

# Conoco Phillips Company

Arapahoe County, Colorado

Sec. 12-T5S-R65W

State Harvard-1H

Plan A (Pilot)

Plan: Rev A0

## Sperry Drilling Services

### Proposal Report

30 October, 2013

Well Coordinates: 1,657,802.06 N, 3,249,865.88 E (39° 38' 10.00" N, 104° 36' 46.08" W)

Ground Level: 5,862.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 70

Centered on Well State Harvard-1H

KB 24 ft @ 5886.00usft (H&P 280)

N

True

API - US Survey Feet - Custom

**HALLIBURTON**

## Plan Report for State Harvard-1H - Rev A0

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)	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
1,200.00	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
1,400.00	0.00	0.00	1,400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,500.00	0.00	0.00	1,500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,600.00	0.00	0.00	1,600.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,700.00	0.00	0.00	1,700.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,881.00	0.00	0.00	1,881.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Fox Hills</b>										
1,900.00	0.00	0.00	1,900.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,031.00	0.00	0.00	2,031.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Pierre Shale</b>										
2,100.00	0.00	0.00	2,100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,200.00	0.00	0.00	2,200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,231.00	0.00	0.00	2,231.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>9 5/8" Casing Pt.</b>										
2,300.00	0.00	0.00	2,300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Begin Nudge @ 2300.00 ft</b>										
2,400.00	2.00	342.50	2,399.98	1.66	-0.52	1.75	2.00	2.00	0.00	342.50
2,450.00	3.00	342.50	2,449.93	3.74	-1.18	3.93	2.00	2.00	0.00	0.00
<b>End Nudge @ 2450.00 ft</b>										
2,500.00	3.00	342.50	2,499.86	6.24	-1.97	6.54	0.00	0.00	0.00	0.00
2,600.00	3.00	342.50	2,599.73	11.23	-3.54	11.78	0.00	0.00	0.00	0.00
2,700.00	3.00	342.50	2,699.59	16.22	-5.12	17.01	0.00	0.00	0.00	0.00
2,800.00	3.00	342.50	2,799.45	21.21	-6.69	22.24	0.00	0.00	0.00	0.00
2,900.00	3.00	342.50	2,899.31	26.21	-8.26	27.48	0.00	0.00	0.00	0.00
3,000.00	3.00	342.50	2,999.18	31.20	-9.84	32.71	0.00	0.00	0.00	0.00
3,100.00	3.00	342.50	3,099.04	36.19	-11.41	37.94	0.00	0.00	0.00	0.00
3,200.00	3.00	342.50	3,198.90	41.18	-12.98	43.18	0.00	0.00	0.00	0.00
3,300.00	3.00	342.50	3,298.77	46.17	-14.56	48.41	0.00	0.00	0.00	0.00
3,400.00	3.00	342.50	3,398.63	51.16	-16.13	53.65	0.00	0.00	0.00	0.00
3,500.00	3.00	342.50	3,498.49	56.15	-17.71	58.88	0.00	0.00	0.00	0.00
3,600.00	3.00	342.50	3,598.36	61.15	-19.28	64.11	0.00	0.00	0.00	0.00
3,700.00	3.00	342.50	3,698.22	66.14	-20.85	69.35	0.00	0.00	0.00	0.00
3,800.00	3.00	342.50	3,798.08	71.13	-22.43	74.58	0.00	0.00	0.00	0.00
3,900.00	3.00	342.50	3,897.94	76.12	-24.00	79.81	0.00	0.00	0.00	0.00
4,000.00	3.00	342.50	3,997.81	81.11	-25.57	85.05	0.00	0.00	0.00	0.00
4,100.00	3.00	342.50	4,097.67	86.10	-27.15	90.28	0.00	0.00	0.00	0.00
4,200.00	3.00	342.50	4,197.53	91.09	-28.72	95.51	0.00	0.00	0.00	0.00
4,300.00	3.00	342.50	4,297.40	96.08	-30.30	100.75	0.00	0.00	0.00	0.00
4,400.00	3.00	342.50	4,397.26	101.08	-31.87	105.98	0.00	0.00	0.00	0.00
4,500.00	3.00	342.50	4,497.12	106.07	-33.44	111.21	0.00	0.00	0.00	0.00
4,600.00	3.00	342.50	4,596.98	111.06	-35.02	116.45	0.00	0.00	0.00	0.00
4,700.00	3.00	342.50	4,696.85	116.05	-36.59	121.68	0.00	0.00	0.00	0.00
4,800.00	3.00	342.50	4,796.71	121.04	-38.16	126.92	0.00	0.00	0.00	0.00

## Plan Report for State Harvard-1H - Rev A0

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)	Toolface Azimuth (°)
4,900.00	3.00	342.50	4,896.57	126.03	-39.74	132.15	0.00	0.00	0.00	0.00
5,000.00	3.00	342.50	4,996.44	131.02	-41.31	137.38	0.00	0.00	0.00	0.00
5,100.00	3.00	342.50	5,096.30	136.02	-42.89	142.62	0.00	0.00	0.00	0.00
5,200.00	3.00	342.50	5,196.16	141.01	-44.46	147.85	0.00	0.00	0.00	0.00
5,300.00	3.00	342.50	5,296.03	146.00	-46.03	153.08	0.00	0.00	0.00	0.00
5,400.00	3.00	342.50	5,395.89	150.99	-47.61	158.32	0.00	0.00	0.00	0.00
5,500.00	3.00	342.50	5,495.75	155.98	-49.18	163.55	0.00	0.00	0.00	0.00
5,530.00	3.00	342.50	5,525.71	157.48	-49.65	165.12	0.00	0.00	0.00	0.00
<b>Begin Drop @ 5530.00 ft</b>										
5,600.00	1.60	342.50	5,595.65	160.16	-50.50	167.93	2.00	-2.00	0.00	180.00
5,680.00	0.00	0.00	5,675.64	161.22	-50.83	169.05	2.00	-2.00	0.00	180.00
<b>End Drop @ 5680.00 ft</b>										
5,700.00	0.00	0.00	5,695.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
5,800.00	0.00	0.00	5,795.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
5,900.00	0.00	0.00	5,895.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,000.00	0.00	0.00	5,995.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,100.00	0.00	0.00	6,095.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,200.00	0.00	0.00	6,195.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,300.00	0.00	0.00	6,295.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,400.00	0.00	0.00	6,395.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,500.00	0.00	0.00	6,495.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,600.00	0.00	0.00	6,595.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,700.00	0.00	0.00	6,695.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,800.00	0.00	0.00	6,795.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
6,900.00	0.00	0.00	6,895.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,000.00	0.00	0.00	6,995.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,100.00	0.00	0.00	7,095.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,200.00	0.00	0.00	7,195.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,300.00	0.00	0.00	7,295.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,400.00	0.00	0.00	7,395.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,500.00	0.00	0.00	7,495.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,600.00	0.00	0.00	7,595.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,665.36	0.00	0.00	7,661.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Sharon Springs</b>										
7,700.00	0.00	0.00	7,695.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,765.36	0.00	0.00	7,761.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Niobrara</b>										
7,800.00	0.00	0.00	7,795.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,825.36	0.00	0.00	7,821.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Niobrara B</b>										
7,866.36	0.00	0.00	7,862.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Niobrara C</b>										
7,900.00	0.00	0.00	7,895.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
7,912.36	0.00	0.00	7,908.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Niobrara D</b>										
8,000.00	0.00	0.00	7,995.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
8,037.36	0.00	0.00	8,033.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Fort Hays</b>										
8,100.00	0.00	0.00	8,095.64	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
8,117.36	0.00	0.00	8,113.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Greenhorn</b>										
8,197.36	0.00	0.00	8,193.00	161.22	-50.83	169.05	0.00	0.00	0.00	0.00
<b>Total Depth 8197.36 ft</b>										

## Plan Report for State Harvard-1H - Rev A0

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
2,300.00	2,300.00	0.00	0.00	Begin Nudge @ 2300.00 ft
2,450.00	2,449.93	3.74	-1.18	End Nudge @ 2450.00 ft
5,530.00	5,525.71	157.48	-49.65	Begin Drop @ 5530.00 ft
5,680.00	5,675.64	161.22	-50.83	End Drop @ 5680.00 ft
8,197.36	8,193.00	161.22	-50.83	Total Depth 8197.36 ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
TD	No Target (Freehand)	342.50	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
0.00	2,231.00	Rev A0	NSG-CT_D/P
2,231.00	8,197.36	Rev A0	MWD

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
2,231.00	2,231.00	9 5/8" Casing Pt.	9-5/8	13-1/2

Formation Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)
1,881.00	1,881.00	Fox Hills			
2,031.00	2,031.00	Pierre Shale			
7,665.36	7,661.00	Sharon Springs			
7,765.36	7,761.00	Niobrara			
7,825.36	7,821.00	Niobrara B			
7,866.36	7,862.00	Niobrara C			
7,912.36	7,908.00	Niobrara D			
8,037.36	8,033.00	Fort Hays			
8,117.36	8,113.00	Greenhorn			

Targets associated with this wellbore

Target Name	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Shape
Airline Road-State 15-12 (500 ft)	0.00	-3,803.40	509.07	Circle
State Harvard-1H_SL	0.00	0.00	0.00	Polygon
Texaco-Chandler St. of CO 'AB' 2 (500 ft)	0.00	-2,530.74	7,106.44	Circle

## Plan Report for State Harvard-1H - Rev A0

### Directional Difficulty Index

Average Dogleg over Survey:	0.07 °/100usft	Maximum Dogleg over Survey:	2.00 °/100usft at 2,450.00 usft
Net Tortosity applicable to Plans:	0.07 °/100usft	Directional Difficulty Index:	3.886

### Audit Info

North Reference Sheet for Sec. 12-T5S-R65W - State Harvard-1H - Plan A (Pilot)

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference .  
Vertical Depths are relative to KB 24 ft @ 5886.00usft (H&P 280). Northing and Easting are relative to State Harvard-1H  
Coordinate System is US State Plane 1983, Colorado Central 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° 0' 0.000 E°, Latitude Origin:39° 45' 0.000 N°  
False Easting: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99997945

Grid Coordinates of Well: 1,657,802.06 usft N, 3,249,865.88 usft E  
Geographical Coordinates of Well: 39° 38' 10.00" N, 104° 36' 46.08" W  
Grid Convergence at Surface is: 0.56°

Based upon Minimum Curvature type calculations, at a Measured Depth of 8,197.36usft  
the Bottom Hole Displacement is 169.05usft in the Direction of 342.50° ( True).  
Magnetic Convergence at surface is: -7.86° (31 December 2013, , BGGM2013)

