

Results of Directional Survey

API number:	30-025-39000		
OGRID:		Operator:	COG OPERATING LLC
		Property:	MC FEDERAL # 32

surface	ULSTR:	K	21	T 17S	R 32E
			1900 FSL	2560 FWL	

BH Loc	ULSTR:	K	21	T 17S	R 32E
			1712 FSL	2314 FWL	

Top Perf/OH	ULSTR:	K	21	T 17S	R 32E
		5454	1672 FSL	2293 FWL	

Bot Perf/OH	ULSTR:	K	21	T 17S	R 32E
		6760	1710 FSL	2312 FWL	

	MD	N/S	E/W	VD
	5433	-229.60	-266.37	5408.17
TOP PERFS/OH	5454	-228.08	-266.65	5429.11
	5496	-225.05	-267.20	5471.00
	5995	-192.66	-254.30	5968.52
BOT PERFS/OH	6760	-189.58	-248.25	6733.52
	6057	-192.41	-253.81	6030.52

NEXT TO LAST	5995	-192.66	-254.30	5968.52
LAST READING	6057	-192.41	-253.81	6030.52
TD	7042	-188.44	-246.03	7015.52

Surface Location	1900	FS	2560	FW
Projected BHL	1712	FS	2314	FW
Location of				
Top Perfs/OH	1672	FS	2293	FW
Bottom Perfs/OH	1710	FS	2312	FW

SUMMARY of Subsurface Locations

Surface Location	K-21-17S-32E	1900	FS	2560	FW	Vert. Depth
Top Perfs/OH	K-21-17S-32E	1672	FS	2293	FW	5429.11
Bottom Perfs/OH	K-21-17S-32E	1710	FS	2312	FW	6733.52
Projected TD	K-21-17S-32E	1712	FS	2314	FW	7015.52



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REFERENCE WELLPATH IDENTIFICATION			
Operator	COG Operating LLC	Slot	No. 32 SHL
Area	Lea County, NM	Well	No. 32
Field	(MC) Sec 21, T17S, R32E	Wellbore	No. 32 ST AWB
Facility	MC Federal No. 32	Sidetrack from	No. 32 AWB at 5224.00 MD

REPORT SETUP INFORMATION			
Projection System	NAD27 / TM New Mexico State Planes, Eastern Zone (3001), US feet	Software System	WellArchitect@ 2.0
North Reference	Grid	User	Victor Hernandez
Scale	0.999943	Report Generated	8/28/2009 at 8:34:07 AM
Convergence at slot	0.30° East	Database/Source file	WA_Midland/No._32_ST_AWB.xml

WELLPATH LOCATION						
	Local coordinates		Grid coordinates		Geographic coordinates	
	North[ft]	East[ft]	Easting[USft]	Northing[USft]	Latitude	Longitude
Slot Location	0.00	0.00	672697.60	661751.90	32°49'04.733"N	103°46'16.287"W
Facility Reference Pt			672697.60	661751.90	32°49'04.733"N	103°46'16.287"W
Field Reference Pt			672697.60	661751.90	32°49'04.733"N	103°46'16.287"W

WELLPATH DATUM			
Calculation method	Minimum curvature	JW #4 on No. 32 SHL (RT) to Facility Vertical Datum	13.00ft
Horizontal Reference Pt	Facility Center	JW #4 on No. 32 SHL (RT) to Mean Sea Level	4055.10ft
Vertical Reference Pt	JW #4 on No. 32 SHL (RT)	Facility Vertical Datum to Mud Line (Facility)	0.00ft
MD Reference Pt	JW #4 on No. 32 SHL (RT)	Section Origin	N 0.00, E 0.00 ft
Field Vertical Reference	Mean Sea Level	Section Azimuth	232.84°

SUR: K-21-17s-32e, 1900/S & 2560/W
BHL: K-21-17s-32e, 1712/S & 2314/W
API # 30-025-39000



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REFERENCE WELLPATH IDENTIFICATION			
Operator	COG Operating LLC	Slot	No. 32 SHL
Area	Lea County, NM	Well	No. 32
Field	(MC) Sec 21, T17S, R32E	Wellbore	No. 32 ST AWB
Facility	MC Federal No. 32	Sidetrack from	No. 32 AWB at 5224.00 MD

WELLPATH DATA (83 stations)									
MD [ft]	Inclination [°]	Azimuth [°]	TVD [ft]	Vert Sect [ft]	North [ft]	East [ft]	Grid East [srv ft]	Grid North [srv ft]	DLS [°/100ft]
0.00	0.000	0.130	0.00	0.00	0.00	0.00	672697.60	661751.90	0.00
100.00	0.250	0.130	100.00	-0.13	0.22	0.00	672697.60	661752.12	0.25
200.00	0.400	20.810	200.00	-0.56	0.76	0.13	672697.72	661752.66	0.19
300.00	0.270	345.300	300.00	-0.95	1.32	0.19	672697.79	661753.22	0.24
400.00	0.090	265.830	400.00	-0.97	1.54	0.05	672697.65	661753.44	0.27
500.00	0.030	273.710	500.00	-0.88	1.53	-0.05	672697.55	661753.43	0.06
600.00	0.170	219.660	600.00	-0.72	1.42	-0.17	672697.43	661753.32	0.15
700.00	0.130	289.390	700.00	-0.51	1.35	-0.38	672697.22	661753.25	0.17
800.00	0.210	301.900	800.00	-0.39	1.48	-0.64	672696.96	661753.38	0.09
900.00	0.400	301.350	899.99	-0.19	1.76	-1.09	672696.51	661753.66	0.19
1000.00	0.360	299.330	999.99	0.06	2.09	-1.66	672695.94	661753.99	0.04
1100.00	0.330	332.830	1099.99	0.14	2.50	-2.07	672695.53	661754.40	0.20
1200.00	0.480	325.170	1199.99	0.07	3.10	-2.44	672695.16	661755.00	0.16
1300.00	0.460	338.530	1299.98	-0.06	3.82	-2.83	672694.77	661755.72	0.11
1400.00	0.450	334.920	1399.98	-0.25	4.55	-3.14	672694.46	661756.45	0.03
1500.00	0.460	330.880	1499.98	-0.39	5.26	-3.50	672694.10	661757.16	0.03
1600.00	0.620	359.520	1599.97	-0.77	6.15	-3.70	672693.90	661758.05	0.31
1700.00	0.800	24.750	1699.97	-1.70	7.32	-3.41	672694.19	661759.22	0.36
1800.00	1.370	39.180	1799.95	-3.48	8.88	-2.37	672695.23	661760.78	0.63
1900.00	1.790	42.470	1899.91	-6.18	10.96	-0.56	672697.04	661762.86	0.43
2000.00	1.880	48.430	1999.86	-9.35	13.20	1.73	672699.33	661765.10	0.21
2065.63	2.000	53.880	2065.45	-11.57	14.59	3.46	672701.06	661766.49	0.34
2160.00	2.000	44.900	2159.76	-14.85	16.73	5.95	672703.55	661768.63	0.33
2191.00	1.760	35.480	2190.75	-15.84	17.50	6.61	672704.21	661769.40	1.26
2223.00	1.400	53.930	2222.73	-16.70	18.13	7.21	672704.81	661770.03	1.93
2254.00	1.160	137.190	2253.73	-17.11	18.12	7.73	672705.33	661770.02	5.52
2285.00	2.250	169.760	2284.72	-16.86	17.30	8.05	672705.65	661769.19	4.57
2348.00	4.180	193.300	2347.62	-14.53	13.84	7.74	672705.34	661765.74	3.65
2410.00	6.300	215.530	2409.36	-9.54	8.88	5.24	672702.84	661760.77	4.67
2473.00	6.900	221.700	2471.94	-2.53	3.24	0.72	672698.32	661755.14	1.47



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REFERENCE WELLPATH IDENTIFICATION			
Operator	COG Operating LLC	Slot	No. 32 SHL
Area	Lea County, NM	Well	No. 32
Field	(MC) Sec 21, T17S, R32E	Wellbore	No. 32 ST AWB
Facility	MC Federal No. 32	Sidetrack from	No. 32 AWB at 5224.00 MD

WELLPATH DATA (83 stations)									
MD [ft]	Inclination [°]	Azimuth [°]	TVD [ft]	Vert Sect [ft]	North [ft]	East [ft]	Grid East [srv ft]	Grid North [srv ft]	DLS [°/100ft]
2536.00	6.770	228.230	2534.50	4.89	-2.06	-4.57	672693.03	661749.84	1.25
2599.00	6.900	230.970	2597.05	12.37	-6.92	-10.28	672687.32	661744.98	0.56
2661.00	7.160	232.490	2658.58	19.96	-11.62	-16.24	672681.36	661740.28	0.52
2723.00	7.530	233.580	2720.07	27.88	-16.38	-22.57	672675.03	661735.52	0.64
2786.00	6.880	231.360	2782.58	35.78	-21.19	-28.84	672668.76	661730.71	1.12
2848.00	6.180	225.110	2844.17	42.80	-25.86	-34.11	672663.50	661726.04	1.61
2911.00	5.700	221.330	2906.84	49.23	-30.61	-38.57	672659.03	661721.30	0.98
2973.00	5.670	224.930	2968.53	55.28	-35.09	-42.77	672654.83	661716.82	0.58
3036.00	8.000	218.360	3031.08	62.61	-40.73	-47.69	672649.91	661711.17	3.90
3098.00	8.020	213.760	3092.48	70.87	-47.71	-52.77	672644.83	661704.20	1.03
3160.00	7.660	219.960	3153.90	78.99	-54.47	-57.83	672639.77	661697.43	1.48
3222.00	8.040	224.580	3215.32	87.31	-60.73	-63.53	672634.08	661691.18	1.19
3285.00	7.860	224.380	3277.71	95.93	-66.94	-69.63	672627.97	661684.96	0.29
3348.00	7.950	224.340	3340.11	104.50	-73.14	-75.69	672621.92	661678.77	0.14
3410.00	8.220	225.870	3401.50	113.14	-79.29	-81.87	672615.74	661672.61	0.56
3472.00	7.450	224.400	3462.92	121.52	-85.25	-87.86	672609.74	661666.66	1.28
3534.00	7.190	224.670	3524.41	129.33	-90.88	-93.40	672604.20	661661.03	0.42
3596.00	8.030	227.290	3585.87	137.48	-96.58	-99.31	672598.30	661655.33	1.47
3659.00	8.210	224.270	3648.23	146.31	-102.78	-105.68	672591.92	661649.12	0.73
3720.00	8.010	227.380	3708.62	154.85	-108.78	-111.85	672585.76	661643.13	0.79
3783.00	7.670	227.230	3771.03	163.40	-114.61	-118.17	672579.44	661637.30	0.54
3845.00	7.900	222.310	3832.46	171.71	-120.57	-124.07	672573.53	661631.34	1.14
3907.00	8.120	221.490	3893.86	180.19	-127.00	-129.84	672567.77	661624.91	0.40
3970.00	7.780	222.270	3956.25	188.75	-133.48	-135.66	672561.95	661618.42	0.57
4032.00	7.440	225.880	4017.71	196.86	-139.38	-141.36	672556.25	661612.52	0.95
4095.00	7.510	222.620	4080.17	204.96	-145.25	-147.08	672550.53	661606.65	0.68
4189.00	7.240	221.260	4173.40	216.80	-154.23	-155.14	672542.47	661597.68	0.34
4282.00	6.700	224.170	4265.71	227.91	-162.52	-162.79	672534.82	661589.39	0.69
4375.00	8.130	220.010	4357.93	239.68	-171.45	-170.80	672526.81	661580.46	1.64
4469.00	8.520	222.930	4450.94	253.03	-181.64	-179.81	672517.80	661570.27	0.61



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REFERENCE WELLPATH IDENTIFICATION

Operator	COG Operating LLC	Slot	No. 32 SHL
Area	Lea County, NM	Well	No. 32
Field	(MC) Sec 21, T17S, R32E	Wellbore	No. 32 ST AWB
Facility	MC Federal No. 32	Sidetrack from	No. 32 AWB at 5224.00 MD

WELLPATH DATA (83 stations) † = interpolated/extrapolated station

MD [ft]	Inclination [°]	Azimuth [°]	TVD [ft]	Vert Sect [ft]	North [ft]	East [ft]	Grid East [srv ft]	Grid North [srv ft]	DLS [°/100ft]
4562.00	8.290	229.140	4542.94	266.50	-191.07	-189.58	672508.03	661560.84	1.01
4656.00	8.100	224.900	4635.98	279.82	-200.20	-199.38	672498.24	661551.72	0.67
4750.00	8.010	245.940	4729.07	292.76	-207.56	-210.03	672487.58	661544.35	3.12
4850.00	8.080	245.650	4828.09	306.40	-213.30	-222.80	672474.81	661538.62	0.08
4944.00	6.120	249.400	4921.37	317.65	-217.78	-233.51	672464.11	661534.13	2.14
5037.00	7.190	237.620	5013.74	328.20	-222.65	-243.06	672454.55	661529.27	1.86
5130.00	6.800	219.440	5106.06	339.36	-230.02	-251.48	672446.14	661521.90	2.41
5224.00	4.370	228.720	5199.61	348.34	-236.68	-257.71	672439.91	661515.24	2.75
5310.00	3.430	320.020	5285.48	351.74	-236.87	-261.82	672435.79	661515.05	6.53
5341.00	4.100	324.850	5316.41	351.75	-235.25	-263.06	672434.56	661516.66	2.39
5372.00	4.100	321.800	5347.33	351.73	-233.47	-264.38	672433.23	661518.44	0.70
5433.00	4.230	343.590	5408.17	350.97	-229.60	-266.37	672431.25	661522.31	2.59
5496.00	4.240	355.510	5471.00	348.89	-225.05	-267.20	672430.41	661526.86	1.39
5558.00	4.900	10.930	5532.81	345.68	-220.17	-266.88	672430.73	661531.75	2.24
5621.00	5.790	18.480	5595.53	341.06	-214.51	-265.36	672432.25	661537.40	1.80
5683.00	6.000	19.440	5657.21	335.77	-208.49	-263.29	672434.32	661543.42	0.37
5745.00	5.030	26.140	5718.92	330.64	-202.99	-261.02	672436.60	661548.92	1.88
5808.00	4.520	25.920	5781.70	325.95	-198.28	-258.72	672438.90	661553.63	0.81
5870.00	2.610	34.220	5843.58	322.44	-194.92	-256.85	672440.76	661557.00	3.18
5902.00	2.150	46.500	5875.55	321.15	-193.90	-256.01	672441.61	661558.01	2.14
5933.00	1.570	55.610	5906.53	320.15	-193.26	-255.24	672442.38	661558.65	2.09
5995.00	0.500	62.900	5968.52	319.03	-192.66	-254.30	672443.32	661559.25	1.74
6057.00†	0.500	62.900	6030.52	318.50	-192.41	-253.81	672443.80	661559.50	0.00



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Area	Lea County, NM	Well	No. 32
Field	(MC) Sec 21, T17S, R32E	Wellbore	No. 32 ST AWB
Facility	MC Federal No. 32	Sidetrack from	No. 32 AWB at 5224.00 MD

TARGETS									
Name	MD [ft]	TVD [ft]	North [ft]	East [ft]	Grid East [srv ft]	Grid North [srv ft]	Latitude	Longitude	Shape
No. 32 PBHL		7000.00	-240.70	-258.60	672439.02	661511.21	32°49'02.365"N	103°46'19.332"W	circle
No. 32 ST01 PBHL		7000.00	-200.00	-258.60	672439.02	661551.91	32°49'02.768"N	103°46'19.330"W	point

WELLPATH COMPOSITION					Ref Wellbore: No. 32 ST AWB	Ref Wellpath: No. 32 ST AWP
Start MD [ft]	End MD [ft]	Positional Uncertainty Model		Log Name/Comment		Wellbore
0.00	2065.63	Generic gyro - continuous (Standard)		GYRO		No. 32 AWB
2065.63	5224.00	NaviTrak (Standard)		MWD		No. 32 AWB
5224.00	5995.00	NaviTrak (Standard)		MWD ST		No. 32 ST AWB
5995.00	6057.00	Blind Drilling (std)		Projection to bit		No. 32 ST AWB