



Company: NGL Water Solutions DJ, LLC  
Well: NGL Apollo 11  
API: 05-123-42210  
Rig Name: Production/ CoreTech  
State/County: Colorado/Weld  
VS-Azi: 0.000 Degrees  
Latitude: 40.48970, Longitude: -104.47285  
All Azimuths referenced to True North  
No Grid Correction Applied



**FIELD COPY ONLY (NOT DEFINITIVE)**

Depth Reference : RKB= Ground Level

**DRILLOG MS GYRO SURVEY CALCULATIONS**

Filename: msgyro\_run01-01-de\_01.ut

Minimum Curvature Method

Report Date/Time: 12/28/2015 / 13:39

Vaughn Survey International

Henderson, CO 80640

303-853-4976

Sean Bratt

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	****
100.000	0.630	222.013	99.998	-0.408	-0.368	-0.408	0.550	222.013	0.630
200.000	0.763	208.418	199.991	-1.402	-1.053	-1.402	1.754	216.891	0.212
300.000	1.452	217.611	299.971	-2.992	-2.143	-2.992	3.681	215.611	0.710
400.000	2.223	229.497	399.920	-5.256	-4.391	-5.256	6.849	219.879	0.855
500.000	3.965	234.729	499.770	-8.512	-8.689	-8.512	12.163	225.589	1.763
600.000	5.198	240.981	599.449	-12.706	-15.473	-12.706	20.021	230.608	1.329
700.000	4.695	249.005	699.078	-16.370	-23.255	-16.370	28.439	234.858	0.854
800.000	3.707	250.867	798.808	-18.896	-30.131	-18.896	35.566	237.907	0.998
900.000	3.367	265.974	898.619	-20.162	-36.114	-20.162	41.361	240.826	0.988
1000.000	3.578	281.706	998.438	-19.735	-42.099	-19.735	46.495	244.885	0.973
1100.000	2.302	281.464	1098.304	-18.702	-47.123	-18.702	50.699	248.353	1.276
1200.000	1.282	254.118	1198.256	-18.609	-50.167	-18.609	53.508	249.648	1.304
1300.000	0.331	252.226	1298.245	-19.004	-51.519	-19.004	54.912	249.753	0.952
1400.000	0.421	219.448	1398.243	-19.375	-52.027	-19.375	55.518	249.574	0.229
1500.000	0.332	222.308	1498.241	-19.873	-52.455	-19.873	56.094	249.250	0.091
1600.000	0.563	273.381	1598.238	-20.059	-53.141	-20.059	56.801	249.320	0.438
1700.000	0.593	291.378	1698.233	-19.841	-54.113	-19.841	57.635	249.864	0.183
1800.000	0.468	307.943	1798.229	-19.402	-54.916	-19.402	58.243	250.542	0.196
1900.000	0.760	44.571	1898.225	-18.678	-54.773	-18.678	57.870	251.170	0.937
2000.000	0.601	70.291	1998.218	-18.029	-53.814	-18.029	56.754	251.478	0.340
2100.000	0.626	74.259	2098.212	-17.704	-52.795	-17.704	55.684	251.462	0.049
2200.000	0.468	113.281	2198.208	-17.717	-51.894	-17.717	54.835	251.150	0.394
2300.000	0.060	180.904	2298.207	-17.931	-51.519	-17.931	54.551	250.810	0.449
2400.000	0.774	135.776	2398.203	-18.467	-51.049	-18.467	54.287	250.112	0.733
2500.000	0.794	147.462	2498.194	-19.536	-50.205	-19.536	53.872	248.738	0.161
2600.000	1.294	104.334	2598.179	-20.399	-48.738	-20.399	52.835	247.288	0.897
2700.000	1.049	79.761	2698.158	-20.516	-46.743	-20.516	51.047	246.303	0.553
2800.000	1.165	80.861	2798.140	-20.192	-44.838	-20.192	49.175	245.757	0.118
2900.000	1.104	74.479	2898.120	-19.773	-42.906	-19.773	47.243	245.258	0.140
3000.000	1.023	61.245	2998.103	-19.085	-41.196	-19.085	45.402	245.142	0.258
3100.000	1.001	58.611	3098.087	-18.201	-39.667	-18.201	43.644	245.353	0.051
3200.000	0.808	44.690	3198.075	-17.245	-38.426	-17.245	42.118	245.830	0.291
3300.000	1.082	34.344	3298.061	-15.964	-37.397	-15.964	40.662	246.883	0.321
3400.000	1.515	33.546	3398.035	-14.083	-36.134	-14.083	38.782	248.707	0.434

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
3500.000	0.792	68.680	3498.016	-12.730	-34.760	-12.730	37.018	249.886	0.980
3600.000	0.732	68.794	3598.007	-12.248	-33.521	-12.248	35.688	249.929	0.060
3700.000	1.134	73.746	3697.993	-11.739	-31.975	-11.739	34.062	249.840	0.410
3800.000	1.221	77.107	3797.972	-11.225	-29.986	-11.225	32.018	249.478	0.111
3900.000	1.075	94.702	3897.952	-11.064	-28.012	-11.064	30.118	248.448	0.380
4000.000	0.840	109.674	3997.939	-11.387	-26.387	-11.387	28.740	246.657	0.341
4100.000	0.599	113.629	4097.931	-11.844	-25.218	-11.844	27.861	244.843	0.247
4200.000	0.506	148.644	4197.926	-12.430	-24.510	-12.430	27.482	243.108	0.344
4300.000	0.964	204.070	4297.919	-13.576	-24.623	-13.576	28.118	241.131	0.795
4400.000	1.620	202.286	4397.893	-15.652	-25.503	-15.652	29.923	238.461	0.657
4500.000	1.650	189.735	4497.852	-18.379	-26.282	-18.379	32.071	235.035	0.359
4600.000	1.170	162.563	4597.823	-20.772	-26.220	-20.772	33.451	231.613	0.810
4700.000	2.052	151.427	4697.783	-23.318	-25.057	-23.318	34.229	227.059	0.932
4800.000	2.323	129.078	4797.711	-26.168	-22.628	-26.168	34.595	220.850	0.888
4900.000	2.102	112.954	4897.638	-28.161	-19.366	-28.161	34.177	214.515	0.658
5000.000	1.581	97.163	4997.587	-29.048	-16.308	-29.048	33.313	209.311	0.723
5100.000	1.259	102.339	5097.556	-29.455	-13.867	-29.455	32.556	205.210	0.346
5200.000	0.778	100.201	5197.540	-29.810	-12.125	-29.810	32.182	202.133	0.482
5300.000	0.225	89.686	5297.535	-29.930	-11.260	-29.930	31.978	200.617	0.558
5400.000	0.590	338.359	5397.534	-29.450	-11.253	-29.450	31.527	200.912	0.704
5500.000	0.897	344.691	5497.525	-28.217	-11.650	-28.217	30.527	202.434	0.318
5600.000	0.758	355.395	5597.515	-26.802	-11.909	-26.802	29.329	203.958	0.208
5700.000	0.630	351.890	5697.507	-25.599	-12.040	-25.599	28.289	205.189	0.135
5800.000	0.661	342.420	5797.501	-24.505	-12.292	-24.505	27.415	206.638	0.111
5900.000	0.720	16.709	5897.494	-23.354	-12.285	-23.354	26.388	207.747	0.411
6000.000	0.857	19.643	5997.485	-22.048	-11.853	-22.048	25.032	208.263	0.143
6100.000	0.291	309.782	6097.480	-21.181	-11.797	-21.181	24.244	209.117	0.805
6200.000	0.202	335.467	6197.479	-20.858	-12.065	-20.858	24.096	210.048	0.140
6300.000	0.076	49.100	6297.479	-20.654	-12.089	-20.654	23.932	210.340	0.195
6400.000	0.364	13.479	6397.478	-20.302	-11.965	-20.302	23.566	210.512	0.305
6500.000	0.318	136.721	6497.477	-20.196	-11.700	-20.196	23.340	210.086	0.600
6600.000	0.031	218.856	6597.477	-20.419	-11.527	-20.419	23.448	209.445	0.316
6700.000	0.460	276.182	6697.476	-20.397	-11.943	-20.397	23.637	210.351	0.444
6800.000	0.374	316.020	6797.473	-20.119	-12.570	-20.119	23.723	211.996	0.296
6900.000	0.399	344.826	6897.471	-19.548	-12.887	-19.548	23.414	213.395	0.194
7000.000	0.443	35.651	6997.469	-18.898	-12.753	-18.898	22.799	214.013	0.363
7100.000	0.280	63.828	7097.467	-18.476	-12.308	-18.476	22.200	213.670	0.237
7200.000	0.741	132.254	7197.463	-18.803	-11.610	-18.803	22.099	211.693	0.690
7300.000	0.673	128.478	7297.455	-19.604	-10.671	-19.604	22.320	208.562	0.083
7400.000	0.698	138.133	7397.448	-20.422	-9.806	-20.422	22.654	205.647	0.118
7500.000	0.930	147.420	7497.438	-21.560	-8.962	-21.560	23.348	202.572	0.267
7600.000	0.977	157.627	7597.424	-23.033	-8.200	-23.033	24.449	199.597	0.176
7700.000	0.592	140.994	7697.415	-24.223	-7.551	-24.223	25.372	197.313	0.444
7800.000	0.418	107.903	7797.411	-24.736	-6.879	-24.736	25.675	195.541	0.332
7900.000	0.430	88.423	7897.409	-24.838	-6.157	-24.838	25.589	193.923	0.144
8000.000	0.460	110.777	7997.406	-24.970	-5.408	-24.970	25.548	192.220	0.175
8100.000	0.675	110.956	8097.401	-25.322	-4.483	-25.322	25.716	190.039	0.215
8200.000	0.716	183.146	8197.395	-26.157	-3.967	-26.157	26.456	188.624	0.820
8300.000	1.083	151.141	8297.383	-27.608	-3.545	-27.608	27.835	187.317	0.609
8400.000	1.425	177.095	8397.360	-29.678	-3.026	-29.678	29.832	185.821	0.654
8500.000	1.326	195.714	8497.332	-32.033	-3.276	-32.033	32.200	185.839	0.455
8600.000	0.933	170.866	8597.312	-33.951	-3.460	-33.951	34.127	185.819	0.619
8700.000	0.749	167.511	8697.302	-35.394	-3.189	-35.394	35.537	185.149	0.191
8800.000	1.444	176.058	8797.283	-37.289	-2.961	-37.289	37.406	184.541	0.712
8900.000	1.924	192.028	8897.240	-40.188	-3.225	-40.188	40.317	184.588	0.667
9000.000	2.692	179.925	8997.159	-44.178	-3.572	-44.178	44.322	184.622	0.905
9100.000	3.566	173.612	9097.009	-49.616	-3.222	-49.616	49.721	183.716	0.938

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
9200.000	4.644	170.868	9196.751	-56.704	-2.234	-56.704	56.748	182.256	1.096
9300.000	5.935	173.888	9296.323	-65.842	-1.041	-65.842	65.850	180.906	1.320
9400.000	7.673	168.211	9395.616	-77.518	0.874	-77.518	77.523	179.354	1.861
9500.000	9.239	165.994	9494.526	-91.843	4.181	-91.843	91.938	177.394	1.600
9600.000	10.628	163.125	9593.025	-108.457	8.801	-108.457	108.814	175.361	1.474
9700.000	11.574	163.940	9691.153	-126.923	14.253	-126.923	127.720	173.593	0.959
9750.000	11.190	163.952	9740.170	-136.405	16.982	-136.405	137.458	172.903	0.769

HORIZONTAL DISPLACEMENT IS  
137.458 FEET AT 172.903 DEGREES