

Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 28-T1N-R67W

Howard 28N-28HZ

Plan A 0

Plan: Plan A 0-Permit

Sperry Drilling Services

Proposal Report

29 May, 2013

Well Coordinates: 1,249,065.34 N, 3,168,601.07 E (40° 00' 55.80" N, 104° 53' 52.95" W)

Ground Level: 5,023.00 ft

Local Coordinate Origin:

Centered on Well Howard 28N-28HZ

Viewing Datum:

RKB @ 17' @ 5040.00ft (Drilling Rig)

TVDs to System:

N

North Reference:

True

Unit System:

API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 43I

HALLIBURTON

Project: Weld County, CO (NAD 83)
Site: Sec. 28-T1N-R67W
Well: Howard 28N-28HZ
Wellbore: Plan A 0
Design: Plan A 0-Permit



SECTION DETAILS

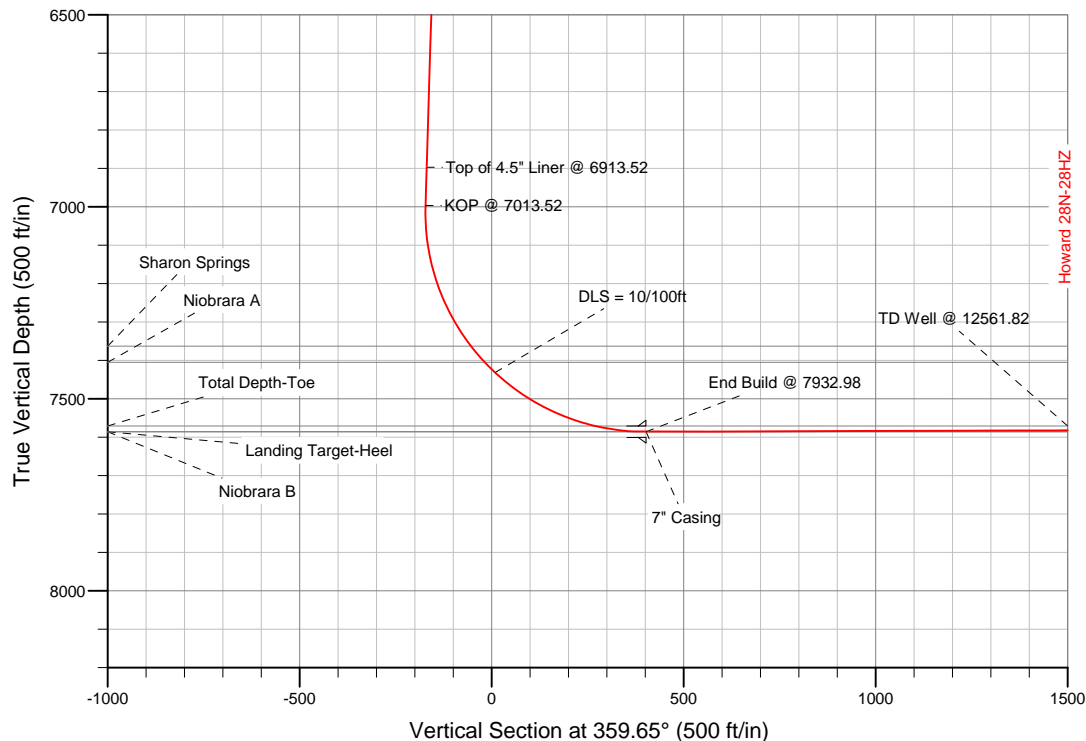
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	DLeg	TFace	VSec	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1300.00	0.00	0.00	1300.00	0.00	0.00	0.00	0.00	0.00	
3	1521.25	4.43	113.13	1521.03	-3.35	7.85	2.00	113.13	-3.40	
4	7013.52	4.43	113.13	6996.93	-169.78	397.56	0.00	0.00	-172.21	
5	7932.98	90.19	359.65	7586.00	405.00	436.00	10.00	-113.40	402.33	Howard 28N-28HZ_CP
6	12561.82	90.19	359.65	7571.00	5033.73	407.74	0.00	0.00	5031.15	Howard 28N-28HZ_BHL

WELLBORE TARGET DETAILS (LAT/LONG)

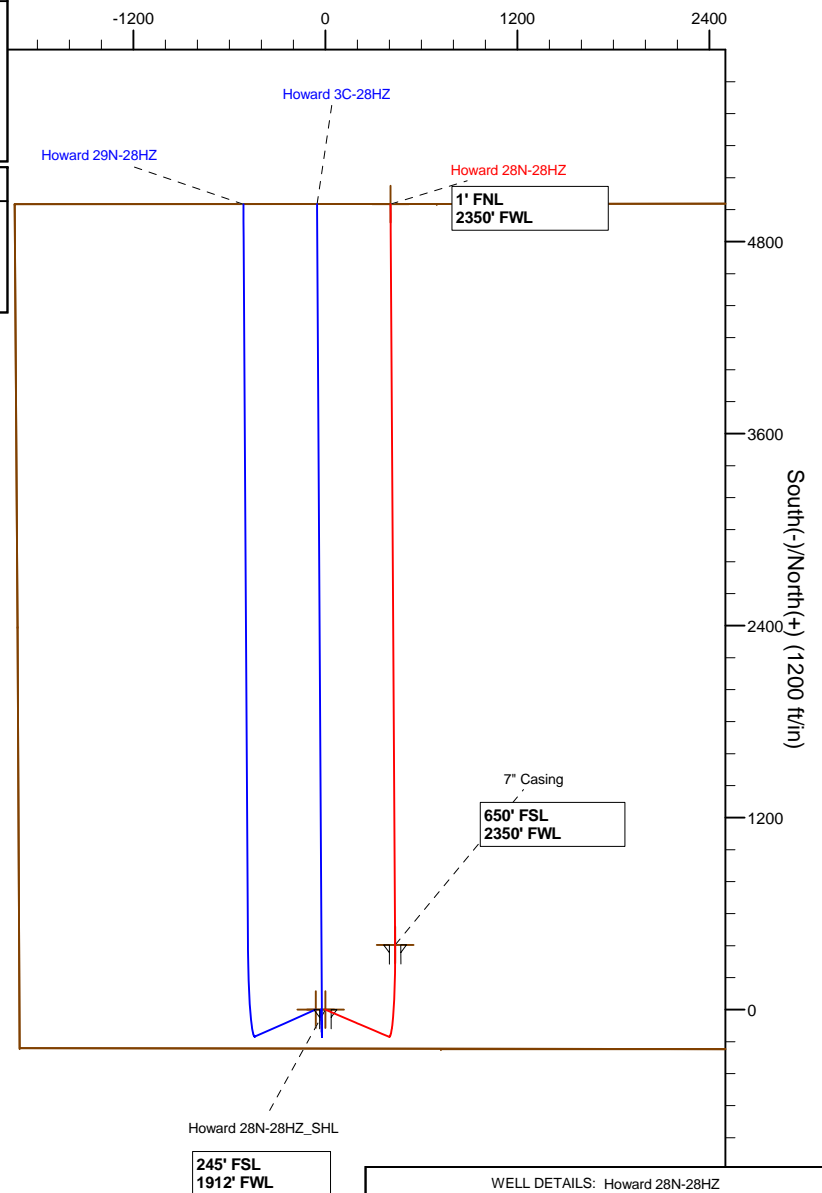
Name	TVD	+N/-S	+E/-W	Latitude	Longitude	Shape
Howard 28N-28HZ_SHL	0.00	0.00	0.00	40.015500	-104.898042	Point
Howard_SEC	3.00	0.41	-59.94	40.015501	-104.898256	Polygon
Howard 28N-28HZ_BHL	7571.00	5033.73	407.74	40.029318	-104.896586	Point
Howard 28N-28HZ_CP	7586.00	405.00	436.00	40.016612	-104.896485	Point

MD TVD

6913.52 6897.23 Top of 4.5" Liner @ 6913.52
7013.52 6996.93 KOP @ 7013.52



West(-)/East(+) (1200 ft/in)



WELL DETAILS: Howard 28N-28HZ

Ground Level: 5023.00
RKB @ 17' @ 5040.00ft (Drilling Rig)

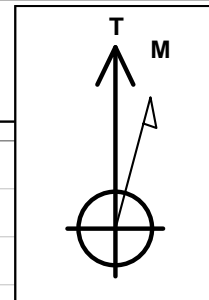
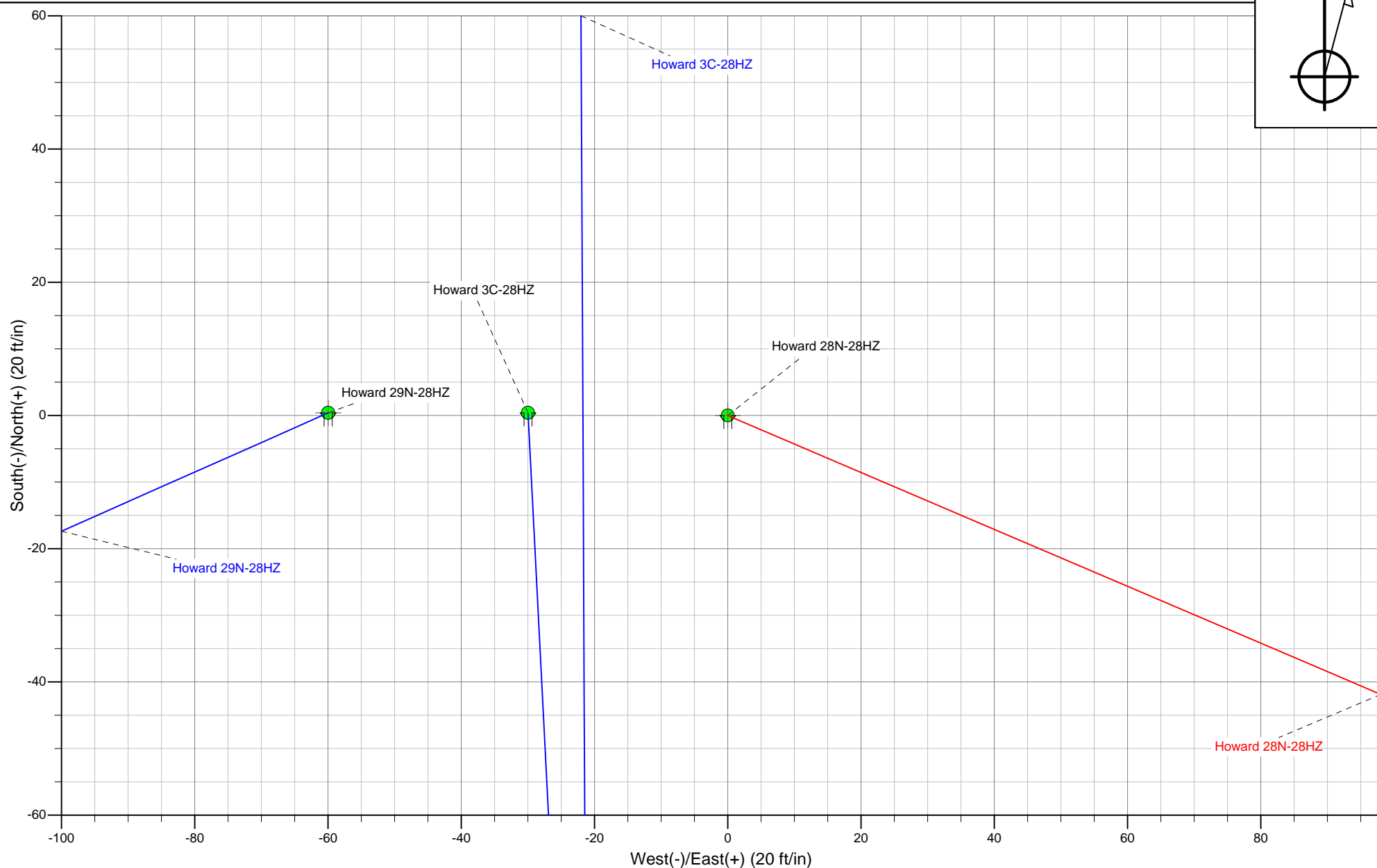
Plan: Plan A 0-Permit (Howard 28N-28HZ/Plan A 0)

Created By: Fred Hartmann Date: 05/30/2013

Project: Weld County, CO (NAD 83)
Site: Sec. 28-T1N-R67W
Well: Howard 28N-28HZ
Plan A 0
Plan A 0-Permit



HALLIBURTON
Sperry Drilling



Plan Report for Howard 28N-28HZ - Plan A 0-Permit

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)	Toolface Azimuth (°)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,182.00	0.00	0.00	1,182.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9 5/8" Casing										
1,200.00	0.00	0.00	1,200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,300.00	0.00	0.00	1,300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Begin Nudge @ 1300.00										
1,400.00	2.00	113.13	1,399.98	-0.69	1.60	-0.70	2.00	2.00	0.00	113.13
1,500.00	4.00	113.13	1,499.84	-2.74	6.42	-2.78	2.00	2.00	0.00	0.00
1,521.25	4.43	113.13	1,521.03	-3.35	7.85	-3.40	2.00	2.00	0.00	0.00
End Nudge @ 1521.25										
1,600.00	4.43	113.13	1,599.55	-5.74	13.44	-5.82	0.00	0.00	0.00	0.00
1,700.00	4.43	113.13	1,699.25	-8.77	20.54	-8.90	0.00	0.00	0.00	0.00
1,800.00	4.43	113.13	1,798.95	-11.80	27.63	-11.97	0.00	0.00	0.00	0.00
1,900.00	4.43	113.13	1,898.65	-14.83	34.73	-15.04	0.00	0.00	0.00	0.00
2,000.00	4.43	113.13	1,998.35	-17.86	41.82	-18.12	0.00	0.00	0.00	0.00
2,100.00	4.43	113.13	2,098.05	-20.89	48.92	-21.19	0.00	0.00	0.00	0.00
2,200.00	4.43	113.13	2,197.76	-23.92	56.01	-24.26	0.00	0.00	0.00	0.00
2,300.00	4.43	113.13	2,297.46	-26.95	63.11	-27.34	0.00	0.00	0.00	0.00
2,400.00	4.43	113.13	2,397.16	-29.98	70.21	-30.41	0.00	0.00	0.00	0.00
2,500.00	4.43	113.13	2,496.86	-33.01	77.30	-33.48	0.00	0.00	0.00	0.00
2,600.00	4.43	113.13	2,596.56	-36.04	84.40	-36.56	0.00	0.00	0.00	0.00
2,700.00	4.43	113.13	2,696.27	-39.07	91.49	-39.63	0.00	0.00	0.00	0.00
2,800.00	4.43	113.13	2,795.97	-42.10	98.59	-42.70	0.00	0.00	0.00	0.00
2,900.00	4.43	113.13	2,895.67	-45.13	105.68	-45.78	0.00	0.00	0.00	0.00
3,000.00	4.43	113.13	2,995.37	-48.16	112.78	-48.85	0.00	0.00	0.00	0.00
3,100.00	4.43	113.13	3,095.07	-51.19	119.87	-51.93	0.00	0.00	0.00	0.00
3,200.00	4.43	113.13	3,194.78	-54.22	126.97	-55.00	0.00	0.00	0.00	0.00
3,300.00	4.43	113.13	3,294.48	-57.25	134.07	-58.07	0.00	0.00	0.00	0.00
3,400.00	4.43	113.13	3,394.18	-60.29	141.16	-61.15	0.00	0.00	0.00	0.00
3,500.00	4.43	113.13	3,493.88	-63.32	148.26	-64.22	0.00	0.00	0.00	0.00
3,600.00	4.43	113.13	3,593.58	-66.35	155.35	-67.29	0.00	0.00	0.00	0.00
3,700.00	4.43	113.13	3,693.29	-69.38	162.45	-70.37	0.00	0.00	0.00	0.00
3,800.00	4.43	113.13	3,792.99	-72.41	169.54	-73.44	0.00	0.00	0.00	0.00
3,900.00	4.43	113.13	3,892.69	-75.44	176.64	-76.51	0.00	0.00	0.00	0.00
4,000.00	4.43	113.13	3,992.39	-78.47	183.73	-79.59	0.00	0.00	0.00	0.00
4,100.00	4.43	113.13	4,092.09	-81.50	190.83	-82.66	0.00	0.00	0.00	0.00
4,200.00	4.43	113.13	4,191.80	-84.53	197.92	-85.73	0.00	0.00	0.00	0.00
4,300.00	4.43	113.13	4,291.50	-87.56	205.02	-88.81	0.00	0.00	0.00	0.00
4,400.00	4.43	113.13	4,391.20	-90.59	212.12	-91.88	0.00	0.00	0.00	0.00
4,500.00	4.43	113.13	4,490.90	-93.62	219.21	-94.96	0.00	0.00	0.00	0.00
4,600.00	4.43	113.13	4,590.60	-96.65	226.31	-98.03	0.00	0.00	0.00	0.00
4,700.00	4.43	113.13	4,690.30	-99.68	233.40	-101.10	0.00	0.00	0.00	0.00
4,800.00	4.43	113.13	4,790.01	-102.71	240.50	-104.18	0.00	0.00	0.00	0.00
4,830.08	4.43	113.13	4,820.00	-103.62	242.63	-105.10	0.00	0.00	0.00	0.00
Sussex										
4,900.00	4.43	113.13	4,889.71	-105.74	247.59	-107.25	0.00	0.00	0.00	0.00
5,000.00	4.43	113.13	4,989.41	-108.77	254.69	-110.32	0.00	0.00	0.00	0.00

Plan Report for Howard 28N-28HZ - Plan A 0-Permit

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)	Toolface Azimuth (°)
5,100.00	4.43	113.13	5,089.11	-111.80	261.78	-113.40	0.00	0.00	0.00	0.00
5,200.00	4.43	113.13	5,188.81	-114.83	268.88	-116.47	0.00	0.00	0.00	0.00
5,300.00	4.43	113.13	5,288.52	-117.86	275.98	-119.54	0.00	0.00	0.00	0.00
5,400.00	4.43	113.13	5,388.22	-120.89	283.07	-122.62	0.00	0.00	0.00	0.00
5,500.00	4.43	113.13	5,487.92	-123.92	290.17	-125.69	0.00	0.00	0.00	0.00
5,600.00	4.43	113.13	5,587.62	-126.95	297.26	-128.76	0.00	0.00	0.00	0.00
5,700.00	4.43	113.13	5,687.32	-129.98	304.36	-131.84	0.00	0.00	0.00	0.00
5,800.00	4.43	113.13	5,787.03	-133.01	311.45	-134.91	0.00	0.00	0.00	0.00
5,900.00	4.43	113.13	5,886.73	-136.04	318.55	-137.99	0.00	0.00	0.00	0.00
6,000.00	4.43	113.13	5,986.43	-139.07	325.64	-141.06	0.00	0.00	0.00	0.00
6,100.00	4.43	113.13	6,086.13	-142.10	332.74	-144.13	0.00	0.00	0.00	0.00
6,200.00	4.43	113.13	6,185.83	-145.13	339.84	-147.21	0.00	0.00	0.00	0.00
6,300.00	4.43	113.13	6,285.54	-148.16	346.93	-150.28	0.00	0.00	0.00	0.00
6,400.00	4.43	113.13	6,385.24	-151.19	354.03	-153.35	0.00	0.00	0.00	0.00
6,500.00	4.43	113.13	6,484.94	-154.22	361.12	-156.43	0.00	0.00	0.00	0.00
6,600.00	4.43	113.13	6,584.64	-157.25	368.22	-159.50	0.00	0.00	0.00	0.00
6,700.00	4.43	113.13	6,684.34	-160.28	375.31	-162.57	0.00	0.00	0.00	0.00
6,800.00	4.43	113.13	6,784.04	-163.31	382.41	-165.65	0.00	0.00	0.00	0.00
6,900.00	4.43	113.13	6,883.75	-166.34	389.50	-168.72	0.00	0.00	0.00	0.00
6,913.52	4.43	113.13	6,897.23	-166.75	390.46	-169.14	0.00	0.00	0.00	0.00
Top of 4.5" Liner @ 6913.52										
7,000.00	4.43	113.13	6,983.45	-169.37	396.60	-171.79	0.00	0.00	0.00	0.00
7,013.52	4.43	113.13	6,996.93	-169.78	397.56	-172.21	0.00	0.00	0.00	0.00
KOP @ 7013.52										
7,100.00	7.99	30.04	7,083.02	-165.88	403.65	-168.35	10.00	4.12	-96.07	-113.40
7,200.00	17.36	12.79	7,180.51	-145.27	410.45	-147.77	10.00	9.36	-17.25	-30.62
7,300.00	27.17	7.61	7,272.95	-108.00	416.79	-110.54	10.00	9.81	-5.18	-13.73
7,400.00	37.08	5.05	7,357.54	-55.21	422.49	-57.79	10.00	9.91	-2.56	-8.92
7,406.88	37.76	4.92	7,363.00	-51.04	422.85	-53.63	10.00	9.93	-1.92	-6.74
Sharon Springs										
7,462.14	43.26	3.99	7,405.00	-15.27	425.62	-17.87	10.00	9.94	-1.68	-6.64
Niobrara A										
7,500.00	47.02	3.46	7,431.70	11.50	427.36	8.89	10.00	9.95	-1.41	-5.93
DLS = 10/100ft										
7,600.00	56.98	2.31	7,493.19	90.11	431.26	87.47	10.00	9.96	-1.15	-5.55
7,700.00	66.95	1.39	7,540.13	178.22	434.08	175.56	10.00	9.97	-0.91	-4.84
7,800.00	76.92	0.61	7,571.10	273.15	435.72	270.49	10.00	9.97	-0.79	-4.41
7,900.00	86.90	359.88	7,585.16	372.03	436.13	369.36	10.00	9.97	-0.72	-4.17
7,932.98	90.19	359.65	7,586.00	405.00	436.00	402.33	10.00	9.97	-0.71	-4.07
End Build @ 7932.98 - Niobrara B - Landing Target-Heel - 7" Casing - Howard 28N-28HZ_CP										
8,000.00	90.19	359.65	7,585.78	472.01	435.59	469.35	0.00	0.00	0.00	-4.06
8,100.00	90.19	359.65	7,585.46	572.01	434.98	569.34	0.00	0.00	0.00	0.00
8,200.00	90.19	359.65	7,585.13	672.01	434.37	669.34	0.00	0.00	0.00	0.00
8,300.00	90.19	359.65	7,584.81	772.01	433.76	769.34	0.00	0.00	0.00	0.00
8,400.00	90.19	359.65	7,584.49	872.01	433.15	869.34	0.00	0.00	0.00	0.00
8,500.00	90.19	359.65	7,584.16	972.00	432.54	969.34	0.00	0.00	0.00	0.00
8,600.00	90.19	359.65	7,583.84	1,072.00	431.93	1,069.34	0.00	0.00	0.00	0.00
8,700.00	90.19	359.65	7,583.51	1,172.00	431.32	1,169.34	0.00	0.00	0.00	0.00
8,800.00	90.19	359.65	7,583.19	1,272.00	430.71	1,269.34	0.00	0.00	0.00	0.00
8,900.00	90.19	359.65	7,582.87	1,371.99	430.10	1,369.34	0.00	0.00	0.00	0.00
9,000.00	90.19	359.65	7,582.54	1,471.99	429.49	1,469.34	0.00	0.00	0.00	0.00
9,100.00	90.19	359.65	7,582.22	1,571.99	428.88	1,569.34	0.00	0.00	0.00	0.00
9,200.00	90.19	359.65	7,581.89	1,671.99	428.27	1,669.34	0.00	0.00	0.00	0.00
9,300.00	90.19	359.65	7,581.57	1,771.98	427.65	1,769.34	0.00	0.00	0.00	0.00
9,400.00	90.19	359.65	7,581.25	1,871.98	427.04	1,869.34	0.00	0.00	0.00	0.00
9,500.00	90.19	359.65	7,580.92	1,971.98	426.43	1,969.34	0.00	0.00	0.00	0.00
9,600.00	90.19	359.65	7,580.60	2,071.98	425.82	2,069.34	0.00	0.00	0.00	0.00
9,700.00	90.19	359.65	7,580.27	2,171.97	425.21	2,169.34	0.00	0.00	0.00	0.00
9,800.00	90.19	359.65	7,579.95	2,271.97	424.60	2,269.34	0.00	0.00	0.00	0.00

Plan Report for Howard 28N-28HZ - Plan A 0-Permit

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)	Toolface Azimuth (°)
9,900.00	90.19	359.65	7,579.63	2,371.97	423.99	2,369.34	0.00	0.00	0.00	0.00
10,000.00	90.19	359.65	7,579.30	2,471.97	423.38	2,469.33	0.00	0.00	0.00	0.00
10,100.00	90.19	359.65	7,578.98	2,571.96	422.77	2,569.33	0.00	0.00	0.00	0.00
10,200.00	90.19	359.65	7,578.65	2,671.96	422.16	2,669.33	0.00	0.00	0.00	0.00
10,300.00	90.19	359.65	7,578.33	2,771.96	421.55	2,769.33	0.00	0.00	0.00	0.00
10,400.00	90.19	359.65	7,578.01	2,871.96	420.94	2,869.33	0.00	0.00	0.00	0.00
10,500.00	90.19	359.65	7,577.68	2,971.96	420.33	2,969.33	0.00	0.00	0.00	0.00
10,600.00	90.19	359.65	7,577.36	3,071.95	419.72	3,069.33	0.00	0.00	0.00	0.00
10,700.00	90.19	359.65	7,577.03	3,171.95	419.11	3,169.33	0.00	0.00	0.00	0.00
10,800.00	90.19	359.65	7,576.71	3,271.95	418.50	3,269.33	0.00	0.00	0.00	0.00
10,900.00	90.19	359.65	7,576.39	3,371.95	417.89	3,369.33	0.00	0.00	0.00	0.00
11,000.00	90.19	359.65	7,576.06	3,471.94	417.28	3,469.33	0.00	0.00	0.00	0.00
11,100.00	90.19	359.65	7,575.74	3,571.94	416.67	3,569.33	0.00	0.00	0.00	0.00
11,200.00	90.19	359.65	7,575.41	3,671.94	416.06	3,669.33	0.00	0.00	0.00	0.00
11,300.00	90.19	359.65	7,575.09	3,771.94	415.45	3,769.33	0.00	0.00	0.00	0.00
11,400.00	90.19	359.65	7,574.76	3,871.93	414.84	3,869.33	0.00	0.00	0.00	0.00
11,500.00	90.19	359.65	7,574.44	3,971.93	414.22	3,969.33	0.00	0.00	0.00	0.00
11,600.00	90.19	359.65	7,574.12	4,071.93	413.61	4,069.33	0.00	0.00	0.00	0.00
11,700.00	90.19	359.65	7,573.79	4,171.93	413.00	4,169.33	0.00	0.00	0.00	0.00
11,800.00	90.19	359.65	7,573.47	4,271.92	412.39	4,269.33	0.00	0.00	0.00	0.00
11,900.00	90.19	359.65	7,573.14	4,371.92	411.78	4,369.32	0.00	0.00	0.00	0.00
12,000.00	90.19	359.65	7,572.82	4,471.92	411.17	4,469.32	0.00	0.00	0.00	0.00
12,100.00	90.19	359.65	7,572.50	4,571.92	410.56	4,569.32	0.00	0.00	0.00	0.00
12,200.00	90.19	359.65	7,572.17	4,671.91	409.95	4,669.32	0.00	0.00	0.00	0.00
12,300.00	90.19	359.65	7,571.85	4,771.91	409.34	4,769.32	0.00	0.00	0.00	0.00
12,400.00	90.19	359.65	7,571.52	4,871.91	408.73	4,869.32	0.00	0.00	0.00	0.00
12,500.00	90.19	359.65	7,571.20	4,971.91	408.12	4,969.32	0.00	0.00	0.00	0.00
12,561.81	90.19	359.65	7,571.00	5,033.72	407.74	5,031.13	0.00	0.00	0.00	0.00
Total Depth-Toe										
12,561.82	90.19	359.65	7,571.00	5,033.73	407.74	5,031.14	0.00	0.00	0.00	0.00
TD Well @ 12561.82 - Howard 28N-28HZ_BHL										

Plan Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
1,300.00	1,300.00	0.00	0.00	Begin Nudge @ 1300.00
1,521.25	1,521.03	-3.35	7.85	End Nudge @ 1521.25
6,913.52	6,897.23	-166.75	390.46	Top of 4.5" Liner @ 6913.52
7,013.52	6,996.93	-169.78	397.56	KOP @ 7013.52
7,500.00	7,431.70	11.50	427.36	DLS = 10/100ft
7,932.98	7,586.00	405.00	436.00	End Build @ 7932.98
12,561.82	7,571.00	5,033.73	407.74	TD Well @ 12561.82

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
User	No Target (Freehand)	359.65	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
0.00	12,561.82	Plan A 0-Permit	MWD

Plan Report for Howard 28N-28HZ - Plan A 0-Permit**Casing Details**

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
1,182.00	1,182.00	9 5/8" Casing	9-5/8	13-1/2
7,932.98	7,586.00	7" Casing	7	8-3/4

Formation Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
4,830.08	4,820.00	Sussex		0.00	
7,406.88	7,363.00	Sharon Springs		0.00	
7,462.14	7,405.00	Niobrara A		0.00	
7,932.98	7,586.00	Niobrara B		0.00	
7,932.98	7,586.00	Landing Target-Heel		0.00	
12,561.81	7,571.00	Total Depth-Toe		0.00	

Targets associated with this wellbore

Target Name	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Shape
Howard 28N-28HZ_SHL	0.00	0.00	0.00	Point
Howard _SEC	3.00	0.41	-59.94	Polygon
Howard 28N-28HZ_BHL	7,571.00	5,033.73	407.74	Point
Howard 28N-28HZ_CP	7,586.00	405.00	436.00	Point

North Reference Sheet for Sec. 28-T1N-R67W - Howard 28N-28HZ - Plan A 0

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.

Vertical Depths are relative to RKB @ 17' @ 5040.00ft (Drilling Rig). Northing and Easting are relative to Howard 28N-28HZ

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.50°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99996523

Grid Coordinates of Well: 1,249,065.34 ft N, 3,168,601.07 ft E

Geographical Coordinates of Well: 40° 00' 55.80" N, 104° 53' 52.95" W

Grid Convergence at Surface is: 0.39°

Based upon Minimum Curvature type calculations, at a Measured Depth of 12,561.82ft
the Bottom Hole Displacement is 5,050.21ft in the Direction of 4.63° (True).

Magnetic Convergence at surface is: -8.30° (29 May 2013, , BGGM2012)

