PATHFINDER
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noble energy

Noble Energy PEN2HHS Surveys 0ft to 16241ft MD Survey Geodetic Report

(Def Survey)

Report Date:	April 16, 2014 - 08:26 AM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Noble Energy	**Vertical Section Azimuth:**	316.875 ° (Grid North)
Field:	WV Ritchie County (NAD27)	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Noble Energy PEN2 Pad / PEN2HHS	**TVD Reference Datum:**	KB
Well:	PEN2HHS	**TVD Reference Elevation:**	1100.100 ft above MSL
Borehole:	Original Borehole	**Seabed / Ground Elevation:**	1074.100 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	-7.859 °
Survey Name:	Noble Energy PEN2HHS Surveys 0ft to 16241ft MD	**Total Gravity Field Strength:**	999.3087mgn (9.80665 Based)
Survey Date:	April 02, 2014	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	248.404 ° / 10414.154 ft / 6.825 / 1.657	**Total Magnetic Field Strength:**	52240.400 nT
Coordinate Reference System:	NAD27 West Virginia State Plane, Northern Zone, US Feet	**Magnetic Dip Angle:**	66.845 °
Location Lat / Long:	N 39° 20' 11.67000", W 81° 0' 45.85000"	**Declination Date:**	April 02, 2014
Location Grid N/E Y/X:	N 308299.820 ftUS, E 1572143.508 ftUS	**Magnetic Declination Model:**	HDGM 2013
CRS Grid Convergence Angle:	-0.9648 °	**North Reference:**	Grid North
Grid Scale Factor:	0.99995343	**Grid Convergence Used:**	-0.9648 °
Version / Patch:	2.7.1043.0	**Total Corr Mag North->Grid North:**	-6.8944 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
SHL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	308299.82	1572143.51	N 39 20 11.67	W 81 0 45.85
	100.00	0.43	104.08	100.00	-0.32	-0.09	0.36	0.43	308299.73	1572143.87	N 39 20 11.67	W 81 0 45.85
	200.00	0.83	107.68	199.99	-1.26	-0.40	1.42	0.40	308299.42	1572144.93	N 39 20 11.67	W 81 0 45.83
	300.00	1.06	127.86	299.98	-2.81	-1.19	2.84	0.40	308298.63	1572146.35	N 39 20 11.66	W 81 0 45.81
	400.00	1.24	130.91	399.96	-4.80	-2.47	4.39	0.19	308297.35	1572147.89	N 39 20 11.65	W 81 0 45.79
	500.00	1.39	130.37	499.93	-7.08	-3.96	6.13	0.15	308295.86	1572149.64	N 39 20 11.63	W 81 0 45.77
	600.00	1.40	130.74	599.90	-9.50	-5.54	7.98	0.01	308294.28	1572151.49	N 39 20 11.62	W 81 0 45.75
	654.00	1.42	120.48	653.89	-10.80	-6.31	9.05	0.47	308293.51	1572152.56	N 39 20 11.61	W 81 0 45.73
	698.00	1.67	121.42	697.87	-11.94	-6.92	10.07	0.57	308292.90	1572153.58	N 39 20 11.60	W 81 0 45.72
	711.04	1.84	103.40	710.90	-12.30	-7.07	10.44	4.41	308292.75	1572153.95	N 39 20 11.60	W 81 0 45.72
	724.00	1.76	128.53	723.86	-12.67	-7.24	10.80	6.07	308292.58	1572154.30	N 39 20 11.60	W 81 0 45.71
	756.00	1.46	115.85	755.85	-13.53	-7.73	11.55	1.45	308292.09	1572155.05	N 39 20 11.60	W 81 0 45.70
	788.00	0.53	69.94	787.84	-13.97	-7.85	12.05	3.61	308291.97	1572155.56	N 39 20 11.59	W 81 0 45.69
	820.00	0.94	332.45	819.84	-13.78	-7.57	12.07	3.56	308292.25	1572155.58	N 39 20 11.60	W 81 0 45.69
	853.00	1.50	334.28	852.83	-13.10	-6.94	11.76	1.70	308292.88	1572155.27	N 39 20 11.60	W 81 0 45.70
	884.00	2.12	329.00	883.82	-12.16	-6.09	11.29	2.07	308293.74	1572154.79	N 39 20 11.61	W 81 0 45.71
	948.00	3.13	321.26	947.75	-9.26	-3.71	9.58	1.67	308296.11	1572153.09	N 39 20 11.63	W 81 0 45.73
	999.00	4.03	320.62	998.65	-6.08	-1.24	7.57	1.77	308298.58	1572151.08	N 39 20 11.66	W 81 0 45.75
	1095.00	3.35	322.82	1094.45	0.08	3.61	3.74	0.72	308303.43	1572147.25	N 39 20 11.71	W 81 0 45.80
	1191.00	2.29	306.57	1190.33	4.75	6.98	0.50	1.37	308306.80	1572144.01	N 39 20 11.74	W 81 0 45.85
	1287.00	1.12	281.34	1286.29	7.40	8.31	-1.96	1.42	308308.13	1572141.55	N 39 20 11.75	W 81 0 45.88
	1382.00	0.85	261.91	1381.28	8.56	8.39	-3.56	0.45	308308.21	1572139.94	N 39 20 11.75	W 81 0 45.90
	1477.00	0.65	213.35	1476.27	8.84	7.85	-4.56	0.68	308307.67	1572138.95	N 39 20 11.75	W 81 0 45.91
	1573.00	1.01	235.77	1572.26	8.85	6.91	-5.56	0.50	308306.73	1572137.95	N 39 20 11.74	W 81 0 45.92
	1669.00	0.43	207.38	1668.25	8.86	6.12	-6.42	0.69	308305.94	1572137.09	N 39 20 11.73	W 81 0 45.93
	1764.00	0.95	201.30	1763.24	8.40	5.07	-6.87	0.55	308304.89	1572136.64	N 39 20 11.72	W 81 0 45.94
	1859.00	0.74	196.95	1858.23	7.75	3.75	-7.34	0.23	308303.57	1572136.17	N 39 20 11.71	W 81 0 45.94
	1955.00	0.77	210.18	1954.23	7.26	2.60	-7.84	0.18	308302.42	1572135.67	N 39 20 11.69	W 81 0 45.95
	2050.00	0.57	189.04	2049.22	6.78	1.58	-8.24	0.33	308301.40	1572135.27	N 39 20 11.68	W 81 0 45.96
	2145.00	0.69	204.15	2144.21	6.27	0.59	-8.55	0.21	308300.41	1572134.96	N 39 20 11.67	W 81 0 45.96
	2241.00	0.82	210.05	2240.20	5.85	-0.53	-9.13	0.16	308299.29	1572134.38	N 39 20 11.66	W 81 0 45.97
	2337.00	0.28	59.63	2336.20	5.60	-1.01	-9.27	1.12	308298.81	1572134.24	N 39 20 11.66	W 81 0 45.97
	2432.00	0.18	8.70	2431.20	5.64	-0.74	-9.05	0.23	308299.08	1572134.46	N 39 20 11.66	W 81 0 45.96
	2526.00	0.30	0.27	2525.20	5.91	-0.35	-9.02	0.13	308299.47	1572134.49	N 39 20 11.67	W 81 0 45.96
	2622.00	0.07	24.39	2621.20	6.12	-0.05	-9.00	0.25	308299.77	1572134.51	N 39 20 11.67	W 81 0 45.96
	2716.00	0.46	272.51	2715.20	6.41	0.02	-9.35	0.52	308299.84	1572134.16	N 39 20 11.67	W 81 0 45.97
	2812.00	0.23	272.01	2811.20	6.82	0.05	-9.93	0.24	308299.87	1572133.58	N 39 20 11.67	W 81 0 45.98
	2908.00	0.02	335.93	2907.20	6.97	0.07	-10.13	0.23	308299.89	1572133.38	N 39 20 11.67	W 81 0 45.98
	3003.00	0.22	236.67	3002.20	7.02	-0.02	-10.29	0.24	308299.80	1572133.22	N 39 20 11.67	W 81 0 45.98
	3099.00	0.30	312.14	3098.20	7.30	0.05	-10.63	0.34	308299.87	1572132.88	N 39 20 11.67	W 81 0 45.99
	3195.00	0.09	227.06	3194.20	7.55	0.17	-10.87	0.32	308299.99	1572132.64	N 39 20 11.67	W 81 0 45.99
	3290.00	0.09	314.20	3289.20	7.63	0.17	-10.98	0.13	308299.99	1572132.53	N 39 20 11.67	W 81 0 45.99
	3385.00	0.19	190.74	3384.20	7.61	0.07	-11.06	0.26	308299.89	1572132.45	N 39 20 11.67	W 81 0 45.99
	3480.00	0.44	221.17	3479.19	7.48	-0.36	-11.33	0.31	308299.46	1572132.18	N 39 20 11.66	W 81 0 45.99
	3572.00	0.31	221.89	3571.19	7.42	-0.81	-11.73	0.14	308299.01	1572131.78	N 39 20 11.66	W 81 0 46.00
	3668.00	0.85	219.43	3667.19	7.31	-1.56	-12.35	0.56	308298.26	1572131.16	N 39 20 11.65	W 81 0 46.01
	3764.00	0.69	195.79	3763.18	6.92	-2.66	-12.96	0.37	308297.16	1572130.55	N 39 20 11.64	W 81 0 46.01
	3860.00	0.90	190.67	3859.17	6.17	-3.96	-13.26	0.23	308295.86	1572130.25	N 39 20 11.63	W 81 0 46.02
	3956.00	0.70	216.95	3955.16	5.63	-5.17	-13.75	0.43	308294.65	1572129.76	N 39 20 11.62	W 81 0 46.02
	4050.00	0.54	221.11	4049.15	5.48	-5.96	-14.39	0.18	308293.86	1572129.12	N 39 20 11.61	W 81 0 46.03
	4146.00	0.12	3.14	4145.15	5.51	-6.20	-14.68	0.67	308293.62	[illegible]	N 39 20 11.61	W 81 0 46.04
	4241.00	0.22	55.78	4240.15	5.55	-6.00	-14.52	0.18	308293.82	[illegible]	N 39 20 11.61	W 81 0 46.03
	4337.00	0.10	292.53	4336.15	5.60	-5.87	-14.45	0.30	308293.95	1572129.06	N 39 20 11.61	W 81 0 46.03
	4432.00	0.15	124.09	4431.15	5.55	-5.90	-14.42	0.26	[illegible]	[illegible]	N 39 20 11.61	W 81 0 46.03
	4527.00	0.29	188.02	4526.15	5.28	-6.21	-14.35	0.28	308293.61	[illegible]	[illegible]	W 81 0 46.03
	4623.00	0.39	341.29	4622.15	5.42	-6.14	-14.49	0.69	308293.68	1572129.02	N 39 20 11.61	W 81 0 46.03
	4718.00	0.59	350.87	4717.15	6.12	-5.35	-14.67	0.23	308294.47	[illegible]	N 39 20 11.61	W 81 0 46.04
	4814.00	0.44	333.30	4813.14	6.89	-4.54	-14.92	0.23	308295.28	[illegible]	N 39 20 11.62	W 81 0 46.04
	4909.00	0.38	297.58	4908.14	7.53	-4.06	-15.36	0.27	308295.76	1572128.15	N 39 20 11.63	W 81 0 46.04
	5005.00	0.35	319.09	5004.14	8.13	-3.70	-15.83	0.15	308296.12	1572127.68	N 39 20 11.63	W 81 0 46.05
	5100.00	0.51	269.23	5099.14	8.70	-3.48	-16.45	0.41	308296.34	[illegible]	N 39 20 11.64	W 81 0 46.06
	5196.00	0.42	295.96	5195.13	9.32	-3.33	-17.19	0.[illegible]	308296.49	1572126.32	N 39 20 11.63	W 81 0 46.07
	5292.00	0.55	278.93	5291.13	10.01	-3.11	-17.96	0.[illegible]	[illegible]	[illegible]	N 39 20 11.64	W 81 0 46.08
	5368.00	0.41	295.17	5367.13	10.55	-2.94	-18.57	0.26	308296.88	[illegible]	N 39 20 11.64	W 81 0 46.09
	5464.00	0.33	296.70	5463.13	11.13	-2.67	-19.13	0.08	308297.15	1572124.38	N 39 20 11.64	W 81 0 46.09

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Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	5512.00	2.04	233.19	5511.11	11.35	-3.12	-19.93	3.99	308296.70	1572123.58	N 39 20 11.64	W 81 0 46.10
	5559.00	7.23	237.02	5557.95	11.97	-5.23	-23.09	11.06	308294.59	1572120.42	N 39 20 11.61	W 81 0 46.14
	5607.00	12.25	239.50	5605.24	13.61	-9.46	-30.01	10.49	308290.36	1572113.50	N 39 20 11.57	W 81 0 46.23
	5655.00	18.21	242.05	5651.76	18.48	-15.19	-40.32	8.35	308264.63	1572103.19	N 39 20 11.51	W 81 0 46.36
	5702.00	19.53	241.20	5696.48	20.14	-22.05	-53.01	7.09	308277.77	1572090.51	N 39 20 11.44	W 81 0 46.52
	5749.00	23.45	239.77	5740.21	24.17	-30.54	-67.98	8.41	308269.28	1572075.54	N 39 20 11.36	W 81 0 46.71
	5798.00	28.66	238.98	5784.21	28.82	-41.52	-86.48	10.66	308258.31	1572057.03	N 39 20 11.25	W 81 0 46.94
	5846.00	33.79	238.04	5825.25	33.82	-54.52	-107.69	10.74	308245.30	1572035.83	N 39 20 11.11	W 81 0 47.21
	5893.00	38.73	237.11	5863.13	38.97	-69.43	-131.13	10.58	308230.39	1572012.38	N 39 20 10.96	W 81 0 47.50
	5941.00	43.80	236.49	5899.20	44.41	-86.77	-157.61	10.60	308213.05	1571985.90	N 39 20 10.79	W 81 0 47.84
	5989.00	46.31	241.51	5933.12	51.57	-104.23	-186.73	9.06	308195.60	1571956.79	N 39 20 10.61	W 81 0 48.20
	6036.00	46.80	248.52	5965.46	62.19	-118.62	-217.62	10.88	308181.21	1571925.89	N 39 20 10.46	W 81 0 48.59
	6084.00	48.07	256.08	5997.95	77.37	-129.33	-251.26	11.89	308170.50	1571892.26	N 39 20 10.35	W 81 0 49.02
	6131.00	50.10	262.52	6028.75	96.42	-135.88	-286.13	11.22	308163.94	1571857.39	N 39 20 10.28	W 81 0 49.46
	6180.00	52.08	268.30	6059.54	120.18	-138.91	-324.11	10.03	308160.92	1571819.41	N 39 20 10.24	W 81 0 49.94
	6227.00	54.26	272.64	6087.72	146.17	-138.51	-361.71	9.01	308161.32	1571781.82	N 39 20 10.24	W 81 0 50.42
	6274.00	58.90	278.21	6114.30	175.27	-134.75	-400.27	10.97	308165.08	1571743.26	N 39 20 10.27	W 81 0 50.91
	6321.00	59.18	282.26	6139.19	207.26	-127.65	-439.49	8.75	308172.17	1571704.04	N 39 20 10.34	W 81 0 51.42
	6370.00	61.16	285.31	6163.58	242.87	-117.52	-480.76	8.77	308182.31	1571662.78	N 39 20 10.43	W 81 0 51.94
	6417.00	62.26	290.81	6185.66	279.12	-104.68	-520.08	10.57	308195.14	1571623.46	N 39 20 10.55	W 81 0 52.45
	6465.00	64.54	294.75	6207.36	318.29	-88.06	-559.83	8.74	308211.77	1571583.91	N 39 20 10.71	W 81 0 52.95
	6512.00	67.52	298.46	6228.46	358.57	-68.82	-598.01	9.60	308231.01	1571545.53	N 39 20 10.89	W 81 0 53.45
	6561.00	71.05	303.04	6243.80	402.58	-45.38	-637.37	11.33	308254.45	1571506.17	N 39 20 11.12	W 81 0 53.95
	6608.00	75.36	308.67	6257.38	446.57	-19.66	-674.26	11.78	308280.16	1571469.28	N 39 20 11.36	W 81 0 54.43
	6658.00	79.87	310.50	6267.68	492.95	9.58	-710.89	12.21	308309.40	1571432.66	N 39 20 11.65	W 81 0 54.90
	6703.00	82.76	313.04	6274.77	539.22	40.52	-745.53	8.15	308340.34	1571398.01	N 39 20 11.95	W 81 0 55.35
	6752.00	85.98	316.55	6279.58	587.93	74.88	-780.12	9.69	308374.69	1571363.43	N 39 20 12.28	W 81 0 55.79
	6800.00	88.31	319.78	6281.97	635.85	110.59	-812.09	8.29	308410.40	1571331.46	N 39 20 12.63	W 81 0 56.21
	6847.00	89.17	320.29	6283.01	682.77	148.60	-842.27	2.13	308446.41	1571301.28	N 39 20 12.98	W 81 0 56.60
	6942.00	89.97	317.87	6283.72	777.69	218.27	-904.61	2.88	308518.08	1571238.94	N 39 20 13.68	W 81 0 57.41
	7037.00	90.14	317.27	6283.63	872.69	288.28	-968.83	0.46	308588.08	1571174.72	N 39 20 14.36	W 81 0 58.24
	7133.00	90.86	317.25	6282.79	968.68	358.78	-1033.98	0.75	308658.58	1571109.58	N 39 20 15.04	W 81 0 59.08
	7228.00	92.06	319.25	6280.37	1063.62	429.63	-1097.21	2.45	308729.43	1571046.35	N 39 20 15.73	W 81 0 59.90
	7324.00	90.24	318.12	6278.44	1159.54	501.71	-1160.58	2.23	308801.51	1570982.99	N 39 20 18.43	W 81 1 0.73
	7419.00	89.97	317.78	6278.27	1254.53	572.24	-1224.22	0.47	308872.04	1570919.35	N 39 20 17.12	W 81 1 1.55
	7514.00	90.21	318.33	6278.12	1349.51	642.89	-1287.73	0.65	308942.68	1570855.84	N 39 20 17.81	W 81 1 2.37
	7610.00	90.14	319.08	6277.83	1445.48	715.02	-1351.08	0.78	309014.80	1570792.49	N 39 20 18.51	W 81 1 3.20
	7705.00	89.83	318.62	6277.85	1540.39	786.66	-1413.47	0.43	309086.44	1570730.11	N 39 20 19.21	W 81 1 4.01
	7801.00	90.38	320.73	6277.87	1636.27	859.95	-1475.48	2.07	309159.73	1570668.12	N 39 20 19.92	W 81 1 4.81
	7897.00	90.58	324.08	6276.87	1731.80	936.01	-1534.02	3.50	309235.78	1570609.58	N 39 20 20.66	W 81 1 5.57
	7992.00	90.65	326.60	6275.85	1825.75	1014.14	-1588.04	2.65	309313.91	1570555.54	N 39 20 21.43	W 81 1 6.28
	8088.00	90.17	326.13	6275.16	1920.44	1094.06	-1641.21	0.70	309393.83	1570502.37	N 39 20 22.21	W 81 1 6.97
	8183.00	90.17	323.79	6274.88	2014.49	1171.84	-1695.75	2.48	309471.60	1570447.84	N 39 20 22.97	W 81 1 7.68
	8279.00	90.31	323.88	6274.48	2109.78	1249.34	-1752.40	0.17	309549.10	1570391.19	N 39 20 23.72	W 81 1 8.42
	8375.00	90.21	323.09	6274.04	2205.14	1326.49	-1809.53	0.83	309626.25	1570334.07	N 39 20 24.48	W 81 1 9.16
	8470.00	90.65	321.25	6273.33	2299.73	1401.52	-1867.79	1.99	309701.27	1570275.81	N 39 20 25.21	W 81 1 9.92
	8566.00	90.14	320.42	6272.87	2395.49	1475.95	-1928.41	1.01	309775.70	1570215.19	N 39 20 25.93	W 81 1 10.71
	8662.00	90.34	320.42	6272.27	2491.31	1549.94	-1989.58	0.21	309849.69	1570154.02	N 39 20 26.65	W 81 1 11.50
	8758.00	90.41	320.70	6271.84	2587.11	1624.08	-2050.57	0.30	309923.82	1570093.04	N 39 20 27.38	W 81 1 12.29
	8853.00	90.31	319.61	6271.04	2681.95	1697.02	-2111.43	1.15	309996.75	1570032.18	N 39 20 28.09	W 81 1 13.08
	8949.00	90.65	319.20	6270.24	2777.85	1769.91	-2173.90	0.55	310069.64	1569969.72	N 39 20 28.80	W 81 1 13.89
	9045.00	90.38	319.21	6269.37	2873.77	1842.58	-2236.62	0.28	310142.31	1569907.00	N 39 20 29.51	W 81 1 14.71
	9140.00	89.93	318.54	6269.12	2968.71	1914.14	-2299.10	0.85	310213.87	1569844.52	N 39 20 30.20	W 81 1 15.52
	9236.00	90.24	318.70	6268.98	3064.66	1986.18	-2362.58	0.36	310285.90	1569781.07	N 39 20 30.90	W 81 1 16.34
	9332.00	90.17	318.27	6268.63	3160.63	2058.06	-2426.19	0.45	310357.78	1569717.44	N 39 20 31.60	W 81 1 17.17
	9427.00	90.21	317.99	6268.32	3255.60	2128.80	-2489.59	0.30	310428.52	1569654.04	N 39 20 32.29	W 81 1 17.99
	9522.00	90.03	317.51	6268.12	3350.59	2199.12	-2553.47	0.54	310498.83	1569590.16	N 39 20 32.98	W 81 1 18.82
	9617.00	90.65	316.70	6267.55	3445.59	2268.72	-2618.13	1.07	310568.43	1569525.51	N 39 20 33.65	W 81 1 19.68
	9712.00	91.34	317.28	6265.90	3540.57	2338.17	-2682.92	0.95	310637.88	1569460.72	N 39 20 34.33	W 81 1 20.49
	9808.00	91.34	319.31	6263.66	3638.51	2409.82	-2746.77	2.11	310709.52	1569396.87	N 39 20 35.03	W 81 1 21.32
	9904.00	90.41	321.41	6262.19	3732.32	2483.73	-2808.00	2.39	310783.43	1569335.64	N 39 20 35.75	W 81 1 22.12
	9998.00	89.93	322.50	6261.91	3825.94	2557.76	-2865.93	1.27	310857.46	1569277.72	N 39 20 36.47	W 81 1 22.87
	10093.00	90.17	323.04	6261.83	3920.44	2633.40	-2923.41	0.62	310933.09	1569220.24	N 39 20 37.21	W 81 1 23.62
	10187.00	89.90	322.96	6261.77	4013.90	2708.47	-2979.98	0.30	311008.16	1569163.88	N 39 20 37.94	W 81 1 24.36
	10282.00	89.86	321.76	6261.97	4108.47	2783.70	-3037.99	1.26	311083.38	1569105.86	N 39 20 38.67	W 81 1 25.11
	10378.00	90.03	321.12	6262.06	4204.16	2858.76	-3097.83	0.69	311158.45	1569045.83	N 39 20 39.40	W 81 1 25.89
	10473.00	89.79	320.75	6262.21	4298.92	2932.52	-3157.70	0.48	311232.20	1568985.96	N 39 20 40.12	W 81 1 26.67
	10568.00	89.97	320.85	6262.41	4393.70	3006.14	-3217.74	0.22	311305.82	1568925.92	N 39 20 40.84	W 81 1 27.45
	10662.00	89.86	320.48	6262.55	4487.50	3078.84	-3277.34	0.43	311378.51	1568866.33	N 39 20 41.55	W 81 1 28.22
	10757.00	90.07	320.05	6262.61	4582.33	3151.88	-3338.08	0.48	311451.55	1568805.59	N 39 20 42.26	W 81 1 29.01
	10853.00	90.10	319.77	6262.47	4678.20	3225.33	-3399.90	0.29	311524.99	1568743.77	N 39 20 42.98	W 81 1 29.81
	10947.00	89.35	318.32	6262.92	4772.12	3296.31	-3461.51	1.74	311595.97	1568682.18	N 39 20 43.67	W 81 1 30.61
	11042.00	89.83	317.99	6263.60	4867.10	3367.08	-3524.89	0.61	311666.74	1568618.79	N 39 20 44.36	W 81 1 31.43
	11136.00	90.65	318.58	6263.21	4961.07	3437.25	-3587.43	1.07	311736.90	1568556.25	N 39 20 45.04	W 81 1 32.24
	11232.00	90.52	318.32	6262.23	5057.03	3509.09	-3651.11	0.30	311808.74	1568492.58	N 39 20 45.74	W 81 1 33.07
	11328.00	90.58	316.35	6261.30	5152.99	3580.80	-3714.92	0.07	311880.45	1568428.77	N 39 20 46.44	W 81 1 33.90
	11423.00	90.28	319.77	6260.59	5247.92	3652.56	-3777.17	1.53	311952.20	1568366.52	N 39 20 47.13	W 81 1 34.70
	11518.00	89.76	319.53	6260.56	5342.80	3724.96	-3838.68	0.60	[illegible]	[illegible]	N 39 20 47.84	W 81 1 35.50
	11614.00	90.38	320.20	6260.44	5438.67	3798.35	-3900.56	0.95	[illegible]	[illegible]	N 39 20 48.55	W 81 1 36.31
	11709.00	90.34	320.61	6259.84	5533.49	3871.58	-3961.10	0.43	312171.19	1568182.60	N 39 20 49.27	W 81 1 37.09
	11804.00	90.72	320.90	6258.96	5628.27	3945.13	-4021.20	0.50	312244.75	[illegible]	[illegible]	W 81 1 37.87
	11899.00	90.45	320.75	6257.99	5723.04	4018.77	-4081.21	0.33	312318.39	1568062.50	N 39 20 50.70	W 81 1 38.65
	11995.00	90.55	320.72	6257.16	5818.82	4093.09	-4141.97	0.11	312392.71	1568001.74	N 39 20 51.43	W 81 1 39.44
	12090.00	90.58	320.98	6256.22	5913.58	4166.76	-4201.94	0.28	[illegible]	[illegible]	N 39 20 52.14	W 81 1 40.22
	12165.00	90.93	322.19	6254.97	6008.25	4241.19	-4260.96	1.33	[illegible]	[illegible]	N 39 20 52.87	W 81 1 40.99
	12279.00	90.55	323.69	6253.75	6101.71	4316.19	-4317.61	1.65	312615.80	1567826.11	N 39 20 53.60	W 81 1 41.73
	12375.00	90.79	325.64	6252.63	6196.82	4394.50	-4373.12	2.05	[illegible]	1567770.60	N 39 20 54.37	W 81 1 42.45
	12468.00	90.55	324.57	6251.54	6288.85	4470.77	-4426.32	1.18	[illegible]	[illegible]	N 39 20 55.11	W 81 1 43.14
	12563.00	90.59	321.63	6250.60	6383.28	4546.73	-4483.35	3.09	312846.33	1567660.37	N 39 20 55.85	W 81 1 43.89

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Comments	MD (ft)	Incl (°)	Azim Grid (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ftUS)	Easting (ftUS)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	12659.00	90.28	319.88	6249.87	6479.05	4621.07	-4544.08	1.85	312920.66	1567599.65	N 39 20 56.58	W 81 1 44.68
	12753.00	90.58	320.08	6249.16	6572.91	4693.05	-4604.53	0.38	312992.65	1567539.21	N 39 20 57.28	W 81 1 45.46
	12849.00	90.55	320.18	6248.22	6668.75	4766.73	-4666.06	0.11	313066.32	1567477.67	N 39 20 58.00	W 81 1 46.26
	12945.00	89.97	318.92	6247.78	6764.64	4839.78	-4728.34	1.44	313139.37	1567415.39	N 39 20 58.71	W 81 1 47.07
	13040.00	90.17	318.81	6247.87	6859.58	4911.33	-4790.84	0.24	313210.91	1567352.90	N 39 20 59.40	W 81 1 47.88
	13135.00	90.24	318.04	6247.33	6954.55	4982.40	-4853.88	0.81	313281.98	1567289.86	N 39 21 0.09	W 81 1 48.70
	13231.00	90.58	319.36	6246.64	7050.49	5054.52	-4917.24	1.42	313354.09	1567226.51	N 39 21 0.80	W 81 1 49.52
	13327.00	90.65	319.72	6245.61	7146.39	5127.55	-4979.53	0.38	313427.13	1567164.22	N 39 21 1.51	W 81 1 50.33
	13422.00	90.79	319.57	6244.41	7241.27	5199.94	-5041.04	0.22	313499.51	1567102.71	N 39 21 2.21	W 81 1 51.13
	13518.00	90.76	319.72	6243.12	7337.15	5273.09	-5103.20	0.16	313572.66	1567040.56	N 39 21 2.93	W 81 1 51.93
	13813.00	90.79	319.32	6241.83	7432.04	5345.35	-5164.86	0.42	313644.91	1566978.90	N 39 21 3.63	W 81 1 52.73
	13709.00	90.96	319.39	6240.37	7527.93	5418.18	-5227.39	0.19	313717.74	1566916.38	N 39 21 4.34	W 81 1 53.54
	13804.00	90.52	319.24	6239.14	7622.84	5490.21	-5289.31	0.49	313789.76	1566854.45	N 39 21 5.04	W 81 1 54.35
	13899.00	91.31	321.41	6237.62	7717.65	5563.32	-5349.95	2.43	313862.87	1566793.82	N 39 21 5.75	W 81 1 55.14
	13995.00	91.07	321.16	6235.63	7813.34	5638.21	-5409.98	0.36	313937.75	1566733.79	N 39 21 6.48	W 81 1 55.92
	14090.00	90.83	319.99	6234.05	7908.13	5711.58	-5470.30	1.26	314011.12	1566673.47	N 39 21 7.20	W 81 1 56.70
	14184.00	90.83	319.83	6232.69	8001.99	5783.48	-5530.83	0.17	314083.02	1566612.95	N 39 21 7.90	W 81 1 57.49
	14280.00	90.89	319.99	6231.25	8097.84	5856.92	-5592.65	0.18	314156.45	1566551.13	N 39 21 8.61	W 81 1 58.29
	14375.00	90.93	320.09	6229.74	8192.69	5929.73	-5653.65	0.11	314229.26	1566490.13	N 39 21 9.32	W 81 1 59.08
	14470.00	91.00	320.83	6228.14	8287.49	6002.98	-5714.12	0.78	314302.51	1566429.66	N 39 21 10.04	W 81 1 59.87
	14566.00	91.00	322.90	6226.47	8383.10	6078.47	-5773.39	2.16	314378.00	1566370.40	N 39 21 10.77	W 81 2 0.64
	14660.00	90.79	324.19	6225.00	8476.45	6154.07	-5829.24	1.39	314453.59	1566314.55	N 39 21 11.51	W 81 2 1.36
	14756.00	90.41	324.97	6223.99	8571.58	6232.29	-5884.87	0.90	314531.81	1566258.92	N 39 21 12.27	W 81 2 2.09
	14851.00	90.03	324.20	6223.63	8665.72	6309.72	-5939.92	0.90	314609.23	1566203.87	N 39 21 13.03	W 81 2 2.81
	14945.00	90.96	323.26	6222.81	8759.04	6385.50	-5995.53	1.41	314685.01	1566148.27	N 39 21 13.77	W 81 2 3.53
	15040.00	91.89	321.58	6220.45	8853.57	8460.76	-6053.45	2.02	314760.27	1566090.36	N 39 21 14.50	W 81 2 4.29
	15135.00	92.00	320.25	6217.23	8948.27	8534.45	-6113.31	1.40	314833.96	1566030.50	N 39 21 15.22	W 81 2 5.06
	15230.00	92.27	318.52	6213.69	9043.11	6606.52	-6175.10	1.84	314906.02	1565968.71	N 39 21 15.92	W 81 2 5.87
	15325.00	91.51	316.41	6210.55	9138.05	6676.48	-6239.29	2.36	314975.97	1565904.52	N 39 21 16.60	W 81 2 6.70
	15420.00	90.89	315.56	6208.57	9233.02	6744.78	-6305.28	1.11	315044.27	1565838.53	N 39 21 17.27	W 81 2 7.55
	15516.00	90.83	315.22	6207.12	9328.97	6813.11	-6372.69	0.36	315112.60	1565771.12	N 39 21 17.93	W 81 2 8.43
	15612.00	90.65	315.24	6205.88	9424.92	6881.26	-6440.30	0.19	315160.75	1565703.52	N 39 21 18.59	W 81 2 9.30
	15708.00	90.45	315.01	6204.96	9520.88	6949.29	-6508.03	0.32	315248.77	1565635.60	N 39 21 19.25	W 81 2 10.18
	15805.00	90.48	315.44	6204.18	9617.83	7018.15	-6576.35	0.44	315317.63	1565567.48	N 39 21 19.92	W 81 2 11.06
	15901.00	90.03	315.20	6203.75	9713.80	7086.41	-6643.85	0.53	315385.88	1565499.98	N 39 21 20.58	W 81 2 11.94
	15996.00	90.62	316.37	6203.21	9808.77	7154.49	-6710.09	1.38	315453.96	1565433.74	N 39 21 21.25	W 81 2 12.79
	16092.00	91.00	318.03	6201.85	9904.76	7224.92	-6775.31	1.77	315524.39	1565368.53	N 39 21 21.93	W 81 2 13.64
Final Survey	16158.00	91.20	318.18	6200.59	9970.73	7274.04	-6819.37	0.38	315573.51	1565324.46	N 39 21 22.41	W 81 2 14.21
Projection to TD	16241.00	91.20	316.18	6198.85	10053.69	7335.88	-6874.71	0.00	315635.35	1565269.14	N 39 21 23.01	W 81 2 14.93

Survey Type: Def Survey

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	26.000	Act Stns	30.000	30.000	SLB_NSG+MSHOT-Depth Only	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft MD
	1	26.000	654.000	Act Stns	30.000	30.000	SLB_NSG+MSHOT	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	654.000	698.000	Act Stns	30.000	30.000	SLB_NSG+SSHOT	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	698.000	711.040	Act Stns	30.000	30.000	SLB_INC_ONLY<10	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	711.040	948.000	Act Stns	30.000	30.000	SLB_NSG+SSHOT	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	948.000	5559.000	Act Stns	30.000	30.000	SLB_INC_ONLY<10	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	5559.000	5846.000	Act Stns	30.000	30.000	SLB_MWD-INC_ONLY>10	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	5846.000	16158.000	Act Stns	30.000	30.000	SLB_MWD-STD	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft
	1	16158.000	16241.000	Act Stns	30.000	30.000	SLB_BLIND+TREND	Original Borehole / Noble Energy PEN2HHS Surveys 0ft to 16241ft

06/12/2015

Noble Energy

noble energy

PATHFINDER
A Schlumberger Company

Borehole:	Well:	Field:	Structure:
Original Borehole	PEN2HHS	WV Ritchie County (NAD27)	Nomac 78

Gravity & Magnetic Parameters

Model:	HDGM 2013	Dip:	66.845°	Date:	02-Apr-2014
MagDec:	-7.859°	FS:	52240.4nT	Gravity FS:	999.309mgn (9.80665 Based)

Surface Location NAD27 West Virginia State Plane, Northern Zone, US Feet

Lat:	N 39 20 11.67	Northing:	308299.82ftUS	Grid Conv:	-0.9648°
Lon:	W 81 0 45.85	Easting:	1572143.508ftUS	Scale Fact:	0.99995343

Miscellaneous

Slot:	PEN2HHS	TVD Ref:	KB(1100.1ft above MSL)
Plan:	Noble Energy PEN2HHS MWD 0ft to update		

Critical Points

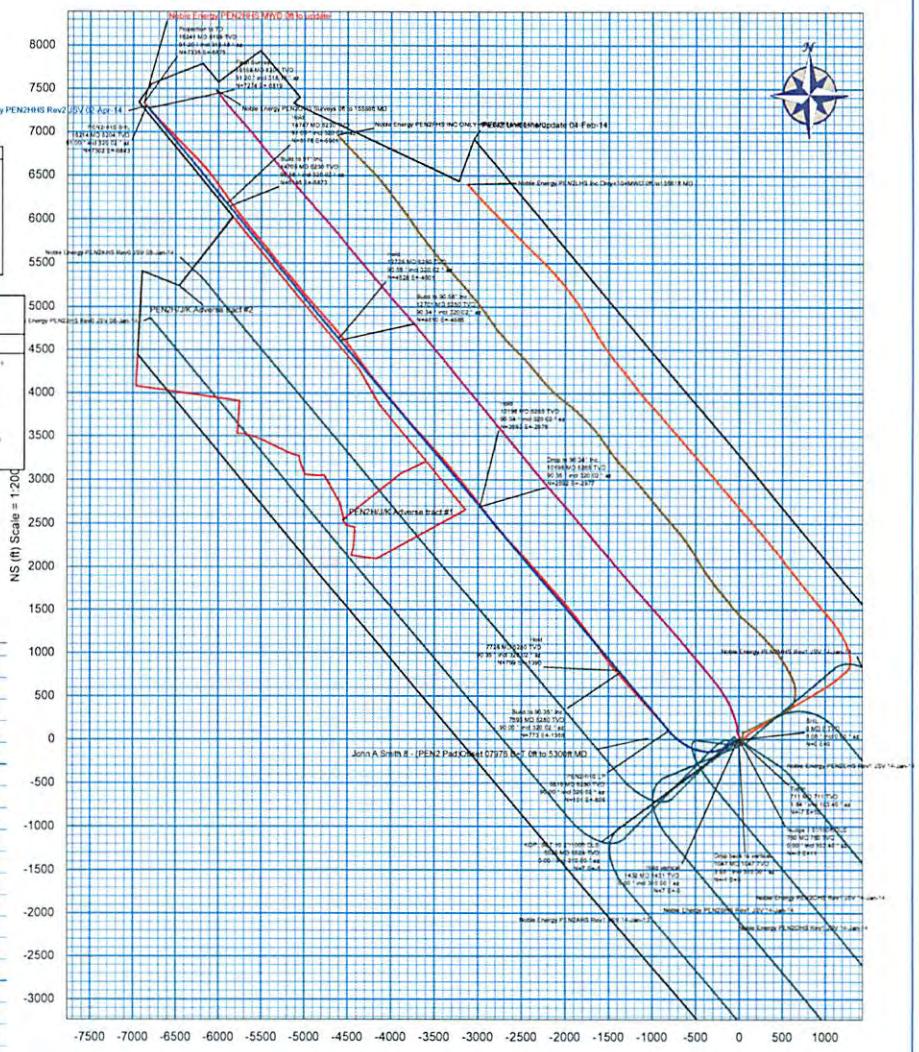
Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
SHL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Final Survey	16158.00	91.20	318.18	6200.59	9970.73	7274.04	-6819.37	0.38
Projection to TD	16241.00	91.20	318.18	6198.85	10053.69	7335.88	-6874.71	0.00

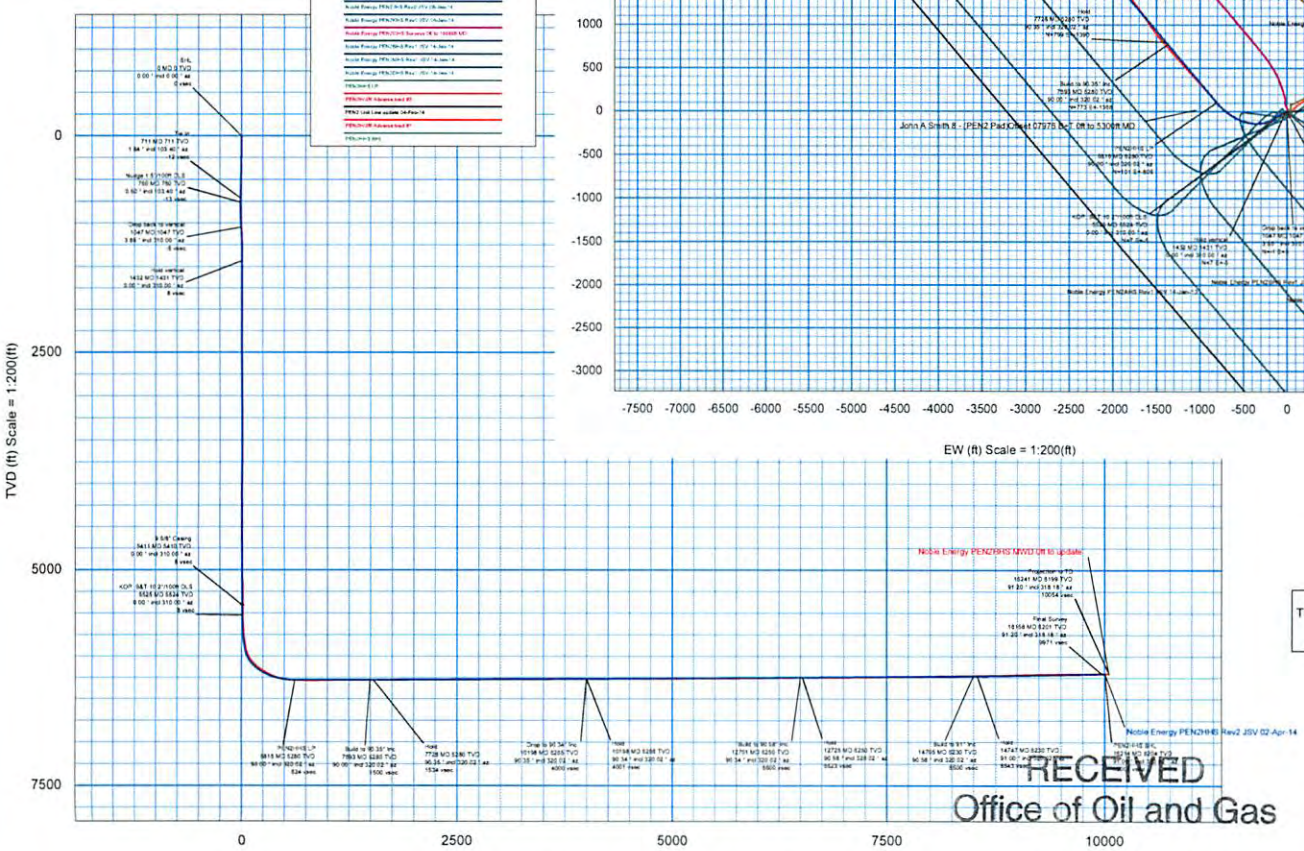
PART	Seq.	Survey Tool Name/ Tool Code	Vendor/Tool	Hole Size (in)	Casing Size	MD From (ft)	MD To (ft)	Frequency (per thousand feet)	Accuracy (ft)	Comments/ Contingency
1	1	SLB_NOGYRO-Gyro Only		30	30	0	26	Act Srvy	1.25	1.25
1	2	SLB_NSG+MSHOT		30	30	26	654	Act Srvy	3.43	2.72
1	3	SLB_NSG+SSHOT		30	30	654	698	Act Srvy	3.48	2.72
1	4	SLB_INC_ONLY+10		30	30	698	711.04	Act Srvy	3.49	2.84
1	5	SLB_NSG+SSHOT		30	30	711.04	948	Act Srvy	3.58	3.11
1	6	SLB_INC_ONLY+10		30	30	948	5559	Act Srvy	69.94	59.55
1	7	SLB_MWD-INC_ONLY+10		30	30	5559	5846	Act Srvy	116.33	74.41
1	8	SLB_MWD-STD		30	30	5846	16158	Act Srvy	296.19	119.5
1	9	SLB_BLIND+TREND		30	30	16158	16241	Act Srvy	311.34	119.89

Surface Location

Northing: 308299.82 Easting: 1572143.508 Latitude: N 39 20 11.67 Longitude: W 81 0 45.85 VSec Azimuth: 316.875

Target Description			Grid Coord						Local Coord	
Target Name	Shape	Dimension	Latitude	Longitude	Northing	Easting	TVD	VSec	N(+)/S(-)	E(+)/W(-)
PEN2HHJK Adverse tract #2	Polyline	N/A	N 39 20 11.67	W 81 0 45.85	308299.82	1572143.51	1100.10	0.00	0.00	0.00
PEN2 Unit Line update 04-Feb-14	Polyline	N/A	N 39 20 11.34	W 81 0 46.23	308256.94	1572113.06	1100.10	-3.21	-32.88	-30.42
PEN2HHJK Adverse tract #1	Polyline	N/A	N 39 20 11.67	W 81 0 45.85	308299.82	1572143.51	1100.10	0.00	0.00	0.00
PEN2HHS BHL	Point	N/A	N 39 21 22.68	W 81 2 14.52	311661.73	1565301.00	6203.92	10007.37	7302.25	-6842.94
PEN2HHS LP	Point	N/A	N 39 20 12.54	W 81 0 56.11	308401.00	1571338.94	6314.00	523.94	-101.19	-604.71





Grid
Mag
True

Grid North
Tot Corr (M->G -6.894°)
Mag Dec (-7.859°)
Grid Conv (-0.965°)

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