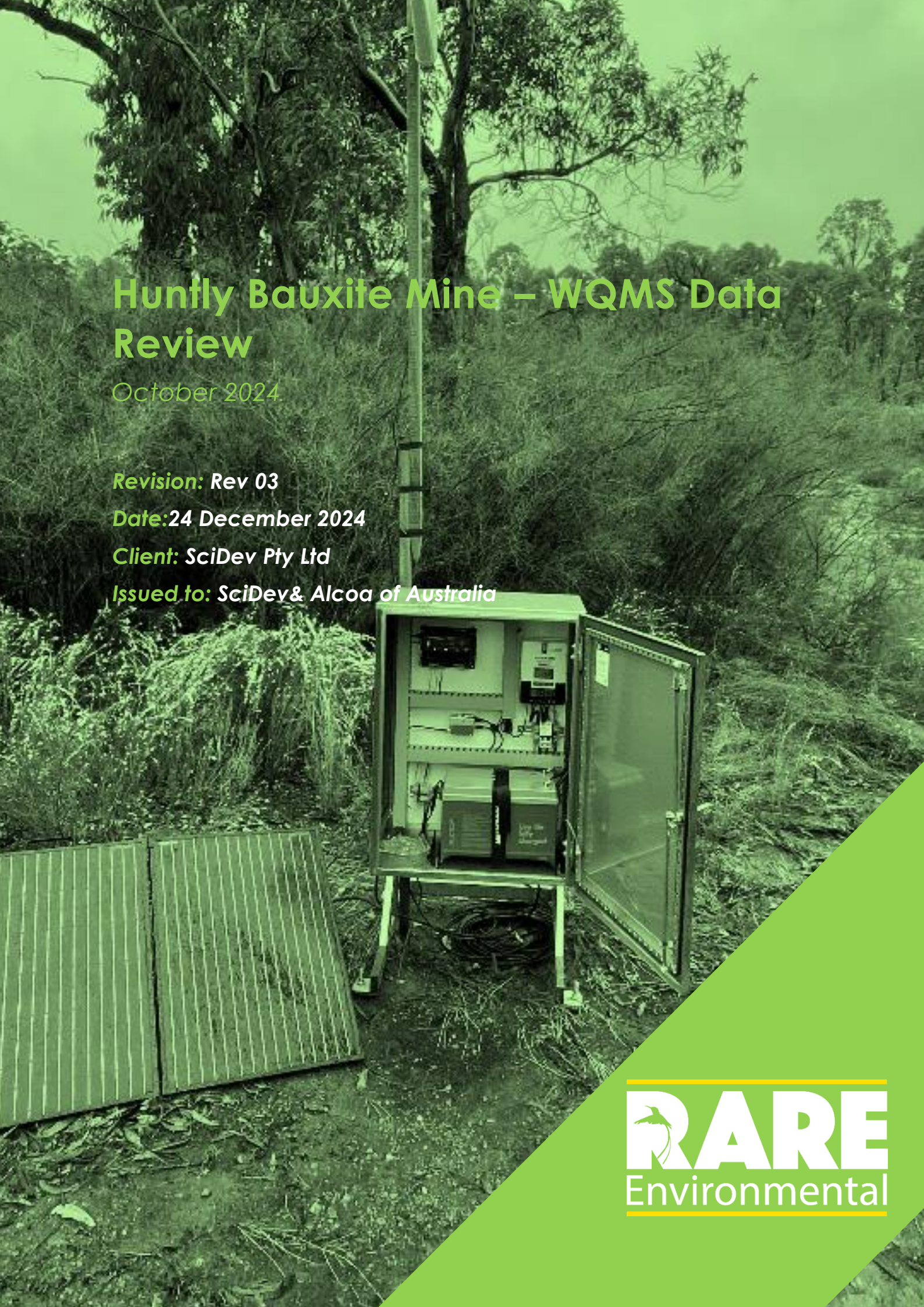

Huntly Bauxite Mine – WQMS Data Review

October 2024

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Date: ***24 December 2024***

Client: ***SciDev Pty Ltd***

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RARE Environmental

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Date	24/12/2024	Date	24/12/2024	Date	24/12/2024

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Contents

1. Executive Summary

This report, prepared by RARE Environmental Pty Ltd and SciDev Pty Ltd for Alcoa, provides an analysis of turbidity data collected from Water Quality Monitoring Systems (WQMSs) deployed at the Huntly bauxite mining operations during October 2024. The primary objective of this analysis was to evaluate the quality of the data, identify potential "true" turbidity exceedance events, and support Alcoa's compliance reporting obligations under Schedule 1, Division 2, Clause 6 of the **Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023**.

The analysis focused on identifying and classifying turbidity events where levels exceeded 25 nephelometric turbidity units (NTU) for at least one hour. Events were categorized as "true" or "false" based on Alcoa's **Turbidity Event Classification Guidelines**, which distinguish actual turbidity increases (true events) from false readings caused by environmental factors such as debris, air bubbles, or fluctuating water levels.

Key findings include:

- **True Events**: Four "true" turbidity exceedance event (Event ID: HUN-2410-001/002/003/004) were identified and further investigated. The event exhibited characteristics consistent with a true event, including a sharp incline and gradual return to baseline turbidity levels. However, it was determined to be unrelated to mining activities.
- **False Events**: Thirty-Three false events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Excluded Units**: Ten WQMS units were excluded from the analysis due to invalid data caused by equipment faults or environmental interference.

The report also highlights periods of missing data, which occurred due to system log-offs, equipment faults, or unplanned shutdowns. These gaps are detailed in the report to ensure transparency in data handling.

2. Scope

RARE Environmental Pty Ltd and SciDev Pty Ltd were engaged by Alcoa to analyze turbidity data collected from the Huntly Water Quality Monitoring Systems (WQMSs). The primary objective of this engagement is to assess the quality of the collected data and identify potential "true" turbidity events. This analysis supports Alcoa's reporting obligations under *Schedule 1, Division 2, Clause 6 of the Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

3. Introduction

3.1. Background

Alcoa of Australia Ltd (Alcoa) operates two bauxite mines, Huntly and Willowdale, approximately 100 km southeast of Perth, Western Australia. These mining operations are subject to environmental controls mandated by the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

Under this Exemption Order, Alcoa is required to implement drainage control measures and monitor effectiveness in water bodies within and downstream of mining operations. Turbidity, a critical water quality parameter, is monitored using Water Quality Monitoring Systems (WQMSs), to detect deviations and identify high-turbidity events.

Alcoa is obligated to report monthly on stream turbidity, including the identification and classification of any “true” high-turbidity exceedance events. (Refer to Appendix B for the site map showing WQMS locations.)

3.2. Monitoring requirements

Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023 specifies that a drainage incident occurs when:

> *a) runoff from a disturbance area enters the surrounding environment, resulting in surface water turbidity of at least 25 NTU for a duration of at least one hour; or*
>
> *b) a discharge from containment infrastructure includes, or may include, environmentally hazardous material.*

Trigger levels for drainage incidents are outlined in *Schedule 1* of the Exemption Order. To meet these requirements, Alcoa has developed "Turbidity Event Classification Guidelines" which define a true turbidity exceedance event as a WQMS recording turbidity levels of at least 25 NTU for a period exceeding one hour.

3.3. Water Quality Management Systems (WQMSs)

During the October 2024 monitoring period, Forty-Two WQMS units were deployed to monitor turbidity levels in streams subject to surface water runoff within and downstream of Huntly mining operations.

Each WQMS unit consists of the following components:

Aquas SMR10 Turbidity Probe

> Positioned at a 90-degree angle to water flow, each probe is equipped with an automatic lens wiper and a guard to protect against larger debris.

Data Taker DT82 Logger

> Records data locally every 6 seconds, with 6-minute averages transmitted via IoT-enabled modems to a cloud-based platform.

Float Switch

Detects whether the sensor is submerged or the stream is dry.

3.4. Purpose

This report aims to analyse turbidity data collected during October 2024, focusing on the identification and classification of "true" turbidity exceedance events based on Alcoa's Turbidity Event Classification Guidelines.

3.5. Exclusions

This report is not intended as:

- An assessment of the WQMS network or Alcoa's compliance with relevant legislation and requirements.
- An evaluation of the suitability of the trigger levels or event classification procedures adopted by Alcoa.

3.6. Abbreviations

	Term
IoT	Internet of Things
NTU	Nephelometric Turbidity Units
WQMS	Water Quality Management System

4. Methodology

4.1. WQMS Locations

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

4.2. Data Review

Data recorded by the WQMS Units was reviewed and potential events where turbidity levels exceeded 25 NTU for at least one hour. Each potential event was categorised as either 'true 'or 'false'.

4.2.1. True Turbidity Exceedance Events

These events are caused by an actual increase in stream turbidity. Per Alcoa's "Turbidity Event Classification Guidelines" true exceedance events typically exhibit:

- A sharp, sudden incline in turbidity levels.
- A return to baseline turbidity levels in a pattern resembling a normal (Gaussian) distribution.

Figure 1 Typical 'true' exceedance event showing the sharp incline and gradual return to background levels.

4.2.2. False Turbidity Exceedance Events

These events are caused by factors unrelated to actual turbidity increase, such as:

- Organic debris (e.g., leaves, sticks, algae) obstructing the sensor
- Air bubbles or water turbulence near the sensor
- Fluctuating water levels intermittently covering and uncover the sensor lens.

False events typically exhibit sharp inclines and declines without the characteristic bell curve shape of true events.

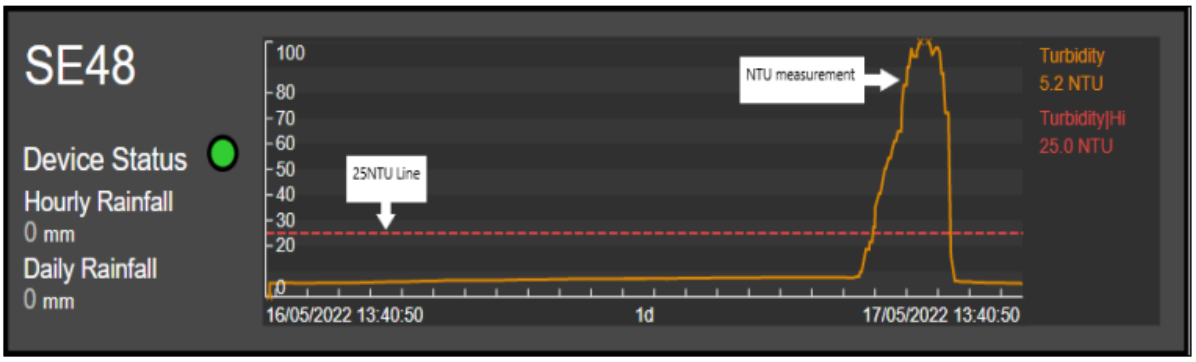

Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, This can occur from unexpected system log-offs, equipment faults, or unplanned shutdowns.

5. Results and Discussion

5.1. Events

Table 1 provides a summary of identified events. Table 2 offers detailed information about each event.

Table 1 Events Summary

Category	# of events
True	4
False	33

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2410-001	DB02T	False	2/10/2024 12:00	2/10/2024 14:24	2 hours, 24 minutes	51.85952	41.33249
HUN-2410-002	ND13T	False	31/10/2024 16:42	31/10/2024 20:12	3 hours, 30 minutes	36.88962	31.74963
HUN-2410-003	SE03T	False	7/10/2024 14:12	7/10/2024 15:48	1 hours, 36 minutes	151.2071	80.13331
HUN-2410-004	SE05T	False	2/10/2024 6:30	2/10/2024 9:06	2 hours, 36 minutes	132.7139	64.54915
HUN-2410-005	SE05T	True	16/10/2024 16:42	16/10/2024 18:36	1 hours, 54 minutes	56.19385	45.03573
HUN-2410-006	SE05T	False	20/10/2024 19:06	20/10/2024 20:06	1 hours	28.47653	26.84875
HUN-2410-007	SE06T	False	21/10/2024 21:03	21/10/2024 22:04	1 hours, 1 minutes	36.3827	30.50728
HUN-2410-008	SE12INV	True	2/10/2024 6:24	2/10/2024 8:36	2 hours, 12 minutes	771.4726	169.1991
HUN-2410-009	SE12INV	False	30/10/2024 14:42	30/10/2024 19:42	4 hours, 60 minutes	5000	2960.401
HUN-2410-010	SE12INV	False	31/10/2024 11:12	31/10/2024 23:54	12 hours, 42 minutes	5000	1051.043
HUN-2410-011	SE12T	False	2/10/2024 6:18	2/10/2024 12:06	5 hours, 48 minutes	559.902	71.04841
HUN-2410-012	SE12T	False	2/10/2024 13:18	3/10/2024 14:24	1 days, 1 hours, 6 minutes	439.341	44.19249
HUN-2410-013	SE12T	False	13/10/2024 19:30	13/10/2024 21:00	1 hours, 30 minutes	2562.578	712.3335
HUN-2410-014	SE12T	False	16/10/2024 20:12	16/10/2024 21:54	1 hours, 42 minutes	505.8603	193.5656
HUN-2410-015	SE12T	False	30/10/2024 5:18	30/10/2024 18:42	13 hours, 24 minutes	708.7634	171.7022

HUN-2410-016	SE12T	False	30/10/2024 19:24	30/10/2024 21:12	1 hours, 48 minutes	735.2362	330.0916
HUN-2410-017	SE12T	False	30/10/2024 23:42	31/10/2024 1:48	2 hours, 6 minutes	1387.914	380.2769
HUN-2410-018	SE15T	False	1/10/2024 6:50	1/10/2024 10:41	3 hours, 50 minutes	61.4129	46.1648
HUN-2410-019	SE15T	False	22/10/2024 4:24	22/10/2024 8:20	3 hours, 56 minutes	44.5954	36.47932
HUN-2410-020	SE15T	False	27/10/2024 16:32	27/10/2024 21:41	5 hours, 9 minutes	1063.416	145.3381
HUN-2410-021	SE15T	False	27/10/2024 22:05	27/10/2024 23:30	1 hours, 25 minutes	74.0398	39.50574
HUN-2410-022	SE15T	False	27/10/2024 23:42	28/10/2024 1:56	2 hours, 13 minutes	41.7976	34.88726
HUN-2410-023	SE15T	False	28/10/2024 2:08	28/10/2024 5:03	2 hours, 56 minutes	59.6395	39.78709
HUN-2410-024	SE15T	False	28/10/2024 5:28	28/10/2024 7:41	2 hours, 13 minutes	44.4158	39.52283
HUN-2410-025	SE15T	False	28/10/2024 7:53	28/10/2024 11:43	3 hours, 50 minutes	45.079	35.06102
HUN-2410-026	SE22T	False	20/10/2024 20:27	20/10/2024 21:46	1 hours, 19 minutes	66.792	44.49274
HUN-2410-027	SE23T	False	3/10/2024 8:54	3/10/2024 10:12	1 hours, 18 minutes	1843.497	188.1771
HUN-2410-028	SE23T	True	12/10/2024 16:12	12/10/2024 17:42	1 hours, 30 minutes	647.5344	161.1279
HUN-2410-029	SE25T	False	31/10/2024 2:30	31/10/2024 11:48	9 hours, 18 minutes	28.06481	26.36112
HUN-2410-030	SE25T	False	31/10/2024 18:12	31/10/2024 23:54	5 hours, 42 minutes	32.30373	29.30754
HUN-2410-031	SE48T	False	17/10/2024 23:42	18/10/2024 6:36	6 hours, 54 minutes	71.51963	52.07618
HUN-2410-032	SE52T	False	2/10/2024 21:00	2/10/2024 23:30	2 hours, 30 minutes	36.82098	33.35982
HUN-2410-033	SE53T	False	28/10/2024 14:54	28/10/2024 21:18	6 hours, 24 minutes	147.4874	54.8887
HUN-2410-034	SE53T	False	28/10/2024 22:12	29/10/2024 6:18	8 hours, 6 minutes	160.5608	61.19161
HUN-2410-035	SE53T	False	29/10/2024 10:06	29/10/2024 13:00	2 hours, 54 minutes	91.62838	61.86948
HUN-2410-036	SE59T	True	2/10/2024 7:36	2/10/2024 11:36	4 hours	34.86252	28.64332
HUN-2410-037	SE61T	False	2/10/2024 8:24	2/10/2024 13:42	5 hours, 18 minutes	48.24142	38.48132

* End date and time provided by Alcoa

5.2. True Event(s)

4 potential 'true' turbidity event were identified during the reporting period.

5.2.1. HUN-2410-005

This event exhibited a sharp incline followed by a gradual return to baseline levels, characteristic of a true event.

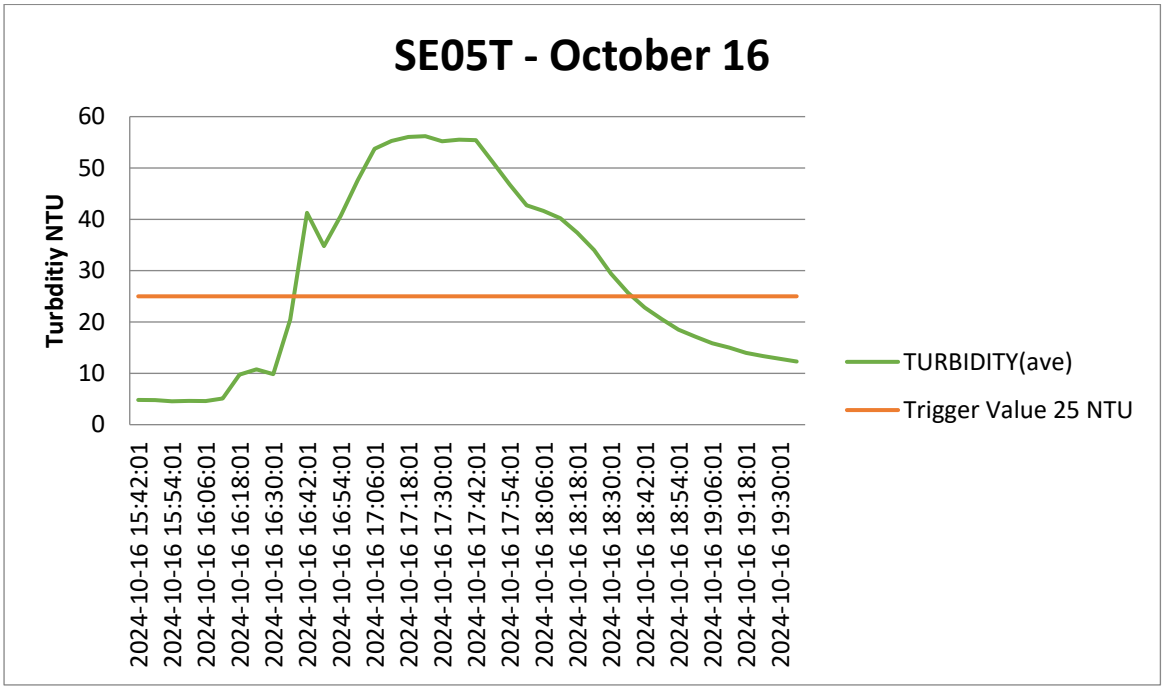

Figure 3 HUN-2410-005

5.2.2. HUN-2410-008

This event exhibited a sharp incline followed by a gradual return to baseline levels, characteristic of a true event.

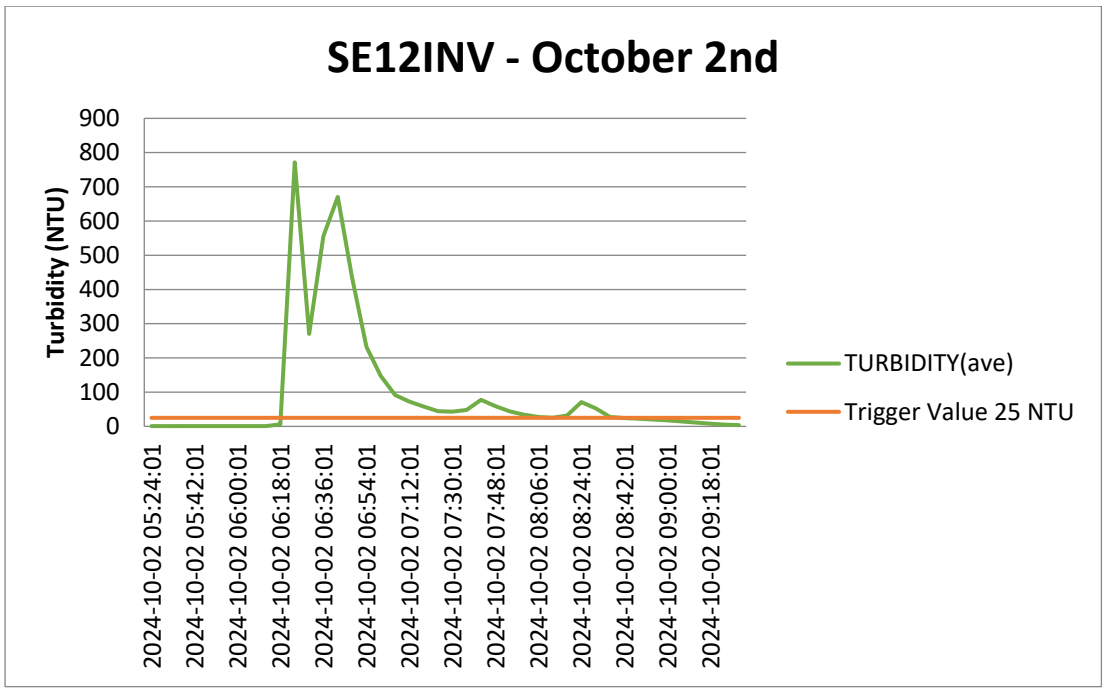

Figure 4 HUN-2410-008

5.2.3. HUN-2410-028

This event exhibited a sharp incline followed by a gradual return to baseline levels, characteristic of a true event.

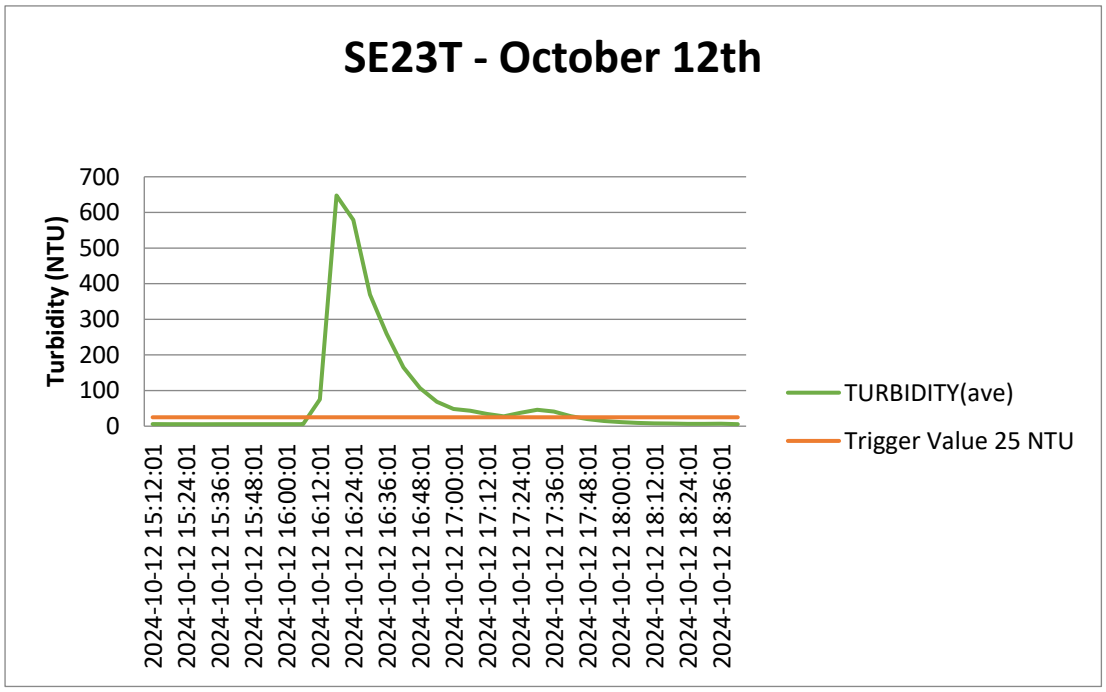

Figure 5 HUN-2410-028

5.2.4. HUN-2410-036

This event exhibited a sharp incline followed by a gradual return to baseline levels, characteristic of a true event.

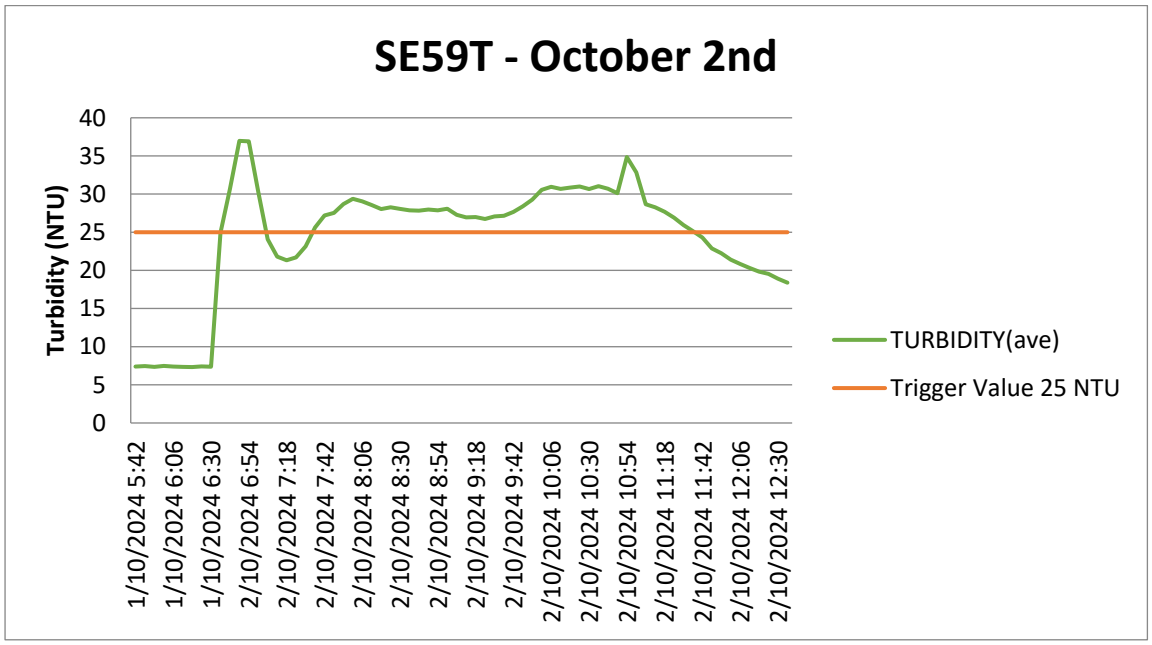

Figure 6 HUN-2410-036

5.3. True Event Investigation(s)

The following investigations were undertaken to classify 'true' events.

Table 3: True Event Investigation Outcomes

Event ID	Event Classification	Alcoa Investigation	Outcome
HUN-2410-005	Non-Mining Related	*Data trend indicates sharp increase in NTU which possibly is evident of organic debris impacting the sensor.*	No further investigation is required
HUN-2410-008	Non-Mining Related	*Data trend indicates false event, extreme turbidity spike from 6.2NTU to 771.47NTU within 6 minutes. Site was last inspected on 29/09/2024, stream level had dropped considerably and the sensor was positioned close to the stream bed. Site inspected on 3/10/2024, stream clear at time of inspection.*	No further investigation is required
HUN-2410-028	Non-Mining Related	*Data trend indicates false event, sharp incline with extreme peak turbidity value, outside of rainfall period. Stream level is very low and sensor is positioned close to the*	No further investigation is required

		stream bed. Stream dry on 15/10/2024	
HUN-2410-036	Non Mining Related	*Site inspected on 3/10/2024. Stream was clear at time of inspection, organic matter from the bare forest floor is present in the stream bed and settled on the sensor which is readily dispersed through the water when disturbed. Sensor was heavily impacted by algae, turbidity reading on arrival 13NTU which dropped to 4.5NTU after cleaning. All mining/rehab areas, haul roads and sumps within the SE59T catchment inspected, no evidence of mining contribution found.*	No further investigation is required

5.4. False Event(s)

Thirty-three false events were identified during the reporting period. Rationale on potential causes is summarised below.

Table 4 False Events Rationale

Event ID	Monitor ID	Rationale	Field Notes
HUN-2410-001	DB02T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-002	ND13T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-003	SE03T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-004	SE05T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	Stream clear at time of inspection, no evidence of mining sediment within the stream bed. Organic matter from the bare forest floor is present in the stream bed and settled on the sensor which is readily dispersed through the water when disturbed. All mining areas within the SE05T catchment have been inspected, no evidence of mining contribution found.
HUN-2410-006	SE05T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	The monitoring site was inspected on 23/10/2024. The reading on arrival was 5.12 NTU and decreased to 3.05 NTU after cleaning. The stream was documented to be flowing and clear, though staining from algae (non-mining related) appeared on rocks and the sensor. All associated low areas, haul road sumps, and bush tracks were inspected. The SE05T catchment area inspection was completed, and no evidence of mining related contribution was found.
HUN-2410-007	SE06T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-009	SE12INV	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-010	SE12INV	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded

HUN-2410-011	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-012	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-013	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-014	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-015	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-016	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-017	SE12T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-018	SE15T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-019	SE15T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-020	SE15T	This event is marked by a sharp incline and sharp return to background levels indicative of a 'false' event	No field notes recorded
HUN-2410-021	SE15T	This event is marked by a sharp incline and sharp return to background levels indicative of a 'false' event	No field notes recorded
HUN-2410-022	SE15T	This event is marked by a gradual increase and a gradual return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-023	SE15T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-024	SE15T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded

HUN-2410-025	SE15T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-026	SE22T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-027	SE23T	This event is marked by a sharp incline and sharp return to background levels indicative of a 'false' event.	No field notes recorded
HUN-2410-029	SE25T	This event is marked by a gradual incline indicative of a 'false' event	No field notes recorded
HUN-2410-030	SE25T	This event is marked by a gradual incline indicative of a 'false' event	No field notes recorded
HUN-2410-031	SE48T	This event is marked by a gradual incline and a sharp return to background levels indicative of a 'false' event	No field notes recorded
HUN-2410-032	SE52T	This event is marked by a gradual incline and a gradual return to background levels indicative of a 'false' event	Site inspected on 3/10/2024. Sensor lense clean, turbidity reading at time of inspection 7.2NTU. No evidence of mining sediment within the stream bed. All mining and rehab pits, haul road and sumps within the SE52T catchment were inspected, no evidence of mining contribution found.
HUN-2410-033	SE53T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-034	SE53T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-035	SE53T	This event is marked by sporadic peaks indicative of a 'false' event.	No field notes recorded
HUN-2410-037	SE61T	This event is marked by a gradual incline and a gradual return to background levels indicative of a 'false' event	Site inspection on 3/10/2024. Stream clear at time of inspection, heavy iron staining in the stream bed and on the sesnsor. Turbidity reading 8.32NTU. The sensor is positioned below a precipice in an area of rapid flow. All mining/rehab areas, haul roads and sumps within the SE61T were inspected, no evidence of mining contribution found.

5.5. Excluded WQMS Units

10 WQMS Units were excluded from analysis due to erroneous data. SciDev confirmed the invalidity of data recorded from these units and provided commentary on the condition of each.

Table 5 Excluded WQMS Units

Unit	Dates	SciDev Comment
SE03INV3	October 1st 3rd	Site inspected on 22/09/2024, stream clear and sensor clean. Sensor is reading incorrectly, maintenance contractor to attend
SE51T	October 1st – 3rd	Probe fault, lens auto-wipe malfunction. Wiper rotating and stopping on the lens.
SE02T	October 1st-3rd	False turbidity values recorded due to probe fault. Probe replaced on 3/10/2024 and faulty probe sent off for assessment. Turbidity readings circa 3.2 NTU after installation of new probe
SE03T	October 3rd	Site inspected on 3/10/2024, heavy debris caught around the probe. Turbidity reading on arrival 57.5 NTU which dropped to 12.3 NTU after cleaning.
ND07T	October 8th – 23rd	Sensor malfunction, sensor reading incorrect values. Sensor repaired on 23/10/2024.
SE03INV2	October 8th	Site inspected on 10/10/2024, stream level drop, sensor out of water.
SE61T	October 18th – 23rd	Sensor fault. Sensor reading high values
SE11T	October 28th	Stream level has dropped and depth is insufficient to cover the sensor. Water has ponded and there is no connecting flow.
SE34T	October 29th – November 3rd	Site inspected stream level has dropped and sensor is out of water. Turbidity value on arrival 34.66 NTU. Sensor cleaned and repositioned mid-depth, turbidity dropped to 0.39 NTU.
SE60T	October 29th	Stream level is dropping and stream flow is weak. Ponded section of the stream where the sensor is situated is slightly stagnant and there is debris in the stream bed

5.6. Missing Data

Periods of missing data are detailed in Table 6.

Table 6 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2410-001	ND04T	27/10/2024 9:12:04 AM	31/10/2024 11:54:04 PM	Sensor malfunction
MD-2410-002	PD01T	01/10/2024 12:01:00	17/10/2024 11:32:32 AM	Data loss de to damaged equipment

MD-2410-003	SE05T	1/10/2024 1:36:00 PM	1/10/2024 2:06:00 PM	Sensor malfunction
MD2410-004	SE12INV	17/10/2024 12:54:04 PM	1/01/1989 1:30:01 AM	Sensor malfunction
MD2410-005	SE61T	17/10/2024 3:12:04 PM	17/10/2024 3:48:01 PM	Sensor malfunction
MD2410-006	SE03INV3	1/10/2024 12:18:04 PM	1/10/2024 1:06:01 PM	Sensor malfunction
MD2410-007	SE03INV3	3/10/2024 1:00:04 PM	3/10/2024 1:36:01 PM	Sensor malfunction

6. Appendices

Appendix A. Huntly Raw WQMS Data

Date	Huntly WQMS Data - October 2024 - Events with turbidity > 25 NTU for an hour or more																
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/10/2024																	
2/10/2024		**1**												**1**			
3/10/2024																	
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17/10/2024																	
18/10/2024																	
19/10/2024																	
20/10/2024														**1**			
21/10/2024															**1**		
22/10/2024																	
23/10/2024																	
24/10/2024																	
25/10/2024																	
26/10/2024																	
27/10/2024																	
28/10/2024																	
29/10/2024																	
30/10/2024																	
31/10/2024								**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 - October 2024 - Events with turbidity > 25 NTU for an hour or more																
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/10/2024						**1**											
2/10/2024				**1**	**1**					**1**	**1**		**1**				
3/10/2024				**1**													
4/10/2024																	
5/10/2024																	
6/10/2024																	
7/10/2024																	
8/10/2024																	
9/10/2024																	
10/10/2024																	
11/10/2024																	
12/10/2024																	
13/10/2024				**1**													
14/10/2024																	
15/10/2024																	
16/10/2024				**1**													
17/10/2024																	
18/10/2024									**1**								
19/10/2024																	
20/10/2024																	
21/10/2024																	
22/10/2024						**1**											
23/10/2024																	
24/10/2024																	
25/10/2024																	
26/10/2024																	
27/10/2024						**3**											
28/10/2024						**3**						**2**					
29/10/2024																	
30/10/2024				**3**	**2**												
31/10/2024																	

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 - October 2024 - Events with turbidity > 25 NTU for an hour or more																
	SE03IN2	SE22T	SE23T	SE25T	SE24T	SE03INV1	SE03INV3	SE24T									
1/10/2024																	
2/10/2024																	
3/10/2024			**1**														
4/10/2024																	
5/10/2024																	
6/10/2024																	
7/10/2024																	
8/10/2024																	
9/10/2024																	
10/10/2024																	
11/10/2024																	
12/10/2024			**1**														
13/10/2024																	
14/10/2024																	
15/10/2024																	
16/10/2024																	
17/10/2024																	
18/10/2024																	
19/10/2024																	
20/10/2024		**1**															
21/10/2024																	
22/10/2024																	
23/10/2024																	
24/10/2024																	
25/10/2024																	
26/10/2024																	
27/10/2024																	
28/10/2024																	
29/10/2024																	
30/10/2024																	
31/10/2024				**2**													

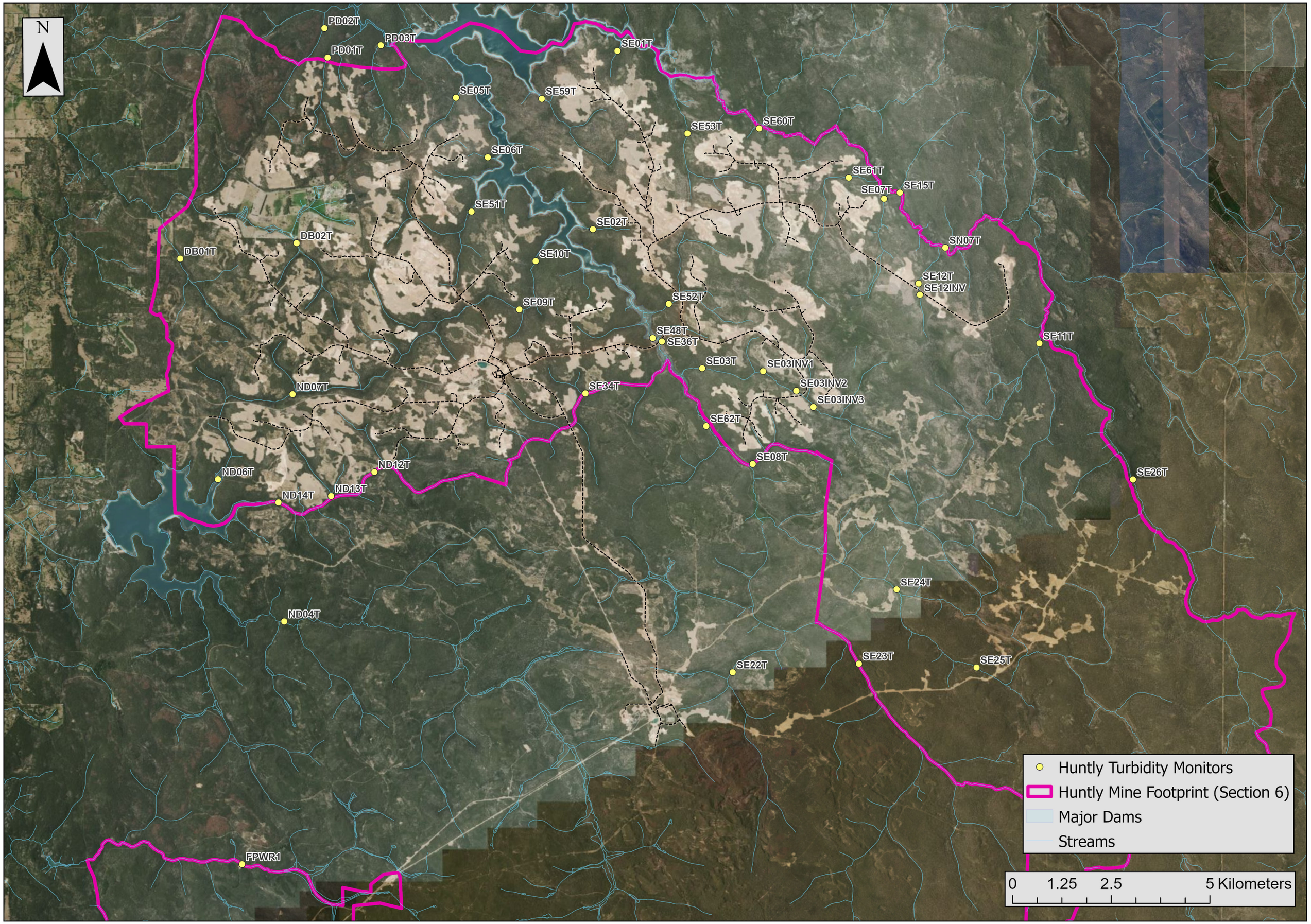
Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text

Date	Huntly WQMS Data - October 2024 - Turbidity (Daily Average, NTU)																
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/10/2024	0.93	11.51	1.01	0.82	1.72	0.99	1.53	1.34	1.09				3.20	5.43	1.32		1.04
2/10/2024	0.96	13.95	0.66	2.27	2.95	1.31	1.69	1.32	2.80		2.10	34.62	15.74	15.30	4.65	1.98	1.08
3/10/2024	0.89	1.80	0.84	1.12	1.72	0.95	1.57	1.23	1.27		1.14		43.20	5.24	7.90	1.75	1.07
4/10/2024	0.91	2.00	1.27	0.97	1.43	0.91	1.54	1.24	1.08		1.06	3.14	6.49	5.43	9.62	1.35	1.04
5/10/2024	0.88	1.38	1.55	1.23	1.48	0.72	1.52	1.23	1.11		6.13	3.13	6.10	4.88	4.32	1.23	1.10
6/10/2024	0.90	1.35	1.21	0.82	1.59	0.72	1.85	1.24	1.18		6.04	3.30	4.91	5.29	3.99	1.17	1.02
7/10/2024	0.90	1.34	1.21	0.81	1.47	0.72	1.84	1.56	1.09		2.39	3.15	11.43	4.99	3.51	1.14	1.03
8/10/2024	0.92	1.34	1.15	0.79	1.38	1288.91	1.51	1.26	1.10		1.91	2.99	8.80	4.82	1.83	1.14	1.03
9/10/2024	0.85	1.33	1.20	0.81	1.53	3998.15	1.52	1.25	1.19		3.23	3.02	4.79	5.21	1.39	1.13	1.02
10/10/2024	0.87	1.33		0.82	1.66	3998.61	1.64	1.27	1.26		3.04	3.30	3.98	5.02	1.40	1.16	1.21
11/10/2024	0.87	1.32	1.39	0.86	1.80	3999.54	1.49	1.29	1.30		4.51	3.07	5.64	5.29	2.01	1.13	0.99
12/10/2024	0.88	1.35	1.42	1.56	1.97	3996.77	1.57	1.28	1.44		6.31	3.35	4.68	5.49	2.22	1.15	0.98
13/10/2024	0.87	1.32	1.30	3.25	2.08	3998.15	2.23	1.13	1.43		3.64	3.16	4.96	5.39	1.29	1.17	1.00
14/10/2024	0.85	1.42	1.54	1.52	2.26	4000.00	1.51	1.13	1.49		1.92	3.20	6.86	5.59	1.53	1.18	1.00
15/10/2024	0.77	1.50	1.29	0.97	2.38	3997.23	1.49	1.16	1.76		1.67	3.45	5.93	5.64	1.75	1.24	1.22
16/10/2024	0.80	4.43	1.25	0.90	2.40	1524.33	1.52	1.44	1.52		17.27	3.88	5.06	9.50	1.11	1.26	1.04
17/10/2024	0.79	1.35	2.01	0.80	2.49	92.72	1.47	1.07	1.39	3.05	4.97	4.03	5.83	5.38	1.23	1.24	1.04
18/10/2024	0.76	2.58	1.34	0.72	2.60	94.59	1.48	1.48	1.14	3.24	3.55	3.83	6.07	5.21	2.29	1.23	1.02
19/10/2024	0.81	1.88	1.42	0.74	2.62	93.87	1.47	1.02	1.15	3.61	20.10	3.47	6.17	5.51	1.75	1.24	1.02
20/10/2024	0.84	1.85	1.81	0.83	3.12	89.13	1.53	1.06	1.64	4.65	0.50	4.10	6.05	8.83	7.87	1.37	1.07
21/10/2024	0.84	1.66	1.15	0.84	2.86	86.85	1.48	1.06	1.53	4.26	0.64	36.12	5.88	5.16	6.81	1.39	1.39
22/10/2024	0.84	1.48	1.17	84.16	2.09	97.27	1.45	1.05	1.10	3.96	0.52	3.49	3.57	5.17	0.56	1.41	1.11
23/10/2024	0.82	1.66	1.27	2.24	2.05		1.44	1.07	1.08	4.05	0.49	3.64	5.62	**5.5**	3.57	1.36	2.13
24/10/2024	0.91	1.50	3.92	0.76	1.87	9.60	1.39	1.08	1.16	4.17	0.44	3.36	2.74	3.73	2.59	1.29	1.12
25/10/2024	0.91	1.43	1.76	1.43	2.02	10.81	1.40	1.36	1.21	4.26	54.75	3.39	2.51	3.93	1.10	1.30	1.09
26/10/2024	0.90	1.46	1.46		2.20	11.67	1.43	1.13	1.27	4.33	2.13	3.45	2.64	4.25	0.68	1.32	1.11
27/10/2024	0.89	1.41	2.28		2.41	12.24	1.45	1.15	1.95	4.60	0.71	3.73	2.70	5.14	1.01	1.31	2.88
28/10/2024	0.89	2.43	1.46		2.50	12.37	1.46	1.25	1.50	4.77	4.05	3.88	2.80	4.82	0.97	1.28	1.11
29/10/2024	0.88	1.68	1.35		2.49	12.59	1.46	1.68	1.26	5.32	0.89	3.57	2.74	8.33	1.33	1.24	1.08
30/10/2024	0.89	1.48	1.28		2.63	12.62	1.48	2.91	1.31	4.37	0.57	3.86	3.64	5.62	0.98	1.22	1.00
31/10/2024	1.02	1.78	1.22		2.88	12.96	1.51	8.93	1.34	4.72	0.55	3.68	3.61	6.30	1.02	1.23	1.07

Date	Huntly WQMS Data - October 2024 - Turbidity (Daily Average, NTU)																
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/10/2024	1.00	1.68	1.49	20.73	0.68	12.91	0.63	0.88	2.51	170.08	3.40	0.61	9.78	1.16	5.19	1.29	2.75
2/10/2024	1.07	11.66	1.73	51.68	28.97	7.84	0.75	1.67	4.02	7.12	11.60	5.24	17.22	6.23	17.84	1.51	2.68
3/10/2024	1.03	1.57	4.26	20.08	1.40	8.87	0.71	2.26	4.72	1.76	7.37	3.61	8.60	1.69	10.64	1.87	3.21
4/10/2024	1.01	1.46	1.68	2.68	0.13	5.68	0.61	1.88	2.82	1.08	4.88	1.15	4.09	1.40	8.08	1.25	2.47
5/10/2024	1.01	15.97	2.27	2.47	0.05	6.04	0.62	0.99	2.58	3.22	5.21	0.85	3.95	1.12	7.79	1.19	2.17
6/10/2024	1.00	1.41	2.17	2.45	0.03	7.40	0.64	0.95	2.56	0.65	0.98	0.64	4.16	1.05	8.22	1.18	2.21
7/10/2024	1.00	1.44	65.20	2.51	0.03	9.89	0.59	0.93	2.37	2.97	0.81	0.36	4.41	1.06	9.06	1.21	2.30
8/10/2024	1.00	1.41	110.32	2.66	0.03	12.58	0.61	0.92	2.26	0.53	0.75	0.35	4.69	1.08	10.57	1.35	2.31
9/10/2024	1.00	2.12	9.15	2.71	0.01	14.89	0.63	0.90	20.83	1.48	0.72	0.37	5.13	1.16	12.29	1.32	2.31
10/10/2024	1.00	1.43	23.08	10.85	0.02	9.37	0.60	0.86	2.18	0.56	0.72	0.34	5.06	1.08	10.80	1.45	2.37
11/10/2024	0.99	1.40	0.35	2.88	0.03	1.36	0.56	5.08	2.10	1.51	0.73	0.39	5.12	1.27	0.01	1.50	2.43
12/10/2024	0.98	1.40	0.27	3.72	0.01	1.50	0.60	1.97	2.11	1.41	0.83	0.49	5.27	3.12	0.07	1.56	2.44
13/10/2024	0.99	1.43	0.19	54.74	0.01	2.68	0.61	0.75	2.18	1.18	1.01	0.66	5.52	0.88	0.01	1.62	2.43
14/10/2024	0.98	1.50	3.21	3.46	0.01	4.14	0.62	0.76	2.65	1.89	0.81	0.71	6.03	0.88	0.26	1.75	2.54
15/10/2024	0.98	1.45	0.08	3.93	0.01	4.80	0.67	0.77	2.52	0.60	0.80	0.65	6.86	0.92	0.01	1.82	2.41
16/10/2024	0.99	1.46	0.10	20.15	0.02	5.54	0.71	0.78	2.34	1.58	0.96	0.76	8.56	0.96	0.02	1.85	2.30
17/10/2024	0.98	1.46	0.09	5.16		5.82	0.57	0.78	3.97	0.64	0.65	0.61	6.26	0.94		1.81	2.24
18/10/2024	0.98	1.46	0.03	2.81	15.39	6.03	0.57	1.85	16.24	0.58	0.77	0.52	6.16	0.86	1.94	1.81	2.49
19/10/2024	1.00	1.48	0.12	3.14	14.98	5.64	0.58	0.92	1.85	0.93	0.73	0.55	2.71	7.15	71.03	2.74	2.07
20/10/2024	0.98	1.58	0.15	6.02	15.29	6.23	0.60	3.74	1.96	2.59	2.24	0.95	5.33	1.19	156.06	2.19	2.17
21/10/2024	0.99	1.67	0.09	4.65	14.86	6.91	0.57	0.95	2.06	1.76	2.20	0.79	3.94	0.89	454.82	2.23	1.91
22/10/2024	1.00	1.52	0.29	5.31	14.41	12.78	0.57	0.86	4.12	0.59	0.70	0.42	3.04	0.89	176.52	1.71	1.89
23/10/2024	1.02	1.52	1.08	6.04	13.61	7.31	0.60	1.69	1.87	1.22	0.76	0.48	3.12	0.88	**215.51**	2.33	1.90
24/10/2024	0.98	1.46	1.49	86.17	12.53	6.69	0.58	0.90	1.83	0.57	0.90	0.22	3.42	0.87	148.76	1.56	1.80
25/10/2024	0.98	1.55	1.53	7.63	12.36	5.13	0.54	0.72	1.87	0.73	1.18	0.31	3.86	0.88	153.04	1.75	1.67
26/10/2024	0.98	1.58	2.15	20.03	12.23	5.32	0.63	0.85	2.13	0.62	4.19	0.45	3.99	0.92	96.22	2.04	1.67
27/10/2024	0.98	1.60	42.70	8.63	11.23	39.52	0.58	0.84	1.90	0.81	4.49	1.38	4.21	1.24	166.96	2.32	1.74
28/10/2024	0.98	1.60	57.84	7.40	10.26	19.50	17.00	0.73	1.87	0.65	4.59	21.42	4.58	0.99	211.41	2.43	2.06
29/10/2024	0.97	1.62	6.92	10.07	9.80	4.40	38.59	1.03	1.95	0.61	4.56	31.23	4.46	48.75	306.85	2.76	1.87
30/10/2024	0.96	1.61	6.77	151.51	638.24	4.41	72.66	1.01	2.34	0.68	4.46	6.91	4.94	320.52	282.00	3.46	1.62
31/10/2024	0.95	1.63	6.82	62.89	565.82	4.59	10.86	0.78	2.83	0.78	11.51	6.80	5.52	2.01	258.00	5.69	1.53

Date	Huntly WQMS Data - October 2024 - Turbidity (Daily Average, NTU)																	
	SE22T	SE23T	SE24T	SE25T	SE26T	SE03INV1	SE03INV2	SE03INV3										
1/10/2024	1.02	6.71	6.01	1.71	7.22	2.10	3.19											
2/10/2024	1.01	7.74	7.18	2.29	6.01	17.13	5.44	53.59										
3/10/2024	0.70	18.09	4.95	3.40	9.24	5.00	5.28											
4/10/2024	0.67	5.12	1.47	3.36	8.72	8.45	3.30	9.57										
5/10/2024	0.69	5.86	1.23	3.91	10.54	21.30	3.15	8.16										
6/10/2024	0.71	5.46	2.08	3.47	10.54	2.49	3.16	7.97										
7/10/2024	0.73	4.92	3.81	3.49	10.71	2.52	3.80	7.73										
8/10/2024	0.85	6.72	4.62	2.95	6.48	2.59	30.15	7.88										
9/10/2024	0.73	5.16	5.41	2.72	9.27	2.62	71.98	7.60										
10/10/2024	0.73	5.53	4.90	3.20	10.28	2.61	88.29	7.82										
11/10/2024	0.74	5.80	3.78	2.28	10.10	2.55	2.88	6.21										
12/10/2024	0.73	17.82	1.89	2.37	10.16	2.70	3.08	6.54										
13/10/2024	0.71	10.39	2.03	2.49	10.35	2.84	3.45	6.79										
14/10/2024	0.74	16.44	2.02	2.81	10.12	2.91	3.69	7.57										
15/10/2024	0.71	11.43	2.11	2.96	10.31	3.05	3.89	8.58										
16/10/2024	0.71	7.33	2.24	2.65	9.91	3.11	4.05	8.69										
17/10/2024	0.78	7.53	2.55	2.54	10.28	3.02	4.09	8.28										
18/10/2024	1.20	7.60	3.47	2.56	10.28	2.60	4.05	7.68										
19/10/2024	1.67	7.63	3.46	2.56	10.27	2.73	3.87	7.09										
20/10/2024	9.21	6.99	2.56	2.37	8.75	3.81	4.18	9.26										
21/10/2024	9.88	8.55	2.84	2.64	9.91	3.20	4.23	8.84										
22/10/2024	8.92	9.86	4.58	2.29	10.71	2.53	4.31	9.14										
23/10/2024	7.73	9.41	6.92	2.14	10.67	2.60	4.44	6.03										
24/10/2024	8.23	9.41	7.64	2.27	10.65	2.57	4.30	1.90										
25/10/2024	8.30	9.80	8.90	3.10	10.51	2.70	2.85	1.11										
26/10/2024	8.11	10.08	6.84	3.17	10.51	9.44	0.01	0.30										
27/10/2024	7.62	10.18	5.77	4.00	10.49	3.05	0.01	0.01										
28/10/2024	8.40	10.07	5.27	4.95	10.48	3.16	0.01	0.01										
29/10/2024	7.56	10.05	4.35	9.02	10.42	3.18	0.07	0.01										
30/10/2024	8.08	10.07	5.12	19.13	10.46	3.07	0.02	0.01										
31/10/2024	9.52	10.04	3.93	26.28	10.56	2.85	0.02	0.01										

Appendix B. Huntly WQMS Locations


N
PD02T
PD03T
PD01T
SE01T
SE05T
SE59T
SE53T
SE60T
SE06T
SE61T
SE07T
SE15T
SE51T
SE02T
DB02T
DB01T
SE10T
SN07T
SE12T
SE12INV
SE52T
SE09T
SE48T
SE36T
SE11T
SE03T
SE03INV1
SE03INV2
SE03INV3
ND07T
SE34T
SE62T
SE08T
ND12T
ND06T
ND13T
ND14T
SE26T
SE24T
ND04T
SE23T
SE25T
SE22T
FPWR1
Huntly Turbidity Monitors
Huntly Mine Footprint (Section 6)
Major Dams
Streams
0
1.25
2.5
5 Kilometers

Appendix C. WQMS General Arrangement

ANTENNA

SOLAR PANEL

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

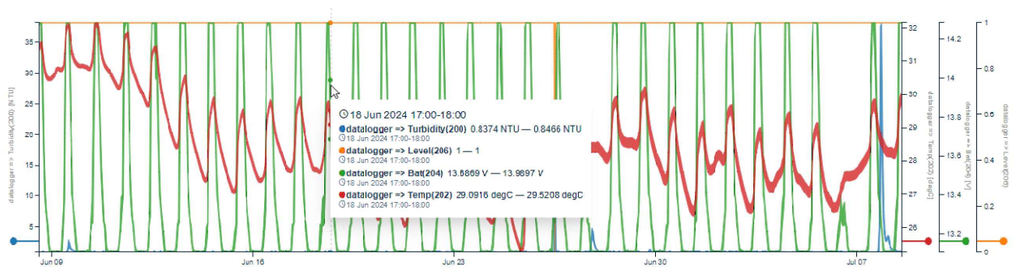
DATA INLET

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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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

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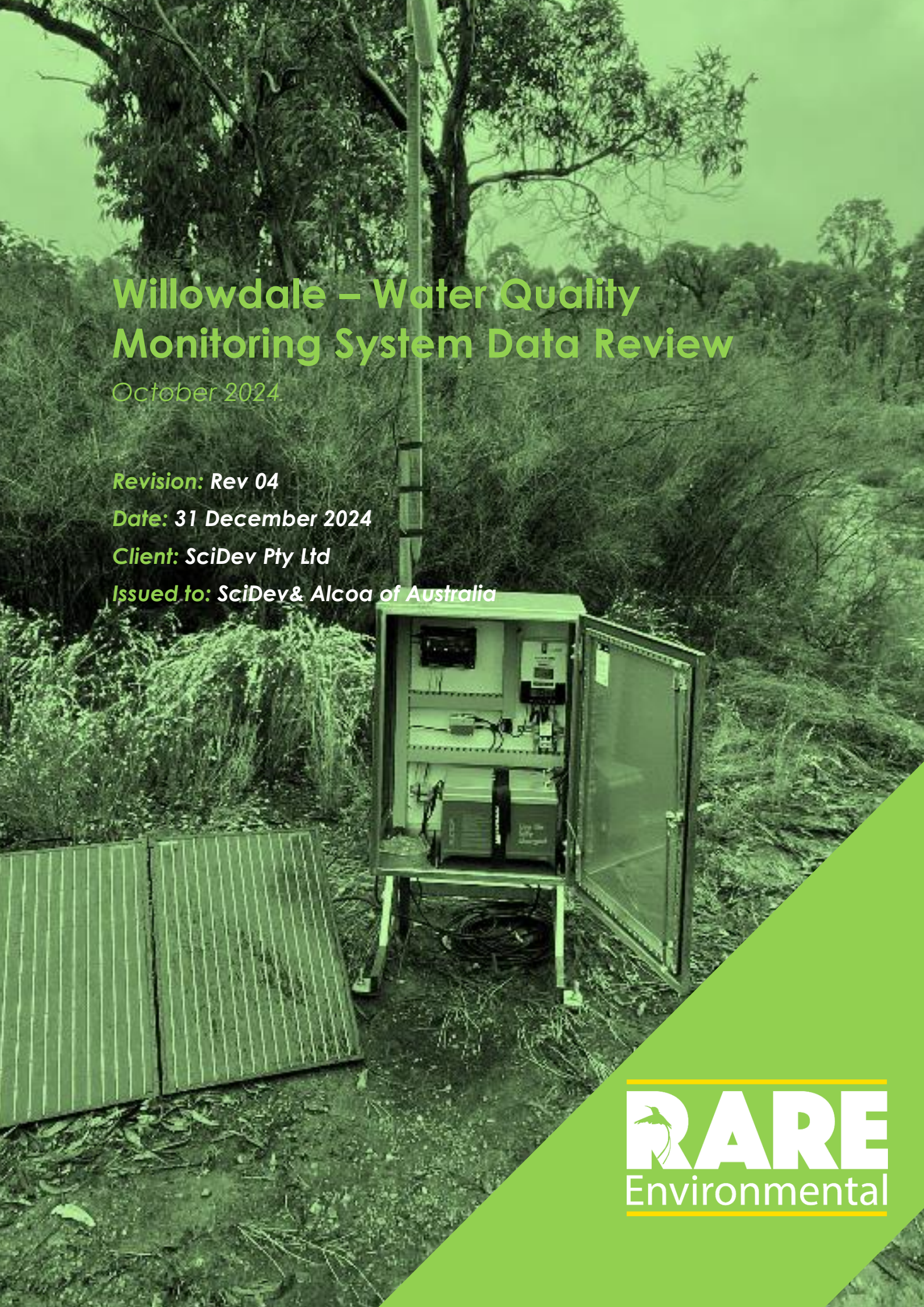
1



Willowdale – Water Quality Monitoring System Data Review

October 2024

Revision: ***Rev 04***

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Client: ***SciDev Pty Ltd***

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RARE Environmental

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01	03/12/24	Issued for internal review	MM	GD	GD	SciDev
02	21/12/24	Revision 2 submitted to client	MM	GD	GD	SciDev
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Prepared by		Technical Review		Approved for Issue	
Michael Minter		Georgia Duffy		Georgia Duffy	
Name	Michael Minter	Name	Georgia Duffy	Name	Georgia Duffy
Position	Env.Engineer	Position	Chemical Engineer	Position	Chemical Engineer
Date	31/12/2024	Date	31/12/2024	Date	31/12/2024

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Infrastructure Sustainability Council MEMBER

Table of Contents

1. Executive Summary

This report, prepared by RARE Environmental Pty Ltd and SciDev Pty Ltd for Alcoa, provides an analysis of turbidity data collected from Water Quality Monitoring Systems (WQMSs) deployed at the Willowdale bauxite mining operations during October 2024. The primary objective of this analysis was to evaluate the quality of the data, identify potential "true" turbidity exceedance events, and support Alcoa's compliance reporting obligations under Schedule 1, Division 2, Clause 6 of the **Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023**.

The analysis focused on identifying and classifying turbidity events where levels exceeded 25 nephelometric turbidity units (NTU) for at least one hour. Events were categorized as "true" or "false" based on Alcoa's **Turbidity Event Classification Guidelines**, which distinguish actual turbidity increases (true events) from false readings caused by environmental factors such as debris, air bubbles, or fluctuating water levels.

Key findings include:

- **True Events**: One "true" turbidity exceedance event (Event ID: WDL-2410-001) was identified and further investigated. The event exhibited characteristics consistent with a true event, including a sharp incline and gradual return to baseline turbidity levels. However, it was determined to be unrelated to mining activities.
- **False Events**: Twenty-two false events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Excluded Units**: Two WQMS units were excluded from the analysis due to invalid data caused by equipment faults or environmental interference.

The report also highlights periods of missing data, which occurred due to system log-offs, equipment faults, or unplanned shutdowns. These gaps are detailed in the report to ensure transparency in data handling.

2. Scope

RARE Environmental Pty Ltd and SciDev Pty Ltd were engaged by Alcoa to analyze turbidity data collected from the Willowdale Water Quality Monitoring Systems (WQMSs). The primary objective of this engagement is to assess the quality of the collected data and identify potential "true" turbidity events. This analysis supports Alcoa's reporting obligations under *Schedule 1, Division 2, Clause 6 of the Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

3. Introduction

3.1. Background

Alcoa of Australia Ltd (Alcoa) operates two bauxite mines, Huntly and Willowdale, approximately 100 km southeast of Perth, Western Australia. These mining operations are subject to environmental controls mandated by the *Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023*.

Under this Exemption Order, Alcoa is required to implement drainage control measures and monitor effectiveness in water bodies within and downstream of mining operations. Turbidity, a critical water quality parameter, is monitored using Water Quality Monitoring Systems (WQMSs), to detect deviations and identify high-turbidity events.

Alcoa is obligated to report monthly on stream turbidity, including the identification and classification of any “true” high-turbidity exceedance events. (Refer to Appendix A for the site map showing WQMS locations.)

3.2. Monitoring requirements

Environmental Protection (Darling Range Bauxite Mining Proposal) Exemption Order 2023 specifies that a drainage incident occurs when:

> *a) runoff from a disturbance area enters the surrounding environment, resulting in surface water turbidity of at least 25 NTU for a duration of at least one hour; or*
>
> *b) a discharge from containment infrastructure includes, or may include, environmentally hazardous material.*

Trigger levels for drainage incidents are outlined in *Schedule 1* of the Exemption Order. To meet these requirements, Alcoa has developed "Turbidity Event Classification Guidelines" which define a true turbidity exceedance event as a WQMS recording turbidity levels of at least 25 NTU for a period exceeding one hour.

3.3. Water Quality Management Systems (WQMSs)

During the October 2024 monitoring period, 4 WQMS units were deployed to monitor turbidity levels in streams subject to surface water runoff within and downstream of Willowdale mining operations.

Each WQMS unit consists of the following components:

Aquas SMR10 Turbidity Probe

> Positioned at a 90-degree angle to water flow, each probe is equipped with an automatic lens wiper and a guard to protect against larger debris.

Data Taker DT82 Logger

> Records data locally every 6 seconds, with 6-minute averages transmitted via IoT-enabled modems to a cloud-based platform.

Float Switch

Detects whether the sensor is submerged or the stream is dry.

3.4. Purpose

This report aims to analyse turbidity data collected during October 2024, focusing on the identification and classification of "true" turbidity exceedance events based on Alcoa's Turbidity Event Classification Guidelines.

3.5. Exclusions

This report is not intended as:

- An assessment of the WQMS network or Alcoa's compliance with relevant legislation and requirements.
- An evaluation of the suitability of the trigger levels or event classification procedures adopted by Alcoa.

3.6. Abbreviations

	Term
IoT	Internet of Things
NTU	Nephelometric Turbidity Units
WQMS	Water Quality Management System

4. Methodology

4.1. WQMS Locations

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

4.2. Data Review

Data recorded by the WQMS Units was reviewed and potential events where turbidity levels exceeded 25 NTU for at least one hour. Each potential event was categorised as either 'true 'or 'false'.

4.2.1. True Turbidity Exceedance Events

These events are caused by an actual increase in stream turbidity. Per Alcoa's "Turbidity Event Classification Guidelines" true exceedance events typically exhibit:

- A sharp, sudden incline in turbidity levels.
- A return to baseline turbidity levels in a pattern resembling a normal (Gaussian) distribution.

Figure 1 Typical 'true' exceedance event showing the sharp incline and gradual return to background levels.

4.2.2. False Turbidity Exceedance Events

These events are caused by factors unrelated to actual turbidity increase, such as:

- Organic debris (e.g., leaves, sticks, algae) obstructing the sensor
- Air bubbles or water turbulence near the sensor
- Fluctuating water levels intermittently covering and uncover the sensor lens.

False events typically exhibit sharp inclines and declines without the characteristic bell curve shape of true events.

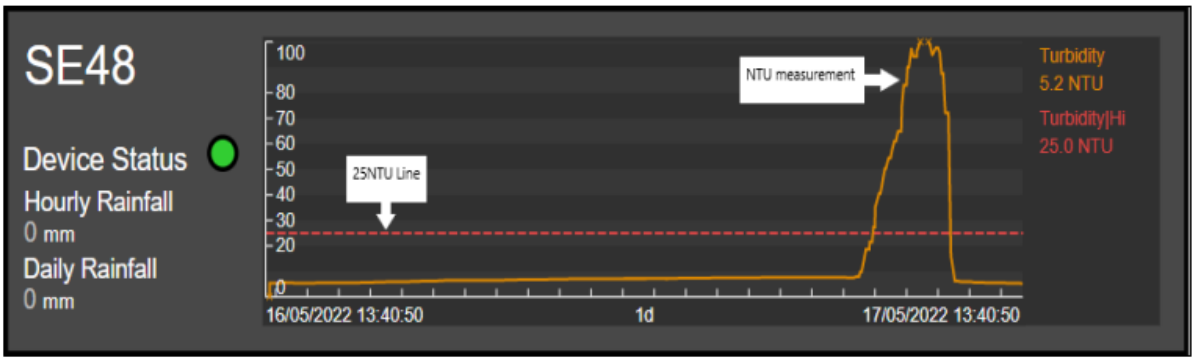

Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, This can occur from unexpected system log-offs, equipment faults, or unplanned shutdowns.

5. Results and Discussion

5.1. Events

Table 1 provides a summary of identified events. Table 2 offers detailed information about each event.

Table 1 Events Summary

Category	# of events
True	0
False	4

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
WDL-2410-01	RHB2	False	00:00 01/10/2024	07:48 01/10/2024	7 hrs 47 min	39.92	34.81
WDL-2410-02	RHB2	False	08:06 01/10/2024	02:12 02/10/2024	18 hrs 5 min	71.69	50.93
WDL-2410-03	RHB2	False	12:30 08/10/2024	00:48 09/10/2024	12 hrs 18 min	212.39	37.16
WDL-2410-04	RHB2	False	03:30 09/10/2024	20:00 15/10/2024	160 hrs 30 min	1269.98	154.88

* End date and time provided by Alcoa

5.2. True Event(s)

0 potential 'true' turbidity event was identified during the reporting period.

5.3. False Event(s)

4 false events were identified during the reporting period. Rationale on potential causes is summarised below.

Table 3 False Events Rationale

Event ID	Monitor ID	Rationale	Field Notes
WDL-2410-01	RHB2	This event is marked by sporadic peaks indicative of a 'false' event.	Stream inspected on 06/10/2024 at 10am. Stream was flowing and the water was clear at the time of the inspection. There was no signs of turbid water or sediment deposition at the monitor location. The probe was observed in correct position. The lens was inspected and the probe repositioned in the clear water. Event classified as a false event.
WDL-2410-02	RHB2	This event is marked by a gradual incline and gradual return to background levels indicative of a 'false' event.	Stream inspected on 06/10/2024 at 10am. Stream was flowing and the water was clear at the time of the inspection. There was no signs of turbid water or sediment deposition at the monitor location. The probe was observed in correct position. The lens was inspected and the probe repositioned in the clear water. Event classified as a false event.
WDL-2410-03	RHB2	This event is marked by sporadic peaks indicative of a 'false' event.	Stream inspected on 03/11/2024 at 9:00am. Stream was flowing and the water was clear at the time of the inspection. Stream is drying out, probe was covered in mud and detritus accumulating around the probe. Probe was cleaned and repositioned in the water, however stream depth is lower than the width of the probe (not fully submerged).
WDL-2410-04	RHB2	This event is marked by sporadic peaks indicative of a 'false' event.	Stream inspected on 03/11/2024 at 9:00am. Stream was flowing and the water was clear at the time of the inspection. Stream is drying out, probe was covered in mud and detritus accumulating around the probe. Probe was cleaned and repositioned in the water, however stream depth is lower than the width of the probe (not fully submerged).

5.4. Excluded WQMS Units

2 WQMS Units were excluded from analysis due to erroneous data. SciDev confirmed the invalidity of data recorded from these units and provided commentary on the condition of each.

Table 4 Excluded WQMS Units

Unit	Dates	SciDev Comment
HV07T	31/10/2024	Stream inspected on 31/10/2024 at 11:00. The stream was not flowing. The probe was situated in a stagnant pond that was murky. No further evidence of sediment build up from overnight rainfall. Turbidity readings showed sharp increases and decreases. Given there is no water flow, it is likely that exisiting shallow, murky pond water created a false event.
RHB2	25/10/2024 – 31/10/2024	Stream inspected on 03/11/2024 at 9:00am. Stream was flowing and the water was clear at the time of the inspection. Stream is drying out, probe was covered in mud and detritus accumulating around the probe. Probe was cleaned and repositioned in the water, however stream depth is lower than the width of the probe (not fully submerged).

5.5. Missing Data

Periods of missing data are detailed in Table 6.

Table 5 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD2410-01	RHB3	10/10/2024 8:36:00 AM	31/10/2024 11:54:17 PM	Data records missing

6. Appendices

Appendix A. Willowdale Raw WQMS Data

Date	Willowdale WQMS Data - October 2024 - Events with turbidity > 25 NTU for an hour or more																
	HV07T	HV49T	RHB2	RHB3													
1/10/2024			**2**														
2/10/2024			**1**														
3/10/2024																	
4/10/2024																	
5/10/2024																	
6/10/2024																	
7/10/2024																	
8/10/2024			**2**														
9/10/2024			**1**														
10/10/2024			**1**														
11/10/2024			**1**														
12/10/2024			**1**														
13/10/2024			**1**														
14/10/2024			**1**														
15/10/2024			**1**														
16/10/2024			**1**														
17/10/2024																	
18/10/2024																	
19/10/2024																	
20/10/2024																	
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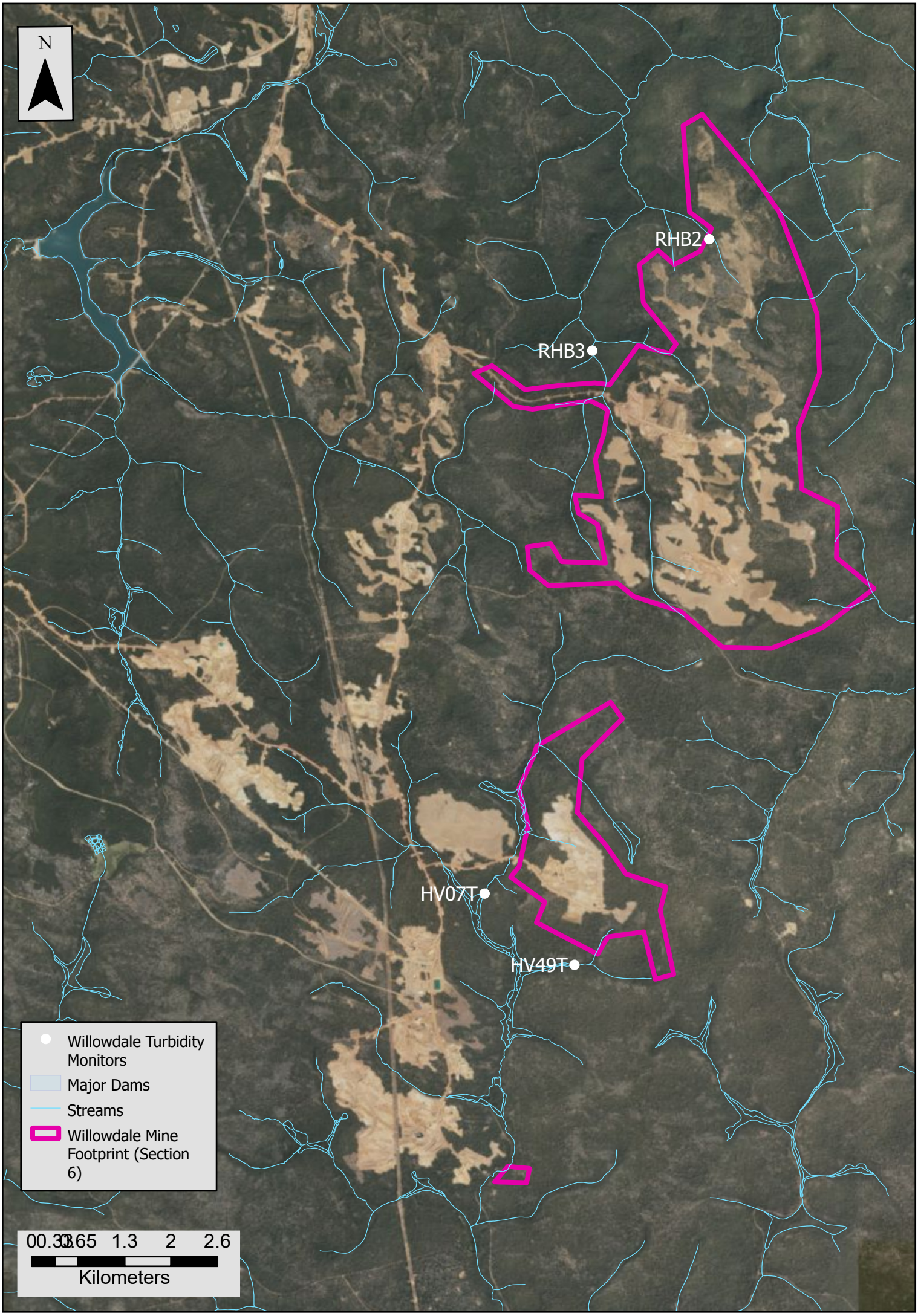
25/10/2024																	
26/10/2024																	
27/10/2024																	
28/10/2024																	
29/10/2024																	
30/10/2024																	
31/10/2024	**1**																

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

Date	Willowdale WQMS Data - October 2024 - Turbidity (Daily Average, NTU)																
	HV07T	HV49T	RHB2	RHB3													
1/10/2024	0.98	1.14	46.98	1.48													
2/10/2024	0.99	1.20	5.96	5.01													
3/10/2024	0.94	1.29	0.03	4.91													
4/10/2024	0.88	1.17	0.01	1.55													
5/10/2024	0.88	1.16	0.03	1.37													
6/10/2024	0.87	1.15	0.04	1.39													
7/10/2024	0.88	1.18	1.02	1.21													
8/10/2024	0.88	1.19	23.24	1.20													
9/10/2024	0.87	1.20	96.59	1.20													
10/10/2024	0.88	1.23	145.51	1.28													
11/10/2024	0.89	1.26	180.07														
12/10/2024	0.94	1.24	180.77														
13/10/2024	1.00	1.33	214.69														
14/10/2024	1.00	1.35	196.95														
15/10/2024	0.87	1.37	29.17														
16/10/2024	1.55	1.23	18.93														
17/10/2024	0.95	0.82	14.39														
18/10/2024	0.88	0.86	13.09														
19/10/2024	1.00	0.87	14.71														
20/10/2024	4.04	0.87	9.47														
21/10/2024	5.81	0.89	12.05														
22/10/2024	6.93	1.55	16.46														
23/10/2024	9.36	1.05	24.00														
24/10/2024	11.88	1.22	19.85														
25/10/2024	7.50	0.94	28.01														
26/10/2024	7.00	0.94	41.00														
27/10/2024	6.19	0.98	24.09														
28/10/2024	9.40	0.96	28.23														
29/10/2024	6.91	1.04	55.27														
30/10/2024	7.30	0.93	33.49														
31/10/2024	15.90	0.92	35.15														

Note: Grey shading indicates no data available for that day at that unit.

Appendix B. Willowdale WQMS Locations


N
RHB2
RHB3
HV07T
HV49T
Willowdale Turbidity Monitors
Major Dams
Streams
Willowdale Mine Footprint (Section 6)
0 0.33 0.65 1.3 2 2.6
Kilometers

Appendix C. WQMS General Arrangement

ANTENNA

SOLAR PANEL

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

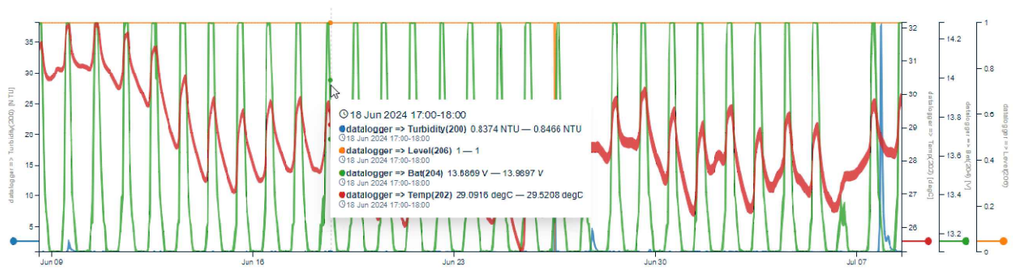
DATA INLET

SENSOR

STREAM DRY

SENSOR

STREAM FLOWING



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