WELL COMPARISON

The Ratler friction reduction tool was used on a pacesetting well paired with an offset. These two wells were drilled by the same crew, using the same bits with nearly identical well profiles and drilling assemblies. These two wells were separated by only 5 miles in the Willesden Green field. The BHA for the two wells that were studied for this comparison are as follows.

DRILLING ASSEMBLY			TOUR 2	
No	Component	OD	ID	Length
1	BIT	159.00	0.00	0.15
1	MOTOR	127.00	0.00	8.89
1	TB REAMER	152.00	57.00	1.64
1	FLEX NMDC	122.00	68.00	4.29
1	NM DC	122.00	70.00	9.44
1	GAP SUB	121.00	67.00	1.12
1	FLEX NMDC	121.00	69.00	9.35
1	X/O	132.00	65.00	0.56
1	190 JTS DP	114.00	69.00	1847.01
1	40 JT HWDP	114.00	71.00	379.27

Well “A” 044-09W5 (no Ratler)

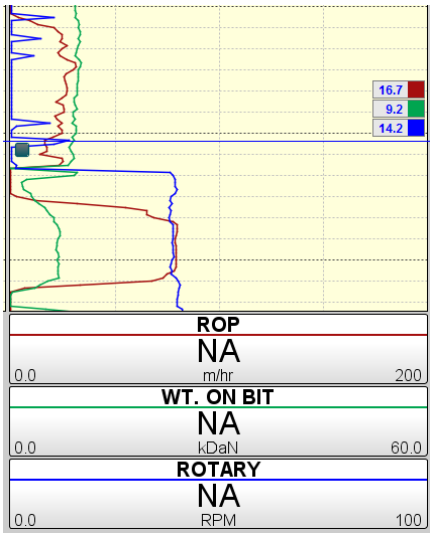
DRILLING ASSEMBLY			TOUR 2	
No	Component	OD	ID	Length
1	BIT	159.00	0.00	0.15
1	MOTOR	125.00	0.00	9.00
1	REAMER	152.00	57.00	1.64
1	FLEX NMDC	122.00	70.00	9.44
1	GAP SUB	121.00	67.00	1.12
1	FLEX NMDC	121.00	69.00	9.35
1	X/O	132.00	65.00	0.56
1	16 STD DP	114.30	69.00	310.72
1	RATTLER	126.00	0.00	7.61
1	86 STD DP	114.30	60.00	1670.12
1	20 STD HWDP	114.30	60.00	379.37

Well “B” 044-09W5 (Ratler)

DATA GATHERING

Pason drilling data was collected from each of the wells. The horizontal sections from each well were extracted for further analysis and the data was sorted to extract the sliding and rotating drilling data separately. This was done by creating a set of rules to eliminate sections of data where drilling was not occurring. Another set of rules were then applied to differentiate between slides and drilling straight ahead. These rules were created by graphing the entire data set and looking for step changes in the data to first approximate the set points. Pason Rig View was then used to verify these set points.

The set points to isolate slides used were ROP>0 and RPM≤15. The ROP set point eliminates non-drilling instances and the RPM cut-off was found to be a good cut-off between the two drilling styles. This was slightly higher than expected, but many instances of orientation corrections during a slide were found to have RPMs reported at these levels. To isolate the straight ahead drilling the settings used were ROP>0 and RPM>15. These filters would be as expected based on the previous filters, and to not lose any data points. A sample of one of these instances is highlighted in the image on the right.



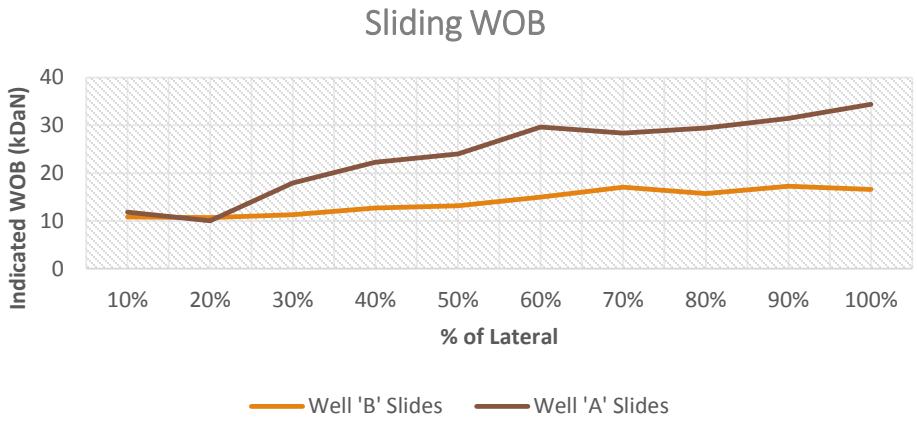
The section used for data analysis from each well were from 2670m to 3925m for well “B” and from 2845 to 4025 for well “A”.

EXTRACTED DATA

The ROP performance of each well was averaged from the filtered data, once each for sliding and rotating. The following table is the results of the data gathering for ROP. It shows a massive increase in ROP performance for the pacesetting well that includes the Ratler.

	Well "B" w/ Ratler	Well "A" w/o Ratler
Sliding ROP	22 m/hr	11.09 m/hr
Rotating ROP	66.85 m/hr	37.48 m/hr
Slides vs. Rotating	33%	30%

Sliding performance of Well "B" vs. Well "A" can be seen in the drastic increase in WOB indicated throughout the lateral section. Indicated WOB in the lateral section is a combination of actual WOB and frictional drag. The Ratler's main goal is to limit the friction while drilling, and the following graph would indicate that more consistent WOB was experienced while drilling the pacesetting Well "B".



This chart plots the average WOB in 10% increments along the lateral sections of each well. It can be seen that Well "A" experienced a dramatic increase in WOB indicated at surface. This would be consistent with significantly increased drag as the well progressed deeper and deeper. It should also be noted that the Ratler prevented significant drag increases through the progression of Well "B" allowing it to experience continued ROP gains over the other well.

CONCLUSION

Both wells, "A" and "B", were drilled in the same area using the same rig, BHA, bits and well profiles. The major differentiator between the two was the inclusion of a Ratler friction reduction system in the pacesetting Well "B". The Ratler friction reduction tool significantly increased drilling ROP and reduced drag for the lateral section. This led to a record run for a well of this type saving time and money for the client.