



June 9, 2014

NM OIL CONSERVATION
ARTESIA DISTRICT

AUG 19 2014

RECEIVED

Concho Resources, Inc.
One Concho Center
600 W. Illinois Avenue
Midland, Texas 79701

30015 41811

Attn: Kanicia Castillo

RE: **Marauder 31 Federal No. 004H**

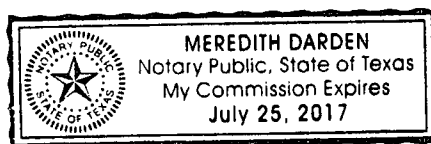
Please find enclosed a copy of the survey from 0.00' to 8,300.00' ran on the above referenced well.

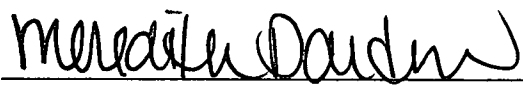
Sincerely,

Keith Havelka
Operations

STATE OF TEXAS §
 §
COUNTY OF NUECES §

This instrument was acknowledged before me on the 9th day of June, A.D., 2014, by Keith Havelka.




Meredith Darden
Notary Public, State of Texas



Company: COG Operating, LLC (Concho)
Lease/Well: Marauder 31 Federal /No. 004H
Location: Sec 31 T19S R31E
Rig Name: Patriot 6
State/County: New Mexico/Eddy
Latitude: 32.62, Longitude: -103.90
GRID North is 0.23 Degrees East of True North
VS-Azi: 0.00 Degrees



Depth Reference : RKB= 17 Feet

DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: ...uder 31 fed #4h gyro-de_01.ut

Minimum Curvature Method

Report Date/Time: 6/9/2014 / 11:11

VES Survey International

West Texas

432-563-5444

Surveyor: Chris Bankson

Marauder 31 Federal No. 004H / API 30-015-41811

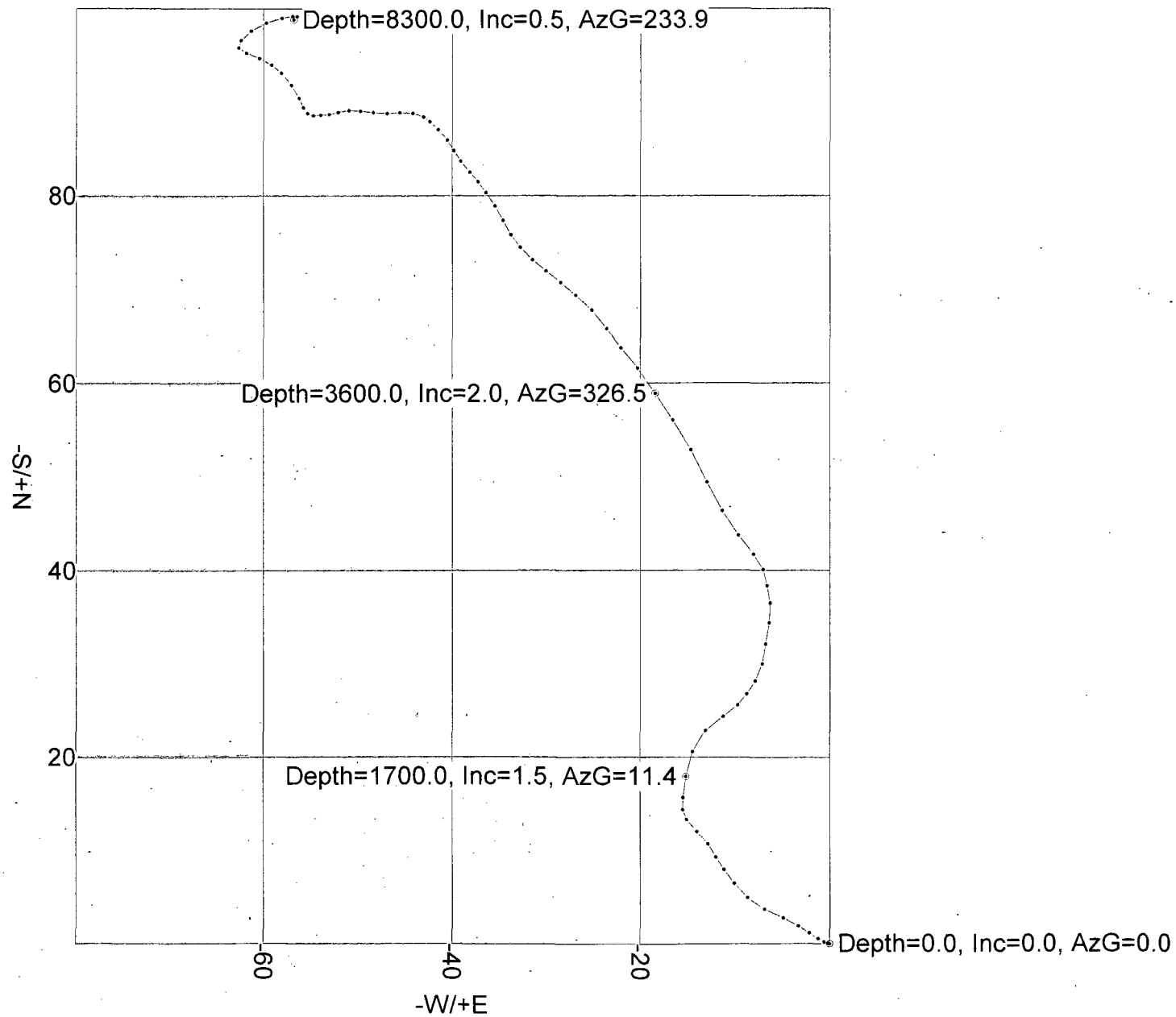
Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
100.00	0.19	287.87	100.00	0.05	-0.16	0.05	0.17	287.87	0.19
200.00	0.32	292.07	200.00	0.21	-0.58	0.21	0.62	289.77	0.13
300.00	0.52	302.33	300.00	0.56	-1.22	0.56	1.34	294.43	0.21
400.00	0.77	300.91	399.99	1.14	-2.18	1.14	2.46	297.63	0.25
500.00	0.88	304.18	499.98	1.92	-3.39	1.92	3.89	299.49	0.12
600.00	1.19	295.10	599.96	2.79	-4.96	2.79	5.69	299.32	0.35
700.00	1.30	296.15	699.94	3.73	-6.93	3.73	7.87	298.31	0.12
800.00	1.23	312.64	799.92	4.96	-8.73	4.96	10.04	299.58	0.37
900.00	1.17	323.64	899.89	6.50	-10.13	6.50	12.04	302.71	0.24
1000.00	0.96	323.21	999.88	7.99	-11.23	7.99	13.79	305.44	0.21
1100.00	0.87	332.23	1099.86	9.33	-12.08	9.33	15.27	307.68	0.17
1200.00	1.00	326.89	1199.85	10.73	-12.91	10.73	16.79	309.73	0.15
1300.00	1.05	310.71	1299.83	12.06	-14.08	12.06	18.54	310.57	0.29
1400.00	0.92	330.77	1399.82	13.36	-15.17	13.36	20.21	311.36	0.37
1500.00	0.41	359.57	1499.81	14.41	-15.56	14.41	21.21	312.80	0.59
1600.00	1.07	2.13	1599.80	15.69	-15.53	15.69	22.08	315.30	0.66
1700.00	1.54	11.42	1699.78	17.94	-15.23	17.94	23.53	319.67	0.52
1800.00	1.64	17.61	1799.74	20.62	-14.53	20.62	25.22	324.82	0.20

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
1900.00	1.46	45.37	1899.70	22.88	-13.19	22.88	26.41	330.03	0.76
2000.00	1.30	57.92	1999.68	24.38	-11.31	24.38	26.88	335.10	0.34
2100.00	0.96	43.12	2099.66	25.60	-9.78	25.60	27.40	339.10	0.45
2200.00	0.80	33.61	2199.64	26.80	-8.81	26.80	28.21	341.80	0.22
2300.00	1.10	32.06	2299.63	28.19	-7.91	28.19	29.28	344.32	0.30
2400.00	1.16	12.27	2399.61	30.00	-7.19	30.00	30.85	346.53	0.39
2500.00	1.31	8.21	2499.59	32.13	-6.81	32.13	32.84	348.04	0.17
2600.00	1.33	10.94	2599.56	34.41	-6.42	34.41	35.00	349.43	0.07
2700.00	1.09	352.98	2699.54	36.49	-6.32	36.49	37.04	350.18	0.45
2800.00	1.10	346.50	2799.52	38.37	-6.66	38.37	38.94	350.16	0.12
2900.00	0.92	346.40	2899.51	40.08	-7.07	40.08	40.70	350.00	0.18
3000.00	1.36	315.85	2999.49	41.71	-8.09	41.71	42.49	349.03	0.73
3100.00	1.63	326.39	3099.45	43.75	-9.70	43.75	44.81	347.50	0.38
3200.00	1.93	327.26	3199.40	46.35	-11.39	46.35	47.73	346.19	0.30
3300.00	2.06	336.37	3299.34	49.40	-13.02	49.40	51.09	345.23	0.34
3400.00	2.37	331.37	3399.27	52.86	-14.73	52.86	54.88	344.43	0.37
3500.00	1.87	327.55	3499.20	56.05	-16.60	56.05	58.46	343.50	0.52
3600.00	2.03	326.49	3599.14	58.91	-18.45	58.91	61.73	342.61	0.17
3700.00	1.70	323.71	3699.09	61.58	-20.31	61.58	64.85	341.75	0.34
3800.00	1.48	317.36	3799.05	63.73	-22.06	63.73	67.44	340.90	0.29
3900.00	1.50	328.43	3899.02	65.80	-23.62	65.80	69.91	340.25	0.29
4000.00	1.44	314.29	3998.98	67.79	-25.21	67.79	72.33	339.60	0.37
4100.00	1.22	310.58	4098.96	69.36	-26.92	69.36	74.40	338.79	0.24
4200.00	1.21	311.07	4198.94	70.75	-28.52	70.75	76.28	338.04	0.01
4300.00	1.02	304.08	4298.92	71.94	-30.06	71.94	77.97	337.32	0.23
4400.00	1.12	315.34	4398.90	73.14	-31.49	73.14	79.63	336.71	0.23
4500.00	0.99	317.29	4498.88	74.47	-32.76	74.47	81.36	336.25	0.13
4600.00	0.94	330.14	4598.87	75.82	-33.76	75.82	83.00	336.00	0.22
4700.00	1.03	332.30	4698.85	77.34	-34.59	77.34	84.72	335.90	0.10
4800.00	0.98	329.82	4798.84	78.87	-35.44	78.87	86.47	335.81	0.07
4900.00	0.99	322.75	4898.82	80.30	-36.39	80.30	88.16	335.62	0.12
5000.00	0.64	326.32	4998.81	81.45	-37.22	81.45	89.55	335.44	0.36
5100.00	0.92	315.05	5098.80	82.48	-38.10	82.48	90.85	335.21	0.32
5200.00	0.82	325.22	5198.79	83.64	-39.07	83.64	92.31	334.96	0.18
5300.00	0.73	331.09	5298.78	84.78	-39.79	84.78	93.66	334.86	0.13
5400.00	0.81	321.05	5398.77	85.89	-40.54	85.89	94.98	334.73	0.16
5500.00	0.89	316.30	5498.76	87.01	-41.53	87.01	96.41	334.49	0.10
5600.00	0.53	311.29	5598.75	87.87	-42.41	87.87	97.57	334.24	0.37
5700.00	0.42	303.05	5698.75	88.38	-43.06	88.38	98.31	334.02	0.13

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
5800.00	0.96	282.78	5798.74	88.76	-44.19	88.76	99.15	333.54	0.58
5900.00	0.65	259.19	5898.73	88.84	-45.56	88.84	99.84	332.85	0.45
6000.00	0.88	271.87	5998.73	88.76	-46.88	88.76	100.38	332.16	0.29
6100.00	0.82	275.59	6098.71	88.85	-48.36	88.85	101.16	331.44	0.08
6200.00	0.72	277.03	6198.70	89.00	-49.70	89.00	101.94	330.82	0.10
6300.00	0.69	269.53	6298.70	89.07	-50.93	89.07	102.61	330.24	0.10
6400.00	0.66	250.48	6398.69	88.88	-52.08	88.88	103.01	329.63	0.23
6500.00	0.48	267.39	6498.69	88.67	-53.03	88.67	103.32	329.12	0.24
6600.00	0.54	262.75	6598.68	88.59	-53.92	88.59	103.71	328.67	0.08
6700.00	0.41	271.30	6698.68	88.54	-54.75	88.54	104.10	328.27	0.15
6800.00	0.38	314.03	6798.68	88.77	-55.34	88.77	104.61	328.06	0.29
6900.00	0.51	332.56	6898.67	89.40	-55.78	89.40	105.38	328.04	0.19
7000.00	0.73	336.40	6998.67	90.38	-56.25	90.38	106.45	328.11	0.23
7100.00	1.12	325.87	7098.65	91.78	-57.05	91.78	108.06	328.13	0.42
7200.00	0.83	312.76	7198.64	93.08	-58.13	93.08	109.74	328.01	0.36
7300.00	0.73	305.35	7298.63	93.94	-59.19	93.94	111.03	327.79	0.14
7400.00	0.94	294.09	7398.62	94.65	-60.46	94.65	112.31	327.43	0.27
7500.00	0.77	291.04	7498.61	95.23	-61.84	95.23	113.54	327.00	0.18
7600.00	0.43	332.05	7598.60	95.80	-62.65	95.80	114.46	326.82	0.53
7700.00	0.72	43.17	7698.60	96.59	-62.39	96.59	114.99	327.14	0.71
7800.00	0.95	50.32	7798.59	97.58	-61.32	97.58	115.25	327.85	0.25
7900.00	1.17	69.90	7898.57	98.46	-59.72	98.46	115.15	328.76	0.42
8000.00	0.83	77.11	7998.56	98.97	-58.06	98.97	114.74	329.60	0.37
8100.00	0.51	84.71	8098.55	99.17	-56.91	99.17	114.34	330.15	0.33
8200.00	0.07	158.02	8198.55	99.15	-56.45	99.15	114.10	330.35	0.49
8300.00	0.54	233.92	8298.55	98.82	-56.80	98.82	113.98	330.11	0.53



VES Survey International
West Texas
432-563-5444
Surveyor: Chris Bankson
Marauder 31 Federal No. 004H / API 30-015-41811



VES Survey Date: 06/04/2014



Survey Report - Geographic



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well Marauder 31 Federal Well No. 4H
Project:	Eddy County, New Mexico	TVD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Site:	Marauder 31 Federal	MD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Well:	Marauder 31 Federal Well No. 4H	North Reference:	Grid
Wellbore:	Original hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original hole	Database:	EDM 5000.1 Ddatabase

Project:	Eddy County, New Mexico		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site:	Marauder 31 Federal		
Site Position:		Northing:	590,651.80 usft
From:	Map	Easting:	631,946.80 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32.62307409
		Longitude:	-103.90476956
		Grid Convergence:	0.23 °

Well:	Marauder 31 Federal Well No. 4H		
Well Position	+N/-S	0.00 usft	Northing: 590,658.80 usft
	+E/-W	0.00 usft	Easting: 632,936.70 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32.62308232
		Longitude:	-103.90155434
		Ground Level:	3,464.80 usft

Wellbore:	Original hole		
Magnetics	Model Name	Sample Date	Declination
	IGRF2010	5/15/2014	(°)
			7.41
			Dip Angle (°)
			60.43
			Field Strength (nT)
			48,528

Design:	Surveys Original hole		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.00	0.00	0.00
			Direction (°)
			179.58

Survey Program	Date	6/11/2014		
From	To	Survey (Wellbore)	Tool Name	Description
(usft)	(usft)			
100.00	8,300.00	Gyro (Original hole)	NS-GYRO-MS	North sensing gyrocompassing m/s
8,394.00	13,407.00	MWD (Original hole)	MWD	MWD - Standard

Survey:									
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude
Depth	(°)	(°)	Depth	(usft)	(usft)	Northing	Easting		
(usft)			(usft)			(usft)	(usft)		
0.00	0.00	0.00	0.00	0.00	0.00	590,658.80	632,936.70	32.62308232	-103.90155434
100.00	0.19	287.87	100.00	0.05	-0.16	590,658.85	632,936.55	32.62308246	-103.90155486
Gyro									
200.00	0.32	292.07	200.00	0.21	-0.57	590,659.01	632,936.13	32.62308290	-103.90155621
300.00	0.52	302.33	300.00	0.55	-1.22	590,659.36	632,935.49	32.62308386	-103.90155829
400.00	0.77	300.91	399.99	1.14	-2.18	590,659.95	632,934.53	32.62308548	-103.90156140
500.00	0.88	304.18	499.98	1.92	-3.39	590,660.72	632,933.32	32.62308763	-103.90156532
600.00	1.19	295.10	599.96	2.79	-4.96	590,661.59	632,931.74	32.62309005	-103.90157043
700.00	1.30	296.15	699.94	3.73	-6.92	590,662.53	632,929.78	32.62309265	-103.90157678
800.00	1.23	312.64	799.92	4.96	-8.73	590,663.76	632,927.97	32.62309605	-103.90158263
900.00	1.17	323.64	899.89	6.51	-10.13	590,665.31	632,926.58	32.62310032	-103.90158714



Survey Report - Geographic



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well Marauder 31 Federal Well No. 4H
Project:	Eddy County, New Mexico	TVD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Site:	Marauder 31 Federal	MD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Well:	Marauder 31 Federal Well No. 4H	North Reference:	Grid
Wellbore:	Original hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original hole	Database:	EDM 5000.1 Ddatabase

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
1,000.00	0.96	323.21	999.88	8.00	-11.23	590,666.80	632,925.47	32.62310444	-103.90159072
1,100.00	0.87	332.23	1,099.86	9.34	-12.09	590,668.15	632,924.62	32.62310814	-103.90159348
1,200.00	1.00	326.89	1,199.85	10.75	-12.92	590,669.55	632,923.79	32.62311200	-103.90159616
1,300.00	1.05	310.71	1,299.83	12.07	-14.09	590,670.88	632,922.61	32.62311567	-103.90159995
1,400.00	0.92	330.77	1,399.82	13.37	-15.18	590,672.18	632,921.53	32.62311925	-103.90160346
1,500.00	0.41	359.57	1,499.81	14.43	-15.57	590,673.23	632,921.13	32.62312216	-103.90160473
1,600.00	1.07	2.13	1,599.80	15.72	-15.54	590,674.52	632,921.17	32.62312571	-103.90160461
1,700.00	1.54	11.42	1,699.78	17.97	-15.24	590,676.77	632,921.47	32.62313189	-103.90160360
1,800.00	1.64	17.61	1,799.74	20.65	-14.54	590,679.46	632,922.17	32.62313925	-103.90160129
1,900.00	1.46	45.37	1,899.70	22.91	-13.20	590,681.71	632,923.51	32.62314545	-103.90159691
2,000.00	1.30	57.92	1,999.68	24.41	-11.33	590,683.21	632,925.37	32.62314954	-103.90159083
2,100.00	0.96	43.12	2,099.66	25.62	-9.80	590,684.43	632,926.91	32.62315286	-103.90158583
2,200.00	0.80	33.61	2,199.64	26.82	-8.84	590,685.62	632,927.87	32.62315613	-103.90158270
2,300.00	1.10	32.06	2,299.63	28.21	-7.94	590,687.01	632,928.76	32.62315995	-103.90157977
2,400.00	1.16	12.27	2,399.61	30.01	-7.22	590,688.82	632,929.49	32.62316490	-103.90157739
2,500.00	1.31	8.21	2,499.59	32.13	-6.84	590,690.94	632,929.86	32.62317072	-103.90157614
2,600.00	1.33	10.94	2,599.56	34.40	-6.46	590,693.21	632,930.25	32.62317696	-103.90157486
2,700.00	1.09	352.98	2,699.54	36.49	-6.35	590,695.29	632,930.35	32.62318269	-103.90157449
2,800.00	1.10	346.50	2,799.52	38.37	-6.69	590,697.17	632,930.01	32.62318785	-103.90157558
2,900.00	0.92	346.40	2,899.51	40.08	-7.11	590,698.88	632,929.60	32.62319257	-103.90157689
3,000.00	1.36	315.85	2,999.49	41.71	-8.12	590,700.51	632,928.58	32.62319706	-103.90158017
3,100.00	1.63	326.39	3,099.45	43.75	-9.73	590,702.55	632,926.97	32.62320268	-103.90158538
3,200.00	1.93	327.26	3,199.40	46.35	-11.43	590,705.15	632,925.27	32.62320985	-103.90159087
3,300.00	2.06	336.37	3,299.34	49.41	-13.06	590,708.21	632,923.64	32.62321828	-103.90159612
3,400.00	2.37	331.37	3,399.27	52.87	-14.77	590,711.68	632,921.93	32.62322782	-103.90160163
3,500.00	1.87	327.55	3,499.20	56.06	-16.64	590,714.87	632,920.06	32.62323661	-103.90160765
3,600.00	2.03	326.49	3,599.14	58.92	-18.49	590,717.72	632,918.21	32.62324448	-103.90161364
3,700.00	1.70	323.71	3,699.09	61.59	-20.35	590,720.39	632,916.35	32.62325184	-103.90161963
3,800.00	1.48	317.36	3,799.05	63.74	-22.10	590,722.54	632,914.60	32.62325776	-103.90162529
3,900.00	1.50	328.43	3,899.02	65.80	-23.66	590,724.60	632,913.04	32.62326345	-103.90163033
4,000.00	1.44	314.29	3,998.98	67.79	-25.25	590,726.60	632,911.46	32.62326895	-103.90163545
4,100.00	1.22	310.58	4,098.96	69.36	-26.96	590,728.17	632,909.75	32.62327328	-103.90164098
4,200.00	1.21	311.07	4,198.94	70.75	-28.56	590,729.55	632,908.14	32.62327711	-103.90164617
4,300.00	1.02	304.08	4,298.92	71.94	-30.09	590,730.75	632,906.61	32.62328041	-103.90165114
4,400.00	1.12	315.34	4,398.90	73.14	-31.52	590,731.94	632,905.19	32.62328370	-103.90165575
4,500.00	0.99	317.29	4,498.88	74.47	-32.79	590,733.27	632,903.91	32.62328737	-103.90165986
4,600.00	0.94	330.14	4,598.87	75.81	-33.78	590,734.62	632,902.92	32.62329109	-103.90166307
4,700.00	1.03	332.30	4,698.85	77.32	-34.61	590,736.12	632,902.09	32.62329524	-103.90166574
4,800.00	0.98	329.82	4,798.84	78.85	-35.46	590,737.66	632,901.25	32.62329947	-103.90166847
4,900.00	0.99	322.75	4,898.82	80.28	-36.41	590,739.08	632,900.29	32.62330340	-103.90167155
5,000.00	0.64	326.32	4,998.81	81.43	-37.24	590,740.24	632,899.46	32.62330658	-103.90167424
5,100.00	0.92	315.05	5,098.80	82.47	-38.12	590,741.27	632,898.58	32.62330942	-103.90167707
5,200.00	0.82	325.22	5,198.79	83.62	-39.10	590,742.43	632,897.61	32.62331261	-103.90168022
5,300.00	0.73	331.09	5,298.78	84.77	-39.81	590,743.57	632,896.89	32.62331577	-103.90168253
5,400.00	0.81	321.05	5,398.77	85.87	-40.56	590,744.68	632,896.14	32.62331882	-103.90168496
5,500.00	0.89	316.30	5,498.76	86.99	-41.55	590,745.79	632,895.16	32.62332189	-103.90168813
5,600.00	0.53	311.29	5,598.76	87.85	-42.43	590,746.66	632,894.27	32.62332428	-103.90169099
5,700.00	0.42	303.05	5,698.75	88.36	-43.08	590,747.16	632,893.62	32.62332567	-103.90169311
5,800.00	0.96	282.78	5,798.74	88.74	-44.21	590,747.55	632,892.50	32.62332675	-103.90169676
5,900.00	0.65	259.19	5,898.73	88.82	-45.58	590,747.63	632,891.12	32.62332698	-103.90170122
6,000.00	0.88	271.87	5,998.73	88.74	-46.91	590,747.54	632,889.80	32.62332677	-103.90170553
6,100.00	0.82	275.59	6,098.71	88.84	-48.39	590,747.64	632,888.32	32.62332705	-103.90171033
6,200.00	0.72	277.03	6,198.71	88.98	-49.72	590,747.79	632,886.98	32.62332746	-103.90171467
6,300.00	0.69	269.53	6,298.70	89.05	-50.95	590,747.86	632,885.76	32.62332768	-103.90171865
6,400.00	0.66	250.48	6,398.69	88.86	-52.09	590,747.66	632,884.61	32.62332715	-103.90172237



Survey Report - Geographic



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well Marauder 31 Federal Well No. 4H
Project:	Eddy County, New Mexico	TVD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Site:	Marauder 31 Federal	MD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Well:	Marauder 31 Federal Well No. 4H	North Reference:	Grid
Wellbore:	Original hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original hole	Database:	EDM 5000.1 Ddatabase

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
6,500.00	0.48	267.39	6,498.69	88.65	-53.05	590,747.45	632,883.65	32.62332658	-103.90172549
6,600.00	0.54	262.75	6,598.68	88.57	-53.94	590,747.37	632,882.76	32.62332637	-103.90172837
6,700.00	0.41	271.30	6,698.68	88.52	-54.77	590,747.32	632,881.94	32.62332624	-103.90173105
6,800.00	0.38	314.03	6,798.68	88.75	-55.36	590,747.56	632,881.34	32.62332690	-103.90173299
6,900.00	0.51	332.56	6,898.67	89.38	-55.81	590,748.18	632,880.90	32.62332862	-103.90173442
7,000.00	0.73	336.40	6,998.67	90.36	-56.27	590,749.16	632,880.44	32.62333132	-103.90173590
7,100.00	1.12	325.87	7,098.65	91.75	-57.07	590,750.55	632,879.64	32.62333516	-103.90173849
7,200.00	0.83	312.76	7,198.64	93.05	-58.15	590,751.85	632,878.56	32.62333874	-103.90174198
7,300.00	0.73	305.35	7,298.63	93.91	-59.20	590,752.72	632,877.50	32.62334112	-103.90174538
7,400.00	0.94	294.09	7,398.62	94.62	-60.47	590,753.42	632,876.24	32.62334307	-103.90174949
7,500.00	0.77	291.04	7,498.61	95.19	-61.84	590,753.99	632,874.86	32.62334467	-103.90175396
7,600.00	0.43	332.05	7,598.60	95.76	-62.65	590,754.57	632,874.06	32.62334625	-103.90175656
7,700.00	0.72	43.17	7,698.60	96.55	-62.39	590,755.36	632,874.31	32.62334842	-103.90175572
7,800.00	0.95	50.32	7,798.59	97.54	-61.33	590,756.34	632,875.38	32.62335112	-103.90175224
7,900.00	1.17	69.90	7,898.57	98.42	-59.73	590,757.22	632,876.98	32.62335352	-103.90174704
8,000.00	0.83	77.11	7,998.56	98.93	-58.06	590,757.74	632,878.64	32.62335491	-103.90174163
8,100.00	0.51	84.71	8,098.55	99.14	-56.92	590,757.94	632,879.79	32.62335546	-103.90173789
8,200.00	0.07	158.02	8,198.55	99.12	-56.45	590,757.92	632,880.26	32.62335541	-103.90173638
8,300.00	0.54	233.92	8,298.55	98.79	-56.81	590,757.59	632,879.90	32.62335449	-103.90173755
8,394.00	1.80	235.90	8,392.53	97.70	-58.39	590,756.50	632,878.32	32.62335152	-103.90174269
MWD surveys									
8,426.00	4.30	207.50	8,424.48	96.35	-59.36	590,755.16	632,877.35	32.62334783	-103.90174586
8,458.00	8.10	200.80	8,456.29	93.18	-60.71	590,751.98	632,875.99	32.62333912	-103.90175031
8,489.00	11.70	197.30	8,486.82	88.13	-62.42	590,746.94	632,874.28	32.62332528	-103.90175593
8,521.00	14.60	189.90	8,517.98	81.06	-64.08	590,739.87	632,872.62	32.62330585	-103.90176141
8,553.00	18.60	190.60	8,548.64	72.07	-65.72	590,730.87	632,870.99	32.62328115	-103.90176683
8,584.00	21.80	187.40	8,577.73	61.50	-67.37	590,720.30	632,869.34	32.62325212	-103.90177234
8,616.00	25.80	186.00	8,607.00	48.67	-68.86	590,707.48	632,867.84	32.62321688	-103.90177736
8,648.00	30.10	186.70	8,635.26	33.77	-70.53	590,692.58	632,866.18	32.62317594	-103.90178296
8,679.00	34.20	183.90	8,661.51	17.35	-72.03	590,676.16	632,864.68	32.62313082	-103.90178805
8,710.00	37.69	179.82	8,686.60	-0.82	-72.59	590,657.98	632,864.12	32.62308087	-103.90179012
330 Hard line intercept @ 8710 MD									
8,711.00	37.80	179.70	8,687.40	-1.44	-72.59	590,657.37	632,864.12	32.62307919	-103.90179012
8,743.00	40.30	176.90	8,712.25	-21.58	-71.97	590,637.22	632,864.73	32.62302381	-103.90178840
8,774.00	43.10	177.20	8,735.39	-42.17	-70.92	590,616.63	632,865.79	32.62296719	-103.90178523
8,806.00	45.70	178.30	8,758.25	-64.54	-70.04	590,594.26	632,866.66	32.62290569	-103.90178269
8,838.00	48.50	179.00	8,780.03	-87.97	-69.49	590,570.83	632,867.21	32.62284128	-103.90178121
8,869.00	51.60	179.30	8,799.94	-111.73	-69.14	590,547.07	632,867.56	32.62277596	-103.90178038
8,901.00	54.70	180.00	8,819.12	-137.34	-68.99	590,521.47	632,867.72	32.62270559	-103.90178022
8,933.00	57.90	180.00	8,836.88	-163.96	-68.99	590,494.85	632,867.72	32.62263242	-103.90178058
8,962.00	60.00	179.70	8,851.83	-188.80	-68.92	590,470.00	632,867.78	32.62256413	-103.90178069
8,996.00	62.70	180.00	8,868.13	-218.63	-68.85	590,440.17	632,867.86	32.62248212	-103.90178083
9,028.00	65.80	180.00	8,882.03	-247.45	-68.85	590,411.35	632,867.86	32.62240291	-103.90178121
9,060.00	69.20	180.80	8,894.28	-277.01	-69.05	590,381.79	632,867.65	32.62232166	-103.90178228
9,091.00	71.10	181.10	8,904.80	-306.16	-69.54	590,352.64	632,867.17	32.62224153	-103.90178424
9,123.00	73.90	180.80	8,914.43	-336.68	-70.04	590,322.13	632,866.66	32.62215767	-103.90178628
9,155.00	76.50	180.00	8,922.60	-367.61	-70.26	590,291.19	632,866.45	32.62207264	-103.90178739
9,186.00	79.20	179.00	8,929.12	-397.91	-69.99	590,260.89	632,866.71	32.62198935	-103.90178692
9,218.00	81.40	178.30	8,934.52	-429.44	-69.25	590,229.36	632,867.46	32.62190267	-103.90178492
9,250.00	82.90	178.30	8,938.89	-461.13	-68.31	590,197.67	632,868.40	32.62181556	-103.90178229
9,281.00	84.70	178.60	8,942.23	-491.93	-67.47	590,166.87	632,869.23	32.62173087	-103.90177999
9,313.00	86.80	179.00	8,944.61	-523.84	-66.81	590,134.97	632,869.90	32.62164317	-103.90177824
9,345.00	86.90	179.30	8,946.36	-555.79	-66.33	590,103.02	632,870.37	32.62155535	-103.90177712
9,408.00	89.00	179.70	8,948.62	-618.74	-65.78	590,040.06	632,870.92	32.62138230	-103.90177616
9,503.00	89.70	180.00	8,949.70	-713.73	-65.53	589,945.07	632,871.17	32.62112119	-103.90177661

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well Marauder 31 Federal Well No. 4H
Project:	Eddy County, New Mexico	TVD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Site:	Marauder 31 Federal	MD Reference:	RKB=3464.8+18 @ 3482.80usft (Patriot 6)
Well:	Marauder 31 Federal Well No. 4H	North Reference:	Grid
Wellbore:	Original hole	Survey Calculation Method:	Minimum Curvature
Design:	Surveys Original hole	Database:	EDM 5000.1 Ddatabase

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
9,598.00	89.60	179.00	8,950.28	-808.73	-64.71	589,850.08	632,872.00	32.62086007	-103.90177517
9,693.00	89.30	178.60	8,951.19	-903.70	-62.72	589,755.10	632,873.99	32.62059898	-103.90176996
9,788.00	89.00	179.30	8,952.60	-998.67	-60.98	589,660.13	632,875.73	32.62033791	-103.90176556
9,883.00	89.50	179.70	8,953.84	-1,093.66	-60.15	589,565.14	632,876.56	32.62007680	-103.90176412
9,978.00	90.60	179.70	8,953.76	-1,188.66	-59.65	589,470.15	632,877.05	32.61981567	-103.90176376
10,073.00	90.70	177.60	8,952.68	-1,283.62	-57.41	589,375.18	632,879.29	32.61955462	-103.90175774
10,168.00	87.70	177.20	8,954.01	-1,378.50	-53.10	589,280.30	632,883.60	32.61929377	-103.90174500
10,263.00	87.80	177.60	8,957.74	-1,473.33	-48.80	589,185.47	632,887.91	32.61903306	-103.90173227
10,357.00	90.10	178.30	8,959.46	-1,567.25	-45.44	589,091.56	632,891.27	32.61877487	-103.90172259
10,452.00	91.50	178.60	8,958.13	-1,662.20	-42.87	588,996.60	632,893.84	32.61851384	-103.90171549
10,547.00	90.30	177.90	8,956.64	-1,757.14	-39.96	588,901.66	632,896.74	32.61825283	-103.90170732
10,642.00	90.20	177.90	8,956.22	-1,852.08	-36.48	588,806.72	632,900.22	32.61799184	-103.90169727
10,737.00	89.30	177.60	8,956.64	-1,947.00	-32.75	588,711.80	632,903.95	32.61773088	-103.90168641
10,832.00	89.80	177.60	8,957.39	-2,041.92	-28.78	588,616.89	632,907.93	32.61746994	-103.90167474
10,927.00	88.00	177.90	8,959.21	-2,136.82	-25.05	588,521.98	632,911.66	32.61720903	-103.90166388
11,054.00	89.70	179.00	8,961.76	-2,263.74	-21.61	588,395.06	632,915.09	32.61686012	-103.90165441
11,149.00	91.10	179.70	8,961.09	-2,358.73	-20.54	588,300.07	632,916.17	32.61659900	-103.90165216
11,244.00	89.30	177.80	8,960.76	-2,453.70	-18.46	588,205.10	632,918.24	32.61633794	-103.90164668
11,307.00	89.50	178.30	8,961.42	-2,516.66	-16.32	588,142.14	632,920.38	32.61616485	-103.90164055
11,402.00	90.60	178.60	8,961.34	-2,611.62	-13.75	588,047.18	632,922.95	32.61590379	-103.90163346
11,497.00	89.90	179.20	8,960.93	-2,706.60	-11.93	587,952.20	632,924.78	32.61564270	-103.90162879
11,592.00	90.60	178.80	8,960.51	-2,801.59	-10.27	587,857.21	632,926.44	32.61538159	-103.90162465
11,687.00	89.60	179.30	8,960.35	-2,896.57	-8.69	587,762.23	632,928.01	32.61512048	-103.90162079
11,781.00	90.00	177.90	8,960.67	-2,990.54	-6.40	587,668.26	632,930.31	32.61486216	-103.90161457
11,877.00	90.70	179.00	8,960.09	-3,086.50	-3.80	587,572.30	632,932.90	32.61459836	-103.90160741
11,971.00	90.80	179.20	8,958.86	-3,180.48	-2.32	587,478.32	632,934.38	32.61434002	-103.90160385
12,066.00	92.00	178.60	8,956.54	-3,275.44	-0.50	587,383.37	632,936.20	32.61407900	-103.90159918
12,161.00	90.90	179.50	8,954.13	-3,370.39	1.07	587,288.41	632,937.78	32.61381797	-103.90159532
12,256.00	90.80	180.60	8,952.72	-3,465.38	0.99	587,193.43	632,937.69	32.61355688	-103.90159684
12,351.00	90.30	180.00	8,951.81	-3,560.37	0.49	587,098.43	632,937.20	32.61329577	-103.90159971
12,447.00	90.00	179.70	8,951.56	-3,656.37	0.74	587,002.43	632,937.45	32.61303189	-103.90160016
12,542.00	90.20	179.20	8,951.39	-3,751.37	1.66	586,907.44	632,938.36	32.61277076	-103.90159845
12,637.00	89.10	180.00	8,951.97	-3,846.36	2.32	586,812.44	632,939.02	32.61250964	-103.90159755
12,732.00	90.20	179.90	8,952.55	-3,941.36	2.40	586,717.45	632,939.11	32.61224852	-103.90159854
12,827.00	90.10	179.70	8,952.30	-4,036.36	2.73	586,622.45	632,939.44	32.61198739	-103.90159871
12,922.00	89.80	178.60	8,952.39	-4,131.34	4.14	586,527.46	632,940.85	32.61172627	-103.90159539
13,017.00	89.50	178.30	8,952.97	-4,226.31	6.71	586,432.50	632,943.42	32.61146521	-103.90158830
13,120.00	89.30	178.60	8,954.05	-4,329.26	9.50	586,329.54	632,946.20	32.61118218	-103.90158061
13,215.00	88.30	179.50	8,956.04	-4,424.23	11.07	586,234.58	632,947.78	32.61092113	-103.90157674
13,407.00	88.30	179.50	8,961.73	-4,616.13	12.75	586,042.67	632,949.45	32.61039361	-103.90157384
Survey projected to 13407.00 MD									

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
100.00	100.00	0.05	-0.16	Gyro
8,394.00	8,392.53	97.70	-58.39	MWD surveys
8,710.00	8,686.60	-0.82	-72.59	330 Hard line intercept @ 8710 MD
13,407.00	8,961.73	-4,616.13	12.75	Survey projected to 13407.00 MD



COG Operating LLC

Well: Marauder 31 Federal Well No. 4H
 Site: Marauder 31 Federal
 Project: Eddy County, New Mexico
 Design: rev1
 Rig: Patriot 6

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Annotation
1	8300.00	0.54	233.92	8298.55	98.79	-56.81	0.00	0.00	-99.20	Survey @ 8300.00 MD
2	8476.46	0.54	233.92	8475.00	97.81	-58.15	0.00	0.00	-98.23	KOP Begin 12"/100' build/turn
3	9220.50	89.59	178.84	8949.86	-376.24	-52.19	12.00	-55.08	375.85	Begin 89.59° lateral
4	13467.23	89.59	178.84	8980.00	-4622.00	33.80	0.00	0.00	4622.12	PBHL/TD

ANNOTATIONS

TVD	MD	Inc	Azi	+N/-S	+E/-W	VSec	Departure	Annotation
100.00	100.00	0.19	287.87	0.05	-0.16	-0.05	0.17	Gyro
8392.53	8394.00	1.80	235.90	97.70	-58.39	-98.12	144.96	MWD surveys
8686.60	8710.00	37.69	179.82	-0.82	-72.59	0.29	245.18	330 Hard line intercept @ 8710 MD
8961.73	13407.00	88.30	179.50	-4616.13	12.75	4616.10	4861.73	Survey projected to 13407.00 MD

Surface Location: RKB=3464.8+18 @ 3482.80usft (Patriot 6)

US State Plane 1927 (Exact solution)

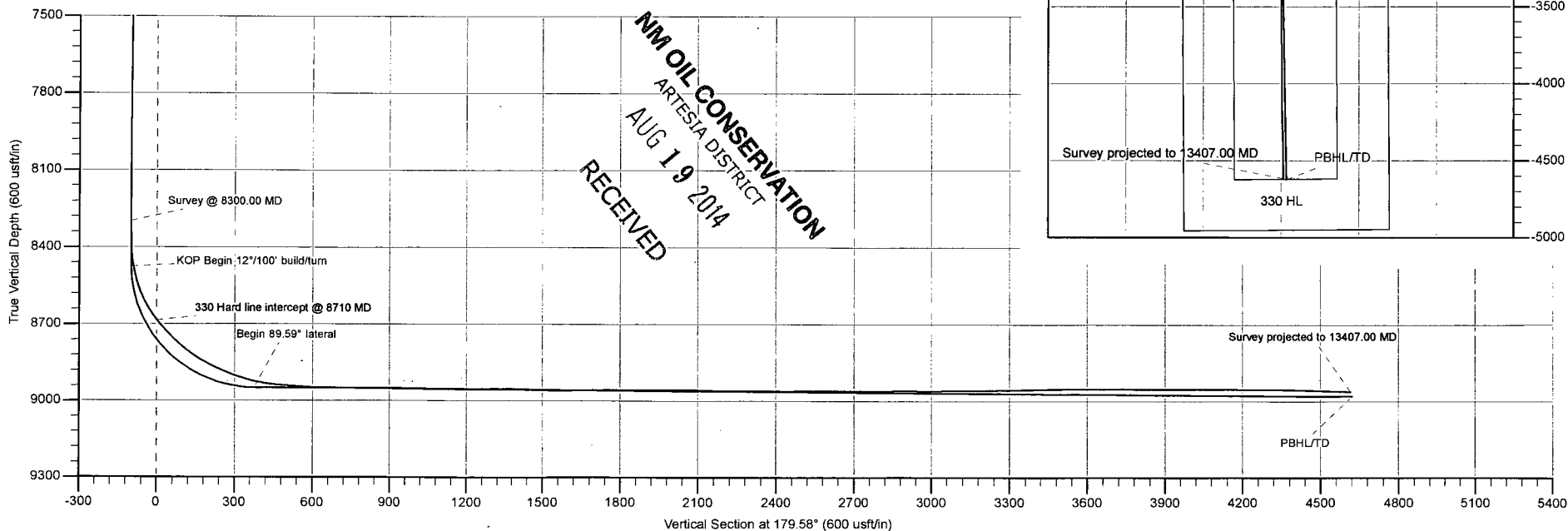
New Mexico East 3001

Northing: 590658.80
 Easting: 632936.70
 Latitude: 32.62308232
 Longitude: -103.90155434
 Total Correction (M => G) To convert a Magnetic Direction to a Grid Direction, Add 7.18°



Azimuths to Grid North
 True North: -0.23°
 Magnetic North: 7.18°

Magnetic Field
 Strength: 48528.4nT
 Dip Angle: 60.43°
 Date: 5/15/2014
 Model: IGRF2010



10:14, June 11 2014

