Monthly Environmental Monitoring Report

Yancoal Mt Thorley Warkworth

September 2019

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Revision History

Version No.	Person Responsible	Document Status	Date
1.0	**Environmental Advisor**	**Final**	**20/11/2019**

1.0 INTRODUCTION

This report has been compiled to provide a monthly summary of environmental monitoring results for Mt Thorley Warkworth (MTW). This report includes all monitoring data collected for the period 1 September to 30 September 2019.

2.0 AIR QUALITY

2.1 Meteorological Monitoring

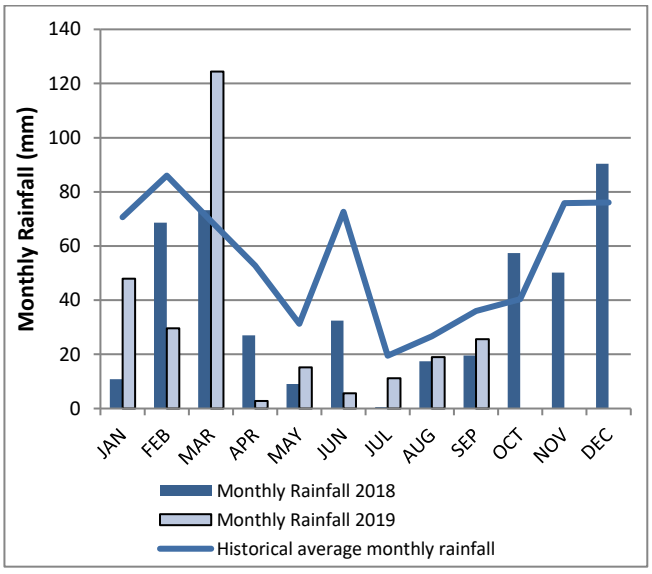
Meteorological data is collected at MTW's 'Charlton Ridge' meteorological station (refer to **Figure 3**: Air Quality Monitoring Locations).

2.1.1 Rainfall

Rainfall for the period is summarised in **Table 1**, the year-to-date trend and historical trend are shown in **Figure 1**.

Table 1: Monthly Rainfall MTW

2019	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
September	5.6	225.6



Note: The historical average monthly rainfall is calculated from 2007 to 2018 monthly totals

Figure 1: Rainfall Trends YTD

2.1.2 Wind Speed and Direction

Winds from the south and northwest were dominant throughout the reporting period as shown in **Figure 2**.

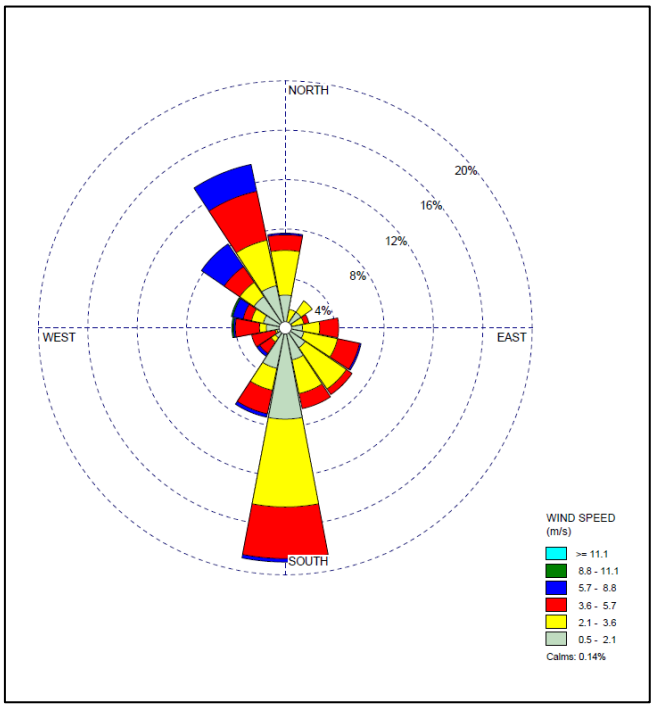


Figure 2: Charlton Ridge Wind Rose – September 2019

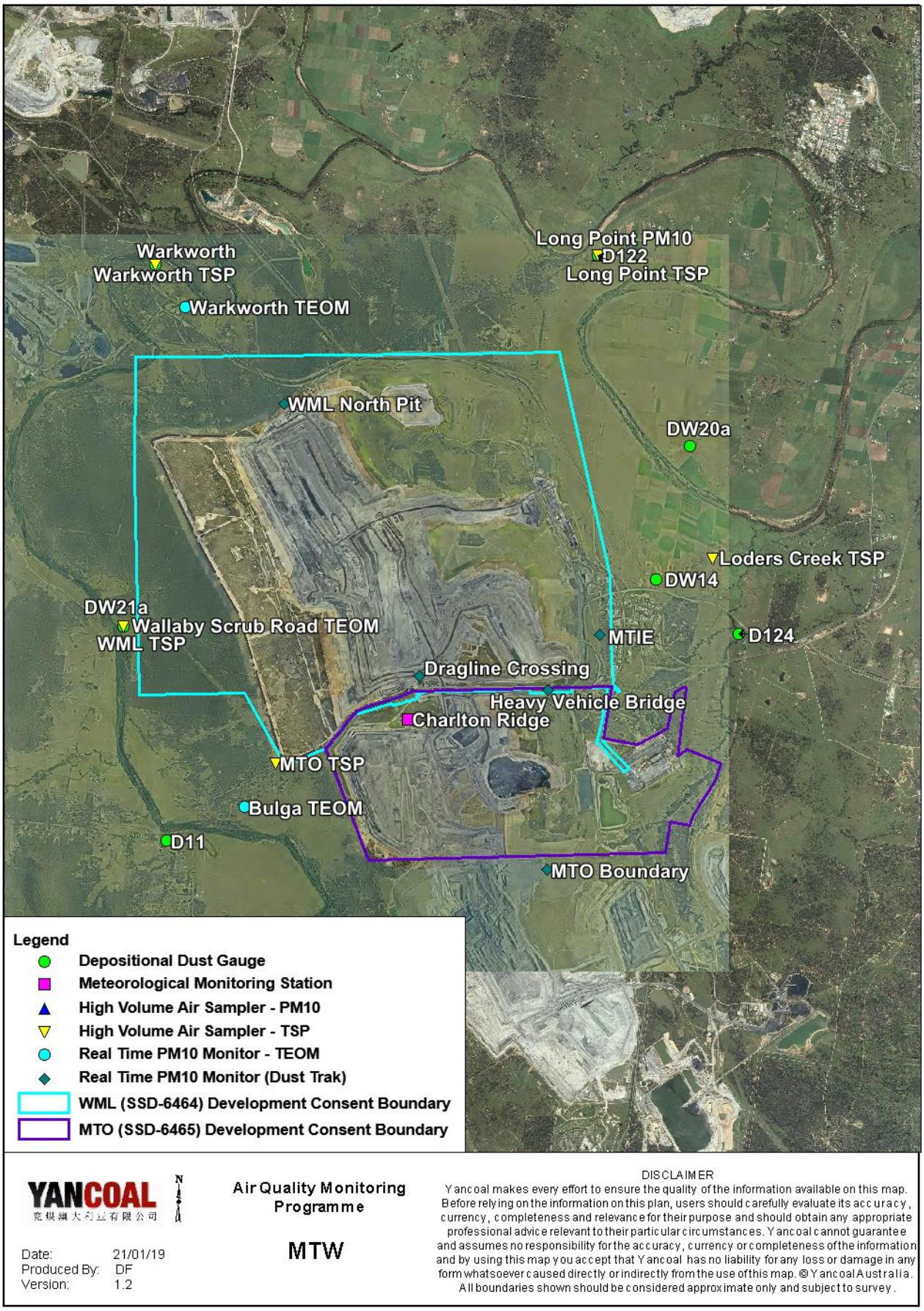


Figure 3: Air Quality Monitoring Locations

2.2 Depositional Dust

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

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.

During the reporting period the D124 and Warkworth monitors recorded monthly results above the long-term impact assessment criteria of 4.0 g/m^2 per month. There is no evidence to suggest that the D124 and Warkworth results are contaminated. Accordingly, the results will be included in the annual average calculation.

An assessment of MTW's contribution to the long-term impact assessment criteria will be provided in the 2019 Annual Review Report.

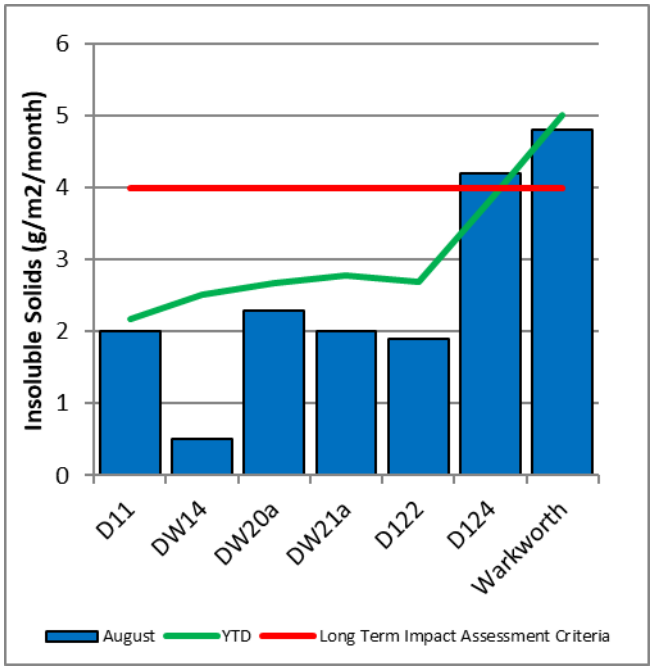


Figure 4: Depositional Dust – September 2019

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 the monitoring station against the short-term impact assessment criteria of 50µg/m^3.

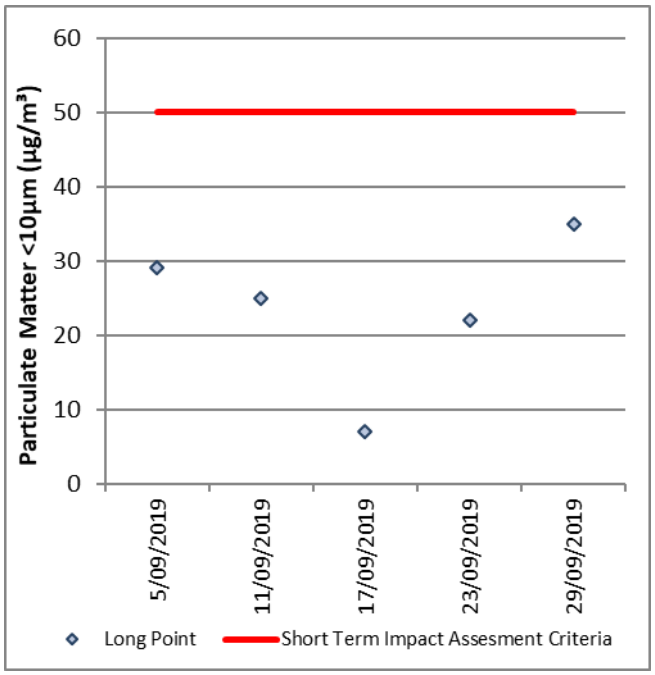


Figure 5: Individual PM_{10} Results – September 2019

Figure 6 shows the annual average PM_{10} results against the long-term impact assessment criteria.

An assessment of MTW's contribution to the long-term Impact assessment criteria will be provided in the 2019 Annual Review Report.

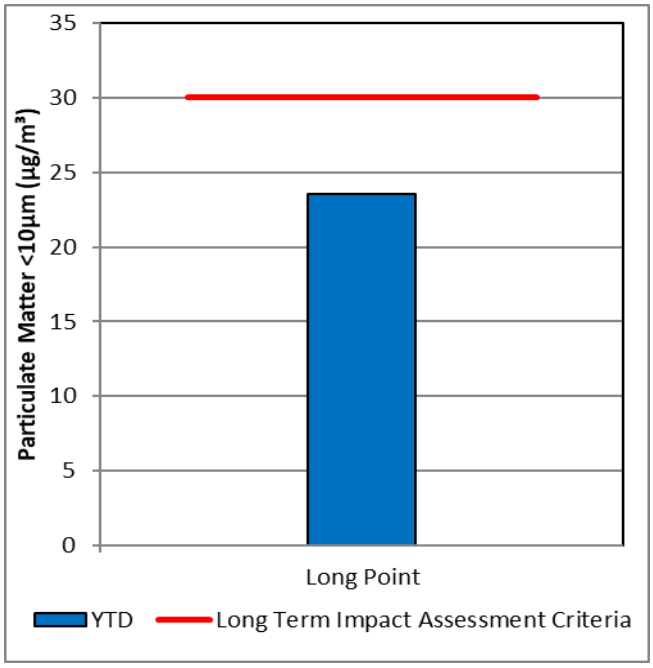


Figure 6: Annual Average PM_{10} – September 2019

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 contribution to the long-term assessment criteria will be reported in the 2019 Annual Review Report

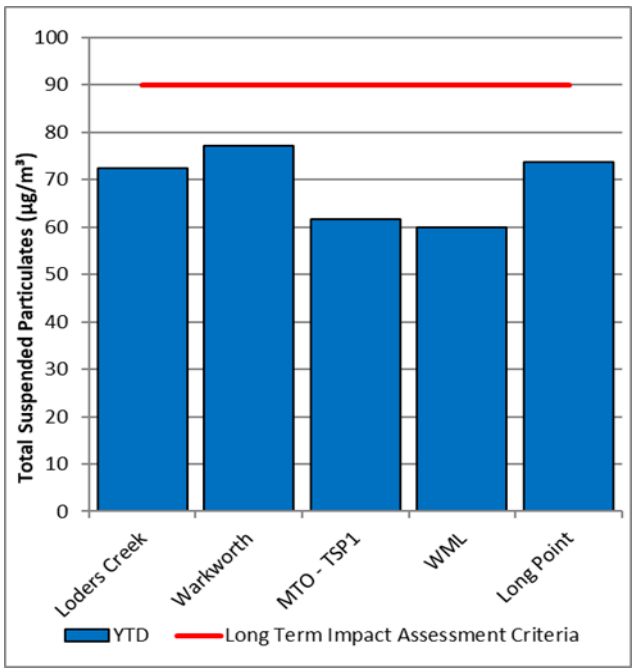


Figure 7: Annual Average Total Suspended Particulates – September 2019

2.3.3 Real Time PM_{10} Results

Mt Thorley Warkworth 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 alarms when particulate matter levels exceed internal trigger limits. It should be noted that the PM10 monitor named the "Wallaby Scrub Road TEOM" is planned to be moved to a representative location west of Wollombi Brook and be renamed "Wambo Road TEOM". This change was submitted to DPIE on 31 July 2019 during an update to the MTW Air Quality Management Plan and was subsequently approved by DPIE on 28 August 2019. Figures in the MEMR will be updated once the monitor has moved to the new location.

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.

On 6 September 2019, the Bulga OEH (73.3 µg/m³), Warkworth OEH (86.9 µg/m³) and Wallaby Scrub Road TEOM's (65.8 µg/m³) exceeded the short term (24hr) criteria. Investigation determined that the wind direction was generally not from MTW's angle of influence. Accordingly, no further action is required.

On 16 September 2019, the Warkworth OEH TEOM (57.4 µg/m³) exceeded the short term (24hr) criteria. Investigation determined that the wind direction was generally not from MTW's angle of influence. Accordingly, no further action is required.

2.3.4 Real Time Alarms for Air Quality

During September, the real time monitoring system generated 235 automated air quality related alerts, including 24 alerts for adverse meteorological conditions and 211 alerts for elevated PM10 levels.

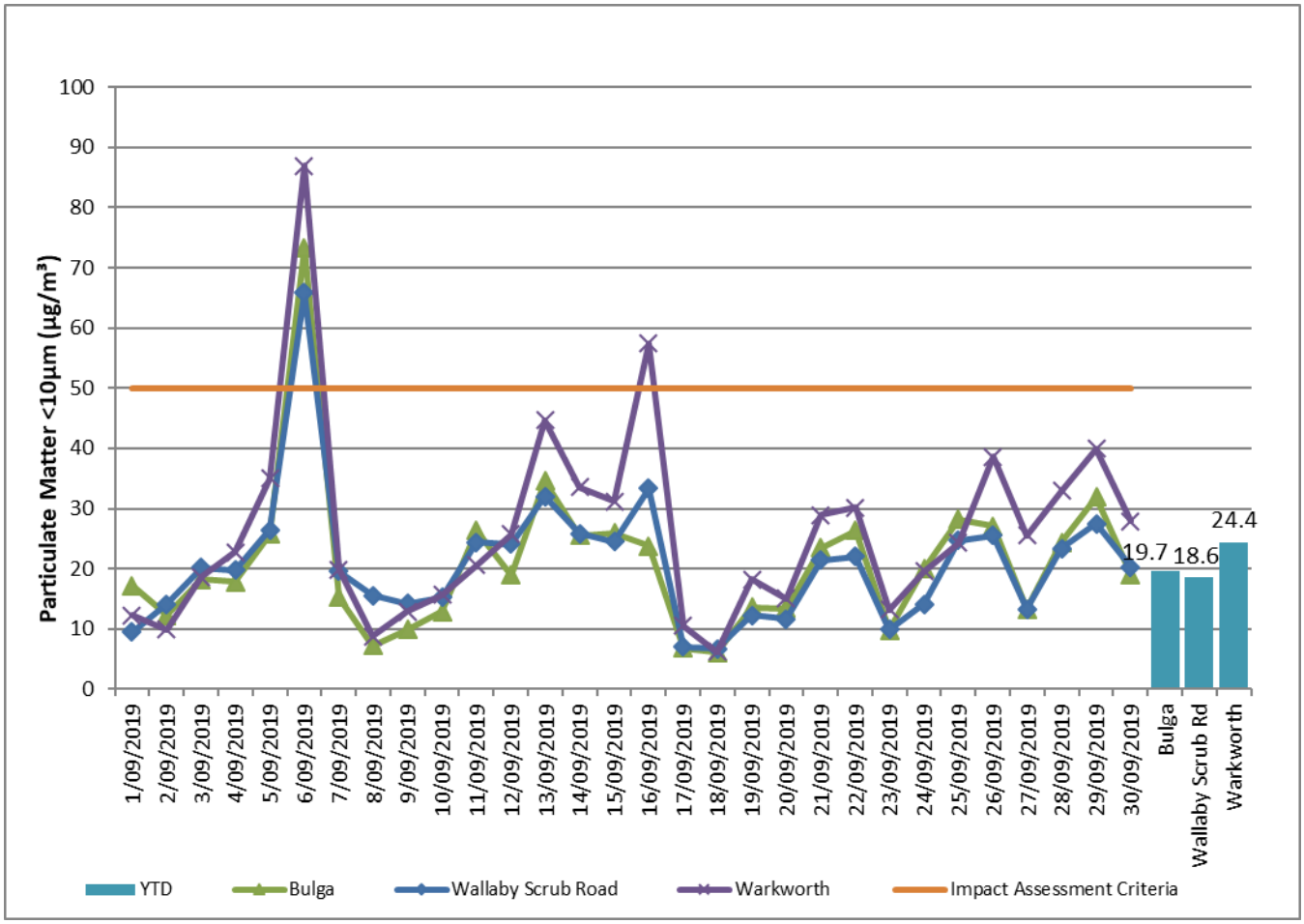


Figure 8: Real Time PM10 24hr average and Year-to-date average – September 2019

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 monitor the potential impact of mining. Other Hunter River tributaries are also monitored.

3.1.1 Surface Water Monitoring Results

Figure 9 to **Figure 11** show the long-term surface water trend (2016 – current) within MTW mine dams. **Figure 12** to **Figure 14** show the long-term surface water trend (2016 - current) in surrounding watercourses.

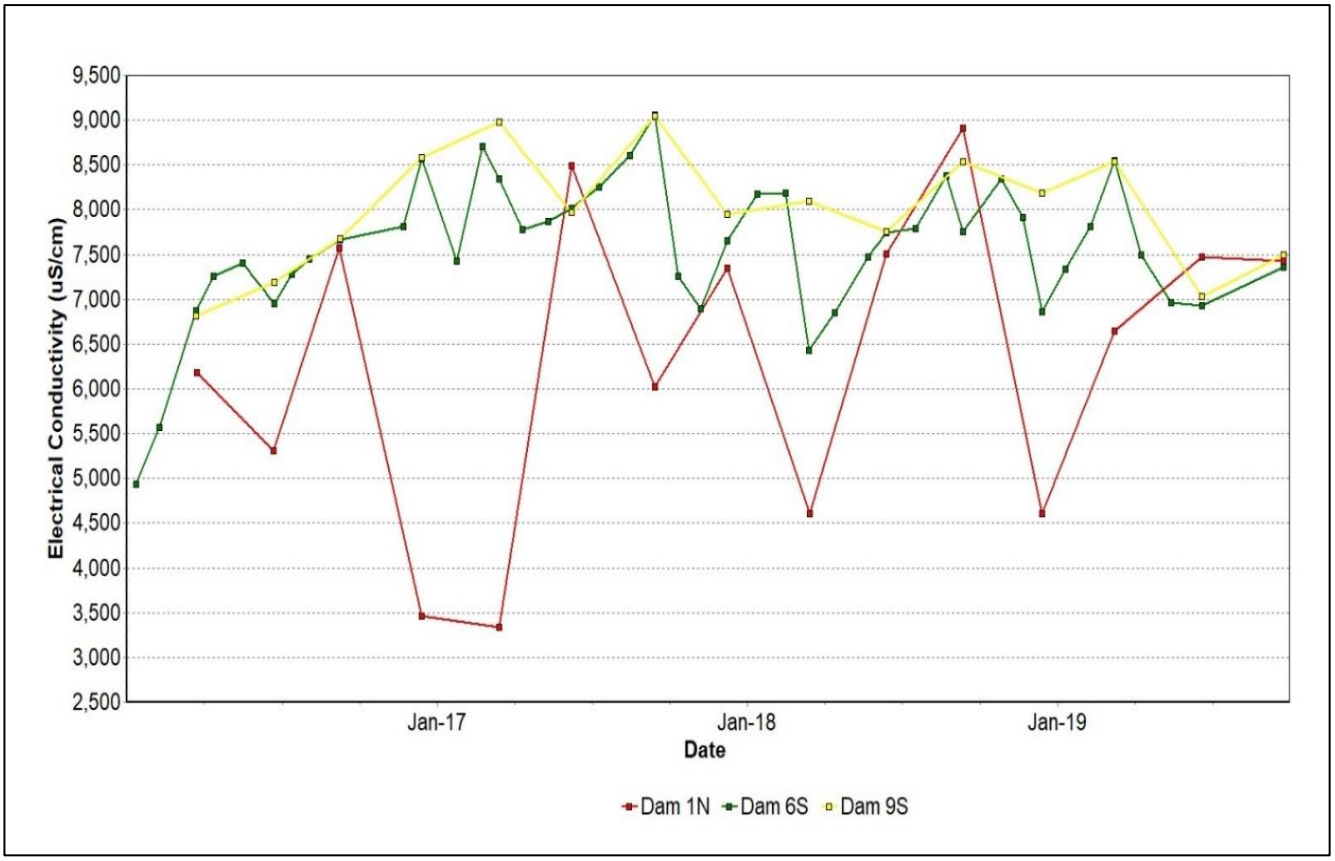


Figure 9: Site Dams Electrical Conductivity Trend – September 2019

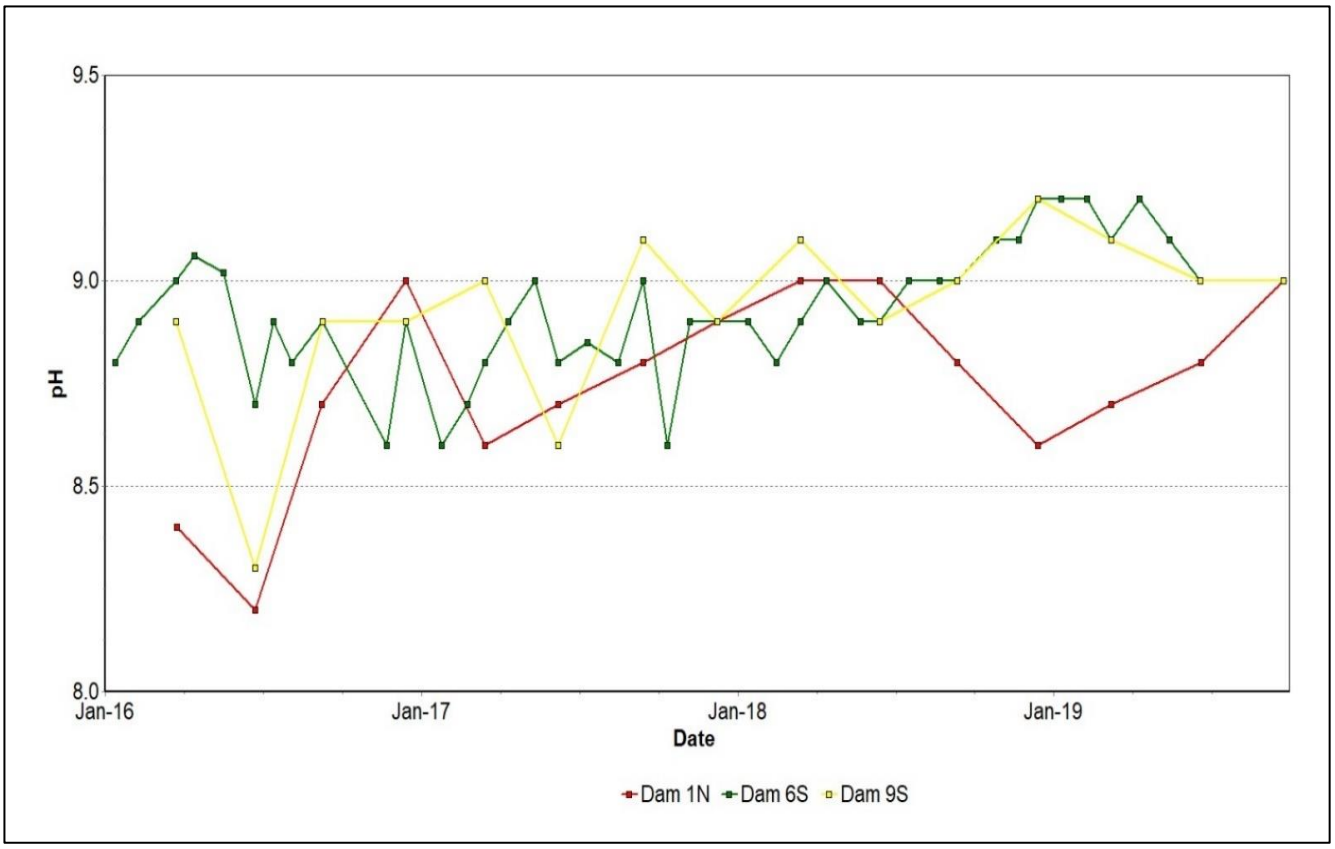


Figure 10: Site Dams pH Trend – September 2019

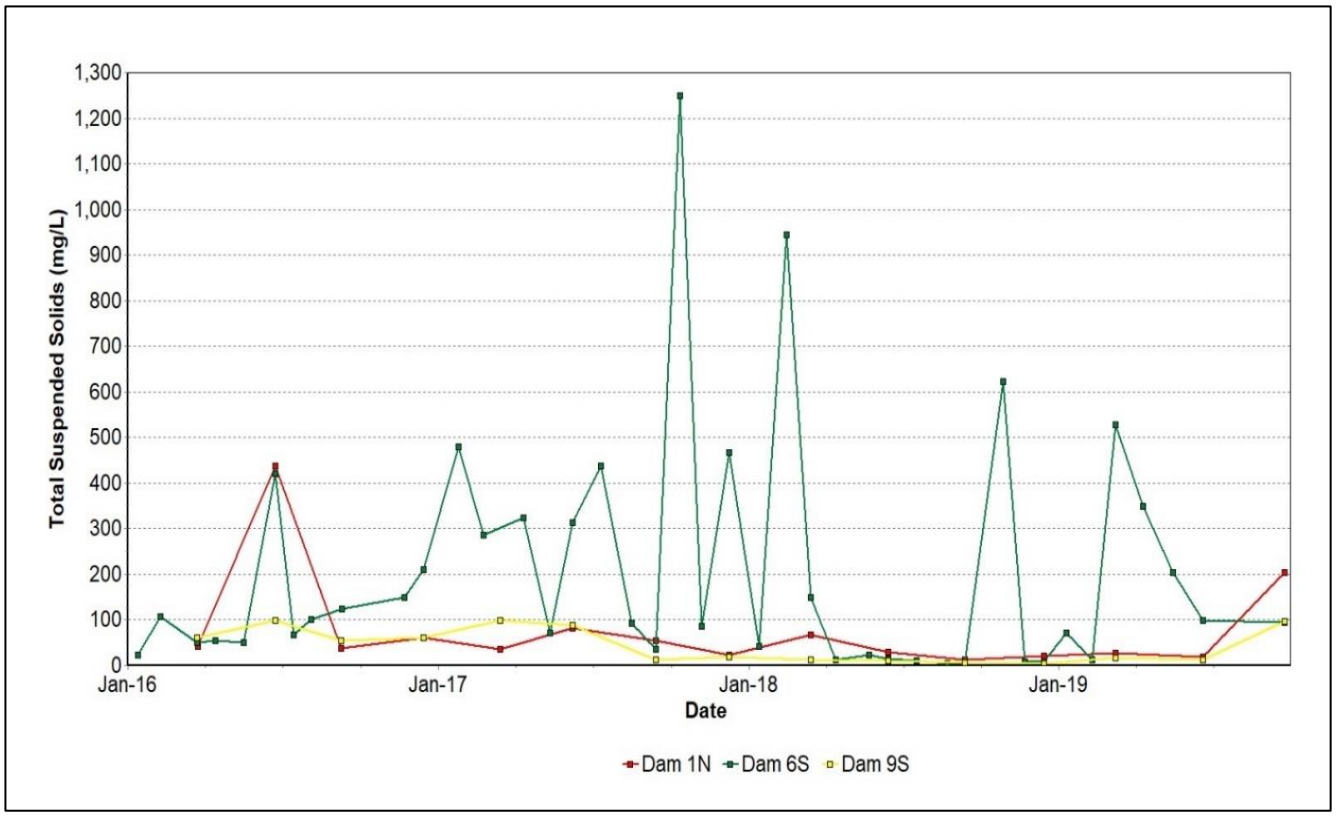
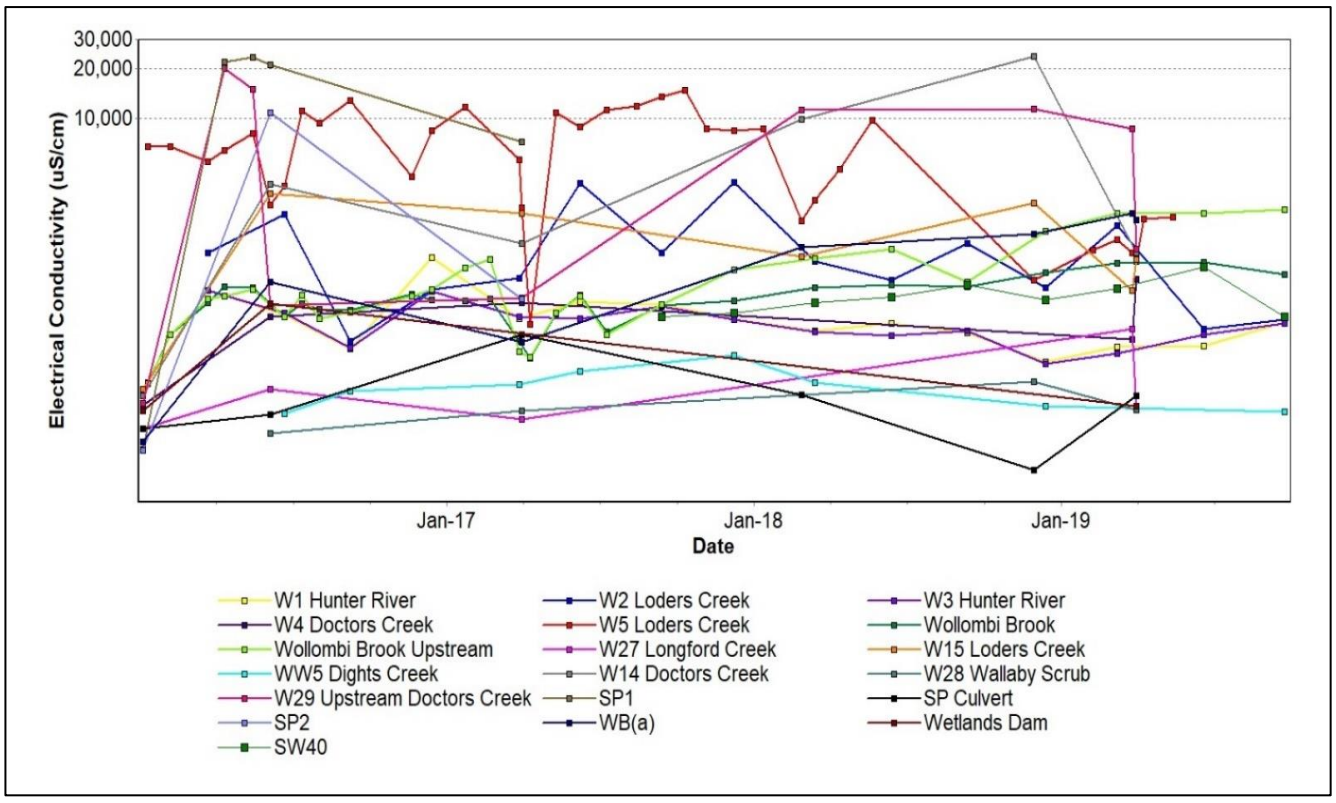
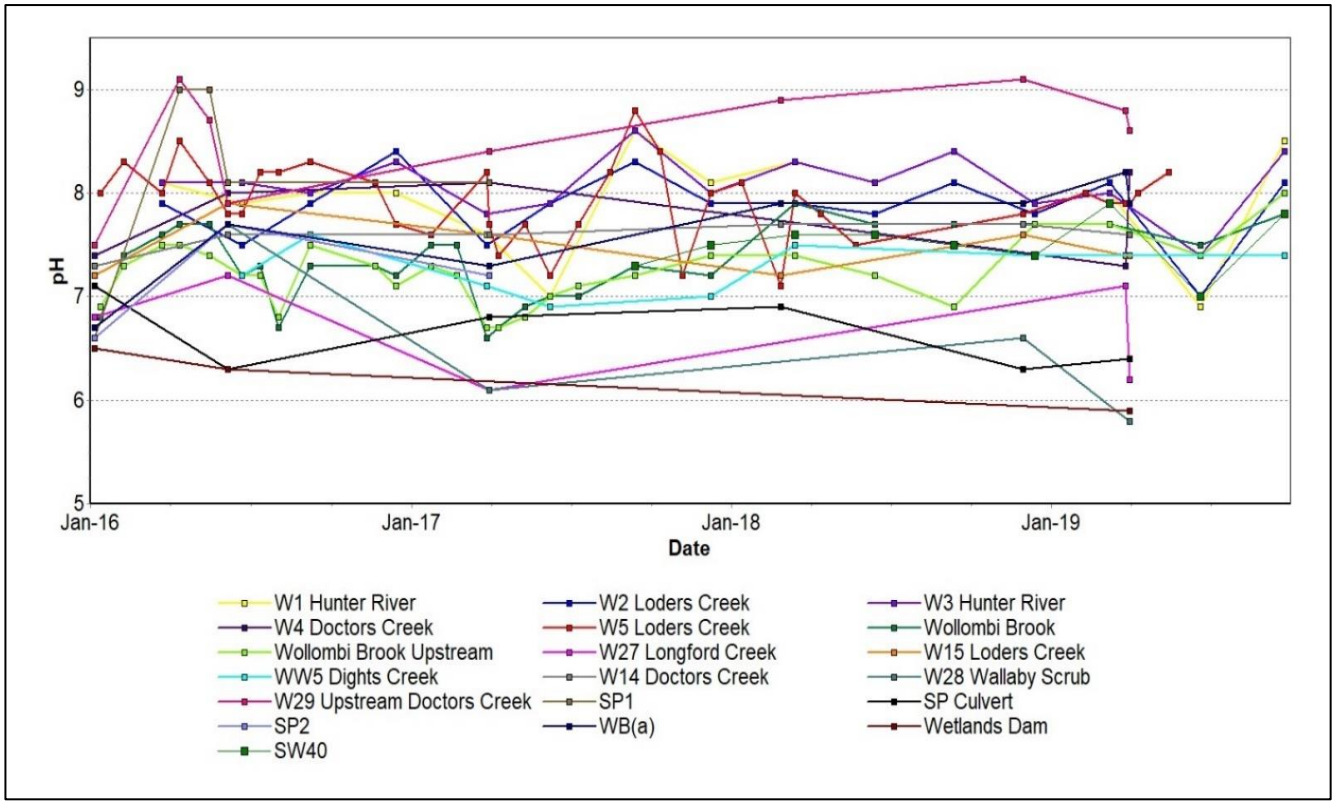


Figure 11: Site Dams Total Suspended Solids Trend – September 2019



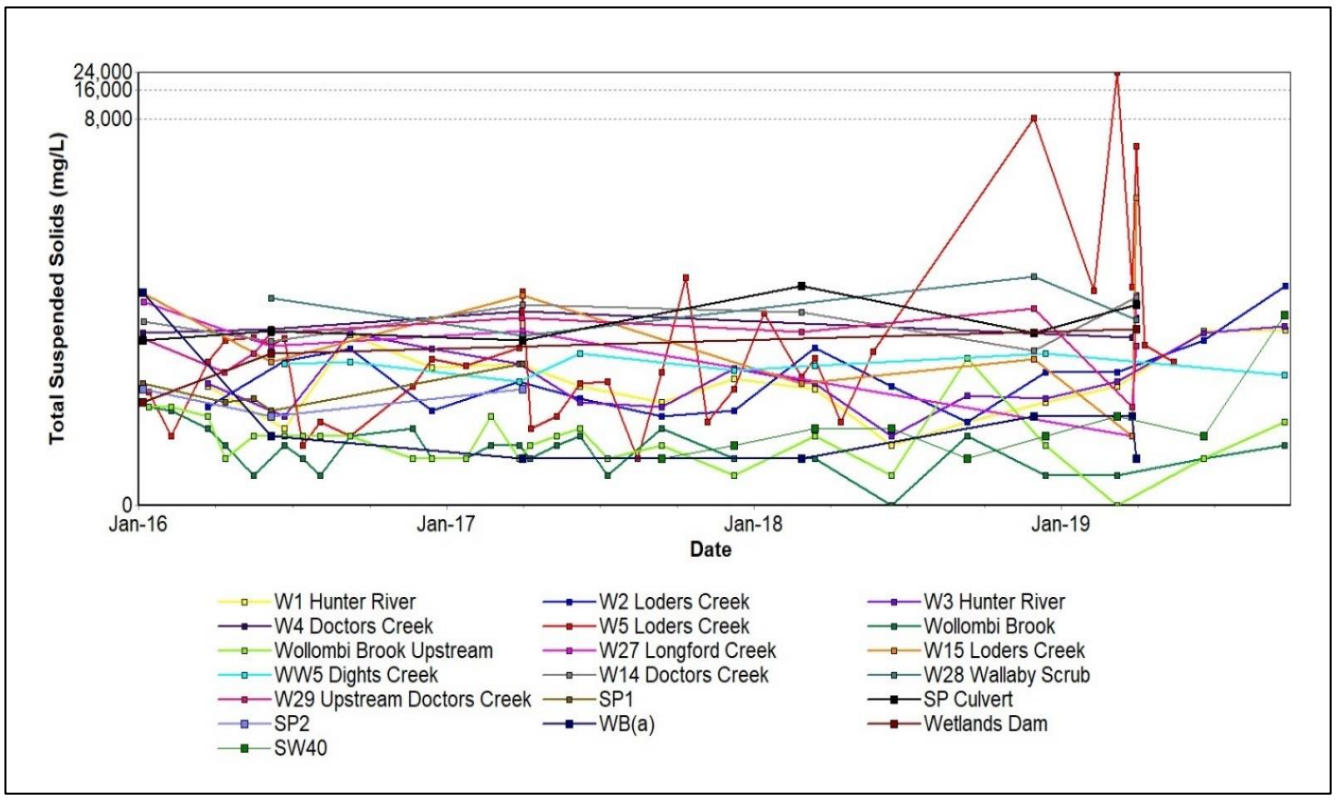
Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 12: Watercourse Electrical Conductivity Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 13: Watercourse pH Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample, or that there was no safe access.

Figure 14: Watercourse Total Suspended Solids Trend – September 2019

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 – September YTD 2019

Site	Date	Trigger Limit Breached	Action Taken in Response
W27	26/03/2019	EC –95th Percentile	Watching Brief* Note: Subsequent monitoring events have confirmed results are back within trigger limits. No further action required.
Wollombi Brook	08/03/2019	EC –95th Percentile	Watching Brief* Note: Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Wollombi Brook Upstream showing similar EC results and trends. Continue to watch and monitor.
Wollombi Brook	19/06/2019	EC –95th Percentile	Watching Brief* Note: Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Wollombi Brook Upstream showing similar EC results and trends. Continue to watch and monitor.
Wollombi Brook	23/09/2019	EC –95th Percentile	Watching Brief* Note: Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Wollombi Brook Upstream showing similar EC results and trends. Continue to watch and monitor. Investigation commenced.
Wollombi Brook Upstream	08/03/2019	EC –95th Percentile	Watching Brief*
Wollombi Brook Upstream	19/06/2019	EC –95th Percentile	Watching Brief* Note: Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Continue to watch and monitor.
Wollombi Brook Upstream	23/09/2019	EC –95th Percentile	Watching Brief* Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Wollombi

Site	Date	Trigger Limit Breached	Action Taken in Response
			Brook showing similar EC results and trends. Investigation commenced.
SW40	08/03/2019	EC –95th Percentile	Watching Brief*
SW40	19/06/2019	EC –95th Percentile	Watching Brief* Note: Elevated EC is considered attributable to prolonged dry climatic conditions, and not related to mining related impacts. Wollombi Brook U/S showing similar EC results and trends. Results from subsequent monitoring events have confirmed results are back within trigger limits.
W1	19/06/2019	pH –5th Percentile	Watching Brief*
W2	19/06/2019	pH –5th Percentile	Watching Brief*
W3	19/06/2019	pH –5th Percentile	Watching Brief*
W4	26/03/2019	pH –5th Percentile	Watching Brief*
W27	31/03/2019	pH –5th Percentile	Watching Brief*
W28	31/03/2019	pH –5th Percentile	Watching Brief*
W1	19/06/2019	TSS – 50mg/L (ANZECC criteria)	Watching Brief*. Note: Unlikely to be associated with MTW mining related impacts.
W1	23/09/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS considered associated with recent rainfall and increased flow rate in the river at the time. Consistent with nearby W2 and W3 measurements. No signs of mining related impact.
W2	23/09/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS considered associated with recent rainfall and increased flow rate in the river at the time. Consistent with nearby W1 and W3 measurements. No signs of mining related impact.
W3	19/06/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS considered associated with recent rainfall and increased flow rate in the river at the time. Consistent with nearby W1 and W2 measurements. No signs of mining related impact.
W3	23/09/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS considered associated with recent rainfall and increased flow rate in the river at the time. Consistent with nearby W1 and W2 measurements. No signs of mining related impact.
W4	31/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Field investigation did not identify any mining related sources of sediment. Elevated TSS results most likely attributable to high intensity rainfall event after prolonged dry period (52mm in 24 hours).

Site	Date	Trigger Limit Breached	Action Taken in Response
W5	09/01/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Field investigation did not identify any mining related sources of sediment. Elevated TSS results considered attributable to sampling from a pool of water with no flow.
W5	08/02/2019	TSS – 50mg/L (ANZECC criteria)	Field investigation did not identify any mining related sources of sediment. Elevated TSS results considered attributable to sampling from a pool of water with no flow.
W5	08/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Investigation did not identify any mining related sources of sediment. Elevated TSS results most likely attributable to sampling from a pool of water with no flow.
W14	31/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Field investigation did not identify any mining related sources of sediment. Elevated TSS results most likely attributable to high intensity rainfall event after prolonged dry period (52mm in 24 hours).
W15	31/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Field investigation did not identify any mining related sources of sediment. Elevated TSS results most likely attributable to high intensity rainfall event after prolonged dry period (52mm in 24 hours).
W27	31/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS results most likely attributable to high intensity rainfall event after prolonged dry period (52mm in 24 hours). In addition, TSS results were potentially affected by turbid water associated with the overtopping of an MTW sediment dam as a result of greater than design rainfall on 30 March 2019. This is discussed further in Section 8.0.
W28	31/03/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS results most likely attributable to high intensity rainfall event after prolonged dry period (52mm in 24 hours). In addition, TSS results were potentially affected by turbid water associated with the overtopping of an MTW sediment dam as a result of greater than design rainfall on 30 March 2019. This is discussed further in Section 8.0.
SW40	23/09/2019	TSS – 50mg/L (ANZECC criteria)	Investigation undertaken. Note: Elevated TSS considered associated with recent rainfall (17-19 and 22 September) resulting in mobilisation of sediment after prolonged dry conditions. Unlikely to be associated with MTW mining related impacts. Continue to monitor.

* = Watching brief established pending outcomes of subsequent monitoring events.

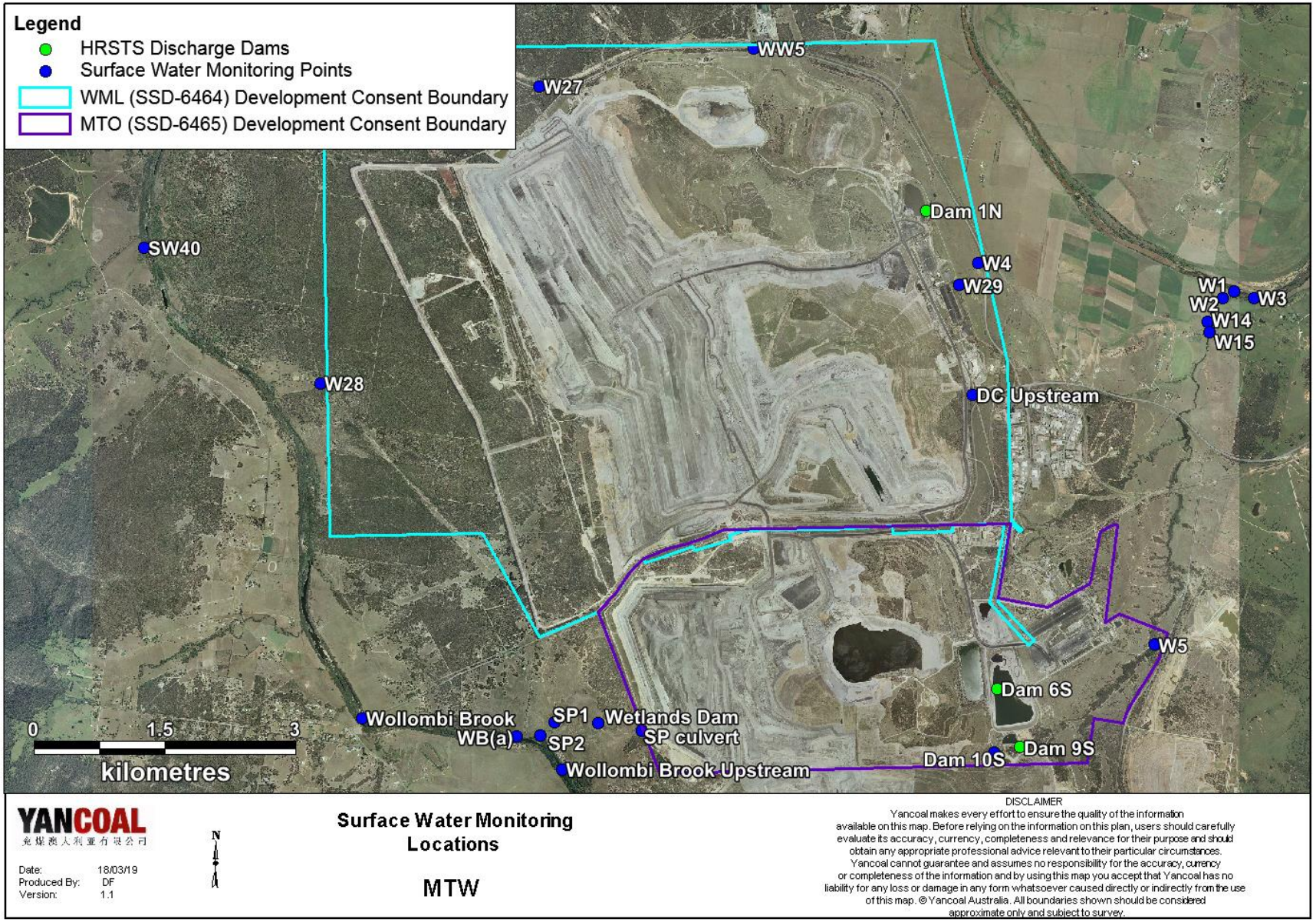


Figure 15: Surface Water Monitoring Location Plan

3.2 Groundwater Monitoring

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

Figure 16 to **Figure 58** show the long-term water quality trends (2016 – current) for groundwater bores monitored at MTW.

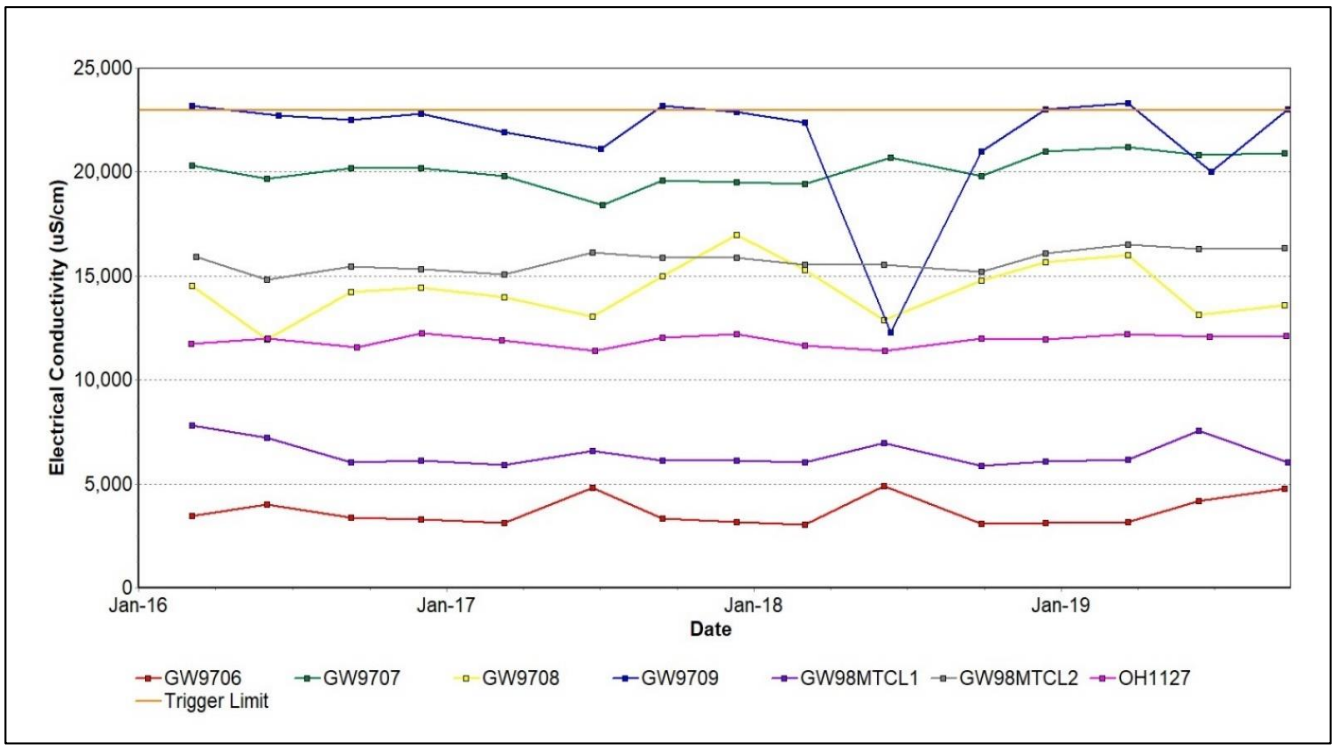


Figure 16: Bayswater Seam Electrical Conductivity Trend – September 2019

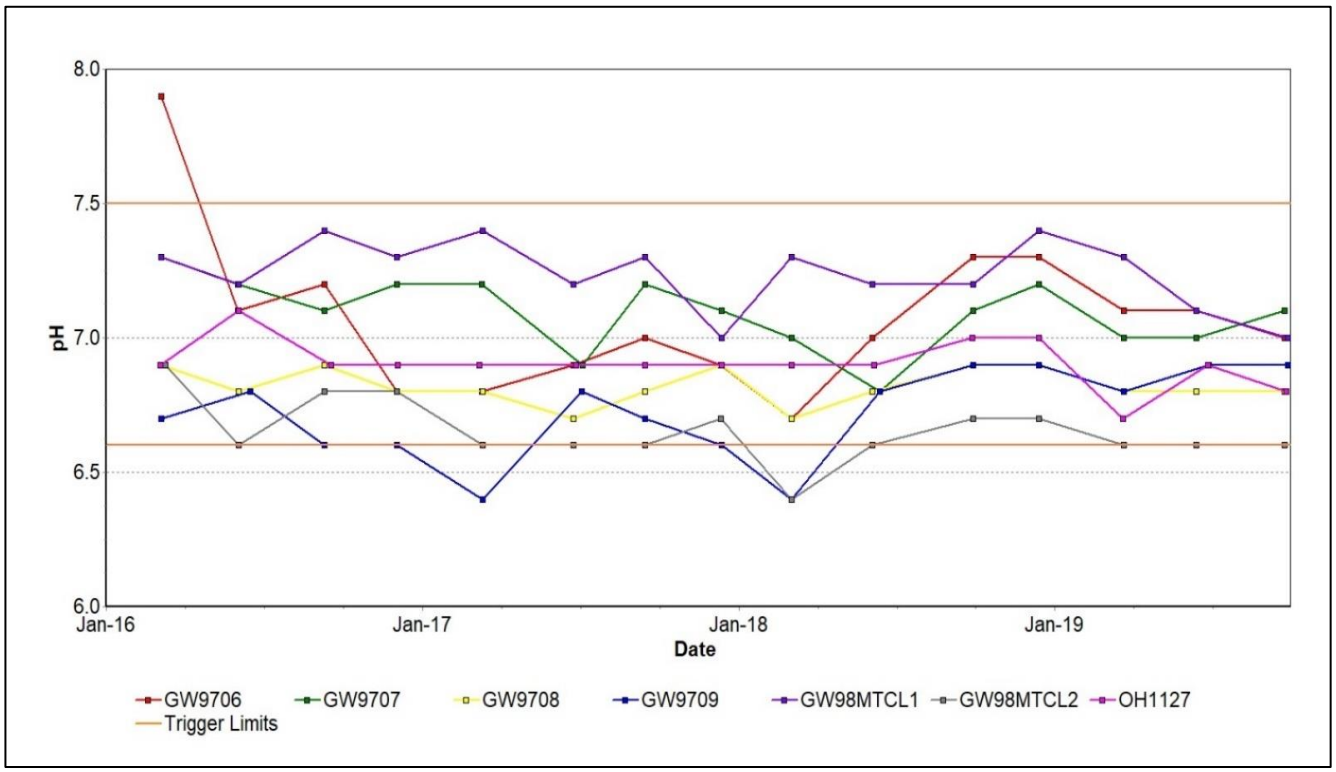


Figure 17: Bayswater Seam pH Trend – September 2019

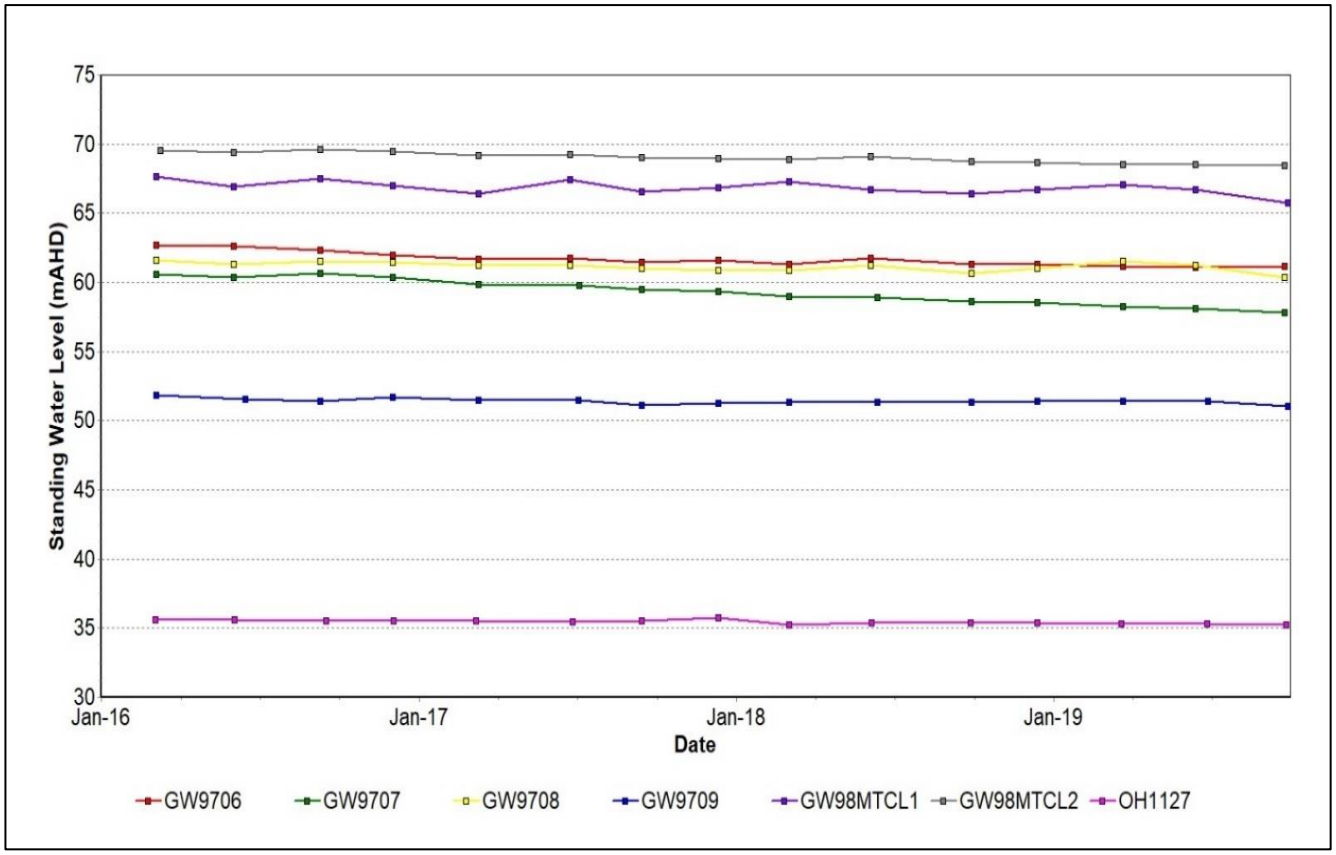


Figure 18: Bayswater Seam Standing Water Level Trend – September 2019

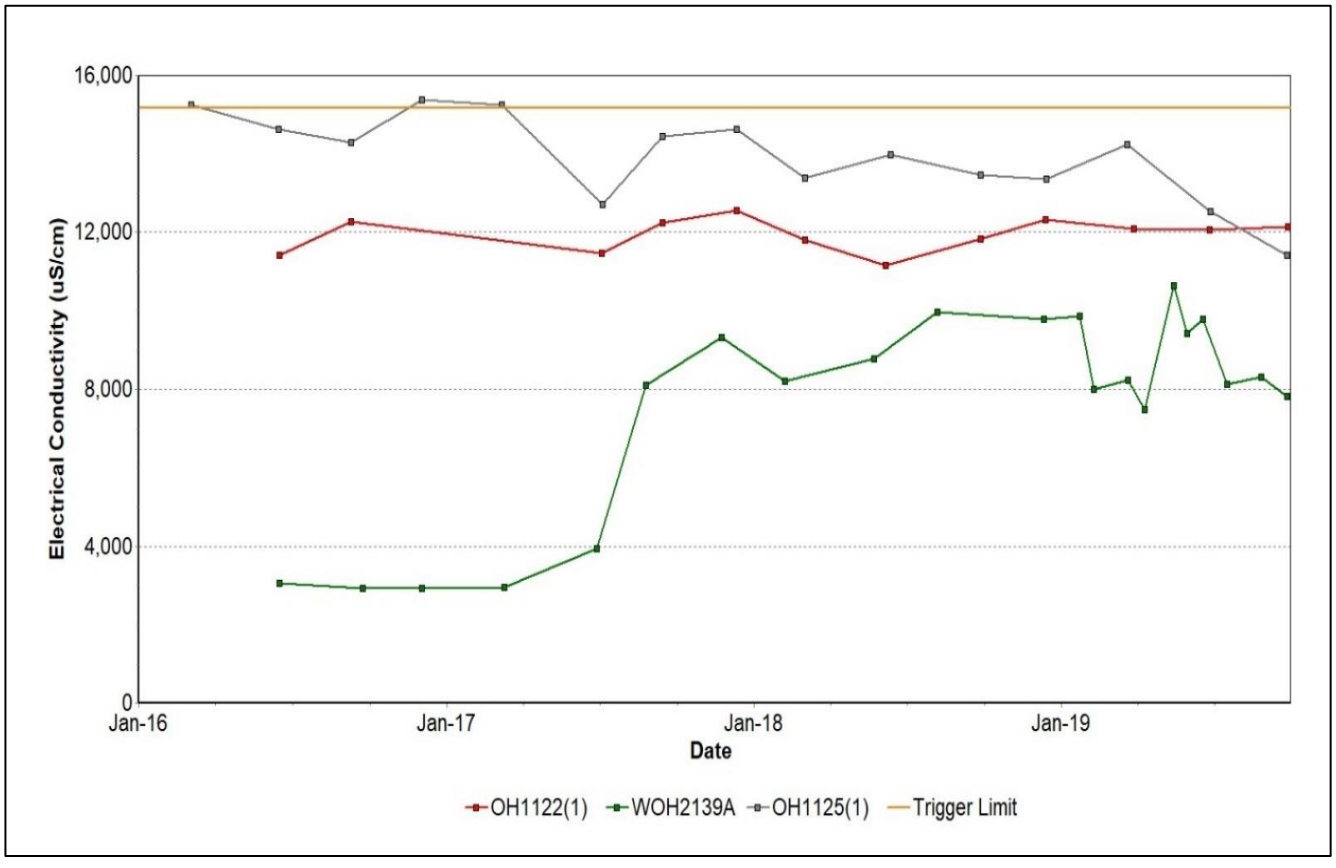


Figure 19: Blakefield Seam Electrical Conductivity Trend – September 2019

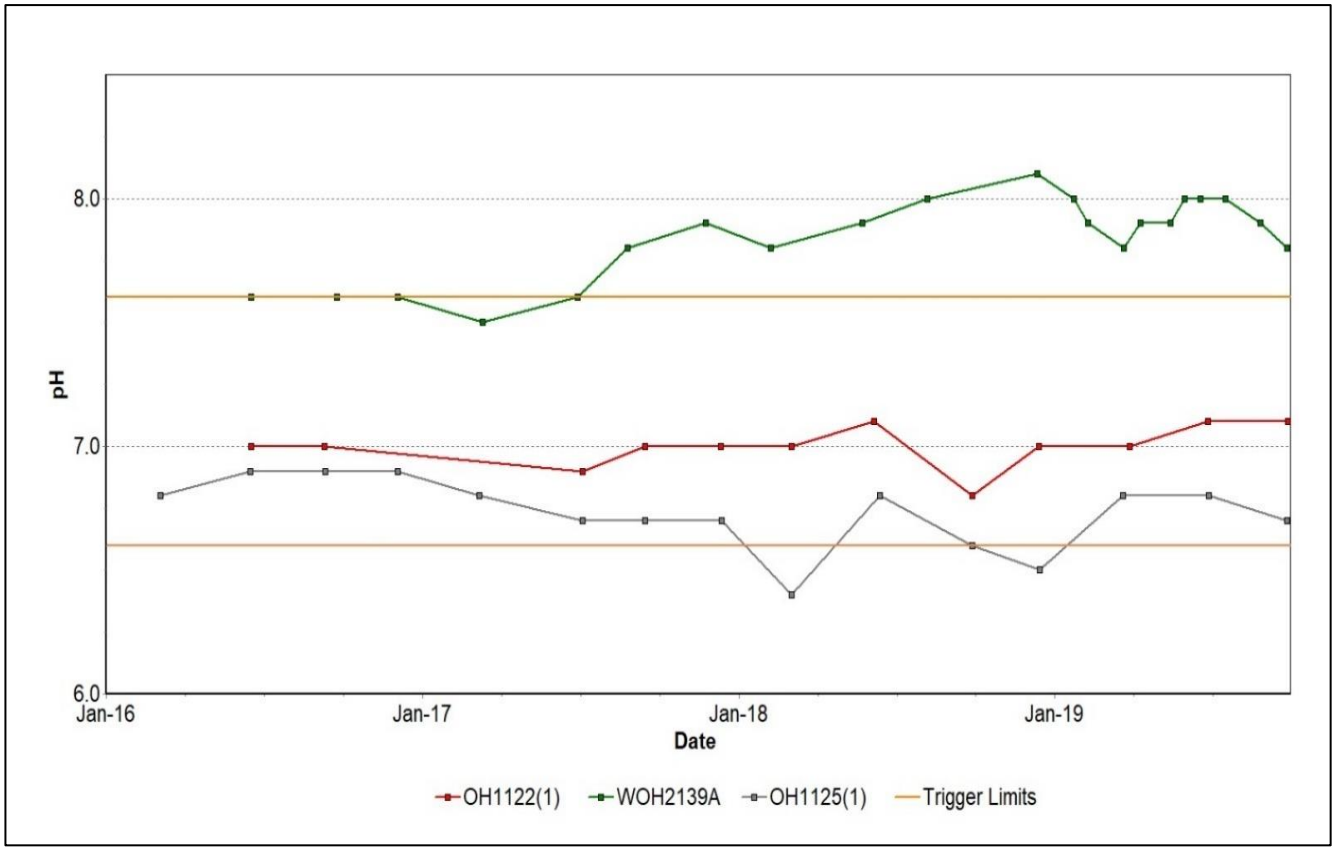


Figure 20: Blakefield Seam pH Trend – September 2019

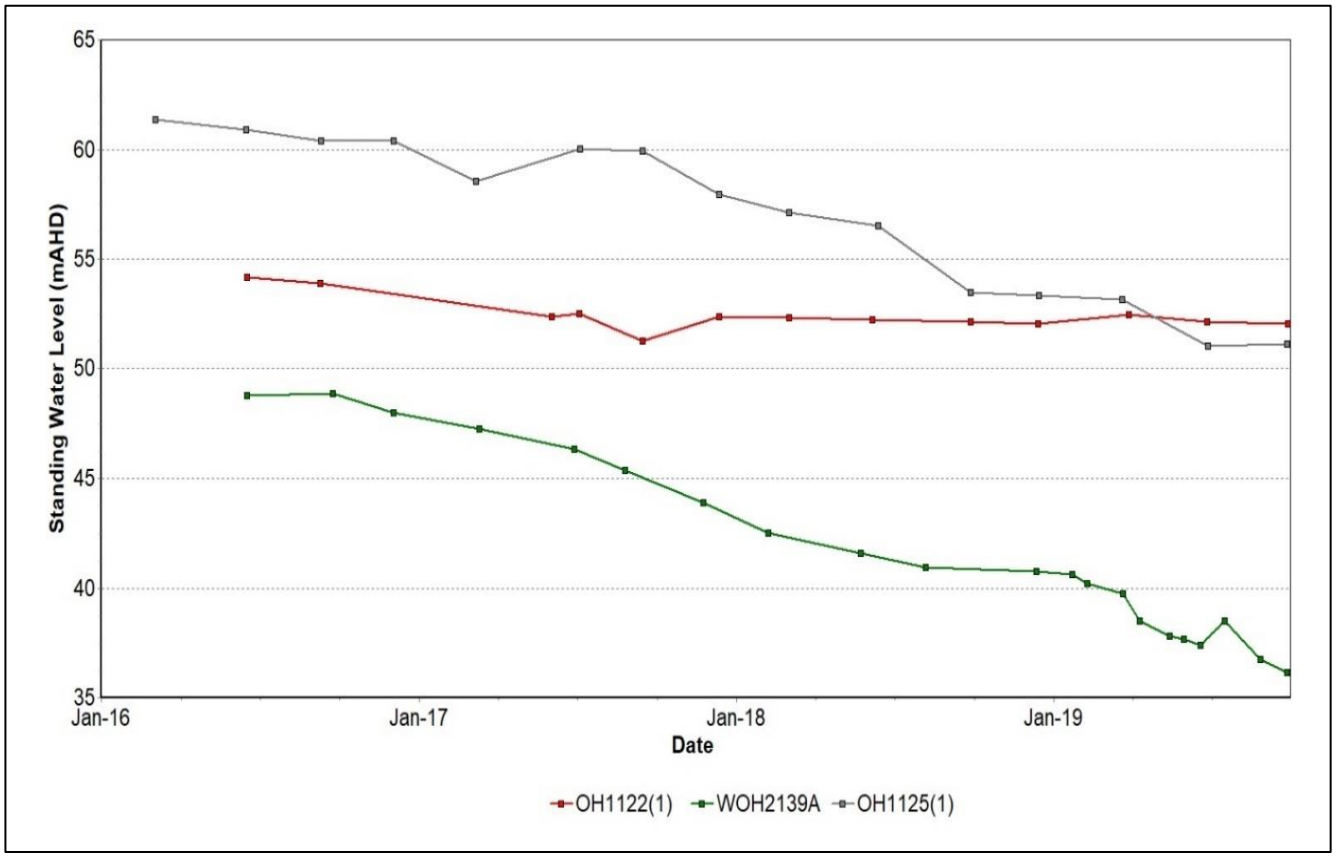


Figure 21: Blakefield Seam Standing Water Level Trend – September 2019

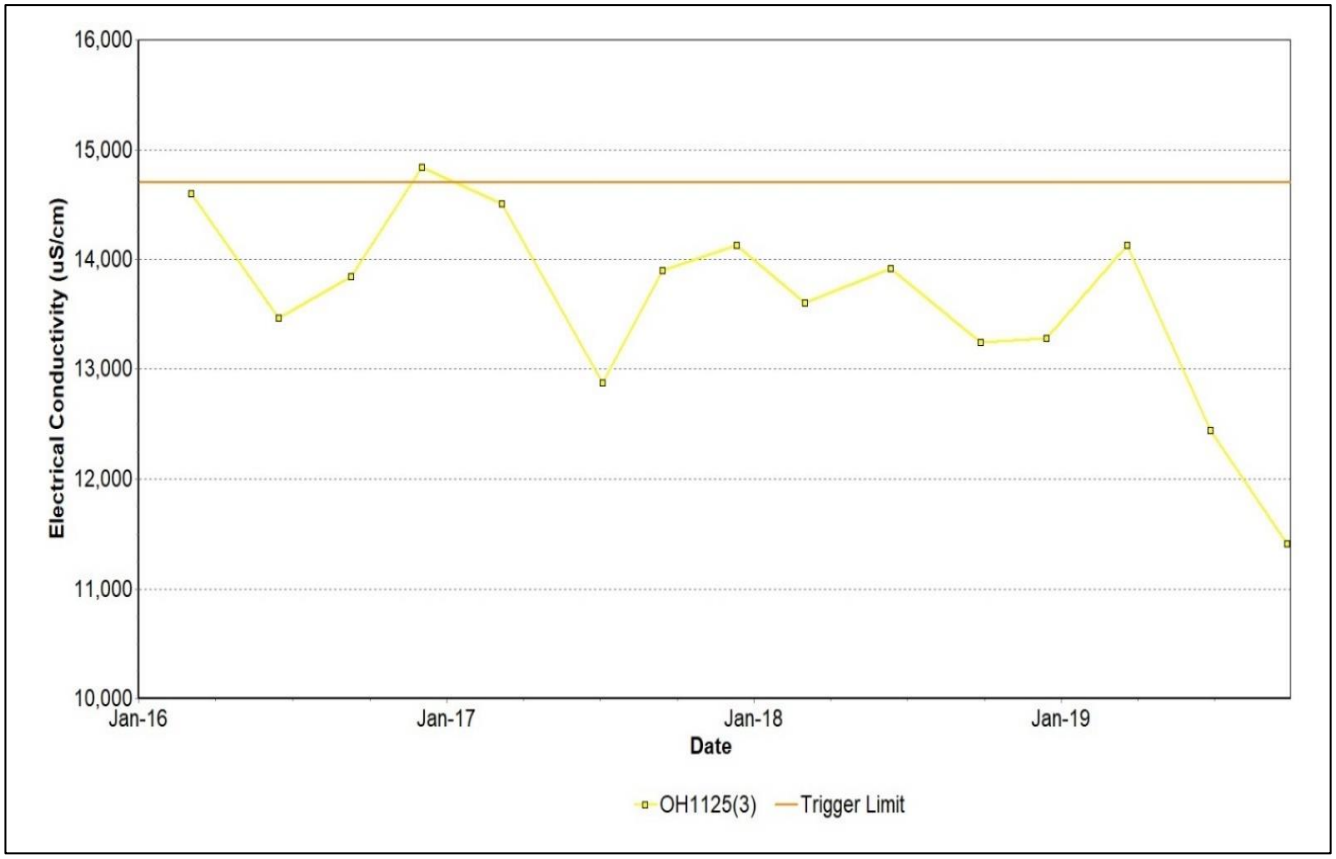


Figure 22: Bowfield Seam Electrical Conductivity Trend – September 2019

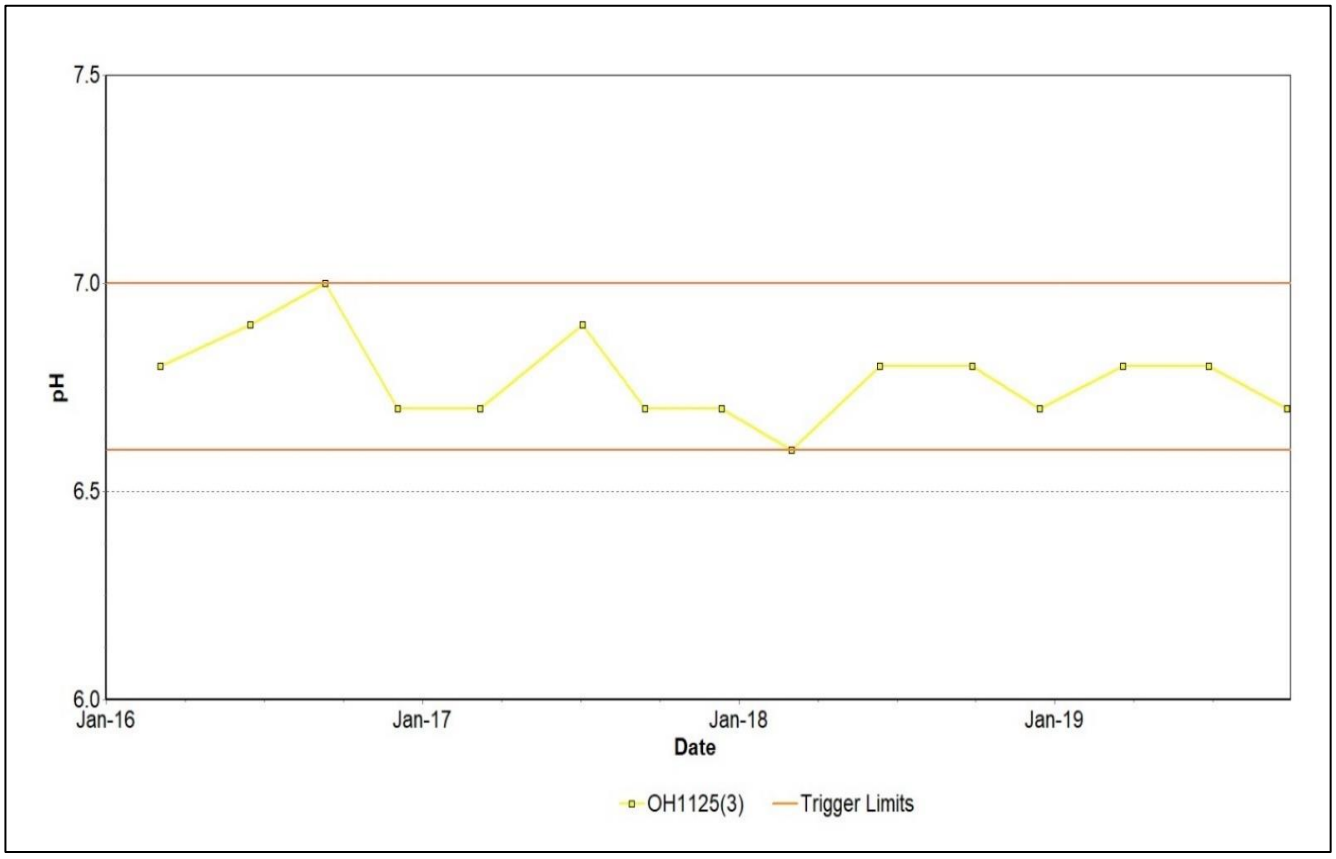


Figure 23: Bowfield Seam pH Trend – September 2019

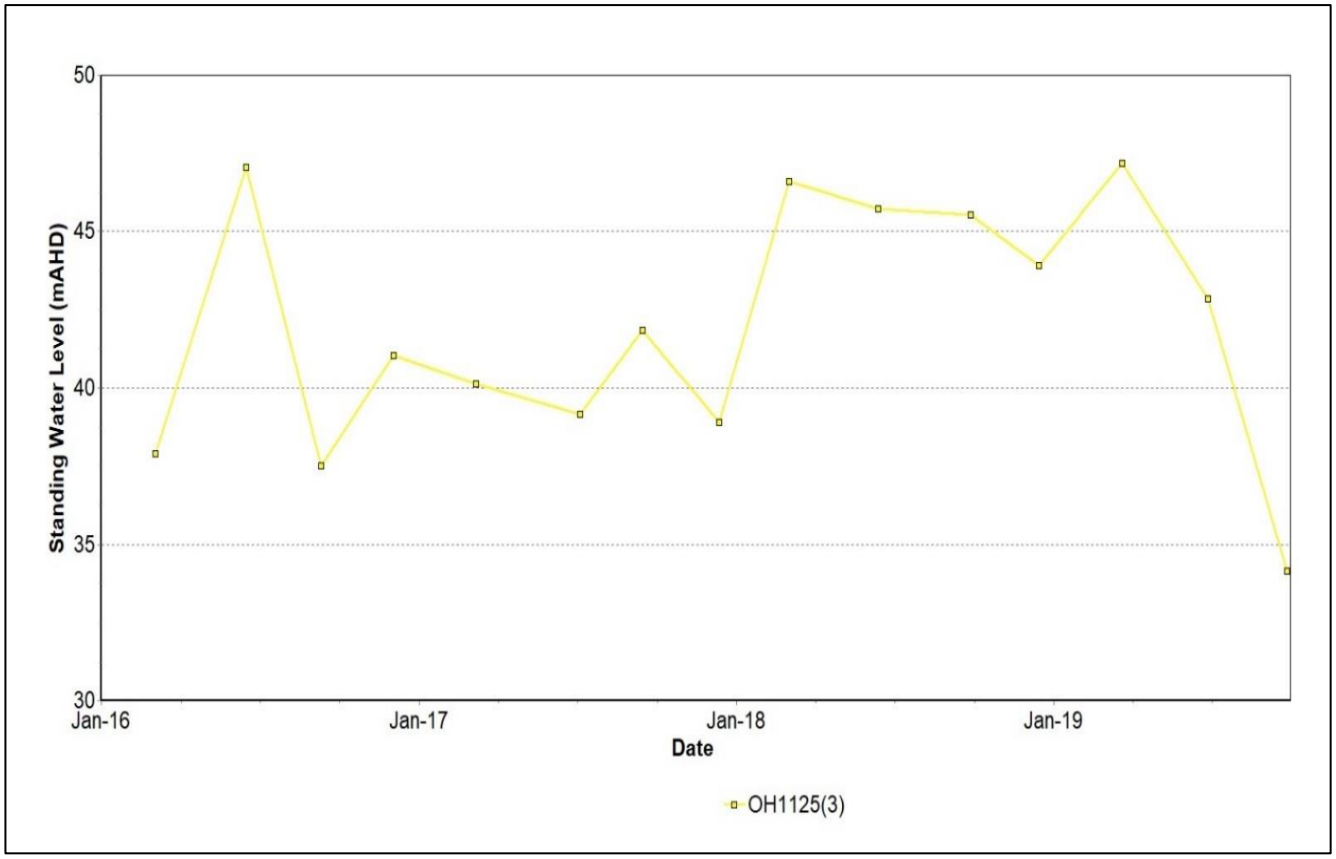


Figure 24: Bowfield Seam Standing Water Level Trend – September 2019

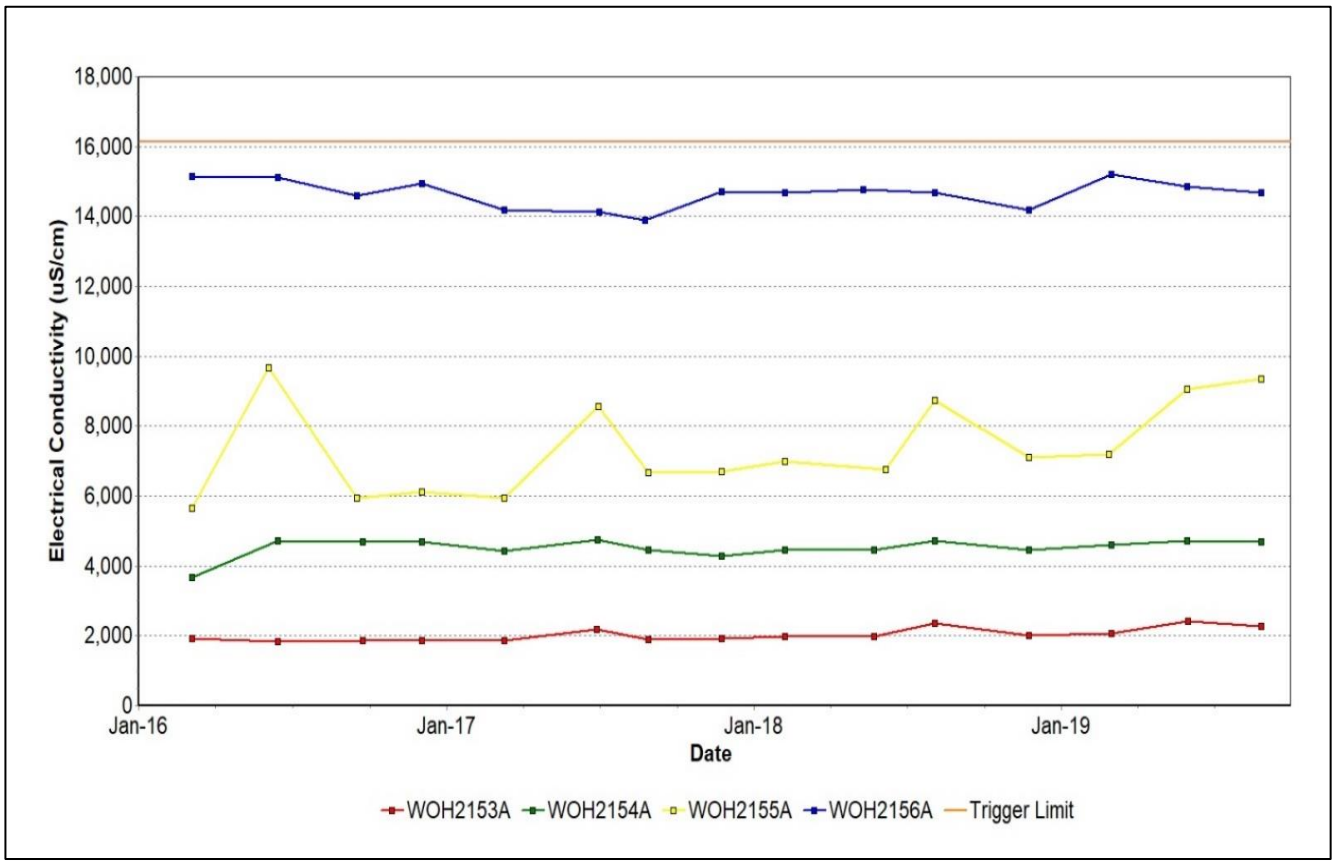


Figure 25: Redbank Seam Electrical Conductivity Trend – September 2019

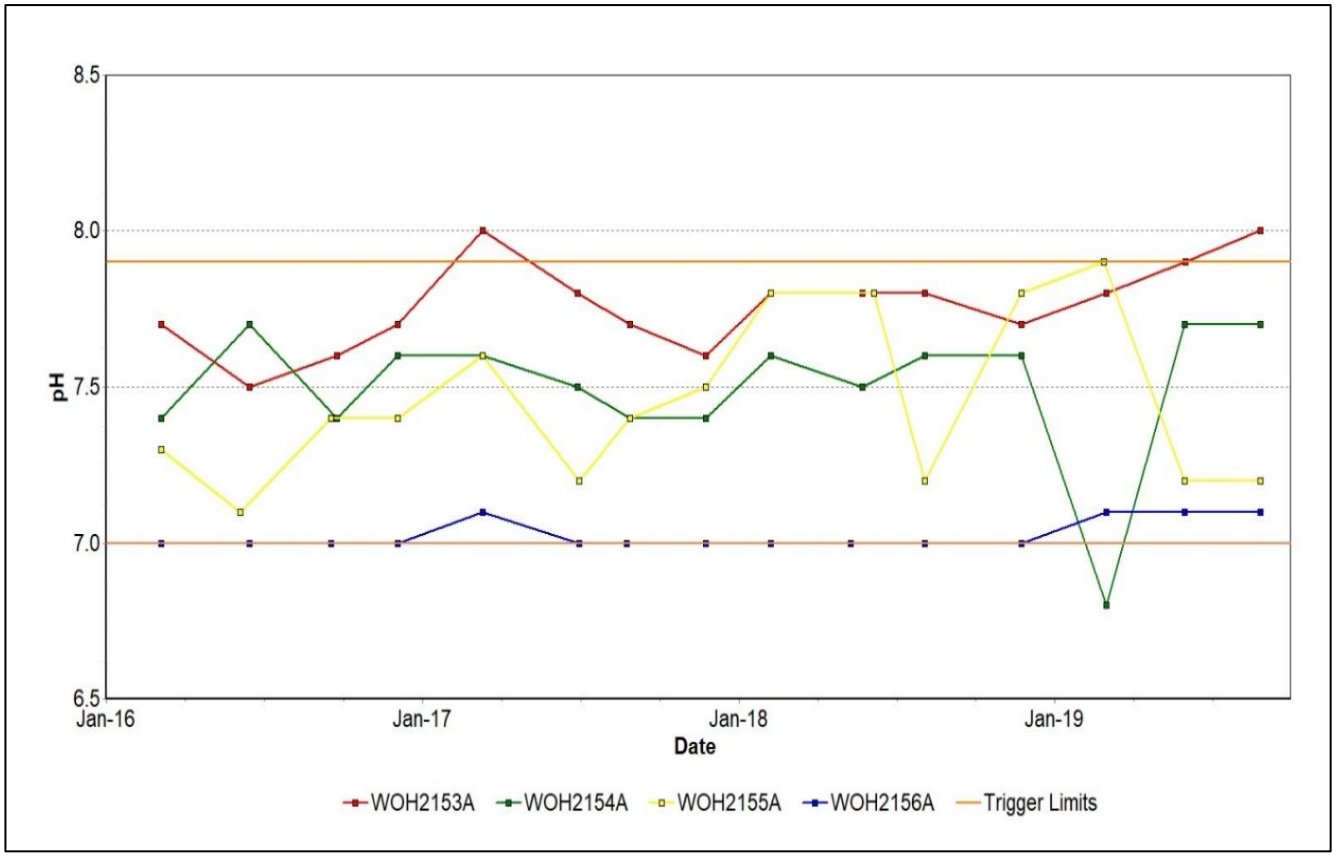


Figure 26: Redbank Seam pH Trend – September 2019

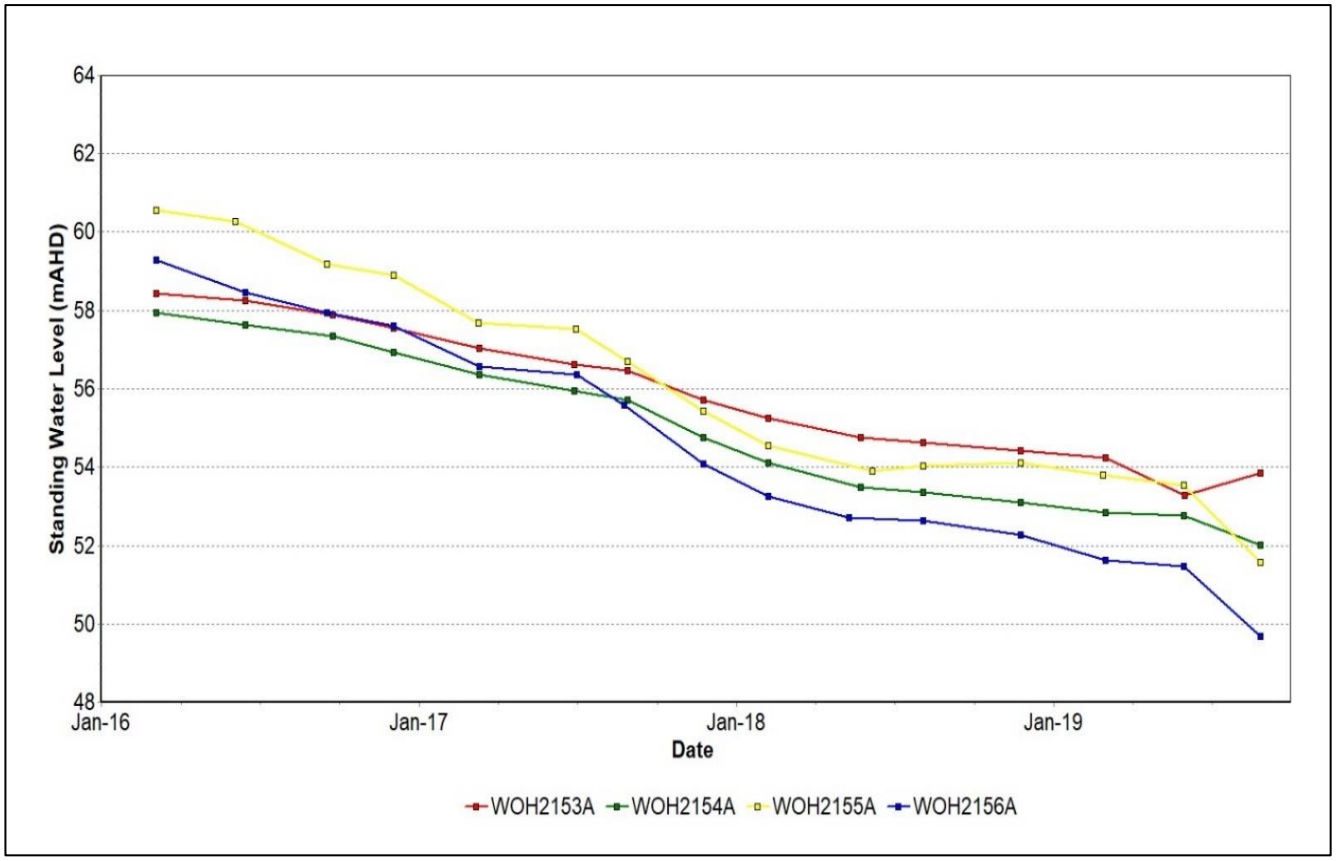


Figure 27: Redbank Seam Standing Water Level Trend – September 2019

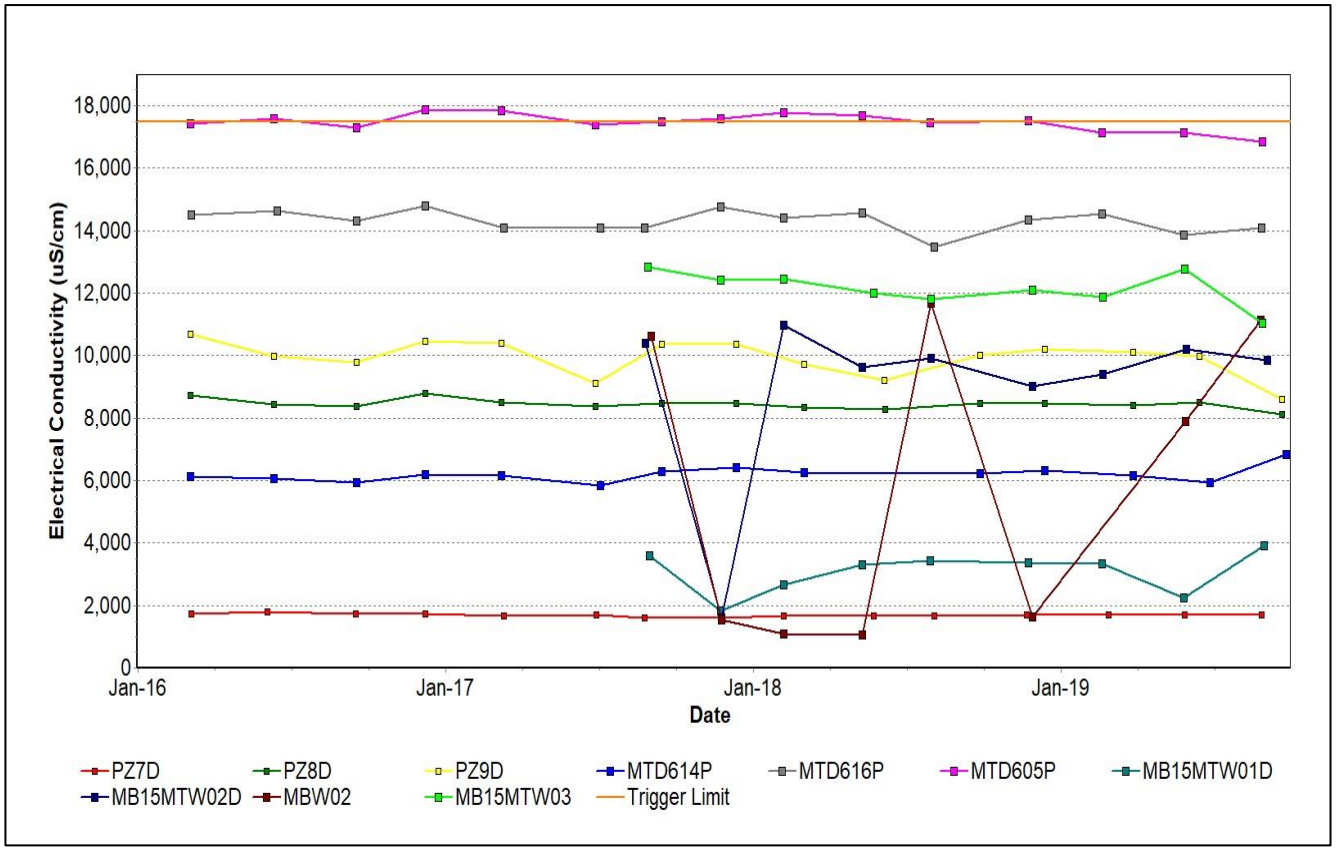


Figure 28: Shallow Overburden Electrical Conductivity Trend – September 2019

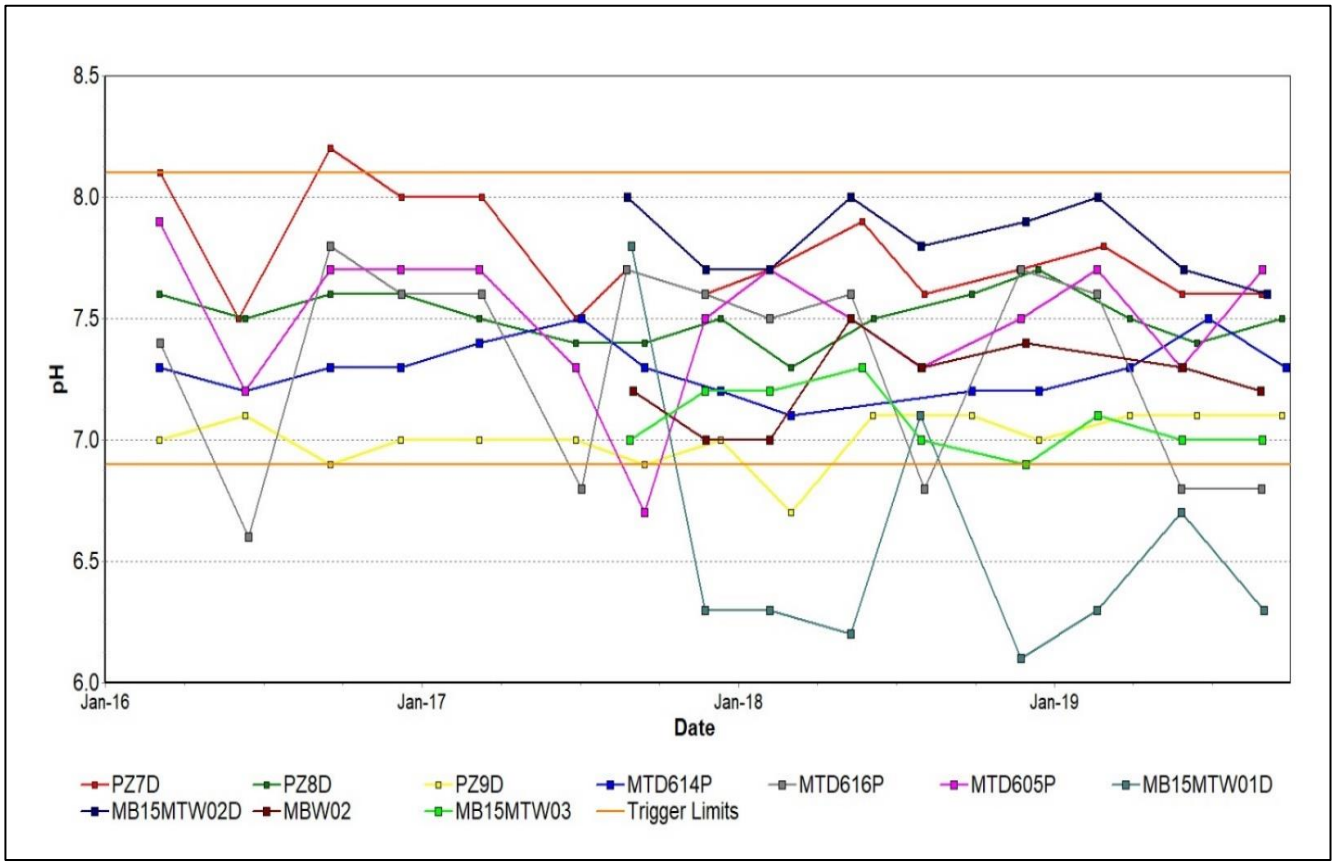


Figure 29: Shallow Overburden pH Trend – September 2019

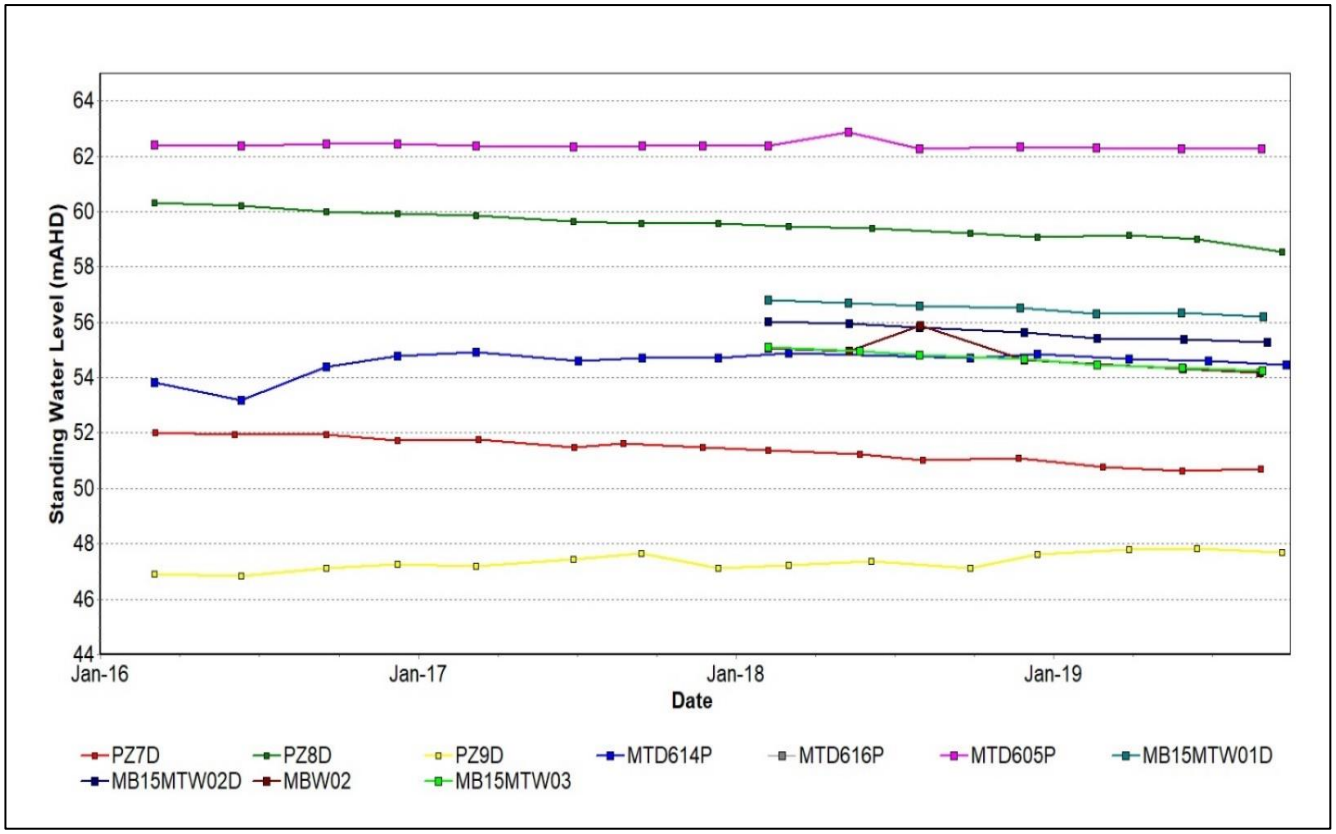
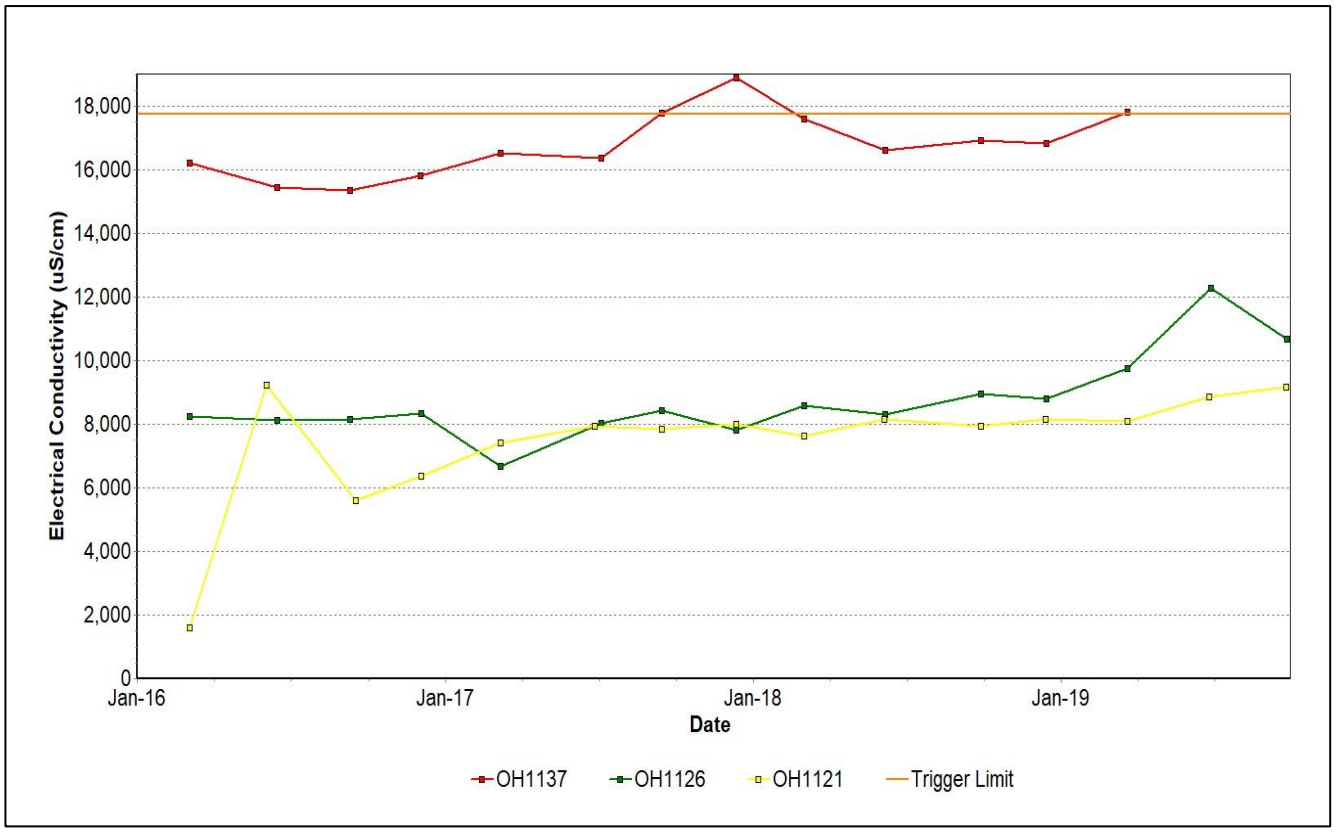
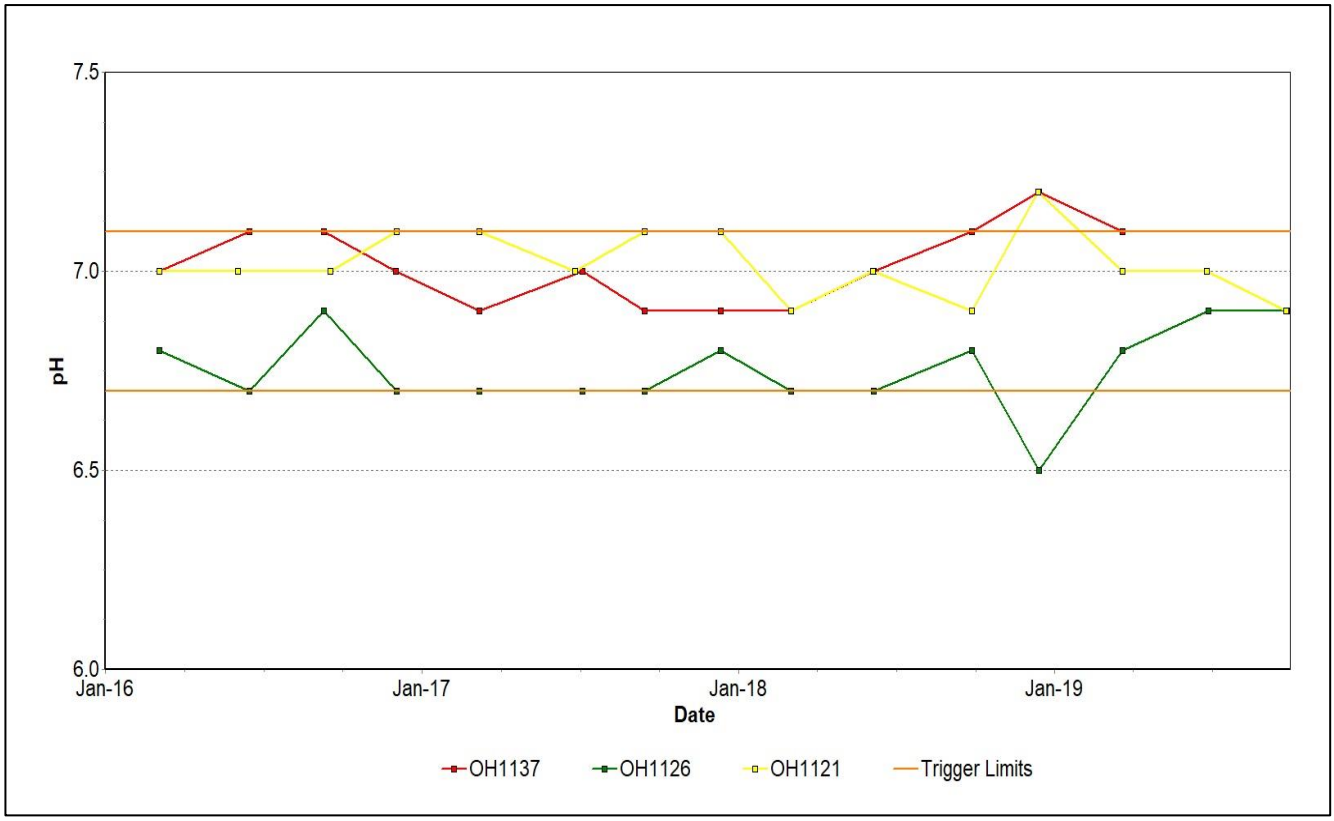


Figure 30: Shallow Overburden Standing Water Level Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 31: Vaux Seam Electrical Conductivity Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 32: Vaux Seam pH Trend – September 2019

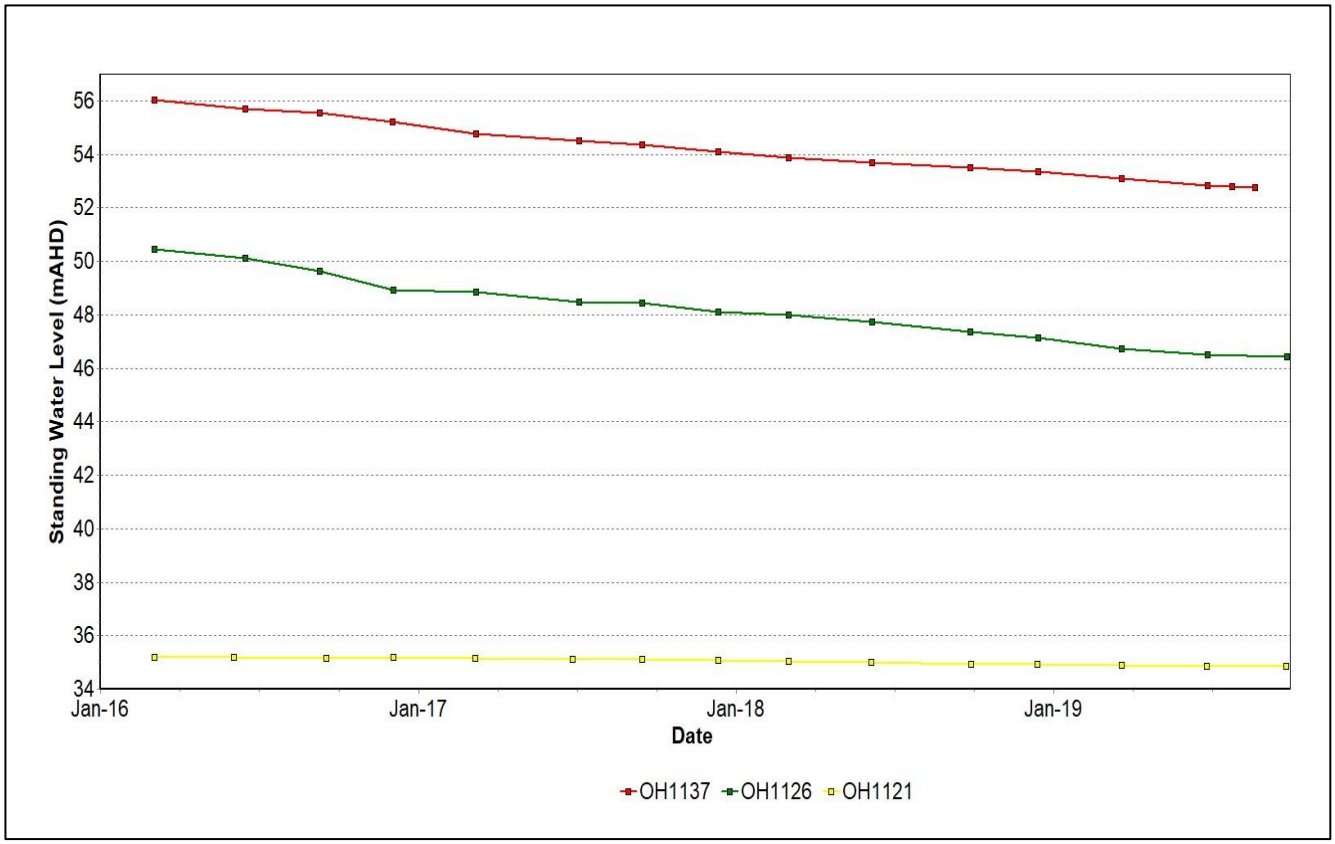
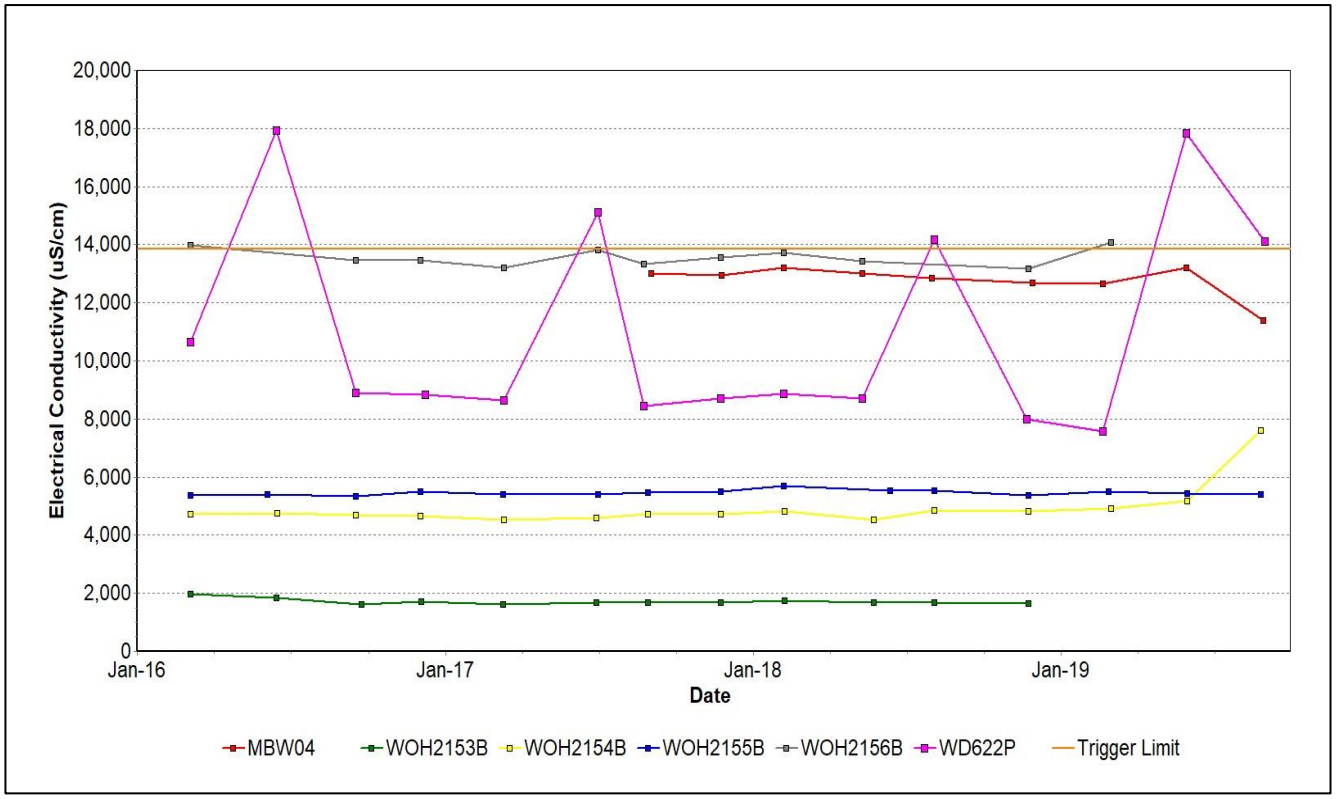
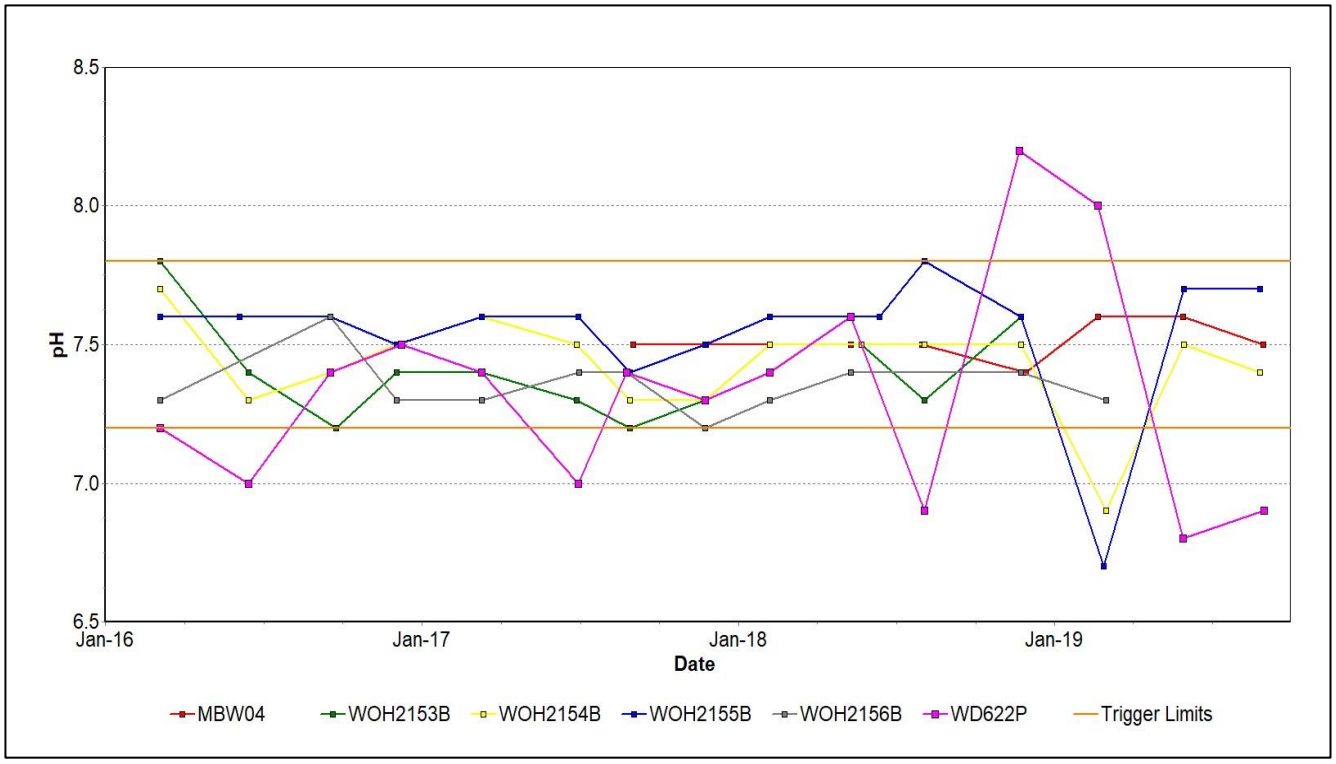


Figure 33: Vaux Seam Standing Water Level Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 34: Wambo Seam Electrical Conductivity Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 35: Wambo Seam pH Trend – September 2019

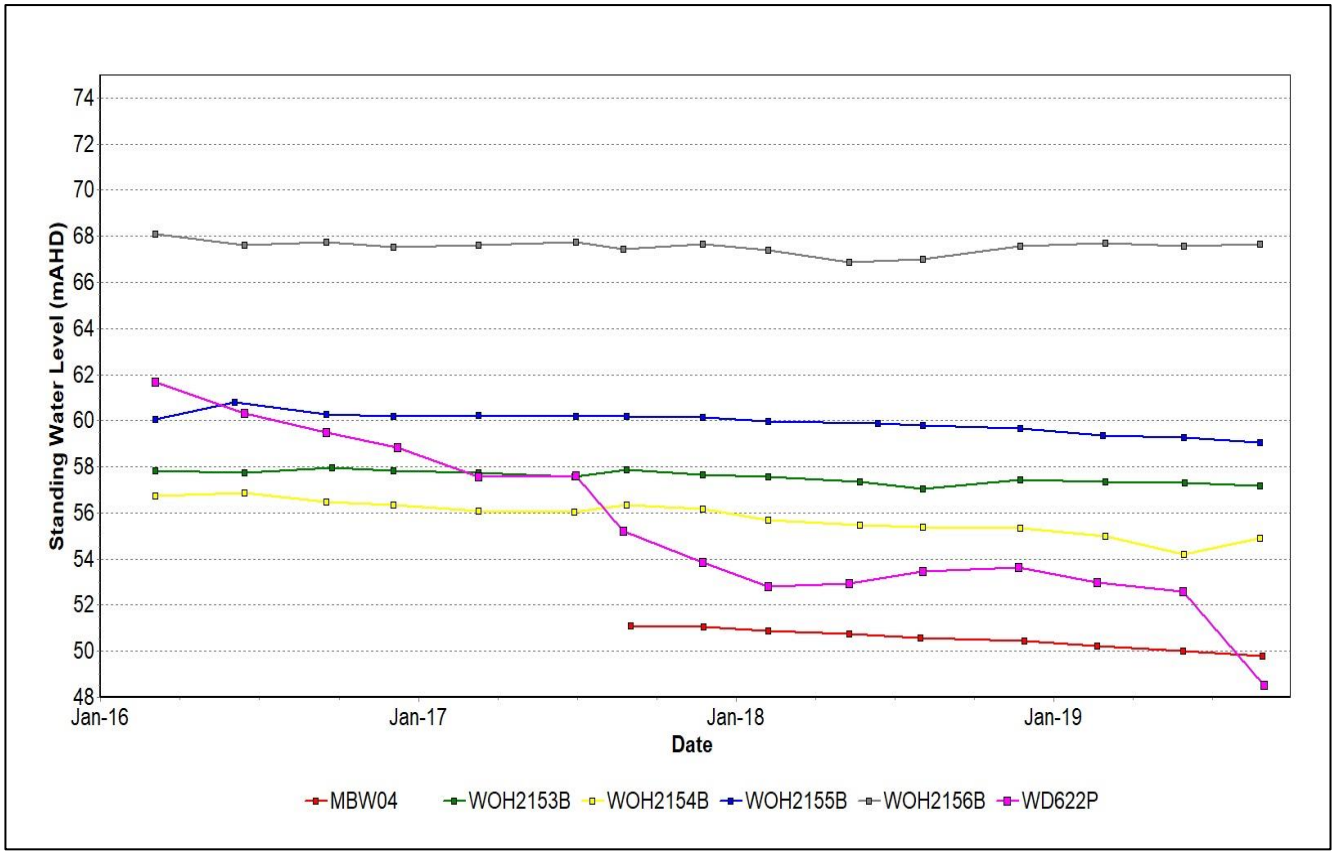


Figure 36: Wambo Seam Standing Water Level Trend – September 2019

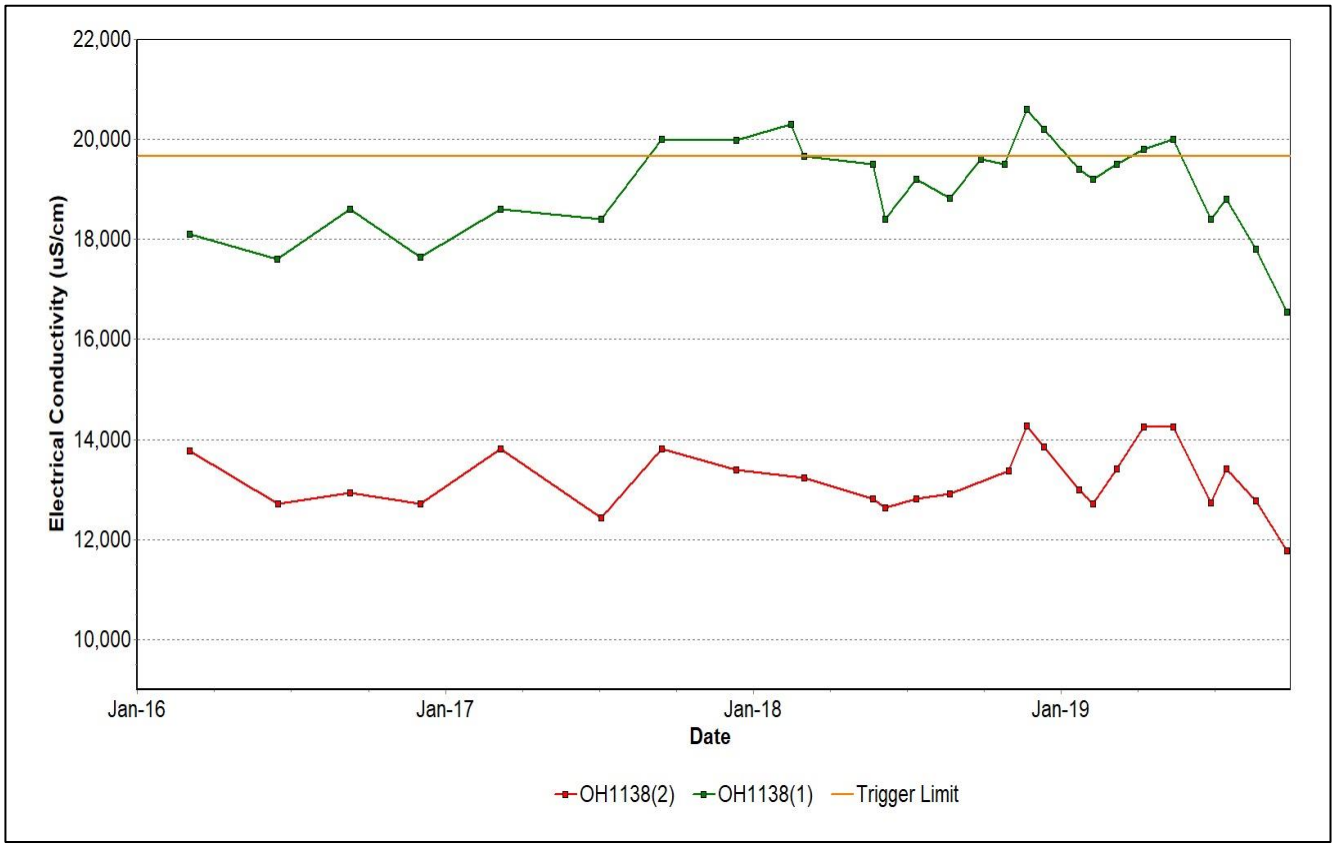


Figure 37: Warkworth Seam Electrical Conductivity Trend – September 2019

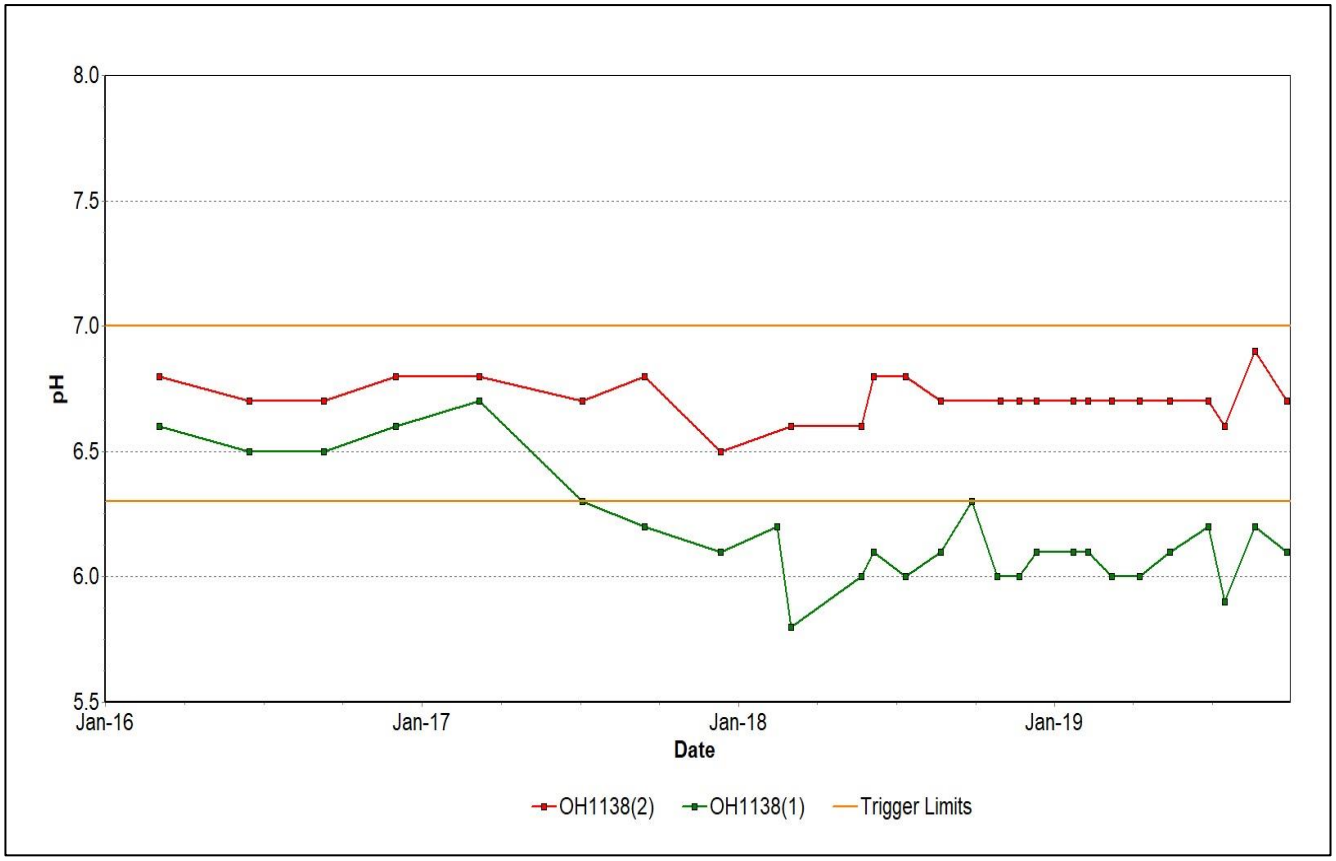


Figure 38: Warkworth Seam pH Trend – September 2019

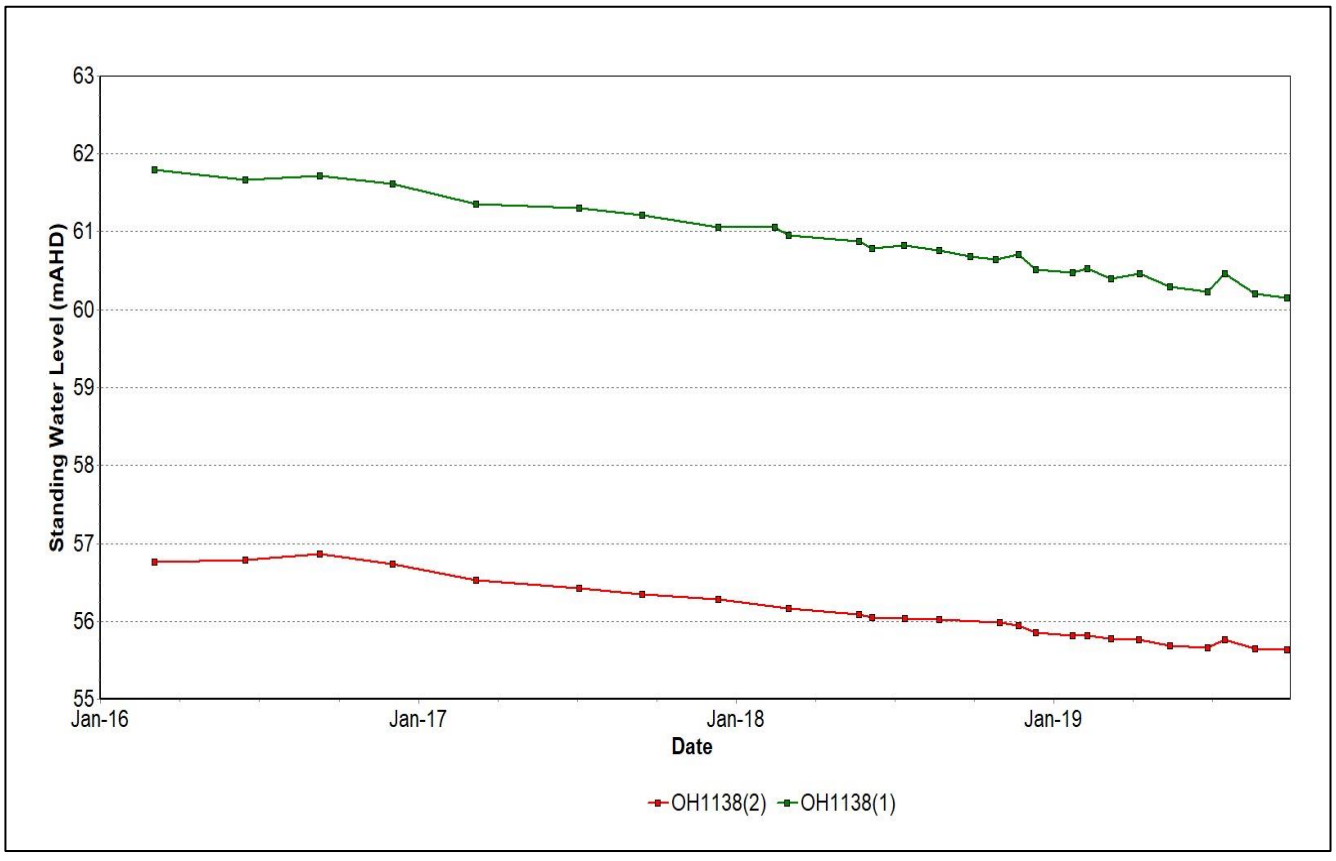


Figure 39: Warkworth Seam Standing Water Level Trend – September 2019

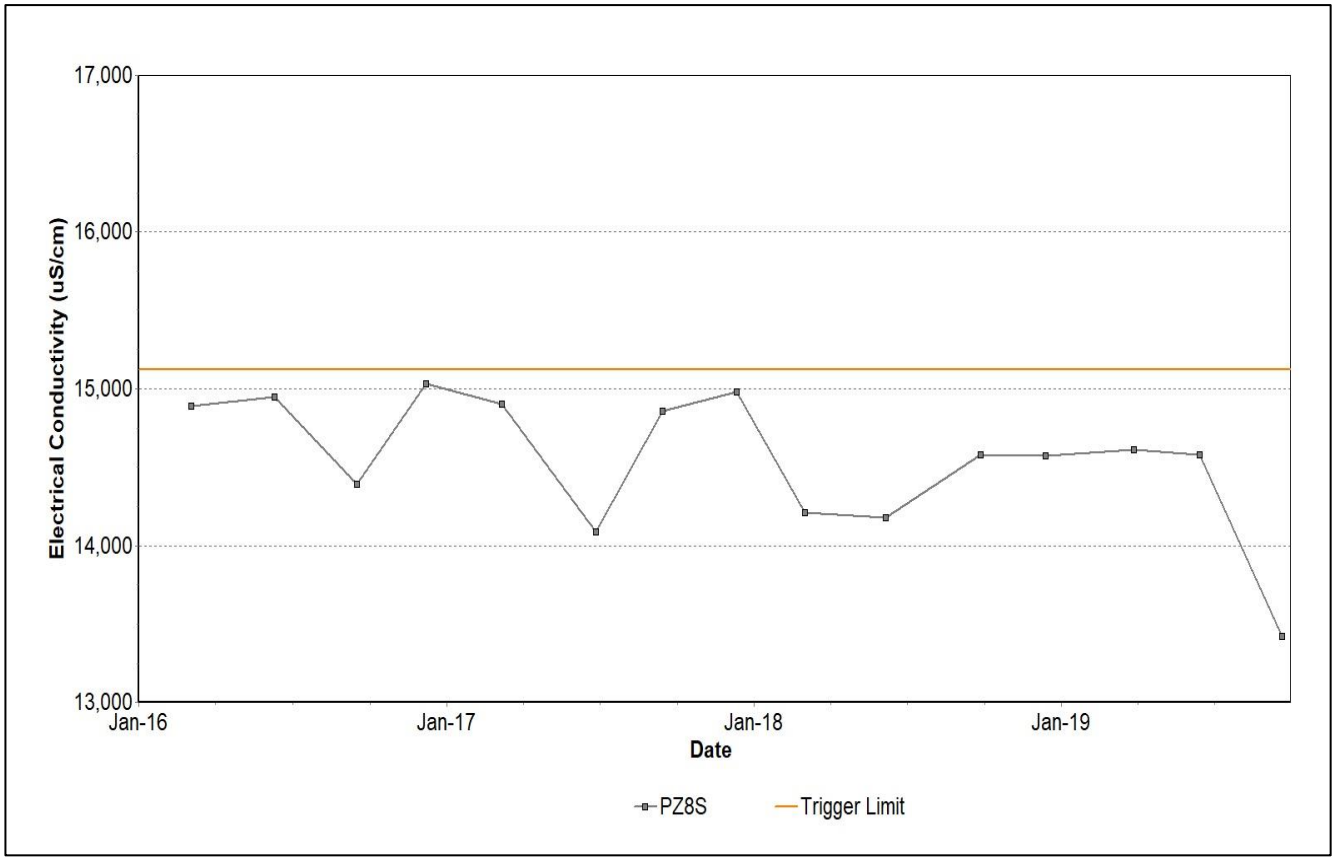


Figure 40: Wollombi Alluvium Electrical Conductivity Trend – September 2019

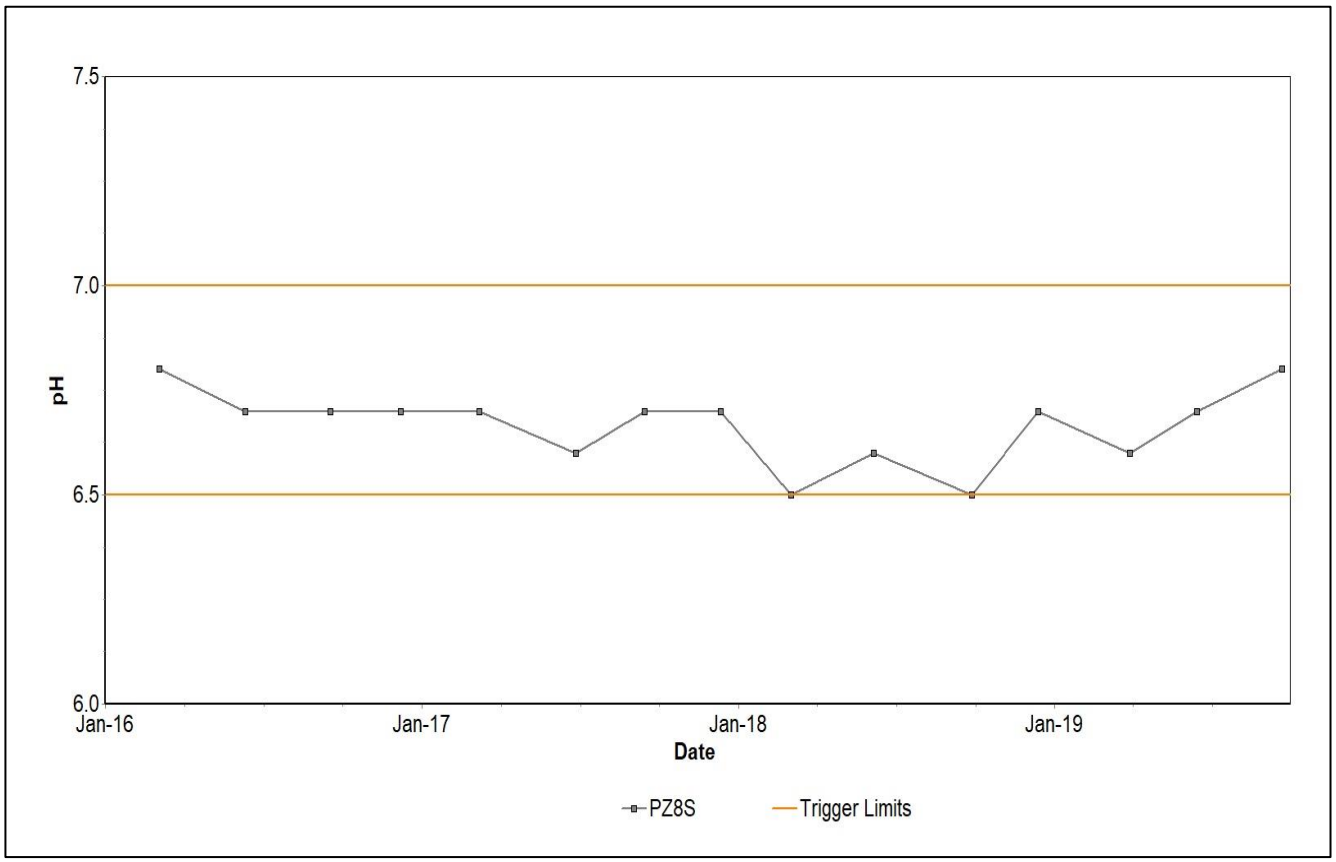
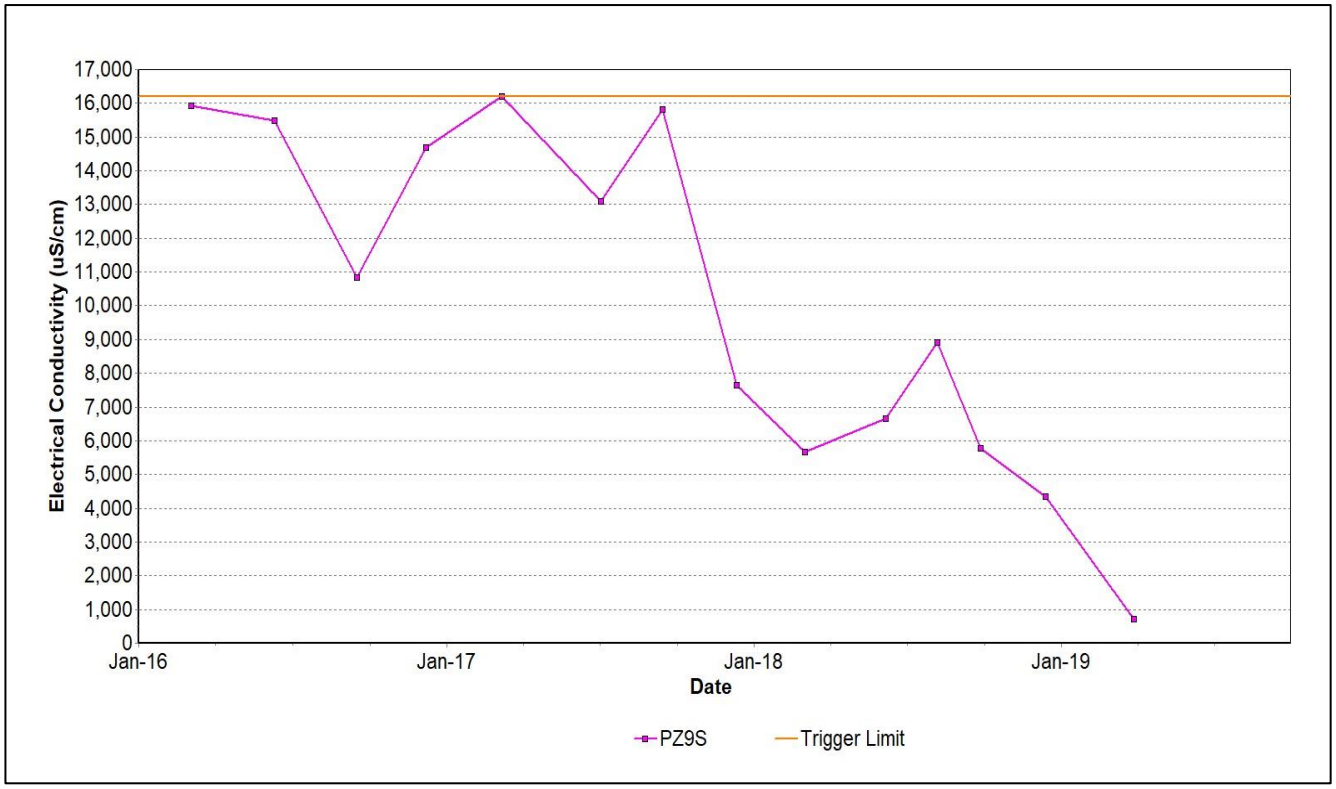
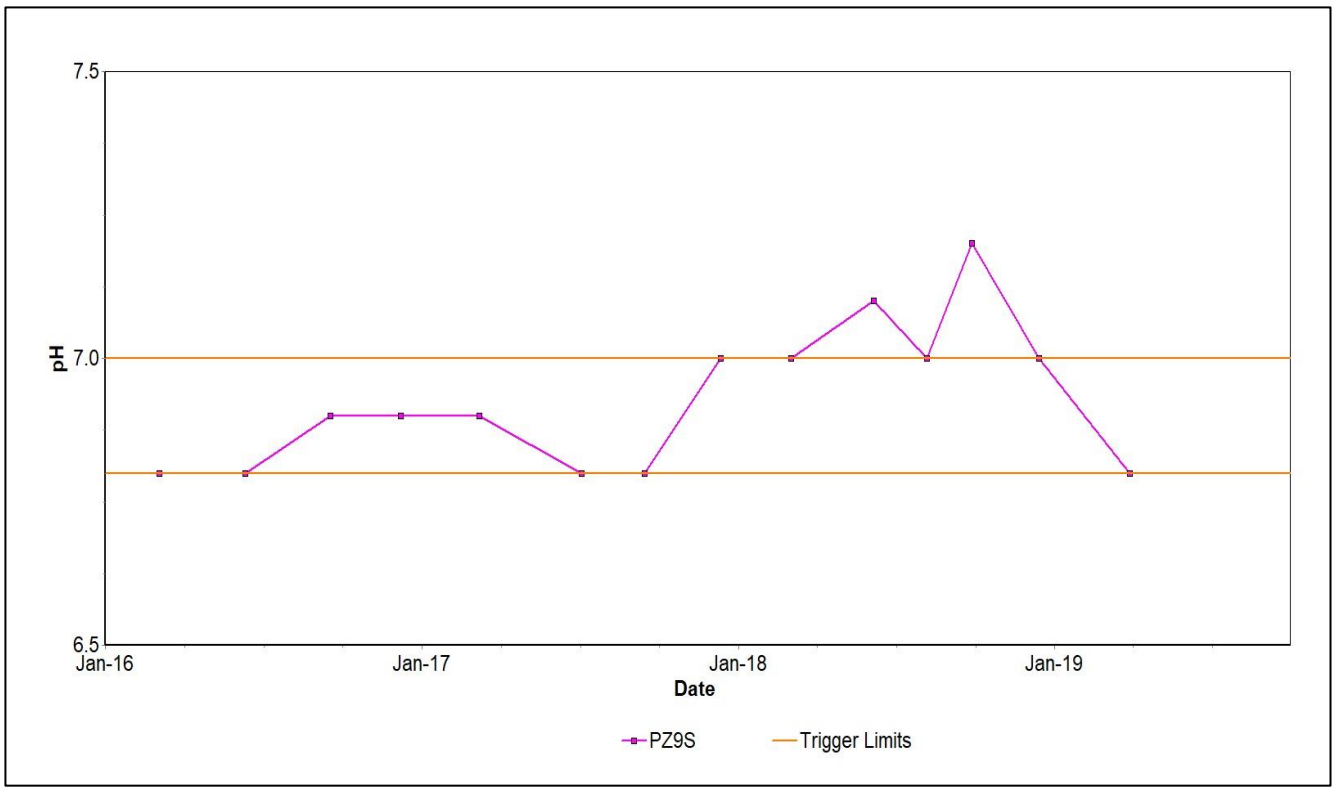


Figure 41: Wollombi Alluvium pH Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 42: Wollombi Alluvium Electrical Conductivity Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 43: Wollombi Alluvium pH Trend – September 2019

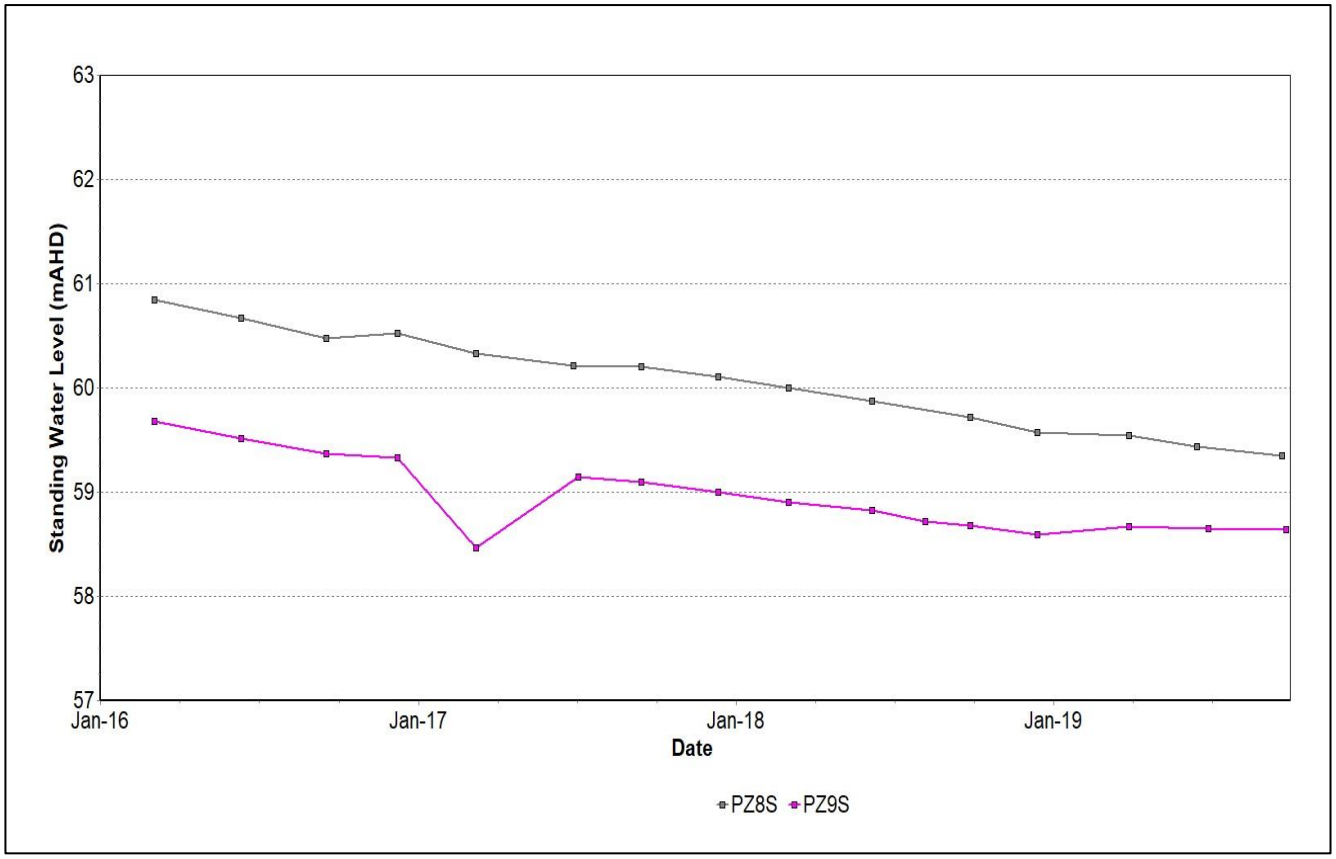


Figure 44: Wollombi Alluvium Standing Water Level Trend – September 2019

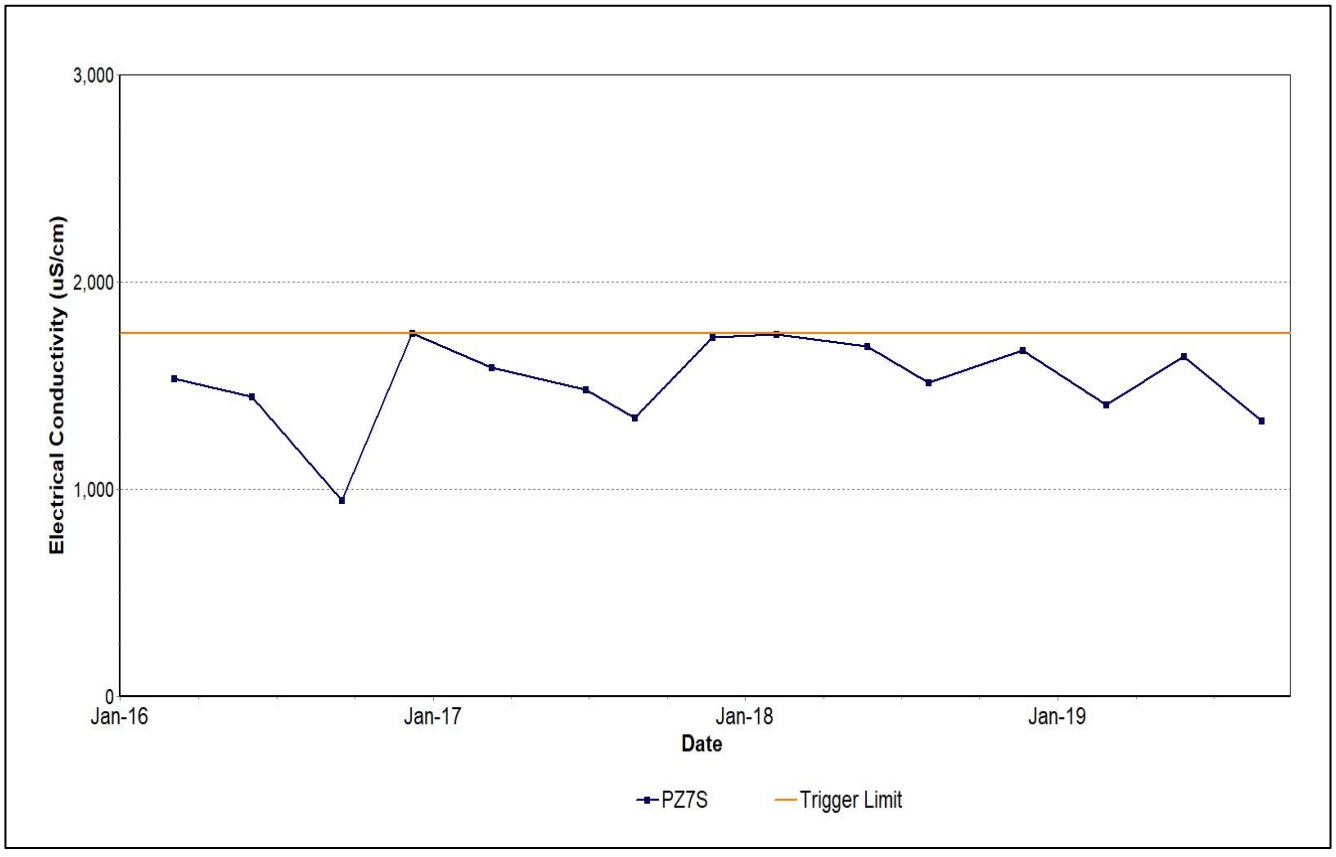


Figure 45: Aeolian Warkworth Sands Electrical Conductivity Trend – September 2019

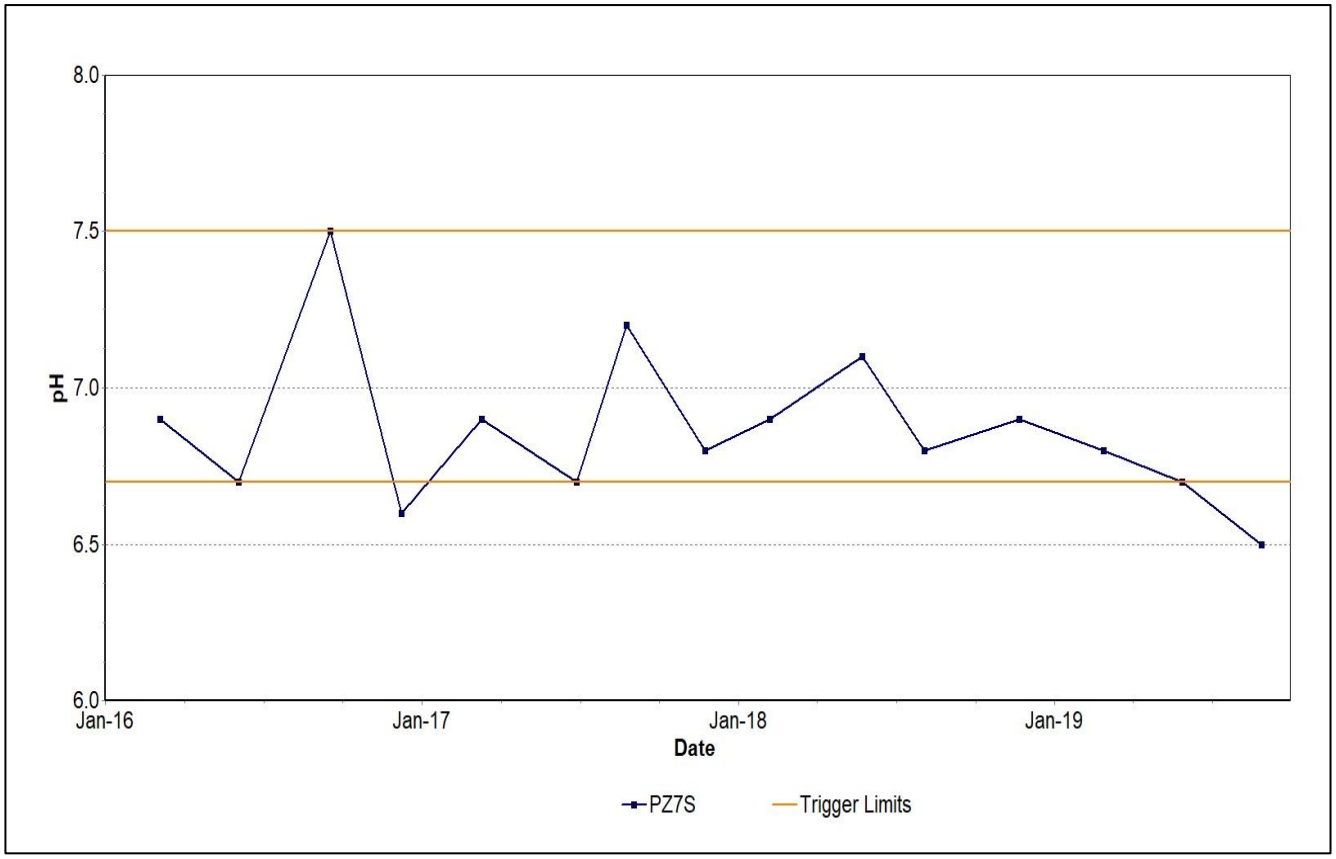


Figure 46: Aeolian Warkworth Sands pH Trend – September 2019

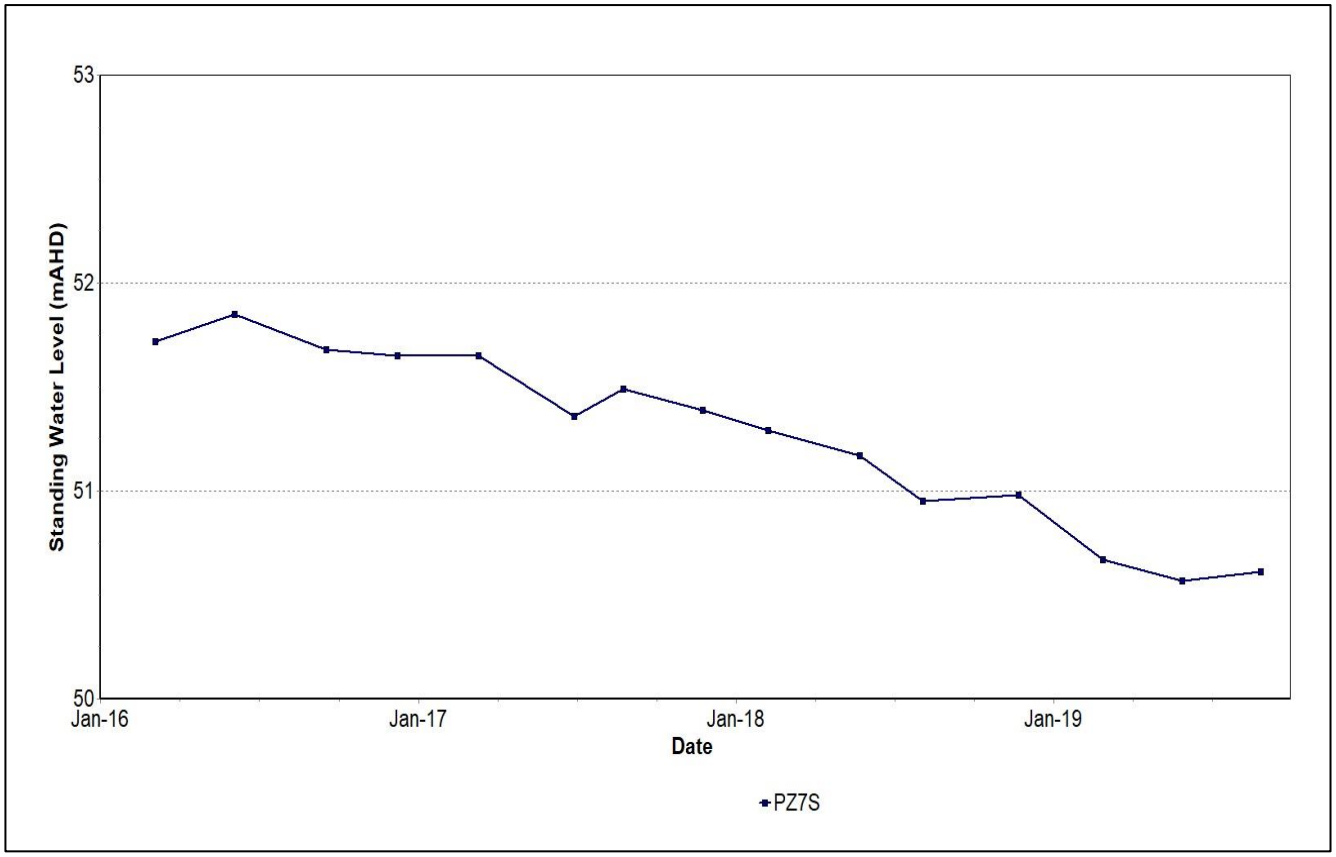


Figure 47: Aeolian Warkworth Sands Standing Water Level Trend – September 2019

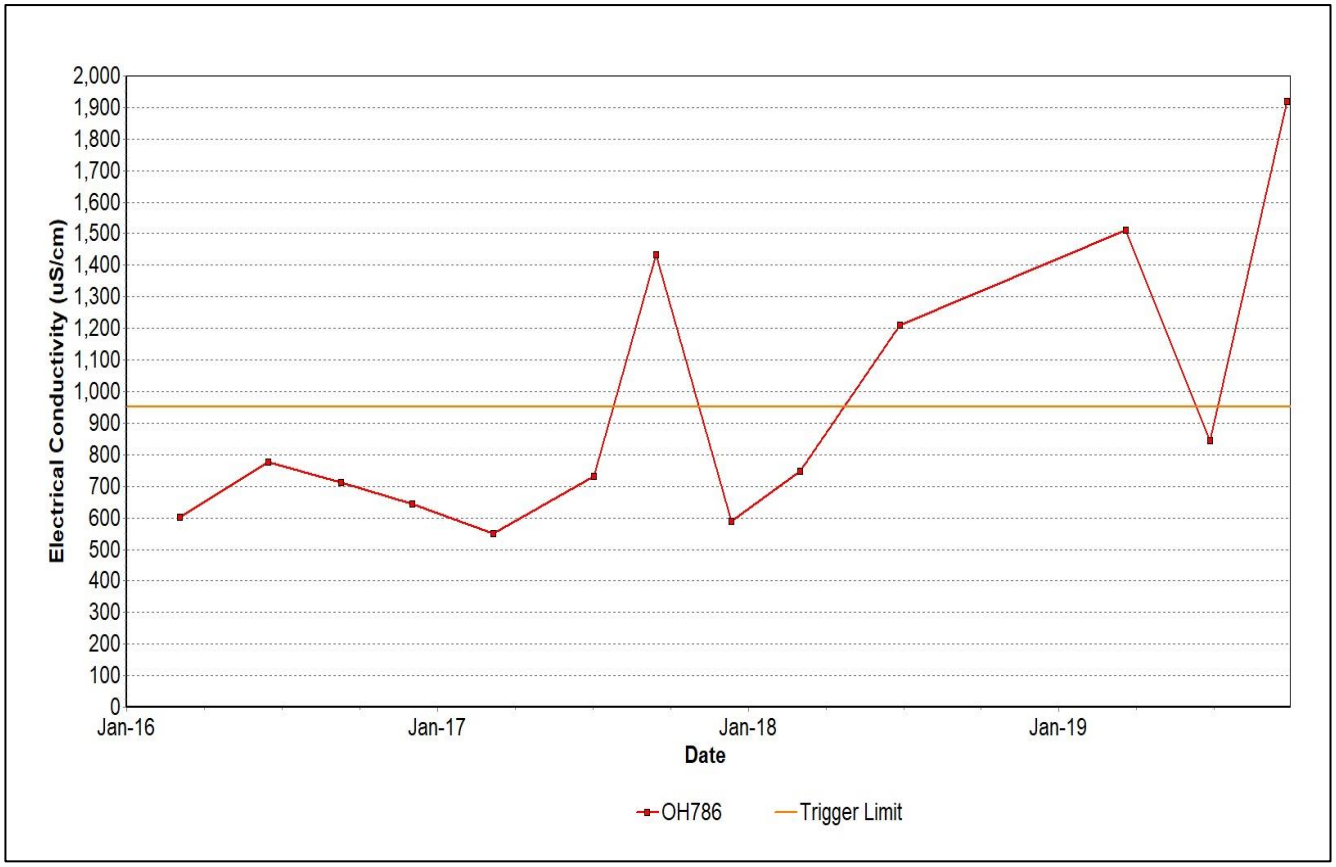


Figure 48: Hunter River Alluvium 1 Electrical Conductivity Trend – September 2019

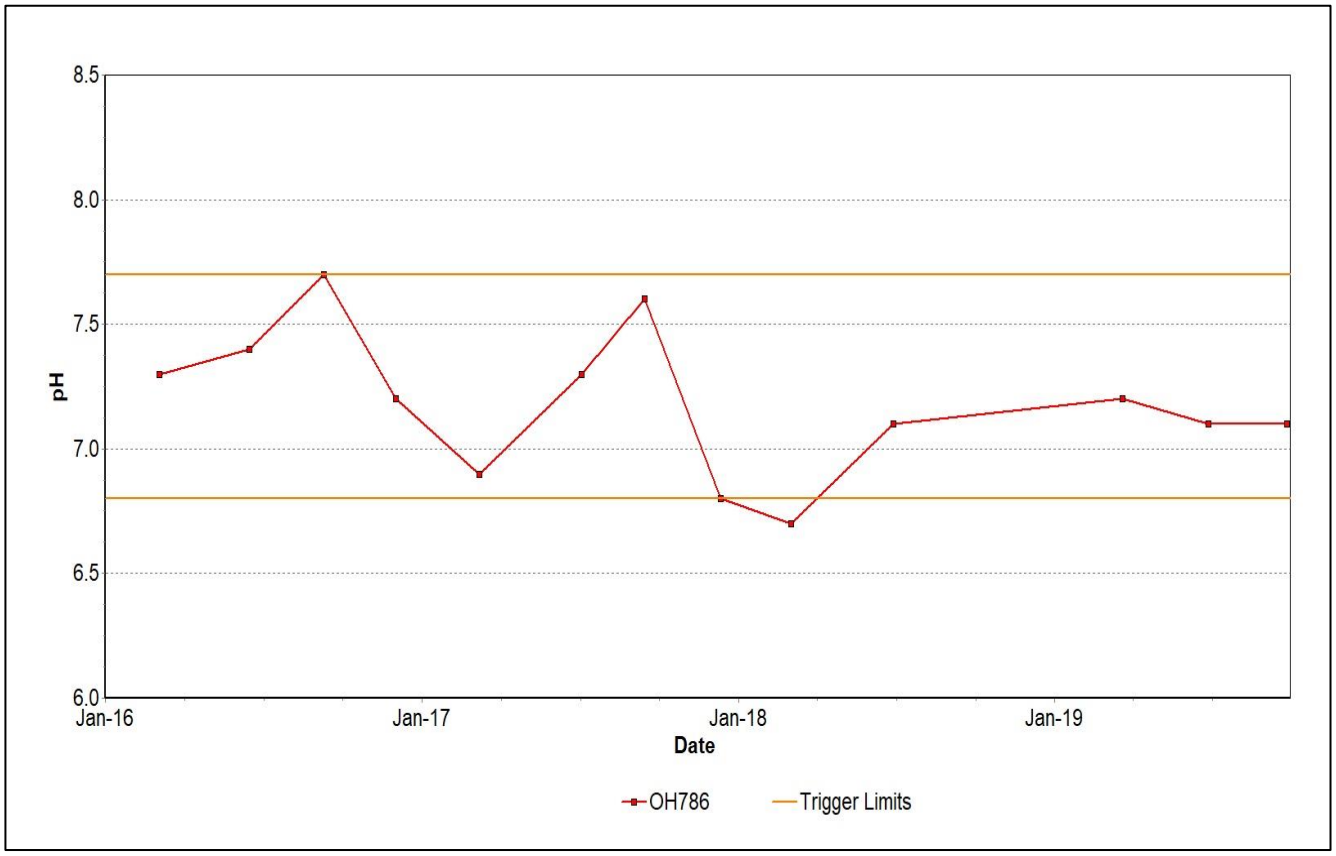


Figure 49: Hunter River Alluvium 1 pH Trend – September 2019

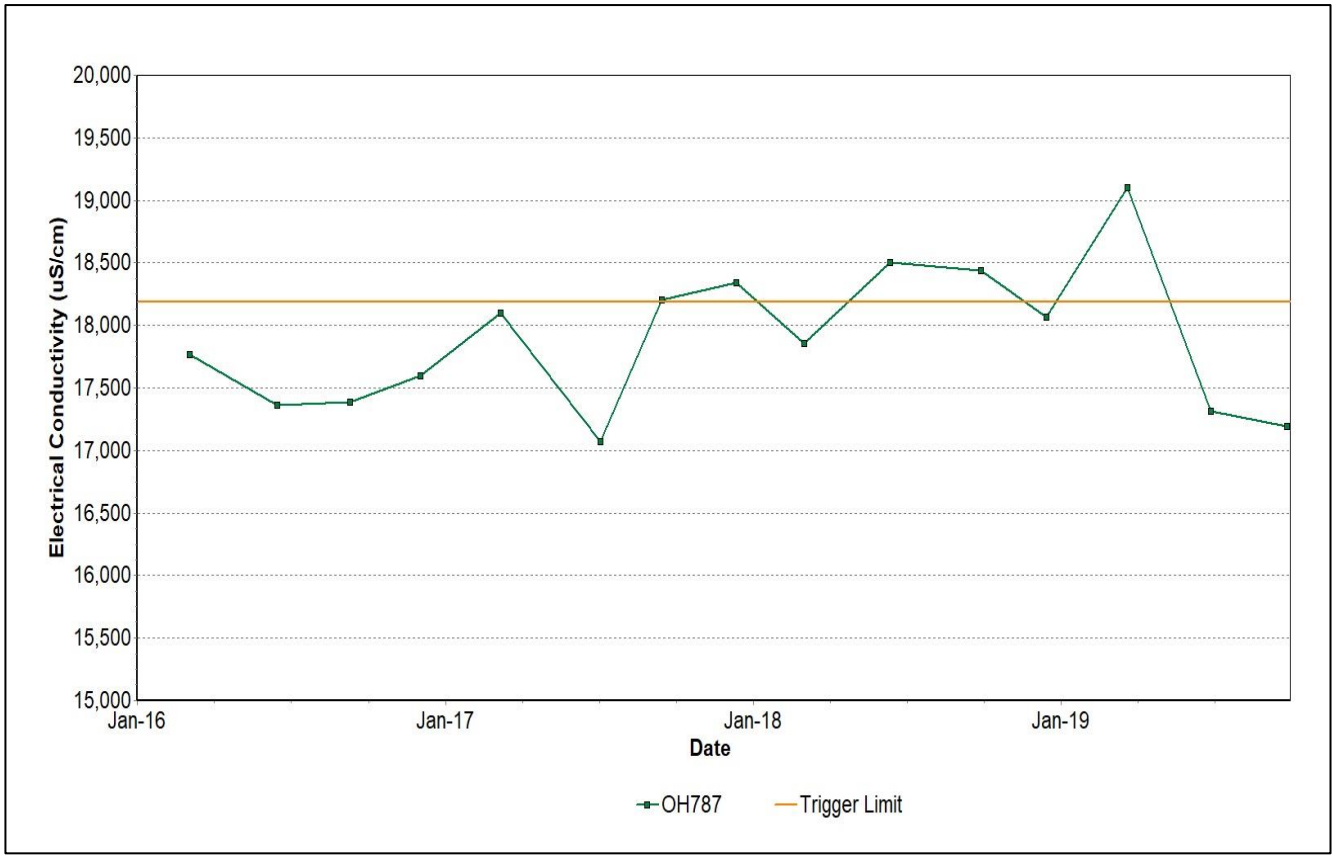


Figure 50: Hunter River Alluvium 2 Electrical Conductivity Trend – September 2019

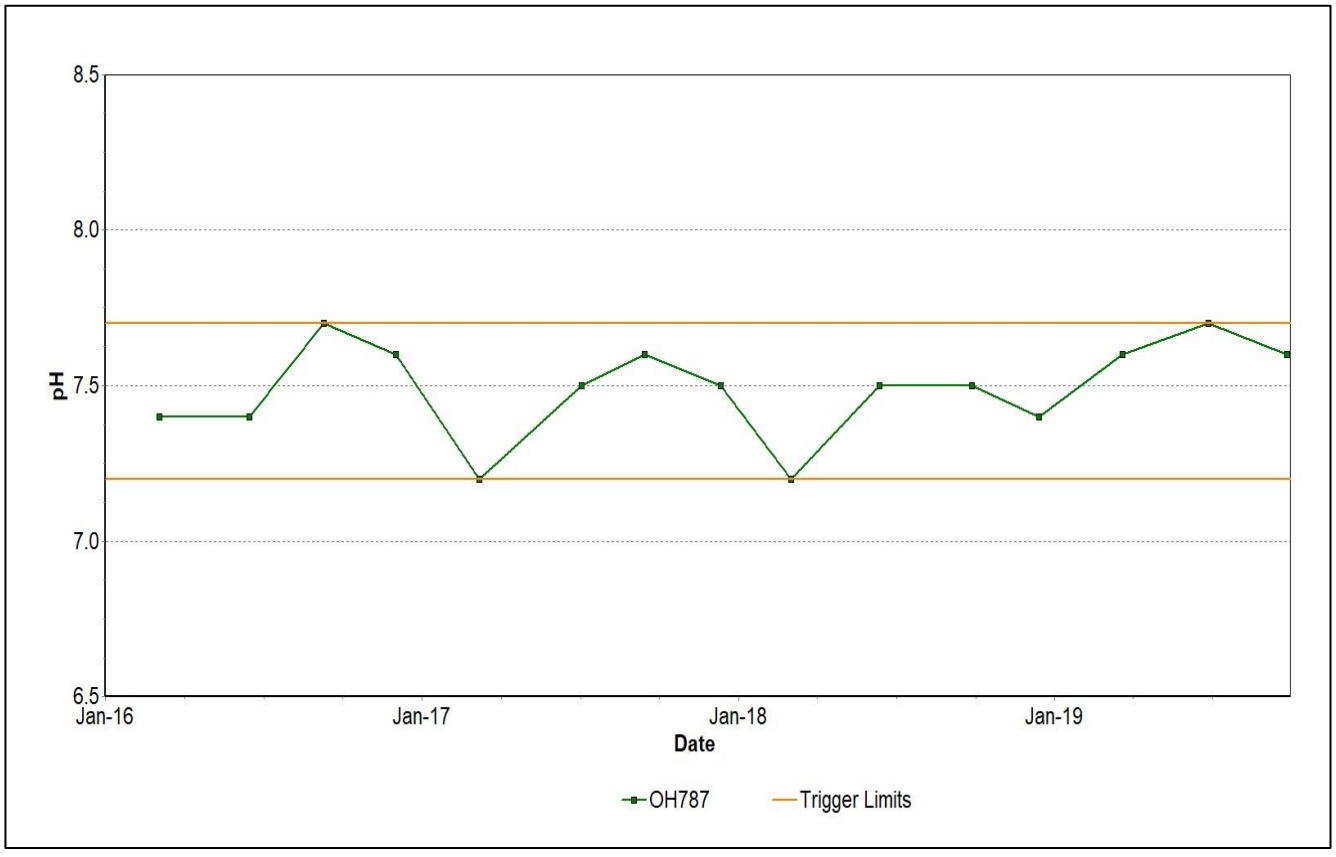


Figure 51: Hunter River Alluvium 2 pH Trend – September 2019

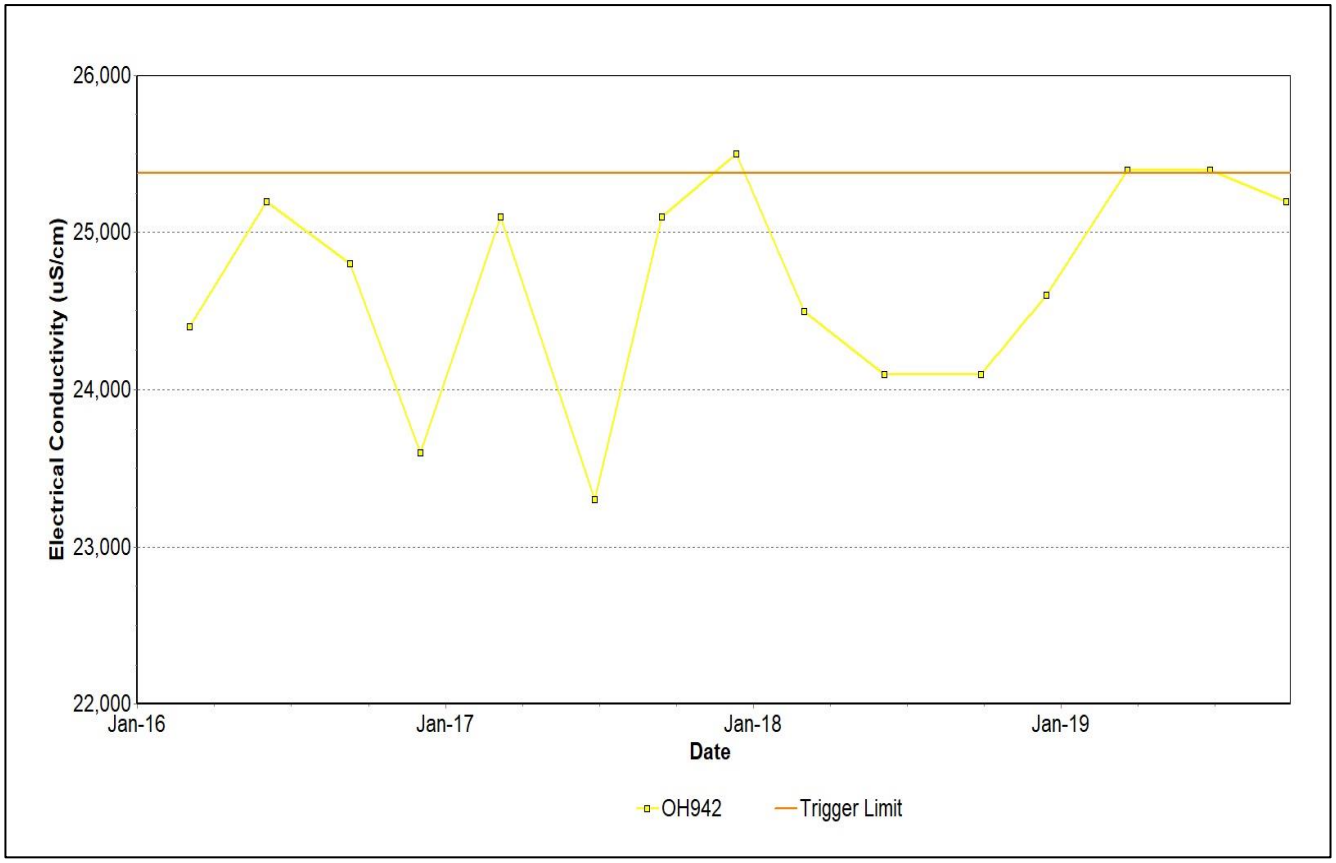


Figure 52: Hunter River Alluvium 3 Electrical Conductivity Trend – September 2019

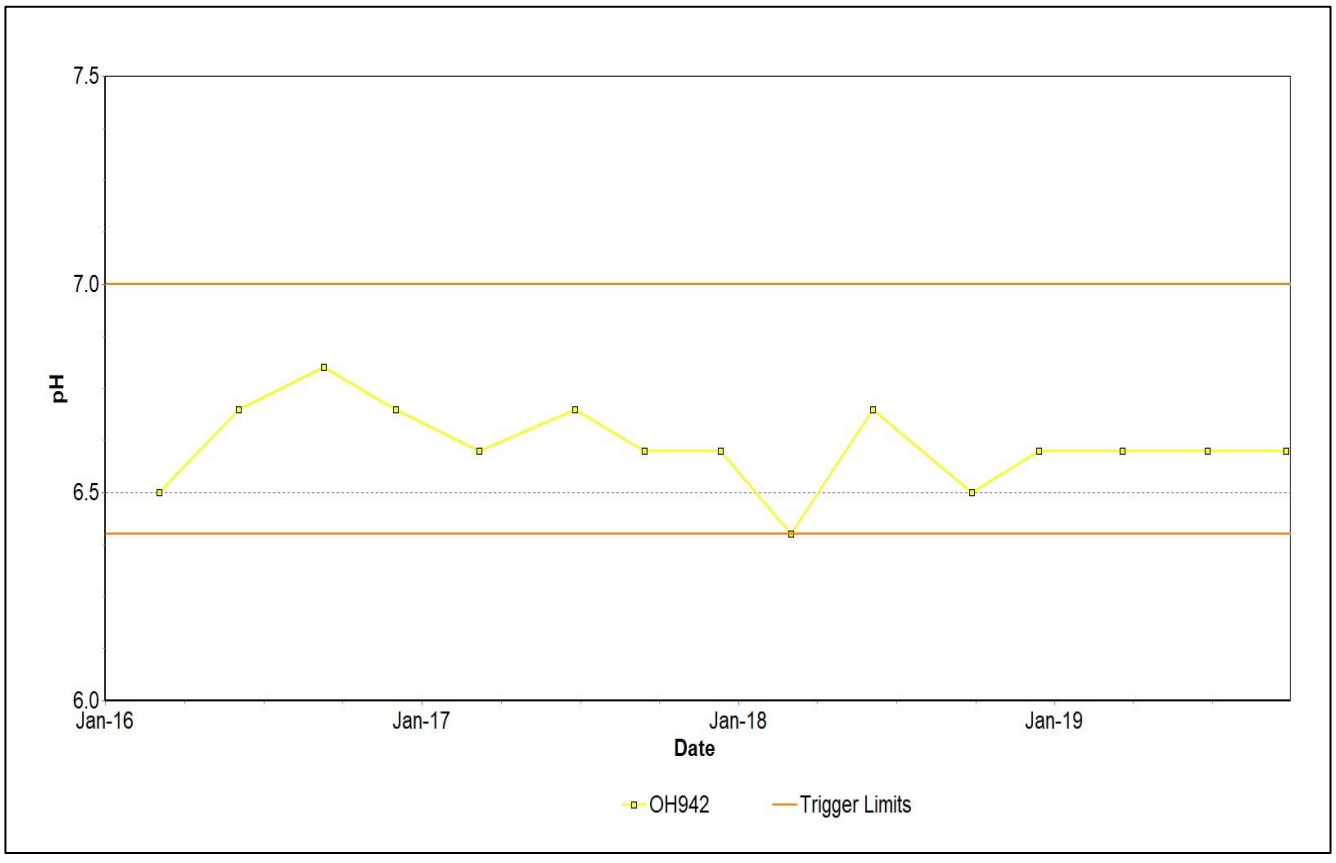
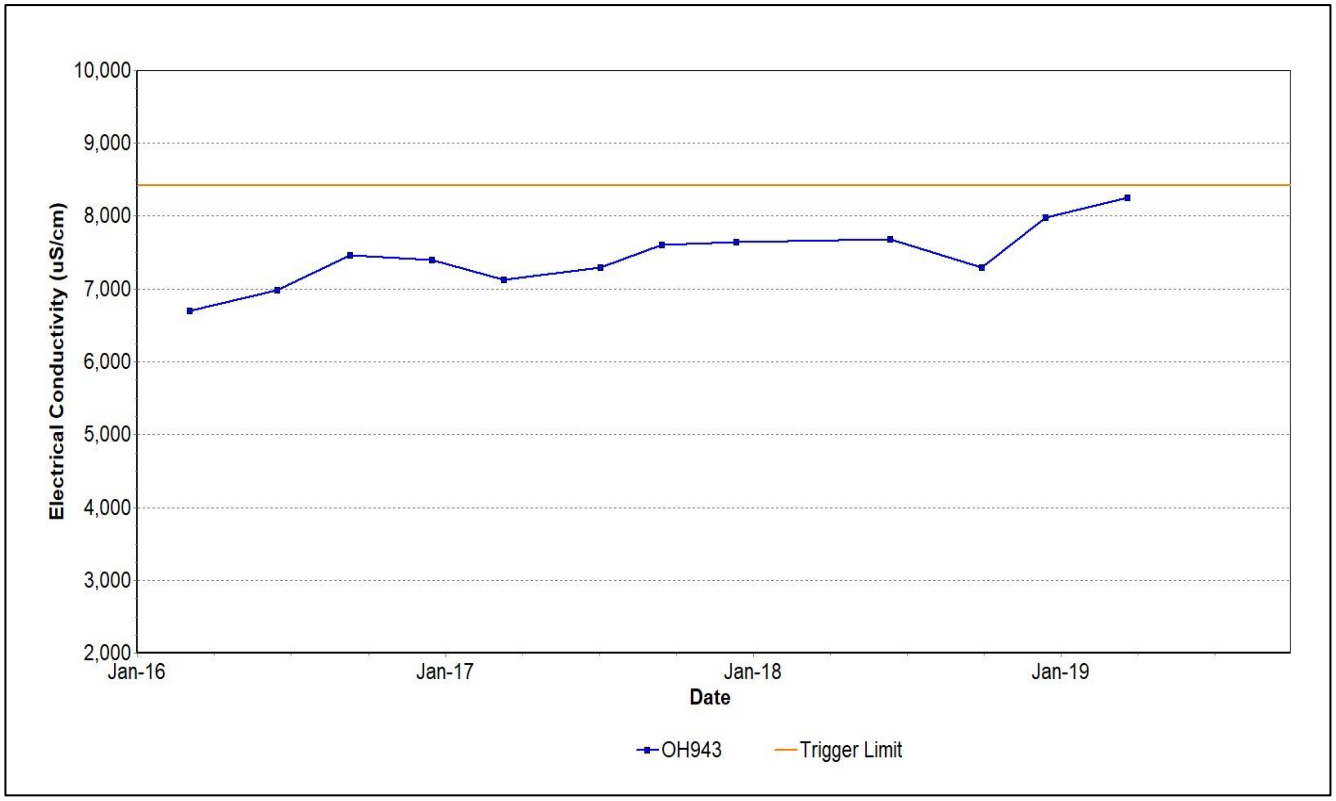
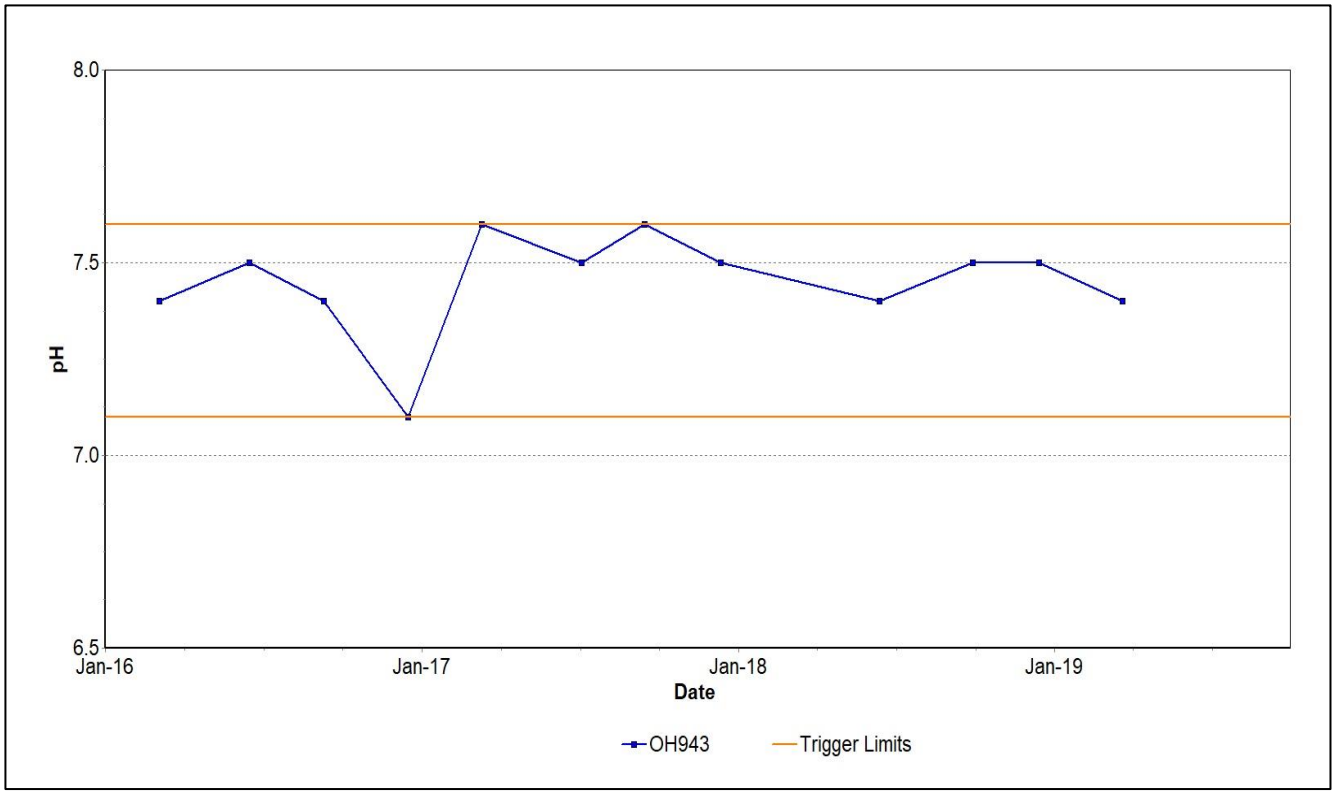


Figure 53: Hunter River Alluvium 3 pH Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 54: Hunter River Alluvium 4 Electrical Conductivity Trend – September 2019



Note: Missing data indicates that there was insufficient water to take a sample.

Figure 55: Hunter River Alluvium 4 pH Trend – September 2019

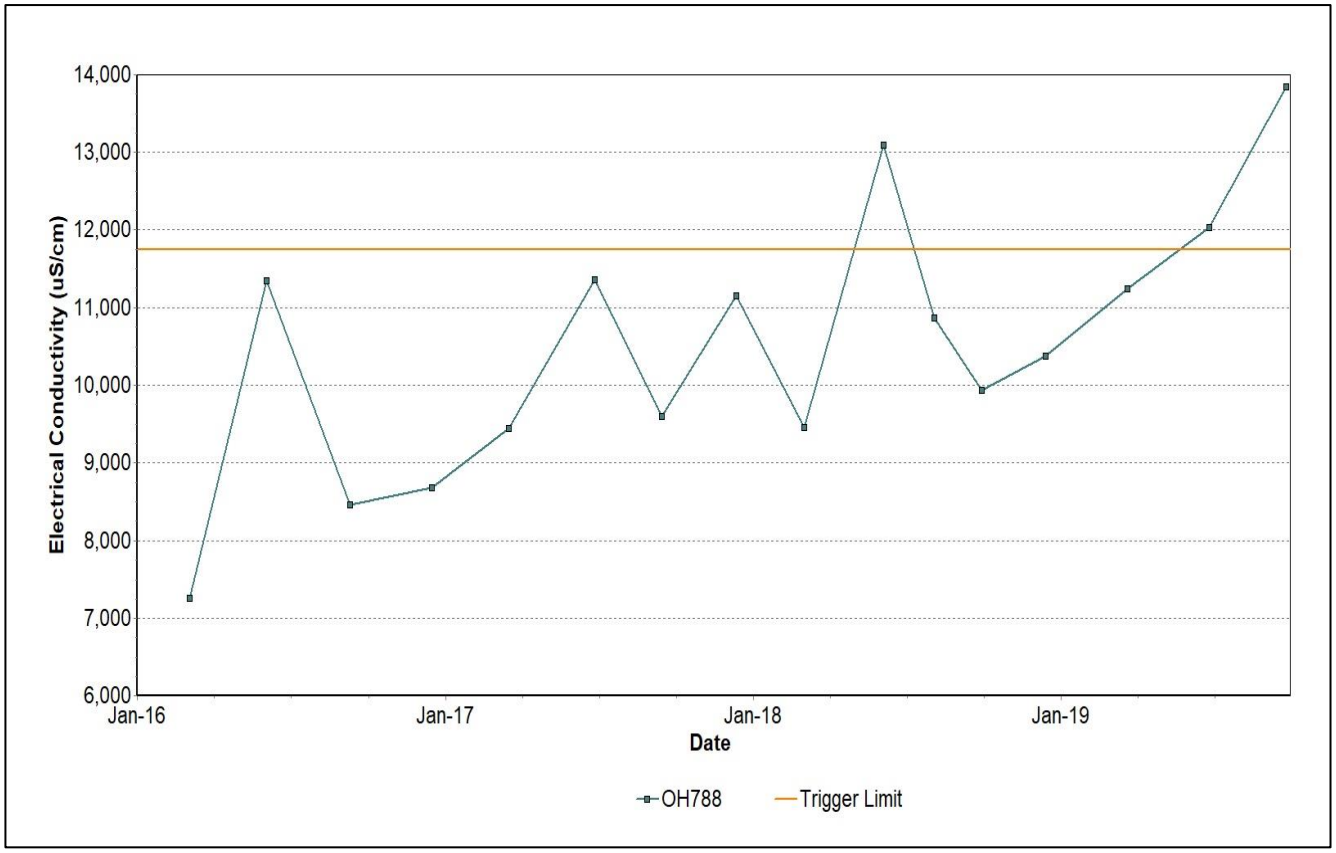


Figure 56: Hunter River Alluvium 5 Electrical Conductivity – September 2019

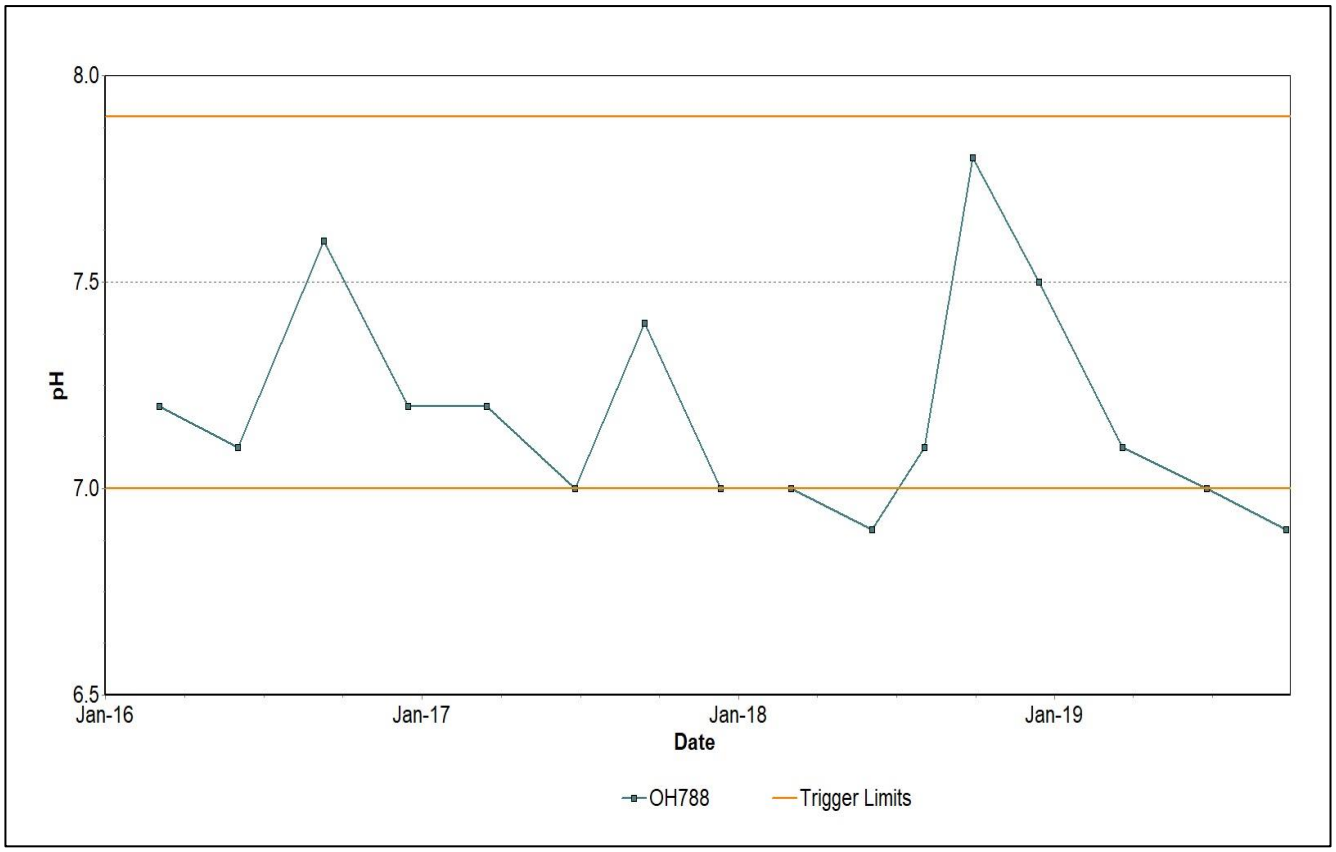


Figure 57: Hunter River Alluvium 5 pH Trend – September 2019

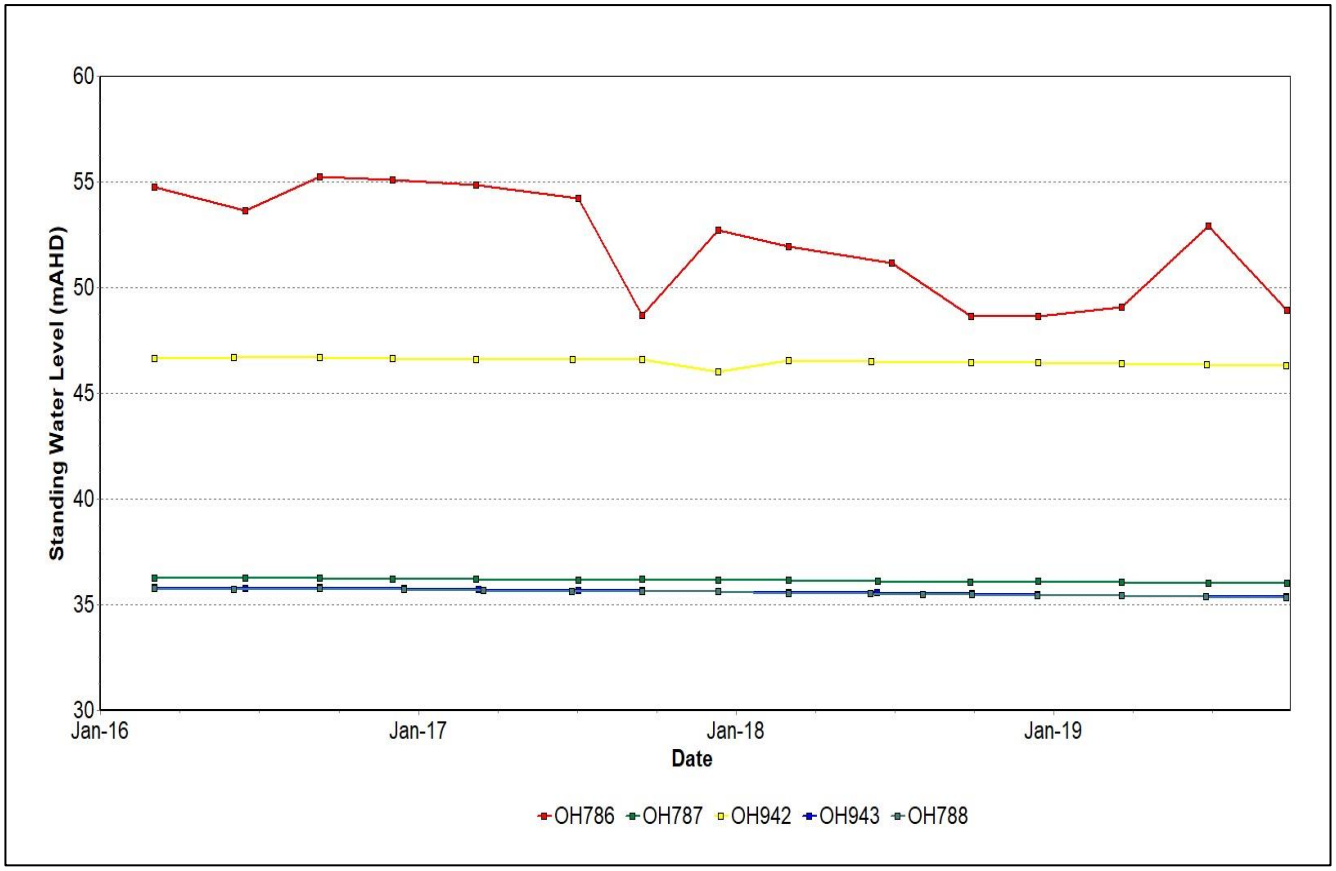


Figure 58: Hunter River Alluvium Standing Water Level Trend – September 2019

3.2.1 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 **Figure 61**.

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

Table 3: Groundwater Triggers – 2019

Site	Date	Trigger Limit Breached	Action Taken in Response
WOH2156B	01/03/2019	EC – 95th Percentile	Watching Brief* Note: Insufficient water volume recorded during sampling rounds in June and September 19
WD625P	01/03/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in May 19 shows values back within trigger limits.
WD625P	30/08/2019	EC – 95th Percentile	Watching Brief*
OH 786	20/03/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in June 19 was within trigger limits
OH 786	26/09/2019	EC – 95th Percentile	Watching Brief* Note: Elevated EC levels likely to be attributed to prolonged dry climatic conditions. Continue to monitor.
OH 787	20/03/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in June 19 and September shows values back within trigger limits.
OH942	20/03/2019	EC – 95th Percentile	Watching Brief*
OH942	26/06/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in September 19 was within trigger limits. No further action required.
OH788	25/06/2019	EC – 95th Percentile	Watching Brief* Note: Elevated EC levels likely to be attributed to prolonged dry climatic conditions. Continue to monitor.
OH788	25/09/2019	EC – 95th Percentile	Watching Brief* Note: Elevated EC levels likely to be attributed to prolonged dry climatic conditions. Continue to monitor.
GW9709	21/03/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in June 19 shows values back within trigger limits.
GW9709	27/09/2019	EC – 95th Percentile	Watching Brief* Note: Elevated EC levels likely to be attributed to prolonged dry climatic conditions. Continue to monitor.

Site	Date	Trigger Limit Breached	Action Taken in Response
OH1137	20/03/2019	EC – 95th Percentile	Watching Brief* Note: Insufficient water volume recorded during sampling rounds in June and September 19. Continue to monitor.
WD622P	29/05/2019	EC – 95th Percentile	Watching Brief*
WD622P	30/08/2019	EC – 95th Percentile	Watching Brief* Note: Bore is located at edge of pre-strip area. Bore likely to influenced by active mining area.
OH1138(1)	09/04/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in June 19 shows values back within trigger limits.
OH1138(1)	14/05/2019	EC – 95th Percentile	Watching Brief* Note: Monitoring result obtained in June 19 shows values back within trigger limits.
OH788	25/09/2019	pH – 5th Percentile	Watching Brief*
PZ7S	27/08/2019	pH – 5th Percentile	Watching Brief*
WOH2139A	22/01/2019	pH – 95th Percentile	Watching Brief*
WOH2139A	08/02/2019	pH – 95th Percentile	Watching Brief*
WOH2139A	21/03/2019	pH – 95th Percentile	Investigation commenced. Note: pH results are dropping and trending back within trigger limits. Continue to watch and monitor trend.
WOH2139A	09/04/2019	pH – 95th Percentile	Under Investigation
WOH2139A	14/05/2019	pH – 95th Percentile	Under Investigation
WOH2139A	18/06/2019	pH – 95th Percentile	Investigation undertaken. Note: pH values for WOH2139A considered to be associated with prolonged dry climatic conditions and are consistent with results obtained since 2017 at this location.
WOH2139A	16/07/2019	pH – 95th Percentile	Investigation undertaken. Note: pH values for WOH2139A considered to be associated with prolonged dry climatic conditions and are consistent with results obtained since 2017 at this location.
WOH2139A	26/08/2019	pH – 95th Percentile	Investigation undertaken. Note: pH values for WOH2139A considered to be associated with prolonged dry climatic conditions and are consistent with results obtained since 2017 at this location.

Site	Date	Trigger Limit Breached	Action Taken in Response
WOH2139A	26/09/2019	pH – 95th Percentile	Investigation undertaken. Note: pH values for WOH2139A considered to be associated with prolonged dry climatic conditions and are consistent with results obtained since 2017 at this location.
WOH2153A	26/08/2019	pH – 95th Percentile	Watching Brief*
WOH2154A	01/03/2019	pH – 5th Percentile	Watching Brief* Note: Monitoring result obtained in May 19 shows values back within trigger limits. No further action required.
MTD616P	27/05/2019	pH – 5th Percentile	Watching Brief*
MTD616P	27/08/2019	pH – 5th Percentile	Watching Brief*
MB15MTW01D	19/02/2019	pH – 5th Percentile	Watching Brief*
MB15MTW01D	27/05/2019	pH – 5th Percentile	Watching Brief*
MB15MTW01D	30/08/2019	pH – 5th Percentile	Investigation undertaken. Note: pH values for MB15MTW01D consistent with prolonged dry weather and are consistent with results obtained over the last 24 months at this location.
WD622P	19/02/2019	pH – 95th Percentile	Watching Brief*
WD622P	29/05/2019	pH – 5th Percentile	Watching Brief*
WD622P	30/08/2019	pH – 5th Percentile	Investigation undertaken: Note: Fluctuating pH is considered to be attributable to coal seam depressurisation, as evidenced by historical trending of falling water level. This trend is consistent with the effects of nearby mining. Fluctuations also coincide with changes to the sampling methodology, from quarterly grab sampling to low flow pumping/purging prior to annual comprehensive sampling and analysis.
WOH2154B	01/03/2019	pH – 5th Percentile	Watching Brief* Note: Monitoring result obtained in May 19 shows values back within trigger limits. No further action required.
WOH2155B	26/02/2019	pH – 5th Percentile	Watching Brief* Note: Monitoring result obtained in May 19 shows values back within trigger limits. No further action required.
WD625P	01/03/2019	pH – 5th Percentile	Watching Brief*
WD625P	31/05/2019	pH – 5th Percentile	Watching Brief* Note: Monitoring result obtained in May 19 shows values back within trigger limits. No further action required.

Site	Date	Trigger Limit Breached	Action Taken in Response
OH 1138(1)	22/01/2019	pH – 5th Percentile	Watching Brief* Continue to monitor on increased frequency
OH 1138(1)	08/02/2019	pH – 5th Percentile	Watching Brief* Continue to monitor on increased frequency
OH 1138(1)	08/03/2019	pH – 5th Percentile	Investigation commenced* Continue to monitor on increased frequency
OH 1138(1)	09/04/2019	pH – 5th Percentile	Under Investigation
OH 1138(1)	14/05/2019	pH – 5th Percentile	Under Investigation
OH 1138(1)	27/06/2019	pH – 5th Percentile	Investigation undertaken. Note: pH values consistent with results obtained at this location since 2017, trending up towards trigger limit in recent months. Continue to monitor on increased frequency.
OH 1138(1)	16/07/2019	pH – 5th Percentile	Watching Brief* Note: pH values consistent with results obtained at this location since 2017, trending up towards trigger limit in recent months. Continue to monitor on increased frequency.
OH 1138(1)	20/08/2019	pH – 5th Percentile	Watching Brief* Note: pH values consistent with results obtained at this location since 2017, trending up towards trigger limit in recent months. Continue to monitor on increased frequency.
OH 1138(1)	26/09/2019	pH – 5th Percentile	Watching Brief* Note: pH values consistent with results obtained at this location since 2017, trending up towards trigger limit in recent months. Continue to monitor on increased frequency.
* = Watching brief established pending outcomes of subsequent monitoring events. No specific actions required.			

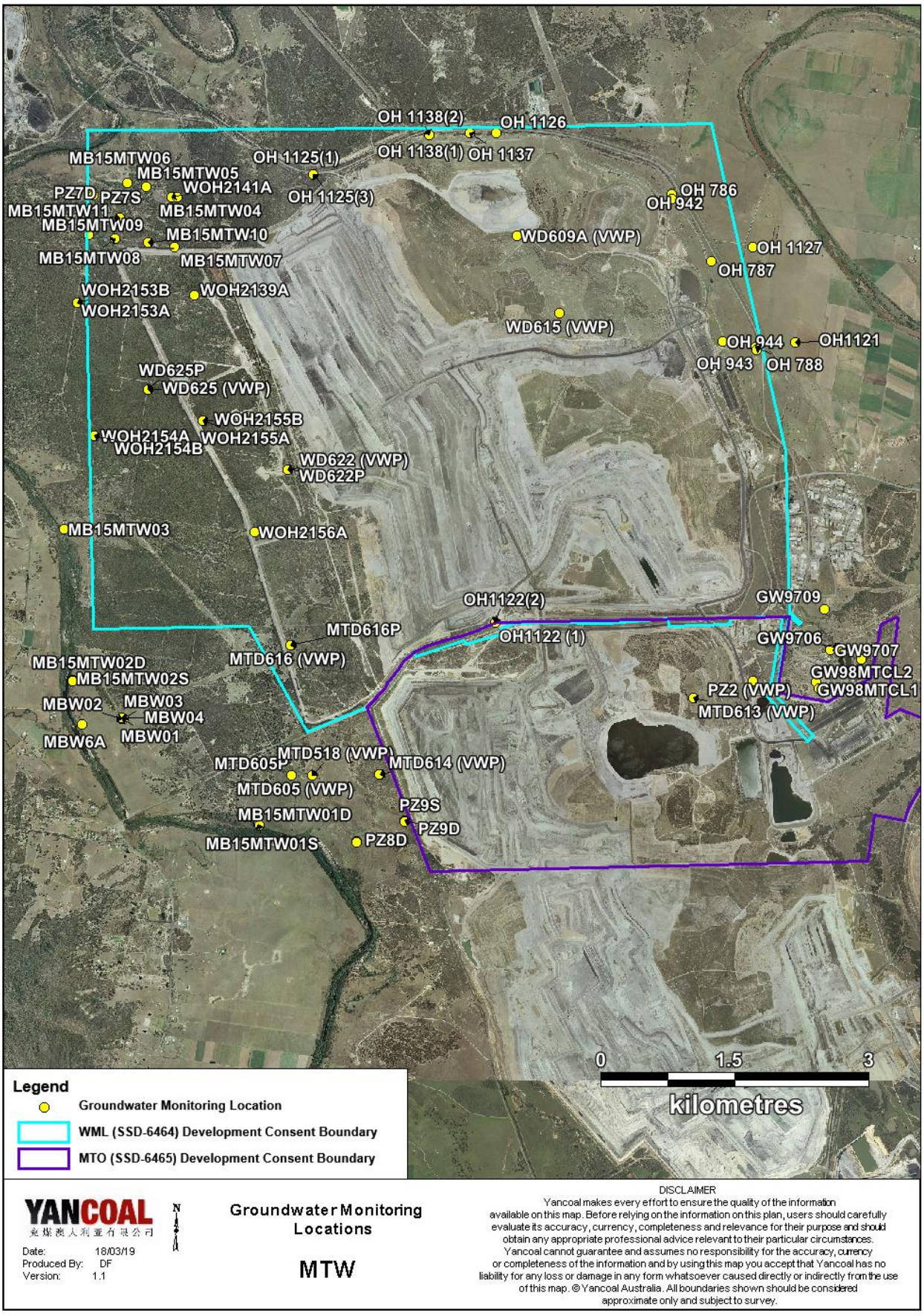


Figure 59: Groundwater Monitoring Location Plan

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 66**.

4.1 Blast Monitoring Results

During September 2019, 19 blasts were initiated at MTW. **Figure 60** to

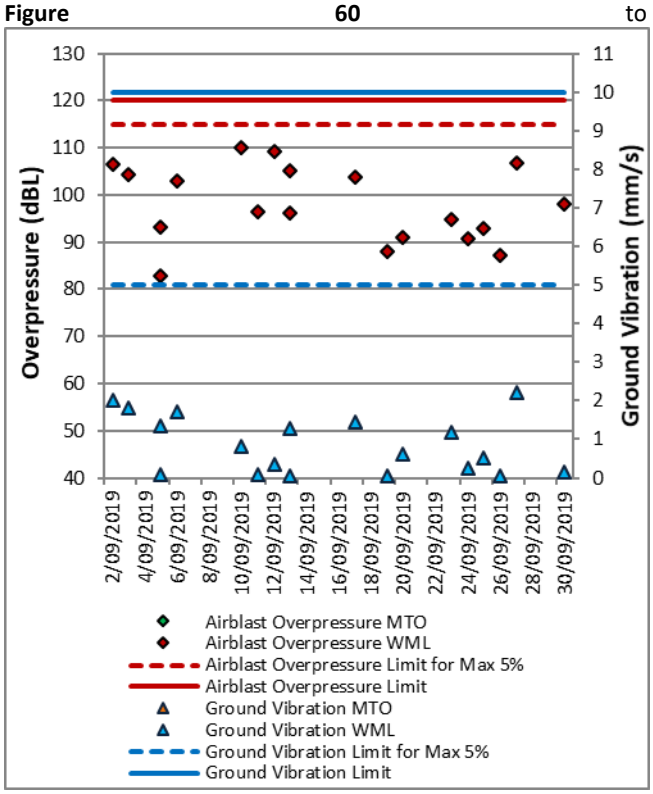


Figure 65 show the blast monitoring results for the reporting period against the impact assessment criteria. The criteria are summarised in **Table 4**.

Table 4: Blasting Limits

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

During the reporting period one blast exceeded the 115 dB(L) threshold for airblast overpressure at the Abbey Green and MTIE blast monitors on 27 September at 11:55. No blast exceeded the 5 mm/s criteria for ground vibration.

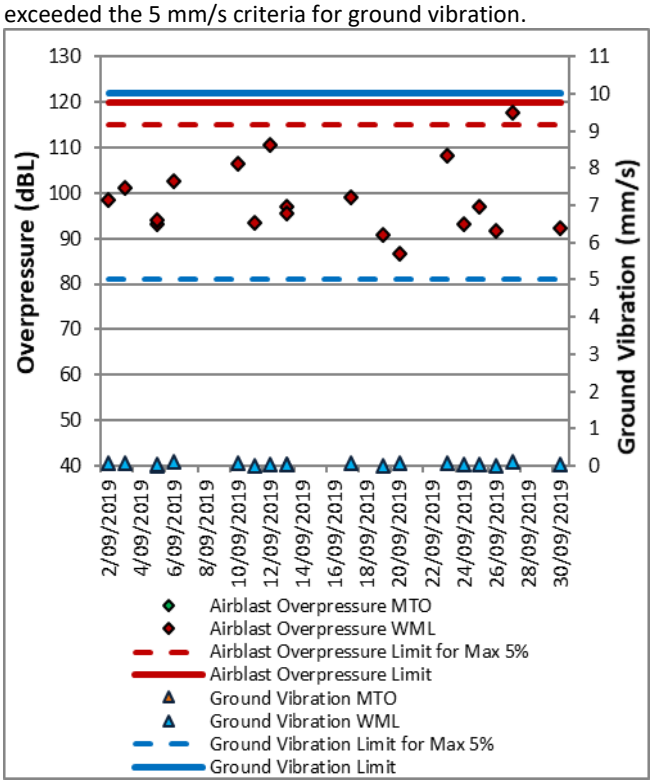


Figure 60: Abbey Green Blast Monitoring Results – September 2019

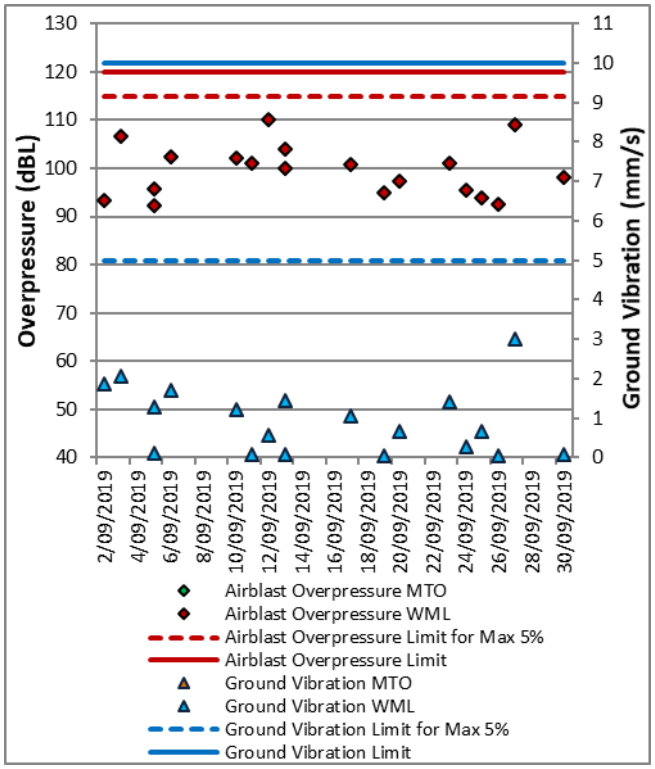


Figure 61: Bulga Village Blast Monitoring Results – September 2019

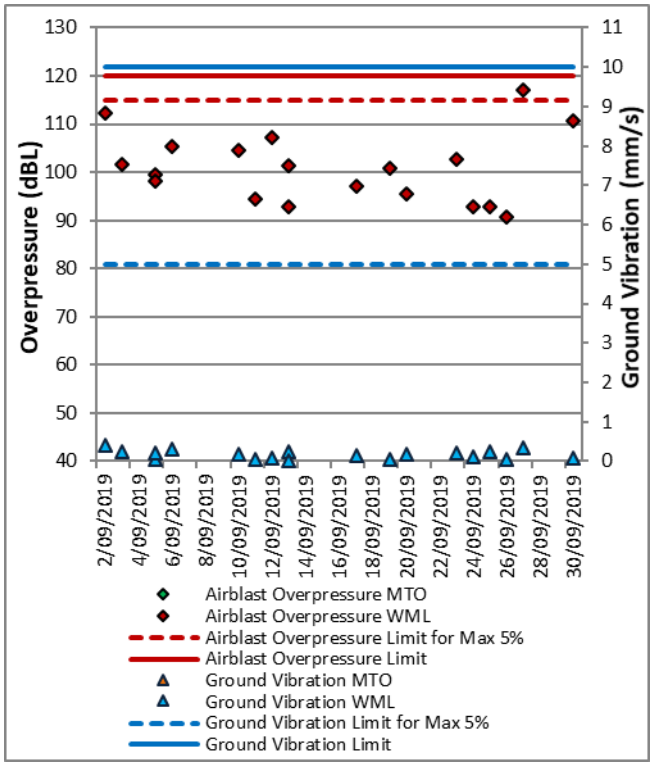


Figure 62: MTIE Blast Monitoring Results – September 2019

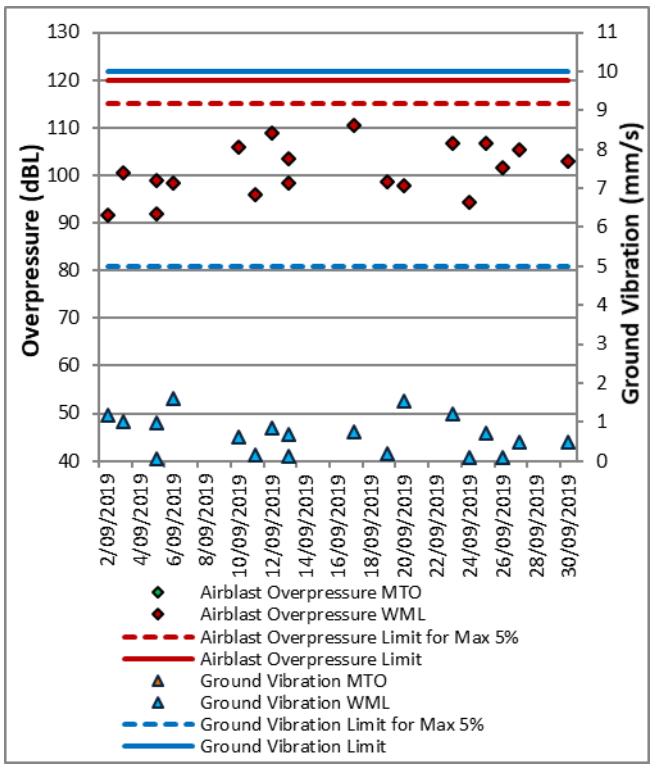


Figure 63: Warkworth Blast Monitoring Results - September 2019

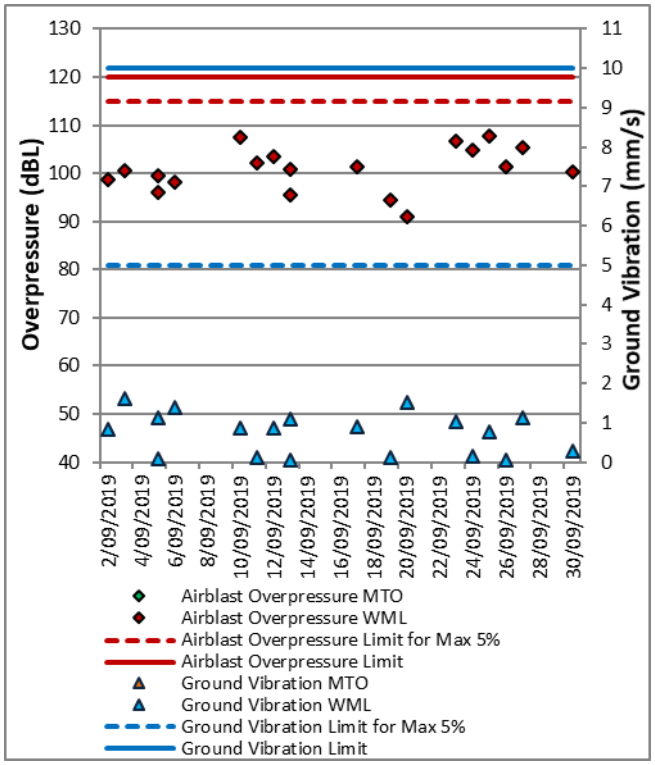


Figure 64: Wambo Road Blast Monitoring Results – September 2019

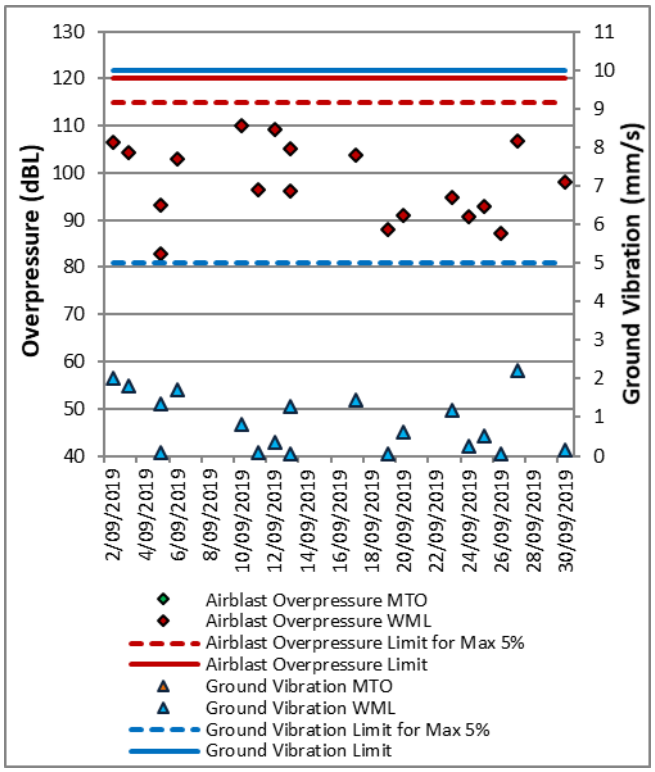


Figure 65: Wollemi Peak Road Blast Monitoring Results - September 2019

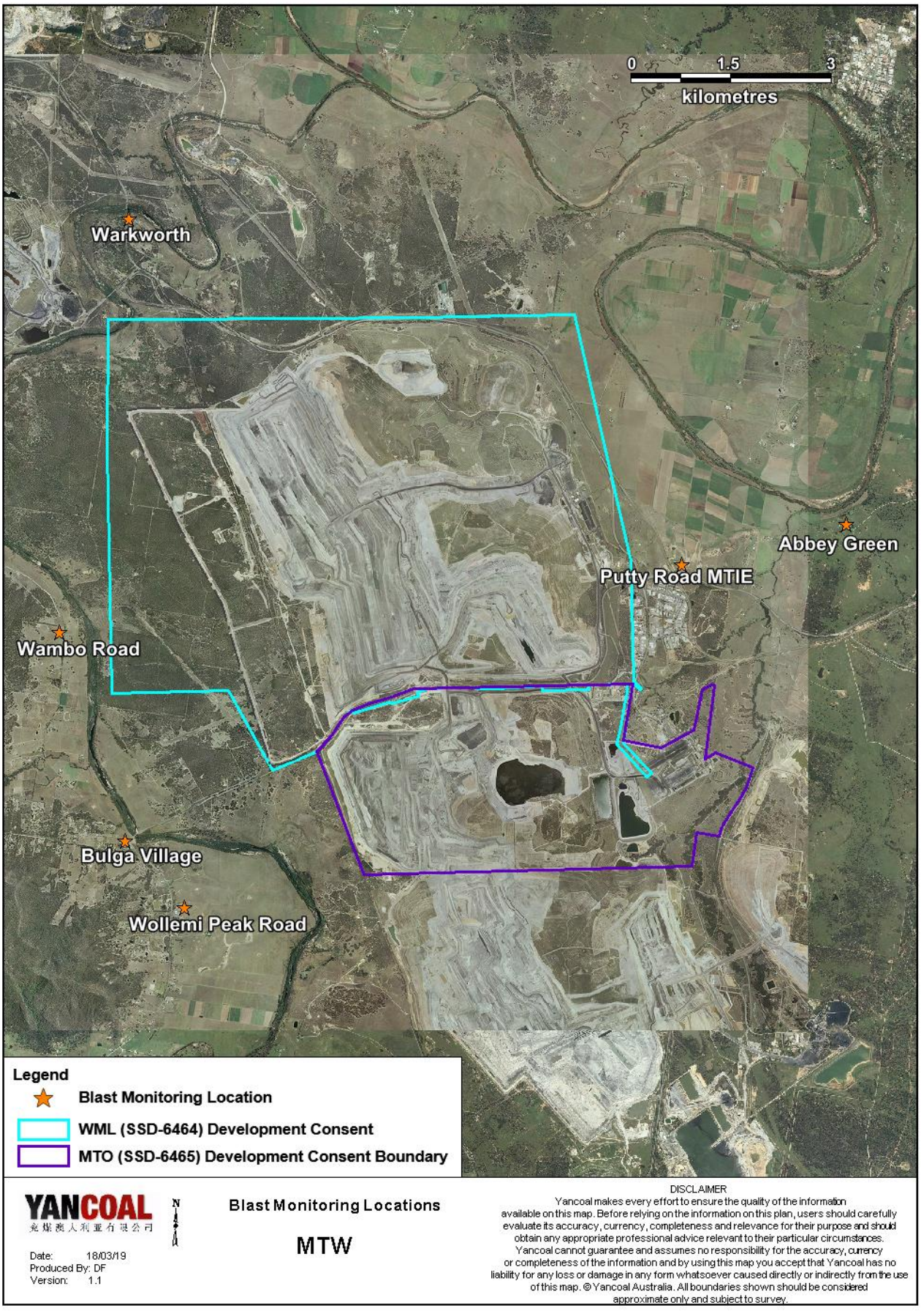


Figure 66: Blast and Vibration Monitoring Location Plan

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 Report. The purpose of the noise surveys is to quantify and describe the acoustic environment around the site and compare results with specified limits. Unattended monitoring (real time noise monitoring) also occurs at five sites surrounding MTW. The attended noise monitoring locations are displayed in **Figure 67**.

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations surrounding MTW on the night of 11 September 2019. 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 **Table 5** and **Table 6**.

Table 5: $L_{Aeq,\ 15\ minute}$ Warkworth Impact Assessment Criteria – September 2019

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	11/09/2019 22:56	1.1	F	37	Yes	IA	Nil
Bulga Village	11/09/2019 23:57	1.3	E	38	Yes	31	Nil
Gouldsville	11/09/2019 21:25	2.2	F	38	No	IA	NA
Inlet Rd	11/09/2019 21:42	1.8	F	37	Yes	32	Nil
Inlet Rd West	11/09/2019 21:09	2.6	E	35	Yes	30	Nil
Long Point	11/09/2019 21:00	1.5	F	35	Yes	IA	Nil
South Bulga	11/09/2019 23:55	1.3	E	35	Yes	IA	Nil
Wambo Road	11/09/2019 23:29	0.9	F	38	Yes	32	Nil

Notes:
1. Noise emission limits 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. Estimated or measured LAeq,15minute attributed to WML;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not Applicable.

Table 6: $L_{A1,\ 1\ minute}$ Warkworth Impact Assessment Criteria – September 2019

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion (dB(A))	Criterion Applies?[1]	WML L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	11/09/2019 22:56	1.1	F	47	Yes	IA	Nil
Bulga Village	11/09/2019 23:57	1.3	E	48	Yes	37	Nil
Gouldsville	11/09/2019 21:25	2.2	F	48	No	IA	NA
Inlet Rd	11/09/2019 21:42	1.8	F	47	Yes	35	Nil
Inlet Rd West	11/09/2019 21:09	2.6	E	45	Yes	41	Nil
Long Point	11/09/2019 21:00	1.5	F	45	Yes	IA	Nil
South Bulga	11/09/2019 23:55	1.3	E	45	Yes	IA	Nil
Wambo Road	11/09/2019 23:29	0.9	F	48	Yes	34	Nil

Notes:
1. Noise emission limits 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. Estimated or measured LA1,1minute attributed to WML;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not Applicable.

5.1.2 MTO Noise Assessment

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

Table 7: $L_{Aeq,\ 15minute}$ Mount Thorley Operations - Impact Assessment Criteria – September 2019

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO L_{Aeq} dB[2,3]	Exceedance[3,4]
Bulga RFS	11/09/2019 22:56	1.1	F	37	Yes	34	Nil
Bulga Village	11/09/2019 23:57	1.3	E	38	Yes	IA	Nil
Gouldsville	11/09/2019 21:25	2.2	F	35	No	IA	NA
Inlet Rd	11/09/2019 21:42	1.8	F	37	Yes	NM	Nil
Inlet Rd West	11/09/2019 21:09	2.6	E	35	Yes	IA	Nil
Long Point	11/09/2019 21:00	1.5	F	35	Yes	IA	Nil
South Bulga	11/09/2019 23:55	1.3	E	36	Yes	<30	Nil
Wambo Road	11/09/2019 23:29	0.9	F	38	Yes	30	Nil

Notes:
1. Noise emission limits 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. Estimated or measured LAeq,15minute attributed to MTO;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.

Table 8: $L_{A1,\ 1Minute}$ Mount Thorley Operations - Impact Assessment Criteria – September 2019

Location	Date and Time	Wind Speed (m/s)	Stability Class	Criterion dB	Criterion Applies?[1]	MTO $L_{A1,\ 1min}$ dB[2,3]	Exceedance[3,4]
Bulga RFS	11/09/2019 22:56	1.1	F	47	Yes	40	Nil
Bulga Village	11/09/2019 23:57	1.3	E	48	Yes	IA	Nil
Gouldsville	11/09/2019 21:25	2.2	F	45	No	IA	Na
Inlet Rd	11/09/2019 21:42	1.8	F	47	Yes	38	Nil
Inlet Rd West	11/09/2019 21:09	2.6	E	45	Yes	IA	Nil
Long Point	11/09/2019 21:00	1.5	F	45	Yes	IA	Nil
South Bulga	11/09/2019 23:55	1.3	E	46	Yes	<30	Nil
Wambo Road	11/09/2019 23:29	0.9	F	48	Yes	47	Nil

Notes:
1. Noise emission limits 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. Estimated or measured LAeq,15minute attributed to MTO;
3. Bold results in red are possible exceedances of relevant criteria;
4. NA in exceedance column means atmospheric conditions outside conditions specified in project approval and so criterion is not applicable.

5.1.3 Low Frequency Assessment

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

Table 9: Low Frequency Noise Assessment – September 2019

Location	Date and Time	Measured Site Only LA_{eq} dB (WML/MTO)	Site Only LC_{eq} dB[1] (WML/MTO)	Site Only LC_{eq}-LA_{eq} dB [1,3] (WML/MTO)	Result Max exceedance of ref spectrum dB[1,3] (WML/MTO)	Penalty dB[1] (WML/MTO)	Exceedance
Bulga RFS	11/09/2019 22:56	IA/34	NA/51	NA/17	NA/Nil	NA/Nil	NA
Bulga Village	11/09/2019 23:57	31/IA	NA/NA	NA/NA	NA/NA	NA/NA	NA
Gouldsville	11/09/2019 21:25	IA/IA	NA/NA	NA/NA	NA/NA	NA/NA	NA
Inlet Rd	11/09/2019 21:42	32/NM	NA/NA	NA/NA	NA/NA	NA/NA	NA
Inlet Rd West	11/09/2019 21:09	30/IA	NA/NA	NA/NA	NA/NA	NA/NA	NA
Long Point	11/09/2019 21:00	IA/IA	NA/NA	NA/NA	NA/NA	NA/NA	NA
South Bulga	11/09/2019 23:55	IA/<30	NA/NA	NA/NA	NA/NA	NA/NA	NA
Wambo Road	11/09/2019 23:29	32/30	NA/NA	NA/NA	NA/NA	NA/NA	NA

Notes:

1. Where it is not possible to determine the site-only result due to the presence of other low-frequency noise sources occurring during the measurement, or where criteria were not applicable due to meteorological conditions, or where site-only contributions were more than 5 dB less than the relevant LAeq criterion this is noted as NA (not available) and no further assessment has been undertaken;

2. As per NPfI, if LCeq −LAeq ≥ 15 dB further assessment of low-frequency noise required as detailed in Sections 2.4 and 3.3 of this report;

3. As per NPfI, compare measured spectrum against reference spectrum to determine if the low-frequency modifying factor is triggered and application of penalty is required.

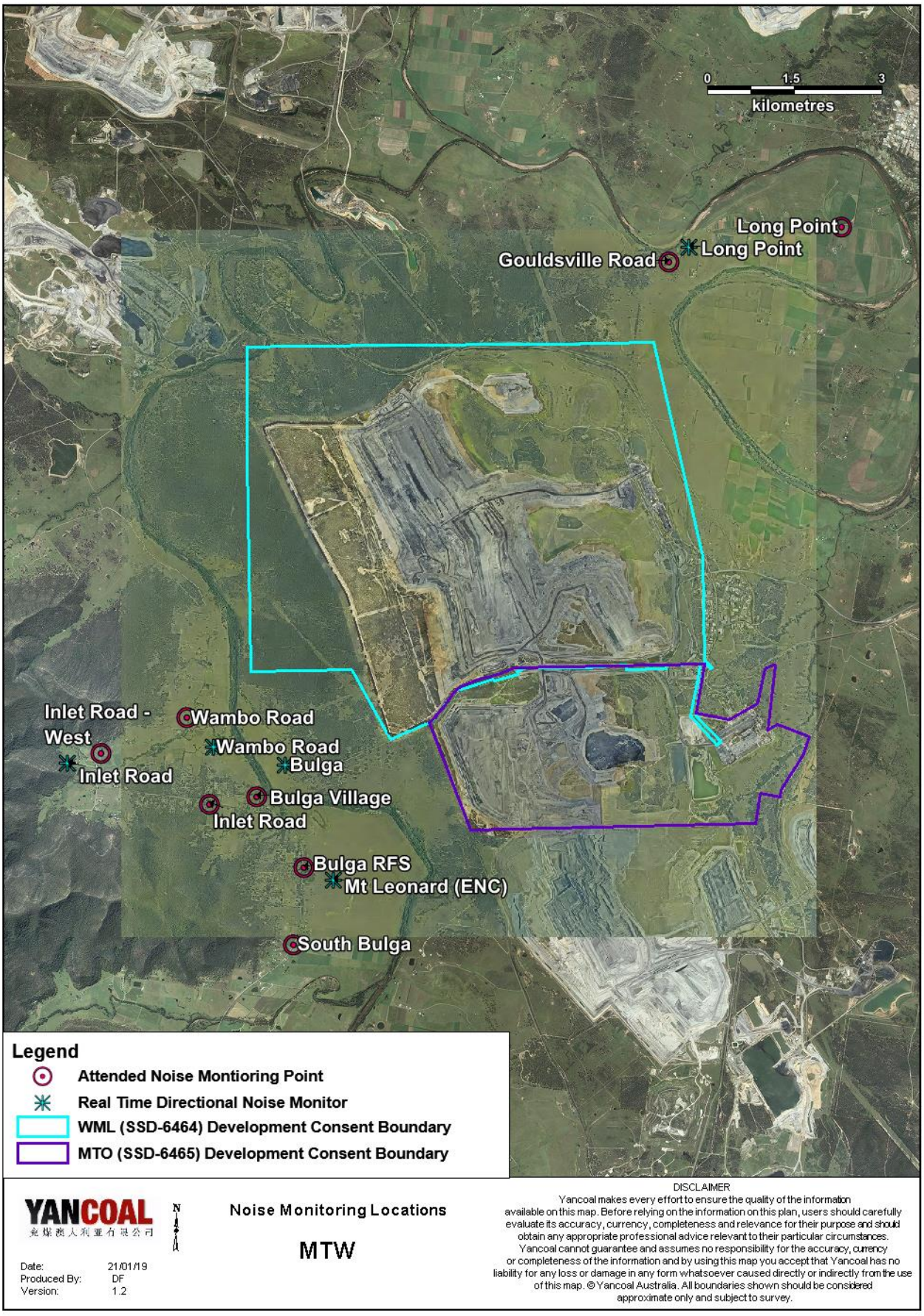


Figure 67: Noise Monitoring Location Plan

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 so as 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 during September are provided in **Table 10**.

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Table 10: Supplementary Attended Noise Monitoring Data – September 2019

No. of assessments	No. of assessments > trigger	No. of nights where assessments > trigger	% greater than trigger
644	6	2	0.9

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

6.0 OPERATIONAL DOWNTIME

During September a total of 682 hours of equipment downtime was logged in response to environmental events such as dust, noise and elevated wind impacts. Operational downtime by equipment type is shown in **Figure 68**.

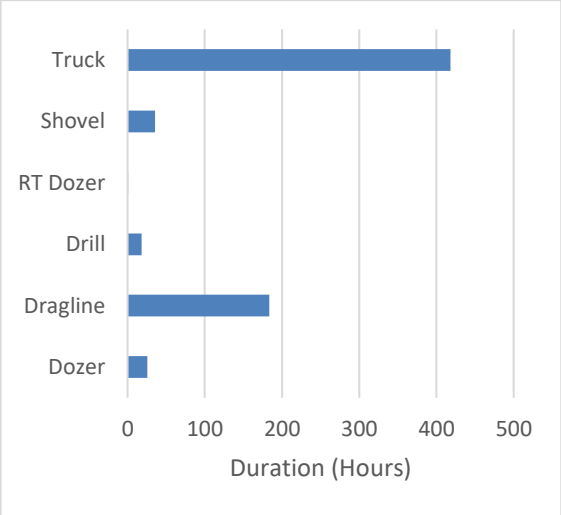

Figure 68: Operational Downtime by Equipment Type – September 2019

7.0 REHABILITATION

During September 3.6Ha of land was released for rehabilitation, 10.4Ha was bulk shaped, 2.4Ha was topsoiled, 2.1Ha was composted and 19.5Ha was rehabilitated. Year-to-date progress can be viewed in **Figure 69**.

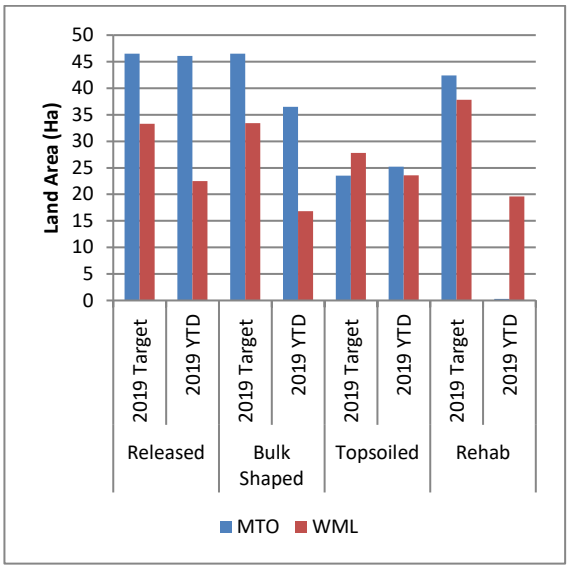

Figure 69: Rehabilitation YTD - September 2019

8.0 ENVIRONMENTAL INCIDENTS

There were no reportable environmental incidents recorded during the reporting period.

9.0 COMPLAINTS

During the reporting period 32 complaints were received, details of these complaints are displayed in **Table 11** below.

Table 11: Complaints Summary - YTD September 2019

	Noise	Dust	Blast	Lighting	Other	Total
January	7	6	9	3	0	25
February	14	16	11	2	0	43
March	20	8	4	2	0	34
April	15	5	3	6	0	29
May	15	8	6	3	0	32
June	13	17	5	0	1	36
July	10	16	3	0	3	32
August	1	32	8	4	0	45
September	7	13	9	2	1	32
October						
November						
December						
Total	102	121	58	22	5	308

Appendix A: Meteorological Data

Table 12: Meteorological Data – Charlton Ridge Meteorological Station – September 2019

Date	Air Temperature Maximum (°C)	Air Temperature Minimum (°C)	Relative Humidity Maximum (%)	Relative Humidity Minimum (%)	Wind Direction Average (°)	Wind Speed Average (m/sec)	Rainfall(mm)
1/09/2019	22	10	87	37	145	2.1	0.0
2/09/2019	24	6	94	12	219	2.4	0.0
3/09/2019	26	7	89	11	222	2.8	0.0
4/09/2019	29	6	75	7	217	2.8	0.0
5/09/2019	27	8	82	18	166	2.2	0.0
6/09/2019	31	9	89	1	247	4.5	0.0
7/09/2019	19	8	67	21	310	6.4	0.0
8/09/2019	20	9	49	17	271	4.3	0.0
9/09/2019	17	7	52	20	236	4.3	0.0
10/09/2019	19	6	80	28	183	2.8	0.0
11/09/2019	21	3	87	24	159	1.7	0.0
12/09/2019	27	4	91	5	285	3.3	0.0
13/09/2019	24	9	78	16	180	2.3	0.0
14/09/2019	24	5	84	13	195	2.6	0.0
15/09/2019	28	5	92	6	193	2.2	0.0
16/09/2019	30	13	67	0	220	4.7	0.0
17/09/2019	15	6	95	67	190	3.7	14.2
18/09/2019	17	8	94	73	180	4.4	8.8
19/09/2019	23	10	97	43	140	2.8	2.2
20/09/2019	25	11	91	38	131	2.6	0.0
21/09/2019	27	11	92	25	171	2.3	0.0
22/09/2019	25	13	79	41	255	3.5	0.4
23/09/2019	23	9	87	12	219	2.8	0.0
24/09/2019	22	9	81	13	168	2.3	0.0
25/09/2019	22	6	70	25	157	1.8	0.0
26/09/2019	23	11	86	27	140	2.2	0.0
27/09/2019	27	10	96	5	287	3.1	0.0
28/09/2019	26	8	69	12	192	2.8	0.0
29/09/2019	24	7	79	21	149	2.4	0.0
30/09/2019	22	11	83	40	133	2.8	0.0

"-" Indicates that data was not available due to technical issues.