SAMPLES AND EXPLANATION

2875.0 to 2878.0 mMDRT - Underweight (less returns at shakers)

2878.0 to 2912.0 mMDRT - No cutting returns at shakers due to well control operation

#### Samples to be split at Baker Hughes Inteq workshop, Bibra Lake

Sample Type	Large Box No.	Interval (mMDRT)
<b>Washed and dried Cutting Samples</b>  <b>To be split into 4 x 200g samples (Set A,B,C,D)</b>	BOX 1	1284.0 – 1390.0
	BOX 2	1390.0 – 1490.0
	BOX 3	1490.0 – 1590.0
	BOX 4	1590.0 – 1690.0
	BOX 5	1690.0 – 1800.0
	BOX 6	1800.0 – 1920.0 <b>(1860.0 sample bag is in Box 7)</b>
	BOX 7	1920.0 – 2010.0
	BOX 8	2010.0 – 2110.0
	BOX 9	2110.0 – 2210.0
	BOX 10	2210.0 – 2310.0
	BOX 11	2310.0 – 2410.0
	BOX 12	2410.0 – 2510.0
	BOX 13	2510.0 – 2610.0
	BOX 14	2610.0 – 2710.0
	BOX 15	2710.0 – 2810.0
	BOX 16	2810.0 – 2845.0
	BOX 17	2845.0 – 2878.0
	Box 18	ZIP LOCK BAGS (4 SETS) – 1284.0 to 2912.0 SMALL ZIP LOCK BAGS- (1 <b>SET E</b> ) – 1284.0 to 2912.0 METAL TAGS ( 5 SETS) – 1284.0 to 2912.0
<b>Samplex Tray Samples</b>  <b>Set F</b>	Box 19 (Wooden Box)	1284.0 – 2912.0

**Mudgas Samples** were collected in **Isotubes** at the following depths:

**SET-G (ISOTUBE SAMPLES)**

**Box 1**

Isotube no.	Depth (mMDRT)	Sample type	Total Gas (%)	C1 (%)	C2 (%)	C3 (%)	Time/Date
1	1300.0	Regular sample	0.0065	0.0012	-	-	17:08 hrs/ 25-Oct-09
2	1400.0	Regular sample	0.0162	0.0048	0.0001	-	20:31 hrs/ 25-Oct-09
3	1500.0	Regular sample	0.0285	0.0132	0.0001	-	23:18 hrs/ 25-Oct-09
4	1600.0	Regular sample	0.0410	0.02	0.0001	-	02:38 hrs/ 26-Oct-09
5	1700.0	Regular sample	0.1008	0.0554	0.0001	-	06:16 hrs/ 26-Oct-09
6	1800.0	Regular sample	0.0310	0.0585	0.0002	-	09:55 hrs/ 26-Oct-09
7	1900.0	Regular sample	0.0359	0.0038	-	-	13:02 hrs/ 26-Oct-09
8	1980.0	Regular sample	0.0400	0.0195	0.0002	0.0001	15:33 hrs/ 26-Oct-09
9	2000.0	Regular sample	0.0382	0.028	0.0003	0.0001	16:08 hrs/ 26-Oct-09
10	2050.0	Regular sample	0.0505	0.0157	0.0002	-	17:28 hrs/ 26-Oct-09
11	2100.0	Regular sample	0.0522	0.0352	0.0004	0.0002	18:41 hrs/ 26-Oct-09
12	2150.0	Regular sample	0.0514	0.0361	0.0004	0.0002	20:14 hrs/ 26-Oct-09
13	2200.0	Regular sample	0.04	0.0307	0.0004	0.0002	22:08 hrs/ 26-Oct-09
14	2250.0	Regular sample	0.042	0.0244	0.0004	0.0002	22:43 hrs/ 26-Oct-09
15	2300.0	Regular sample	0.12	0.031	0.0005	0.0002	01:27 hrs/ 27-Oct-09
16	2350.0	Regular sample	0.16	0.0763	0.0013	0.0005	03:17 hrs/ 27-Oct-09
17	2400.0	Regular sample	0.17	0.1065	0.0019	0.0008	04:53 hrs/ 27-Oct-09
18	2450.0	Regular sample	0.13	0.098	0.0023	0.0009	05:21 hrs/ 27-Oct-09
19	2500.0	Regular sample	0.13	0.066	0.0016	0.0007	07:52 hrs/ 27-Oct-09
20	2550.0	Regular sample	0.18	0.0967	0.0025	0.0011	09:29 hrs/ 27-Oct-09
21	2600.0	Regular sample	0.13	0.0615	0.0017	0.009	11:09 hrs/ 27-Oct-09
22	2650.0	Regular sample	0.1285	0.0944	0.0028	0.0014	12:40 hrs/ 27-Oct-09
23	2700.0	Regular sample	0.1190	0.0746	0.0025	0.0013	14:44 hrs/ 27-Oct-09
24	2750.0	Regular sample	0.110	0.0911	0.0032	0.0017	16:06 hrs/ 27-Oct-09
25	2800.0	Regular sample	0.09	0.0755	0.0032	0.0019	18:13 hrs/ 27-Oct-09



**Box 2**

<b>Isotube no.</b>	<b>Depth (mMDRT)</b>	<b>Sample type</b>	<b>Total Gas (%)</b>	<b>C1 (%)</b>	<b>C2 (%)</b>	<b>C3 (%)</b>	<b>Time/Date</b>
2	2815.0	Regular sample	0.1130	0.0845	0.0038	0.0038	18:57 hrs/ 27-Oct-09
1	2820.0	Regular sample	0.1443	0.0982	0.0038	0.0022	19:10 hrs/ 27-Oct-09
3	2830.0	Regular sample	0.4673	0.2138	0.0055	0.0025	19:46 hrs/ 18-Jul-09
4	2840.0	Regular sample	0.2166	0.2204	0.0021	0.0011	20:04 hrs/ 27-Oct-09
5	2850.0	Regular sample	0.3151	0.8893	0.0202	0.0075	20:35 hrs/ 18-Jul-09
6	2855.0	Regular sample	2.8	1.7572	0.0402	0.015	20:48 hrs/ 27-Oct-09
7	2860.0	Regular sample	1.37	0.9481	0.0221	0.0084	21:02 hrs/ 27-Oct-09
8	2870.0	Regular sample	1.49	1.6033	0.0372	0.0141	21:20 hrs/ 27-Oct-09
9	2880.0	Regular sample	0.044	0.0332	0.001	0.0006	00:35 hrs/ 28-Oct-09
10	2881.6	Bleed off choke and kill lane	0.2027	0.0247	0.0007	0.0004	08:10 hrs/ 28-Oct-09
11	2881.6	Bleed off choke and kill lane	1.16	0.0247	0.0007	0.0004	08:24 hrs/ 28-Oct-09
12	2885.38	Circulate with kill mud	1.94	0.0272	0.0009	0.0004	16:48 hrs/ 28-Oct-09
13	2890.0	Circulate with kill mud	1.04	0.4966	0.0149	0.0066	19:10 hrs/ 28-Oct-09
14	2900.0	Regular sample	0.04	0.3785	0.0111	0.0052	04:15 hrs/ 29-Oct-09
15	2910.0	Regular sample	0.5392	0.5107	0.0146	0.0065	22:40 hrs/ 29-Oct-09

**Mud Samples and Mud Filtrate samples** were collected and stored in glass bottles at the following depths:

**SET H (Mud Sample and Mud Filtrate)**

**Somerset-1**

<b>Sample Type</b>	<b>Depth (mMDRT)</b>	<b>Time/Date</b>	<b>Volume</b>
Drilling Fluid (WBM)	1290.0	09:40hrs, 25-Oct-09	500 mL
Drilling Fluid (WBM)	2427.0	05:40hrs, 27-Oct-09	500 mL
Drilling Fluid (WBM)	2820.0	19:00hrs, 27-Oct-09	500 mL
Drilling Fluid (WBM)	2900.0	02:15hrs, 29-Oct-09	500 mL
Drilling Fluid (WBM)	2912.0	18:00hrs, 01-Nov-09	500 mL

Mud Filtrate (WBM)	1290.0	09:40hrs, 25-Oct-09	25 mL
Mud Filtrate (WBM)	2427.0	05:40hrs, 27-Oct-09	25 mL
Mud Filtrate (WBM)	2820.0	19:00hrs, 27-Oct-09	25 mL
Mud Filtrate (WBM)	2900.5	02:15hrs, 29-Oct-09	25 mL
Mud Filtrate (WBM)	2912.0	18:00hrs, 01-Nov-09	25 mL

## **SECTION 4**

### **PRESSURE EVALUATION**

## 4.1 Pore Pressure Evaluation

Baker Hughes INTEQ formation pressure evaluation services commenced from first returns at the top of the 311m (12-1/4") hole section at 1284.0 mMDRT. Formation evaluation was carried out using surface sensor data collected while drilling, and real-time LWD, as well as offset data provided by the client for correlation purposes. All depths in this discussion refer to "metres Measured Depth below Rotary Table" (mMDRT) unless otherwise stated.

The corrected drilling exponent Dxc was plotted continually while drilling proceeded in an attempt to identify a normal compaction trend and any subsequent deviations from this trend, which might have indicated changes in formation pore pressure. Background gas, including both liberated while drilling and while circulating off-bottom, the nature of cuttings and cavings, general borehole condition together with lagged mud temperatures, were the main tools used in estimating the degree of mud overbalance during drilling.

At Somerset-1 a formation fluid density of 1.03sg was assumed for all pressure gradient calculations. Pore Pressure was observed to be normal in the 445mm (17-1/2") hole section. In the 311mm (12-1/4") hole section, the pore pressure was seen to increase from 1.03sg to about 1.28sg EMW. As drilling progressed, the pore pressure was seen to become normally pressured to a depth of 2757.0 mMDRT. From 2757.0 to 2817.0 mMDRT, the pore pressure increased from 1.28 to 1.34sg EMW.

A kick occurred in when the active pit volume showed an increase gradually. The predicted pore pressure increased from 1.34 to 1.67sg EMW. The well was killed by using 1.7sg EMW.

The pore pressure prediction was made based on MWD Resistivity and Dxc data.

### Dxc Calculation

The following brief description of the Dxc is an extraction from Baker Hughes INTEQ manual; **Formation Pressure Evaluation Pore Pressure Evaluation Techniques**. Please refer to it for further clarification.

Bingham (1965) proposed a relationship between penetration rate, weight on bit, rotary speed, and bit diameter, Jorden and Shirley (1966) solved the equation and allowed a constant, "a", to be unity, but made the d-exponent lithology specific. In a constant lithology, the d-exponent should increase as the depth, compaction and differential pressure across the bottom increase. Upon penetration of a geopressured zone, compaction and differential pressure will decrease and will be reflected by a decrease in the d-exponent. Since differential pressure is dependent upon the mud density as well as formation pore pressure, Rehm and McClendon (1971) proposed a correction for this, hence the Dxc.

$$Dxc = [\log (R/60N) / \log (12W/10^3B)] \times [N.FBG/ECD]$$

Where

Dxc = corrected d-exponent (dimensionless)  
 R = rate of penetration (ft/hr)  
 N = rotary speed (rpm)  
 B = hole diameter (inches)  
 N.FBG = normal formation balance gradient (ppg)  
 ECD = effective circulating density (ppg)  
 W = weight on bit (1000 lbs)

Factors not considered by the Dxc in its basic form are drilling hydraulics, tooth efficiency (tooth wear and change in bit type) and lithology variation (matrix strength). If differential pressure becomes too large, the simple ratio correction will not completely compensate for its effect on the drill rate. In addition, the relationships among force applied (W/B), rotary speed (N), differential pressure (N.FBG/ECD), and rate of penetration (R) are more complex than the Dxc formulation would imply. While working within "normal" working ranges, radical changes in any of these parameters (for example, change in hole size after setting casing) may result in a change in the Dxc.

Whilst sliding with a downhole motor, bit RPM values are calculated from the flowrates used, as specified by the manufacturer. And in high angle deviated holes, the translation of the weight onto the bit may not be very exact, thus affecting the Dxc. Use of a PDC bit too, was seen affecting the Dxc.

## 4.2 Fracture Pressure Evaluation

Fracture pressure estimation for Somerset-1 was made using the Daines minimum tensile strength method. For a full explanation of this method, refer to INTEQ Manual MS-156 "The Theory and Evaluation of Formation Pressures".

Using Daines minimum tensile strength method the local effective stress ratio was determined and subsequent fracture pressures were calculated as the well progressed making use of the predicted pore pressure, calculated overburden gradient and the appropriate Poisson ratio for the lithology. The calculated fracture pressure is presented on the Pressure Evaluation Plot (Enclosure 3).

Fracture pressure evaluation commenced at the start of the 311mm (12-1/4") section.

### Hole Section 311mm (12-1/4")

A LeakOff Test (LOT) was conducted at the 1289.0 mMDRT.

LOT / FIT	Hole Size	Hole Depth	Casing Size	Shoe Depth	Applied Pressure	Test Mud Weight	Fracture Gradient
LOT	311mm (12-1/4")	1289.0 mMDRT 1288.9 mTVDRT	340 mm (13-3/8")	1278.6 mMDRT 1278.5 mTVDRT	824psi	1.25 sg	1.70 sg EMW

### Daines minimum tensile strength methodology

Daines' technique calculates the fracture pressures employing the following equation:

$$P_f = ((S - P_p) * \{u/1-u\}) + ((S - P_p) * B) + P_p$$

Where

$P_f$  = Fracture pressure (psi)

$P_p$  = Pore pressure (psi)

$S$  = Overburden pressure (psi)

$u$  = Poisson's ratio (dimensionless)


$B$  = Effective stress ratio (dimensionless)

During drilling, bulk densities were calculated from cuttings lithology together with data from offset wells.


The Poisson's ratio was derived by comparing the formation type drilled with a list of established values. The effective stress ratio "Beta" was calculated from the results of leak off tests where the fracture gradient is actually measured. Once the ratio had been derived the result was used over the following hole section to calculate the fracture pressure using overburden pressure, estimated pore pressure and Poisson's ratio for each lithology.

It must however be stressed that this method of fracture pressure calculation relies heavily upon the formation being pressured up to the point of fracture. The use in the equation of data from formation integrity tests (in which the formation is pressured to a predetermined point and no further) rather than a full leak off test will underestimate subsequent fracture pressures.


## **APPENDICES**

BIT RUN SUMMARY																																	
OPERATOR Woodside Energy Ltd					WELL NAME Somerset-1					LOCATION T/34P					CONTRACTOR Diamond Offshore							RIG Ocean Patriot											
<div><div>BAKER HUGHES</div><div>INTEQ</div></div> <div> woodside</div>				Mud Pump Data 914mm (36"), 508mm (20"), 343mm (13.5") & 241mm (9.5") section 6" Liner - 0.1017 bbl/stk			BIT DULL CHARACTERISTICS												REASONS PULLED														
							BC - Broken Cone			CI - Cone Interference			JD - Junk Damage			PB - Pinched Bit			SS - Self-Sharpening			BHA - Bottomhole Assembly			LOG - Run Logs			FM - Formation Change			TD - Total / Csg depth		
							BT - Broken Teeth			CR - Cored			LC - Lost Cone			PN - Plugged Nozzle			TR - Tracking			DMF - Downhole Motor failure			RIG - Rig repair			HP - Hole Problems			TQ - Torque		
							BU - Balled Up			CT - Chipped Teeth			LN - Lost Nozzle			RG - Rounded Gauge			WO - Washed-Out Bit			DSF - Drill String failure			CM - Condition Mud			HR - Hours			TW - Twist-Off		
							CC - Cracked Cone			FC - Flat Crested Wear			LT - Lost Teeth			RO - Ring Out			WT - Worn Teeth			DST - Drill Stem Test			CP - Core Point			PP - Pump Pressure			WC - Weather Conditions		
CD - Cone Dragged			HC - Heat Checking			OC - Off-Center Wear			SD - Shirltail Damage			NO - No Dull Characs.			DTF - Downhole Tool Failure			DP - Drill Plug			PR - Penetration rate			WO - Washout - Drill String									
BHA #	BIT No.	MAKE	TYPE	TFA sq.in.	JETS	SERIAL No.	DEPTH IN m	METRES ON BIT	HRS ON BOTTOM	AV ROP m/hr	IADC HRS	WOB klb	RPM S/M	TBR krev	SPP psi	FLOW IN gpm	TQ kft-lb	GRADE								MW s.g.	REMARKS						
																		I	O	D	L	B	G	O	R								
914mm (36") Hole Section 524.5 - 572.5 mMDRT																																	
1	NB1	Varel	MILL TOOTH	0.9204	3x20	766R1	524.5	48.0	3.0	16.0	4.00	1.4-17.9	24 - 70 / 24 - 70	103.7	45-1294	537-946	0-7.9	1	1	0	0	0	0	0	0	TD	1.04	TD 914mm (36") Section					
444mm (17-1/2") Hole Section 572.5 - 1482.0 mMDRT																																	
2	NB2	Smith	MILL TOOTH	0.9204	3x16, 3x12	PM6863	572.5	711.5	8.2	86.8	9.00	2.0-61.9	24-89 / 123-214	104.5	1373-4428	766-1270	1.1-11.9	1	1	WT	A	E	I	PN	TD	1.04	TD 444mm (17-1/2") Section						
311mm (12-1/4") Hole Section 1284.0 - 2912.0 mMDRT																																	
3	NB3	Smith	MDSi716LHBPX	1.1045	10 x 12	JD0772	1284.0	1628.0	42.4	38.4	43.00	4-40	15-165 / 15-165	414.3	1827-4618	690-1126	1-14	1	2	WT	S	X	I	CT	HP	1.25-1.31	TD 311mm (12-1/4") Section						





Bit Hydraulics Summary

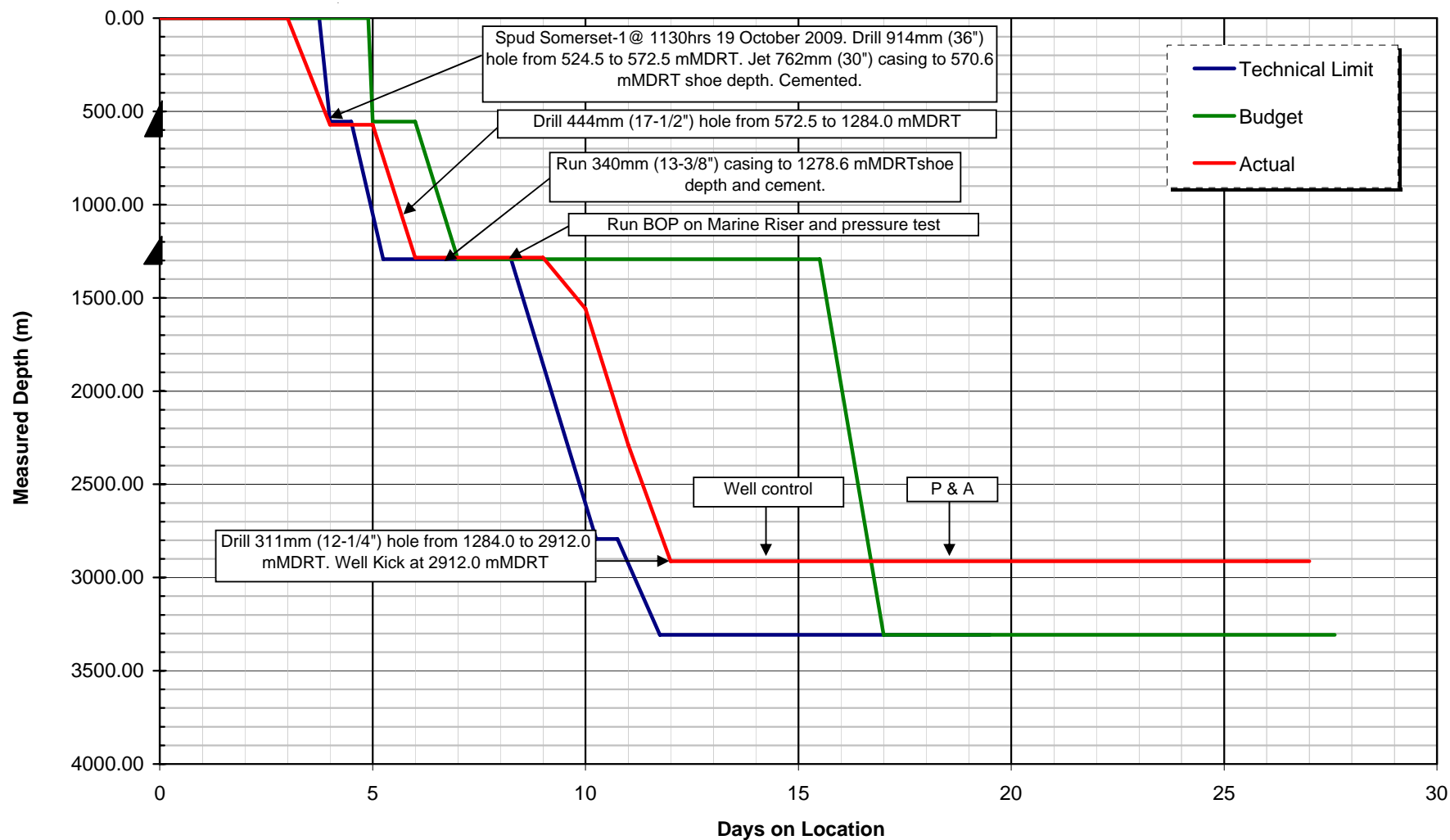


Operator Woodside Energy Ltd						Well Name Somerset-1				Location T/34P			Drilling Contractor Diamond Offshore						Rig Ocean Patriot			
Drillstring Abbreviations N Normal M MWD P Positive Displacement Motor A Adjustable Gauge Stabilizer C Core										Hydraulics Models Robertson-Stiff model used for drilling with mud Bingham Model used for coring and drilling with sea water												
Bit No.	Depth (m)	Hole Size in	Jets x 1/32"	TFA in^2	Drill String Type	Mud Type	Mud Density sg	PV cP	YP lbs/100 ft sq	Flow Rate gpm	Pump Pressure psi	Jet Vel m/sec	Impact Force lb/sq in	Surface Hydraulic Power hp	Power/ Area hp/sq in	Bit Loss psi	Bit Loss %	Pipe Loss psi	Total Loss psi	ECD sg	Annular Velocities DP OH m/min	DC OH m/min
311mm (12-1/4") Hole Section																						
NB2	1557	12-1/4	10 x 32	1.1045	M	WBM	1.26	20	28	990	4149	87.8	13.19	2381.5	3.38	676	16.47	601	2828	1.3240	59.14	73.35
NB2	2290	12-1/4	10 x 32	1.1045	M	WBM	1.30	21	32	980	4150	87.7	12.89	2332.8	3.25	661	16.19	886	2535	1.4262	59.73	86.80
NB2	2620	12-1/4	10 x 32	1.1045	M	WBM	1.30	21	32	845	4217	74.8	9.890	2108.7	2.15	507	11.85	1011	2763	1.4477	50.48	73.35



INTEQ

**Woodside Energy Ltd**  
**Somerset-1**  
**Time vs. Depth**



DRILL TYPE	DESTINATION	REMARKS
<b>DRILL CUTTINGS 200G</b> Washed/air dried (200g zip lock bags)  <b><u>FOUR sets (A,B,C,D)</u></b> All sets to be sent to:  Core Laboratories 447-449 Belmont Ave Kewdale WA 6105 Attn: James Brown	<b><u>Set A. Geosciences Australia</u></b>   <b><u>Set B. MRT (Tasmania)</u></b> Geological Survey Stores and Transportation Depot 37 Harris Street Carlisle WA 6101  <b><u>Sets C &amp; D. WEL</u></b>	Core Lab to forward to <b>Geoscience Australia</b> Cnr Jerrabomberra Avenue & Hindmarsh Drive Symonston ACT, 2609 GPO Box-378, Canberra ACT,2601          <b>Core Lab to store</b>
<b>FIS SAMPLES (30g) (SET E)</b> (in small plastic bags)	<b>Core Laboratories, Perth</b> address as above.	Core Lab to on-send to WEL
<b>SAMPLEX TRAYS (SET F)</b>	<b>Core Laboratories, Perth</b> address as above.	1 Set in wooden boxes.
<b>MUDGAS SAMPLES (SET G)</b>	<b>Core Laboratories, Perth</b> address as above.	Core Lab to forward to 41-45 Furnace Road Welshpool WA 6106  Contact: Cindy Barber Tel: 9458 8877 Email: cindy@geotechnical- services.com.au
<b>MUD SAMPLES AND (SET H)</b> <b>MUD MILTRATE</b>	<b>Core Laboratories, Perth</b> address as above.	Core Lab to on-send to Geotech fridge.

## Mudlogging Samples Compliancy Checklist

It is critically important for all cuttings samples to be compliant with both Government and Woodside requirements. Please help us to ensure compliance by following the sampling program for the well, and completing this checklist. Woodside appreciates your help with this.

Well: Somerset-1  
 Mudlogging Contractor: Baker Hughes Inteq  
 Crew Chief Name at TD: \_\_\_\_\_  
 Sample Catchers Names: \_\_\_\_\_

**CREW CHIEF TO COMPLETE, SIGN AND THEN SEND TO OPS GEOLOGIST**

YES	
✓	Correct weight (200 g +) - or reason why underweight marked on bag.
✓	Samples dry (& free of oily residue for SBM).
✓	Correct sampling intervals.
✓	Correct number of splits.
✓	Correct marking of split boxes.
✓	Correct bag types (plastic for WBM / foil for SBM).
✓	Correct labelling (indelible pen for plastic bags with WBM / metals tags for SBM).
✓	Legible labelling.
✓	Empty and labelled bags for missed intervals, with reason why missed (eg high ROP, cored interval, washed off shakers, lost circulation).
✓	Comprehensive sample manifest taped to outside of split boxes.
✓	This declaration has been sent to the ops geologist within 7 days of TD of the well.

Signed By Crew Chief: (Sgd)

Date: November 2009

**ENCLOSURES**



## INTEQ LOG SUITE

Drilling Data Plot

Formation Evaluation

Pressure Data Plot

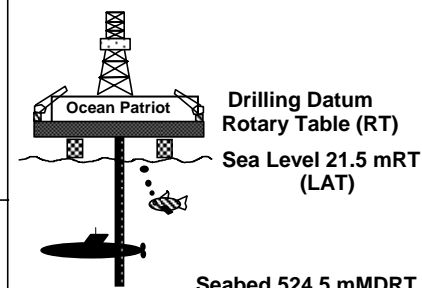
Gas Ratio Plot

## ABBREVIATIONS

NB	New Bit	SG	Swab Gas
RB	Rerun Bit	SVG	Survey Gas
CB	Core Bit	C	Carbide Test
WOB	Weight on Bit	MW	Mud Density sg
RPM	Revs per Minute	V	Funnel Viscosity
FLC	Flow Check	F	Filtrate - API
FLCG	Flow Check Gas	FC	Filter Cake
PR	Poor Returns	PV	Plastic Viscosity
NR	No Returns	YP	Yield Point
LAT	Logged after trip	SOL	Solids %
BG	Background Gas	Sd	Sand %
TG	Trip Gas	Cl	Chlorides
STG	Short trip Gas	RM	Mud Resistivity
CG	Connection Gas	RMF	Filtrate Resistivity
SWG	Swab Gas	TVD	Total Vertical Depth

## LITHOLOGY SYMBOLS

Calcarene	Calcsiltite	Argillaceous Calcsiltite	Calclutite
Dolomitic Calcarene	Dolomitic Calclutite	Argillaceous Calclutite	Volcanic
Siltstone	Calcareous Siltstone	Argillaceous Siltstone	Sandstone
Claystone	Calcareous Claystone	Silty Claystone	Calcareous Sandstone



Jet 762mm Conductor to shoe depth at 569.4 mMDRT

914mm (36") & 444mm (17-1/2") sections was drilled riser-less with SeaWater and PHG/Guar Gum sweep

340mm (13-38") Casing shoe set at 1278.6 mMDRT

311mm Hole to 2912 mMDRT Drilled with 1.25-1.31sg Ultra Drill WBM

311mm (12-1/4") Hole to TD at 2912.0 mMDRT

**Company** Woodside Energy Limited

**Well** Somerset-1

**Permit** T/34P

**Region** Otway Basin

**Designation** Vertical Exploration

**Coordinates** 039° 20' 36.757" S  
142° 44' 56.144" E

**Datum** GDA94 Zone 54

**Spud Date** 19 October 2009

**Spud Depth** 524.5 mMDRT

**RT – Sea Level** 21.5 m above LAT

**Total Depth** 2912.0 mMDRT

**Contractor** Diamond Offshore

**Rig** Ocean Patriot

**Type** Semi-Submersible

## LOG INTERVAL

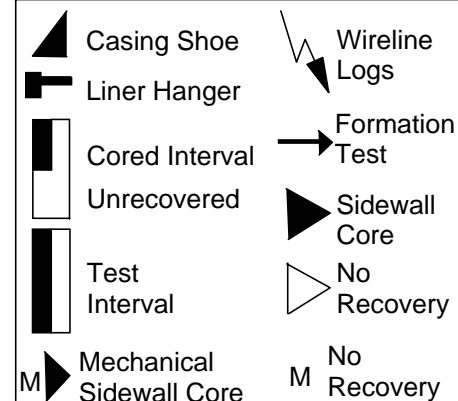
**Depth** 524.5 – 2912.0 mMDRT

**Date** 19 – 27 October 2009

**Scale** 1:500

**Data Engineers** S.Shahadan, Gokula.K.Ramanathan

**Loggers** R. Dhanda, P. Kadam, J. Bladen, S. Turnbull



**FORMATION EVALUATION LOG**  
1:500

# **DRILLING DATA PLOT**

1:1000



# **PRESSURE EVALUATION PLOT**

1:2500

**GAS RATIO PLOT**  
1:1000