

Results of Directional Survey

DD

API number:	30-025-40236		
OGRID:		Operator:	COG OPERATING LLC
		Property:	BC FEDERAL # 30D

surface	ULSTR:	G	20	T	17S	R	32E
				2310	FNL	2437	FEL

BH Loc	ULSTR:	F	20	T	17S	R	32E
7044	MD	7010.5	TVD	2305	FNL	2977	FEL

Top Perf/OH	ULSTR:	G	20	T	17S	R	32E
5390	MD	5367.4	TVD	2298	FNL	2788	FEL

Bot Perf/OH	ULSTR:	F	20	T	17S	R	32E
6800	MD	6768.4	TVD	2304	FNL	2946	FEL

	MD	N/S	E/W	VD
	5383	11.84	-350.30	5360.45
TOP PERFS/OH	5390	11.83	-351.15	5367.40
	5476	11.65	-361.63	5452.75
	6794	5.88	-508.44	6762.46
BOT PERFS/OH	6800	5.88	-509.24	6768.41
	6857	5.88	-516.81	6824.90

NEXT TO LAST	6994	5.12	-533.62	6960.86
LAST READING	7044	4.52	-539.53	7010.50
TD	7044	4.52	-539.53	7010.50

Surface Location	2310	FN	2437	FE
Projected BHL	2305	FN	2977	FE
Location of				
Top Perfs/OH	2298	FN	2788	FE
Bottom Perfs/OH	2304	FN	2946	FE

SUMMARY of Subsurface Locations

Surface Location	G-20-17S-32E	2310	FN	2437	FE	Vert. Depth
Top Perfs/OH	G-20-17S-32E	2298	FN	2788	FE	5367.40
Bottom Perfs/OH	F-20-17S-32E	2304	FN	2946	FE	6768.41
Projected TD	F-20-17S-32E	2305	FN	2977	FE	7010.50

MAR 22 2012



HOBBS OCD

FEB 08 2012

RECEIVED

COG Operating LLC

Lea County, NM (NAD27 NME)

BC Federal #30

BC Federal #30

OH

Design: Actual

Standard Survey Report

02 December, 2011

SUR: G-20-17S-32E, 2310/N & 2437/E
BHL; F-20-17S-32E, 2305/N & 2977/E
API #30-025-40236



Scientific Drilling
Directional Drilling Operations



Scientific Drilling

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well BC Federal #30
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB Elev (13') @ 4005 00usft (JW #4)
Site:	BC Federal #30	MD Reference:	KB Elev (13') @ 4005 00usft (JW #4)
Well:	BC Federal #30	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM: Julio

Project	Lea County, NM (NAD27 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	BC Federal #30		
Site Position:		Northing:	662,802 50 usft
From:	Map	Easting:	667,694 90 usft
Position Uncertainty:	0 00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 49' 15 388 N
		Longitude:	103° 47' 14 844 W
		Grid Convergence:	0 30 °

Well	BC Federal #30		
Well Position	+N/-S	0 00 usft	Northing:
	+E/-W	0 00 usft	Easting:
Position Uncertainty	0 00 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 15 388 N
		Longitude:	103° 47' 14 844 W
		Ground Level:	3,992 00 usft

Wellbore	OH		
Magnetics	Model Name	Sample Date	Declination
	IGRF2010	2011/11/14	(°)
			7 68
			Dip Angle
			(°)
			60 69
			Field Strength
			(nT)
			48,906

Design	Actual		
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
			(°)
			270 82

Survey Program	Date 2011/12/02		
From	To	Survey (Wellbore)	Tool Name
(usft)	(usft)		
100 00	2,103 00	Gyro Survey (OH)	Keeper
2,142 00	7,044 00	MWD Survey (OH)	MWD
			Description
			Standard Wireline Keeper ver 1 0 2
			MWD - Standard

Survey									
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn
Depth	(°)	(°)	Depth	(usft)	(usft)	Section	Rate	Rate	Rate
(usft)			(usft)			(usft)	(°/100usft)	(°/100usft)	(°/100usft)
0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00
100 00	0 19	304 61	100 00	0 09	-0 14	0 14	0 19	0 19	0 00
200 00	0 11	133 65	200 00	0 12	-0 20	0 21	0 30	-0 08	-170 96
300 00	0 14	24 96	300 00	0 17	-0 08	0 08	0 20	0 03	-108 69
400 00	0 16	100 75	400 00	0 25	0 11	-0 10	0 18	0 02	75 79
500 00	0 14	167 43	500 00	0 11	0 27	-0 27	0 17	-0 02	66 68
600 00	0 17	231 05	600 00	-0 11	0 18	-0 18	0 17	0 03	63 62
700 00	0 12	106 46	700 00	-0 23	0 17	-0 17	0 26	-0 05	-124 59
800 00	0 34	194 26	800 00	-0 55	0 19	-0 20	0 36	0 22	87 80
900 00	0 63	232 98	899 99	-1 17	-0 32	0 30	0 42	0 29	38 72



Scientific Drilling

Survey Report



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Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB Elev (13') @ 4005.00usft (JW #4)
Site:	BC Federal #30	MD Reference:	KB Elev (13') @ 4005.00usft (JW #4)
Well:	BC Federal #30	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,000.00	0.34	259.20	999.99	-1.55	-1.05	1.03	0.36	-0.29	26.22
1,100.00	0.43	279.68	1,099.99	-1.54	-1.71	1.69	0.16	0.09	20.48
1,200.00	0.37	277.86	1,199.99	-1.44	-2.40	2.38	0.06	-0.06	-1.82
1,300.00	0.39	260.27	1,299.98	-1.45	-3.06	3.03	0.12	0.02	-17.59
1,400.00	0.18	51.53	1,399.98	-1.41	-3.27	3.25	0.55	-0.21	151.26
1,500.00	0.90	41.98	1,499.98	-0.73	-2.62	2.61	0.72	0.72	-9.55
1,600.00	1.34	49.11	1,599.96	0.62	-1.21	1.22	0.46	0.44	7.13
1,700.00	1.84	47.11	1,699.92	2.48	0.85	-0.81	0.50	0.50	-2.00
1,800.00	2.18	34.78	1,799.86	5.13	3.11	-3.04	0.55	0.34	-12.33
1,900.00	2.10	39.49	1,899.79	8.11	5.36	-5.24	0.19	-0.08	4.71
2,000.00	1.83	47.57	1,999.73	10.60	7.71	-7.55	0.39	-0.27	8.08
2,013.00	1.76	49.37	2,012.72	10.87	8.01	-7.85	0.69	-0.54	13.85
2,103.00	1.71	42.79	2,102.68	12.76	9.97	-9.79	0.23	-0.06	-7.31
Gyro Tie-in									
2,142.00	1.69	39.82	2,141.67	13.62	10.73	-10.54	0.23	-0.05	-7.62
2,204.00	1.11	7.36	2,203.65	14.92	11.40	-11.18	1.55	-0.94	-52.35
2,267.00	1.37	302.78	2,266.64	15.94	10.84	-10.61	2.13	0.41	-102.51
2,328.00	1.77	299.06	2,327.61	16.79	9.41	-9.16	0.68	0.66	-6.10
2,391.00	2.16	290.26	2,390.58	17.67	7.44	-7.19	0.78	0.62	-13.97
2,453.00	2.89	282.46	2,452.52	18.41	4.82	-4.55	1.30	1.18	-12.58
2,516.00	3.71	273.08	2,515.41	18.87	1.23	-0.96	1.55	1.30	-14.89
2,579.00	4.43	273.42	2,578.25	19.12	-3.23	3.50	1.14	1.14	0.54
2,641.00	5.10	267.71	2,640.04	19.15	-8.38	8.65	1.32	1.08	-9.21
2,704.00	5.89	263.96	2,702.75	18.70	-14.39	14.65	1.38	1.25	-5.95
2,767.00	6.72	265.86	2,765.37	18.10	-21.28	21.54	1.36	1.32	3.02
2,860.00	6.13	264.70	2,857.78	17.24	-31.65	31.89	0.65	-0.63	-1.25
2,953.00	6.06	264.64	2,950.26	16.33	-41.48	41.71	0.08	-0.08	-0.06
3,047.00	6.67	268.82	3,043.68	15.75	-51.88	52.10	0.81	0.65	4.45
3,141.00	7.13	272.43	3,137.00	15.89	-63.17	63.39	0.67	0.49	3.84
3,235.00	6.76	272.18	3,230.31	16.34	-74.52	74.75	0.39	-0.39	-0.27
3,328.00	7.27	277.38	3,322.61	17.31	-85.83	86.07	0.88	0.55	5.59
3,421.00	6.48	275.13	3,414.94	18.53	-96.89	97.15	0.90	-0.85	-2.42
3,514.00	7.29	272.42	3,507.27	19.25	-108.01	108.28	0.94	0.87	-2.91
3,607.00	6.90	270.66	3,599.56	19.56	-119.50	119.76	0.48	-0.42	-1.89
3,701.00	8.07	270.67	3,692.76	19.71	-131.74	132.01	1.24	1.24	0.01
3,794.00	7.51	268.49	3,784.90	19.62	-144.34	144.61	0.68	-0.60	-2.34
3,886.00	7.57	267.59	3,876.10	19.21	-156.41	156.67	0.14	0.07	-0.98
3,980.00	7.35	268.43	3,969.31	18.78	-168.60	168.86	0.26	-0.23	0.89
4,073.00	6.94	266.13	4,061.58	18.24	-180.16	180.40	0.54	-0.44	-2.47
4,166.00	7.87	266.84	4,153.81	17.51	-192.12	192.35	1.00	1.00	0.76
4,259.00	7.53	270.14	4,245.97	17.18	-204.57	204.80	0.60	-0.37	3.55
4,353.00	7.19	267.90	4,339.19	16.98	-216.61	216.83	0.47	-0.36	-2.38
4,447.00	7.06	269.60	4,432.47	16.72	-228.26	228.48	0.26	-0.14	1.81



Scientific Drilling

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well BC Federal #30
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB Elev (13') @ 4005 00usft (JW #4)
Site:	BC Federal #30	MD Reference:	KB Elev (13') @ 4005 00usft (JW #4)
Well:	BC Federal #30	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

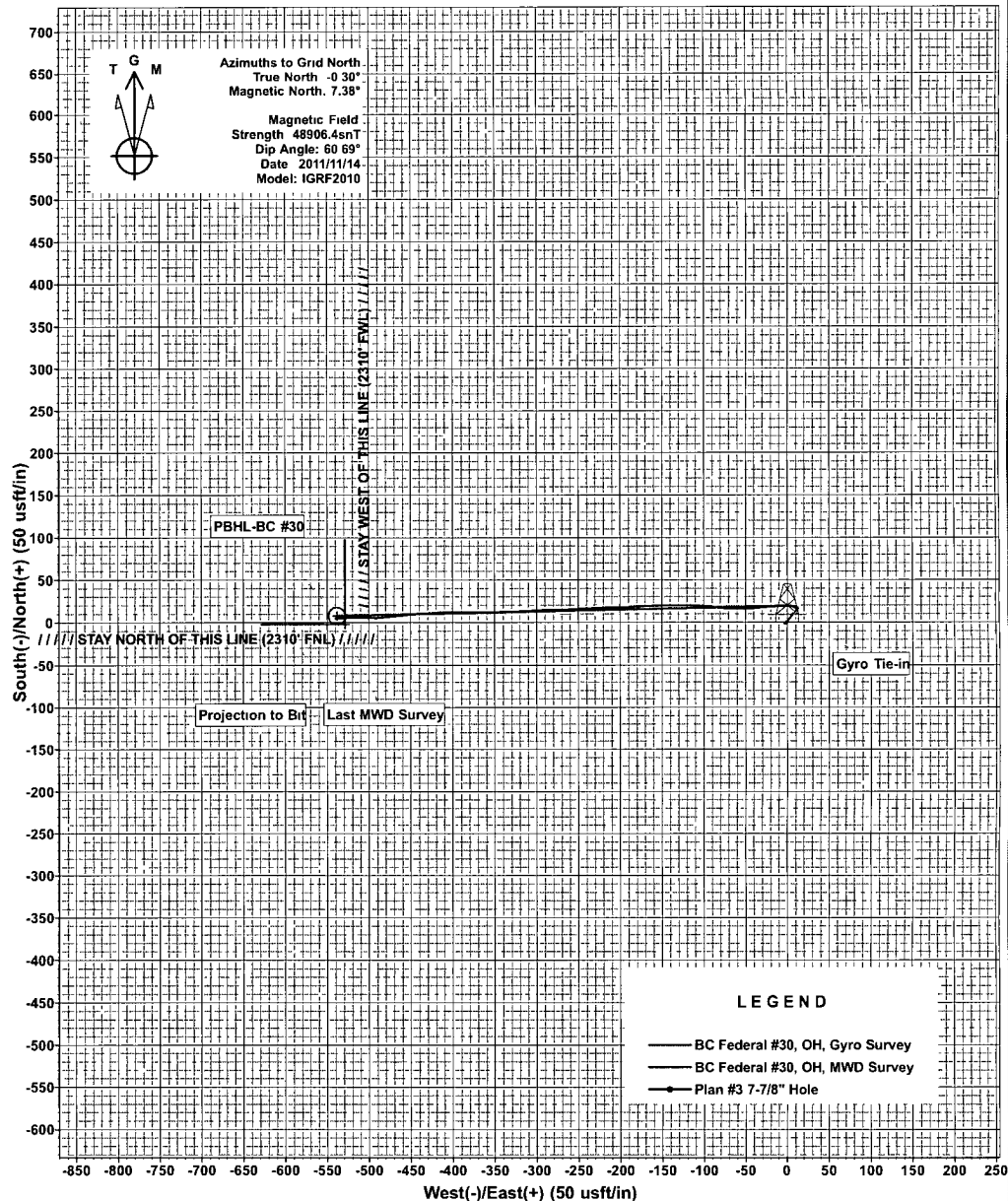
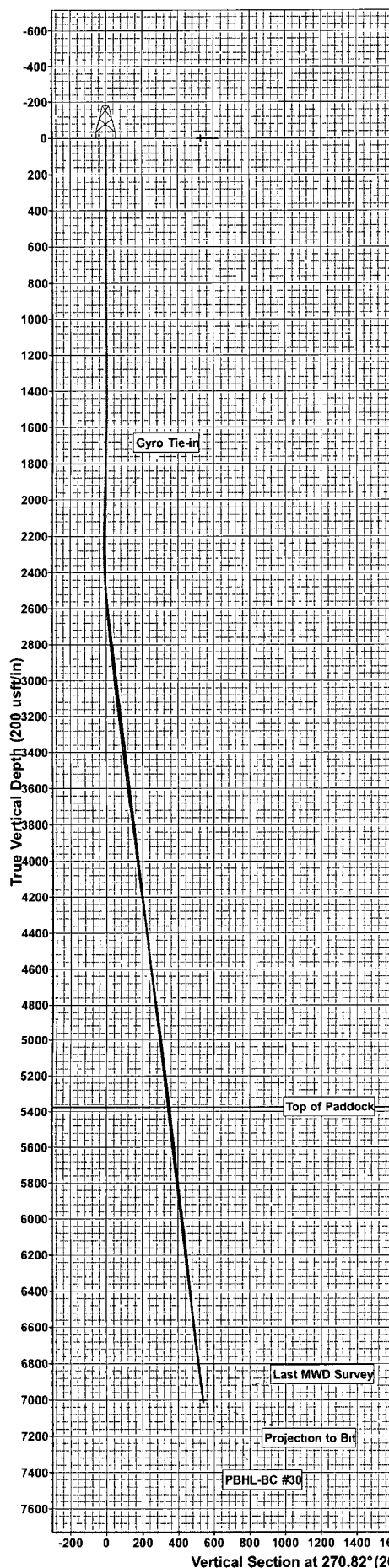
Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,540 00	6 91	265 31	4,524 78	16 22	-239 55	239 76	0 58	-0 16	-4 61
4,634 00	8 20	266 86	4,617 96	15 39	-251 88	252 08	1 39	1 37	1 65
4,728 00	7 81	269 04	4,711 05	14 92	-264 96	265 15	0 53	-0 41	2 32
4,821 00	7 87	268 03	4,803 18	14 59	-277 64	277 83	0 16	0 06	-1 09
4,916 00	7 72	268 44	4,897 30	14 20	-290 52	290 70	0 17	-0 16	0 43
5,010 00	7 40	266 19	4,990 48	13 62	-302 87	303 04	0 46	-0 34	-2 39
5,103 00	7 61	267 21	5,082 68	12 92	-315 00	315 15	0 27	0 23	1 10
5,196 00	7 10	267 33	5,174 92	12 36	-326 89	327 04	0 55	-0 55	0 13
5,290 00	7 22	269 38	5,268 19	12 02	-338 60	338 74	0 30	0 13	2 18
5,383 00	7 23	268 84	5,360 45	11 84	-350 30	350 43	0 07	0 01	-0 58
5,476 00	6 77	269 24	5,452 75	11 65	-361 63	361 76	0 50	-0 49	0 43
5,570 00	6 62	270 42	5,546 11	11 62	-372 59	372 72	0 22	-0 16	1 26
5,664 00	6 14	269 68	5,639 53	11 63	-383 03	383 16	0 52	-0 51	-0 79
5,758 00	6 01	271 94	5,733 00	11 77	-392 98	393 11	0 29	-0 14	2 40
5,852 00	7 06	267 77	5,826 39	11 71	-403 67	403 80	1 23	1 12	-4 44
5,945 00	7 16	268 14	5,918 68	11 30	-415 17	415 29	0 12	0 11	0 40
6,040 00	7 25	265 01	6,012 93	10 58	-427 06	427 17	0 42	0 09	-3 29
6,134 00	6 61	268 14	6,106 24	9 89	-438 38	438 47	0 79	-0 68	3 33
6,227 00	6 40	266 57	6,198 64	9 41	-448 90	448 99	0 30	-0 23	-1 69
6,320 00	6 32	261 81	6,291 07	8 37	-459 14	459 22	0 57	-0 09	-5 12
6,420 00	5 69	266 71	6,390 52	7 30	-469 54	469 60	0 81	-0 63	4 90
6,515 00	5 51	262 55	6,485 07	6 44	-478 76	478 81	0 47	-0 19	-4 38
6,607 00	5 39	267 18	6,576 65	5 65	-487 46	487 49	0 50	-0 13	5 03
6,670 00	5 87	271 08	6,639 35	5 57	-493 64	493 66	0 97	0 76	6 19
6,732 00	6 85	271 75	6,700 97	5 74	-500 50	500 53	1 59	1 58	1 08
6,794 00	7 86	270 37	6,762 46	5 88	-508 44	508 47	1 65	1 63	-2 23
6,857 00	7 41	269 56	6,824 90	5 88	-516 81	516 84	0 73	-0 71	-1 29
6,918 00	7 03	268 12	6,885 41	5 73	-524 47	524 50	0 69	-0 62	-2 36
6,994 00	6 83	264 20	6,960 86	5 12	-533 62	533 63	0 68	-0 26	-5 16
Last MWD Survey									
7,044 00	6 83	264 20	7,010 50	4 52	-539 53	539 54	0 00	0 00	0 00
Projection to Bit									

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
2,103 00	2,102 68	12 76	9 97	Gyro Tie-in
6,994 00	6,960 86	5 12	-533 62	Last MWD Survey
7,044 00	7,010 50	4 52	-539 53	Projection to Bit

Checked By	Approved By	Date:
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Scientific Drilling for COG Operating LLC
Site: Lea County, NM (NAD27 NME)
Well: BC Federal #30
Wellbore: OH
Design: Plan #3 7-7/8" Hole



Azimuths to Grid North
True North -0.30°
Magnetic North 7.38°

Magnetic Field
Strength 48906.4snT
Dip Angle: 60.69°
Date 2011/11/14
Model: IGRF2010

LEGEND

- BC Federal #30, OH, Gyro Survey
- BC Federal #30, OH, MWD Survey
- Plan #3 7-7/8" Hole

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
North HL-BC #30	0 00	-2 30	-528 40	662800.20	667166 50	32° 49' 15 393 N	103° 47' 21 036 W	Rectangle (Sides: L0 00 W100 00)
West HL-BC #30	0 00	-2 30	-528 40	662800.20	667166 50	32° 49' 15 393 N	103° 47' 21 036 W	Rectangle (Sides: L10 0 00 W0 00)
PBHL-BC #30	7000 00	7 70	-538 40	662810.20	667156 50	32° 49' 15 492 N	103° 47' 21.153 W	Circle (Radius: 10 00)

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Target
1	2103.00	1.71	42.79	2102.68	12.76	9.97	0.00	0.00	-9.79	
2	2200.00	1.71	42.79	2199.64	14.88	11.94	0.00	0.00	-11.72	
3	2608.05	6.88	268.80	2606.82	18.84	-8.40	2.00	-142.62	8.67	
4	7033.10	6.88	268.80	7000.00	7.70	-538.40	0.00	0.00	538.46	PBHL-BC #30

WELL DETAILS: BC Federal #30

+N/-S	+E/-W	Ground Level:	3992.00
0.00	0.00	Northing	662802 50
		Easting	667694 90
		Latitude	32° 49' 15 388 N
		Longitude	103° 47' 14.844 W

PROJECT DETAILS: Lea County, NM (NAD27 NME)

Plan: Plan #3 7-7/8" Hole (BC Federal #30/OH)

Geodetic System: US State Plane 1927 (Exact solution)	Created By: Julio Pina	Date: 14-Nov-11
Datum: NAD 1927 (NADCON CONUS)		
Ellipsoid: Clarke 1866	Checked: _____	Date: _____
Zone: New Mexico East 3001		
System Datum: Mean Sea Level	Reviewed: _____	Date: _____
	Approved: _____	Date: _____