

COG Operating

Eddy County, NM (NAN27 NME)

Harvard Federal #12

Harvard Federal #12

OH

Design: Actual

Standard Survey Report

02 December, 2008



Scientific Drilling

Survey Report



Company:	COG Operating	Local Co-ordinate Reference:	Well Harvard Federal #12
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	Ground Elev @ 3745.00ft (Rig Silver Oak #5)
Site:	Harvard Federal #12	MD Reference:	Ground Elev @ 3745.00ft (Rig Silver Oak #5)
Well:	Harvard Federal #12	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 2003.16 Single User Db

Project:	Eddy County, NM (NAN27 NME)		
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: Harvard Federal #12		
Site Position:	Northing: 674,713 800 ft	Latitude: 32° 51' 15.266 N
From: Map	Easting: 622,094 100 ft	Longitude: 103° 56' 8.685 W
Position Uncertainty: 0.00 ft	Slot Radius: "	Grid Convergence: 0 22 °

Well	Harvard Federal #12				
Well Position	+N/-S	0 00 ft	Northing:	674,713 800 ft	Latitude: 32° 51' 15.266 N
	+E/-W	0.00 ft	Easting:	622,094.100 ft	Longitude: 103° 56' 8.685 W
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level: 3,745.00 ft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF200510	12/2/2008	8.09	60 78	49,233

Design:	Actual			
Audit Notes:				
Version:	1 0	Phase:	ACTUAL	Tie On Depth: 0 00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0 00	0 00	0.00	44 72

Survey Program		Date	12/2/2008		
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
100 00	1,244 00	GYRO (OH)	Keeper	Standard Wireline Keeper ver 1.0.2	
1,435 00	6,086 00	MWD (OH)	MWD	MWD - Standard	

Survey									
Measured Depth	Inclination	Azimuth	Vertical Depth	+N/-S	+E/-W	Vertical Section	Dogleg Rate	Build Rate	Turn Rate
(ft)	(°)	(°)	(ft)	(ft)	(ft)	(ft)	(°/100ft)	(°/100ft)	(°/100ft)
0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
100 00	0.48	162.84	100.00	-0.40	0 12	-0.20	0 48	0.48	0 00
200 00	0 23	179 06	200 00	-1 00	0 25	-0 54	0 27	-0 25	16 22
300 00	0 33	79 40	300 00	-1 15	0 54	-0 44	0 43	0 10	-99 66
400 00	0 49	96 24	399 99	-1 14	1 24	0 06	0 20	0 16	16 84
500 00	0 73	123 41	499 99	-1 54	2 20	0 46	0 37	0 24	27 17
600 00	0 89	125 76	599 98	-2 34	3 36	0 70	0 16	0.16	2 35
700 00	0.80	131.91	699 97	-3 26	4 51	0 86	0 13	-0 09	6 15
800 00	0 69	132.04	799 96	-4 13	5 48	0 92	0 11	-0 11	0 13
900 00	0 37	135.76	899 95	-4 77	6 15	0.94	0.32	-0 32	3 72
1,000 00	0 58	89 22	999 95	-4 99	6 88	1 30	0 42	0 21	-46 54
1,100 00	0 59	108 71	1,099 95	-5 15	7 88	1 88	0 20	0 01	19 49

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Well:	Harvard Federal #12	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 2003 16 Single User Db

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	
1,200.00	0.70	88.15	1,199.94	-5.30	8.98	2.55	0.25	0.11	-20.56	
1,244.00	0.68	103.54	1,243.94	-5.35	9.50	2.88	0.42	-0.05	34.98	
Last gyro survey										
1,435.00	0.68	91.23	1,434.92	-5.64	11.73	4.25	0.08	0.00	-6.45	
1,499.00	2.06	86.10	1,498.90	-5.57	13.26	5.37	2.16	2.16	-8.02	
1,594.00	3.42	65.96	1,593.79	-4.30	17.55	9.30	1.73	1.43	-21.20	
1,690.00	5.14	65.35	1,689.52	-1.34	24.08	15.99	1.79	1.79	-0.64	
1,785.00	7.28	63.32	1,783.96	3.14	33.32	25.68	2.26	2.25	-2.14	
1,881.00	8.23	49.74	1,879.09	10.31	44.00	38.29	2.14	0.99	-14.15	
1,977.00	9.32	41.43	1,973.97	20.58	54.39	52.90	1.74	1.14	-8.66	
2,072.00	10.32	40.52	2,067.58	32.82	65.01	69.06	1.07	1.05	-0.96	
2,168.00	11.24	39.07	2,161.88	46.62	76.49	86.95	1.00	0.96	-1.51	
2,231.00	10.79	39.10	2,223.72	55.96	84.08	98.93	0.71	-0.71	0.05	
2,359.00	10.99	36.79	2,349.41	75.03	98.95	122.94	0.38	0.16	-1.80	
2,486.00	11.20	39.05	2,474.04	94.31	113.97	147.20	0.38	0.17	1.78	
2,613.00	11.11	35.41	2,598.64	113.86	128.83	171.55	0.56	-0.07	-2.87	
2,709.00	9.36	35.75	2,693.11	127.73	138.75	188.39	1.82	-1.82	0.35	
2,804.00	10.53	37.21	2,786.68	140.92	148.51	204.63	1.26	1.23	1.54	
2,900.00	11.79	43.10	2,880.87	155.06	160.52	223.13	1.77	1.31	6.14	
2,995.00	11.34	40.50	2,973.94	169.25	173.22	242.15	0.72	-0.47	-2.74	
3,091.00	10.66	40.68	3,068.18	183.16	185.13	260.41	0.71	-0.71	0.19	
3,219.00	12.33	44.42	3,193.61	201.90	202.42	285.89	1.43	1.30	2.92	
3,346.00	11.81	45.27	3,317.80	220.74	221.14	312.45	0.43	-0.41	0.67	
3,473.00	11.81	46.79	3,442.11	238.78	239.85	338.43	0.24	0.00	1.20	
3,601.00	11.49	46.27	3,567.47	256.56	258.61	364.27	0.26	-0.25	-0.41	
3,728.00	10.97	48.59	3,692.04	273.30	276.81	388.97	0.54	-0.41	1.83	
3,854.00	10.91	46.43	3,815.75	289.45	294.44	412.85	0.33	-0.05	-1.71	
3,917.00	10.70	48.32	3,877.64	297.44	303.13	424.64	0.65	-0.33	3.00	
3,982.00	9.74	48.67	3,941.60	305.09	311.76	436.15	1.48	-1.48	0.54	
4,046.00	8.13	45.83	4,004.83	311.82	319.07	446.08	2.61	-2.52	-4.44	
4,141.00	6.41	51.72	4,099.06	319.78	328.06	458.06	1.97	-1.81	6.20	
4,205.00	5.11	47.11	4,162.74	323.94	332.95	464.45	2.15	-2.03	-7.20	
4,300.00	3.78	44.17	4,257.45	329.06	338.23	471.81	1.42	-1.40	-3.09	
4,427.00	2.42	39.84	4,384.26	334.12	342.87	478.67	1.09	-1.07	-3.41	
4,523.00	1.04	42.43	4,480.21	336.32	344.75	481.56	1.44	-1.44	2.70	
4,682.00	0.60	81.19	4,639.20	337.52	346.55	483.67	0.43	-0.28	24.38	
4,873.00	0.65	37.38	4,830.19	338.53	348.19	485.55	0.25	0.03	-22.94	
5,056.00	0.48	55.53	5,013.18	339.79	349.46	487.33	0.13	-0.09	9.92	
5,256.00	0.49	17.92	5,213.17	341.08	350.41	488.92	0.16	0.00	-18.80	
5,415.00	0.56	26.86	5,372.17	342.42	350.97	490.26	0.07	0.04	5.62	
5,606.00	0.48	59.61	5,563.16	343.65	352.08	491.93	0.16	-0.04	17.15	
5,766.00	0.19	32.35	5,723.15	344.22	352.80	492.83	0.20	-0.18	-17.04	
5,957.00	0.80	30.20	5,914.15	345.64	353.64	494.43	0.32	0.32	-1.13	
6,039.00	0.48	60.50	5,996.14	346.30	354.23	495.32	0.56	-0.39	36.95	
MWD Survey										
6,086.00	0.48	60.50	6,043.14	346.50	354.57	495.70	0.00	0.00	0.00	
Projection to Bit										

Scientific Drilling
Survey Report

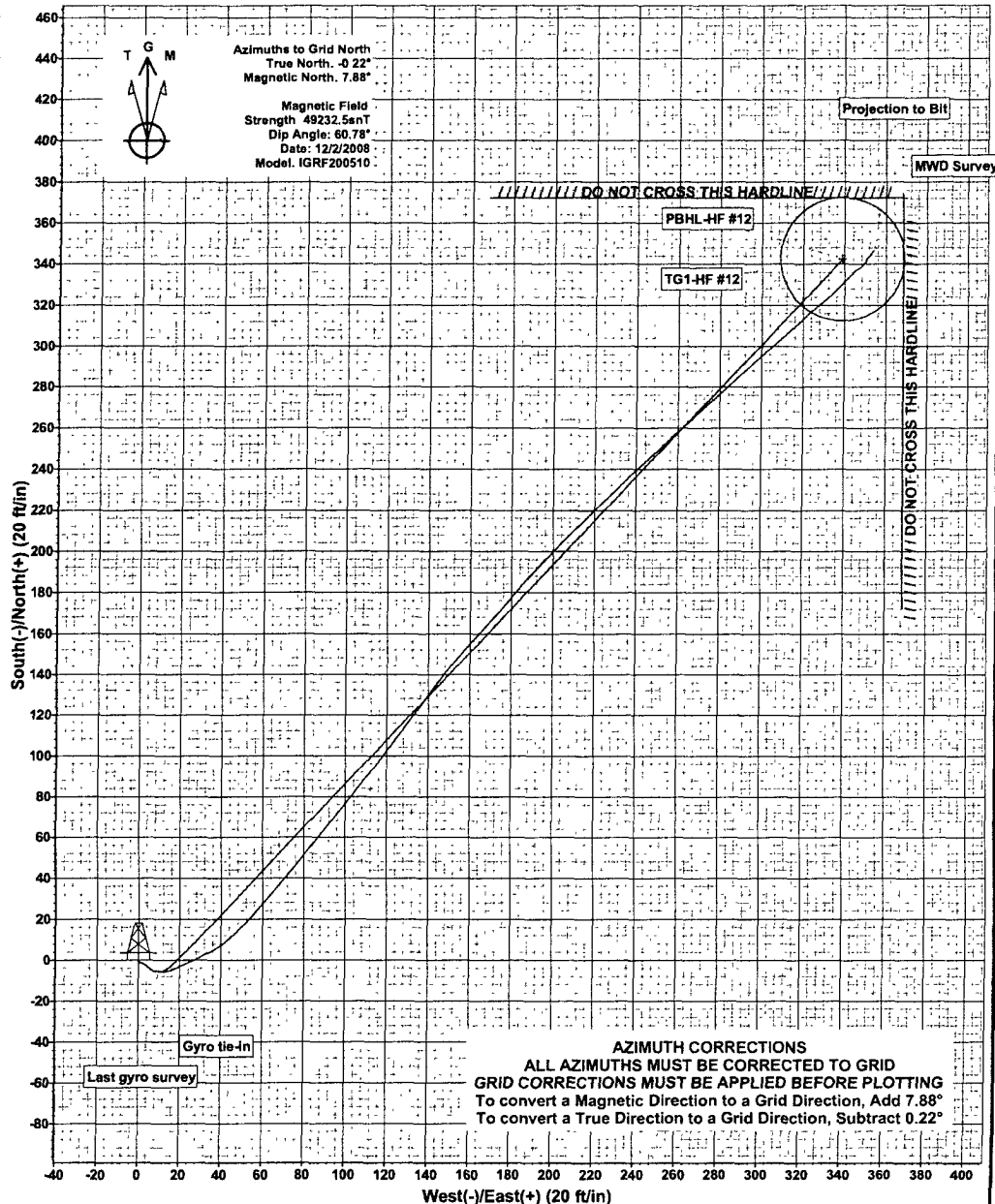


Company:	COG Operating	Local Co-ordinate Reference:	Well Harvard Federal #12
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	Ground Elev @ 3745.00ft (Rig Silver Oak #5)
Site:	Harvard Federal #12	MD Reference:	Ground Elev @ 3745.00ft (Rig Silver Oak #5)
Well:	Harvard Federal #12	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 2003.16 Single User Db

Targets									
Target Name	hit/miss target	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	
Shape		(°)	(°)	(ft)	(ft)	(ft)	(ft)	(ft)	
Hardline N-HF #12		0.00	0.00	0.00	372.30	368.70	675,086.100	622,462.800	32° 51' 18.936 N 103° 56' 4.346 W
- actual wellpath misses by 523.97ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Rectangle (sides W0.00 H200.00 D0.00)									
TG1-HF #12		0.00	0.00	4,425.00	342.48	339.17	675,056.277	622,433.266	32° 51' 18.642 N 103° 56' 4.694 W
- actual wellpath misses by 8.58ft at 4467.84ft MD (4425.07 TVD, 335.28 N, 343.84 E)									
- Circle (radius 30.00)									
Hardline E-HF #12		0.00	0.00	0.00	372.30	368.70	675,086.100	622,462.800	32° 51' 18.936 N 103° 56' 4.346 W
- actual wellpath misses by 523.97ft at 0.00ft MD (0.00 TVD, 0.00 N, 0.00 E)									
- Rectangle (sides W200.00 H0.00 D0.00)									
PBHL-HF #12		0.00	0.00	5,950.00	342.48	339.17	675,056.277	622,433.266	32° 51' 18.642 N 103° 56' 4.694 W
- actual wellpath misses by 15.15ft at 5992.72ft MD (5949.87 TVD, 346.01 N, 353.90 E)									
- Circle (radius 30.00)									

Checked By: _____ Approved By: _____ Date: _____

Scientific Drilling
Directional Drilling Operations



WELLBORE TARGET DETAILS (MAP CO-ORDINATES)								
Name	TVD	+N/S	+E/W	Northing	Easting	Latitude	Longitude	Shape
Hardline E-HF #12	0.00	372.30	368.70	675086.100	622462.800	32°51' 18.936 N	103°55' 4.346 W	Rectangle (Sides: L200.00 W0.00)
Hardline N-HF #12	0.00	372.30	368.70	675086.100	622462.800	32°51' 18.936 N	103°55' 4.346 W	Rectangle (Sides: L0.00 W200.00)
TG1-HF #12	4425.00	342.48	339.17	675056.277	622433.266	32°51' 18.642 N	103°56' 4.694 W	Circle (Radius: 30.00)
PBHL-HF #12	5950.00	342.48	339.17	675056.277	622433.266	32°51' 18.642 N	103°56' 4.694 W	Circle (Radius: 30.00)

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	DLeg	TFace	VSec	Target
1	1244.00	0.68	103.54	1243.94	-5.35	9.50	0.00	0.00	2.88	
2	1400.00	0.68	103.54	1399.93	-5.78	11.30	0.00	0.00	3.84	
3	1800.60	10.33	43.02	1798.28	19.99	38.19	2.50	-63.87	41.08	
4	4052.78	10.33	43.02	4013.94	315.31	313.81	0.00	0.00	444.95	
5	4466.08	0.00	0.00	4425.00	342.48	339.17	2.50	180.00	482.00	TG1-HF #12
6	5991.08	0.00	0.00	5950.00	342.48	339.17	0.00	0.00	482.00	PBHL-HF #12

		Ground Level:		3745.00		
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.00	0.00	674713.800	622094.100	32° 51' 15.266 N	103° 56' 8.585 W	

Geodetic System:	US State Plane 1927 (Exact solution)	Created By:	Julio Pina	Date:	02-Dec-08
Datum:	NAD 1927 (NADCON CONUS)				
Ellipsoid:	Clarke 1866	Checked:	_____	Date:	_____
Zone:	New Mexico East 3001				
System Datum:	Mean Sea Level	Reviewed:	_____	Date:	_____
		Approved:	_____	Date:	_____