



Government of South Australia

Department for Energy and Mining



Department for Energy and Mining

Caroline-1 Tubing and Casing

Report

August 2019

Disclaimer

This report has been commissioned by the Department for Energy and Mining (DEM). The information contained in this report originates from a variety of sources. Although all reasonable care has been taken in the preparation and compilation of the information by DEM and Wellsafe Pty Ltd, it has been provided in good faith for general information only and does not purport to be professional advice. No warranty, express or implied, is given as to the completeness, correctness, accuracy, reliability or currency of the materials.

DEM and the Crown in the right of the State of South Australia does not accept responsibility for and will not be held liable to any recipient of the information for any loss or damage however caused (including negligence) which may be directly or indirectly suffered as a consequence of use of these materials. DEM reserves the right to update, amend or supplement the information from time to time at its discretion.

Contacts

Energy Resources Division Department for Energy and Mining (DEM)

Level 4, 11 Waymouth Street ADELAIDE SA 5000

GPO Box 320 ADELAIDE SA 5001

P: +61 8 8463 3000

E: DEM.Petroleum@sa.gov.au

W: www.energymining.sa.gov.au/industry/energy-resources

Wellsafe Pty Ltd

Level 1 67 Greenhill Road, Wayville South Australia 5034

Post: PO Box 820, Unley SA 5061 Australia Phone: 1300 258 685 Email: <u>solutions@wellsafe.com.au</u>

Contents

1.	Execut	tive Summary	2
2.	Introd	uction	3
3.	Well II	nformation	3
V	Vell Descri	iption	3
V	Vell Data		4
	3.1.1	Basic Well Data	4
	3.1.2	Hole Design	4
	3.1.3	Casing and Cementing	5
	3.1.4	Stratigraphy	6
4.	Well D	Diagrams	6
	4.1.1	Well Status at Time of Decommissioning	6
	4.1.2	Downhole Diagrams Prior to Decommissioning	7
5.	Well L	ocation	9
6.	Well L	ogs	10
	6.1.1	Reservoir Temperature Data	10
	6.1.2	Corrosion logs – MTD/ MFC	10
7.	Select	ion, Cutting and Storage Process	11
	7.1.1	Palletised 2-3/8" Tubing	13
	7.1.2	Palletised 5-1/2" Casing	17
8.	Appen	ndices	19
	Appendi	x A – 2-3/8" Tubing MFC and MTD Logs	19
	Appendi	x B – 5-1/2" Casing MTD Log	43

1. Executive Summary

Caroline-1 was a CO_2 producing well that was in operation from 1967 until 2018, when it was successfully plugged and abandoned.

During this time, no major servicing was completed on the well and none of the production tubing or casing was replaced. Given this, and the logged condition of the tubing and casing, selected joints from depths of interest were put aside for potential further analysis.

In total, 50 joints of 2-3/8" Tubing and 18 joints of 5-1/2" Casing were retained from Caroline-1. These samples were transported to Adelaide, cut into small pieces and palletised, and stored on site at TAFE SA Tonsley Campus.

The following report describes the process and delves into the reasons of interest that led to retaining each joint of casing and tubing. The log data corresponding to each joint can be found in the Appendices below.

The tubing and casing is available for industry inspection, on site at TAFE SA Tonsley Campus.

2. Introduction

Caroline-1 was spudded by Alliance Oil Development Australia N.L. in September 1966 and reached a total depth of 3371m in January 1967. The well was completed in February 1967 as a CO_2 producer.

In September 2018, Caroline-1 well was decommissioned, after Air Liquide Australia (ALA) had contracted Wellsafe to manage the operation. The decommissioning activities were completed on 22 September 2018, without any major incidents occurring.

Analysis of the Multi-Finger Calliper (MFC) and Magnetic Thickness Detector (MTD) logs run prior to well decommissioning showed the condition of the casing and tubing after the well had produced CO_2 for around 50 years at the time, and no recompletion programs had been run over that time.

As such the Department for Energy and Mining (DEM), in co-operation with Wellsafe and Air Liquide, selected certain zones of interest in the tubing and casing joints to store for industry to use for further study. These joints were put aside on site at Caroline-1 and sent to Adelaide upon completion of decommissioning operations.

3. Well Information

The following section provides the well information available at the time of decommissioning.

Well Description

The Caroline-1 well was drilled by ODE Rig No.1 and completed as a Carbon Dioxide Producer. Operations at the Caroline-1 Well were conducted in accordance with the requirements of the South Australian *Petroleum Act 1940* which has now been replaced with the South Australian *Petroleum and Geothermal Energy Act 2000*.

The Caroline-1 well was spudded by Alliance Oil Development Australia N.L. in September 1966 and reached a total depth of 3371m in January 1967. The well was completed in February 1967 as a CO_2 producer. The deepest formation penetrated was the Eumeralla Formation of the Otway Group. After a series of drill stem tests, the well was completed in two upper units of the Otway Group. The Waarre Formation, and a transition unit between the Waarre and Eumeralla Formations. Production from the well since February 1968 had shown that the clear majority of the CO_2 had come from two small perforated intervals in the Waarre Formation.

The well was a single completion, producing through a 2-3/8" tubing string with a packer set in the 5-1/2" production casing at 2475m. The total depth of the well was 3371m and was plugged back to 2865m prior to running production casing. A diesel cap was placed in the annulus between production casing and tubing, and above drilling mud. This was evidenced during decommissioning operations whereby drilling mud had coated the production tubing and well logging operations had identified a hang up at approximately 500m depth. The diesel levels in the annulus were monitored over the course of well life as part of ongoing integrity monitoring activities, and the levels were reported to be unchanged during the productive life of the well.

Apart from intermittent production during 1968, the well had produced CO_2 almost continuously at an average rate of 1.25million SCFPD (65t per day). The maximum continuous rate was approximately 1.9million SCFPD (100t per day). The estimated production in 2014 was 6,950t

compared to 7,737t produced in 2013. The reduction in production output was due to depletion of the resource and the well was ultimately shut-in in January 2017, and decommissioned in September 2018.

Well Data

3.1.1 Basic Well Data

Table 1: Caroline-1 Well Data Card

General Data									
Permit Holder	Air Liquide (as at August 2019)								
Well Name	Caroline 1								
Well Type	Onshore Carbon Dioxide Well								
Permit	PPL 21								
Drilling Contractor/Rig	ODE # 1								
Well drilled	September 1966 to February 1967								
TD original	3,371mKB (11,061ft)								
Location, Depths and Reference System									
Surface Location (Lat, Long)	37 ° 56 ' 30" S, 140 ° 54 ' 30" E								
Surface Location (Grid)	677379.42mE; 5728374.14mN								
Grid Reference	UTM Zone 54S Australian Datum 1	984							
Surface casing	13-3/8" H40 48ppf BTC	225.5mKB MD (740ft)							
Intermediate Casing	9 -5/8" J55 36ppf	959.5mKB MD (3,148ft)							
Production Casing	5-1/2" N80/J55 17ppf LTC/STC	2,860mKB MD (9,385.4ft)							
Tubing (existing)	2-3/8" J55 4.7ppf	2,455mKB MD (8,055ft)							
Perforations	8,204 – 8,210ft (6ft)	8,820 – 8,830ft (10ft)							
	8,214 – 8,230ft (16ft)	8,870 – 8,880ft (10ft)							
Tubing Head adaptor / Xmas Tree	7-1/16" 3M x 3-1/8" 3M / 3-1/8"	3M m/vs x 2-1/16" 3/5M w/v							
Reservoir Details									
Pressure	Current SITHP ~ 800psi	PC and IC Annuli zero psi							
Temperature	Normal Geothermal gradient								

3.1.2 Hole Design

Table 2: Caroline-1 Hole Design

Size	Top Depth (ft)	Bottom Depth (ft)
22"	16	165
18"	165	510
17-1/2"	510	761
12-1/4"	761	3150
8-3/8"	3150	11061

3.1.3 Casing and Cementing

Casing Size	Grade	Weight (lb/ft)	Coupling	Collapse PSI	Burst PSI	Drift ID (API)	Coupling OD (")
13-3/8″	H40	48	BTC	740	1730	12.559"	14.375
9-5/8″	J55	36	ТВС	2020	3520	8.675″	10.62
5-1/2"	N80	17	LTC	6290	7740	4.767"	6.050
5-1/2"	J55	17	STC / LTC	4910	5320	4.767"	6.050

Table 3: Caroline-1 Casing

Table 4: Caroline-1 Cementing

Outer Casing	Inner Casing	Annular Capacity	Cement Logs
13-3/8" 48lb/ft	9-5/8" 36lb/ft	0.06706bbl/ft	CBL dated 1 December 1966
9-5/8" 36lb/ft	5-1/2" 17lb/ft	0.04793bbl/ft	CBL dated 20 September 2018
5-1/2" 17lb/ft	2-3/8" 4.6lb/ft	0.01777bbl/ft	CBL dated 14 February 1967
			CBL dated 29 March 2001

3.1.4 Stratigraphy

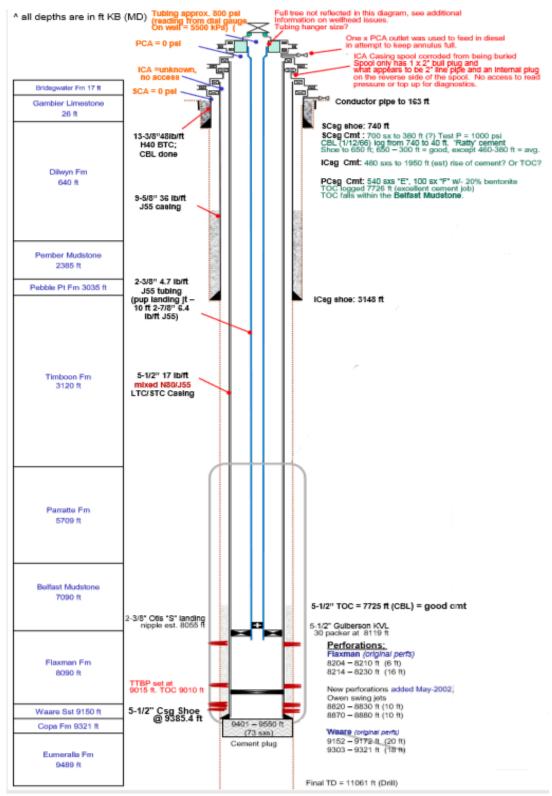
TIME	CHRONOS			spore-pollen zones		ROCK UNIT	OIL AND GAS	DEPOSITIONAL ENVIRONMENT	TECT		STRUCTURAL EVENTS	
(Ma)	S ERI ES HOLOCE NE	DIVISION	STAGES	Lunes			OCCOMMENCES		SIA	uES		-
10	PLIOCEN E-PLEISTOCENE	2				RECENT VOLCANICS		Basattic pyroclastics of Mt Gambier region.				
	MIOCENE	Early	Serravallian	T bellus	PURY	Gambier Limestone			A 10		Inversion	Т
25 -	OLIGOCENE	Late Early	Burdigalian to Rupelian	P. tuberculatus	TEBURY	21 m Gellibrand Mari			mpression		sea level changes channelling	
30 1		Late	Priabonian	N. asperus	분	A service and a service a		Marine prograding	E IS	BN	Construction of the	10
		Middle	Bartonian	NRRANDA	-	- Marrawaburk Marl Mecunga Fm		TTTTTTT	ī	SPREADING	Continued thermal subsidence	A R
	EOCENE		Lutetian	P. asperopolus		Dilwyn Formation 593 m	-0- Fahlay 1	Diwn: fluxel and deta.	÷.		- dastic starvation	BIE
		Early	Ypresian	M. diversus	UPP			deta. Pember: Inter-	1	N SEA		GAMRIER RASIN
54 -	PALEOCENE	Late	Thanetian	L. balmei	WANGERRIP	Pember Mudstone 198 m	e Curdie 1	distributary bay muds.		NYNSYL		
65 -	PALEUGENE	Early	Danian	10000000	>	Pebble Point Formation 90 m	e Lindon 1	Pebble Point: Inter- distributary bay muds.	9	P		
			Maastrictian	T. longus		Timboon		Timboon: upper deta plain	SPREADING			
73 -						Sandstone		deta plain regressive unit, intermittert marginal	SPR			
				T. Illiei		Paaratte		marine influence.	OCEAN	1	1	
			Campanian			Formation		Paaratte: lower deta plain, legoonal and marginal shoreface.	N O	1		
			3.6	1000000000	5	1590m E			SOUTHERN			
	·			N. senectus	SHERBROOK GROUP	1987 m Ü		Beifast: complex of upper pro-delta, slope, delta front and	Slow .	11	Episodic uplift	
83 -		Late			ŏ	Amount	Brazic cz Roof 1	Interdistributary facios, mixed sand/	0	11	and erosion events	
			Santonian	T apoxyexinus	RBR	Slope Argonaut Member	-b-Port Campbel 1 Caroline 1 (Co ₂)	mud slope tan. Flaxman: lower detta		11	100000000000000	
87.5- 88.5-			Coniacian		HS I	Belfast Mudstone	North Paarate 3 Westgate 1A	plain distributary, proximal to 7marine		12	Thermal subsidence (down to south)	
			Turonian	P. mawsonii		/7 1362 m	Minerva 1 Normanby 1A	- restricted marine environment. Waarre: upper deita		RFTNG		
						Flavman Fm Waarme Se	V Iona 1	plain to low sinuosity fluvial, beach barrier,		SEA		
91 -					0000	Copa Fm 204 m	-Grumby 1 North Paarate 1	co al swamp. Copa: meandering fluvial to lacustrine		TASMAN	Rifting south of Tartwaup Hinge	•
96 -	CRETACEOUS		Cenomanian	A. distocarinatus	196	167 martill	Caroline 1 Minerva 1 La Balla 1	fluvial to lacustrine possible upper delta plain.	+	M	Continental separation	
				P. pannosus			Thylacine 1 Geographe 1	Europala: mandatho	Λ		regional uplift — erosion, NW-SE compression	
			Albian	C.paradoxa		Eumeralla unnamed	Crayfsh 1A Port Campball 4 Windermare 1 Orayfsh 1	fuvial lecustrine and baclewamp. Local channel sands from	11			N
				C.striatus		Formation	Windermare 1 © Crayfish 1 #Katnock 2	base level reactivation.	11		Offshore rift/ onshore sag	OTWAY BASIN
113 -			Aptian		IGROUP	/ ² 2500 m+ 21 m	- Windermane 2		RIFT			MAN
			Barremian	P. notensis	RGR	Winder meine Sandistone Member	Katnock 1	Windermere: meandering to distal braided fluvial.	SAG/R			6
19 -					SUPE	Katnook Ss		braided fluvial.	3		Tilling, folding,	
25 -						690 m		Katnook:	1		uplift, erosion	
		Early	Hauterivian	upper F. wonthagg lensis	OTWAY	S P	Cold Matericals Road	meandering to distal braided fluvial.	1			
					0 O	Laira Formation	- Has eigrove Reid	Laira: lecustrine, minor meandering fluvial.	11			
21						Laira Formation 890 m upper Sawpt	Haseigrove Reid → Haseigrove Reid → Redman Field → Ladbroke Grove Field ↓ Ladbroke Grove Field ↓ Ladbroke Grove Field ↓ Ladbroke Ha	LIVE.	11			
31 -				lower	CRANFISH	upper Sawpit shale mbr	L- Crayfish 1A	Pretty Hit sandy braided fluvial.	11			
			Valanginian	F. wonthaggiansis	5	Pretty Hill	Wynn 1	Sawpit Shale: lucustrine, overbank.	11		Riting	
				Upper C. australiensis		Formation Sampit as mbl	Kilanoola 1	Sawpit Sandstone:	11			
138 -			Berriasian	L.C. australiensis		25000 m	I ower Sawpit shale member with unnamed shale at base	braided, minor meandering fluvial.	11			
44 -			Tithonian			Casterton		Casterton: lacustrine. fluviolacustrine.	9			
	JURAS SIC	Late	Kimmeridgian	R. watherooensis			-of-Bungaloo 1 • Sawpt 1,2		RFTNG			
150 -		Undiffer- entiated				Unnamed unit 246 m+	e Sawpit 12	mmmmm			Doming MW CE avtembra	
300 -					ш	Jahahhhhhhhhhhhhhh		hann			Doming, NW-SE extension	
	PALAEOZOIC					KANMANTOO GROUP		Sandstone, low-grade metasediments, phylite,metavoicanics.				
550				-		EQUIVALENTS	* Kalangadoo 1 (00g)	grante intrusives			204662-077	

Figure 1: Caroline-1 Stratigraphy

4. Well Diagrams

4.1.1 Well Status at Time of Decommissioning

Caroline 1 was shut-in with SITHP of ~800psi.



4.1.2 Downhole Diagrams Prior to Decommissioning

Figure 3: Caroline-1 Downhole Diagram

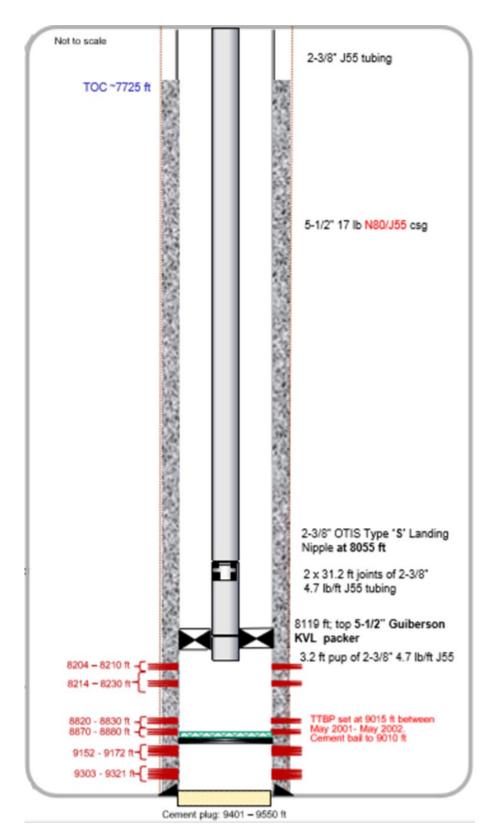


Figure 4: Caroline-1 Downhole Diagram Inset

5. Well Location

The Air Liquide Caroline-1 CO_2 well is located in PPL 21 in the Otway Basin at 640 Carba Road, Caroline, South Australia, 22km South East of Mount Gambier.

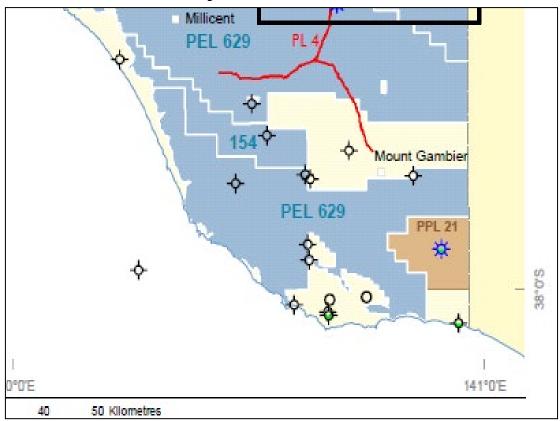


Figure 5: Caroline-1 Well Location

6. Well Logs

The following section provides the well log information available at the time of the decommissioning.

SGS GAUGE REPORT SUMMARY Caroline 1											
Date	May 22, 2015										
Test	Test Static Gradient Survey to determine fluid level										
Formation	Multiple formations, un-named in programme										
Perf's	8204-8830										
WL Operator	perator B. Arthur										
Note	Bottom gauge o	lata used to ge	nerate Grad	ient report.							
Date	Time on Depth			Temp	Depth	Gradient	Comments				
dd/mm/yy	hh:mm:ss	hh:mm:ss	psia	degC	KB	psi/ft					
22/05/2015	15:02:30	15:04:30	3053.12	92.16	8800	0	On Depth				
22/05/2015	15:06:30	15:08:30	2926.57	89.66	8500	0.422	•				
22/05/2015	15:10:30	15:12:30	2808.41	84.63	8200	0.394					
22/05/2015	15:14:40	15:16:40	2739.21	82.37	7900	0.231					
22/05/2015	15:18:30	15:20:30	2669.67	80.10	7600	0.232					
22/05/2015	15:22:30	15:24:30	2599.64	77.78	7300	0.233					
22/05/2015	15:26:20	15:26:20	2529.87	75.47	7000	0.233					
22/05/2015	15:34:10	15:36:10	2297.52	68.53	6000	0.232					
22/05/2015	15:42:00	15:44:00	2065.07	61.41	5000	0.232					
22/05/2015	15:49:50	15:51:50	1833.89	54.07	4000	0.231					
22/05/2015	15:57:30	15:59:30	1600.69	46.42	3000	0.233					
22/05/2015	16:05:30	16:07:30	1348.53	36.35	2000	0.252					
22/05/2015	16:09:20	16:11:20	1265.78	33.71	1700	0.276					
22/05/2015	16:13:20	16:15:20	1185.59	31.02	1400	0.267					
22/05/2015	16:17:20	16:19:20	1100.60	28.57	1100	0.283					
22/05/2015	16:21:20	16:23:20	1014.62	25.93	800	0.287					
22/05/2015	16:25:20	16:27:20	923.37	22.61	500	0.304					
22/05/2015	16:29:20	16:31:20	825.92	18.95	200	0.325					
22/05/2015	16:34:00	16:39:00	757.03	15.24	0	0.344	Lubricator				

6.1.1 Reservoir Temperature Data

Figure 2: Caroline-1 Reservoir Temperature Data

6.1.2 Corrosion logs – MTD/ MFC

MFC identified some high penetration rates intervals in the 2-3/8" tubing with the highest penetration rates up to 41.1%. These high penetrated intervals corresponding to pitting damage depths.

MTD tool did not detect severe damage at the corresponding pitting damage depths, most likely due to circumferentially average nature of electromagnetic response signal and thus reduced directivity of wall loss estimation.

No severe localized damages can be revealed in 2-3/8" tubing, according to MFC.

2-3/8" tubing corrosion evaluation from MTD shows wall loss mostly less than 12% and some joints with wall loss up to 17.1%. No severe localized damages in 2-3/8" tubing according to MTD.

With respect to corrosive damage, indication of damage is recorded in most of the 2-3/8" tubing joints in the forms of isolated pits, scattered pits, areas of corrosion and roughness of the casing I.D.

The tubing was also analysed for any possible mechanical damage, such as deformations. No tubing deformations were evident in the recordings.

5-1/2'' casing corrosion evaluation from MTD shows wall loss mostly less than 12% and some joints with wall loss up to 14.8%. No severe localized damages in 5-1/2'' casing according to MTD.

The temperature log mostly tends to follow normal geothermal gradient and did not show any significant changes within the logged interval.

7. Selection, Cutting and Storage Process

The MTD and MFC logs run on Caroline-1 in 2015 were analysed and particular areas of interest were identified. These areas of interest were used with estimated depths of tubing and casing to determine which joints would correlate to these areas. This correlation process can be seen in Appendix A (tubing) and Appendix B (casing), and shows estimations of what condition each section of each joint is in.

All joints of tubing and casing that were pulled from the well during the decommissioning operations were marked sequentially. After the process was complete the rig crew identified the joints that were required by DEM. These joint numbers and the reasoning each joint was selected can be found in Section 6.1 and Section 6.2 below, along with other critical information about them.

The joints were transported from Caroline-1 to Tonsley TAFE, Adelaide, where they are currently stored. In order to safely and easily store the tubing and casing, each joint was cut into smaller sections and palletised. The pallet each joint is stacked on can be found in Section 6.1 and Section 6.2 below.

Each length of 2-3/8" tubing was cut into two sections, in order to: fit them on the pallets, not be too long for transporting, and reduce the weight to a more manageable amount. This was done onsite at Tonsley TAFE, using a 9" drop saw. This ensured the tubing integrity was not impacted and areas of interest were maintained in largely undisturbed condition.

As the 5-1/2'' casing was much larger and heavier, each joint was cut into 4 sections. This once again ensured the sections would: fit on the pallets, not be too long for transporting and reduce the weight to a more reasonable amount.

Given the greater thickness and material strength, a contractor was called into Tonsley TAFE to cut the casing. This process involved using an oxy-fuel cutter to get through the casing with a flame.

Markings were made prior to the contractor's arrival, positioning the cuts at equal lengths where possible. However, in order to ensure any area of particular interest was conserved, a 1m buffer zone was left around that point. This created some small differences in section length.

The contractor then drilled a small hole along the cut line to use as a pilot hole, took the oxy flame to the hole and cut around the perimeter of the casing. This process created clean cuts, which removed less casing than the width of the drill bit. The heat from the flame impacted on the casing either side of the cut, however this impact is considered negligible. As can be seen in Figures 6 and 7 below, the heat from the flame affected at most 2cm either side of the cut and thus left the casing in good condition for further analysis. All pallets are now stored and can be viewed on request at Tonsley TAFE, Adelaide.



Figure 6: Caroline-1 5-1/2" Casing Cut with Oxy Cutter

Figure 7: Caroline-1 5-1/2" Casing Cut with Oxy Cutter



7.1.1 Palletised 2-3/8" Tubing

Table 5: 2-3/8" Tubing Data											
Joint #	Section	Section Length (m)	Est. Length (m)	Measured Joint Length (m)	Difference (m)	Est. Depth (m)	Est. Depth (ft)	Feature / Importance			
1	Α	4.780	9.540	9.630	0.09	9.54	31.3	Near surface			
	В	4.850	0.010		0.05	0.04	51.5	Iveal surface			
2	Α	4.800	9.540	9.640	0.10	19.08	62.6	Near surface			
-	В	4.840	0.040	0.040	0.10	10.00	02.0	Near Surface			
3	Α	4.760	9.540	9.520	-0.02	28.62	93.9	Near surface			
	В	4.760	0.040	0.020	-0.02	20.02		Near Surface			
11	Α	4.840	9.540	9.620	0.08	104.94	344.3	High pitting			
	В	4.780	0.040	3.340 3.020	0.00	104.04	344.3	riigir pitulig			
12	Α	4.820	9.540	9.540 9.650	0.11	114.48	375.6	High pitting			
	В	4.830	3.340		0.11	114.40	575.0	riigii pitang			
13	Α	4.800	9.540	540 9.530	-0.01	124.02	406.9	High pitting			
15	В	4.730	5.540	3.550	-0.01	124.02	400.5	riigii pitulig			
15	Α	4.840	9.540	9.640	0.10	143.10	469.5	Damaged pipe			
15	В	4.800	5.540	3.040	0.10	145.10	405.5	Damaged pipe			
32	Α	4.810	9.540	9.650	0.11	305.28	1001.6	Sample point			
	В	4.840	5.546	3.000	0.11	303.20	1001.0	Sample point			
51	Α	4.800	9.540	9.630	0.09	486.54	1596.3	High pitting			
51	В	4.830		3.000	0.09	400.04	1550.5	righ plung			
52	Α	4.770	9.540	9.590	0.05	496.08	1627.6	High pitting			
52	В	4.820	5.540	3.330	0.05	430.00	1027.0	righ pluing			
53	Α	4.680	9.540	9.360	-0.18	505.62	1658.9	High pitting			
55	В	4.680	5.540	3.300	-0.16	303.02	1030.3	right pluing			
55	Α	4.770	9,540	9.540	0.00	524.70	1721.5	Odd calliper			
55	В	4.770	3.340	3.340	0.00	524.70	1721.5	response			
63	Α	4.850	9.540	9.650	0.11	601.02	1971.9	Scale build-up			
03	В	4.800	5.540	5.000	0.11	001.02	1371.3	ocale build-up			
75	Α	4.820	9.540	9.640	0.10	715.50	2347.4	Scale build-up			
75	В	4.820	9.040	5.040	0.10	715.50	2347.4	Scale build-up			
76	Α	4.810	9.540	9.650	0.11	725.04	2378.7	Scale build-up			
70	В	4.840	9.040	9.000	0.11	725.04	2310.1	ocale build-up			
82	Α	4.810	0.540	9.640	0.10	782.28	2566.5	Scale build-up			
02	В	4.830	9.540	9.040	0.10	102.20	2000.0				
	Α	4.840	0.540	0.050	0.44	040.00		Low wall			
85	В	4.810	9.540	9.650	0.11	810.90	2660.4	thickness / hig pitting			

Table 5: 2-3/8" Tubing Data

Joint #	Section	Section Length (m)	Est. Length (m)	Measured Joint Length (m)	Difference (m)	Est. Depth (m)	Est. Depth (ft)	Feature / Importance			
	Α	4.830						Low wall			
86	В	4.830	9.540	9.540 9.660	0.12	820.44	2691.7	thickness / high pitting			
	А	4.830						Low wall			
87	В	4.790	9.540	9.620	0.08	829.98	2723.0	thickness / high pitting			
	Α	4.820	0.540	0.050		077.00	0070.5				
92	В	4.830	9.540	9.650	0.11	877.68	2879.5	Damaged pipe			
113	Α	4.830	0.540	0.650	0.44	4.079.02	2526.0	Coodining			
113	В	4.820	9.540	9.650	0.11	1,078.02	3536.8	Good pipe			
123	Α	4.840	9.540	9.660	0.12	1,173.42	3849.8	Good pipe			
125	В	4.820	9.540	9.000	0.12	1,173.42	3043.0	Good pipe			
124	Α	4.840	9.540	9.610	0.07	1,182.96	3881.1	Good pipe			
124	В	4.770	5.540	5.010	0.07		5001.1	COOG pipe			
129	A	4.850	9,540	0 9.670	0.13	1.230.66	4037.6	High pitting			
	В	4.820			0.10	1,200.00					
130	A	4.830	9.540	9.640	0.10	1,240.20	4068.9	High pitting			
	В	4.810		0.010		.,					
141	Α	4.800	9.540	9.650	0.11	1,345.14	4413.2	High pitting			
	В	4.850				.,					
142	A	4.710	9.540	9.620	0.08	1,354.68	4444.5	High pitting			
142	В	4.910									
143	A	4.800	9,540	9.660	0.12	1,364.22	4475.8	High pitting			
	В	4.860									
145	A	4.820	9.540	9.650	0.11	1,383.30	4538.4	High pipe damage			
	B	4.830						-			
146	A	4.830	9.540	9.650	0.11	1,392.84	4569.7	High pipe damage			
	B	4.820						uamage			
147	A B	4.765 4.875	9.540	9.640	0.10	1,402.38	4601.0	Good pipe			
	A	4.800									
149	в	4.860	9.540	9.660	0.12	1,421.46	4663.6	High pitting			
	A	4.820									
155	В	4.820	9.540	9.640	0.10	1,478.70	4851.4	Damaged pipe			
	A	4.810									
156	В	4.840	9.540	9.650	0.11	1,488.24	4882.7	Damaged pipe			
	Α	4.790									
174	В	4.810	9.540	9.600	0.06	1,659.96	5446.1	High pitting			
	A	4.810			0.44	1.000.00		High pitting			
175	В	4.840	9.540	9.650	0.11	1,669.50	5477.4				
476	Α	4.820	0.540	0.540	0.540	0.540	0.000	0.00	4.070.04	FF00 7	Lligh sitting
176	В	4.800	9.540	9.620	0.08	1,679.04	5508.7	High pitting			

Joint #	Section	Section Length (m)	Est. Length (m)	Measured Joint Length (m)	Difference (m)	Est. Depth (m)	Est. Depth (ft)	Feature / Importance	
192	Α	4.880	9.540	9.690	0.15	1.831.68	6009.4	Sample point	
132	В	4.810	5.540	3.050	0.15	1,001.00	0003.4	Cample point	
215	Α	4.500	9.540	9.130	-0.41	2,051,10	6729.3	Scale build-up	
215	В	4.630		40 9.150	-0.41	2,001.10	0723.5	ocale build-up	
216	Α	4.830	9.540	9.670	0.13	2.060.64	6760.6	Scale build-up	
210	В	4.840	5.540		0.15	2,000.04	0700.0	Scale Dullu-up	
244	Α	4.890	9.540	9.650	0.11	2,327.76	7637.0		
	В	4.760	9.540	5.050	0.11	2,021.10	1001.0		
245	Α	4.870	9.540	9.540	9.630	0.09	2,337.30	7668.3	
245	В	4.760	5.546	0.000	0.05	2,001.00	7000.5		
246	Α	4.800	9.540	9 540	9.550	0.01	2,346.84	7699.6	Scale build-up
240	В	4.750		0.000	0.01	2,040.04	7000.0	Scale Dullu-up	
247	Α	4.520	9.540 9.0	9.000	-0.54	2.356.38	7730.9	Scale build-up	
241	В	4.480		0.000	-0.54	_,		Ocale Maile up	
248	Α	4.760	9 540	9,540 9,540	0.00	2,365.92	7762.2	Scale build-up	
240	В	4.780	0.040	0.040	0.00		1102.2	ocale balla ap	
249	Α	4.640	9,540	9.230	-0.31	2,375.46	7793.5	Damaged pipe	
240	В	4.590	0.040	0.200	0.01	2,010.40	1100.0	Damaged pipe	
250	Α	3.830	9,540	7.730	-1.81	2,385.00	7824.8	Damaged pipe	
200	В	3.900	0.040	1.100	1.01	2,000.00	7024.0	Damaged pipe	
Top of fish	NA	4.310	NA	NA	NA			Top of fish	
Wireline cut	NA	4.240	NA	NA				Wireline cut	

Pallet	Joint #	Pallet	Joint #	Pallet	Joint #
	76		123		15
	142		246		12
	143		247		55
1	145		250	5	52
	147		244		85
	149		248		92
	156	3	113		1
	141		245	6	13
	146		129		53
	155		124		75
	192		51		63
2	215		Top of fish		11
2	174		Wireline cut		
	176		87		
	175		32		
	176		86		
	216	4	3		
		4	130		
			82		
			249		
			2		

Table 6: Pallet Catalogue for 2-3/8" Tubing Stored at Tonsley TAFE

7.1.2 Palletised 5-1/2" Casing

Joint #	Section	Section Length (m)	Est. Joint Length (m)	Measured Joint Length (m)	Difference (m)	Est. Depth (m)	Est. Depth (ft)	Feature / Importance		
	Α	2.50								
1	В	2.50	10.00	10.11	0.11	10.00	32.81			
· · ·	С	2.50	10.00	10.11	0.11	10.00	32.01			
	D	2.61								
	Α	2.50								
2	В	2.50	10.00	10.31	0.31	20.00	65.62	Near		
2	С	2.50	10.00	10.31	0.31	20.00	05.02	Surface		
	D	2.81								
	Α	2.50								
3	В	2.50	10.00	10.04	0.04	30.00	00 42			
3	С	2.50	10.00	10.04	0.04	30.00	98.43			
	D	2.54								
13	Α	2.50	10.00							
	В	2.50			10.06	0.06	130.00	426.51		
	С	2.50	10.00	10.00	0.00	130.00	420.31	Scaling /		
	D	2.56								
	Α	2.50	10.00	10.00						Eccentricity
14	В	2.50			10.04	0.04	140.00	459.32		
14	С	2.50			10.00	10.00	10.04	0.04	140.00	409.32
	D	2.54								
	Α	2.50								
16	В	2.50	10.00	9.61	-0.39	160.00	524.93			
10	С	2.50	10.00	9.01	-0.59					
	D	2.11						Maximum		
	Α	2.50							Wall Loss	
17	В	2.50	10.00	10.01	0.04	170.00	557.74			
17	С	2.50	10.00	10.01	0.01	170.00	557.74			
	D	2.51								
	A	2.50								
23	В	2.50	10.00	10.16	0.16	230.00	754.59			
25	С	3.00	10.00	10.10	0.10	230.00	704.09			
F	D	2.16						Anomaly in MTD 2015		
	Α	2.50								
24	В	2.50	10.00	0 10.21	0.21	240.00	787.40			
24	С	2.50	10.00							
	D	2.71								

Table 7: 5-1/2" Casing Data

Joint #	Section	Section Length (m)	Est. Joint Length (m)	Measured Joint Length (m)	Difference (m)	Est. Depth (m)	Est. Depth (ft)	Feature / Importance	
34	Α	2.50		10.3	0.30				
	В	2.50	10.00			240.00	1115.49		
	С	2.50	10.00			340.00	1115.49		
	D	2.80							
	Α	2.50							
35	В	2.50	10.00	9.9	-0.10	350.00	1148.29		
- 55	С	2.50	10.00	9.9	-0.10	300.00	1140.29	155 0100	
	D	2.40						J55/N80 Crossover	
	Α	2.80						CIUSSOVEI	
36	В	2.80	10.00	8.4	-1.60	360.00	1181.10		
	С	2.80	1						
	Α	2.50			0.24	370.00			
27	В	2.50	40.00	10.24			1213.91		
37	С	2.50	10.00						
	D	2.74							
	Α	2.50	10.00		0.35	900.00	2952.76		
00	В	2.50		40.00 40.05					
90	С	2.50		.00 10.35					
	D	2.85							Scaling to Wall Loss
	Α	2.00							
91	В	2.00	40.00	10.35	0.35	910.00	2985.56		
91	С	3.00	10.00						
	D	3.35							
	Α	2.50					3149.61		
	В	2.50	40.00	40.05					
96	С	2.50	10.00	10.25	0.25	960.00			
	D	2.75	1						
	Α	2.50							
	В	2.50	10.00	40.00				Last Joints	
97	С	2.50		10.00	10.26	0.26	970.00	3182.41	
	D	2.76							
98	Α	2.40							
(Cut Off)	В	2.37	6.00	4.77	-10.77	976.00	3202.10		

Table 8: Pallet Catalogue for 5-1/2" Casing Stored at Tonsley TAFE

Pallet	Joint #	Pallet	Joint #	Pallet	Joint #
	2		1		14
1	36	3	3	5	17
	90		97		98
	16		13		23
2	24	4	35	6	34
	91		96		37

8. Appendices

Appendix A – 2-3/8" Tubing MFC and MTD Logs

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
1-3	Surface – 28.62 (0 – 94)	Near surface

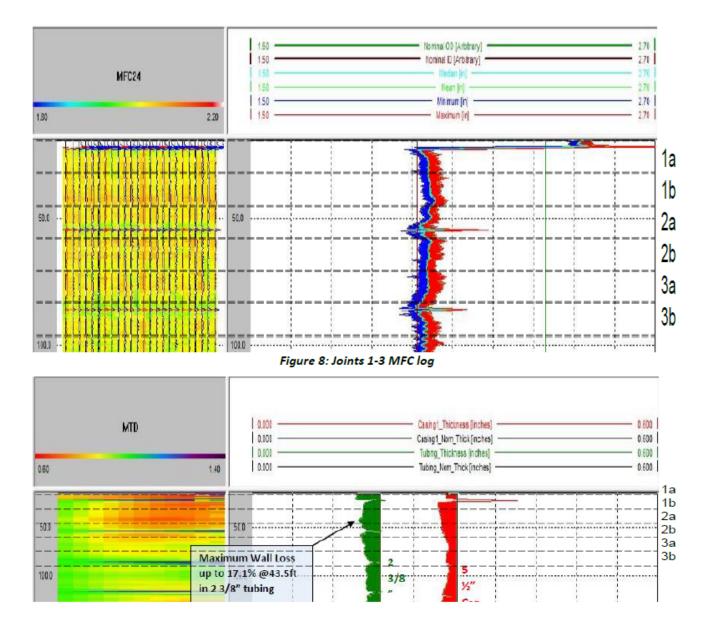
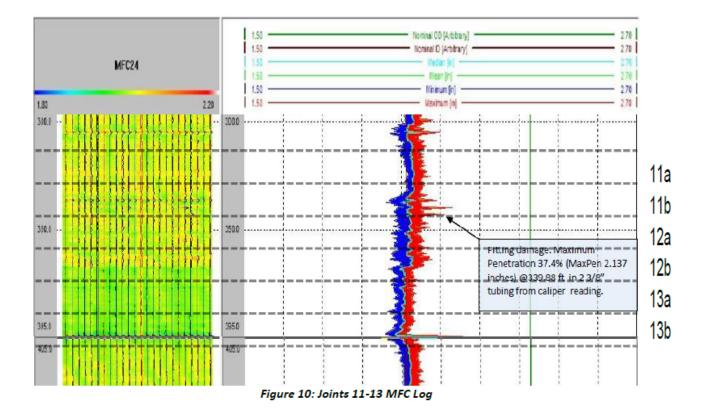


Figure 9: Joints 1-3 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
11 - 13	95.40 - 124.02 (313 - 407)	High pitting



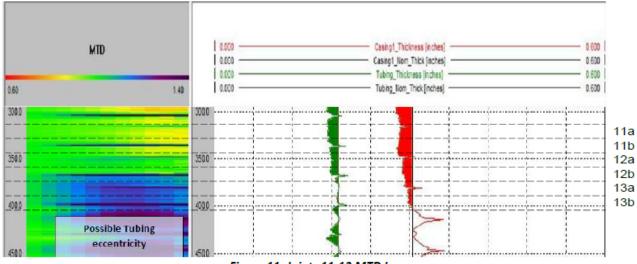


Figure 11: Joints 11-13 MTD Log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
15	133.56 – 143.10 (438 – 469)	Damaged pipe

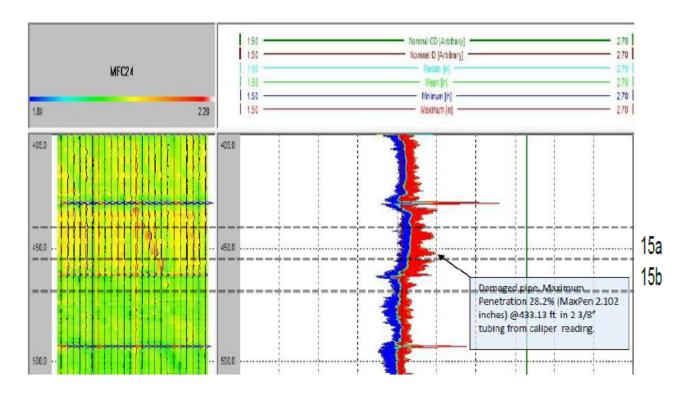
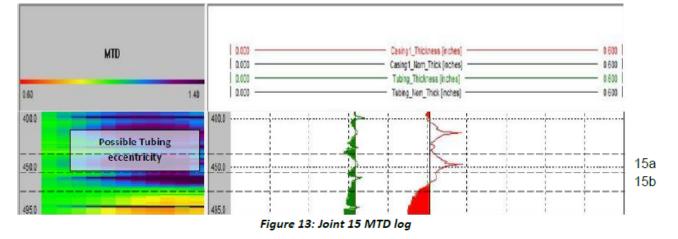


Figure 12: Joint 15 MFC log



	Joint Range	Est. Depth Range (m (ft))	Reason for Interest
ſ	32	295.74 - 305.28 (970 - 1002)	Sample point

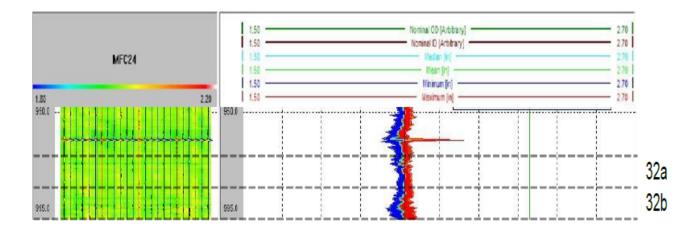


Figure 14: Joint 32 MFC Log

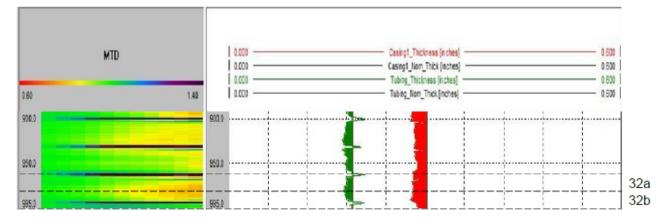


Figure 15: Joint 32 MTD Log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
51 - 53	477.0 – 505.62 (1565 – 1659)	High pitting

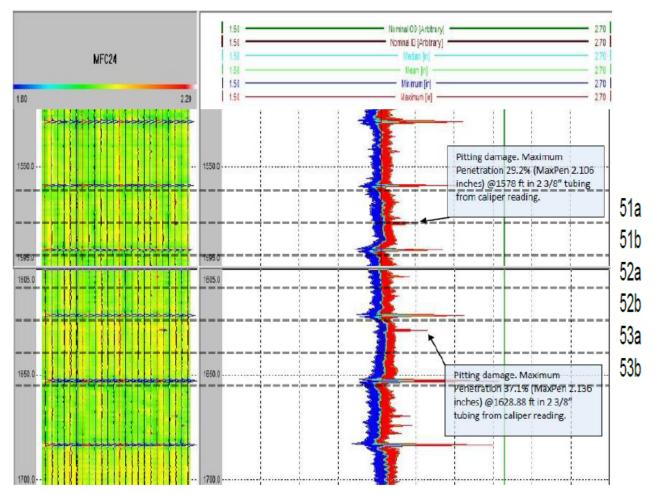
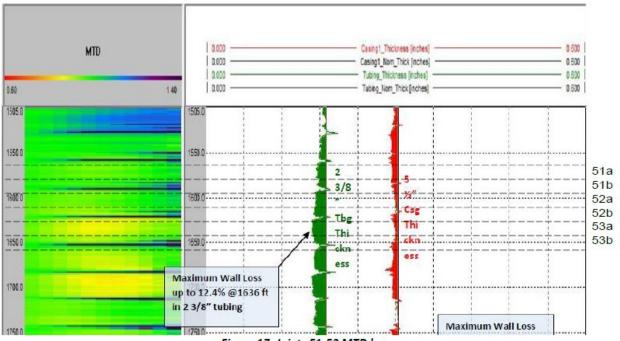
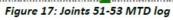
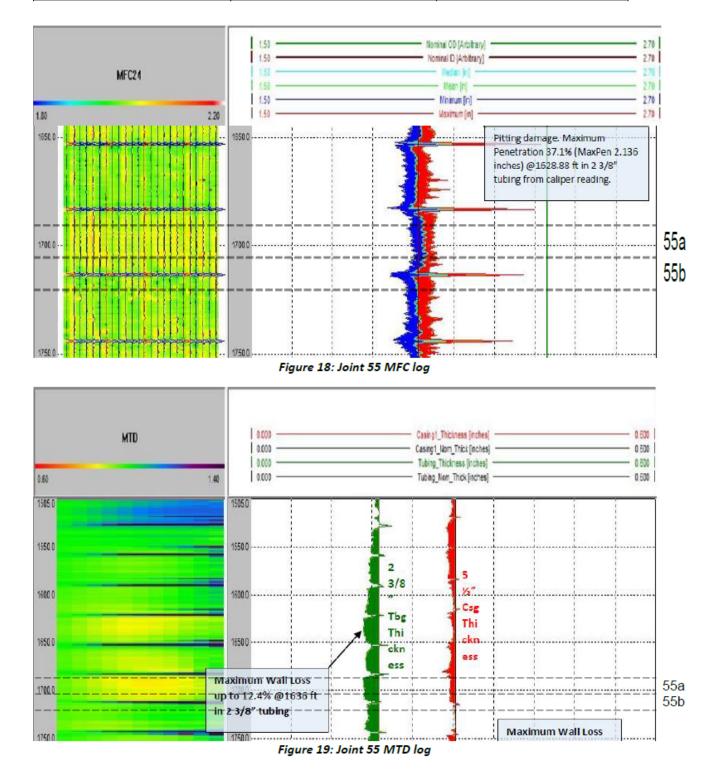


Figure 16: Joints 51-53 MFC log





Joint Range	Est. Depth Range (m (ft))	Reason for Interest
55	515.16 - 524.70 (1690 - 1721)	Odd calliper response



Joint Range	Est. Depth Range (m)	Reason for Interest
63	591.48 - 601.02 (1941 - 1972)	Scale build-up

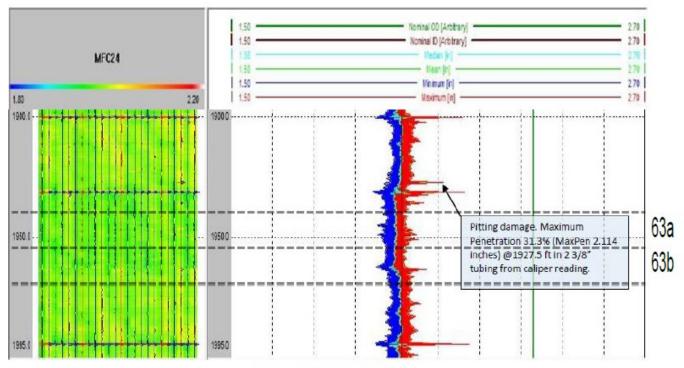


Figure 20: Joint 63 MFC log

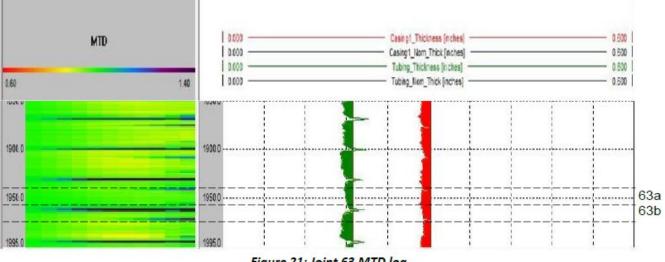


Figure 21: Joint 63 MTD log

Joint Range	Est. Depth Range (m)	Reason for Interest
75 -76	705.96 – 725.04 (2316 – 2379)	Scale build-up

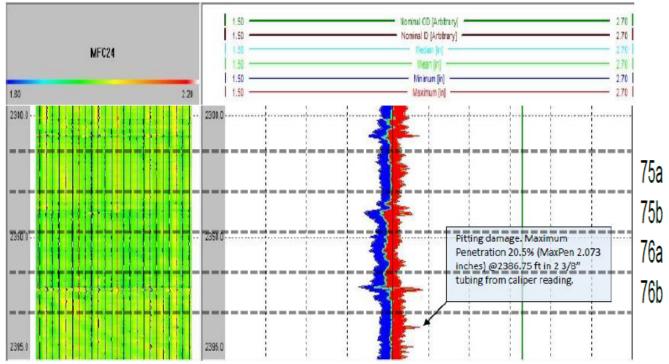


Figure 22: Joints 75-76 MFC log

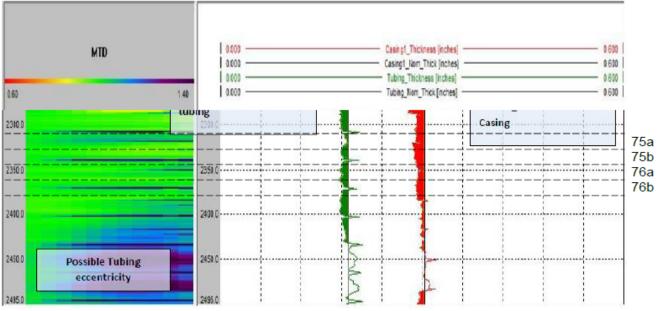
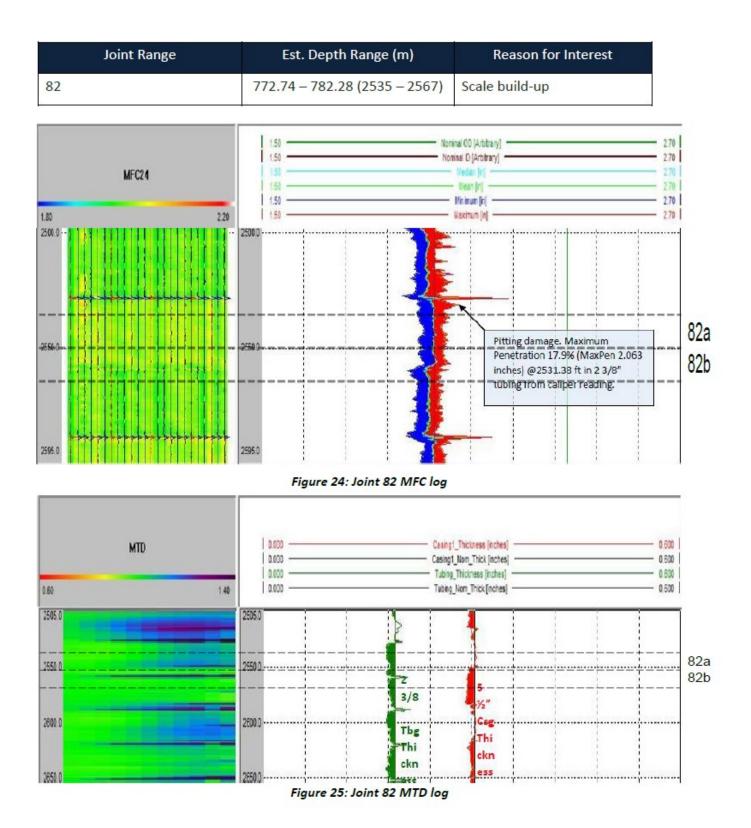


Figure 23: Joints 75-76 MTD log



Page |28

Joint Range	Est. Depth Range (m)	Reason for Interest
85 - <mark>8</mark> 7	801.36 - 829.98 (2629 - 2723)	Low wall thickness / high pitting

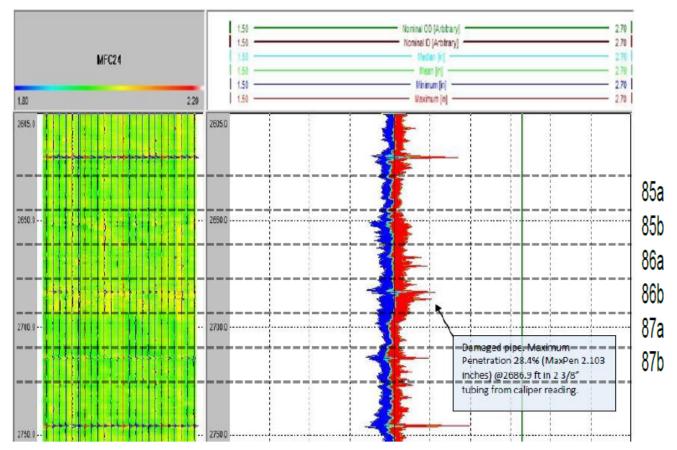


Figure 26: Joints 85-87 MFC log

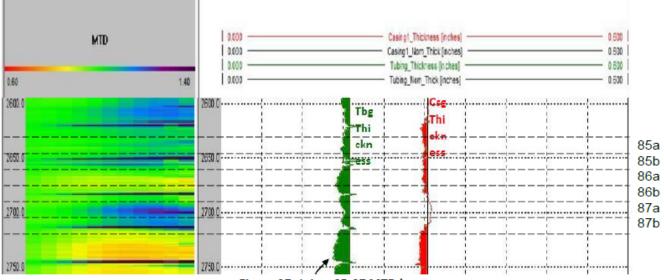


Figure 27: Joints 85-87 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
92	868.14 - 877.68 (2848 - 2880)	Damaged pipe

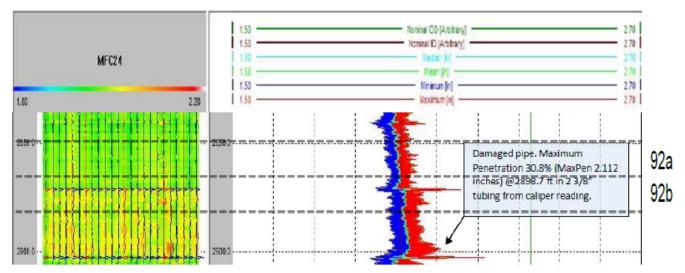
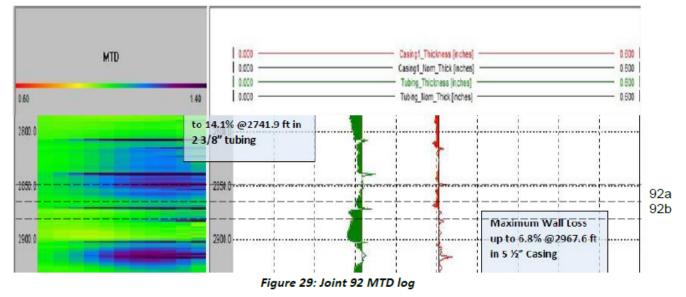
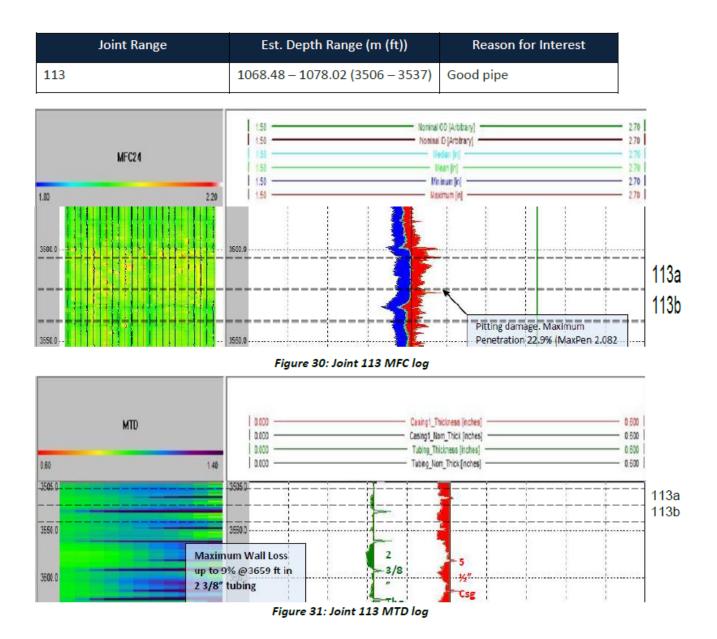
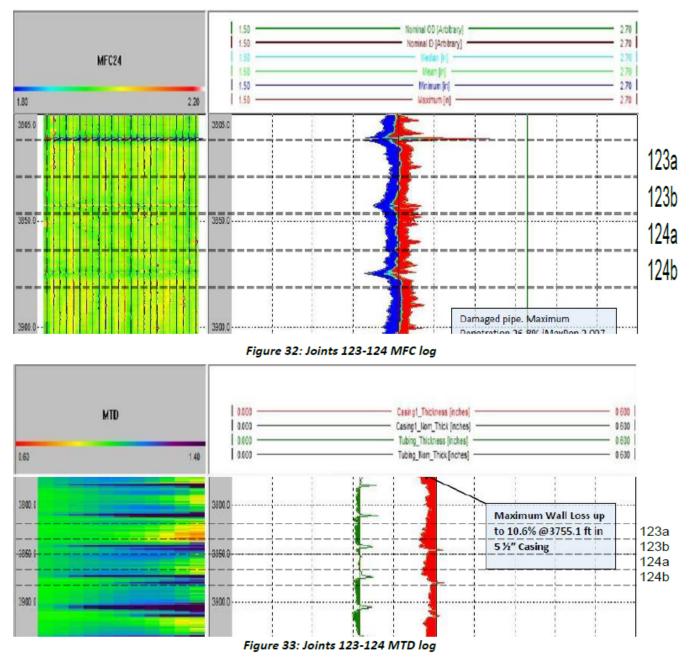


Figure 28: Joint 92 MFC log

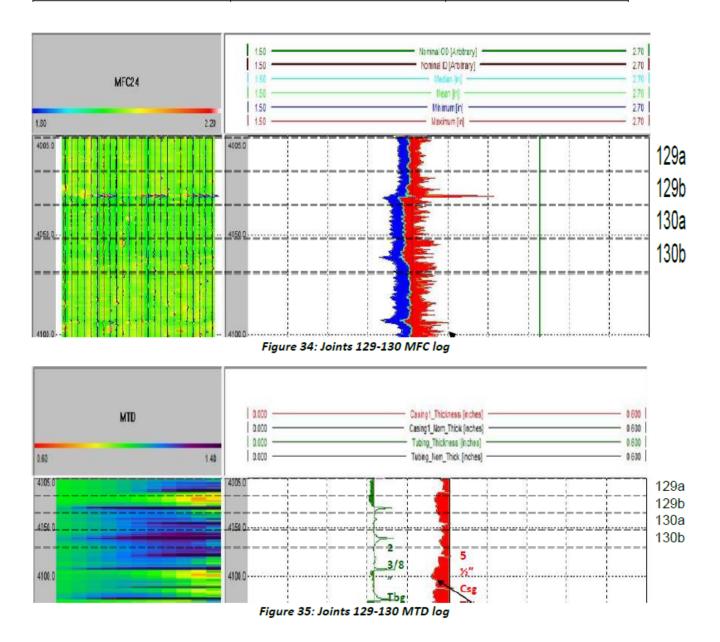




Joint Range	Est. Depth Range (m (ft))	Reason for Interest
123 - 124	1163.88 – 1182.96 (3819 – 3881)	Good pipe



Joint Range	Est. Depth Range (m (ft))	Reason for Interest
129 - 130	1221.12 - 1240.20 (4006 - 4069)	High pitting



Joint Range	Est. Depth Range (m (ft))	Reason for Interest
141 - 143	1335.60 - 1364.22 (4382 - 4476)	High pitting

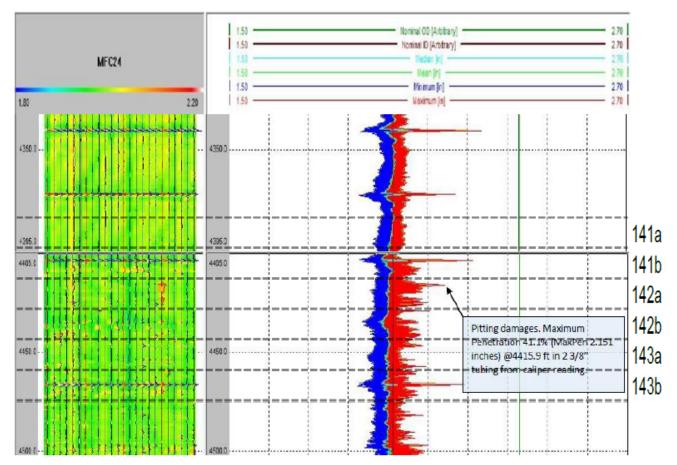
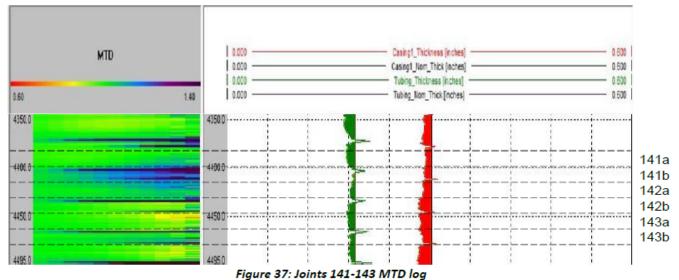


Figure 36: Joints 141-143 MFC log



Joint Range	Est. Depth Range (m (ft))	Reason for Interest
145 - 147	1373.76 – 1402.38 (4507 – 4601)	High pipe damage / Good pipe jt. 147?

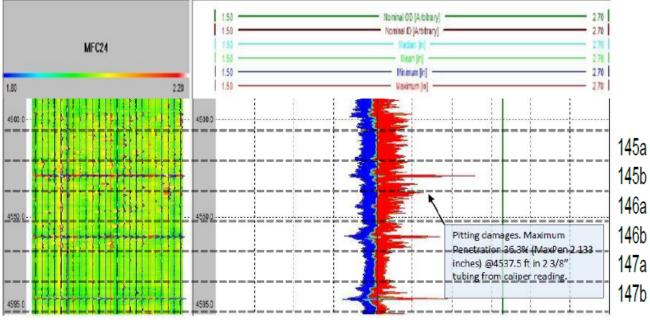
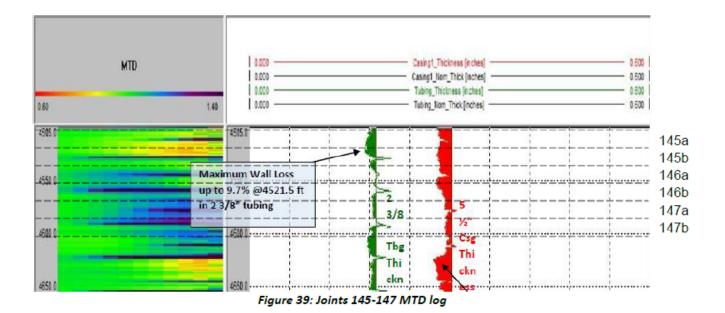


Figure 38: Joints 145-147 MFC log



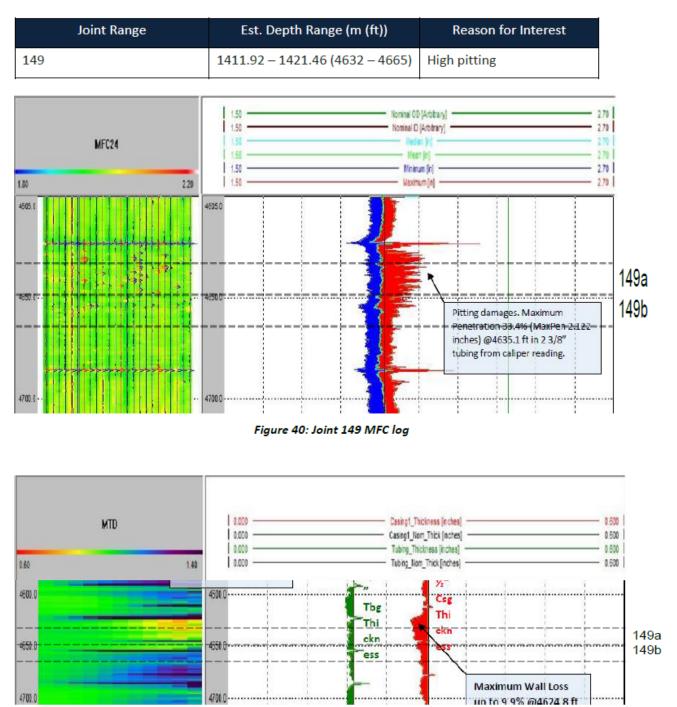


Figure 41: Joint 149 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
155 - 156	1469.16 – 1488.24 (4820 – 4883)	Damaged pipe

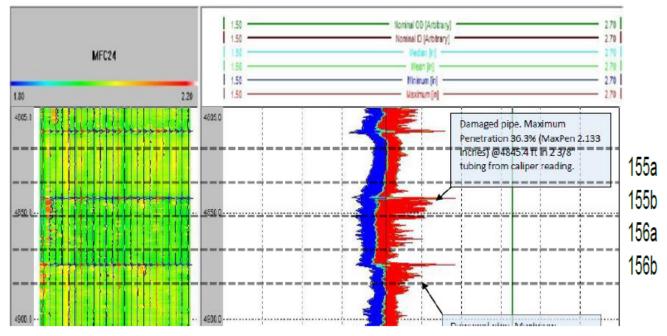
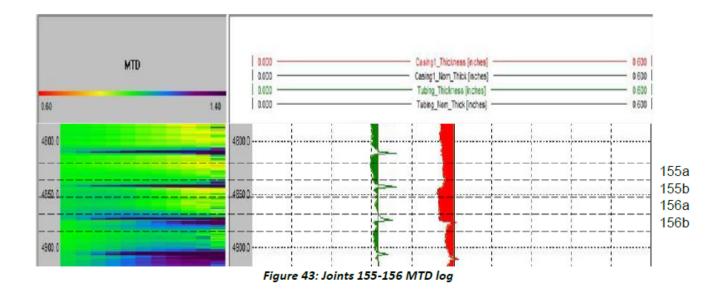


Figure 42: Joints 155-156 MFC log



Joint Range	Est. Depth Range (m (ft))	Reason for Interest
174 - 176	1650.42 – 1679.04 (5414 – 5509)	High pitting

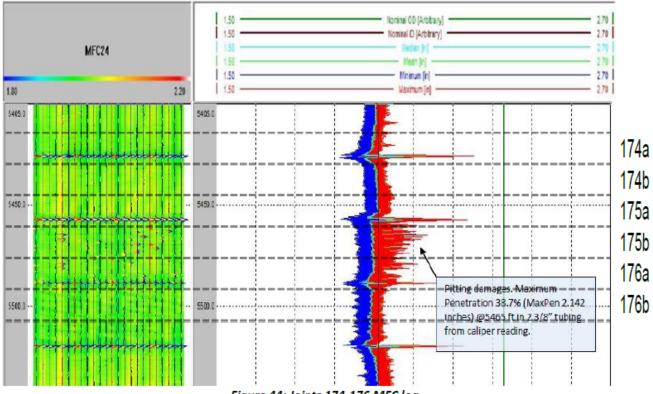


Figure 44: Joints 174-176 MFC log

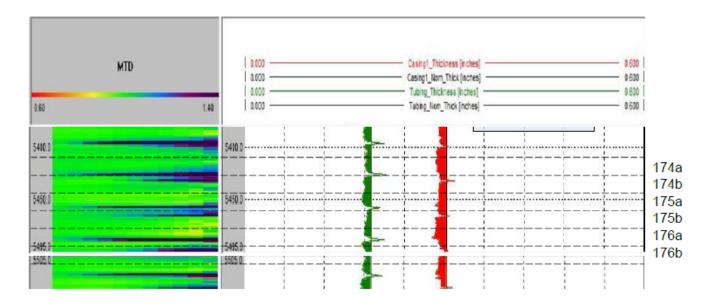
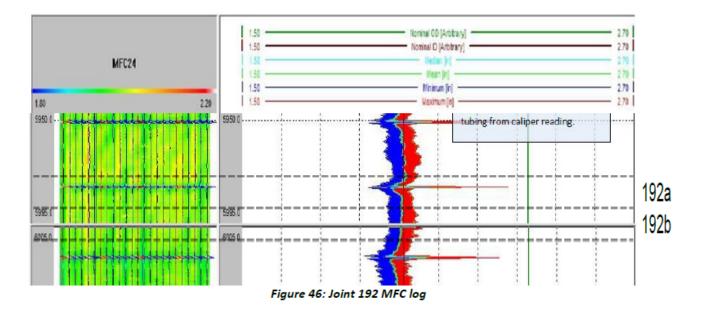
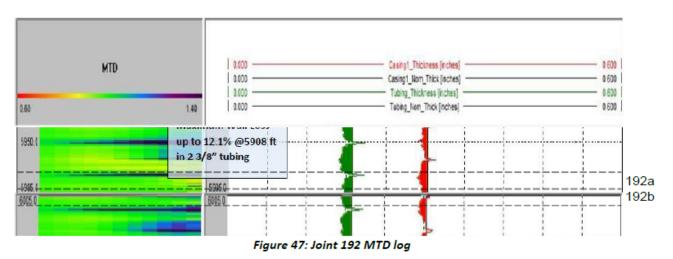


Figure 45: Joints 174-176 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
192	1822.14 – 1831.68 (5978 – 6009)	Sample point





Joint Range	Est. Depth Range (m (ft))	Reason for Interest
215 - 216	2041.56 - 2060.64 (6698 - 6761)	Scale build-up

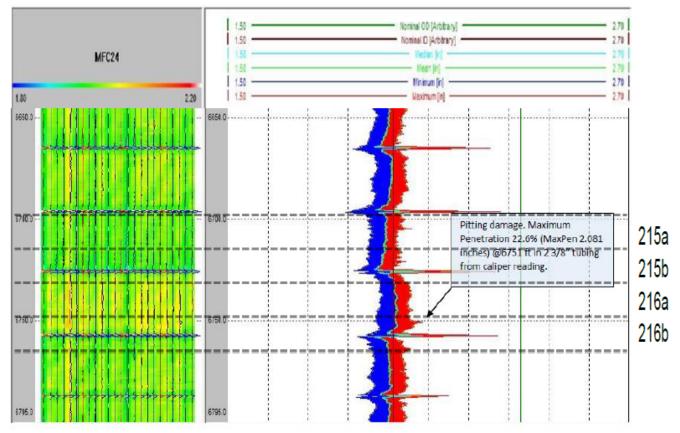


Figure 48: Joints 215-216 MFC log

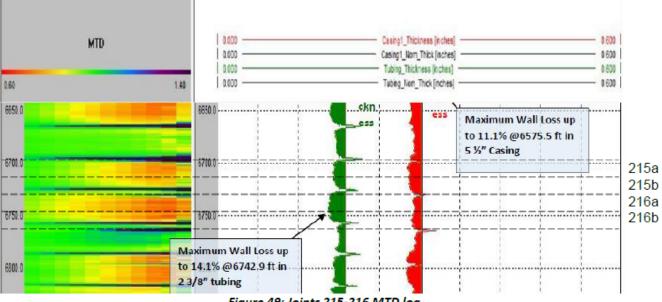
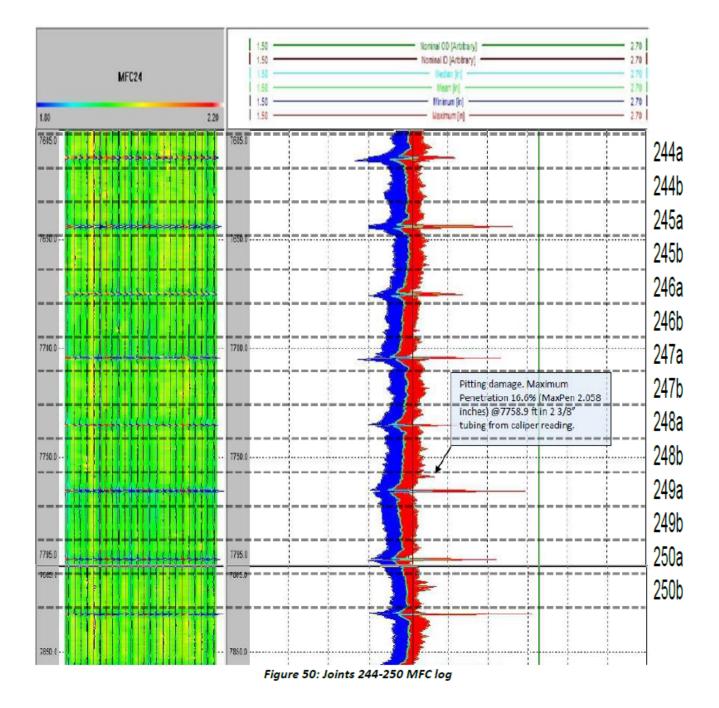


Figure 49: Joints 215-216 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
244 - 245	2318.22 - 2337.30 (7606 - 7668)	?
246 - 248	2337.30 - 2365.92 (7668 - 7762)	Scale build-up
249 - 250	2365.92 – 2385.00 (7762 – 7825)	Damaged pipe / Last joints



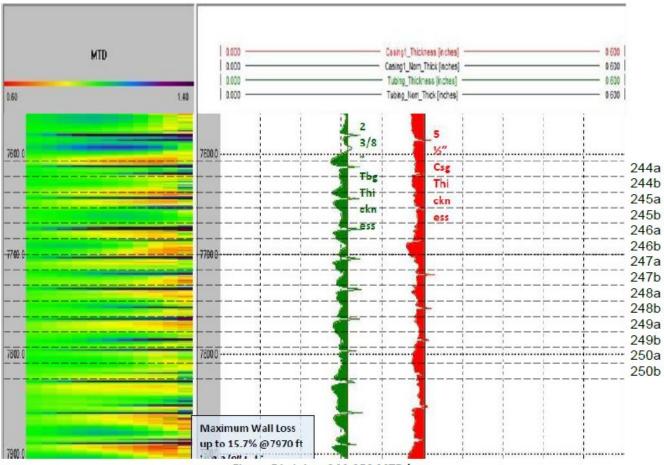


Figure 51: Joints 244-250 MTD log

Appendix B – 5-1/2" Casing MTD Log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
1-3	Surface – 30.0 <mark>(</mark> 0 – 98)	Near Surface

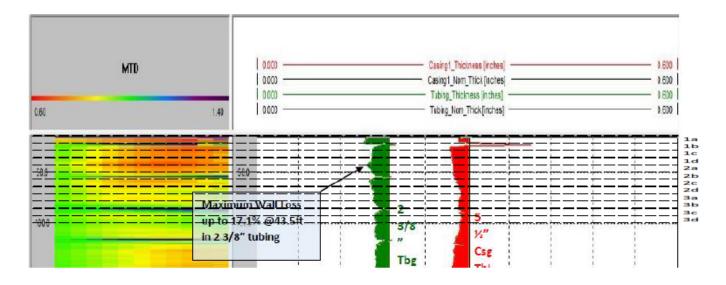


Figure 52: Joints 1-3 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
13 - 14	120.0 – 140.0 (394 – 459)	Scale / eccentricity

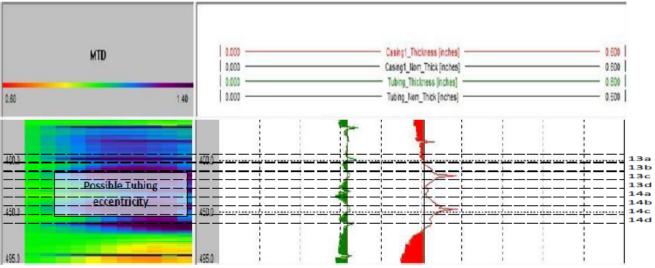


Figure 53: Joints 13-14 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
16 - 17	150.0 – 170.0 (492 – 558)	Maximum wall loss

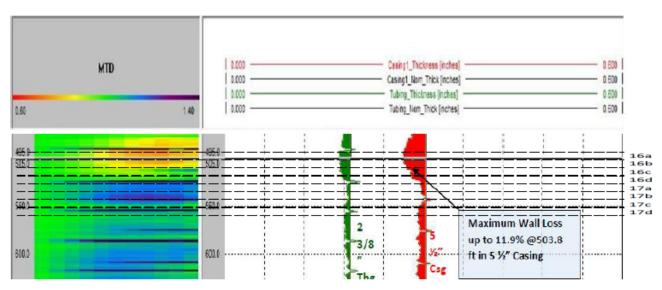


Figure 54: Joints 16-17 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
23 - 24	220.0 – 240.0 (722 – 787)	Anomaly in MTD 2015

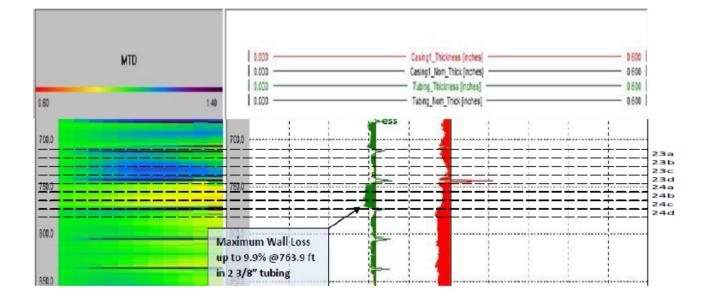


Figure 55: Joints 23-24 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
34 - 37	330.0 - 370.0 (1083 - 1214)	J55/N80 crossover

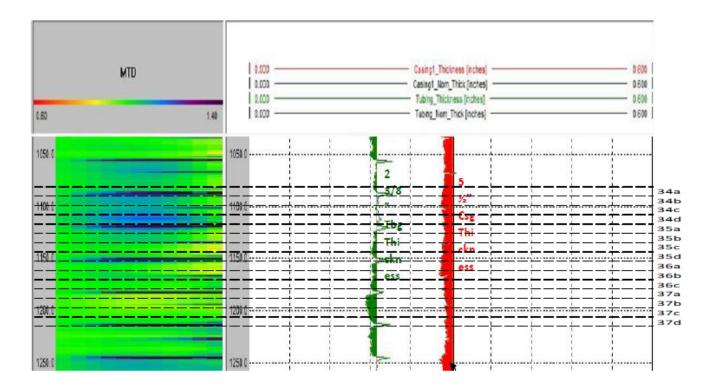


Figure 56: Joints 34-37 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
90 - 91	890.0 – 910.0 (2920 – 2986)	Scaling to wall loss

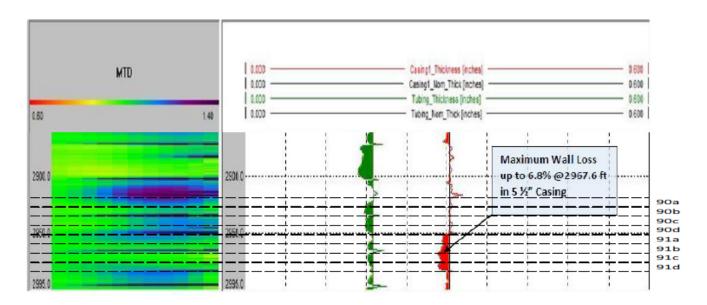


Figure 57: Joints 90-91 MTD log

Joint Range	Est. Depth Range (m (ft))	Reason for Interest
96 – 98	950.0 – 976.0 (3117 – 3202)	Last joints cut & pulled

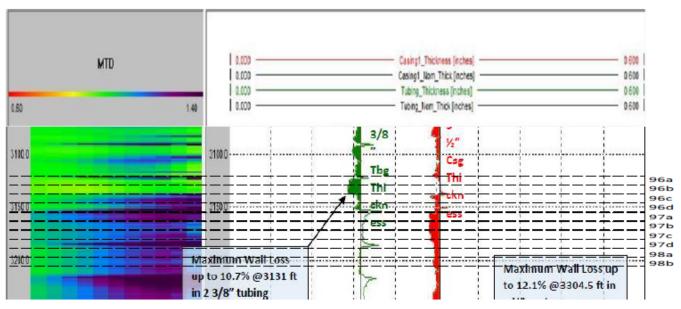


Figure 58: Joints 96-98 MTD log