



Company: Noble Energy
Rig: Production/VES
API # 05-123-37097

Date: 6-24-13
Surveyor: Justin Williams

VS: 0.000
Lat : 40.75959

Long: -103.819

Well: Castor Federal LD13-78HN

Location: Weld County, Colorado

North Reference: GRID

Convergence: Grid north is -1.09 of True North

Declination: 8.1

Depth Reference: RKB = Ground Level

Elevation: 4628

Total Depth as Drilled: 9888

Lat & Long obtained by handheld GPS at wellhead

HA Gyro Survey Calculations

Depth	Inc	AzG	N/-S	E/-W	TVD	DL	VS	CD	Cbrg
0.000	0.000	0.000	0.000	0.000	0.000	****	0.000	0.000	0.000
30.000	0.155	204.473	-0.037	-0.017	30.000	0.515	-0.037	0.040	204.473
60.000	0.228	291.633	-0.052	-0.089	60.000	0.895	-0.052	0.103	239.831
90.000	0.401	294.052	0.013	-0.240	89.999	0.580	0.013	0.241	273.120
120.000	0.501	279.517	0.078	-0.465	119.998	0.503	0.078	0.472	279.464
150.000	0.413	274.296	0.107	-0.702	149.998	0.325	0.107	0.711	278.689
180.000	0.450	278.507	0.133	-0.927	179.997	0.165	0.133	0.936	278.160
210.000	0.285	256.542	0.133	-1.116	209.996	0.716	0.133	1.124	276.796
240.000	0.328	273.126	0.120	-1.274	239.996	0.328	0.120	1.280	275.395
270.000	0.160	280.376	0.133	-1.401	269.995	0.570	0.133	1.407	275.404
300.000	0.111	285.525	0.148	-1.470	299.995	0.169	0.148	1.477	275.742
330.000	0.096	307.359	0.171	-1.518	329.995	0.139	0.171	1.527	276.420
360.000	0.067	333.263	0.202	-1.546	359.995	0.153	0.202	1.559	277.438
390.000	0.194	340.234	0.265	-1.571	389.995	0.423	0.265	1.593	279.585
420.000	0.171	352.070	0.357	-1.594	419.995	0.146	0.357	1.634	282.634
450.000	0.075	15.946	0.420	-1.595	449.995	0.357	0.420	1.650	284.769
480.000	0.149	3.812	0.478	-1.587	479.995	0.258	0.478	1.658	286.767
510.000	0.106	352.484	0.545	-1.588	509.995	0.164	0.545	1.679	288.929
540.000	0.068	347.399	0.590	-1.596	539.995	0.129	0.590	1.701	290.281
570.000	0.213	316.803	0.648	-1.638	569.995	0.526	0.648	1.761	291.578
600.000	0.196	331.310	0.733	-1.700	599.994	0.180	0.733	1.852	293.329
630.000	0.045	330.645	0.789	-1.731	629.994	0.506	0.789	1.902	294.496
660.000	0.085	215.276	0.781	-1.749	659.994	0.373	0.781	1.916	294.046
690.000	0.080	214.622	0.745	-1.774	689.994	0.018	0.745	1.924	292.780
720.000	0.072	173.900	0.709	-1.784	719.994	0.178	0.709	1.920	291.672
750.000	0.060	137.466	0.678	-1.771	749.994	0.144	0.678	1.897	290.957
780.000	0.263	207.294	0.606	-1.792	779.994	0.830	0.606	1.892	288.667
810.000	0.072	258.512	0.540	-1.842	809.994	0.751	0.540	1.920	286.349
840.000	0.249	214.303	0.483	-1.898	839.994	0.678	0.483	1.958	284.276
870.000	0.248	210.937	0.373	-1.968	869.994	0.049	0.373	2.003	280.745
900.000	0.101	190.104	0.292	-2.006	899.993	0.524	0.292	2.027	278.274
930.000	0.141	251.890	0.254	-2.046	929.993	0.431	0.254	2.061	277.080
960.000	0.049	147.565	0.232	-2.074	959.993	0.534	0.232	2.087	276.379
990.000	0.265	178.882	0.152	-2.066	989.993	0.750	0.152	2.071	274.202
1020.000	0.109	177.250	0.054	-2.063	1019.993	0.520	0.054	2.064	271.495
1050.000	0.021	223.792	0.021	-2.065	1049.993	0.320	0.021	2.066	270.593

1080.000	0.230	160.148	-0.039	-2.049	1079.993	0.738	-0.039	2.049	268.905
1110.000	0.305	134.903	-0.152	-1.972	1109.993	0.459	-0.152	1.978	265.591
1140.000	0.333	142.234	-0.277	-1.862	1139.992	0.166	-0.277	1.882	261.531
1170.000	0.065	154.102	-0.362	-1.801	1169.992	0.898	-0.362	1.837	258.648
1200.000	0.189	87.066	-0.374	-1.744	1199.992	0.582	-0.374	1.784	257.882
1230.000	0.179	97.399	-0.378	-1.648	1229.992	0.116	-0.378	1.691	257.084
1260.000	0.148	97.791	-0.389	-1.563	1259.992	0.103	-0.389	1.611	256.019
1290.000	0.212	124.203	-0.426	-1.479	1289.991	0.344	-0.426	1.539	253.943
1320.000	0.853	185.637	-0.679	-1.455	1319.990	2.580	-0.679	1.606	244.983
1350.000	1.546	177.288	-1.306	-1.458	1349.983	2.379	-1.306	1.957	228.155
1380.000	1.475	174.699	-2.094	-1.403	1379.973	0.329	-2.094	2.521	213.818
1410.000	1.340	171.634	-2.826	-1.316	1409.964	0.516	-2.826	3.117	204.976
1440.000	1.359	171.654	-3.525	-1.214	1439.956	0.064	-3.525	3.728	198.999
1470.000	1.458	171.788	-4.255	-1.107	1469.947	0.331	-4.255	4.396	194.591
1500.000	1.516	171.441	-5.025	-0.994	1499.936	0.196	-5.025	5.122	191.188
1530.000	1.443	165.408	-5.783	-0.840	1529.926	0.574	-5.783	5.843	188.262
1560.000	1.672	162.206	-6.565	-0.611	1559.915	0.818	-6.565	6.593	185.315
1590.000	2.775	166.744	-7.689	-0.310	1589.892	3.719	-7.689	7.695	182.312
1620.000	4.842	178.339	-9.662	-0.107	1619.825	7.318	-9.662	9.662	180.636
1650.000	4.983	178.921	-12.230	-0.046	1649.715	0.498	-12.230	12.230	180.215
1680.000	5.956	177.112	-15.087	0.057	1679.578	3.293	-15.087	15.087	179.783
1710.000	6.503	174.422	-18.333	0.301	1709.401	2.068	-18.333	18.335	179.061
1740.000	6.682	172.264	-21.753	0.701	1739.202	1.019	-21.753	21.764	178.155
1770.000	7.644	171.395	-25.456	1.234	1768.968	3.227	-25.456	25.486	177.224
1800.000	8.861	172.501	-29.720	1.834	1798.656	4.090	-29.720	29.776	176.468
1830.000	9.177	172.910	-34.385	2.431	1828.286	1.076	-34.385	34.470	175.956
1860.000	9.524	176.666	-39.237	2.871	1857.887	2.339	-39.237	39.341	175.815
1890.000	11.817	178.332	-44.785	3.105	1887.366	7.711	-44.785	44.893	176.034
1920.000	12.760	180.079	-51.169	3.190	1916.679	3.378	-51.169	51.268	176.433
1950.000	12.731	178.278	-57.786	3.284	1945.940	1.328	-57.786	57.880	176.747
1980.000	12.382	176.557	-64.301	3.577	1975.222	1.707	-64.301	64.401	176.816
2010.000	11.967	177.348	-70.619	3.914	2004.548	1.490	-70.619	70.727	176.828
2040.000	12.051	174.953	-76.845	4.333	2033.891	1.685	-76.845	76.967	176.773
2070.000	12.953	172.703	-83.300	5.036	2063.180	3.416	-83.300	83.452	176.540
2100.000	13.174	171.342	-90.014	5.978	2092.403	1.264	-90.014	90.213	176.201
2130.000	13.062	170.948	-96.742	7.026	2121.621	0.479	-96.742	96.997	175.846
2160.000	12.839	167.870	-103.348	8.259	2150.858	2.416	-103.348	103.678	175.431
2190.000	12.535	168.621	-109.799	9.602	2180.125	1.152	-109.799	110.218	175.002
2220.000	12.415	169.523	-116.161	10.831	2209.417	0.762	-116.161	116.665	174.673
2250.000	12.343	168.343	-122.473	12.065	2238.720	0.877	-122.473	123.066	174.374
2280.000	12.129	168.707	-128.704	13.330	2268.038	0.756	-128.704	129.392	174.087
2310.000	12.130	169.530	-134.894	14.520	2297.368	0.577	-134.894	135.673	173.856
2340.000	12.694	173.149	-141.267	15.486	2326.668	3.202	-141.267	142.113	173.744
2370.000	12.955	163.463	-147.764	16.837	2355.923	7.211	-147.764	148.720	173.500
2400.000	12.776	175.277	-154.294	18.067	2385.175	8.774	-154.294	155.349	173.321
2430.000	12.275	179.148	-160.789	18.388	2414.461	3.258	-160.789	161.837	173.476
2460.000	11.122	182.418	-166.869	18.313	2443.838	4.430	-166.869	167.871	173.737

2490.000	10.969	181.239	-172.613	18.129	2473.282	0.911	-172.613	173.563	174.004
2520.000	10.335	180.063	-178.158	18.065	2502.765	2.232	-178.158	179.071	174.210
2550.000	8.369	178.190	-183.032	18.131	2532.365	6.633	-183.032	183.927	174.343
2580.000	7.861	177.743	-187.264	18.280	2562.064	1.705	-187.264	188.154	174.425
2610.000	6.896	178.391	-191.114	18.412	2591.815	3.230	-191.114	191.999	174.497
2640.000	5.356	175.089	-194.309	18.582	2621.643	5.262	-194.309	195.196	174.537
2670.000	4.774	179.177	-196.953	18.720	2651.526	2.282	-196.953	197.840	174.570
2700.000	4.361	179.980	-199.342	18.738	2681.431	1.395	-199.342	200.220	174.630
2730.000	2.992	183.923	-201.263	18.685	2711.368	4.637	-201.263	202.129	174.696
2760.000	2.911	190.785	-202.793	18.489	2741.329	1.207	-202.793	203.634	174.791
2790.000	2.673	188.647	-204.232	18.241	2771.293	0.867	-204.232	205.045	174.896
2820.000	2.158	186.454	-205.485	18.073	2801.266	1.742	-205.485	206.279	174.974
2850.000	1.917	174.822	-206.546	18.054	2831.248	1.592	-206.546	207.334	175.004
2880.000	1.224	174.459	-207.365	18.131	2861.236	2.310	-207.365	208.156	175.003
2910.000	0.830	156.850	-207.884	18.247	2891.231	1.669	-207.884	208.683	174.984
2940.000	0.460	176.570	-208.204	18.340	2921.229	1.421	-208.204	209.010	174.966
2970.000	0.468	213.905	-208.426	18.278	2951.228	0.991	-208.426	209.226	174.988
3000.000	0.737	221.399	-208.673	18.083	2981.227	0.931	-208.673	209.455	175.047
3030.000	0.368	230.670	-208.878	17.881	3011.225	1.262	-208.878	209.642	175.107
3060.000	0.524	194.689	-209.072	17.771	3041.224	1.044	-209.072	209.826	175.141
3090.000	0.350	227.048	-209.267	17.670	3071.224	0.985	-209.267	210.012	175.174
3120.000	0.678	240.527	-209.417	17.448	3101.222	1.158	-209.417	210.142	175.237
3150.000	0.305	238.142	-209.546	17.226	3131.221	1.245	-209.546	210.253	175.301
3180.000	0.196	242.252	-209.612	17.113	3161.221	0.368	-209.612	210.310	175.333
3210.000	0.603	246.393	-209.699	16.923	3191.220	1.358	-209.699	210.381	175.386
3240.000	0.435	235.108	-209.828	16.685	3221.219	0.651	-209.828	210.490	175.454
3270.000	0.291	256.484	-209.911	16.517	3251.218	0.651	-209.911	210.559	175.501
3300.000	0.146	221.777	-209.957	16.418	3281.218	0.634	-209.957	210.598	175.529
3330.000	0.576	264.989	-209.998	16.242	3311.217	1.600	-209.998	210.626	175.577
3360.000	0.589	242.054	-210.084	15.956	3341.216	0.773	-210.084	210.689	175.657
3390.000	0.574	239.565	-210.232	15.690	3371.214	0.098	-210.232	210.817	175.732
3420.000	0.554	245.725	-210.368	15.428	3401.213	0.213	-210.368	210.933	175.806
3450.000	0.506	262.199	-210.446	15.164	3431.212	0.530	-210.446	210.991	175.878
3480.000	0.457	245.437	-210.513	14.924	3461.211	0.496	-210.513	211.042	175.945
3510.000	0.014	235.581	-210.565	14.812	3491.210	1.476	-210.565	211.086	175.976
3540.000	0.054	213.481	-210.579	14.801	3521.210	0.136	-210.579	211.099	175.979
3570.000	0.172	206.717	-210.631	14.773	3551.210	0.394	-210.631	211.149	175.988
3600.000	0.266	203.905	-210.735	14.725	3581.210	0.317	-210.735	211.249	176.003
3630.000	0.689	179.066	-210.979	14.700	3611.209	1.537	-210.979	211.490	176.014
3660.000	0.632	158.452	-211.313	14.763	3641.207	0.810	-211.313	211.828	176.004
3690.000	0.249	168.855	-211.531	14.837	3671.206	1.299	-211.531	212.051	175.988
3720.000	0.609	161.453	-211.747	14.900	3701.205	1.212	-211.747	212.270	175.975
3750.000	0.405	137.103	-211.975	15.023	3731.204	0.976	-211.975	212.507	175.946
3780.000	0.271	118.813	-212.087	15.157	3761.203	0.567	-212.087	212.628	175.912
3810.000	0.462	164.826	-212.238	15.251	3791.203	1.119	-212.238	212.785	175.890
3840.000	0.620	118.842	-212.433	15.425	3821.202	1.490	-212.433	212.992	175.847
3870.000	0.278	170.172	-212.583	15.580	3851.201	1.655	-212.583	213.153	175.808

3900.000	0.253	165.270	-212.719	15.609	3881.201	0.111	-212.719	213.291	175.803
3930.000	0.554	153.090	-212.912	15.691	3911.200	1.037	-212.912	213.490	175.785
3960.000	0.308	122.763	-213.085	15.825	3941.199	1.092	-213.085	213.672	175.753
3990.000	0.747	142.626	-213.284	16.011	3971.198	1.565	-213.284	213.884	175.707
4020.000	0.302	165.005	-213.516	16.150	4001.196	1.606	-213.516	214.126	175.674
4050.000	0.533	151.974	-213.715	16.236	4031.195	0.827	-213.715	214.331	175.655
4080.000	0.200	172.563	-213.890	16.309	4061.195	1.176	-213.890	214.511	175.640
4110.000	0.296	167.108	-214.018	16.333	4091.195	0.329	-214.018	214.640	175.636
4140.000	0.474	115.111	-214.146	16.462	4121.194	1.245	-214.146	214.778	175.604
4170.000	0.719	155.741	-214.370	16.652	4151.192	1.580	-214.370	215.016	175.558
4200.000	0.719	156.950	-214.715	16.803	4181.190	0.051	-214.715	215.372	175.525
4230.000	0.485	113.637	-214.940	16.993	4211.189	1.650	-214.940	215.610	175.480
4260.000	0.235	190.340	-215.051	17.098	4241.188	1.625	-215.051	215.730	175.454
4290.000	0.126	221.574	-215.136	17.066	4271.188	0.477	-215.136	215.812	175.465
4320.000	0.124	227.529	-215.182	17.020	4301.188	0.043	-215.182	215.855	175.478
4350.000	0.372	188.621	-215.301	16.981	4331.188	0.953	-215.301	215.969	175.490
4380.000	0.319	207.683	-215.471	16.928	4361.187	0.419	-215.471	216.135	175.508
4410.000	0.398	230.341	-215.611	16.809	4391.186	0.537	-215.611	216.265	175.542
4440.000	0.253	236.430	-215.714	16.673	4421.186	0.496	-215.714	216.358	175.580
4470.000	0.364	245.349	-215.791	16.531	4451.185	0.401	-215.791	216.423	175.619
4500.000	0.266	178.725	-215.900	16.446	4481.185	1.185	-215.900	216.526	175.644
4530.000	0.332	198.892	-216.052	16.420	4511.185	0.412	-216.052	216.675	175.654
4560.000	0.327	173.385	-216.219	16.401	4541.184	0.485	-216.219	216.840	175.662
4590.000	0.315	111.045	-216.334	16.488	4571.184	1.107	-216.334	216.961	175.642
4620.000	0.324	145.550	-216.433	16.613	4601.183	0.632	-216.433	217.070	175.611
4650.000	0.389	172.020	-216.604	16.675	4631.183	0.584	-216.604	217.245	175.598
4680.000	0.563	160.275	-216.844	16.739	4661.182	0.661	-216.844	217.489	175.586
4710.000	0.474	151.958	-217.092	16.847	4691.181	0.387	-217.092	217.745	175.563
4740.000	0.141	180.118	-217.239	16.906	4721.180	1.187	-217.239	217.896	175.550
4770.000	0.863	157.405	-217.484	16.992	4751.179	2.448	-217.484	218.147	175.533
4800.000	3.383	169.740	-218.564	17.237	4781.156	8.489	-218.564	219.243	175.491
4830.000	5.870	170.466	-220.948	17.649	4811.056	8.293	-220.948	221.652	175.433
4860.000	7.045	171.961	-224.283	18.160	4840.865	3.956	-224.283	225.017	175.371
4890.000	7.592	172.485	-228.070	18.676	4870.620	1.835	-228.070	228.833	175.319
4920.000	8.537	172.959	-232.244	19.208	4900.323	3.159	-232.244	233.037	175.272
4950.000	10.384	171.523	-237.129	19.880	4929.914	6.207	-237.129	237.961	175.208
4980.000	12.915	169.981	-243.105	20.862	4959.294	8.497	-243.105	243.999	175.095
5010.000	16.268	173.275	-250.582	21.938	4988.323	11.511	-250.582	251.541	174.997
5040.000	18.318	173.978	-259.445	22.924	5016.965	6.869	-259.445	260.455	174.950
5070.000	20.326	177.210	-269.339	23.673	5045.275	7.581	-269.339	270.377	174.977
5100.000	21.376	178.096	-280.008	24.108	5073.309	3.654	-280.008	281.043	175.079
5130.000	22.815	174.673	-291.264	24.830	5101.107	6.435	-291.264	292.321	175.127
5160.000	24.705	173.767	-303.289	26.050	5128.563	6.414	-303.289	304.405	175.091
5190.000	26.111	173.800	-316.084	27.444	5155.660	4.687	-316.084	317.274	175.038
5220.000	27.497	170.817	-329.485	29.262	5182.438	6.439	-329.485	330.782	174.925
5250.000	30.528	170.969	-343.850	31.564	5208.670	10.106	-343.850	345.296	174.755
5280.000	33.763	171.058	-359.615	34.056	5234.068	10.786	-359.615	361.224	174.590

5310.000	37.269	170.753	-376.821	36.813	5258.482	11.699	-376.821	378.614	174.420
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