

# **PDC ENERGY**

**WELD COUNTY, COLORADO  
NW NW SEC. 19 T4N R63W 6th P.M.  
SATER 19E-223  
JOB #2016-005-135**

**09 February, 2016**

**Survey: FINAL SURVEYS**





Project: WELD COUNTY, COLORADO  
Site: NW NW SEC. 19 T4N R63W 6th P.M.  
Well: SATER 19E-223  
Wellbore: JOB #2016-005-135  
Design: FINAL SURVEYS

ANNOTATIONS

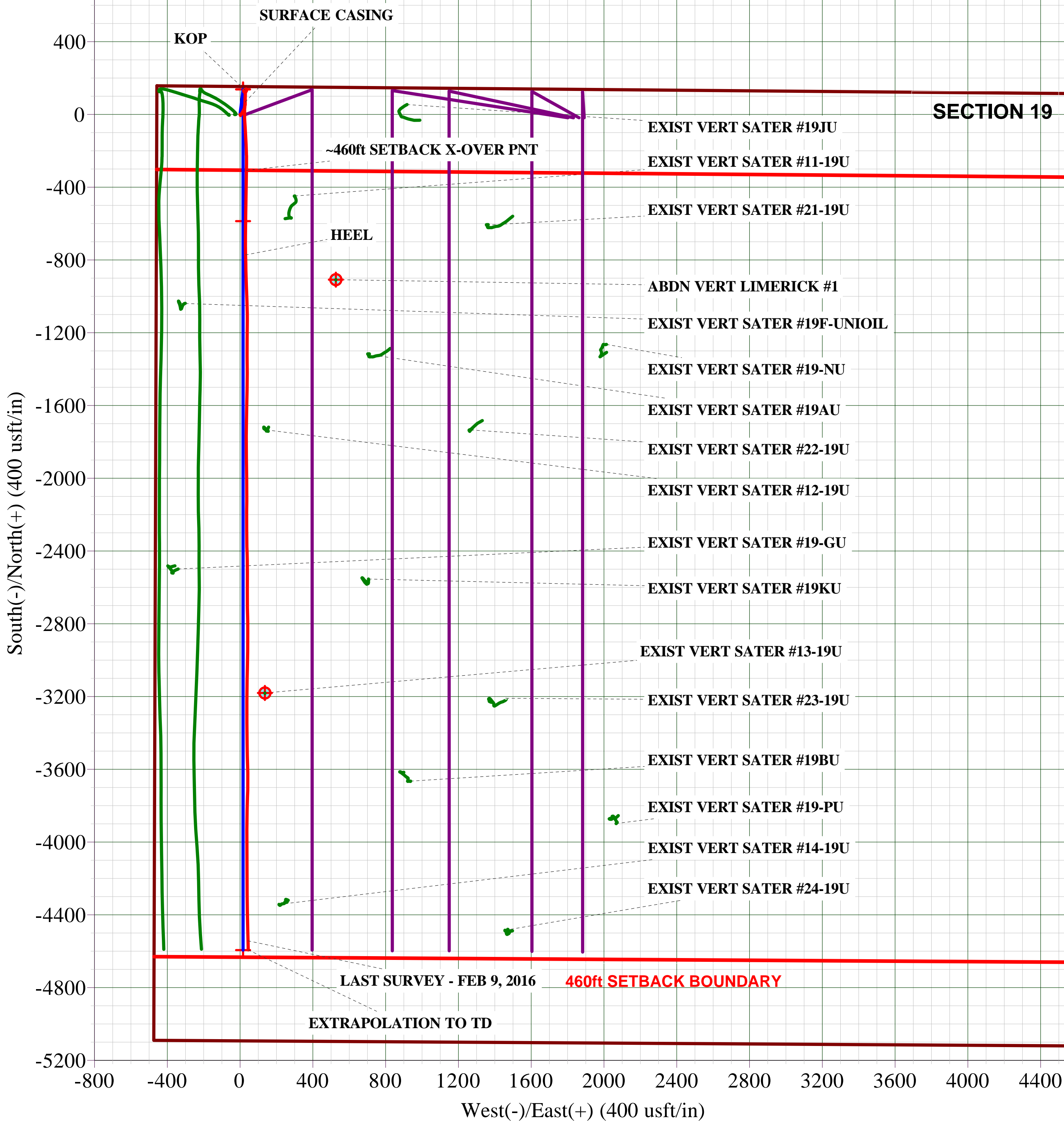
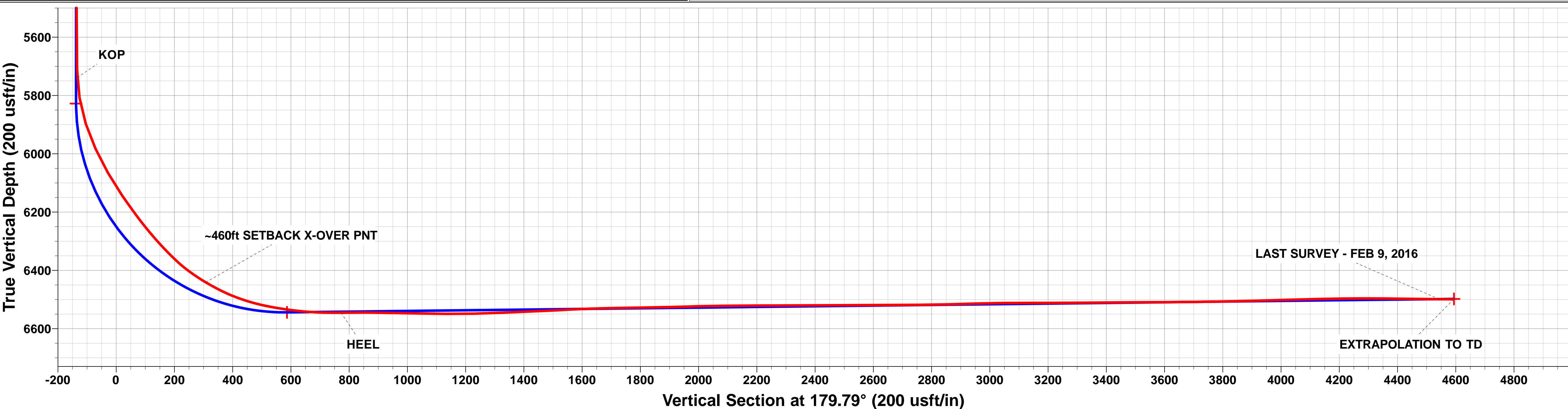
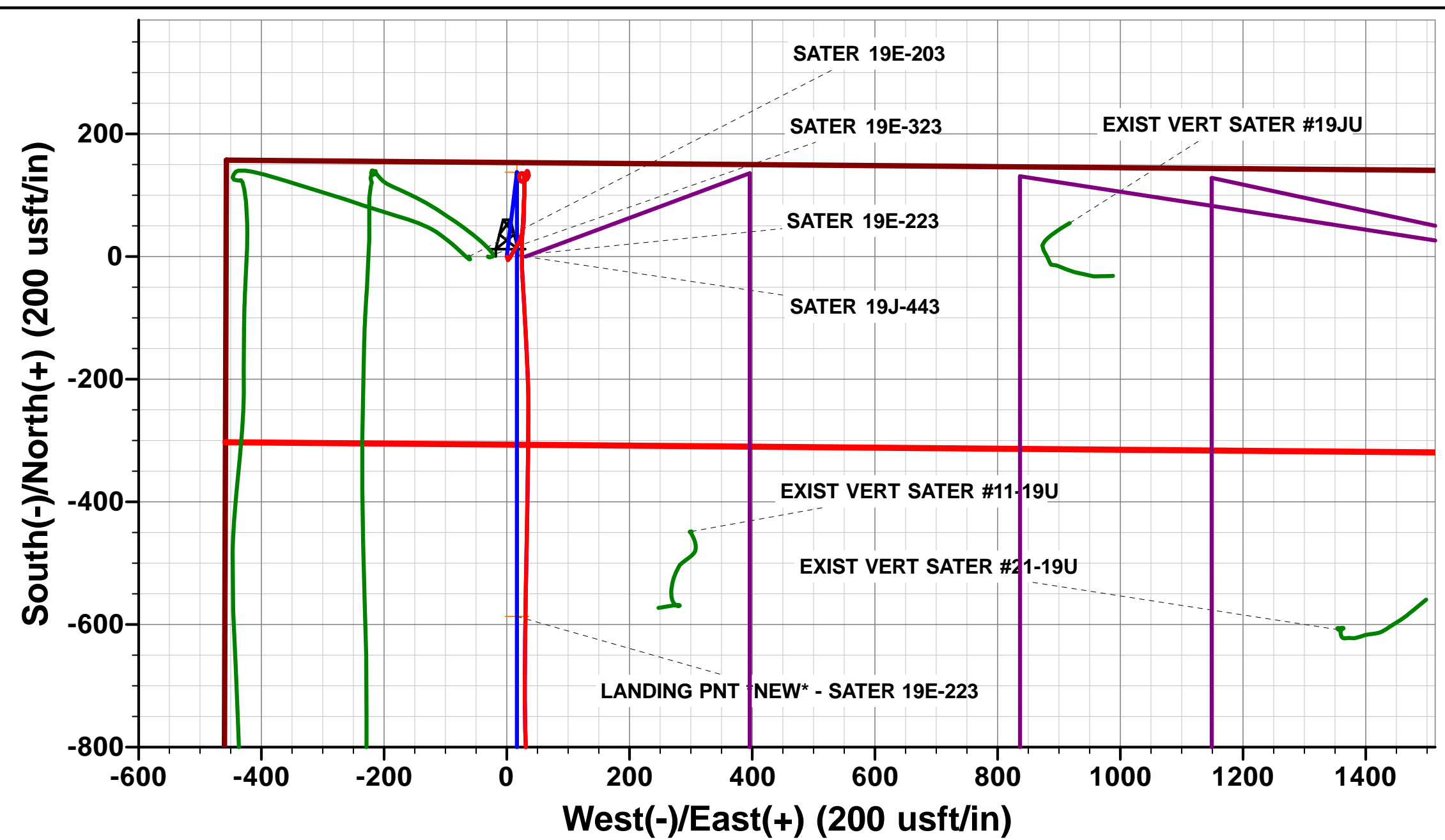
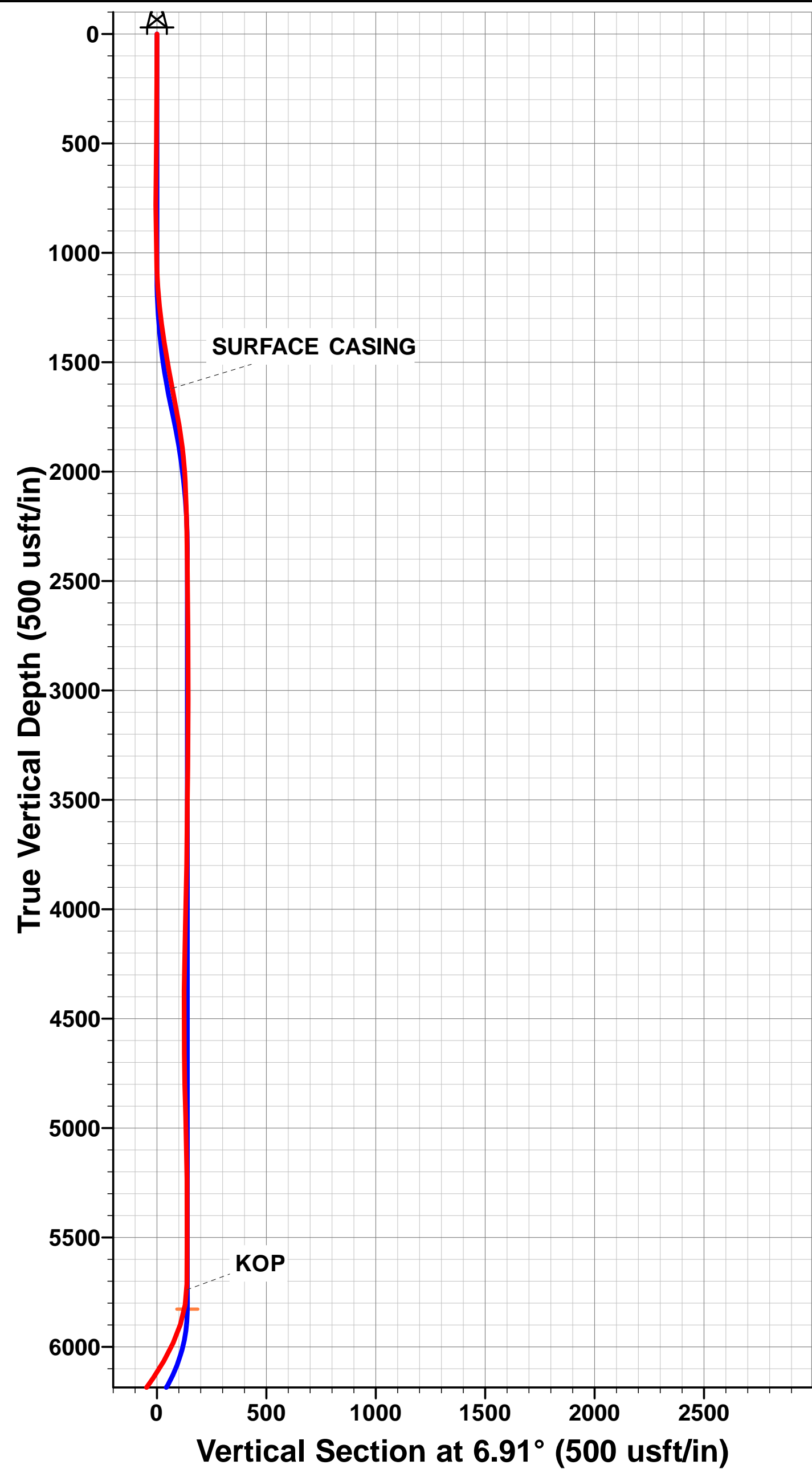
TVD	MD	Inc	Azi	+N/-S	+E/-W	VSect	Dep	Annotation
1619.3	1625.0	10.93	1.36	67.8	27.8	-67.7	89.6	SURFACE CASING
5739.2	5750.0	2.87	167.60	133.6	28.2	-133.5	222.7	KOP
6440.9	6605.0	59.18	180.79	-307.3	35.0	307.4	663.5	~460ft SETBACK X-OVER PNT
6545.3	7088.0	90.08	178.77	-772.2	30.2	772.3	1127.8	HEEL
6498.9	10860.0	89.60	178.40	-4542.9	43.8	4543.0	4899.0	LAST SURVEY - FEB 9, 2016
6499.3	10910.0	89.60	178.40	-4592.9	45.2	4593.0	4949.0	EXTRAPOLATION TO TD

AS DRILLED LOCAL COORDINATES:

SHL: 154ft FNL & 456t FWL Sec 19  
HZ LP: 924.9ft FNL & 488.3ft FWL Sec 19  
BHL: 501ft FSL & 516.5ft FWL Sec 19

WELLBORE TARGET DETAILS (LAT/LONG)

Name	TVD	+N/-S	+E/-W	Latitude	Longitude
BHL - SATER 19E-223	6498.0	-4593.9	16.7	40.291870	-104.487990
KOP - SATER 19E-223	5827.9	137.7	16.7	40.304858	-104.487990
LANDING PNT *NEW* - SATER 19E-223	6544.0	-586.7	16.7	40.302870	-104.487990



# Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well SATER 19E-223
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Site:</b>	NW NW SEC. 19 T4N R63W 6th P.M.	<b>MD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Well:</b>	SATER 19E-223	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB #2016-005-135	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

<b>Project</b>	WELD COUNTY, COLORADO		
<b>Map System:</b>	US State Plane 1983	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	North American Datum 1983		
<b>Map Zone:</b>	Colorado Northern Zone		Using geodetic scale factor

Site	NW NW SEC. 19 T4N R63W 6th P.M.				
Site Position:		Northing:	1,355,372.81 usft	Latitude:	40.304480
From:	Lat/Long	Easting:	3,282,168.18 usft	Longitude:	-104.488270
Position Uncertainty:	0.0 usft	Slot Radius:	1.10000ft	Grid Convergence:	0.65 °

Well	SATER 19E-223					
Well Position	+N-S	0.0 usft	Northing:	1,355,373.49 usft	Latitude:	40.304480
	+E-W	0.0 usft	Easting:	3,282,229.53 usft	Longitude:	-104.488050
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	4,660.0 usft

<b>Wellbore</b>	JOB #2016-005-135				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2015	30/12/2015	8.21	66.86	52,540

<b>Design</b>	FINAL SURVEYS				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.0
<b>Vertical Section:</b>	<b>Depth From (TVD) (usft)</b>	<b>+N-S (usft)</b>	<b>+E-W (usft)</b>	<b>Direction (°)</b>	
	0.0	0.0	0.0	179.79	

<b>Survey Program</b>	<b>Date</b>	09/02/2016			
<b>From (usft)</b>	<b>To (usft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
226.0	10,910.0	FINAL SURVEYS (JOB #2016-005-135)	MWD	MWD - Standard	

<b>Survey</b>										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N-S (usft)	+E-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.0	0.00	0.00	0.0	4,673.0	0.0	0.0	0.0	0.00	0.00	0.00
226.0	0.40	147.00	226.0	4,447.0	-0.7	0.4	0.7	0.18	0.18	0.00
502.0	0.50	164.00	502.0	4,171.0	-2.6	1.3	2.6	0.06	0.04	6.16
782.0	0.80	172.80	782.0	3,891.0	-5.7	1.9	5.7	0.11	0.11	3.14
1,069.0	2.80	27.90	1,068.9	3,604.1	-1.5	5.4	1.6	1.21	0.70	-50.49
1,356.0	8.40	29.70	1,354.4	3,318.6	22.9	19.1	-22.8	1.95	1.95	0.63
1,578.0	11.30	1.30	1,573.2	3,099.8	58.7	27.6	-58.6	2.51	1.31	-12.79
<b>SURFACE CASING</b>										
1,625.0	10.93	1.36	1,619.3	3,053.7	67.8	27.8	-67.7	0.79	-0.79	0.12
1,794.0	9.60	1.60	1,785.6	2,887.4	97.9	28.6	-97.8	0.79	-0.79	0.14
2,081.0	2.40	356.10	2,070.9	2,602.1	127.9	28.9	-127.8	2.51	-2.51	-1.92
2,368.0	0.90	49.80	2,357.8	2,315.2	135.3	30.2	-135.2	0.70	-0.52	18.71
2,656.0	0.40	23.00	2,645.7	2,027.3	137.7	32.3	-137.6	0.20	-0.17	-9.31

## Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well SATER 19E-223
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Site:</b>	NW NW SEC. 19 T4N R63W 6th P.M.	<b>MD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Well:</b>	SATER 19E-223	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB #2016-005-135	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

## Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
2,943.0	0.50	23.50	2,932.7	1,740.3	139.8	33.2	-139.7	0.03	0.03	0.17
3,231.0	0.90	156.90	3,220.7	1,452.3	138.8	34.6	-138.7	0.45	0.14	46.32
3,519.0	0.60	186.90	3,508.7	1,164.3	135.3	35.3	-135.1	0.17	-0.10	10.42
3,807.0	0.70	153.10	3,796.7	876.3	132.2	35.9	-132.1	0.14	0.03	-11.74
4,094.0	2.10	217.90	4,083.6	589.4	126.5	33.5	-126.4	0.67	0.49	22.58
4,382.0	1.60	262.70	4,371.5	301.5	121.8	26.2	-121.7	0.52	-0.17	15.56
4,670.0	0.80	348.20	4,659.4	13.6	123.3	21.8	-123.2	0.60	-0.28	29.69
4,958.0	1.80	345.30	4,947.3	-274.3	129.6	20.3	-129.5	0.35	0.35	-1.01
5,245.0	1.60	63.70	5,234.2	-561.2	135.8	22.7	-135.7	0.75	-0.07	27.32
5,532.0	0.70	173.60	5,521.2	-848.2	135.8	26.5	-135.7	0.68	-0.31	38.29
5,724.0	0.80	104.40	5,713.2	-1,040.2	134.3	27.9	-134.2	0.45	0.05	-36.04
<b>KOP</b>										
5,750.0	2.87	167.60	5,739.2	-1,066.2	133.6	28.2	-133.5	10.02	7.94	243.09
5,819.0	9.70	178.90	5,807.7	-1,134.7	126.1	28.7	-126.0	10.02	9.90	16.37
5,911.0	17.50	180.80	5,897.1	-1,224.1	104.5	28.7	-104.4	8.49	8.48	2.07
6,003.0	25.20	183.50	5,982.7	-1,309.7	71.1	27.3	-71.0	8.44	8.37	2.93
6,096.0	29.60	183.10	6,065.2	-1,392.2	28.3	24.8	-28.2	4.74	4.73	-0.43
6,188.0	34.50	177.10	6,143.2	-1,470.2	-20.4	24.9	20.5	6.35	5.33	-6.52
6,280.0	36.90	176.30	6,217.9	-1,544.9	-74.0	28.0	74.1	2.66	2.61	-0.87
6,372.0	41.30	177.20	6,289.3	-1,616.3	-131.9	31.3	132.0	4.82	4.78	0.98
6,464.0	45.60	177.40	6,356.1	-1,683.1	-195.1	34.3	195.2	4.68	4.67	0.22
6,560.0	55.90	180.60	6,416.7	-1,743.7	-269.3	35.4	269.4	11.03	10.73	3.33
<b>-460ft SETBACK X-OVER PNT</b>										
6,605.0	59.18	180.79	6,440.9	-1,767.9	-307.3	35.0	307.4	7.30	7.29	0.43
6,656.0	62.90	181.00	6,465.6	-1,792.6	-351.9	34.3	352.0	7.30	7.29	0.40
6,751.0	71.90	180.70	6,502.1	-1,829.1	-439.5	33.0	439.6	9.48	9.47	-0.32
6,847.0	79.70	181.00	6,525.6	-1,852.6	-532.5	31.6	532.6	8.13	8.12	0.31
6,942.0	83.70	181.10	6,539.3	-1,866.3	-626.5	29.9	626.6	4.21	4.21	0.11
7,038.0	89.40	179.40	6,545.1	-1,872.1	-722.2	29.4	722.3	6.19	5.94	-1.77
<b>HEEL</b>										
7,088.0	90.08	178.77	6,545.3	-1,872.3	-772.2	30.2	772.3	1.86	1.37	-1.26
7,133.0	90.70	178.20	6,545.0	-1,872.0	-817.2	31.4	817.3	1.86	1.37	-1.26
7,229.0	88.70	178.80	6,545.5	-1,872.5	-913.2	33.9	913.3	2.18	-2.08	0.62
7,355.0	89.10	177.30	6,547.9	-1,874.9	-1,039.1	38.2	1,039.2	1.23	0.32	-1.19
7,451.0	89.20	180.60	6,549.3	-1,876.3	-1,135.0	40.0	1,135.2	3.44	0.10	3.44
7,546.0	91.70	180.50	6,548.6	-1,875.6	-1,230.0	39.1	1,230.1	2.63	2.63	-0.11
7,642.0	92.20	179.90	6,545.3	-1,872.3	-1,326.0	38.7	1,326.1	0.81	0.52	-0.62
7,738.0	92.90	179.50	6,541.1	-1,868.1	-1,421.9	39.2	1,422.0	0.84	0.73	-0.42
7,833.0	92.20	181.40	6,536.8	-1,863.8	-1,516.8	38.5	1,516.9	2.13	-0.74	2.00
7,929.0	93.30	181.00	6,532.2	-1,859.2	-1,612.6	36.5	1,612.7	1.22	1.15	-0.42
8,025.0	90.50	180.90	6,529.0	-1,856.0	-1,708.5	34.9	1,708.7	2.92	-2.92	-0.10
8,121.0	90.90	179.90	6,527.9	-1,854.9	-1,804.5	34.2	1,804.7	1.12	0.42	-1.04
8,215.0	91.50	179.40	6,525.9	-1,852.9	-1,898.5	34.8	1,898.6	0.83	0.64	-0.53
8,311.0	91.70	178.50	6,523.2	-1,850.2	-1,994.5	36.6	1,994.6	0.96	0.21	-0.94
8,406.0	90.40	180.90	6,521.5	-1,848.5	-2,089.4	37.1	2,089.6	2.87	-1.37	2.53
8,502.0	90.30	180.00	6,520.9	-1,847.9	-2,185.4	36.3	2,185.5	0.94	-0.10	-0.94
8,598.0	90.20	179.70	6,520.5	-1,847.5	-2,281.4	36.6	2,281.5	0.33	-0.10	-0.31
8,694.0	90.20	179.10	6,520.1	-1,847.1	-2,377.4	37.6	2,377.5	0.62	0.00	-0.62
8,790.0	90.30	178.40	6,519.7	-1,846.7	-2,473.4	39.7	2,473.5	0.74	0.10	-0.73
8,885.0	90.40	180.80	6,519.1	-1,846.1	-2,568.4	40.3	2,568.5	2.53	0.11	2.53
8,981.0	90.20	179.60	6,518.6	-1,845.6	-2,664.4	40.0	2,664.5	1.27	-0.21	-1.25
9,077.0	90.20	178.50	6,518.3	-1,845.3	-2,760.4	41.6	2,760.5	1.15	0.00	-1.15
9,173.0	91.60	180.70	6,516.8	-1,843.8	-2,856.3	42.2	2,856.5	2.72	1.46	2.29

# Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well SATER 19E-223
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Site:</b>	NW NW SEC. 19 T4N R63W 6th P.M.	<b>MD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Well:</b>	SATER 19E-223	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB #2016-005-135	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	Subsea Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
9,269.0	91.90	180.00	6,513.9	-1,840.9	-2,952.3	41.7	2,952.4	0.79	0.31	-0.73
9,364.0	90.20	181.80	6,512.1	-1,839.1	-3,047.3	40.2	3,047.4	2.61	-1.79	1.89
9,459.0	90.20	180.70	6,511.8	-1,838.8	-3,142.2	38.1	3,142.4	1.16	0.00	-1.16
9,555.0	90.20	179.90	6,511.4	-1,838.4	-3,238.2	37.6	3,238.3	0.83	0.00	-0.83
9,651.0	90.50	179.90	6,510.9	-1,837.9	-3,334.2	37.8	3,334.3	0.31	0.31	0.00
9,747.0	90.50	179.40	6,510.0	-1,837.0	-3,430.2	38.3	3,430.3	0.52	0.00	-0.52
9,842.0	90.10	178.80	6,509.5	-1,836.5	-3,525.2	39.8	3,525.3	0.76	-0.42	-0.63
9,937.0	90.30	178.10	6,509.2	-1,836.2	-3,620.2	42.4	3,620.3	0.77	0.21	-0.74
10,033.0	90.90	182.20	6,508.2	-1,835.2	-3,716.2	42.2	3,716.3	4.32	0.62	4.27
10,129.0	91.20	181.40	6,506.4	-1,833.4	-3,812.1	39.1	3,812.2	0.89	0.31	-0.83
10,224.0	91.40	180.50	6,504.3	-1,831.3	-3,907.0	37.6	3,907.2	0.97	0.21	-0.95
10,320.0	91.60	179.40	6,501.8	-1,828.8	-4,003.0	37.6	4,003.1	1.16	0.21	-1.15
10,416.0	91.40	180.20	6,499.2	-1,826.2	-4,099.0	38.0	4,099.1	0.86	-0.21	0.83
10,511.0	91.20	179.70	6,497.1	-1,824.1	-4,194.0	38.1	4,194.1	0.57	-0.21	-0.53
10,607.0	89.70	179.30	6,496.3	-1,823.3	-4,289.9	38.9	4,290.1	1.62	-1.56	-0.42
10,703.0	89.30	179.00	6,497.2	-1,824.2	-4,385.9	40.3	4,386.0	0.52	-0.42	-0.31
10,799.0	89.30	178.70	6,498.4	-1,825.4	-4,481.9	42.3	4,482.0	0.31	0.00	-0.31
LAST SURVEY - FEB 9, 2016										
10,860.0	89.60	178.40	6,498.9	-1,825.9	-4,542.9	43.8	4,543.0	0.70	0.49	-0.49
EXTRAPOLATION TO TD										
10,910.0	89.60	178.40	6,499.3	-1,826.3	-4,592.9	45.2	4,593.0	0.00	0.00	0.00

# Survey Report



<b>Company:</b>	PDC ENERGY	<b>Local Co-ordinate Reference:</b>	Well SATER 19E-223
<b>Project:</b>	WELD COUNTY, COLORADO	<b>TVD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Site:</b>	NW NW SEC. 19 T4N R63W 6th P.M.	<b>MD Reference:</b>	KB @ 4673.0usft (ENS 135)
<b>Well:</b>	SATER 19E-223	<b>North Reference:</b>	True
<b>Wellbore:</b>	JOB #2016-005-135	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	FINAL SURVEYS	<b>Database:</b>	EDM 5000.1 Single User Db

Targets									
Target Name	- hit/miss target	Dip Angle	Dip Dir.	TVD	+N-S	+E-W	Northing	Easting	
- Shape		(°)	(°)	(usft)	(usft)	(usft)	(usft)	(usft)	
EXIST VERT SATER		0.00	0.00	7,317.0	-3,180.4	136.7	1,352,195.02	3,282,402.50	40.295750
- survey misses target center by 811.4usft at 9493.8usft MD (6511.7 TVD, -3177.0 N, 37.8 E)									-104.487560
- Circle (radius 30.0)									
KOP - SATER 19E-22		0.00	0.00	5,827.9	137.7	16.7	1,355,511.38	3,282,244.66	40.304858
- survey misses target center by 19.3usft at 5835.9usft MD (5824.3 TVD, 123.0 N, 28.8 E)									-104.487990
- Point									
BHL - SATER 19E-22		0.00	0.00	6,498.0	-4,593.9	16.7	1,350,780.31	3,282,298.69	40.291870
- survey misses target center by 28.5usft at 10910.0usft MD (6499.3 TVD, -4592.9 N, 45.2 E)									-104.487990
- Point									
LANDING PNT *NEW		0.00	0.00	6,544.0	-586.7	16.7	1,354,787.05	3,282,252.93	40.302870
- survey misses target center by 16.9usft at 6903.6usft MD (6534.5 TVD, -588.3 N, 30.6 E)									-104.487990
- Point									
ABDN VERT LIMERIC		0.00	0.00	7,207.0	-908.2	526.6	1,354,471.40	3,282,766.45	40.301987
- survey misses target center by 824.6usft at 7253.5usft MD (6546.0 TVD, -937.7 N, 34.5 E)									-104.486162
- Circle (radius 30.0)									

Survey Annotations				
Measured Depth	Vertical Depth	Local Coordinates		Comment
(usft)	(usft)	+N-S	+E-W	
(usft)	(usft)	(usft)	(usft)	
1,625.0	1,619.3	67.8	27.8	SURFACE CASING
5,750.0	5,739.2	133.6	28.2	KOP
6,605.0	6,440.9	-307.3	35.0	~460ft SETBACK X-OVER PNT
7,088.0	6,545.3	-772.2	30.2	HEEL
10,860.0	6,498.9	-4,542.9	43.8	LAST SURVEY - FEB 9, 2016
10,910.0	6,499.3	-4,592.9	45.2	EXTRAPOLATION TO TD

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_