"Zero" inflow and possible untreated sewage discharge at Burford STW on December 27th 2017

Peter Hammond, March 11th 2019

Summary

In response to freedom of information requests to Thames Water Utilities Ltd (TWUL) and the Environment Agency (EA), WASP has established that on December 27th 2017 "a power issue" at Burford Sewage Treatment Works (STW) caused sewage to be diverted to a "storm tank" from where an estimated 204 cu m spilled into the River Windrush containing at least 60 cu m of raw, untreated sewage. TWUL failed to send an engineer within the statutory 2 hour maximum for several A1 and A1P alarms raised on the day. The works did not return to normal for at least several days. These conclusions differ from the explanation of Mr Richard Aylard, TWUL's Director for External Affairs and Sustainability, but are in keeping with TWUL's Data Protection Adviser who admitted to pump failures at the works causing sewage to be diverted to the storm tank. As far as WASP is aware, TWUL have not reported this potential sewage spill to the EA.

Background

In response to Ashley Smith's EIR 08 087, "inlet" flow data to Burford STW was provided by TWUL. The extract for 21st to 28th Dec 2017 (inclusive) is shown in Fig. 1:

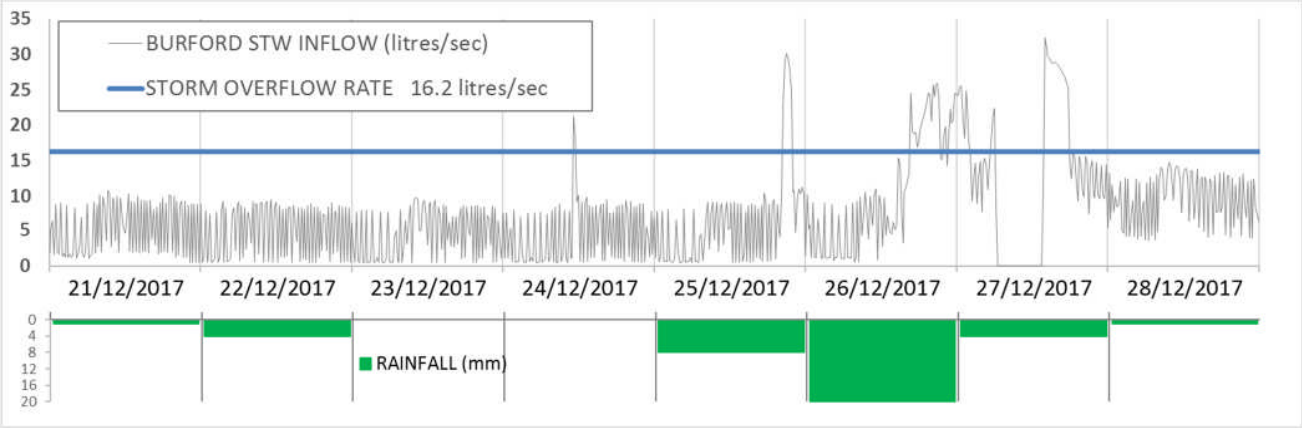

Figure 1 "Inflow" (Burford STW) and rainfall (Brize Norton) 21-28 Dec 2017 (incl)

For about 7 hours, approximately between 06:30 and 13:30 on Dec 27th 2017, the inflow was recorded as "zero" (Fig. 1). This was related by Peter Hammond and Ashley Smith in a briefing meeting to members of Burford Council in early Nov 2018 who later raised the issue in a separate meeting with TWUL's External Affairs and Sustainability Director, Richard Aylard, on Nov 7th 2018. In an email reply to Burford Council, in early December 2018, Mr. Aylard reported the following:

> *"We were experiencing severe wet weather on 27th December 2017 in the area, which resulted in high volumes of flow entering the sewage treatment works (STW). This triggered alarms to be sent to our Waste Operational Control Centre and an operator was called to site. During his site round, the operator observed*

that the river level was so high that it was flooding the final effluent outfall chamber. Since an accurate sample could not, therefore, be taken he noted this as a no flow (the only option other than recording quality parameters within our system) and recorded his findings in the log book. The site returned to normal operation the following day."

At nearby Brize Norton weather station, daily rainfall was recorded as zero or low between Dec 21st and Dec 28th 2017 except for Dec 25th and 26th when it was 8 mm and 20mm respectively (Fig. 1). On Feb 12th 2019, in reply to Peter Hammond's EIR 12-007 of Dec 11th 2018, the TWUL Data Protection Advisor (DPA) offered the following explanation:

"The site experienced a power issue, which caused the inlet pumps to cut out. Flow would then have diverted to the storm tanks. At the time there was no EDM in place and we have no certainty as to whether a discharge from the storm tanks was or was not made."

Establishing the likelihood of a discharge of untreated sewage into the River Windrush

In order to decide if there was a discharge of untreated sewage into the River Windrush, important issues are whether the storm tank became full, if it overflowed and for how long there may have been a discharge. The volume of the storm tank at Burford STW is 117 m^3 in compliance with the EA's minimum capacity to cope with 2 hours at the permitted overflow setting which at Burford STW is 16.2 litres per sec[1]. To determine the extent of any discharge of untreated sewage into the River Windrush during the period of "zero" flow, the following need to be established:

a) the period for which untreated sewage was diverted into the storm tank;
b) whether, during this period, the contents of the storm tank were pumped away for normal treatment;
c) an estimated volume of sewage inflow to the Burford STW;
d) an estimated storm tank overflow of untreated sewage into the river.

Fortunately, EIR 12-007 also requested relevant details of telemetry exchanges between Burford STW and TWUL's Waste Operating Control Centre (WOCC) at Reading, log book entries kept at Burford STW that were identified on a visit to the works and records of requests for technical support visits at Burford STW. These data provide the relevant facts.

a) The period for which untreated sewage was diverted into the storm tank

The telemetry records suggest that problems started at Burford STW probably before but certainly as early as **05:08** on Dec 27th 2017 when the message "**Communications state - Failed - Alarm raised"** was transmitted to the WOCC. By **06:08**, other messages confirmed failure of both inlet pumps[2]:

06:08	BALANCE PUMP 2	State changed from NORMAL to FAILED, value is 1 (Current data) - Alarm raised
06:08	BALANCE PUMP 1	State changed from NORMAL to FAILED, value is 1 (Current data) - Alarm raised

[1] 116.64 m^3 = 16.2 litres/sec * 2 * 60 * 60 / 1000

[2] Lines 60 and 61 of Burford Telemetry Data

At **08:16**, just over 2 hours later, the storm tank overflow alarm message was sent to the WOCC[3]

08:06 STORM TANK OVERFLOW State changed from NORMAL to ALARM, value is 1 (Current data) - Alarm raised

This suggests the storm tank was receiving overflow from the balancing tank between **08:16** and **13:43** when a message was sent informing the WOCC of return to a NORMAL setting:[4]

13:43 STORM TANK OVERFLOW State changed to NORMAL, value is 0 (Logged data)

The return of the storm tank overflow to a normal state occurred after an engineer arrived at Burford STW, manually reset the failed pumps and recorded the following entry in the Burford STW logbook (Fig. 2):

27/12/2017 13:30
Site round checklist completed
Comments
High RL well found
Pump tripped, reset OK
Inlet pumps tripped, reset OK
Balancing tank full and storm tanks full
Balancing tank down below storm overflow
No sample taken – outlet flooded
Sludge holding tank full

Figure 2 Entry in Burford STW log book by visiting TWUL engineer for 27/12/2017

There is no recorded interchange between Burford STW and the WOCC between 10:30 and 13:20 during which it seems that no remedial action was undertaken. The timing of the job raised to attend Burford STW was provided in response to EIR 12-007 as **08:16**. It appears that it took well more than the required 2 hours for an engineer to attend and try to get the STW back into a state of normality. Consistent with Mr Aylard's explanation to Burford Town Council, the outlet pipe was flooded and no (quality) sample was made. However, there is no mention of a "zero" flow being recorded by the engineer. Indeed, flows are not measured manually by an operator but by MCERTS meter.

b) Emptying of storm tank contents for full treatment

As the storm tank continued to receive diverted untreated sewage, it was not possible for its contents to be pumped onward for treatment since telemetry messages confirm that all inlet and return liquor pumps had failed at **06:08** and did not return to a normal state[5,6,7] until **13:42**, presumably when reset by the visiting engineer.

[3] Line 89 of Burford Telemetry Data
[4] Line 118 of Burford Telemetry Data
[5] Lines 56 and 57 of Burford Telemetry Data
[6] Lines 124 and 125 of Burford Telemetry Data
[7] Lines 121 and 122 of Burford Telemetry Data

RETURN LIQUOR PUMP 2	Alarm "27-Dec-2017 06:07:46 State changed from NORMAL to FAILED, value is 3 (Current data)" accepted, comment "SAP Notification Raised"
RETURN LIQUOR PUMP 1	Alarm "27-Dec-2017 06:07:46 State changed from NORMAL to FAILED, value is 3 (Current data)" accepted, comment "SAP Notification Raised"
RETURN LIQUOR PUMP 2	State changed from FAILED to NORMAL, value is 0 (Current data) - Alarm cleared
RETURN LIQUOR PUMP 1	State changed from FAILED to NORMAL, value is 0 (Current data) - Alarm cleared
BALANCE PUMP 2	State changed from FAILED to NORMAL, value is 0 (Current data) - Alarm cleared
BALANCE PUMP 1	State changed from FAILED to NORMAL, value is 0 (Current data) - Alarm cleared

c) Estimated volume of diverted inflow to the Burford STW;

Because Burford STW only records flow to full treatment at its inlet and the inlet pumps had failed, there is no record of the actual sewage flow into the works for Dec 27th 2017 between 08:16 and 13:42. Moreover, the inflow was affected by rainfall. One way to estimate the sewage inflow separate from the rainfall effect is to consider the same December period for years when there was little or no rainfall. Ashley Smith, in response to EIR THM113877 to the EA, was provided with daily flow data for Burford STW between 2005 and 2017 (unfortunately contrary to permit requirements, no data had been provided by TWUL for 2009). For Dec 22 to 31 (inclusive), the daily inflow levels for each of the 12 years are plotted in Fig. 3 below:

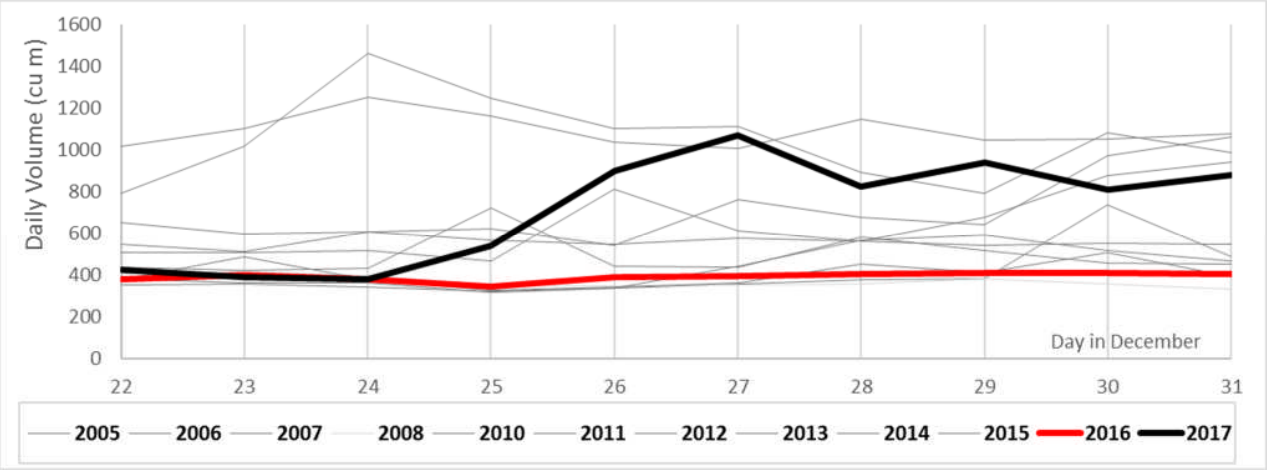

Figure 3: daily flow at Burford STW for Dec 22 to 31 for each year 2005-2017 apart from 2009

The years 2016 and 2017 have been highlighted as 2017 (in black) is the year of interest and 2016 (in red) shows daily volumes that are unaffected, in comparison to 2017, by rainfall as in the relevant period it was zero or very low (Fig. 4).

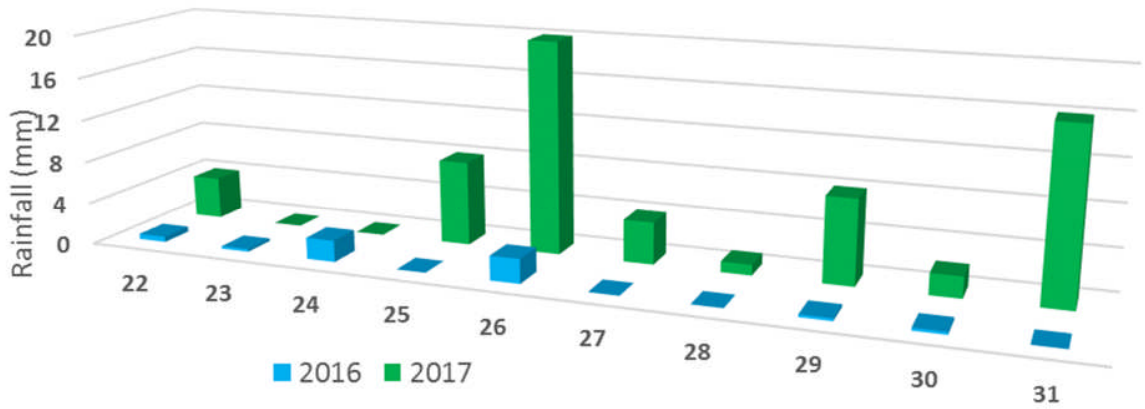

Figure 4: rainfall comparison at Brize Norton for Dec 22nd to 31st for 2016 and 2017

Therefore, a possible estimate of diverted sewage inflow at Burford STW on Dec 27th 2017 could be derived from data for 2016.

d) Estimated storm tank overflow of untreated sewage into the River Windrush

For the 5.5 hr period 08:15 to 13:45, flow was diverted to the storm tank on December 27th 2017. At 06:00, the rate of flow to treatment was 22.3 litres/sec and at 13:45 it was 32.4 litres/sec – respectively about 1.4 and 2 times the storming overflow rate of 16.2 litres/sec. A conservative estimate, therefore, of the flow rate for 5.5 hrs, while the STORM OVERFLOW remained in an ALARM state, is the storm overflow rate. At this rate, the storm tank can avoid spilling into the River Windrush for 2 hours. Hence, the volume of flow spilling into the river is 3.5 hours at 16.2 litres per sec which is about 204 cu m – almost 2 storm tanks worth. This was a flow of untreated sewage swollen by rain induced road run-off etc. How much of this flow might have been raw, untreated sewage? As seen above, in Fig. 3, in the corresponding period of 2016 when there was almost no rainfall, the average daily flow was a fairly constant rate of about 400 cu m per day. So, a very conservative estimate of the amount of **raw** untreated sewage spilled into the River Windrush on Dec 27th 2017 is 3.5 hrs @ 400 cu m per day – approximately 60 cu m.

Conclusion

The TWUL Data Protection Adviser suggested that "*we have no certainty as to whether a discharge from the storm tanks was or was not made*". The analysis above shows that a discharge of sewage into the River Windrush was inevitable due to more than 5 hours' delay in attending the works following alarms and a request for a technician to intervene. With very conservative assumptions, it is possible to estimate that the volume of spill into the river was more than 204 cu m containing untreated sewage of at least 60 cu m.

It was also suggested that "*The site returned to normal operation the following day*". In fact, OXIDATION TRENCH 2, having failed twice on Dec 27th, failed again on Dec 28th. On Dec 29th, the FST ROTATION, having failed on Dec 27th, failed yet again. Indeed, an engineer attended Burford STW on December 28th, 29th and 30th and as the log book records below confirm to respond to alarms on the latter two occasions:

28/12/2017 (no time given)
Site round checklist completed
Comments
Site round
No sample – outlet chamber flooded. Photo taken. Informed WOCC (Waste Control)
Sludge holding tank 80% full
Cleaned blanket probe and blanket dip done
Storm tank empty
Sample from chamber for L7 A 1.5 C 10 T 98

29/12/2017 11:00
Comments
No sample due to watercourse backing up into chamber
Rang WOCC (Waste Control) and took picture
On site for FST (final settlement tank) rotational fail. No key for panel box, informed manager
SHT (sludge holding tank) 100% full, decanted whilst on site
Rang Manager about issue, said he will sort it

30/12/2017
Comments
Called for inlet P2 alarm, rest ran in hand/auto, left in auto A=0.06, T=9.7, C=5
Alarm cleared at WOCC (Waste Control)

Figure 5 Entries in Burford STW log book by visiting TWUL engineer for 28/12 to 30/12 2017

At present, we do not have telemetry data after Dec 30th 2017 so it is not possible to say how soon the works returned to normal functioning.

APPENDIX

Efficiency of TWUL response to alarms

The TWUL Data Protection Adviser provided the following table defining the required response times for the various grades of alarm sent to the WOCC at Reading.

Alarm Priority	Action response by control centre (on receipt of alarm)	Attendance target
A1P	15 minutes	P1 (within 2 hours)
A1	60 minutes	P2 (within 2 hours)
A2	90 minutes	P3 (within 4 hours)
A3	Next working day	P6 (within 3 working days)

TWUL response to alarms on 27/12/2017

		Source	STORM TANK OVERFLOW
Line	Alarm	Time	Message/Response time/Efficiency
89	A1	08:15	State changed to **ALARM**, value is 1 (Logged data)
92	A1	08:16	State changed from NORMAL to **ALARM**, value is 1 (Current data) - Alarm raised
103	A3	08:33	Alarm "27-Dec-2017 08:15:32 State changed from NORMAL to **ALARM**, value is 1 (Current data)" accepted, comment "Repeat Alarm as per operation"
118	E1	13:41	State changed to **NORMAL**, value is 0 (Logged data)
123	A1	13:42	State changed from ALARM to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	BALANCE PUMP 1 & BALANCE PUMP 2
Line	Alarm	Time	Message/Response time/Efficiency
60&61	A2	06:08	State changed from NORMAL to **FAILED**, value is 1 (Current data) - Alarm raised
95	E3	08:16	<S2S> Alarm > 27/12/2017 06:08:25 > State changed from NORMAL to **FAILED**, value is 1 (Current data) > S2S initiated from > KEMBO1ZZRWK23
96	E3	08:16	<S2S> Success > > A2 > 27/12/2017 06:08:25 > **FAILED** > 10632504
97&98	A3	08:17	Alarm "27-Dec-2017 06:08:25 State changed from NORMAL to **FAILED**, value is 1 (Current data)" accepted, comment **"SAP Notification Raised"**
121&122	A2	13:42	State changed from FAILED to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	BALANCING TANK
Line	Alarm	Time	Message/Response time/Efficiency
67	A1P	06:38	State changed to **HIGH**, value is 1 (Logged data)
70	A1P	06:39	State changed from NORMAL to **HIGH**, value is 1 (Current data) - Alarm raised
73	A3	06:39	Alarm "27-Dec-2017 06:38:39 State changed from NORMAL to HIGH, value is 1 (Current data)" accepted, comment "Wet Weather"
149	E1	14:03	State changed to **NORMAL**, value is 0 (Logged data)
152	A1P	14:03	State changed from HIGH to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	OXIDATION DITCH 2 DO
Line	Alarm	Time	Message/Response time/Efficiency
36	A2	02:56	State changed from NORMAL to **HIGH**, value is 1 (Logged data) - Alarm raised
42	A3	02:57	Alarm "27-Dec-2017 02:56:05 State changed from NORMAL to HIGH, value is 1 (Logged data)" accepted, comment "Repeat Alarm as per operation"
43	E2	04:48	State changed to **NORMAL**, value is 0 (Logged data)
46	A2	05:00	State changed from HIGH to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 2hrs 4 mins FAILED ACTION RESPONSE

		Source	OXIDATION DITCH 2 DO
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
74	A2	06:53	State changed to **HIGH**, value is 1 (Logged data)
77	A2	06:54	State changed from NORMAL to **HIGH**, value is 1 (Current data) - Alarm raised
80	A3	06:59	Alarm "27-Dec-2017 06:53:09 State changed from NORMAL to **HIGH**, value is 1 (Current data)" accepted, comment "Repeat Alarm as per operation"
161	E2	14:09	State changed to **NORMAL**, value is 0 (Logged data)
164	A2	14:10	State changed from HIGH to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	**OXIDATION DITCH 1 DO**
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
104	A2	08:52	State changed to **HIGH**, value is 1 (Logged data)
107	A3	08:53	State changed from NORMAL to **HIGH**, value is 1 (Current data) - Alarm raised
110	A3	08:58	Alarm "27-Dec-2017 08:52:20 State changed from NORMAL to **HIGH**, value is 1 (Current data)" accepted, comment "Repeat Alarm as per operation"
143	E2	13:55	State changed to **NORMAL**, value is 0 (Logged data)
146	A2	13:56	State changed from HIGH to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	**Burford STW**
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
47	A1	05:08	Communications state - **Failed** - Alarm raised
48	A1	05:08	Lost comms with outstation on channel "System.Channels.PROTEUS 1K2 GP 02 CH 02"
50	A1	05:09	Communications state - **Healthy**, PSTN - Alarm cleared
54	A3	05:11	Alarm "27-Dec-2017 05:08:19 Communications state - Failed" accepted, comment "Alarm Cleared"
			Response time: OK
		Source	**FST ROTATION**
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
55	A2	06:07	State changed to FAILED, value is 1 (Logged data)
62	A2	06:08	State changed from NORMAL to **FAILED**, value is 1 (Current data) - Alarm raised
101	A3	08:17	Alarm "27-Dec-2017 06:07:45 State changed from NORMAL to FAILED, value is 1 (Current data)" accepted, comment **"SAP Notification Raised"**
155	E1	14:04	State changed to **NORMAL**, value is 0 (Logged data)
158	A2	14:05	State changed from FAILED to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	**RETURN LIQUOR PUMP 1 AND RETURN LIQUOR PUMP 2**
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
56&57	A2	06:07	State changed to **FAILED**, value is 3 (Logged data)
63&64	A2	06:08	State changed from NORMAL to **FAILED**, value is 3 (Current data) - Alarm raised
99&100	A2	08:17	Alarm "27-Dec-2017 06:07:46 State changed from NORMAL to **FAILED**, value is 3 (Current data)" accepted, comment **"SAP Notification Raised"**
124&125	A2	13:42	State changed from FAILED to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 5hrs + FAILED ACTION RESPONSE
		Source	**RETURN LIQUOR WET WELL**
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
111	A2	10:49	State changed to **HIGH**, value is 1 (Logged data)
114	A2	10:50	State changed from NORMAL to **HIGH**, value is 1 (Current data) - Alarm raised
117	A3	13:20	Alarm "27-Dec-2017 10:49:23 State changed from NORMAL to **HIGH**, value is 1 (Current data)" accepted, comment "Matter in hand"
126	E2	13:43	State changed to **NORMAL**, value is 0 (Logged data)
127	A2	13:43	State changed to **NORMAL**, value is 0 (Logged data)

			Response time: OK

TWUL response to alarms on 28/12/2017

		Source	OXIDATION DITCH 2 DO
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
175	A2	06:41	State changed to **HIGH**, value is 1 (Logged data)
178	A2	06:41	State changed from NORMAL to **HIGH**, value is 1 (Current data) - Alarm raised
181	A3	06:54	Alarm "27-Dec-2017 06:53:09 State changed from NORMAL to **HIGH**, value is 1 (Current data)" accepted, comment "Repeat Alarm as per operation"
182	E2	07:12	State changed to **NORMAL**, value is 0 (Logged data)
185	A2	07:13	State changed from HIGH to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: OK

TWUL response to alarms on 29/12/2017

		Source	FST ROTATION
Line	**Alarm**	**Time**	**Message/Response time/Efficiency**
211	A2	04:31	
214	A2	04:31	State changed from NORMAL to **FAILED**, value is 1 (Current data) - Alarm raised
217	E3	05:17	<S2S> Alarm > 29/12/2017 04:31:04 > State changed from NORMAL to **FAILED**, value is 1 (Current data) > S2S initiated from > KEMBO1ZZRWK23
218	E3	05:17	<S2S> Success > > A2 > 29/12/2017 04:31:04 > **FAILED** > 10633183
219	A3	05:27	Alarm "29-Dec-2017 04:31:04 State changed from NORMAL to **FAILED**, value is 1 (Current data)" accepted, comment **"SAP Notification Raised"**
220	E1	11:49	State changed to **NORMAL**, value is 0 (Logged data)
221	A2	11:50	State changed from FAILED to **NORMAL**, value is 0 (Current data) - Alarm cleared
			Response time: 6hrs + FAILED ACTION RESPONSE