

CIRCA CLEANOUT SIMULATION GRAPH

Dimension Bid

Important parameter for cleanout

- Reservoir Details (Pressure, Temperature)
- Well Details (Accessories, Completion size)
- Fill Characteristic (Size and geometry, volume)
- CT String & BHA

Important parameter for cleanout

➤ Reservoir Details (Pressure, Temperature)

Flow Summary

SUMMARY OF FLOW RESULTS

Produced Fluids	
Pressure known at:	Perforations
Production Mode:	No Production
Fluid Composition:	Oil Only
Circulated Fluids	
Fluid Composition:	Nitrified Water
Liquid:	1.00 bbl/min
Solids:	0.00 bbl/min
Gas:	300.0 scf/min
Circulation Point:	1485.00 m
HHP Required :	76.22 HP

COMPLETION:

Wellhead Pressure.....	121.6 psi g
Hydrostatic pressure loss.....	722.2 psi
Friction pressure loss.....	101.4 psi
Kinetic pressure loss.....	-0.3 psi
Restriction pressure loss.....	0.1 psi
Equivalent Circulation Density[ECD]...	3.97 lb/gal (US)

Perforation Pressure.....	945.0 psi g
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Hydrostatic pressure loss.....	90.4 psi
Friction pressure loss.....	37.0 psi
Kinetic pressure loss.....	-0.1 psi
Restriction pressure loss.....	0.7 psi

Bottom Hole Pressure.....	1072.9 psi g
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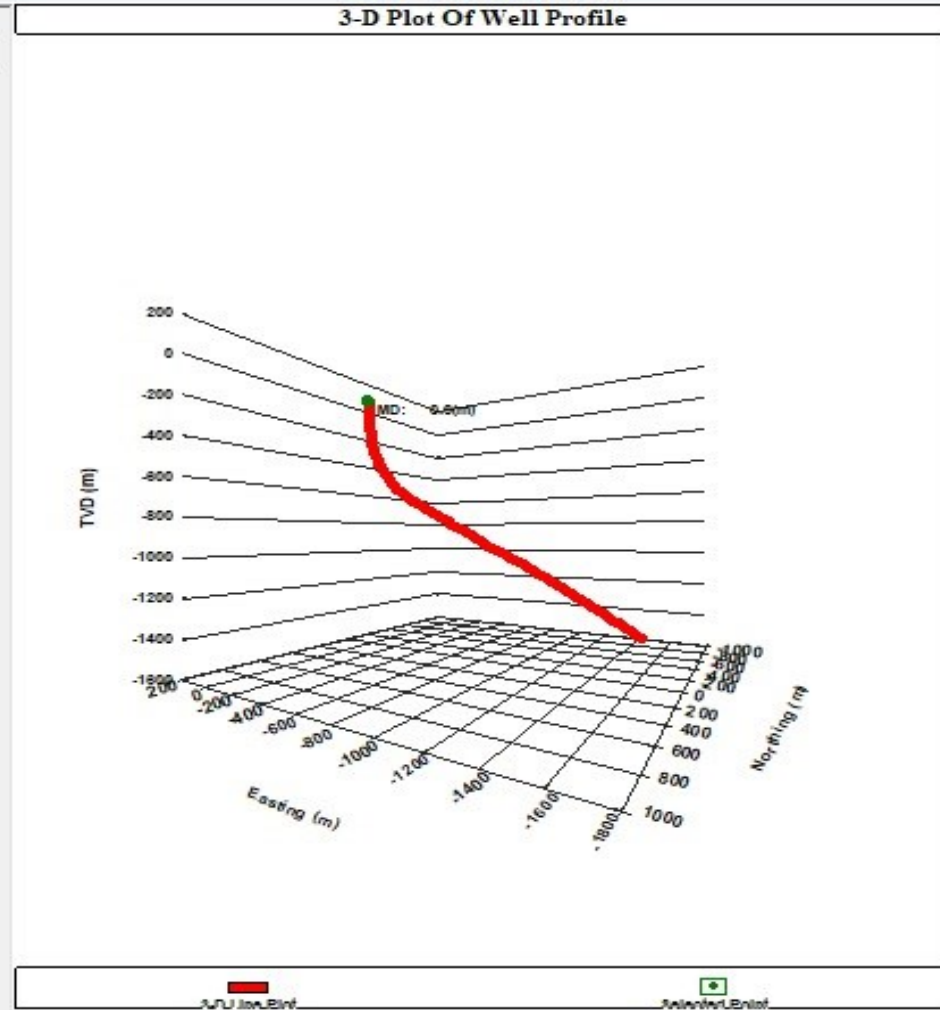
FROM CIRCULATION POINT TO WELLHEAD:

Liquid transit time.....	12 min
Gas transit time.....	9 min
Annular volume.....	29.8 bbl

Important parameter for cleanout

Well Details (Accessories, Completion size)

#	TVD (m)
1	0.000
2	39.136
3	106.670
4	119.553
5	129.427
6	139.296
7	149.156
8	159.012
9	168.871
10	178.765
11	184.658
12	209.211
13	236.277
14	264.215
15	291.873
16	319.151
17	345.830
18	371.864



Well Data | Rig Up | Job Design | Transient | Reports | Graphs

Well Profile | Completion | Production | Temperature

Components | Gas Lift

Complex Annulus

Consider Helical Deformation of the Completion Completion Material Def...

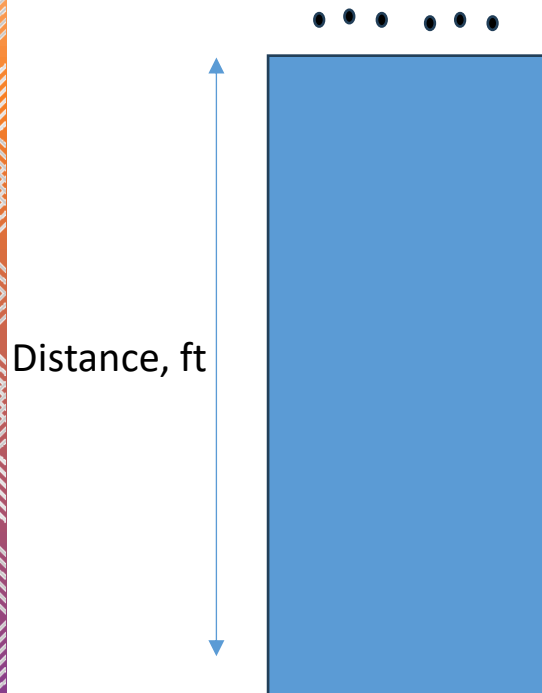
Set Down Weight: 0.00 lbf

Component	From m	To m	ID in
API Tubing	0.000	2107.000	2.992
SSSV	147.700		2.813
Nipple	300.900		2.813
Side Door	1898.900		2.813
Packer	1904.600		2.887
Side Door	1918.900		2.813
Nipple	1991.600		2.813
Packer	1996.600		2.887
Side Door	2003.700		2.813
Nipple	2017.900		2.813
Packer	2023.000		2.887
Side Door	2028.000		2.813
Nipple	2073.800		2.813
Nono Nipple	2086.000		2.750

Important parameter for cleanout

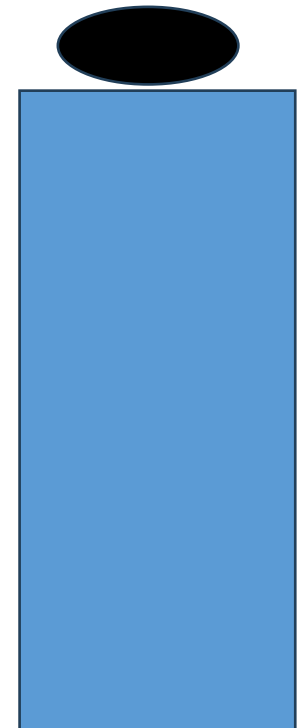
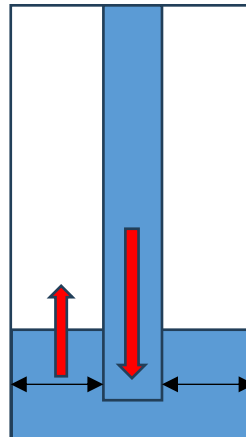
- Fill Characteristic (Size and geometry, volume)

$$\text{Settling Velocity} = \text{Distance} / \text{Time}$$



$$\text{Annular Velocity} = \text{Flowrate} / \text{Annular Capacity}$$

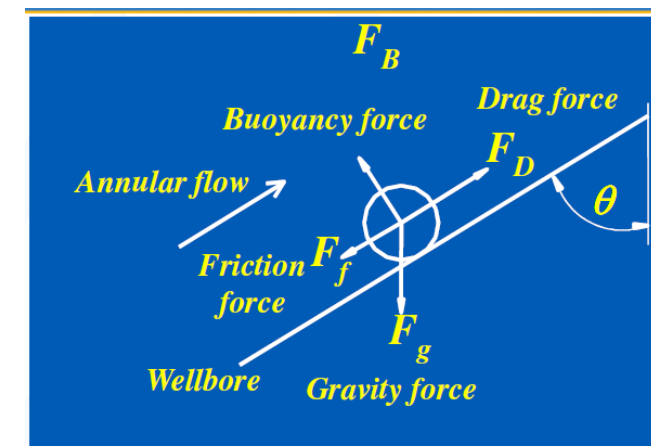
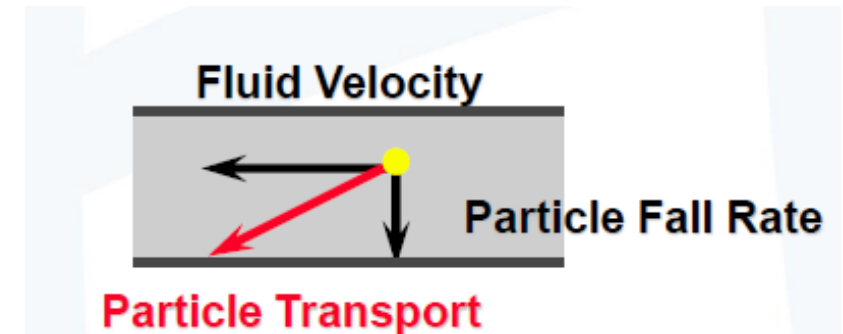
Q, Flowrate



Basic Rule of Thumb for Cleanout

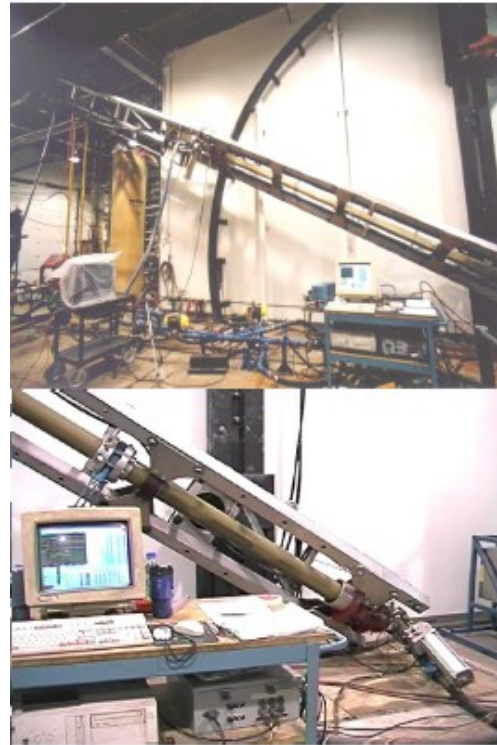
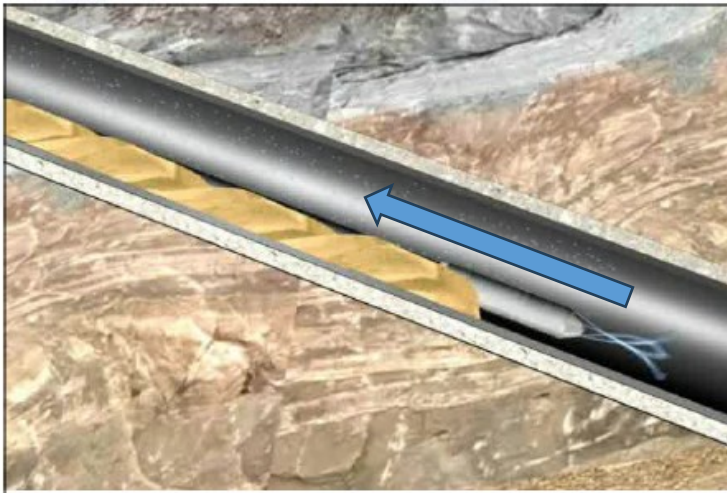
- Basic rule of thumb for solid lifting is Fluid Annular velocity > Settling velocity .
- For reference only, the recommended speed of fluid as per table below :

Hole Size/ Orientation API Units	ft/min
Vertical	50
4.75" OH – 5.5" Casing	180
6.25" OH / 7" Casing	200



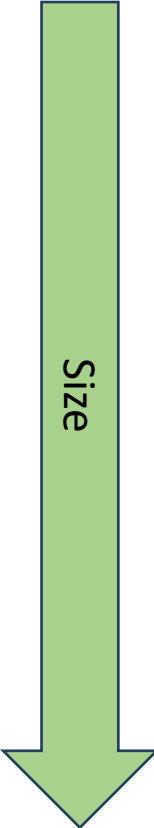
Basic Rule of Thumb for Cleanout

- However CIRCA is more Accurate, using empirical Data (Testing actual condition) inside the software :
- Fit math model to the data and Integrate math model result into CIRCA



Preset Fill Data in CIRCA- CTRAN

Formation Sand	Irregular shape & size SG 2.65 Size Range: 0.001 to 0.190 inches
20 / 40 Carbolite	Spherical particles SG 2.71 Size Range: 0.017 to 0.033 inches
20 / 40 Bauxite	Spherical particles SG 3.56 Size Range: 0.017 to 0.033 inches
7mm Rock Chips	Irregular shape SG 2.71 Size Range: 0.25 to 0.3 inches



CT String & BHA

Well Data | Rig Up | Job Design | Transient | Reports | Graphs

Surface Equipment | Work String | Bottom Hole Assembly

Internal Cable Option Cable Definition

OD upsets Upset OD: in Joint Length: m

Import cycle string file... Load CTES string data... Load GLOBAL CSV string data...

Length m	OD in	Whip End Thickness in	True-Taper (R)	Continuously-Tapered
4412.590	1.500	0.125	<input type="checkbox"/>	<input type="checkbox"/>

Calculate WS Internal Vol.: 21.97 bbl
 WS Total Length: 4412.590 m
 WS Total Weight: 26574.20 lb

Well Data | Rig Up | Job Design | Transient | Reports | Graphs

Surface Equipment | Work String | Bottom Hole Assembly

BHA Components BPV/PDM/Nozzle/Tornado Roto-Jet/Separator

BHA Shear Limit 0.00 lbf BHA Compression Limit 0.00 lbf

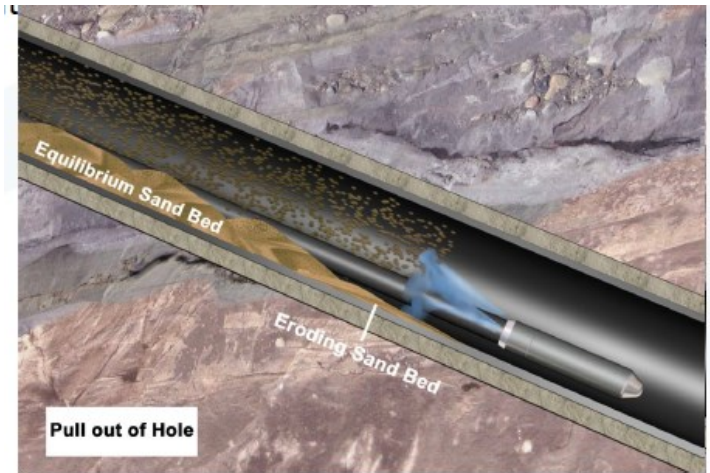
Calculate Ball Drop Travel Time Steel Ball Size: 0.50 in

Burst Pressure: psi Tolerance (%):

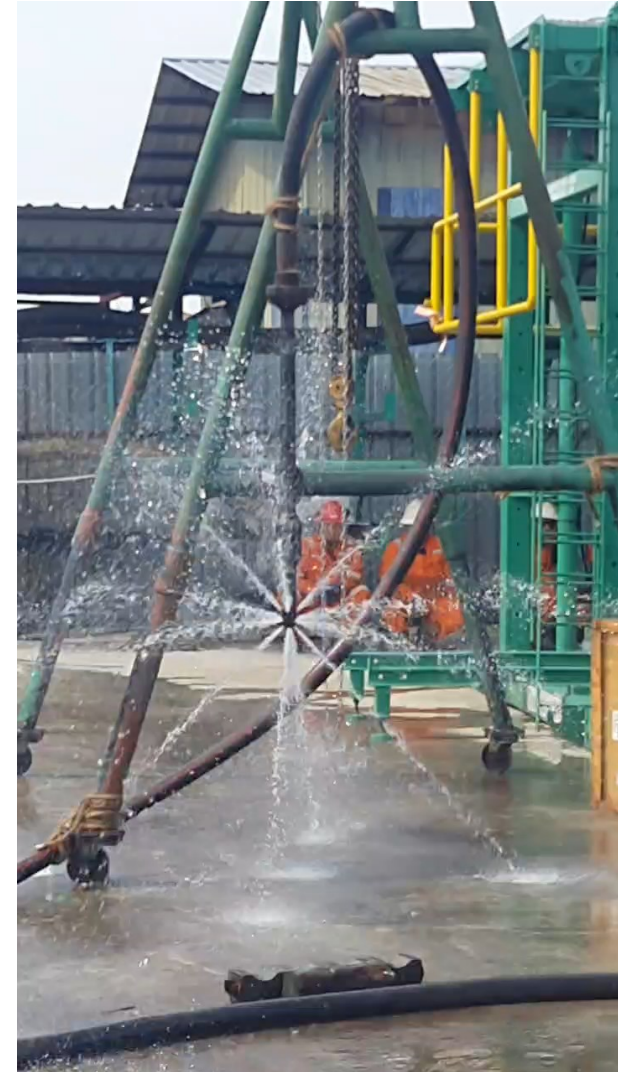
TeleCoil Type:

Component	Length ft	ID in	OD in	Roller
End Connector	0.80	1.000	2.125	1.0
Motorhead Assembly	2.50	1.000	2.125	1.0
Downhole Filter	3.20	1.000	2.125	1.0
Nozzle	1.00			

Calculate BHA Weight: 61.01 lb
 BHA Length: 7.50 ft

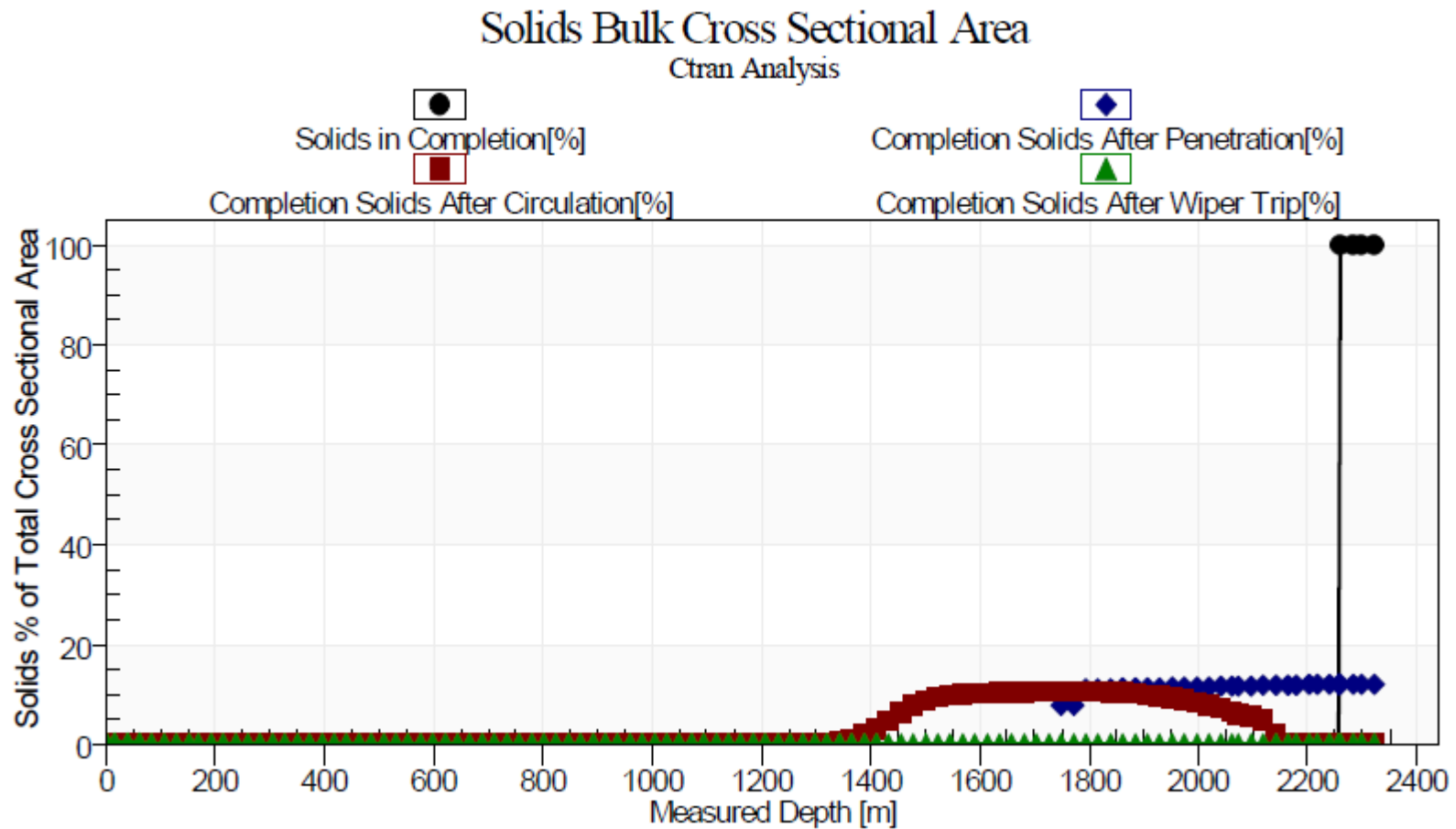


CT String & BHA



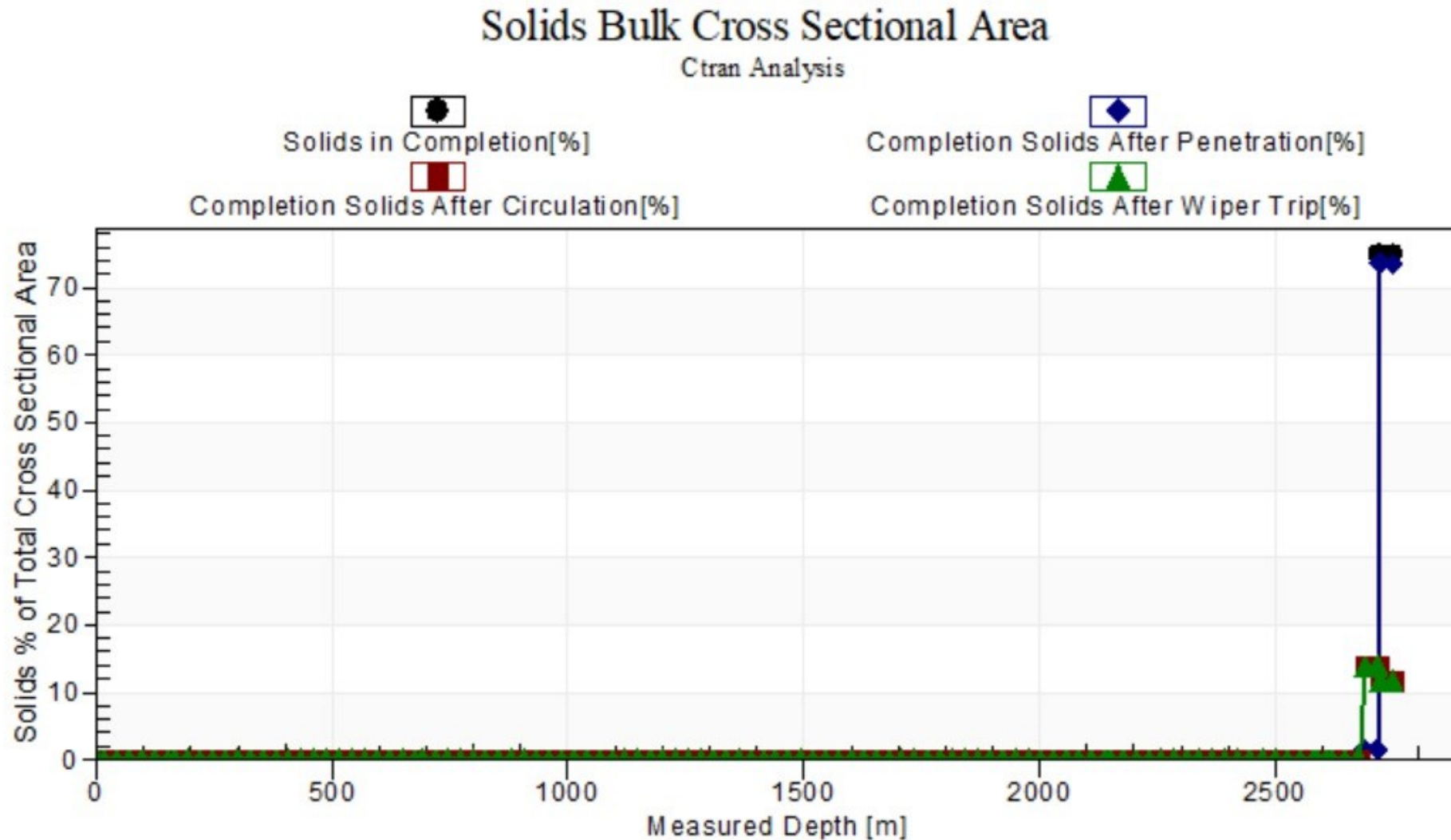
CIRCA - Cleanout Graph / Table

Solid Distribution Graph (Example 1)



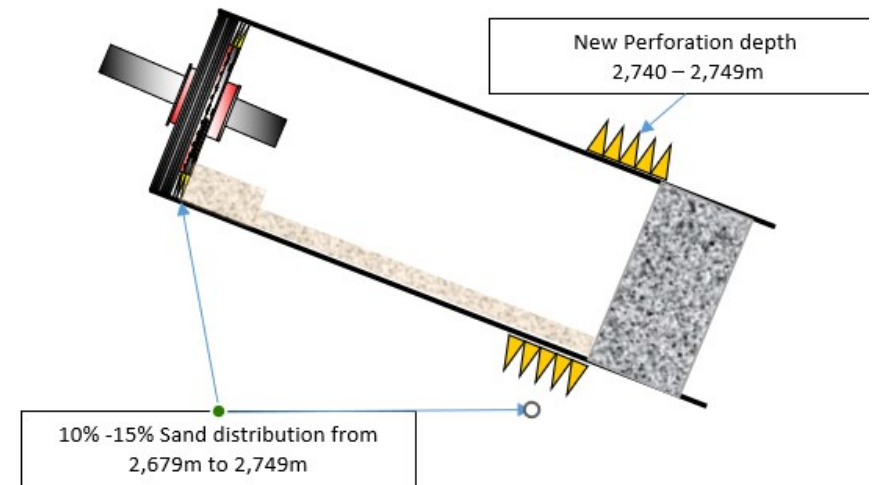
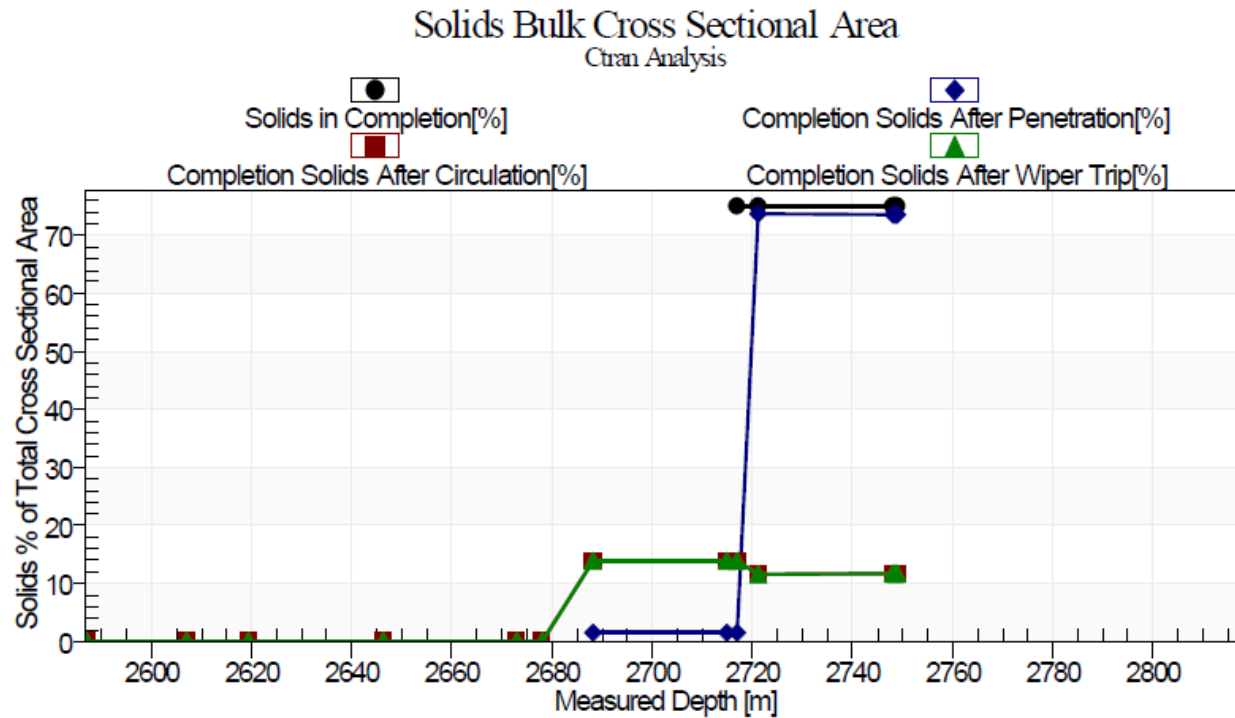
CIRCA - Cleanout Graph / Table

Solid Distribution Graph (Example 2)



CIRCA - Cleanout Graph / Table

Solid Distribution Graph Example 2 (Zoom IN)



CIRCA - Cleanout Graph / Table

Ctran Summary

SUMMARY OF HOLE CLEANING RESULTS

Solid/fill inside the well

Initial Condition:	
% of fill interval occupied by solids before cleanout ...	100.0 %
Top of fill	2257.01 m
Deepest Circulation point	2323.00 m
Bottom of fill	2323.00 m
Initial Volume of Solids.....	1.3 bbl
Initial Mass of Solids.....	642.3 lb

Solids type: Mud Residue/Formation Fines
Fluid Description: Nitrified Water

Circulation time after penetrate

Penetration Hole Cleaning Mode:	
Penetration rate.....	5.0 ft/min
Penetration time.....	0.72 hr
Solids volume in the well after penetration	1.3 bbl
Solids mass in the well after penetration	642.3 lb

Circulation Hole Cleaning Mode:	
Hole circulation time	1.00 hr
Solids volume in the well after circulation.....	1.3 bbl
Solids mass in the well after circulation.....	642.3 lb

Wiper trip time

Wiper Trip Hole Cleaning Mode:	
Wiper Trip Scheme: User Specified rate, Tornado not	
Wiper trip time	6.41 hr
Solids volume in the well after wiper trip	0.0 bbl
Solids mass in the well after wiper trip	0.0 lb

Volume of Fluids Pumped During Penetration, Circulation & Wiper Trip:	
Gas volume	146400.0 scf
Liquid Volume	341.6 bbl
Penetration, Circulation & Wiper Trip time	8.13 hr

Cleanout Graph / Table

Flow Summary

SUMMARY OF FLOW RESULTS

Produced Fluids
 Pressure known at:
 Production Mode:
 Fluid Composition:

Perforations
 No Production
 Oil Only

Circulated Fluids
 Fluid Composition: Nitrified Water

Liquid:	0.70 bbl/min
Solids:	0.00 bbl/min
Gas:	300.0 scf/min
Circulation Point:	2323.00 m
HHP Required :	42.22 HP

Circulating Rate suggested from CIRCA

COMPLETION:

Wellhead Pressure.....	324.5 psi g
Hydrostatic pressure loss.....	830.3 psi
Friction pressure loss.....	377.9 psi
Kinetic pressure loss.....	-2.6 psi
Restriction pressure loss.....	0.9 psi
Equivalent Circulation Density[ECD]...	5.61 lb/gal (US)

Perforation Pressure

Perforation Pressure.....	1531.0 psi g
Hydrostatic pressure loss.....	16.0 psi
Friction pressure loss.....	8.9 psi
Kinetic pressure loss.....	-0.1 psi
Restriction pressure loss.....	0.2 psi

Bottom Hole Pressure.....	1556.0 psi g
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FROM CIRCULATION POINT TO WELLHEAD:

Liquid transit time.....	16 min
Gas transit time.....	13 min
Annular volume.....	27.5 bbl

Cleanout Graph / Table

Volume below circulation point.....	0.0 bbl
Total liquid volume.....	12.7 bbl
Total gas volume.....	14.7 bbl
(Surface equivalent).....	4264.0 scf
 WORKSTRING:	
Liquid:	0.7000 bbl/min
Gas:	0.43 MMscf/day
Pressure at reel rotating joint.....	2446.9 psi g
Friction pressure loss on reel.....	654.8 psi
Hydrostatic pressure loss on reel....	0.1 psi
 Pressure inside WS at Gooseneck.....	1792.1 psi g
Hydrostatic pressure loss.....	-1176.3 psi
Friction pressure loss.....	1169.1 psi
Equivalent Circulation Density[ECD]...	0.03 lb/gal (US)
 BHA total pressure loss	243.3 psi
BHA Hydrostatic loss	-0.1 psi
BHA Friction loss	0.2 psi
Nozzle	243.2 psi
 Circulation Point pressure	1556.0 psi g
 FROM REEL ROTATING JOINT TO CIRCULATION POINT:	
Liquid transit time.....	17 min
Gas transit time.....	15 min
Displacement Volume.....	16.7 bbl
Internal Volume.....	18.8 bbl
Internal liquid volume.....	12.0 bbl
Internal gas volume.....	6.8 bbl
(Surface equivalent).....	4528.1 scf
 Length of Workstring on reel.....	1365.30 m
	16

Expected bottomhole pressure exit nozzle



Cleanout Graph / Table

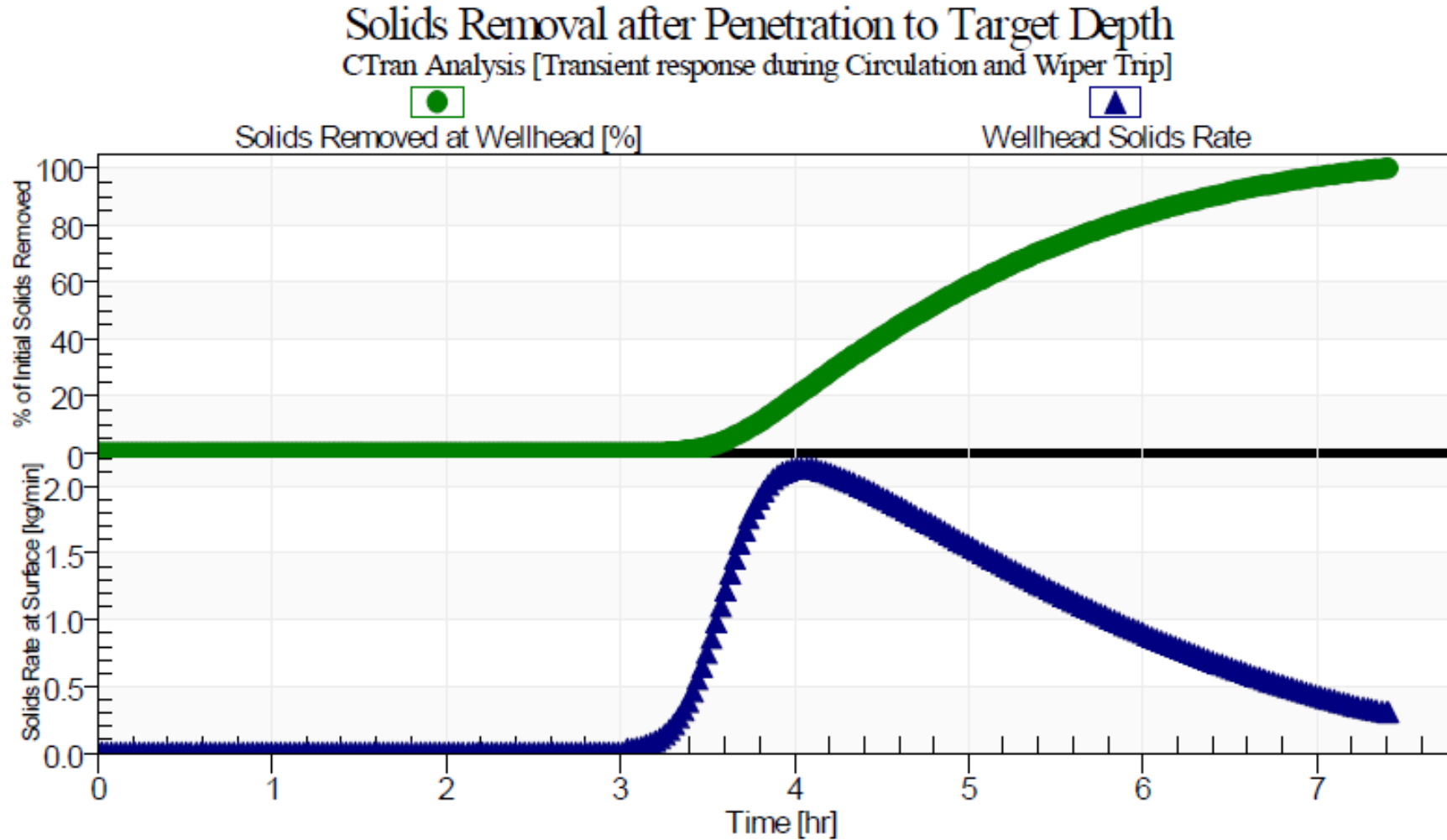
Flow State

Measured Depth[Flow] <i>m</i>	Temperature	Completion Pressure	Workstring Pressure	Concentric Pressure	Completion Liquid Velocity <i>ft/min</i>	Workstring Liquid Velocity <i>ft/min</i>	Concentric Liquid Velocity <i>ft/min</i>
0.0	40.0	324.5	1792.1	0.0	710	840	0
16.2	40.8	335.4	1799.8	0.0	697	840	0
38.7	41.8	350.5	1810.7	0.0	680	841	0
61.3	42.9	365.8	1821.5	0.0	664	841	0
83.8	44.0	381.1	1832.4	0.0	649	841	0
106.4	45.0	396.5	1843.1	0.0	635	843	0
128.9	46.1	411.9	1853.8	0.0	623	843	0
151.5	47.2	427.4	1864.6	0.0	732	843	0
169.7	48.0	440.1	1873.3	0.0	601	842	0
192.2	49.1	455.9	1884.2	0.0	591	842	0
214.8	50.2	471.7	1895.1	0.0	580	842	0
237.3	51.2	487.7	1906.0	0.0	571	842	0
259.9	52.3	503.7	1916.9	0.0	562	843	0
282.4	53.4	519.8	1927.7	0.0	553	844	0
305.0	54.4	535.8	1938.4	0.0	653	846	0
305.2	54.4	536.1	1938.5	0.0	545	847	0
327.8	55.5	552.2	1948.9	0.0	538	848	0
350.4	56.5	568.1	1959.0	0.0	530	852	0
372.9	57.5	583.8	1968.6	0.0	524	855	0
395.5	58.5	599.4	1977.9	0.0	517	859	0
418.0	59.4	614.7	1986.6	0.0	511	862	0
440.6	60.3	629.7	1994.8	0.0	506	866	0
463.1	61.2	644.4	2002.5	0.0	501	869	0

Flow State (continued)

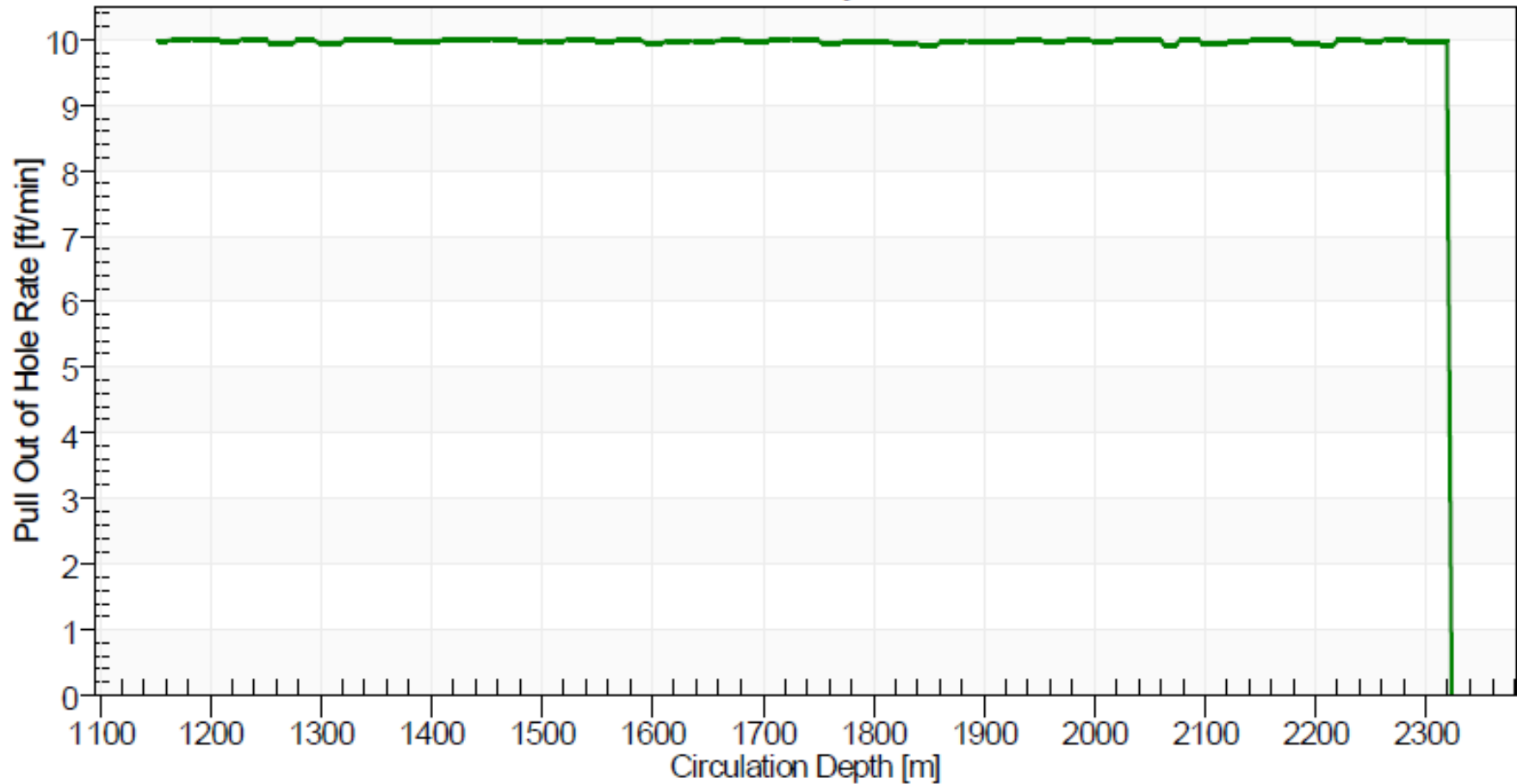
Measured Depth[Flow] <i>m</i>	Temperature	Completion Pressure	Workstring Pressure	Concentric Pressure	Completion Liquid Velocity <i>ft/min</i>	Workstring Liquid Velocity <i>ft/min</i>	Concentric Liquid Velocity <i>ft/min</i>
2042.0	95.0	1385.3	1838.4	0.0	581	716	0
2062.0	95.4	1397.2	1835.5	0.0	580	717	0
2073.8	95.6	1404.3	1833.9	0.0	483	718	0
2096.3	96.1	1417.7	1830.7	0.0	482	719	0
2118.9	96.6	1431.1	1827.5	0.0	481	720	0
2141.4	97.0	1444.7	1824.3	0.0	480	721	0
2164.0	97.5	1458.3	1821.2	0.0	574	722	0
2179.4	97.8	1467.7	1819.0	0.0	479	722	0
2202.0	98.3	1481.3	1815.9	0.0	572	723	0
2217.4	98.6	1490.8	1813.8	0.0	477	724	0
2240.0	99.1	1504.6	1810.7	0.0	570	725	0
2257.0	99.5	1515.1	1808.3	0.0	569	725	0
2260.4	99.5	1517.2	1807.8	0.0	471	725	0
2283.0	100.0	1531.0	1804.7	0.0	470	726	0
2299.4	100.3	1541.2	1802.5	0.0	471	727	0
2322.0	100.8	1555.2	1799.4	0.0	620	728	0
2322.7	100.8	1555.8	1799.3	0.0	470	728	0
2323.0	100.9	1556.0	1799.2	0.0	470	10342	0

Cleanout Graph / Table



Cleanout Graph / Table

Tripping Speed to be used while Pulling Out of Hole
CTran Analysis



Thank you