Huntly Bauxite Mine – WQMS Data Review

February2025

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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 February 2025. 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**: Zero "true" turbidity exceedance events were identified.
- **Further Investigation**: One event was flagged for further investigation.
- **False Events**: Ninety-eight 'false' events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Excluded Units**: Twenty-eight 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 logoffs, 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 analyse 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 February2025 monitoring period, forty-four 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 February2025, 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.

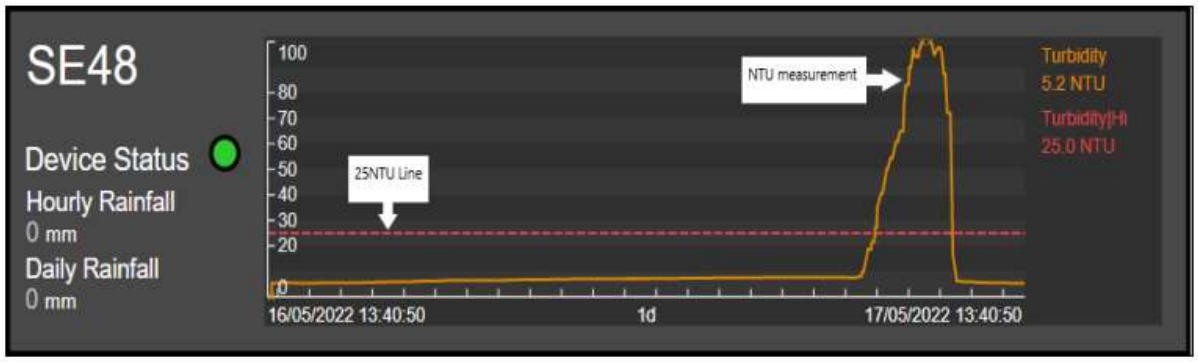


Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, this can occur from unexpected system logoffs, 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
Flagged for further investigation	1
False	97

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2502-001	DB02T	'False'	8/02/2025 5:41	8/02/2025 7:18	1h 37m	163.55	92.65
HUN-2502-002	DB02T	'False'	9/02/2025 8:27	9/02/2025 12:17	3h 50m	185.88	82.39
HUN-2502-003	DB02T	'False'	10/02/2025 7:35	10/02/2025 11:31	3h 57m	398.04	86.80
HUN-2502-004	DB02T	'False'	11/02/2025 12:04	11/02/2025 14:05	2h 1m	97.06	50.67
HUN-2502-005	DB02T	'False'	12/02/2025 3:56	12/02/2025 6:21	2h 25m	167.57	93.93
HUN-2502-006	ND06T	'False'	1/02/2025 2:30	1/02/2025 4:36	2h 6m	282.44	81.19
HUN-2502-007	ND06T	'False'	1/02/2025 12:54	1/02/2025 14:00	1h 6m	82.87	58.38
HUN-2502-008	ND06T	'False'	2/02/2025 5:00	2/02/2025 9:12	4h 12m	335.89	121.29
HUN-2502-009	ND06T	'False'	2/02/2025 9:36	2/02/2025 11:24	1h 48m	649.07	263.41
HUN-2502-010	ND06T	'False'	12/02/2025 9:06	12/02/2025 20:54	11h 48m	129.56	59.71
HUN-2502-011	ND06T	'False'	12/02/2025 21:36	13/02/2025 1:48	4h 12m	159.32	117.96
HUN-2502-012	ND06T	'False'	16/02/2025 19:36	16/02/2025 21:48	2h 12m	32.84	30.06
HUN-2502-013	ND06T	'False'	17/02/2025 18:12	18/02/2025 0:30	6h 18m	83.09	62.64
HUN-2502-014	ND06T	'False'	23/02/2025 10:48	23/02/2025 13:06	2h 18m	35.62	33.98
HUN-2502-015	ND06T	'False'	27/02/2025 16:06	27/02/2025 23:42	7h 36m	337.14	70.19
HUN-2502-016	ND06T	'False'	28/02/2025 1:18	28/02/2025 5:12	3h 54m	383.65	98.26

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2502-017	ND06T	'False'	28/02/2025 7:24	28/02/2025 11:00	3h 36m	107.07	33.04
HUN-2502-018	ND06T	'False'	28/02/2025 11:18	28/02/2025 23:54	12h 36m	85.19	46.95
HUN-2502-019	ND07T	'False'	16/02/2025 7:29	16/02/2025 8:36	1h 7m	27.86	26.89
HUN-2502-020	ND07T	'False'	16/02/2025 12:14	16/02/2025 13:27	1h 13m	28.58	27.82
HUN-2502-021	ND07T	'False'	24/02/2025 19:24	25/02/2025 5:30	10h 6m	767.68	412.22
HUN-2502-022	ND07T	'False'	25/02/2025 21:16	26/02/2025 4:57	7h 41m	644.26	396.62
HUN-2502-023	ND07T	'False'	26/02/2025 18:59	27/02/2025 7:18	12h 19m	935.10	259.82
HUN-2502-024	ND07T	'False'	27/02/2025 22:15	28/02/2025 3:00	4h 45m	122.33	80.08
HUN-2502-025	ND07T	'False'	28/02/2025 19:28	28/02/2025 23:55	4h 27m	3854.31	583.53
HUN-2502-026	PD01T	'False'	11/02/2025 20:37	11/02/2025 21:50	1h 13m	122.79	71.09
HUN-2502-027	SE02T	'False'	3/02/2025 15:06	4/02/2025 15:24	24h 18m	110.09	65.55
HUN-2502-028	SE02T	'False'	6/02/2025 4:06	14/02/2025 11:08	199h 2m	625.04	458.90
HUN-2502-029	SE02T	'False'	17/02/2025 4:35	24/02/2025 11:28	174h 52m	882.57	572.15
HUN-2502-030	SE02T	'False'	28/02/2025 7:23	28/02/2025 23:57	16h 34m	74.53	48.01
HUN-2502-031	SE03INV1	'False'	28/02/2025 4:16	28/02/2025 5:23	1h 7m	190.42	87.69
HUN-2502-032	SE03INV2	'False'	4/02/2025 13:29	6/02/2025 2:22	36h 52m	78.31	37.54
HUN-2502-033	SE03INV2	'False'	14/02/2025 6:22	14/02/2025 12:14	5h 52m	29.67	27.35
HUN-2502-034	SE03INV2	'False'	21/02/2025 7:40	21/02/2025 8:41	1h 1m	87.21	72.81
HUN-2502-035	SE03T	'False'	1/02/2025 22:25	2/02/2025 1:21	2h 56m	68.06	47.79
HUN-2502-036	SE03T	'False'	2/02/2025 21:09	3/02/2025 1:36	4h 27m	147.85	109.31
HUN-2502-037	SE03T	'False'	4/02/2025 20:44	5/02/2025 2:35	5h 52m	183.14	96.28
HUN-2502-038	SE03T	'False'	5/02/2025 19:33	5/02/2025 21:29	1h 55m	204.04	108.65
HUN-2502-039	SE03T	'False'	6/02/2025 19:36	6/02/2025 21:19	1h 43m	159.73	89.53

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2502-040	SE03T	'False'	7/02/2025 19:02	7/02/2025 21:15	2h 13m	151.04	89.70
HUN-2502-041	SE03T	'False'	8/02/2025 20:17	8/02/2025 22:25	2h 7m	149.42	90.23
HUN-2502-042	SE03T	'False'	15/02/2025 20:27	16/02/2025 2:25	5h 58m	237.36	137.99
HUN-2502-043	SE03T	'False'	16/02/2025 16:15	16/02/2025 19:47	3h 32m	268.13	121.89
HUN-2502-044	SE03T	'False'	17/02/2025 16:54	17/02/2025 18:49	1h 55m	163.62	92.17
HUN-2502-045	SE03T	'False'	23/02/2025 7:03	24/02/2025 10:37	27h 35m	440.41	39.08
HUN-2502-046	SE05T	'False'	7/02/2025 12:16	10/02/2025 13:00	72h 44m	964.04	310.53
HUN-2502-047	SE05T	'False'	16/02/2025 1:08	16/02/2025 14:28	13h 20m	72.30	40.19
HUN-2502-048	SE05T	'False'	23/02/2025 9:18	24/02/2025 14:36	29h 18m	86.80	44.38
HUN-2502-049	SE06T	'False'	5/02/2025 16:54	9/02/2025 8:12	87h 18m	644.44	253.67
HUN-2502-050	SE06T	'False'	9/02/2025 9:54	9/02/2025 19:48	9h 54m	1225.28	656.33
HUN-2502-051	SE06T	'False'	12/02/2025 11:54	12/02/2025 17:48	5h 54m	89.16	51.64
HUN-2502-052	SE06T	'False'	12/02/2025 18:30	14/02/2025 11:12	40h 42m	600.61	293.10
HUN-2502-053	SE06T	'False'	21/02/2025 2:42	24/02/2025 0:30	69h 48m	1693.17	95.35
HUN-2502-054	SE06T	'False'	28/02/2025 15:45	28/02/2025 16:45	1h 1m	2068.98	587.04
HUN-2502-055	SE52T	'False'	5/02/2025 15:00	5/02/2025 16:06	1h 6m	115.96	73.78
HUN-2502-056	SE52T	'False'	6/02/2025 15:00	6/02/2025 16:06	1h 6m	127.89	79.62
HUN-2502-057	SE52T	'False'	7/02/2025 14:42	7/02/2025 15:48	1h 6m	132.01	84.37
HUN-2502-058	SE52T	'False'	8/02/2025 15:06	8/02/2025 16:18	1h 12m	128.54	84.25
HUN-2502-059	SE52T	'False'	9/02/2025 15:36	10/02/2025 2:54	11h 18m	1785.47	354.25
HUN-2502-060	SE52T	'False'	10/02/2025 17:12	11/02/2025 0:48	7h 36m	231.88	108.61
HUN-2502-061	SE52T	'False'	11/02/2025 23:24	13/02/2025 1:54	26h 30m	810.94	583.27
HUN-2502-062	SE52T	'False'	13/02/2025 17:18	13/02/2025 19:48	2h 30m	197.56	104.07

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2502-063	SE52T	'False'	14/02/2025 1:18	14/02/2025 3:42	2h 24m	156.58	91.71
HUN-2502-064	SE52T	'False'	14/02/2025 16:12	14/02/2025 17:13	1h 1m	127.04	89.15
HUN-2502-065	SE52T	'False'	16/02/2025 11:27	16/02/2025 12:34	1h 7m	76.68	56.91
HUN-2502-066	SE52T	**Additional Investigation Required**	19/02/2025 15:58	19/02/2025 18:42	2h 44m	166.19	60.73
HUN-2502-067	SE52T	'False'	20/02/2025 15:00	20/02/2025 16:01	1h 1m	206.27	109.95
HUN-2502-068	SE52T	'False'	21/02/2025 17:28	22/02/2025 0:45	7h 16m	994.47	204.20
HUN-2502-069	SE52T	'False'	22/02/2025 17:25	22/02/2025 19:14	1h 49m	605.28	169.33
HUN-2502-070	SE52T	'False'	23/02/2025 0:35	23/02/2025 2:24	1h 49m	3788.42	1852.59
HUN-2502-071	SE52T	'False'	24/02/2025 3:03	24/02/2025 4:10	1h 7m	134.52	88.05
HUN-2502-072	SE52T	'False'	26/02/2025 2:24	26/02/2025 3:24	1h 1m	118.71	79.97
HUN-2502-073	SE52T	'False'	27/02/2025 1:56	27/02/2025 2:56	1h 1m	114.53	75.36
HUN-2502-074	SE53T	'False'	6/02/2025 14:58	6/02/2025 16:29	1h 31m	187.27	80.44
HUN-2502-075	SE53T	'False'	6/02/2025 23:58	7/02/2025 5:31	5h 33m	156.07	92.77
HUN-2502-076	SE53T	'False'	7/02/2025 11:47	7/02/2025 12:54	1h 7m	168.30	91.71
HUN-2502-077	SE59T	'False'	13/02/2025 3:06	13/02/2025 4:55	1h 49m	249.88	117.33
HUN-2502-078	SE61T	'False'	9/02/2025 22:18	10/02/2025 0:00	1h 42m	25.93	25.64
HUN-2502-079	SE61T	'False'	10/02/2025 2:36	10/02/2025 15:06	12h 30m	30.20	25.42
HUN-2502-080	SE61T	'False'	10/02/2025 18:30	11/02/2025 2:54	8h 24m	25.68	25.54
HUN-2502-081	SE61T	'False'	11/02/2025 4:48	11/02/2025 18:06	13h 18m	26.39	25.88
HUN-2502-082	SE61T	'False'	11/02/2025 18:48	11/02/2025 20:00	1h 12m	26.42	26.28
HUN-2502-083	SE61T	'False'	11/02/2025 20:36	11/02/2025 22:30	1h 54m	26.53	26.33
HUN-2502-084	SE61T	'False'	11/02/2025 22:48	12/02/2025 17:24	18h 36m	26.44	26.22

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
HUN-2502-085	SE61T	'False'	12/02/2025 17:54	12/02/2025 20:12	2h 18m	26.64	26.38
HUN-2502-086	SE61T	'False'	12/02/2025 23:24	13/02/2025 1:00	1h 36m	26.84	26.72
HUN-2502-087	SE61T	'False'	13/02/2025 3:54	13/02/2025 18:36	14h 42m	27.16	26.90
HUN-2502-088	SE61T	'False'	13/02/2025 19:18	13/02/2025 23:00	3h 42m	27.50	27.34
HUN-2502-089	SE61T	'False'	13/02/2025 23:30	14/02/2025 1:00	1h 30m	27.64	27.40
HUN-2502-090	SE61T	'False'	14/02/2025 1:42	14/02/2025 8:12	6h 30m	117.50	29.17
HUN-2502-091	SE61T	'False'	27/02/2025 16:30	27/02/2025 18:18	1h 48m	25.38	25.19
HUN-2502-092	SE61T	'False'	27/02/2025 19:24	27/02/2025 21:24	2h 0m	25.44	25.38
HUN-2502-093	SE61T	'False'	27/02/2025 22:42	28/02/2025 2:00	3h 18m	25.61	25.53
HUN-2502-094	SE61T	'False'	28/02/2025 4:00	28/02/2025 19:00	14h 60m	25.82	25.45
HUN-2502-095	SE61T	'False'	28/02/2025 20:54	28/02/2025 23:54	2h 60m	26.21	26.08
HUN-2502-096	ND06T	'False'	23/02/2025 1:30	23/02/2025 2:30	1h 0m	29.41	35.26
HUN-2502-097	SE06T	'False'	15/02/2025 12:36	15/02/2025 13:36	1h 0m	31.83	45.98
HUN-2502-098	SE52T	'False'	3/02/2025 17:00	3/02/2025 18:00	1h 0m	96.66	161.99

* End date and time provided by Alcoa

5.2. Additional Investigation

One event was flagged for additional investigation.

5.2.1. HUN-2502-066

The event occurring between 15:58 and 18:42 on the 19th of February exhibits a sharp, sudden incline in turbidity levels followed by a gradual return to baseline levels in a pattern resembling a normal (Gaussian) distribution as shown in Figure 3 below. This criteria is in line with a typical true event as per the 'Turbidity Event Classification Guidelines'.

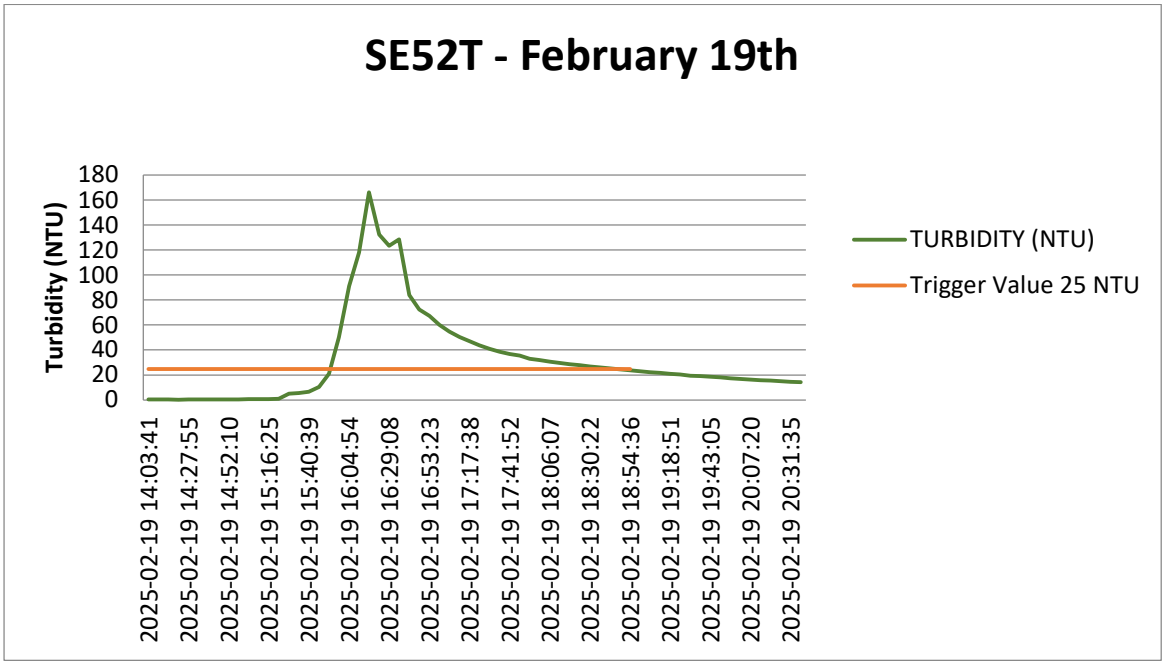


Figure 3 HUN-2501-066

Further investigation into the event and location have determined the following

- The event is followed by recuring peaks in the days following (refer figure 4) suggesting environmental disturbance or sensor fault.
- No rainfall was recorded on 19 February 2025 according to the Wagerup weather station data provided by Murdoch University (Murdoch University, 2025)

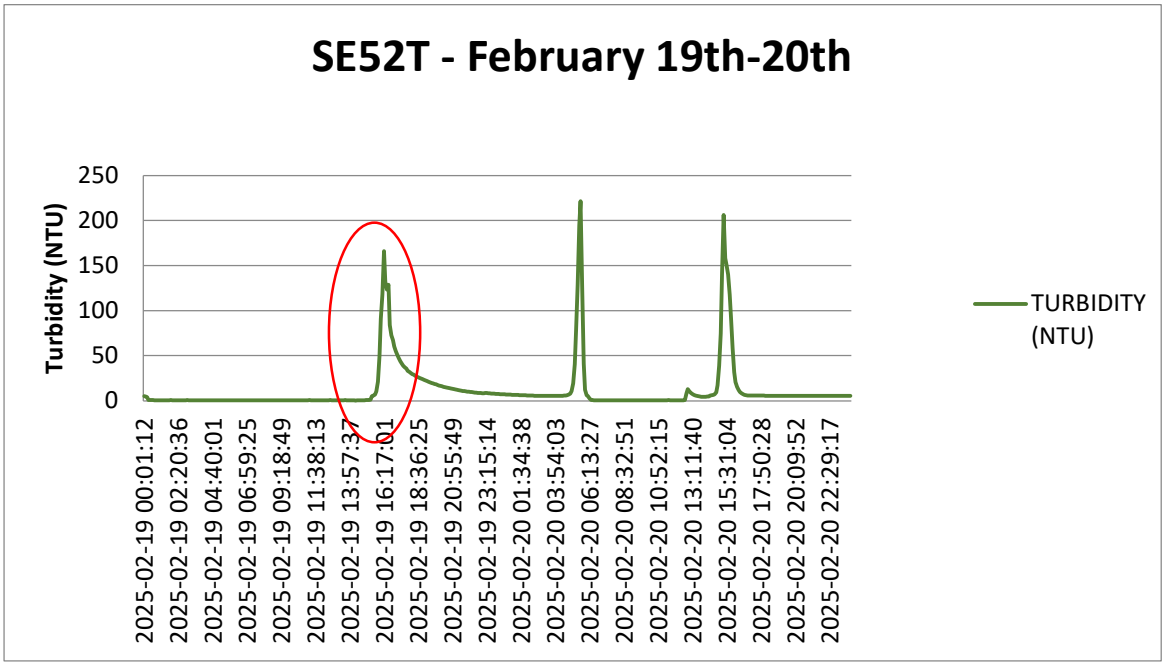


Figure 4 SE52T February 19th-20th

Field notes provided by Alcoa are included below

“Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment, Data trend indicates false event, likely lens impacted by algae/debris or intermittently out of water

Based on the field notes, recurring peaks and no recorded rainfall this event is considered a ‘false’ event. No additional investigation is required.

5.3. True Event(s)

Zero ‘true’ turbidity event were identified during the reporting period.

5.4. False Event(s)

Ninety-eight ‘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
HUN-2502-001	DB02T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 15/02/2025 and stream is dry. Sensor was found in a dry state. No Rainfall.
HUN-2502-002	DB02T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on 15/02/2025 and stream is dry. Sensor was found in a dry state. No Rainfall.
HUN-2502-003	DB02T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on 15/02/2025 and stream is dry. Sensor was found in a dry state. No Rainfall.
HUN-2502-004	DB02T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 15/02/2025 and stream is dry. Sensor was found in a dry state. No Rainfall.
HUN-2502-005	DB02T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 15/02/2025 and stream is dry. Sensor was found in a dry state. No Rainfall.
HUN-2502-006	ND06T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site visited 02/02/2025, stream dropped and sensor above stream.
HUN-2502-007	ND06T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited 02/02/2025, stream dropped and sensor above stream.
HUN-2502-008	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited 02/02/2025, stream dropped and sensor above stream.
HUN-2502-009	ND06T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site visited 02/02/2025, stream dropped and sensor above stream.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-010	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected by SciDev , stream clear and flowing. No rain in the proceeding 24 hours. Data indicates a false event. No mining related impact.
HUN-2502-011	ND06T	This event is marked by a rapid increase and a rapid decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected by SciDev , stream clear and flowing. No rain in the proceeding 24 hours. Data indicates a false event. No mining related impact.
HUN-2502-012	ND06T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected by SciDev , stream clear and flowing. No rain in the proceeding 24 hours. Data indicates a false event. No mining related impact.
HUN-2502-013	ND06T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected by SciDev , stream clear and flowing. No rain in the proceeding 24 hours. Data indicates a false event. No mining related impact.
HUN-2502-014	ND06T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected 01/03/2025. Stream is very shallow and sensor is intermittantly impacted by stream bed sediment.
HUN-2502-015	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected 01/03/2025. Stream is very shallow and sensor is intermittantly impacted by stream bed sediment.
HUN-2502-016	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected 01/03/2025. Stream is very shallow and sensor is intermittantly impacted by stream bed sediment.
HUN-2502-017	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected 01/03/2025. Stream is very shallow and sensor is intermittantly impacted by stream bed sediment.
HUN-2502-018	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected 01/03/2025. Stream is very shallow and sensor is intermittantly impacted by stream bed sediment.
HUN-2502-019	ND07T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-020	ND07T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-021	ND07T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-022	ND07T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-023	ND07T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-024	ND07T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-025	ND07T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 17/02/2025. Stream stagnant, no connecting flow. Lense is only just submerged and stream is heavily impacted by algae.
HUN-2502-026	PD01T	This event is marked by sporadic peaks. This is indicative of a false event	Data trend indicates false event, likely debris impacting the lense. Stream level is very low and algae/debris prsent in the stream bed
HUN-2502-027	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site inspected on 14/02/2025, stream clear and flowing. Sensor heavily impacted by algae. NTU on arrival was 615.9571 and post clean reduced to 2.5721 NTU.
HUN-2502-028	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 14/02/2025, stream clear and flowing. Sensor heavily impacted by algae. NTU on arrival was 615.9571 and post clean reduced to 2.5721 NTU.
HUN-2502-029	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 24/02/2025. Turbidity reading on arrival 806.77NTU which dropped to 6.4NTU once cleaned. Heavy build up of algae in the stream bed which is smothering the sensor, water is clear.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-030	SE02T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 01/03/2025, stream clear and flowing. Sensor heavily impacted by algae. NTU on arrival was 110.1683 and post clean reduced to 3.2602 NTU.
HUN-2502-031	SE03INV1	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on 1/03/2025, stream very low and lense impacted by algae. Data trend indicates false event, likely debris caught on lense.
HUN-2502-032	SE03INV2	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 14/02/2024. Stream level very low. Stream bed and sensor impacted by red algae and organic debris.
HUN-2502-033	SE03INV2	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 14/02/2024. Stream level very low. Stream bed and sensor impacted by red algae and organic debris.
HUN-2502-034	SE03INV2	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	No field notes available
HUN-2502-035	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-036	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-037	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-038	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-039	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-040	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-041	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level is dropping and debris/algae present in the stream bed. Sensor is positioned close to the stream bed and debris is becoming caught around the lense.
HUN-2502-042	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level drop, sensor partially out of water.
HUN-2502-043	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level drop, sensor partially out of water.
HUN-2502-044	SE03T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Stream level drop, sensor partially out of water.
HUN-2502-045	SE03T	This event is marked by sporadic peaks. This is indicative of a false event	Stream level drop, sensor partially out of water.
HUN-2502-046	SE05T	This event is marked by a gradual increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on 16/02/2025, stream clear & flowing. Stream bed & sensor impacted by red algae & iron. Data trend indicates false event, possibly algae or debris impacting NTU.
HUN-2502-047	SE05T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 16/02/2025, stream clear & flowing. Stream bed & sensor impacted by red algae & iron. Data trend indicates false event, possibly algae or debris impacting NTU.
HUN-2502-048	SE05T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 24/02/2025, sensor impacted by algae. Turbidity reading on arrival 47.65NTU which dropped to 4.03NTU after cleaning. Stream is very low and heavily impacted by algae.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-049	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-050	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-051	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-052	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-053	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-054	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on 24/02/2025, sensor impacted by algae. Turbidity reading on arrival 934.55NTU which dropped to 12.27NTU after cleaning. Stream is very low and heavily impacted by algae and debris, stream level only just covering the lense.
HUN-2502-055	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-056	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-057	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-058	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-059	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-060	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-061	SE52T	This event is marked by a rapid increase and a rapid decrease in turbidity with sporadic peaks. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-062	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-063	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream is stagnant with green algae & leaf litter present on sensor and in stream bed. Data trend indicates false event and no rainfall.
HUN-2502-064	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris
HUN-2502-065	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-066	SE52T	This event is followed by a series of sporadic peaks. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-067	SE52T	This event is marked by a gradual increase in turbidity with a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-068	SE52T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-069	SE52T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-070	SE52T	This event is marked by a rapid increase and a rapid decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-071	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-072	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-073	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water
HUN-2502-074	SE53T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 13/02/2025. Stream level very low and debris/algae present around the sensor. Data trend indicates false event, potentially debris caught around the lense.
HUN-2502-075	SE53T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 13/02/2025. Stream level very low and debris/algae present around the sensor. Data trend indicates false event, potentially debris caught around the lense.
HUN-2502-076	SE53T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on 13/02/2025. Stream level very low and debris/algae present around the sensor. Data trend indicates false event, potentially debris caught around the lense.
HUN-2502-077	SE59T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited on 15/02/2025, stream clear and flowing. Algae present on stream bed. Data trend indicates a false event, sensor possibly impacted by debris and algae.
HUN-2502-078	SE61T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-079	SE61T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-080	SE61T	This event is marked by a rapid increase and a sustained peak. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-081	SE61T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-082	SE61T	This event is marked by sporadic peaks. This is indicative of a false event	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-083	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-084	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-085	SE61T	This event is marked by a sustained flat line value over 25 NTU before a rapid decrease. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-086	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-087	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-088	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2502-089	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-090	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 14/02/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 27.6346 and post clean NTU 9.6948.
HUN-2502-091	SE61T	This event is marked by a gradual increase and rapid decrease in turbidity. This is indicative of a false event.	Site visited on 01/03/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 26.2069 and post clean NTU 15.3186.
HUN-2502-092	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 01/03/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 26.2069 and post clean NTU 15.3186.
HUN-2502-093	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 01/03/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 26.2069 and post clean NTU 15.3186.
HUN-2502-094	SE61T	This event is marked by a rapid increase and decrease in turbidity. This is indicative of a false event.	Site visited on 01/03/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 26.2069 and post clean NTU 15.3186.
HUN-2502-095	SE61T	This event is marked by a rapid increase followed by a sustained flat line value over 25 NTU. This is indicative of a false event.	Site visited on 01/03/25, stream clear and flowing. Sensor and stream bed heavily burdened by algae. NTU on arrival 26.2069 and post clean NTU 15.3186.
HUN-2502-096	ND06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected by SciDev , stream clear and flowing. No rain in the proceeding 24 hours. Data indicates a false event. No mining related impact.
HUN-2502-097	SE06T	This event is marked by sporadic peaks. This is indicative of a false event	Site inspected on the 15/02/2025, stream is very shallow, narrow and clear. Sensor is impacted by stream bed sediment and organic matter. No rainfall.
HUN-2502-098	SE52T	This event is marked by a gradual increase and a gradual decrease in turbidity. This is indicative of a false event.	Site inspected on the 14/02/2025, stream level was very low and sensor close to the stream bed within algae/sediment. Data trend indicates false event, likely lense impacted by algae/debris or intermittently out of water

5.5. Excluded WQMS Units

Twenty-eight WQMS Units were excluded from analysis due to erroneous data. Alcoa 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
DB01T	01/02/2025-28/02/2025	Stream dry as of 3/01/2025
FPWR1	01/02/2025-28/02/2025	Stream dry as of 1/01/2025. Monitor offline due to fault.
ND04T	01/02/2025-28/02/2025	Stream dry as of 1/01/2025
ND12T	01/02/2025-28/02/2025	Stream dry as of 21/12/2024
ND13T	01/02/2025-28/02/2025	Stream dry as of 16/01/2025
PD02T	01/02/2025-28/02/2025	No Data
PD03T	01/02/2025-28/02/2025	No Data
SE01T	01/02/2025-28/02/2025	Stream dry as of 4/01/2025
SE03INV3	01/02/2025-28/02/2025	Stream dry as of 28/11/2024.
SE07T	01/02/2025-28/02/2025	Stream dry as of 28/11/2024
SE08T	01/02/2025-28/02/2025	Stream dry as of 31/01/2025
SE09T	01/02/2025-28/02/2025	Stream dry as of 5/01/2025
SE10T	01/02/2025-28/02/2025	Stream dry as of 5/01/2025
SE11T	01/02/2025-28/02/2025	Stream dry as of 28/10/2024
SE12INV	01/02/2025-28/02/2025	Stream dry as of 5/11/2024
SE12T	01/02/2025-28/02/2025	Stream dry as of 8/12/2024
SE15T	01/02/2025-28/02/2025	Stream dry as of 16/11/2024
SE22T	01/02/2025-28/02/2025	Stream dry as of 14/12/2024
SE23T	01/02/2025-28/02/2025	Stream dry as of 15/10/2024
SE24T	01/02/2025-28/02/2025	Stream dry as of 2/11/2024
SE25T	01/02/2025-28/02/2025	Stream dry as of 2/11/2024
SE26T	01/02/2025-28/02/2025	Stream dry as of 15/10/2024
SE34T	01/02/2025-28/02/2025	Stream dry as of 28/12/2024
SE36T	01/02/2025-28/02/2025	Stream dry as of 5/01/2025
SE48T	01/02/2025-28/02/2025	Stream dry as of 23/12/2024
SE60T	01/02/2025-28/02/2025	Stream dry as of 5/12/2024
SE62T	01/02/2025-28/02/2025	Stream dry as of 28/12/2024
SN07T	01/02/2025-28/02/2025	Stream dry as of 26/01/2025

5.6. Missing Data

Periods of missing data are detailed in Table 6.

Table 5 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2502-001	ND06T	12/02/2025 4:54	12/02/2025 9:06	4 hours 12 minutes data loss on 12/02/2025 due to system fault

MD-2502-002	DB02T	2/02/2025 5:24	2/02/2025 10:10	No field notes provided
MD-2502-003	DB02T	12/02/2025 6:52	12/02/2025 9:00	No field notes provided
MD2502-004	DB02T	14/02/2025 8:14	14/02/2025 10:09	No field notes provided
MD2502-005	DB02T	22/02/2025 8:49	22/02/2025 11:39	No field notes provided
MD2502-006	ND07T	2/02/2025 13:50	2/02/2025 17:07	No field notes provided
MD2502-007	ND07T	3/02/2025 16:10	3/02/2025 17:22	No field notes provided
MD2502-008	ND07T	5/02/2025 15:50	5/02/2025 17:17	No field notes provided
MD2502-009	ND07T	6/02/2025 15:13	6/02/2025 18:04	No field notes provided
MD2502-010	ND07T	7/02/2025 15:23	7/02/2025 17:55	No field notes provided
MD2502-011	ND14T	14/02/2025 13:59	14/02/2025 15:05	No field notes provided
MD2502-012	PD01T	7/02/2025 15:13	7/02/2025 16:17	No field notes provided

MD2502-013	PD01T	7/02/2025 18:03	7/02/2025 19:44	No field notes provided
MD2502-014	SE03INV2	6/02/2025 17:07	6/02/2025 21:47	No field notes provided
MD2502-015	SE51T	14/02/2025 22:20	15/02/2025 3:08	No field notes provided
MD2502-016	SE52T	16/02/2025 19:44	17/02/2025 0:32	No field notes provided
MD2502-017	SE61T	9/02/2025 0:48	9/02/2025 1:54	No field notes provided
MD2502-018	SE61T	26/02/2025 3:24	26/02/2025 4:30	No field notes provided

6. References

- Murdoch University (2025). *Alcoamet Daily Rainfall Records*. Retrieved from http://wwwmet.murdoch.edu.au/alcoamet/dailyrainfall.php

7. Appendices

Appendix A. Huntly Raw WQMS Data

Date	Huntly WQMS Data - February2025 - 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
1/02/2025					**2**								**1**				
2/02/2025					**2**								**1**				
3/02/2025												**1**					
4/02/2025													**1**				
5/02/2025													**1**		**1**		
6/02/2025												**1**	**1**				
7/02/2025													**1**	**1**			
8/02/2025		**1**											**1**				
9/02/2025		**1**													**1**		
10/02/2025		**1**															
11/02/2025		**1**								**1`**							
12/02/2025		**1**			**2**										**2**		
13/02/2025																	
14/02/2025																	
15/02/2025													**1**		**1**		
16/02/2025					**1**	**2**							**1**	**1**			
17/02/2025					**1**							**1**	**1**				
18/02/2025																	
19/02/2025																	
20/02/2025																	
21/02/2025															**1**		
22/02/2025																	
23/02/2025					**1**								**1**	**1**			
24/02/2025						**1**											
25/02/2025						**1**											
26/02/2025						**1**											
27/02/2025					**1**	**1**											
28/02/2025					**3**	**1**						**1**			**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 -February2025 - 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
1/02/2025																	
2/02/2025																	
3/02/2025											**1**						
4/02/2025																	
5/02/2025																	
6/02/2025																	
7/02/2025												**2**					
8/02/2025												**1**					
9/02/2025															**1**		
10/02/2025											**1**				**2**		
11/02/2025											**1**				**4**		
12/02/2025															**2**		
13/02/2025											**1**				**3**		
14/02/2025											**2**		**1**		**1**		
15/02/2025																	
16/02/2025											**1**						
17/02/2025																	
18/02/2025																	
19/02/2025											**1**						
20/02/2025											**1**						
21/02/2025											**1**						
22/02/2025											**1**						
23/02/2025											**1**						
24/02/2025											**1**						
25/02/2025																	
26/02/2025											**1**						
27/02/2025											**1**				**3**		
28/02/2025															**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 - February2025 - Events with turbidity > 25 NTU for an hour or more																
	SE03INV2	SE22T	SE23T	SE25T	SE24T	SE03INV1	SE03INV3	SE24T									
1/02/2025																	
2/02/2025																	
3/02/2025																	
4/02/2025	**1**																
5/02/2025																	
6/02/2025																	
7/02/2025																	
8/02/2025																	
9/02/2025																	
10/02/2025																	
11/02/2025																	
12/02/2025																	
13/02/2025																	
14/02/2025	**1**																
15/02/2025																	
16/02/2025																	
17/02/2025																	
18/02/2025																	
19/02/2025																	
20/02/2025																	
21/02/2025	**1**																
22/02/2025																	
23/02/2025																	
24/02/2025																	
25/02/2025																	
26/02/2025																	
27/02/2025																	
28/02/2025						**1**											

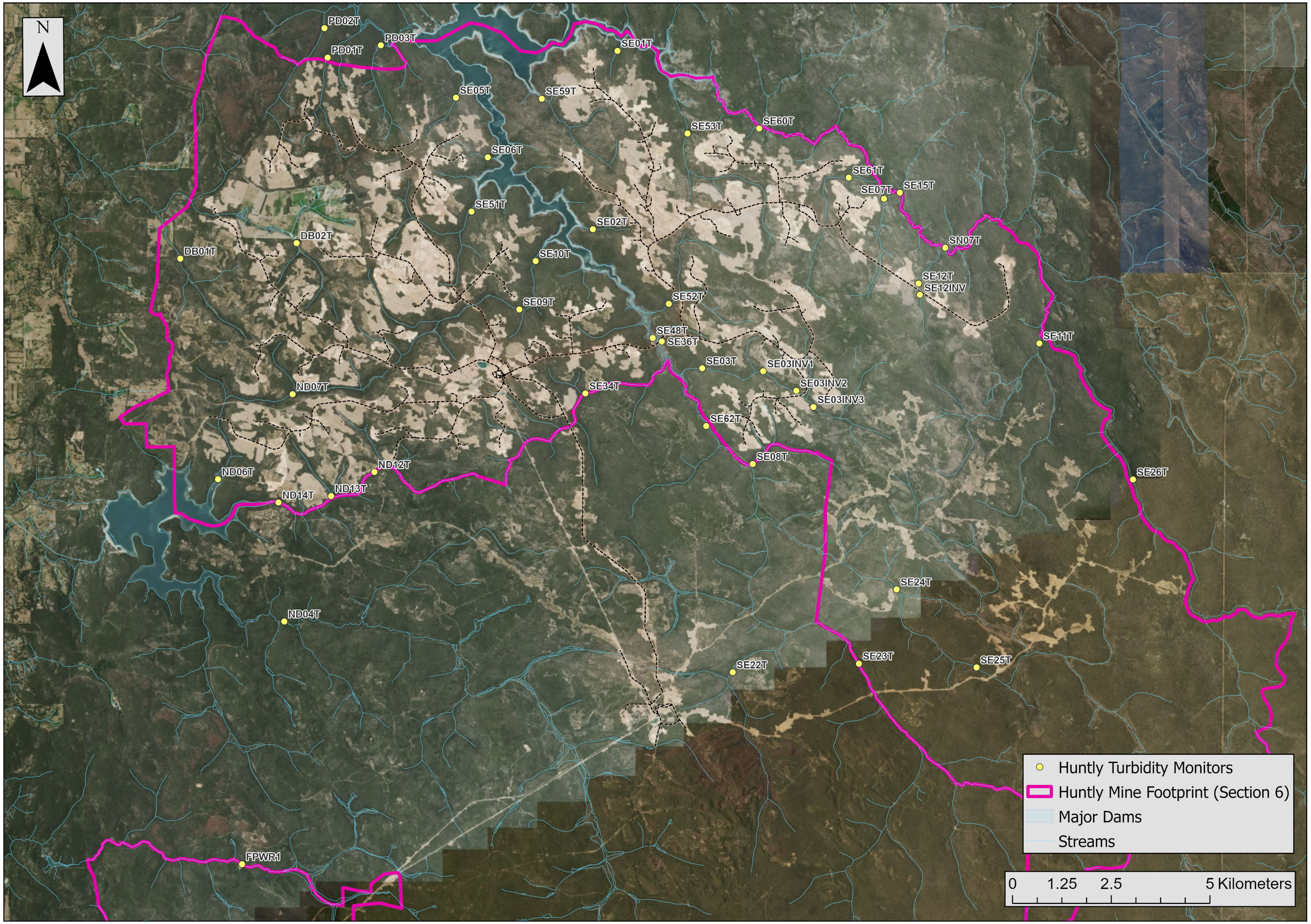
Note: False events have been annotated by **black** bold text. True events for further investigation are annotated by **red** bold text

Date	Huntly WQMS Data - February2025 - Turbidity (Daily Average, NTU)																
	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
1/02/2025		1.36			14.67	3.56				1.78	2.85		9.75	9.57	0.47		
2/02/2025		1.36			44.71	3.00				1.50	3.92		22.07	5.43	1.17		
3/02/2025		1.47			1.25	2.50			1.08	2.29	22.86		14.24	6.88	2.06		
4/02/2025		2.07			1.40	1.98			0.82	1.77	53.89		21.51	7.43	4.04		
5/02/2025		7.36			1.74	1.33			0.91	1.60	7.57		30.15	10.07	37.70		
6/02/2025		4.44			2.33	0.12			0.86	1.73	68.47		17.15	9.46	150.31		
7/02/2025		5.44			3.85	0.53			0.83	1.87	230.05		14.55	27.72	301.09		
8/02/2025		14.80			2.43	2.06			1.26	2.54	359.40		15.71	119.84	351.17		
9/02/2025		19.84			5.27	5.94			2.74	2.32	468.05		7.63	416.53	366.35		
10/02/2025		20.48			7.36	10.26			0.86	2.57	550.46		7.71	389.95	16.21		
11/02/2025		10.01			9.29	12.27			0.85	8.46	609.85		8.99	8.28	4.13		
12/02/2025		19.41			55.83	4.69			24.04	6.69	618.41		9.28	15.49	70.85		
13/02/2025		8.76			10.22	4.90			0.93	4.02	617.63		8.62	13.30	279.07		
14/02/2025		21.16			4.96	7.25			1.20	4.50	291.35		13.02	6.46	167.70		
15/02/2025		11.75			2.76	14.49			0.83	2.90	2.72		32.39	12.75	9.83		
16/02/2025		4.18			6.74	18.76			0.94	1.53	6.84		50.01	24.76	1.02		
17/02/2025		7.38			18.34	18.88			1.43	1.39	64.99		15.25	3.37	0.89		
18/02/2025		6.07			4.00	5.24			0.91	1.90	263.82		7.87	7.92	1.70		
19/02/2025		6.13			3.23	3.60			0.92	2.59	435.88		8.83	9.86	4.19		
20/02/2025		6.37			4.14	10.87			0.96	1.94	590.72		12.80	7.86	16.85		
21/02/2025		6.48			3.00	3.37			1.01	1.77	735.36		14.42	7.14	50.38		
22/02/2025		6.73			5.91	3.24			0.94	1.79	813.65		20.17	13.90	79.42		
23/02/2025		6.76			16.58	5.32			0.86	2.38	850.36		31.50	26.64	148.53		
24/02/2025		6.69			6.50	77.87			0.90	2.23	421.43		21.85	36.92	48.22		
25/02/2025		6.64			3.91	133.74			1.25	3.40	3.18		1.89	3.44	0.77		
26/02/2025		6.49			8.33	172.76			0.87	2.10	3.33		2.68	3.66	0.87		
27/02/2025		6.62			32.54	66.58			0.89	1.96	7.09		3.64	5.65	1.08		
28/02/2025		6.78			50.08	123.98			0.90	1.85	39.21		2.58	5.00	31.47		

Date	Huntly WQMS Data - February2025 - Turbidity (Daily Average, NTU)																
	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
1/02/2025										1.07	7.21	1.47	4.79		17.16		
2/02/2025										1.44	8.46	1.79	5.17		18.49		
3/02/2025										0.34	9.78	1.99	5.84		19.45		
4/02/2025										0.35	8.77	2.34	6.39		20.70		
5/02/2025										0.21	8.70	2.74	8.12		21.43		
6/02/2025										0.42	9.32	10.98	5.06		22.79		
7/02/2025										0.32	10.46	33.64	5.33		23.21		
8/02/2025										0.28	10.40	15.36	6.19		23.82		
9/02/2025										0.46	114.80	17.18	6.96		24.28		
10/02/2025										0.63	94.04	0.90	8.36		25.26		
11/02/2025										0.91	15.67	1.08	7.75		25.78		
12/02/2025										0.30	596.71	1.48	7.98		26.07		
13/02/2025										0.50	59.31	1.13	25.81		26.82		
14/02/2025										3.25	18.51	0.03	9.22		15.79		
15/02/2025										0.47	9.50	0.11	5.61		11.48		
16/02/2025										0.51	10.11	0.15	4.45		13.03		
17/02/2025										0.11	5.82	0.34	4.62		14.44		
18/02/2025										0.07	6.41	0.39	4.90		15.95		
19/02/2025										0.06	10.54	0.17	5.61		17.67		
20/02/2025										0.10	12.78	0.23	6.28		18.65		
21/02/2025										0.07	69.85	0.20	6.72		19.58		
22/02/2025										0.23	18.77	0.06	6.55		20.97		
23/02/2025										0.15	155.15	0.04	6.99		21.88		
24/02/2025										0.06	10.04	0.19	7.88		21.93		
25/02/2025										0.18	6.51	0.25	10.04		23.09		
26/02/2025										0.80	8.57	0.19	13.07		23.98		
27/02/2025										0.18	4.43	0.14	12.35		24.92		
28/02/2025										0.15	4.61	0.06	14.83		25.50		

Date	Huntly WQMS Data - February2025 - Turbidity (Daily Average, NTU)																
	SE03INV2	SE22T	SE23T	SE25T	SE24T	SE03INV1	SE03INV3	SE24T									
1/02/2025	1.42					1.63											
2/02/2025	1.89					1.70											
3/02/2025	5.66					1.88											
4/02/2025	20.88					1.95											
5/02/2025	39.43					1.94											
6/02/2025	9.43					2.84											
7/02/2025	2.73					2.09											
8/02/2025	4.61					2.44											
9/02/2025	7.97					2.52											
10/02/2025	16.67					2.64											
11/02/2025	8.17					3.48											
12/02/2025	11.92					2.64											
13/02/2025	16.62					3.17											
14/02/2025	13.34					2.71											
15/02/2025	1.45					2.68											
16/02/2025	1.42					3.21											
17/02/2025	1.58					2.58											
18/02/2025	2.19					2.69											
19/02/2025	7.19					12.49											
20/02/2025	8.79					2.52											
21/02/2025	9.42					2.64											
22/02/2025	4.25					4.87											
23/02/2025	5.68					2.71											
24/02/2025	7.08					2.63											
25/02/2025	9.64					2.70											
26/02/2025	13.68					3.99											
27/02/2025	18.36					2.76											
28/02/2025	22.00					7.09											

Appendix B. Huntly WQMS Locations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PD03T
PD01T
SE01T
SE05T
SE59T
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SE60T
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SE61T
SE07T
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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

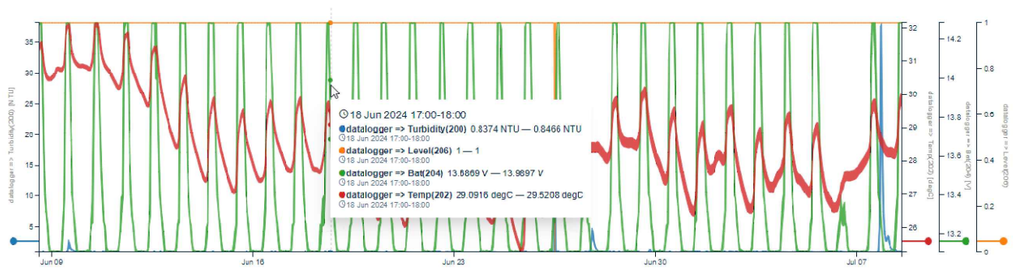
DATA INLET

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.	

ALL DIMENSIONS IN MILLIMETRES U.N.O.
LEVELS ARE IN METRES ON AHD U.N.O.
DO NOT SCALE DRAWING
IF IN DOUBT - ASK
TOLERANCES ISO2768-m U.N.O.

CLIENT

NSW - BUILDING G, 22 POWERS RD, SEVEN HILLS, NSW 2147
(02) 8385 5357
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waterservices@scidev.com.au
www.scidev.com.au
SCIDEV

TITLE
IOT TURBIDITY MONITORING STATION
SITE LAYOUT
GENERAL ARRANGEMENT

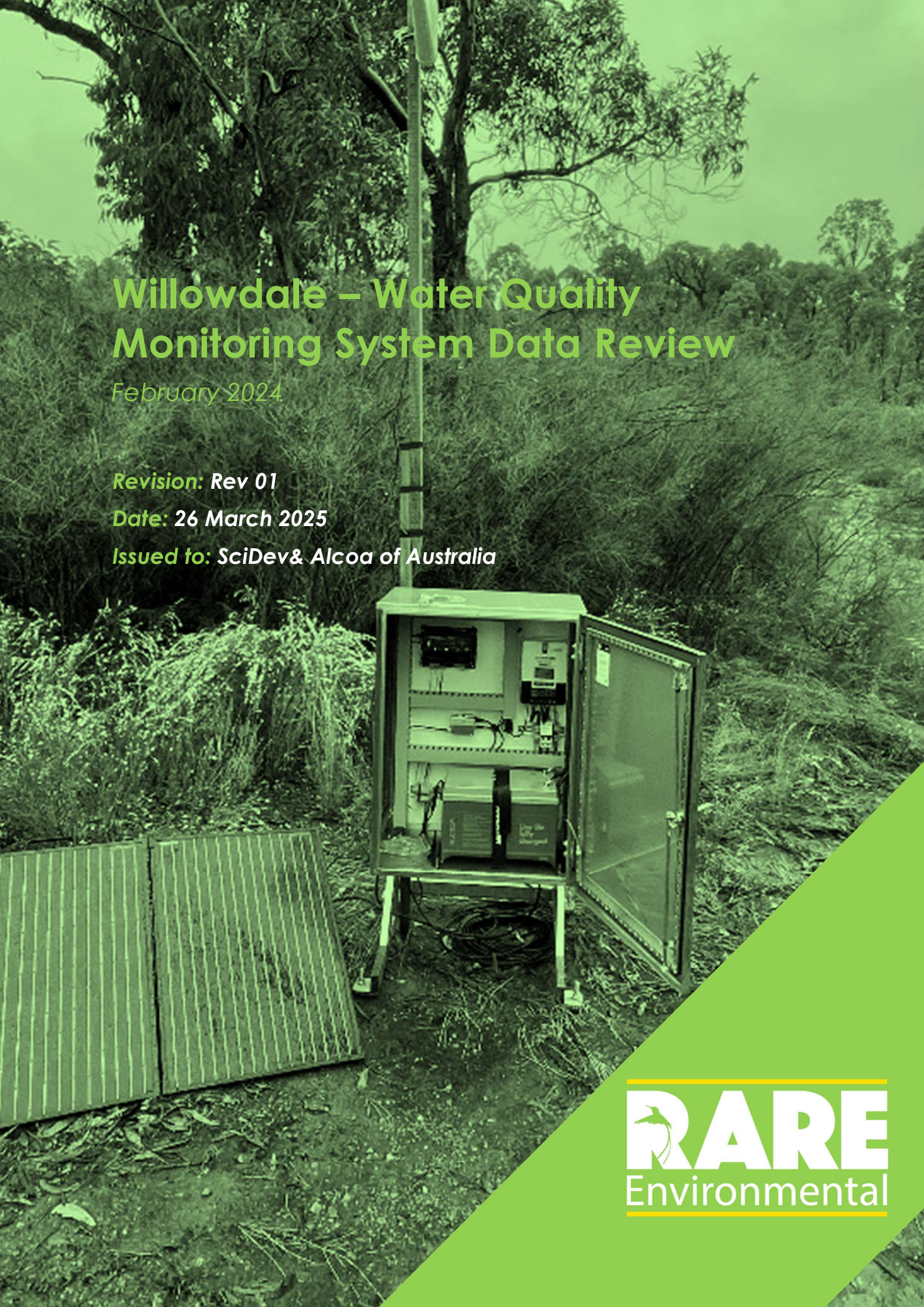
SHEET 1 OF 2

SCALE NTS OR AS SHOWN

DRAWING NO.
HI0090 - ALCOA WQMS

SHEET SIZE
A3

REV.
1



Willowdale – Water Quality Monitoring System Data Review

February 2024

Revision: ***Rev 01***

Date: ***26 March 2025***

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

RARE Environmental

Document Control

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Project Number	RP24050
Client Reference	PO002447

Document History and Status						
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01	26/03/25	Issued to client	MM	GD	GD	Alcoa

Report Sign Off					
Report Version	01				
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	26/03/25	Date	26/03/25	Date	26/03/25

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Infrastructure Sustainability Council MEMBER

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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 February 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**: Zero "true" turbidity exceedance events were identified.
- **Further Investigation**: Zero events were flagged for further investigation.
- **False Events**: Ten '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 logoffs, 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 analyse 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 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 February 2024 monitoring period, 4 Turbidity units were deployed in section 6 areas 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 February 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.

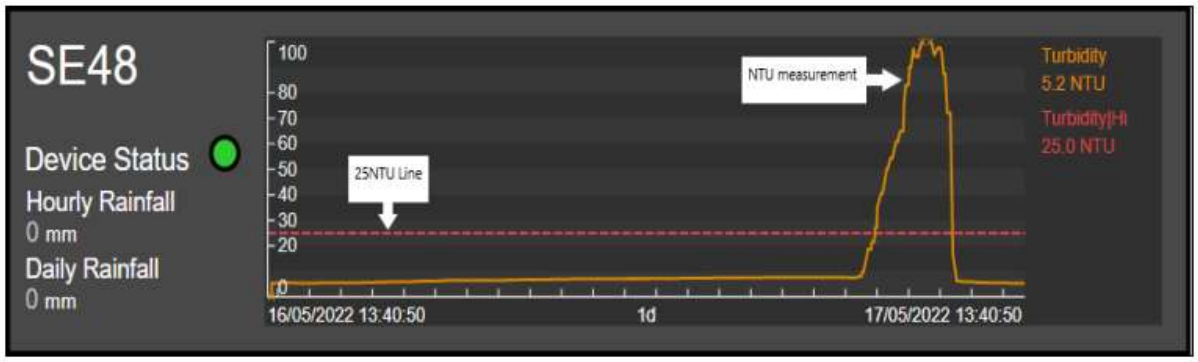


Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

4.2.3. Missing Data

Missing data occurs when a WQMS unit fails to record information, this can occur from unexpected system logoffs, 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
Flagged for further investigation	0
False	10

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
WDL-2502-001	RHB2	'False'	4/02/2025 21:48	4/02/2025 23:00	1 hr 12 min	81.87	32.80
WDL-2502-002	RHB2	'False'	5/02/2025 6:48	5/02/2025 9:00	2 hr 12 min	402.47	191.97
WDL-2502-003	RHB2	'False'	5/02/2025 10:12	5/02/2025 11:36	1 hr 23 min	78.80	47.49
WDL-2502-004	RHB2	'False'	5/02/2025 13:36	5/02/2025 22:18	8 hr 42 min	158.93	60.30
WDL-2502-005	RHB2	'False'	5/02/2025 22:30	6/02/2025 0:18	1 hr 48 min	46.30	34.23
WDL-2502-006	RHB2	'False'	6/02/2025 5:00	6/02/2025 23:48	18 hr 48 min	751.74	208.23
WDL-2502-007	RHB2	'False'	7/02/2025 3:24	7/02/2025 6:30	3 hr 5 min	206.92	78.75
WDL-2502-008	RHB2	'False'	10/02/2025 10:18	10/02/2025 18:54	8 hr 36 min	94.27	46.53

WDL-2502-009	RHB2	'False'	12/02/2025 8:18	12/02/2025 17:24	9 hr 6 min	104.94	63.12
WDL-2502-010	RHB2	'False'	14/02/2025 19:48	14/02/2025 21:18	1 hr 30 min	57.43	39.56

5.2. Additional Investigation

Zero events were identified for further investigation.

5.3. True Event(s)

Zero potential 'true' turbidity events were identified during the reporting period.

5.4. False Event(s)

Ten '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-2502-001	RHB2	This event is marked by a rapid increase and rapid decrease back to background levels, this is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-002	RHB2	This event is marked by a gradual increase and rapid decrease back to background levels with multiple sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-003	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor.

			Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-004	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-005	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-006	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has

			caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-007	RHB2	This event is marked by a rapid increase and rapid decrease back to background levels with multiple sporadic peaks, this is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-008	RHB2	This event is marked by a gradual increase and gradual decrease to background levels with multiple sporadic peaks, this is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.

WDL-2502-009	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.
WDL-2502-010	RHB2	This event is marked by sporadic peaks. This is indicative of a false event	Stream inspected on 15/02/2025 at 9:00am. Stream had very low flow, but was clear at the time of inspection. There were no signs of sediment deposition at the monitor location. Red algae that has caused turbidity issues previously was still present at the monitor. Algae build up was cleaned from the probe sensor and the probe was returned to the stream in a calm section of water (approx. 30cm upstream of previous location). Turbidity readings immediately returned to 8 NTU. Investigation approximately 100m upstream of the monitor location found the stream to be dry. It is likely this stream is fed by groundwater sources. Events classified as false events.

5.5. Excluded WQMS Units

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

Table 4 Excluded WQMS Units

Unit	Dates	Alcoa Comment
HV07	01/02/2025-28/02/2025	Stream dry, probe installed in a bucked of deionised water for protection
HV49T	01/02/2025-28/02/2025	Stream dry, probe installed in a bucked of deionised water for protection

5.6. Missing Data

Periods of missing data are detailed in Table 6.

Table 3 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2502-01	RHB2	22/02/2025	22/02/2025	4 hours of sensor fault logged between 3:18 and 8:48
MD-2502-02	RHB3	10/02/2025	10/02/2025	No data logged 10/02/2025

6. Appendices

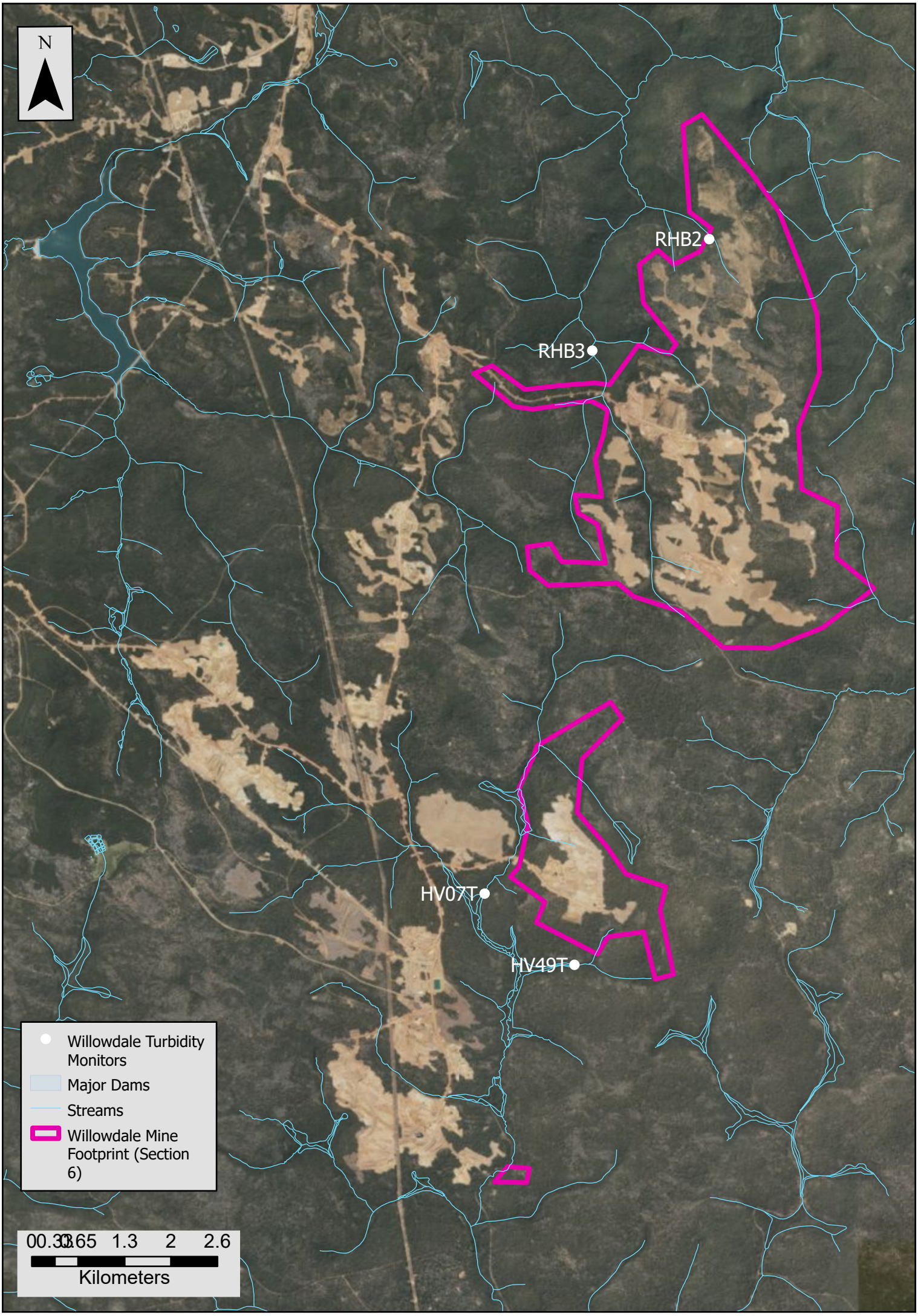
Appendix A. Willowdale Raw WQMS Data

Date	Willowdale WQMS Data - February 2024 - Events with turbidity > 25 NTU for an hour or more			
	HV07T	HV49T	RHB2	RHB3
1/02/2025				
2/02/2025				
3/02/2025				
4/02/2025			**1**	
5/02/2025			**4**	
6/02/2025			**1**	
7/02/2025			**1**	
8/02/2025				
9/02/2025				
10/02/2025			**1**	
11/02/2025				
12/02/2025			**1**	
13/02/2025				
14/02/2025			**1**	
15/02/2025				
16/02/2025				
17/02/2025				
18/02/2025				
19/02/2025				
20/02/2025				
21/02/2025				
22/02/2025				
23/02/2025				
24/02/2025				
25/02/2025				
26/02/2025				
27/02/2025				
28/02/2025				

Date	Willowdale WQMS Data - February 2024 – Daily Average Turbidity (NTU)			
	HV07T	HV49T	RHB2	RHB3
1/02/2025			11.74	0.40
2/02/2025			12.88	0.42
3/02/2025			13.07	0.39
4/02/2025			14.33	0.41
5/02/2025			55.14	0.42
6/02/2025			167.41	0.43
7/02/2025			28.98	0.42
8/02/2025			19.51	0.42
9/02/2025			11.32	0.40
10/02/2025			29.76	
11/02/2025			13.89	0.36
12/02/2025			33.98	0.39
13/02/2025			12.85	0.38
14/02/2025			17.77	0.36
15/02/2025			11.65	0.38
16/02/2025			10.94	0.40
17/02/2025			9.93	0.40
18/02/2025			16.95	0.37
19/02/2025			10.31	0.35
20/02/2025			10.43	0.38
21/02/2025			10.29	0.36
22/02/2025			10.06*	0.37
23/02/2025			11.09	0.40
24/02/2025			14.31	0.42
25/02/2025			10.25	0.41
26/02/2025			11.31	0.41
27/02/2025			9.98	0.39
28/02/2025			12.49	0.40

* - Adjusted average with sensor fault data removed

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

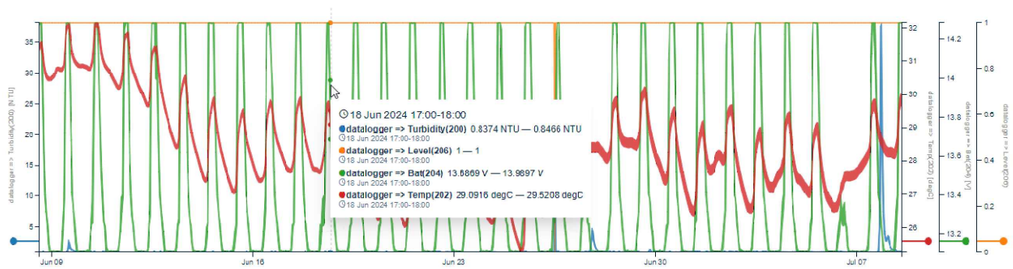
DATA INLET

SENSOR

STREAM DRY

SENSOR

STREAM FLOWING



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

ALL DIMENSIONS IN MILLIMETRES U.N.O.
LEVELS ARE IN METRES ON AHD U.N.O.
DO NOT SCALE DRAWING
IF IN DOUBT - ASK
TOLERANCES ISO2768-m U.N.O.

CLIENT

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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