

BISON EXPLORATION

**ARAPAHOE COUNTY, COLORADO (NAD 83)
SE NE SEC. 22 T4S R64W 6th P.M.
HOULIHAN 4-64 22A 21-8**

ORIGINAL WELLBORE

30 March, 2017

Plan: PROPOSAL #1



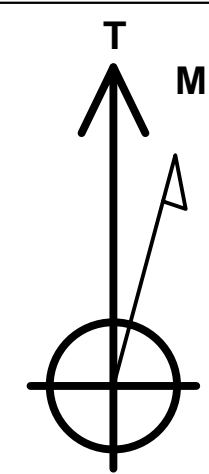
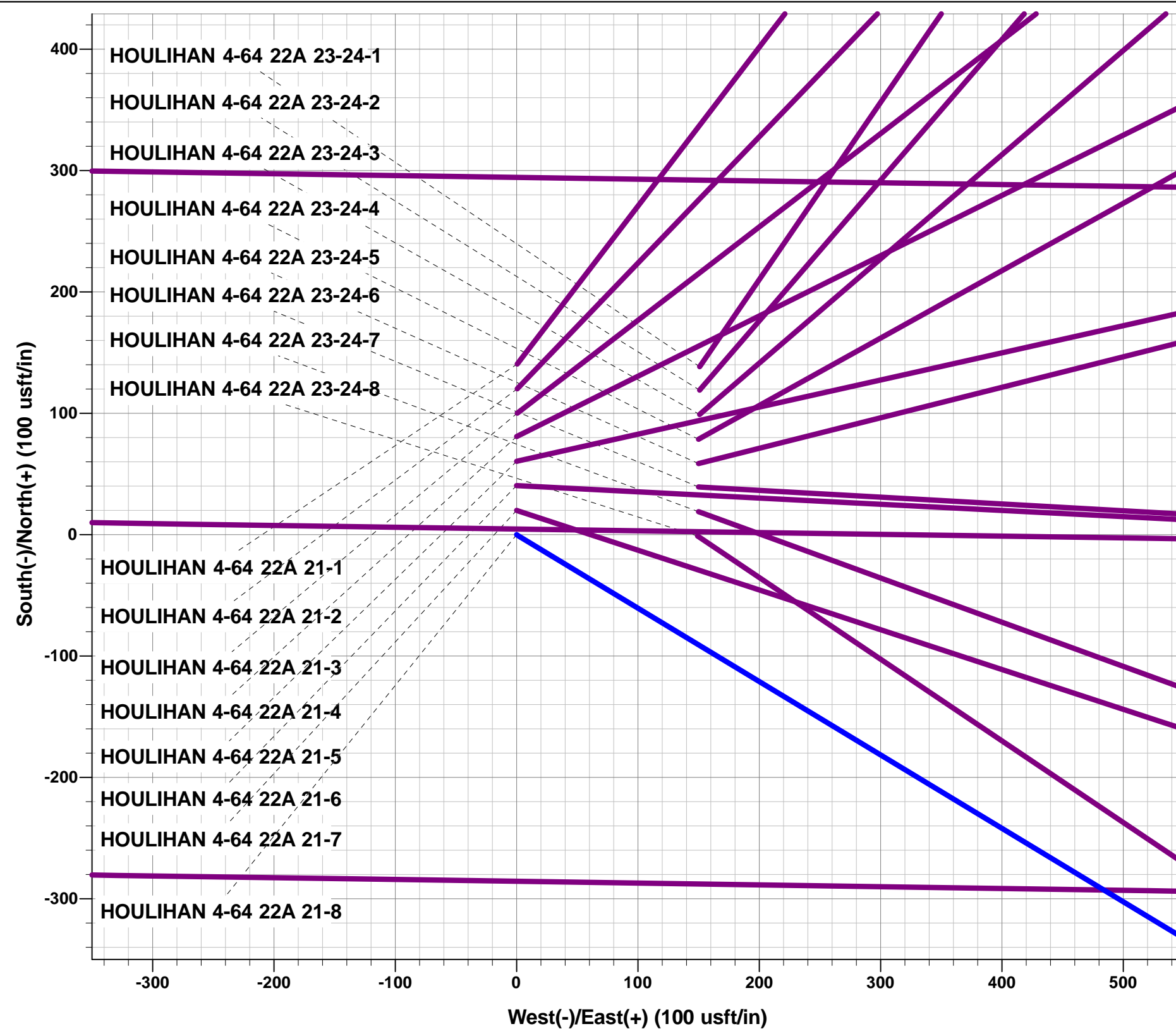
Project: ARAPAHOE COUNTY, COLORADO (NAD 83)
Site: SE NE SEC. 22 T4S R64W 6th P.M.
Well: HOULIHAN 4-64 22A 21-8
Wellbore: ORIGINAL WELLBORE
Design: PROPOSAL #1

ANNOTATIONS

TVD	MD	Inc	Azi	+N/-S	+E/-W	VSect	Dep	Annotation
0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	SHL: 1914ft FNL & 1005ft FEL of Sec 22
100.0	100.0	0.00	0.00	0.0	0.0	0.0	0.0	START NUDGE (2°/100ft BUR)
695.7	700.0	12.00	121.17	-32.4	53.6	-51.9	62.6	EOB TO 12° INC
5462.5	5573.4	12.00	121.17	-556.8	920.6	-892.5	1075.9	END OF TANGENT
6058.2	6173.5	0.00	0.00	-589.2	974.2	-944.4	1138.5	EOD TO VERTICAL
7033.2	7148.5	0.00	0.00	-589.2	974.2	-944.4	1138.5	KOP (10°/100ft BUR)
7589.3	7909.2	76.07	270.84	-582.8	539.2	-510.3	1573.7	BEGIN PROD INTERVAL
7606.2	8048.5	90.00	270.84	-580.8	401.3	-372.6	1711.5	HZ LP *NEW*: 2490ft FNL & 597.9ft FEL of Sec 22
7606.2	17538.7	90.00	270.84	-441.7	-9088.0	9098.7	11201.8	BHL: 2490ft FNL & 460ft FWL of Sec 21

WELLBORE TARGET DETAILS (LAT/LONG)

Name	TVD	+N/-S	+E/-W	Latitude	Longitude
KOP - HOULIHAN 4-64 22A 21-8	7033.2	-589.2	974.2	39.688413	-104.527746
BHL - HOULIHAN 4-64 22A 21-8	7606.2	-441.7	-9088.0	39.688814	-104.563500
HZ LP *NEW* - HOULIHAN 4-64 22A 21-8	7606.2	-580.8	401.3	39.688437	-104.529782



Azimuths to True North
Magnetic North: 8.05°

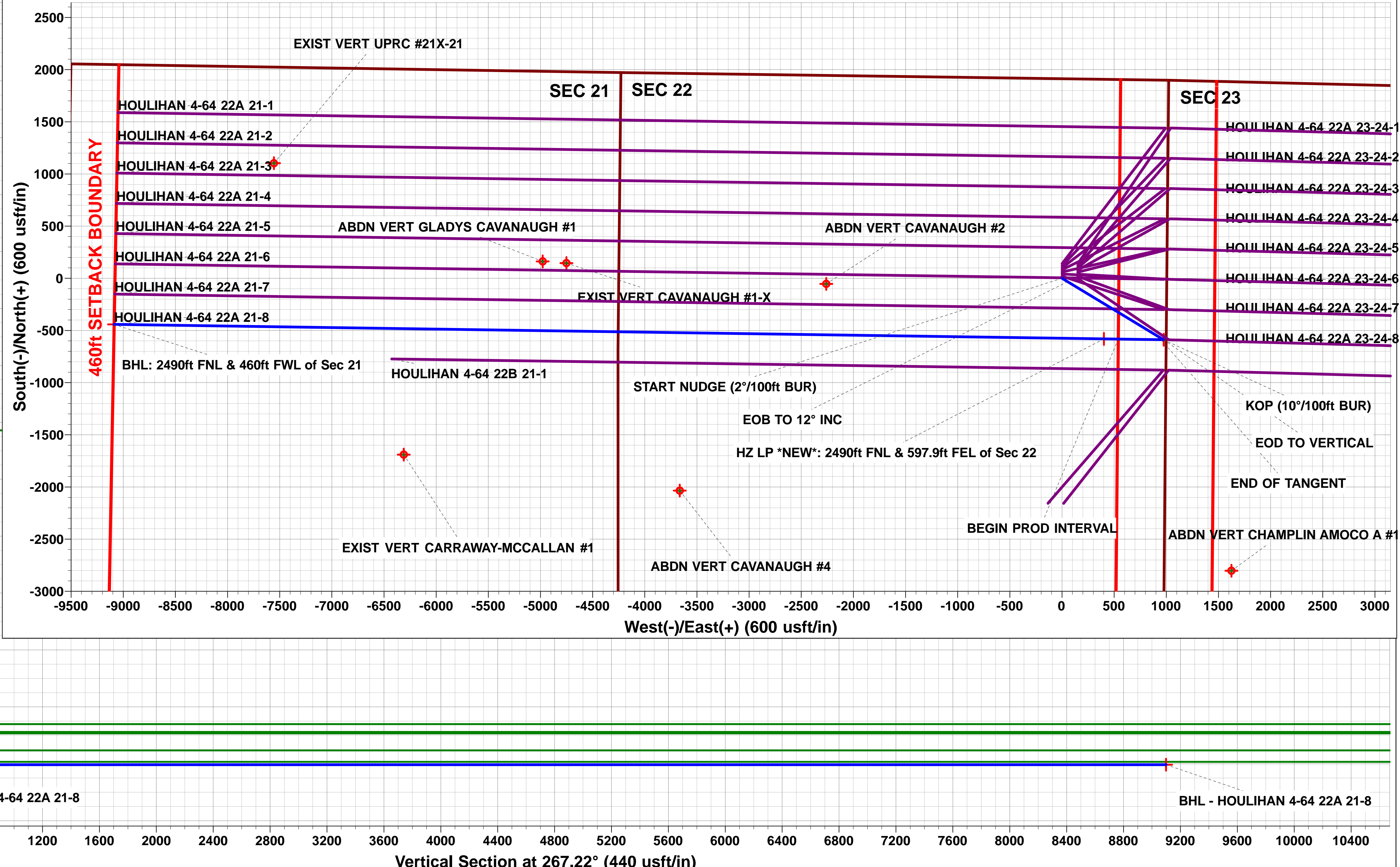
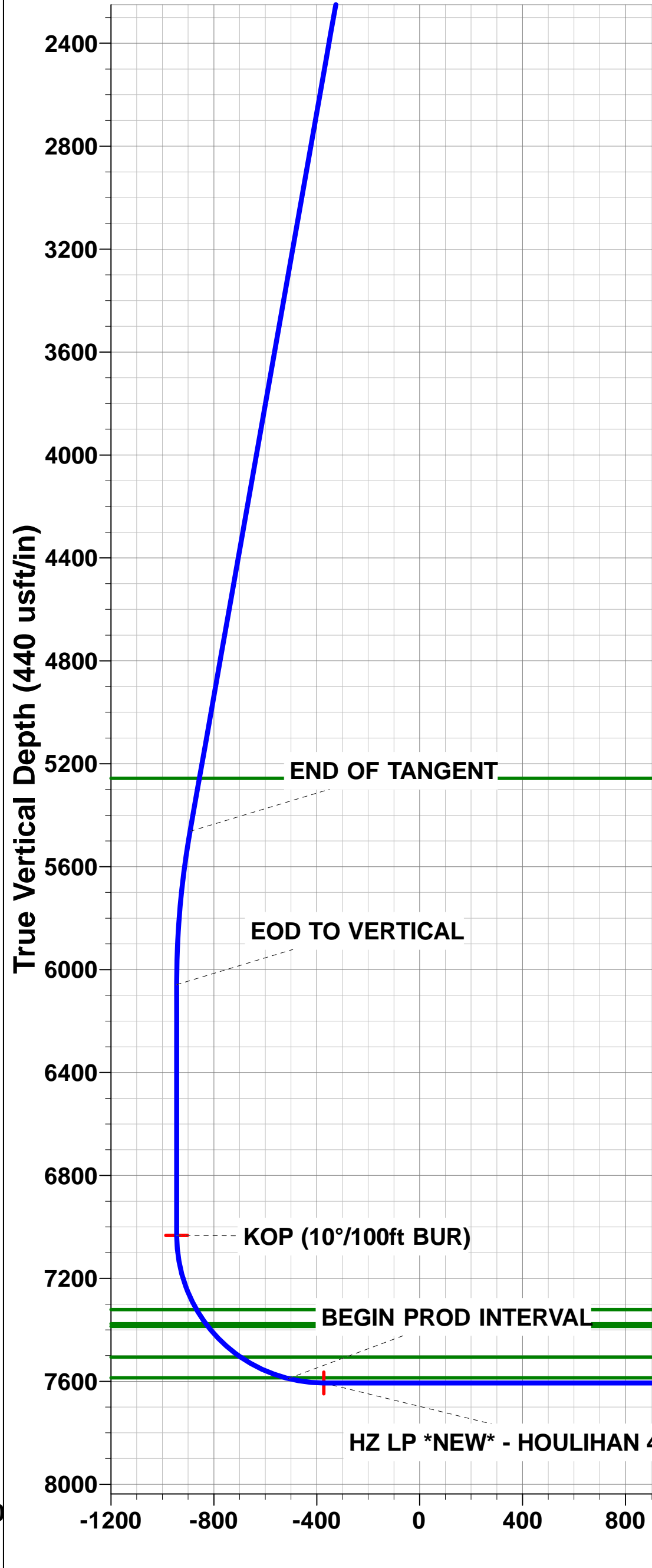
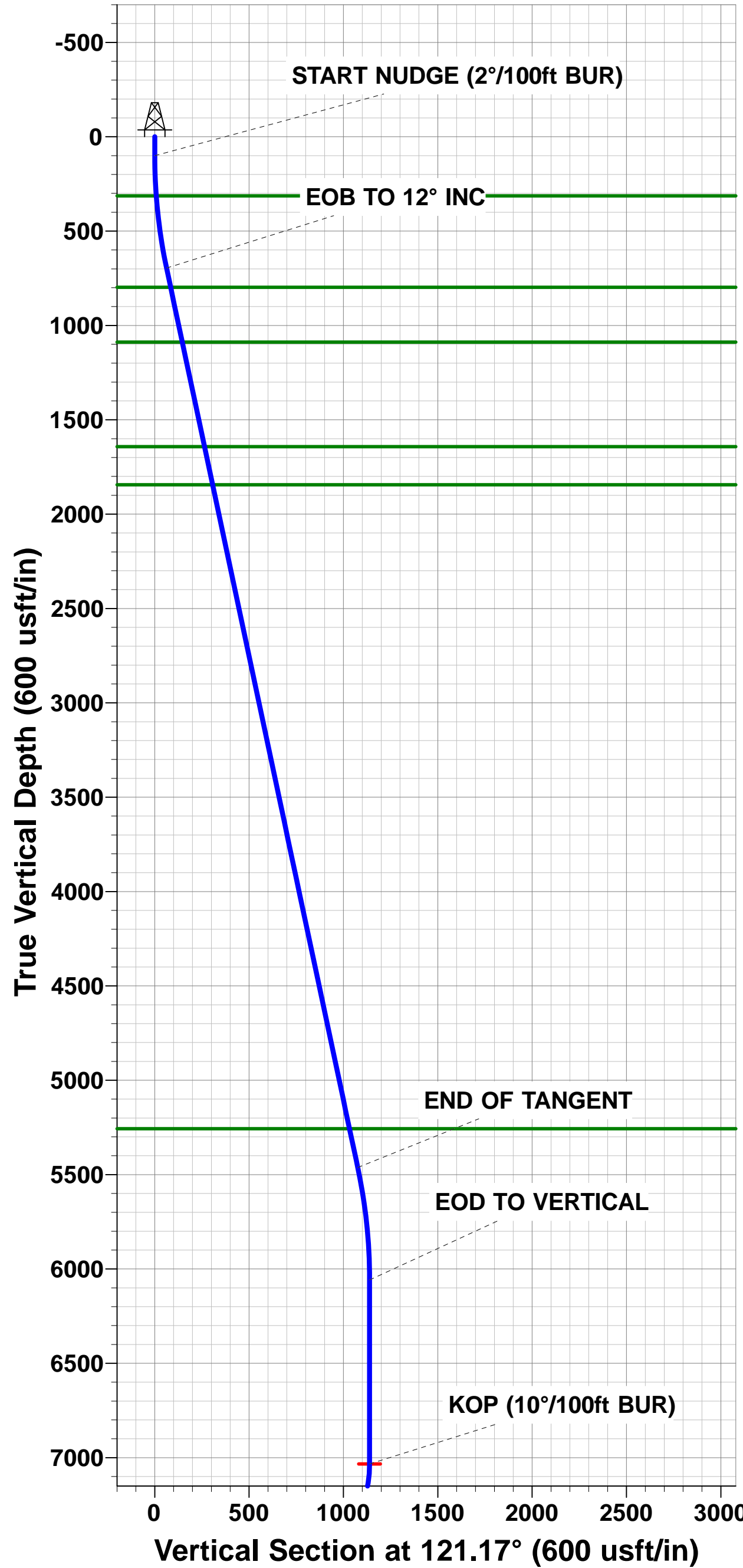
Magnetic Field
Strength: 52062.7snT
Dip Angle: 66.33°
Date: 30/03/2017
Model: IGRF2015

FORMATION TOP DETAILS

TVDPath	MDPath	Formation
313.2	313.4	DENVER
798.2	804.9	UPPER ARAPAHOE
1088.2	1101.3	LOWER ARAPAHOE
1642.2	1667.7	LARAMIE - FOX HILLS
1844.2	1874.2	PIERRE SHALE
5256.2	5362.5	SHANNON SANDSTONE MBR
7321.2	7450.2	SHARON SPRINGS SHALE
7376.2	7516.2	NIOBRARA FORMATION
7386.2	7528.8	NIOBRARA A CHALK
7506.2	7704.9	NIOBRARA B CHALK
7586.2	7896.8	NIOBRARA C CHALK

PROPOSED LOCAL COORDINATES:

SHL: 1914ft FNL & 1005ft FEL of Sec 22
BEGIN PROD INT: 2490ft FNL & 460ft FEL of Sec 22
HZ LP: 2490ft FNL & 597.9ft FEL of Sec 22
BHL: 2490ft FNL & 460ft FWL of Sec 21



Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-8
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Project	ARAPAHOE COUNTY, COLORADO (NAD 83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		Using geodetic scale factor

Site	SE NE SEC. 22 T4S R64W 6th P.M.		
Site Position:		Northing:	1,677,817.09 usft
From:	Lat/Long	Easting:	3,272,633.76 usft
Position Uncertainty:	0.0 usft	Slot Radius:	1.10000ft
		Latitude:	39.690417
		Longitude:	-104.531206
		Grid Convergence:	0.61 °

Well	HOULIHAN 4-64 22A 21-8		
Well Position	+N/-S	-140.6 usft	Northing:
	+E/-W	-0.6 usft	Easting:
Position Uncertainty	0.0 usft		Wellhead Elevation:
			Latitude:
			Longitude:
			Ground Level:

Wellbore	ORIGINAL WELLBORE				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	30/03/2017	8.05	66.33	52,063

Design	PROPOSAL #1			
Audit Notes:				
Version:	Phase:	PROTOTYPE	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	7,606.2	0.0	0.0	267.22

Plan Sections											
MD (usft)	Inc (°)	Azi (°)	Vertical Depth	SS (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	-5,726.2	0.0	0.0	0.00	0.00	0.00	0.00	
100.0	0.00	0.00	100.0	-5,626.2	0.0	0.0	0.00	0.00	0.00	0.00	
700.0	12.00	121.17	695.7	-5,030.5	-32.4	53.6	2.00	2.00	0.00	121.17	
5,573.4	12.00	121.17	5,462.5	-263.7	-556.8	920.6	0.00	0.00	0.00	0.00	
6,173.5	0.00	0.00	6,058.2	332.0	-589.2	974.2	2.00	-2.00	0.00	180.00	
7,148.5	0.00	0.00	7,033.2	1,307.0	-589.2	974.2	0.00	0.00	0.00	0.00	KOP - HOULIHAN 4
8,048.5	90.00	270.84	7,606.2	1,880.0	-580.8	401.3	10.00	10.00	0.00	270.84	
17,538.7	90.00	270.84	7,606.2	1,880.0	-441.7	-9,088.0	0.00	0.00	0.00	0.00	BHL - HOULIHAN 4

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Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
SHL: 1914ft FNL & 1005ft FEL of Sec 22										
0.0	0.00	0.00	0.0	5,726.20	0.0	0.0	0.0	0.00	0.00	0.00
START NUDGE (2°/100ft BUR)										
100.0	0.00	0.00	100.0	5,626.20	0.0	0.0	0.0	0.00	0.00	0.00
200.0	2.00	121.17	200.0	5,526.22	-0.9	1.5	-1.4	2.00	2.00	0.00
300.0	4.00	121.17	299.8	5,426.36	-3.6	6.0	-5.8	2.00	2.00	0.00
DENVER										
313.4	4.27	121.17	313.2	5,413.00	-4.1	6.8	-6.6	2.00	2.00	0.00
400.0	6.00	121.17	399.5	5,326.75	-8.1	13.4	-13.0	2.00	2.00	0.00
500.0	8.00	121.17	498.7	5,227.50	-14.4	23.9	-23.1	2.00	2.00	0.00
600.0	10.00	121.17	597.5	5,128.73	-22.5	37.2	-36.1	2.00	2.00	0.00
EOB TO 12° INC										
700.0	12.00	121.17	695.7	5,030.54	-32.4	53.6	-51.9	2.00	2.00	0.00
800.0	12.00	121.17	793.4	4,932.76	-43.2	71.4	-69.2	0.00	0.00	0.00
UPPER ARAPAHOE										
804.9	12.00	121.17	798.2	4,928.00	-43.7	72.2	-70.0	0.00	0.00	0.00
900.0	12.00	121.17	891.3	4,834.95	-53.9	89.2	-86.4	0.00	0.00	0.00
1,000.0	12.00	121.17	989.1	4,737.13	-64.7	106.9	-103.7	0.00	0.00	0.00
1,100.0	12.00	121.17	1,086.9	4,639.32	-75.4	124.7	-120.9	0.00	0.00	0.00
LOWER ARAPAHOE										
1,101.3	12.00	121.17	1,088.2	4,638.00	-75.6	125.0	-121.2	0.00	0.00	0.00
1,200.0	12.00	121.17	1,184.7	4,541.50	-86.2	142.5	-138.2	0.00	0.00	0.00
1,300.0	12.00	121.17	1,282.5	4,443.69	-97.0	160.3	-155.4	0.00	0.00	0.00
1,400.0	12.00	121.17	1,380.3	4,345.88	-107.7	178.1	-172.7	0.00	0.00	0.00
1,500.0	12.00	121.17	1,478.1	4,248.06	-118.5	195.9	-189.9	0.00	0.00	0.00
1,600.0	12.00	121.17	1,576.0	4,150.25	-129.2	213.7	-207.2	0.00	0.00	0.00
LARAMIE - FOX HILLS										
1,667.7	12.00	121.17	1,642.2	4,084.00	-136.5	225.7	-218.8	0.00	0.00	0.00
1,700.0	12.00	121.17	1,673.8	4,052.43	-140.0	231.5	-224.4	0.00	0.00	0.00
1,800.0	12.00	121.17	1,771.6	3,954.62	-150.8	249.3	-241.7	0.00	0.00	0.00
PIERRE SHALE (BASE FOX HILLS)										
1,874.2	12.00	121.17	1,844.2	3,882.00	-158.8	262.5	-254.5	0.00	0.00	0.00
1,900.0	12.00	121.17	1,869.4	3,856.80	-161.5	267.1	-258.9	0.00	0.00	0.00
2,000.0	12.00	121.17	1,967.2	3,758.99	-172.3	284.9	-276.2	0.00	0.00	0.00
2,100.0	12.00	121.17	2,065.0	3,661.17	-183.0	302.6	-293.4	0.00	0.00	0.00
2,200.0	12.00	121.17	2,162.8	3,563.36	-193.8	320.4	-310.7	0.00	0.00	0.00
2,300.0	12.00	121.17	2,260.7	3,465.55	-204.6	338.2	-327.9	0.00	0.00	0.00
2,400.0	12.00	121.17	2,358.5	3,367.73	-215.3	356.0	-345.2	0.00	0.00	0.00
2,500.0	12.00	121.17	2,456.3	3,269.92	-226.1	373.8	-362.4	0.00	0.00	0.00
2,600.0	12.00	121.17	2,554.1	3,172.10	-236.8	391.6	-379.6	0.00	0.00	0.00
2,700.0	12.00	121.17	2,651.9	3,074.29	-247.6	409.4	-396.9	0.00	0.00	0.00
2,800.0	12.00	121.17	2,749.7	2,976.47	-258.4	427.2	-414.1	0.00	0.00	0.00
2,900.0	12.00	121.17	2,847.5	2,878.66	-269.1	445.0	-431.4	0.00	0.00	0.00
3,000.0	12.00	121.17	2,945.4	2,780.84	-279.9	462.8	-448.6	0.00	0.00	0.00
3,100.0	12.00	121.17	3,043.2	2,683.03	-290.6	480.6	-465.9	0.00	0.00	0.00
3,200.0	12.00	121.17	3,141.0	2,585.21	-301.4	498.4	-483.1	0.00	0.00	0.00
3,300.0	12.00	121.17	3,238.8	2,487.40	-312.2	516.1	-500.4	0.00	0.00	0.00
3,400.0	12.00	121.17	3,336.6	2,389.59	-322.9	533.9	-517.6	0.00	0.00	0.00
3,500.0	12.00	121.17	3,434.4	2,291.77	-333.7	551.7	-534.9	0.00	0.00	0.00
3,600.0	12.00	121.17	3,532.2	2,193.96	-344.4	569.5	-552.1	0.00	0.00	0.00
3,700.0	12.00	121.17	3,630.1	2,096.14	-355.2	587.3	-569.4	0.00	0.00	0.00
3,800.0	12.00	121.17	3,727.9	1,998.33	-366.0	605.1	-586.6	0.00	0.00	0.00
3,900.0	12.00	121.17	3,825.7	1,900.51	-376.7	622.9	-603.9	0.00	0.00	0.00

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Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,000.0	12.00	121.17	3,923.5	1,802.70	-387.5	640.7	-621.1	0.00	0.00	0.00
4,100.0	12.00	121.17	4,021.3	1,704.88	-398.3	658.5	-638.4	0.00	0.00	0.00
4,200.0	12.00	121.17	4,119.1	1,607.07	-409.0	676.3	-655.6	0.00	0.00	0.00
4,300.0	12.00	121.17	4,216.9	1,509.26	-419.8	694.1	-672.9	0.00	0.00	0.00
4,400.0	12.00	121.17	4,314.8	1,411.44	-430.5	711.9	-690.1	0.00	0.00	0.00
4,500.0	12.00	121.17	4,412.6	1,313.63	-441.3	729.6	-707.4	0.00	0.00	0.00
4,600.0	12.00	121.17	4,510.4	1,215.81	-452.1	747.4	-724.6	0.00	0.00	0.00
4,700.0	12.00	121.17	4,608.2	1,118.00	-462.8	765.2	-741.9	0.00	0.00	0.00
4,800.0	12.00	121.17	4,706.0	1,020.18	-473.6	783.0	-759.1	0.00	0.00	0.00
4,900.0	12.00	121.17	4,803.8	922.37	-484.3	800.8	-776.4	0.00	0.00	0.00
5,000.0	12.00	121.17	4,901.6	824.55	-495.1	818.6	-793.6	0.00	0.00	0.00
5,100.0	12.00	121.17	4,999.5	726.74	-505.9	836.4	-810.9	0.00	0.00	0.00
5,200.0	12.00	121.17	5,097.3	628.92	-516.6	854.2	-828.1	0.00	0.00	0.00
5,300.0	12.00	121.17	5,195.1	531.11	-527.4	872.0	-845.4	0.00	0.00	0.00
SHANNON SANDSTONE MBR										
5,362.5	12.00	121.17	5,256.2	470.00	-534.1	883.1	-856.1	0.00	0.00	0.00
5,400.0	12.00	121.17	5,292.9	433.30	-538.1	889.8	-862.6	0.00	0.00	0.00
5,500.0	12.00	121.17	5,390.7	335.48	-548.9	907.6	-879.8	0.00	0.00	0.00
END OF TANGENT										
5,573.4	12.00	121.17	5,462.5	263.66	-556.8	920.6	-892.5	0.00	0.00	0.00
5,600.0	11.47	121.17	5,488.6	237.64	-559.6	925.3	-897.0	2.00	-2.00	0.00
5,700.0	9.47	121.17	5,586.9	139.31	-569.0	940.8	-912.1	2.00	-2.00	0.00
5,800.0	7.47	121.17	5,685.8	40.41	-576.6	953.4	-924.3	2.00	-2.00	0.00
5,900.0	5.47	121.17	5,785.2	-58.95	-582.5	963.0	-933.6	2.00	-2.00	0.00
6,000.0	3.47	121.17	5,884.8	-158.64	-586.5	969.7	-940.1	2.00	-2.00	0.00
6,100.0	1.47	121.17	5,984.7	-258.54	-588.7	973.4	-943.7	2.00	-2.00	0.00
EOD TO VERTICAL										
6,173.5	0.00	0.00	6,058.2	-332.00	-589.2	974.2	-944.4	2.00	-2.00	0.00
6,200.0	0.00	0.00	6,084.7	-358.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,300.0	0.00	0.00	6,184.7	-458.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,400.0	0.00	0.00	6,284.7	-558.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,500.0	0.00	0.00	6,384.7	-658.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,600.0	0.00	0.00	6,484.7	-758.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,700.0	0.00	0.00	6,584.7	-858.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,800.0	0.00	0.00	6,684.7	-958.54	-589.2	974.2	-944.4	0.00	0.00	0.00
6,900.0	0.00	0.00	6,784.7	-1,058.54	-589.2	974.2	-944.4	0.00	0.00	0.00
7,000.0	0.00	0.00	6,884.7	-1,158.54	-589.2	974.2	-944.4	0.00	0.00	0.00
7,100.0	0.00	0.00	6,984.7	-1,258.54	-589.2	974.2	-944.4	0.00	0.00	0.00
KOP (10°/100ft BUR)										
7,148.5	0.00	0.00	7,033.2	-1,307.00	-589.2	974.2	-944.4	0.00	0.00	0.00
7,200.0	5.15	270.84	7,084.7	-1,358.47	-589.2	971.9	-942.1	10.00	10.00	0.00
7,300.0	15.15	270.84	7,183.0	-1,456.78	-588.9	954.3	-924.6	10.00	10.00	0.00
7,400.0	25.15	270.84	7,276.7	-1,550.53	-588.4	919.9	-890.2	10.00	10.00	0.00
SHARON SPRINGS SHALE										
7,450.2	30.15	270.84	7,321.2	-1,595.00	-588.1	896.6	-867.0	9.96	9.96	0.00
7,500.0	35.15	270.84	7,363.1	-1,636.89	-587.7	869.7	-840.2	10.04	10.04	0.00
NIOBRARA FORMATION										
7,516.2	36.77	270.84	7,376.2	-1,650.00	-587.5	860.2	-830.7	10.00	10.00	0.00
NIOBRARA A CHALK										
7,528.8	38.03	270.84	7,386.2	-1,660.00	-587.4	852.6	-823.0	10.00	10.00	0.00
7,600.0	45.15	270.84	7,439.4	-1,713.23	-586.7	805.3	-775.9	10.00	10.00	0.00
7,700.0	55.15	270.84	7,503.4	-1,777.22	-585.6	728.6	-699.4	10.00	10.00	0.00
NIOBRARA B CHALK										

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-8
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
7,704.9	55.64	270.84	7,506.2	-1,780.00	-585.5	724.6	-695.3	10.00	10.00	0.00
7,800.0	65.15	270.84	7,553.1	-1,826.92	-584.3	642.0	-612.9	10.00	10.00	0.00
NIORARA C CHALK										
7,896.8	74.83	270.84	7,586.2	-1,860.00	-583.0	551.2	-522.2	10.00	10.00	0.00
7,900.0	75.15	270.84	7,587.0	-1,860.83	-583.0	548.1	-519.2	10.00	10.00	0.00
BEGIN PROD INTERVAL										
7,909.2	76.07	270.84	7,589.3	-1,863.12	-582.8	539.2	-510.3	10.00	10.00	0.00
8,000.0	85.15	270.84	7,604.1	-1,877.91	-581.5	449.7	-420.9	10.00	10.00	0.00
HZ LP *NEW*: 2490ft FNL & 597.9ft FEL of Sec 22										
8,048.5	90.00	270.84	7,606.2	-1,879.96	-580.8	401.3	-372.6	10.00	10.00	0.00
8,100.0	90.00	270.84	7,606.2	-1,879.96	-580.0	349.8	-321.2	0.00	0.00	0.00
8,200.0	90.00	270.84	7,606.2	-1,879.96	-578.6	249.8	-221.4	0.00	0.00	0.00
8,300.0	90.00	270.84	7,606.2	-1,879.96	-577.1	149.8	-121.6	0.00	0.00	0.00
8,400.0	90.00	270.84	7,606.2	-1,879.96	-575.6	49.8	-21.8	0.00	0.00	0.00
8,500.0	90.00	270.84	7,606.2	-1,879.96	-574.2	-50.2	78.0	0.00	0.00	0.00
8,600.0	90.00	270.84	7,606.2	-1,879.96	-572.7	-150.2	177.8	0.00	0.00	0.00
8,700.0	90.00	270.84	7,606.2	-1,879.96	-571.2	-250.2	277.6	0.00	0.00	0.00
8,800.0	90.00	270.84	7,606.2	-1,879.96	-569.8	-350.2	377.4	0.00	0.00	0.00
8,900.0	90.00	270.84	7,606.2	-1,879.96	-568.3	-450.1	477.2	0.00	0.00	0.00
9,000.0	90.00	270.84	7,606.2	-1,879.96	-566.9	-550.1	577.0	0.00	0.00	0.00
9,100.0	90.00	270.84	7,606.2	-1,879.96	-565.4	-650.1	676.8	0.00	0.00	0.00
9,200.0	90.00	270.84	7,606.2	-1,879.96	-563.9	-750.1	776.6	0.00	0.00	0.00
9,300.0	90.00	270.84	7,606.2	-1,879.96	-562.5	-850.1	876.4	0.00	0.00	0.00
9,400.0	90.00	270.84	7,606.2	-1,879.96	-561.0	-950.1	976.2	0.00	0.00	0.00
9,500.0	90.00	270.84	7,606.2	-1,879.96	-559.5	-1,050.1	1,076.0	0.00	0.00	0.00
9,600.0	90.00	270.84	7,606.2	-1,879.96	-558.1	-1,150.1	1,175.8	0.00	0.00	0.00
9,700.0	90.00	270.84	7,606.2	-1,879.96	-556.6	-1,250.1	1,275.6	0.00	0.00	0.00
9,800.0	90.00	270.84	7,606.2	-1,879.96	-555.1	-1,350.0	1,375.4	0.00	0.00	0.00
9,900.0	90.00	270.84	7,606.2	-1,879.96	-553.7	-1,450.0	1,475.2	0.00	0.00	0.00
10,000.0	90.00	270.84	7,606.2	-1,879.96	-552.2	-1,550.0	1,575.0	0.00	0.00	0.00
10,100.0	90.00	270.84	7,606.2	-1,879.96	-550.7	-1,650.0	1,674.8	0.00	0.00	0.00
10,200.0	90.00	270.84	7,606.2	-1,879.96	-549.3	-1,750.0	1,774.6	0.00	0.00	0.00
10,300.0	90.00	270.84	7,606.2	-1,879.96	-547.8	-1,850.0	1,874.4	0.00	0.00	0.00
10,400.0	90.00	270.84	7,606.2	-1,879.96	-546.3	-1,950.0	1,974.2	0.00	0.00	0.00
10,500.0	90.00	270.84	7,606.2	-1,879.96	-544.9	-2,050.0	2,074.0	0.00	0.00	0.00
10,600.0	90.00	270.84	7,606.2	-1,879.96	-543.4	-2,150.0	2,173.8	0.00	0.00	0.00
10,700.0	90.00	270.84	7,606.2	-1,879.96	-541.9	-2,249.9	2,273.6	0.00	0.00	0.00
10,800.0	90.00	270.84	7,606.2	-1,879.96	-540.5	-2,349.9	2,373.4	0.00	0.00	0.00
10,900.0	90.00	270.84	7,606.2	-1,879.96	-539.0	-2,449.9	2,473.2	0.00	0.00	0.00
11,000.0	90.00	270.84	7,606.2	-1,879.96	-537.5	-2,549.9	2,573.0	0.00	0.00	0.00
11,100.0	90.00	270.84	7,606.2	-1,879.96	-536.1	-2,649.9	2,672.8	0.00	0.00	0.00
11,200.0	90.00	270.84	7,606.2	-1,879.96	-534.6	-2,749.9	2,772.6	0.00	0.00	0.00
11,300.0	90.00	270.84	7,606.2	-1,879.96	-533.1	-2,849.9	2,872.4	0.00	0.00	0.00
11,400.0	90.00	270.84	7,606.2	-1,879.96	-531.7	-2,949.9	2,972.2	0.00	0.00	0.00
11,500.0	90.00	270.84	7,606.2	-1,879.96	-530.2	-3,049.9	3,072.0	0.00	0.00	0.00
11,600.0	90.00	270.84	7,606.2	-1,879.96	-528.7	-3,149.9	3,171.8	0.00	0.00	0.00
11,700.0	90.00	270.84	7,606.2	-1,879.96	-527.3	-3,249.8	3,271.6	0.00	0.00	0.00
11,800.0	90.00	270.84	7,606.2	-1,879.96	-525.8	-3,349.8	3,371.4	0.00	0.00	0.00
11,900.0	90.00	270.84	7,606.2	-1,879.96	-524.3	-3,449.8	3,471.2	0.00	0.00	0.00
12,000.0	90.00	270.84	7,606.2	-1,879.96	-522.9	-3,549.8	3,571.0	0.00	0.00	0.00
12,100.0	90.00	270.84	7,606.2	-1,879.96	-521.4	-3,649.8	3,670.8	0.00	0.00	0.00
12,200.0	90.00	270.84	7,606.2	-1,879.96	-519.9	-3,749.8	3,770.6	0.00	0.00	0.00
12,300.0	90.00	270.84	7,606.2	-1,879.96	-518.5	-3,849.8	3,870.4	0.00	0.00	0.00

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-8
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey										
MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
12,400.0	90.00	270.84	7,606.2	-1,879.96	-517.0	-3,949.8	3,970.2	0.00	0.00	0.00
12,500.0	90.00	270.84	7,606.2	-1,879.96	-515.5	-4,049.8	4,070.0	0.00	0.00	0.00
12,600.0	90.00	270.84	7,606.2	-1,879.96	-514.1	-4,149.7	4,169.8	0.00	0.00	0.00
12,700.0	90.00	270.84	7,606.2	-1,879.96	-512.6	-4,249.7	4,269.6	0.00	0.00	0.00
12,800.0	90.00	270.84	7,606.2	-1,879.96	-511.1	-4,349.7	4,369.4	0.00	0.00	0.00
12,900.0	90.00	270.84	7,606.2	-1,879.96	-509.7	-4,449.7	4,469.2	0.00	0.00	0.00
13,000.0	90.00	270.84	7,606.2	-1,879.96	-508.2	-4,549.7	4,569.0	0.00	0.00	0.00
13,100.0	90.00	270.84	7,606.2	-1,879.96	-506.7	-4,649.7	4,668.8	0.00	0.00	0.00
13,200.0	90.00	270.84	7,606.2	-1,879.96	-505.3	-4,749.7	4,768.6	0.00	0.00	0.00
13,300.0	90.00	270.84	7,606.2	-1,879.96	-503.8	-4,849.7	4,868.4	0.00	0.00	0.00
13,400.0	90.00	270.84	7,606.2	-1,879.96	-502.3	-4,949.7	4,968.2	0.00	0.00	0.00
13,500.0	90.00	270.84	7,606.2	-1,879.96	-500.9	-5,049.6	5,068.0	0.00	0.00	0.00
13,600.0	90.00	270.84	7,606.2	-1,879.96	-499.4	-5,149.6	5,167.8	0.00	0.00	0.00
13,700.0	90.00	270.84	7,606.2	-1,879.96	-497.9	-5,249.6	5,267.6	0.00	0.00	0.00
13,800.0	90.00	270.84	7,606.2	-1,879.96	-496.5	-5,349.6	5,367.4	0.00	0.00	0.00
13,900.0	90.00	270.84	7,606.2	-1,879.96	-495.0	-5,449.6	5,467.2	0.00	0.00	0.00
14,000.0	90.00	270.84	7,606.2	-1,879.96	-493.5	-5,549.6	5,567.0	0.00	0.00	0.00
14,100.0	90.00	270.84	7,606.2	-1,879.96	-492.1	-5,649.6	5,666.8	0.00	0.00	0.00
14,200.0	90.00	270.84	7,606.2	-1,879.96	-490.6	-5,749.6	5,766.6	0.00	0.00	0.00
14,300.0	90.00	270.84	7,606.2	-1,879.96	-489.2	-5,849.6	5,866.4	0.00	0.00	0.00
14,400.0	90.00	270.84	7,606.2	-1,879.96	-487.7	-5,949.5	5,966.2	0.00	0.00	0.00
14,500.0	90.00	270.84	7,606.2	-1,879.96	-486.2	-6,049.5	6,066.0	0.00	0.00	0.00
14,600.0	90.00	270.84	7,606.2	-1,879.96	-484.8	-6,149.5	6,165.8	0.00	0.00	0.00
14,700.0	90.00	270.84	7,606.2	-1,879.96	-483.3	-6,249.5	6,265.6	0.00	0.00	0.00
14,800.0	90.00	270.84	7,606.2	-1,879.96	-481.8	-6,349.5	6,365.4	0.00	0.00	0.00
14,900.0	90.00	270.84	7,606.2	-1,879.96	-480.4	-6,449.5	6,465.2	0.00	0.00	0.00
15,000.0	90.00	270.84	7,606.2	-1,879.96	-478.9	-6,549.5	6,565.0	0.00	0.00	0.00
15,100.0	90.00	270.84	7,606.2	-1,879.96	-477.4	-6,649.5	6,664.8	0.00	0.00	0.00
15,200.0	90.00	270.84	7,606.2	-1,879.96	-476.0	-6,749.5	6,764.6	0.00	0.00	0.00
15,300.0	90.00	270.84	7,606.2	-1,879.96	-474.5	-6,849.5	6,864.4	0.00	0.00	0.00
15,400.0	90.00	270.84	7,606.2	-1,879.96	-473.0	-6,949.4	6,964.2	0.00	0.00	0.00
15,500.0	90.00	270.84	7,606.2	-1,879.96	-471.6	-7,049.4	7,064.0	0.00	0.00	0.00
15,600.0	90.00	270.84	7,606.2	-1,879.96	-470.1	-7,149.4	7,163.8	0.00	0.00	0.00
15,700.0	90.00	270.84	7,606.2	-1,879.96	-468.6	-7,249.4	7,263.6	0.00	0.00	0.00
15,800.0	90.00	270.84	7,606.2	-1,879.96	-467.2	-7,349.4	7,363.4	0.00	0.00	0.00
15,900.0	90.00	270.84	7,606.2	-1,879.96	-465.7	-7,449.4	7,463.2	0.00	0.00	0.00
16,000.0	90.00	270.84	7,606.2	-1,879.96	-464.2	-7,549.4	7,563.0	0.00	0.00	0.00
16,100.0	90.00	270.84	7,606.2	-1,879.96	-462.8	-7,649.4	7,662.8	0.00	0.00	0.00
16,200.0	90.00	270.84	7,606.2	-1,879.96	-461.3	-7,749.4	7,762.6	0.00	0.00	0.00
16,300.0	90.00	270.84	7,606.2	-1,879.96	-459.8	-7,849.3	7,862.4	0.00	0.00	0.00
16,400.0	90.00	270.84	7,606.2	-1,879.96	-458.4	-7,949.3	7,962.2	0.00	0.00	0.00
16,500.0	90.00	270.84	7,606.2	-1,879.96	-456.9	-8,049.3	8,062.0	0.00	0.00	0.00
16,600.0	90.00	270.84	7,606.2	-1,879.96	-455.4	-8,149.3	8,161.8	0.00	0.00	0.00
16,700.0	90.00	270.84	7,606.2	-1,879.96	-454.0	-8,249.3	8,261.6	0.00	0.00	0.00
16,800.0	90.00	270.84	7,606.2	-1,879.96	-452.5	-8,349.3	8,361.4	0.00	0.00	0.00
16,900.0	90.00	270.84	7,606.2	-1,879.96	-451.0	-8,449.3	8,461.2	0.00	0.00	0.00
17,000.0	90.00	270.84	7,606.2	-1,879.96	-449.6	-8,549.3	8,561.0	0.00	0.00	0.00
17,100.0	90.00	270.84	7,606.2	-1,879.96	-448.1	-8,649.3	8,660.8	0.00	0.00	0.00
17,200.0	90.00	270.84	7,606.2	-1,879.96	-446.6	-8,749.2	8,760.6	0.00	0.00	0.00
17,300.0	90.00	270.84	7,606.2	-1,879.96	-445.2	-8,849.2	8,860.4	0.00	0.00	0.00
17,400.0	90.00	270.84	7,606.2	-1,879.96	-443.7	-8,949.2	8,960.2	0.00	0.00	0.00
17,500.0	90.00	270.84	7,606.2	-1,879.96	-442.2	-9,049.2	9,060.0	0.00	0.00	0.00
BHL: 2490ft FNL & 460ft FWL of Sec 21										
17,538.7	90.00	270.84	7,606.2	-1,880.00	-441.7	-9,088.0	9,098.7	0.00	0.00	0.00

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-8
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5726.2usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-8	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey										
MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)

Formations						
MD (usft)	TVD (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
313.4	313.2	DENVER				
804.9	798.2	UPPER ARAPAHOE				
1,101.3	1,088.2	LOWER ARAPAHOE				
1,667.7	1,642.2	LARAMIE - FOX HILLS				
1,874.2	1,844.2	PIERRE SHALE (BASE FOX HILLS				
5,362.5	5,256.2	SHANNON SANDSTONE MBR				
7,450.2	7,321.2	SHARON SPRINGS SHALE				
7,516.2	7,376.2	NIOBRARA FORMATION				
7,528.8	7,386.2	NIOBRARA A CHALK				
7,704.9	7,506.2	NIOBRARA B CHALK				
7,896.8	7,586.2	NIOBRARA C CHALK				

Plan Annotations				
MD (usft)	TVD (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
0.0	0.0	0.0	0.0	SHL: 1914ft FNL & 1005ft FEL of Sec 22
100.0	100.0	0.0	0.0	START NUDGE (2°/100ft BUR)
700.0	695.7	-32.4	53.6	EOB TO 12° INC
5,573.4	5,462.5	-556.8	920.6	END OF TANGENT
6,173.5	6,058.2	-589.2	974.2	EOD TO VERTICAL
7,148.5	7,033.2	-589.2	974.2	KOP (10°/100ft BUR)
7,909.2	7,589.3	-582.8	539.2	BEGIN PROD INTERVAL
8,048.5	7,606.2	-580.8	401.3	HZ LP *NEW*: 2490ft FNL & 597.9ft FEL of Sec 22
17,538.7	7,606.2	-441.7	-9,088.0	BHL: 2490ft FNL & 460ft FWL of Sec 21