



Project: Lea Co., NM (NAD 83)
 Site: Sec 21-T9S-R35E
 Well: Sodbuster 21 FEE #4H
 Wellbore: HZ [240537]
 Design: FINAL



Azimuths to Grid North
 True North: -0.53°
 Magnetic North: 6.40°

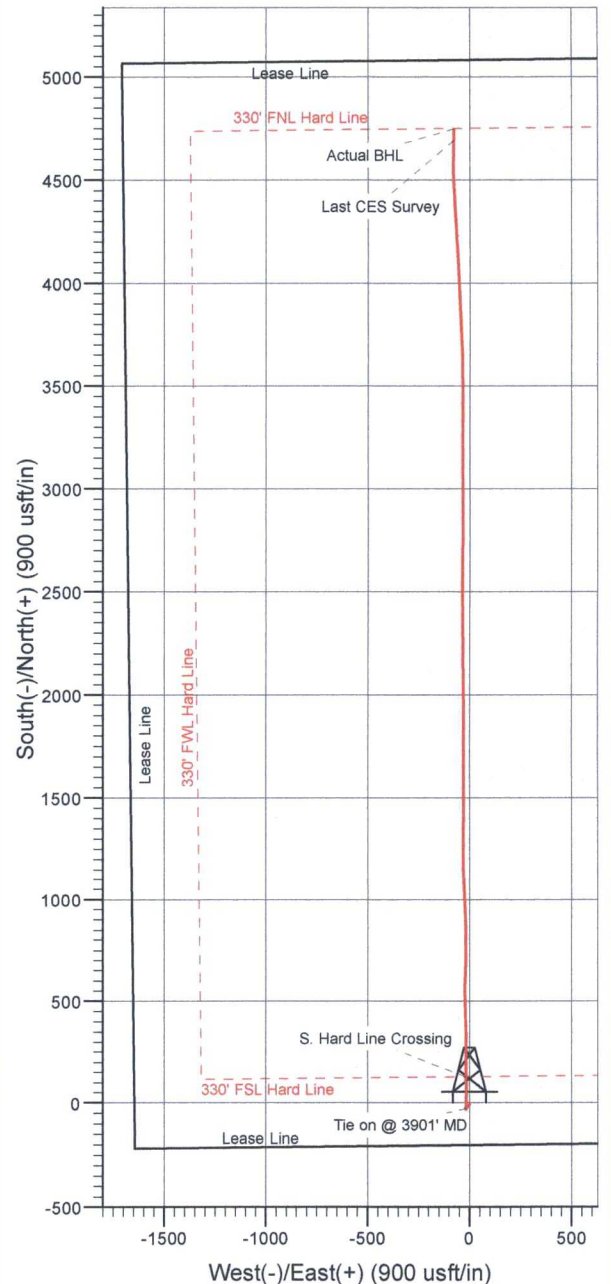
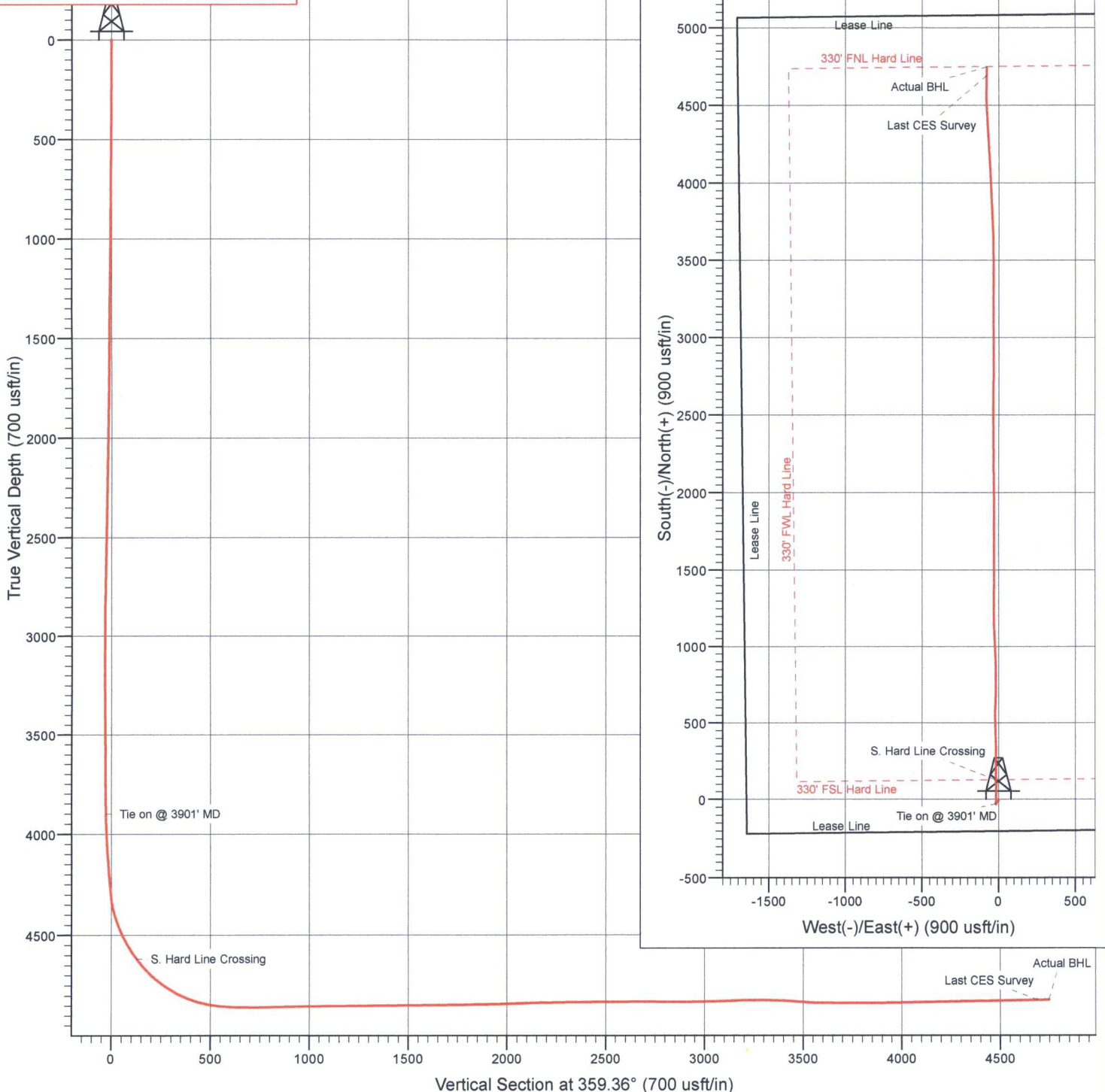
Magnetic Field
 Strength: 48802.1snT
 Dip Angle: 61.30°
 Date: 3/31/2017
 Model: HDGM

+N/-S	+E/-W	Northing	Ground Level: Easting	Latitude	Longitude
0.00	0.00	915554.90	4152.00 835306.30	33.513005	-103.368855

ANNOTATIONS

TVD	MD	Inc	Azi	+N/-S	+E/-W	Vsect	Annotation
3901.00	3901.40	0.60	28.00	-27.96	-16.20	-27.77	Tie on @ 3901' MD
4618.58	4650.00	36.88	0.65	127.46	-16.56	127.64	S. Hard Line Crossing
4823.70	9292.00	91.40	0.90	4691.15	-77.85	4691.73	Last CES Survey
4822.33	9348.00	91.40	0.90	4747.13	-76.97	4747.70	Actual BHL

Actual Bottom Hole Location
 332' FNL / 1625' FWL
 X:835229.33 Y:920302.03





Cathedral Energy Services

Survey Report



Company:	Manzano LLC	Local Co-ordinate Reference:	Well Sodbuster 21 FEE #4H
Project:	Lea Co., NM (NAD 83)	TVD Reference:	13' KB @ 4165.00usft (Norton #4)
Site:	Sec 21-T9S-R35E	MD Reference:	13' KB @ 4165.00usft (Norton #4)
Well:	Sodbuster 21 FEE #4H	North Reference:	Grid
Wellbore:	HZ [240537]	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Project	Lea Co., NM (NAD 83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	Sec 21-T9S-R35E			
Site Position:		Northing:	915,554.90 usft	Latitude: 33.513005
From:	Map	Easting:	835,306.30 usft	Longitude: -103.368855
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16"	Grid Convergence: 0.53 °

Well	Sodbuster 21 FEE #4H			
Well Position	+N/-S	0.00 usft	Northing:	915,554.90 usft
	+E/-W	0.00 usft	Easting:	835,306.30 usft
Position Uncertainty	0.00 usft		Wellhead Elevation:	0.00 usft
			Ground Level:	4,152.00 usft

Wellbore	HZ [240537]				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	3/31/2017	6.93	61.30	48,802

Design	FINAL			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 3,901.40
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	359.36

Survey Program	Date	4/15/2017		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
200.40	3,901.40	Invictus Surveys (Pilot Hole)	ISCWSA MWD	MWD - ISCWSA
3,979.00	9,348.00	CES MWD (HZ [240537])	MWD+HDGM	OWSG MWD + HDGM

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
200.40	0.40	142.00	200.40	-0.55	0.43	-0.56	0.20	0.20	
295.40	0.70	184.00	295.39	-1.39	0.59	-1.40	0.51	0.32	
387.40	0.70	151.00	387.39	-2.44	0.83	-2.45	0.43	0.00	
477.40	0.30	302.00	477.39	-2.80	0.89	-2.81	1.08	-0.44	
568.40	0.60	150.00	568.38	-3.09	0.93	-3.10	0.96	0.33	
660.40	0.30	64.00	660.38	-3.40	1.39	-3.41	0.71	-0.33	
756.40	0.90	272.00	756.38	-3.26	0.86	-3.27	1.22	0.62	
851.40	0.90	138.00	851.37	-3.79	0.61	-3.80	1.74	0.00	
947.40	0.80	219.00	947.37	-4.87	0.70	-4.88	1.15	-0.10	
1,042.40	0.50	132.00	1,042.36	-5.66	0.59	-5.67	0.97	-0.32	
1,232.40	1.20	179.00	1,232.34	-8.21	1.24	-8.22	0.49	0.37	



Cathedral Energy Services

Survey Report



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Site:	Sec 21-T9S-R35E	MD Reference:	13' KB @ 4165.00usft (Norton #4)
Well:	Sodbuster 21 FEE #4H	North Reference:	Grid
Wellbore:	HZ [240537]	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
1,328.40	0.50	261.00	1,328.33	-9.28	0.84	-9.29	1.29	-0.73	
1,423.40	1.30	223.00	1,423.32	-10.13	-0.30	-10.13	1.01	0.84	
1,518.40	1.00	228.00	1,518.30	-11.47	-1.65	-11.45	0.33	-0.32	
1,613.40	1.20	233.00	1,613.28	-12.63	-3.06	-12.59	0.23	0.21	
1,709.40	0.30	179.00	1,709.28	-13.48	-3.86	-13.44	1.10	-0.94	
1,804.40	0.70	218.00	1,804.27	-14.19	-4.22	-14.14	0.53	0.42	
1,935.00	1.20	202.00	1,934.85	-16.09	-5.22	-16.03	0.43	0.38	
1,995.40	1.00	251.00	1,995.24	-16.84	-5.95	-16.78	1.54	-0.33	
2,090.40	1.40	223.00	2,090.22	-17.96	-7.53	-17.88	0.74	0.42	
2,186.40	1.40	196.00	2,186.20	-19.95	-8.65	-19.85	0.68	0.00	
2,282.40	1.40	219.00	2,282.17	-21.99	-9.71	-21.88	0.58	0.00	
2,377.40	1.00	215.00	2,377.15	-23.57	-10.92	-23.44	0.43	-0.42	
2,472.40	1.20	219.00	2,472.13	-25.02	-12.02	-24.88	0.23	0.21	
2,567.40	1.20	222.00	2,567.11	-26.53	-13.31	-26.38	0.07	0.00	
2,663.40	1.20	196.00	2,663.09	-28.25	-14.26	-28.08	0.56	0.00	
2,758.40	1.20	214.00	2,758.07	-30.03	-15.09	-29.85	0.40	0.00	
2,854.40	1.10	205.00	2,854.05	-31.69	-16.04	-31.51	0.21	-0.10	
2,948.40	0.80	224.00	2,948.04	-32.98	-16.88	-32.79	0.46	-0.32	
3,044.40	0.30	221.00	3,044.03	-33.66	-17.51	-33.46	0.52	-0.52	
3,139.40	0.30	355.00	3,139.03	-33.60	-17.70	-33.40	0.58	0.00	
3,235.40	0.40	344.00	3,235.03	-33.02	-17.81	-32.82	0.13	0.10	
3,330.40	0.10	272.00	3,330.03	-32.70	-17.99	-32.50	0.40	-0.32	
3,426.40	0.20	296.00	3,426.03	-32.63	-18.22	-32.42	0.12	0.10	
3,520.40	0.70	11.00	3,520.03	-31.99	-18.26	-31.78	0.72	0.53	
3,617.40	0.80	23.00	3,617.02	-30.79	-17.88	-30.58	0.19	0.10	
3,712.40	0.70	31.00	3,712.01	-29.68	-17.32	-29.48	0.15	-0.11	
3,806.40	0.60	37.00	3,806.00	-28.79	-16.73	-28.60	0.13	-0.11	
3,901.40	0.60	28.00	3,901.00	-27.96	-16.20	-27.77	0.10	0.00	Tie on @ 3901' MD
3,979.00	2.40	351.60	3,978.57	-25.99	-16.24	-25.81	2.51	2.32	
4,075.00	3.90	5.80	4,074.42	-20.75	-16.21	-20.57	1.75	1.56	
4,170.00	4.80	12.10	4,169.15	-13.65	-15.05	-13.48	1.07	0.95	
4,265.00	4.90	353.10	4,263.81	-5.74	-14.70	-5.57	1.69	0.11	
4,297.00	4.90	353.70	4,295.70	-3.02	-15.02	-2.85	0.16	0.00	
4,329.00	7.10	352.60	4,327.52	0.30	-15.42	0.47	6.88	6.87	
4,361.00	11.70	357.40	4,359.08	5.50	-15.82	5.68	14.57	14.37	
4,392.00	15.90	0.70	4,389.18	12.89	-15.91	13.07	13.78	13.55	
4,424.00	18.90	4.40	4,419.71	22.45	-15.46	22.62	9.99	9.37	
4,456.00	21.00	4.50	4,449.79	33.33	-14.62	33.49	6.56	6.56	
4,488.00	23.20	1.00	4,479.44	45.35	-14.06	45.51	8.01	6.87	
4,520.00	25.80	359.60	4,508.56	58.62	-13.99	58.77	8.32	8.12	
4,552.00	29.90	356.80	4,536.85	73.55	-14.49	73.71	13.45	12.81	
4,583.00	32.40	355.40	4,563.37	89.55	-15.59	89.72	8.40	8.06	
4,615.00	34.30	358.70	4,590.11	107.11	-16.48	107.29	8.21	5.94	
4,647.00	36.60	0.60	4,616.17	125.67	-16.58	125.85	7.97	7.19	
4,650.00	36.88	0.65	4,618.58	127.46	-16.56	127.64	9.42	9.37	S. Hard Line Crossing
4,679.00	39.60	1.10	4,641.35	145.41	-16.29	145.58	9.42	9.38	
4,710.00	41.90	2.00	4,664.84	165.63	-15.74	165.80	7.66	7.42	
4,742.00	45.30	1.60	4,688.01	187.69	-15.04	187.85	10.66	10.62	
4,774.00	49.50	0.30	4,709.66	211.23	-14.66	211.39	13.46	13.12	
4,806.00	52.40	359.30	4,729.82	236.08	-14.75	236.23	9.38	9.06	
4,838.00	54.80	358.80	4,748.81	261.83	-15.18	261.99	7.60	7.50	
4,869.00	58.20	359.40	4,765.92	287.68	-15.59	287.83	11.09	10.97	
4,901.00	61.40	0.30	4,782.01	315.33	-15.66	315.48	10.29	10.00	



Cathedral Energy Services
Survey Report



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Wellbore:	HZ [240537]	Survey Calculation Method:	Minimum Curvature
Design:	FINAL	Database:	USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
4,933.00	64.20	0.20	4,796.64	343.79	-15.53	343.94	8.75	8.75	
4,965.00	66.70	359.20	4,809.93	372.89	-15.69	373.04	8.31	7.81	
4,996.00	70.40	358.30	4,821.27	401.73	-16.32	401.89	12.24	11.94	
5,028.00	74.10	357.10	4,831.02	432.18	-17.55	432.35	12.10	11.56	
5,060.00	76.80	357.30	4,839.06	463.11	-19.06	463.30	8.46	8.44	
5,091.00	79.70	358.20	4,845.37	493.43	-20.25	493.63	9.78	9.35	
5,123.00	82.00	359.00	4,850.46	525.02	-21.02	525.22	7.60	7.19	
5,155.00	84.30	0.30	4,854.28	556.78	-21.21	556.99	8.24	7.19	
5,187.00	86.30	1.10	4,856.90	588.67	-20.82	588.87	6.73	6.25	
5,218.00	88.50	1.90	4,858.30	619.63	-20.01	619.81	7.55	7.10	
5,314.00	90.20	0.90	4,859.39	715.59	-17.67	715.74	2.05	1.77	
5,410.00	91.30	0.50	4,858.14	811.57	-16.49	811.70	1.22	1.15	
5,504.00	91.30	356.50	4,856.00	905.50	-18.95	905.65	4.25	0.00	
5,600.00	90.90	357.40	4,854.16	1,001.34	-24.06	1,001.55	1.03	-0.42	
5,695.00	91.00	358.90	4,852.58	1,096.28	-27.13	1,096.51	1.58	0.11	
5,790.00	89.70	359.90	4,852.00	1,191.26	-28.12	1,191.51	1.73	-1.37	
5,885.00	91.10	0.10	4,851.34	1,286.26	-28.12	1,286.50	1.49	1.47	
5,980.00	89.50	359.70	4,850.84	1,381.26	-28.29	1,381.49	1.74	-1.68	
6,076.00	91.50	0.40	4,850.01	1,477.25	-28.20	1,477.47	2.21	2.08	
6,171.00	90.10	0.30	4,848.68	1,572.23	-27.62	1,572.44	1.48	-1.47	
6,266.00	91.30	0.60	4,847.52	1,667.22	-26.88	1,667.42	1.30	1.26	
6,361.00	90.50	359.70	4,846.03	1,762.21	-26.63	1,762.40	1.27	-0.84	
6,456.00	91.40	359.20	4,844.45	1,857.19	-27.54	1,857.38	1.08	0.95	
6,551.00	90.90	359.10	4,842.54	1,952.16	-28.95	1,952.36	0.54	-0.53	
6,646.00	92.20	359.40	4,839.98	2,047.11	-30.19	2,047.32	1.40	1.37	
6,742.00	91.80	359.30	4,836.62	2,143.05	-31.28	2,143.26	0.43	-0.42	
6,836.00	91.00	359.20	4,834.33	2,237.01	-32.51	2,237.24	0.86	-0.85	
6,932.00	90.10	359.10	4,833.41	2,333.00	-33.93	2,333.23	0.94	-0.94	
7,027.00	90.30	359.80	4,833.07	2,427.99	-34.85	2,428.23	0.77	0.21	
7,122.00	91.30	0.20	4,831.75	2,522.98	-34.85	2,523.21	1.13	1.05	
7,217.00	90.10	0.60	4,830.59	2,617.97	-34.18	2,618.19	1.33	-1.26	
7,312.00	89.10	0.40	4,831.25	2,712.96	-33.35	2,713.16	1.07	-1.05	
7,407.00	89.80	0.20	4,832.16	2,807.95	-32.86	2,808.15	0.77	0.74	
7,502.00	90.80	359.70	4,831.67	2,902.95	-32.94	2,903.14	1.18	1.05	
7,597.00	91.10	359.90	4,830.09	2,997.94	-33.27	2,998.12	0.38	0.32	
7,692.00	91.60	0.20	4,827.85	3,092.91	-33.19	3,093.09	0.61	0.53	
7,787.00	92.00	359.70	4,824.87	3,187.86	-33.27	3,188.04	0.67	0.42	
7,883.00	90.40	359.50	4,822.86	3,283.84	-33.94	3,284.01	1.68	-1.67	
7,978.00	86.40	0.60	4,825.51	3,378.78	-33.86	3,378.95	4.37	-4.21	
8,073.00	86.10	0.30	4,831.72	3,473.57	-33.12	3,473.73	0.45	-0.32	
8,168.00	88.30	358.80	4,836.36	3,568.45	-33.86	3,568.60	2.80	2.32	
8,263.00	89.80	357.70	4,837.94	3,663.39	-36.76	3,663.57	1.96	1.58	
8,358.00	90.10	357.80	4,838.02	3,758.31	-40.49	3,758.53	0.33	0.32	
8,453.00	90.10	357.40	4,837.86	3,853.23	-44.47	3,853.49	0.42	0.00	
8,548.00	89.90	357.10	4,837.86	3,948.12	-49.03	3,948.42	0.38	-0.21	
8,643.00	91.60	357.40	4,836.61	4,043.00	-53.59	4,043.35	1.82	1.79	
8,738.00	91.50	357.10	4,834.04	4,137.85	-58.14	4,138.25	0.33	-0.11	
8,833.00	91.40	356.80	4,831.64	4,232.69	-63.19	4,233.13	0.33	-0.11	
8,929.00	90.70	356.70	4,829.88	4,328.52	-68.64	4,329.02	0.74	-0.73	
9,024.00	90.40	356.10	4,828.97	4,423.33	-74.60	4,423.89	0.71	-0.32	
9,119.00	91.40	358.80	4,827.48	4,518.21	-78.83	4,518.81	3.03	1.05	
9,214.00	91.10	0.90	4,825.40	4,613.18	-79.08	4,613.78	2.23	-0.32	
9,292.00	91.40	0.90	4,823.70	4,691.15	-77.85	4,691.73	0.38	0.38	Last CES Survey



Cathedral Energy Services
Survey Report



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Site:	Sec 21-T9S-R35E	MD Reference:	13' KB @ 4165.00usft (Norton #4)
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Wellbore:	HZ [240537]	Survey Calculation Method:	Minimum Curvature
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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	Build Rate (°/100u)	Formations / Comments
9,348.00	91.40	0.90	4,822.33	4,747.13	-76.97	4,747.70	0.00	0.00	Actual BHL

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
P3 PBHL - Sodbuster 2'	0.00	0.00	4,829.50	4,750.40	-53.40	920,305.30	835,252.90	33.526060	-103.368886
- actual wellpath misses target center by 24.85usft at 9348.00usft MD (4822.33 TVD, 4747.13 N, -76.97 E)									
- Point									

Measured Depth (usft)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Comment
3,901.40	3,901.00	-27.96	-16.20	Tie on @ 3901' MD
4,650.00	4,618.58	127.46	-16.56	S. Hard Line Crossing
9,292.00	4,823.70	4,691.15	-77.85	Last CES Survey
9,348.00	4,822.33	4,747.13	-76.97	Actual BHL

Checked By: _____ Approved By: _____ Date: _____