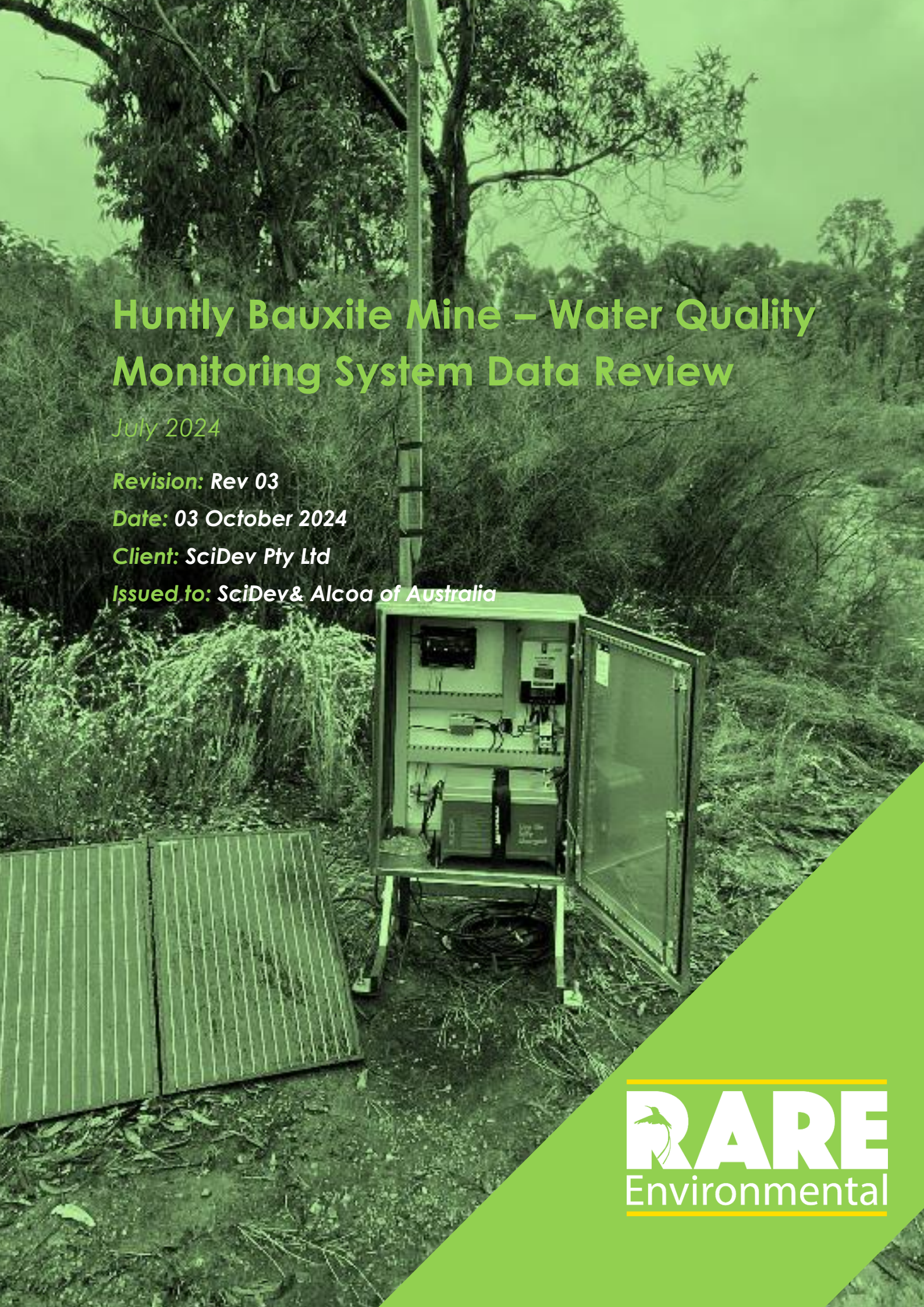

Huntly Bauxite Mine – Water Quality Monitoring System Data Review

July 2024

Revision: ***Rev 03***

Date: ***03 October 2024***

Client: ***SciDev Pty Ltd***

Issued to: ***SciDev& Alcoa of Australia***

RARE Environmental

Document Control

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Contents

1. Introduction

1.1. Purpose

RARE Environmental Pty Ltd (RARE) was engaged by SciDev Pty Ltd (SciDev) to analyse and comment on raw turbidity monitoring data collected by their Water Quality Monitoring Systems (WQMSs) at the Huntly Bauxite Mine, owned and operated by Alcoa of Australia Limited (Alcoa). Stream turbidity monitoring is a core regulatory requirement stipulated as part of Alcoa's approvals and operating framework. The data for this reporting period was collected in July of 2024.

This report has been prepared to assess the quality of data provided and identify potential drainage incidents ('true' events) per the procedure detailed below within that data. Where possible recommendations are made for either WQMS network upgrades or further investigation of events identified within the data. This report should not be considered an assessment of the WQMS network and/or Alcoa's compliance to relevant legislation and requirements, nor should it be considered an assessment of the suitability of the adopted trigger level and event classification procedure.

1.2. Context

Data from each location has been collected and compared against the drainage incident trigger level outlined in the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023* Schedule 1 Division 2 Cl. 6. Trigger events have then been assessed against Alcoa's turbidity event classification guidelines to determine whether the event is true, i.e. caused by stream turbidity, or false, i.e. caused by stream debris, algae or other. For the purpose of this report a turbidity event is an event where turbidity levels, measured by a WQMS, are at least 25 nephelometric turbidity units (NTU) for a period of at least 1 hour.

A site map showing the WQMSs locations is provided in **Appendix A**.

1.3. Monitoring Requirements

Under Schedule 1, Division 2 ("Controls on activities"), of the *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* a drainage incident is defined as:

a) *a runoff from a disturbance area to the surrounding environment of surface water that has a turbidity of at least 25 nephelometric turbidity units for a period of at least 1 hour; or*
b) *a discharge from containment infrastructure that includes or may include environmentally hazardous material;*

1.4. Water Quality Monitoring System (WQMS)

At the Huntly site, for this reporting period, 33 (thirty-three) WQMSs have been installed in streams within or downstream of mining operations to monitor stream turbidity levels. Each turbidity monitoring station is fitted with an Aquas SMR10 turbidity probe. The Aquas probes are placed directly in the streams, mounted at 90 degrees to the flow of water. Each sensor has a guard to protect the lens from larger debris and the units are fitted with a lens screen wiper. Note: disruptions or errant readings can occur with smaller pieces of debris (leaves etc.).

Data is collected via a Data Taker DT82 logger. Data from each logger is linked to an IOT data modem to transmit to a cloud-based platform. Data is logged locally in 6 second intervals with a 6-minute average pushed into the cloud-based platform. A float switch or cell indicates sensor immersion or a dry stream.

1.5. Data Review & Event Classification Process

Data produced by the WQMSs is reviewed by RARE per the following procedure and in consultation with SciDev. This allows for the identification of true events that require investigation to determine whether the mining operations may have contributed to the elevated turbidity levels, and false events.

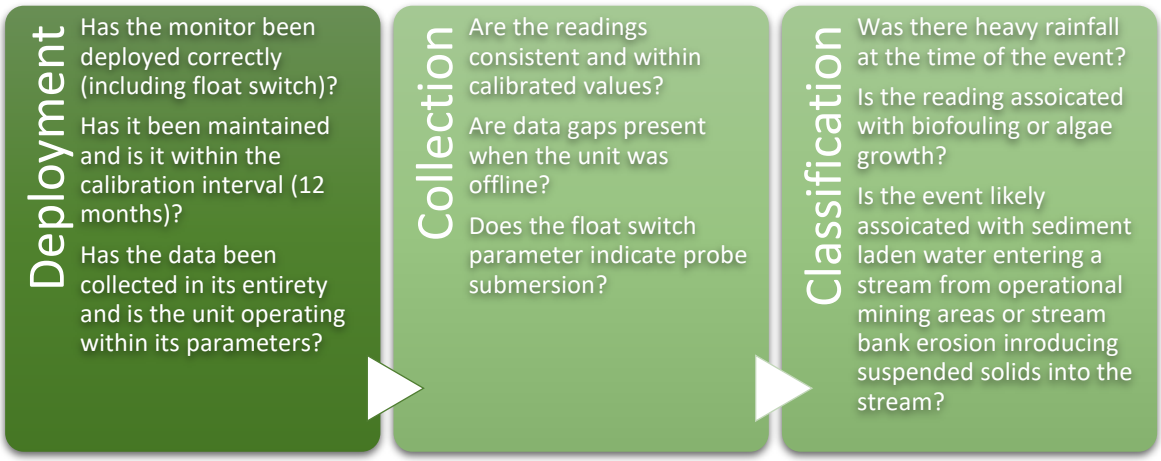


Figure 1: Data Review & Event Classification Process

The process considers the physical aspects of the WQMS deployment, the data collection by that monitor and finally classification of the events identified in that data. Classification of events is per Alcoa's procedure to identify events as true or false.

A 'true' stream turbidity exceedance event that is caused by an actual increase in stream water turbidity. Alcoa has identified that 'true' turbidity exceedance events typically show a sharp turbidity incline before gradually trailing off as the stream turbidity level returns to background.

Figure 2: Typical 'true' exceedance event showing the sharp incline and gradually return to background levels.

'False' stream turbidity exceedance events are caused by factors other than an actual increase in stream water turbidity (i.e. organic debris covering the monitor such as sticks/leaves/algae, stream water turbulence or air bubbles and fluctuating water levels that intermittently cover the monitor lens and then recede). Alcoa has identified that 'false' turbidity exceedance events typically illustrate sharp inclines and declines for turbidity when the data is graphed over time and lack the distinctive 'bell curve' shape that is associated with 'true' turbidity exceedance events.

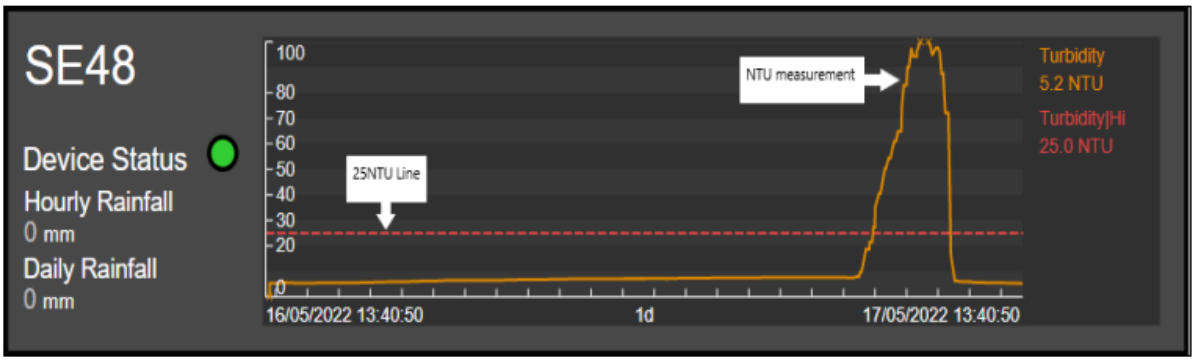


Figure 3: Typical 'false' exceedance event showing both a sharp incline and decline.

Any 'true' events identified in this report have been listed in **Section 3**.

2. WQMS Data Review

For the reporting period of July 2024, 233,491 data points were collected by 33 (thirty-three) WQMSs across the Huntly site. From this data a total of 96 (ninety-six) events were flagged where turbidity levels above 25 were held for an hour or more. The following sections review this data, beginning with the deployment and operation of the WQMSs.

2.1. Deployment & Collection

From the data provided there were several units producing erroneous results, marked by spikes and/or non-sensical peaks.

RARE have identified WQMSs in **Table 1** that require review in regards erroneous data. SciDev confirmed that the data generated by these units is invalid and has therefore been excluded from further analysis.

Excluding the data from these units leaves 80 (eighty) potential turbidity events during the reporting period across 16 (sixteen) units as discussed in the following section.

Table 1: WQMS Requiring Review

Unit	Dates	SciDev Comment
SE02T	July 2nd to 4th (4 events)	Sensor reading high turbidity values. Grab sample returned a reading of 9.9NTU. Maintenance contractor scheduled to inspect and assess on 4/07/2024
SE11T	July 6th to 7th (3 events)	Stream dry
SE12T	July 26th	Site inspected on 26/07/2024. Stream clear, leaf litter/debris built up around sensor. Turbidity value on arrival 62.48 which dropped to 2.06 after cleaning.
SE62T	July 1st (2 events)	Stream dry, no sign of recent flow
SE62T	July 3rd (2 events)	Stream dry, no sign of recent flow
FPWR1	July 27th (2 events)	Stream dry, no sign of recent flow
SE53T	July 26th (2 events)	Stream level dropped, sensor out of water

2.2. Classification

Analysing the data collected outside of the above periods leaves 80 (eighty) potential turbidity events during the reporting period across 16 (sixteen) units as summarised in **Table 2**. For this reporting period there were 40 (forty) 'true' turbidity events identified. Refer to the following section for analysis.

Table 2: Turbidity events summary

Date	Huntly WQMS Data - July 2024 - Events with turbidity > 25 NTU for an hour or more																
	DB01T	DB02T	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T	SE09T
1/07/2024			**4**														
2/07/2024			**2**														
3/07/2024			**2**														
4/07/2024																	
5/07/2024			**3**														
6/07/2024																	
7/07/2024																	
8/07/2024																	
9/07/2024												**1**	**1**				
10/07/2024																	
11/07/2024																	
12/07/2024																	
13/07/2024			**1**														
14/07/2024																	
15/07/2024			**2**													**2**	
16/07/2024			**1**													**2**	
17/07/2024													**1**			**2**	
18/07/2024									**2**			**1**	**1**				
19/07/2024																	
20/07/2024																	
21/07/2024																	
22/07/2024			**1**														
23/07/2024									**1**			**1**	**1**		**1**		
24/07/2024																	
25/07/2024																	
26/07/2024																	
27/07/2024																	
28/07/2024									**1**			**1**	**2**				
29/07/2024																	
30/07/2024																	
31/07/2024																	

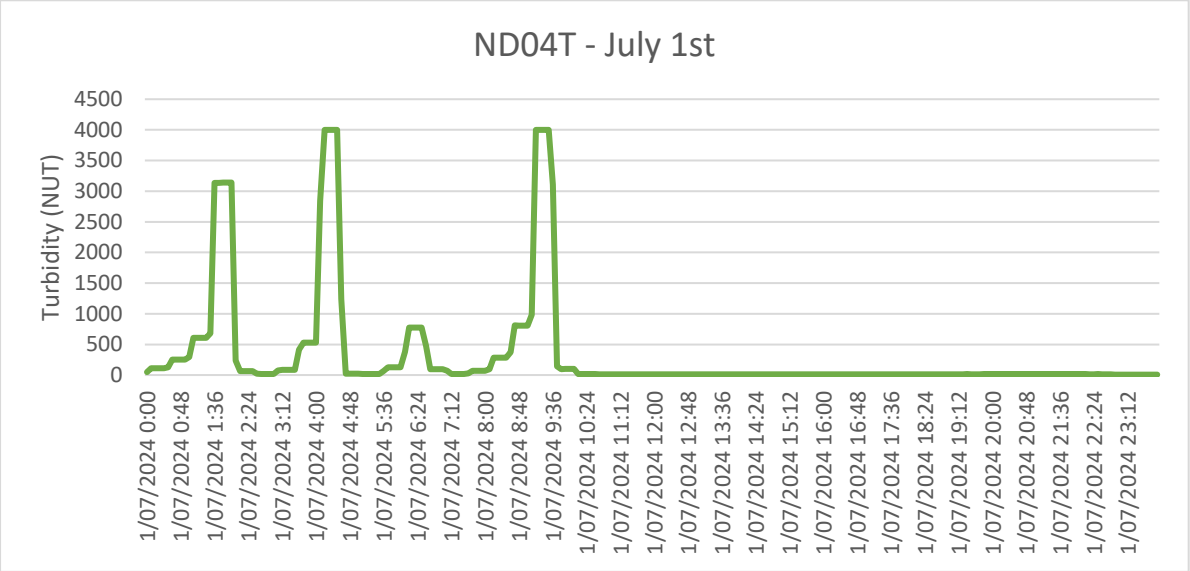
Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text. See following section for analysis.

Date	Huntly WQMS Data - July 2024 - Events with turbidity > 25 NTU for an hour or more															
	SE10T	SE11T	SE12T	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T	FPWR1
1/07/2024						**2**						**1**				
2/07/2024																
3/07/2024						**2**										
4/07/2024						**1**										
5/07/2024						**1**										
6/07/2024																
7/07/2024																
8/07/2024																
9/07/2024									**1**		**2**		**1**			
10/07/2024																
11/07/2024																
12/07/2024													**1**			
13/07/2024								**5**								
14/07/2024								**2**					**2**			
15/07/2024																
16/07/2024																
17/07/2024											**1**					
18/07/2024								**1**	**1**		**1**		**1**			
19/07/2024																
20/07/2024																
21/07/2024																
22/07/2024																
23/07/2024		**1**	**2**					**1**	**1**	**1**	**1**		**1**			
24/07/2024										**1**						
25/07/2024																
26/07/2024																
27/07/2024																
28/07/2024			**2**	**1**					**1**		**1**		**1**			
29/07/2024												**1**				
30/07/2024																
31/07/2024			**1**													

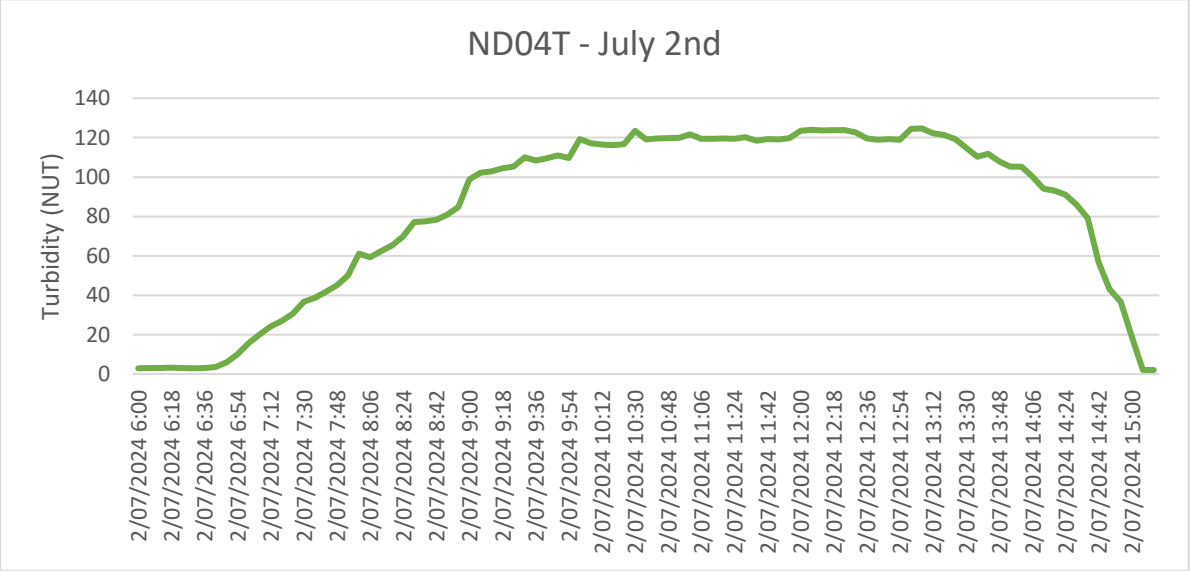
Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text.
See following section for analysis.

2.2.1. ND04T Potential Turbidity Events

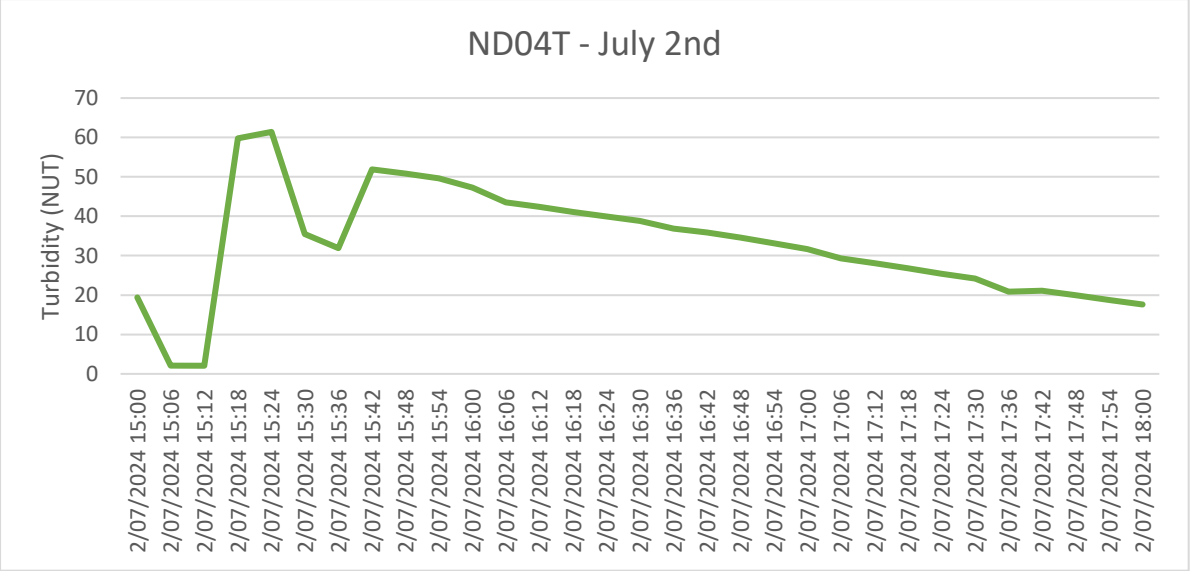
Chart(s) for data flagged at monitor ND04T are shown below for the potential events identified in the reporting period.



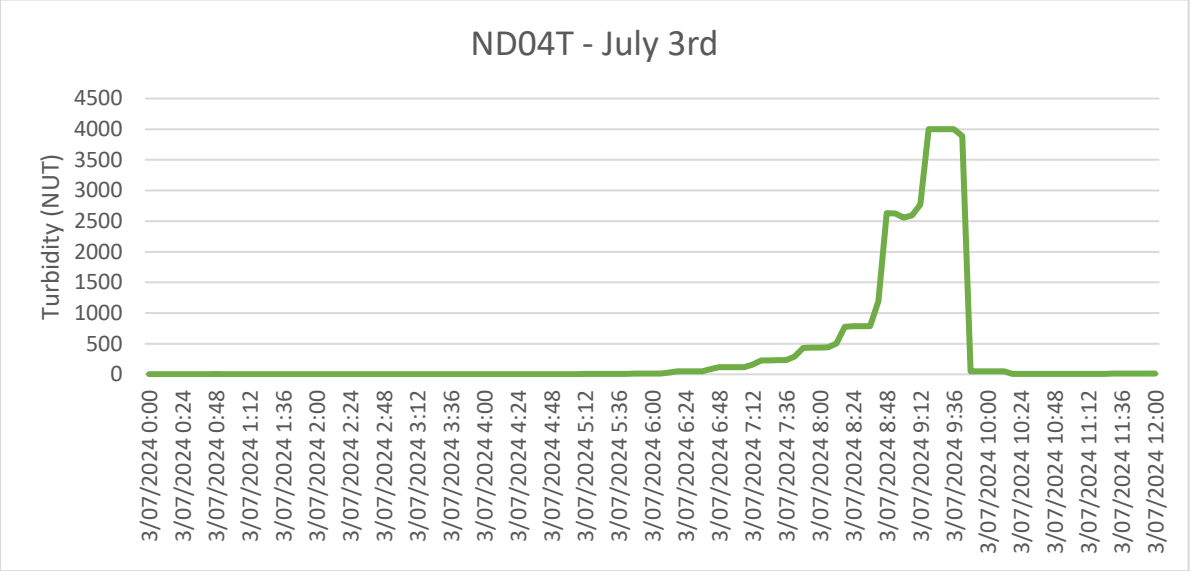
This event is marked by sharp inclines and declines indicative of a 'false' event.



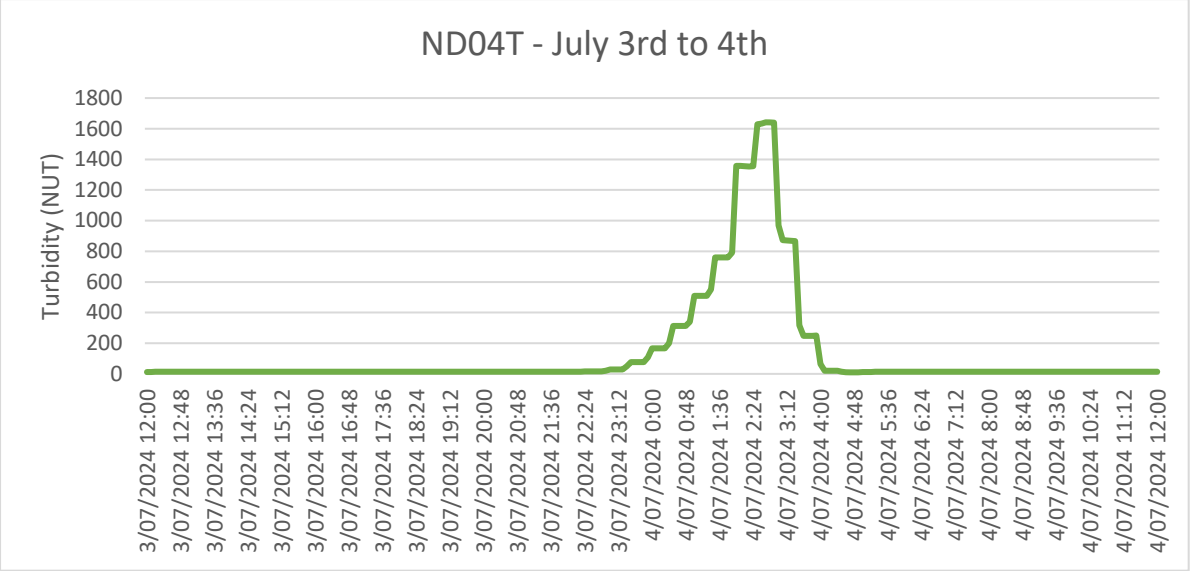
The event is marked by sharp incline and slow return to background levels indicative of a 'true' event, flagged for further investigation.



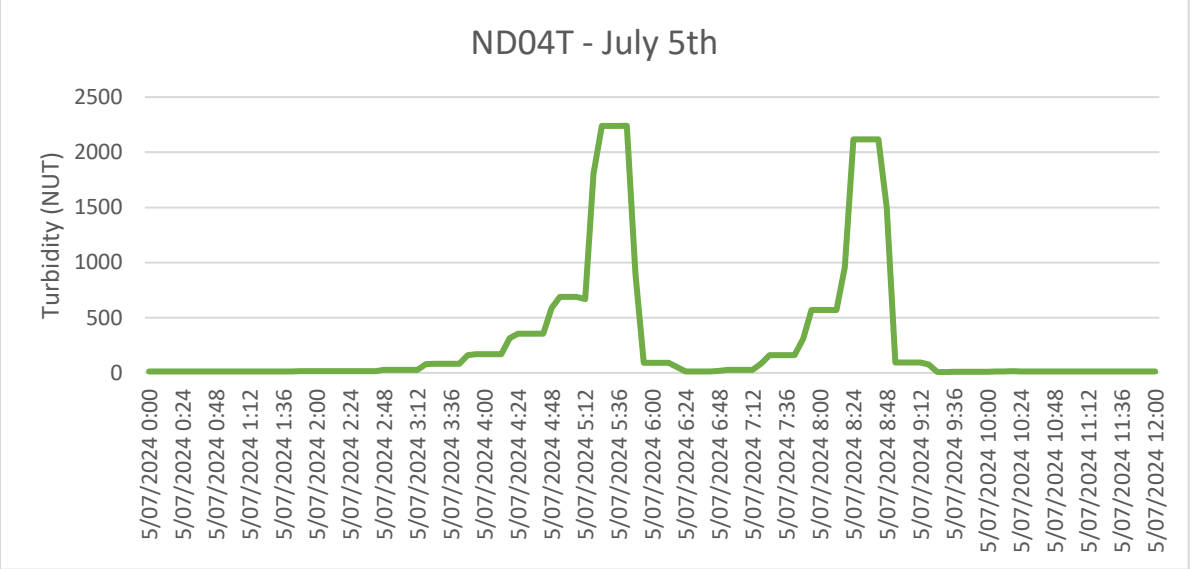
The event is marked by sharp incline and slow return to background levels indicative of a 'true' event, flagged for further investigation.



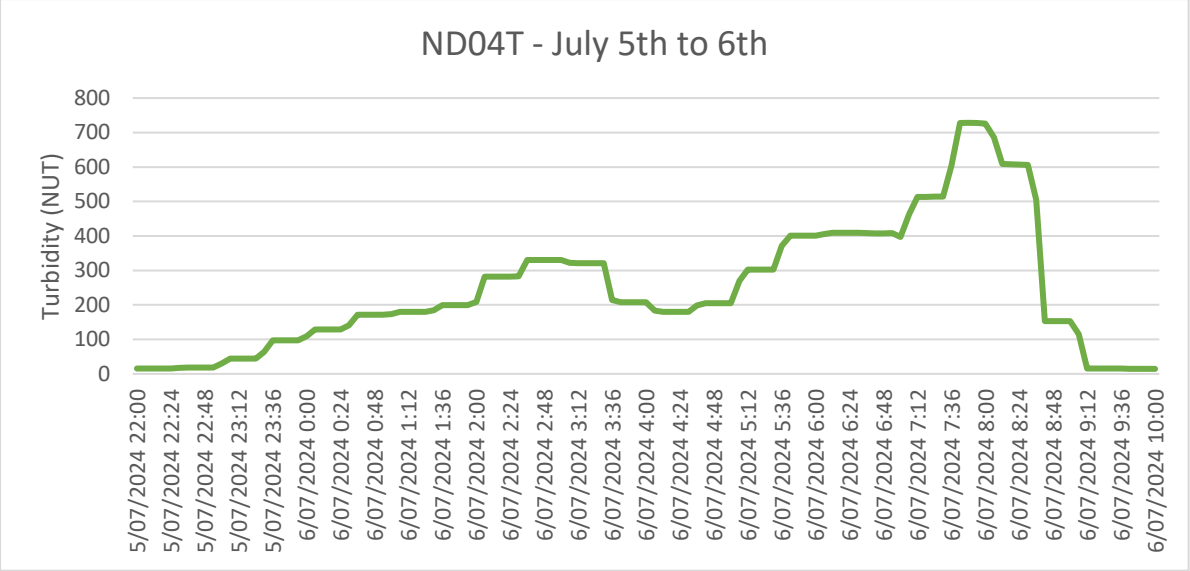
This event is marked by a sharp decline indicative of a 'false' event.



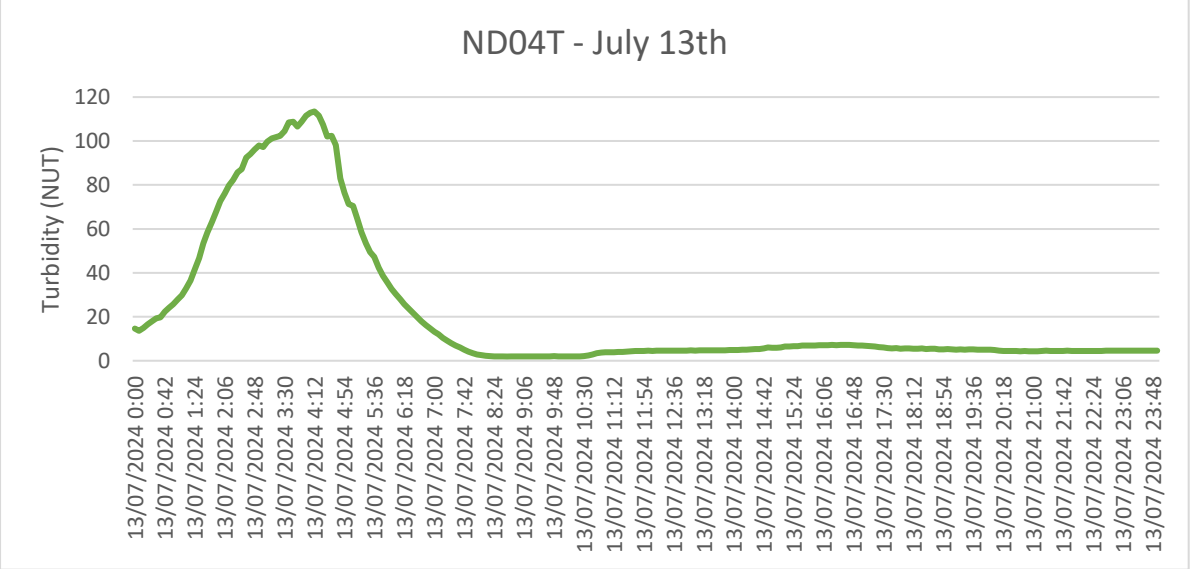
This event is marked by a sharp decline indicative of a 'false' event.



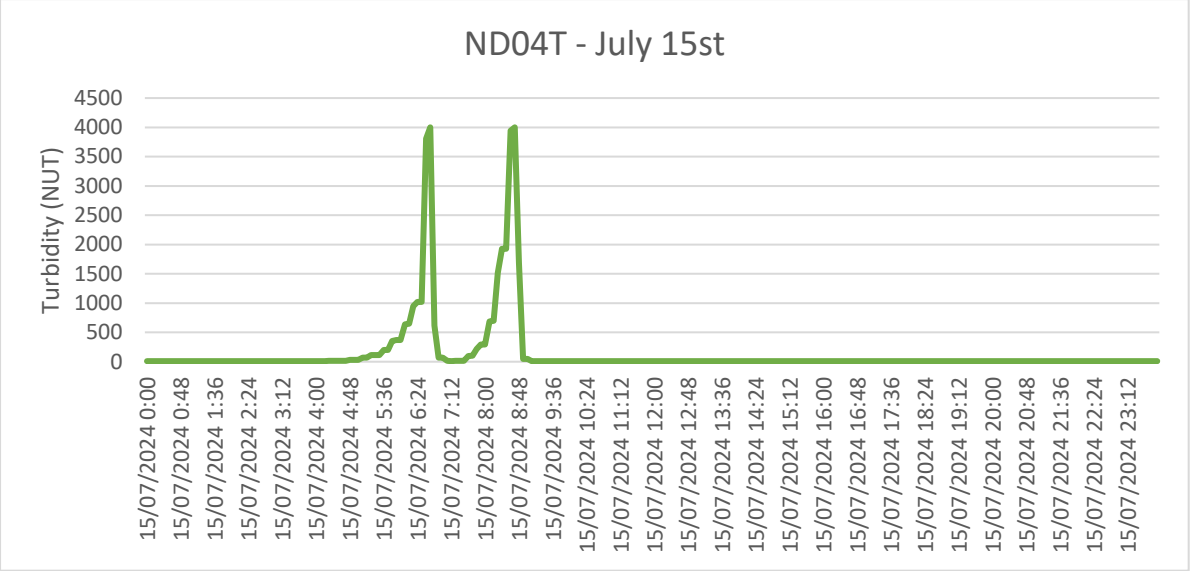
These events are marked by sharp declines indicative of a 'false' event.



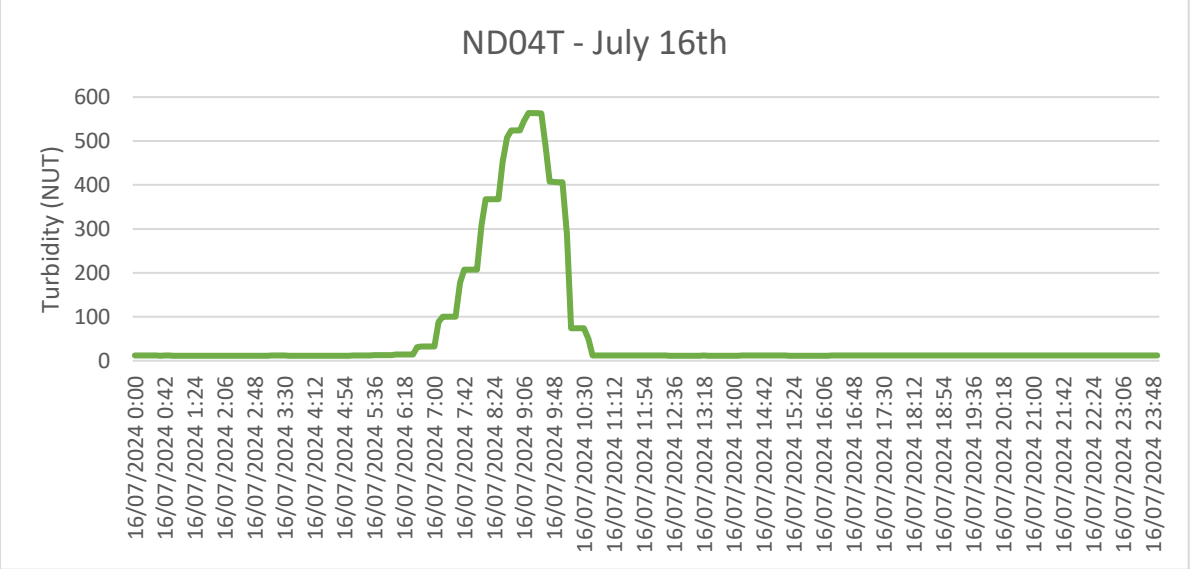
This event is marked by sharp declines indicative of a 'false' event.



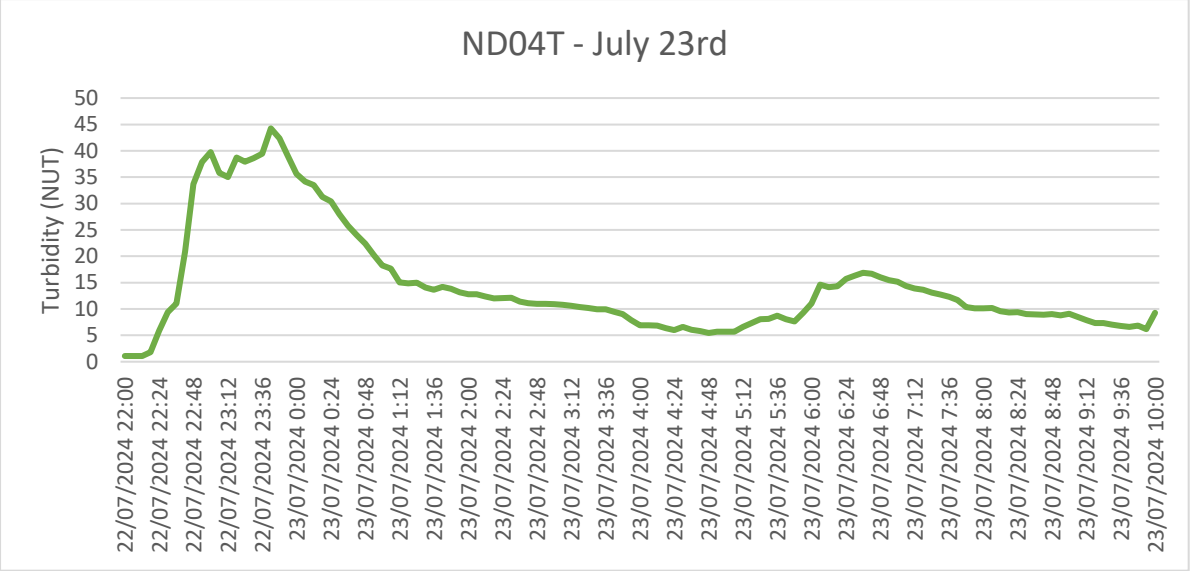
The event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



These events are marked by sharp declines indicative of a 'false' event.



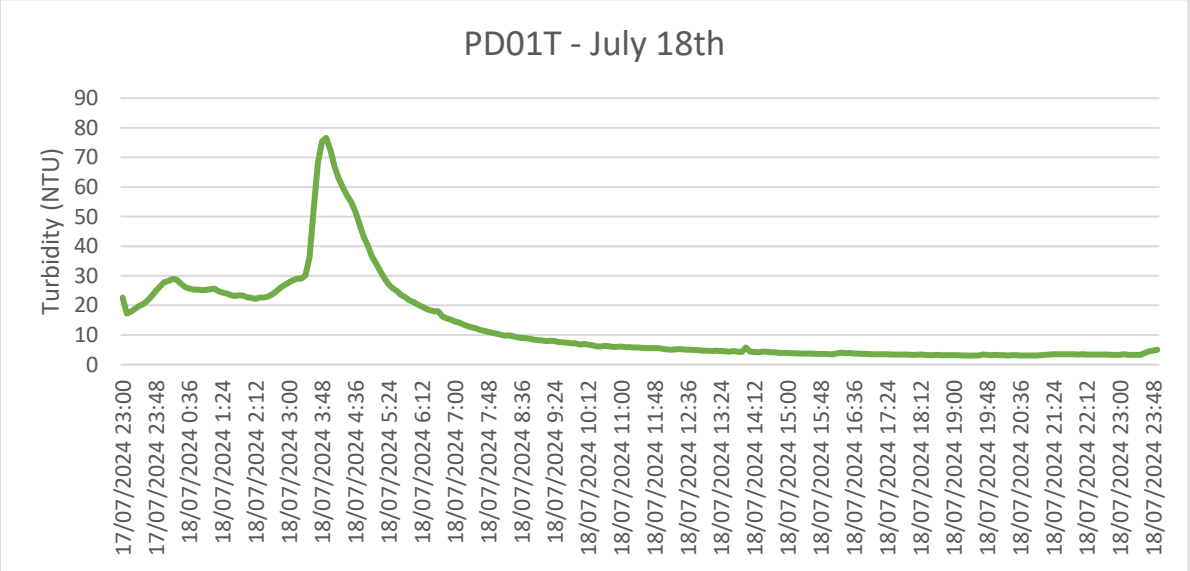
The event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



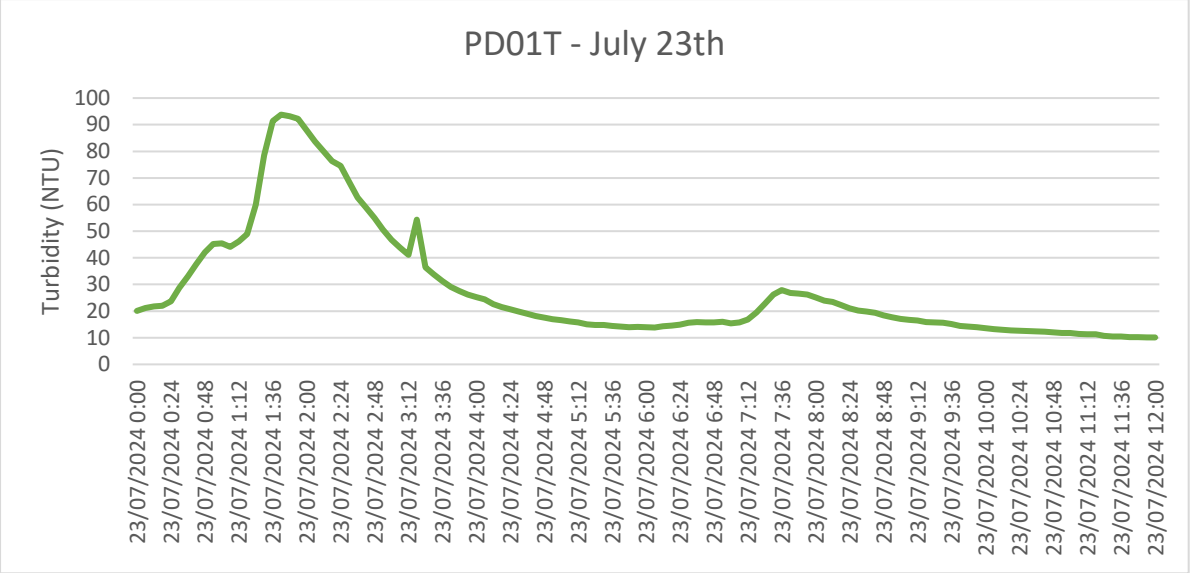
The event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.2. PD01T Potential Turbidity Events

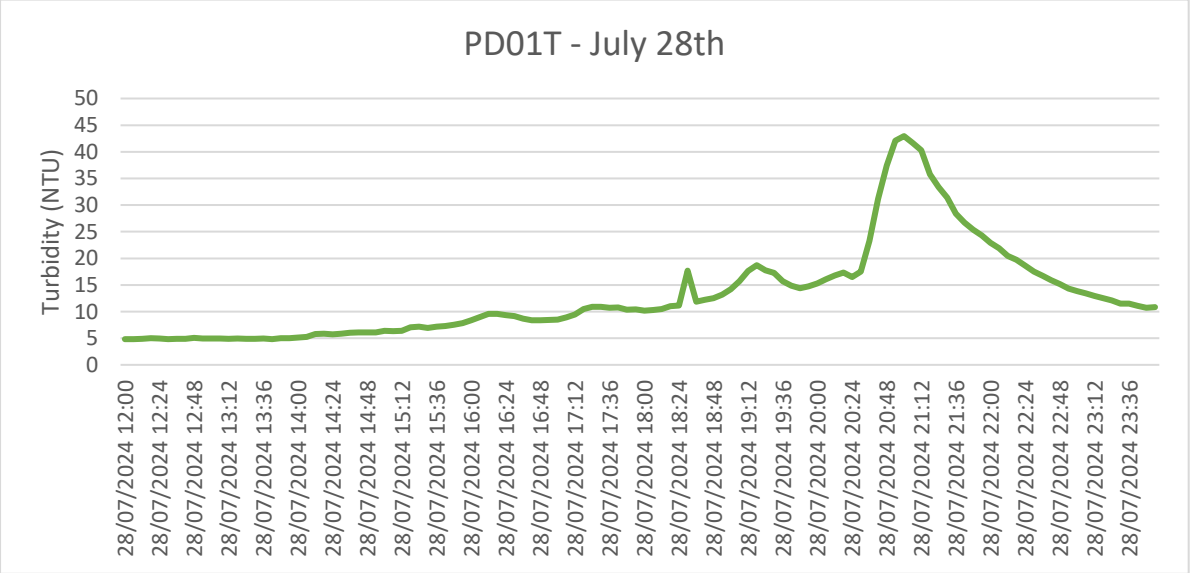
Chart(s) for data flagged at monitor PD01T are shown below for the potential events identified in the reporting period.



These events are marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



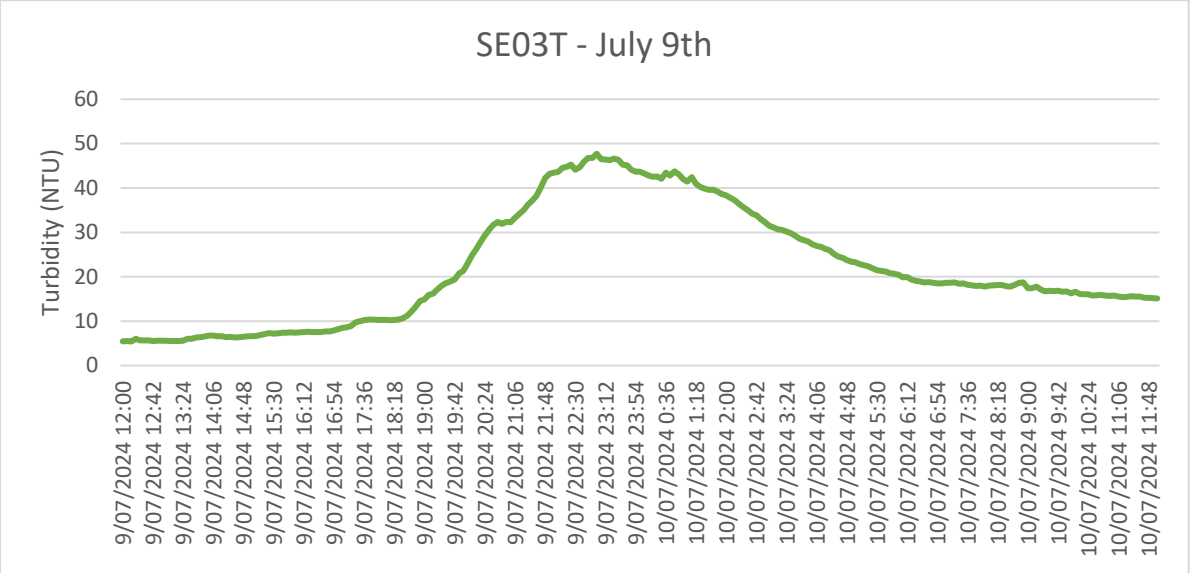
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



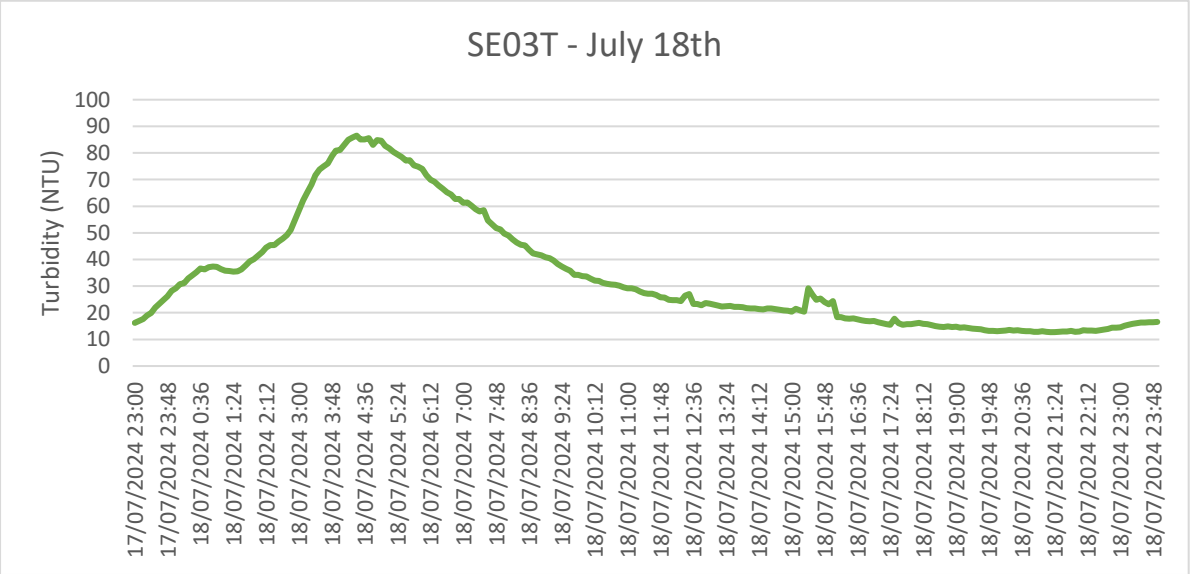
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.3. SE03T Potential Turbidity Events

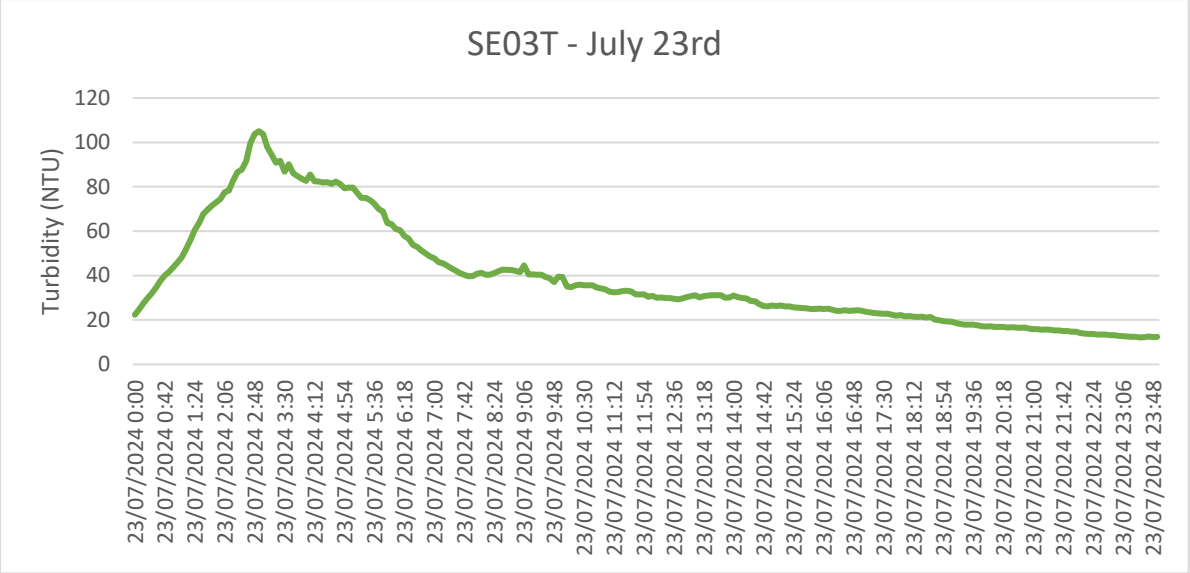
Chart(s) for data flagged at monitor SE03T are shown below for the potential events identified in the reporting period.



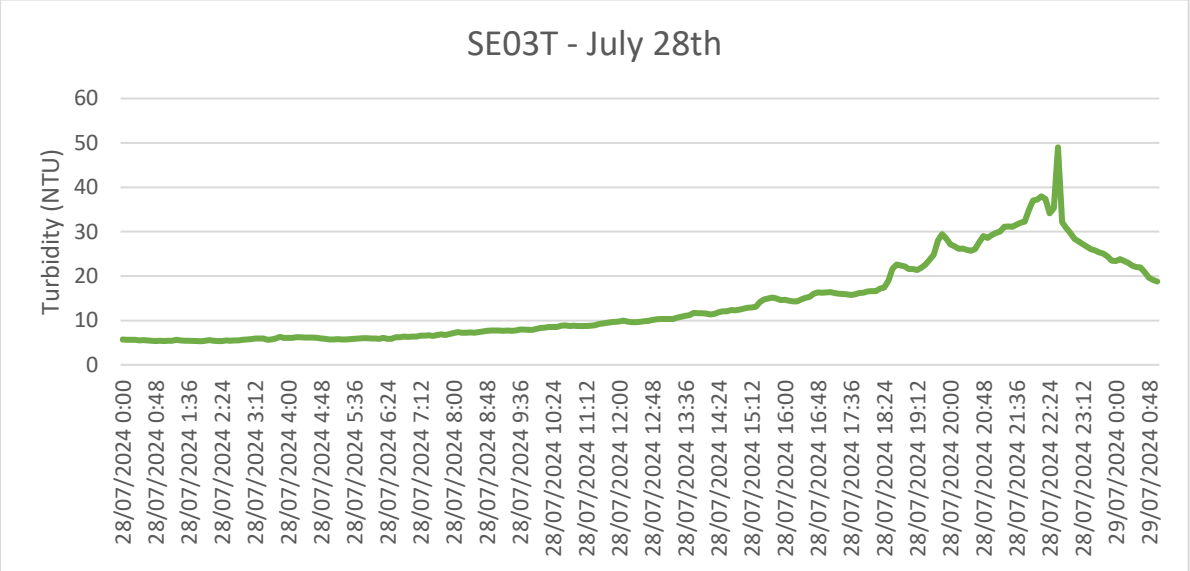
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



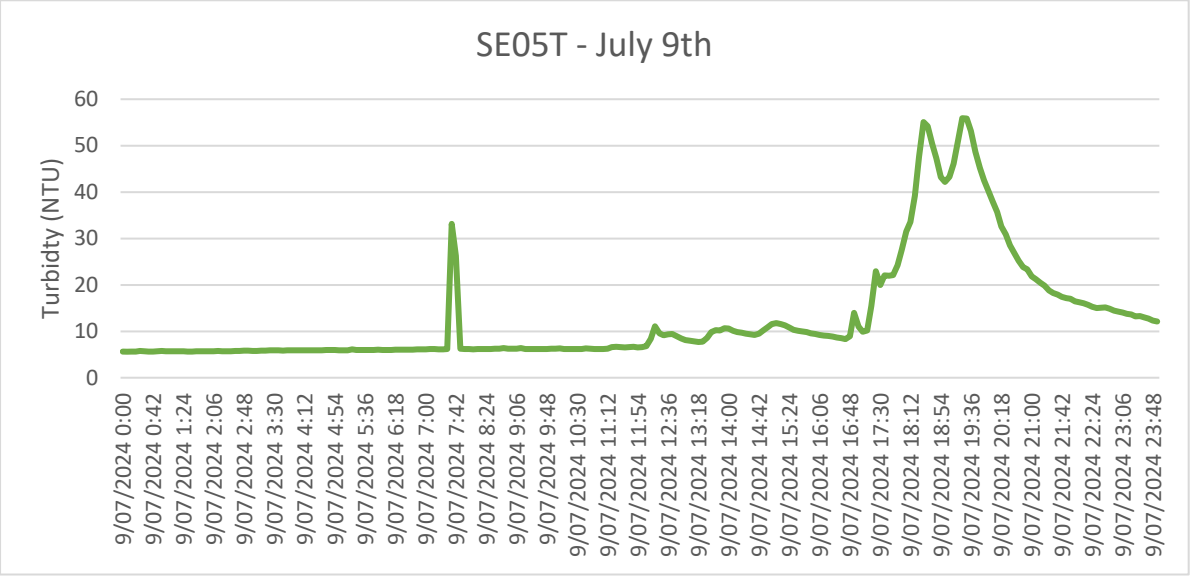
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



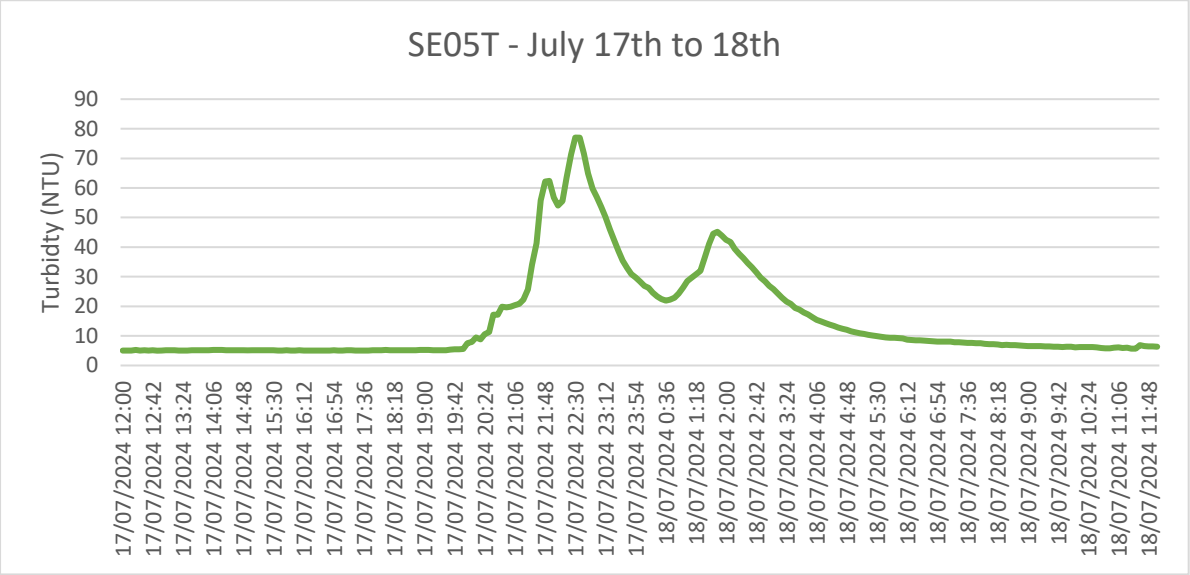
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.4. SE05T Potential Turbidity Event

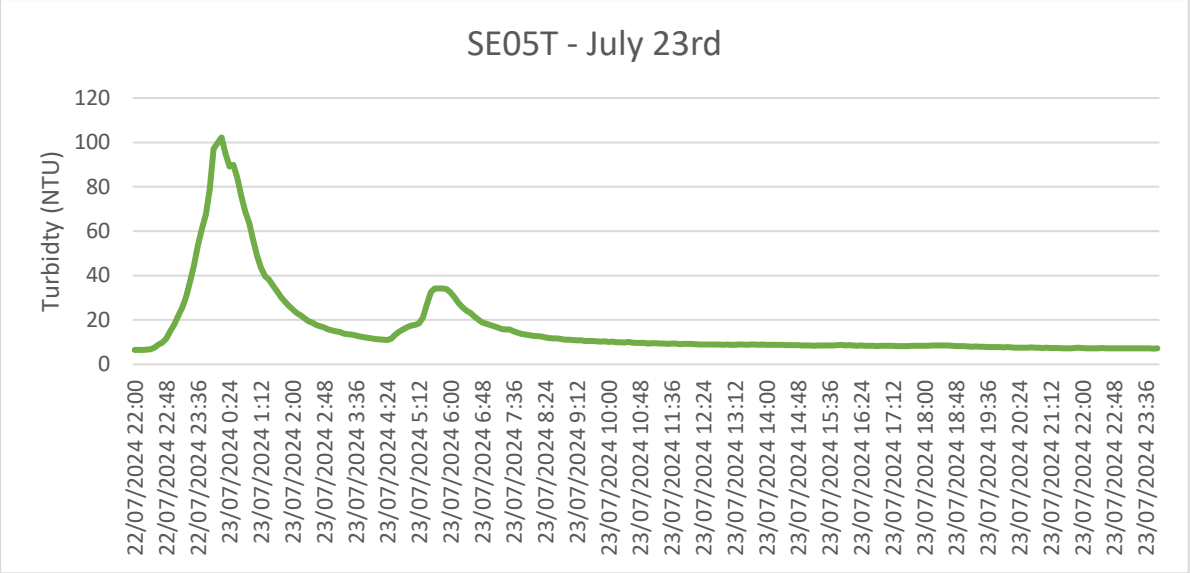
Chart(s) for data flagged at monitor SE05T are shown below for the potential events identified in the reporting period.



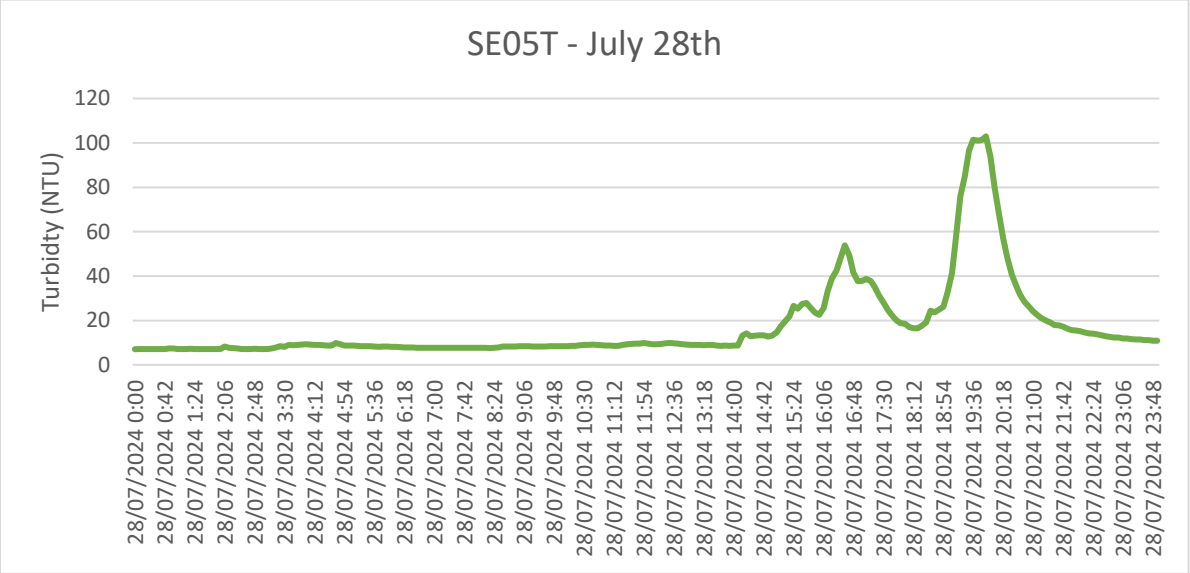
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



These events are marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



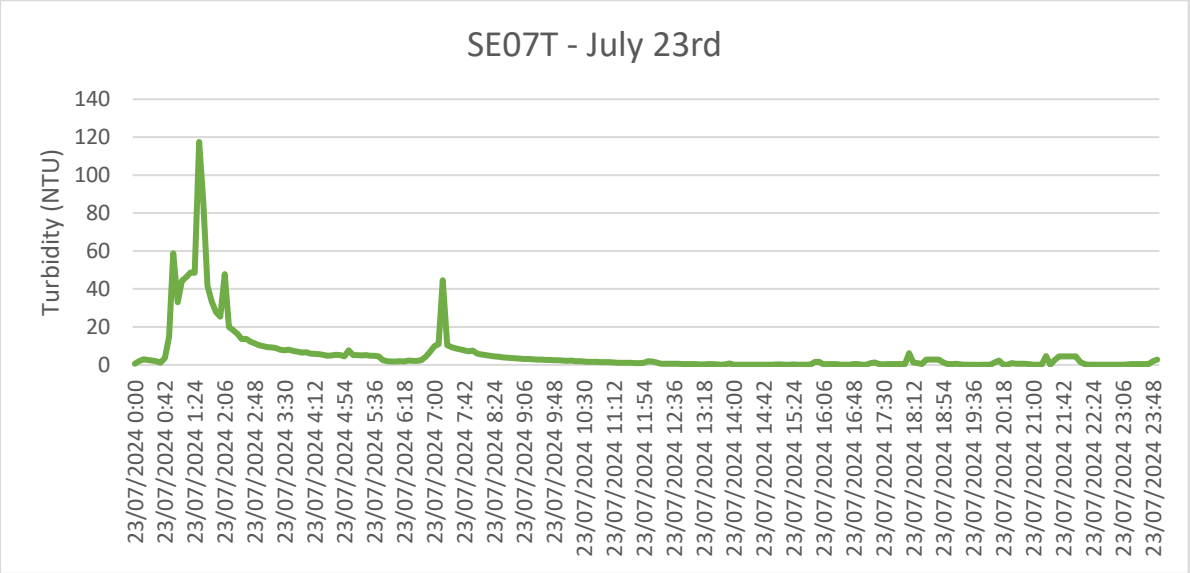
These events are marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



These events are marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation

2.2.5. SE07T Potential Turbidity Events

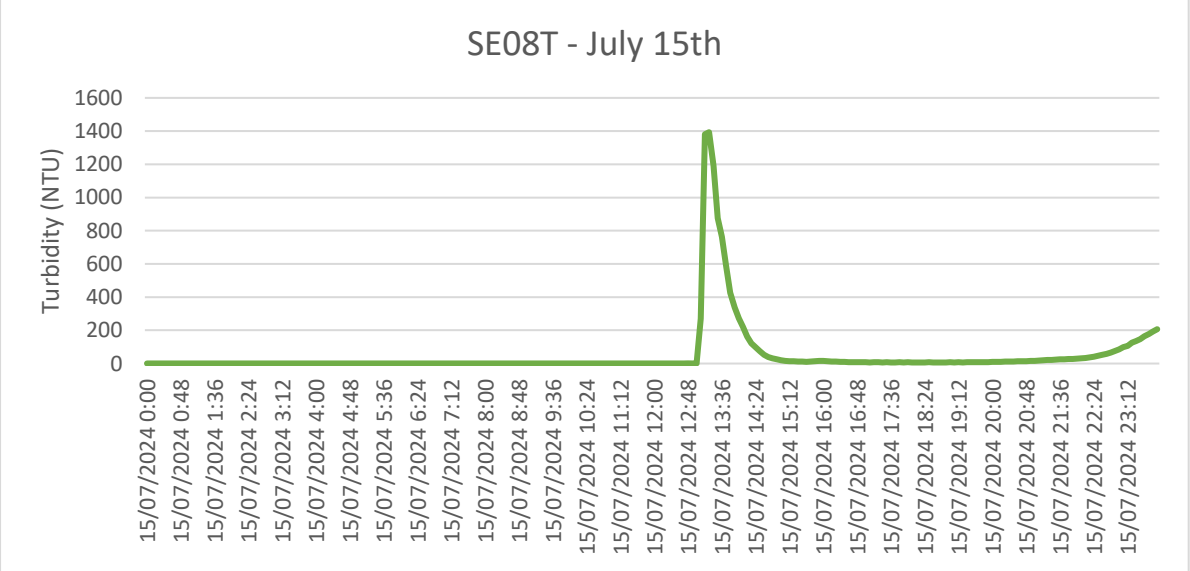
Chart(s) for data flagged at monitor SE07T are shown below for the potential events identified in the reporting period.



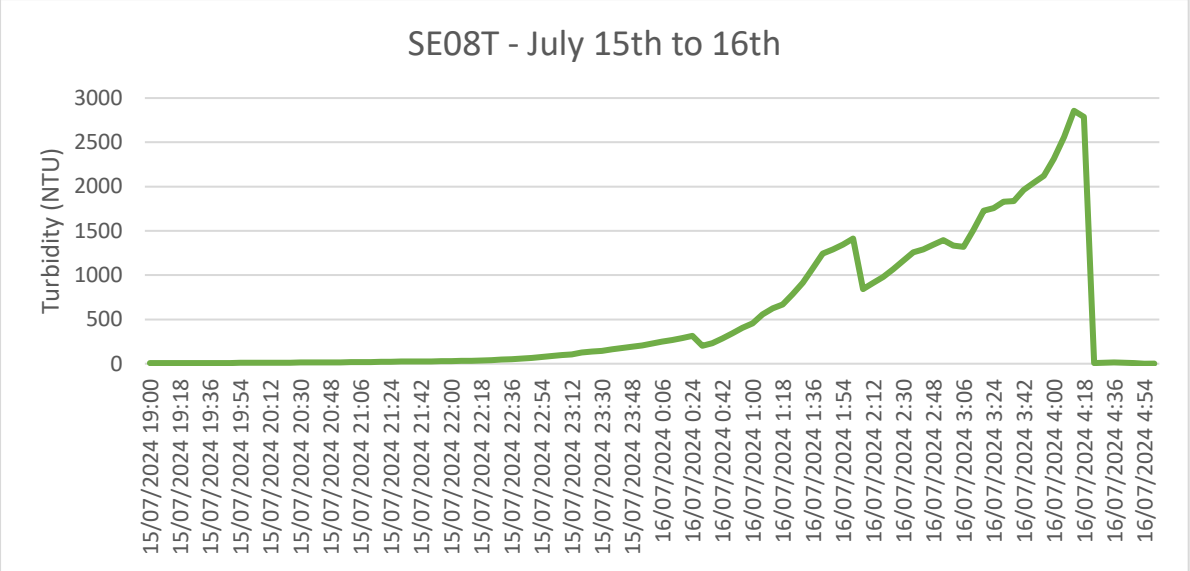
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation

2.2.6. SE08T Potential Turbidity Events

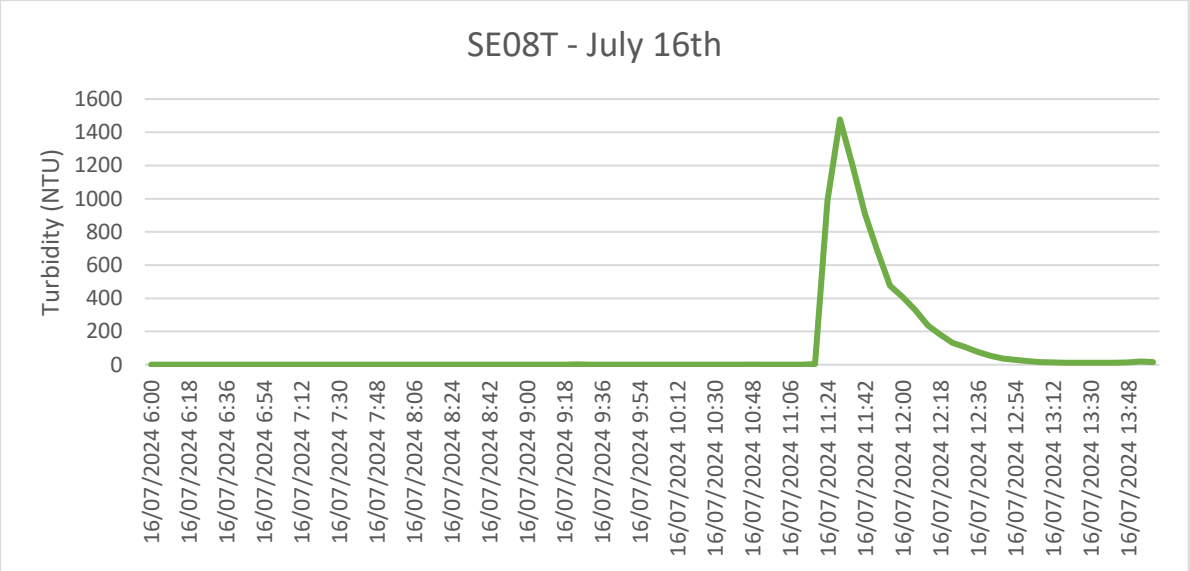
Chart(s) for data flagged at monitor SE08T are shown below for the potential events identified in the reporting period.



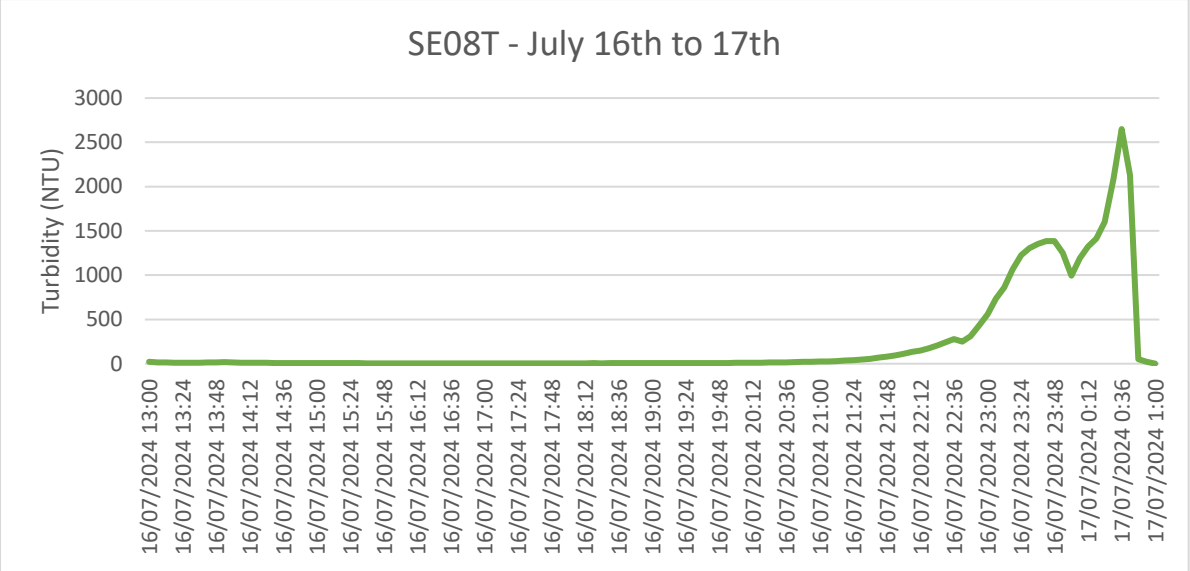
This event is marked by a sharp incline and decline indicative of a 'false' event.



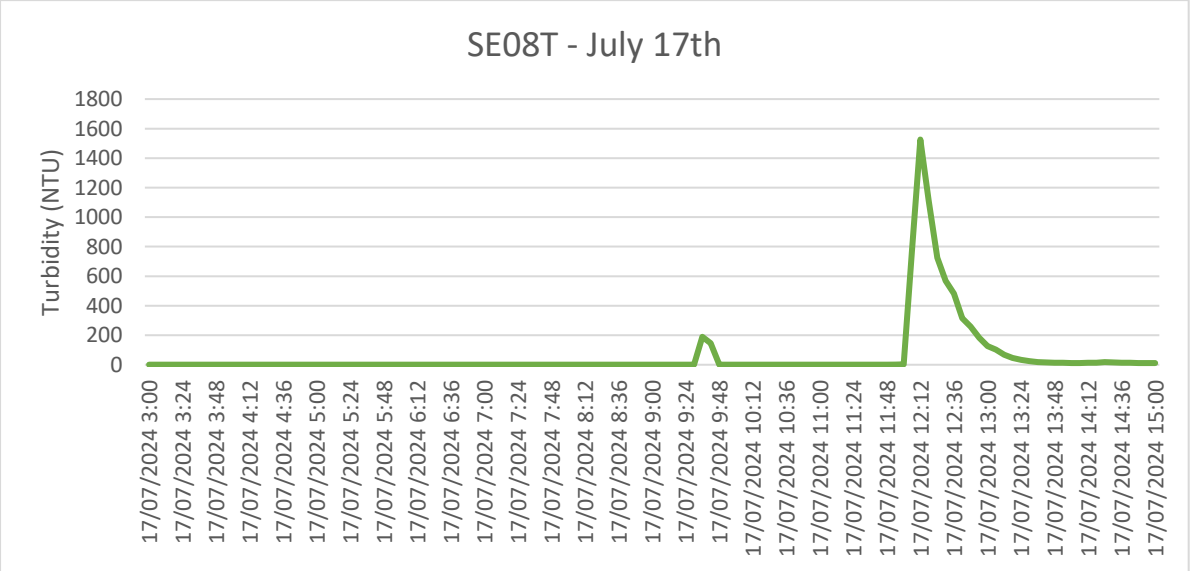
This event is marked by a sharp decline indicative of a 'false' event.



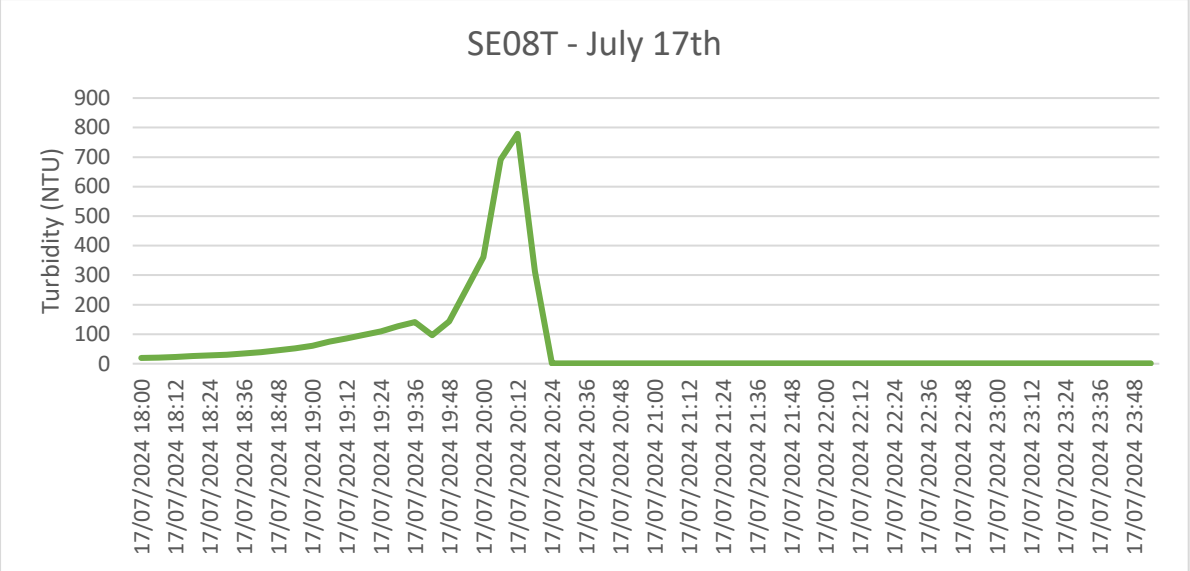
This event is marked by a sharp incline and decline indicative of a 'false' event.



This event is marked by a sharp decline indicative of a 'false' event.



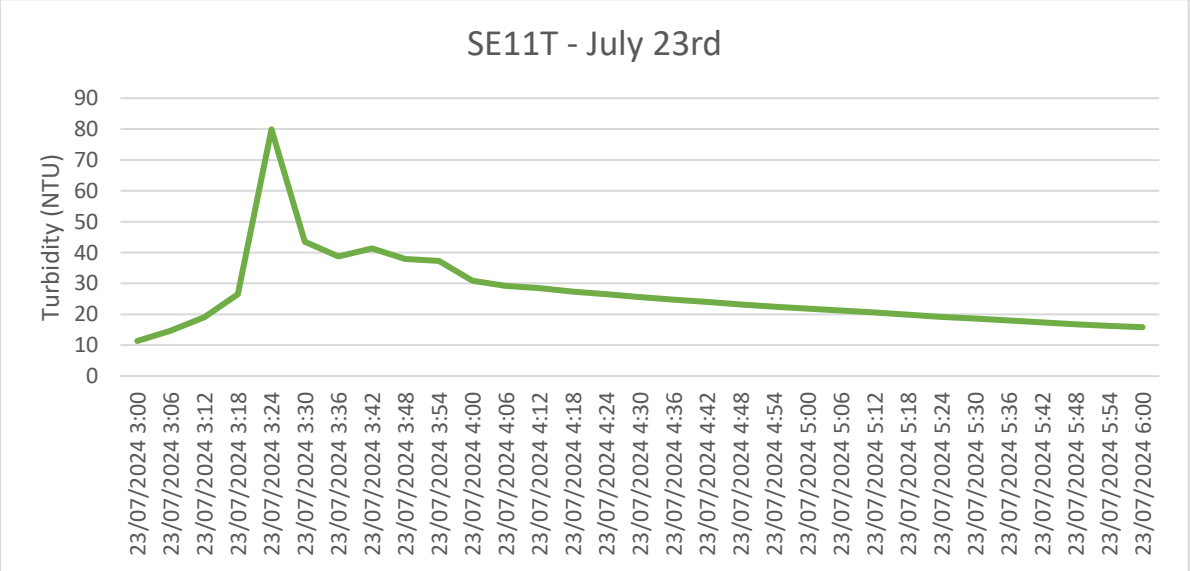
This event is marked by a sharp incline and decline indicative of a 'false' event.



This event is marked by a sharp decline indicative of a 'false' event.

2.2.7. SE11T Potential Turbidity Events

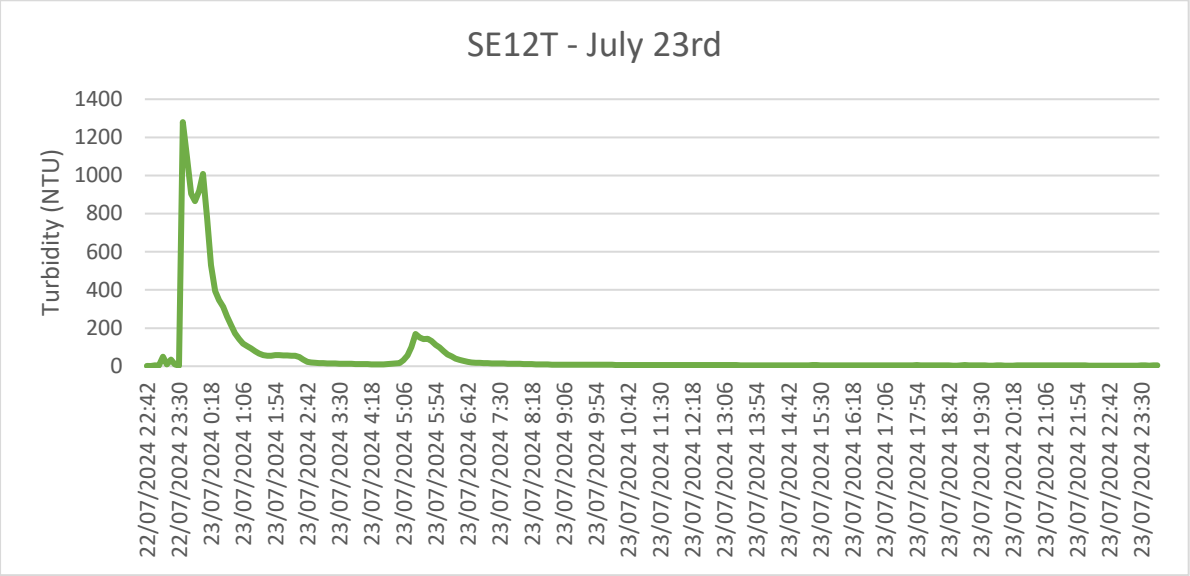
Chart(s) for data flagged at monitor SET are shown below for the potential events identified in the reporting period.



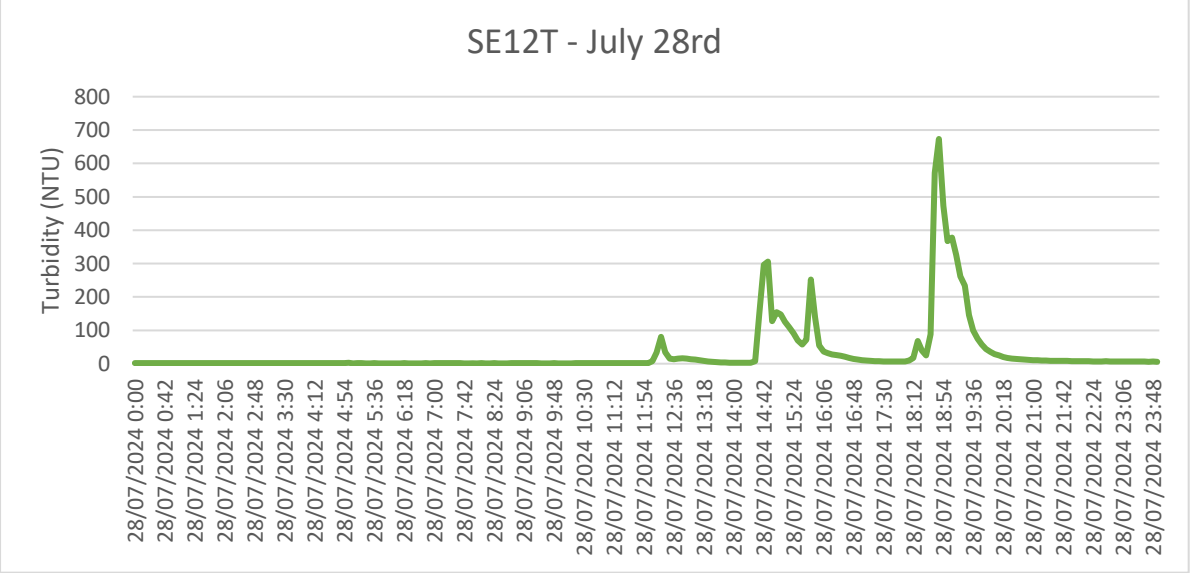
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation

2.2.8. SE12T Potential Turbidity Events

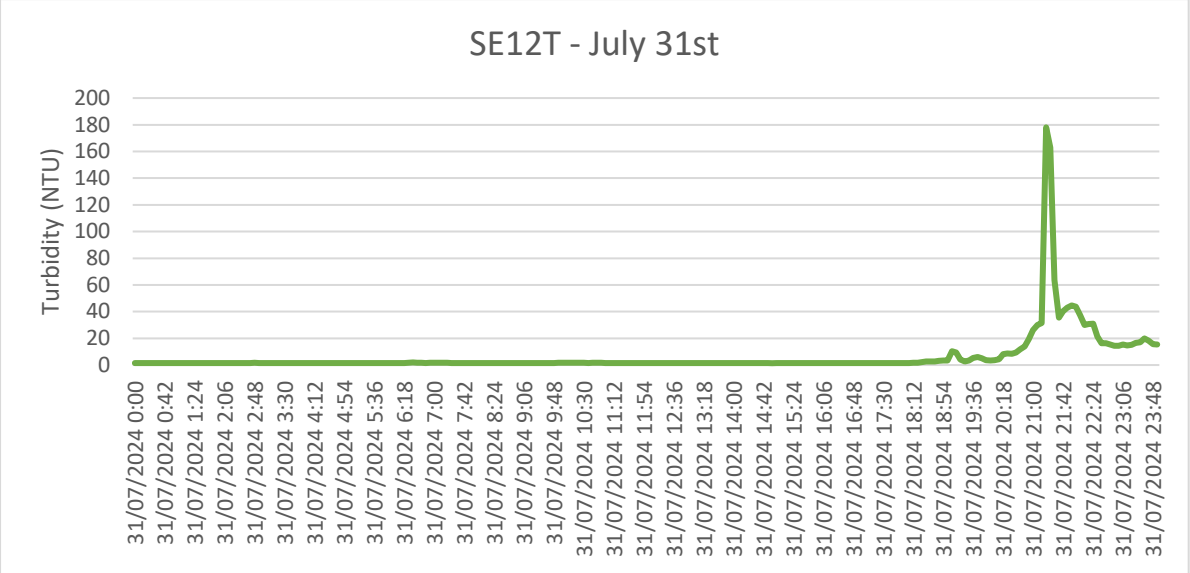
Chart(s) for data flagged at monitor SE12T are shown below for the potential events identified in the reporting period.



These events are marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



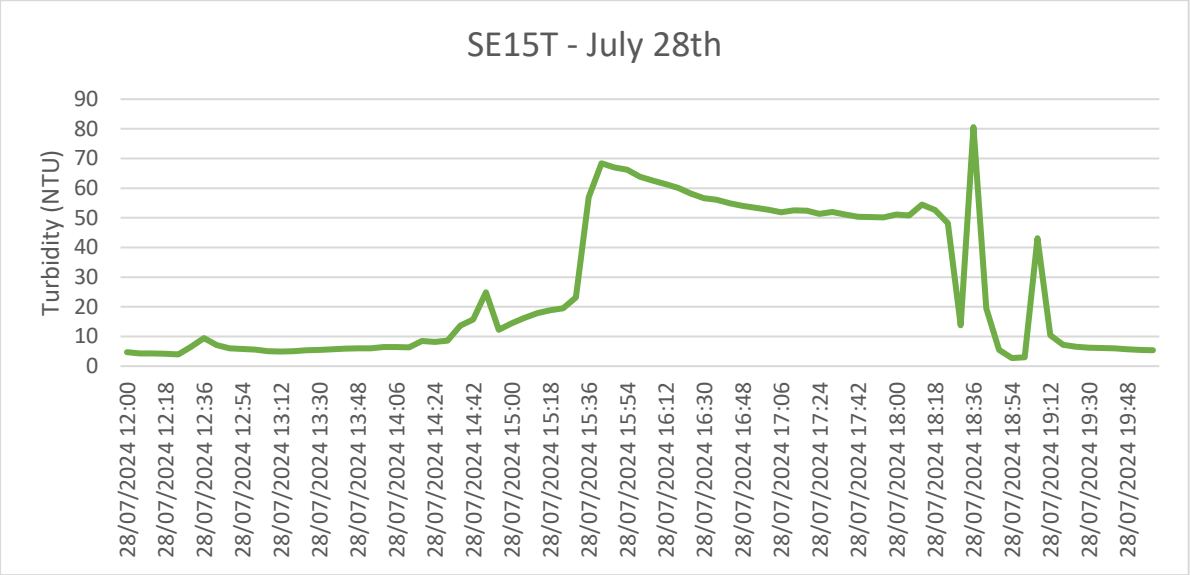
These events are marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.9. SE15T Potential Turbidity Events

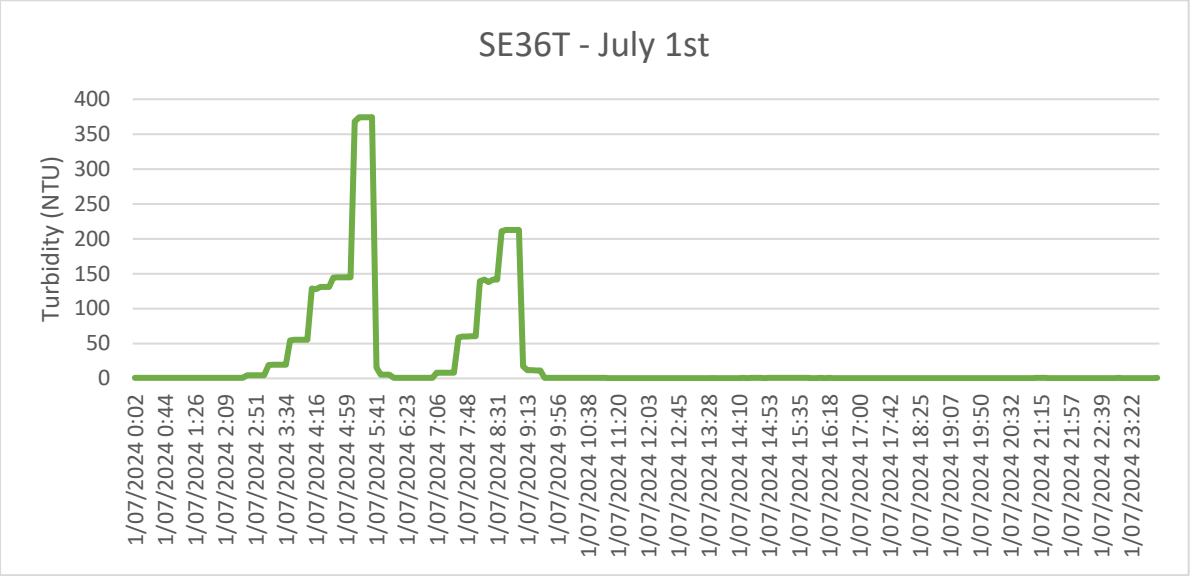
Chart(s) for data flagged at monitor SE15T are shown below for the potential events identified in the reporting period.



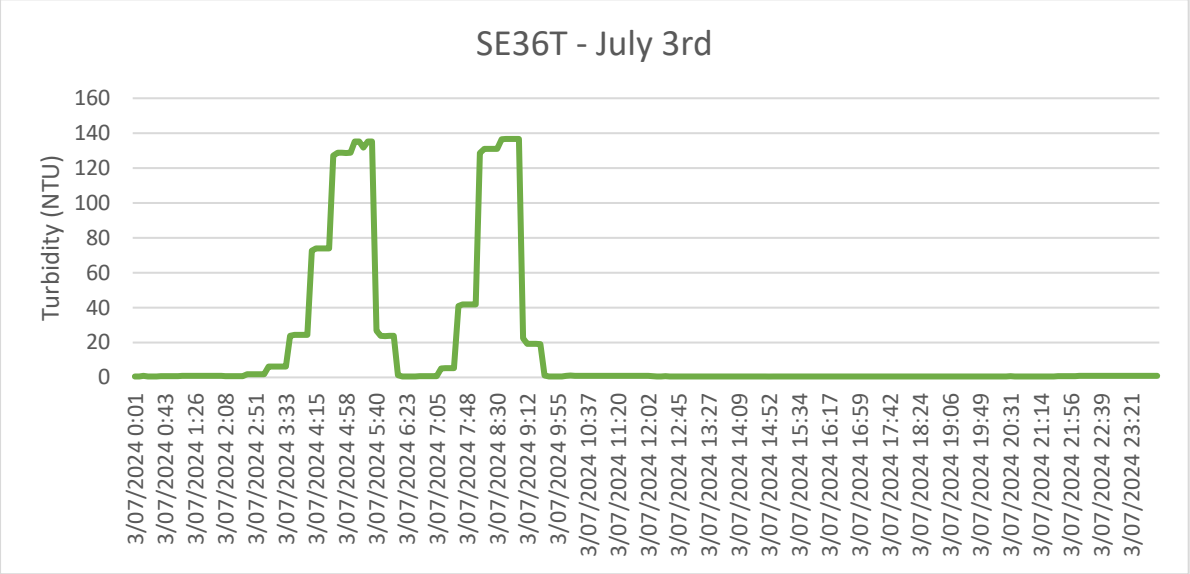
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event. Despite some sporadic peaks, this event has been flagged for further investigation.

2.2.10. SE36T Potential Turbidity Events

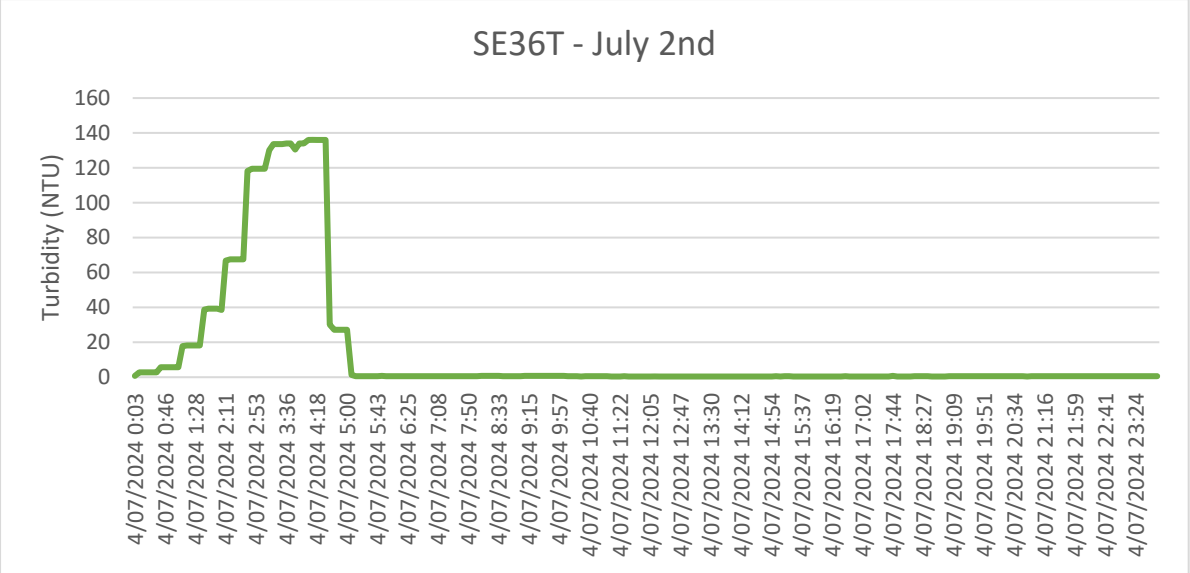
Chart(s) for data flagged at monitor SE36T are shown below for the potential events identified in the reporting period.



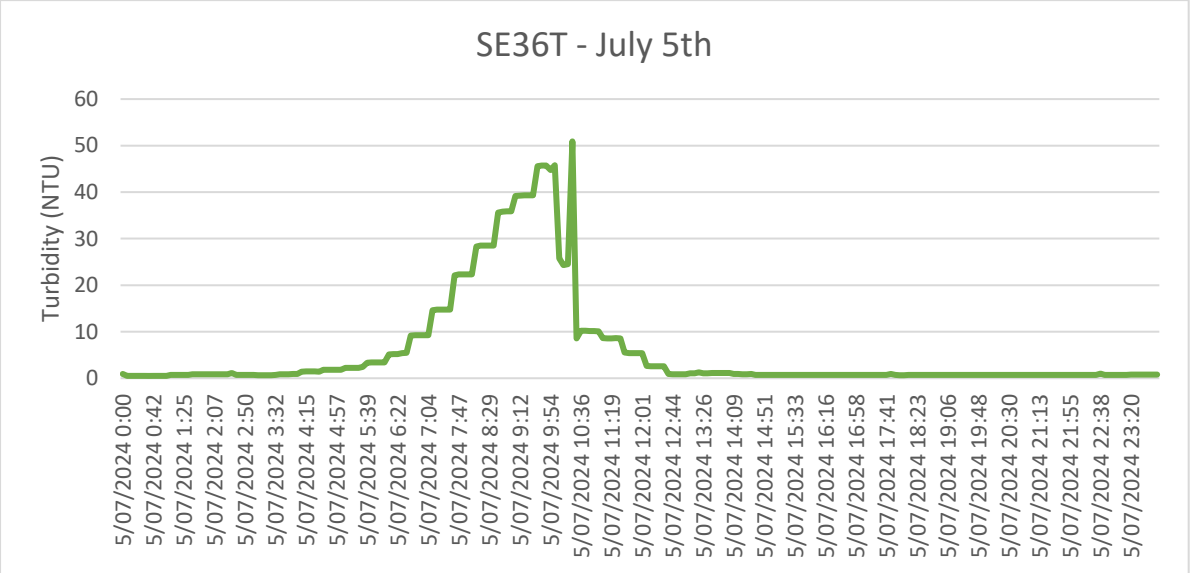
These events are marked by sharp declines indicative of a 'false' event.



These events are marked by sharp declines indicative of a 'false' event.



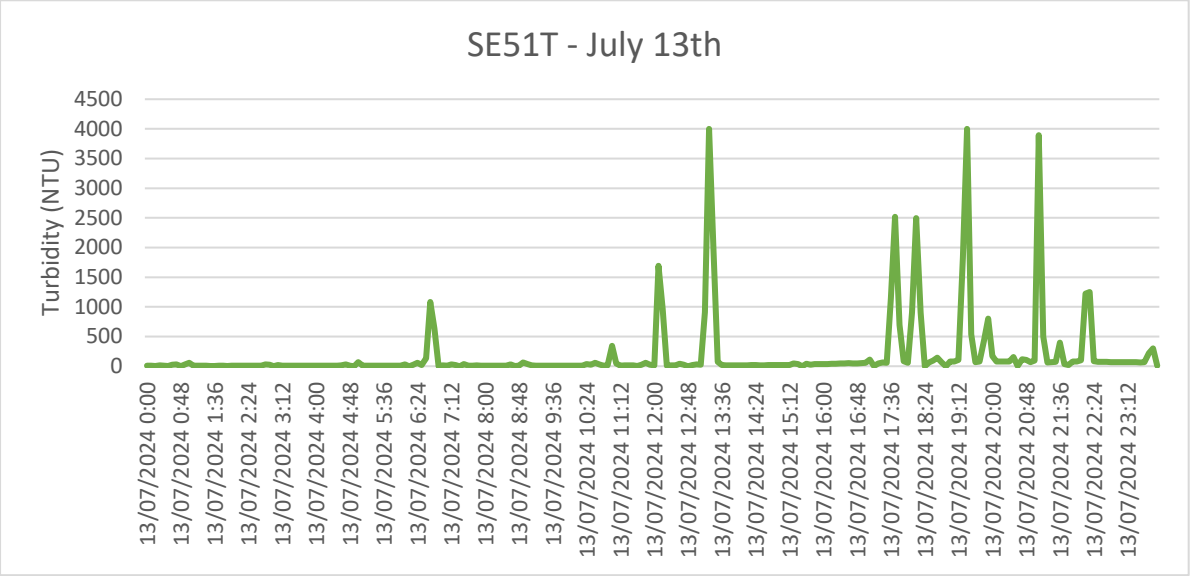
This event is marked by a sharp decline indicative of a 'false' event.



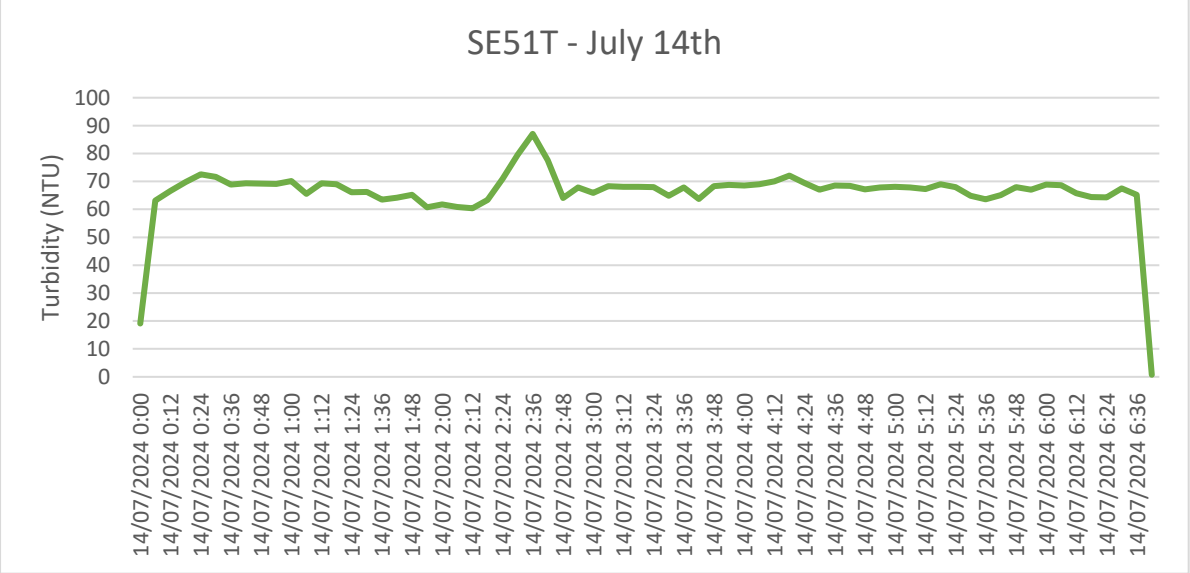
This event is marked by a sharp decline indicative of a 'false' event.

2.2.11. SE51T Potential Turbidity Events

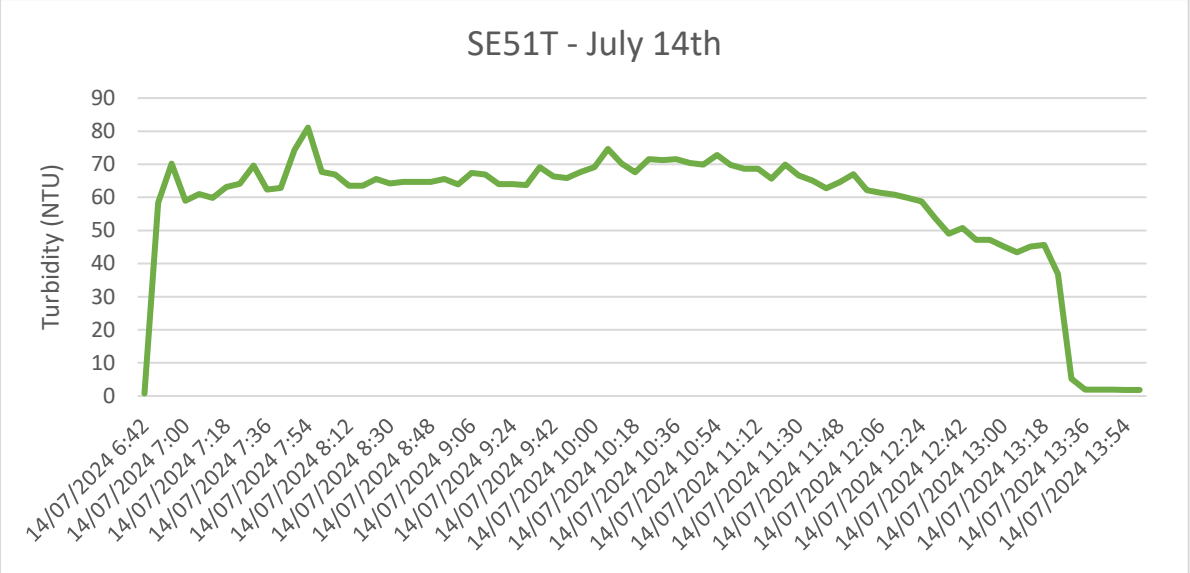
Chart(s) for data flagged at monitor SE51T are shown below for the potential events identified in the reporting period.



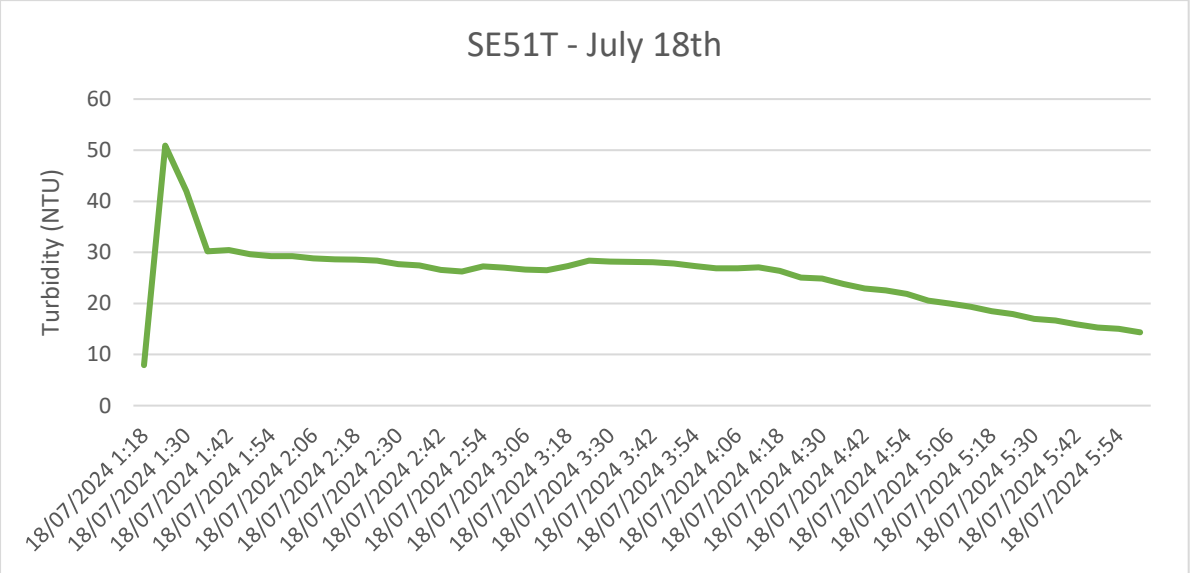
These events are marked by sporadic peaks indicative of a 'false' event.



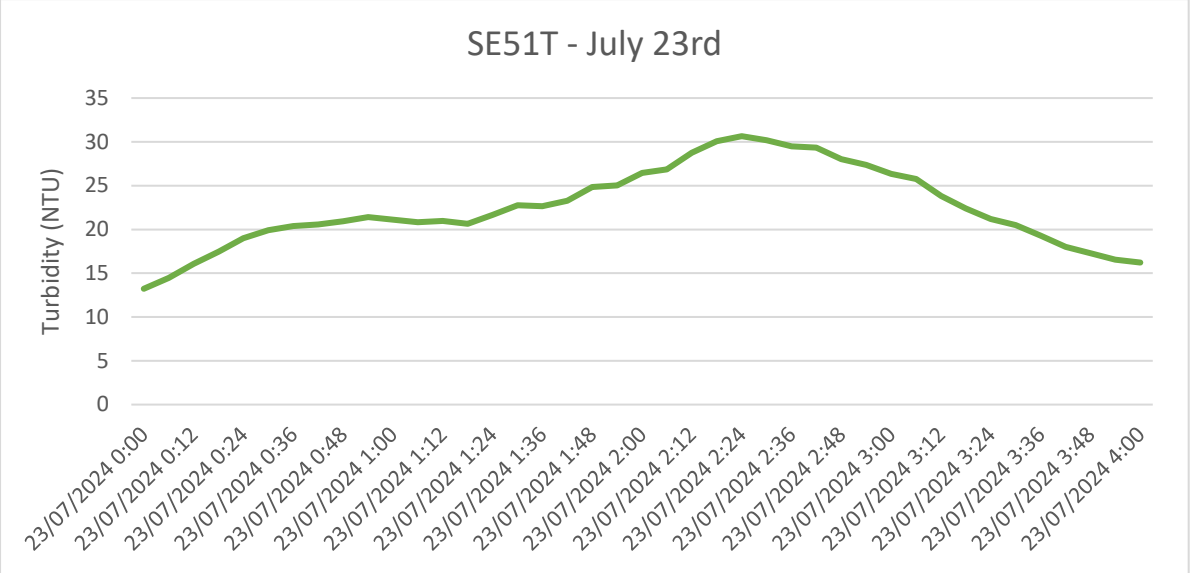
This event is marked by a sharp incline and decline indicative of a 'false' event.



This event is marked by a sharp incline and decline indicative of a 'false' event.



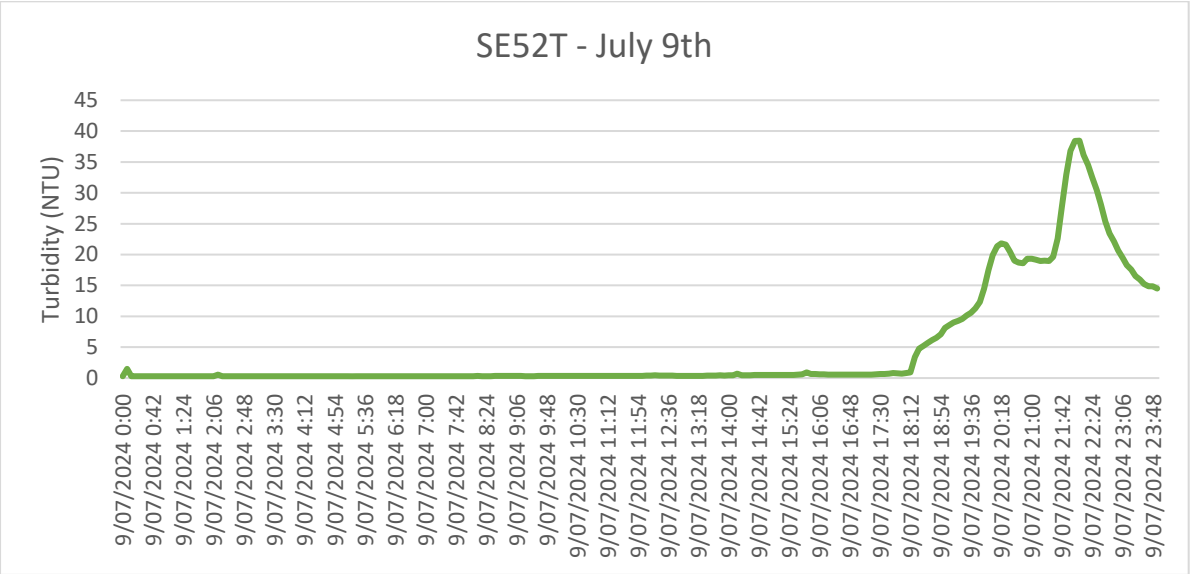
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



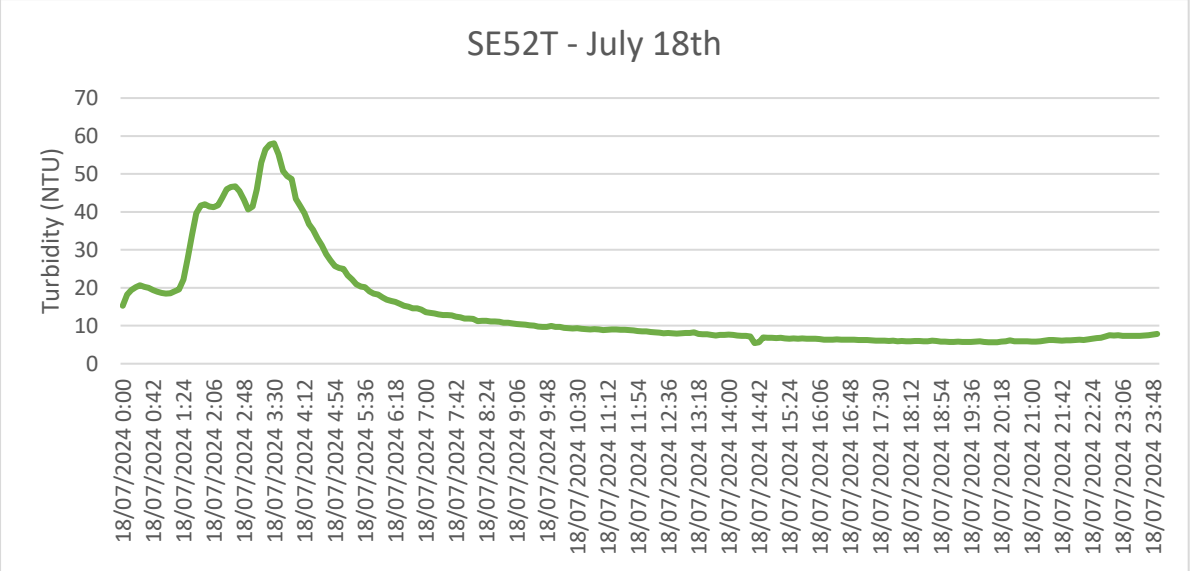
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.12. SE52T Potential Turbidity Events

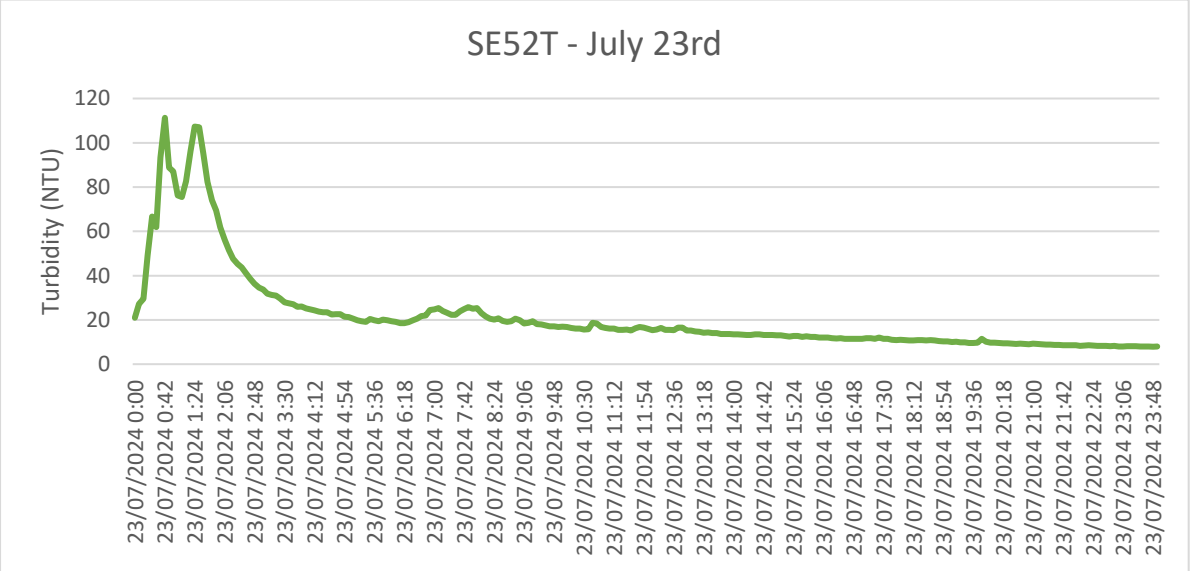
Chart(s) for data flagged at monitor SE52T are shown below for the potential events identified in the reporting period.



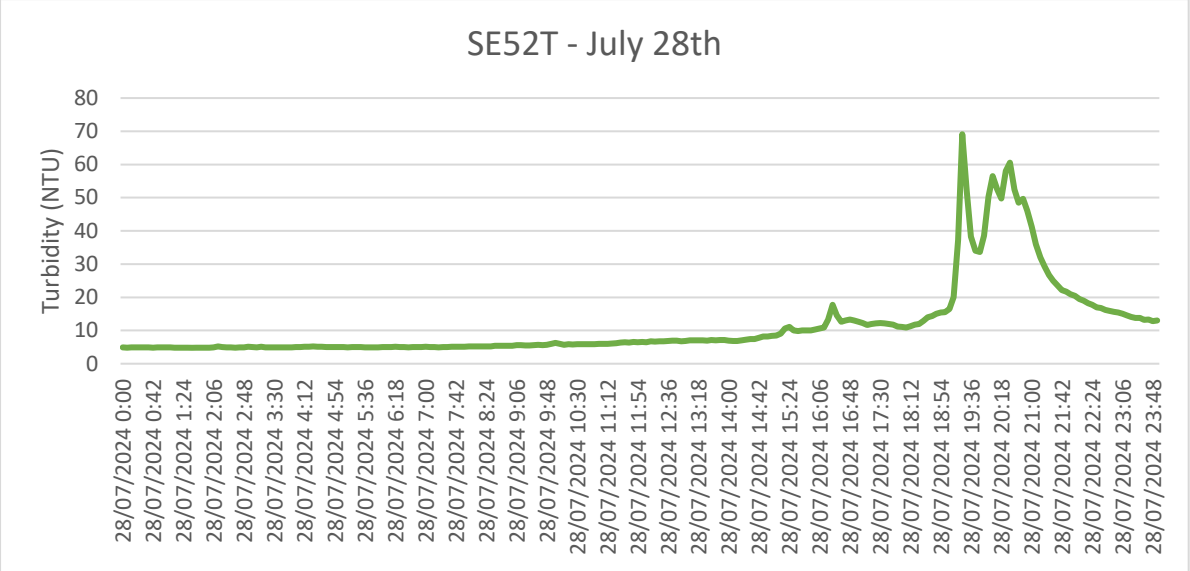
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



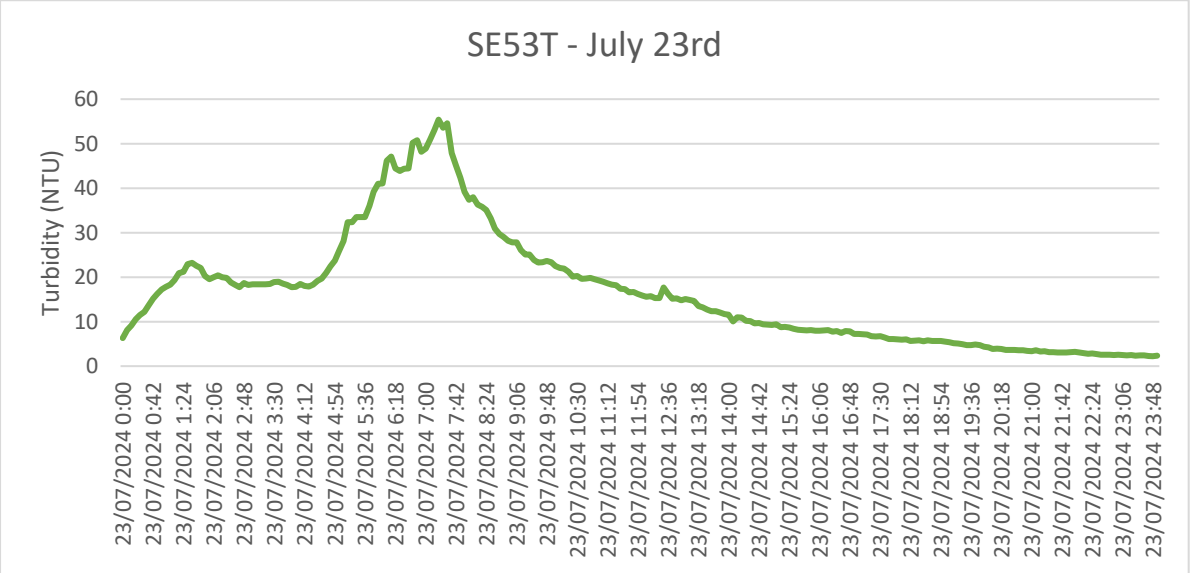
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



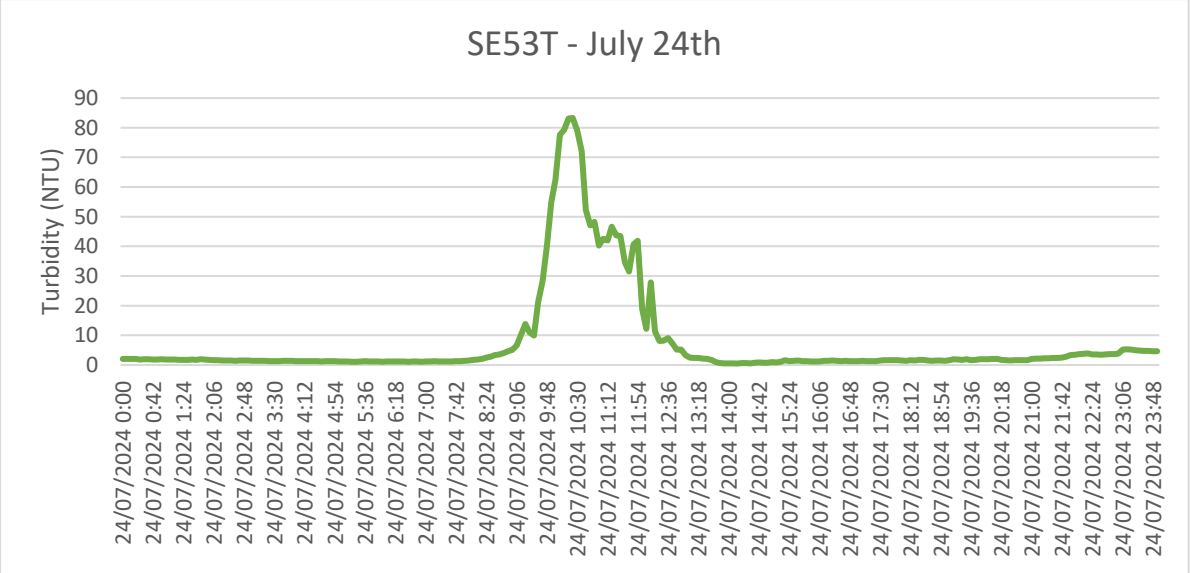
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.13. SE53T Potential Turbidity Events

Chart(s) for data flagged at monitor SE53T are shown below for the potential events identified in the reporting period.



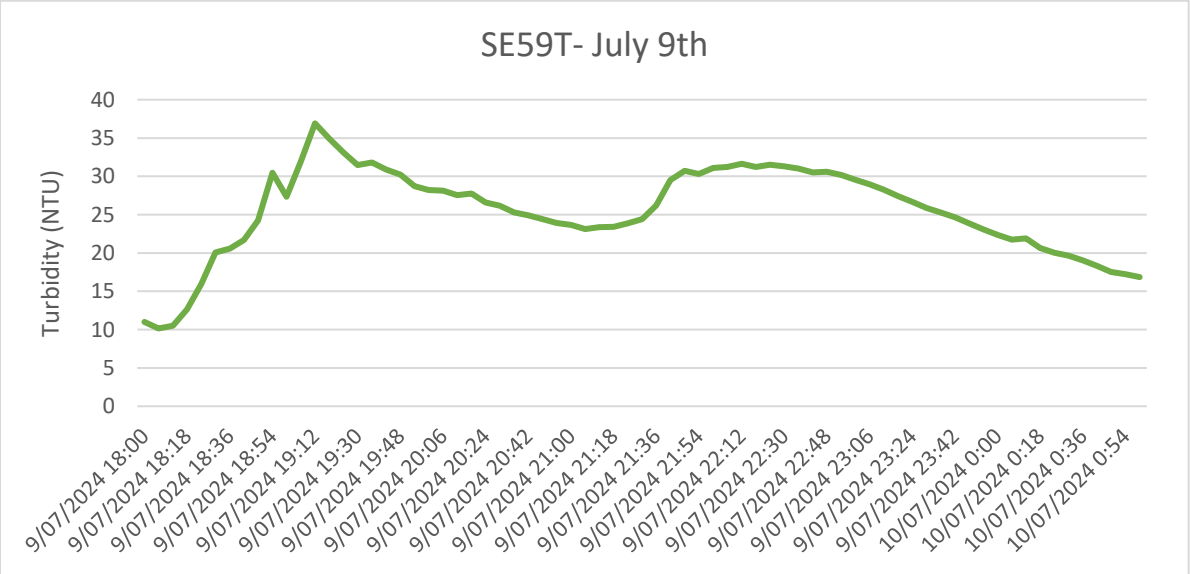
This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



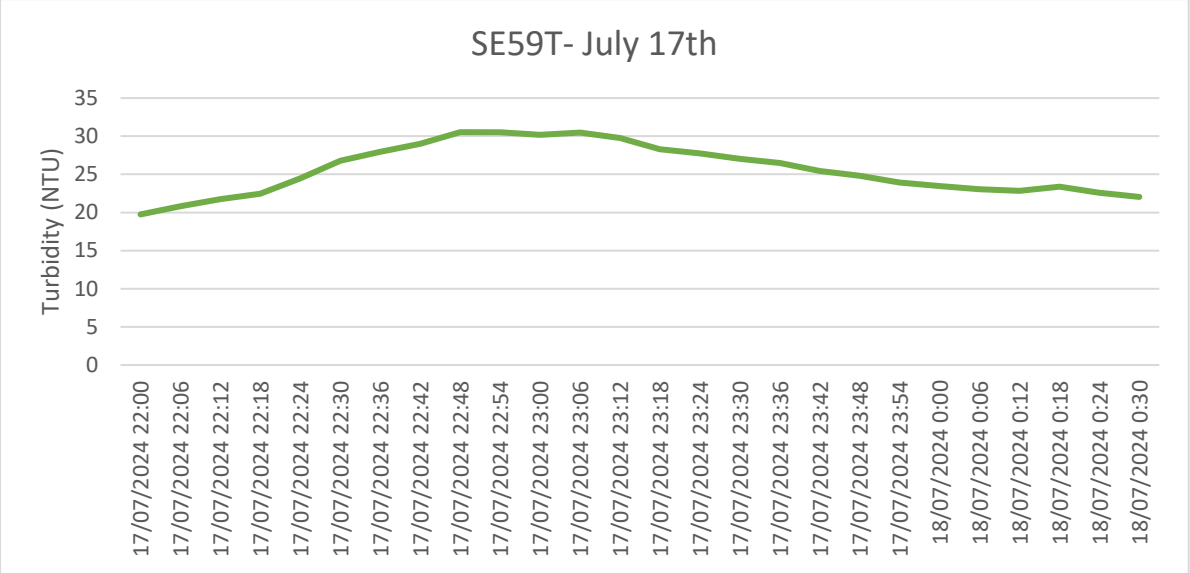
This event is marked by a sharp incline and a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.14. SE59T Potential Turbidity Events

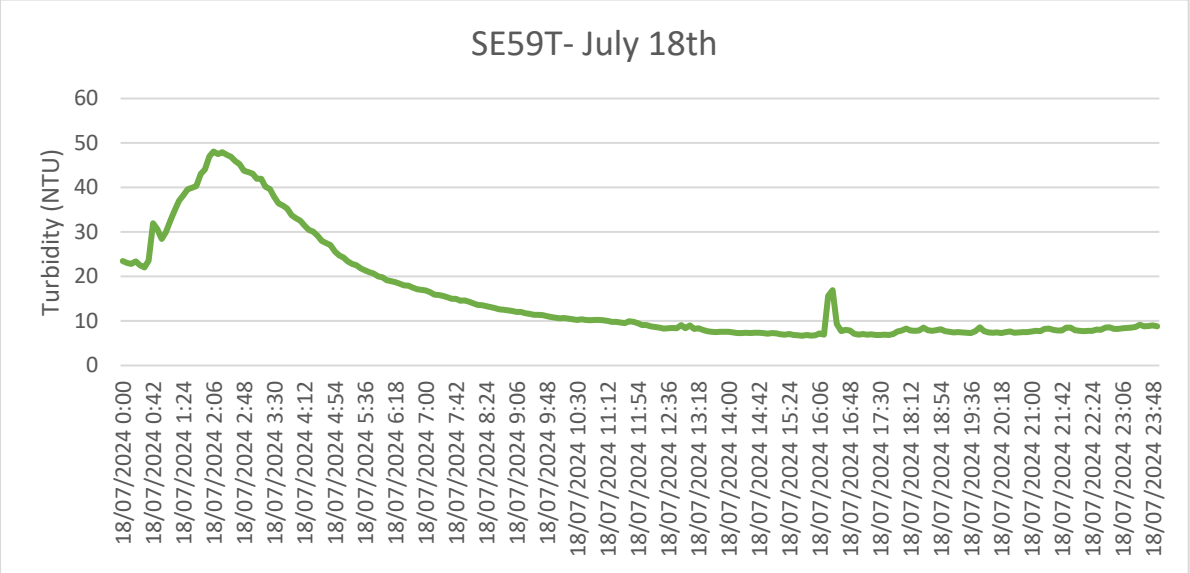
Chart(s) for data flagged at monitor SE59T are shown below for the potential events identified in the reporting period.



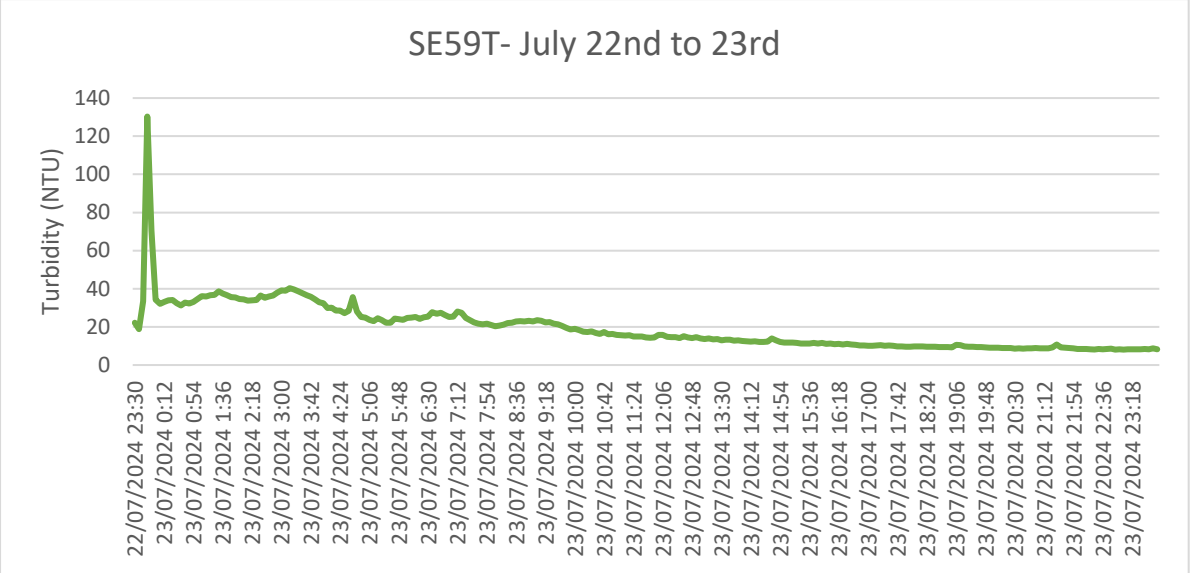
These events are marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



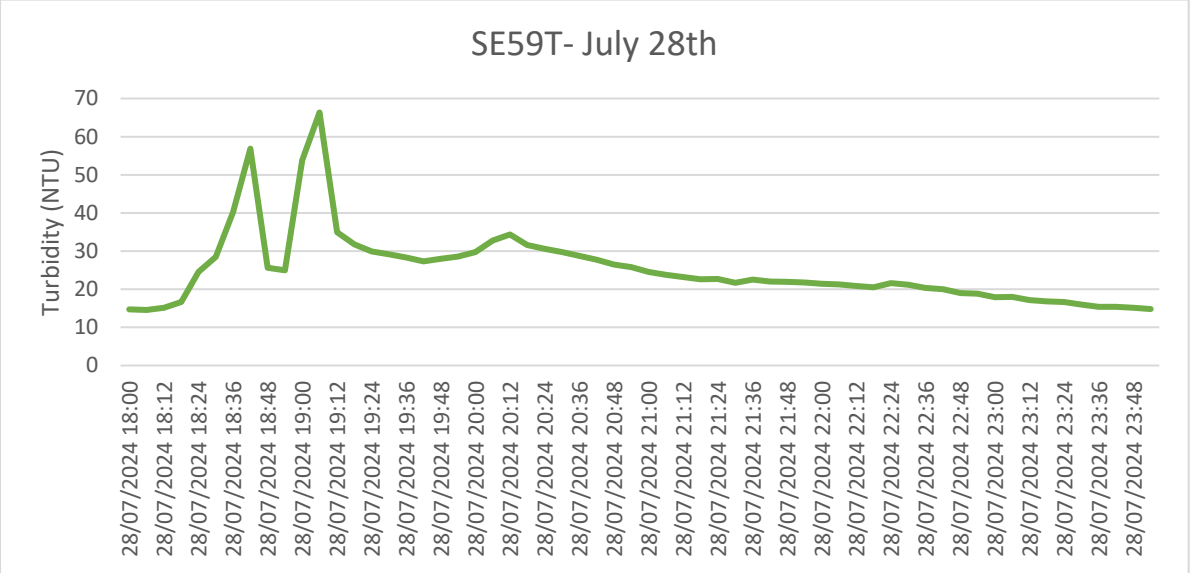
These events are marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



These events are marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



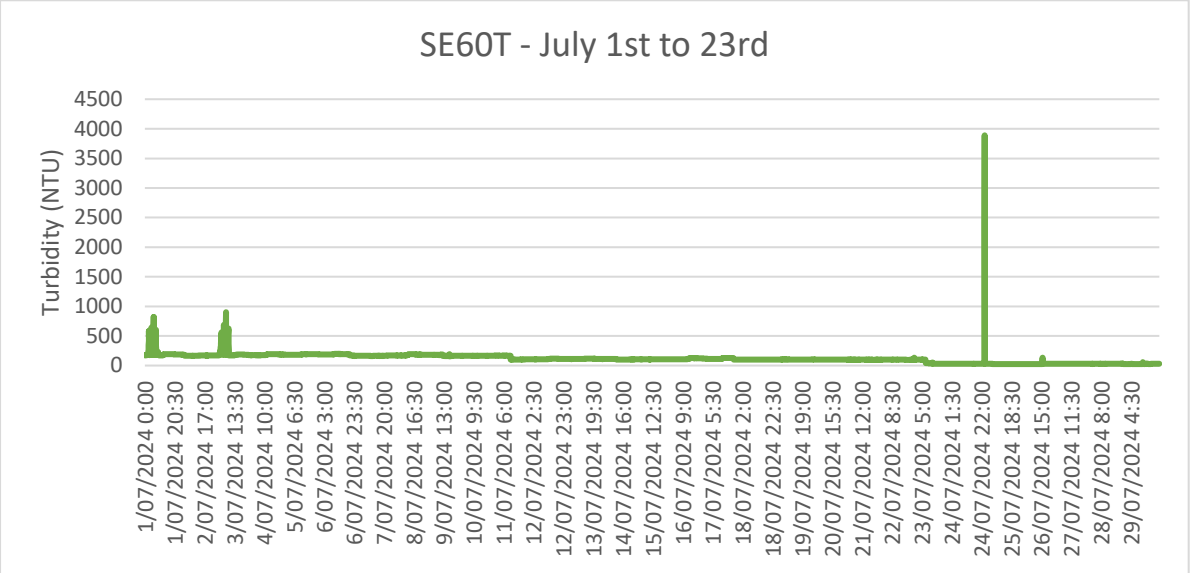
These events are marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



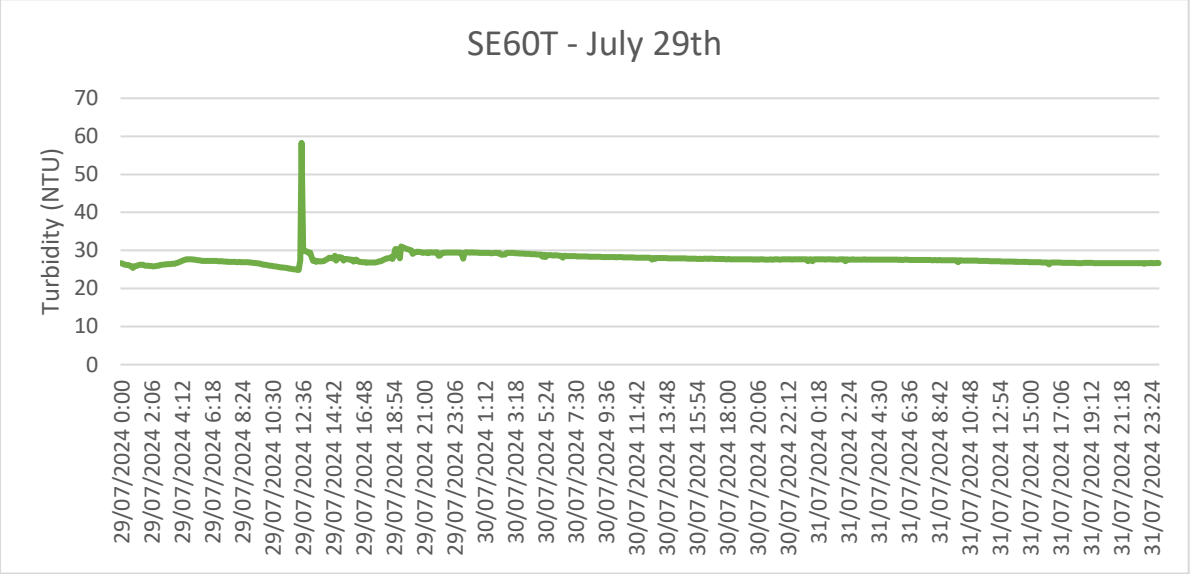
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.2.15. SE60T Potential Turbidity Events

Chart(s) for data flagged at monitor SE60T are shown below for the potential events identified in the reporting period.



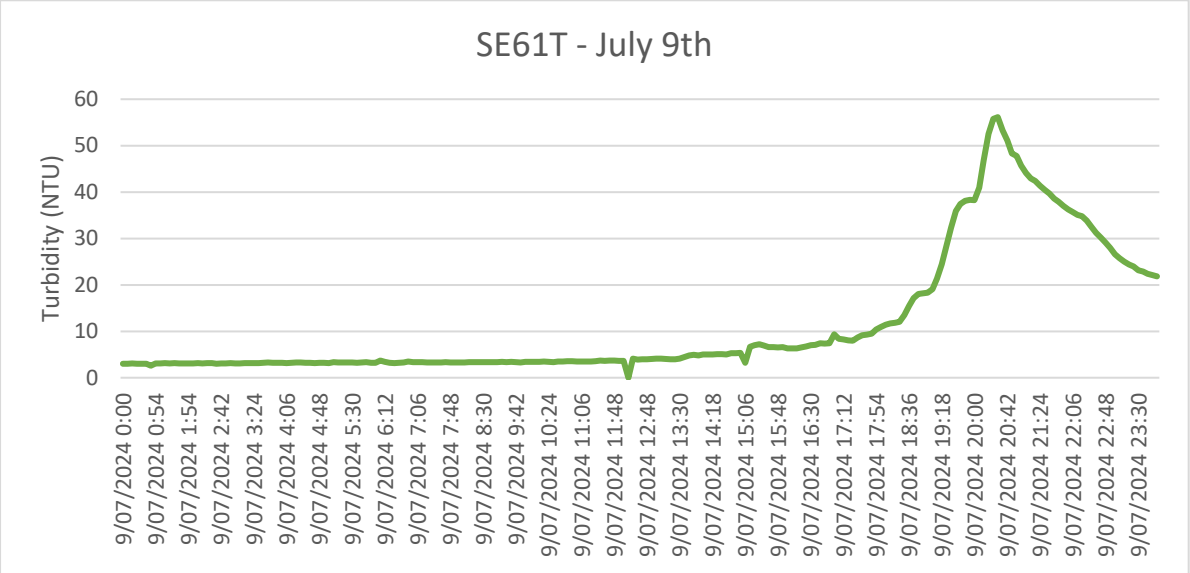
This event is marked by a sharp inclines and declines indicative of a 'false' event.



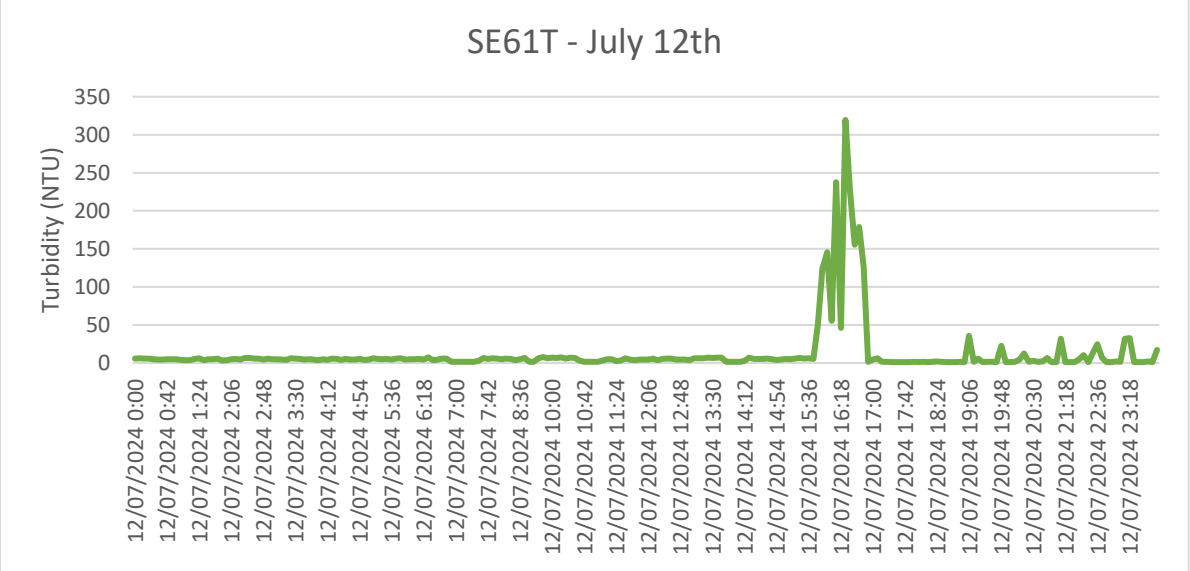
This event is marked by a sharp incline and decline indicative of a 'false' event.

2.2.16. SE61T Potential Turbidity Events

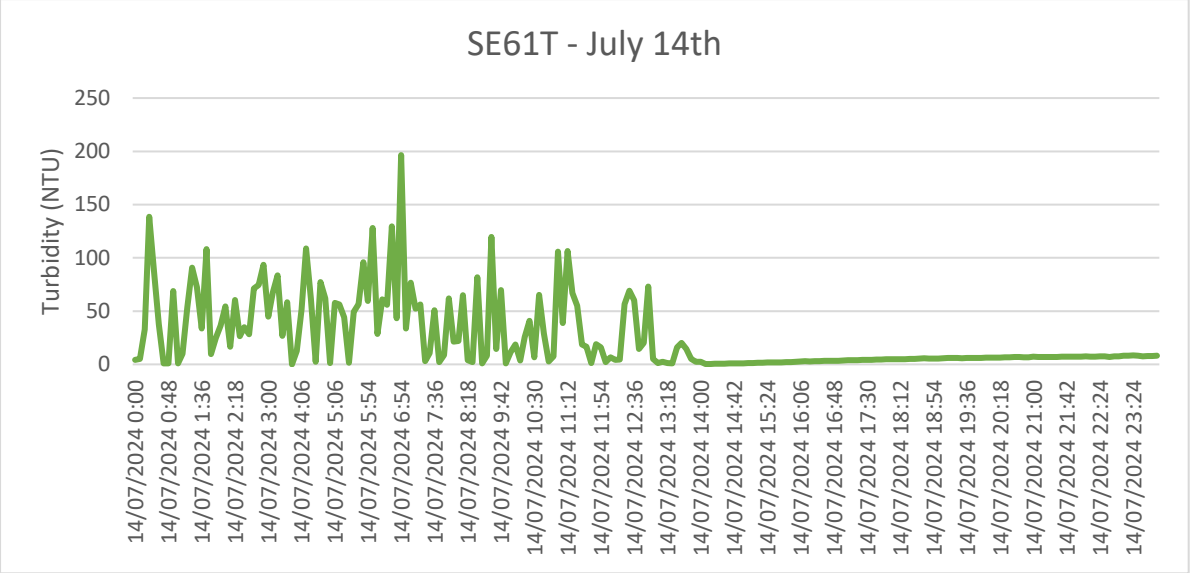
Chart(s) for data flagged at monitor SE61T are shown below for the potential events identified in the reporting period.



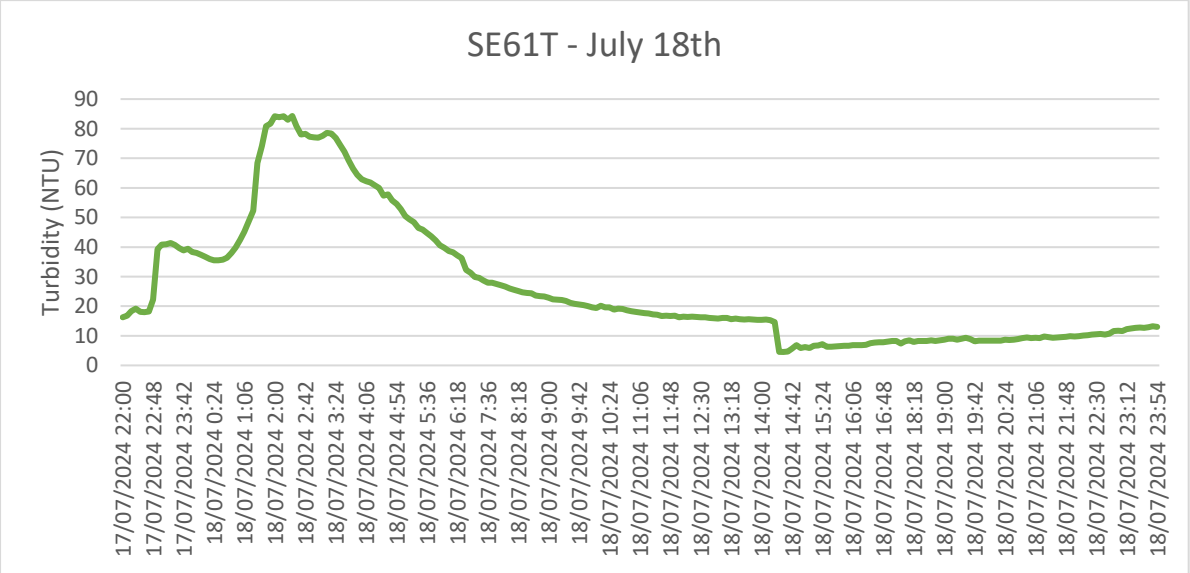
This event is marked by a sharp incline and gradual return to background levels indicative of a 'true' event, flagged for further investigation.



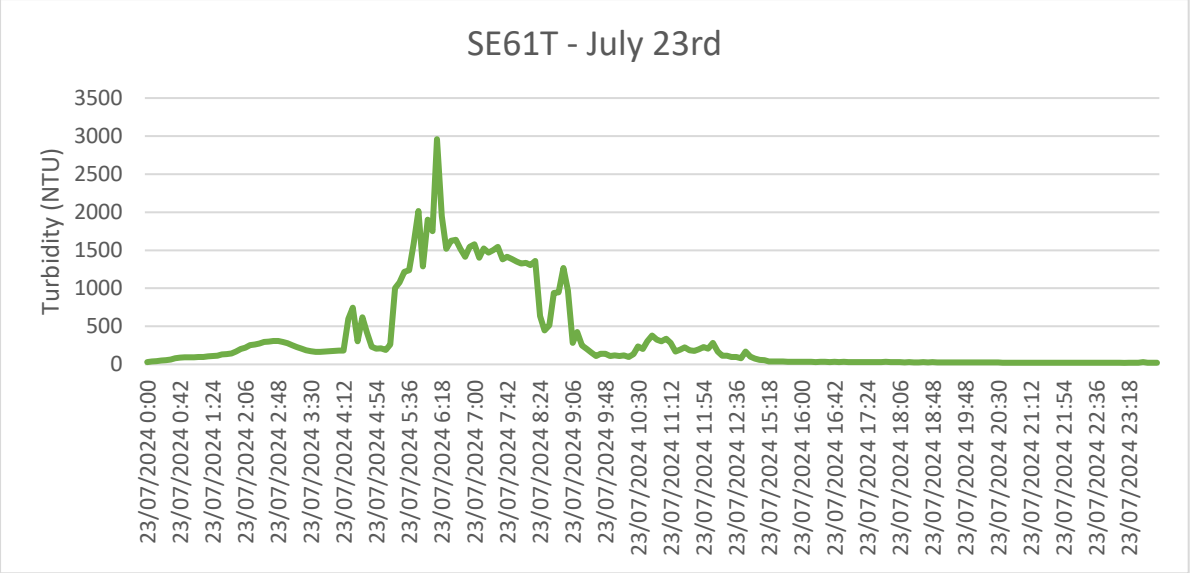
This event is marked by sporadic peaks indicative of a 'false' event.



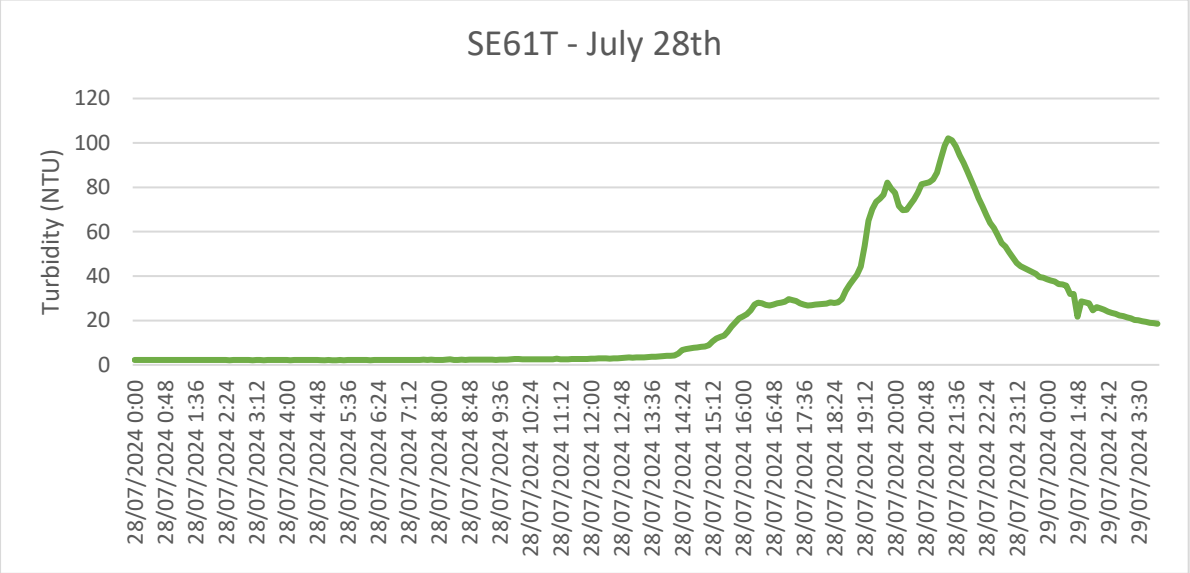
These events are marked by sporadic peaks indicative of a 'false' event.



This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.



This event is marked by a gradual return to background levels indicative of a 'true' event, flagged for further investigation.

2.3. True Turbidity Events

For this reporting period, 40 (forty) potential drainage or 'true' incidents were identified for further investigation.

Table 3: True Turbidity Events

Event ID	Monitor	Date(s)	Start Time	End Time	Duration	Peak Turbidity (NTU)
HUN-2406-001	ND04T	02/07/24	7:18:00 AM	2:54:00 PM	7hrs 36min	124.67
	ND04T	02/07/24	3:18:00 PM	5:24:00 PM	2hr 6min	61.40
HUN-2407-002	ND04T	13/07/24	12:54:00 AM	6:18:00 AM	5hrs 24min	113.45
HUN-2407-003	ND04T	16/07/24	6:36:00 AM	10:36:00 AM	4hrs	536.76
HUN-2407-004	ND04T	22/07/24 – 23/07/24	10:48:00 PM	12:36:00 AM	1hr 48min	44.25
HUN-2407-005	PD01T	17/07/24 – 18/07/24	11:54:00 PM	1:12:00 AM	1hr 12min	28.89
	PD01T	18/07/24	2:48:00 AM	5:30:00 AM	2hrs 42min	76.58
HUN-2407-006	PD01T	23/07/24	12:30:00 AM	4:05:00 AM	3hrs 35min	93.78
HUN-2407-007	PD01T	28/07/24	8:42:00 PM	9:48:00 PM	1hr 6min	42.94
HUN-2407-008	SE03T	09/07/24 – 10/07/24	8:12:00 PM	4:30:00 AM	8hrs 18min	47.72
HUN-2407-009	SE03T	17/07/24 – 18/07/24	11:48:00 PM	11:42:00 AM	11hrs 54min	86.51
HUN-2407-010	SE03T	23/07/24	12:06:00 AM	12:42:00 PM	12hrs 36min	105.10
HUN-2407-011	SE03T	28/07/24	7:47:00 PM	11:43:00 PM	3hrs 56min	49.00
HUN-2407-012	SE05T	09/07/24	6:00:00 PM	8:42:00 PM	2hrs 42min	55.91
HUN-2407-013	SE05T	17/07/24 – 18/07/24	9:24:00 PM	12:12:00 AM	2hrs 48min	77.08
	SE05T	18/07/24	1:00:00 AM	3:06:00 AM	2hrs 6min	45.23
HUN-2407-014	SE05T	22/07/24 – 23/07/24	11:17:00 PM	1:54:00 AM	2hrs 37min	102.26
HUN-2407-015	SE05T	28/07/24	3:24:00 PM	5:30:00 PM	2hrs 6min	53.90
HUN-2407-016	SE05T	28/07/24	6:54:00 PM	8:54:00 PM	2hrs	102.96
HUN-2407-017	SE07T	23/07/24	12:54:00 AM	2:06:00 AM	1hr 12min	117.48
HUN-2407-018	SE11T	23/07/24	3:18:00 AM	4:30:00 AM	1hr 12min	79.92
HUN-2407-019	SE12T	22/07/024 – 23/07/24	11:36:00 PM	2:36:00 AM	3hrs	1279.92
HUN-2407-020	SE12T	23/07/24	5:06:00 AM	6:36:00 AM	1hr 30min	168.65
HUN-2407-021	SE12T	28/07/24	2:36:00 PM	4:24:00 PM	1hr 48min	305.96
HUN-2407-022	SE12T	28/07/24	6:18:00 PM	8:06:00 PM	1hr 48min	673.32
HUN-2407-023	SE12T	31/07/24	9:00:00 PM	10:24:00 PM	1hr 24min	178.04
HUN-2407-024	SE15T	28/07/24	3:36:00 PM	6:36:00 PM	3hrs	80.57
HUN-2407-025	SE51T	18/07/24	1:24:00 AM	4:24:00 AM	3hrs	50.90
HUN-2407-026	SE51T	23/07/24	1:53:00 AM	3:12:00 AM	1hr 13min	30.64
HUN-2407-027	SE52T	09/07/24	9:42:00 PM	10:42:00 PM	1hr	38.45
HUN-2407-028	SE52T	18/07/24	1:30:00 PM	4:48:00 PM	3hrs 18min	58.06
HUN-2407-029	SE52T	23/07/24	12:00:00 AM	4:00:00 AM	3hrs 54min	111.29
HUN-2407-030	SE52T	28/07/24	7:18:00 PM	9:24:00 PM	2hrs 6min	69.09
HUN-2407-031	SE53T	23/07/24	5:00:00 AM	9:24:00 AM	4hrs 24min	55.39
HUN-2407-032	SE53T	24/07/24	9:42:00 AM	11:54:00 AM	2hrs 12min	83.30
HUN-2407-033	SE59T	09/07/24	6:54:00 PM	8:36:00 PM	1hr 42min	36.90
	SE59T	09/07/24	9:36:00 PM	11:36:00 PM	2hrs	31.63
HUN-2407-034	SE59T	17/07/24	10:30:00 PM	11:42:00 PM	1hr 12min	30.52
	SE59T	18/07/24	12:42:00 AM	4:54:00 AM	4hrs 12min	48.10
HUN-2407-035	SE59T	22/07/24 – 23/07/24	11:42:00 PM	4:54:00 AM	5hrs 12min	130.30
HUN-2407-036	SE59T	28/07/24	6:30:00 PM	8:54:00 PM	2hrs 24min	66.34
HUN-2407-037	SE61T	09/07/24	7:24:00 PM	11:12:00 PM	3hrs 48min	56.14
HUN-2407-038	SE61T	17/07/24 – 18/07/24	11:06:00 PM	8:18:00 AM	8hrs 18min	51.45
HUN-2407-039	SE61T	23/07/24	12:00:00 AM	19:12:00 PM	19hrs 12min	2959.32
HUN-2407-040	SE61T	28/07/24 – 29/07/24	4:18:00 PM	2:30:00 AM	9hrs 6min	102.07

2.4. Investigation Outcomes

SciDev provided the following in regards to the identified 'true' events.

Table 4: Investigation Outcomes

Event ID	Event Classification	Alcoa Investigation
HUN-2407-001	Non-Mining Related	*Sensor is submerged in water however stream is stagnant.*
HUN-2407-002	Non-Mining Related	*Sensor is submerged in water however stream is stagnant.*
HUN-2407-003	Non-Mining Related	*Sensor is submerged in water however stream is stagnant.*
HUN-2407-004	Non-Mining Related	*Sensor is submerged in water however stream is stagnant.*
HUN-2407-005	Non-Mining Related	*Data trend shows gradual incline and decline coinciding with rainfall. Site was inspected by operational personnel on the 18/07/2024 and stream was clear and flowing. No evidence of mining event or sediments at the time of the inspection. Catchment area inspected, with no evidence of mining contribution found. Access track that runs along stream had lots of water pooled on it with evidence of run off into bush.*
HUN-2407-006	Non-Mining Related	*Data trend shows gradual incline and decline coinciding with rainfall. Site was inspected by operational personnel on the 18/07/2024 and stream was clear and flowing. No evidence of mining event or sediments at the time of the inspection. Catchment area inspected, with no evidence of mining contribution found. Access track that runs along stream had lots of water pooled on it with evidence of run off into bush.*
HUN-2407-007	Non-Mining Related	*Site inspected. Catchment inspection completed. No evidence of mining contribution found.*
HUN-2407-008	Non-Mining Related	*Data trend shows gradual incline and decline coinciding with rainfall. Site inspected on 10/06/2024, turbidity on arrival 13.65 NTU which reduced to 9.58 NTU after lens cleaning. Stream slightly turbid in appearance which is generally noted at this site. Catchment inspection has been completed; no evidence of mining related contribution found.*
HUN-2407-009	Non-Mining Related	*Staff inspected monitor and cleaned sensor. Stream is flowing with rainfall intensity and debris removed from sensor. No evidence of mining related activity found on this visit.*
HUN-2407-010	Non-Mining Related	*Data trend indicates true turbidity event coinciding with rainfall. Water level in stream is very high and submerged the access platform. SE03T had a high NTU reading on arrival and remain unchanged on departure. stream looks turbid with vegetation surrounding sensor. Rainwater upwelling from the ground through forest tract and into the forest at Blacklock 8. Catchment investigation shows no mining related activity impacting stream or surrounding areas,*
HUN-2407-011	Non-Mining Related	*Inspection of the monitor catchment identified erosion of a forest track approximately 1.8km upstream of SE03 which may have contributed to the turbidity event.*
HUN-2407-012	Non-Mining Related	*Site inspected on 10/07/2024, turbidity reading 6.52 which dropped to 4.7 after cleaning. No evidence of new mining related sediment deposition in the stream bed. Catchment inspection completed. No issues found.*

HUN-2407-013	Non-Mining Related	*Site was inspected on the 18/07/2024. Stream turbidity appearance at the time of inspection was noted as dark with suspended organic matter/sediment similarly noted after previous turbidity events at this site this year. Surrounding forest was impacted by fires in November 2023 and the forest floor is bare, with visible erosion scours and sediment build up in the stream bed and on the stream bank. Suspended particles are readily dispersed through the water when disturbed. Catchment inspection completed. No evidence of mining related contribution found.*
HUN-2407-014	Non-Mining Related	*Data trend shows gradual incline and decline coinciding with rainfall - likely a true event. Site was inspected on the 23/07/2024. Stream turbidity appearance at the time of inspection was noted as dark with suspended organic matter/sediment similarly noted after previous turbidity events at this site this year. Surrounding forest was impacted by fires in November 2023 and the forest floor is bare, with visible erosion scours and sediment build up in the stream bed and on the stream bank. Suspended particles are readily dispersed through the water when disturbed. Catchment inspection completed. No evidence of mining related contribution found.*
HUN-2407-015	Non-Mining Related	*Catchment inspection completed. No evidence of mining contribution found.*
HUN-2407-016	Non-Mining Related	*Catchment inspection completed. No evidence of mining contribution found.*
HUN-2407-017	Non-Mining Related	*Site inspected on 24/07/2024, sensor impacted by heavy build-up of leaf litter/debris. Catchment area inspected, no evidence of mining contribution found, however substantial forest track run off noted which has contacted the stream and sediment deposition on the forest floor.*
HUN-2407-018	Non-Mining Related	*Site was inspected on 18/07/2024, water was pooled around the sensor, but stream was not flowing, and sensor was above water. Site inspected again after a further approximately 78mm of rainfall recorded, stream flowing, and heavy build-up of leaf litter/debris caught around sensor, float and on the stream beds. Catchment area inspected; no evidence of mining contribution found. Heavy forest track run off is flowing from Thorpe Road into the forest and contacting the stream.*
HUN-2407-019	Non-Mining Related	*Site inspected on 16/07/2024, stream dry. Site inspected again on 24/07/2024 after a further approximately 120mm of rainfall recorded, stream flowing, and leaf litter/debris caught around sensor.* *Data indicates potentially false event, turbidity values spiked from 3.2NTU to 1279.92 NTU within 6 minutes followed by a gradual decline, and then again spiking into the next event at 5:06AM. As increase in turbidity values coincided with rainfall, event has been investigated to rule out mining contribution. No issues were observed during catchment inspection.*
HUN-2407-020	Non-Mining Related	*Site inspected on 16/07/2024, stream dry. Site inspected again on 24/07/2024 after a further approximately 120mm of rainfall recorded, stream flowing, and leaf litter/debris caught around sensor.* *Data indicated potentially false event resulting from first stream flow and flush through of debris. As increase in turbidity values coincided with rainfall, event has been investigated to rule out mining contribution. No issues were observed during catchment inspection.*
HUN-2407-021	Verified Drainage Incident	*Investigation identified that erosion of the northern Wittwer haul road embankment likely contributed to the turbidity events recorded at SE12. Deployment of a temporary upstream turbidity monitor has also identified*

		a forest track upstream of Wittwer Haul Road as a significant contributor to stream turbidity levels recorded at SE12.
HUN-2407-022	Verified Drainage Incident	*Investigation identified that erosion of the northern Wittwer haul road embankment likely contributed to the turbidity events recorded at SE12. Deployment of a temporary upstream turbidity monitor has also identified a forest track upstream of Wittwer Haul Road as a significant contributor to stream turbidity levels recorded at SE12.*
HUN-2407-023	Verified Drainage Incident	*Investigation identified that erosion of the northern Wittwer haul road embankment likely contributed to the turbidity events recorded at SE12. Deployment of a temporary upstream turbidity monitor has also identified a forest track upstream of Wittwer Haul Road as a significant contributor to stream turbidity levels recorded at SE12.*
HUN-2407-024	Non-Mining Related	*First stream flow at this site. Site last inspected on 24/07/2024, stream was dry. Site inspected again on 29/07/2024, stream flowing and water level very deep. Event likely caused by initial flow causing stream bed flush, however catchment area was inspected to rule out mining causation. No issues found.*
HUN-2407-025	Non-Mining Related	*Data trend indicated true event, showing turbidity to coincide with rainfall occurring during the event. Water level in stream quite high, almost going over access platform. Vegetation growing on the stream bank is flowing with the current around the sensor and is potentially contributing to some of the turbidity spikes. Forest track into SE51T has had round humps installed by DBCA several years ago to slow water flowing down track - water flows directly into stream in multiple places. No mining impact observed - no sumps overflowing or drainage events from surrounding operational areas.*
HUN-2407-026	Non-Mining Related	*Data trend indicated true event, showing turbidity to coincide with rainfall occurring during the event. Water level in stream quite high, almost going over access platform. Vegetation growing on the stream bank is flowing with the current around the sensor and is potentially contributing to some of the turbidity spikes. Forest track into SE51T has had round humps installed by DBCA several years ago to slow water flowing down track - water flows directly into stream in multiple places. No mining impact observed - no sumps overflowing or drainage events from surrounding operational areas.*
HUN-2407-027	Non-Mining Related	*Site inspected on 13/07/2024, stream clear and turbidity reading <1NTU. Sensor found positioned cross-stream, this may have had a minor contribution to increased turbidity values. Ground water flowing down forest track and into the forest upstream of the monitor. Catchment area inspected; no evidence of mining contribution found.*
HUN-2407-028	Non-Mining Related	*Inspected and cleaned sensor, downloaded data. Stream is flowing and debris removed around sensor. No evidence of mining related activity found on this visit.*
HUN-2407-029	Non-Mining Related	*Site was inspected on 23/07/2024 due to heavy rainfall event. Stream was noted to have a dark colour indicating a turbidity true event. Sediments and organic matter were noted upon arrival on this visit. Debris dispersed through water and clogging around sensor. Turbidity spikes noted on Pi vision evident of heavy wash down. Water level in stream is high and water upwelling across the forest tract and into the forest. All sumps inspected did not overflow and no drainage risk found during this investigation. Catchment investigation shows no mining related activity was impacting stream.*
HUN-2407-030	Non-Mining Related	*Catchment inspection completed. No evidence of mining contribution found.*

HUN-2407-031	Non-Mining Related	*Site inspected on 23/07/2024, stream slightly turbid, dark in appearance resembling organic matter. Sensor lens was clean, turbidity reading 10.8NTU. Catchment area inspected. No evidence of mining contribution found. Water is upwelling alongside a forest track, running along the forest track and into the stream channel between Ksiler 11 / Rance 7. The stream runs parallel to (and intercepts) the forest track in this area.*
HUN-2407-032	Non-Mining Related	*Data trend shows turbidity values increase from 9.9NTU to 28.39 within 12 minutes within only 0.2mm of rainfall since 7:00AM. Turbidity values then decrease as rainfall increases, suggesting potentially debris caught up around sensor being flushed through, indicating false event. A further 7.2mm of rainfall was recorded in the following 24hrs during which time turbidity values remained below 5.2NTU.*
HUN-2407-033	Non-Mining Related	*Site inspected on 11/07/2024, turbidity value on arrival 8.8 which dropped to 3.2 after cleaning. Catchment inspection completed. No evidence of mining related contribution found.*
HUN-2407-034	Non-Mining Related	*Inspected and cleaned sensor, downloaded data. Stream is flowing and debris removed around sensor. spikes noticed on pie during heavy rainfall intensity but seems to drop to normal NTU levels. No evidence of mining related activity found on this visit.*
HUN-2407-035	Non-Mining Related	*Site inspected on 24/07/2024. Stream clear and no evidence of mining related sediment deposition in the stream bed. Catchment inspection completed. No evidence of mining related contribution found.*
HUN-2407-036	Non-Mining Related	*Site inspected on 30/07/2024. Stream clear and no evidence of mining related sediment deposition in the stream bed. Catchment inspection completed. No evidence of mining related contribution found.*
HUN-2407-037	Non-Mining Related	*Site inspected on 11/07/2024, stream clear, turbidity reading on arrival 4.26 which reduced to 1.2 after cleaning. Sensor had been relocated further downstream in a less turbulent area however this resulted in the sensor sitting closer to the stream bed. Catchment area has been inspected. No evidence of mining contribution found.*
HUN-2407-038	Non-Mining Related	*Catchment inspection completed. No evidence of mining contribution found.*
HUN-2407-039	Non-Mining Related	*Site inspected on 23/07/2024. Stream turbid and fast flowing. Turbidity value 46.43 which dropped to 40.58 after cleaning. Sensor is positioned below a precipice in the turbulent flow. Algal growth has been a consistent issue at this site, and water testing has shown high levels of Biochemical Oxygen Demand. Suspended particles are visibly mobilised with the turbulent stream flow. Catchment area has been inspected. No evidence of mining contribution found. Areas of forest track run off are contacting the stream.*
HUN-2407-040	Non-Mining Related	*Site inspected on 29/07/2024. Stream turbid and fast flowing. Turbidity value 10.1NTU which dropped to 9.79 after cleaning. Sensor is positioned below a precipice in the turbulent flow. Algal growth has been a consistent issue at this site, and water testing has shown high levels of Biochemical Oxygen Demand. Suspended particles are visibly mobilised with the turbulent stream flow. Catchment area has been inspected. No evidence of mining contribution found. Areas of forest track run off are contacting the stream.*

No further investigation is required at this time of the events flagged within.

3. Recommendations

3.1. WQMS Network

RARE recommends:

- WQMSs include a flow switch or similar mechanism to detect when the stream is dry if they haven't been fitted with one.
- Perform routine maintenance on all units to ensure their correct operation.
- Continue monitoring Biochemical Oxygen Demand levels at SE61T.

4. Raw WQMS Data

Date	Huntly WQMS Data - July 2024 - Events with turbidity > 25 NTU for an hour or more																
	DB01T	DB02T	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T	SE09T
1/07/2024			**4**														
2/07/2024			**2**								**1**						
3/07/2024			**2**								**3**						
4/07/2024																	
5/07/2024			**3**														
6/07/2024																	
7/07/2024																	
8/07/2024																	
9/07/2024												**1**	**1**				
10/07/2024																	
11/07/2024																	
12/07/2024																	
13/07/2024			**1**														
14/07/2024																	
15/07/2024			**2**													**2**	
16/07/2024			**1**													**2**	
17/07/2024													**1**			**2**	
18/07/2024									**2**			**1**	**1**				
19/07/2024																	
20/07/2024																	
21/07/2024																	
22/07/2024			**1**														
23/07/2024									**1**			**1**	**1**		**1**		
24/07/2024																	
25/07/2024																	
26/07/2024																	
27/07/2024																	
28/07/2024									**1**			**1**	**2**				
29/07/2024																	
30/07/2024																	
31/07/2024																	

Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text.

Date	Huntly WQMS Data - July 2024 - Events with turbidity > 25 NTU for an hour or more															
	SE10T	SE11T	SE12T	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T	FPWR1
1/07/2024						**2**						**1**		**2**		
2/07/2024																
3/07/2024						**2**								**2**		
4/07/2024						**1**										
5/07/2024						**1**										
6/07/2024		**1**														
7/07/2024		**2**														
8/07/2024																
9/07/2024									**1**		**2**		**1**			
10/07/2024																
11/07/2024																
12/07/2024													**1**			
13/07/2024								**5**								
14/07/2024								**2**					**2**			
15/07/2024																
16/07/2024																
17/07/2024											**1**					
18/07/2024								**1**	**1**		**1**		**1**			
19/07/2024																
20/07/2024																
21/07/2024																
22/07/2024																
23/07/2024		**1**	**2**					**1**	**1**	**1**	**1**		**1**			
24/07/2024										**1**						
25/07/2024																
26/07/2024			**1**							**2**						
27/07/2024																**2**
28/07/2024			**2**	**1**					**1**		**1**		**1**			
29/07/2024												**1**				
30/07/2024																
31/07/2024			**1**													

Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text.

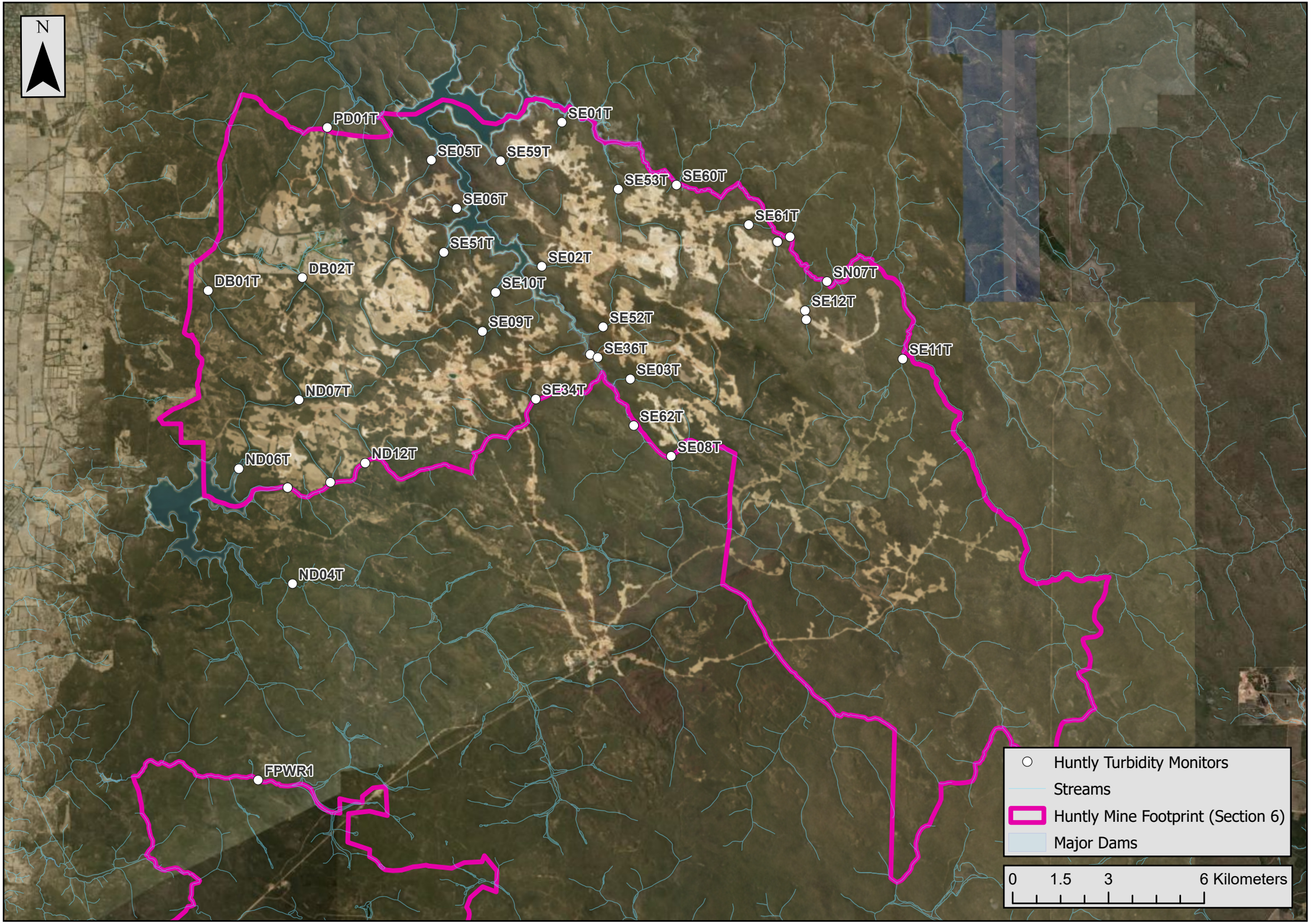
Date	Huntly WQMS Data - July 2024 - Turbidity (Daily Average, NTU)																
	DB01T	DB02T	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T	SE09T
1/07/2024	1.0	1.5	**331.4**	1.3	0.5	1.7	1.4	0.9	1.9	0.1	24.7	3.6	3.1	0.7	1.4	1.2	1.1
2/07/2024	1.0	1.6	**43.8**	1.8	0.5	1.7	1.4	1.6	2.6	0.3	**101.4**	3.9	4.8	1.1	1.0	1.1	1.1
3/07/2024	1.0	1.5	**184.8**	1.3	0.5	1.7	1.4	0.9		0.2	**25.3**	2.3	3.4	1.2	1.2	1.2	1.1
4/07/2024	0.9	1.5	**136.5**	1.3	0.5	1.7	1.4	0.9	1.8	0.2	23.2	3.3	4.0	1.1	2.0	1.2	1.1
5/07/2024	1.0	1.6	**150.4**	1.3	3.5	1.7	1.4	0.9	1.8	0.2	7.2	2.5	4.6	1.6	2.2	1.2	1.1
6/07/2024	1.0	1.5	**129.9**	1.4		2.4	1.8	1.0	2.2	0.2	4.0	3.1	4.7	3.1	0.6	1.2	1.4
7/07/2024	0.9	1.5	11.0	2.1		1.8	1.4	1.6	3.6	1.7	4.6	7.2	8.3	5.7	0.9	1.2	1.1
8/07/2024	0.9	1.5	5.6	1.9		1.7	1.4	1.1	2.6	0.2	3.8	4.8	5.0	1.0	1.0	1.1	1.0
9/07/2024	0.9	1.9	4.3	3.1		1.8	1.4	2.9	5.0	0.4	4.0	10.9	12.9	2.0	2.1	1.1	1.0
10/07/2024	0.9	1.7	3.1	3.6		1.8	1.4	2.5	3.8	0.3	5.7	17.7	6.1	1.0	0.5	1.1	1.1
11/07/2024	0.9	1.5	2.0	2.2	0.6	10.1	1.4	1.1	1.8	0.3	3.9	4.0	3.7	1.0		1.2	1.1
12/07/2024	0.9	1.5	2.3		0.5	1.7	1.4	0.9	2.3	0.5	3.9	2.8	3.3	1.1		1.1	1.1
13/07/2024	0.9	1.5	21.5		0.5	2.4	1.4	0.9	2.3	0.4	6.0	2.5	3.6	1.4		1.1	1.1
14/07/2024	0.9	1.5	**91.3**		0.6	1.8	1.5	0.9	2.4	0.4	3.9	2.4	3.9	1.5		1.1	1.1
15/07/2024	0.9	1.5	**144.7**		0.6	2.0	1.5	0.9	2.5	0.6	4.1	2.1	4.1	2.9		**43.5**	1.2
16/07/2024	0.9	1.5	**57.8**		0.7	1.8	1.5	0.8	2.7	0.6	3.9	3.8	4.3	2.4	0.3	**285.4**	1.1
17/07/2024	0.9	1.5	**27.1**			1.8	1.5	1.1	5.2	0.7	4.1	3.3	10.0	3.2	0.4	**125.9**	1.1
18/07/2024	1.0	2.6	7.2		**53.8**	2.2	1.7	6.5	13.2	0.6	4.5	**34.7**	12.1	1.6	0.8	1.2	1.3
19/07/2024	1.0	1.5	3.3		0.7	2.0	1.5	2.2	5.5	0.6	4.2	10.8	6.3	1.3	1.3	1.1	1.1
20/07/2024	0.9	1.5	1.6		0.6	1.9	1.5	1.4	6.2	0.8	4.1	6.2	5.1	1.3	0.3	19.5	1.2
21/07/2024	0.9	1.5	1.8		0.7	2.0	1.5	1.9	7.6	0.9	4.1	10.3	6.6		1.2	1.1	1.1
22/07/2024	0.9	1.5	2.5		0.7	2.1	1.5	1.8	5.3	0.9	4.1	8.5	7.2		0.6	1.0	1.1
23/07/2024	1.1	1.6	7.6		1.5	2.6	1.9	5.4	17.7	1.0	5.5	**39.2**	16.6		5.6	1.4	5.8
24/07/2024	1.0	1.6	1.3		0.9	2.0	1.9	1.4	5.0	0.6	4.6	9.5	6.6		2.0	1.1	1.1
25/07/2024	0.9	1.6	3.5	1.7	0.6	1.9	1.8	1.2	4.9	0.4	4.3	8.3	7.8		1.2	2.7	1.0
26/07/2024	0.9	2.3	6.2	1.7	0.6	1.9	1.6	1.3	5.9	1.5	4.6	10.8	7.2		1.8	1.2	1.1
27/07/2024	0.9	1.8	1.6	1.4	0.6	1.8	1.6	1.0	5.2	1.6	4.4	6.4	7.0		1.5	1.1	1.1
28/07/2024	0.9	1.6	3.7	1.5	0.7	1.9	1.7	1.7	8.5	11.3	4.7	13.0	17.2		6.1	1.2	1.1
29/07/2024	0.9	1.6	2.4	1.5	0.8		1.6	1.3	5.3	0.5	5.1	10.6	7.3		1.3	1.1	1.2
30/07/2024	0.9	2.7	1.6	1.3	0.6		1.6	1.0	3.7	0.3	4.7	7.8	5.3		2.7	1.1	1.3
31/07/2024	0.9	1.6	1.4	1.3	0.6		1.6	1.3	4.4	1.3	4.6	10.6	5.9		1.6	3.5	1.0

Note: Daily averages above 25 NTU have been annotated by **black** bold text. Daily averages inclusive of with true events for further investigation are annotated by **red** bold text. Grey shading indicates no data available for that day at that unit.

Date	Huntly WQMS Data - July 2024 - Turbidity (Daily Average, NTU)															
	SE10T	SE11T	SE12T	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T	FPWR1
1/07/2024	1.4	4.2	1.4	7.2	6.6	**25.9**	2.0	**35.7**	0.2	0.8	3.5	**214.8**	2.1	**77.9**	5.9	
2/07/2024	9.4	3.6	1.3	6.3	6.5	0.5	2.1	**90.4**	0.2	0.8	5.4	**170.6**	2.7	7.1	5.4	
3/07/2024	1.3	4.0	1.5	7.5	6.7	15.7	7.9	**59.3**	0.2	0.7	4.5	**216.8**	1.9	**122.6**	5.8	
4/07/2024	21.5	4.1	1.6	7.4	6.6	14.3	1.8	**62.6**	0.2	1.3	4.8	**182.8**	2.9	13.1	5.7	
5/07/2024	1.3	4.2	1.8	7.3	6.6	5.9	1.8	**167.0**	0.2	0.8	5.3	**187.8**	3.6	5.7	5.6	
6/07/2024	1.4	**36.5**	1.8	7.1	6.7	0.8	1.9	**202.0**	0.3	0.8	5.8	**188.8**	4.0	5.5	6.0	
7/07/2024	1.4	**43.6**	2.3	6.4	6.5	0.9	3.3	**281.1**	0.7	0.5	6.7	**165.0**	6.7	4.2	4.9	
8/07/2024	1.3	3.4	1.3	6.9	6.5	0.9	2.2	**139.5**	0.4	0.9	3.8	**178.0**	3.4	6.0	5.3	
9/07/2024	1.4	5.8	5.9	6.9	6.4	0.8	2.5	**134.1**	4.4	1.4	11.7	**172.6**	11.2	2.4	4.7	
10/07/2024	1.6	2.3	1.3	6.7	6.4	1.5	3.4	**252.5**	5.8	1.9	10.5	**165.3**	8.8	4.2	4.9	
11/07/2024	1.4	3.4	1.4	5.9	6.7	0.9	2.3	**298.3**	0.7	0.2	6.9	**133.7**	4.1	5.1	5.5	
12/07/2024	1.3	3.6	1.5	7.2	7.2	0.9	2.7	**152.4**	0.5	0.7	4.2	**109.3**	12.1	5.4	5.3	
13/07/2024	2.0	3.8	1.7	7.0	6.9	0.8	2.4	**175.1**	0.5	0.5	4.2	**112.4**	16.5	15.8	5.7	
14/07/2024	1.3	3.6	1.6	6.4	6.9	0.8	2.5	**68.9**	0.5	0.6	4.4	**106.4**	**25.0**	5.4	5.8	
15/07/2024	1.6	3.7	1.6	6.9	6.6	1.8	2.7	**45.0**	0.5	0.6	4.7	**106.0**	8.8	5.1	5.8	
16/07/2024	1.3	3.8	1.7	7.1	6.5	2.0	2.8	**57.3**	0.5	0.7	5.3	**114.5**	10.3	6.3	5.9	
17/07/2024	11.2	**30.6**	1.8	9.2	6.4	0.9	4.3	**45.5**	1.1	1.0	8.7	**114.9**	12.8	4.9	5.5	
18/07/2024	2.2	16.4	3.7	6.3	6.4	3.0	6.2	**33.8**	14.5	10.1	15.9	**101.5**	**26.7**	9.7	3.6	
19/07/2024	1.7	0.8	1.5	5.5	6.0	1.8	3.0	**39.3**	5.8	1.3	6.4	**102.2**	11.4	4.2	3.0	
20/07/2024	1.4	0.3	1.5	6.6	1.6	3.2	2.2	**48.7**	2.2	0.1	5.3	**100.9**	10.2	4.5	2.9	
21/07/2024	1.6	0.4	5.0	5.5	1.3	7.2	2.4	**27.5**	4.3	0.3	5.7	**98.2**	12.3	3.1	2.4	
22/07/2024	1.4	0.3	6.4	7.1	1.2	1.4	2.4	**32.5**	4.0	0.2	6.6	**98.5**	12.6	4.1	2.2	
23/07/2024	2.6	12.9	**49.9**	7.1	1.9	8.1	11.9	**52.4**	21.7	16.7	19.6	**54.6**	**339.3**	5.9	3.3	
24/07/2024	1.8	0.5	6.7	7.3	1.2	3.7	7.3	**36.8**	6.7	7.4	6.1	**28.2**	15.8	4.9	2.9	
25/07/2024	1.4	0.4	4.4	5.7	1.2	2.5	5.2	2.9	5.8	3.0	4.6	**53.0**	11.8	3.4	2.8	
26/07/2024	1.4	0.4	17.3	5.6	1.2	2.0	4.3	3.3	6.8	23.6	5.1	**28.1**	7.3	2.3	4.2	7.2
27/07/2024	1.3	0.3	2.0	7.2	1.2	1.8	7.0	**33.5**	5.3	0.1	4.4	**28.1**	2.6	2.0	2.2	15.3
28/07/2024	1.4	0.5	**30.4**	12.6	1.3	1.8	3.6	**77.4**	11.5	4.6	13.6	**28.4**	19.4	1.9	2.5	
29/07/2024	1.5	1.5	3.3	4.5	1.2	2.1	4.0	**68.8**	8.0	3.6	7.9	**27.5**	12.5	1.9	4.9	5.3
30/07/2024	20.0	3.2	1.9	3.2	1.1	1.7	3.4	**118.8**	5.9	0.5	4.7	**28.3**	4.4	1.9	2.9	6.4
31/07/2024	1.3	7.0	6.0	2.4	1.3	1.8	3.2	9.3	6.4	0.4	3.5	**27.2**	4.0	1.7	2.6	7.1

Note: Daily averages above 25 NTU have been annotated by **black** bold text. Daily averages inclusive of with true events for further investigation are annotated by **red** bold text. Grey shading indicates no data available for that day at that unit.

Appendix A. Huntly WQMS Locations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SE01T
SE05T
SE59T
SE53T
SE60T
SE06T
SE61T
SE51T
SE02T
DB02T
DB01T
SE10T
SN07T
SE12T
SE09T
SE52T
SE36T
SE11T
SE03T
ND07T
SE34T
SE62T
SE08T
ND12T
ND06T
ND04T
FPWR1
Huntly Turbidity Monitors
Streams
Huntly Mine Footprint (Section 6)
Major Dams
0
1.5
3
6 Kilometers

Appendix B. WQMS General Arrangement

ANTENNA

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DATA TRANSMISSION TO IOT

DATA OUTLET

POWER INLET

40 X 60 MM CABLE DUCT

20 AMP MPPT
SOLAR CHARGER

40 X 60 MM CABLE DUCT

SIERRA WIRELESS FX30

40 X 60 MM CABLE DUCT

12 V, 120 AH LI-ION BATTERY

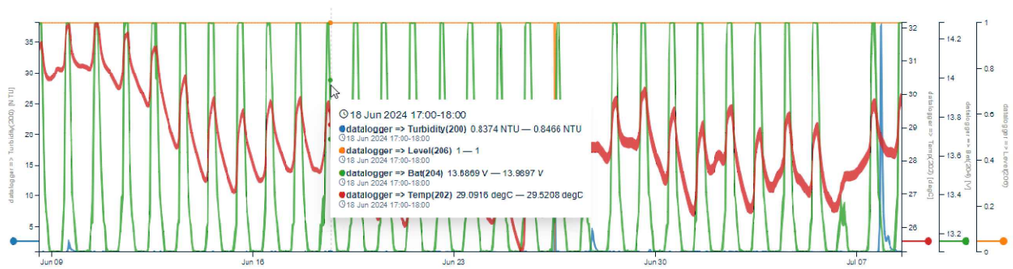
DATA INLET

SENSOR

STREAM DRY

SENSOR

STREAM FLOWING



REV.	REMARKS	DATE	DESIGNED	DRAWN	CHECKED	APPROVED	REFERENCE DRAWINGS
0	ISSUE FOR APPROVAL	05.07.2024	A.K.	S.A.	A.K.	A.K.	

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IF IN DOUBT - ASK
TOLERANCES ISO2768-m U.N.O.

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www.scidev.com.au
SCIDEV

TITLE
IOT TURBIDITY MONITORING STATION
SITE LAYOUT
GENERAL ARRANGEMENT

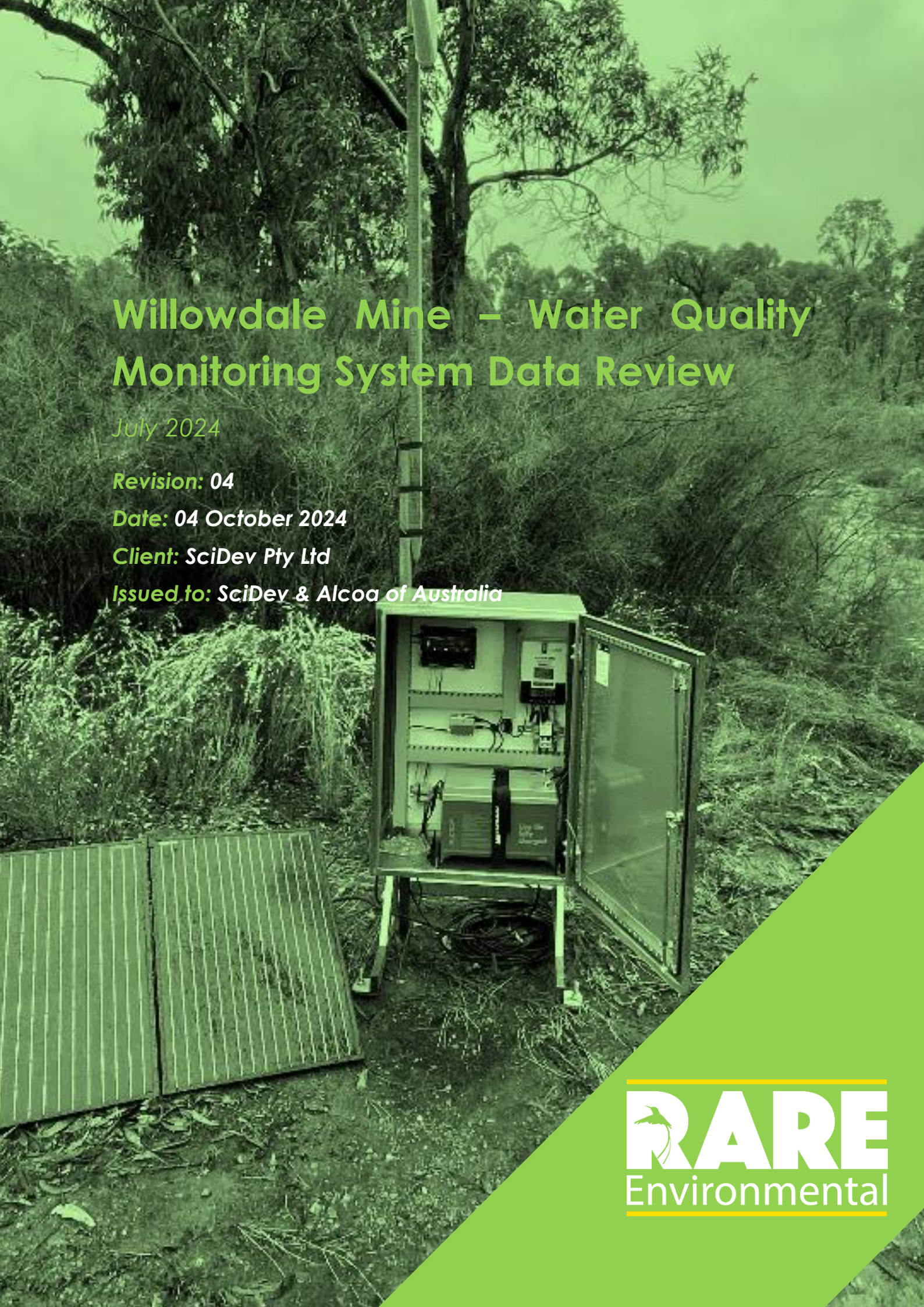
SHEET 1 OF 2

SCALE NTS OR AS SHOWN

DRAWING NO.
HI0090 - ALCOA WQMS

SHEET SIZE
A3

REV.
1



Willowdale Mine – Water Quality Monitoring System Data Review

July 2024

Revision: ***04***

Date: ***04 October 2024***

Client: ***SciDev Pty Ltd***

Issued to: ***SciDev & Alcoa of Australia***

RARE Environmental

Document Control

Project Details	
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Project Name	SciDev WQ Data Processing
Project Number	RP24050
Client	SciDev
Client Reference	PO002447

Document History and Status						
Revision	Date	Description	Prepared	Reviewed	Approved	Issued to
01	04/09/24	For internal review	SM	CR	CR	SciDev
02	23/09/24	Alcoa feedback	SM	RD	RD	SciDev
03	03/10/24	Alcoa feedback	SM	CR	CR	SciDev
04	04/10/24	Alcoa feedback	SM	CR	CR	SciDev

Report Sign Off					
Report Version	02				
Prepared by		Technical Review		Approved for Issue	
Name	Sarah Mathew	Name	Chris Redford	Name	Chris Redford
Position	Env. Scientist	Position	Env. Scientist	Position	Env. Scientist
Date	04/09/2024	Date	04/09/2024	Date	04/09/2024

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Contents

1. Introduction

1.1. Purpose

RARE Environmental Pty Ltd (RARE) was engaged by SciDev Pty Ltd (SciDev) to analyse and comment on raw turbidity monitoring data collected by their Water Quality Monitoring Systems (WQMSs) in Section 6 of the Willowdale Mine, owned and operated by Alcoa of Australia Limited (Alcoa). Stream turbidity monitoring is a core regulatory requirement stipulated as part of Alcoa's approvals and operating framework. The data for this reporting period was collected in July of 2024.

This report has been prepared to assess the quality of data provided and identify potential drainage incidents ('true' events) per the procedure detailed below within that data. Where possible recommendations are made for either WQMS network upgrades or further investigation of events identified within the data. This report should not be considered an assessment of the WQMS network and/or Alcoa's compliance to relevant legislation and requirements, nor should it be considered an assessment of the suitability of the adopted trigger level and event classification procedure.

1.2. Context

Data from each location has been collected and compared against the drainage incident trigger level outlined in the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023* Schedule 1 Division 2 Cl. 6. Trigger events have then been assessed against Alcoa's turbidity event classification guidelines to determine whether the event is true, i.e. caused by stream turbidity, or false, i.e. caused by stream debris, algae or other. For the purpose of this report a turbidity event is an event where turbidity levels, measured by a WQMS, are at least 25 nephelometric turbidity units (NTU) for a period of at least 1 hour.

A site map showing the WQMSs locations is provided in **Appendix A**.

1.3. Monitoring Requirements

Under Schedule 1, Division 2 ("Controls on activities"), of the *Environmental Protection (Darling Range Bauxite Mining Proposals) Exemption Order 2023* a drainage incident is defined as:

a) *a runoff from a disturbance area to the surrounding environment of surface water that has a turbidity of at least 25 nephelometric turbidity units for a period of at least 1 hour; or*
b) *a discharge from containment infrastructure that includes or may include environmentally hazardous material;*

1.4. Water Quality Monitoring System (WQMS)

At the Willowdale site, for this reporting period, 3 (three) active WQMSs have been installed in Section 6, in streams within or downstream of mining operations to monitor stream turbidity levels. Each turbidity monitoring station is fitted with an Aquas SMR10 turbidity probe. The Aquas probes are placed directly in the streams, mounted at 90 degrees to the flow of water. Each sensor has a guard to protect the lens from larger debris and the units are fitted with a lens screen wiper. Note: disruptions or errant readings can occur with smaller pieces of debris (leaves etc.).

Data is collected via a Data Taker DT82 logger. Data from each logger is linked to an IOT data modem to transmit to a cloud-based platform. Data is logged locally in 6 second intervals with a 6-minute average pushed into the cloud-based platform. A float switch or cell indicates sensor immersion or a dry stream.

1.5. Data Review & Event Classification Process

Data produced by the WQMSs is reviewed by RARE per the following procedure and in consultation with SciDev. This allows for the identification of true events that require investigation to determine whether the mining operations may have contributed to the elevated turbidity levels, and false events.

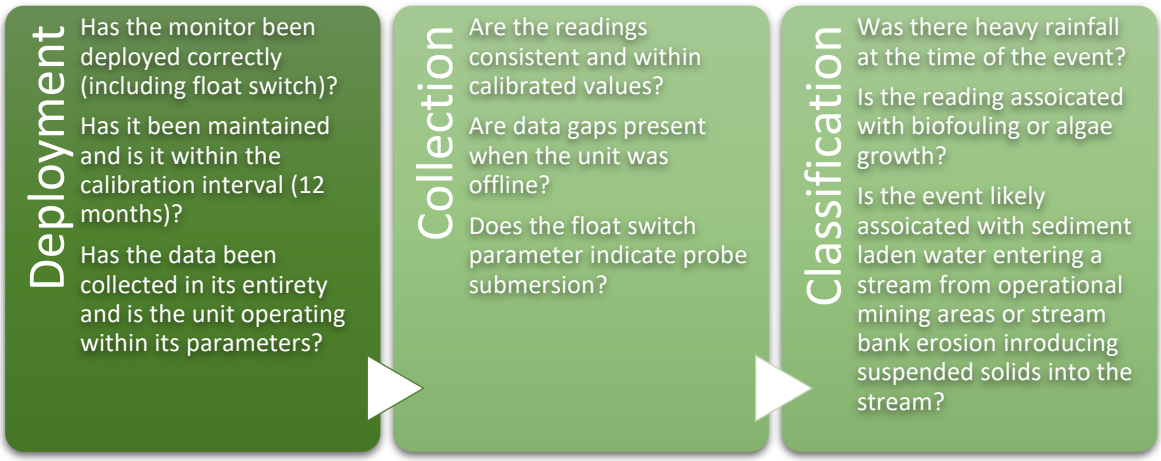

Figure 1: Data Review & Event Classification Process

The process considers the physical aspects of the WQMS deployment, the data collection by that monitor and finally classification of the events identified in that data. Classification of events is per Alcoa's procedure to identify events as true or false.

A 'true' stream turbidity exceedance event that is caused by an actual increase in stream water turbidity. Alcoa has identified that 'true' turbidity exceedance events typically show a sharp turbidity incline before gradually trailing off as the stream turbidity level returns to background.

Figure 2: Typical 'true' exceedance event showing the sharp incline and gradually return to background levels.

'False' stream turbidity exceedance events are caused by factors other than an actual increase in stream water turbidity (i.e. organic debris covering the monitor such as sticks/leaves/algae, stream water turbulence or air bubbles and fluctuating water levels that intermittently cover the monitor lens and then recede). Alcoa has identified that 'false' turbidity exceedance events typically illustrate sharp inclines and declines for turbidity when the data is graphed over time and lack the distinctive 'bell curve' shape that is associated with 'true' turbidity exceedance events.

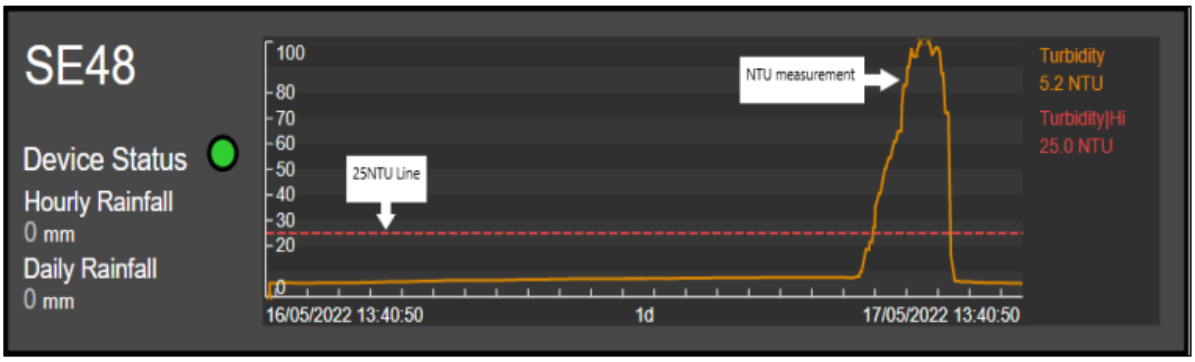

Figure 3: Typical 'false' exceedance event showing both a sharp incline and decline.

Any 'true' events identified in this report have been listed in **Section 3**.

2. WQMS Data Review

For the reporting period of July 2024, 13,593 data points were collected by 3 (three) active WQMSs across Section 6 of the Willowdale site. From this data a total of 7 (seven) events were flagged where turbidity levels above 25 were held for an hour or more. The following sections review this data, beginning with the deployment and operation of the WQMSs.

2.1. Deployment & Collection

A new water quality monitor, identified as RHB2, was installed on July 30th 2024, and therefore had limited data available during the month of July.

RARE have identified WQMSs in **Table 1** that require review in regards erroneous data. SciDev confirmed that the data generated by these units was invalid and therefore excluded from further analysis.

Excluding the data from these units leaves 4 (four) potential turbidity events during the reporting period across 3 (three) units as discussed in the following section.

Table 1. WQMS Requiring Review

Unit	Dates	SCIDEV Comment
PTM01	1st July to 10th July	Stream was dry at the time of the turbidity event, though there was evidence that water had been present and pooled at the monitor location. There was evidence of water flow off the forest track into the stream bed at the monitor location. Turbidity maintenance contractor was contacted to complete a calibration of the probe following incorrect turbidity readings through June and the start of July. Contractor investigated the monitor on 10/07/2024 and conducted maintenance on the probe. Probe readings returned to 2 NTU upon completion of maintenance. Probe was returned to a dry stream. Event classified as a false event.

2.2. Classification

Analysing the data collected outside of the above periods leaves 4 (four) potential turbidity events during the reporting period across 3 (three) units as summarised in **Table 2**.

For this reporting period no 'true' turbidity events identified. Refer to the following section for analysis.

Table 2. Turbidity events summary

Date	Willowdale WQMS Data -July 2024 - Events with turbidity > 25 NTU for an hour or more		
	HV07	PTM01	RHB2
1/07/2024			
2/07/2024			
3/07/2024			
4/07/2024			
5/07/2024			
6/07/2024			
7/07/2024			
8/07/2024			
9/07/2024			
10/07/2024			
11/07/2024			
12/07/2024			
13/07/2024			
14/07/2024			
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16/07/2024			
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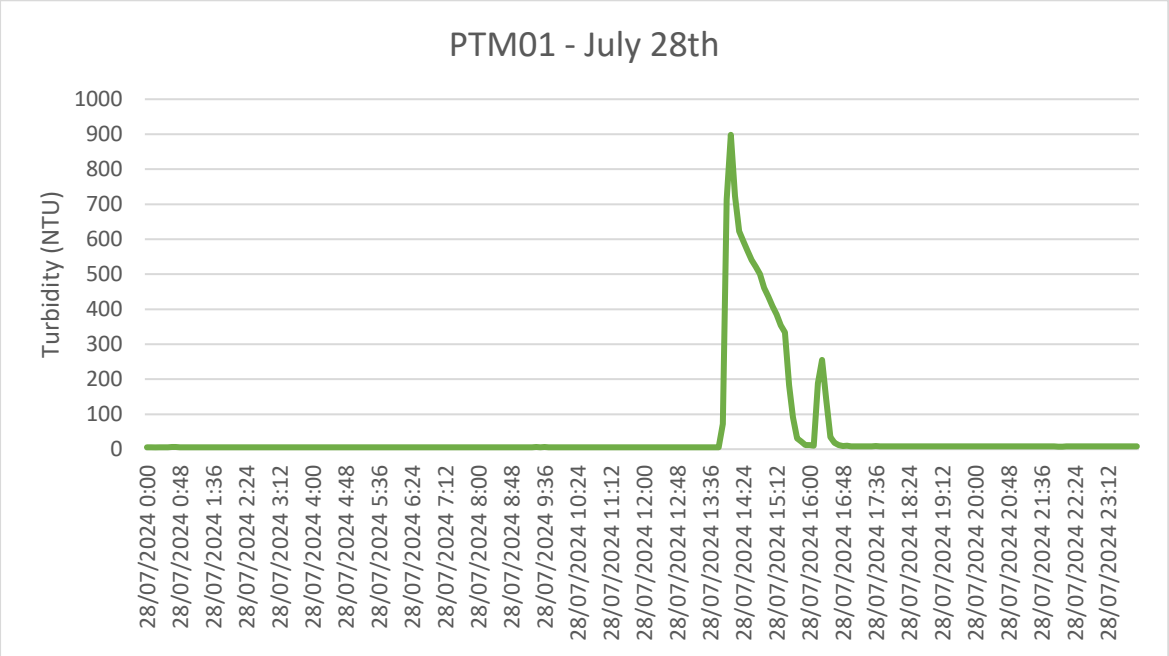
19/07/2024			
20/07/2024			
21/07/2024			
22/07/2024			
23/07/2024			
24/07/2024			
25/07/2024			
26/07/2024			
27/07/2024			
28/07/2024	**1**	**1**	
29/07/2024	**1**		
30/07/2024			
31/07/2024			**1**

Note: Grey cells indicate data has been excluded. False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text. See following section for analysis.

2.2.1. PTM01 Potential Turbidity Events

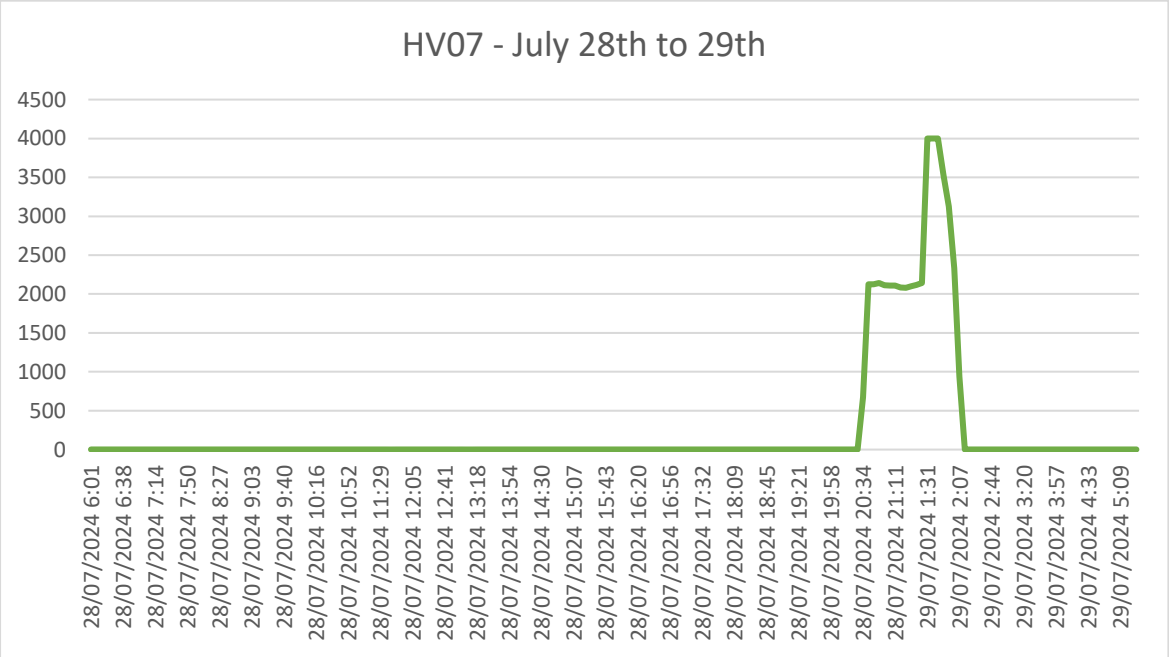
Chart(s) for data flagged at monitor PTM01 are shown below for the potential events identified in the reporting period.



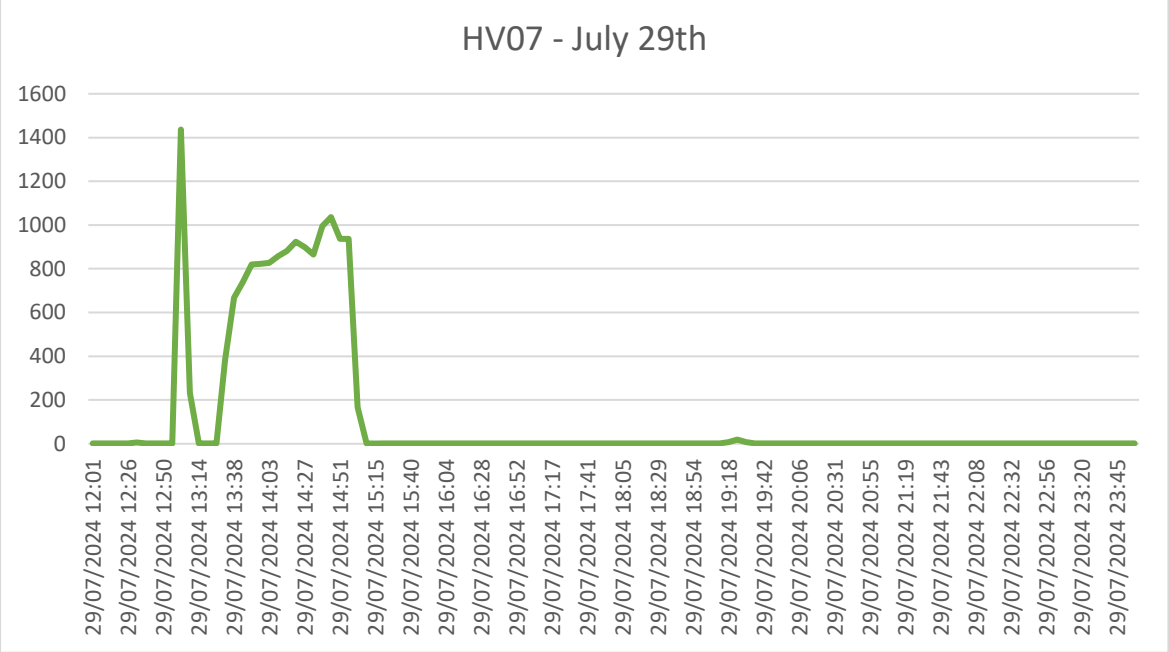
This event is marked by a sharp incline and decline, indicative of a 'false' event.

2.2.2. HV07 Potential Turbidity Events

Chart(s) for data flagged at monitor HV07 are shown below for the potential events identified in the reporting period.



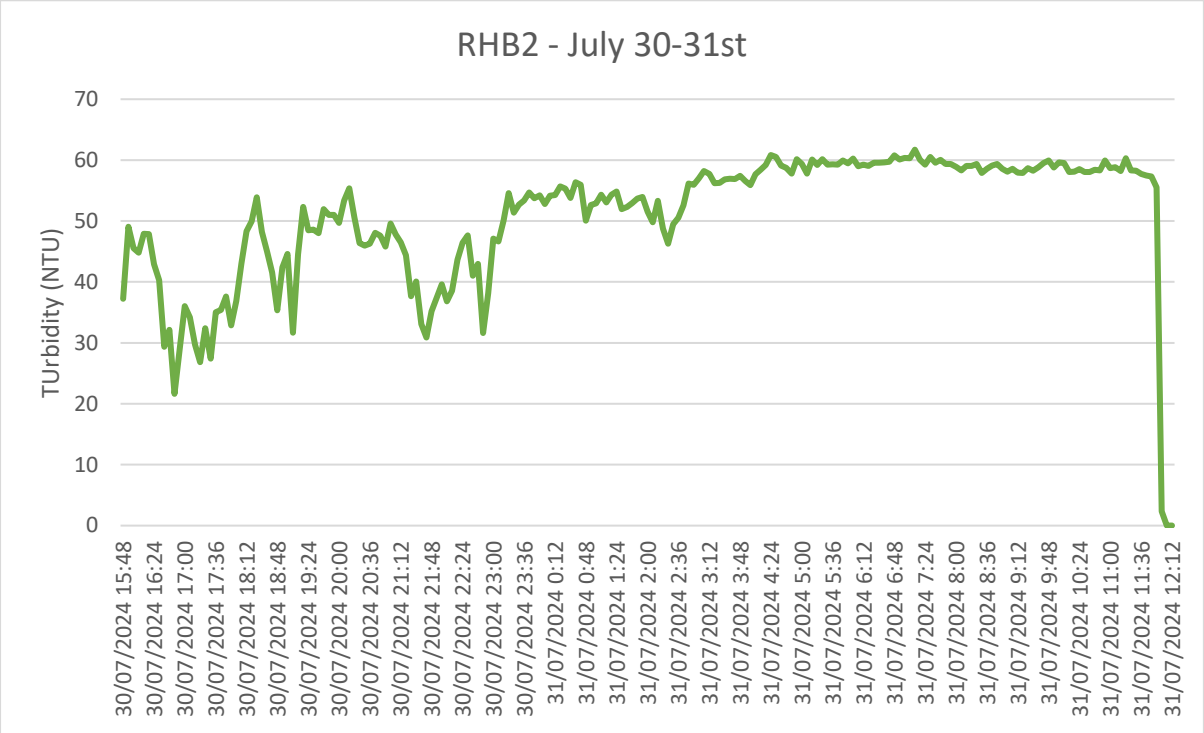
This event is marked by a sharp incline and decline, indicative of a 'false' event.



This event is marked by a sharp incline and decline, indicative of a 'false' event.

2.2.3. RHB2 Potential Turbidity Events

Chart(s) for data flagged at monitor RHB2 are shown below for the potential events identified in the reporting period.



This event is marked by a sharp incline and decline, indicative of a 'false' event.

2.3. True Turbidity Events

For this reporting period, no potential drainage or 'true' incidents were identified for further investigation.

3. Recommendations

3.1. WQMS Network

RARE recommends:

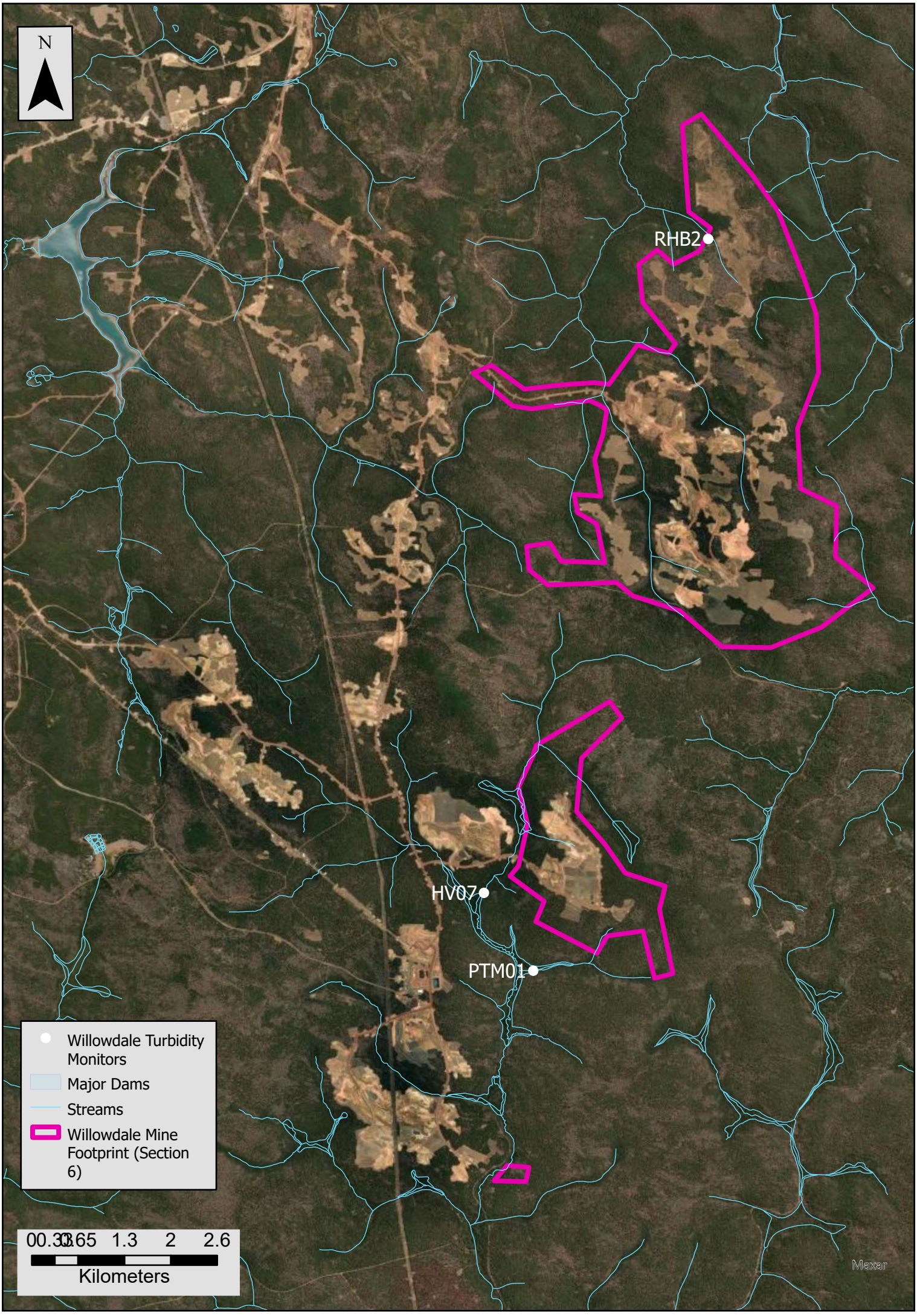
- Perform a maintenance and deployment review of all units to ensure their correct operation.

4. Raw WQMS Data

Date	Willowdale WQMS Data -June 2024 - Turbidity (Daily Average, NTU)		
	HV07	PTM01	RHB2
1/07/2024	0.93	**84.69**	
2/07/2024	1.00	**111.01**	
3/07/2024	0.94	**63.52**	
4/07/2024	0.91	**73.35**	
5/07/2024	0.92	**84.59**	
6/07/2024	0.93	**84.16**	
7/07/2024	1.84	**73.86**	
8/07/2024	0.89	**72.84**	
9/07/2024	7.60	**61.27**	
10/07/2024	1.00	16.49	
11/07/2024	0.90	4.95	
12/07/2024	0.90	5.26	
13/07/2024	0.89	5.42	
14/07/2024	0.90	5.51	
15/07/2024	0.91	5.68	
16/07/2024	0.91	5.50	
17/07/2024	10.29	6.74	
18/07/2024	7.64	14.59	
19/07/2024	0.99		
20/07/2024	0.94		
21/07/2024	0.91		
22/07/2024	1.78		
23/07/2024	1.83	7.95	
24/07/2024	0.96	7.86	
25/07/2024	0.97	6.79	
26/07/2024	0.91	5.99	
27/07/2024	0.91	5.25	
28/07/2024	**68.20**	**43.50**	
29/07/2024	**207.22**	7.26	
30/07/2024	1.00	6.59	**42.33**
31/07/2024	0.99	15.50	**32.74**

Note: Daily averages above 25 NTU have been annotated by black bold text. Daily averages inclusive of with true events for further investigation are annotated by red bold text. Grey shading indicates no data available for that day at that unit.

Appendix A. Willowdale WQMS Locations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RHB2
HV07
PTM01
Willowdale Turbidity Monitors
Major Dams
Streams
Willowdale Mine Footprint (Section 6)
0 0.33 0.65 1.3 2 2.6
Kilometers
Maxar

Appendix B. WQMS General Arrangement

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DATA TRANSMISSION TO IOT

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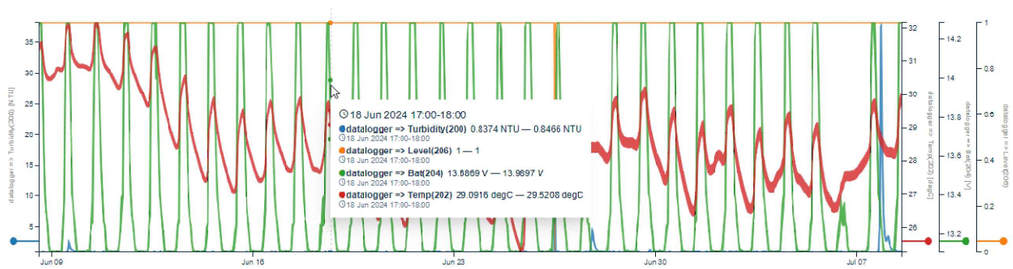

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SHEET SIZE
A3

REV.
1