Monthly Environmental Monitoring Report

Yancoal Mount Thorley Warkworth

December 2022

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Revision History

Version No.	Version Details	Date
1.1	Original	30/04/2023
1.2	Revised Section 4.1 Blast Monitoring Result Figures	01/06/2023

1.0 INTRODUCTION

This report has been compiled to provide a monthly summary of environmental monitoring results for Mount Thorley Warkworth (MTW). This report includes all monitoring data collected for the period 1 December to 31 December 2022.

2.0 AIR QUALITY

2.1 Meteorological Monitoring

Meteorological data is collected at MTW's 'Charlton Ridge' meteorological station (refer to **Figure 3**: Air Quality Monitoring Locations).

2.1.1 Rainfall

Rainfall for the reporting period is summarised in **Table 1**. The year-to-date monthly rainfall totals, 2022 monthly rainfall totals and historical average monthly rainfall trend are shown in **Figure 1**.

Table 1: Monthly Rainfall MTW

2022	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
December	22.4	1070

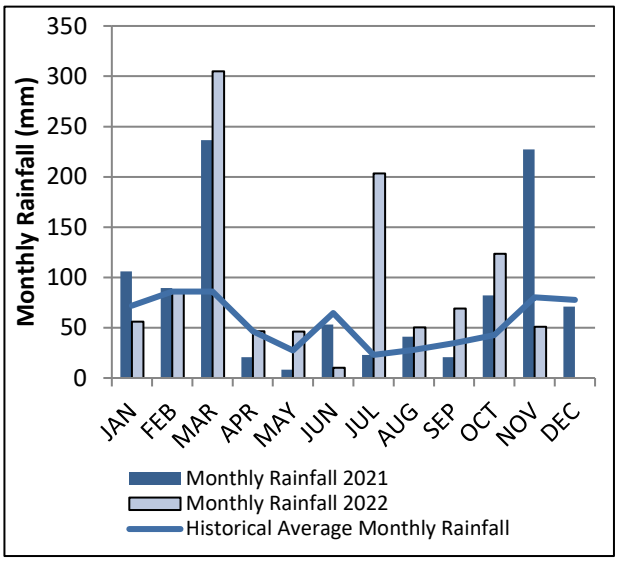

Figure 1: Rainfall Trend YTD

Note: The historical average monthly rainfall is calculated from 2007 to 2021 monthly totals

2.1.2 Wind Speed and Direction

Winds from the South and Southeast were dominant during the reporting period as shown in **Figure 2.**

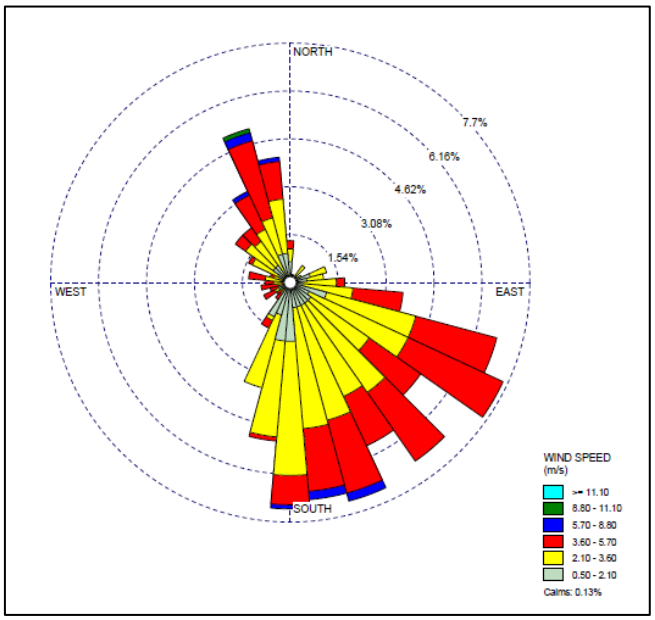

Figure 2: Charlton Ridge Wind Rose – December 2022

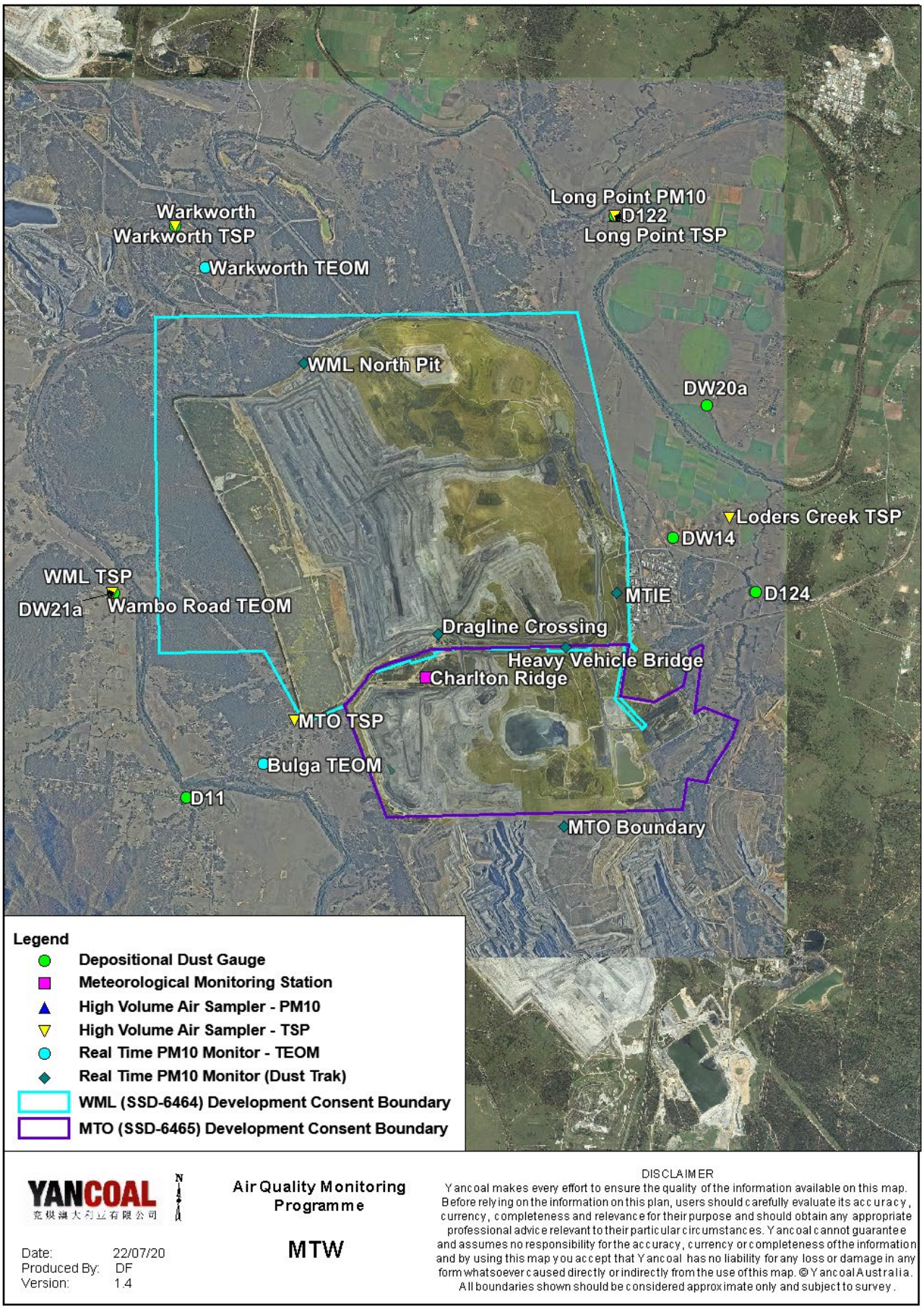

Figure 3: Air Quality Monitoring Locations

2.2 Depositional Dust

To monitor air quality, MTW operates and maintains a network of seven depositional dust gauges, situated on private and mine owned land surrounding MTW.

During the reporting period the Warkworth monitor recorded a monthly result above the long-term impact assessment criteria of 4.0 g/m^2 per month. There is no evidence to suggest that the Warkworth result is contaminated. Accordingly, the result will be included in the annual average calculation.

Figure 4 displays insoluble solids results from depositional dust gauges during the reporting period compared against the year-to-date average and the annual impact assessment criteria.

An annual assessment of MTW's compliance with the Long-Term Impact Assessment Criteria will be provided in the 2022 Annual Review Report.

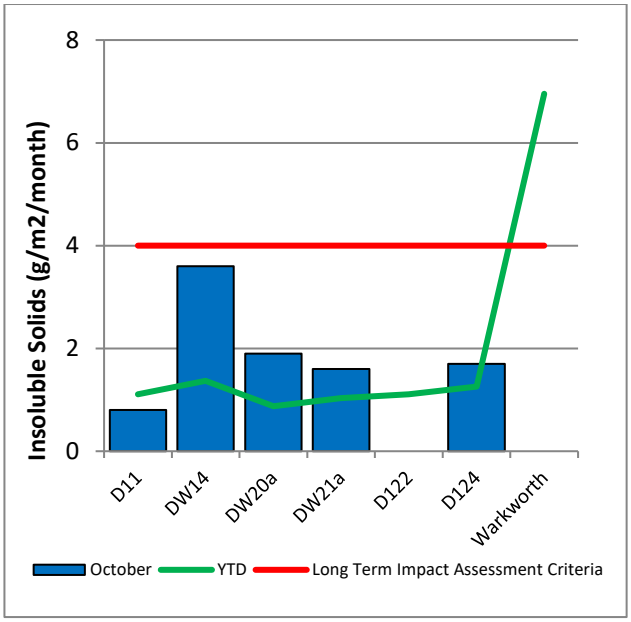

Figure 4: Depositional Dust – December 2022

2.3 Suspended Particulates

Suspended particulates are measured by a network of High Volume Air Samplers (HVAS) measuring Total Suspended Particulates (TSP) and Particulate Matter <10µm (PM_{10}). The location of these monitors can be found in **Figure 3**. Each HVAS was run for 24 hours on a six-day cycle in accordance with EPA requirements.

2.3.1 HVAS PM_{10} Results

Figure 5 shows the individual PM_{10} results at each monitoring station against the short-term impact assessment criteria of 50µg/m^3.

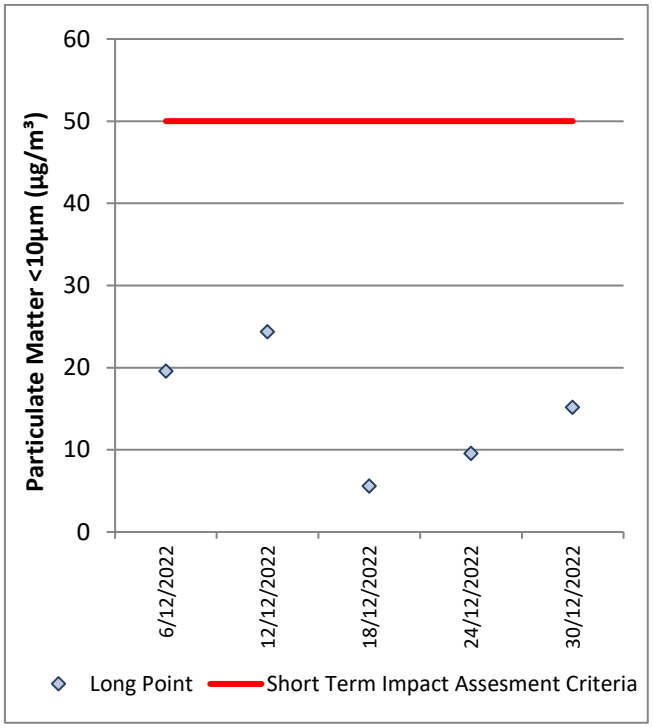

Figure 5: Individual PM10 Results – December 2022

Figure 6 shows the annual average PM10 result against the long term impact assessment criteria.

An assessment of MTW's compliance with the Long-Term Impact Assessment Criteria will be provided in the 2022 Annual Review Report.

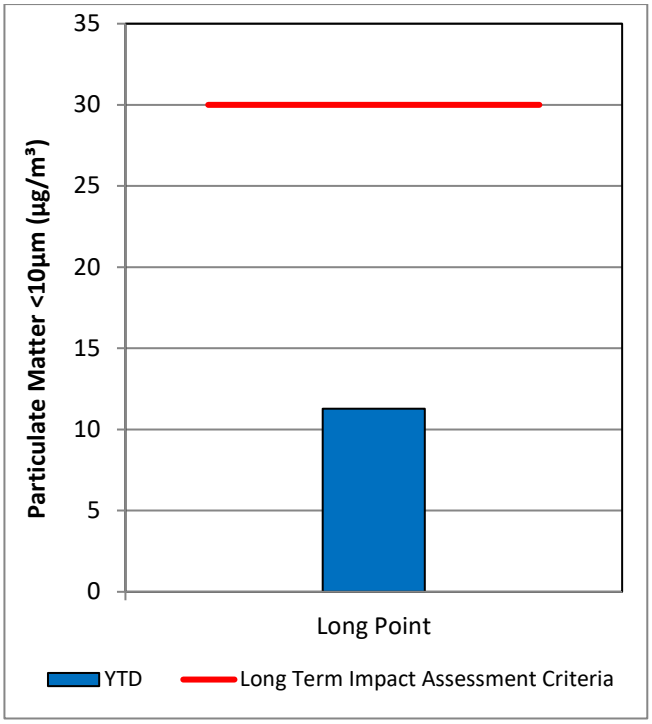

Figure 6: Annual Average PM_{10} – December 2022

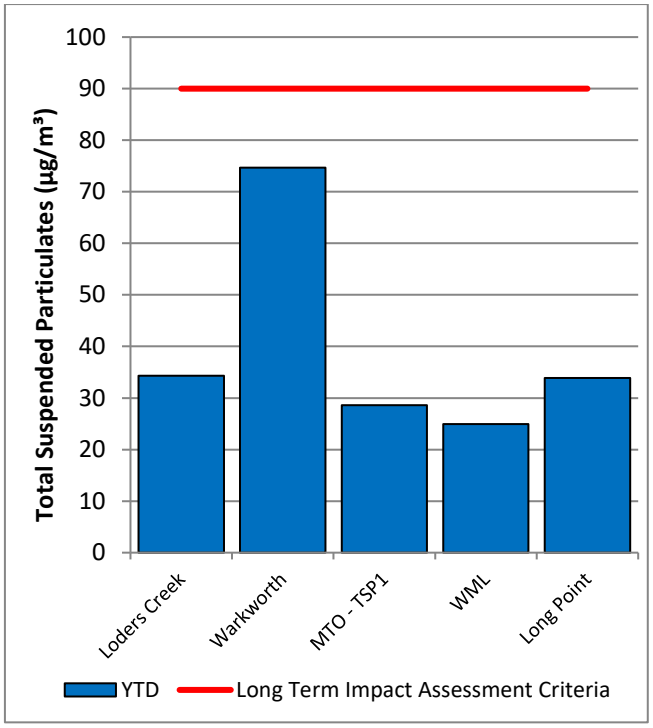

Figure 7: Annual Average Total Suspended Particulates – December 2022

2.3.2 TSP Results

Figure 7 shows the annual average TSP results compared against the long-term impact assessment criteria of 90µg/m³.

An assessment of MTW's compliance with the Long-Term Impact Assessment Criteria will be provided in the 2022 Annual Review Report.

2.3.3 Real Time PM_{10} Results

MTW maintains a network of real time PM_{10} monitors. The real time air quality monitoring stations continuously log information and transmit data to a central database, generating internal alerts when particulate matter levels exceed internal trigger limits.

Results for real time dust sampling are shown in **Figure 8**, including the daily 24-hour average PM_{10} result and the annual PM_{10} average.

Data was not available on 11 and 18 December 2022 from the Bulga Monitor due to equipment issues.

2.3.4 Real Time Alarms for Air Quality

During December, the real time monitoring system generated 34 automated air quality related alerts, including 10 alerts for adverse meteorological conditions and 24 alerts for elevated PM_{10} levels.

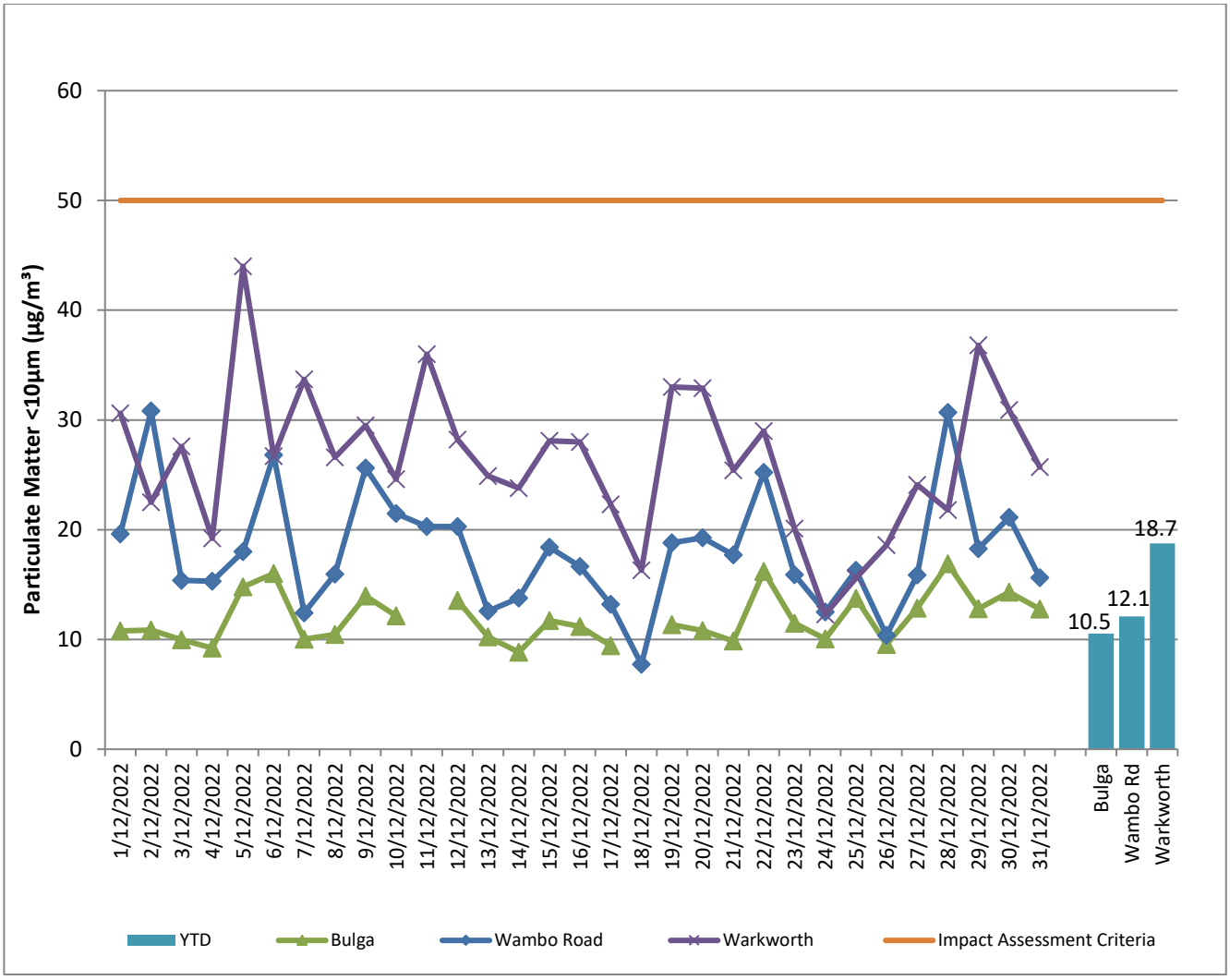

Figure 8: Real Time PM_{10} daily 24hr average (line graphs) and YTD annual average (column graphs) – December 2022

3.0 WATER QUALITY

MTW maintains a network of surface water and groundwater monitoring sites.

3.1 Surface Water

Monitoring is conducted at mine site dams and surrounding natural watercourses. The surface water monitoring locations are outlined in **Figure 15**.

Surface water courses are sampled on a monthly or quarterly sampling regime. Water quality is evaluated through the parameters of pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS). The Hunter River and the Wollombi Brook are sampled both upstream and downstream of mining operations, to record background water quality and to monitor the potential impact of mining on the river system. Other Hunter River tributaries are also monitored.

3.1.1 Surface Water Monitoring results

Figure 9 to **Figure 11** show the long-term surface waste trend (2019 – current) within MTW mine dams. **Figure 12** to **Figure 14** show the long-term surface water trend (2019 – current) in surrounding watercourses.

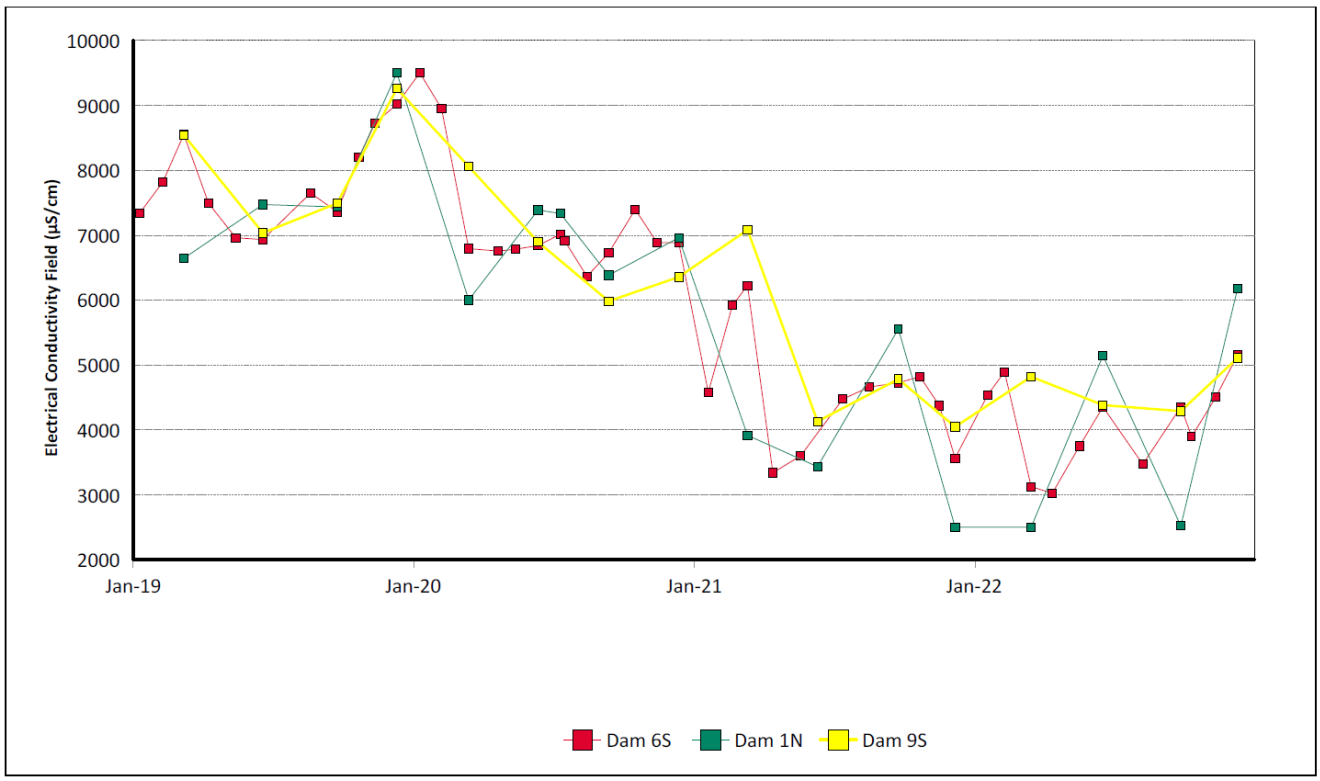

Figure 9: Site Dams Electrical Conductivity Field Trend – December 2022

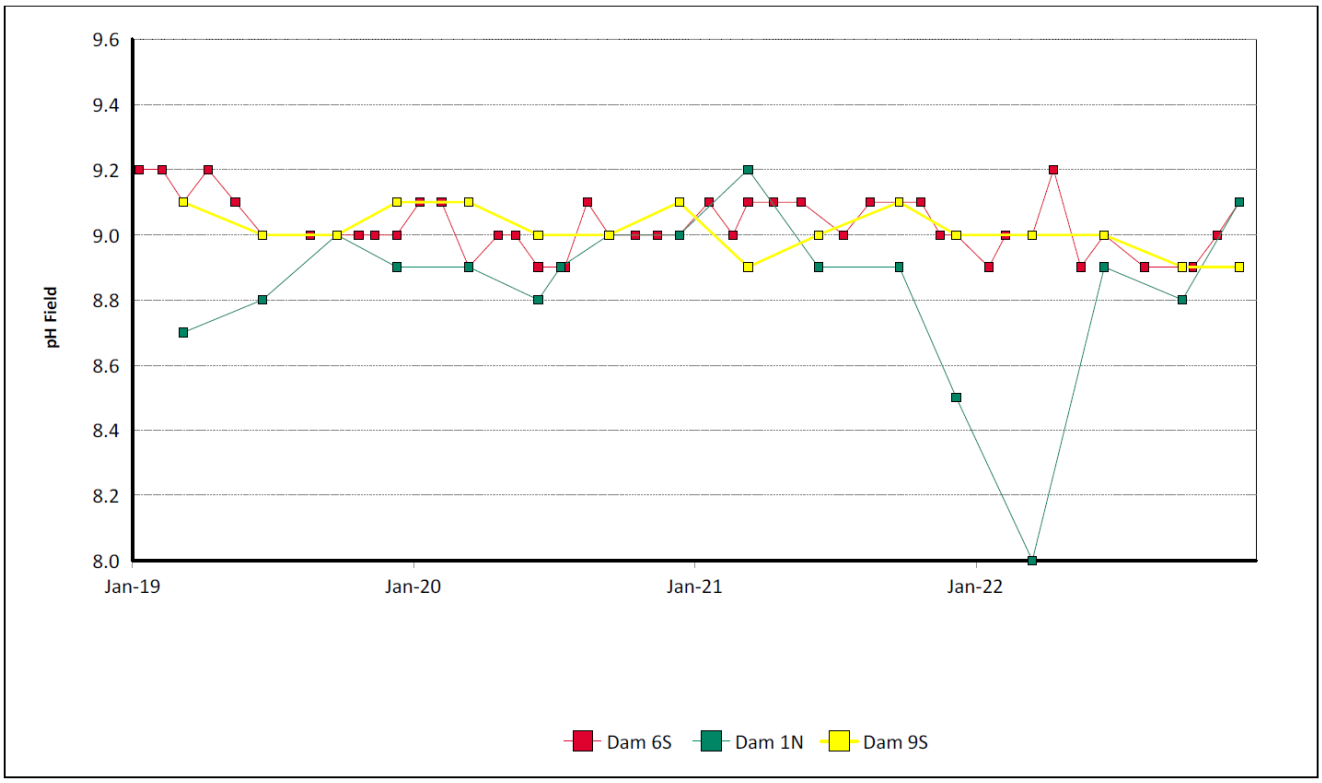

Figure 10: Site Dams pH Field Trend – December 2022

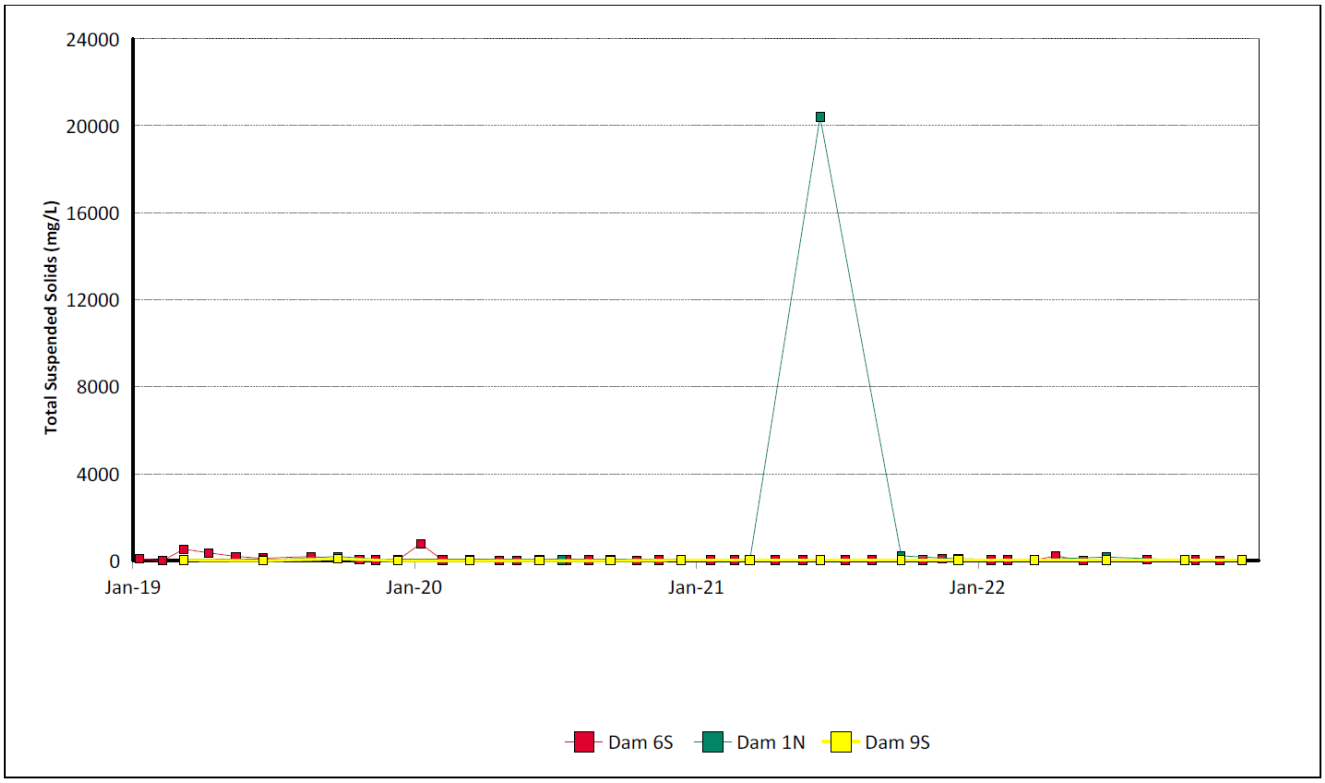

Figure 11: Site Dams Total Suspended Solids Trend - December 2022

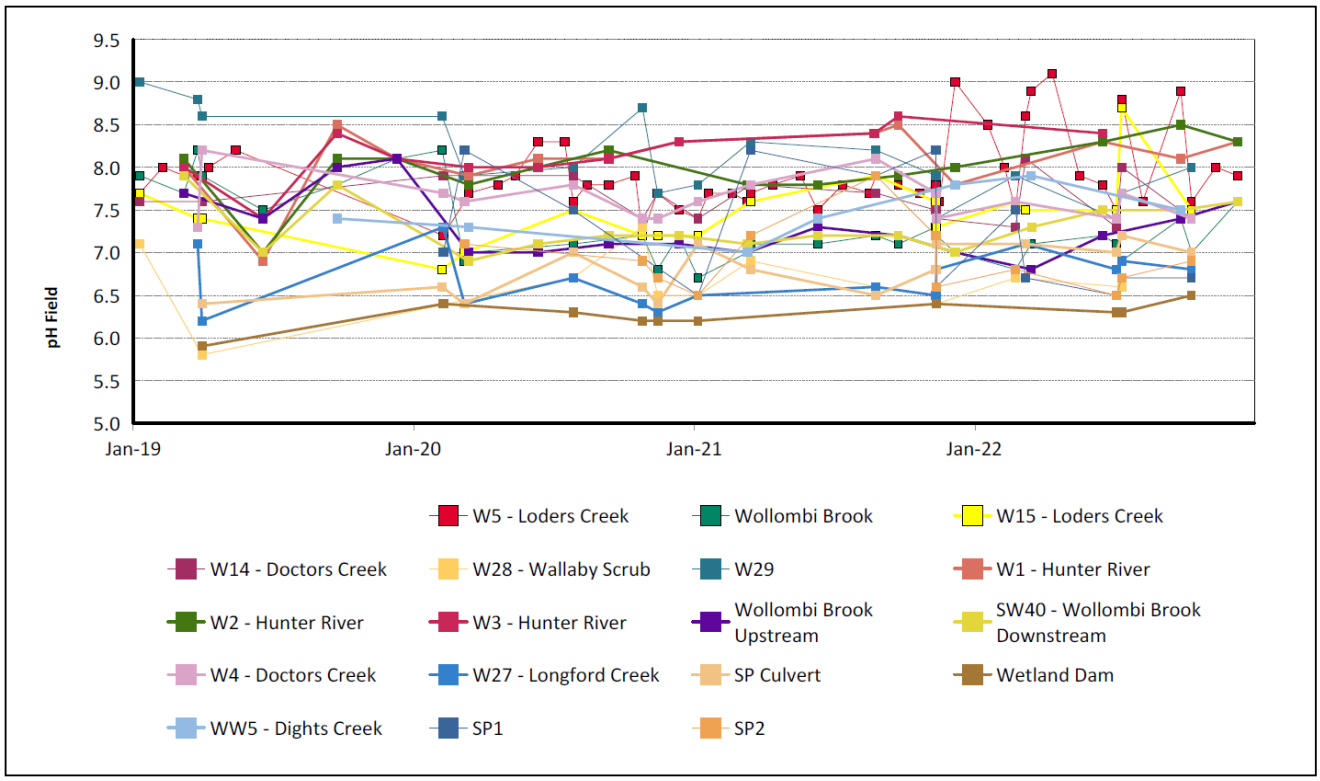

Figure 12: Watercourse pH Field Trend - December 2022

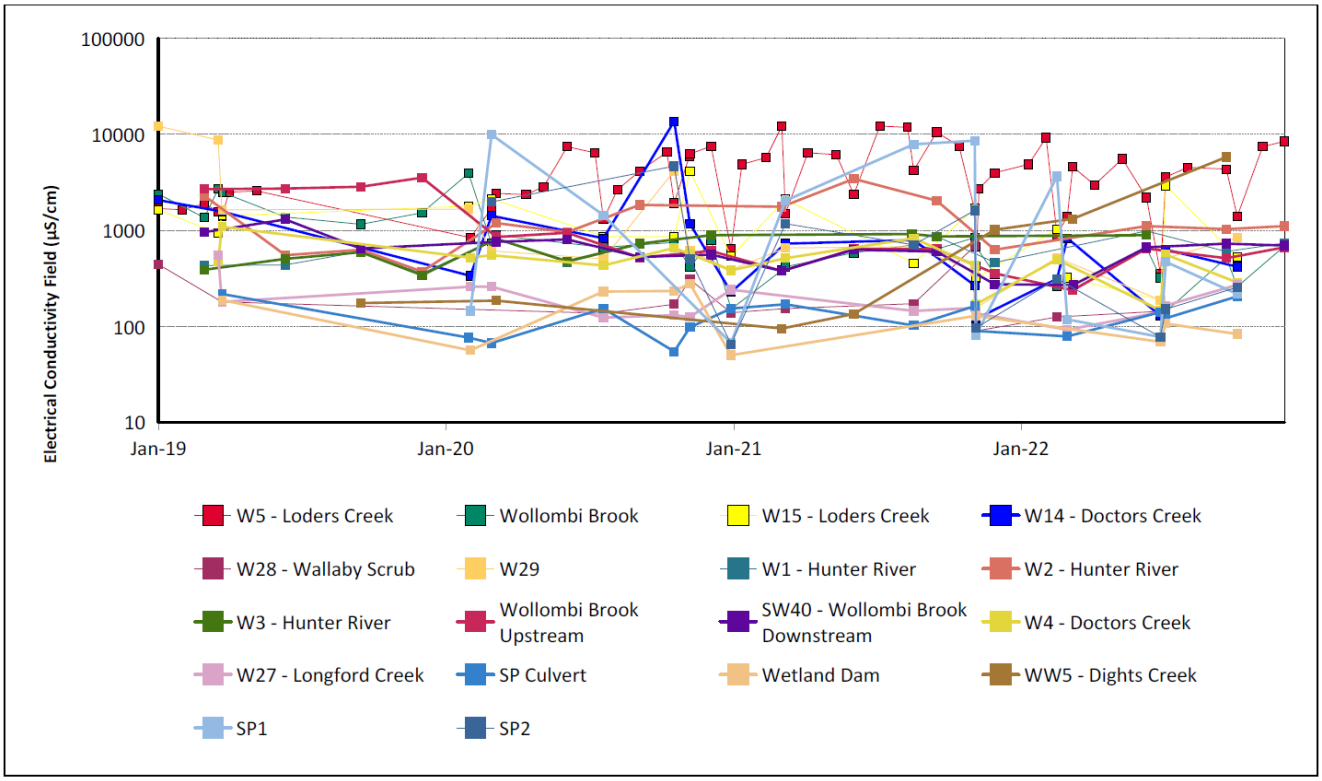

Figure 13: Watercourse Electrical Conductivity Field Trend - December 2022

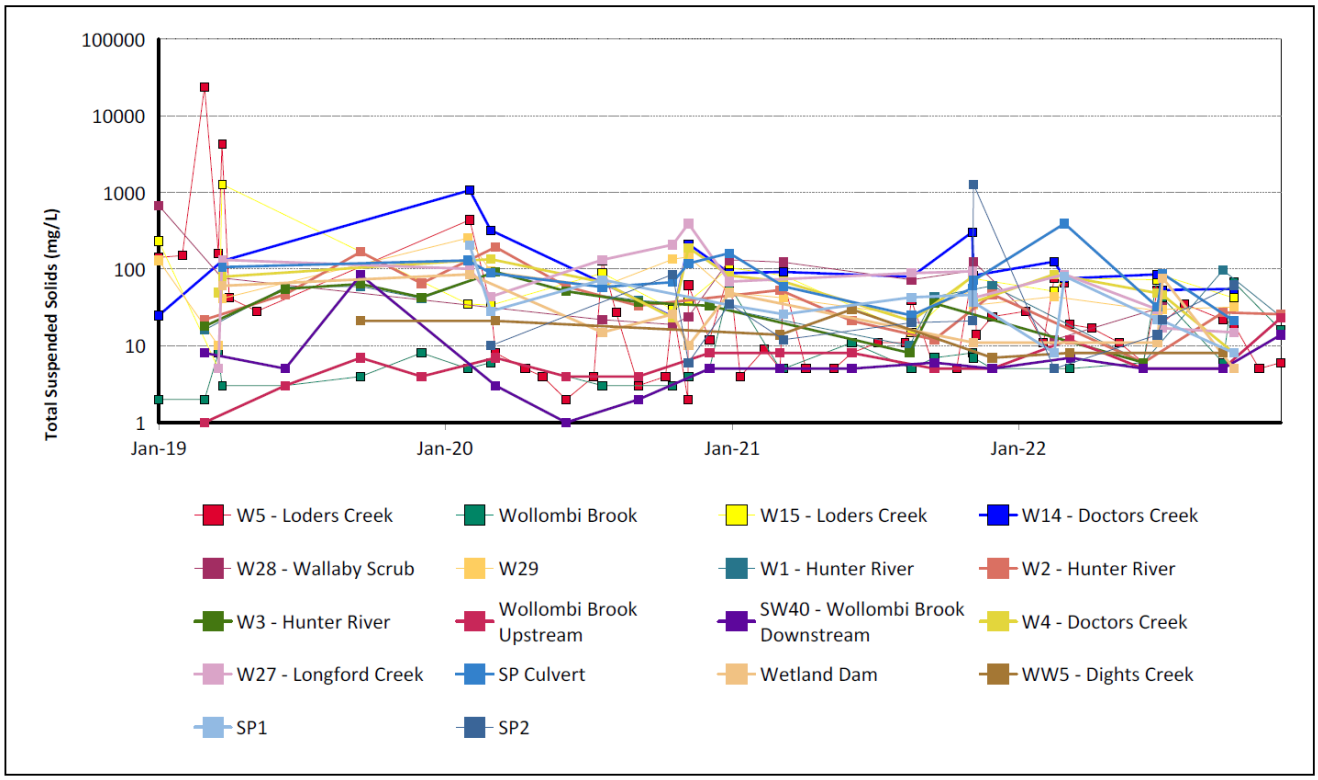

Figure 14: Watercourse Total Suspended Solids Trend - December 2022

3.1.2 Surface Water Trigger Tracking

Internal trigger limits have been developed to assess monitoring data on an on-going basis, and to highlight potentially adverse surface water impacts. The process for evaluating monitoring results against the internal triggers and subsequent responses are outlined in the MTW Water Management Plan.

Current internal surface water trigger limit breaches are summarised in **Table 2**.

Table 2: Surface Water Trigger Tracking – December 2022

Site	Date	Trigger Limit Breached	Action Taken in Response
WW5	15/03/2022	EC – 95th Percentile	Watching Brief*
SP1	04/07/2022	pH – 5th Percentile	Watching Brief*
W5	15/03/2022	pH – 95th Percentile	Watching Brief*
W5	12/04/2022	pH – 95th Percentile	Watching Brief*
W5	26/09/2022	pH – 95th Percentile	Watching Brief*
W15	11/07/2022	pH – 95th Percentile	Watching Brief*
W29	04/07/2022	pH – 5th Percentile	Watching Brief*
W29	11/07/2022	pH – 5th Percentile	Watching Brief*
SP1	08/03/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 7/03/2022 and 78.4mm on 8/03/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W1	26/09/2022	TSS – 50mg/L (ANZECC criteria)	W1 is the upstream Hunter River monitoring location and observations were that the flow rate was very fast at the time of monitoring, likely resulting in mobilisation of sediment from upstream sources. No MTW site sources of sediment identified. No follow up required.
W4	23/02/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (21.0mm on 22/02/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W5	23/02/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (21.0mm on 22/02/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.

Site	Date	Trigger Limit Breached	Action Taken in Response
W5	8/03/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 7/03/2022 and 78.4mm on 8/03/2022), resulting in mobilisation of sediment. No follow up required.
W5	04/07/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (76 mm on 3/07/2022), resulting in mobilisation of sediment.
W14	23/02/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (21.0mm on 22/02/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W14	8/03/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 7/03/2022 and 78.4mm on 8/03/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W14	04/07/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (76 mm on 3/07/2022 and 23.2 mm on 4/07/2022), resulting in mobilisation of sediment in Doctors Creek. In addition, TSS results were potentially affected by turbid water associated with the overtopping of one mine water sump at WML, which was reported to EPA and DPE.
W14	11/07/2022	TSS – 50mg/L (ANZECC criteria)	No mine site sources of sediment identified. Upstream sample W29 (which is closer to MTW) indicates source of sediment may be partially attributable to runoff from downstream farming properties. No follow up required.
W14	10/10/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event(s) (66.6 mm from 5/10/2022 to 9/10/2022), resulting in mobilisation of sediment. No mine site sources of sediment identified. Upstream sample W29 (which is closer to MTW) indicates source of sediment may be partially attributable to runoff from downstream farming properties. No follow up required.
W15	23/02/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (21.0mm on 22/02/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.
W15	8/03/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 7/03/2022 and 78.4mm on 8/03/2022), resulting in mobilisation of sediment. MTW were also

Site	Date	Trigger Limit Breached	Action Taken in Response
			discharging into Loders Creek from Dam 9S on this day, although TSS results from the discharge point were below the trigger limit. No follow up required.
W15	04/07/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (76 mm on 3/07/2022 23.2 mm on 4/07/2022), resulting in mobilisation of sediment in Loders Creek. No mine site sources of sediment identified.
W15	11/07/2022	TSS – 50mg/L (ANZECC criteria)	MTW were discharging into Loders Creek from Dam 9S on this day, although TSS results from the discharge point were below the trigger limit. Apart from the licenced discharge water, no mine site sources of sediment identified. No follow up required.
W27	8/03/2022	TSS – 50mg/L (ANZECC criteria)	Elevated TSS associated with high runoff due to rainfall event (53.2mm on 7/03/2022 and 78.4mm on 8/03/2022), resulting in mobilisation of sediment. No MTW site sources of sediment identified. No follow up required.

3.2 HRSTS Discharge

MTW participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from licensed discharge points located at Dam 1N and Dam 9S. Discharges can only take place subject to HRSTS regulations.

During the reporting period licenced HRSTS discharge from Dam 9S (EPL 1976 Point 4) occurred on 1st and 2nd December discharging a total of 9.76 ML.

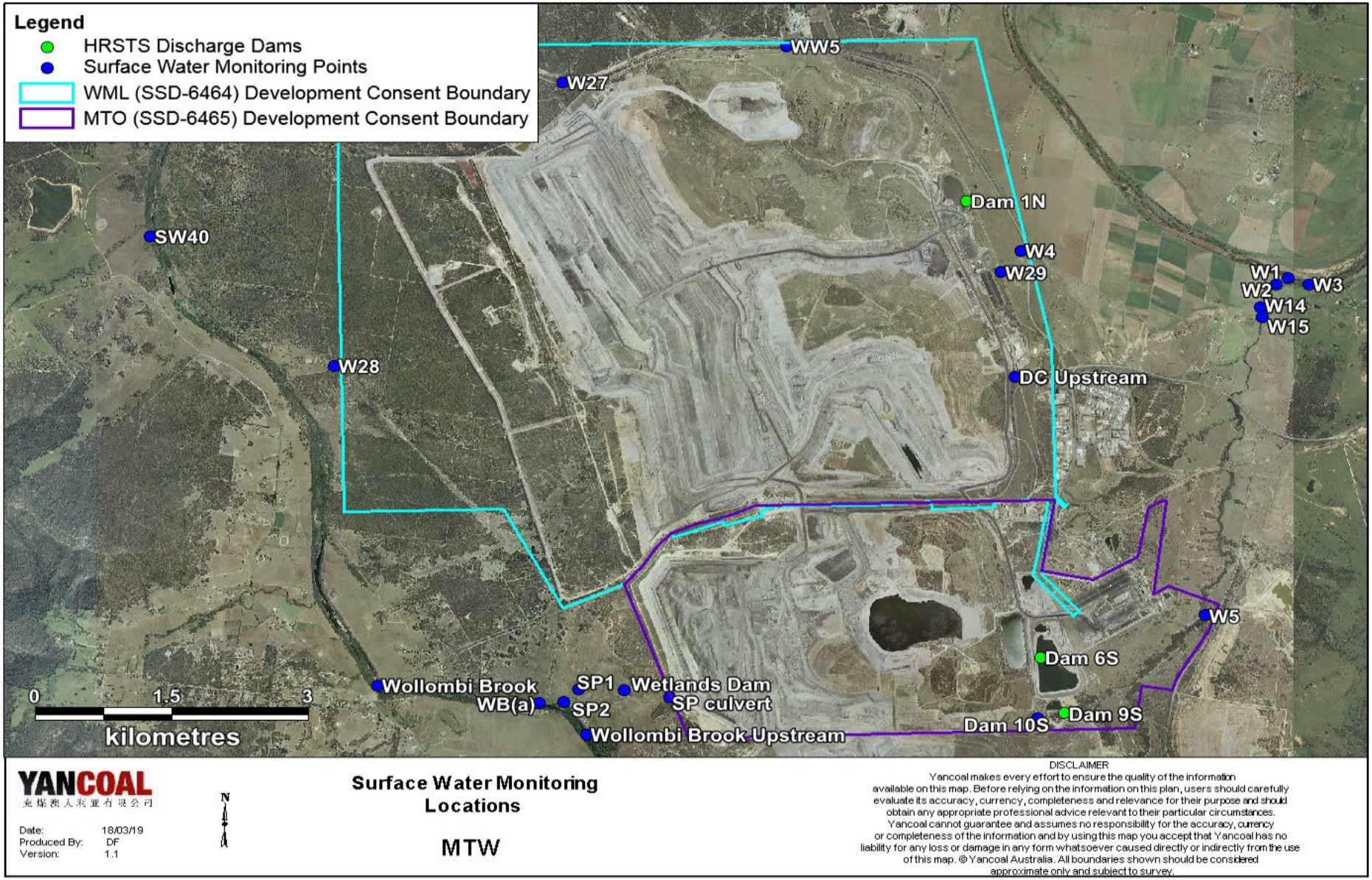

Figure 15: Surface Water Monitoring Location Plan

3.3 Groundwater Monitoring

Groundwater monitoring is undertaken on a quarterly basis in accordance with the MTW Groundwater Monitoring Programme.

Figure 16 to **Figure 64** show the long-term water quality trends (2019 - current) for groundwater bores monitored at MTW.

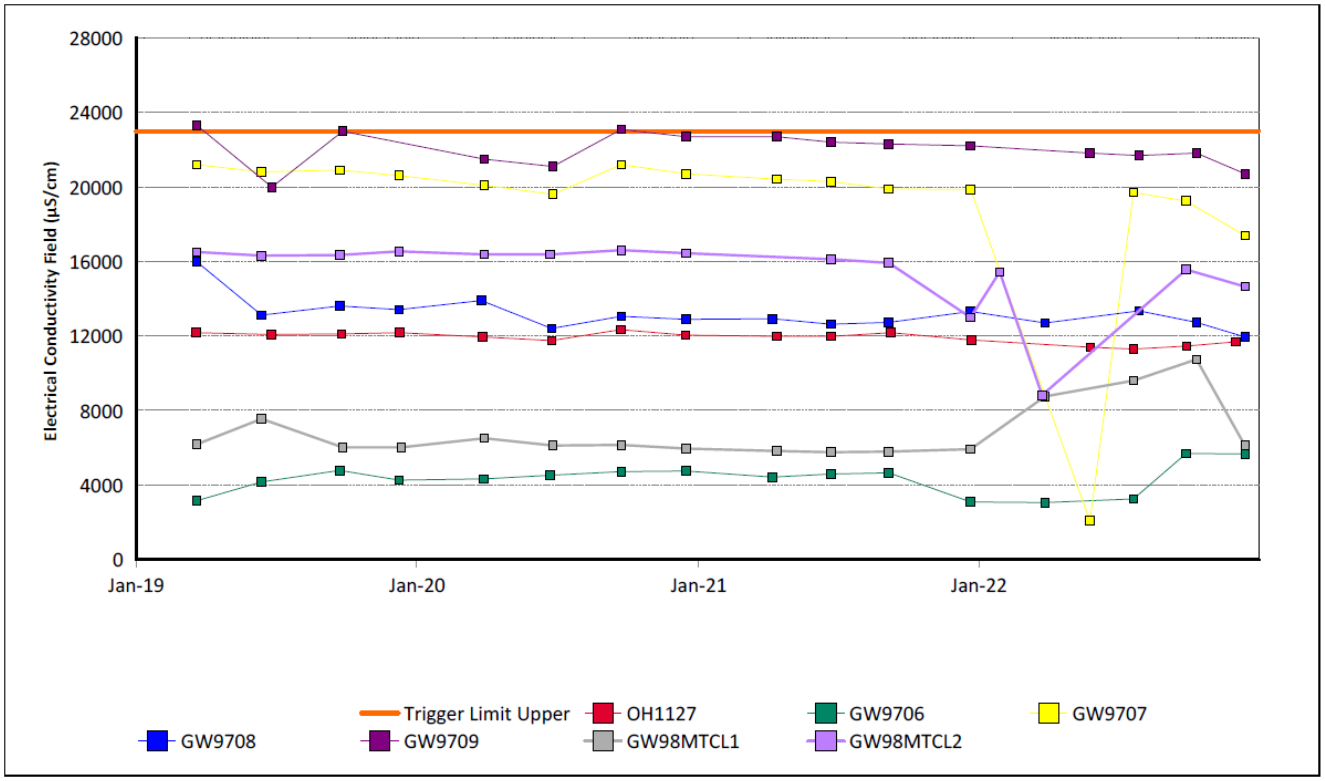

Figure 16: Bayswater Seam Electrical Conductivity Field Trend - December 2022

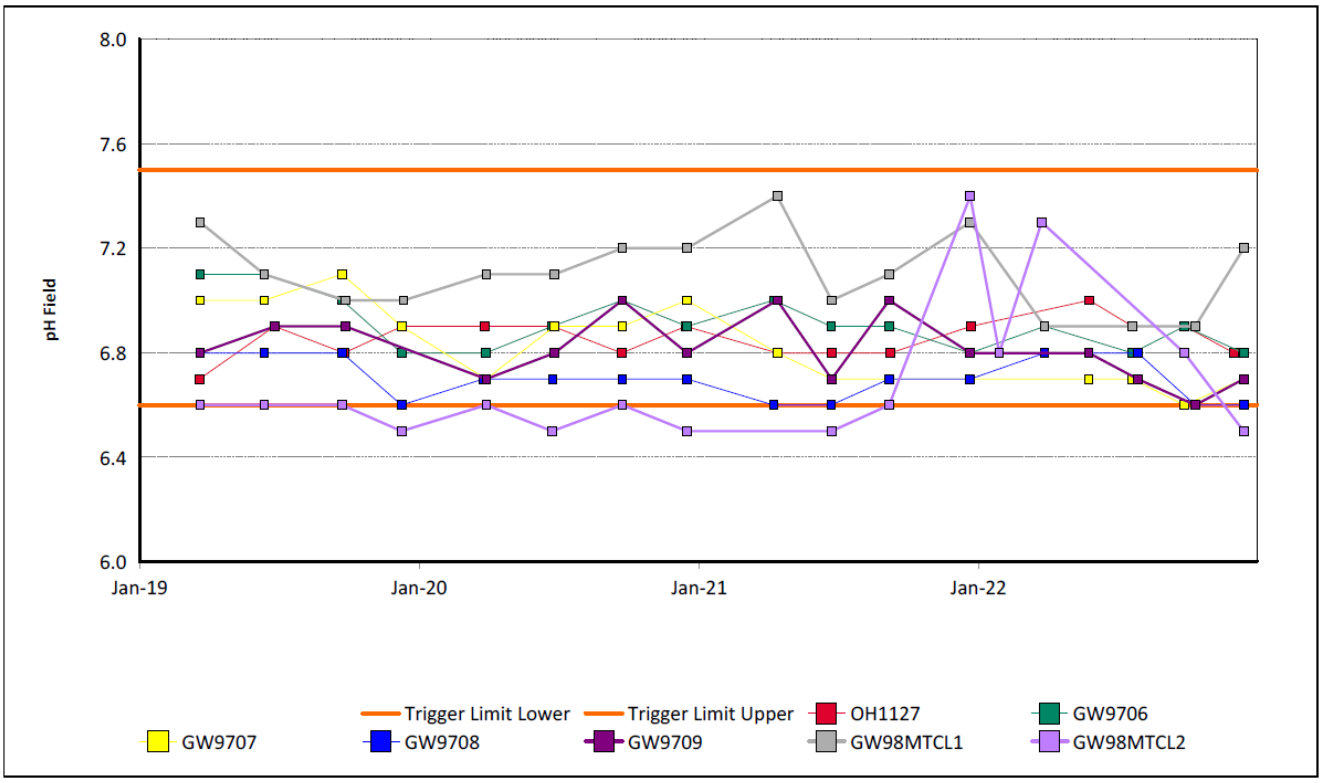

Figure 17: Bayswater Seam pH Field Trend - December 2022

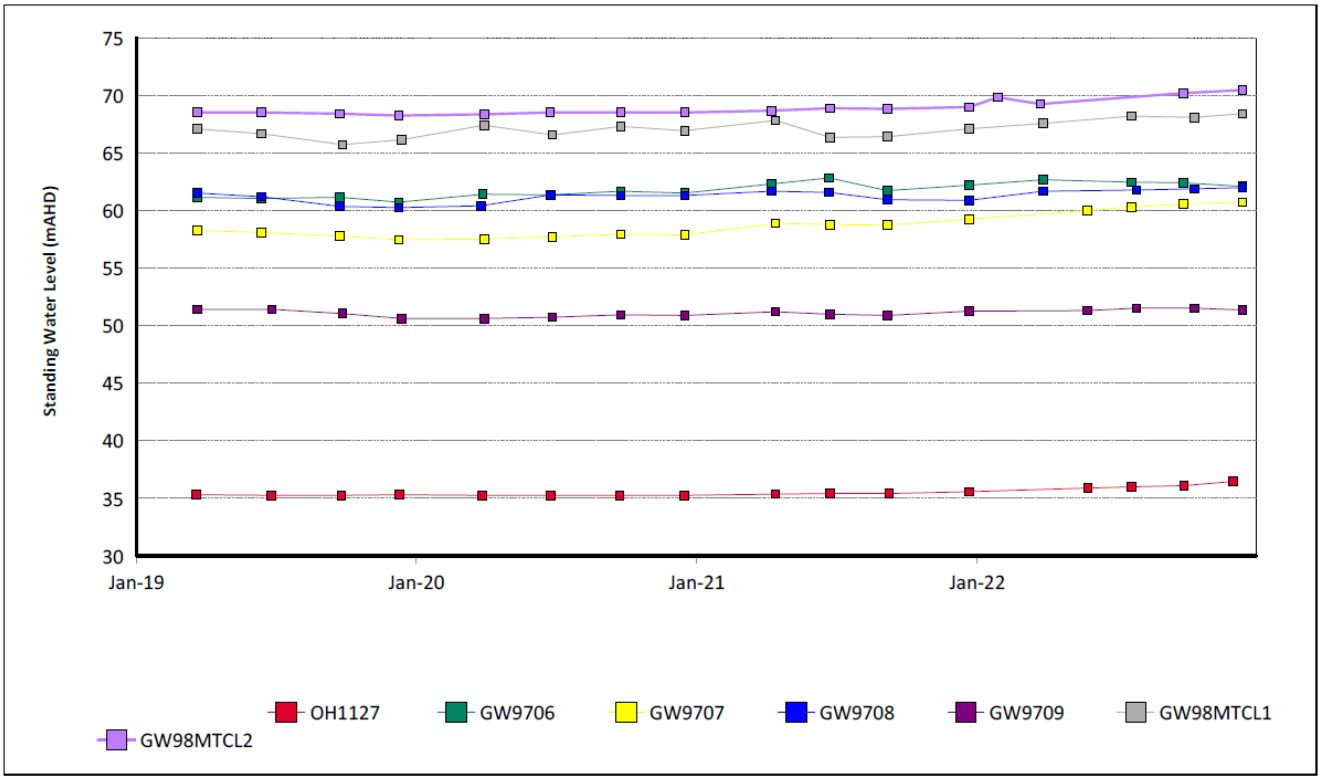

Figure 18: Bayswater Seam Standing Water Level Trend - December 2022

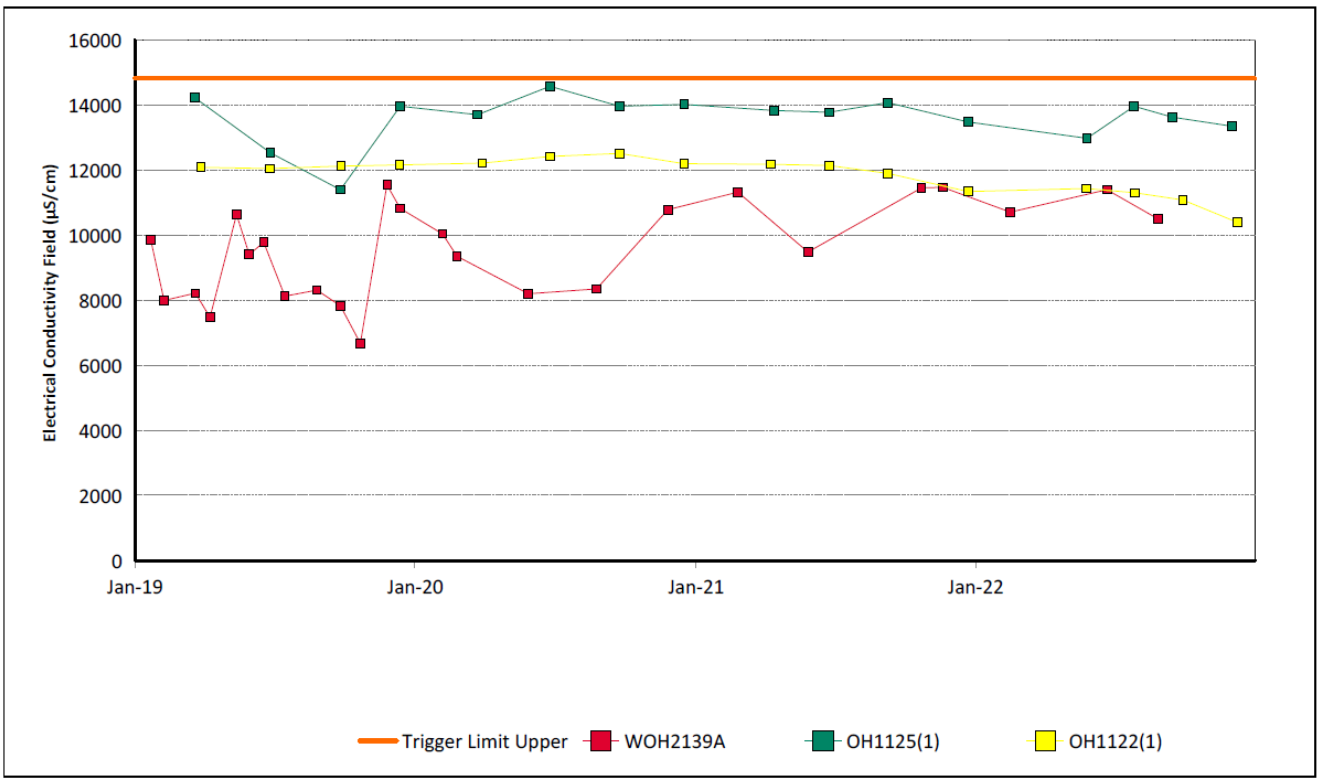

Figure 19: Blakefield Seam Electrical Conductivity Field Trend - December 2022

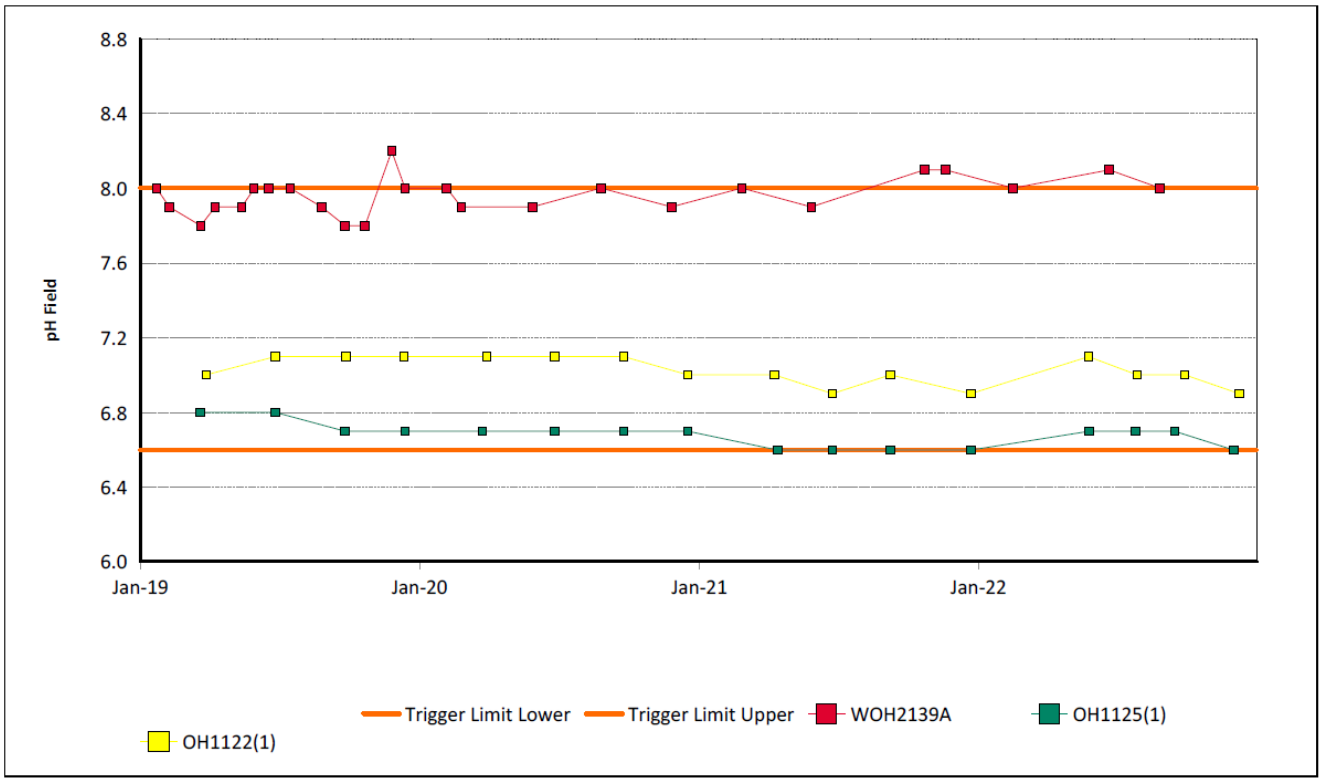

Figure 20: Blakefield Seam pH Field Trend - December 2022

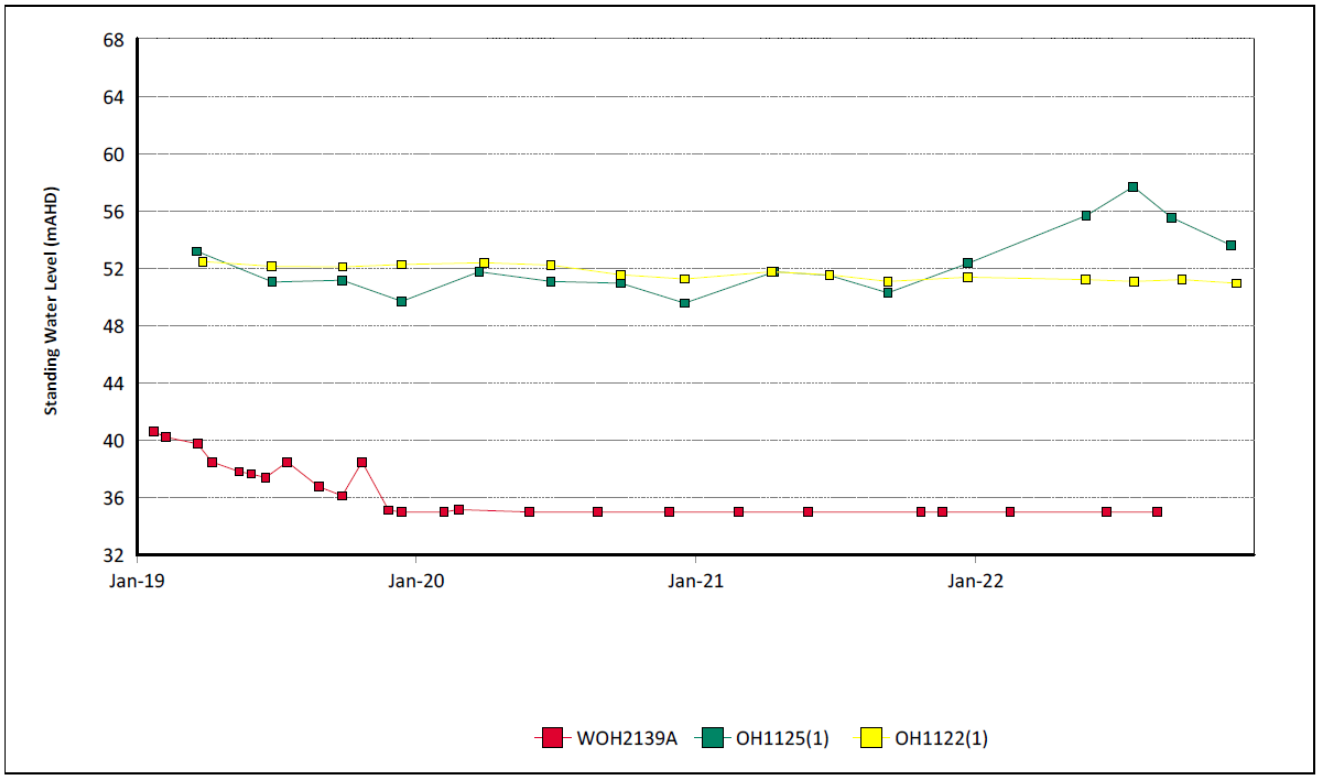

Figure 21: Blakefield Seam Standing Water Level Trend - December 2022

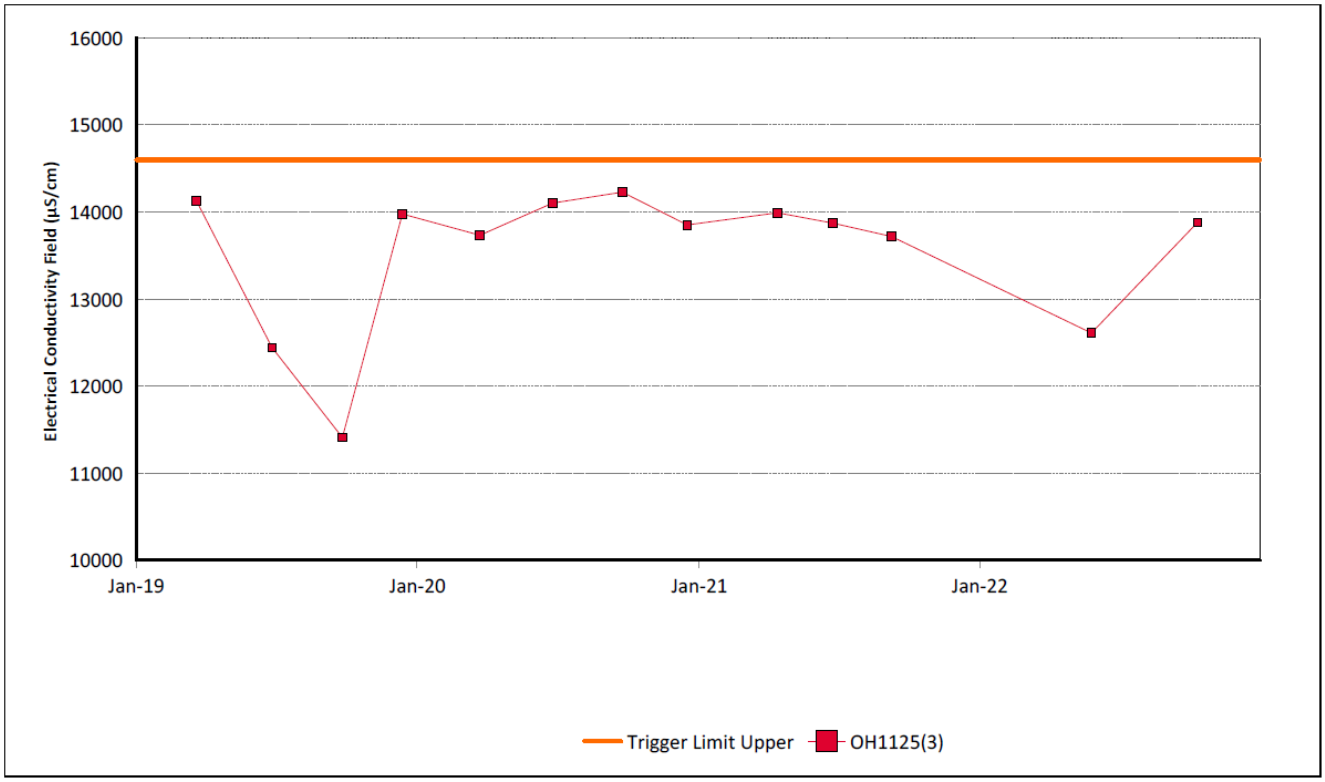

Figure 22: Bowfield Seam Electrical Conductivity Field Trend - December 2022

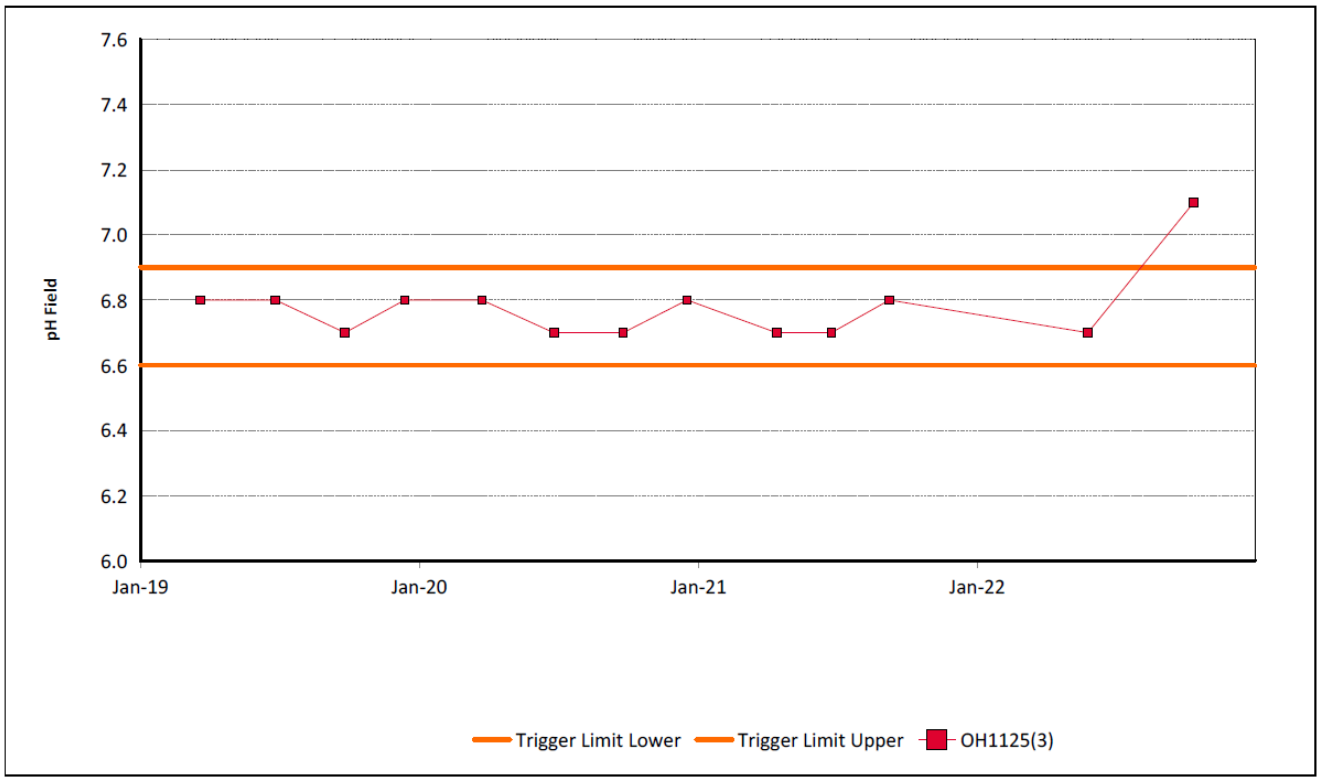

Figure 23: Bowfield Seam pH Field Trend - December 2022

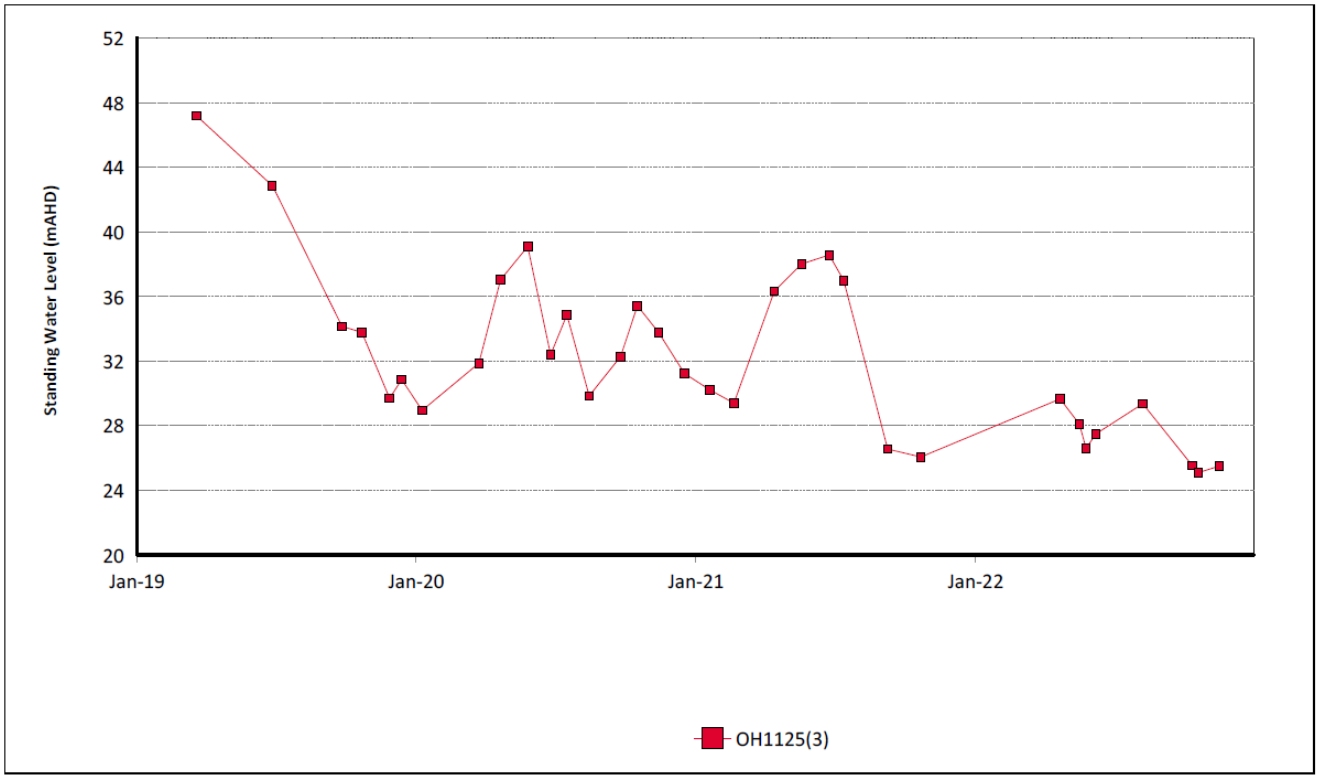

Figure 24: Bowfield Seam Standing Water Level Trend - December 2022

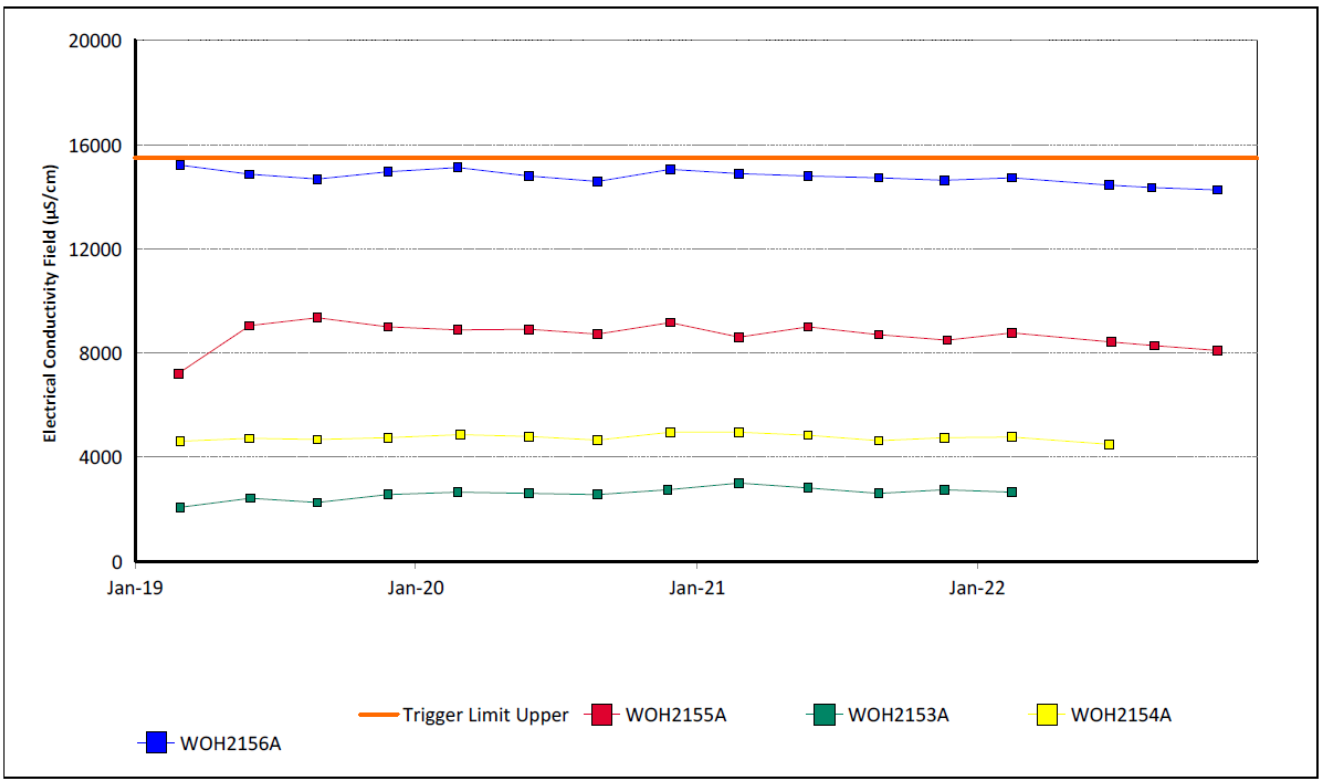

Figure 25: Redbank Seam Electrical Conductivity Field Trend - December 2022

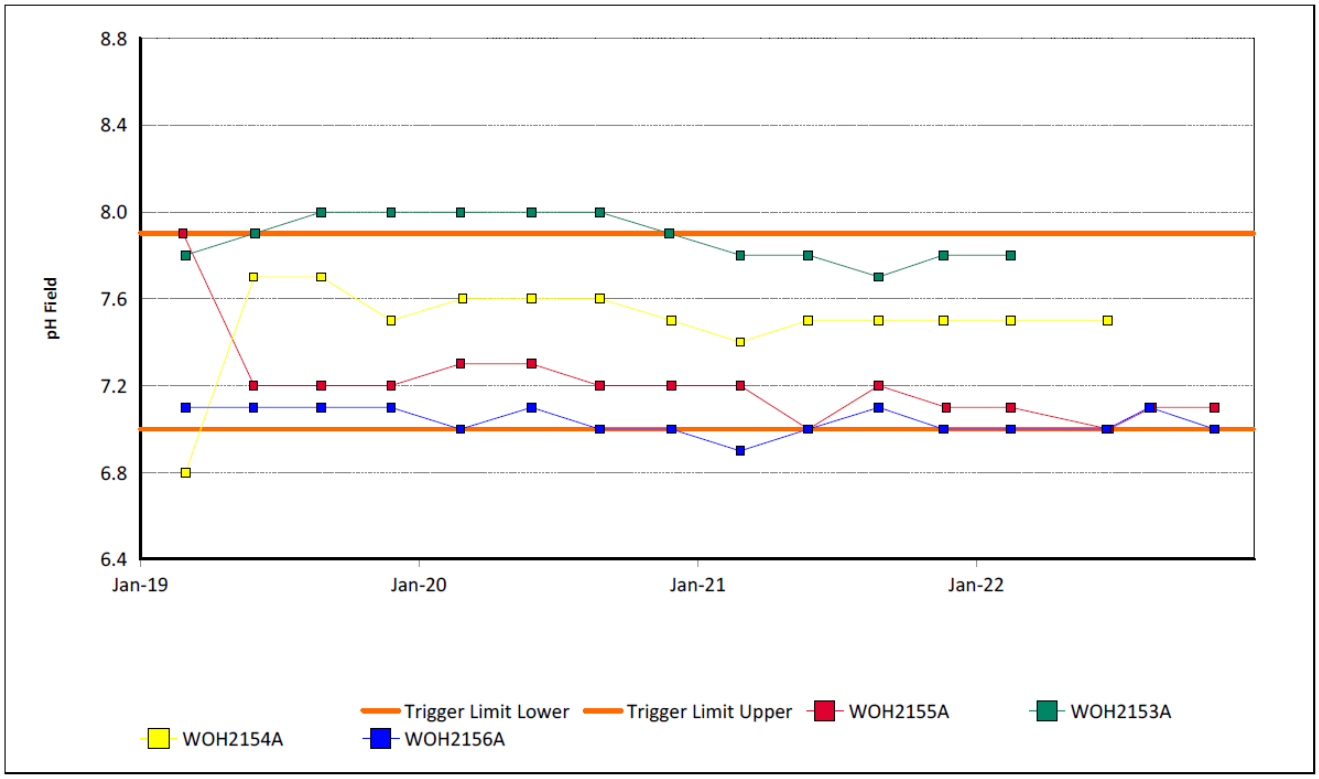

Figure 26: Redbank Seam pH Field Trend - December 2022

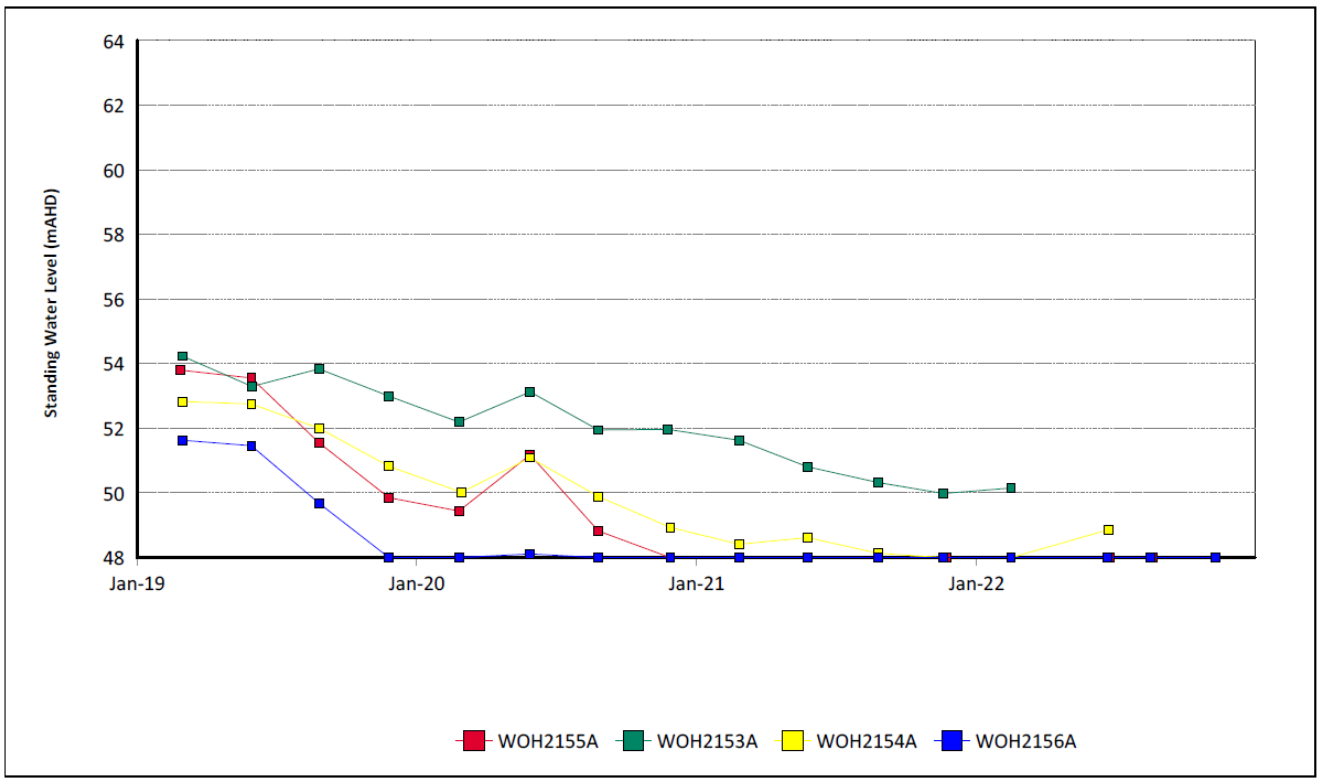

Figure 27: Redbank Seam Standing Water Level Trend - December 2022

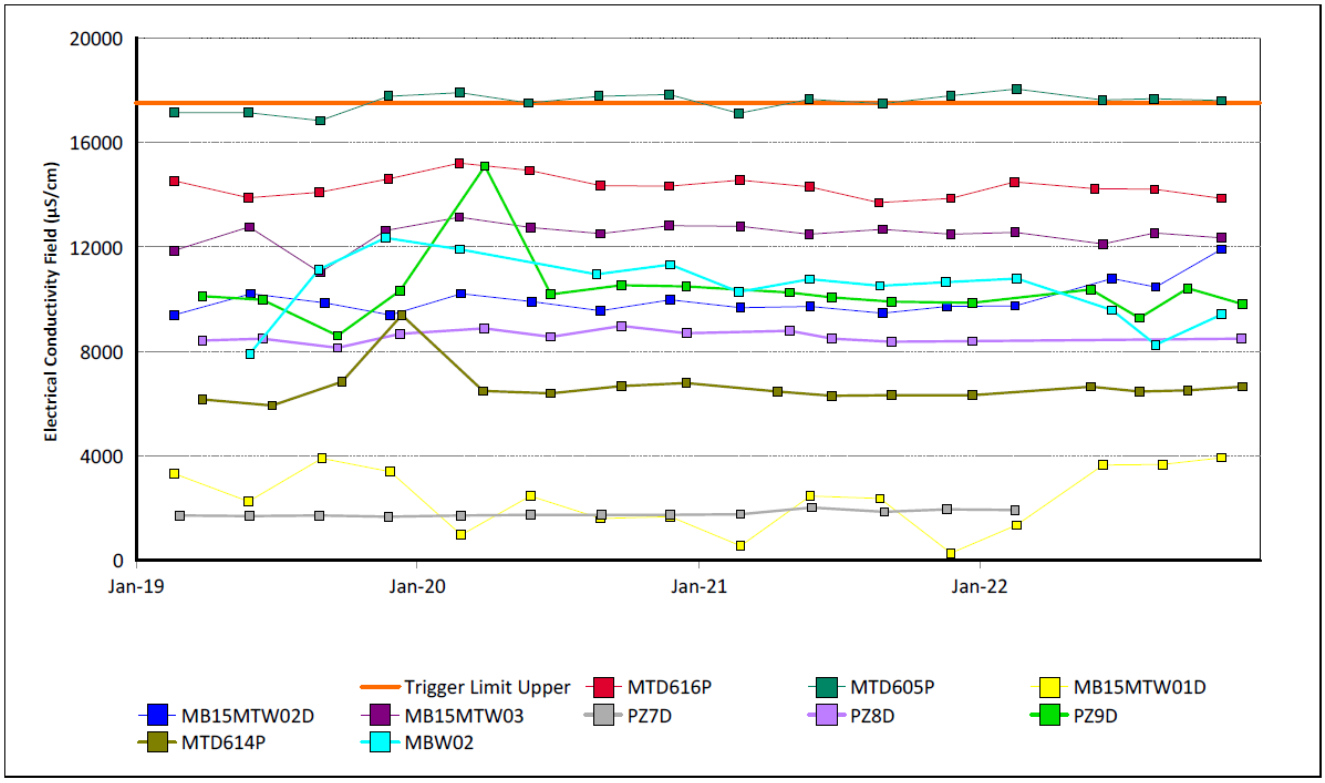

Figure 28: Shallow Overburden Electrical Conductivity Field Trend - December 2022

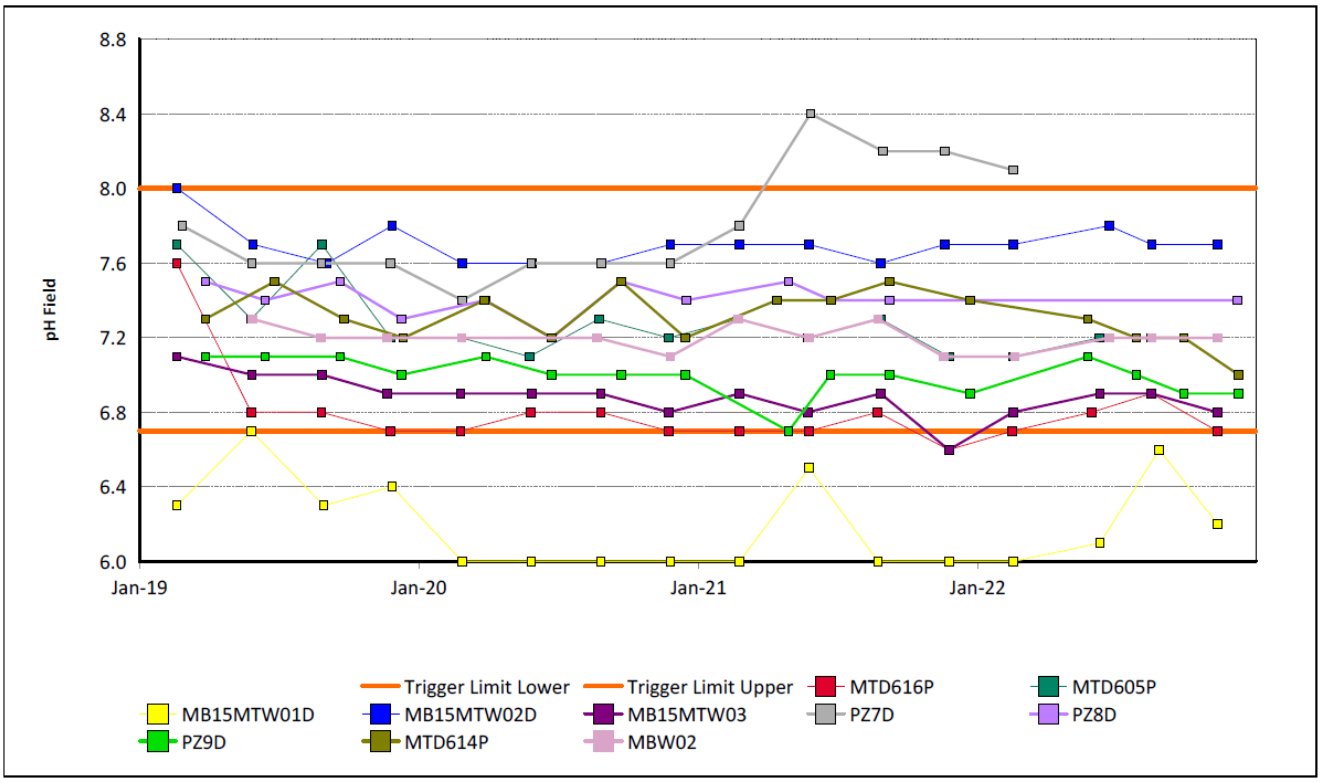

Figure 29: Shallow Overburden pH Field Trend - December 2022

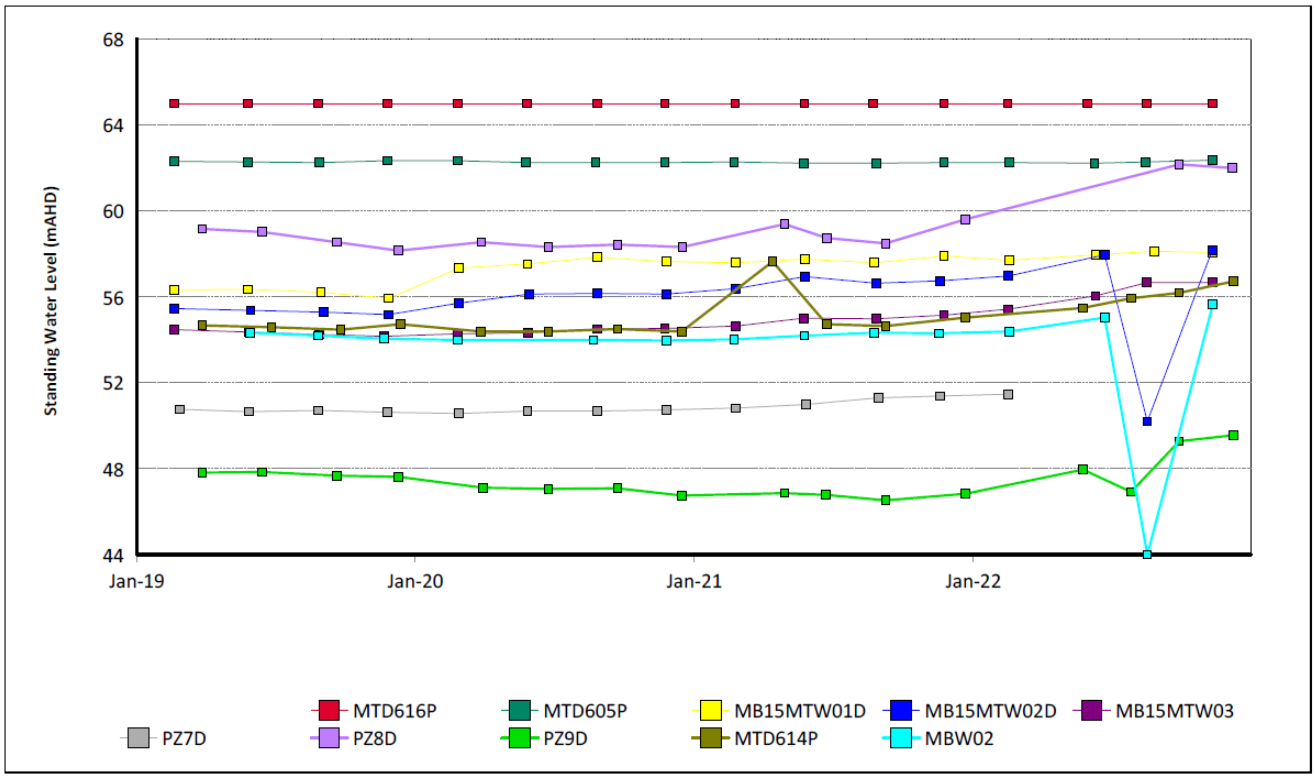

Figure 30: Shallow Overburden Standing Water Level Trend - December 2022

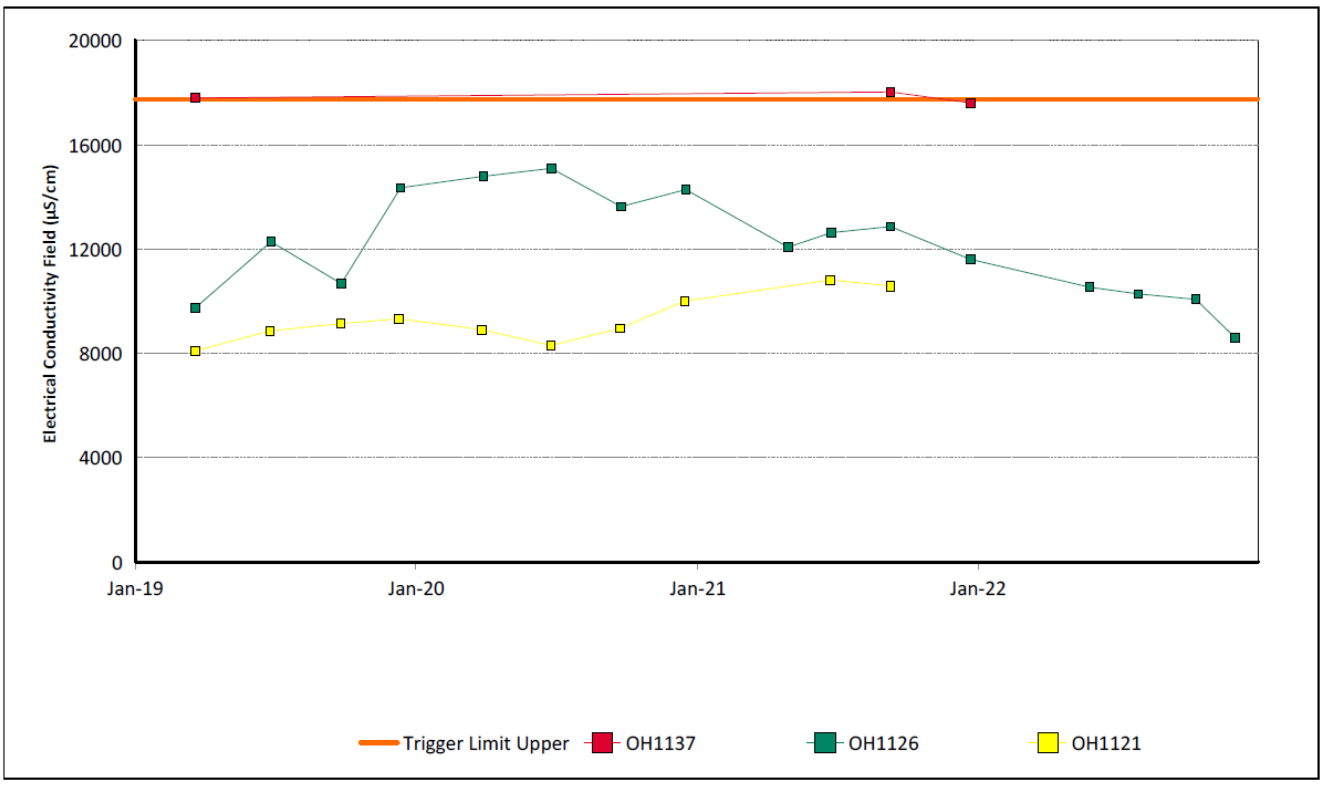

Figure 31: Vaux Seam Electrical Conductivity Field Trend - December 2022

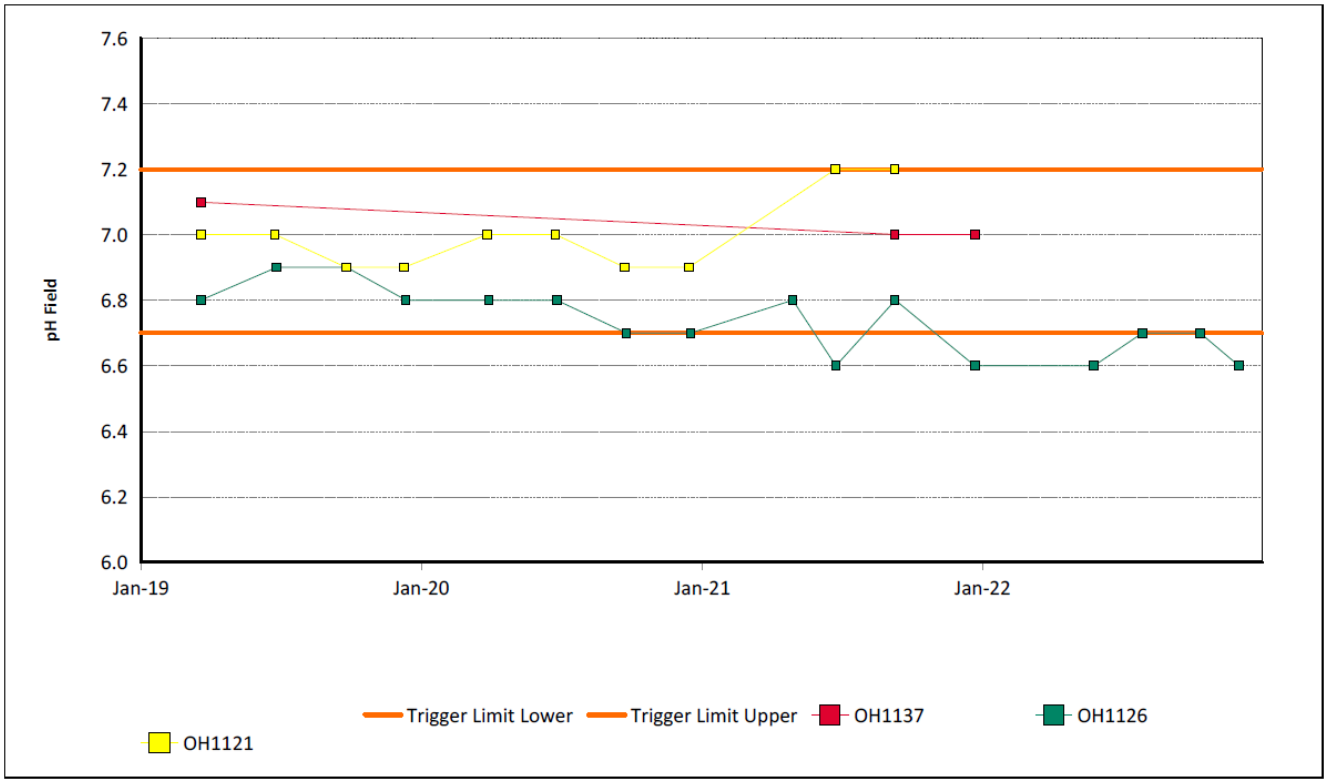

Figure 32: Vaux Seam pH Field Trend - December 2022

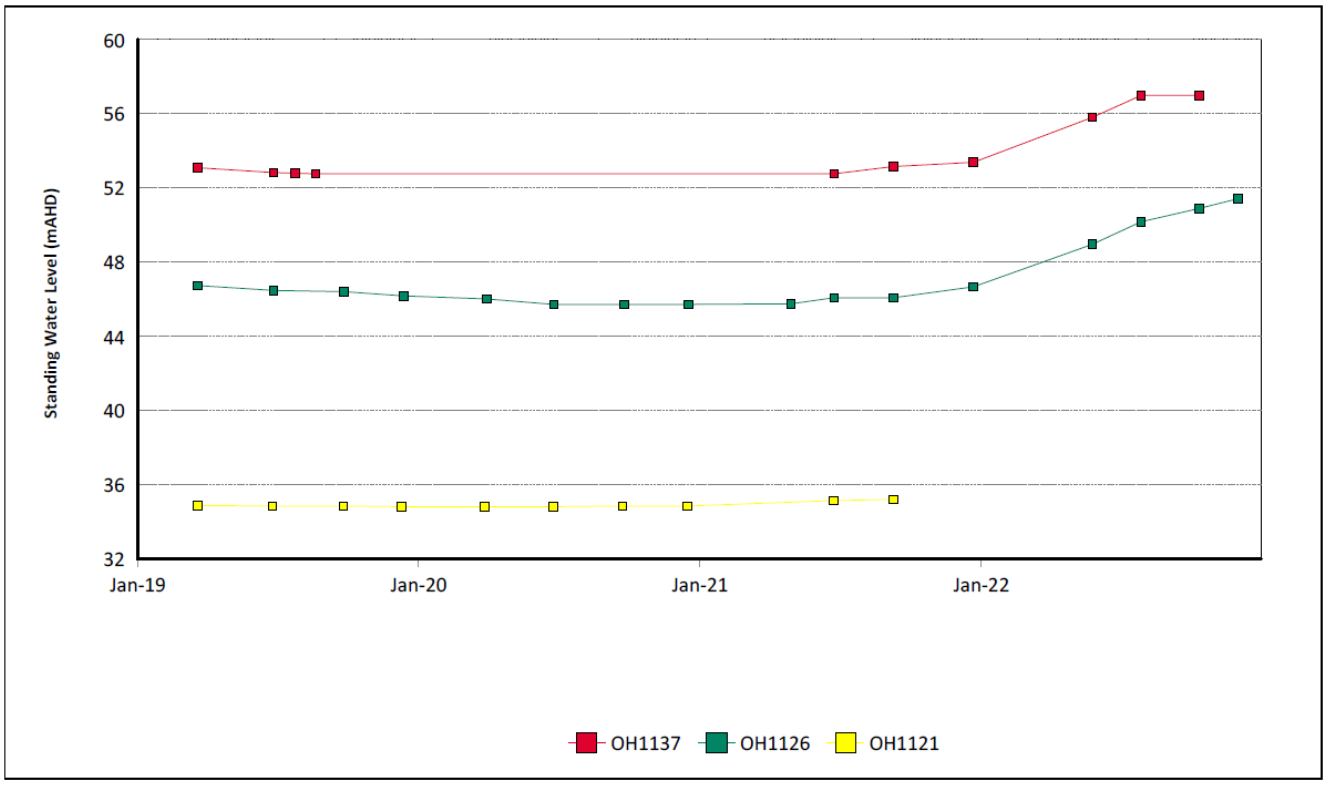

Figure 33: Vaux Seam Standing Water Level Trend - December 2022

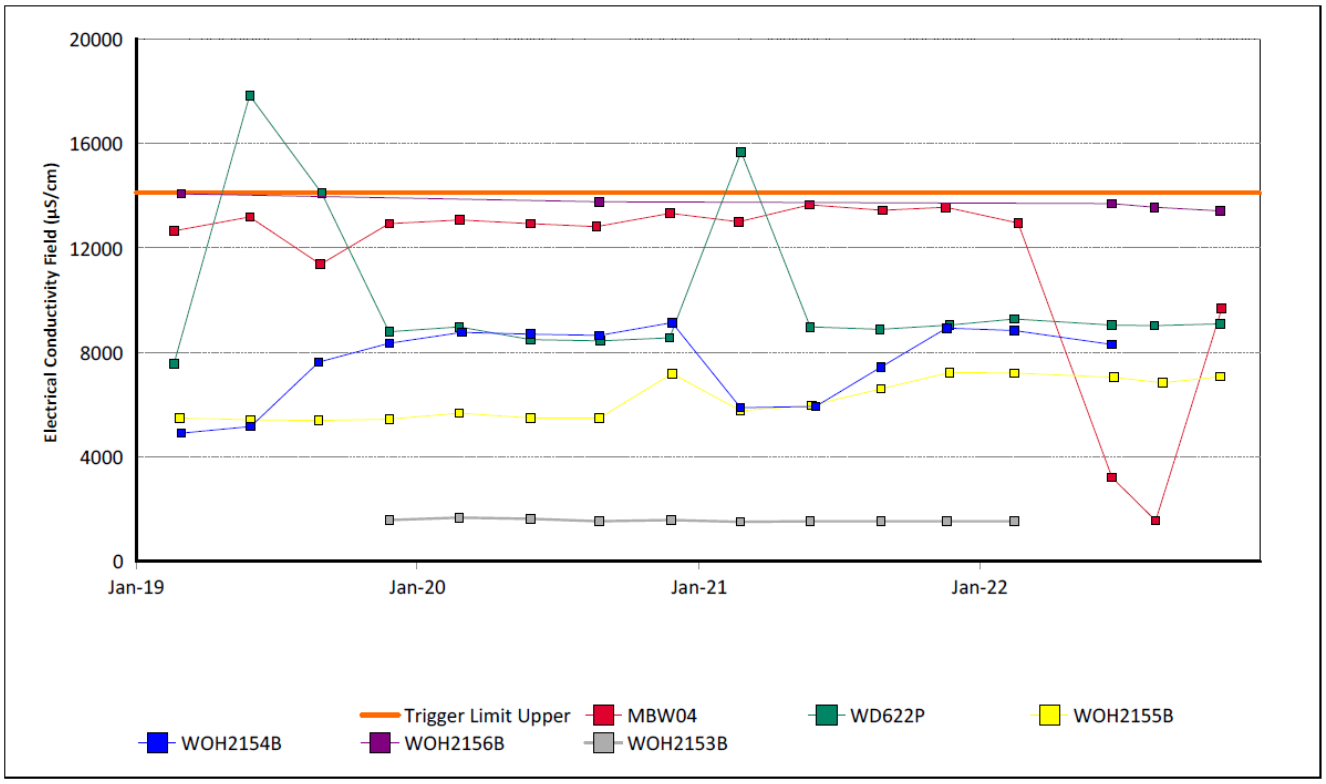

Figure 34: Wambo Seam Electrical Conductivity Field Trend - December 2022

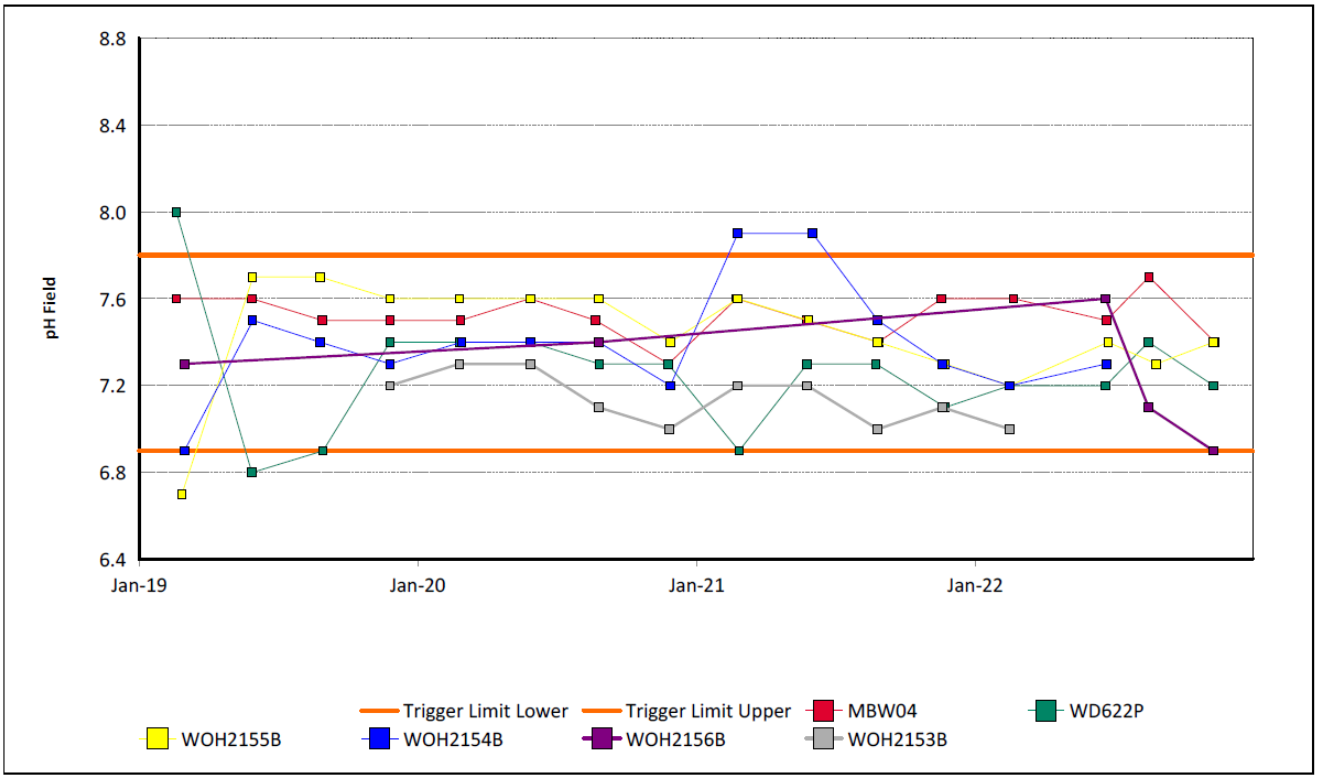

Figure 35: Wambo Seam pH Field Trend - December 2022

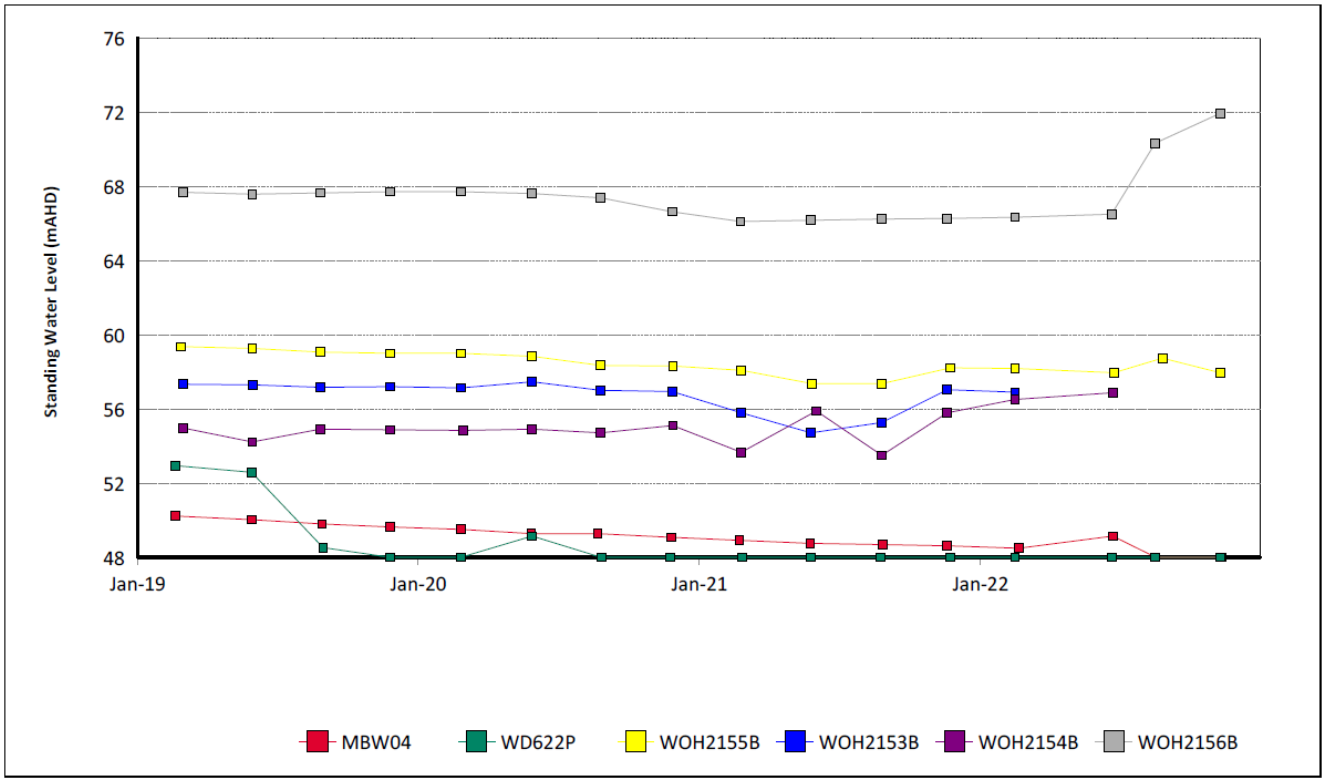

Figure 36: Wambo Seam Standing Water Level Trend - December 2022

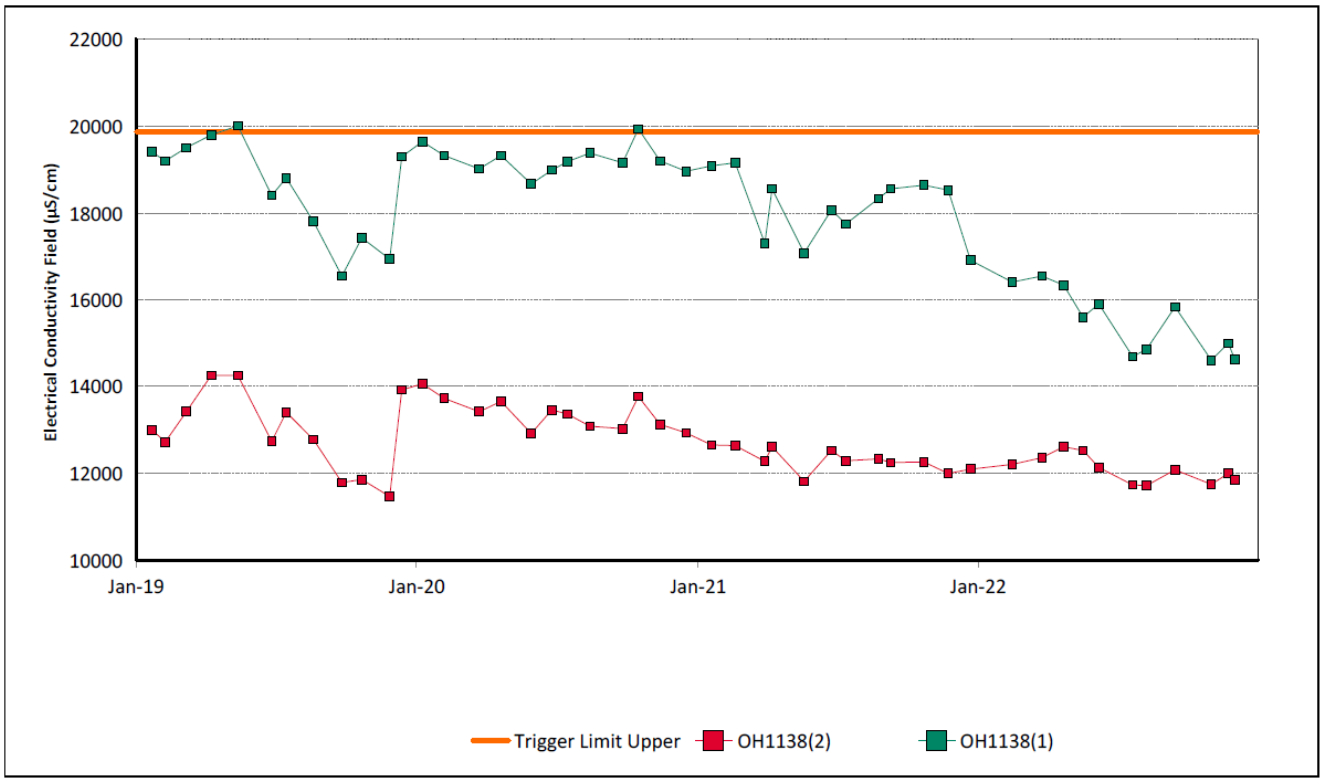

Figure 37: Warkworth Seam Electrical Conductivity Field Trend - December 2022

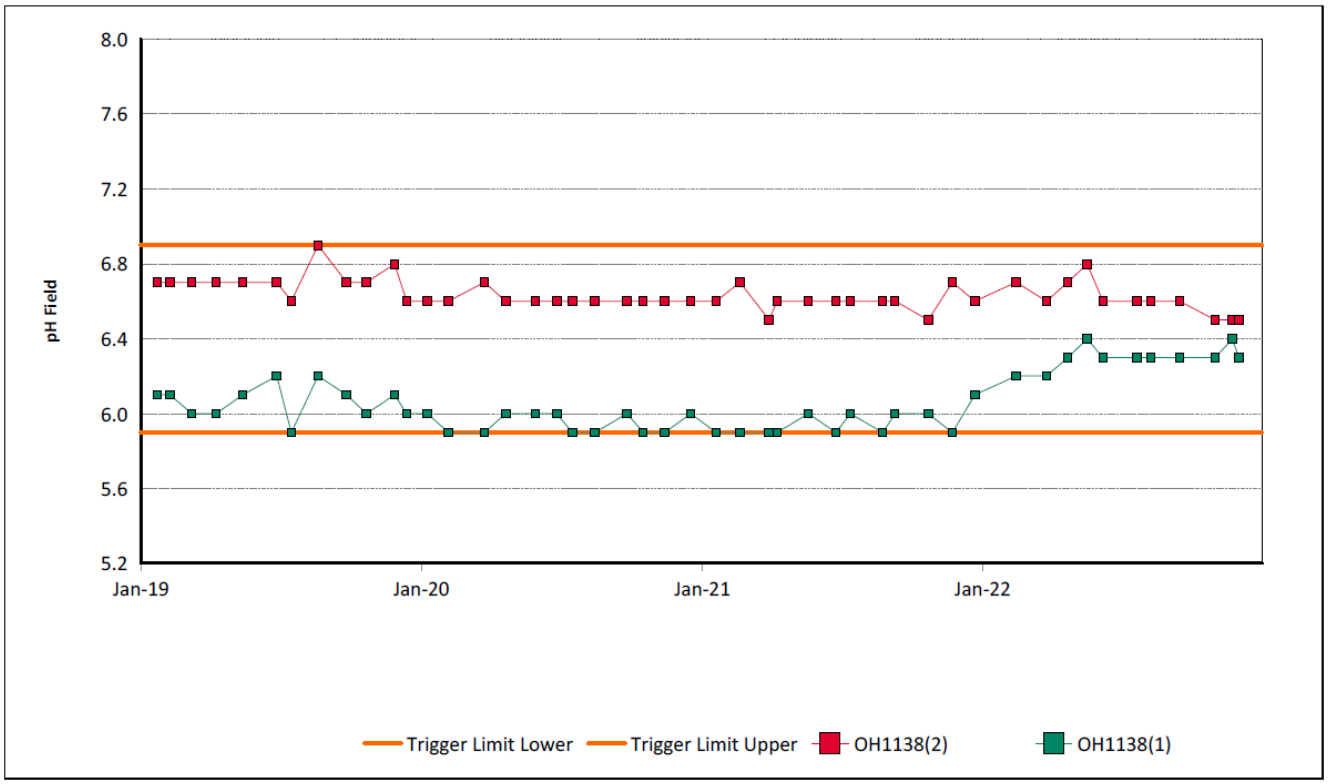

Figure 38: Warkworth Seam pH Field Trend - December 2022

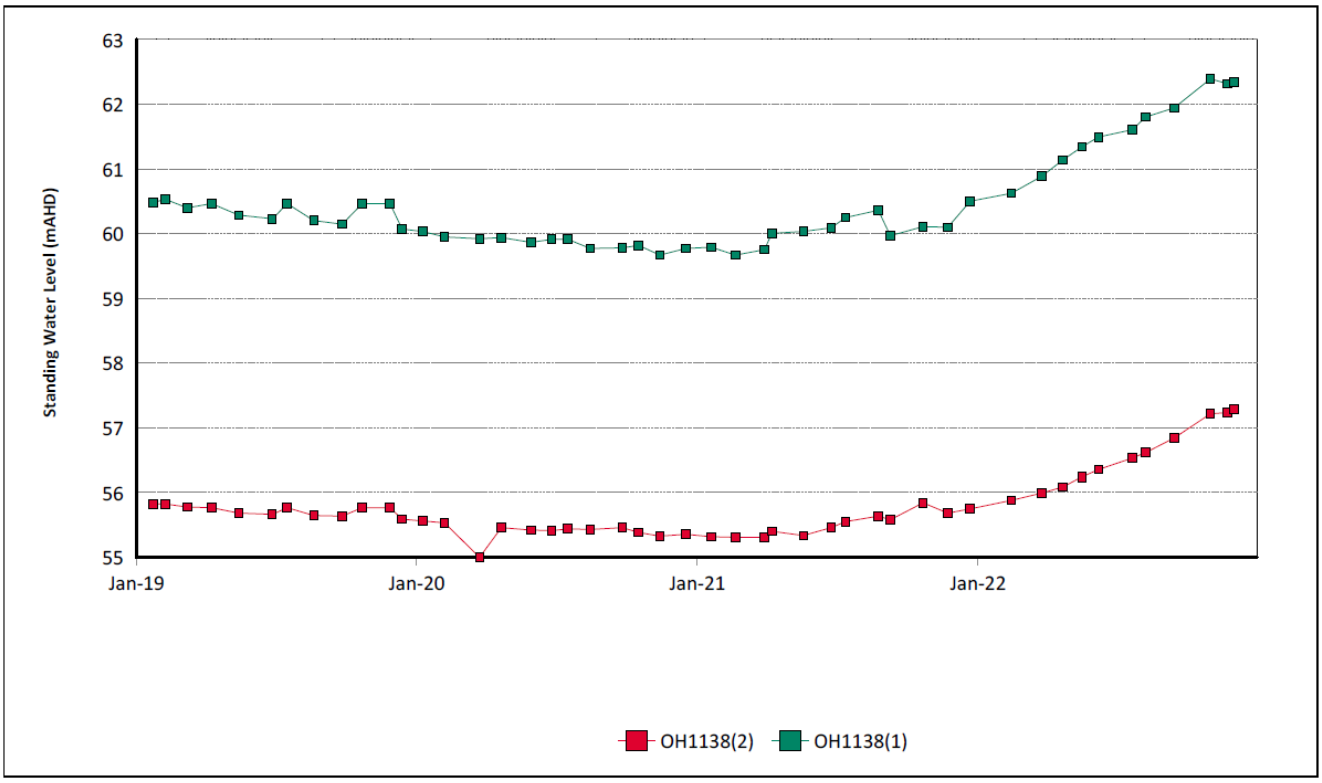

Figure 39: Warkworth Seam Standing Water Level Trend - December 2022

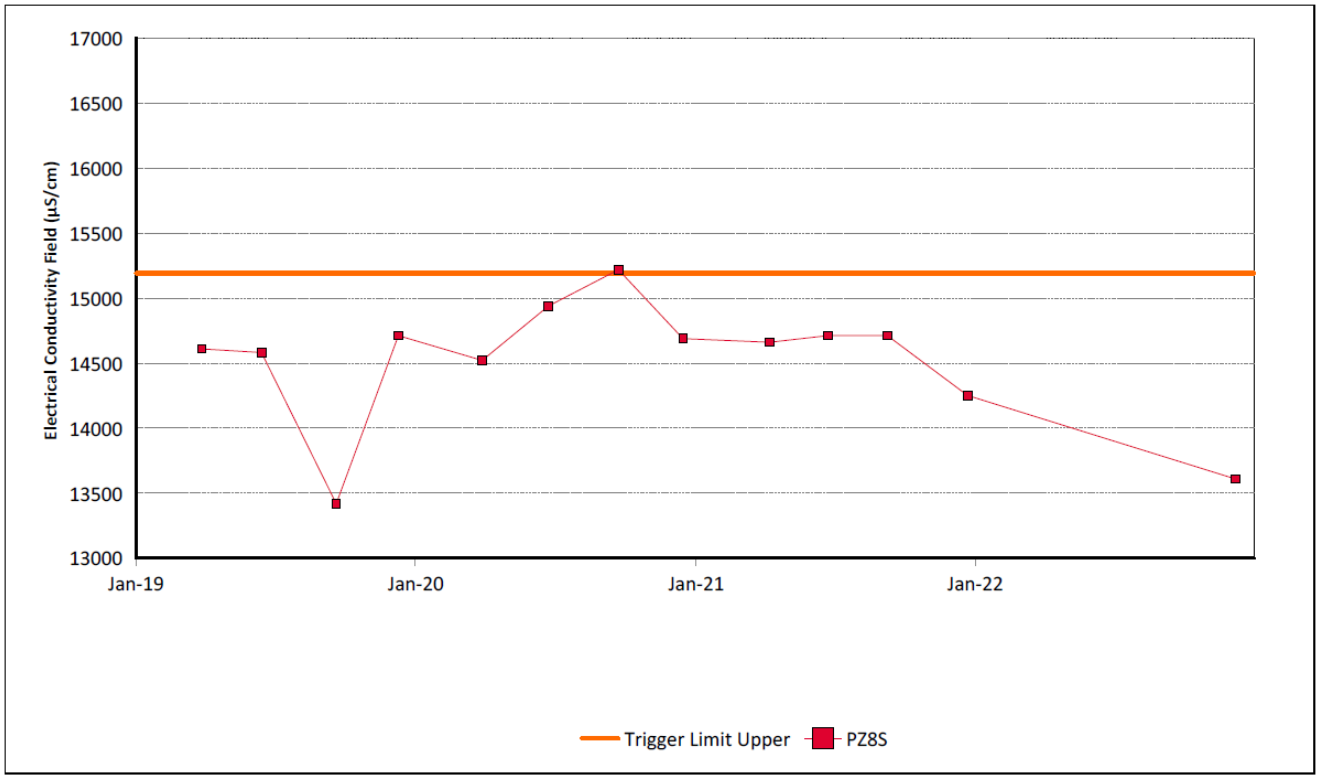

Figure 40: Wollombi Alluvium 1 Electrical Conductivity Field Trend - December 2022

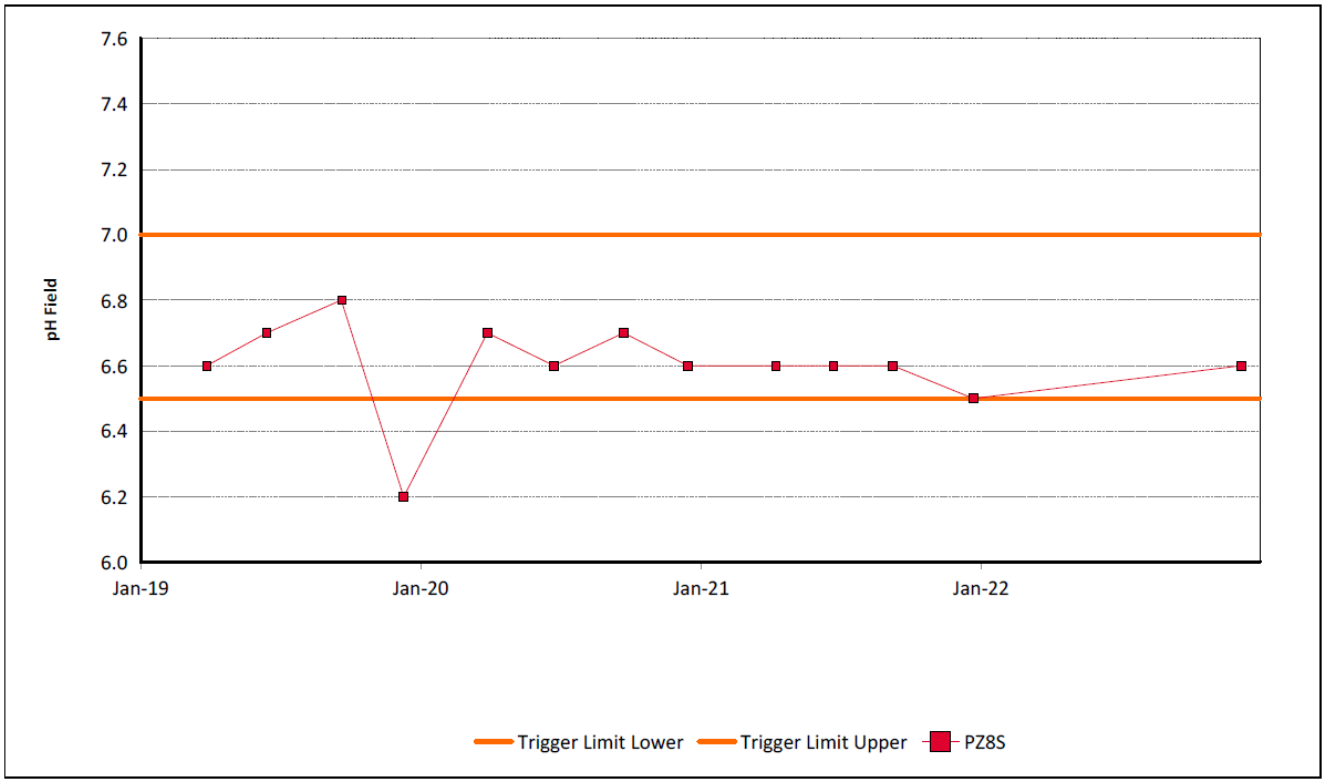

Figure 41: Wollombi Alluvium 1 pH Field Trend - December 2022

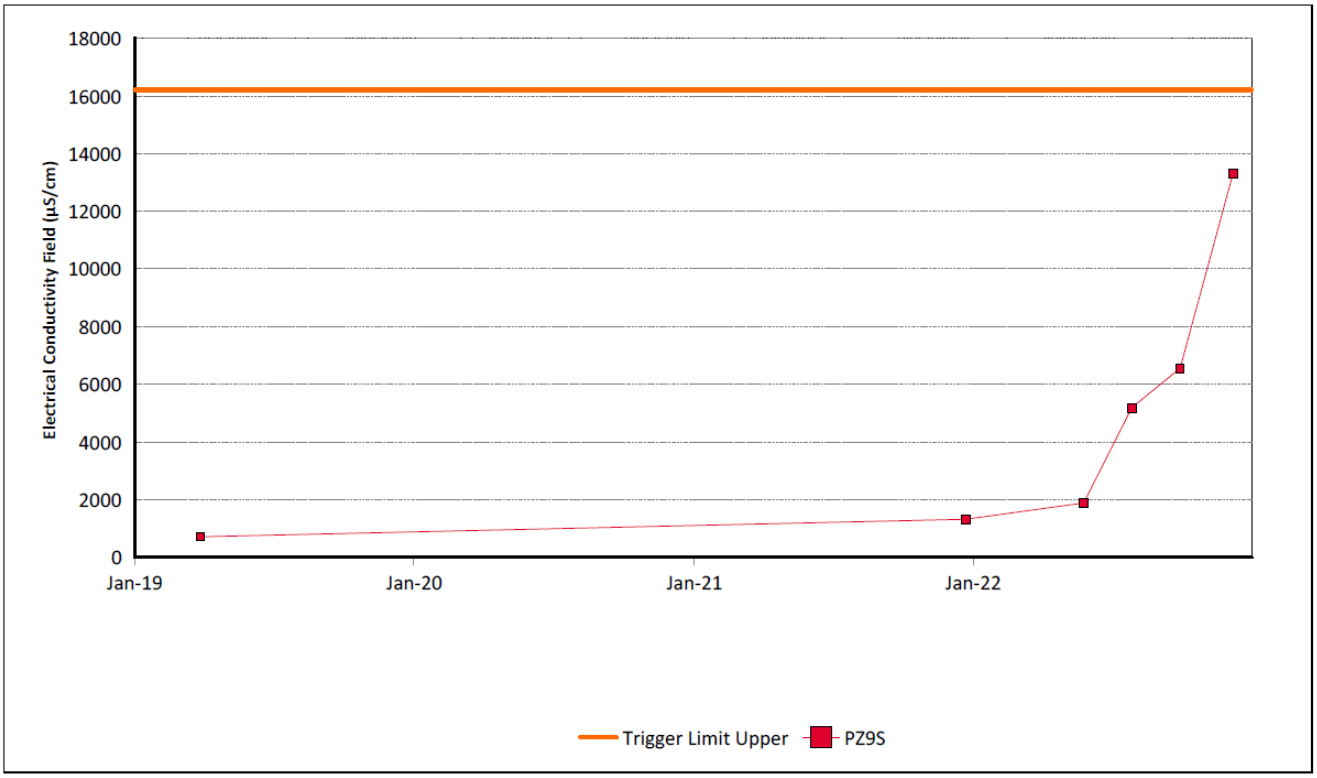

Figure 42: Wollombi Alluvium 2 Electrical Conductivity Field Trend – December 2022

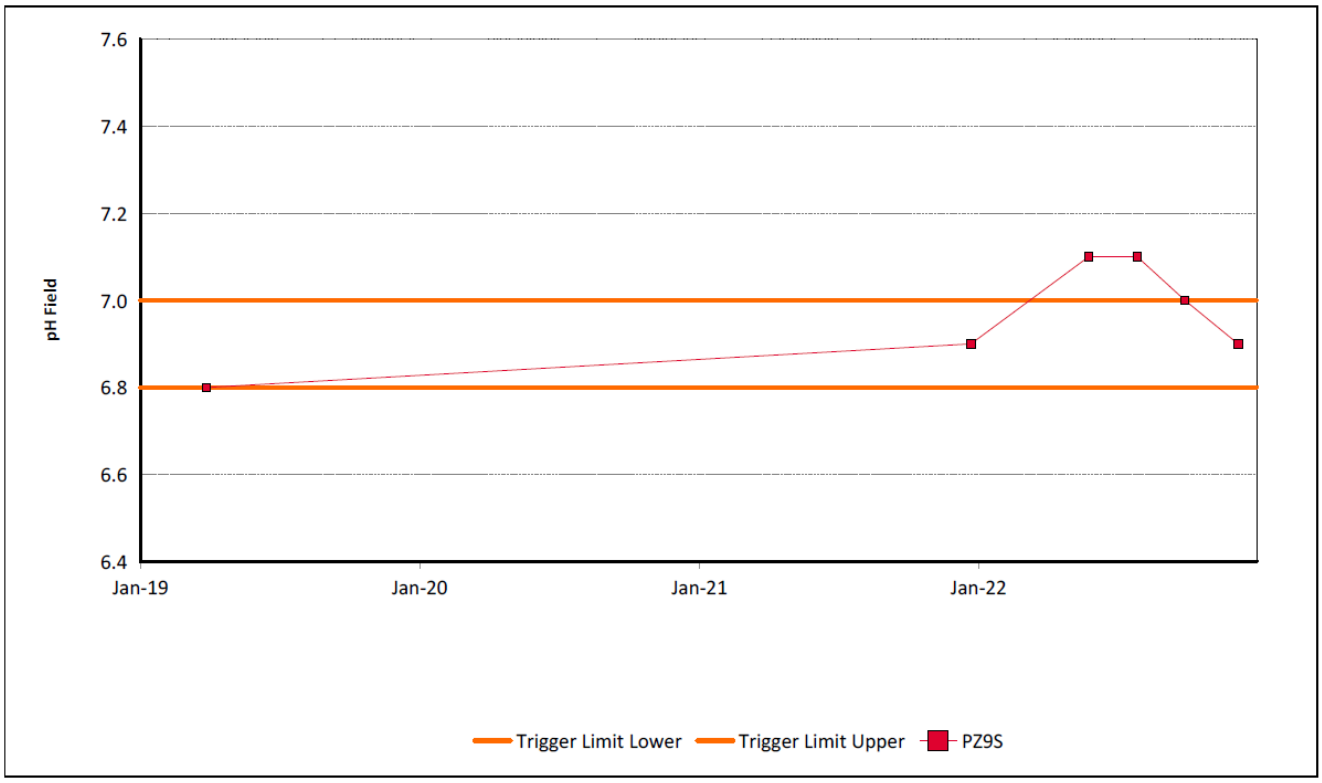

Figure 43: Wollombi Alluvium 2 pH Field Trend - December 2022

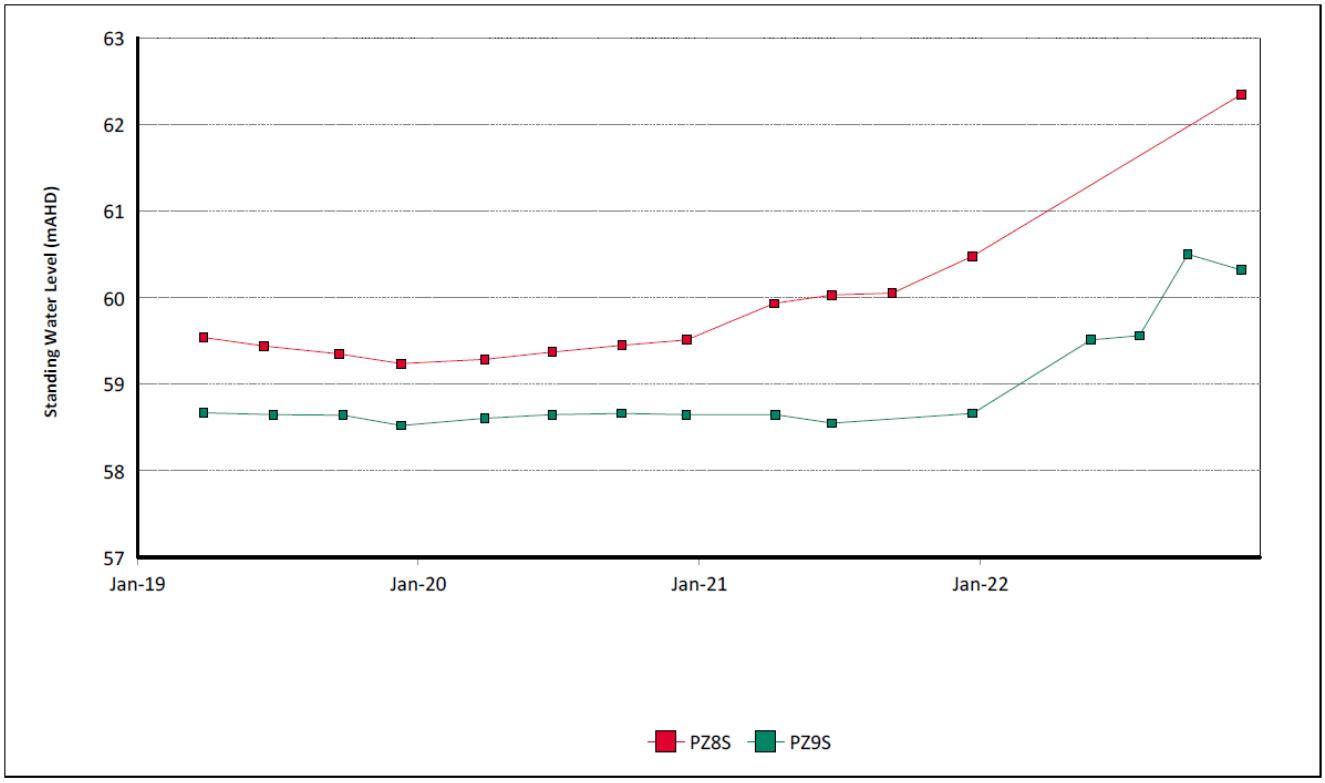

Figure 44: Wollombi Alluvium Standing Water Level Trend - December 2022

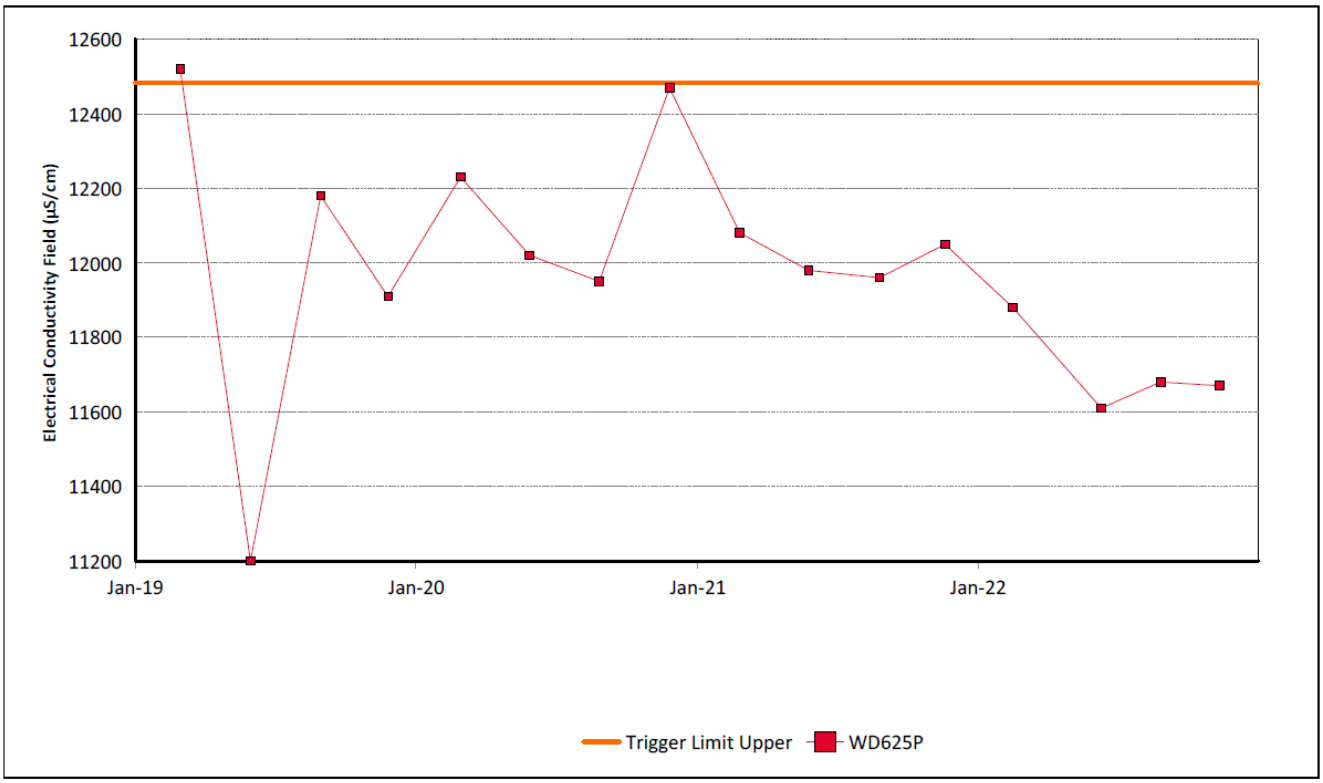

Figure 45: Woodlands Hill Seam Electrical Conductivity Field Trend - December 2022

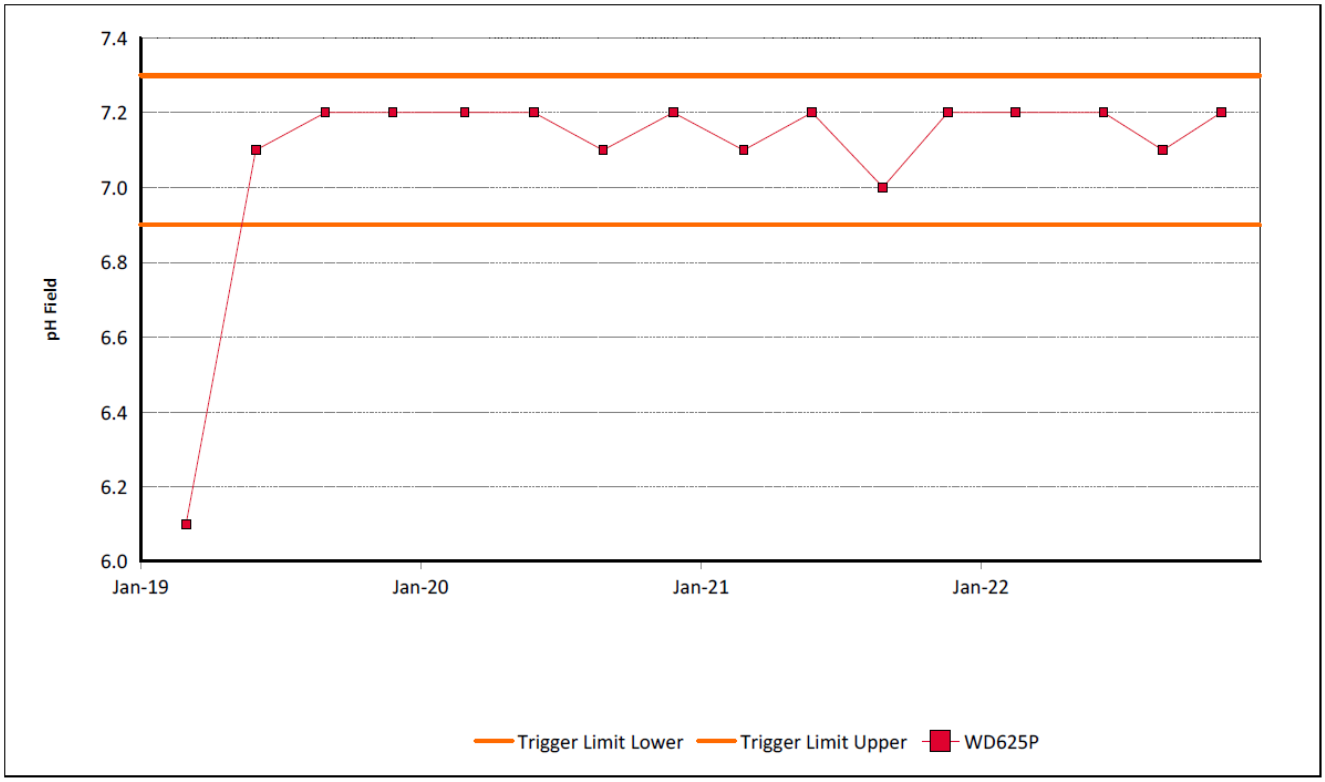

Figure 46: Woodlands Hill Seam pH Field Trend - December 2022

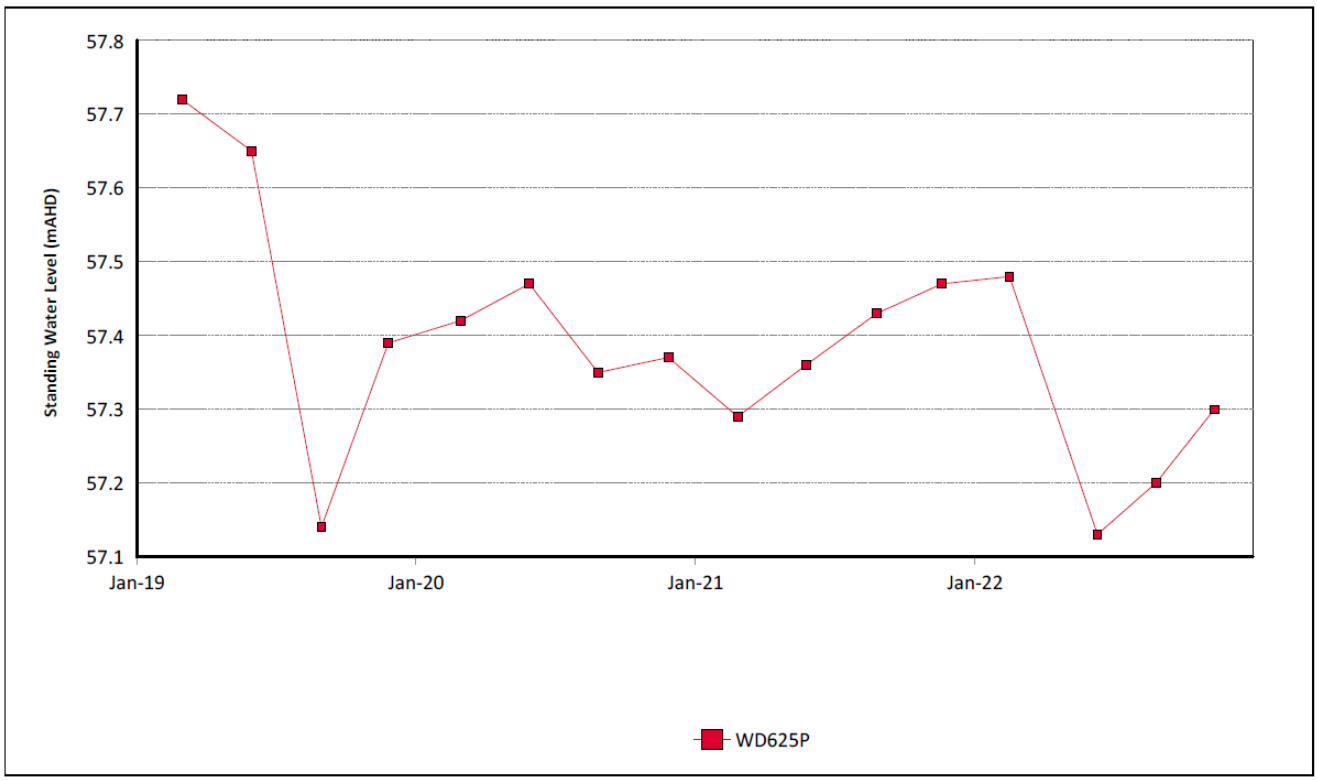

Figure 47: Woodlands Hill Seam Standing Water Level Trend - December 2022

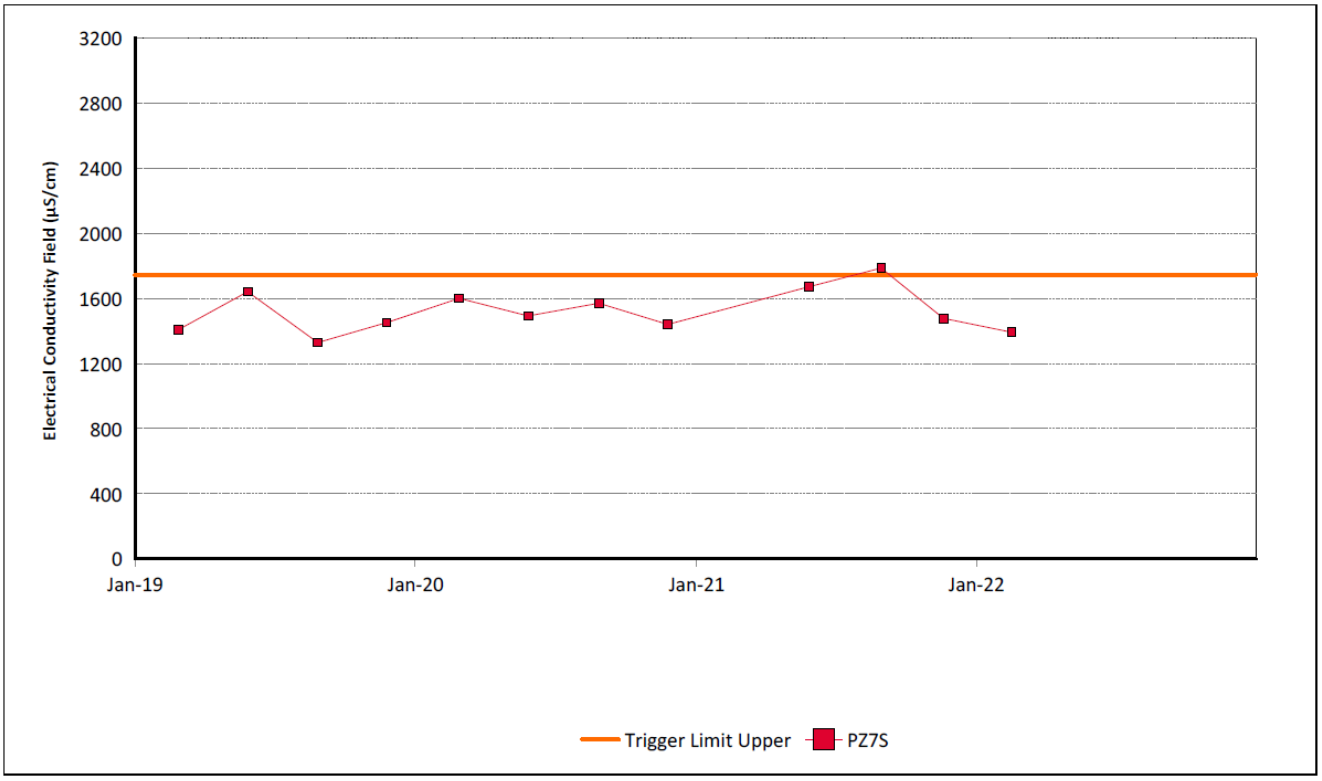

Figure 48: Aeolian Warkworth Sands Electrical Conductivity Field Trend - December 2022

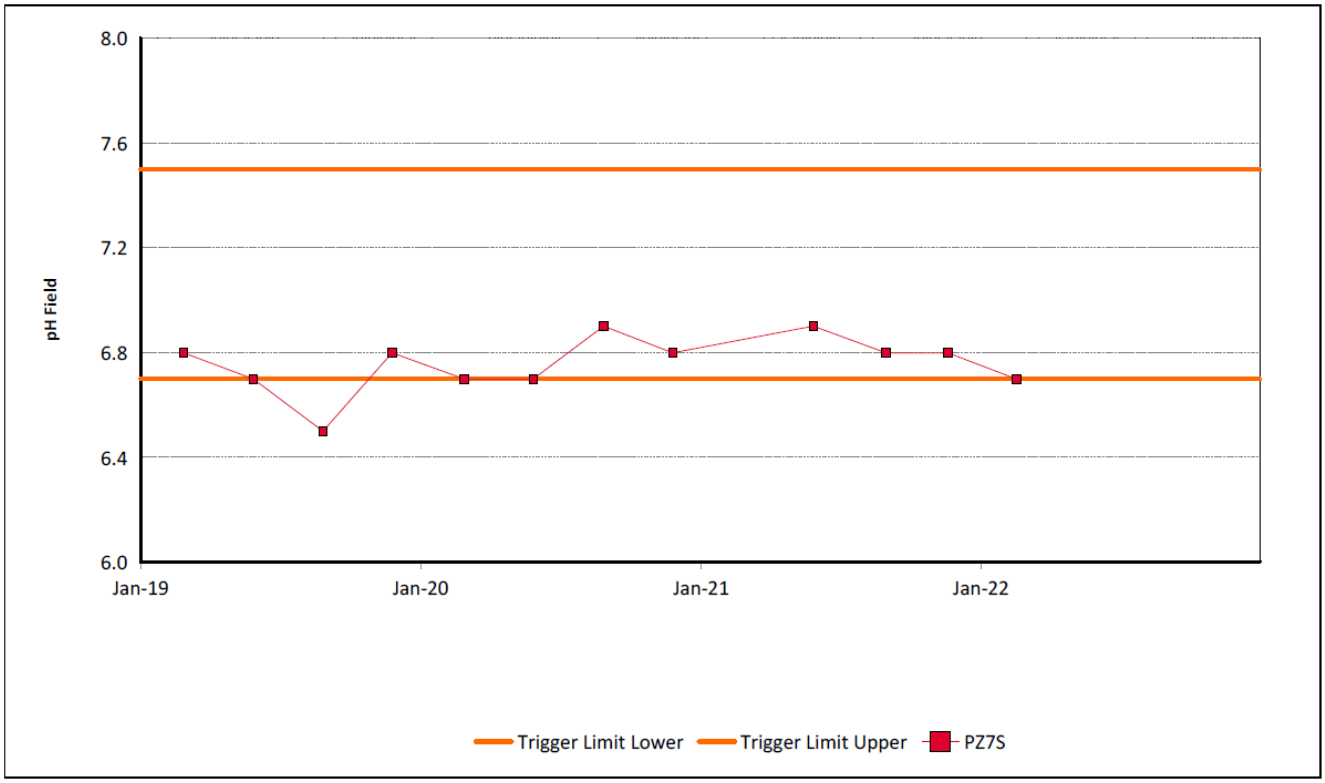

Figure 49: Aeolian Warkworth Sands pH Field Trend - December 2022

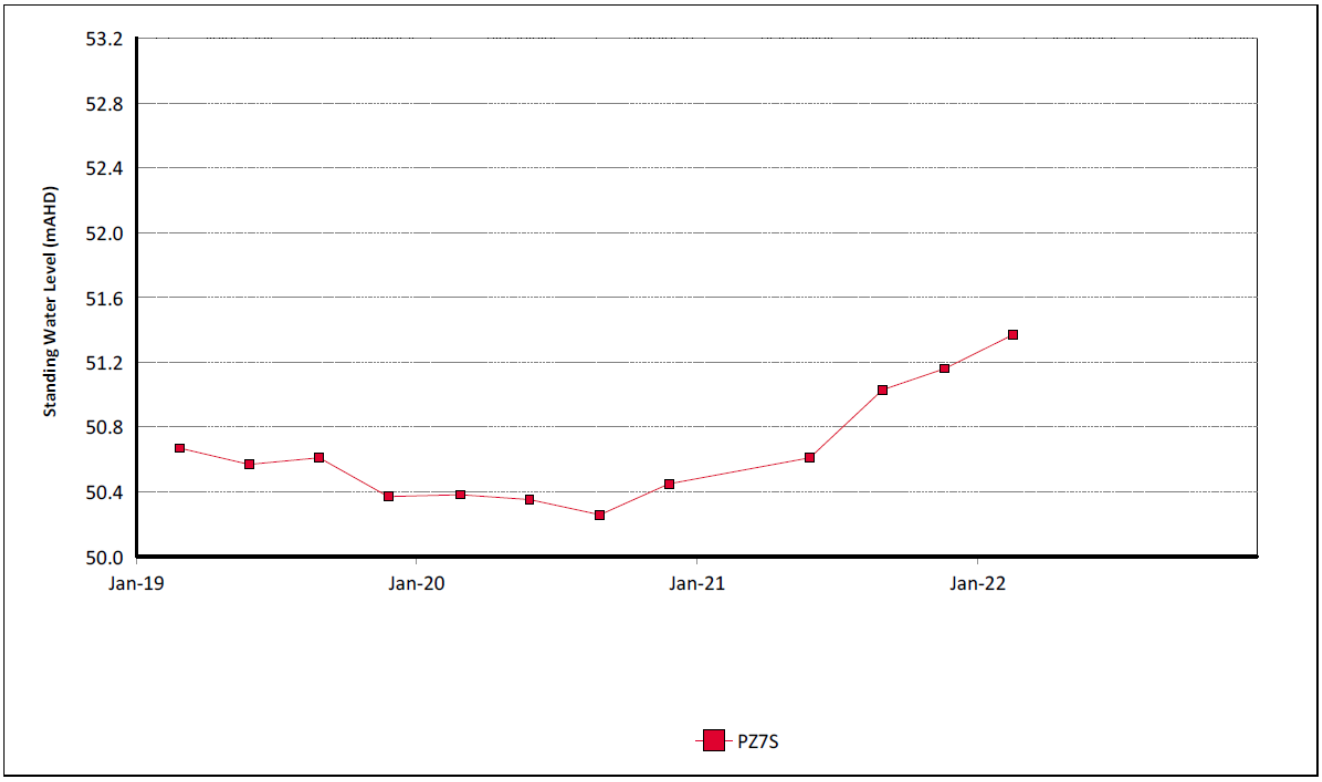

Figure 50: Aeolian Warkworth Sands Standing Water Level Trend - December 2022

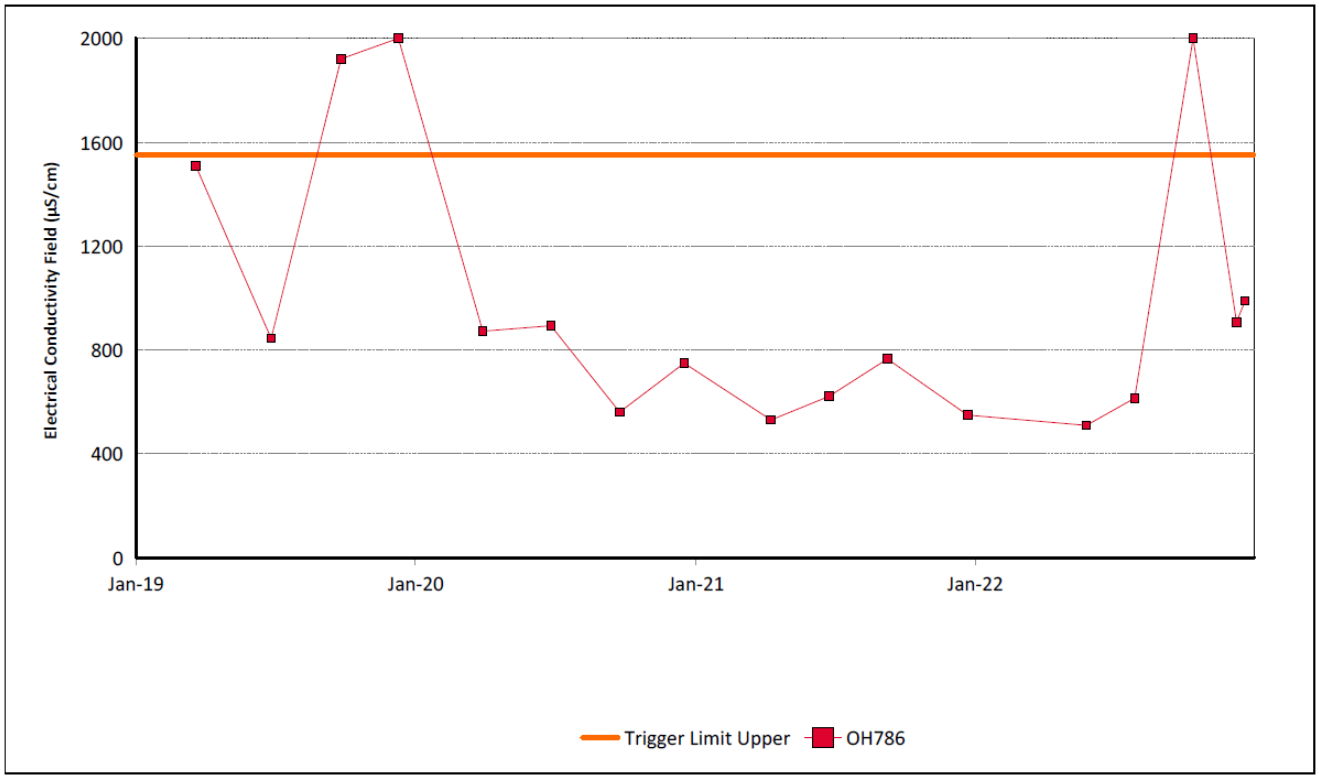

Figure 51: Hunter River Alluvium 1 Electrical Conductivity Field Trend - December 2022

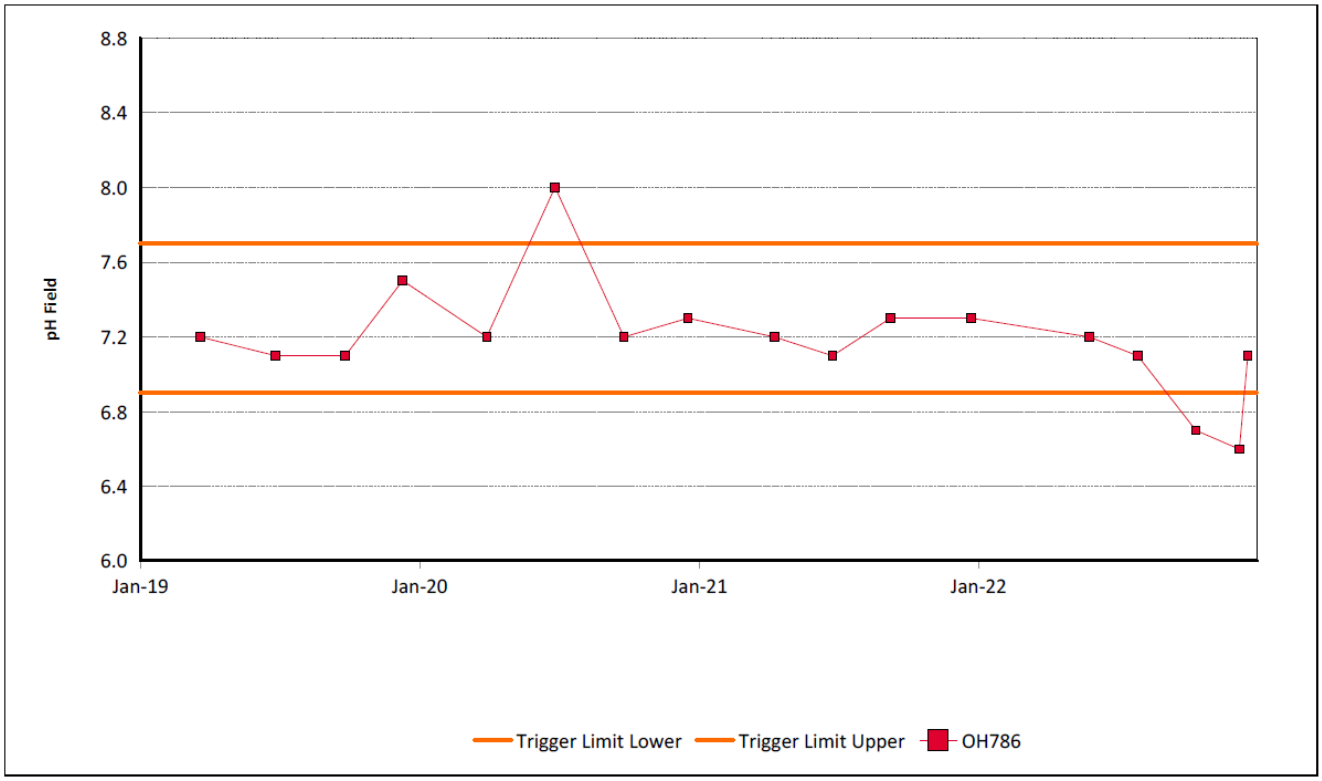

Figure 52: Hunter River Alluvium 1 pH Field Trend - December 2022

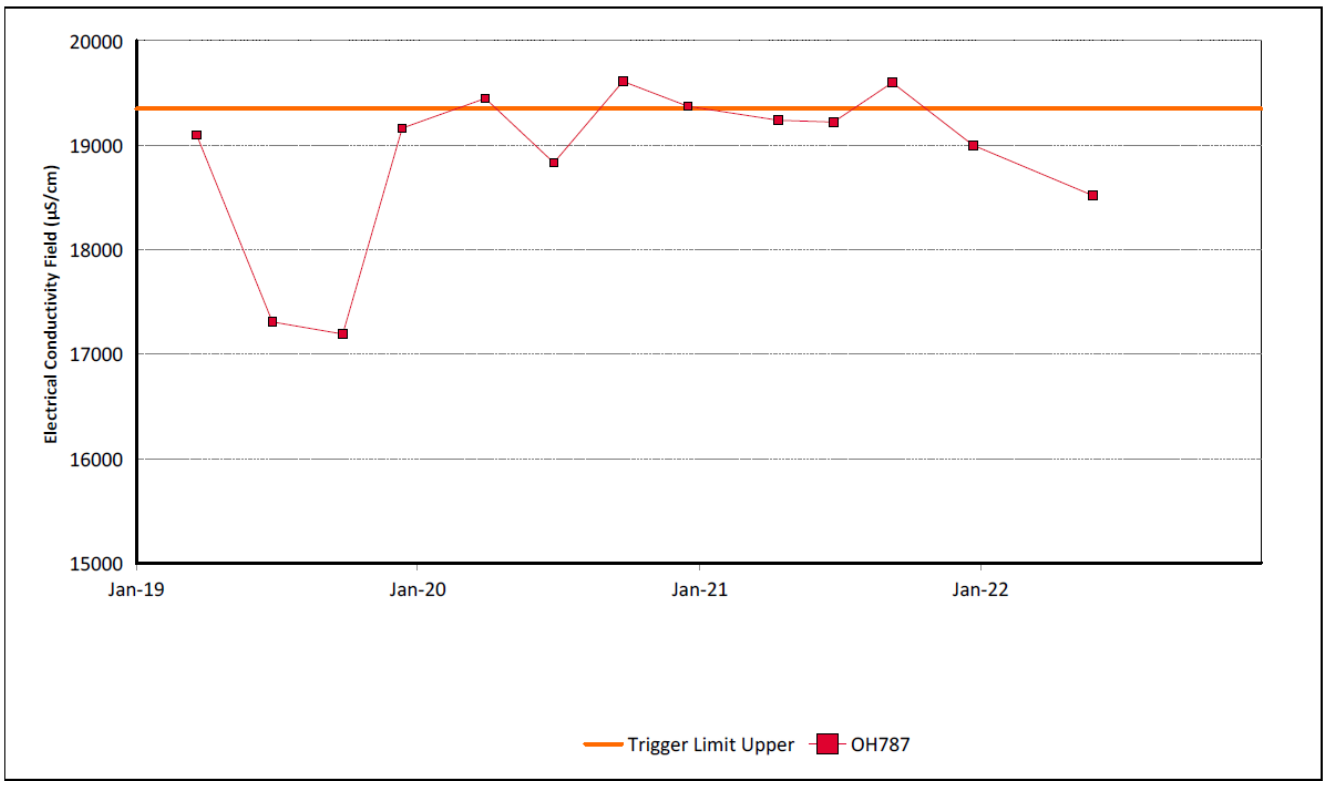

Figure 53: Hunter River Alluvium 2 Electrical Conductivity Field Trend - December 2022

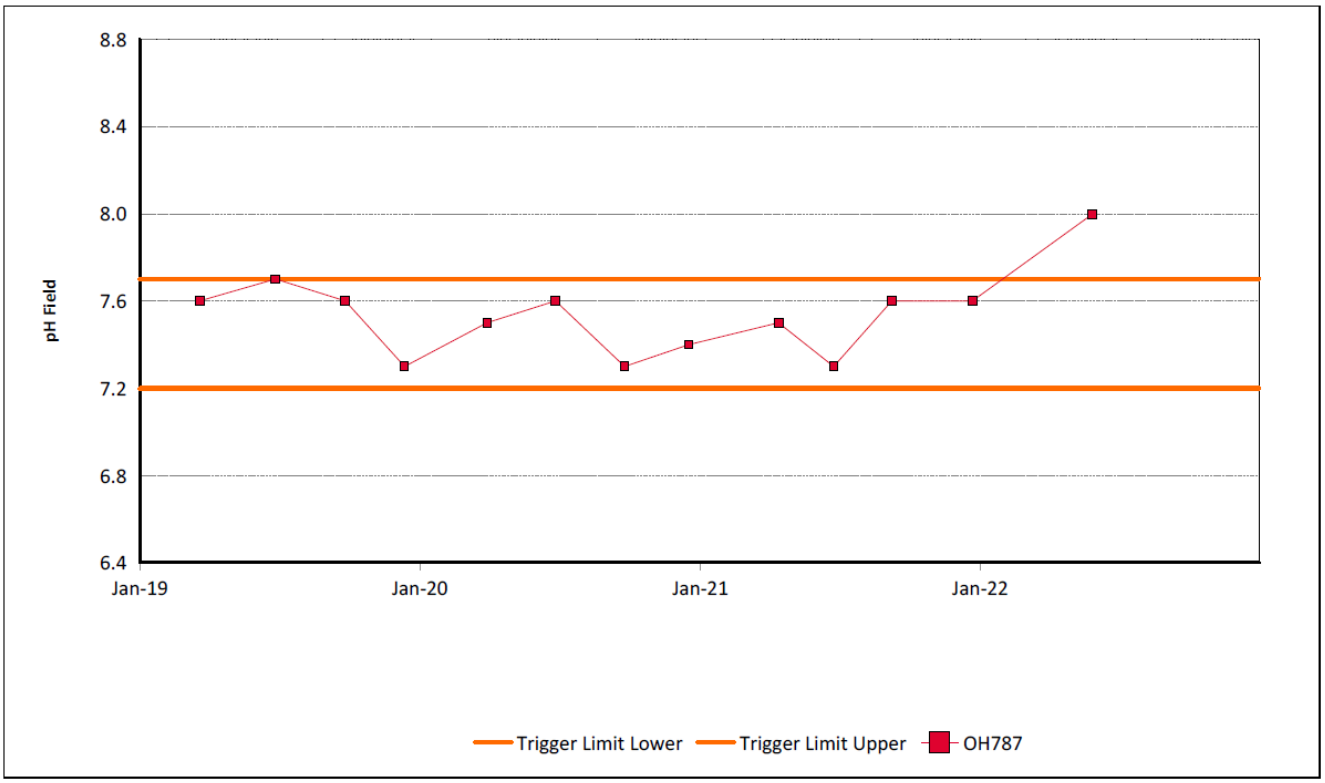

Figure 54: Hunter River Alluvium 2 pH Field Trend - December 2022

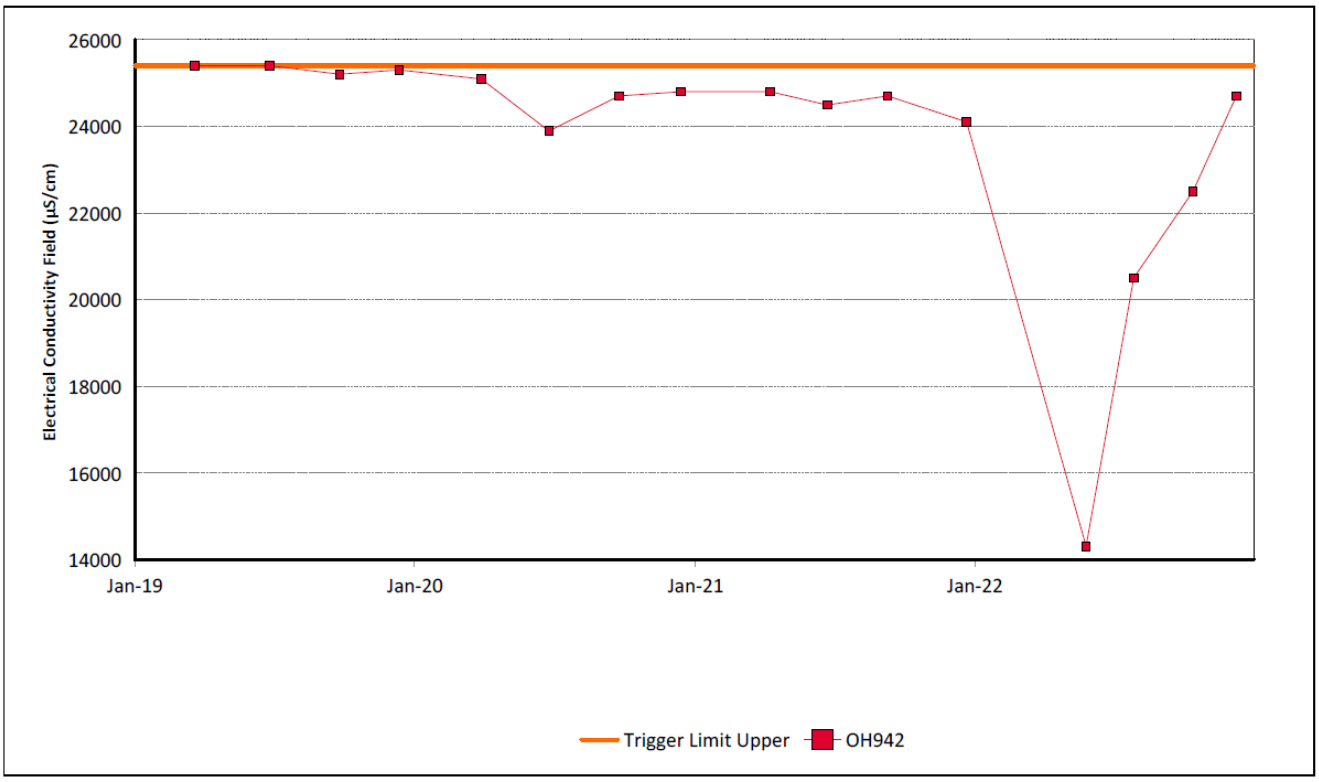

Figure 55: Hunter River Alluvium 3 Electrical Conductivity Field Trend - December 2022

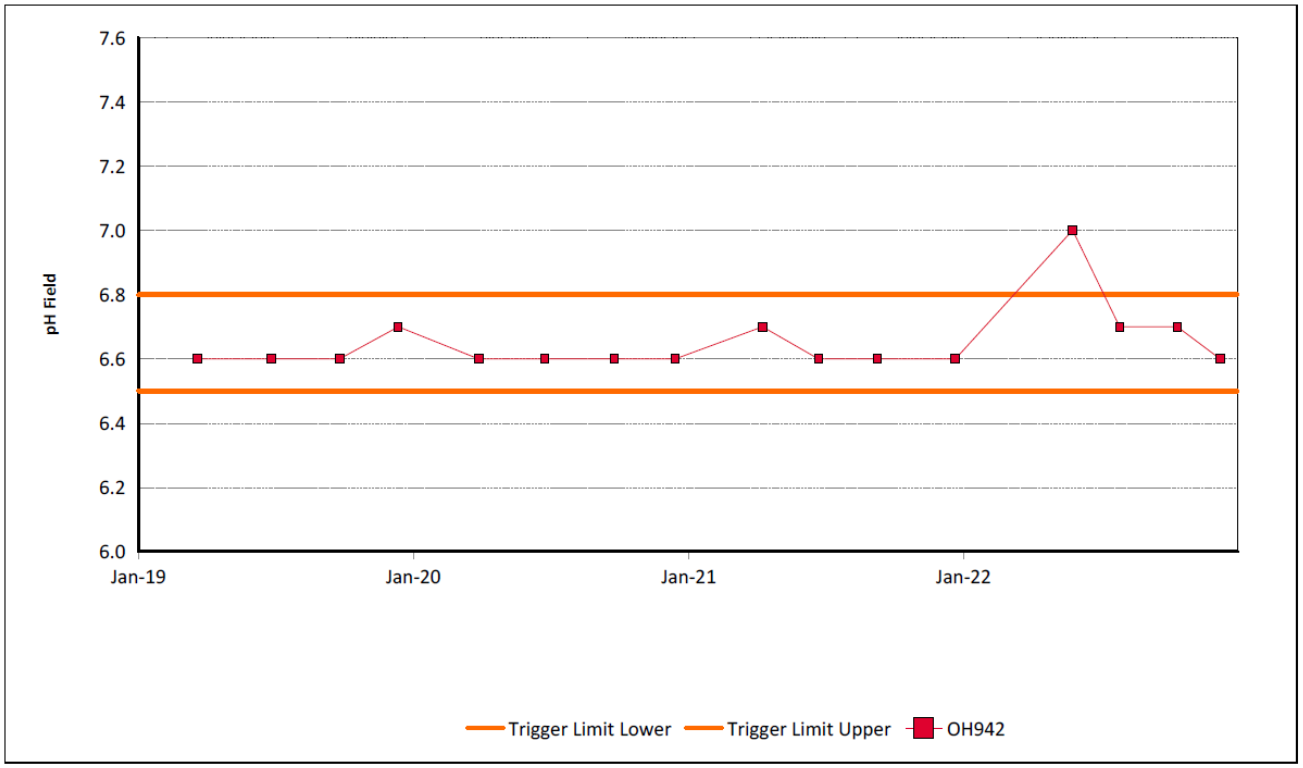

Figure 56: Hunter River Alluvium 3 pH Field Trend - December 2022

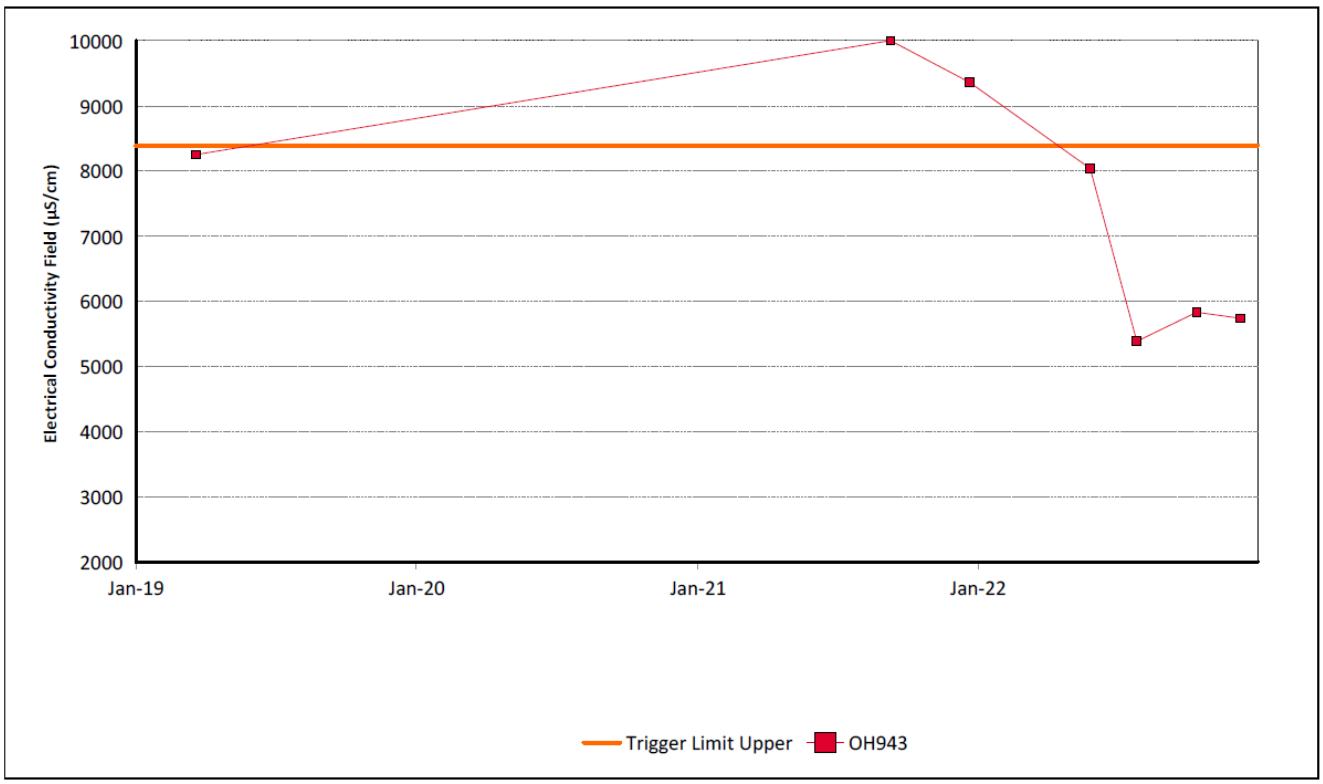

Figure 57: Hunter River Alluvium 4 Electrical Conductivity Field Trend - December 2022

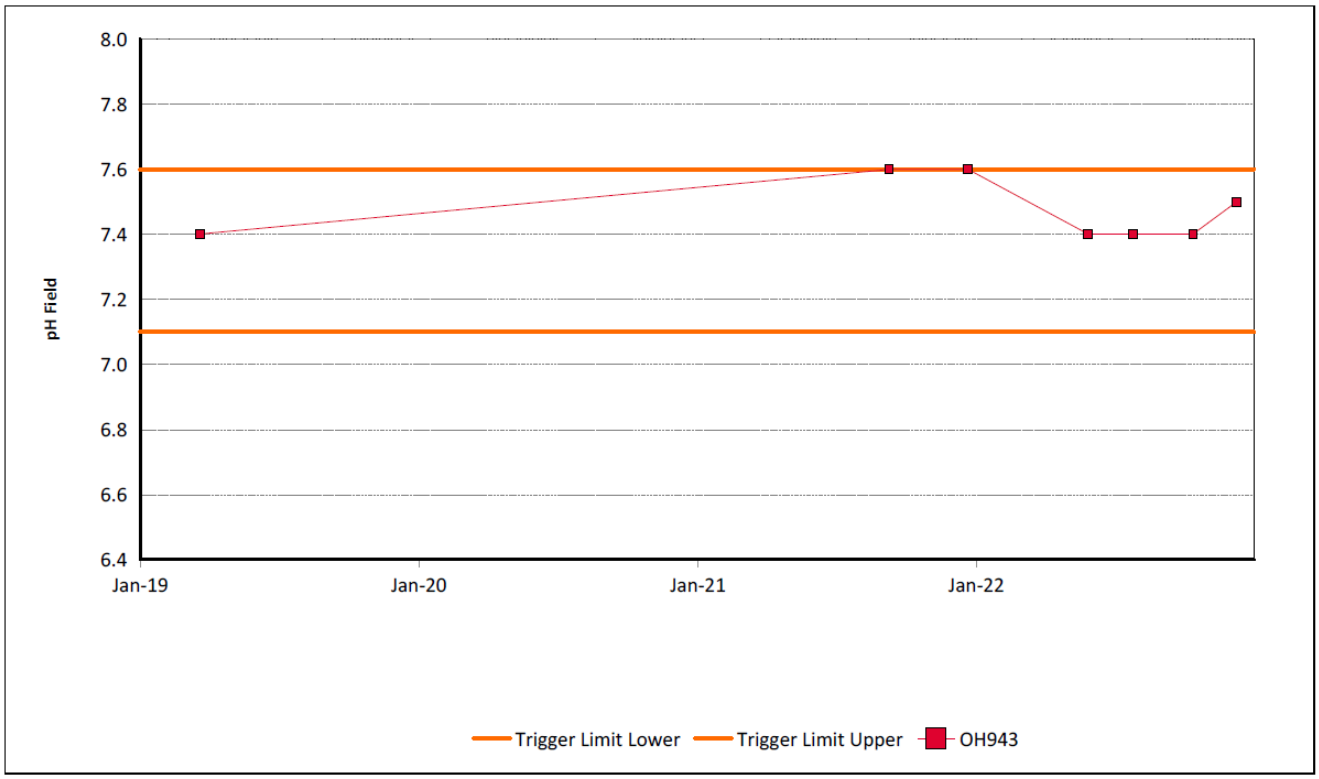

Figure 58: Hunter River Alluvium 4 pH Field Trend - December 2022

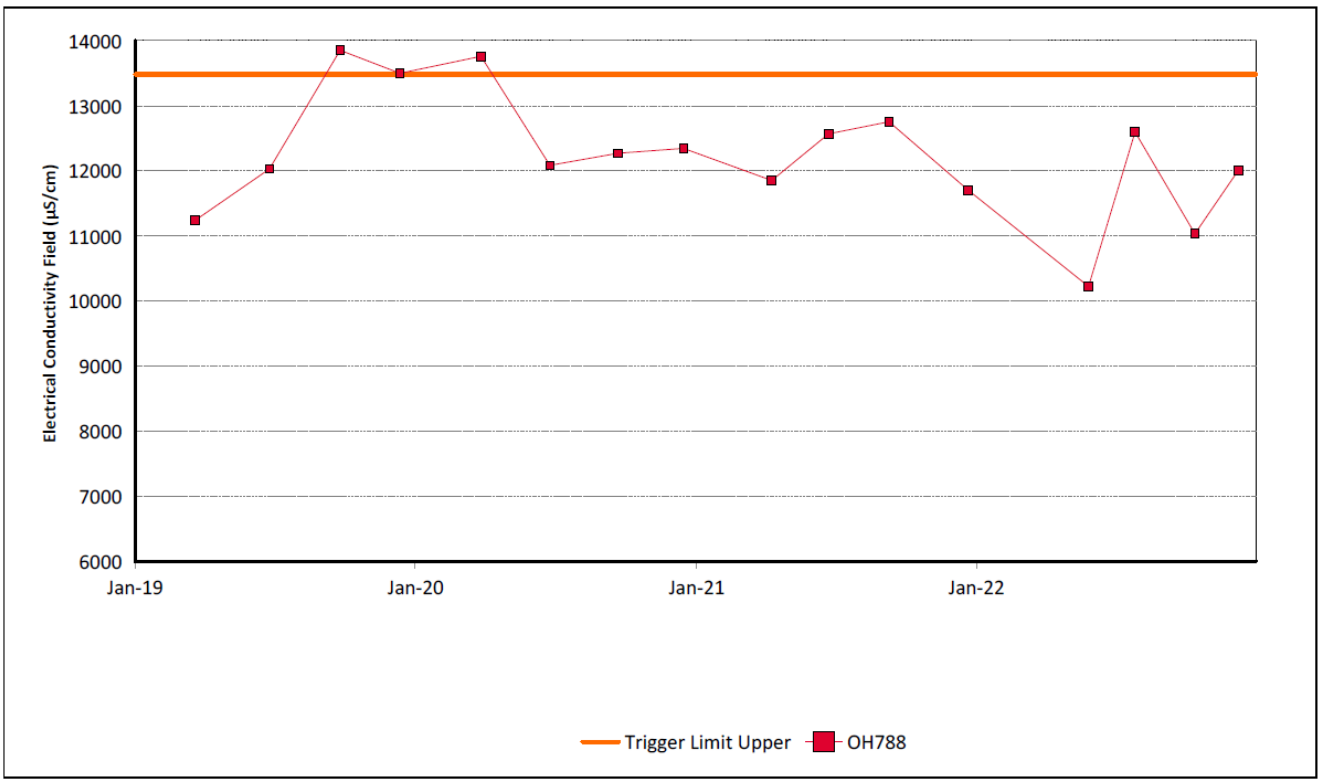

Figure 59: Hunter River Alluvium 5 Electrical Conductivity Field Trend - December 2022

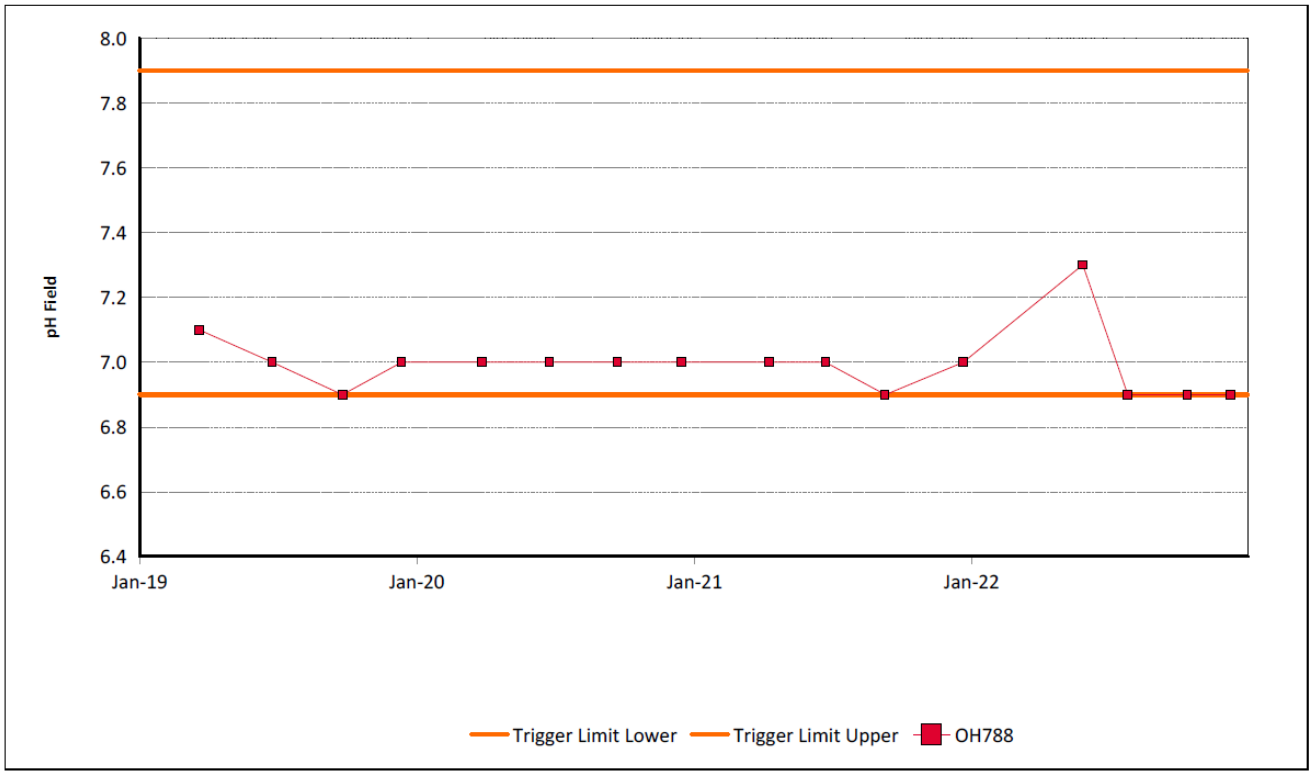

Figure 60: Hunter River Alluvium 5 pH Field Trend - December 2022

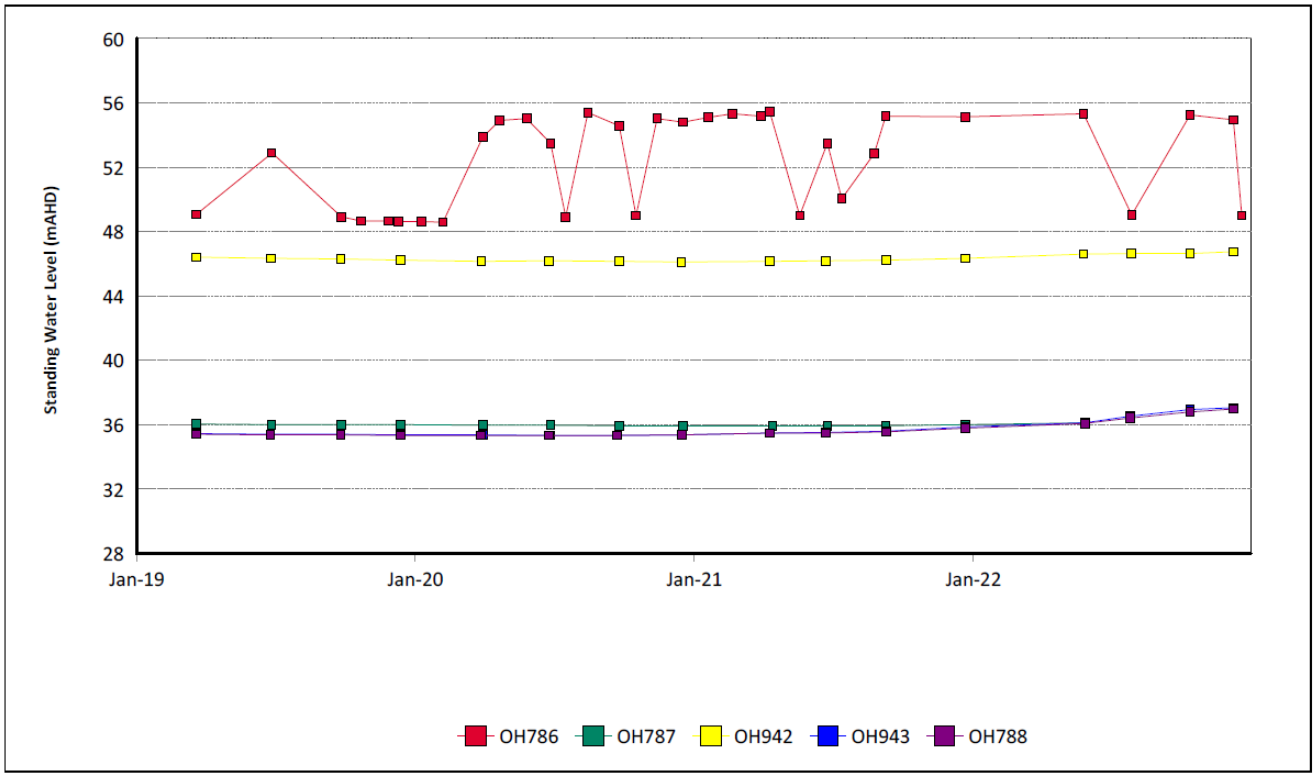

Figure 61: Hunter River Alluvium Standing Water Level Trend - December 2022

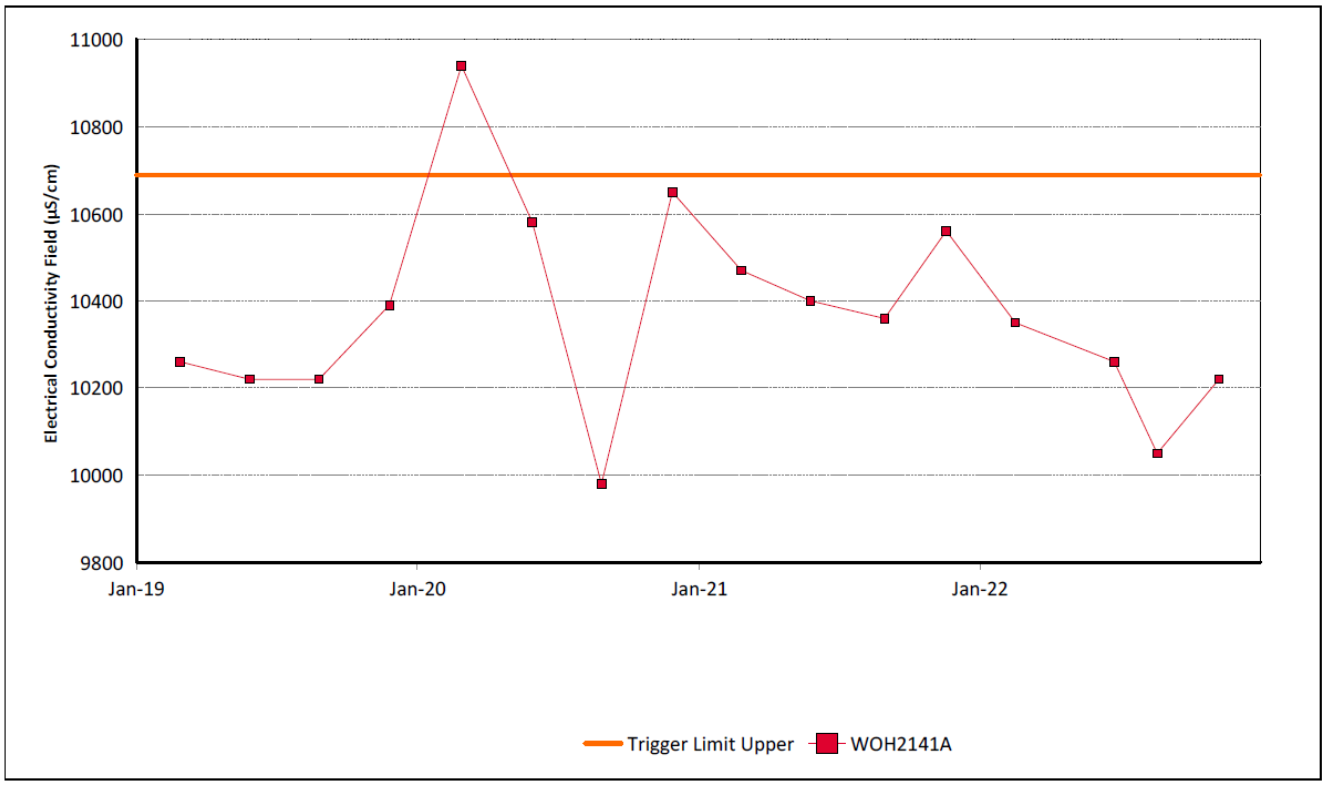

Figure 62: Whynot Seam Electrical Conductivity Field Trend - December 2022

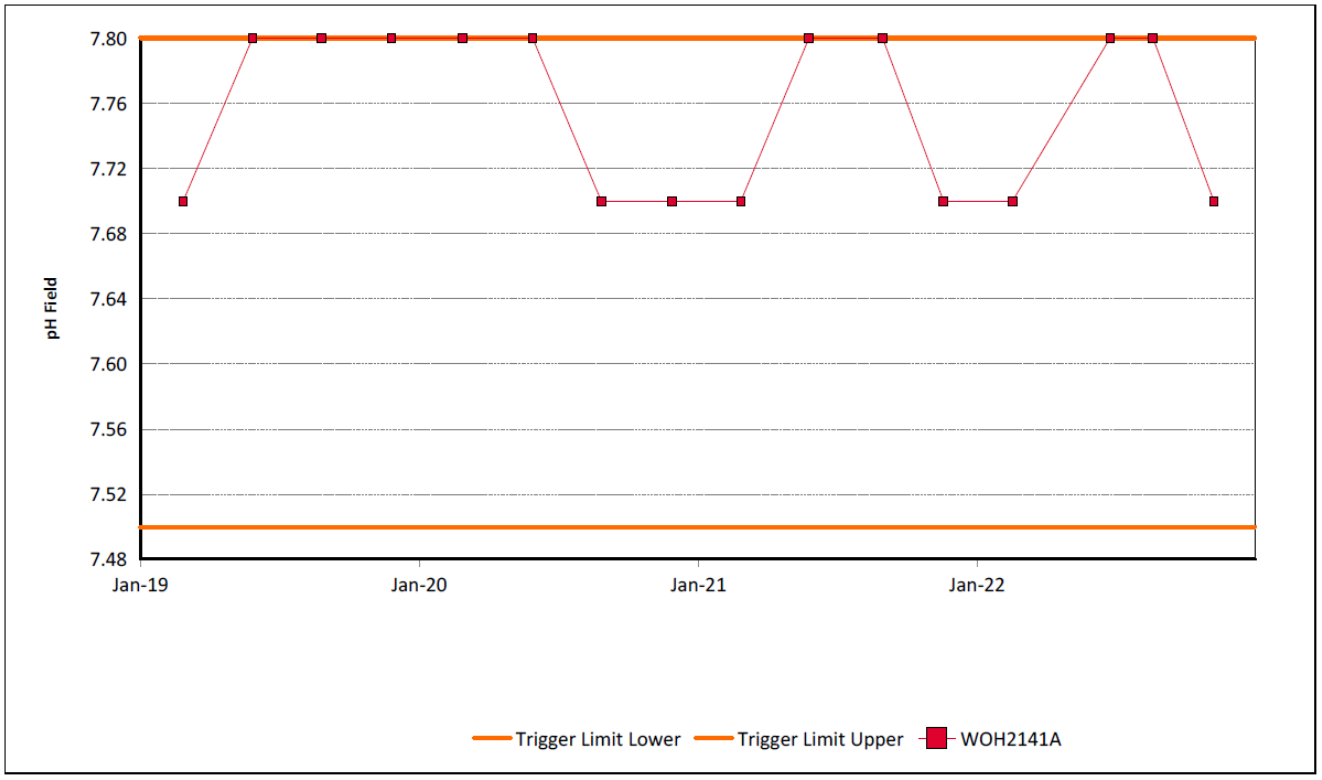

Figure 63: Whynot Seam pH Field Trend - December 2022

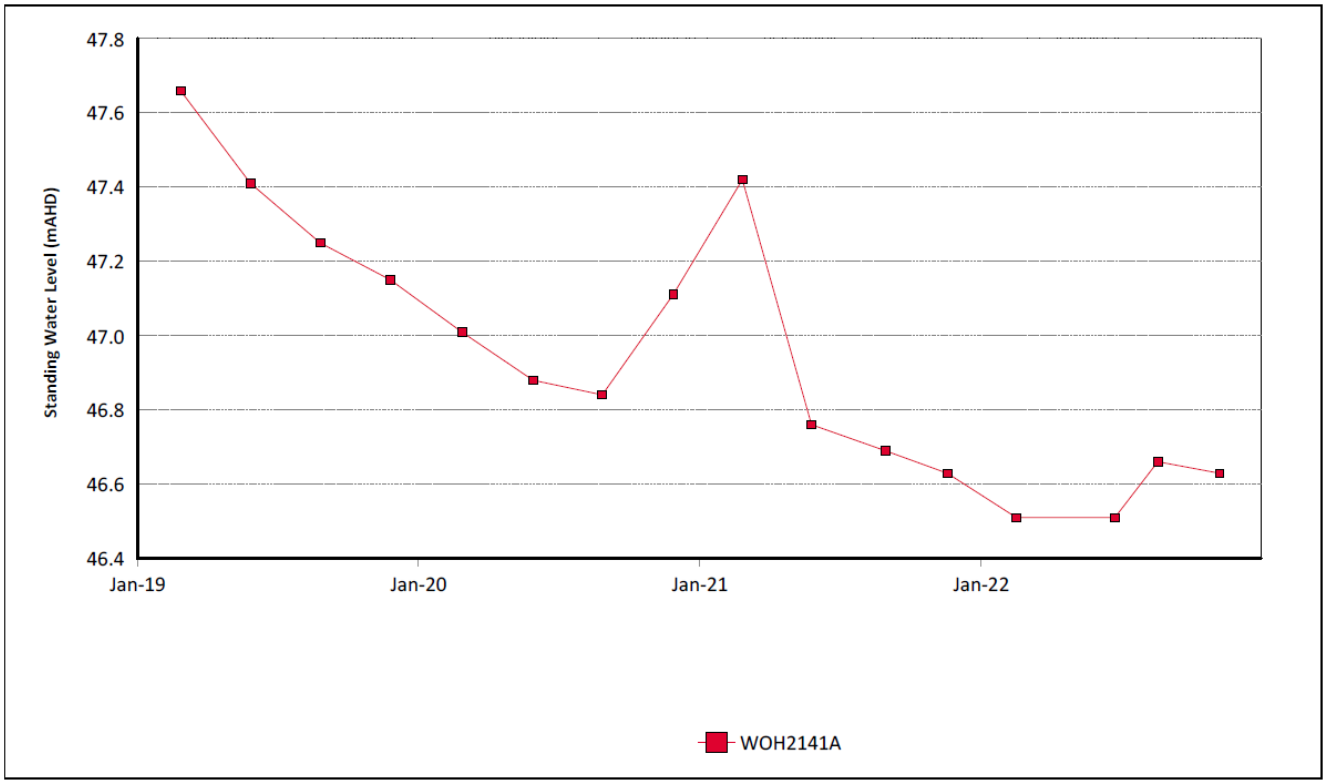

Figure 64: Whynot Seam Standing Water Level Trend - December 2022

3.3.1 Groundwater Trigger Tracking

Internal trigger limits have been developed to assess monitoring data on an on-going basis, and to highlight potentially adverse groundwater impacts. The process for evaluating monitoring results against the internal triggers and subsequent responses are outlined in the MTW Water Management Plan. Locations of groundwater bores are shown in

Current internal groundwater trigger limit breaches are summarised in **Table 3**

Table 3: Groundwater Trigger Tracking – December 2022

Site	Date	Trigger Limit Breached	Action Taken in Response
MB15MTW01D	17/02/2022	pH –5th Percentile	Consultant engaged to complete investigation.
MB15MTW01D	10/06/2022	pH –5th Percentile	Investigation completed. The consultant identified in their report that "it is likely the trigger values derived for shallow overburden bores do not accurately represent in-situ groundwater water quality for MB15MTW01D". MB15MTW01D is part of a larger dataset from the shallow overburden seam. The 5th percentile of the seam is currently 6.7 while the 5th percentile of MB15MTW01D is 5.4. The result is consistent with previous results and within sample location trigger levels. No further investigation required.
MB15MTW01D	26/08/2022	pH –5th Percentile	Investigation previously completed. The consultant identified in their report that "it is likely the trigger values derived for shallow overburden bores do not accurately represent in-situ groundwater water quality for MB15MTW01D". MB15MTW01D is part of a larger dataset from the shallow overburden seam. The 5th percentile of the seam is currently 6.7 while the 5th percentile of MB15MTW01D is 5.4. The result is consistent with previous results and within sample location trigger levels. No further investigation required.
MB15MTW01D	11/11/2022	pH –5th Percentile	Investigation previously completed. The consultant identified in their report that "it is likely the trigger values derived for shallow overburden bores do not accurately represent in-situ groundwater water quality for MB15MTW01D". MB15MTW01D is part of a larger dataset from the shallow overburden seam. The 5th percentile of the seam is currently 6.7 while the 5th percentile of MB15MTW01D is 5.4. The result is consistent with previous results and within sample location trigger levels. No further investigation required.

Site	Date	Trigger Limit Breached	Action Taken in Response
PZ7D	16/02/2022	pH –95th Percentile	Investigation completed. The consultant identified in their report that the high pH could indicate that stagnant water is present within the bore. PZ7D displays a subdued response to rainfall recharge, with recorded groundwater levels remaining relatively stable since December 2011. The limited response to rainfall recharge indicates limited surface connectivity and/or overlying sediments with low hydraulic conductivity. PZ7D is part of a larger dataset from the shallow overburden seam. The 95th percentile of the seam is currently 8 while the 95th percentile of PZ7D is 8.2. The result is consistent with previous results and within sample location trigger levels. No further investigation required.
OH1125 (3)	19/10/2022	pH –95th Percentile	Watching Brief* On 1 December 2022 this bore was noted as dry.
OH1126	26/05/2022	pH –5th Percentile	OH1126 returned to above pH 5th percentile trigger level for the sample on 28 July 2022.
OH1126	1/12/2022	pH –5th Percentile	Watching Brief*
OH786	12/10/2022	pH –5th Percentile	Watching Brief*
OH786	8/12/2022	pH –5th Percentile	OH786 was resampled on 19 December 2022 and returned to above pH 5th percentile trigger level.
OH787	27/05/2022	pH –95th Percentile	Watching Brief*
OH942	26/05/2022	pH –95th Percentile	OH942 returned to below the pH 95th percentile trigger level for the sample on 27 July 2022.
WOH2139A	21/06/2022	pH –95th Percentile	WOH2139A returned to below the pH 95th percentile trigger level for the sample on 26 August 2022.
PZ9S	25/05/2022	pH –95th Percentile	Watching Brief*
PZ9S	27/07/2022	pH –95th Percentile	PZ9S returned to below the pH 95th percentile trigger level for the sample on 28 September 2022.
GW98MTCL2	13/12/2022	pH –5th Percentile	Watching Brief*
MTD605P	17/02/2022	EC – 95th Percentile	Watching Brief*
MTD605P	9/06/2022	EC – 95th Percentile	Investigation completed. MTD605P is part of a larger dataset from the shallow overburden seam. The 95th percentile of the seam is currently 17,516uS/cm while the 95th percentile of MTD605P is 17,933uS/cm. The result is consistent with previous results and within sample location trigger levels. No further investigation required. Watching Brief*
MTD605P	26/08/2022	EC – 95th Percentile	Investigation previously completed. MTD605P is part of a larger dataset from the shallow overburden seam. The 95th percentile of the seam is currently 17,516uS/cm while the 95th percentile of MTD605P is 17,933uS/cm. The result is consistent with previous results and within sample location trigger levels. No further investigation required. Watching Brief*

Site	Date	Trigger Limit Breached	Action Taken in Response
MTD605P	11/11/2022	EC – 95th Percentile	Investigation previously completed. MTD605P is part of a larger dataset from the shallow overburden seam. The 95th percentile of the seam is currently 17,516uS/cm while the 95th percentile of MTD605P is 17,933uS/cm. The result is consistent with previous results and within sample location trigger levels. No further investigation required. Watching Brief*
OH786	12/10/2022	EC – 95th Percentile	OH786 returned to below the EC 95th percentile trigger level for the sample on 8 December 2022.
* = Watching brief established pending outcomes of subsequent monitoring events. No specific actions required.			

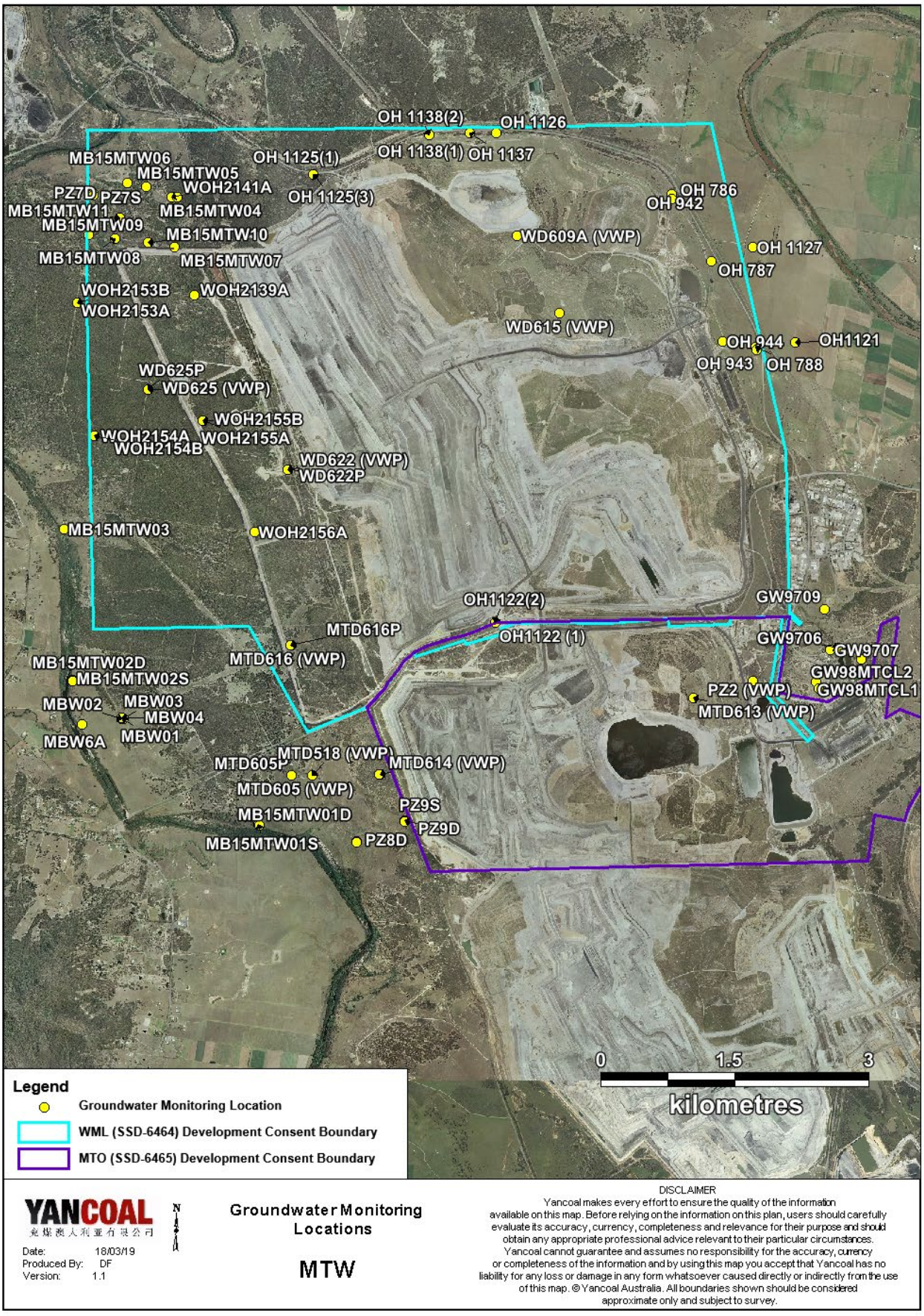

Figure 65: Groundwater Monitoring Location Plan

4.0 BLAST MONITORING

MTW have a network of six blast monitoring units. These are located at nearby privately owned residences and function as regulatory compliance monitors.

The location of these monitors can be found in **Figure 72**.

4.1 Blast Monitoring Results

During December 2022, 20 blasts were initiated at MTW. **Figure 66** to **Figure 71** show the blast monitoring results for the reporting period against the impact assessment criteria. The criteria are summarised in **Table 4**.

Table 4: Blasting Limits

Airblast Overpressure (dB(L))	Comments
115	5% of the total number of blasts in a 12 month period at WML or MTO
120	0%
Ground Vibration (mm/s)	**Comments**
5	5% of the total number of blasts in a 12 month period at WML or MTO
10	0%

During the reporting period no blasts exceeded the 115 dB(L) 5% threshold for airblast overpressure or 5mm/s 5% threshold for ground vibration.

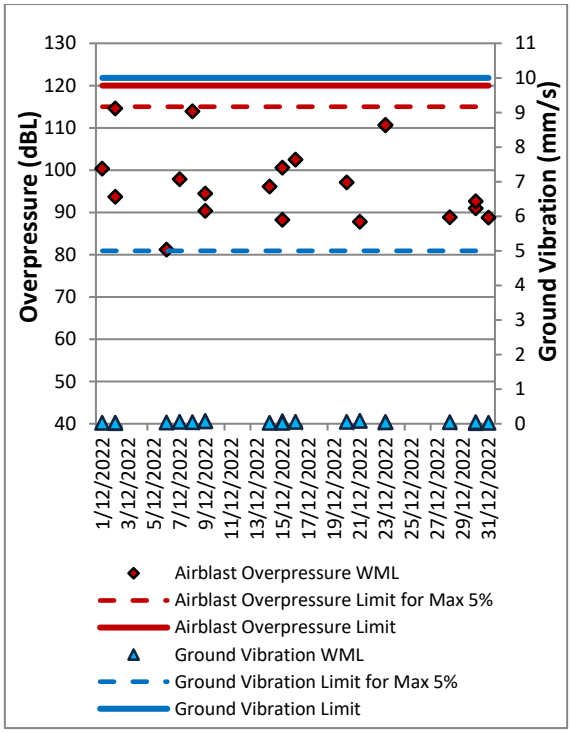

Figure 66: Abbey Green Blast Monitoring Results – December 2022

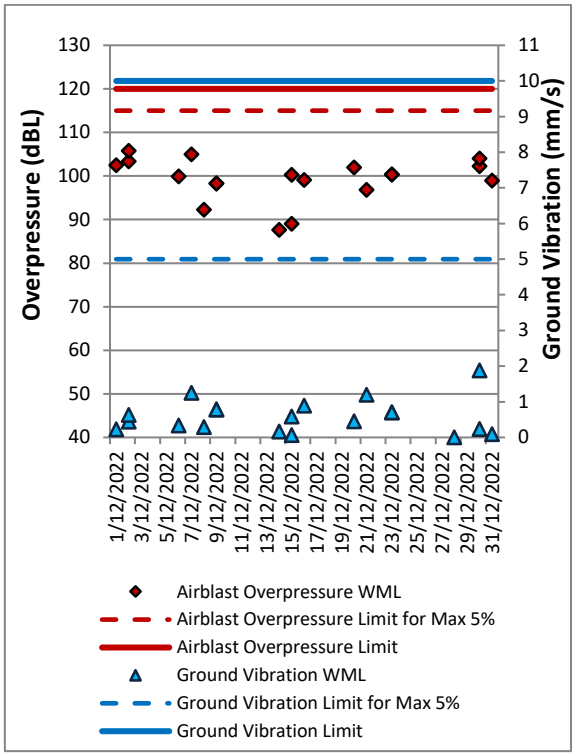

Figure 67: Bulga Village Blast Monitoring Results – December 2022

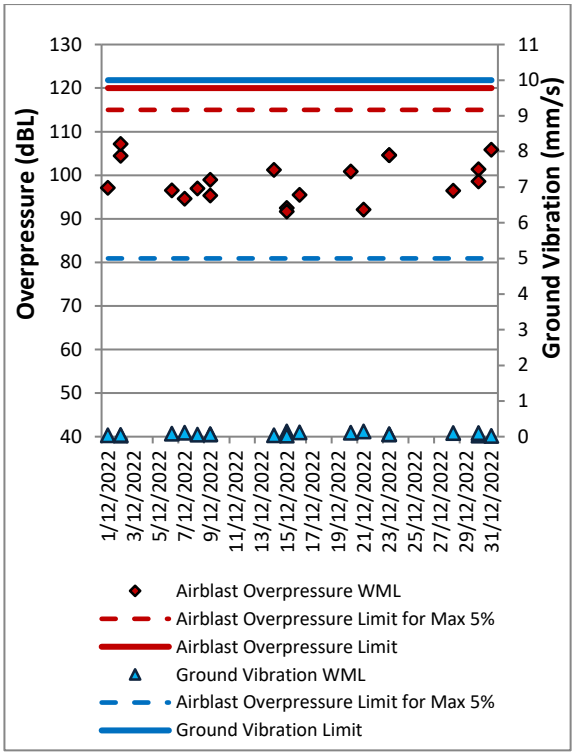

Figure 68: MTIE Blast Monitoring Results - December 2022

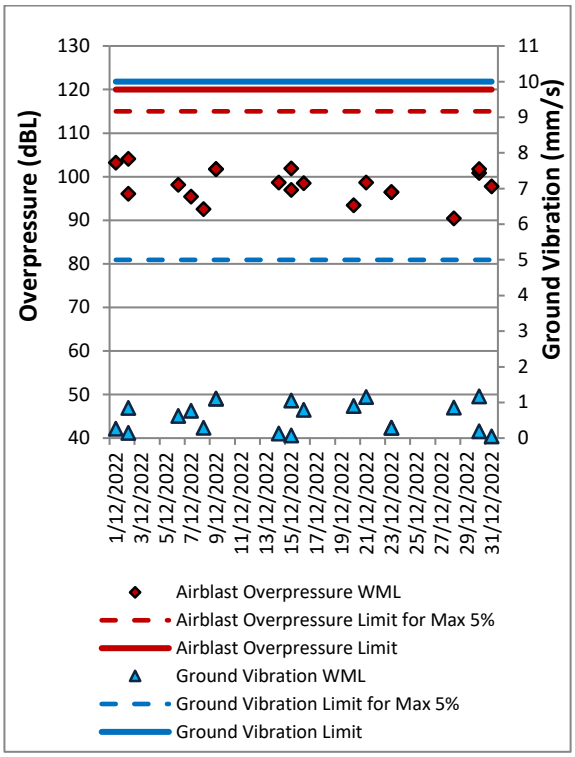

Figure 69: Wambo Road Blast Monitoring Results - December 2022

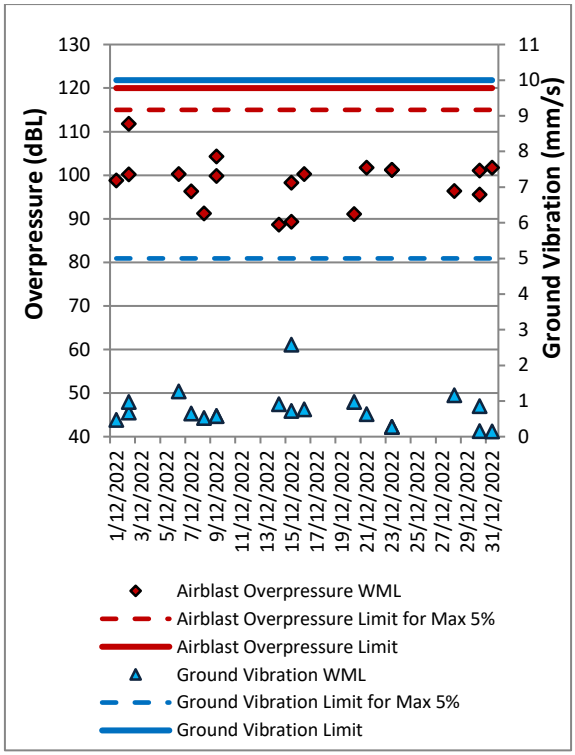

Figure 70: Warkworth Blast Monitoring Results - December 2022

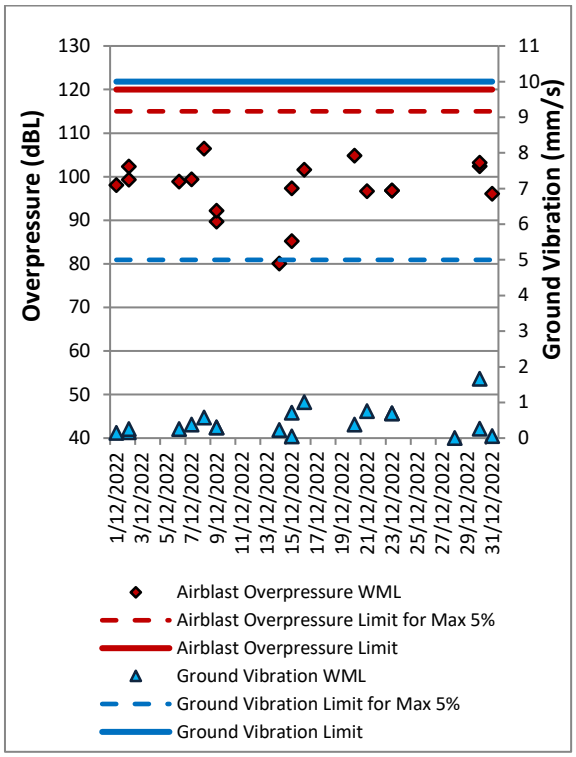

Figure 71: Wollemi Peak Road Blast Monitoring Results - December 2022

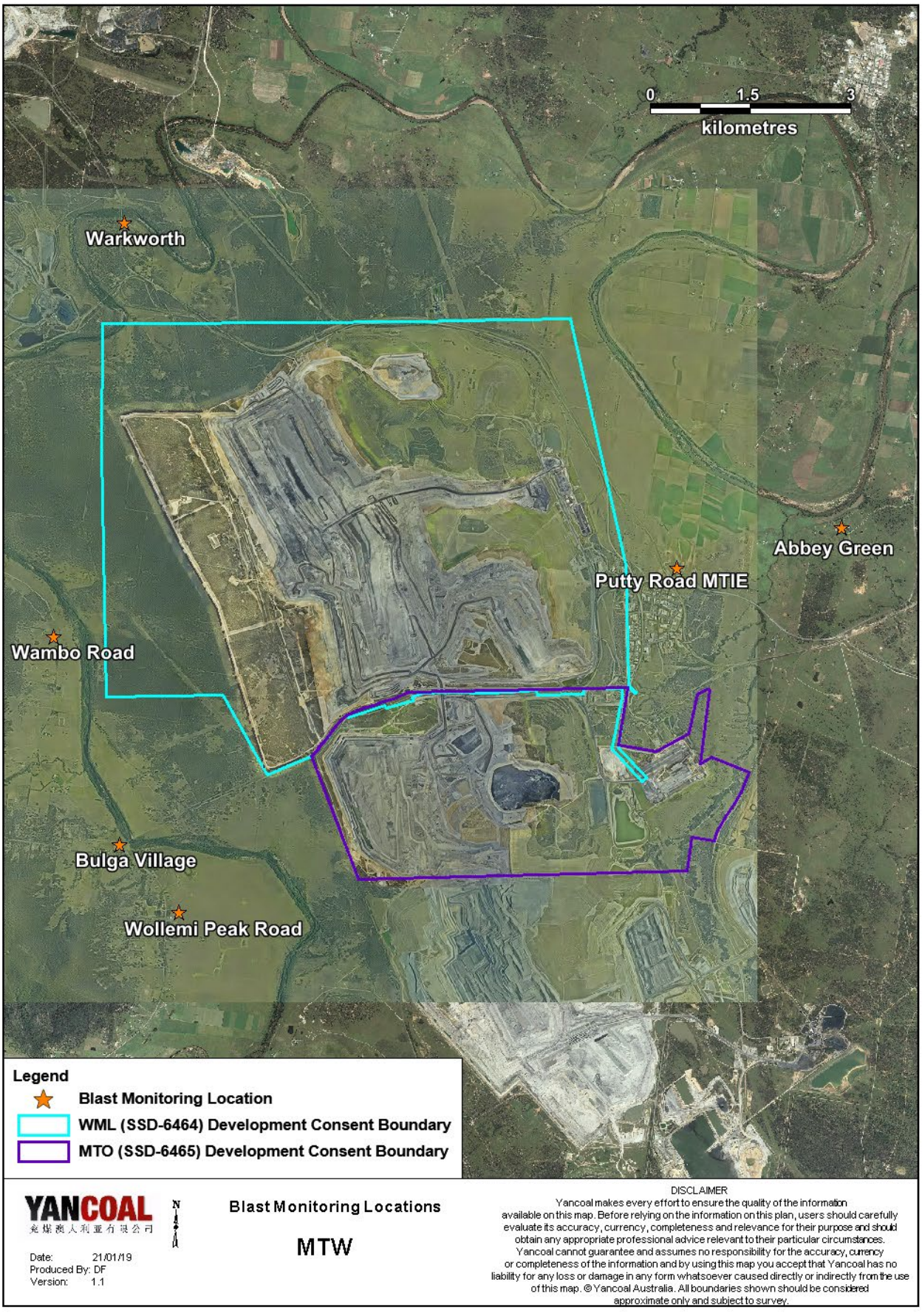

Figure 72: MTW Blast Monitoring Location Plan

5.0 NOISE

Routine attended noise monitoring is carried out in accordance with the MTW Noise Management Plan. A review against EIS predictions will be reported in the Annual Review. The purpose of the noise surveys is to quantify and describe the acoustic environment around the site and compare results with specified limits. Real time noise monitoring also occurs at five sites surrounding MTW. Noise monitoring locations are displayed in **Figure 73**.

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations surrounding MTW on the night of 1st December 2022. All measurements complied with the relevant criteria. Results are detailed in **Table 5 to Table 8.**

5.1.1 WML Noise Assessment

Compliance assessments undertaken against the WML noise criteria are presented in **Tables 5** and **6**.

Table 5: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – December 2022

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML L_{Aeq} dB[2,3,4]	Exceedance[3,4]
Bulga RFS	2/12/2022 0:11	3.0	D	37	Yes	IA	Nil
Bulga Village	1/12/2022 23:13	2.6	D	38	Yes	IA	Nil
Gouldsville	1/12/2022 21:23	2.6	D	35	Yes	31	Nil
Inlet Rd	1/12/2022 21:25	2.6	D	37	Yes	26	Nil
Inlet Rd West	1/12/2022 21:02	2.8	D	35	Yes	<25	Nil
Long Point	1/12/2022 21:00	2.8	D	35	Yes	IA	Nil
South Bulga	2/12/2022 0:34	2.7	D	36	Yes	IA	Nil
Wambo Road	1/12/2022 21:53	3.0	D	38	Yes	25	Nil

Notes:
1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Site-only LAeq,15minute attributed to WML, including modifying factors if applicable;
3. Bold results in red indicate exceedance of relevant criterion; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable.

Table 6: $L_{A1,\ 1\ minute}$ Warkworth - Impact Assessment Criteria – December 2022

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB(A)	Criterion Applies?[1]	WML $L_{A1,\ 1min}$ dB[2,3,4]	Exceedance[3,4]
Bulga RFS	2/12/2022 0:11	3.0	D	47	Yes	IA	Nil
Bulga Village	1/12/2022 23:13	2.6	D	48	Yes	IA	Nil
Gouldsville	1/12/2022 21:23	2.6	D	48	Yes	35	Nil
Inlet Rd	1/12/2022 21:25	2.6	D	47	Yes	35	Nil
Inlet Rd West	1/12/2022 21:02	2.8	D	45	Yes	<25	Nil
Long Point	1/12/2022 21:00	2.8	D	45	Yes	IA	Nil
South Bulga	2/12/2022 0:34	2.7	D	45	Yes	IA	Nil
Wambo Road	1/12/2022 21:53	3.0	D	48	Yes	31	Nil

Notes:
1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Site-only LA1,1minute attributed to WML;
3. Bold results in red indicate exceedance of relevant criterion; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable.

5.1.2 MTO Noise Assessment

Compliance assessments undertaken against the MTO noise criteria are presented in **Table 7** and **8**.

Table 7: $L_{Aeq, 15minute}$ Mount Thorley - Impact Assessment Criteria – December 2022

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3,4]	Exceedance[3,4]
Bulga RFS	2/12/2022 0:11	3.0	D	37	Yes	31	Nil
Bulga Village	1/12/2022 23:13	2.6	D	38	Yes	<25	Nil
Gouldsville	1/12/2022 21:23	2.6	D	35	Yes	IA	Nil
Inlet Rd	1/12/2022 21:25	2.6	D	37	Yes	IA	Nil
Inlet Rd West	1/12/2022 21:02	2.8	D	35	Yes	IA	Nil
Long Point	1/12/2022 21:00	2.8	D	35	Yes	IA	Nil
South Bulga	2/12/2022 0:34	2.7	D	36	Yes	IA	Nil
Wambo Road	1/12/2022 21:53	3.0	D	38	Yes	IA	Nil

Notes:
1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Site-only LAeq,15minute attributed to MTO, including modifying factors if applicable;
3. Bold results in red indicate exceedance of relevant criterion; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable.

Table 8: $L_{A1, 1Minute}$ Mount Thorley - Impact Assessment Criteria – December 2022

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1, 1min}$ dB[2,3,4]	Exceedance[3,4]
Bulga RFS	2/12/2022 0:11	3.0	D	47	Yes	34	Nil
Bulga Village	1/12/2022 23:13	2.6	D	48	Yes	31	Nil
Gouldsville	1/12/2022 21:23	2.6	D	45	Yes	IA	Nil
Inlet Rd	1/12/2022 21:25	2.6	D	47	No	IA	Nil
Inlet Rd West	1/12/2022 21:02	2.8	D	45	Yes	IA	Nil
Long Point	1/12/2022 21:00	2.8	D	45	No	IA	Nil
South Bulga	2/12/2022 0:34	2.7	D	46	Yes	IA	Nil
Wambo Road	1/12/2022 21:53	3.0	D	48	Yes	IA	Nil

Notes:
1. Noise criteria apply during all meteorological conditions except the following: during periods of rain or hail; average wind speed at microphone height exceeds 5 m/s; wind speeds greater than 3 m/s measured at 10 metres above ground level; stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or stability category G temperature inversion conditions. Criterion may or may not apply due to rounding of meteorological data values;
2. Site-only LA1,1minute attributed to MTO;
3. Bold results in red indicate exceedance of relevant criterion; and
4. NA in exceedance column means atmospheric conditions outside conditions specified in consent, therefore criterion was not applicable.

5.1.3 NPfI Low Frequency Assessment

In accordance with the requirements of the EPA's Noise Policy for Industry (NPfI), the applicability of the low frequency modification factor corrections has been assessed. There were no noise measurements taken during the reporting period which required the penalty to be applied. The WML assessment for low frequency noise is shown in **Table 9** and the MTO assessment for low frequency noise is shown in **Table 10**. **.**

Table 9: Warkworth Low Frequency Noise Assessment – December 2022

Location	Date and Time	Measured WML LAeq dB	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[1]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [1,2]	Penalty dB[2]
Bulga RFS	2/12/2022 0:11	IA	Yes	No	No	NA	No	NA	Nil
Bulga Village	1/12/2022 23:13	IA	Yes	No	No	NA	No	NA	Nil
Gouldsville	1/12/2022 21:23	31	Yes	No	No	NA	No	NA	Nil
Inlet Rd	1/12/2022 21:25	26	Yes	No	No	NA	No	NA	Nil
Inlet Rd West	1/12/2022 21:02	<25	Yes	No	No	NA	No	NA	Nil
Long Point	1/12/2022 21:00	IA	Yes	No	No	NA	No	NA	Nil
South Bulga	2/12/2022 0:34	IA	Yes	No	No	NA	No	NA	Nil
Wambo Road	1/12/2022 21:53	25	Yes	No	No	NA	No	NA	Nil

Notes:
1. NA denotes 'not applicable'; and
2. Bold results indicate that application of NPfI modifying factor/s is required.

Table 10: Mount Thorley Operations Low Frequency Noise Assessment – December 2022

Location	Date and Time	Measured WML LAeq dB	Criterion Applies?	Intermittency Modifying Factor?	Tonality Modifying Factor?	Frequency of Tonality[1]	Low-frequency Modifying Factor?	Maximum Exceedance of Reference Spectrum [1,2]	Penalty dB[2]
Bulga RFS	2/12/2022 0:11	31	Yes	No	No	NA	No	NA	Nil
Bulga Village	1/12/2022 23:13	<25	Yes	No	No	NA	No	NA	Nil
Gouldsville	1/12/2022 21:23	IA	Yes	No	No	NA	No	NA	Nil
Inlet Rd	1/12/2022 21:25	IA	Yes	No	No	NA	No	NA	Nil
Inlet Rd West	1/12/2022 21:02	IA	Yes	No	No	NA	No	NA	Nil
Long Point	1/12/2022 21:00	IA	Yes	No	No	NA	No	NA	Nil
South Bulga	2/12/2022 0:34	IA	Yes	No	No	NA	No	NA	Nil
Wambo Road	1/12/2022 21:53	IA	Yes	No	No	NA	No	NA	Nil

Notes:
1. NA denotes 'not applicable'; and
2. Bold results indicate that application of NPfI modifying factor/s is required.

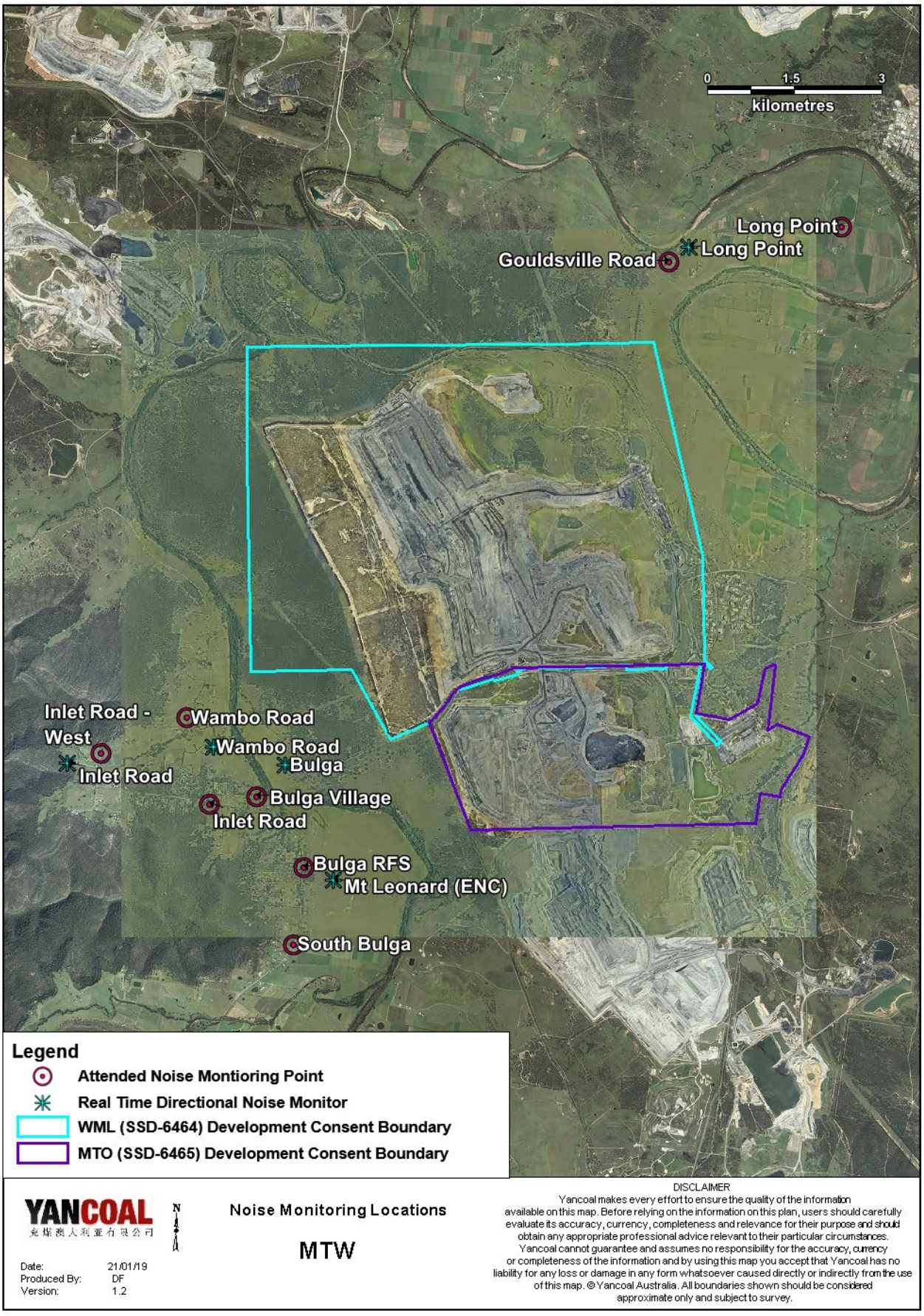

Figure 73: Noise Monitoring Location Plan

5.2 Noise Management Measures

A program of targeted supplementary attended noise monitoring is in place at MTW, supported by the real-time directional monitoring network and ensuring the highest level of noise management is maintained. The supplementary program is undertaken by MTW personnel and involves:

- Routine inspections from both inside and outside the mine boundary;
- Routine and as-required handheld noise assessments (undertaken in response to noise alarm and/or community complaint), comparing measured levels against consent noise limits; and
- Validation monitoring following operational modifications to assess the adequacy of the modifications.

Where a noise assessment identifies noise emissions which are exceeding the relevant noise limit(s) for any particular residence, modifications will be made to ensure that the noise event is resolved within 75 minutes of identification. The actions taken are commensurate with the nature and severity of the noise event, but can include:

- Changing the haul route to a less noise sensitive haul;
- Changing dump locations (in-pit or less exposed dump option);
- Reducing equipment numbers;
- Shut down of task; or
- Site shut down.

A summary of these assessments undertaken are provided in **Table 11**.

Table 11: Supplementary Attended Noise Monitoring Data – December 2022

No. of assessments	No. of assessments > trigger	No. of nights where assessments > trigger	% greater than trigger
576	2	2	0.347

Note: Measurements are taken under all meteorological conditions, including conditions under which the consent noise criteria do not apply.

6.0 OPERATIONAL DOWNTIME

During December, a total of 393 hours of equipment downtime was logged in response to environmental events such as dust, noise and adverse meteorological conditions. Operational downtime by equipment type is shown in **Figure 74**.

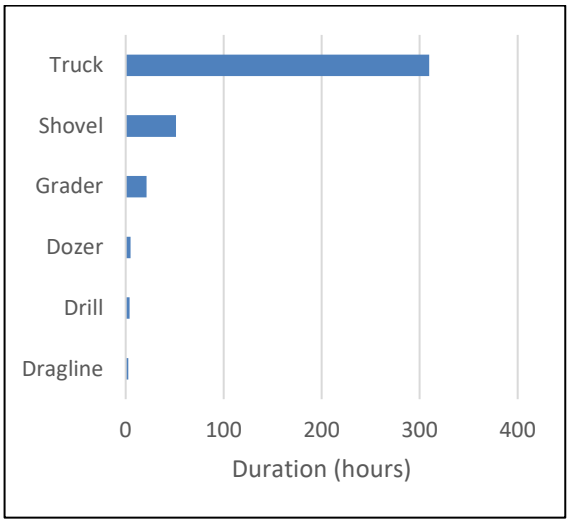

Figure 74: Operational Downtime by Equipment Type – December 2022

7.0 REHABILITATION

During December 2022, 5.47 Ha of land was released, 4.65 Ha was bulk shaped, 9.77 was top soiled, 1.23 Ha was composted and 24.24 Ha was rehabilitated.

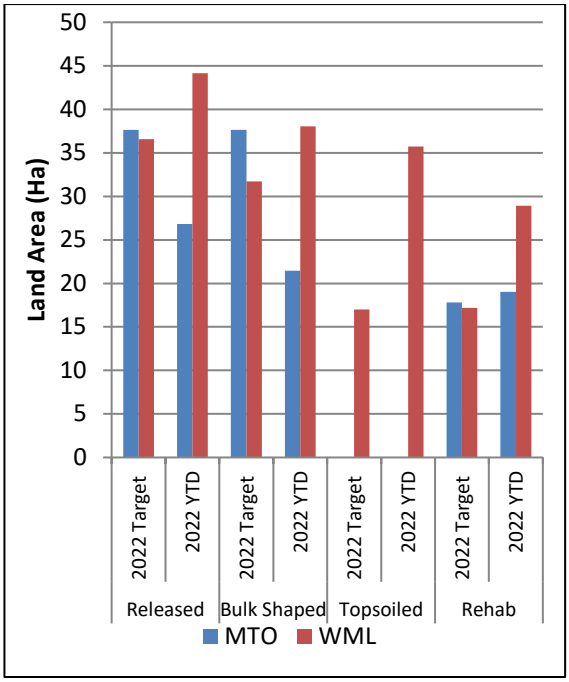

Figure 75: Rehabilitation YTD – December 2022

8.0 ENVIRONMENTAL INCIDENTS

There were no environmental incident recorded during the reporting period.

9.0 COMPLAINTS

7 complaints were received during the reporting period. Details of these complaints are shown in **Table 12** below.

Table 12: Complaints Summary YTD

	Noise	Dust	Blast	Lighting	Other	Total
January	2	1	4	0	0	7
February	8	0	5	0	1	14
March	8	0	3	0	0	11
April	1	0	7	6	0	14
May	4	0	6	1	0	11
June	0	1	4	1	0	6
July	7	0	5	0	1	13
August	3	0	5	0	0	8
September	2	0	2	2	0	6
October	7	1	3	2	0	13
November	2	0	3	5	1	11
December	3	1	0	3	0	7
Total	47	4	47	20	3	121

Appendix A: Meteorological Data

Table 13: Meteorological Data – Charlton Ridge Meteorological Station – December 2022

Date	Air Temperature		Relative Humidity		Wind Direction	Wind Speed	Rainfall
	Maximum (°C)	Minimum (°C)	Maximum (%)	Minimum (%)	Average (°)	Average (m/sec)	total (mm)
1/12/2022	22	9	84	48	143	3.1	0.0
2/12/2022	25	8	86	38	151	3.7	0.0
3/12/2022	26	6	98	34	149	2.8	0.0
4/12/2022	28	6	96	37	136	2.5	0.0
5/12/2022	34	6	100	23	241	2.9	0.0
6/12/2022	29	13	90	38	137	3.0	0.2
7/12/2022	25	13	79	32	289	3.9	0.0
8/12/2022	29	7	92	13	238	3.5	0.0
9/12/2022	26	4	84	29	149	2.7	0.0
10/12/2022	24	7	87	47	134	2.8	0.0
11/12/2022	34	5	98	23	203	2.5	0.0
12/12/2022	27	13	99	28	251	3.9	2.8
13/12/2022	29	5	68	18	269	3.2	0.0
14/12/2022	26	3	80	14	245	3.4	0.0
15/12/2022	27	8	75	19	210	2.4	0.0
16/12/2022	25	4	78	28	141	3.2	0.0
17/12/2022	25	5	83	34	155	3.5	0.0
18/12/2022	24	5	95	41	159	3.5	0.0
19/12/2022	25	4	99	31	160	3.8	0.0
20/12/2022	25	8	84	33	150	3.0	0.0
21/12/2022	24	12	76	38	119	3.4	0.0
22/12/2022	27	7	100	27	171	2.0	4.0
23/12/2022	29	6	100	41	234	2.7	2.8
24/12/2022	31	9	100	43	209	2.6	12.6
25/12/2022	33	8	99	28	173	2.3	0.0
26/12/2022	34	8	98	16	146	2.5	0.0
27/12/2022	32	6	93	20	133	3.3	0.0
28/12/2022	33	7	99	11	124	2.1	0.0
29/12/2022	29	9	93	48	166	3.6	0.0
30/12/2022	30	9	92	34	134	3.6	0.0
31/12/2022	30	8	95	34	138	3.3	0.0