

039-25785

**Scientific Drilling**

Gyroscopic Survey Report
for
Black Hills

Well Location	Jicarilla 460-16 #4
Well Name	Jicarilla 460-16 #4
Rig Name	A Plus 14
Survey Date	05/17/13
Latitude	36.8073556N
North Reference	True North
Grid Correction	None
Depth Reference	RKB (12.00 ft)
Calculation Method	Minimum Curvature
Section (VS) Ref	0.00N (ft), 0.00E (ft), 115.31Azim (deg)
Definitive Survey	Out Run - Definitive
Operator(s)	B. Willhight

Well Notes

Survey from RKB to 3177' in 4.5" casing

OIL CONS. DIV DIST. 3
APR 23 2014



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Survey: Out Run - Definitive
Survey Date: 05/17/13

MD ft	Inc deg	Azim deg	TVD ft	VS ft	+N/-S ft	+E/-W ft	DLS ft
0.00	0.00	0.00	0.00	0.00	0.00	0.00	Invalid
25.00	0.15	40.34	25.00	0.01	0.02	0.02	0.60
50.00	0.30	40.34	50.00	0.03	0.10	0.08	0.60
75.00	0.45	40.34	75.00	0.08	0.22	0.19	0.60
100.00	0.60	40.34	100.00	0.14	0.40	0.34	0.60
125.00	0.68	46.20	125.00	0.22	0.60	0.53	0.42
150.00	0.66	36.85	149.99	0.30	0.82	0.72	0.45
175.00	0.55	50.42	174.99	0.38	1.01	0.90	0.72
200.00	0.52	55.66	199.99	0.49	1.15	1.09	0.23
225.00	0.64	55.38	224.99	0.62	1.30	1.30	0.48
250.00	0.76	46.33	249.99	0.75	1.49	1.53	0.64
275.00	0.72	51.38	274.99	0.88	1.70	1.78	0.31
300.00	0.68	60.27	299.99	1.03	1.87	2.03	0.46
325.00	0.78	62.96	324.98	1.22	2.02	2.31	0.43
350.00	0.87	59.56	349.98	1.43	2.20	2.62	0.42
375.00	0.79	54.90	374.98	1.63	2.39	2.93	0.43
400.00	0.81	61.49	399.98	1.81	2.58	3.23	0.37
425.00	0.87	65.07	424.97	2.04	2.74	3.55	0.33
450.00	0.88	58.55	449.97	2.27	2.92	3.89	0.40
475.00	0.78	56.22	474.97	2.46	3.12	4.19	0.40
500.00	0.84	59.49	499.96	2.65	3.30	4.49	0.29
525.00	0.86	59.94	524.96	2.86	3.49	4.81	0.08
550.00	0.74	52.07	549.96	3.04	3.68	5.10	0.62
575.00	0.78	62.03	574.96	3.21	3.86	5.38	0.55
600.00	0.86	57.12	599.96	3.41	4.04	5.69	0.41
625.00	0.74	61.01	624.95	3.60	4.22	5.98	0.49
650.00	0.73	66.53	649.95	3.80	4.37	6.27	0.29
675.00	0.82	67.17	674.95	4.03	4.50	6.58	0.37
700.00	0.83	69.14	699.95	4.27	4.63	6.92	0.12
725.00	0.84	85.92	724.94	4.56	4.71	7.27	0.97
750.00	0.94	89.66	749.94	4.90	4.72	7.66	0.48
775.00	0.92	84.43	774.94	5.26	4.74	8.06	0.35
800.00	0.83	92.49	799.93	5.60	4.76	8.44	0.62
825.00	1.00	94.95	824.93	5.97	4.73	8.84	0.70
850.00	1.03	92.61	849.93	6.39	4.70	9.29	0.19
875.00	0.96	97.48	874.92	6.79	4.66	9.72	0.44
900.00	1.07	93.61	899.92	7.21	4.62	10.16	0.54
925.00	1.11	91.85	924.91	7.65	4.60	10.63	0.19
950.00	1.11	99.15	949.91	8.10	4.55	11.11	0.56



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Survey:		Out Run - Definitive					
Survey Date:		05/17/13					
MD ft	Inc deg	Azim deg	TVD ft	VS ft	+N/-S ft	+E/-W ft	DLS 7100ft
975.00	1.15	93.39	974.90	8.57	4.50	11.60	0.48
1000.00	1.17	89.10	999.90	9.03	4.49	12.11	0.36
1025.00	1.12	92.31	1024.89	9.48	4.48	12.61	0.32
1050.00	1.23	94.30	1049.89	9.96	4.45	13.12	0.45
1075.00	1.23	90.21	1074.88	10.45	4.43	13.66	0.35
1100.00	1.31	100.23	1099.88	10.97	4.38	14.21	0.93
1125.00	1.36	98.17	1124.87	11.53	4.29	14.78	0.28
1150.00	1.46	93.25	1149.86	12.11	4.23	15.39	0.63
1175.00	1.39	92.79	1174.86	12.68	4.19	16.01	0.27
1200.00	1.45	95.17	1199.85	13.26	4.15	16.63	0.33
1225.00	1.55	93.29	1224.84	13.87	4.10	17.28	0.44
1250.00	1.56	96.31	1249.83	14.50	4.05	17.96	0.33
1275.00	1.61	97.45	1274.82	15.16	3.96	18.64	0.25
1300.00	1.74	97.70	1299.81	15.86	3.87	19.37	0.51
1325.00	1.83	94.77	1324.80	16.59	3.78	20.14	0.50
1350.00	1.86	99.61	1349.78	17.36	3.68	20.94	0.64
1375.00	2.13	99.34	1374.77	18.20	3.54	21.80	1.06
1400.00	2.15	96.33	1399.75	19.09	3.41	22.72	0.45
1425.00	2.12	98.27	1424.73	19.97	3.29	23.65	0.31
1450.00	2.20	101.23	1449.72	20.88	3.13	24.57	0.55
1475.00	2.40	103.16	1474.70	21.85	2.92	25.55	0.88
1500.00	2.46	102.43	1499.67	22.89	2.69	26.59	0.26
1525.00	2.34	103.14	1524.65	23.91	2.45	27.61	0.50
1550.00	2.42	106.19	1549.63	24.93	2.19	28.61	0.60
1575.00	2.54	107.10	1574.61	26.00	1.88	29.65	0.51
1600.00	2.51	104.39	1599.58	27.09	1.58	30.71	0.49
1625.00	2.47	104.28	1624.56	28.15	1.31	31.76	0.15
1650.00	2.50	107.68	1649.54	29.22	1.01	32.81	0.60
1675.00	2.51	105.51	1674.51	30.30	0.70	33.85	0.38
1700.00	2.51	107.44	1699.49	31.38	0.39	34.90	0.34
1725.00	2.32	100.94	1724.47	32.42	0.13	35.92	1.33
1750.00	2.28	103.20	1749.45	33.39	-0.08	36.90	0.40
1775.00	2.27	101.94	1774.43	34.36	-0.29	37.87	0.21
1800.00	2.25	101.39	1799.41	35.32	-0.49	38.84	0.10
1825.00	2.30	100.29	1824.39	36.28	-0.68	39.81	0.25
1850.00	2.04	95.54	1849.37	37.18	-0.81	40.75	1.24
1875.00	2.04	97.00	1874.35	38.02	-0.91	41.63	0.21
1900.00	2.00	98.67	1899.34	38.86	-1.03	42.50	0.28



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MD ft	Inc deg	Azim deg	TVD ft	VS ft	+N/-S ft	+E/-W ft	DLS 7100ft
1925.00	2.05	99.25	1924.32	39.71	-1.17	43.38	0.21
1950.00	2.13	98.51	1949.31	40.59	-1.31	44.28	0.36
1975.00	2.13	96.85	1974.29	41.47	-1.43	45.20	0.25
2000.00	2.04	94.68	1999.27	42.33	-1.52	46.11	0.49
2025.00	2.01	96.32	2024.26	43.16	-1.61	46.98	0.27
2050.00	1.96	100.04	2049.24	43.99	-1.73	47.84	0.55
2075.00	2.03	103.11	2074.23	44.83	-1.91	48.69	0.53
2100.00	2.07	103.11	2099.21	45.71	-2.11	49.56	0.15
2125.00	2.03	101.40	2124.19	46.58	-2.30	50.44	0.31
2150.00	2.03	103.23	2149.18	47.44	-2.49	51.30	0.26
2175.00	1.98	105.81	2174.16	48.30	-2.71	52.15	0.41
2200.00	1.80	109.38	2199.15	49.12	-2.95	52.93	0.86
2225.00	1.91	117.22	2224.14	49.92	-3.28	53.67	1.10
2250.00	2.04	121.36	2249.12	50.78	-3.70	54.42	0.79
2275.00	1.99	121.37	2274.11	51.65	-4.15	55.17	0.22
2300.00	2.07	119.87	2299.09	52.54	-4.61	55.94	0.39
2325.00	2.10	121.11	2324.07	53.44	-5.07	56.72	0.21
2350.00	2.10	120.75	2349.06	54.35	-5.54	57.50	0.06
2375.00	2.02	122.57	2374.04	55.25	-6.01	58.27	0.41
2400.00	2.02	132.69	2399.03	56.11	-6.55	58.97	1.43
2425.00	2.05	132.59	2424.01	56.95	-7.15	59.62	0.12
2450.00	2.15	135.60	2448.99	57.82	-7.79	60.28	0.60
2475.00	2.26	136.15	2473.97	58.72	-8.48	60.95	0.43
2500.00	2.25	135.71	2498.96	59.64	-9.18	61.63	0.07
2525.00	2.31	139.75	2523.94	60.56	-9.92	62.30	0.69
2550.00	2.40	145.30	2548.91	61.47	-10.74	62.92	0.98
2575.00	2.37	143.88	2573.89	62.38	-11.58	63.53	0.27
2600.00	2.25	142.31	2598.87	63.27	-12.39	64.13	0.53
2625.00	2.39	145.15	2623.85	64.16	-13.21	64.73	0.71
2650.00	2.43	150.66	2648.83	65.05	-14.10	65.29	0.94
2675.00	2.44	152.50	2673.81	65.91	-15.03	65.79	0.31
2700.00	2.49	152.91	2698.78	66.76	-15.99	66.29	0.21
2725.00	2.47	150.72	2723.76	67.63	-16.94	66.80	0.39
2750.00	2.58	153.40	2748.74	68.51	-17.92	67.32	0.64
2775.00	2.64	156.95	2773.71	69.39	-18.95	67.79	0.69
2800.00	2.63	156.09	2798.68	70.25	-20.00	68.25	0.17
2825.00	2.57	157.62	2823.66	71.10	-21.05	68.70	0.36
2850.00	2.67	157.48	2848.63	71.95	-22.10	69.13	0.39



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2875.00	2.77	159.14	2873.60	72.81	-23.21	69.57	0.52
2900.00	2.68	158.26	2898.58	73.68	-24.31	70.00	0.41
2925.00	2.40	159.18	2923.55	74.48	-25.34	70.41	1.14
2950.00	2.55	161.20	2948.53	75.25	-26.36	70.77	0.70
2975.00	2.45	160.17	2973.50	76.01	-27.39	71.13	0.42
3000.00	2.53	159.41	2998.48	76.79	-28.41	71.51	0.33
3025.00	2.28	158.03	3023.46	77.55	-29.38	71.89	1.01
3050.00	2.25	156.02	3048.44	78.29	-30.29	72.27	0.34
3075.00	2.33	156.66	3073.42	79.04	-31.21	72.67	0.35
3100.00	2.42	155.73	3098.40	79.82	-32.16	73.09	0.37
3125.00	2.42	155.78	3123.37	80.63	-33.12	73.53	0.02
3150.00	2.47	158.15	3148.35	81.43	-34.10	73.94	0.45
3175.00	2.34	159.31	3173.33	82.19	-35.08	74.32	0.55
3177.00	2.33	159.41	3175.33	82.25	-35.16	74.35	0.55