

Huntly Bauxite Mine – WQMS Data Review

January 2026

Revision: Rev 02

Date: 2 April 2026

Issued to: SciDev & Alcoa of Australia



Document Control

Project Details	
Document Title	Huntly Bauxite Mine – WQMS Data Review
Document No	RP24050 HUN WQMS Data Review - January 2026
Project Name	SciDev WQ Data Processing
Project Number	RP24050
Client	SciDev
Client Reference	PO002447

Document History and Status						
Revision	Date	Description	Prepared	Reviewed	Approved	Issued to
01	12/03/26	Issued for review	MM	GD	GD	Alcoa
02	02/04/26	Amended with comments	MM	GD	GD	Alcoa

Report Sign Off					
Report Version	02				
Prepared by	Technical Review		Approved for Issue		
<i>Michael Minter</i>	<i>Georgia Duffy</i>		<i>Georgia Duffy</i>		
Name	Michael Minter	Name	Georgia Duffy	Name	Georgia Duffy
Position	Env. Engineer	Position	Chemical Engineer	Position	Chemical Engineer
Date	02/04/26	Date	02/04/26	Date	02/04/26

RARE Environmental Pty Ltd
 ABN 41617855017
 110/117 Old Pittwater Rd
 Brookvale NSW 2100 Australia
 P: 0413 223 401
www.rare-enviro.com.au



Contents

Document Control	2
1. Executive Summary	4
2. Scope	5
3. Introduction.....	6
3.1. Background.....	6
3.2. Monitoring requirements	6
3.3. Water Quality Management Systems (WQMSs).....	6
3.4. Purpose.....	7
3.5. Exclusions	7
3.6. Abbreviations.....	7
4. Methodology.....	8
4.1. WQMS Locations	8
4.2. Data Review	8
4.2.1. True Turbidity Exceedance Events.....	8
4.2.2. False Turbidity Exceedance Events.....	8
4.2.3. Missing Data	9
5. Results and Discussion	10
5.1. Events	10
5.2. Additional Investigation	12
5.3. True Event(s).....	12
5.4. False Event(s).....	12
5.5. Excluded WQMS Units.....	23
5.6. Missing Data	24
6. Appendices.....	25
Appendix A. Huntly Raw WQMS Data	26
Appendix B. Huntly WQMS Locations	33
Appendix C. WQMS General Arrangement	35

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 (WQMS) deployed at the Huntly bauxite mining operations during January 2026. 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:

- **Excluded Units:** Thirty-two WQMS units were excluded from the analysis due to invalid data caused by equipment faults or environmental interference.
- **False Events:** Thirty-six 'False' events were identified, primarily attributed to factors such as debris accumulation, sensor obstructions, and water turbulence.
- **Further Investigation:** Zero events were flagged for further investigation.
- **True Events:** Zero "True" turbidity exceedance events were identified.

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 January 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 January 2026 monitoring period, forty-three 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 six seconds, with six-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 January 2026, 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.

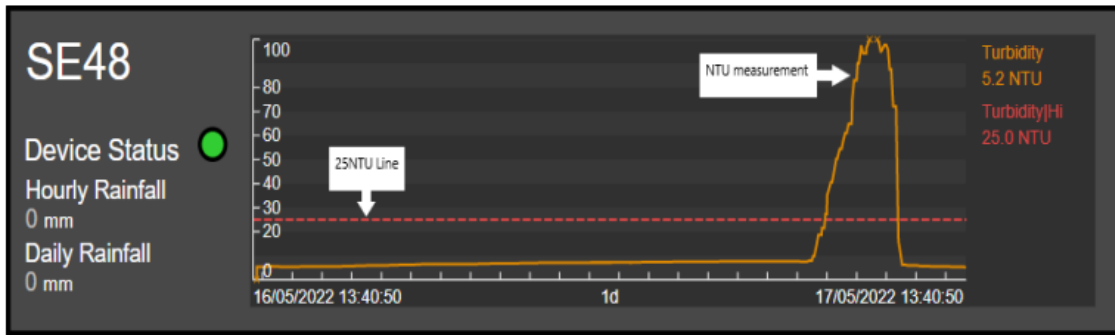


Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline.

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	36

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Average Turbidity (NTU)	Peak Turbidity (NTU)
HUN-2601-001	ND06T	'False'	01/01/2026 00:30:01	01/01/2026 01:36:01	1h 6m	1212.20	2110.50
HUN-2601-002	ND06T	'False'	07/01/2026 00:18:01	07/01/2026 01:24:01	1h 6m	82.50	133.60
HUN-2601-003	ND07T	'False'	02/01/2026 07:12:01	02/01/2026 08:30:01	1h 18m	30.40	33.60
HUN-2601-004	SE02T	'False'	01/01/2026 01:54	01/01/2026 07:54	6h 00m	37.70	57.30
HUN-2601-005	SE02T	'False'	01/01/2026 11:06	01/01/2026 14:06	3h 00m	25.80	27.10
HUN-2601-006	SE02T	'False'	01/01/2026 15:06	01/01/2026 16:12	1h 06m	27.00	28.40
HUN-2601-007	SE02T	'False'	01/01/2026 17:00	01/01/2026 19:12	2h 12m	27.20	28.20
HUN-2601-008	SE02T	'False'	01/01/2026 19:30	01/01/2026 20:42	1h 12m	27.40	28.10
HUN-2601-009	SE02T	'False'	01/01/2026 21:24	04/01/2026 11:18	61h 54m	155.60	496.10
HUN-2601-010	SE03INV1	'False'	01/01/2026 00:00	04/01/2026 10:12	82h 12m	195.90	289.30
HUN-2601-011	SE03INV1	'False'	23/01/2026 16:00	31/01/2026 13:05	189h 05m	61.40	1044.90
HUN-2601-012	SE03T	'False'	01/01/2026 00:00	01/01/2026 01:00	1h 00m	45.40	53.40
HUN-2601-013	SE03T	'False'	01/01/2026 15:06	02/01/2026 02:42	11h 36m	42.50	71.30
HUN-2601-014	SE03T	'False'	02/01/2026 14:54	03/01/2026 03:06	12h 12m	47.10	492.60
HUN-2601-015	SE03T	'False'	03/01/2026 14:36	04/01/2026 03:42	13h 06m	45.30	59.70
HUN-2601-016	SE03T	'False'	21/01/2026 02:18	21/01/2026 05:24	3h 06m	40.70	52.60

Event ID	WQMS ID	Event Category	Start	End	Duration	Average Turbidity (NTU)	Peak Turbidity (NTU)
HUN-2601-017	SE03T	'False'	21/01/2026 15:36	22/01/2026 06:36	15h 00m	225.30	370.50
HUN-2601-018	SE03T	'False'	22/01/2026 08:06	23/01/2026 02:12	18h 06m	142.60	348.20
HUN-2601-019	SE03T	'False'	23/01/2026 06:06	24/01/2026 09:12	27h 06m	313.60	486.80
HUN-2601-020	SE03T	'False'	24/01/2026 13:48	25/01/2026 03:24	13h 36m	199.50	297.00
HUN-2601-021	SE05T	'False'	30/01/2026 05:30	30/01/2026 06:30	1h 00m	39.80	76.30
HUN-2601-022	SE06T	'False'	02/01/2026 01:24:01	02/01/2026 04:06:01	2h 42m	46.00	72.00
HUN-2601-023	SE06T	'False'	02/01/2026 04:54:01	02/01/2026 06:18:01	1h 24m	32.10	39.10
HUN-2601-024	SE06T	'False'	02/01/2026 06:30:01	06/01/2026 01:30:01	3d 19h 0m	151.90	760.40
HUN-2601-025	SE06T	'False'	06/01/2026 02:00:01	06/01/2026 03:00:01	1h 0m	55.80	139.40
HUN-2601-026	SE06T	'False'	12/01/2026 12:42:01	12/01/2026 20:24:01	7h 42m	71.30	110.10
HUN-2601-027	SE06T	'False'	15/01/2026 22:36:01	16/01/2026 00:18:01	1h 42m	97.40	143.60
HUN-2601-028	SE06T	'False'	19/01/2026 03:00:01	26/01/2026 14:18:00	7d 11h 18m	771.30	3574.10
HUN-2601-029	SE06T	'False'	27/01/2026 13:36:01	27/01/2026 21:24:01	7h 48m	40.00	112.50
HUN-2601-030	SE06T	'False'	27/01/2026 21:36:01	29/01/2026 05:06:01	1d 7h 30m	184.70	1136.90
HUN-2601-031	SE06T	'False'	29/01/2026 05:36:01	30/01/2026 12:00:39	1d 6h 25m	158.00	825.30
HUN-2601-032	SE52T	'False'	01/01/2026 04:06:01	01/01/2026 13:00:01	8h 54m	46.40	76.10
HUN-2601-033	SE52T	'False'	01/01/2026 15:06:01	01/01/2026 16:12:01	1h 6m	27.10	28.60
HUN-2601-034	SE52T	'False'	01/01/2026 16:24:01	01/01/2026 19:00:01	2h 36m	30.90	42.00
HUN-2601-035	SE52T	'False'	02/01/2026 04:30:01	02/01/2026 09:06:01	4h 36m	96.50	183.20
HUN-2601-036	SE52T	'False'	02/01/2026 12:36:01	04/01/2026 08:18:01	1d 19h 42m	288.40	2469.80

5.2. Additional Investigation

Zero events were flagged for additional investigation.

5.3. True Event(s)

Zero 'True' turbidity events were identified during the period.

5.4. False Event(s)

Thirty-six '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-2601-001	ND06T	This event shows an abrupt rise to a sustained elevated plateau followed by a sharp return to baseline. The prolonged high-level response and abrupt “reset” is likely influenced by probe position effects, intermittent exposure, or localised interference.	Site inspected on 04/01/2026, stream flow and depth had decreased, and the sensor was positioned out of the water. Cleaned and repositioned into the stream.
HUN-2601-002	ND06T	This event does not present as a single clean pulse and includes an abrupt rise, short, elevated phase and sharp return to baseline. On this basis it is treated as false and likely influenced by localised sediment interference or sensor effects.	Site inspected on 17/01/2026. The sensor was sitting on the stream bed and was impacted by stream bed sediment. The sensor was cleaned and repositioned to a deeper part of the stream.
HUN-2601-003	ND07T	This event is characterised by a marginal exceedance close to the trigger threshold with limited pulse structure and no distinct recession pattern. This pattern is consistent with a false event and may reflect baseline effects, low-flow sensor influence, or other localised interference.	Site inspected on 2/1/2026. The stream depth has decreased, and the sensor was positioned above the water.
HUN-2601-004	SE02T	This event is characterised by a sustained elevated response with limited structure. likely reflecting probe/baseline effects.	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2601-005	SE02T	This event is characterised by a marginal exceedance with very limited pulse structure. The near-constant value elevation is to baseline instability or probe interference.	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.
HUN-2601-006	SE02T	This event does not present as a single clean pulse and instead shows a short exceedance with limited rise and recession. The irregular pattern is more consistent with a false event, likely influenced by localised sensor effects or baseline elevation	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.
HUN-2601-007	SE02T	This event is characterised by a sustained, near-constant elevation with limited pulse structure and no distinct Gaussian-style recession. This pattern is consistent with a false event and likely reflects probe/baseline effects rather than a genuine in-stream turbidity increase.	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.
HUN-2601-008	SE02T	This event is characterised by a short-duration, low-level exceedance remaining close to the trigger threshold without a distinct peak and recession pattern. The event shape is not consistent with a true turbidity pulse and is instead indicative of a false	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.

Event ID	Monitor ID	Rationale	Field Notes
		event, likely reflecting baseline effects or localised interference at the probe.	
HUN-2601-009	SE02T	This event shows a prolonged elevated response with multiple irregular step changes and no single smooth rise and recession back to baseline. The extended duration and progressive drift-like behaviour are indicative of a false event, likely associated with probe/baseline effects or localised interference.	Site inspected on 04/01/2026 and stream is low and slightly tannin. The stream bed, sensor and float were heavily impacted with algae. Data trend supports sensor impacted from algae.
HUN-2601-010	SE03INV1	This event is characterised by a prolonged elevated response with gradual increase in turbidity, and an abrupt return to near-zero. This pattern is inconsistent with a true turbidity pulse and is more indicative of a false event, likely reflecting probe/baseline effects or localised sensor interference.	Site inspected 4/01/2026, sensor heavily impacted by algae/decaying organic matter. Turbidity value on arrival 263.11 which dropped to 0.61 NTU post clean.
HUN-2601-011	SE03INV1	This event does not present as a single clean pulse and instead includes multiple irregular spikes followed by a prolonged elevated period above the trigger threshold. The extended duration and irregular pulse structure are consistent with a false event, likely	Site inspected on 31/01/2026, stream flowing, shallow and clear. Sensor heavily impacted by algae/leaf litter. Pre clean NTU 46.1238 and post clean NTU 1.7516.

Event ID	Monitor ID	Rationale	Field Notes
		influenced by localised interference at the sensor face	
HUN-2601-012	SE03T	This event is characterised by a sustained elevated reading followed by a gradual decline. The absence of a defined event peak and the progressive fall toward baseline are indicative of a false event, likely reflecting probe exposure or baseline effects.	Stream level dropped, causing the sensor to be exposed. The lens was cleaned and the sensor repositioned to mid-depth. Turbidity readings stabilised at a baseline of 1.25 NTU.
HUN-2601-013	SE03T	This event is characterised by a sustained, near-constant elevation with limited pulse structure and no distinct Gaussian-style recession. The broad elevated plateau and abrupt disturbances at the start and end of the event are consistent with a false event, likely reflecting probe/baseline effects associated with low water level.	Stream level dropped, causing the sensor to be exposed. The lens was cleaned and the sensor repositioned to mid-depth. Turbidity readings stabilised at a baseline of 1.25 NTU.
HUN-2601-014	SE03T	This event does not present as a single clean pulse and instead includes a sustained elevated plateau with an isolated sharp spike above the broader event trend. This pattern is indicative of a false event, likely influenced by localised interference or probe effects.	Stream level dropped, causing the sensor to be exposed. The lens was cleaned and the sensor repositioned to mid-depth. Turbidity readings stabilised at a baseline of 1.25 NTU.
HUN-2601-015	SE03T	This event is characterised by a rapid rise to a sustained elevated plateau followed by an abrupt decline. The	Stream level dropped, causing the sensor to be exposed. The lens was cleaned and the sensor repositioned to mid-depth. Turbidity readings stabilised at a baseline of 1.25 NTU.

Event ID	Monitor ID	Rationale	Field Notes
		prolonged near-constant elevation and reset-like drop are indicative of a false event, likely reflecting baseline instability or probe exposure effects.	
HUN-2601-016	SE03T	This event does not present as a single clean pulse and instead shows an abrupt rise above the trigger threshold followed by an uneven decline with additional irregular pulses. The event shape is indicative of a false event, likely reflecting localised probe interference or unstable sensor conditions	Site was visited on 30/01/2026. Stream level was very low, with the sensor only just remaining submerged. The level float sensor data has been fluctuating between 1 (flow) and 0 (dry) since 15/01/2026 due to the low water level. The sensor was found to be impacted by sediment and decaying organic matter from the stream bed, and it was removed and cleaned. The erratic data trend is consistent with a false event caused by the debris.
HUN-2601-017	SE03T	This event is characterised by a prolonged elevated response with multiple plateaus, abrupt step changes and reset-like drops. This pattern is indicative of a false event, likely related to probe/baseline effects under low-flow conditions.	Site was visited on 30/01/2026. Stream level was very low, with the sensor only just remaining submerged. The level float sensor data has been fluctuating between 1 (flow) and 0 (dry) since 15/01/2026 due to the low water level. The sensor was found to be impacted by sediment and decaying organic matter from the stream bed, and it was removed and cleaned. The erratic data trend is consistent with a false event caused by the debris.
HUN-2601-018	SE03T	This event does not present as a single pulse and instead includes multiple irregular spikes above the trigger threshold, likely influenced by localised interference at the sensor face.	Site was visited on 30/01/2026. Stream level was very low, with the sensor only just remaining submerged. The level float sensor data has been fluctuating between 1 (flow) and 0 (dry) since 15/01/2026 due to the low water level. The sensor was found to be impacted by sediment and decaying organic matter from the stream bed, and it was removed and cleaned.

Event ID	Monitor ID	Rationale	Field Notes
			The erratic data trend is consistent with a false event caused by the debris.
HUN-2601-019	SE03T	This event is characterised by repeated abrupt rises and drops, rather than a single smooth event pulse. The irregular and blocky structure is indicative of a false event, likely reflecting probe effects, unstable wetted conditions, or localised interference	Site was visited on 30/01/2026. Stream level was very low, with the sensor only just remaining submerged. The level float sensor data has been fluctuating between 1 (flow) and 0 (dry) since 15/01/2026 due to the low water level. The sensor was found to be impacted by sediment and decaying organic matter from the stream bed, and it was removed and cleaned. The erratic data trend is consistent with a false event caused by the debris.
HUN-2601-020	SE03T	This event is characterised by an irregular rise into a sustained elevated plateau followed by an abrupt recession. The prolonged elevated signal and reset-like decline are consistent with a false event, likely reflecting baseline instability, unstable sensor conditions, or localised interference.	Site was visited on 30/01/2026. Stream level was very low, with the sensor only just remaining submerged. The level float sensor data has been fluctuating between 1 (flow) and 0 (dry) since 15/01/2026 due to the low water level. The sensor was found to be impacted by sediment and decaying organic matter from the stream bed, and it was removed and cleaned. The erratic data trend is consistent with a false event caused by the debris.
HUN-2601-021	SE05T	This event does not present as a single clean turbidity pulse and instead shows a brief elevated response with irregular pulse structure likely reflecting localised sensor interference or unstable probe conditions.	Site inspected on 30/01/2026, stream is flowing, low and clear. The sensor and stream bed was heavily impacted by red algae/oxide.
HUN-2601-022	SE06T	This event does not present as a single clean pulse and instead shows an abrupt rise from low baseline to an	Data trend indicates false event, sharp incline and decline with erratic trend and very high peaks. The stream level is very low, and the stream bed is heavily burdened by natural

Event ID	Monitor ID	Rationale	Field Notes
		erratic elevated response, followed by an uneven decline rather than a smooth recession. This is indicative of a false event.	sediment and decaying organic debris which is interfering with the sensor.
HUN-2601-023	SE06T	This event is characterised by a marginal exceedance close to the trigger threshold with limited structure. The irregular pattern is indicative of a false event, likely reflecting baseline instability or localised sensor effects.	Data trend indicates false event, sharp incline and decline with erratic trend. The stream level is very low, and the stream bed is heavily burdened by natural sediment and decaying organic debris which is interfering with the sensor.
HUN-2601-024	SE06T	This event is characterised by a prolonged elevated response with multiple irregular step changes, and spikes. The extended duration and highly erratic structure are indicative of a false event, likely reflecting probe/baseline effects and localised interference.	Data trend indicates false event, sharp incline and decline with erratic trend and very high peaks. The stream level is very low, and the stream bed is heavily burdened by natural sediment and decaying organic debris which is interfering with the sensor.
HUN-2601-025	SE06T	This event does not represent a clean pulse and instead appears as a short residual elevated response with irregular fluctuations. This pattern is indicative of a false event, likely reflecting ongoing probe instability or residual localised interference	Data trend indicates false event, sharp incline and decline with erratic trend and very high peaks. The stream level is very low, and the stream bed is heavily burdened by natural sediment and decaying organic debris which is interfering with the sensor.
HUN-2601-026	SE06T	This event is characterised by a sustained elevated plateau with gradual upward drift and an abrupt return to	Site inspected on 17/01/2026. The stream level is very low, and the stream bed is heavily burdened by natural sediment

Event ID	Monitor ID	Rationale	Field Notes
		near baseline. This pattern is indicative of a false event, likely reflecting probe/baseline effects under shallow flow conditions.	and decaying organic debris which is interfering with the sensor. The sensor is only just submerged.
HUN-2601-027	SE06T	This event does not present as a single clean pulse and instead includes multiple abrupt rises and short elevated plateaus above the trigger threshold. The irregular structure is indicative of a false event, likely influenced by unstable conditions and localised interference at the sensor.	Site inspected on 17/01/2026. The stream level is very low, and the stream bed is heavily burdened by natural sediment and decaying organic debris which is interfering with the sensor. The sensor is only just submerged.
HUN-2601-028	SE06T	This event is characterised by a prolonged elevated response with multiple large spikes. This pattern is indicative of a false event, likely reflecting localised interference and probe effects under very low flow conditions.	Site inspected due to Turbidity reading 'failure' message on Pi. The stream level was low, slowly flowing and sediment/leaf litter has built up on the stream bed as noted on previous inspections. The built-up sediment and leaf litter was impacting the sensor which is positioned just below the low stream water level on the stream bed. The sensor was cleaned which cleared the error message. On arrival the turbidity reading was 2005.66, then post-cleaning significantly dropped to 1.21 NTU.
HUN-2601-029	SE06T	This event is characterised by a marginal exceedance with limited pulse structure and no clear recession pattern. The event shape is indicative of a false event, likely reflecting baseline instability or localised sediment interference at the sensor.	Site inspected on 30/01/2026, stream is flowing, very shallow and clear. The sensor was impacted by stream bed sediment and algae. The data trend incline and decline spikes support sensor was impacted by sediment.

Event ID	Monitor ID	Rationale	Field Notes
HUN-2601-030	SE06T	This event does not present as a single clean pulse and instead includes multiple irregular spikes and elevated periods above the trigger threshold. The erratic structure is consistent with a false event, likely influenced by localised sediment interference and unstable probe conditions.	Site inspected on 30/01/2026, stream is flowing, very shallow and clear. The sensor was impacted by stream bed sediment and algae. The data trend incline and decline spikes support sensor was impacted by sediment
HUN-2601-031	SE06T	This event is characterised by a sustained elevated response with irregular spikes and plateaus, followed by an abrupt return to near-zero. This pattern is indicative of a false event, likely reflecting probe/baseline effects or localised interference at the sensor.	Site inspected on 30/01/2026, stream is flowing, very shallow and clear. The sensor was impacted by stream bed sediment and algae. The data trend incline and decline spikes support sensor was impacted by sediment.
HUN-2601-032	SE52T	This event is characterised by a sustained elevated response with gradual upward drift. This pattern is indicative of a false event, likely reflecting probe/baseline effects or localised interference at the sensor.	Site visited on 04/01/2026 and stream low and clear. Stream bed and sensor heavily impacted by green algae likely contributed to event.
HUN-2601-033	SE52T	This event is characterised by a marginal exceedance close to the trigger threshold with limited pulse structure and no distinct bell-shaped recession. This is inconsistent indicative of a false event, likely reflecting	Site vested on 04/01/2026 and stream low and clear. Stream bed and sensor heavily impacted by green algae likely contributed to event.

Event ID	Monitor ID	Rationale	Field Notes
		baseline instability or localised probe effects.	
HUN-2601-034	SE52T	This event does not present as a single clean pulse and instead shows a gradual increase followed by an abrupt decline to baseline. This is indicative of a false event, likely influenced by localised interference at the sensor face.	Site visited on 04/01/2026 and stream low and clear. Stream bed and sensor heavily impacted by green algae likely contributed to event.
HUN-2601-035	SE52T	This event does not present as a single clean pulse and instead is characterised by a sustained elevated plateau with multiple internal peaks followed by a sharp recession. This is indicative of a false event, likely influenced by localised interference at the sensor face.	Site visited on 04/01/2026 and stream low and clear. Stream bed and sensor heavily impacted by green algae likely contributed to event.
HUN-2601-036	SE52T	This event is characterised by a prolonged elevated response with multiple irregular step changes, extreme late-stage spikes and abrupt reset behaviour. This is indicative of a false event, likely reflecting localised interference and probe effects.	Site visited on 04/01/2026 and stream low and clear. Stream bed and sensor heavily impacted by green algae likely contributed to event.

5.5. Excluded WQMS Units

Thirty-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/	Comments
DB01T	03/12/2025-31/01/2026	Stream dry on 3/12/2025
FPWR1	12/11/2025-31/01/2026	Stream dry as of 12/11/2025
ND04T	02/12/2025-31/01/2026	Stream dry as of 2/12/2025
ND12T	15/12/2025-31/01/2026	Stream dry as of 15/12/2025
ND13T	13/01/2026-31/01/2026	Stream dry as of 13/01/2026
PD02T	01/12/2025-31/01/2026	Awaiting Water Corp approval to access Pipe head catchment area
PD03T	01/12/2025-31/01/2026	Awaiting Water Corp approval to access Pipe head catchment area
SE01T	01/12/2025-31/01/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE03INV3	01/12/2025-31/01/2026	Stream dry as of 1/12/2025
SE04T	20/11/2025-31/01/2026	New monitoring site installed 20/11/2025, stream dry at time of installation.
SE07T	01/11/2025-30/11/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE08T	09/01/2026-31/01/2026	Stream dry as of 9/01/2026
SE09T	04/01/2026-31/01/2026	Site inspected on 04/01/2026 and stream is dry.
SE10T	01/01/2026-31/01/2026	Stream dry as of 1/01/2026
SE11T	01/12/2025-31/01/2026	Stream dry as of 3/11/2025 at 2:48 AM
SE12INV	12/11/2025-31/01/2026	Stream dry as of 12/11/2025
SE12T	03/12/2025-31/01/2026	Stream dry as of 3/12/2025
SE12INV	12/11/2025-31/01/2026	Stream dry as of 12/11/2025
SE15T	01/12/2025-31/01/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE22T	01/12/2025-31/01/2026	Stream dry as of 1/12/2025
SE23T	3/10/2025 -31/01/2026	Stream dry as of 3/10/2025 at 1:42 PM
SE24T	12/11/2025-31/01/2026	Stream dry as of 12/11/2025
SE25T	12/11/2025-31/01/2026	Stream dry as of 12/11/2025
SE26T	28/09/2025-31/01/2026	Stream dry as of 28/09/2025 (dry stream false events omitted)
SE34T	15/12/2025-31/01/2026	Stream dry as of 15/12/2025

SE36T	19/12/2025-31/01/2026	Stream dry as of 19/12/2025
SE48T	21/12/2025-31/01/2026	Stream dry as of 21/12/2025
SE53T	18/09/2025-31/01/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE60T	18/09/2025-31/01/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE61T	18/09/2025-31/01/2026	Unit removed from the field on 18/09/2025 due to DBCA prescribed burns. Awaiting DBCA approval to access for reinstatement once prescribed burns are completed.
SE62T	17/12/2025-31/01/2026	Stream dry as of 17/12/2025
SN07T	31/01/2026-31/01/2026	Stream dry as of 31/01/2026

5.6. Missing Data

Periods of missing data are detailed in Table 5.

Table 5 Missing Data Summary

Missing Data ID	Unit	Start	End	Comments
MD-2601-001	ND07T	30/01/2026 01:36:01	31/01/2026 23:54:02	Level float sensor fluctuating between 0 (dry) and 1 (flow) from 7/01/2026 to 31/01/2026 due to low water level.
MD-2601-002	SE02T	04/01/2026 11:18:01	14/01/2026 14:12:01	Sensor reading fault code 4/01/2026 to 14/01/2026. Equipment repaired on 14/01/2026.
MD-2601-003	SE05T	04/01/2026 13:48:01	05/01/2026 03:54:01	Sensor reading fault code and below calibration intermittently from 1/01/2026 to 14/01/2026 due to equipment fault. Equipment repaired on 14/01/2026

6. Appendices

Appendix A. Huntly Raw WQMS Data

Huntly WQMS Data – January 2026 - Events with turbidity > 25 NTU for an hour or more																	
Date	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
01/01/2026					1							6	2				
02/01/2026						1							1		3		
03/01/2026													1				
04/01/2026																	
05/01/2026																	
06/01/2026															2		
07/01/2026					1												
08/01/2026																	
09/01/2026																	
10/01/2026																	
11/01/2026																	
12/01/2026															1		
13/01/2026																	
14/01/2026																	
15/01/2026																	
16/01/2026															1		
17/01/2026																	
18/01/2026																	
19/01/2026																	
20/01/2026																	
21/01/2026													2				
22/01/2026													1				
23/01/2026													1				
24/01/2026													1				
25/01/2026																	
26/01/2026															1		
27/01/2026															1		
28/01/2026																	
29/01/2026															1		
30/01/2026														1	1		
31/01/2026																	

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

Huntly WQMS Data -January 2026 - Events with turbidity > 25 NTU for an hour or more																	
Date	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
01/01/2026											3						
02/01/2026											2						
03/01/2026																	
04/01/2026																	
05/01/2026																	
06/01/2026																	
07/01/2026																	
08/01/2026																	
09/01/2026																	
10/01/2026																	
11/01/2026																	
12/01/2026																	
13/01/2026																	
14/01/2026																	
15/01/2026																	
16/01/2026																	
17/01/2026																	
18/01/2026																	
19/01/2026																	
20/01/2026																	
21/01/2026																	
22/01/2026																	
23/01/2026																	
24/01/2026																	
25/01/2026																	
26/01/2026																	
27/01/2026																	
28/01/2026																	
29/01/2026																	
30/01/2026																	
31/01/2026																	

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

Huntly WQMS Data – January 2026 - Events with turbidity > 25 NTU for an hour or more																
Date	SE22T	SE23T	SE24T	SE25T	SE26T	SE03INV1	SE03INV3									
01/01/2026						1										
02/01/2026																
03/01/2026																
04/01/2026																
05/01/2026																
06/01/2026																
07/01/2026																
08/01/2026																
09/01/2026																
10/01/2026																
11/01/2026																
12/01/2026																
13/01/2026																
14/01/2026																
15/01/2026																
16/01/2026																
17/01/2026																
18/01/2026																
19/01/2026																
20/01/2026																
21/01/2026																
22/01/2026																
23/01/2026						1										
24/01/2026																
25/01/2026																
26/01/2026																
27/01/2026																
28/01/2026																
29/01/2026																
30/01/2026																
31/01/2026																

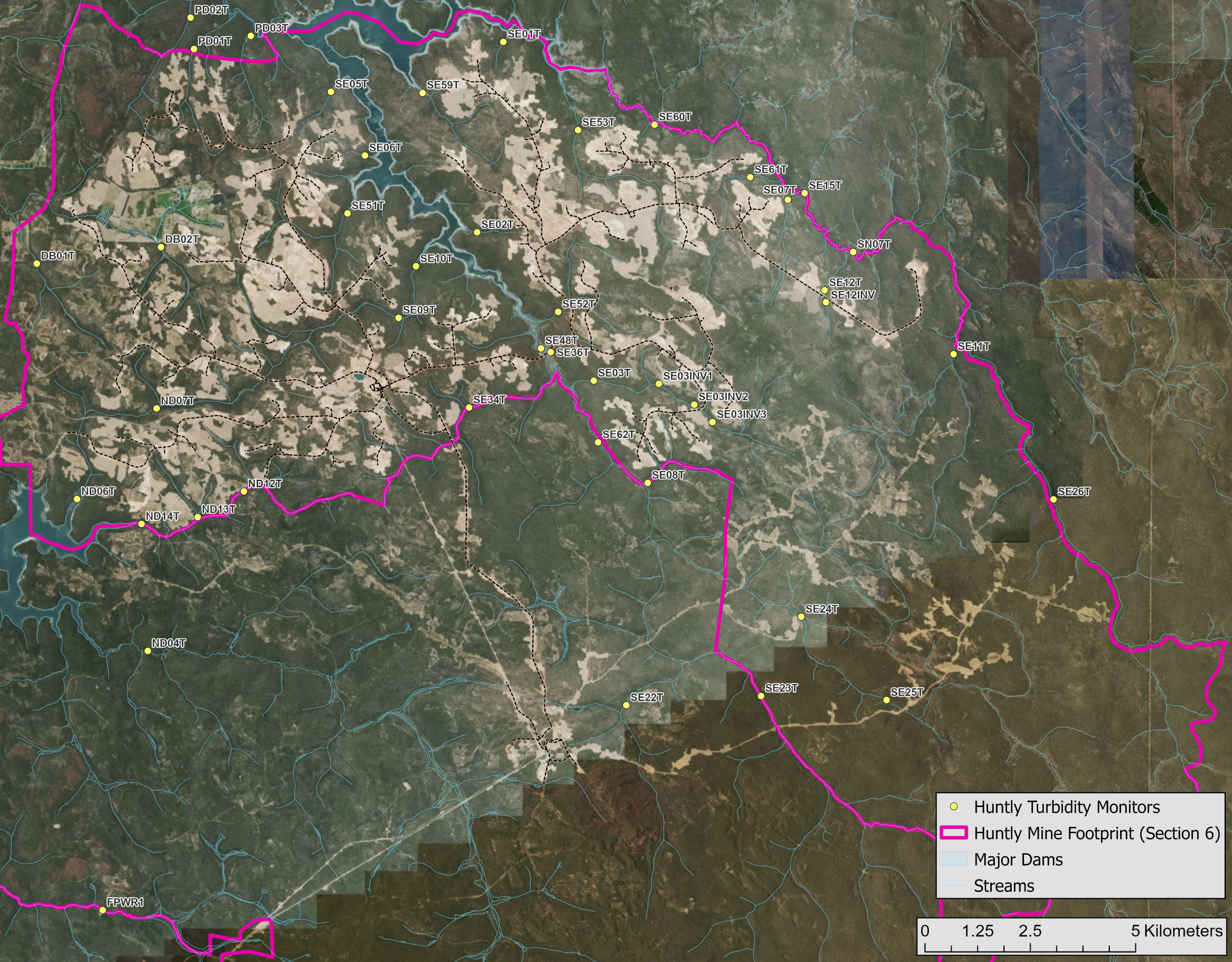
Note: False events have been annotated by **black** bold text. True events are annotated by **red** bold text.

Huntly WQMS Data – January 2026 - Turbidity (Daily Average, NTU)																	
Date	DB01T	DB02T	FPWR1	ND04T	ND06T	ND07T	ND12T	ND13T	ND14T	PD01T	SE01T	SE02T	SE03T	SE05T	SE06T	SE07T	SE08T
01/01/2026		1.48			72.77	15.48		1.83	2.79	1.79		29.18	20.49	9.31	1.12		0.94
02/01/2026		2.52			12.62	12.54		4.29	2.90	1.51		47.78	26.84	13.53	56.61		0.96
03/01/2026		12.36			12.83	13.66		3.67	3.02	1.61		220.76	25.96	15.08	94.56		7.93
04/01/2026		12.96			8.84	13.36		3.55	2.45	1.58		274.19	10.28	8.25	135.59		2.90
05/01/2026		9.52			2.04	13.35		3.02	1.24	1.69			1.23	4.26	284.16		3.82
06/01/2026		1.68			12.27	13.42		4.04	1.25	1.80			1.21	6.41	31.08		5.74
07/01/2026		2.38			28.81	13.79		4.21	1.28	1.51			1.35	6.59	5.58		8.19
08/01/2026		1.35			5.42	7.53		4.27	1.39	1.71			1.45	5.37	4.94		8.01
09/01/2026		1.38			7.91	0.65		4.24	1.34	2.23			1.85	1.23	4.23		7.49
10/01/2026		1.66			6.63	0.68		4.24	1.37	2.00			1.61	2.52	4.55		
11/01/2026		2.81			6.90	0.73		4.11	1.59	1.92			2.29	2.67	12.71		
12/01/2026		2.96			8.89	0.74		3.96	1.45	1.42			1.61	1.49	36.27		
13/01/2026		4.78			5.36	0.90		4.02	1.36	1.03			1.70	2.68	2.71		
14/01/2026		2.50			3.63	0.83			1.44	1.34		3.76	1.70	8.58	4.26		
15/01/2026		5.38			4.54	0.93			1.39	1.39		3.93	1.73	11.88	14.03		
16/01/2026		11.30			5.70	0.85			1.47	1.53		3.98	1.73	11.80	7.05		
17/01/2026		8.33			2.41	0.86			1.44	1.19		4.18	1.96	11.86	3.20		
18/01/2026		6.89			1.73	0.95			1.39	1.43		4.28	2.14	13.00	1.00		
19/01/2026		1.43			1.55	0.89			1.34	1.93		4.48	2.21	12.09	70.20		
20/01/2026		1.39			1.67	0.98			1.36	1.45		4.73	3.13	11.91	75.31		
21/01/2026		1.40			1.74	0.91			1.40	1.66		4.65	74.97	11.72	580.92		
22/01/2026		1.48			1.77	1.29			1.51	1.91		4.20	184.88	11.61	747.49		
23/01/2026		1.68			1.89	1.23			1.41	1.51		4.46	224.78	11.68	1376.10		
24/01/2026		1.90			2.08	1.33			1.53	2.37		4.53	227.36	13.14	1017.37		
25/01/2026		2.71			2.09	1.09			1.52	3.74		6.09	38.66	12.73	974.47		
26/01/2026		1.61			1.95	1.10			1.52	2.03		5.72	2.67	12.69	924.20		
27/01/2026		1.47			2.07	1.07			1.52	3.20		6.14	2.71	13.47	33.41		
28/01/2026		1.43			2.19	1.05			1.74	3.33		6.51	2.56	12.38	176.27		
29/01/2026		1.54			2.26	1.03			1.50	5.68		7.47	2.55	12.80	189.30		
30/01/2026		1.69			2.21	0.91			1.66	4.20		8.90	3.34	15.29	60.09		
31/01/2026		1.81			2.42				1.52	3.62		6.20	5.52	13.84	0.34		

Huntly WQMS Data – January 2026 - Turbidity (Daily Average, NTU)																	
Date	SE09T	SE10T	SE11T	SE12T	SE12INV	SE15T	SE34T	SE36T	SE48T	SE51T	SE52T	SE53T	SE59T	SE60T	SE61T	SE62T	SN07T
01/01/2026	2.95									1.61	28.20		4.44				7.59
02/01/2026	7.21									1.61	47.97		5.21				6.42
03/01/2026	9.94									1.47	276.19		4.92				6.84
04/01/2026	10.19									1.52	225.66		5.05				6.98
05/01/2026										1.52	1.87		5.92				6.99
06/01/2026										1.54	1.97		6.45				7.27
07/01/2026										1.49	2.46		6.54				7.57
08/01/2026										1.44	3.04		7.27				7.58
09/01/2026										1.50	3.48		8.01				7.58
10/01/2026										1.49	4.00		5.95				7.57
11/01/2026										1.51	4.71		5.90				7.57
12/01/2026										1.53	5.06		6.11				7.58
13/01/2026										1.41	5.14		6.42				7.57
14/01/2026										1.26	5.36		5.97				7.56
15/01/2026										1.27	5.68		6.48				7.22
16/01/2026										1.38	5.77		7.49				7.20
17/01/2026										1.37	5.78		7.37				6.94
18/01/2026										1.37	6.40		6.87				6.91
19/01/2026										1.36	6.90		6.49				6.92
20/01/2026										1.33	7.33		4.80				6.91
21/01/2026										1.34	7.22		5.07				6.91
22/01/2026										1.37	6.71		5.74				6.89
23/01/2026										1.31	5.80		5.81				6.89
24/01/2026										1.30	5.17		6.08				6.88
25/01/2026										1.38	5.90		6.37				6.89
26/01/2026										1.47	6.71		7.19				6.94
27/01/2026										1.41	6.52		7.25				6.95
28/01/2026										1.35	7.37		7.17				6.95
29/01/2026										1.34	9.69		6.79				6.97
30/01/2026										1.28	9.85		6.02				6.97
31/01/2026										1.26	7.34		5.00				7.00

Date	Huntly WQMS Data – January 2026 - Turbidity (Daily Average, NTU)															
	SE22T	SE23T	SE24T	SE25T	SE26T	SE03INV1	SE03INV3									
01/01/2026						139.94										
02/01/2026						178.74										
03/01/2026						244.05										
04/01/2026						109.34										
05/01/2026						2.10										
06/01/2026						1.03										
07/01/2026						1.27										
08/01/2026						1.48										
09/01/2026						1.53										
10/01/2026						1.71										
11/01/2026						3.34										
12/01/2026						1.75										
13/01/2026						2.03										
14/01/2026						1.72										
15/01/2026						1.67										
16/01/2026						1.49										
17/01/2026						2.54										
18/01/2026						3.51										
19/01/2026						6.63										
20/01/2026						10.28										
21/01/2026						10.36										
22/01/2026						14.55										
23/01/2026						23.79										
24/01/2026						135.24										
25/01/2026						97.37										
26/01/2026						56.69										
27/01/2026						35.68										
28/01/2026						36.30										
29/01/2026						46.16										
30/01/2026						41.61										
31/01/2026						24.83										

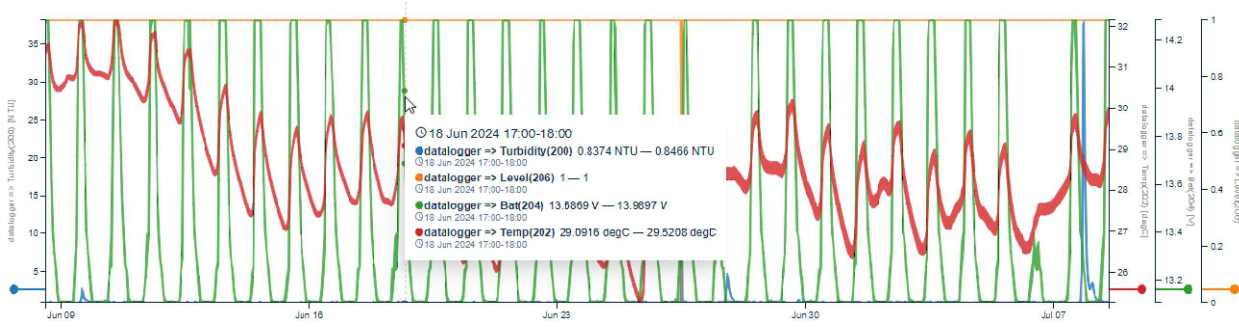
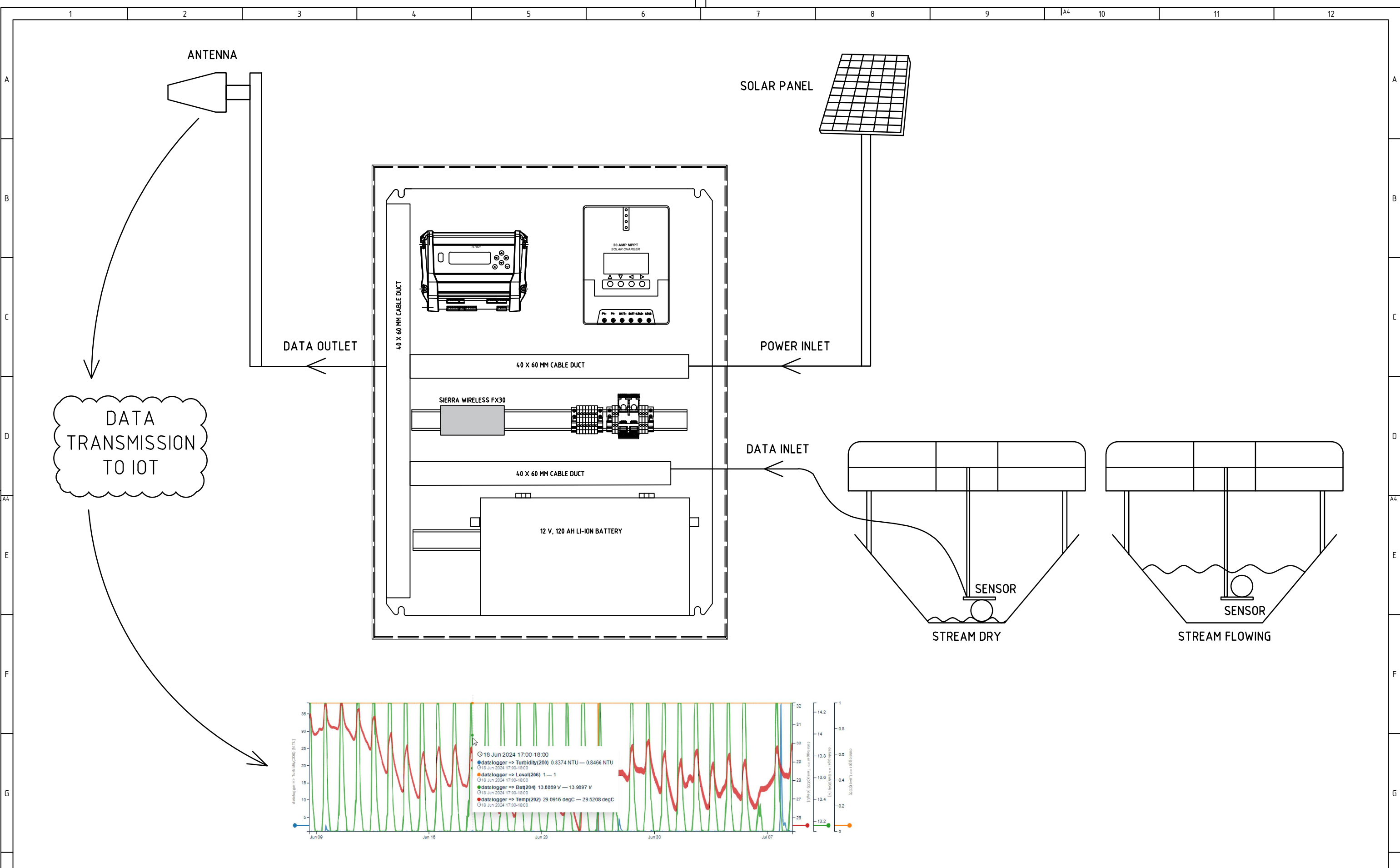
Appendix B. Huntly WQMS Locations



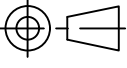
-  Huntly Turbidity Monitors
-  Huntly Mine Footprint (Section 6)
-  Major Dams
-  Streams



Appendix C. WQMS General Arrangement




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 UNO.
 LEVELS ARE IN METRES ON AHD UNO.
 DO NOT SCALE DRAWING
 IF IN DOUBT - ASK
 TOLERANCES ISO2768-m UNO.
 © SCIDEV

CLIENT

NSW - BUILDING G, 22 POWERS RD, SEVEN HILLS, NSW 2147
 (02) 8385 5357
 WA - 512, 1A QUEEN ST FREEMANTLE WA 6160
 (08) 6245 9843
 waterservices@scidev.com.au
 www.scidev.com.au



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

January 2026

Revision: Rev 02

Date: 02 April 2026

Issued to: SciDev & Alcoa of Australia



Document Control

Project Details	
Document Title	Willowdale – Water Quality Monitoring System Data Review
Document No	RP24050 WDL WQMS Data Review - January 2026
Project Name	WQ Data Processing
Project Number	RP24050
Client Reference	PO002447

Document History and Status						
Revision	Date	Description	Prepared	Reviewed	Approved	Issued to
01	13/03/2026	Issued to client	MM	GD	GD	Alcoa
02	02/04/2026	Amended with comments	MM	GD	GD	Alcoa

Report Sign Off					
Report Version		02			
Prepared by		Technical Review		Approved for Issue	
<i>Michael Minter</i>		<i>Georgia Duffy</i>		<i>Georgia Duffy</i>	
Name	Michael Minter	Name	Georgia Duffy	Name	Georgia Duffy
Position	Env. Engineer	Position	Chemical Engineer	Position	Chemical Engineer
Date	02/04/2026	Date	02/04/2026	Date	02/04/2026

RARE Environmental Pty Ltd
 ABN 41617855017
 110/117 Old Pittwater Rd
 Brookvale NSW 2100 Australia
 P: 0413 223 401
www.rare-enviro.com.au



Contents

Document Control	i
1. Executive Summary	3
2. Scope	4
3. Introduction.....	5
3.1. Background	5
3.2. Monitoring requirements	5
3.3. Water Quality Management Systems (WQMSs).....	5
3.4. Purpose.....	6
3.5. Exclusions	6
3.6. Abbreviations.....	6
4. Methodology	7
4.1. WQMS Locations	7
4.2. Data Review	7
4.2.1. True Turbidity Exceedance Events.....	7
4.2.2. False Turbidity Exceedance Events.....	7
4.2.3. Missing Data	8
5. Results and Discussion	9
5.1. Events	9
5.2. Additional Investigation	9
5.2.1. WDL-2601-002 Additional Investigation	9
5.3. True Event(s).....	10
5.4. False Event(s)	10
5.5. Excluded WQMS Units.....	12
5.6. Missing Data	12
6. Appendices	13
Appendix A. Willowdale Raw WQMS Data	14
Appendix B. Willowdale WQMS Locations	17
Appendix C. WQMS General Arrangement	19

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 (WQMS) deployed at the Willowdale bauxite mining operations during January 2026. 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:

- **False Events:** Five 'False' events were identified, primarily attributed to transient local interference
- **Further Investigation:** One event was flagged for further investigation.
- **True Events:** Zero "True" turbidity exceedance event were identified.
- **Excluded Units:** Two WQMS unit were temporarily excluded from the analysis due to limited water in the stream.

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 January 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 January 2026 monitoring period, four Turbidity units were deployed in section six 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 six 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 January 2026, 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 WQMS 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.

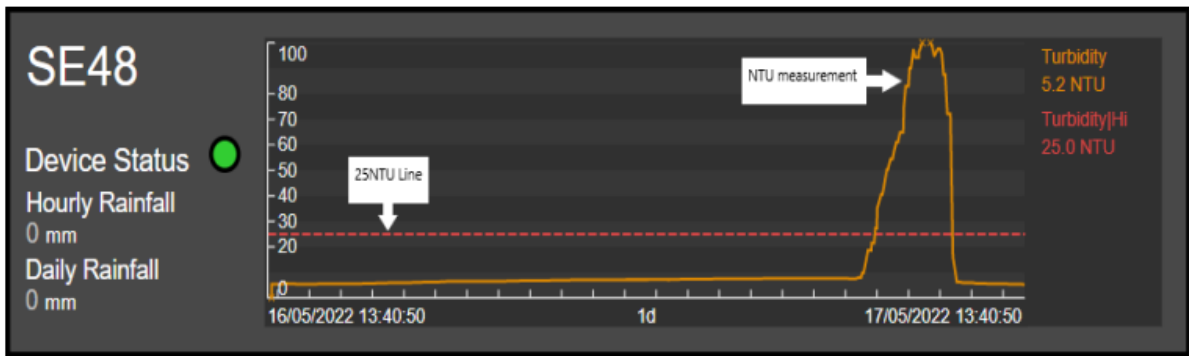


Figure 2 Typical 'false' exceedance event showing both a sharp incline and decline

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	4

Table 2 Events Details

Event ID	WQMS ID	Event Category	Start	End	Duration	Peak Turbidity (NTU)	Average Turbidity (NTU)
WDL-2601-001	RHB3	'False'	4/01/2026 20:02	4/01/2026 23:59	3h 56m	1319.3	510.3
WDL-2601-002	RHB2	Additional Investigation Required	7/01/2026 23:30	8/01/2026 4:30	5h 0m	87.2	37.8
WDL-2601-003	RHB2	'False'	9/01/2026 4:24	13/01/2026 6 2:36	3d 22h 12m	2154.3	1280.4
WDL-2601-004	RHB2	'False'	17/01/2026 6 4:07	17/01/2026 6 11:41	7h 35m	1838.6	989.0
WDL-2601-005	RHB2	'False'	18/01/2026 6 11:01	18/01/2026 6 14:34	3h 32m	4000.0	1820.8

5.2. Additional Investigation

One event was flagged for additional investigation

5.2.1. WDL-2601-002 Additional Investigation

The event, occurring between 23:30 on the 7th of January and 04:30 on the 8th of January at RHB2 exhibits a sharp, 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'.

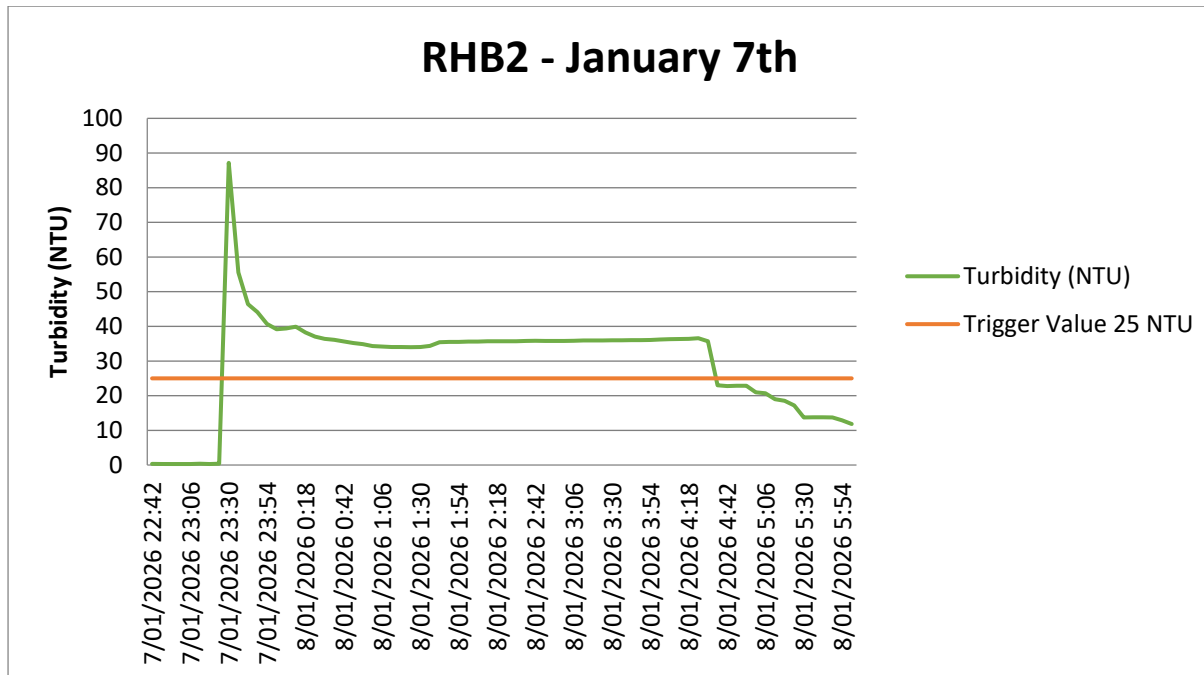


Figure 3 - WDL-2601-002

The RHB2 event recorded on 07/01/2026 to 08/01/2026 presents as a turbidity exceedance characterised by an initial sharp spike followed by a gradual recession. While this pattern could suggest a genuine short-duration increase in stream turbidity, site records do not support a true event. No visible signs of elevated turbidity or sediment deposition were observed during the inspection, and no rainfall was recorded in the preceding 24 hours. The monitor was also experiencing technical difficulties during this period, which were not resolved until 13/01/2026. In the absence of corroborating field evidence, and given the known instrument issues, the event is considered most likely to reflect sensor-related interference such as signal drift, temporary fouling, or debris affecting the sensor lens, rather than a true in-stream turbidity response. The event is therefore classified as false.

Field notes provided by Alcoa are included below.

“Event not identified until 30/01/2025. The unit was inspected on 11/01/2026 following other issues at this monitor. No signs of turbidity events were identified during this inspection and 0mm of rainfall was recorded in the preceding 24 hours, but the unit was having technical difficulties. The unit issues were resolved on 13/01/2026. Event classified as a false event.”

5.3. True Event(s)

Zero true events were identified during the reporting period.

5.4. False Event(s)

Four false events were identified during the reporting period.

Table 3 False Events Rationale

Event ID	Monitor ID	Rationale	Field Notes
WDL-2601-001	RHB3	This event does not present as a single clean pulse and includes multiple irregular pulses above the trigger rather than a smooth rise and recession. On this basis it is treated as false and likely influenced by localised interference.	Event not identified until 30/01/2025. Due to the extended period between the event and its identification an in field inspection was not undertaken. Based on the shape of the turbidity readings graph (a sudden increase maintained for several hours followed by a sudden decrease) and the extremely high turbidity readings throughout the event, this event has been classified as a false event.
WDL-2601-003	RHB2	This event does not present as a single clean pulse and includes obvious step changes, plateaus, sudden drops and rebounds. This is likely caused by progressive fouling or due to a baseline shift. On this basis it is treated as false.	Inspection and manual download undertaken 11/01/2026 at 10.15am. Creek flowing and clear. No signs of damage to the unit, however unit still offline. Unit has showed a fault status throughout entire turbidity event. Maintenance contractor attended unit on 13/01/2025 and resolved issue. Event classified as a false event.
WDL-2601-004	RHB2	This event does not present as a single clean pulse and includes a sustained plateau above the trigger value. This is likely due to intermittent obstruction of the probe. The event is considered false.	Event not identified until 30/01/2025. Due to the extended period between the event and its identification, an in field inspection was not undertaken. Based on the shape of the turbidity readings graph (a sudden increase maintained for several hours followed by a sudden decrease) and the extremely high turbidity readings throughout the event, this event has been classified as a false event.
WDL-2601-005	RHB2	This event includes multiple sharp jumps in turbidity with several results above the operating range of the sensor. The likely cause for this is a monitor or logger fault. On this basis the event is considered false.	Inspection undertaken on 18/01/2026 at 2:25pm. Creek clear and flowing however the flow was slow and the water level was shallow. Probe was inspected and was partially out of water. There was a build-up of algae. The probe was cleaned and repositioned in the stream. Turbidity reading dropped to <1NTU after cleaning. Event classified as a false event.

5.5. Excluded WQMS Units

Two WQMS Unit was 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 1 Excluded WQMS Units

Unit	Dates	Comments
HV07T	01/01/2026-31/01/2026	Stream dry. Probe installed in bucket of deionised water.
HV49T	01/01/2026-31/01/2026	Unit upgraded to a telemetered unit on 21/01/2026. Stream dry.

5.6. Missing Data

No periods of missing data were identified during the reporting period.

6. Appendices

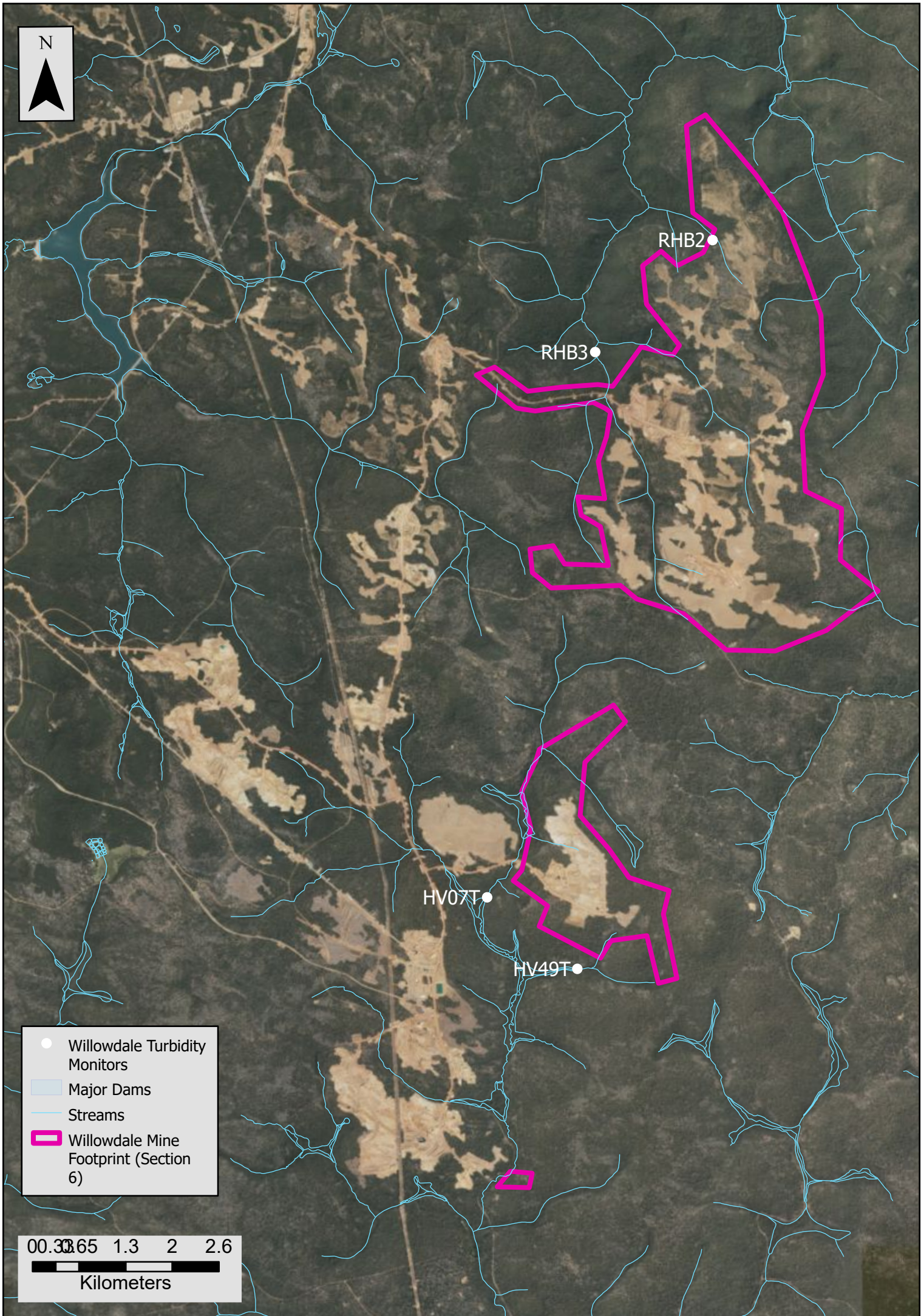
Appendix A. Willowdale Raw WQMS Data

Willowdale WQMS Data - January 2026 - Events with turbidity > 25 NTU for an hour or more				
Date	HV07T	HV49T	RHB2	RHB3
1/01/2026				
2/01/2026				
3/01/2026				
4/01/2026				1
5/01/2026				
6/01/2026				
7/01/2026			1	
8/01/2026				
9/01/2026			1	
10/01/2026				
11/01/2026				
12/01/2026				
13/01/2026				
14/01/2026				
15/01/2026				
16/01/2026				
17/01/2026			1	
18/01/2026			1	
19/01/2026				
20/01/2026				
21/01/2026				
22/01/2026				
23/01/2026				
24/01/2026				
25/01/2026				
26/01/2026				
27/01/2026				
28/01/2026				
29/01/2026				
30/01/2026				
31/01/2026				

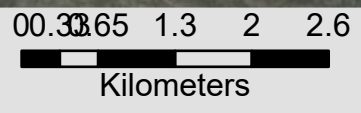
Date	Willowdale WQMS Data - January 2026 – Daily Average Turbidity (NTU)			
	HV07T	HV49T	RHB2	RHB3
1/01/2026			0.28	1.28
2/01/2026			0.27	1.61
3/01/2026			0.24	1.28
4/01/2026			0.26	87.02
5/01/2026			0.25	1.19
6/01/2026			0.25	2.35
7/01/2026			1.40	1.11
8/01/2026			14.93	1.17
9/01/2026			1384.54	12.92
10/01/2026			1585.10	1.07
11/01/2026			1355.89	1.07
12/01/2026			642.69	1.17
13/01/2026			70.20	1.06
14/01/2026			0.20	1.20
15/01/2026			0.27	1.11
16/01/2026			0.85	3.13
17/01/2026			329.46	1.60
18/01/2026			278.55	1.12
19/01/2026			0.38	1.05
20/01/2026			0.41	1.02
21/01/2026			0.36	0.99
22/01/2026			0.45	1.35
23/01/2026			0.34	1.08
24/01/2026			0.38	1.06
25/01/2026			0.35	1.10
26/01/2026			0.43	1.07
27/01/2026			0.43	1.18
28/01/2026			0.59	2.43
29/01/2026			0.97	1.84
30/01/2026			1.26	1.83
31/01/2026			1.76	0.99

* - Adjusted average with sensor fault data removed

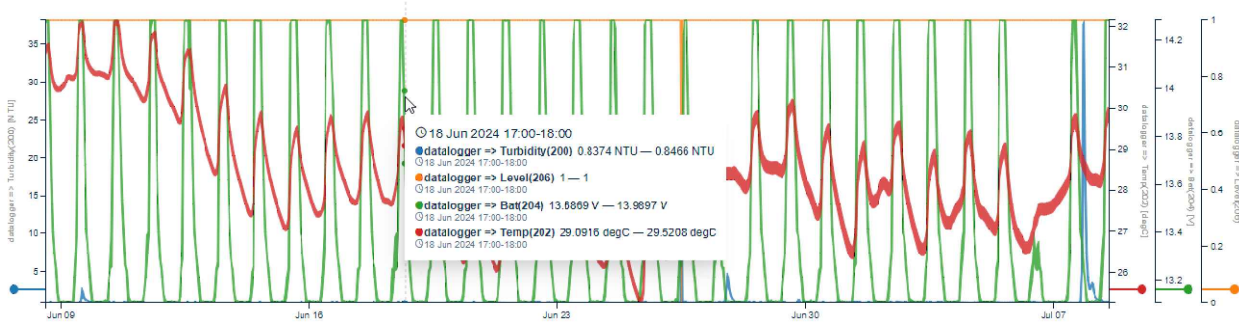
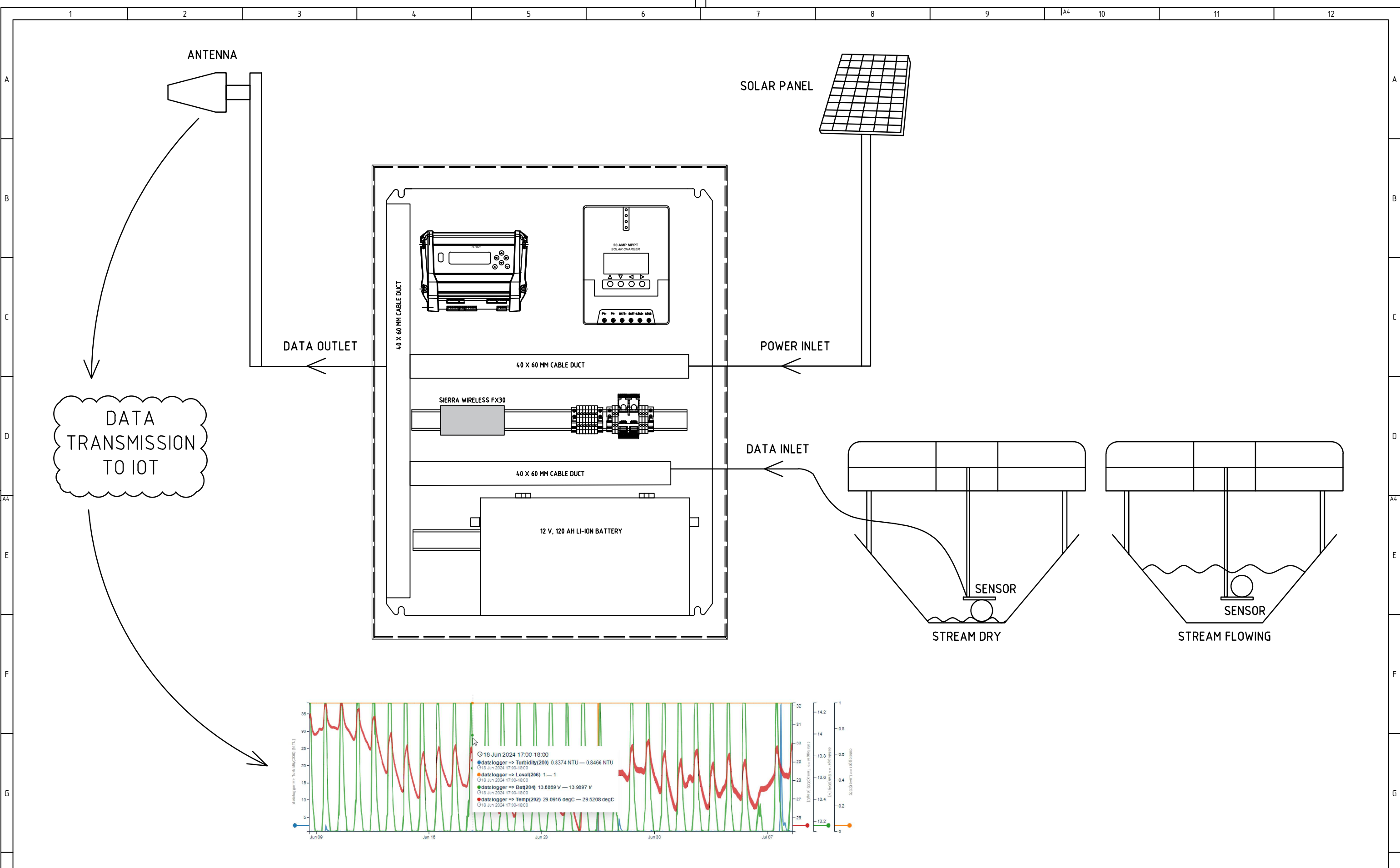
Appendix B. Willowdale WQMS Locations



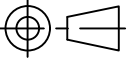
- Willowdale Turbidity Monitors
- Major Dams
- Streams
- ▭ Willowdale Mine Footprint (Section 6)



Appendix C. WQMS General Arrangement




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 UNO.
 LEVELS ARE IN METRES ON AHD UNO.
 DO NOT SCALE DRAWING
 IF IN DOUBT - ASK
 TOLERANCES ISO2768-m UNO.
 © SCIDEV

CLIENT

NSW - BUILDING G, 22 POWERS RD, SEVEN HILLS, NSW 2147
 (02) 8385 5357
 WA - 512, 1A QUEEN ST FREEMANTLE WA 6160
 (08) 6245 9843
 waterservices@scidev.com.au
 www.scidev.com.au



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