



# **TEP Rocky Mountain LLC Clough NR 22-3 Casing Integrity Report**



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## **Casing Integrity Interpretation**

TEP Rocky Mountain LLC  
Clough NR 22-3  
API # 05-045-23904  
October 06, 2018

<b>Casing Description</b>	<b>Size (in)</b>	<b>Casing Weight (lb/ft)</b>	<b>Depth Interval (ft)</b>
<b>Surface Casing</b>	9 5/8	36	Surface – 1126
<b>Production String</b>	4 1/2	11.6	Surface – 10241

## **Objective**

Inspect the casing condition in the 4 1/2-inch casing.

## **Operation**

Reliance Oilfield Services utilized a 40-finger Sondex Multifinger Imaging Tool (MIT) for internal casing inspection. The MIT was logged on October 06, 2018.

## **Interpretation Summary**

The MIT casing inspection data was evaluated in WIPER from 6238.34 – 10168.26 feet. In total, 90 joints were analyzed on a joint-by-joint basis. The area immediately surrounding the collars was ignored during processing.

For this well, the maximum penetration values were calculated from the mode ID, which is the measured ID of the joint, estimated from “good areas of pipe.” The mode ID of the joints range from 3.92 – 4.02 inches. The nominal ID of this well (4 1/2 -inch 11.6-pound casing) is 4.0 inches.

The largest anomaly in the well has a maximum penetration value of 100% at a depth of 7794.5 feet. This is a repeatable multi-finger anomaly and is classified as a possible hole. A “possible hole” is any anomaly with a penetration value larger than 80%. Even though only the largest anomaly for this joint is listed in the report, it’s important to note that the ID of the entire joint is very inconsistent with average ID values, ranging from 3.98 – 4.21 inches (not including the hole). In fact, approximately half of the joint has ID values greater than 4.11 inches. The log data showing this anomaly is shown in Figure 1, the cross section is shown in Figure 2, and 3D images of this anomaly are shown in Figure 3 and Figure 4.

The second largest anomaly in the well has a maximum penetration value of 21.01% at a depth of 9176.2 feet. The log data showing this anomaly is shown in Figure 5, the cross section is shown in Figure 6, and 3D images of this anomaly are shown in Figure 7 and Figure 8.

All other joints have maximum penetration values under 13%.

Please see the attached Joint Tabulation Table at the end of the report for more information.

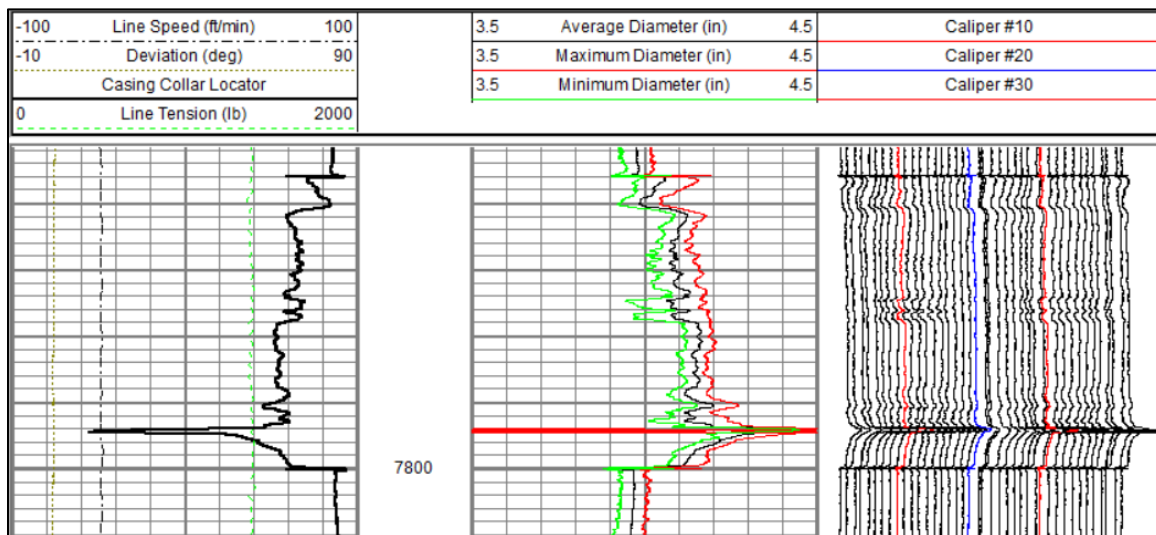


Figure 1. Log data of the anomaly at 7794.5 feet.

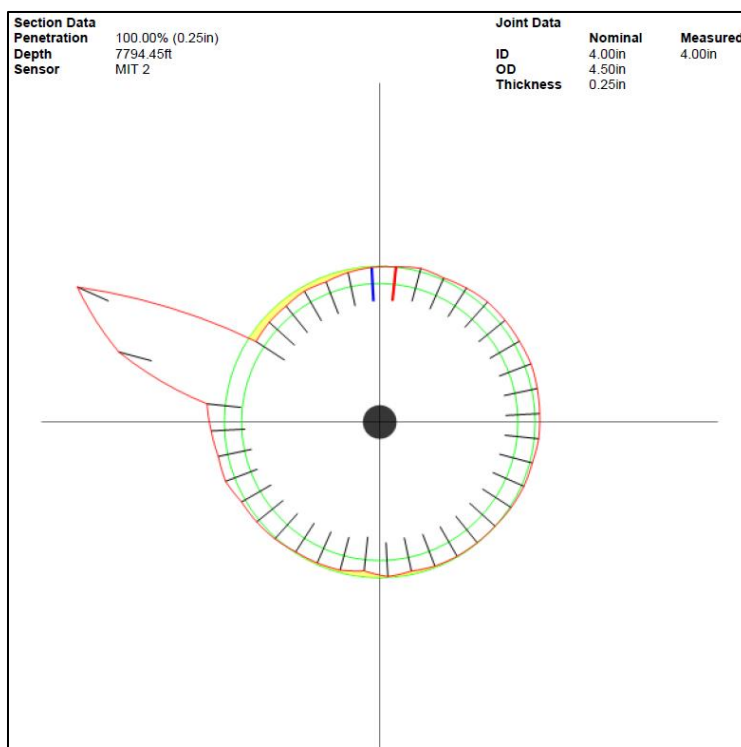


Figure 2. Cross-section of the anomaly at 7794.5 feet.

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All interpretations of Logs made by Reliance Oilfield Services employees will give the customer the benefits of their best judgment. Since all interpretations are personal opinions, based on inferences from electrical and or other measurements, we do not, and cannot, guarantee the accuracy of any interpretation, except in a case of willful negligence or willful misconduct on our part, be liable or responsible for any lose, cost, damage or expenses incurred or sustained by the customer resulting from any interpretations made by our agents, officers or employees.

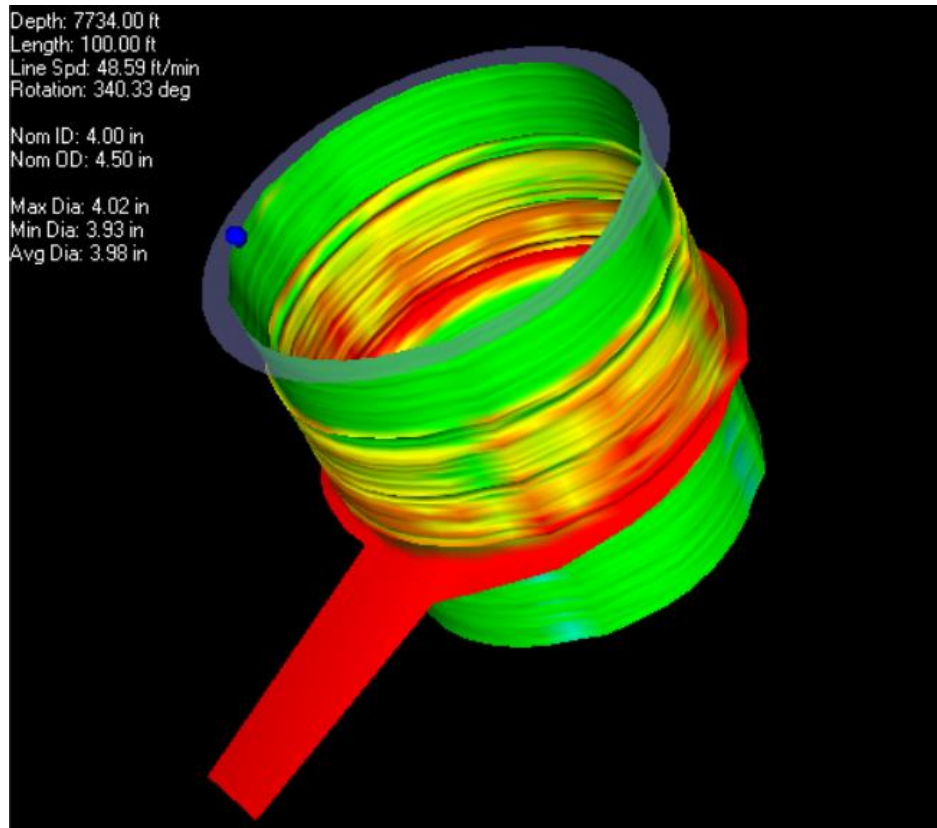


Figure 3. 3D image of the anomaly at 7794.5 feet.

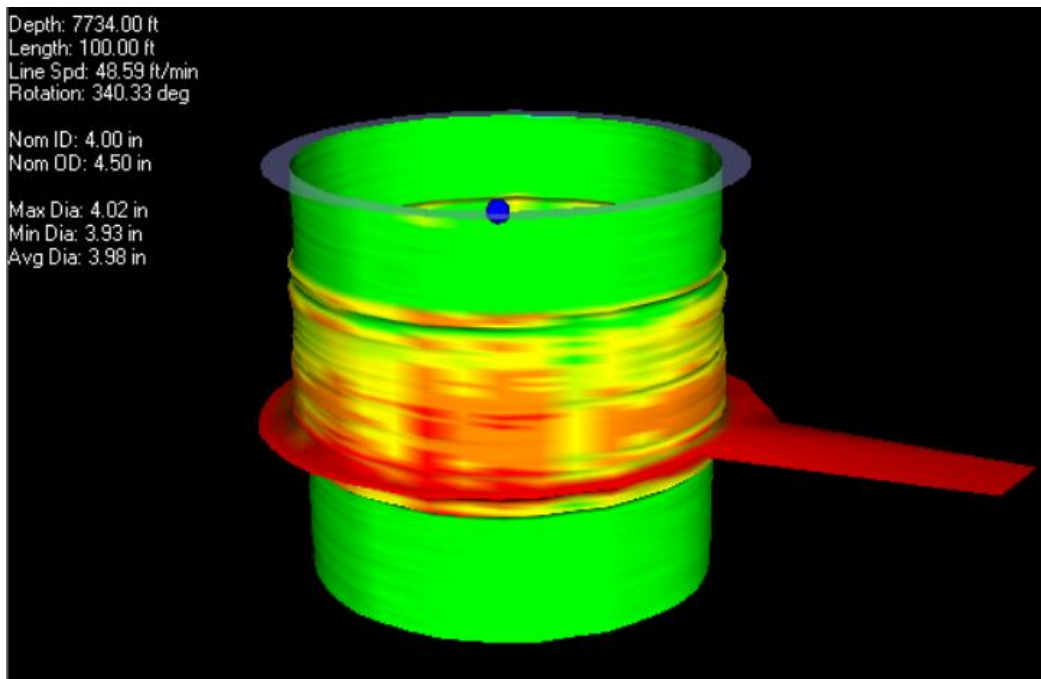


Figure 4. 3D image of the anomaly at 7794.5 feet.

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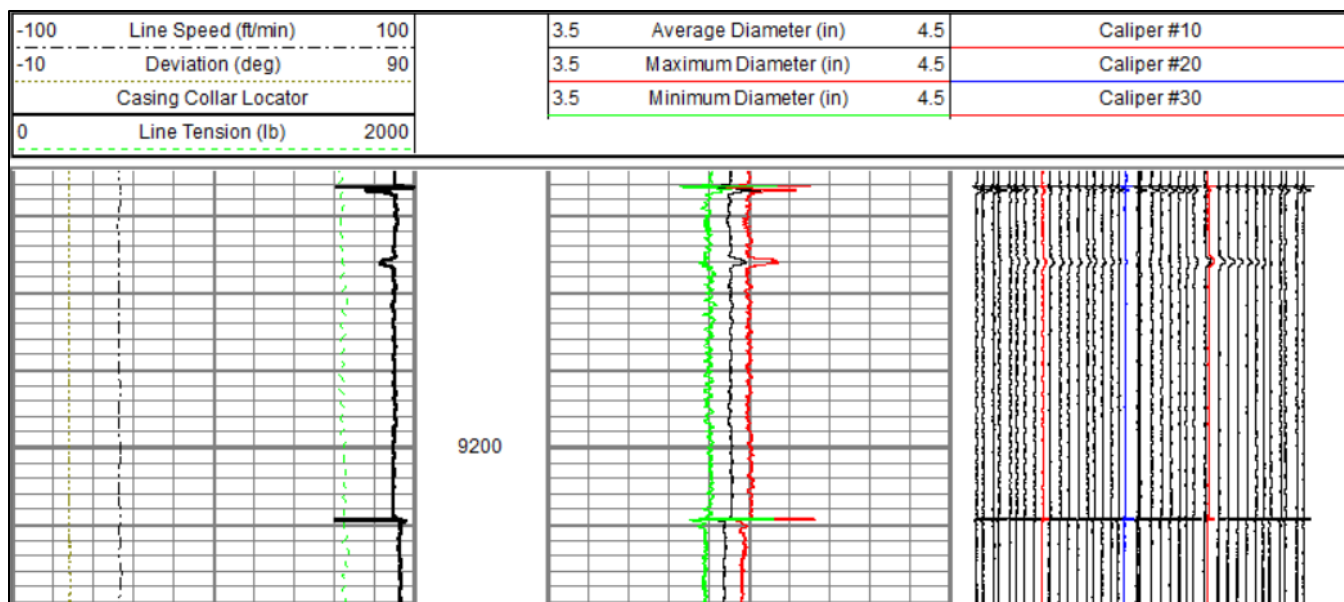


Figure 5. Log data of the anomaly at 9176.2 feet.

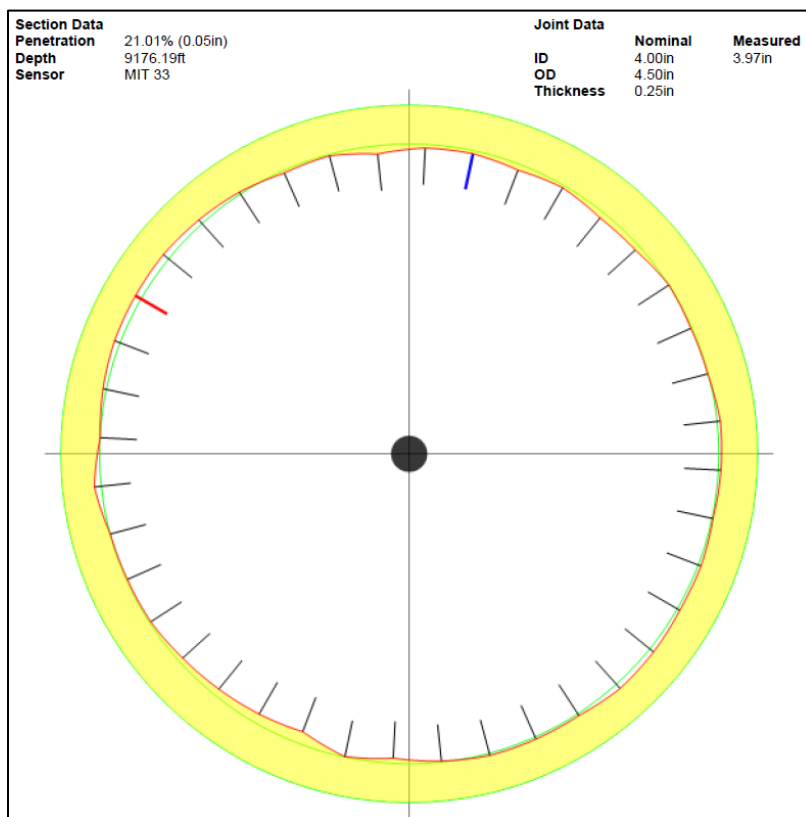


Figure 6. Cross-section of the anomaly at 9176.2 feet.



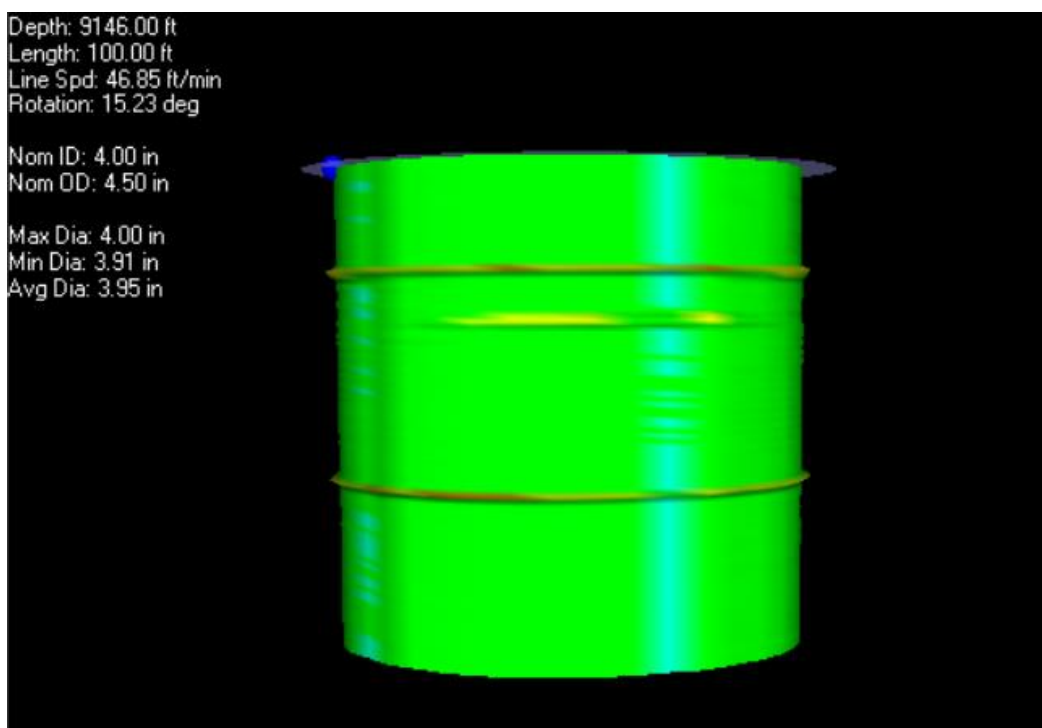


Figure 7. 3D image of the anomaly at 9176.2 feet.

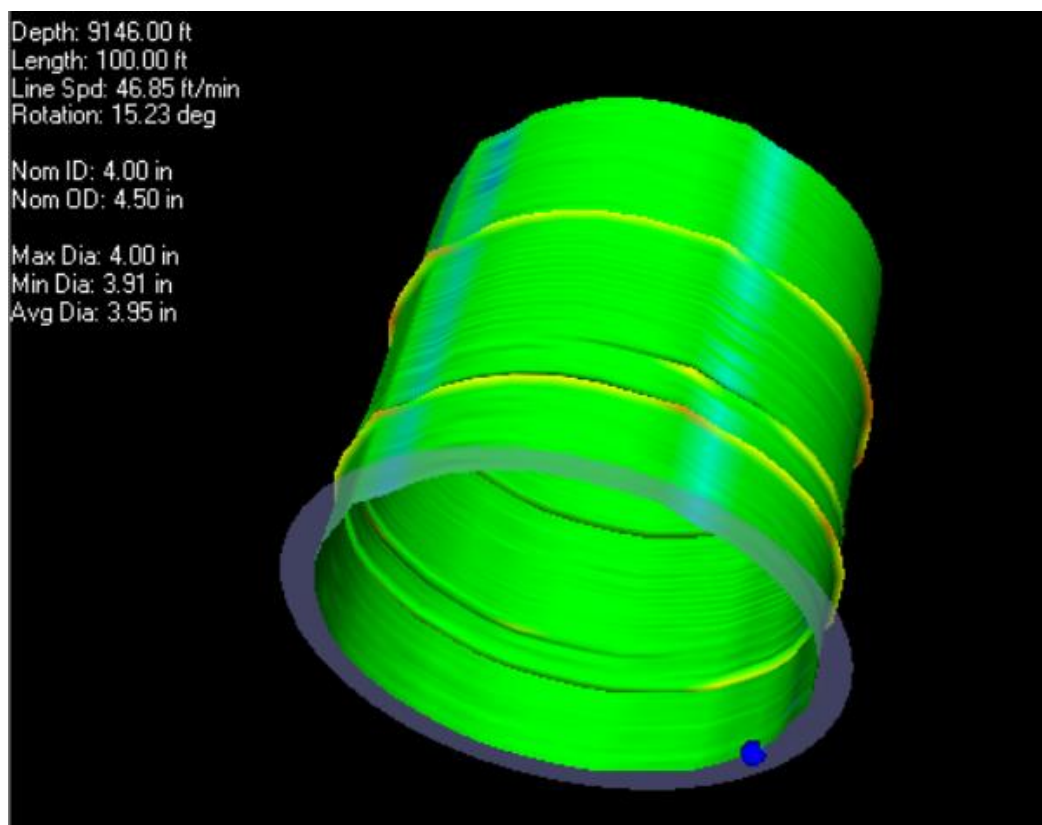


Figure 8. 3D image of the anomaly at 9176.2 feet.

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# Casing Inspection Report



**Company** TEP Rocky Mountain LLC  
**Field** Rulison  
**Well** Clough NR 22-3  
**Country** USA  
**County** Garfield  
**State** Colorado  
**Analysed By** E. Siegel  
**Survey Date** 06-OCT-2018

## Tools Used in Analysis

**Serial No:**

Zone	Size (in)	Weight (lb/ft)	Length (ft)	Nom ID (in)	Grade
1	4.500	11.600	3982.8	4.000	UNKNOWN

## Analysis Overview

Joints Analysed = 90

Reported depth range = 6238.34ft - 10168.26ft

Joints with possible hole = 1

These results were generated semi-automatically, using Sondex WIPER analysis software. The data was acquired using Sondex casing inspection tools. Sondex accepts no responsibility for the accuracy of the results that are presented.

All items in the string are referred to as 'Joints'. This includes completion items such as cross-overs. Normal joints are identified by integer numbers, sequential in depth. Short joints and completion items are identified by numbers after the decimal point.

### DISCLAIMER:

All interpretations are opinions, based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions.

V-3.18



# Casing Inspection Report



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**Country** USA  
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**Analysed By** E. Siegel  
**Survey Date** 06-OCT-2018

**Tools Used in Analysis**

**Serial No:**

## Most penetrated joints

Penetration of 100.00% (0.25in) in Joint 37 at depth 7794.5ft  
Penetration of 21.01% (0.05in) in Joint 69 at depth 9176.2ft  
Penetration of 12.74% (0.03in) in Joint 63 at depth 8948.6ft  
Penetration of 12.62% (0.03in) in Joint 53 at depth 8502.7ft  
Penetration of 11.09% (0.03in) in Joint 14 at depth 6775.1ft





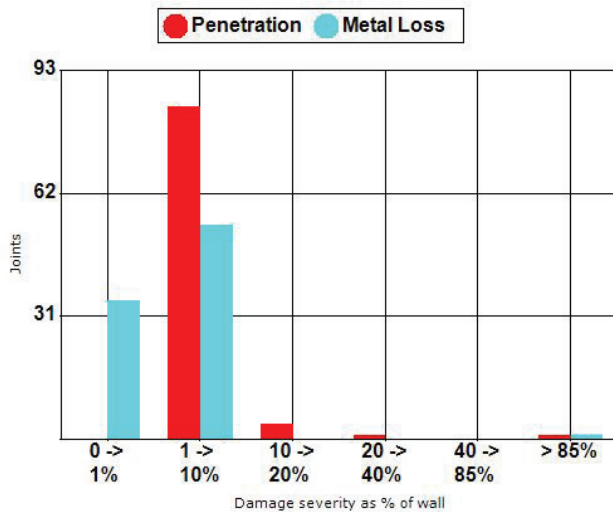
# MIT Report Overview

## Body Region Penetrations



**Company** TEP Rocky Mountain LLC  
**Field** Rulison  
**Well** Clough NR 22-3  
**Country** USA  
**County** Garfield  
**State** Colorado  
**Analysed By** E. Siegel  
**Survey Date** 06-OCT-2018

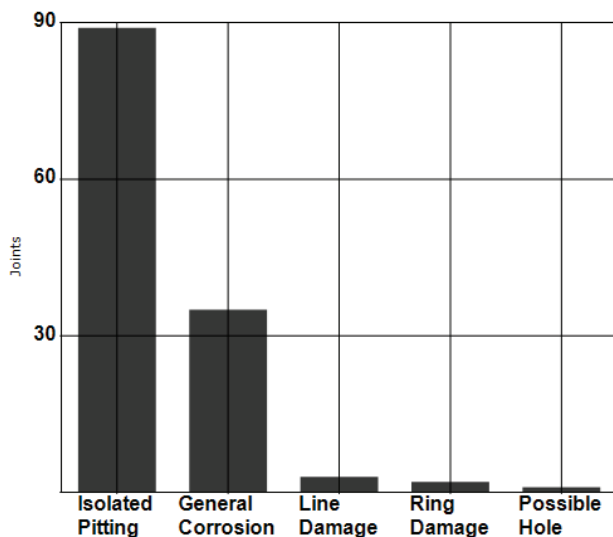
Penetration and Metal Loss



Number of joints analysed (Total =90)

Pens	0	84	4	1	0	1
Loss	35	54	0	0	0	1

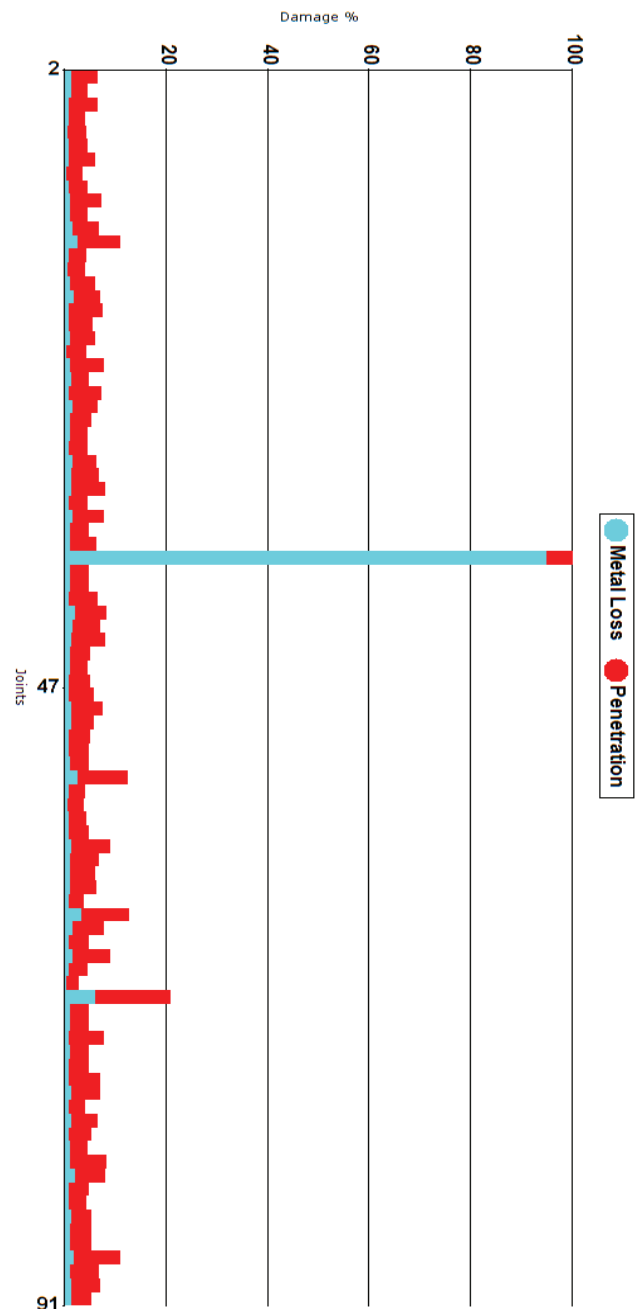
Damage Configuration



Number of joints damaged (Total =89/90)

89	35	3	2	1
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Damage Profile (% Wall)



# MIT Joint Tabulation Sheet (Penetration)

Data: field/well/run1/Merge Survey Date: 06-OCT-2018

Location: USA

MIT Grade 1[0%-19%] 2[20%-39%] 3[40%-59%] 4[60%-79%] 5[80%-100%]

■ Penetration  
■ Metal Loss

Joint	Depth ft	Nom ID in	Mode ID in	Penetration		Metal Loss %	Grade	Damage Description	Profile (%)	
				Body in	%				0	100
2	6238.3	4.000	3.99	0.02	6.5	1.4	1	Light Corrosion		
3	6281.8	4.000	3.99	0.01	4.7	1.3	1	Light Pitting		
4	6325.1	4.000	4.01	0.02	6.7	0.9	1	Light Pitting		
5	6371.1	4.000	4.01	0.01	4.0	0.8	1	Light Pitting		
6	6393.9	4.000	4.00	0.01	4.2	0.7	1	Light Pitting		
7	6438.4	4.000	4.01	0.01	4.5	0.8	1	Light Pitting		
8	6484.6	4.000	3.98	0.01	6.0	0.9	1	Light Pitting		
9	6529.1	4.000	4.01	0.01	3.7	0.4	1	Light Pitting		
10	6572.4	4.000	3.98	0.01	4.6	0.8	1	Light Pitting		
11	6616.2	4.000	4.00	0.02	7.2	1.2	1	Light Corrosion		
12	6659.7	4.000	3.99	0.01	4.5	1.0	1	Light Pitting		
13	6704.2	4.000	4.00	0.02	6.8	1.5	1	Light Corrosion		
14	6746.4	4.000	4.02	0.03	11.1	2.6	1	Moderate Line Damage		
15	6789.2	4.000	4.01	0.01	4.3	0.9	1	Light Pitting		
16	6835.4	4.000	3.99	0.01	4.0	0.6	1	Light Pitting		
17	6875.9	4.000	4.02	0.02	6.1	1.0	1	Light Pitting		
18	6920.3	4.000	3.96	0.02	7.0	1.8	1	Light Pitting		
19	6964.1	4.000	4.01	0.02	7.5	0.8	1	Light Pitting		
20	7008.5	4.000	3.99	0.01	5.6	0.8	1	Light Pitting		
21	7052.8	4.000	4.00	0.02	6.0	1.2	1	Light Corrosion		
22	7097.0	4.000	4.00	0.01	4.2	0.4	1	Light Pitting		
23	7138.3	4.000	3.98	0.02	7.8	1.2	1	Light Corrosion		
24	7182.3	4.000	4.00	0.01	4.7	1.4	1	Light Corrosion		
25	7225.4	4.000	3.96	0.02	7.4	0.9	1	Light Pitting		
26	7269.8	4.000	3.98	0.02	6.6	1.5	1	Light Corrosion		
27	7313.6	4.000	4.00	0.01	5.3	1.1	1	Light Corrosion		
28	7357.9	4.000	3.97	0.01	4.6	1.1	1	Light Pitting		
29	7402.4	4.000	3.98	0.01	4.6	0.9	1	Light Pitting		
30	7446.7	4.000	3.98	0.02	6.4	1.6	1	Light Corrosion		
31	7490.5	4.000	3.98	0.02	6.8	1.4	1	Light Corrosion		
32	7535.0	4.000	4.00	0.02	8.0	1.4	1	Light Corrosion		
33	7578.3	4.000	3.98	0.01	4.5	0.8	1	Light Pitting		
34	7622.8	4.000	3.99	0.02	7.8	1.6	1	Light Corrosion		
35	7666.3	4.000	3.95	0.01	4.8	1.0	1	Light Pitting		
36	7709.7	4.000	3.98	0.02	6.2	1.2	1	Light Corrosion		
37	7755.9	4.000	4.00	0.25	100	95.0	5	Multiple possible holes		
38	7800.2	4.000	3.98	0.01	4.7	1.1	1	Light Pitting		
39	7844.4	4.000	3.98	0.01	4.9	1.2	1	Light Corrosion		
40	7889.0	4.000	3.98	0.02	6.5	0.9	1	Light Pitting		
41	7933.4	4.000	3.97	0.02	8.2	2.1	1	Light Corrosion		
42	7975.7	4.000	3.98	0.02	7.2	1.5	1	Light Corrosion		
43	8018.8	4.000	3.95	0.02	8.0	1.3	1	Light Corrosion		
44	8063.2	4.000	4.00	0.01	5.0	1.2	1	Light Pitting		
45	8107.7	4.000	3.99	0.01	4.6	1.0	1	Light Pitting		
46	8152.3	4.000	3.97	0.01	5.0	1.0	1	Light Pitting		
47	8198.4	4.000	4.00	0.01	5.7	0.8	1	Light Pitting		
48	8244.7	4.000	4.00	0.02	7.5	1.3	1	Light Corrosion		
49	8288.9	4.000	3.96	0.01	5.9	1.3	1	Light Corrosion		
50	8332.6	4.000	3.97	0.01	5.1	0.8	1	Light Pitting		
51	8377.0	4.000	3.97	0.01	4.8	0.9	1	Light Pitting		
52	8421.5	4.000	3.97	0.01	4.9	1.2	1	Light Pitting		
53	8464.8	4.000	3.99	0.03	12.6	2.7	1	Moderate Corrosion		
54	8506.1	4.000	3.99	0.01	4.1	0.9	1	Light Pitting		
55	8550.4	4.000	3.96	0.01	3.9	0.7	1	Light Pitting		
56	8596.5	4.000	3.96	0.01	4.4	0.8	1	Light Pitting		
57	8640.9	4.000	3.98	0.01	4.9	0.9	1	Light Pitting		

# MIT Joint Tabulation Sheet (Penetration)

Data: field/well/run1/Merge Survey Date: 06-OCT-2018

Location: USA

MIT Grade 1[0%-19%] 2[20%-39%] 3[40%-59%] 4[60%-79%] 5[80%-100%]

■ Penetration  
■ Metal Loss

Joint	Depth ft	Nom ID in	Mode ID in	Penetration		Metal Loss %	Grade	Damage Description	Profile (%)	
				Body in	%				0	100
58	8684.5	4.000	3.98	0.02	9.1	1.4	1	Light Corrosion	■	
59	8728.3	4.000	3.98	0.02	6.8	1.2	1	Light Pitting	■	
60	8772.7	4.000	3.96	0.02	6.2	1.1	1	Light Pitting	■	
61	8817.2	4.000	3.97	0.02	6.2	1.2	1	Light Pitting	■	
62	8861.0	4.000	3.96	0.01	3.9	0.8	1	Light Pitting	■	
63	8905.5	4.000	4.00	0.03	12.7	3.3	1	Moderate Line Damage	■	
64	8949.8	4.000	3.95	0.02	7.7	1.7	1	Light Corrosion	■	
65	8992.9	4.000	3.98	0.01	4.8	0.8	1	Light Pitting	■	
66	9037.3	4.000	3.98	0.02	9.1	1.5	1	Light Corrosion	■	
67	9080.7	4.000	3.95	0.01	4.5	0.8	1	Light Pitting	■	
68	9125.1	4.000	3.98	0.01	2.7	0.5	1	-	■	
69	9166.4	4.000	3.97	0.05	21.0	6.1	2	Light Ring Damage	■	
70	9209.4	4.000	3.97	0.01	4.9	1.1	1	Light Pitting	■	
71	9252.5	4.000	3.98	0.01	4.9	1.0	1	Light Pitting	■	
72	9296.9	4.000	3.95	0.02	7.8	0.8	1	Light Pitting	■	
73	9343.1	4.000	3.96	0.01	4.8	1.1	1	Light Pitting	■	
74	9387.6	4.000	3.97	0.01	4.8	0.8	1	Light Pitting	■	
75	9432.1	4.000	3.95	0.02	7.0	0.9	1	Light Pitting	■	
76	9476.7	4.000	3.94	0.02	7.2	1.4	1	Light Corrosion	■	
77	9520.1	4.000	3.96	0.01	4.0	0.8	1	Light Pitting	■	
78	9561.8	4.000	3.96	0.02	6.7	1.3	1	Light Corrosion	■	
79	9603.1	4.000	3.95	0.01	5.2	0.8	1	Light Pitting	■	
80	9647.4	4.000	3.97	0.01	4.6	1.0	1	Light Pitting	■	
81	9691.9	4.000	3.94	0.02	8.3	1.2	1	Light Corrosion	■	
82	9735.2	4.000	3.95	0.02	7.9	2.0	1	Light Corrosion	■	
83	9778.4	4.000	3.94	0.01	4.9	0.9	1	Light Pitting	■	
84	9822.9	4.000	3.96	0.01	4.4	0.9	1	Light Pitting	■	
85	9861.8	4.000	3.93	0.01	5.3	1.3	1	Light Corrosion	■	
86	9905.1	4.000	3.94	0.01	5.3	1.1	1	Light Pitting	■	
87	9949.5	4.000	3.92	0.01	5.2	1.1	1	Light Pitting	■	
88	9992.9	4.000	3.95	0.03	10.9	1.8	1	Moderate Corrosion	■	
89	10036.4	4.000	3.94	0.02	6.9	1.0	1	Light Pitting	■	
90	10080.8	4.000	3.92	0.02	7.0	1.4	1	Light Corrosion	■	
91	10122.8	4.000	3.96	0.01	5.4	1.3	1	Light Corrosion	■	



# Glossary of Terms



<b>Company</b>	TEP Rocky Mountain LLC
<b>Field</b>	Rulison
<b>Well</b>	Clough NR 22-3
<b>Country</b>	USA
<b>County</b>	Garfield
<b>State</b>	Colorado
<b>Analysed By</b>	E. Siegel
<b>Survey Date</b>	06-OCT-2018

## Analysis Information

Field	Name of oil field
Well	Name of the well
Company	Company owning the well
Country	Location of well or company
Analysed By	Name of log analyst
Survey Date	Date of survey
MIT	Multifinger Imaging Tool

## Pipe Information

Zone	Area of the well, containing pipe of the same grade
Joint	A single section of pipe
Size	Outer diameter of pipe
Nom OD	Nominal (expected) outer diameter of pipe, identical to 'Size'
Nom ID	Nominal (expected) inner diameter of pipe
Nom Thickness	Nom Thickness Nominal (expected) wall thickness of pipe
Weight	Weight of pipe
Grade	Grade of pipe

## Damage Types

Penetration	Point damage, measured as absolute units or as a % of nominal wall thickness
Projection	Scale in the inside of the pipe, measured as absolute units or as a % of nominal wall thickness
Metal Loss	Circumferential damage, weakening the pipe. Measured as a % of cross-sectional wall area
Pitting	Small, isolated points of penetration
Corrosion	Large areas of penetration, may be any shape
Line Damage	A narrow area of penetration running along the length of the pipe
Ring Damage	Penetration damage that is spread around the circumference of the pipe
Possible Hole	A penetration that may be deep enough to have caused a hole through the pipe wall

## Results Tables

Joint	The number of the joint in the well
Depth	The depth of the top of the joint
Nom ID	The Nominal ID of the joint
Mode ID	The measured ID of the joint, estimated from 'good' areas of pipe
Modal Change %	The % difference between Measured and nominal ID
Penetration	The worst penetration point in the region as absolute value and % of nominal wall thickness
Projection	The worst projection point in the region as absolute value and % of nominal wall thickness
Body	Damage in the body region of the joint (between coupling regions)
Coupling	Damage in the coupling regions of the joint
Metal Loss	The worst % loss of wall area in the joint
Min ID	The smallest ID measurement made in the joint
Area Loss	Worst % loss of flowing area in the joint
Description	Text description of and damage within the joint
Damage Profile	Graph of damage within the joint
Avg Dev	The average deviation in the joint