HUNTER VALLEY OPERATIONS

Monthly Environmental Monitoring Report

December 2019

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1.0 INTRODUCTION

This report has been compiled to provide a monthly summary of environmental monitoring results for Hunter Valley Operations (HVO). This report includes all monitoring data collected for the period 1 December to 31 December 2019.

2.0 AIR QUALITY

2.1 Meteorological Monitoring

HVO maintains two meteorological stations; 'HVO Corporate' and 'Cheshunt' (Refer to Figure 4: Air Quality Monitoring Location Plan).

2.1.1 Rainfall

Rainfall for the period is summarised in Table 1. The 2019 trend and historical trends are shown in Figure 1.

Table 1: Rainfall data - December 2019

2019	Monthly Rainfall (mm)	Cumulative Rainfall (mm)
December	*0.2*	*336.8*

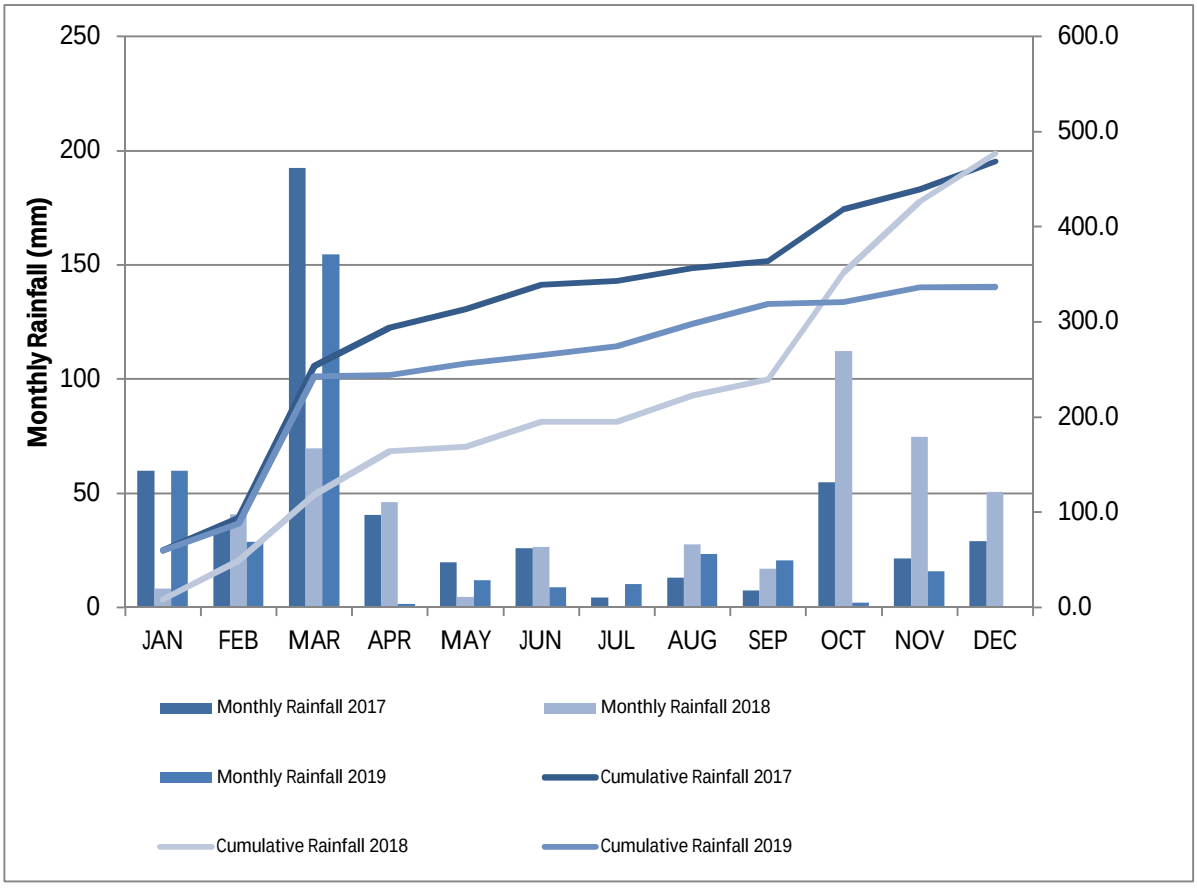

Figure 1: Rainfall Summary 2019

2.1.2 Wind Speed and Direction

East to South Easterly winds were dominant during December as shown in Figure 2 (HVO Corporate) and Figure 3 (HVO Cheshunt).

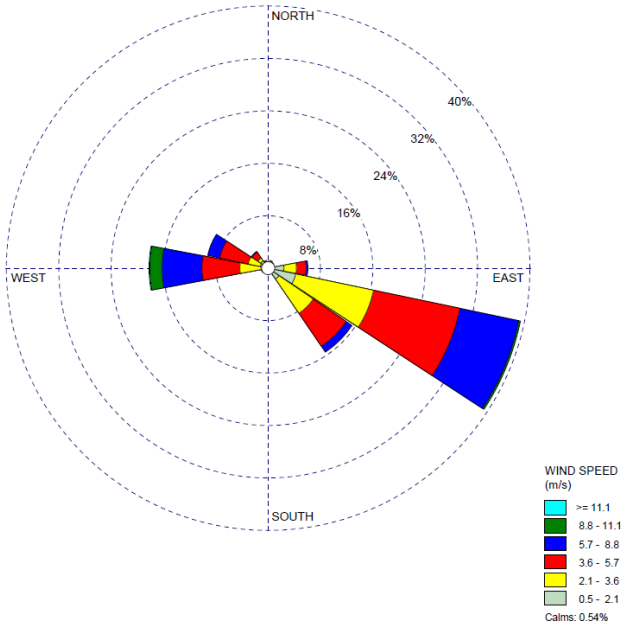

Figure 2: HVO Corporate Wind Rose – December 2019

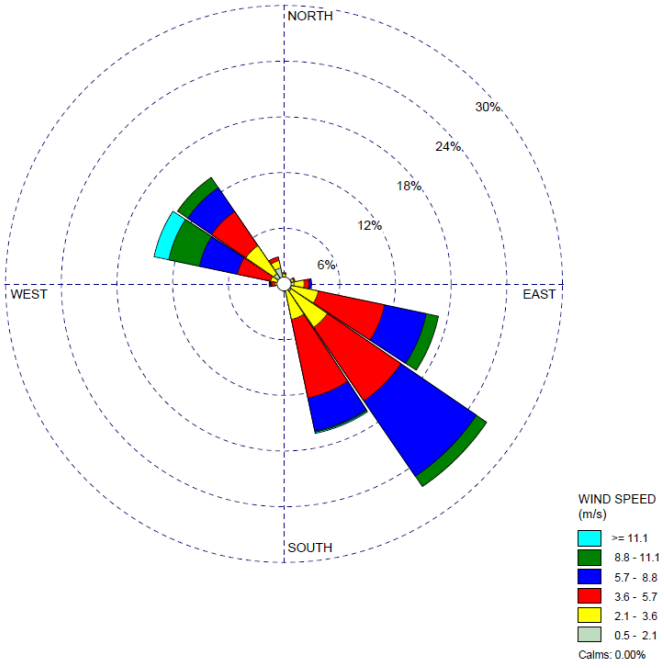

Figure 3: HVO Cheshunt Wind Rose – December 2019

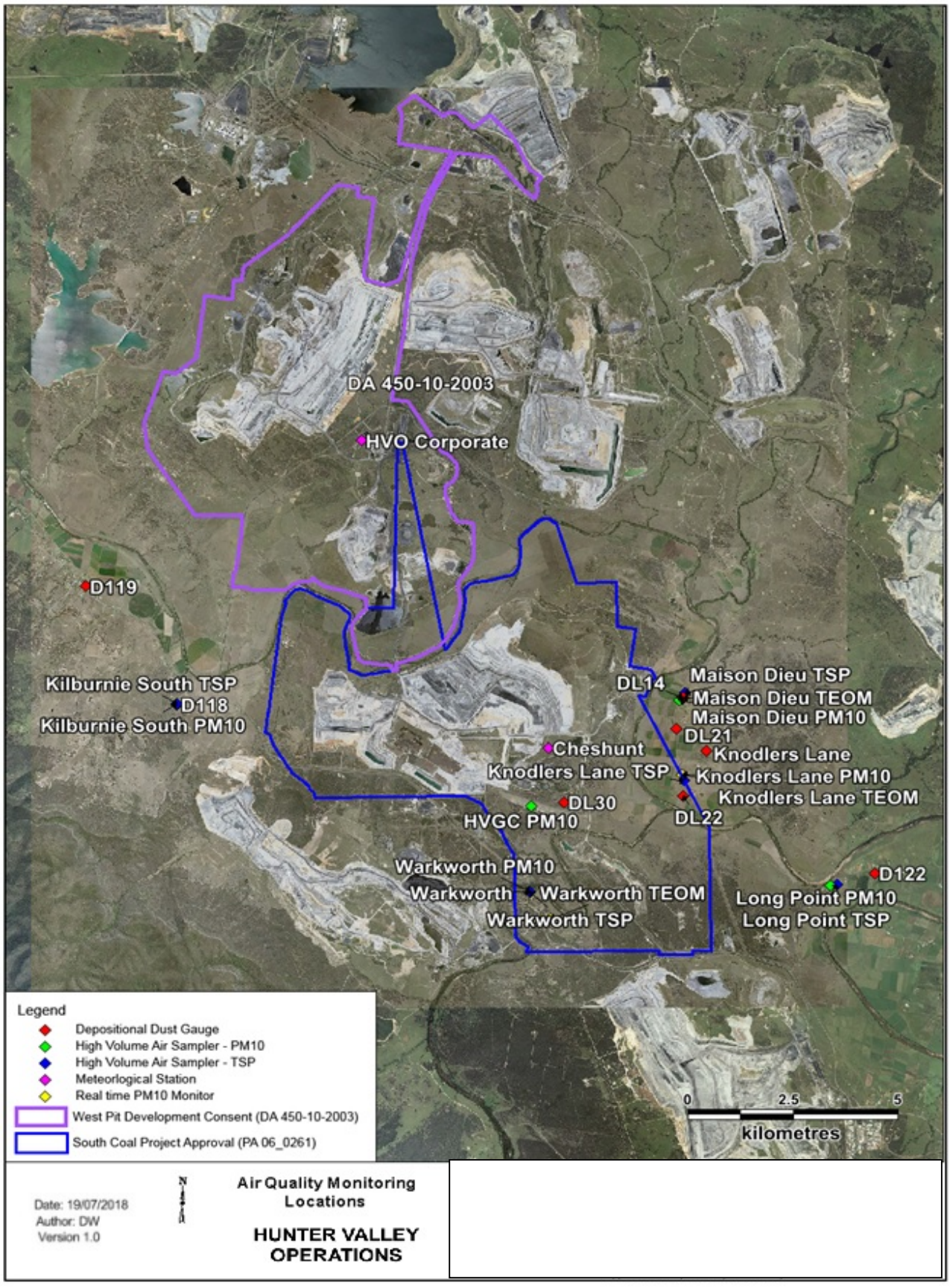

Figure 4: Air Quality Monitoring Location Plan

2.2 Depositional Dust

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

Figure 5 displays insoluble solids results from depositional dust gauges during the reporting period compared against the annual impact assessment criteria.

During the reporting period the DL30, DL118, DL119, DL21, DL122 and Warkworth monitors recorded a monthly result above the long term impact assessment criteria of 4.0 g/m^2 per month.

An assessment of HVO's contribution against the long term impact assessment criteria will be provided in the 2019 Annual Review.

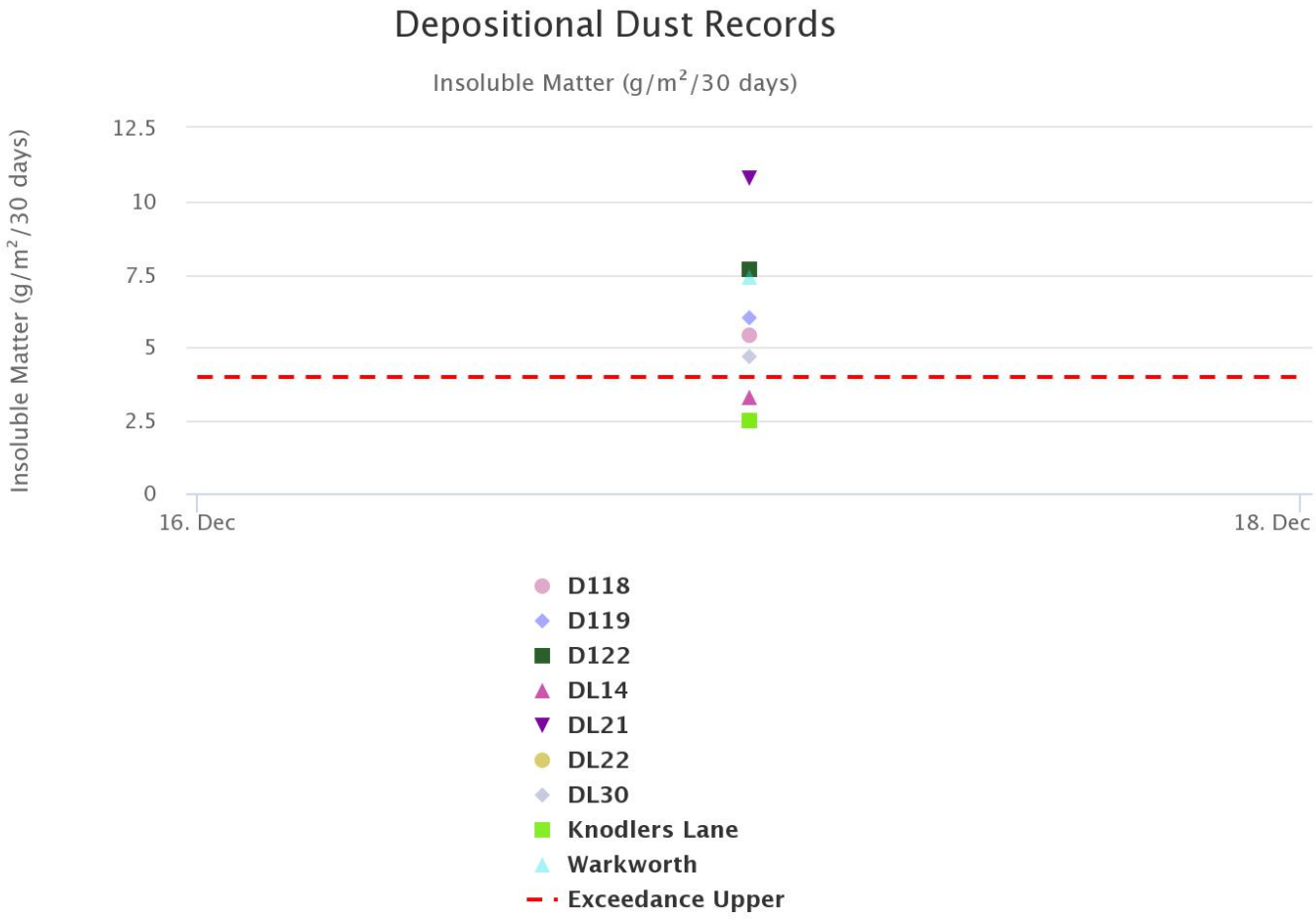

Figure 5: Depositional Dust Results – December 2019

2.2 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 4. Each HVAS was run for 24 hours on a six-day cycle.

2.2.1 HVAS PM_{10} Results

Figure 6 shows individual PM_{10} results at each monitoring station against the short term impact assessment criteria of 50 µg/m^3. During the reporting period, all monitors recorded an exceedance above the short term impact assessment criteria of 50 µg/m^3.

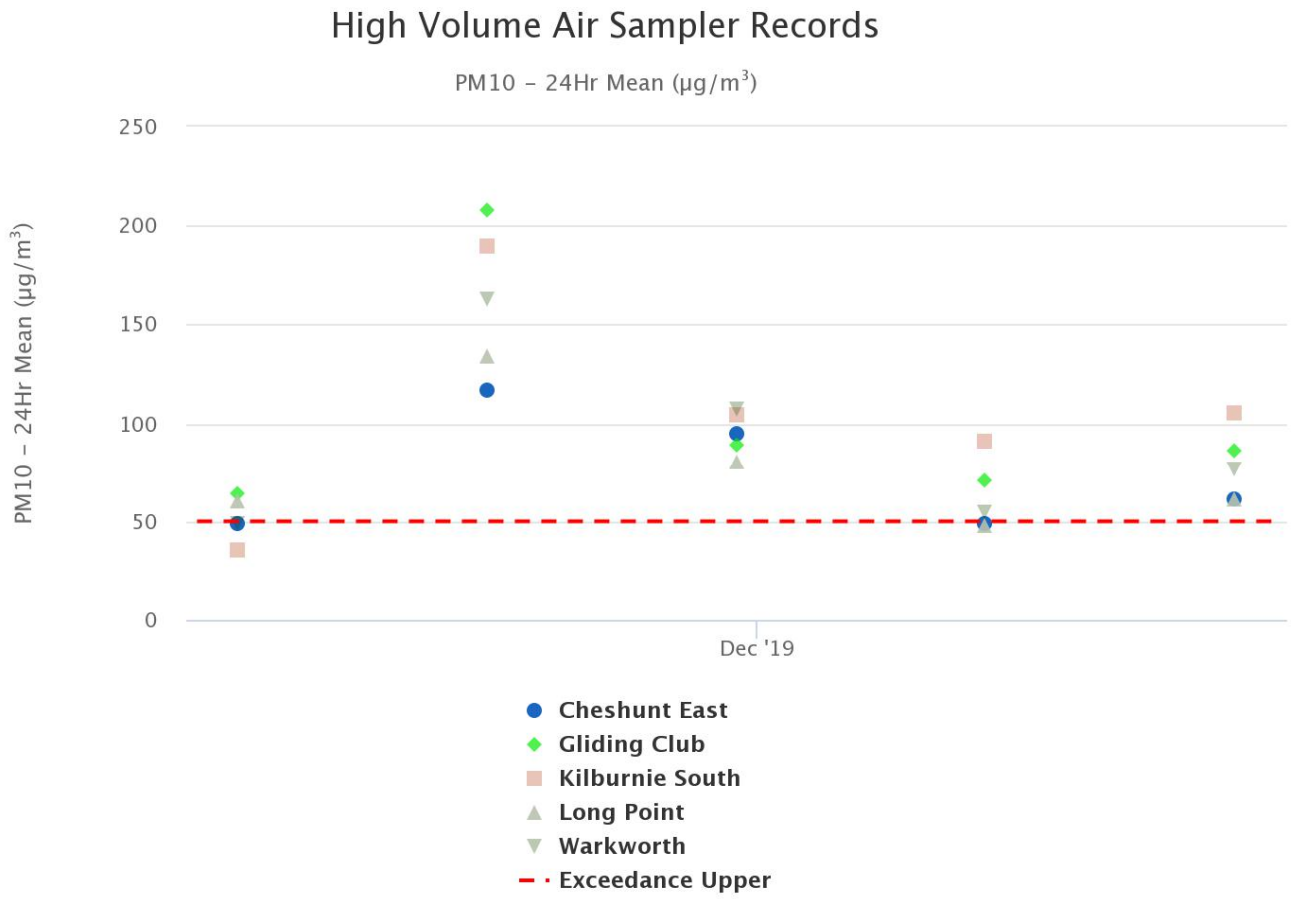

Figure 6: Individual PM_{10} Results – December 2019

Figure 7 shows the year to date annual average PM10 results. During the reporting period, all monitors recorded an exceedance above the PM10 Annual Rolling Mean of 30µg/m^3.

An assessment of HVO's contribution against the long term impact assessment criteria will be provided in the 2019 Annual Review.

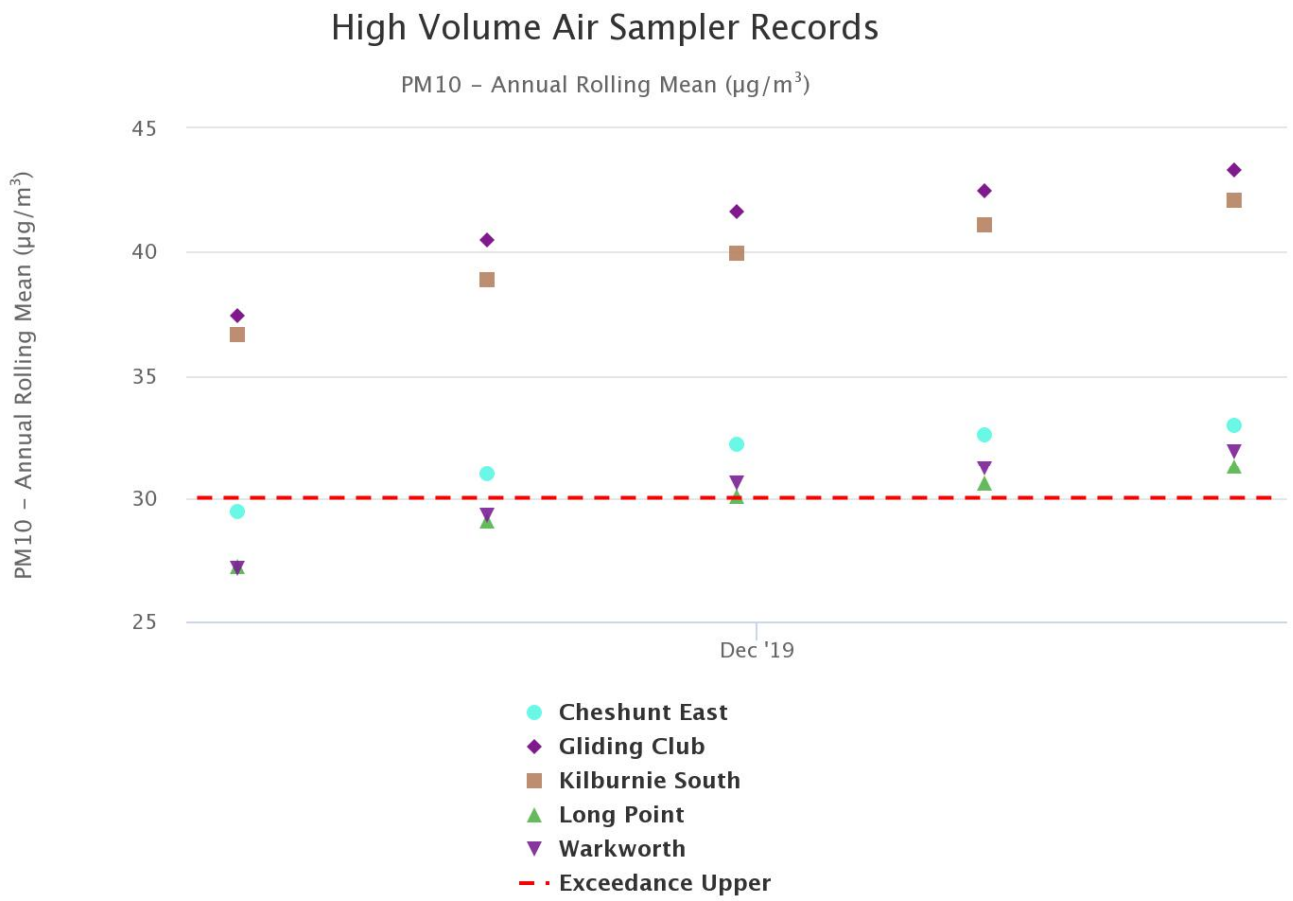

Figure 7: Year to Date Average PM_{10} – as at end of December 2019

2.2.2 TSP Results

Figure 8 shows the annual average TSP results compared against the long term impact assessment criteria of 90µg/m³. During the reporting period, the Kilburnie South and Warkworth monitors recorded exceedances above the long term impact assessment criteria of 90µg/m³.

An assessment of HVO's contribution against the long term impact assessment criteria will be provided in the 2019 Annual Review.

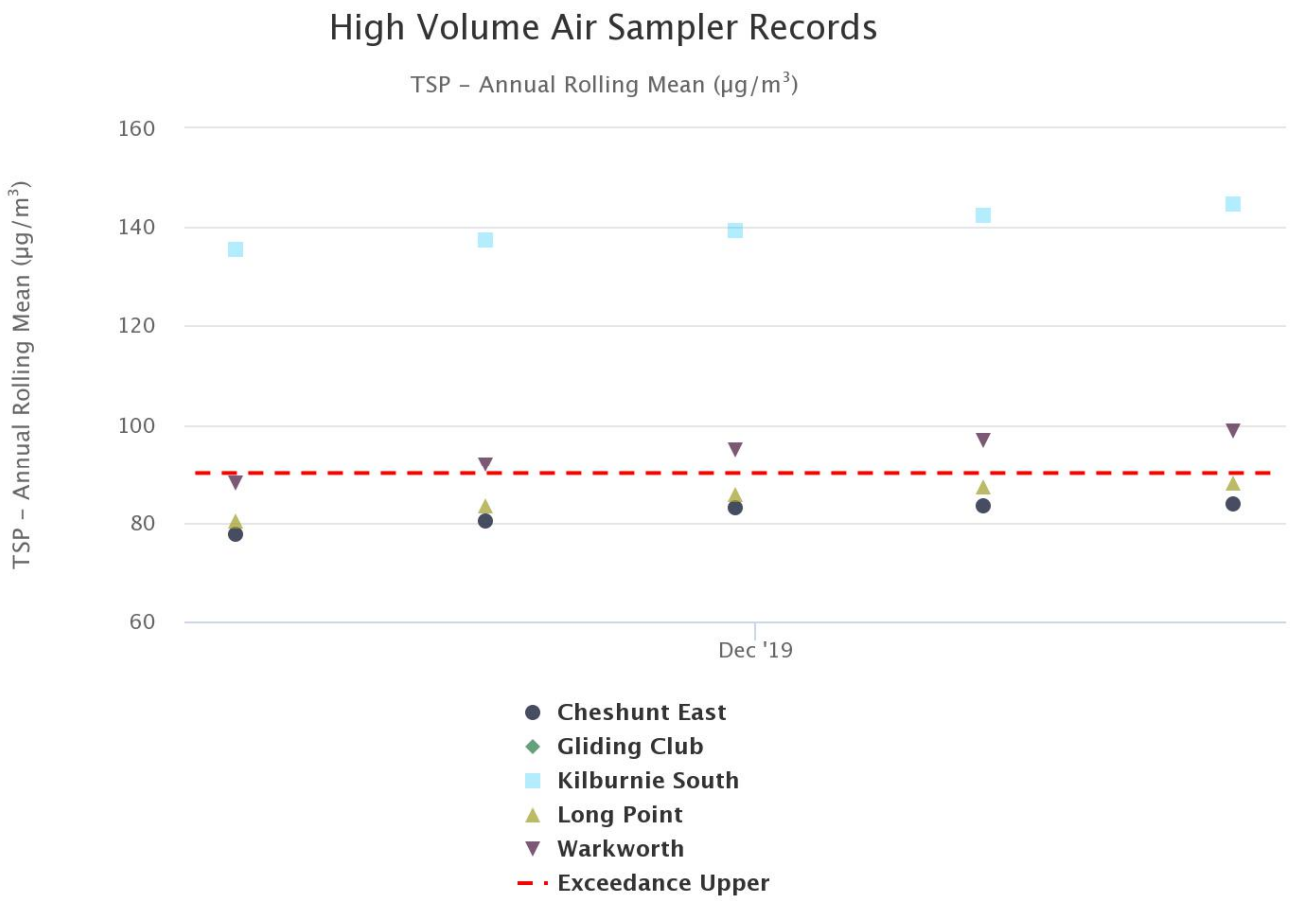

Figure 8: Year to Date Average Total Suspended Particulates – as at end of December 2019

2.2.3 Real Time PM10 Results

Hunter Valley Operations 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. Results from real time PM_{10} monitoring are used as a reactive measure to guide mining operations to help achieve compliance with the relevant conditions of the project approval.

Results for real time dust sampling is shown in Figure 9, including the daily 24 hour average PM10 result and the year to date 24 hour PM_{10} annual average.

During the reporting period, all monitors exceeded the daily 24 hour average PM10 result (50µg/m³).

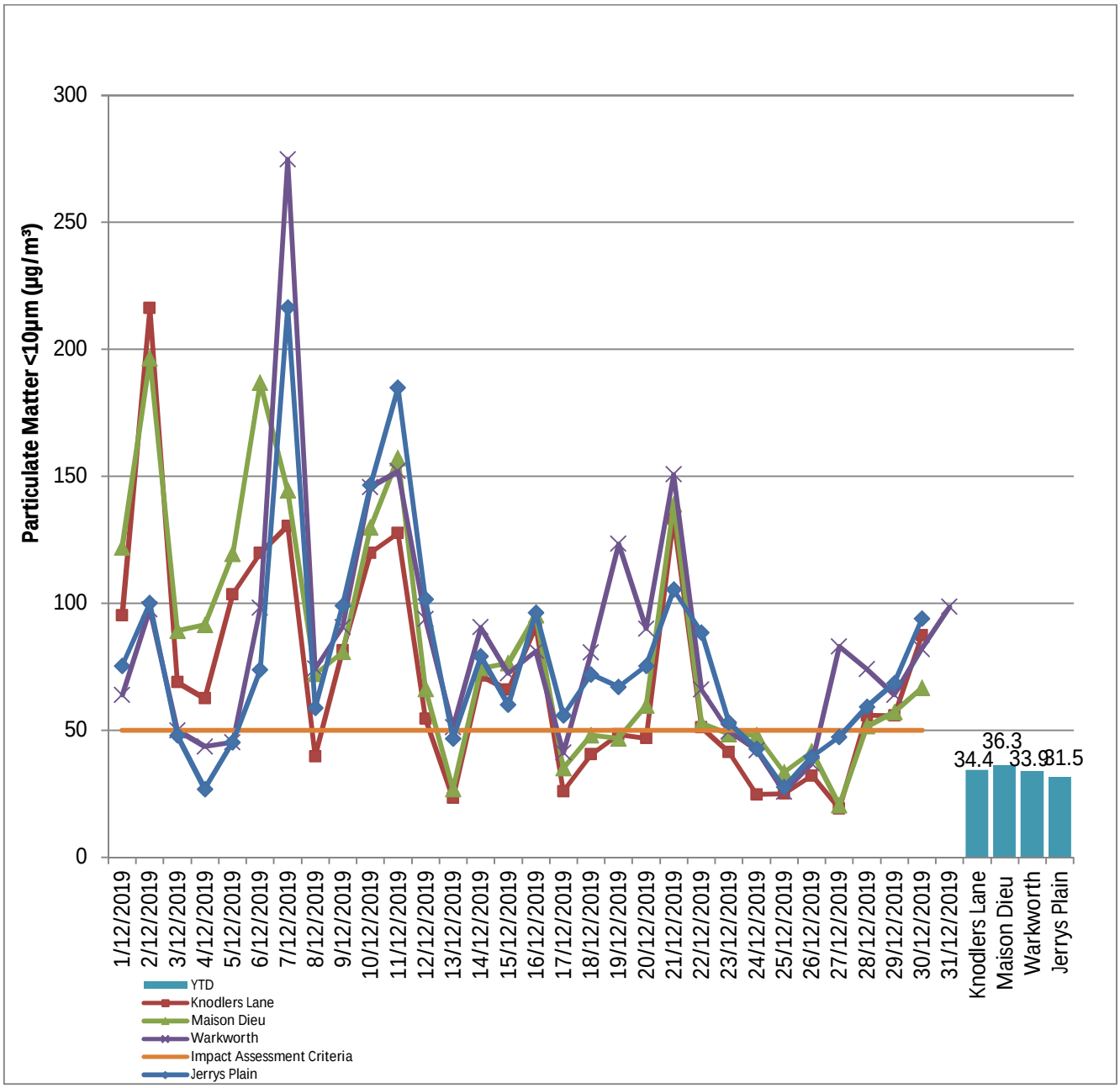

Figure 9: Real Time PM_{10} 24hr average and YTD average – December 2019

Table 2: Real-time PM10 Investigation Results

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
01/12/2019	Knodlers Lane	112.2	95.5	An internal investigation determined HVO maximum potential contribution to be in the order of 95.5ug/m3 based on prevailing wind conditions. 1 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
01/12/2019	Maison Dieu	93.1	70.5	An internal investigation determined HVO maximum potential contribution to be in the order of 70.5ug/m3 based on prevailing wind conditions. 1 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
01/12/2019	Warkworth	62.9	2.9	An internal investigation determined HVO maximum potential contribution to be in the order of 2.9ug/m3 based on prevailing wind conditions.
01/12/2019	Jerrys Plain South	70.8	11.1	An internal investigation determined HVO maximum potential contribution to be in the order of 11.1ug/m3 based on prevailing wind conditions.
01/12/2019	Jerrys Plain North	70.8	4.2	An internal investigation determined HVO maximum potential contribution to be in the order of 4.2ug/m3 based on prevailing wind conditions. 1 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
02/12/2019	Knodlers Lane	199.2	105.9	An internal investigation determined HVO maximum potential contribution to be in the order of 105.9ug/m3 based on prevailing wind conditions. 2 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
02/12/2019	Maison Dieu	213.3	119.9	An internal investigation determined HVO maximum potential contribution to be in the order of 119.9ug/m3 based on prevailing wind conditions. 2 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
02/12/2019	Warkworth	98.7	3.1	An internal investigation determined HVO maximum potential contribution to be in the order of 3.1ug/m3 based on prevailing wind conditions.
02/12/2019	Jerrys Plain South	101.2	0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
02/12/2019	Jerrys Plain North	101.2	0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
03/12/2019	Knodlers Lane	90.3	46.3	An internal investigation determined HVO maximum potential contribution to be in the order of 46.3ug/m3 based on prevailing wind conditions.
03/12/2019	Maison Dieu	69.0	22.9	An internal investigation determined HVO maximum potential contribution to be in the order of 22.9ug/m3 based on prevailing wind conditions.
04/12/2019	Knodlers Lane	91.5	66.5	An internal investigation determined HVO maximum potential contribution to be in the order of 66.5ug/m3 based on prevailing wind conditions. 4 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
04/12/2019	Maison Dieu	62.6	35.7	An internal investigation determined HVO maximum potential contribution to be in the order of 35.7ug/m3 based on prevailing wind conditions.
05/12/2019	Knodlers Lane	119.3	76.9	An internal investigation determined HVO maximum potential contribution to be in the order of 76.9ug/m3 based on prevailing wind conditions. 5 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
05/12/2019	Maison Dieu	103.2	60.8	An internal investigation determined HVO maximum potential contribution to be in the order of 60.8ug/m3 based on prevailing wind conditions. 5 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
06/12/2019	Knodlers Lane	192.2	119.4	An internal investigation determined HVO maximum potential contribution to be in the order of 119.4ug/m3 based on prevailing wind conditions. 6 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
06/12/2019	Maison Dieu	119.5	46.6	An internal investigation determined HVO maximum potential contribution to be in the order of 46.6ug/m3 based on prevailing wind conditions. 6 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
06/12/2019	Warkworth	102.0	46.6	An internal investigation determined HVO maximum potential contribution to be in the order of 46.6ug/m3 based on prevailing wind conditions. 6 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
06/12/2019	Jerrys Plain South	75.6	0.9	An internal investigation determined HVO maximum potential contribution to be in the order of 0.9ug/m3 based on prevailing wind conditions.
06/12/2019	Jerrys Plain North	75.6	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
07/12/2019	Knodlers Lane	146.0	21.7	An internal investigation determined HVO maximum potential contribution to be in the order of 21.7ug/m3 based on prevailing wind conditions.
07/12/2019	Maison Dieu	130.5	18.1	An internal investigation determined HVO maximum potential contribution to be in the order of 18.1ug/m3 based on prevailing wind conditions.
07/12/2019	Warkworth	243.5	15.7	An internal investigation determined HVO maximum potential contribution to be in the order of 15.7ug/m3 based on prevailing wind conditions.
07/12/2019	Jerrys Plain South	207.2	38.8	An internal investigation determined HVO maximum potential contribution to be in the order of 38.8ug/m3 based on prevailing wind conditions.
07/12/2019	Jerrys Plain North	216.4	49.3	An internal investigation determined HVO maximum potential contribution to be in the order of 49.3ug/m3 based on prevailing wind conditions.
08/12/2019	Knodlers Lane	72.3	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
08/12/2019	Warkworth	75.1	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
08/12/2019	Jerrys Plain South	58.2	14.0	An internal investigation determined HVO maximum potential contribution to be in the order of 14.0ug/m3 based on prevailing wind conditions.
08/12/2019	Jerrys Plain North	58.2	48.1	An internal investigation determined HVO maximum potential contribution to be in the order of 48.1ug/m3 based on prevailing wind conditions. 8 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
09/12/2019	Knodlers Lane	78.6	11.8	An internal investigation determined HVO maximum potential contribution to be in the order of 11.8ug/m3 based on prevailing wind conditions.
09/12/2019	Maison Dieu	79.3	5.8	An internal investigation determined HVO maximum potential contribution to be in the order of 5.8ug/m3 based on prevailing wind conditions.
09/12/2019	Warkworth	101.7	3.5	An internal investigation determined HVO maximum potential contribution to be in the order of 3.5ug/m3 based on prevailing wind conditions.
09/12/2019	Jerrys Plain South	94.4	12.9	An internal investigation determined HVO maximum potential contribution to be in the order of 12.9ug/m3 based on prevailing wind conditions.
09/12/2019	Jerrys Plain North	94.4	1.2	An internal investigation determined HVO maximum potential contribution to be in the order of 1.2ug/m3 based on prevailing wind conditions. 9 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
10/12/2019	Knodlers Lane	134.6	41.1	An internal investigation determined HVO maximum potential contribution to be in the order of 41.1ug/m3 based on prevailing wind conditions.
10/12/2019	Maison Dieu	119.7	35.0	An internal investigation determined HVO maximum potential contribution to be in the order of 35.0ug/m3 based on prevailing wind conditions.
10/12/2019	Warkworth	145.7	44.7	An internal investigation determined HVO maximum potential contribution to be in the order of 44.7ug/m3 based on prevailing wind conditions.
10/12/2019	Jerrys Plain South	146.6	20.6	An internal investigation determined HVO maximum potential contribution to be in the order of 20.6ug/m3 based on prevailing wind conditions.
10/12/2019	Jerrys Plain North	146.6	16.5	An internal investigation determined HVO maximum potential contribution to be in the order of 16.5ug/m3 based on prevailing wind conditions. 9 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
11/12/2019	Knodlers Lane	154.5	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
11/12/2019	Maison Dieu	129.9	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
11/12/2019	Warkworth	152.0	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
11/12/2019	Jerrys Plain South	184.8	39.4	An internal investigation determined HVO maximum potential contribution to be in the order of 39.4ug/m3 based on prevailing wind conditions.
11/12/2019	Jerrys Plain North	184.8	25.6	An internal investigation determined HVO maximum potential contribution to be in the order of 25.6ug/m3 based on prevailing wind conditions. 11 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
12/12/2019	Knodlers Lane	62.8	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
12/12/2019	Maison Dieu	50.7	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
12/12/2019	Warkworth	93.7	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
12/12/2019	Jerrys Plain South	105.7	44.0	An internal investigation determined HVO maximum potential contribution to be in the order of 44.0ug/m3 based on prevailing wind conditions.
12/12/2019	Jerrys Plain North	105.7	24.8	An internal investigation determined HVO maximum potential contribution to be in the order of 24.8ug/m3 based on prevailing wind conditions. 12 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
13/12/2019	Warkworth	51.1	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
14/12/2019	Knodlers Lane	76.2	20.9	An internal investigation determined HVO maximum potential contribution to be in the order of 20.9ug/m3 based on prevailing wind conditions.
14/12/2019	Maison Dieu	73.5	20.8	An internal investigation determined HVO maximum potential contribution to be in the order of 20.8ug/m3 based on prevailing wind conditions.
14/12/2019	Warkworth	90.5	24.0	An internal investigation determined HVO maximum potential contribution to be in the order of 24.0ug/m3 based on prevailing wind conditions.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
14/12/2019	Jerrys Plain South	79.0	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
14/12/2019	Jerrys Plain North	81.4	3.6	An internal investigation determined HVO maximum potential contribution to be in the order of 3.6ug/m3 based on prevailing wind conditions. 14 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
15/12/2019	Knodlers Lane	74.9	24.2	An internal investigation determined HVO maximum potential contribution to be in the order of 24.2ug/m3 based on prevailing wind conditions.
15/12/2019	Maison Dieu	64.3	13.0	An internal investigation determined HVO maximum potential contribution to be in the order of 13.0ug/m3 based on prevailing wind conditions.
15/12/2019	Warkworth	72.4	17.6	An internal investigation determined HVO maximum potential contribution to be in the order of 17.6ug/m3 based on prevailing wind conditions.
15/12/2019	Jerrys Plain South	60.0	4.3	An internal investigation determined HVO maximum potential contribution to be in the order of 4.3ug/m3 based on prevailing wind conditions.
15/12/2019	Jerrys Plain North	59.8	4.4	An internal investigation determined HVO maximum potential contribution to be in the order of 4.4ug/m3 based on prevailing wind conditions. 15 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
16/12/2019	Knodlers Lane	95.8	5.0	An internal investigation determined HVO maximum potential contribution to be in the order of 5.0ug/m3 based on prevailing wind conditions.
16/12/2019	Maison Dieu	64.3	4.2	An internal investigation determined HVO maximum potential contribution to be in the order of 4.2ug/m3 based on prevailing wind conditions.
16/12/2019	Warkworth	78.6	9.1	An internal investigation determined HVO maximum potential contribution to be in the order of 9.1ug/m3 based on prevailing wind conditions.
16/12/2019	Jerrys Plain South	96.3	45.5	An internal investigation determined HVO maximum potential contribution to be in the order of 45.5ug/m3 based on prevailing wind conditions.
16/12/2019	Jerrys Plain North	96.4	41.1	An internal investigation determined HVO maximum potential contribution to be in the order of 41.1ug/m3 based on prevailing wind conditions. 16 December appeared to be

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
				affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
17/12/2019	Jerrys Plain South	55.8	34.8	An internal investigation determined HVO maximum potential contribution to be in the order of 34.8ug/m3 based on prevailing wind conditions.
17/12/2019	Jerrys Plain North	56.1	10.3	An internal investigation determined HVO maximum potential contribution to be in the order of 10.3ug/m3 based on prevailing wind conditions. 17 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
18/12/2019	Warkworth	80.6	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
18/12/2019	Jerrys Plain South	71.9	17.0	An internal investigation determined HVO maximum potential contribution to be in the order of 17.0ug/m3 based on prevailing wind conditions.
18/12/2019	Jerrys Plain North	73.0	13.0	An internal investigation determined HVO maximum potential contribution to be in the order of 13.0ug/m3 based on prevailing wind conditions. 18 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
19/12/2019	Warkworth	129.0	18.7	An internal investigation determined HVO maximum potential contribution to be in the order of 18.7ug/m3 based on prevailing wind conditions.
19/12/2019	Jerrys Plain South	85.8	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
19/12/2019	Jerrys Plain North	85.8	22.5	An internal investigation determined HVO maximum potential contribution to be in the order of 22.5ug/m3 based on prevailing wind conditions. 19 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
20/12/2019	Knodlers Lane	59.0	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
20/12/2019	Warkworth	83.8	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
20/12/2019	Jerrys Plain South	75.5	43.5	An internal investigation determined HVO maximum potential contribution to be in the order of 43.5ug/m3 based on prevailing wind conditions.
20/12/2019	Jerrys Plain North	75.5	13.6	An internal investigation determined HVO maximum potential contribution to be in the order of 13.6ug/m3 based on prevailing wind conditions.
21/12/2019	Knodlers Lane	140.2	31.1	An internal investigation determined HVO maximum potential contribution to be in the order of 31.1ug/m3 based on prevailing wind conditions.
21/12/2019	Maison Dieu	135.0	34.9	An internal investigation determined HVO maximum potential contribution to be in the order of 34.9ug/m3 based on prevailing wind conditions.
21/12/2019	Warkworth	157.4	32.9	An internal investigation determined HVO maximum potential contribution to be in the order of 32.9ug/m3 based on prevailing wind conditions.
21/12/2019	Jerrys Plain South	124.3	1.9	An internal investigation determined HVO maximum potential contribution to be in the order of 1.9ug/m3 based on prevailing wind conditions.
21/12/2019	Jerrys Plain North	124.3	3.4	An internal investigation determined HVO maximum potential contribution to be in the order of 3.4ug/m3 based on prevailing wind conditions. 21 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
22/12/2019	Knodlers Lane	51.3	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
22/12/2019	Maison Dieu	50.3	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
22/12/2019	Warkworth	60.0	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.
22/12/2019	Jerrys Plain South	69.8	29.0	An internal investigation determined HVO maximum potential contribution to be in the order of 29.0ug/m3 based on prevailing wind conditions.
22/12/2019	Jerrys Plain North	69.8	17.0	An internal investigation determined HVO maximum potential contribution to be in the order of 17.0ug/m3 based on prevailing wind conditions. 22 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
23/12/2019	Jerrys Plain South	51.6	6.0	An internal investigation determined HVO maximum potential contribution to be in the order of 6.0ug/m3 based on prevailing wind conditions.
23/12/2019	Jerrys Plain North	69.8	2.3	An internal investigation determined HVO maximum potential contribution to be in the order of 2.3ug/m3 based on prevailing wind conditions. 23 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
27/12/2019	Jerrys Plain South	69.4	40.4	An internal investigation determined HVO maximum potential contribution to be in the order of 40.4ug/m3 based on prevailing wind conditions.
27/12/2019	Jerrys Plain North	69.4	14.8	An internal investigation determined HVO maximum potential contribution to be in the order of 14.8ug/m3 based on prevailing wind conditions. 27 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
28/12/2019	Maison Dieu	56.0	3.7	An internal investigation determined HVO maximum potential contribution to be in the order of 3.7ug/m3 based on prevailing wind conditions.
28/12/2019	Warkworth	98.6	41.2	An internal investigation determined HVO maximum potential contribution to be in the order of 41.2ug/m3 based on prevailing wind conditions.
28/12/2019	Jerrys Plain South	62.1	10.1	An internal investigation determined HVO maximum potential contribution to be in the order of 10.0ug/m3 based on prevailing wind conditions.
28/12/2019	Jerrys Plain North	62.1	26.5	An internal investigation determined HVO maximum potential contribution to be in the order of 26.5ug/m3 based on prevailing wind conditions. 28 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
29/12/2019	Knodlers Lane	54.5	2.0	An internal investigation determined HVO maximum potential contribution to be in the order of 2.0ug/m3 based on prevailing wind conditions.
29/12/2019	Maison Dieu	57.4	3.4	An internal investigation determined HVO maximum potential contribution to be in the order of 3.4ug/m3 based on prevailing wind conditions.
29/12/2019	Warkworth	64.1	18.8	An internal investigation determined HVO maximum potential contribution to be in the order of 18.8ug/m3 based on prevailing wind conditions.

Date	Site	Total Measured Result (µg/m3)	Estimated contribution from HVO (µg/m3 / %)	Discussion
29/12/2019	Jerrys Plain South	70.6	23.4	An internal investigation determined HVO maximum potential contribution to be in the order of 23.4ug/m3 based on prevailing wind conditions.
29/12/2019	Jerrys Plain North	70.6	7.1	An internal investigation determined HVO maximum potential contribution to be in the order of 7.1ug/m3 based on prevailing wind conditions. 29 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
30/12/2019	Knodlers Lane	66.7	17.6	An internal investigation determined HVO maximum potential contribution to be in the order of 17.6ug/m3 based on prevailing wind conditions.
30/12/2019	Maison Dieu	87.4	27.7	An internal investigation determined HVO maximum potential contribution to be in the order of 27.7ug/m3 based on prevailing wind conditions.
30/12/2019	Warkworth	81.9	13.4	An internal investigation determined HVO maximum potential contribution to be in the order of 13.4ug/m3 based on prevailing wind conditions.
30/12/2019	Jerrys Plain South	94.0	11.7	An internal investigation determined HVO maximum potential contribution to be in the order of 11.7ug/m3 based on prevailing wind conditions.
30/12/2019	Jerrys Plain North	94.0	15.1	An internal investigation determined HVO maximum potential contribution to be in the order of 15.1ug/m3 based on prevailing wind conditions. 30 December appeared to be affected by regional bushfire smoke, the results are therefore deemed affected by an extraordinary event.
31/12/2019	Knodlers Lane	125.7	30.0	An internal investigation determined HVO maximum potential contribution to be in the order of 30.0ug/m3 based on prevailing wind conditions.
31/12/2019	Maison Dieu	119.1	42.2	An internal investigation determined HVO maximum potential contribution to be in the order of 42.2ug/m3 based on prevailing wind conditions.
31/12/2019	Warkworth	98.6	41.2	An internal investigation determined HVO maximum potential contribution to be in the order of 41.2ug/m3 based on prevailing wind conditions.
31/12/2019	Jerrys Plain South	103.6	3.4	An internal investigation determined HVO maximum potential contribution to be in the order of 3.4ug/m3 based on prevailing wind conditions.
31/12/2019	Jerrys Plain North	103.6	0.0	An internal investigation determined HVO maximum potential contribution to be in the order of 0.0ug/m3 based on prevailing wind conditions.

2.2.4 Real Time Alarms for Air Quality

During December the real time monitoring system generated 581 automated air quality related alarms. 156 alarms were related to adverse weather conditions and 425 alarms relating to PM_{10}.

3.0 WATER QUALITY

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

3.1 Surface Water

Surface water courses are sampled on a quarterly sampling regime. Water quality is evaluated through the parameters of pH, Electrical Conductivity (EC) and Total Suspended Solids (TSS). The location of surface water monitoring locations is shown in Figure 10.

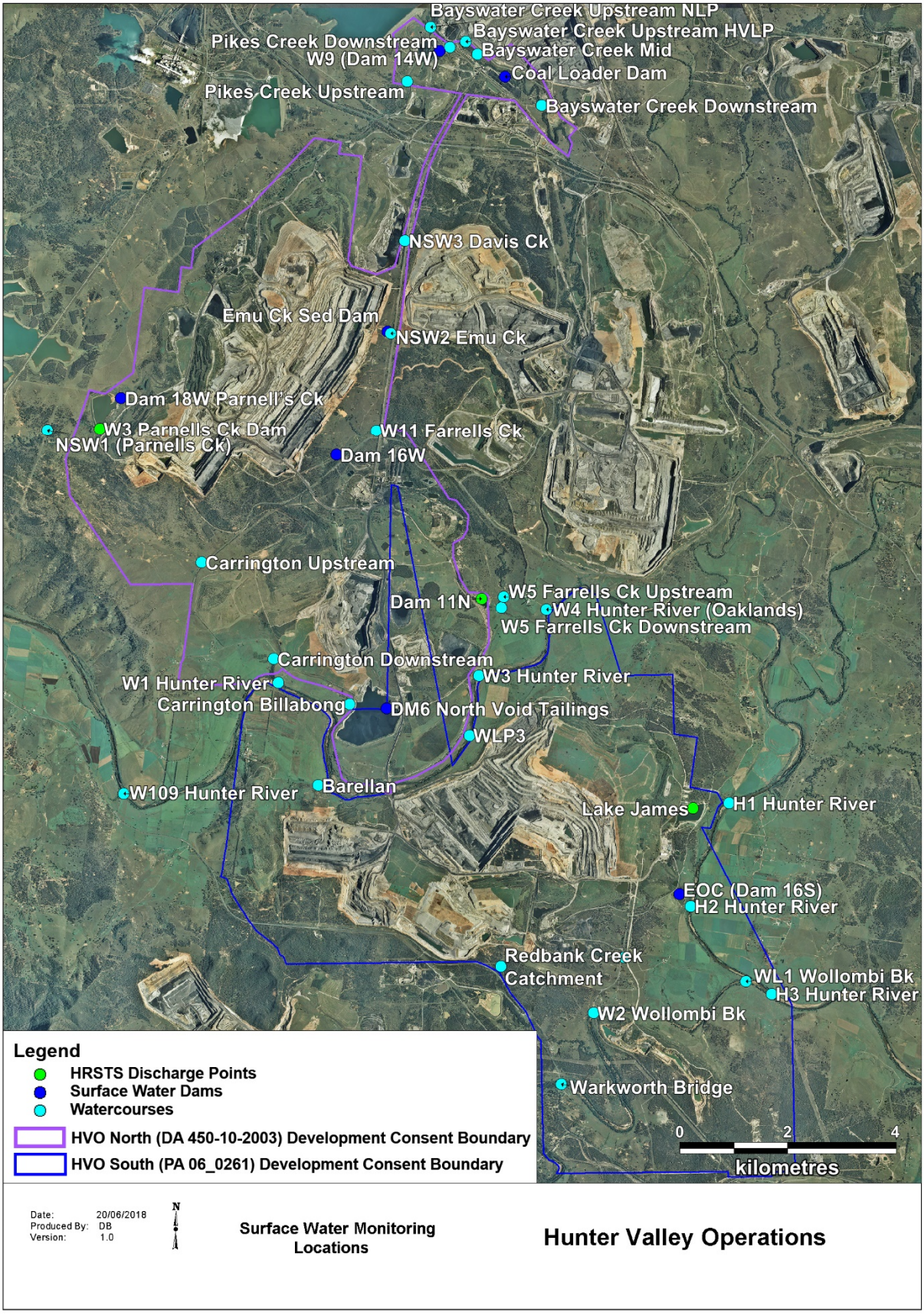

Figure 10: HVO Surface Water Monitoring Locations

Figure 11 to Figure 13 show the long term surface water trend (2016- current) within HVO mine dams. Figures 14 to 22 show the long term surface water trend (2016 – current) in surrounding watercourses.

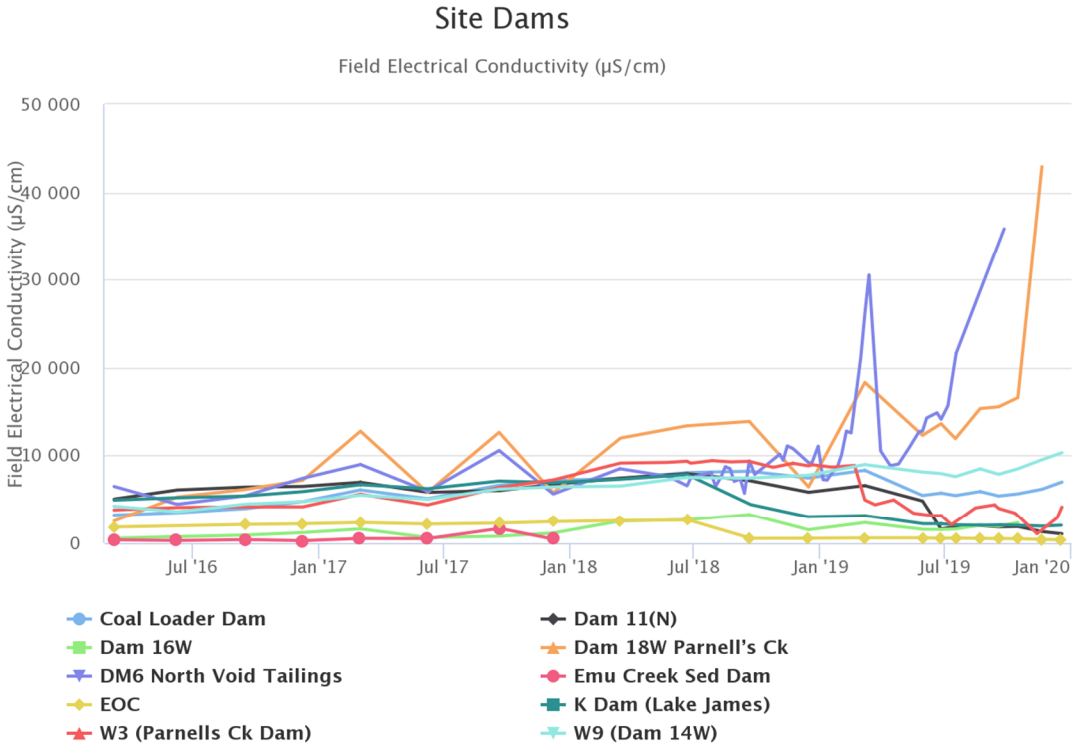

Figure 11: Site Dams Electrical Conductivity Trend – December 2019

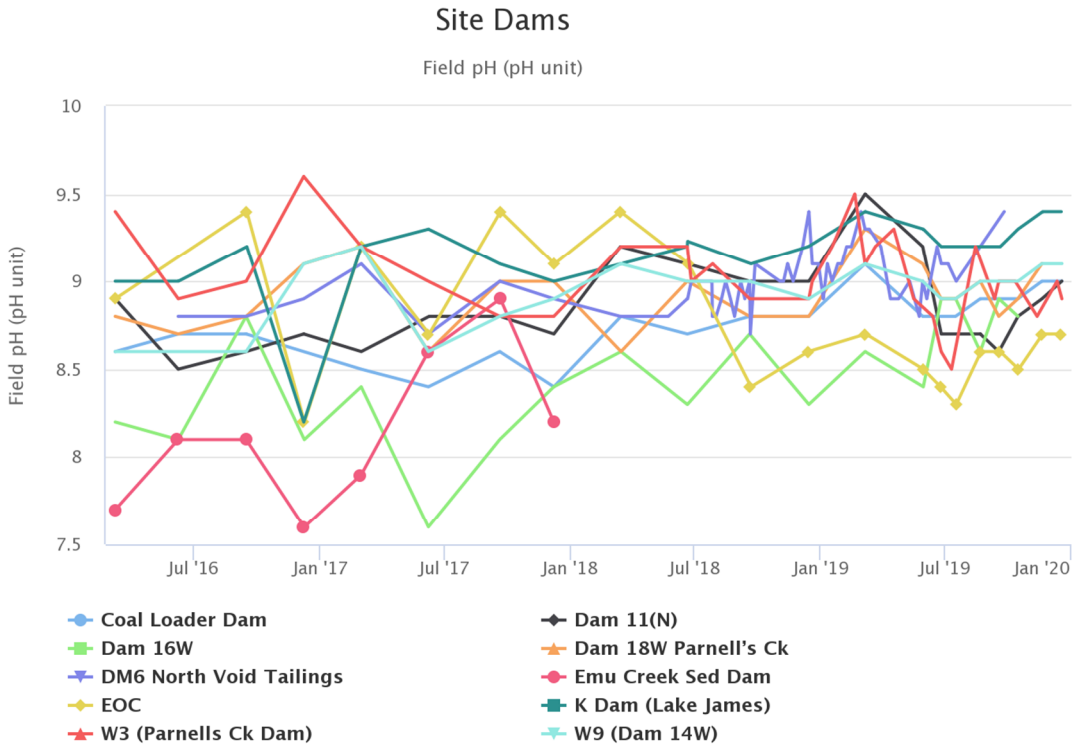

Figure 12: Site Dams pH Trend – December 2019

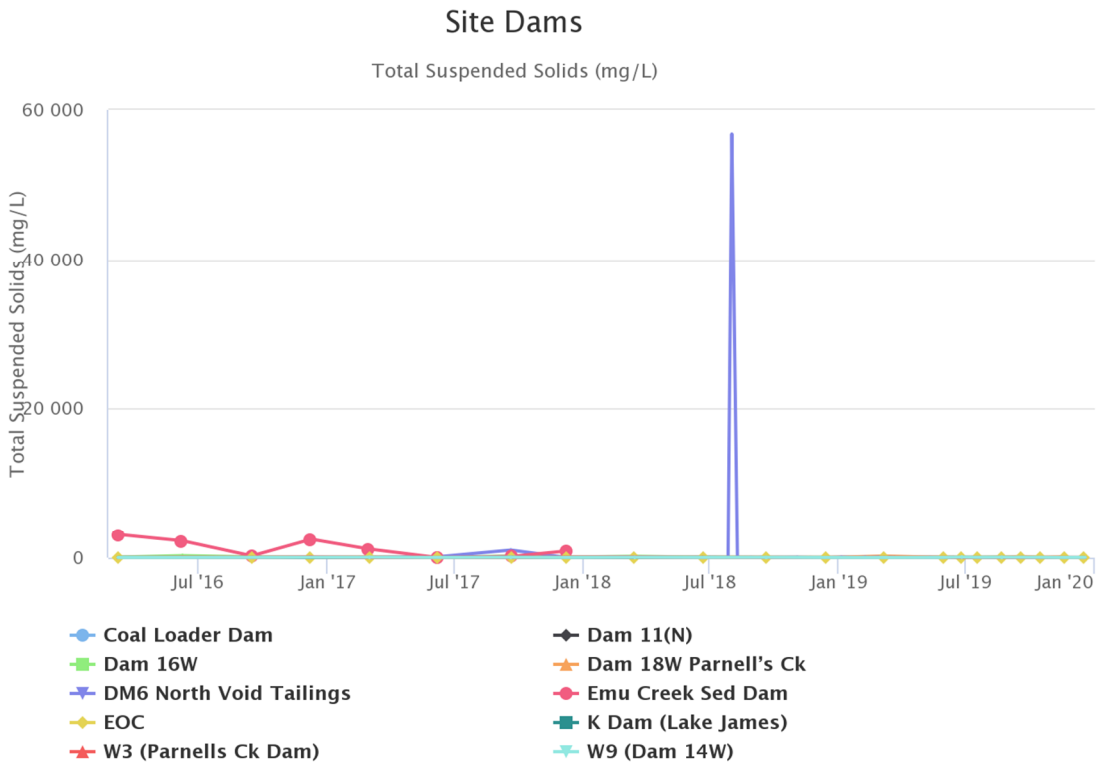

Figure 13: Site Dams Total Suspended Solids Trend – December 2019

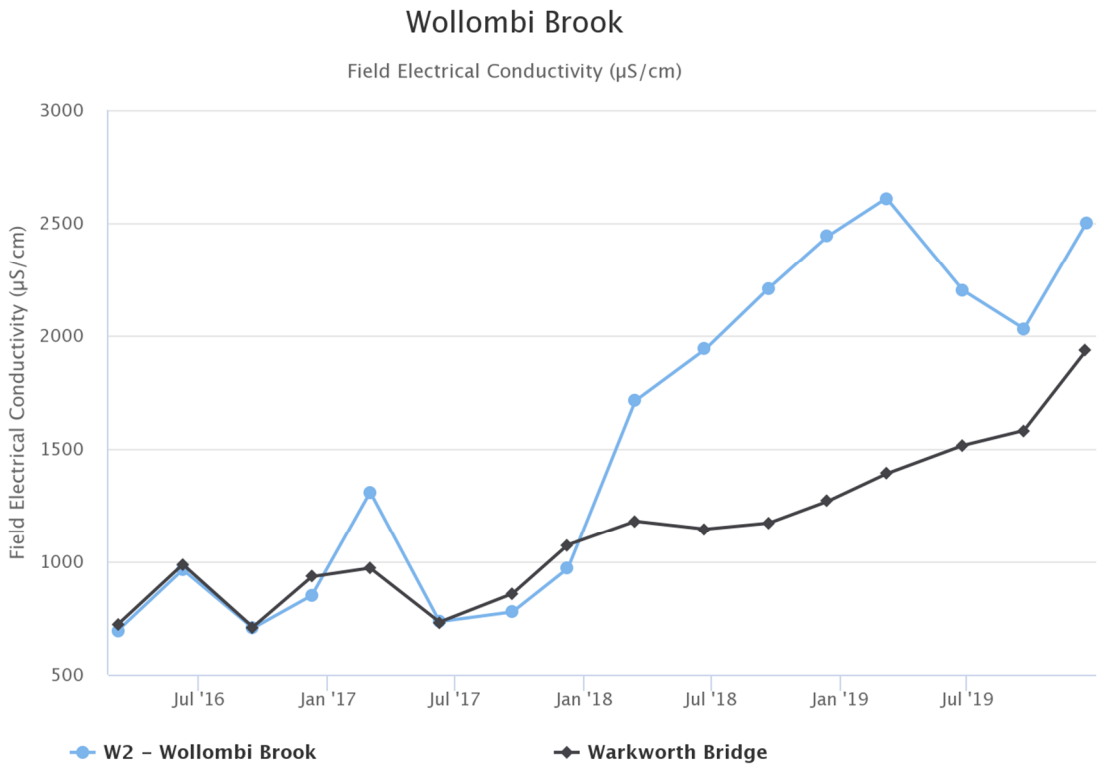

Figure 14: Wollombi Brook Electrical Conductivity Trend – December 2019

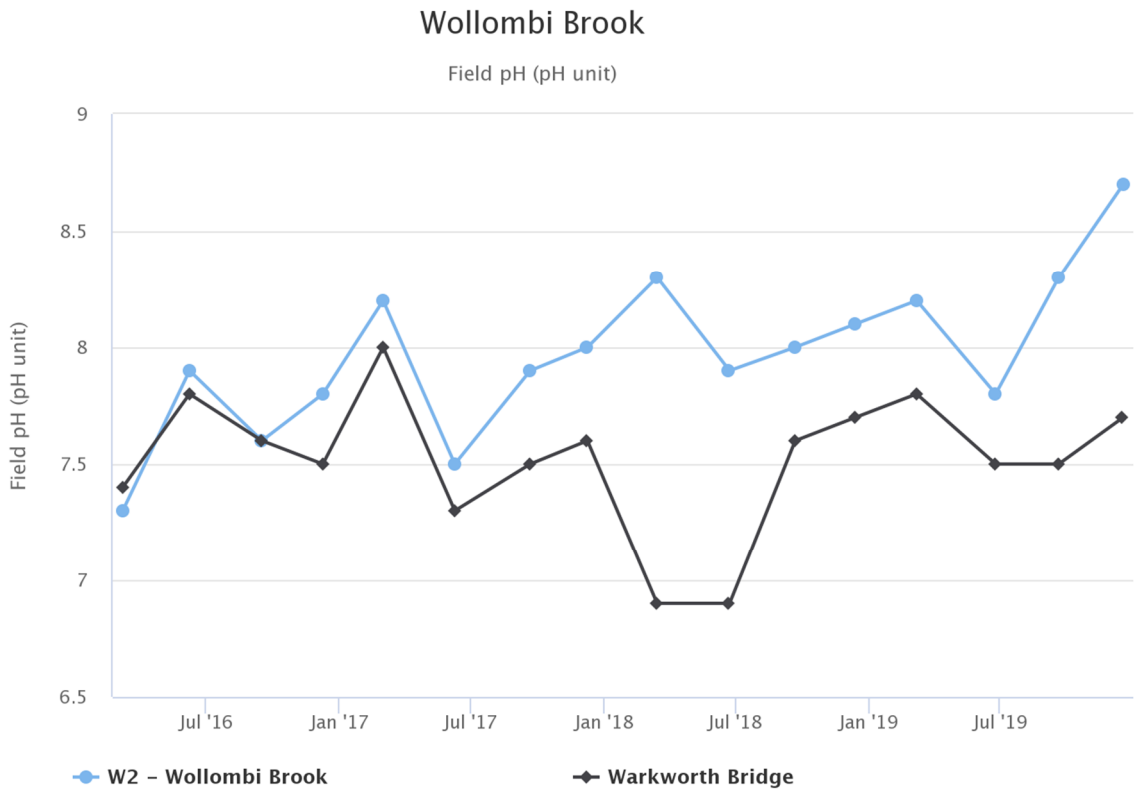

Figure 15: Wollombi Brook pH Trend – December 2019

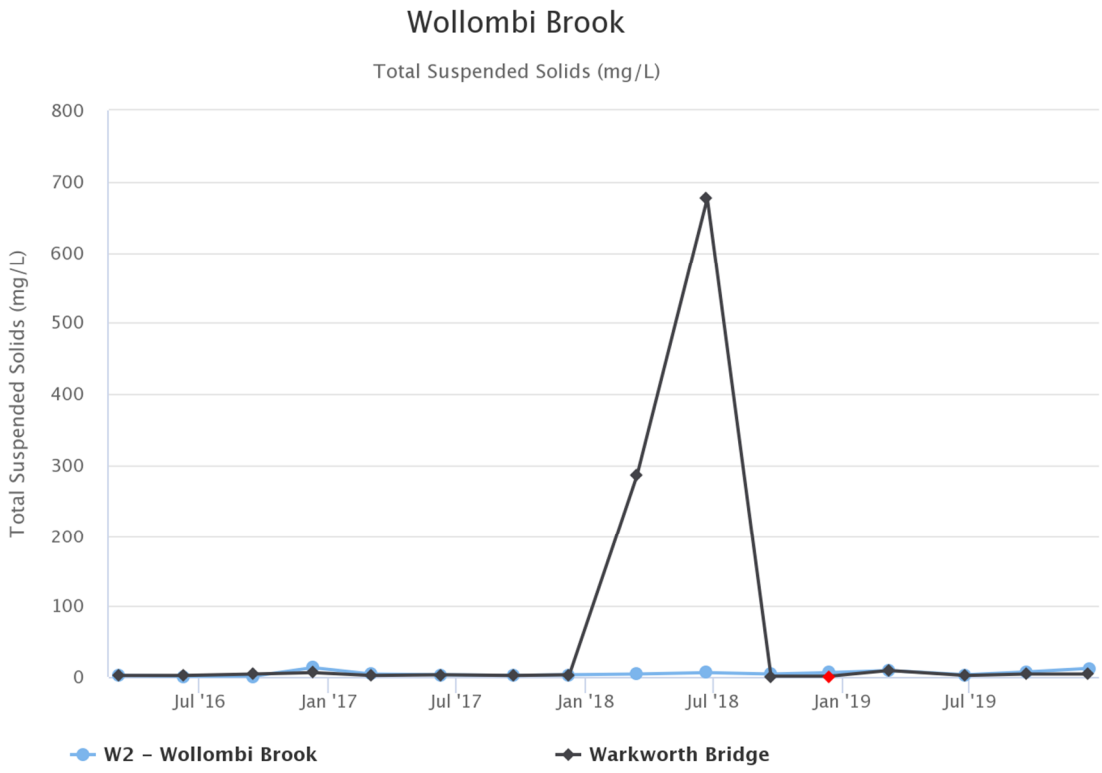

Figure 16: Wollombi Brook Total Suspended Solids Trend – December 2019

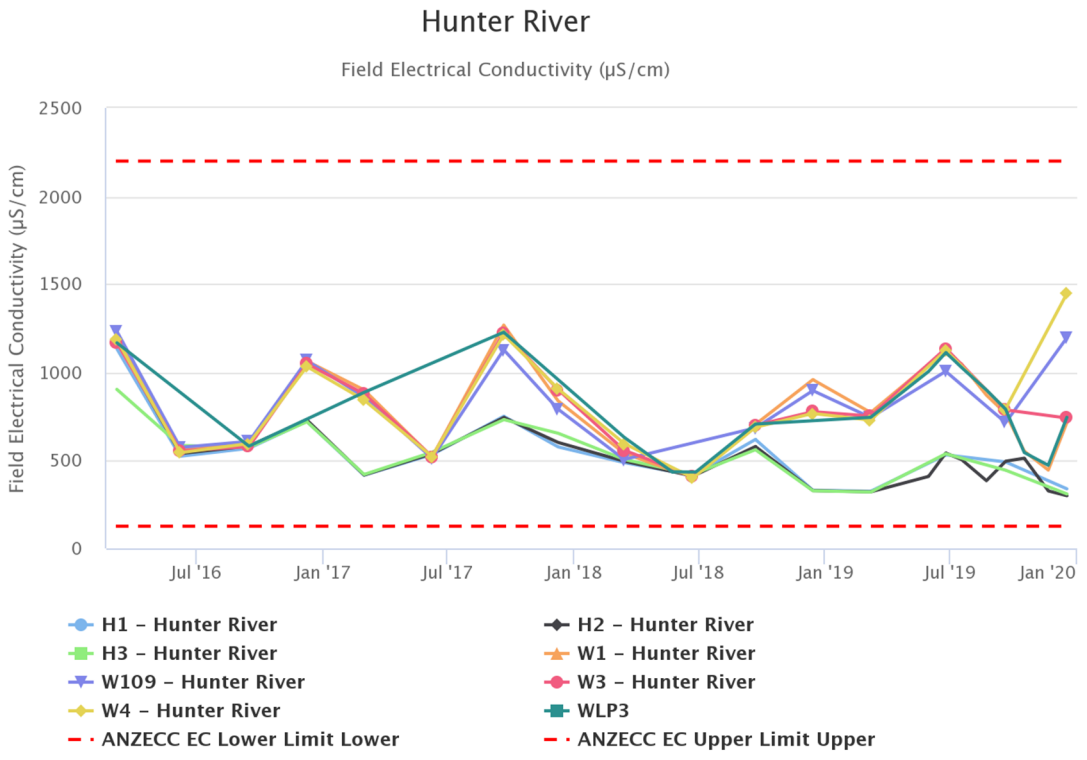

Figure 17: Hunter River Electrical Conductivity Trend – December 2019

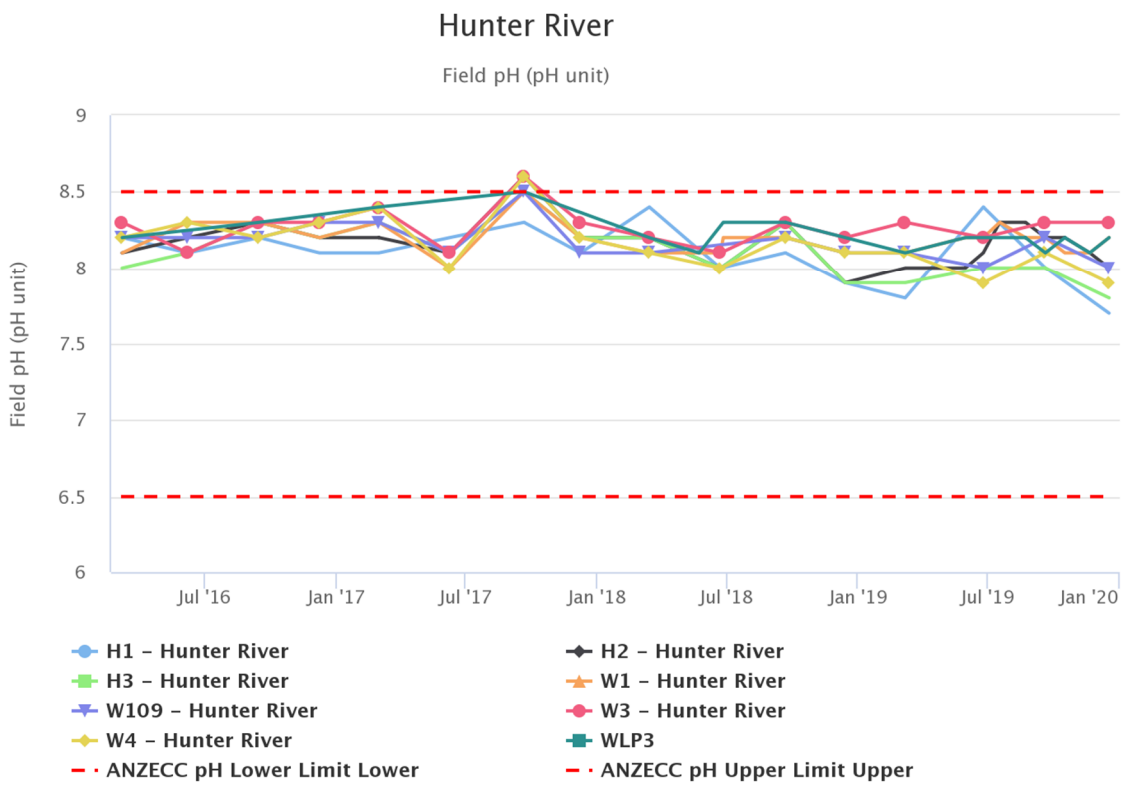

Figure 18: Hunter River pH Trend – December 2019

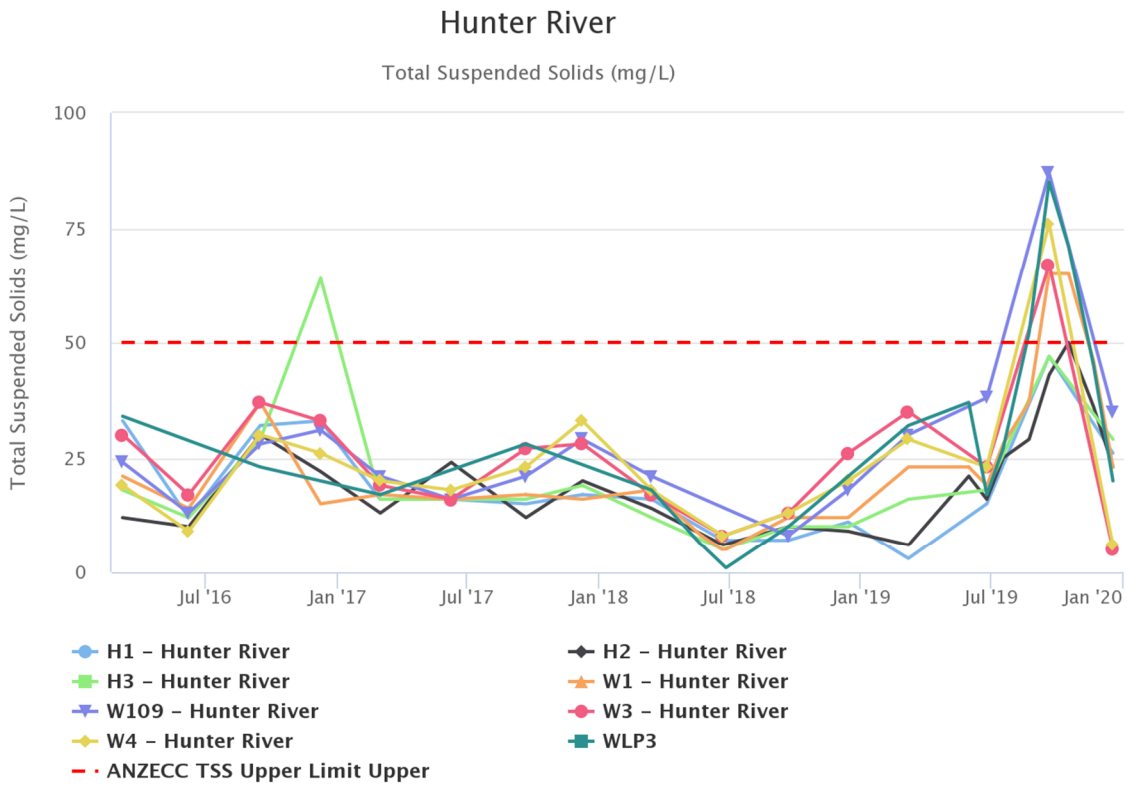

Figure 19: Hunter River Total Suspended Solids – December 2019

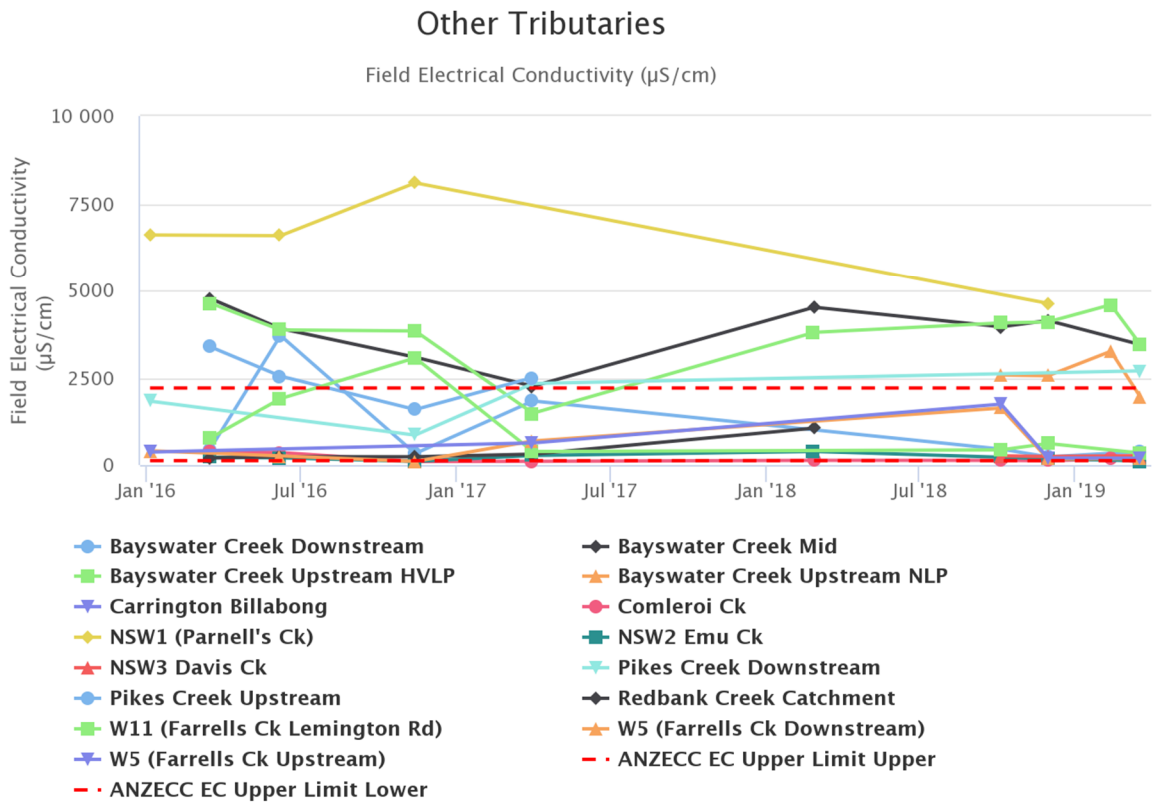

Figure 20: Other Tributaries Electrical Conductivity Trend – December 2019

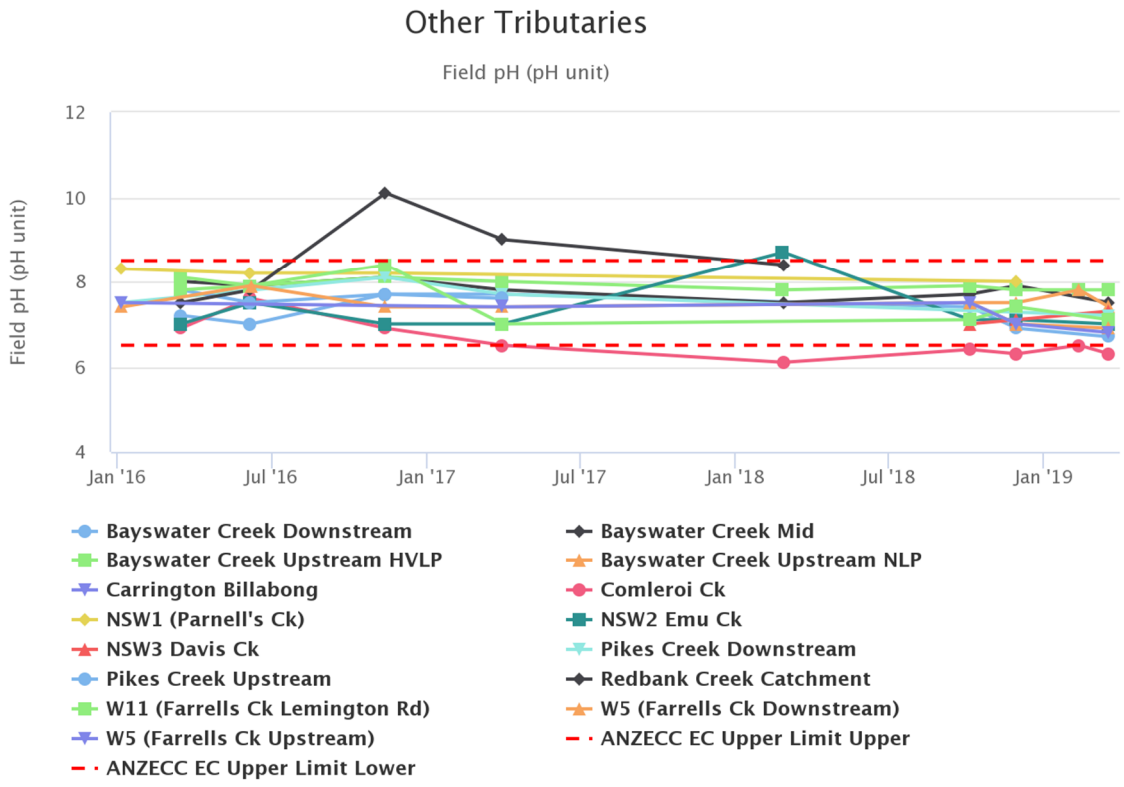

Figure 21: Other Tributaries pH Trend – December 2019

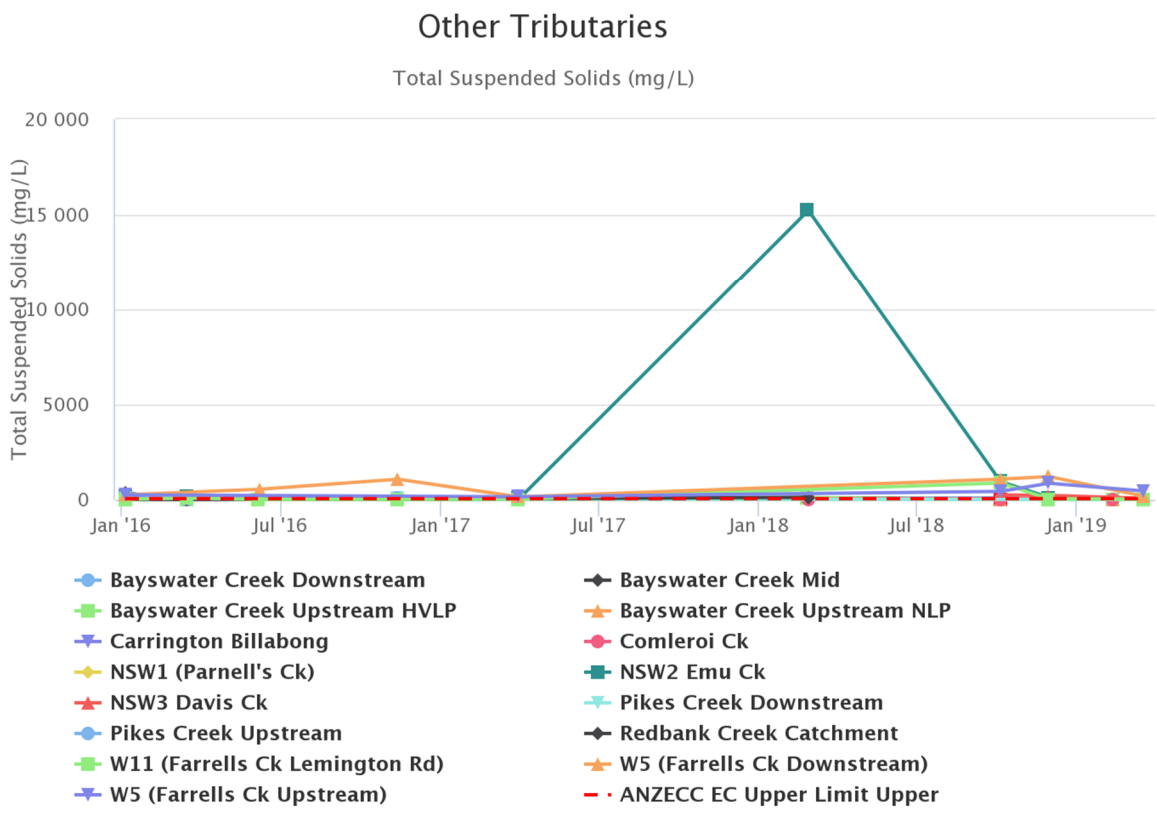

Figure 22: Other Tributaries Total Suspended Solids Trend – December 2019

3.2 Site Water Use

Under water allocation licences issued by the Water NSW, HVO is permitted to extract water from the Hunter River. During the reporting period, HVO extracted 437.4 ML of water from the Hunter River.

3.3 HRSTS Discharge

HVO participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from licensed discharge points Dam 11N (to Farrell's Creek), Lake James (to the Hunter River) and Parnell's Dam (to Parnell's Creek). Discharges can only take place subject to HRSTS regulations.

During the reporting period no water was discharged under the HRSTS.

3.4 Surface Water Trigger Limits

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 HVO Water Management Plan.

Current internal trigger limits that have been breached are summarised in Table 3.

Table 3: Surface Water Trigger Limit Summary – Q4 2019

Site	Date	Trigger Limit Breached	Action taken in response
W4 - Hunter River	17/12/2019 7:45	pH – 5th percentile	First Exceedance. Watching Brief
W4 - Hunter River	17/12/2019 7:45	EC – 95th percentile	First Exceedance. Watching Brief
H1 - Hunter River	17/12/2019 7:10	pH - 5th percentile	First Exceedance. Watching Brief
Warkworth Bridge	17/12/2019 9:55	EC – 95th percentile	Ninth exceedance of EC 95th Percentile trigger (1935us/cm). Field observations indicate that sample was taken from a pool of water as there was no flow in the Brook. Downstream monitoring (WL1) indicated still water and lower EC level (442us/cm). Based on this it can be assumed that the sample taken is not representative of flows in the Brook and that there is no impact to suggest mining influence. Maintain watching Brief*
W2 - Wollombi Brook	17/12/2019 10:55	pH - 95th percentile	First Exceedance. Watching Brief
W2 - Wollombi Brook	17/12/2019 10:55	EC – 95th percentile	Eighth exceedance of EC 95th Percentile trigger (2500us/cm). Field observations indicate that sample was taken from a pool of water as there was no flow in the Brook. Downstream monitoring (WL1) indicated still water and lower EC level (442us/cm). Based on this it can be assumed that the sample taken is not representative of flows in the Brook and that there is no impact to suggest mining influence. Maintain watching Brief*
WL1	17/12/2019 10:20	TSS	Second Breach of TSS Trigger. Field observations indicate that the water at the sampling site was still and slightly turbid when the sample was taken. Observation at the downstream monitoring location (H3 in the Hunter) indicate the water was flowing slowly and was slightly turbid. Downstream results (29mg/L) at better water quality than that measured at WL1 indicating that the TSS results may be isolated to a local source to the sampling location and not from a broader impact. Maintain Watching Brief*

* = Watching Brief established pending outcomes of subsequent monitoring events. No further action required.

3.4 Groundwater Monitoring Results

Groundwater monitoring is undertaken on a quarterly basis in accordance with the HVO Water Management Plan and Ground Water Monitoring Programme. Groundwater monitoring sites are shown in Figure 23. Figure 24 to Figure 80 show the long term trends (2016 – current) for ground water bores monitored at HVO.

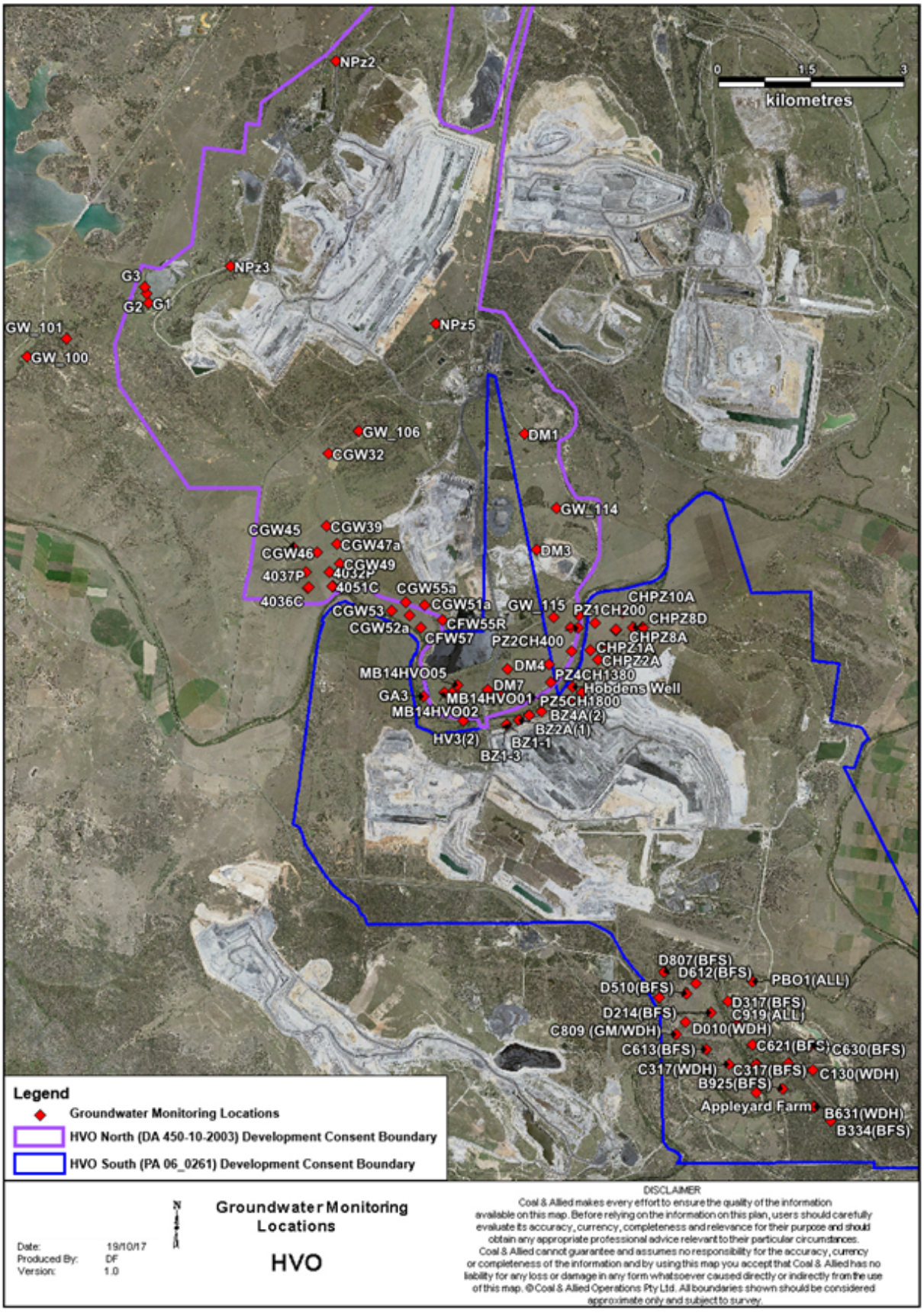

Figure 23: Groundwater Monitoring Locations at HVO

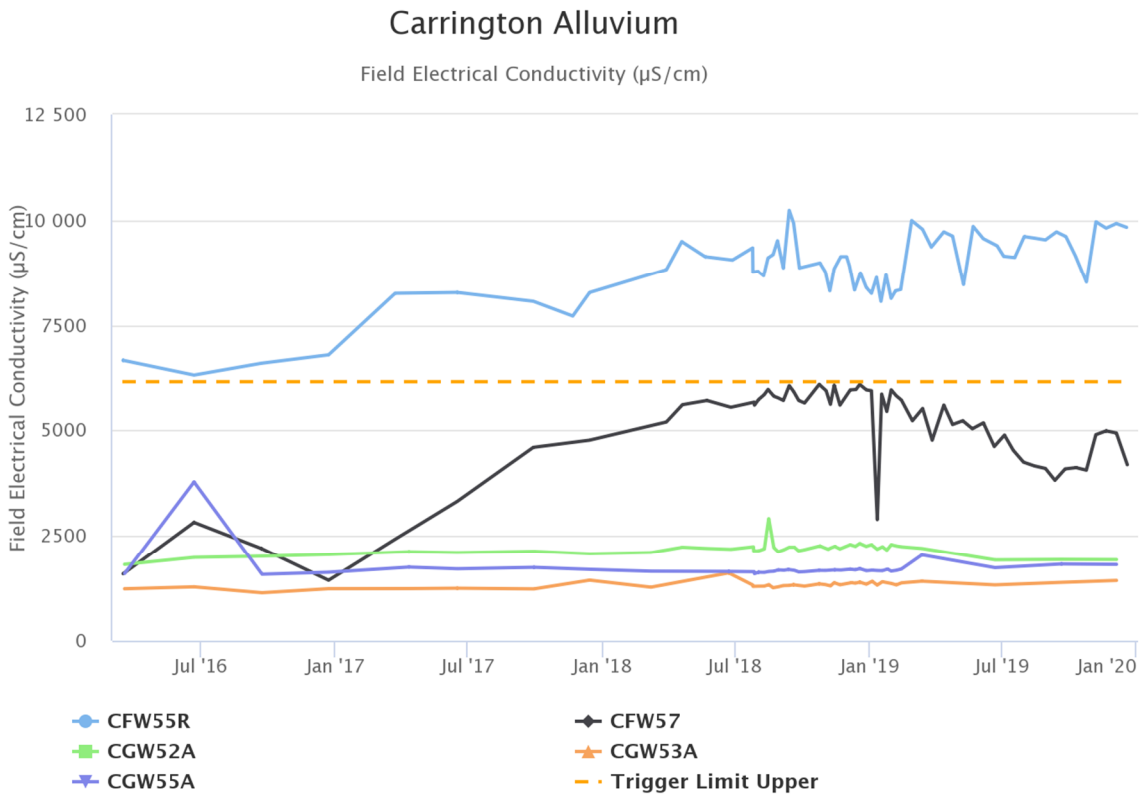

Figure 24: Carrington Alluvium Electrical Conductivity Trend –December 2019

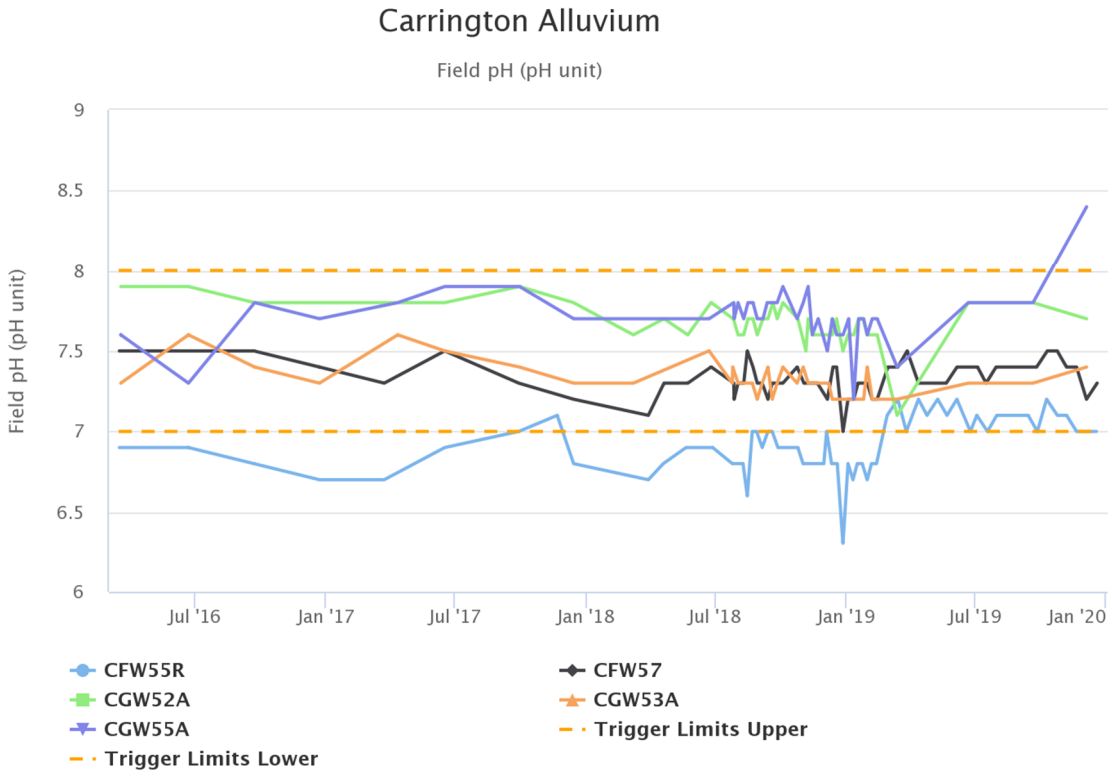

Figure 25: Carrington Alluvium pH Trend – December 2019

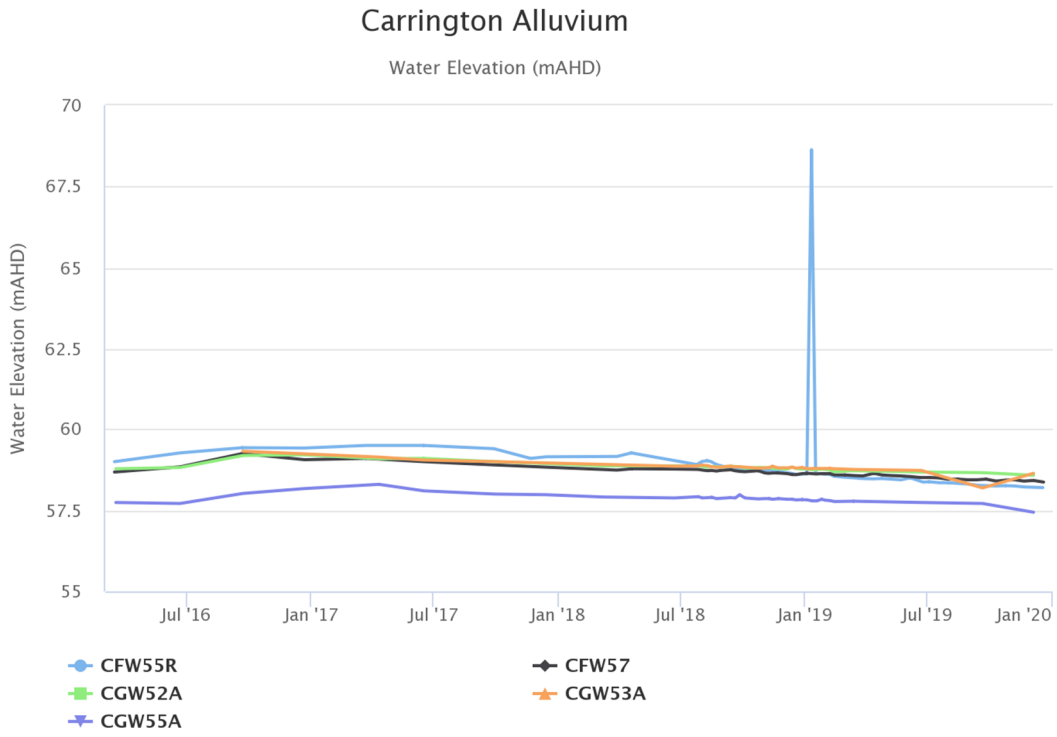

Figure 26: Carrington Alluvium Standing Water Level – December 2019

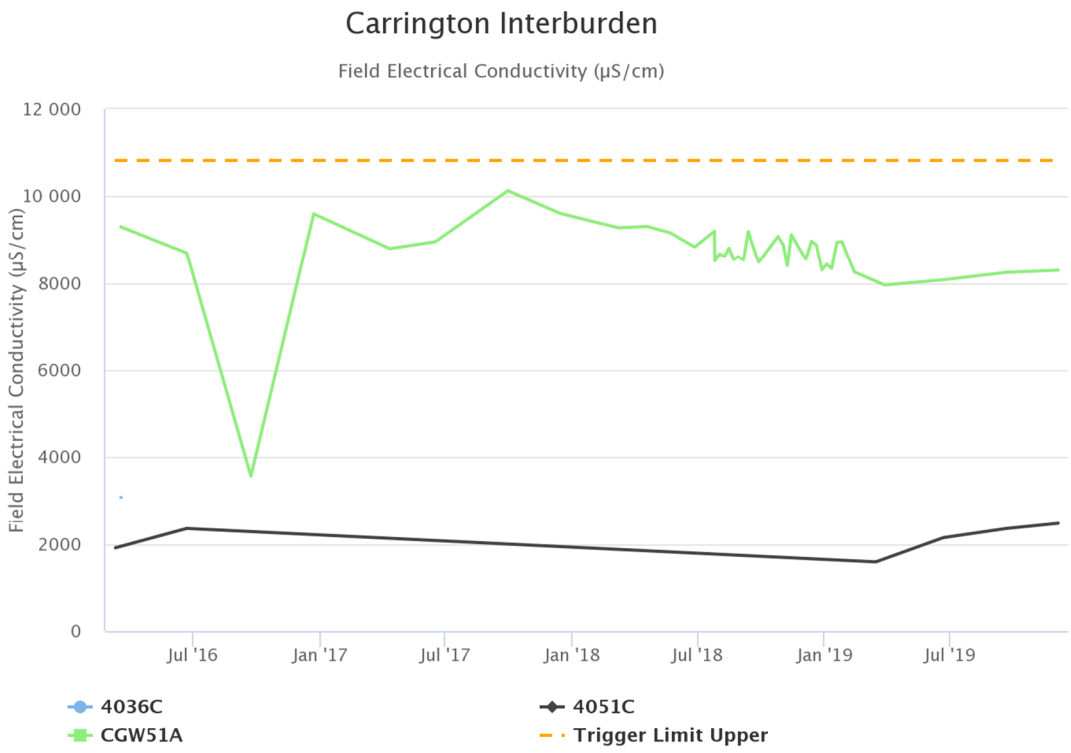

Figure 27: Carrington Interburden Electrical Conductivity Trend – December 2019

Note that 4036C has been dry since June 2018

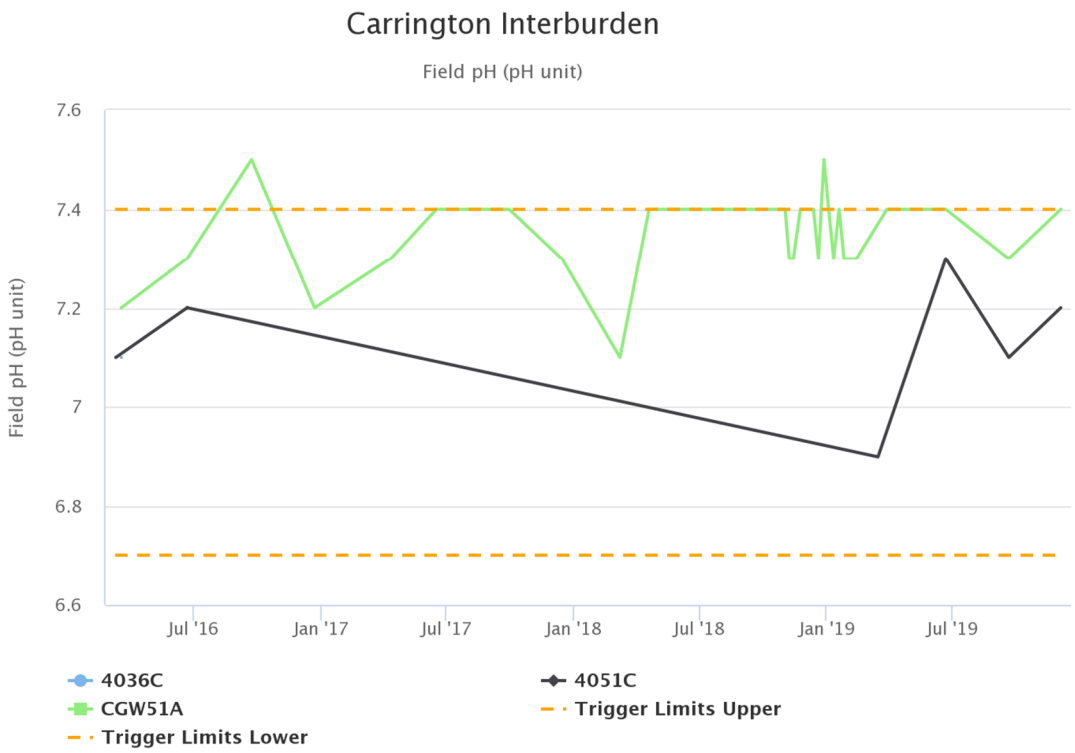

Figure 28: Carrington Interburden pH Trend – December 2019

Note that 4036C has been dry since June 2018

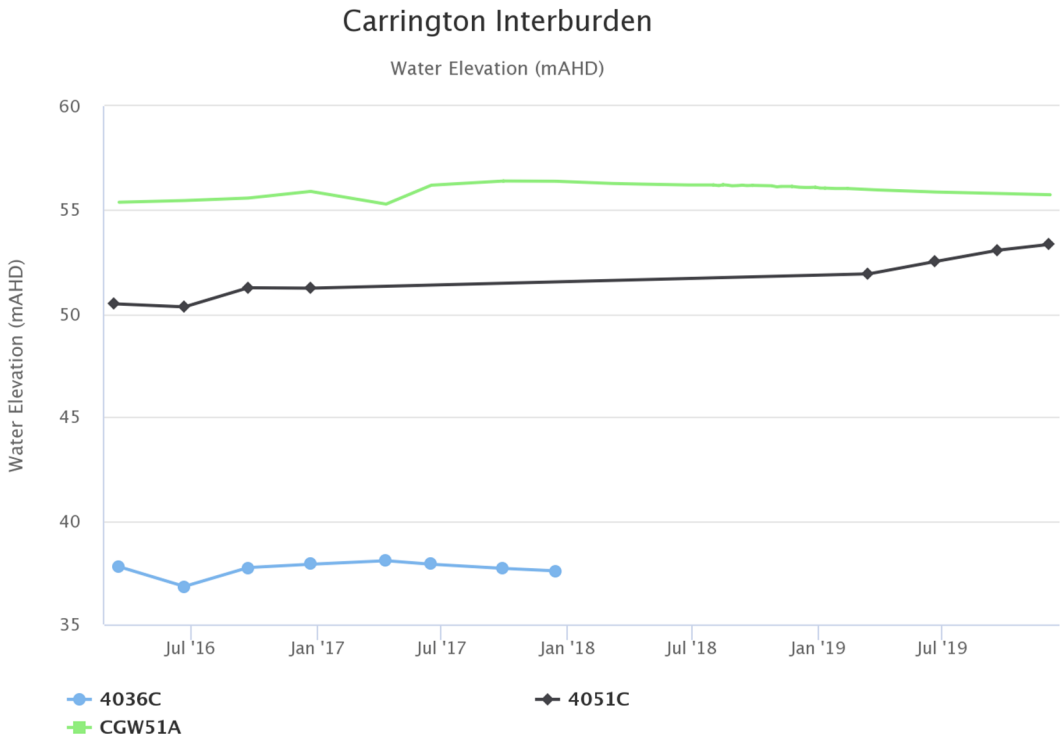

Figure 29: Carrington Interburden Standing Water Level – December 2019

Note that 4036C has been dry since June 2018

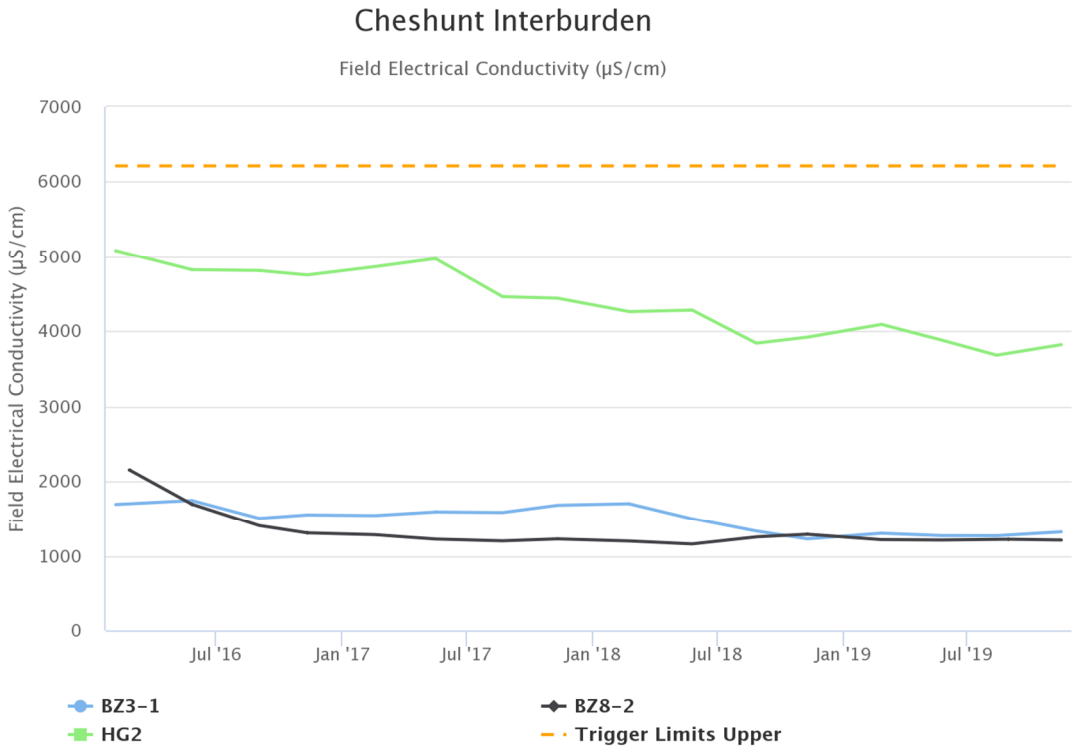

Figure 30: Cheshunt Interburden Electrical Conductivity Trend – December 2019

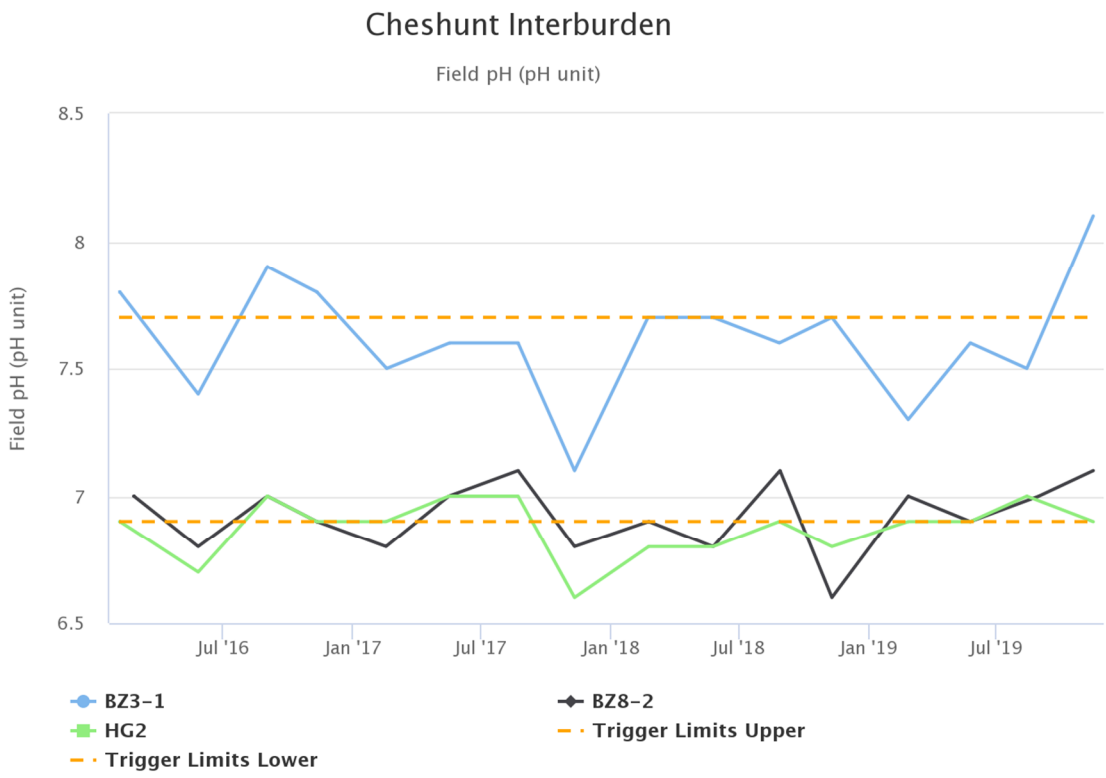

Figure 31: Cheshunt Interburden pH Trend – December 2019

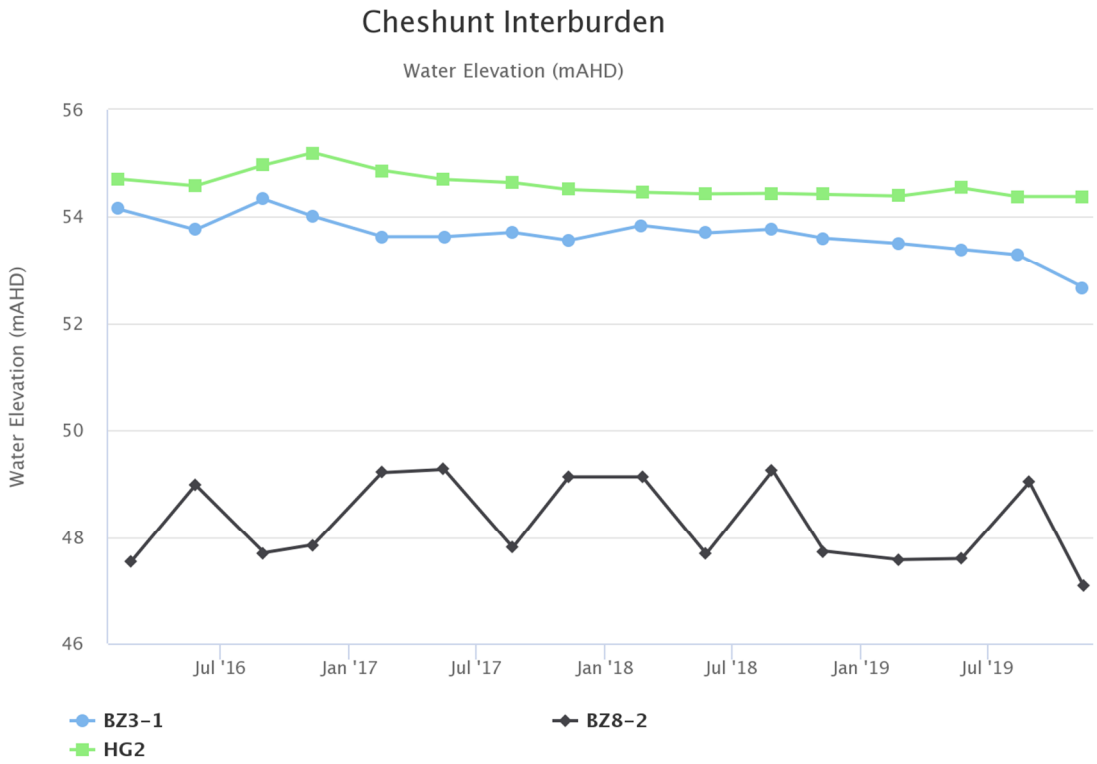

Figure 32: Cheshunt Interburden Standing Water Level – December 2019

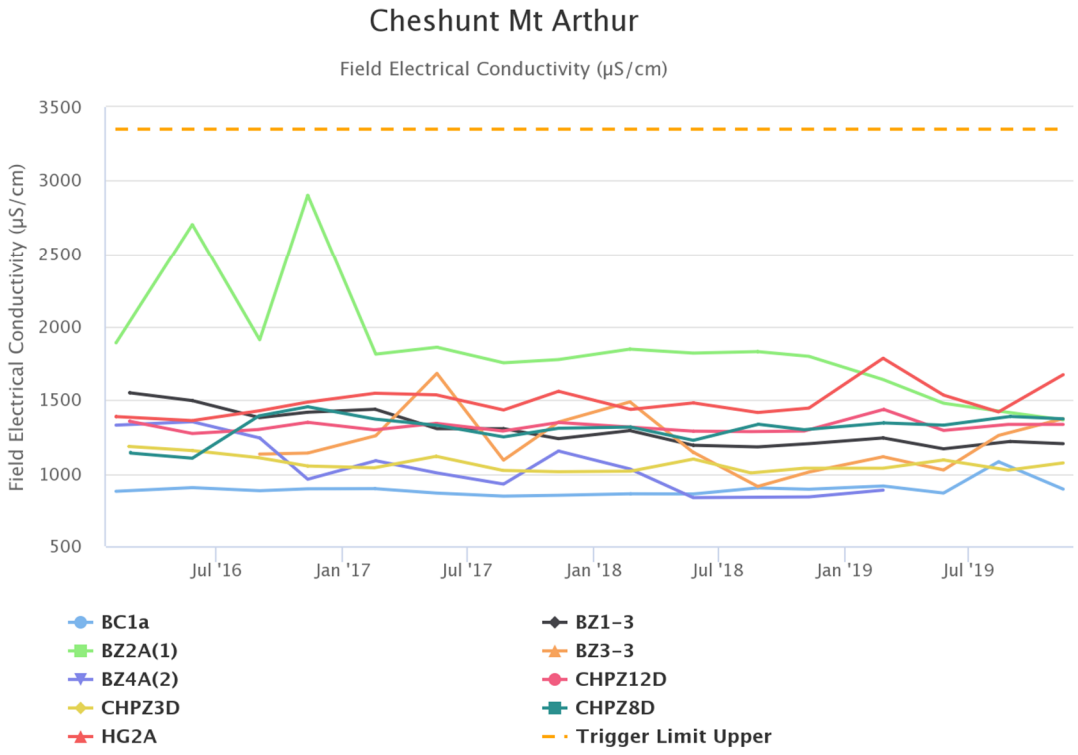

Figure 33: Cheshunt Mt Arthur Electrical Conductivity Trend – December 2019

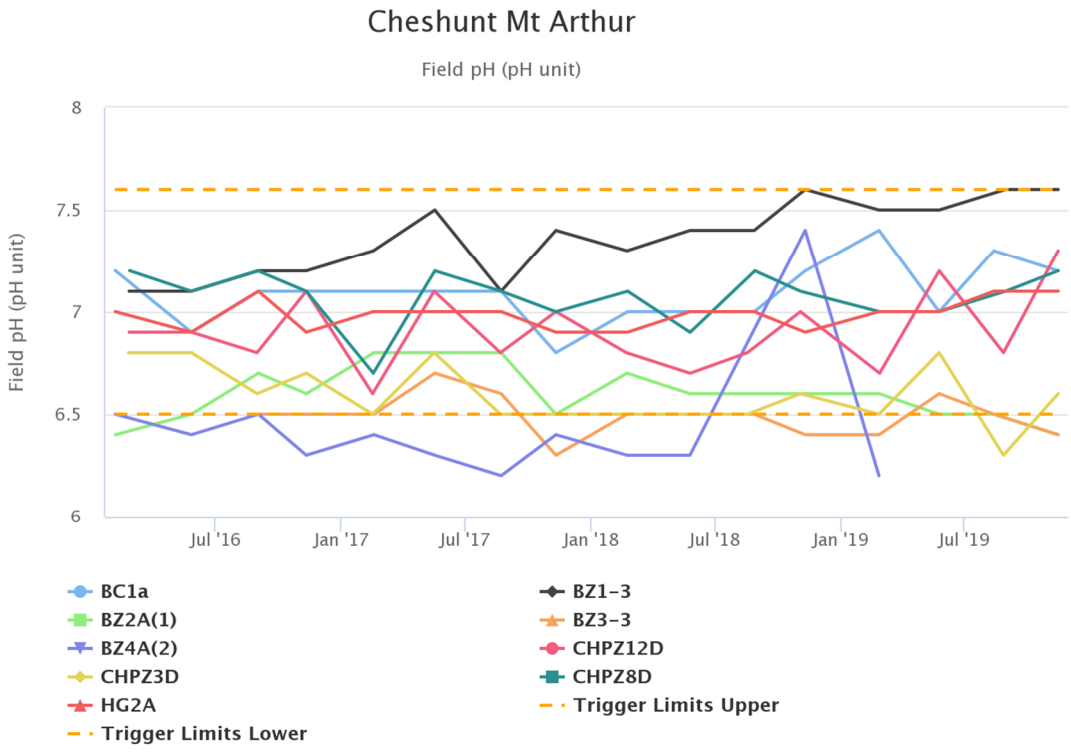

Figure 34: Cheshunt Mt Arthur pH Trend – December 2019

Note insufficient water recorded for November 2019 sample

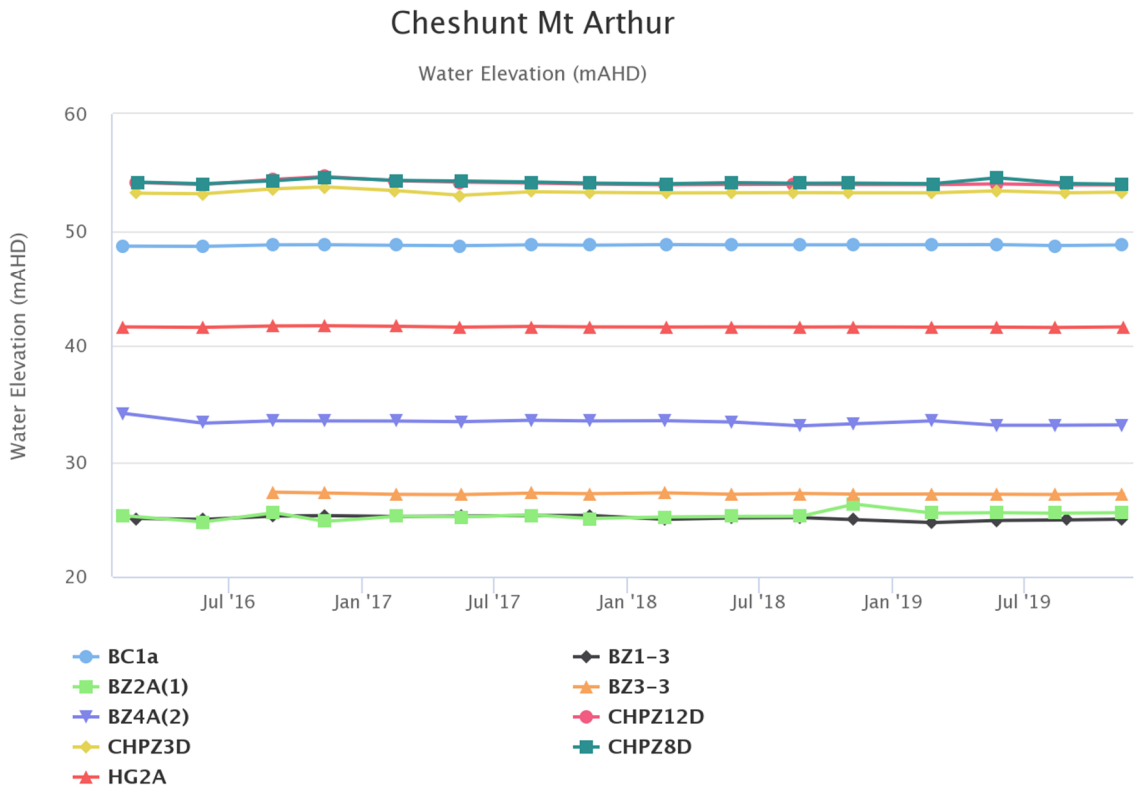

Figure 35: Cheshunt Mt Arthur Standing Water Level – December 2019

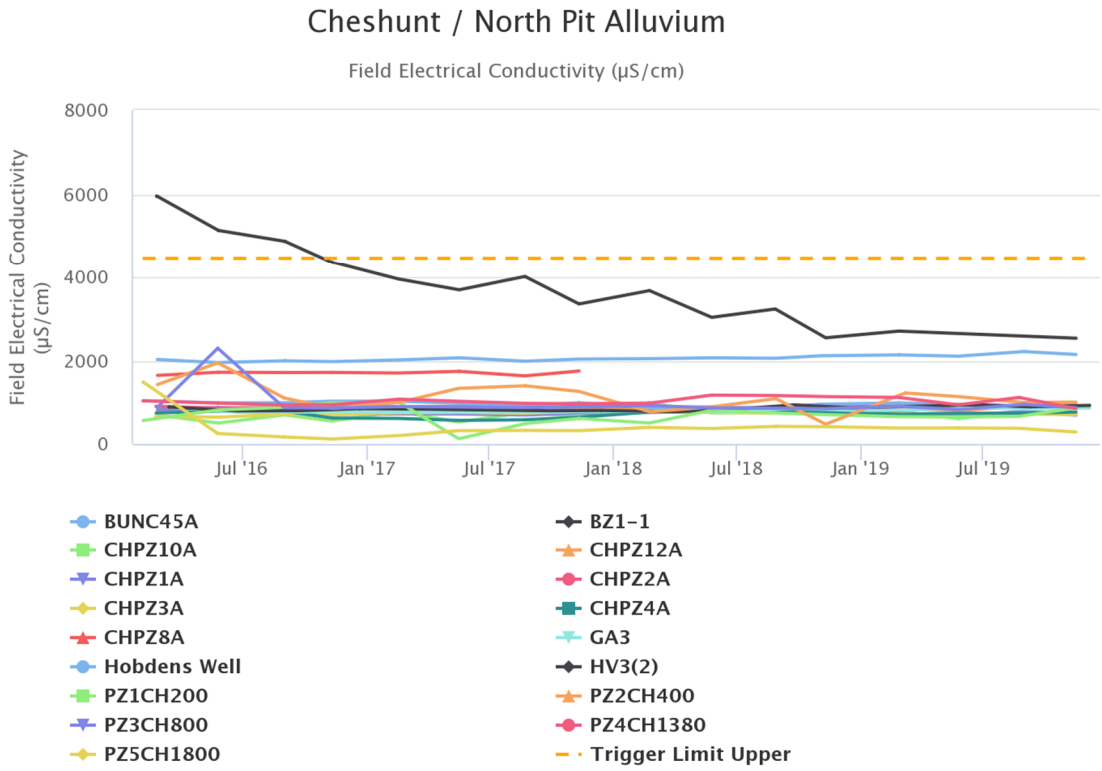

Figure 36: Cheshunt / North Pit Alluvium Electrical Conductivity Trend – December 2019

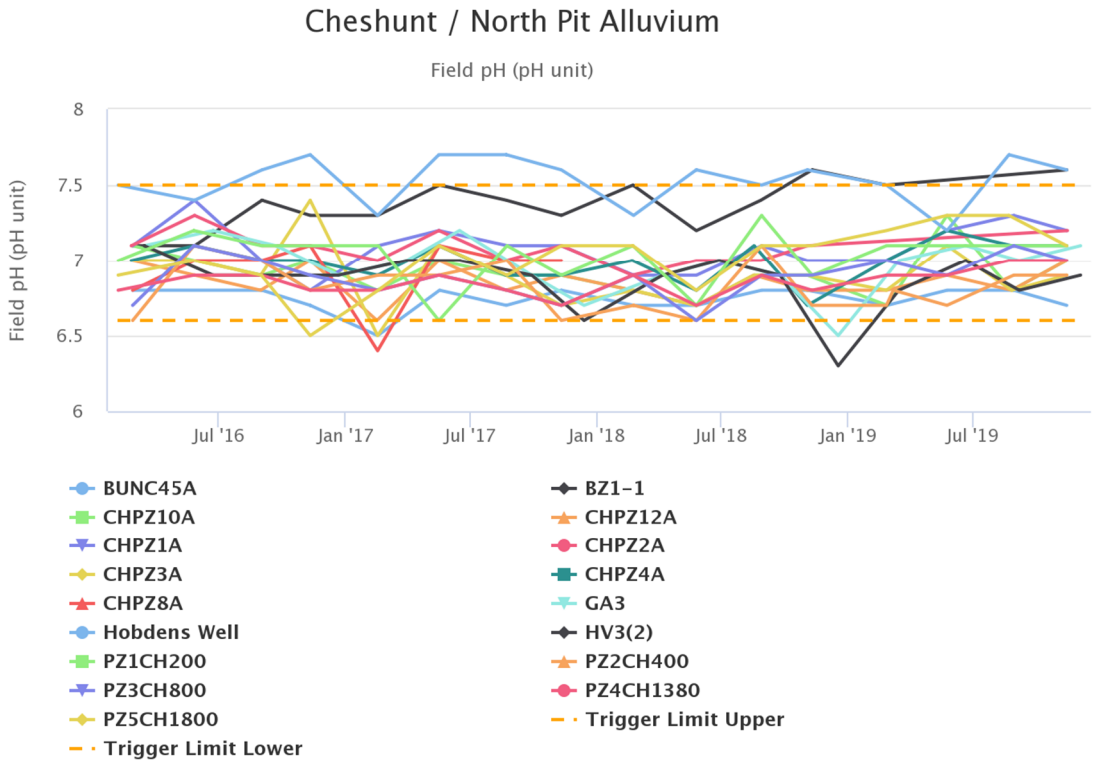

Figure 37: Cheshunt / North Pit Alluvium pH Trend – December 2019

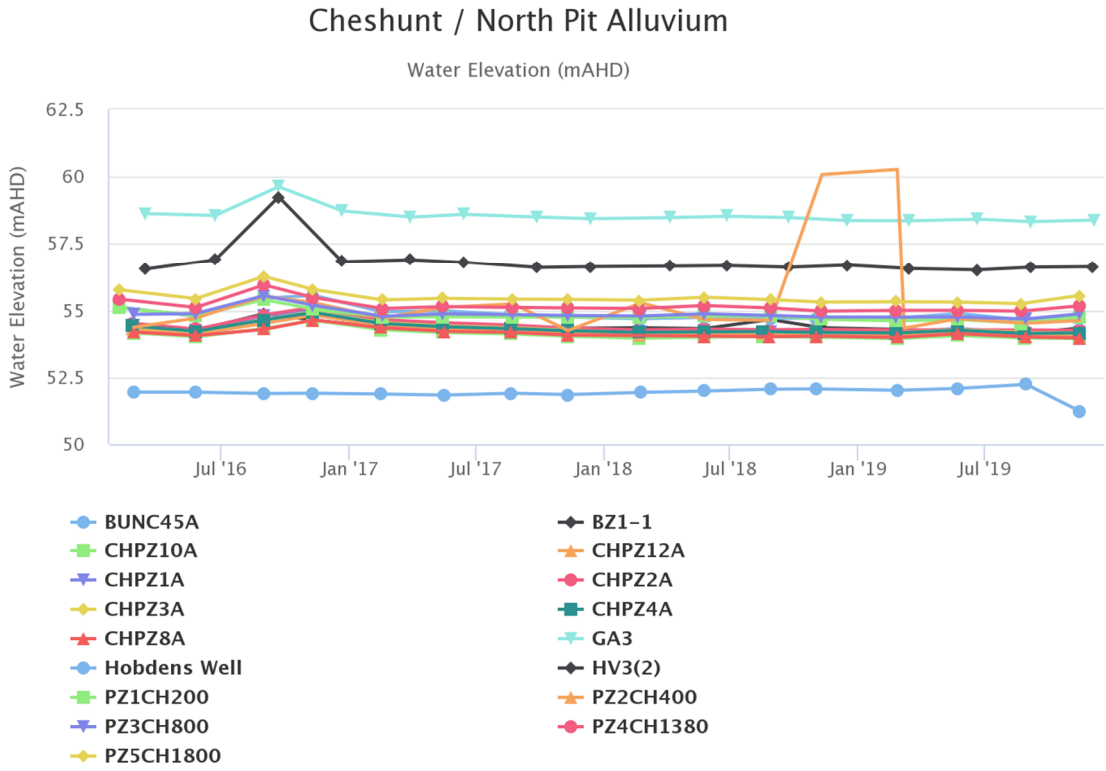

Figure 38: Cheshunt / North Pit Alluvium Standing Water Level – December 2019

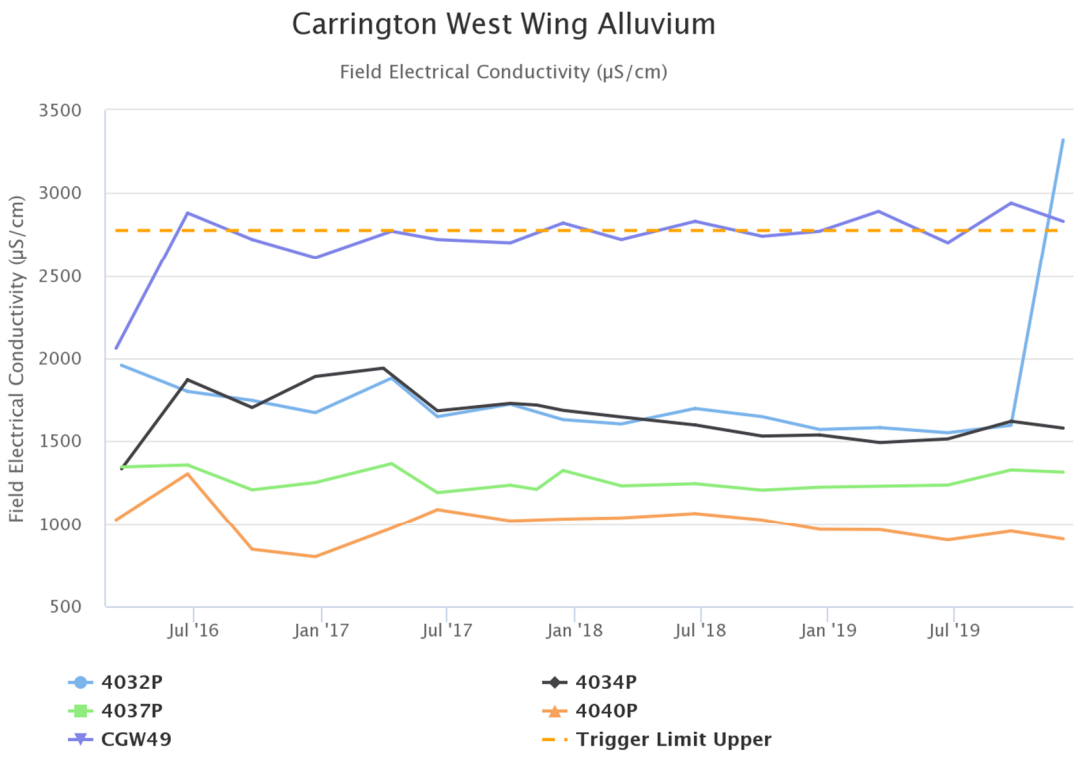

Figure 39: Carrington West Wing Alluvium Electrical Conductivity Trend – December 2019

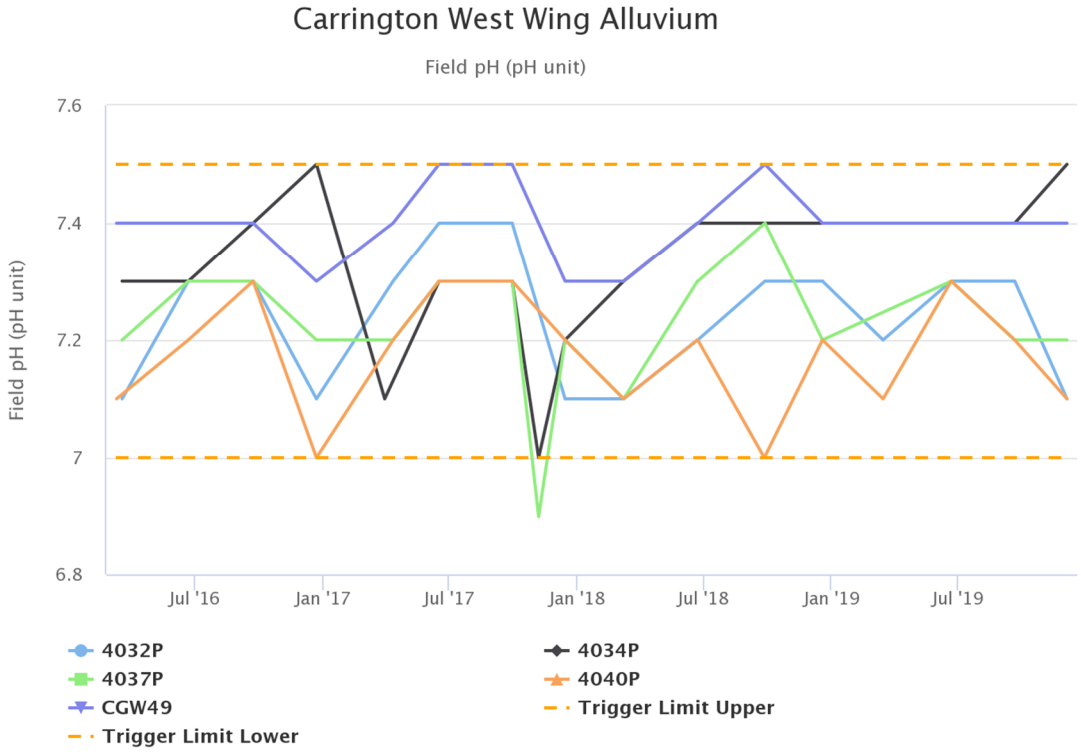

Figure 40: Carrington West Wing Alluvium pH Trend – December 2019

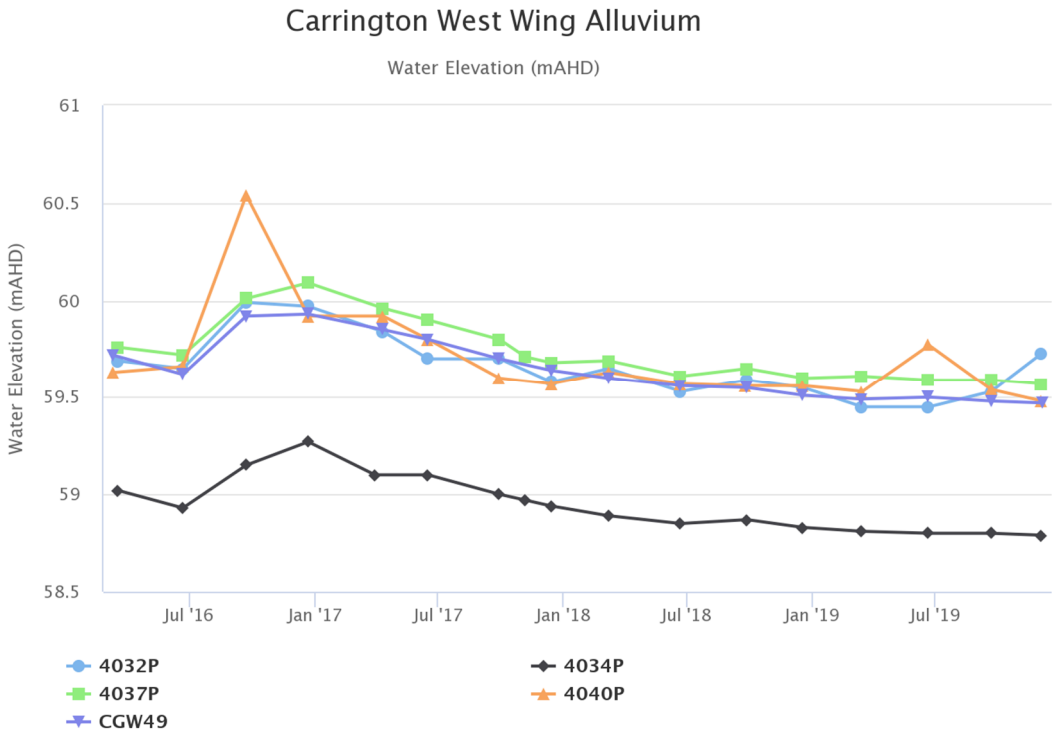

Figure 41: Carrington West Wing Alluvium Standing Water Level – December 2019

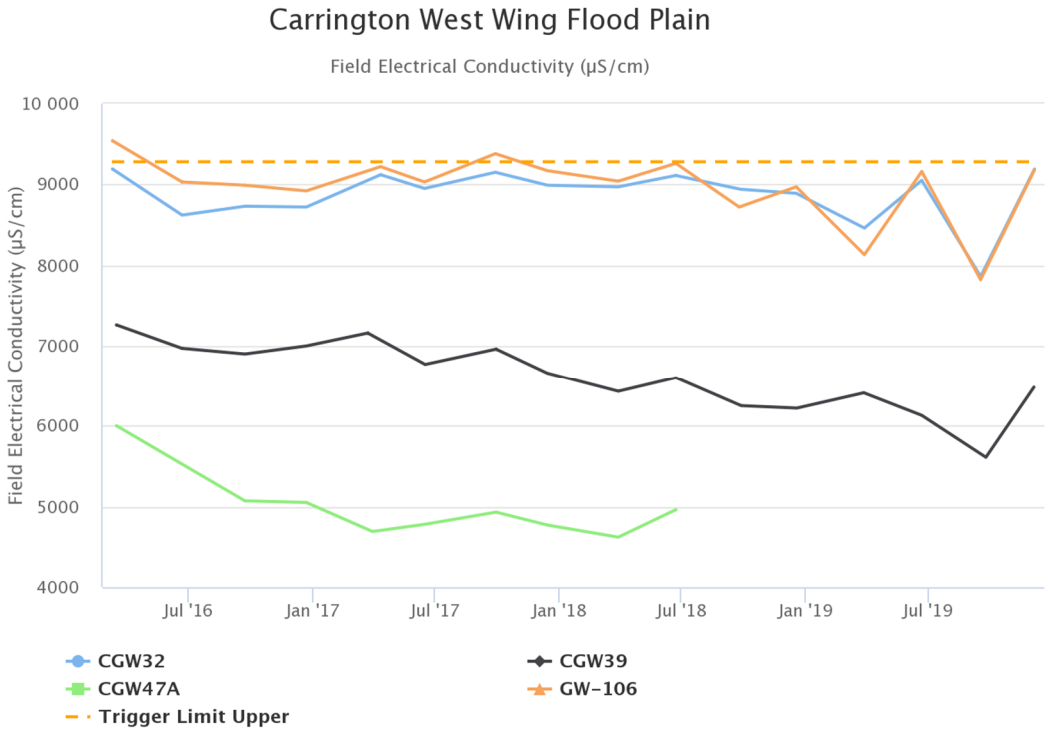

Figure 42: Carrington West Wing Flood Plain Electrical Conductivity Trend – December 2019

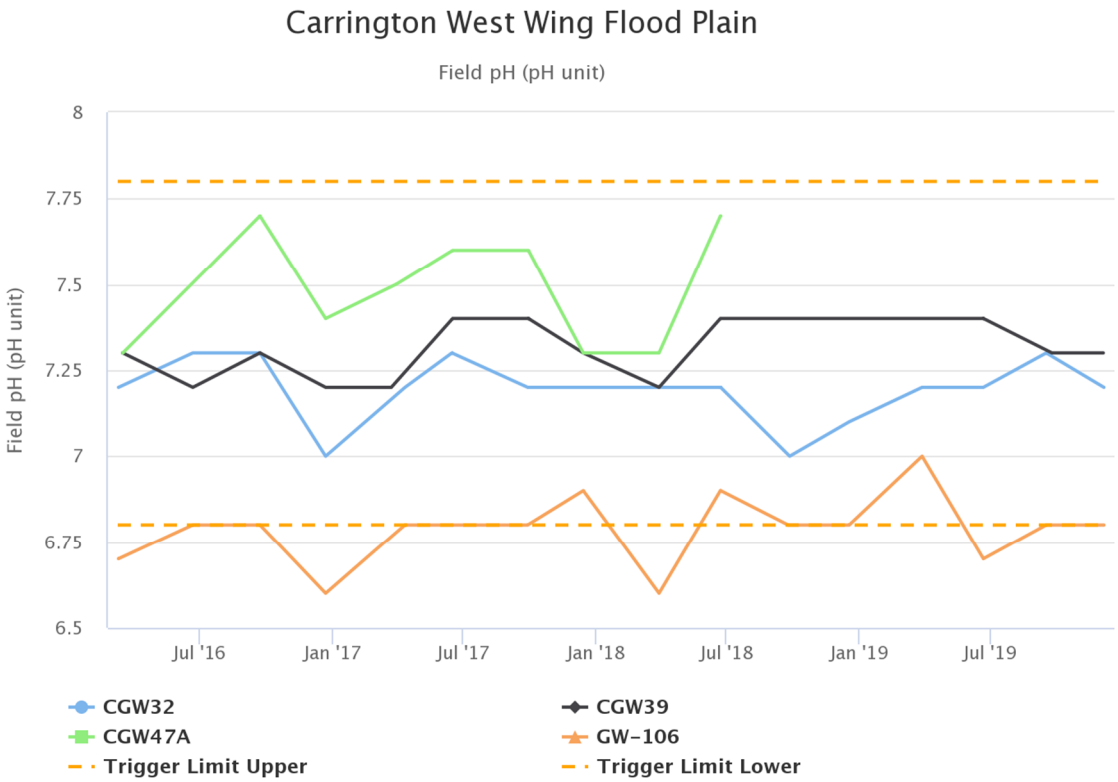

Figure 43: Carrington West Wing Flood Plain pH Trend – December 2019

Note that insufficient water recorded for December sample for CGW47A

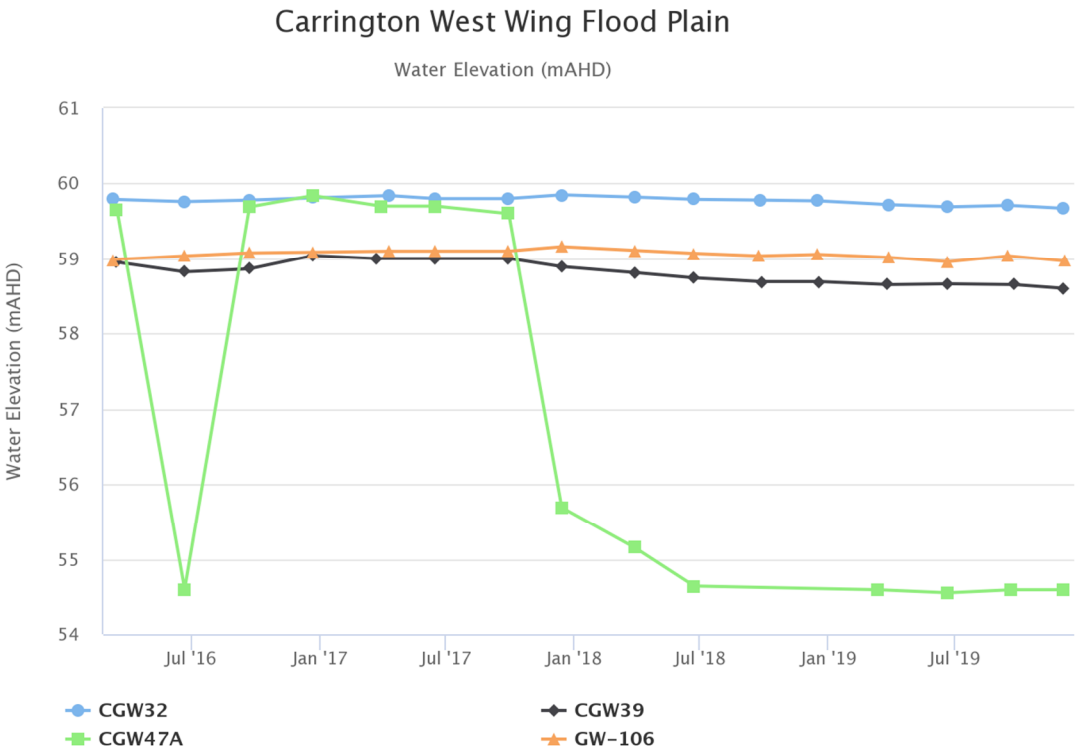

Figure 44: Carrington West Wing Flood Plain Standing Water Level – December 2019

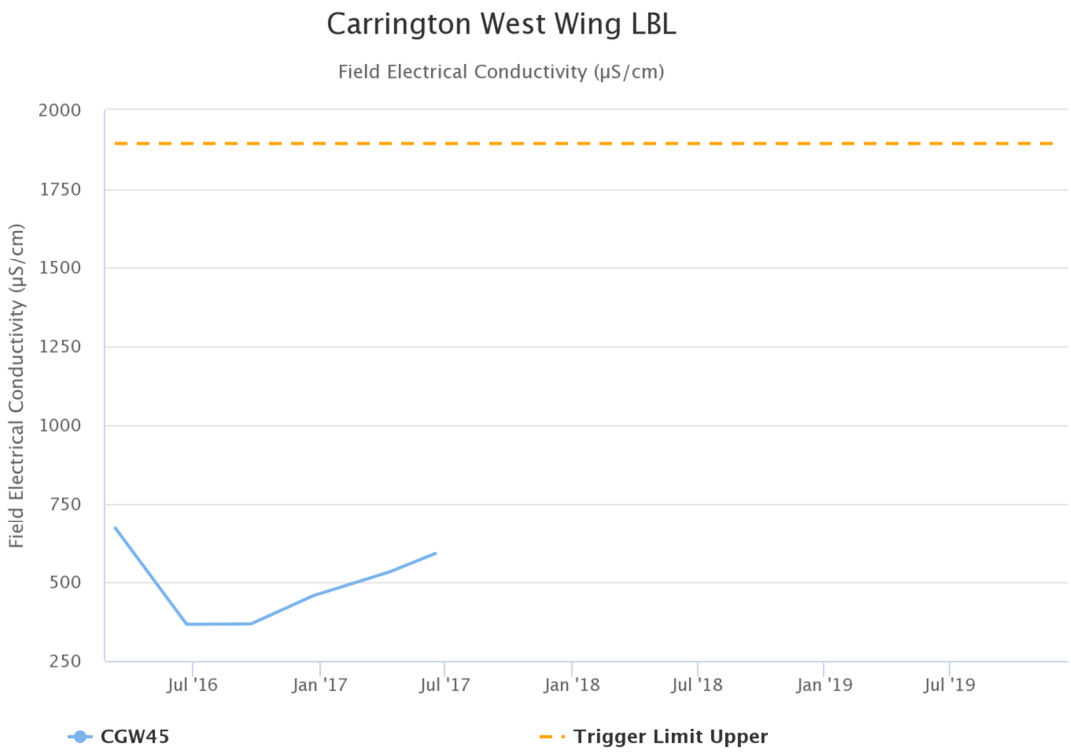

Figure 45: Carrington West Wing LBL Electrical Conductivity Trend – December 2019*

*CGW45 has been blocked since June 2017 hence why no data is shown in Figure 45 after this date.

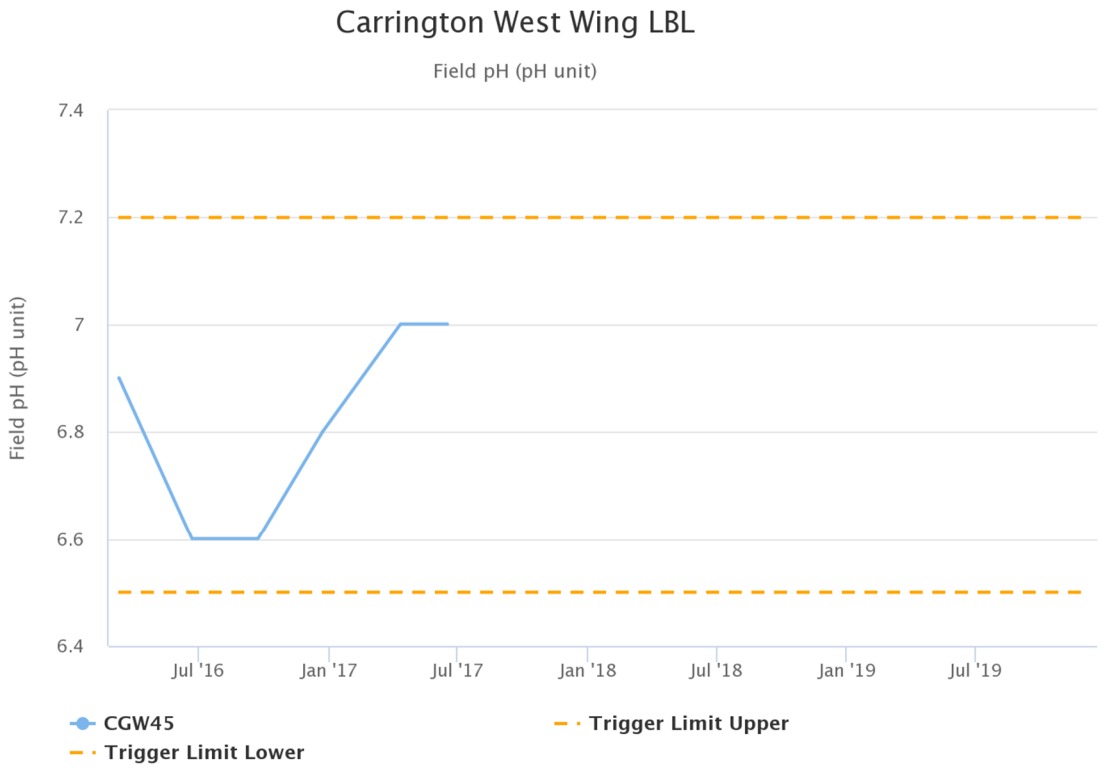

Figure 46: Carrington West Wing LBL pH Trend – December 2019

*CGW45 has been blocked since June 2017 hence why no data is shown Figure 46 after this date.

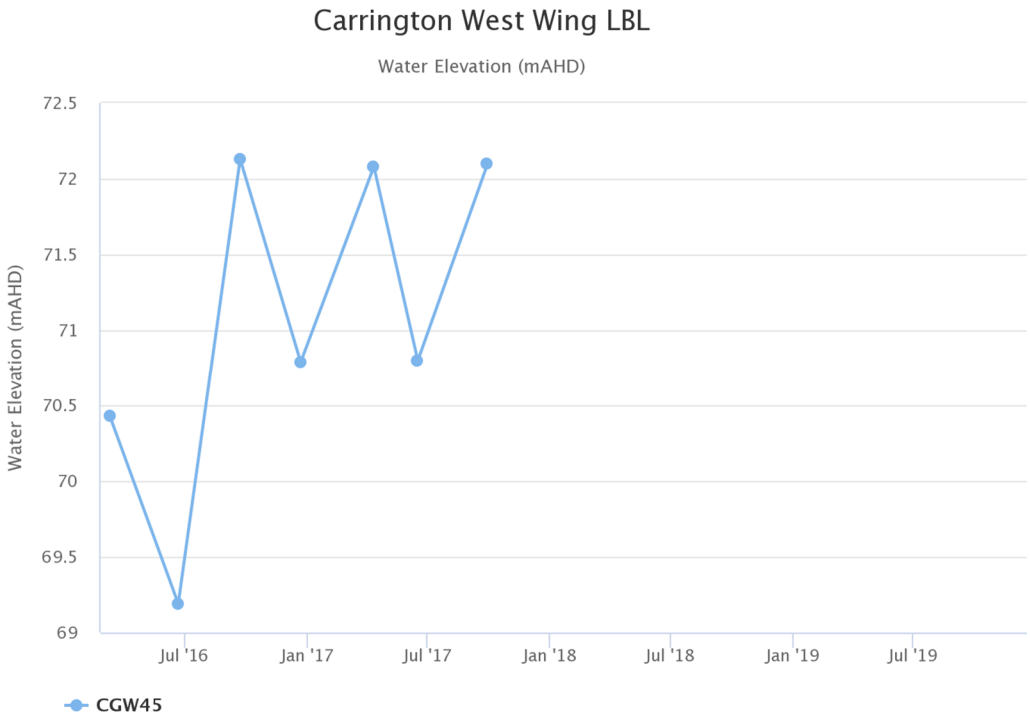

Figure 47: Carrington West Wing LBL Standing Water Level – December 2019

*CGW45 has been blocked since June 2017 hence why no data is shown Figure 47 after this date.

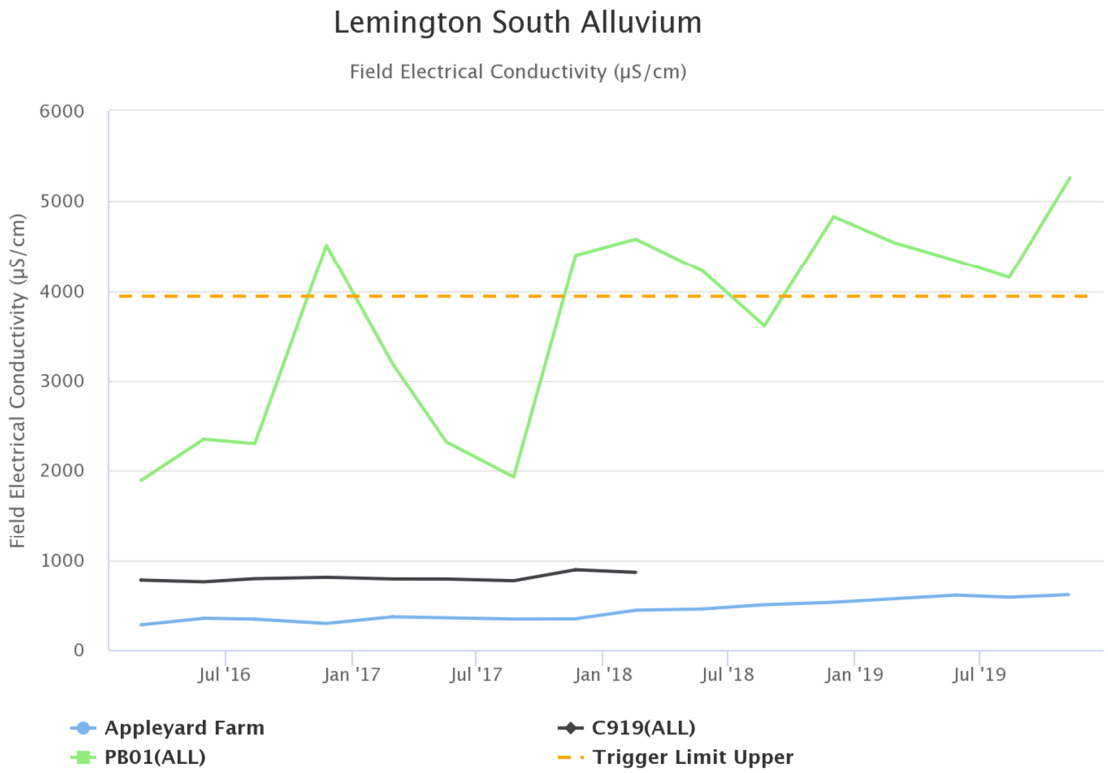

Figure 48: Lemington South Alluvium Electrical Conductivity Trend – December 2019

Note that C919 (ALL) is dry

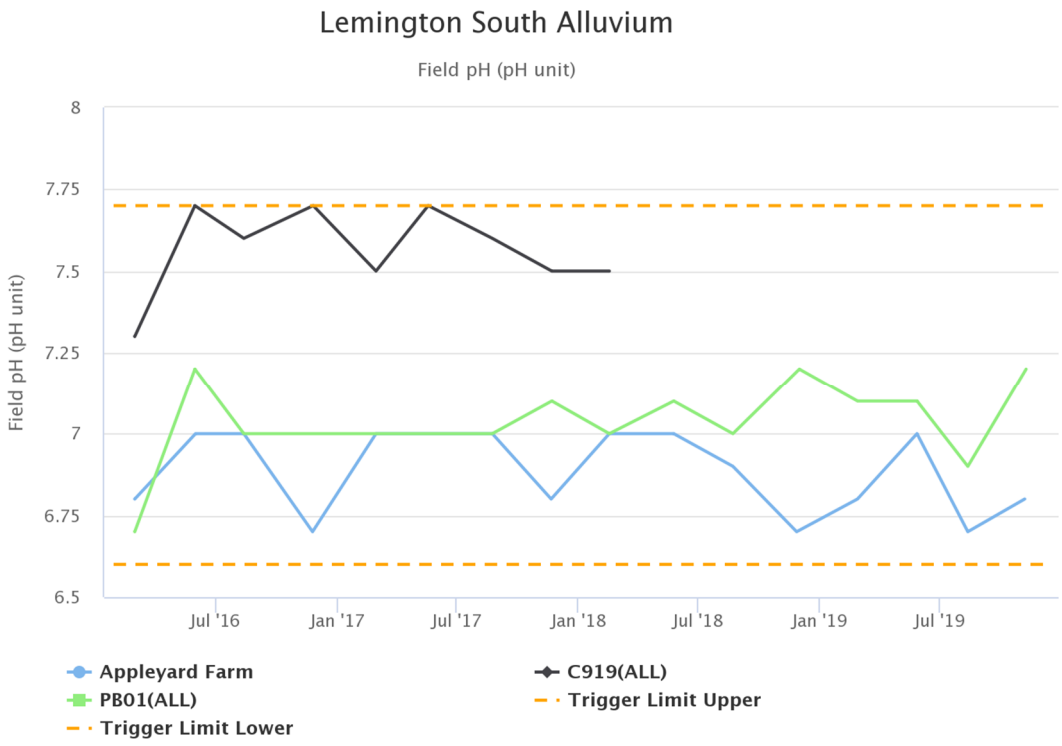

Figure 49: Lemington South Alluvium pH Trend – December 2019

Note that C919 (ALL) is dry

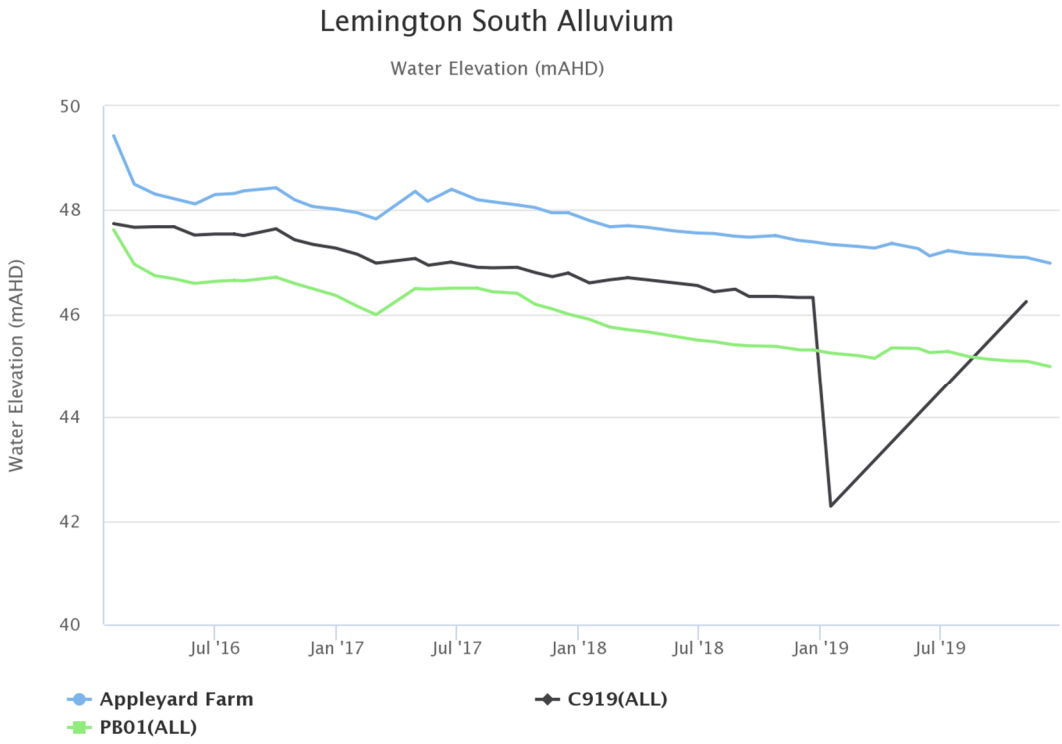

Figure 50: Lemington South Alluvium Standing Water Level Trend – December 2019*

*C919(ALL) has been dry from February to June 2019

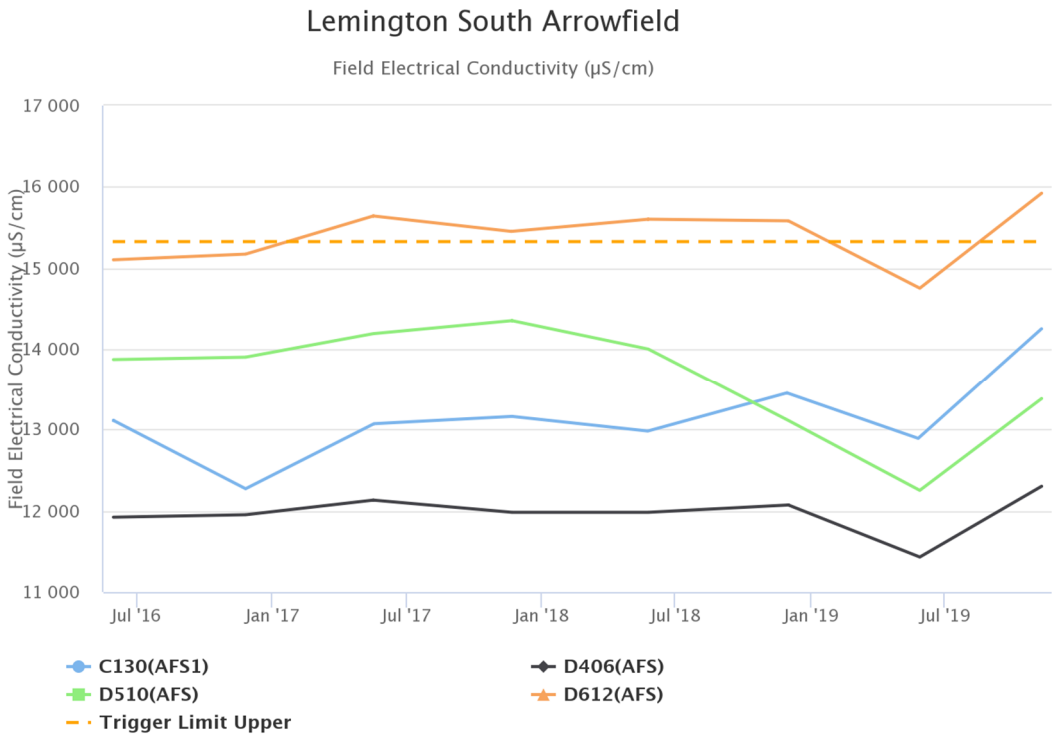

Figure 51: Lemington South Arrowfield Electrical Conductivity Trend – December 2019

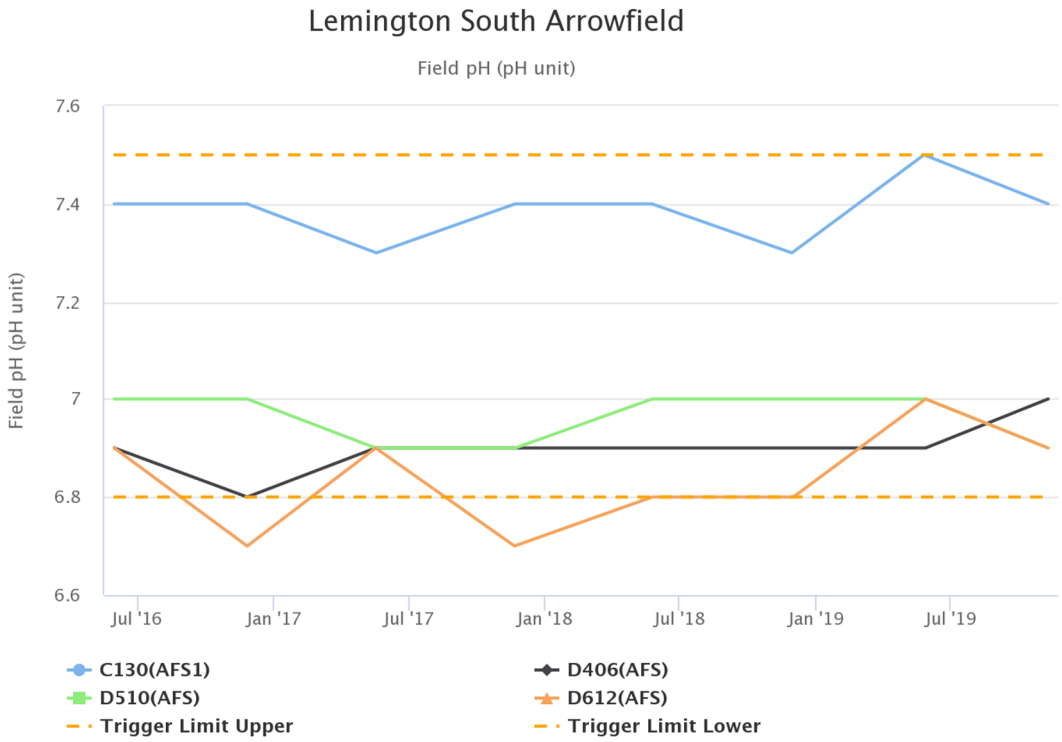

Figure 52: Lemington South Arrowfield pH Trend – December 2019

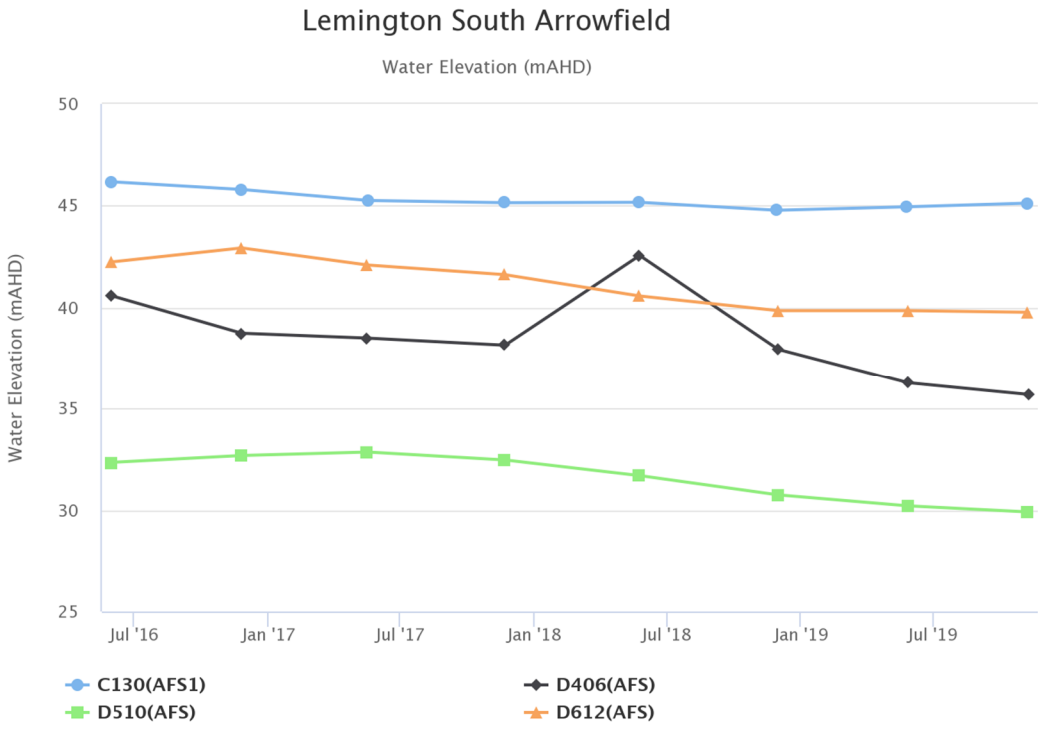

Figure 53: Lemington South Arrowfield Standing Water Level – December 2019

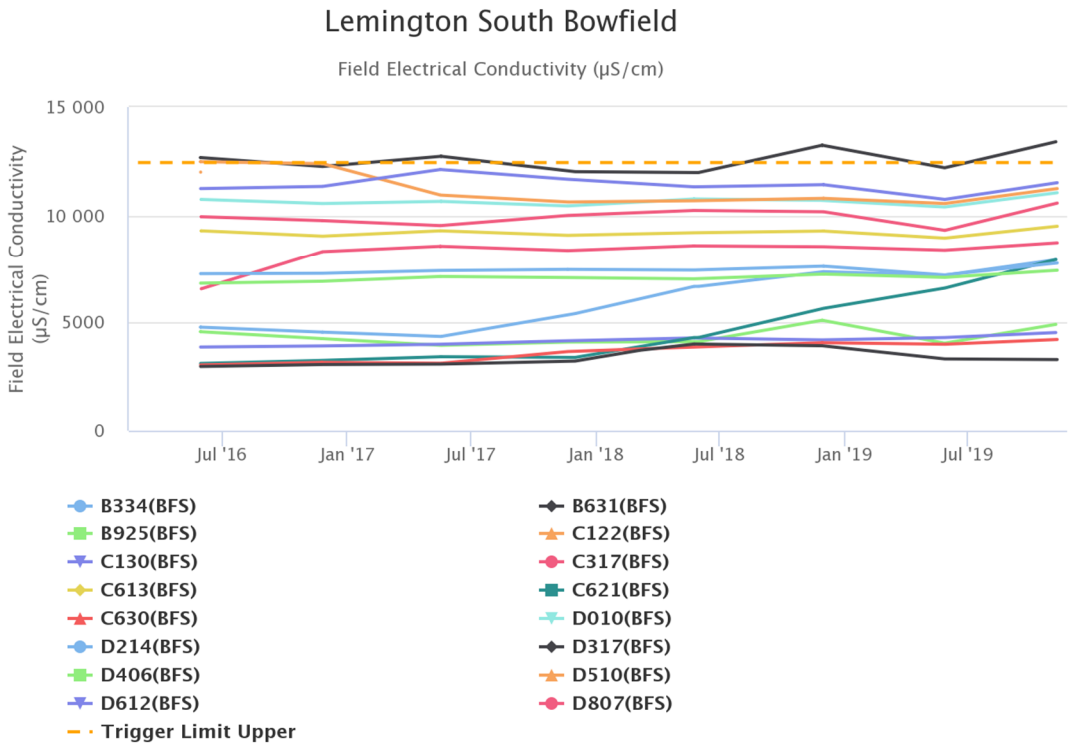

Figure 54: Lemington South Bowfield Electrical Conductivity Trend – December 2019

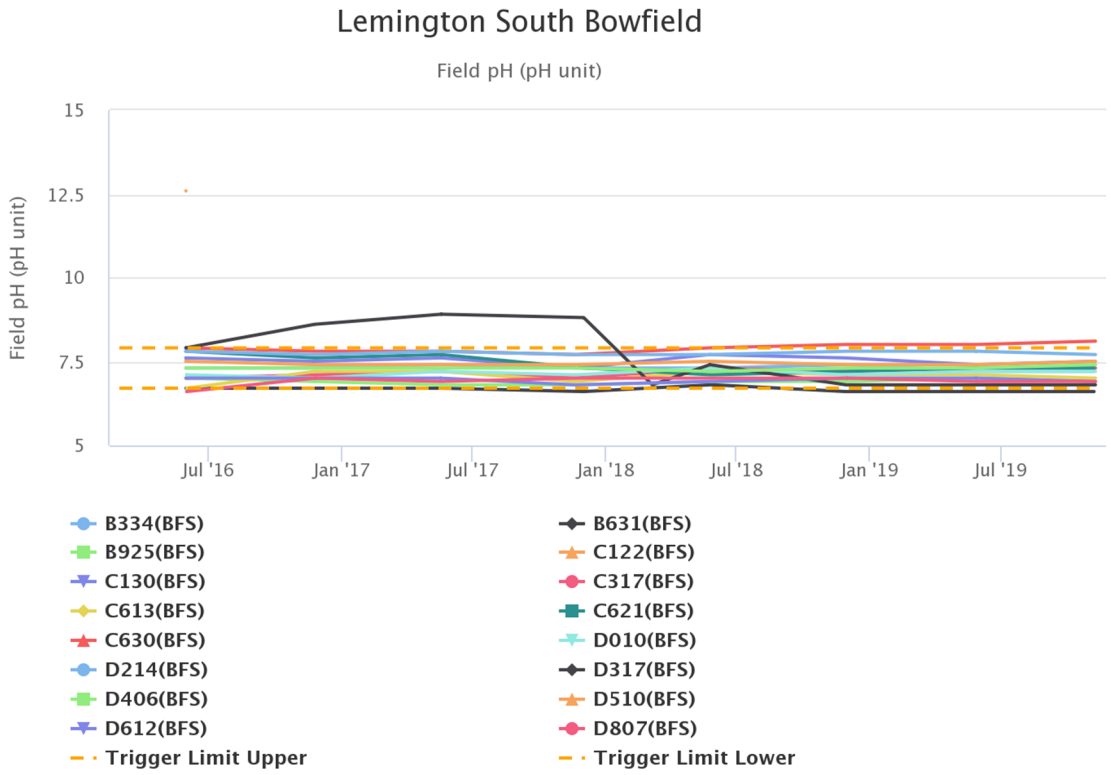

Figure 55: Lemington South Bowfield pH Trend – December 2019

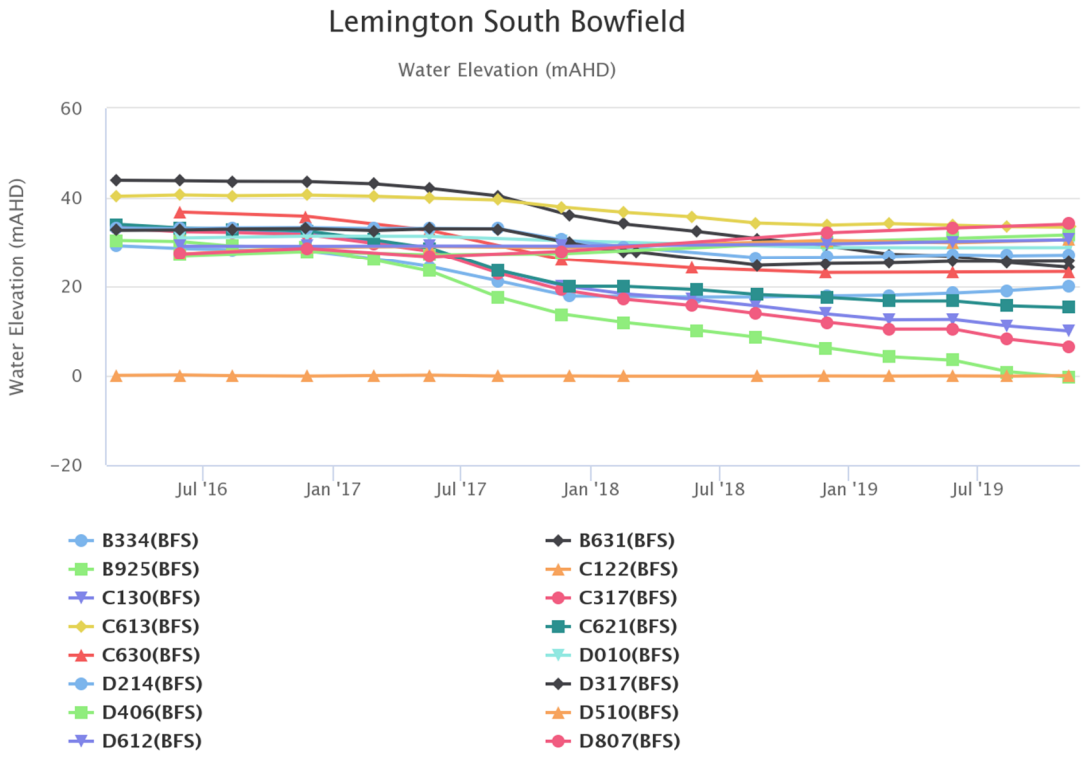

Figure 56: Lemington South Bowfield Standing Water Level – December 2019

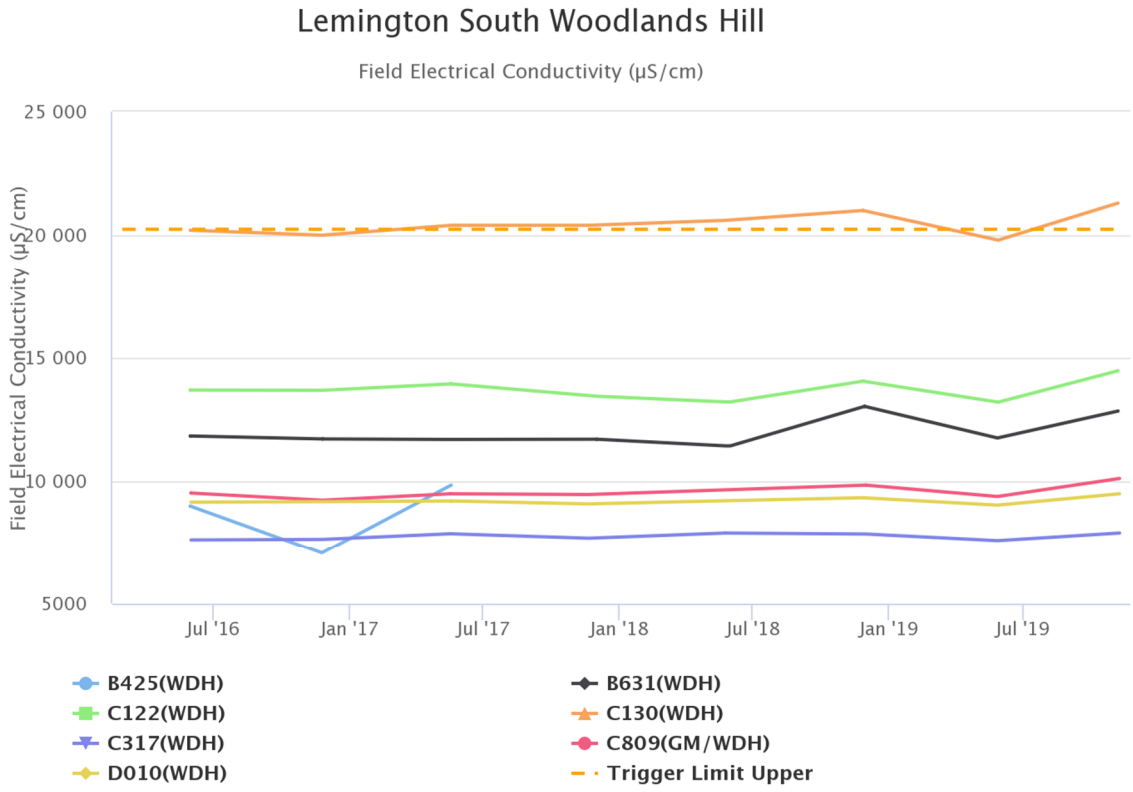

Figure 57: Lemington South Woodlands Hill Electrical Conductivity Trend – December 2019

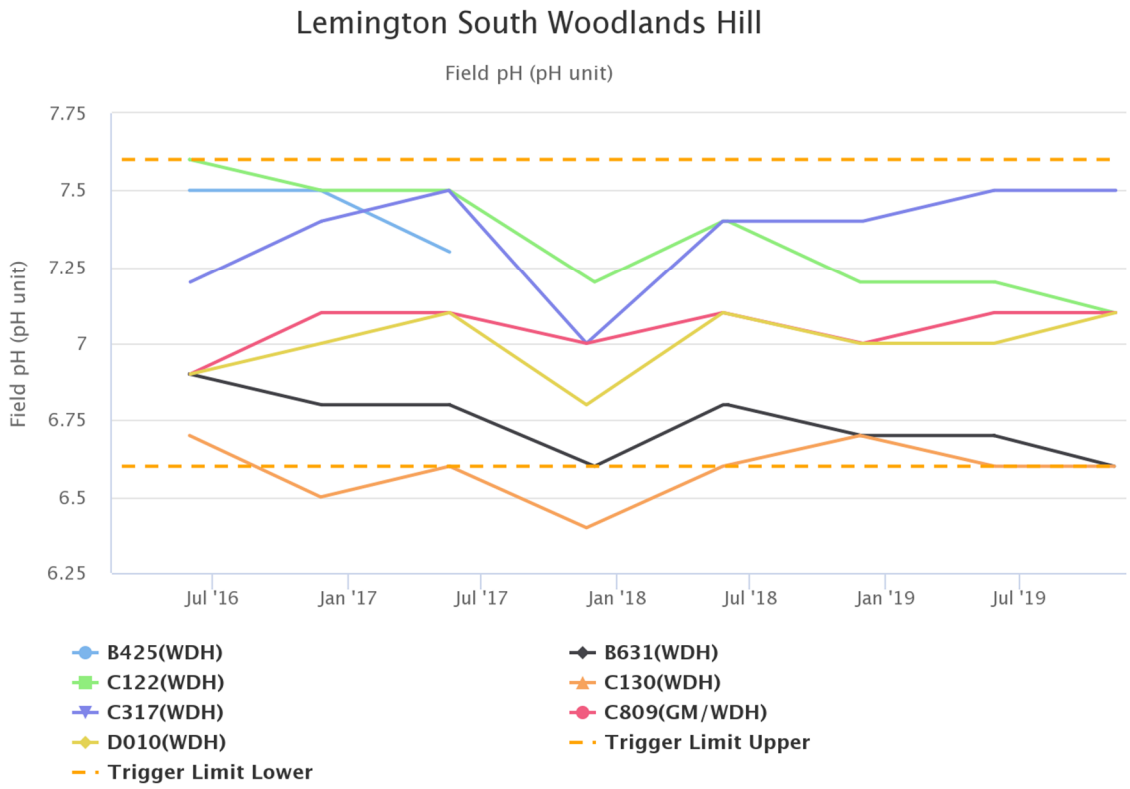

Figure 58: Lemington South Woodlands Hill pH Trend – December 2019

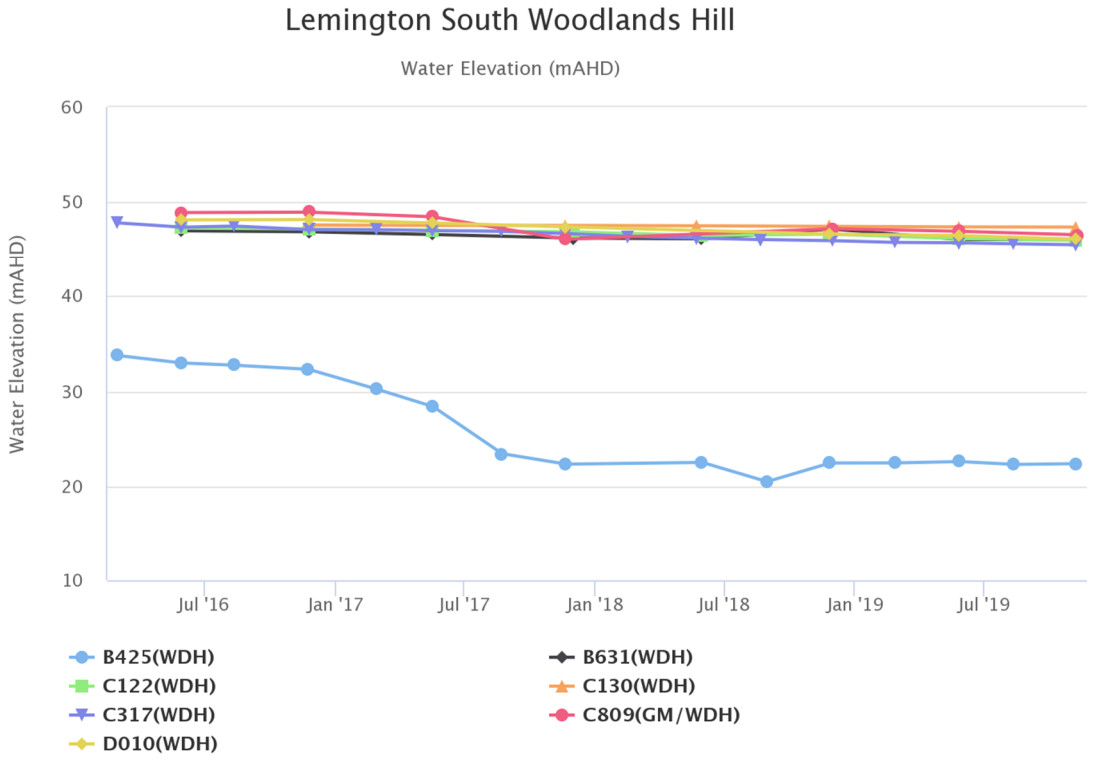

Figure 59: Lemington South Woodlands Hill Standing Water Level – December 2019

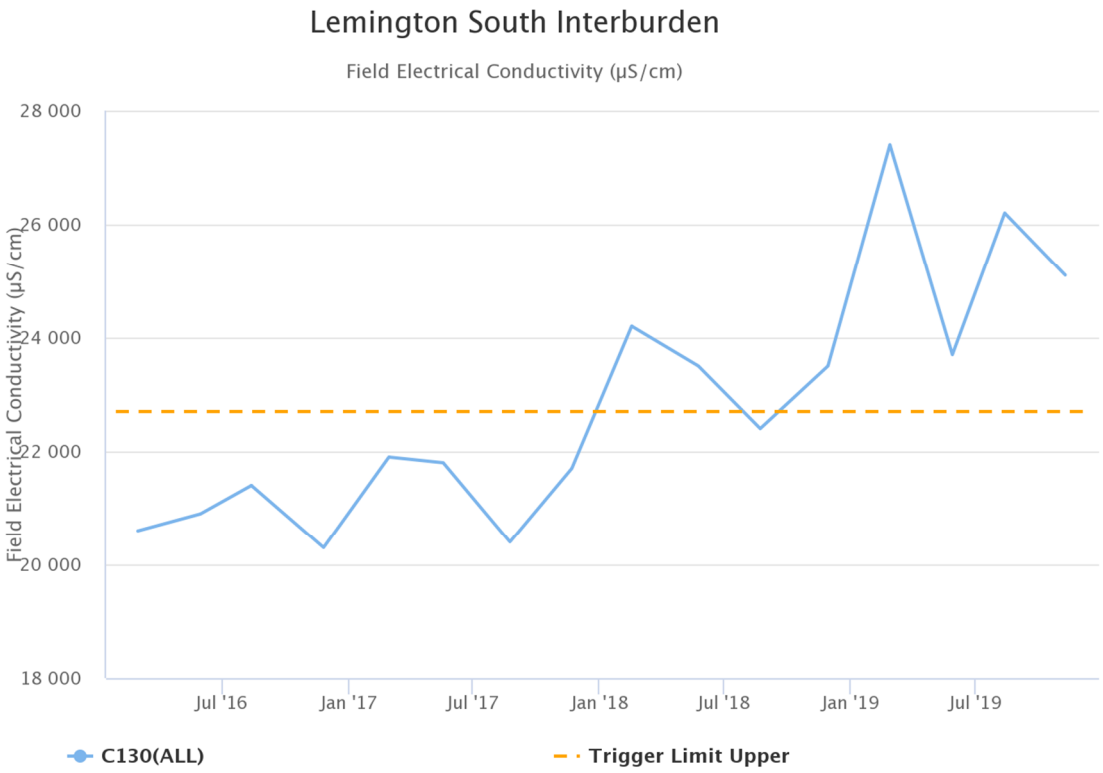

Figure 60: Lemington South Interburden Electrical Conductivity Trend – December 2019

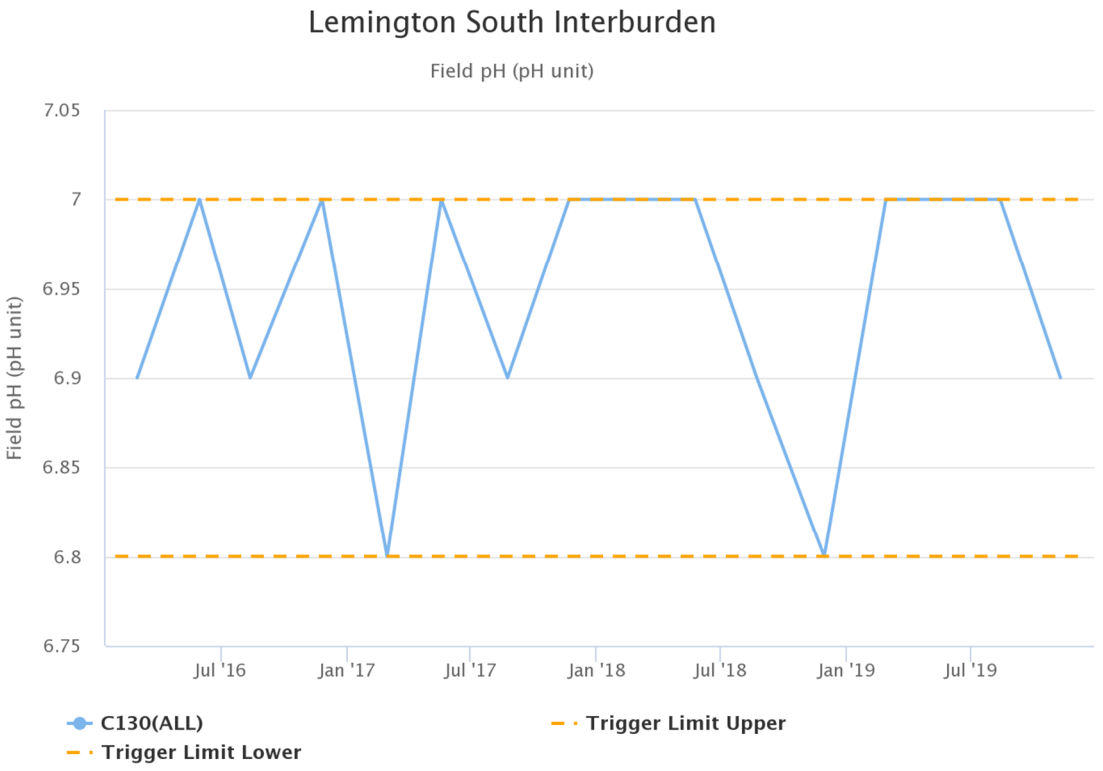

Figure 61: Lemington South Interburden pH Trend – December 2019

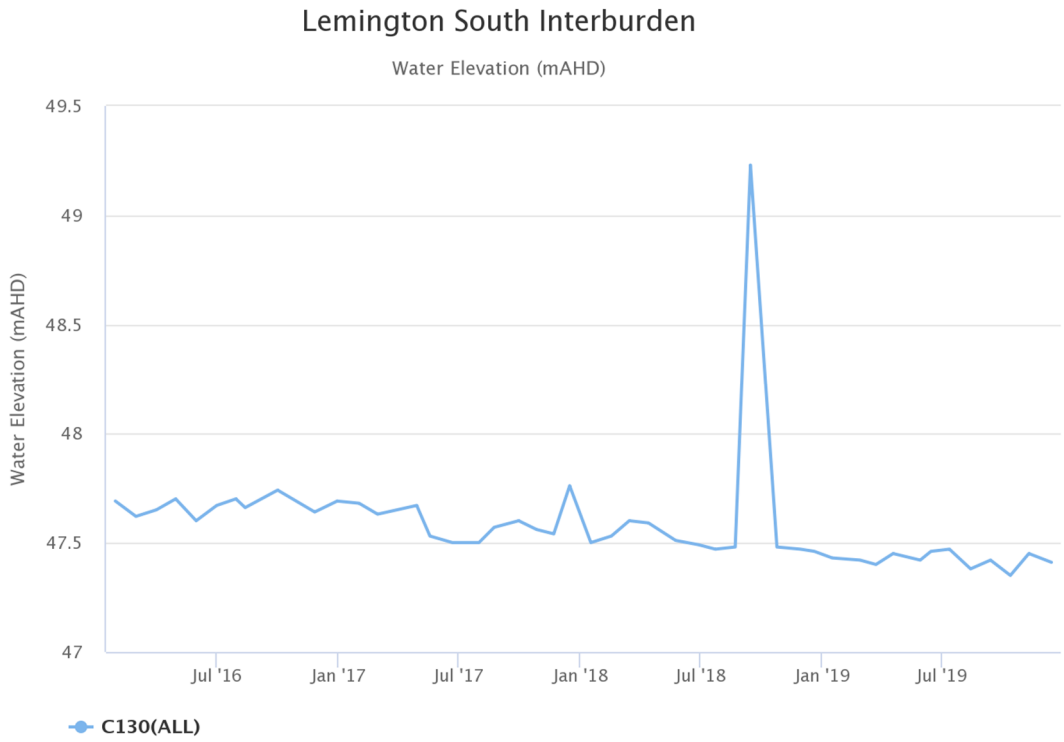

Figure 62: Lemington South Interburden Standing Water Level – December 2019

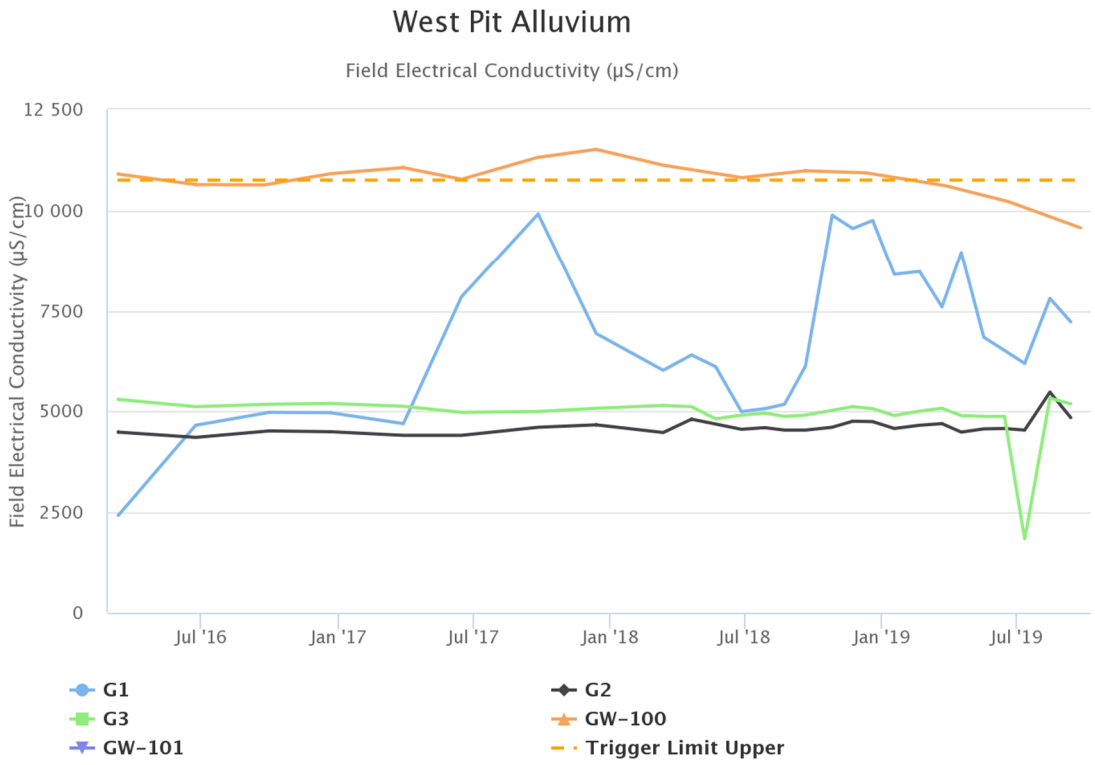

Figure 63: West Pit Alluvium Electrical Conductivity Trend – December 2019

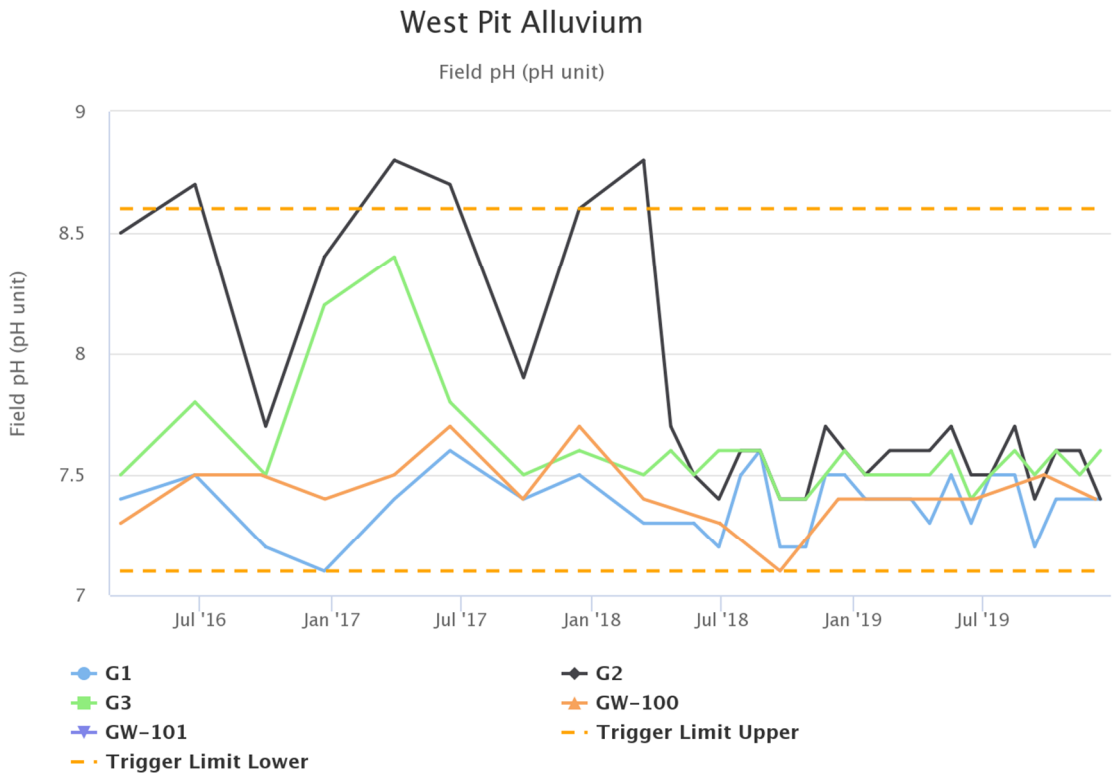

Figure 64: West Pit Alluvium pH Trend – December 2019

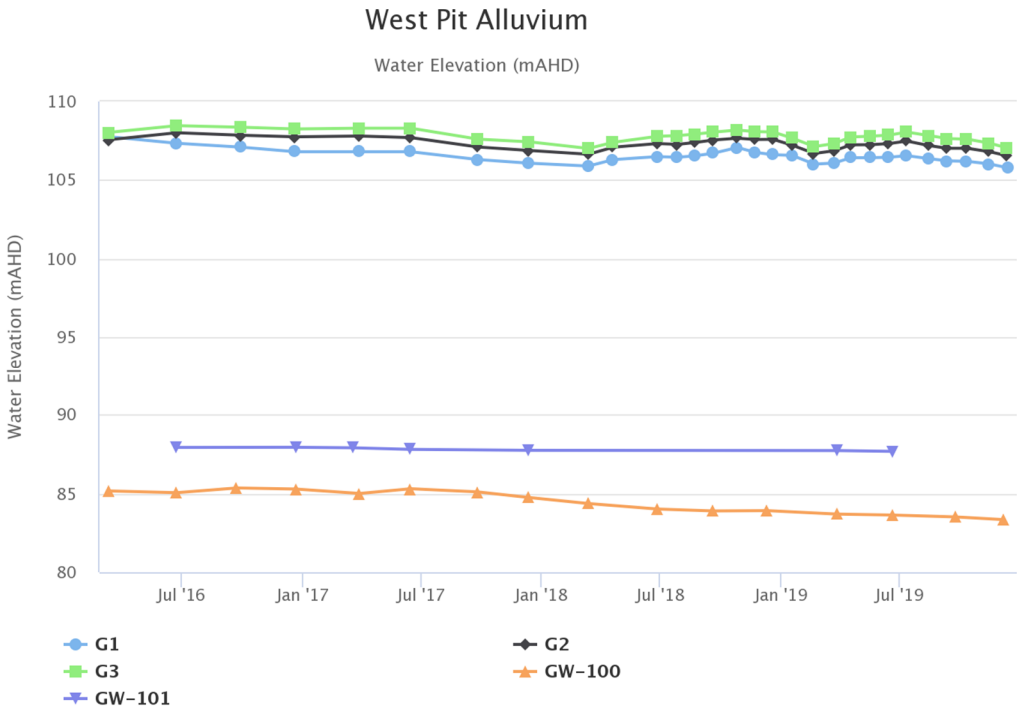

Figure 65: West Pit Alluvium Standing Water Level – December 2019

Note that Bore GW101 dry after June 2019

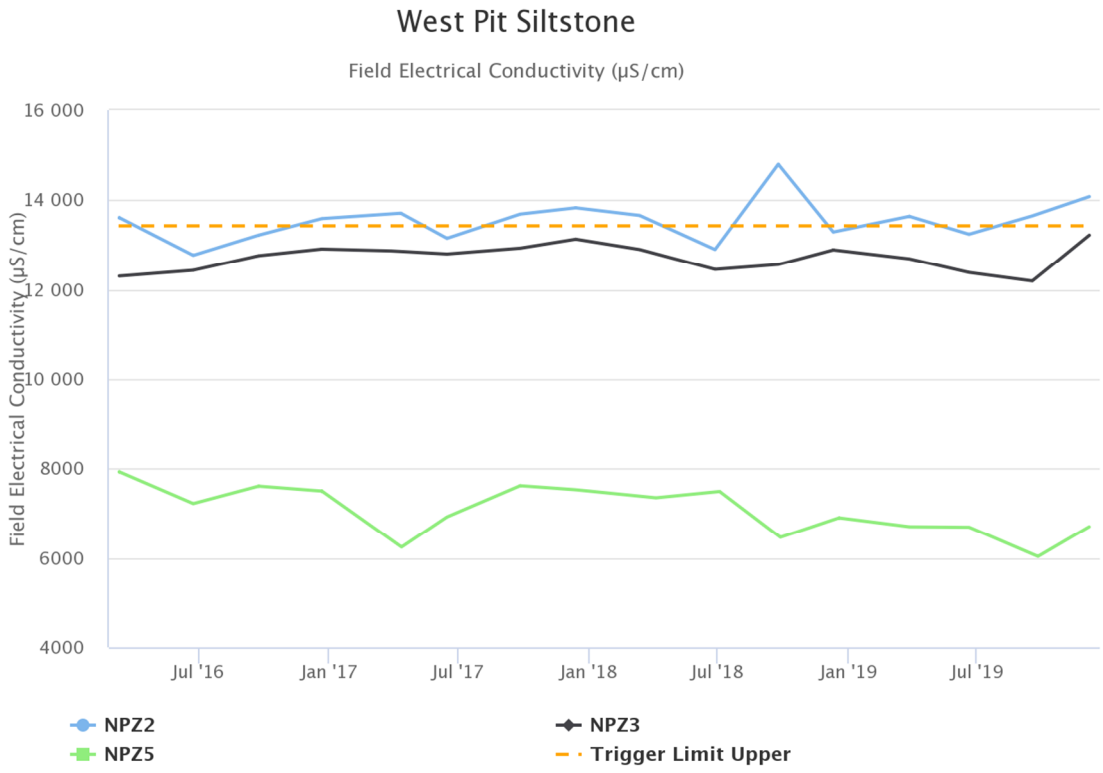

Figure 66: West Pit Siltstone Electrical Conductivity Trend – December 2019

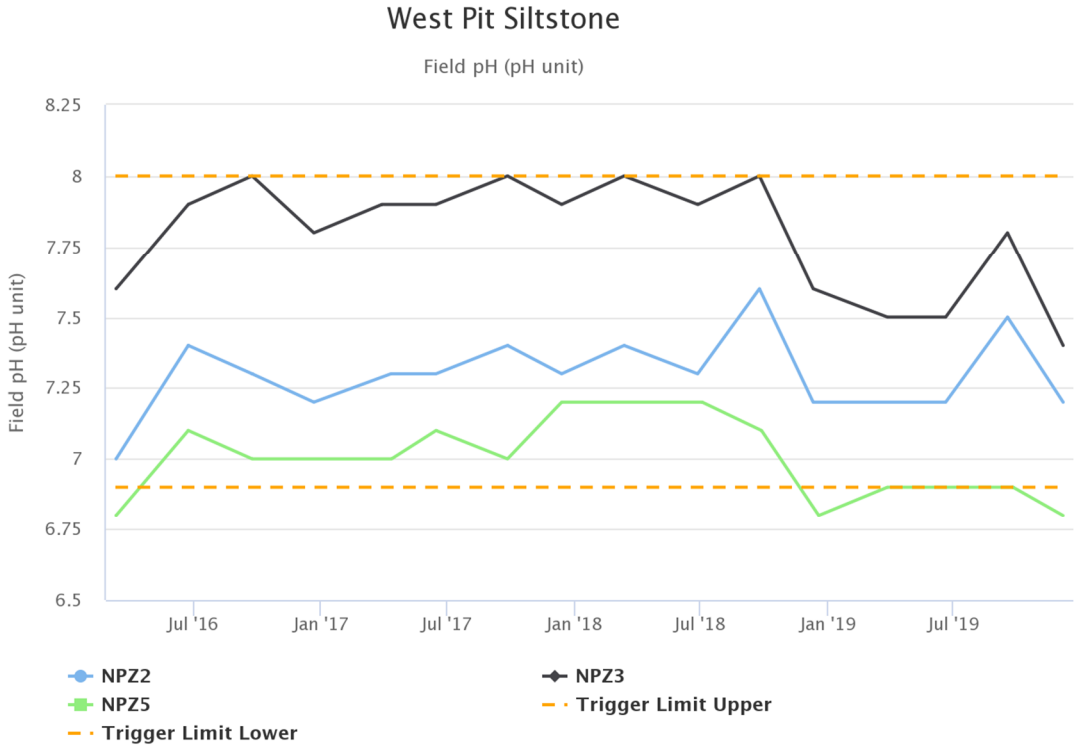

Figure 67: West Pit Siltstone pH Trend – December 2019

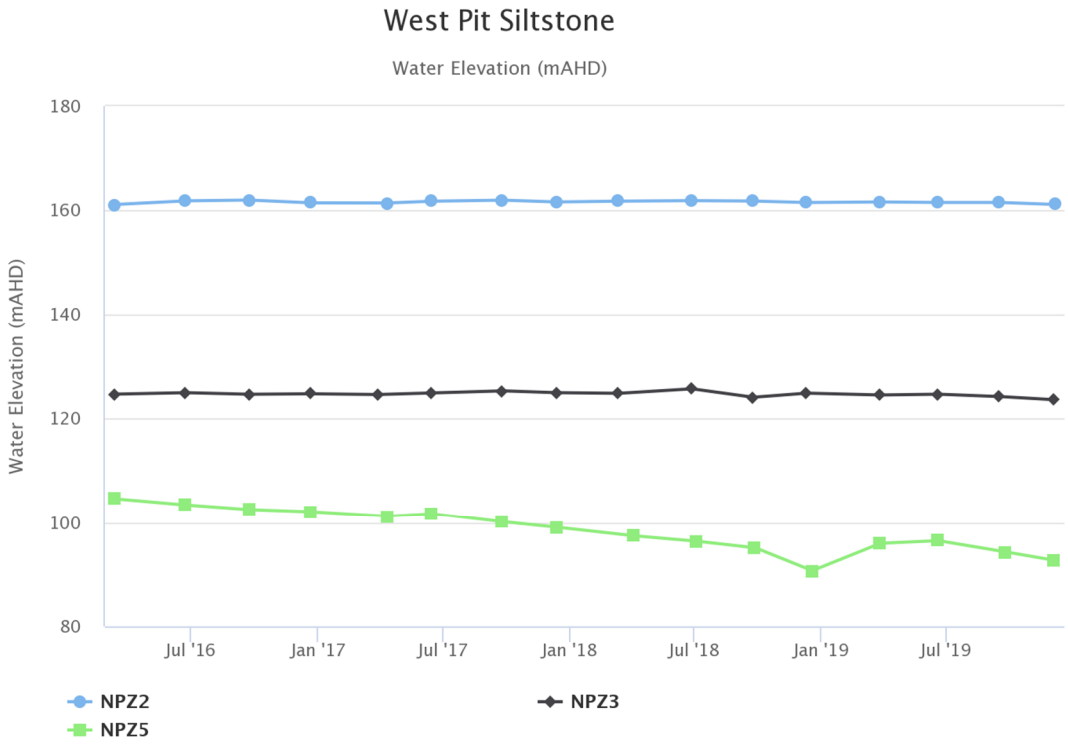

Figure 68: West Pit Siltstone Standing Water Level – December 2019

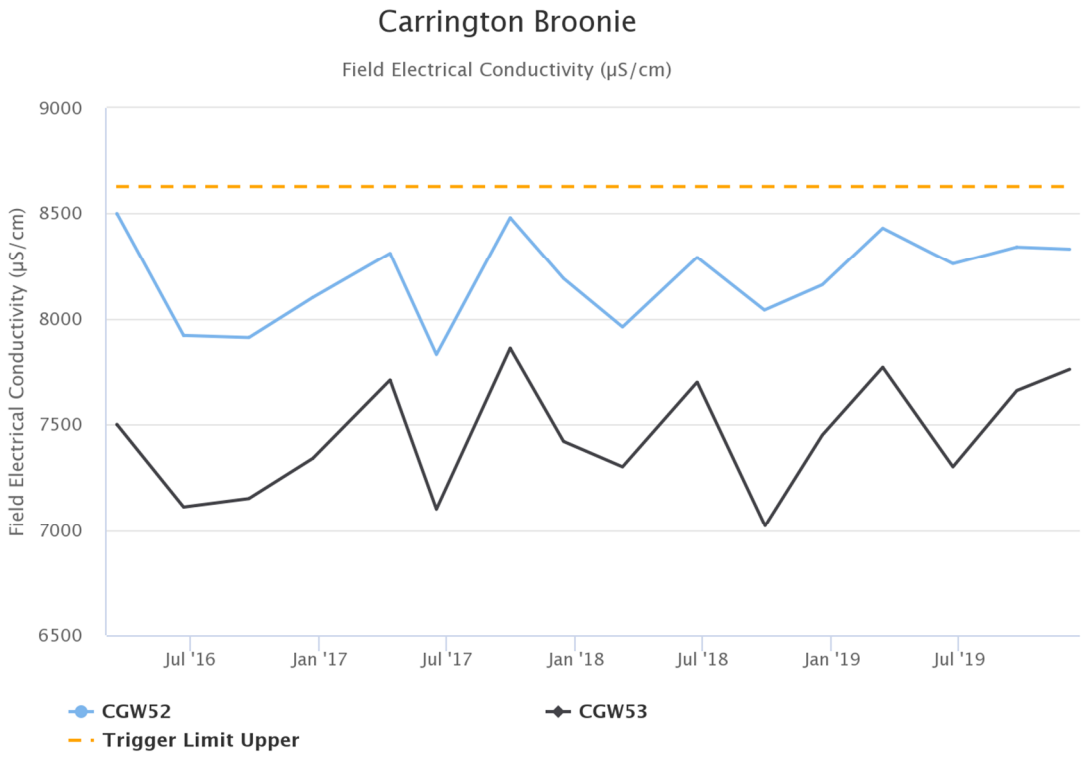

Figure 69: Carrington Broonie Electrical Conductivity Trend – December 2019

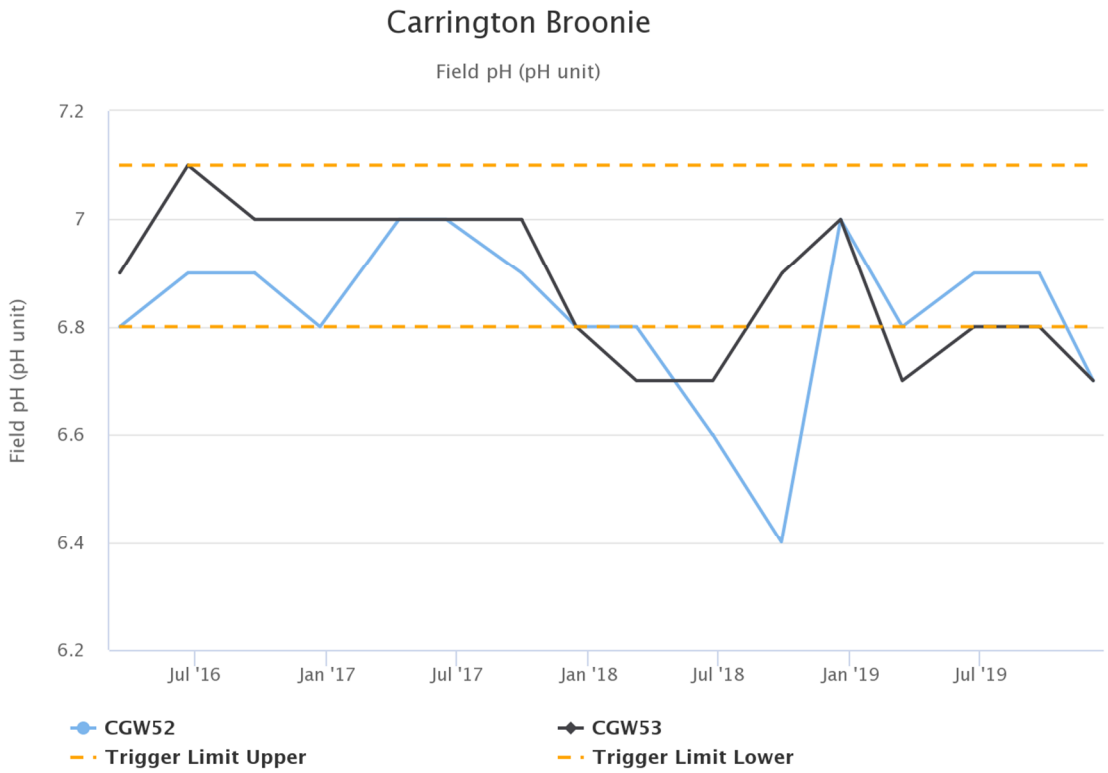

Figure 70: Carrington Broonie pH Trend – December 2019

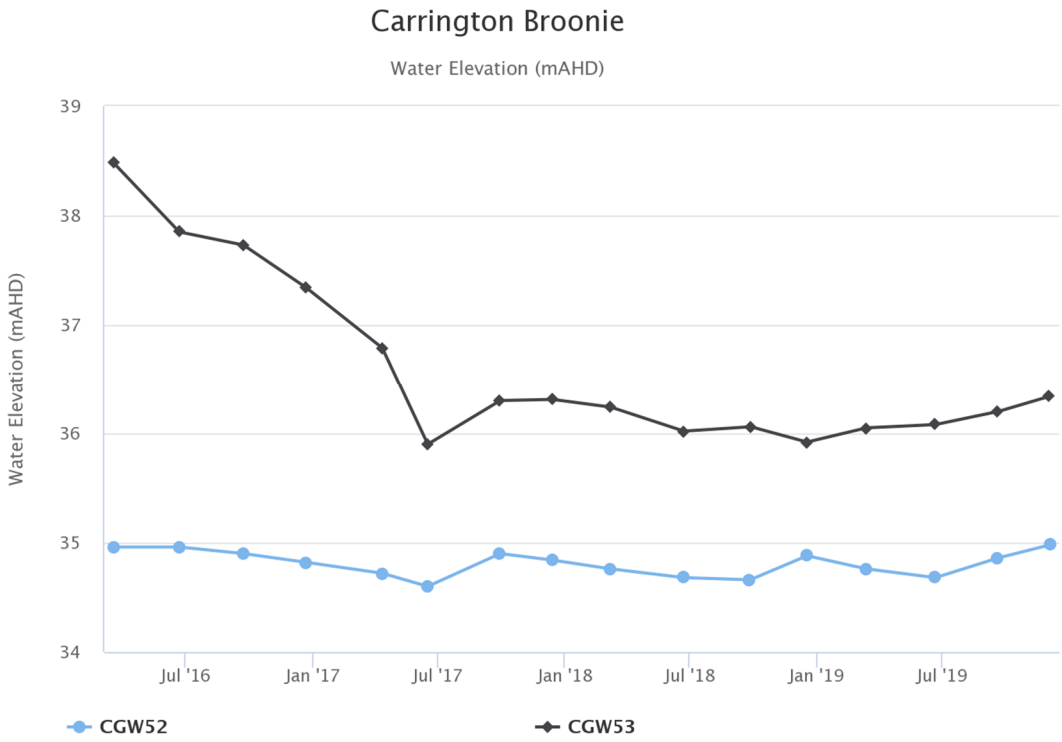

Figure 71: Carrington Broonie Standing Water Level – December 2019

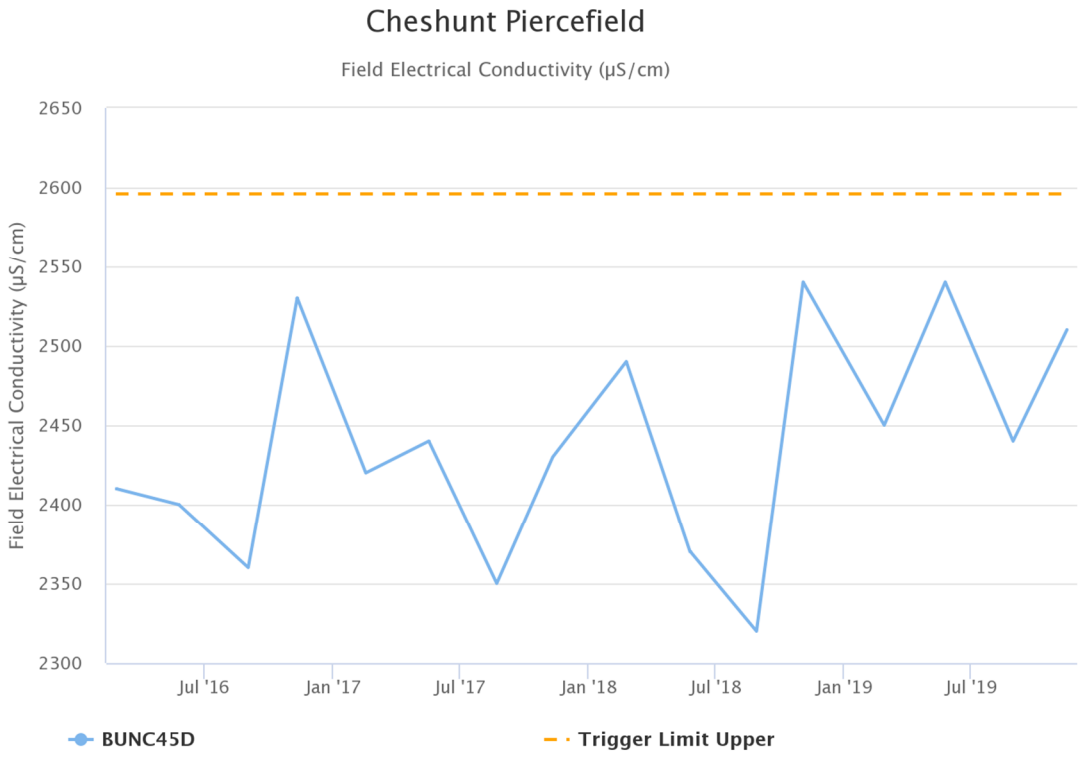

Figure 72: Cheshunt Piercefield Electrical Conductivity Trend –December 2019

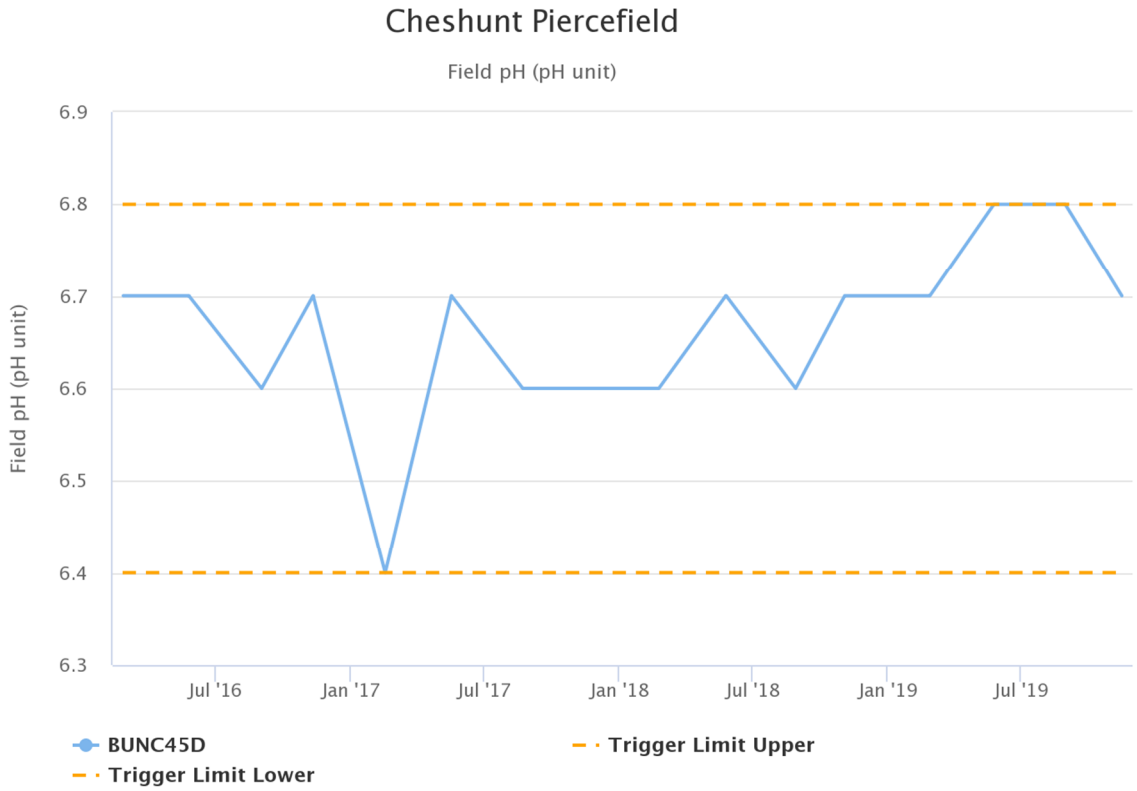

Figure 73: Cheshunt Piercefield pH Trend – December 2019

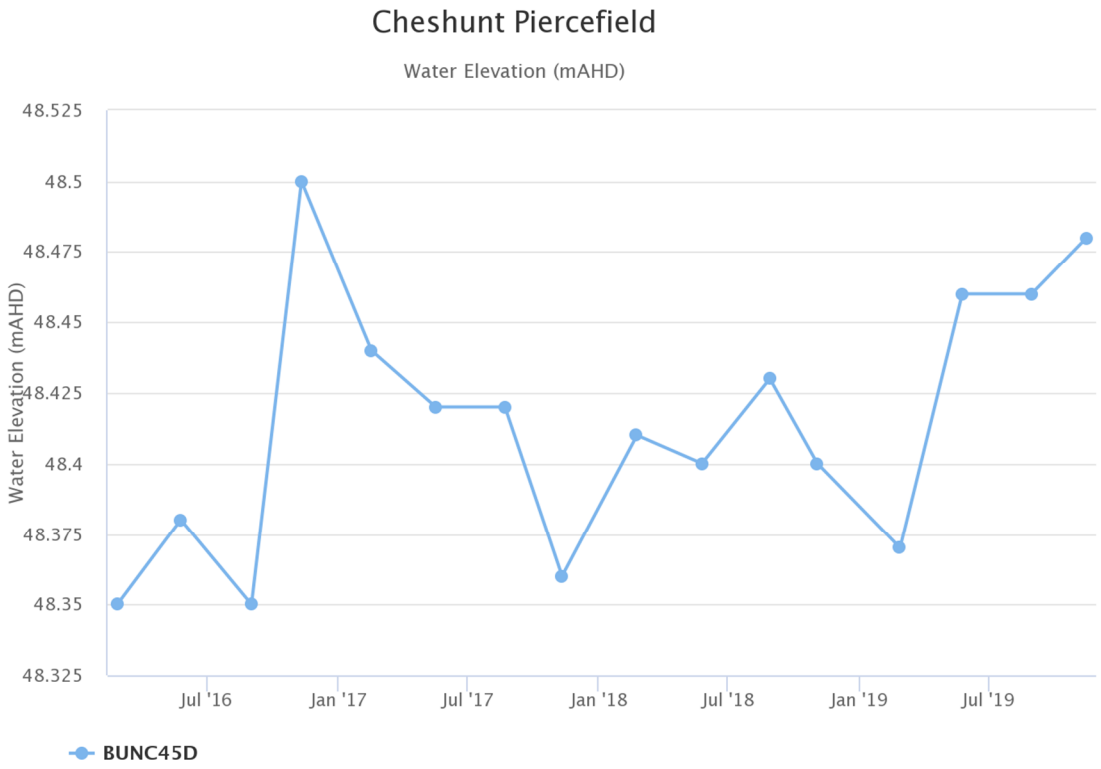

Figure 74: Cheshunt Piercefield Standing Water Level – December 2019

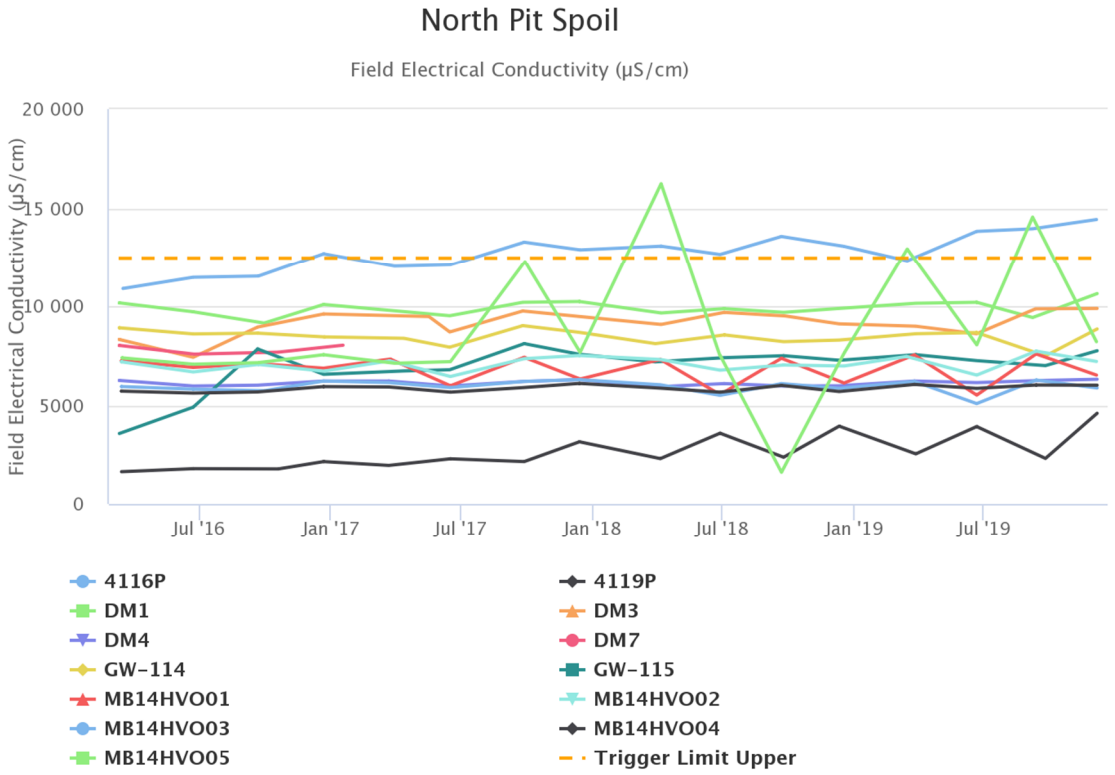

Figure 75: North Pit Spoil Electrical Conductivity Trend – December 2019

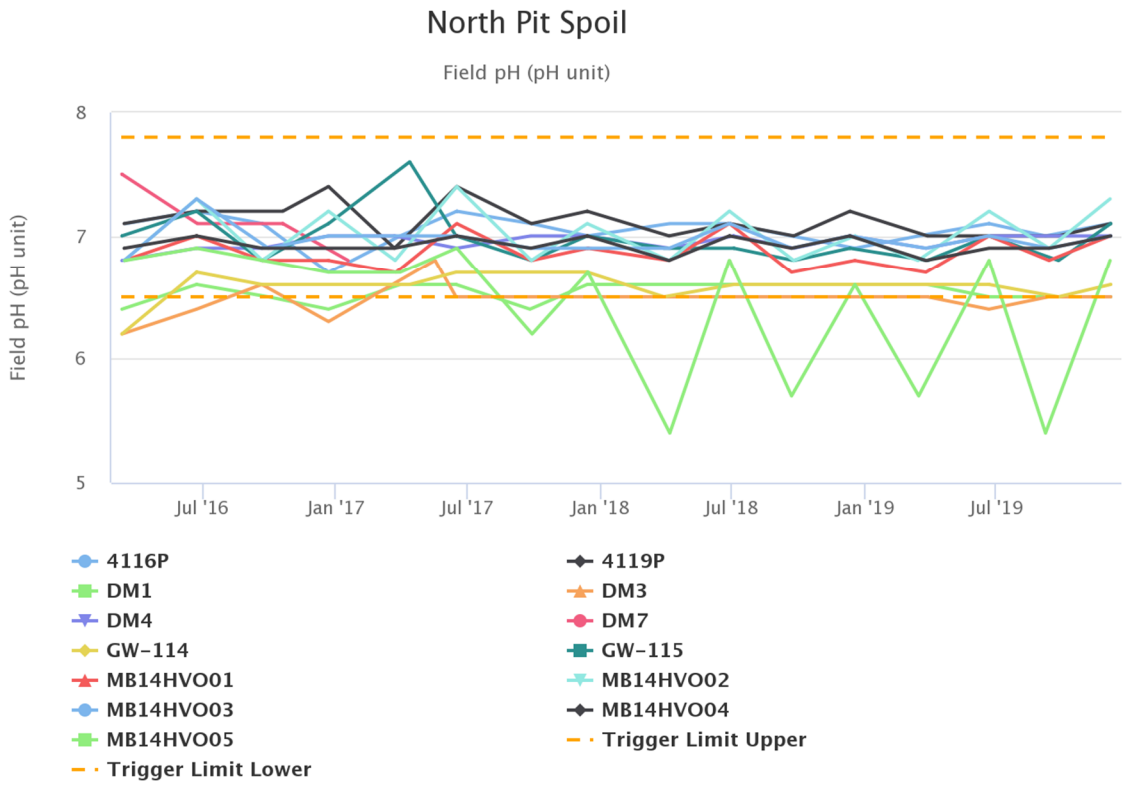

Figure 76: North Pit Spoil pH Trend – December 2019

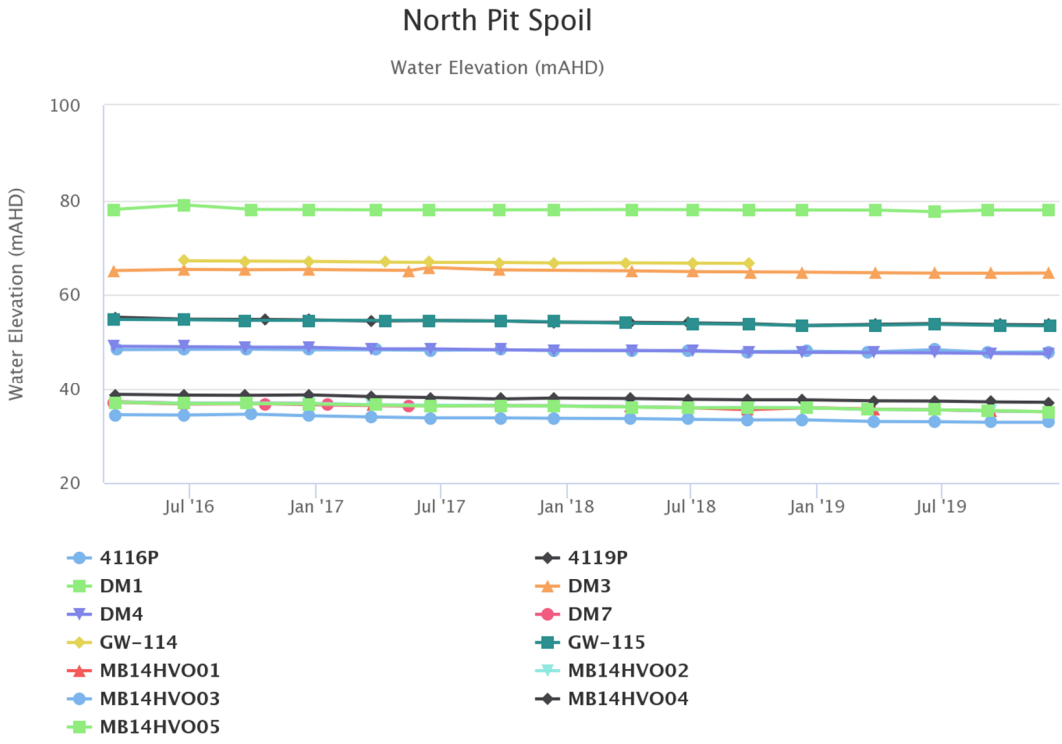

Figure 77: North Pit Spoil Standing Water Level – December 2019

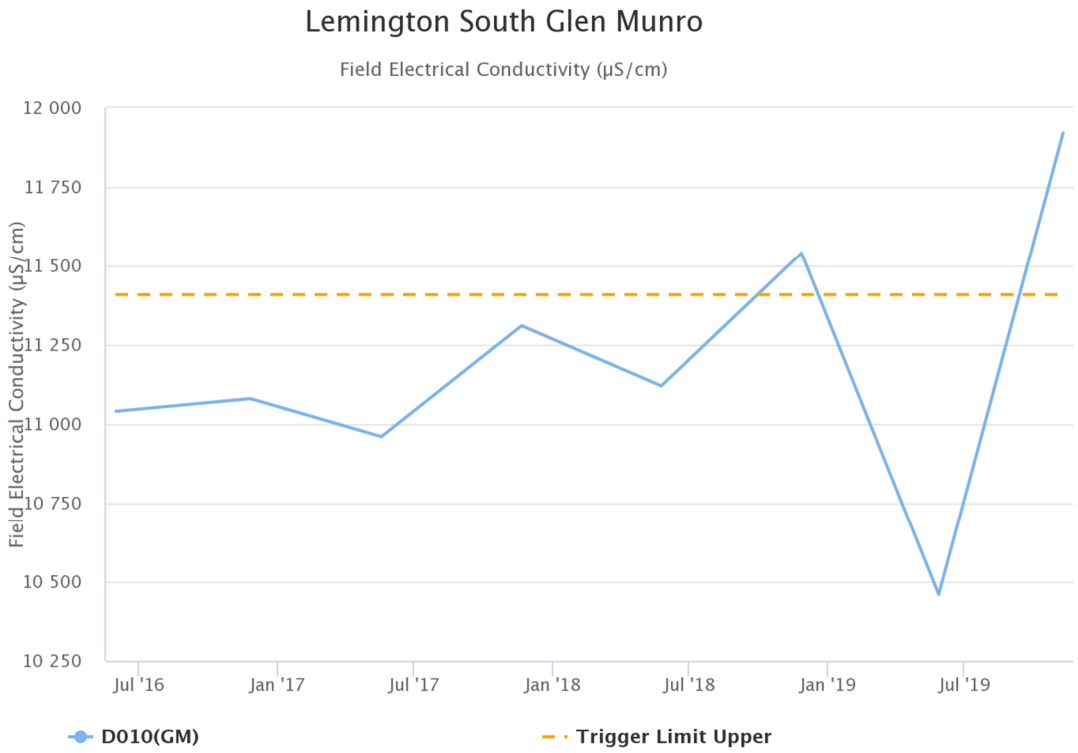

Figure 78: Lemington South Glen Munro Electrical Conductivity Trend – December 2019

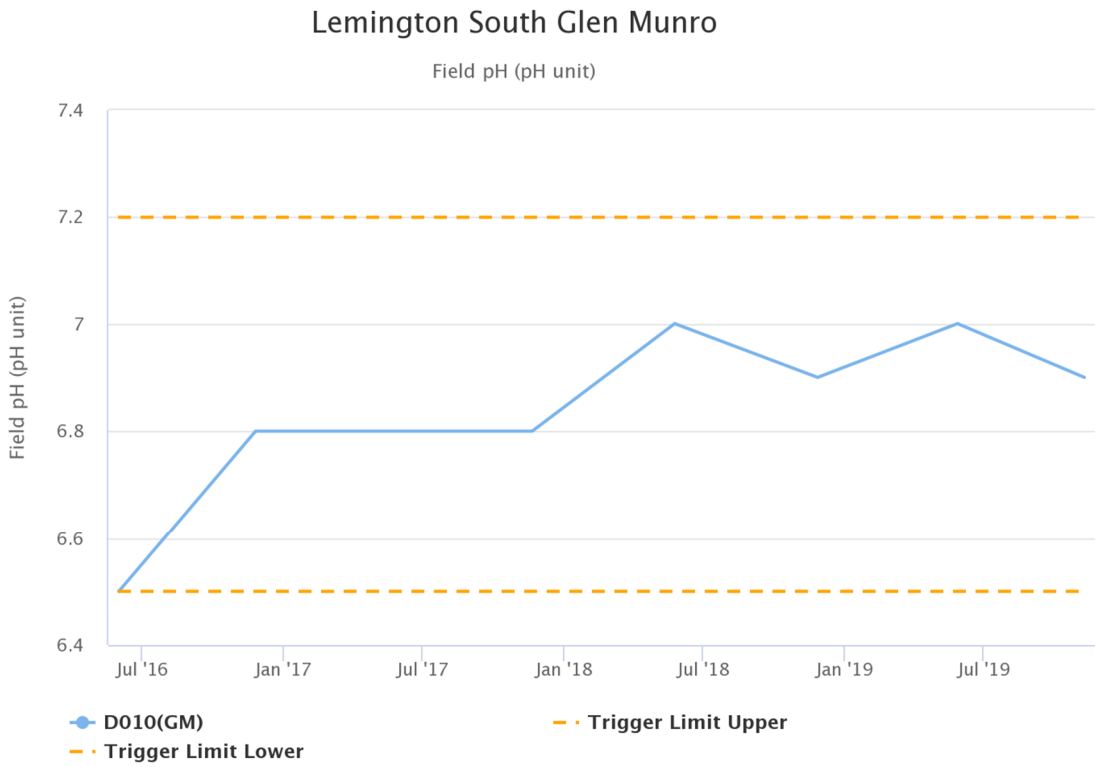

Figure 79: Lemington South Glen Munro pH Trend – December 2019

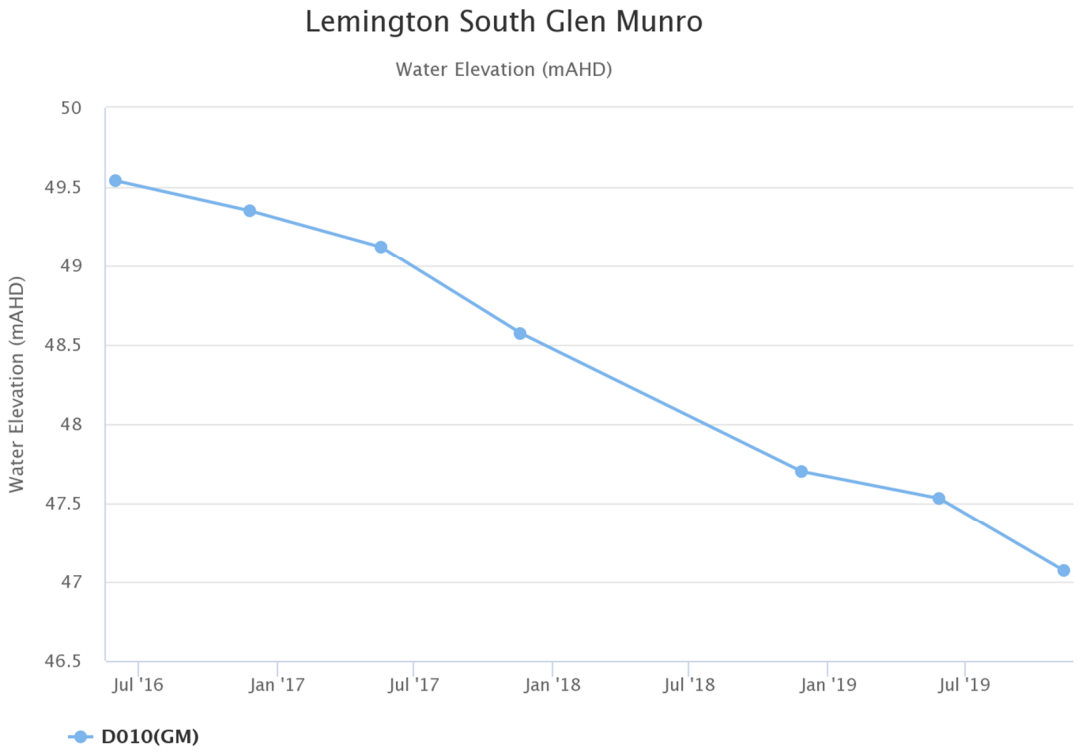

Figure 80: Lemington South Glen Munro Standing Water Level Trend – December 2019

3.5 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 HVO Water Management Plan.

Current internal trigger limits breaches are summarised in Table 4.

Table 4: Groundwater Triggers – Q4 2019

Site	Date	Trigger Limit Breached	Action Taken in Response
CFW55R	9/10/2019 10:45	EC – 95th Percentile	Investigation in progress
CFW55R	24/10/2019 12:35	EC – 95th Percentile	Investigation in progress
B631(BFS)	6/11/2019 13:35	pH - 5th Percentile	Third exceedance – investigation commenced
B631(BFS)	6/11/2019 13:35	EC – 95th Percentile	First exceedance - Watching brief established*
C130(ALL)	8/11/2019 10:35	EC – 95th Percentile	Third exceedance – investigation commenced
C130(WDH)	6/11/2019 10:50	EC – 95th Percentile	First exceedance - Watching brief established*
C630(BFS)	8/11/2019 10:20	pH - 95th Percentile	First exceedance - Watching brief established*
D010(GM)	8/11/2019 11:06	EC – 95th Percentile	Third exceedance – investigation commenced
D612(AFS)	8/11/2019 12:30	EC – 95th Percentile	First exceedance - Watching brief established*
PB01(ALL)	8/11/2019 12:05	EC – 95th Percentile	Third exceedance – investigation commenced

Site	Date	Trigger Limit Breached	Action Taken in Response
BZ1-1	14/11/2019 11:30	pH - 95th Percentile	First exceedance - Watching brief established*
BZ2A(1)	14/11/2019 11:20	pH - 5th Percentile	First exceedance - Watching brief established*
BZ3-1	14/11/2019 11:05	pH - 95th Percentile	First exceedance - Watching brief established*
BZ3-3	14/11/2019 11:10	pH - 5th Percentile	First exceedance - Watching brief established*
Hobdens Well	14/11/2019 10:50	pH - 95th Percentile	Second exceedance – Maintain watching brief
CFW55R	6/11/2019 13:00	EC – 95th Percentile	Investigation in progress
CFW55R	20/11/2019 12:00	EC – 95th Percentile	Investigation in progress
NPZ5	5/12/2019 8:00	pH - 5th Percentile	First exceedance - Watching brief established*
4032P	4/12/2019 12:30	EC – 95th Percentile	First exceedance - Watching brief established*
CGW49	4/12/2019 12:50	EC – 95th Percentile	Second exceedance – Maintain watching brief
4116P	4/12/2019 13:15	EC – 95th Percentile	Investigation in progress
CFW55R	4/12/2019 10:15	EC – 95th Percentile	Investigation in progress
CFW55R	18/12/2019 8:55	EC – 95th Percentile	Investigation in progress

* = Watching brief established pending outcomes of subsequent monitoring events. No specific actions required.

4.0 BLASTING

HVO have a network of five 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 83. Blasting criteria are summarised in Table 5.

Table 5: Blasting Criteria

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%*

4.1 Blast Monitoring Results

During December, 16 blasts were initiated at HVO. Figure 81 and Figure 82 show the blast monitoring results for the reporting period against the impact assessment criteria.

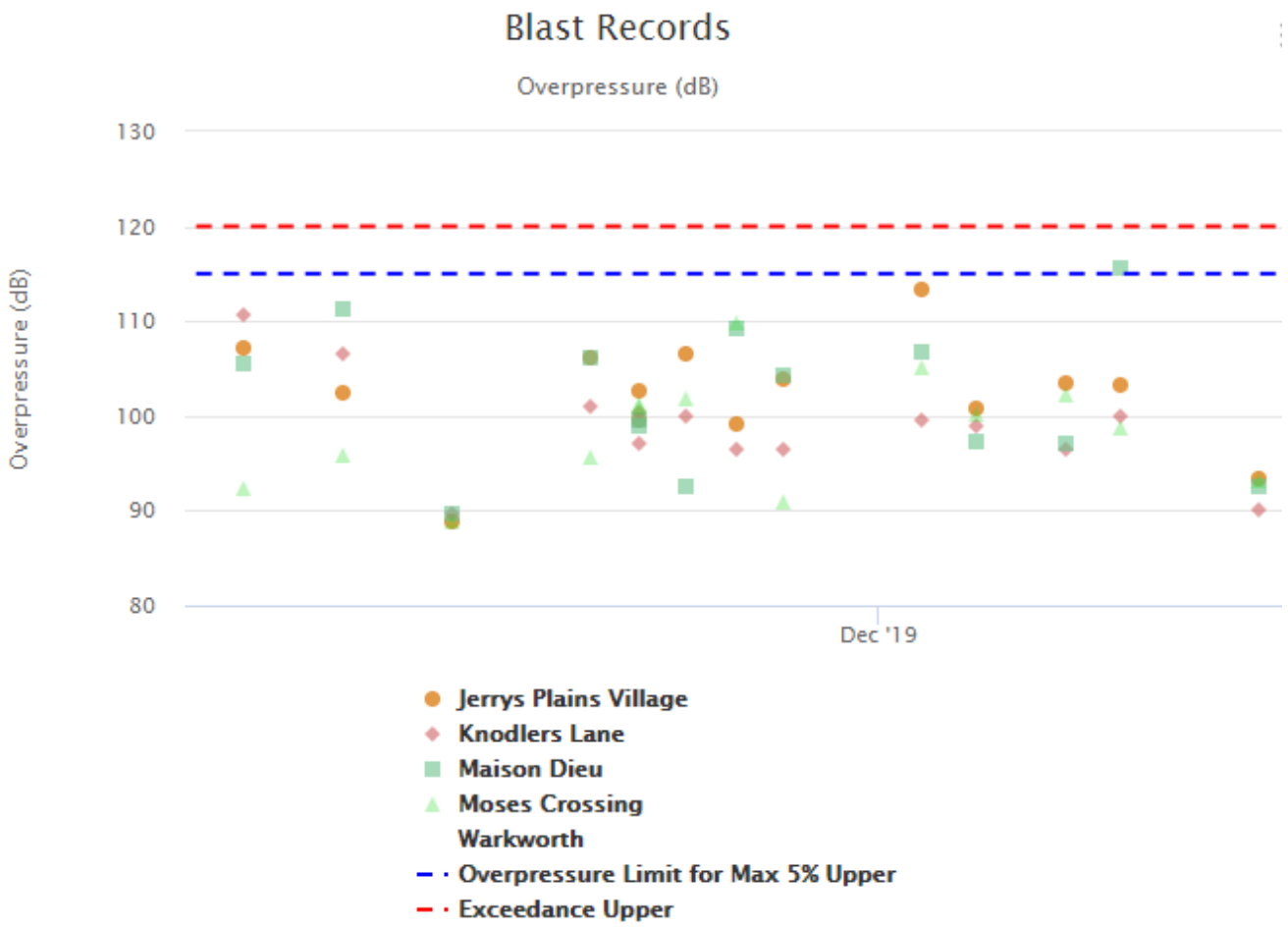

Figure 81: Overpressure Blast Monitoring Results – December 2019

Figure 82: Ground Vibration Blast Monitoring Results – December 2019

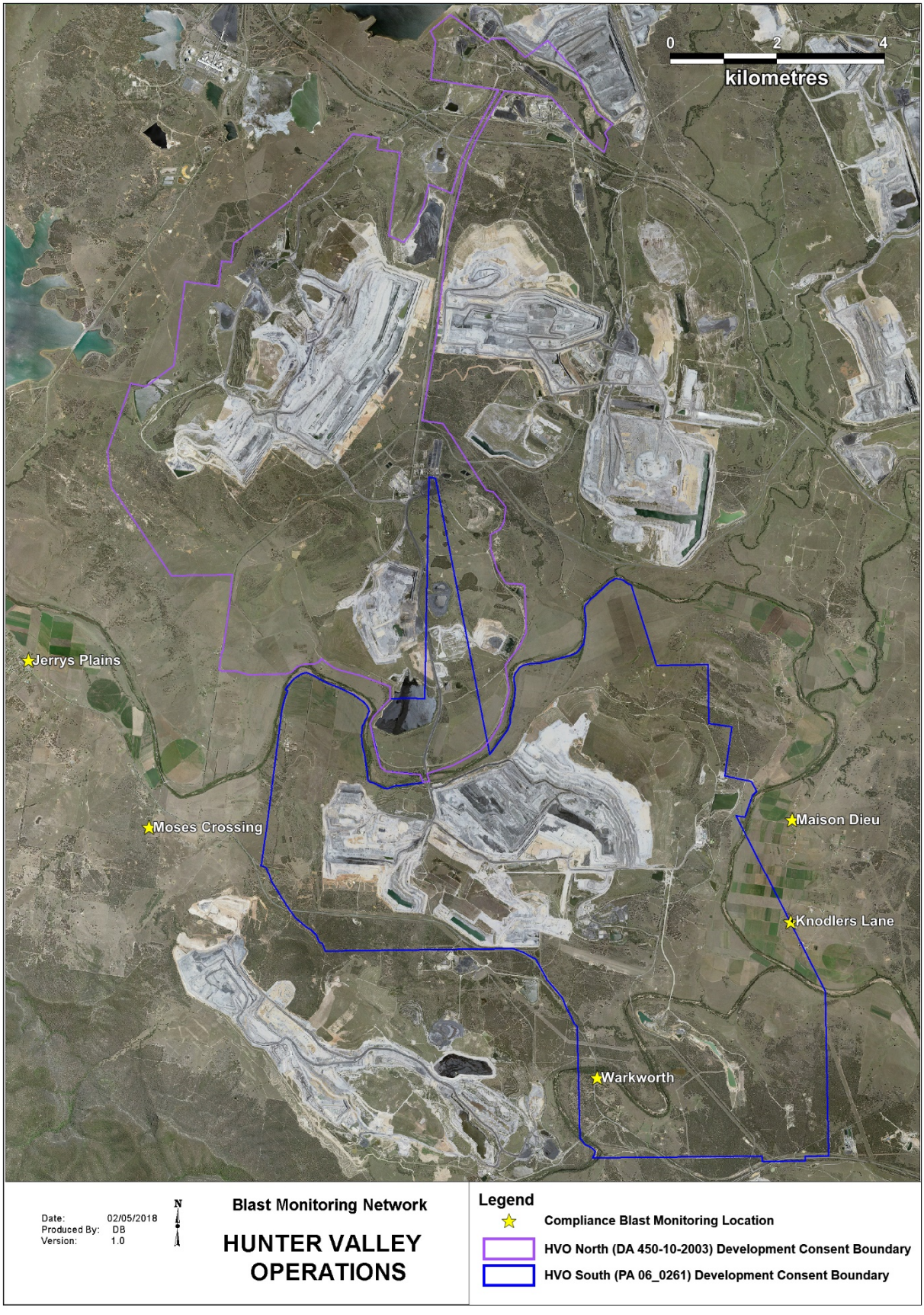

Figure 83: Blast Monitoring Location Plan

5.0 NOISE

Routine attended noise monitoring is carried out at defined locations around HVO as described in the HVO Noise Monitoring Programme. 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 HVO. The attended noise monitoring locations are displayed in Figure 84.

5.1 Attended Noise Monitoring Results

Attended monitoring was conducted at receiver locations surrounding HVO on the night of 5 December 2019 with no non-compliances recorded. Monitoring results are detailed in Table 6 to Table 10.

Table 6: $L_{Aeq,\ 15\ minute}$ HVO South - Impact Assessment Criteria – December 2019

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class[1]	Criterion dB (A)	Criterion Applies?[2]	HVO South L_{Aeq} dB[3,4]	Exceedance[4,5]
Knodlers Lane	*05/12/2019 21:00*	*5.5*	*D*	*39*	*No*	*28*	*NA*
Maison Dieu	*05/12/2019 21:49*	*3.4*	*D*	*39*	*No*	*29*	*NA*
Shearers Lane	*05/12/2019 21:28*	*4.0*	*D*	*41*	*No*	*32*	*NA*
Kilburnie South	*05/12/2019 23:13*	*3.6*	*E*	*39*	*No*	*IA*	*Nil*
Jerrys Plains Village	*05/12/2019 21:44*	*3.4*	*D*	*35*	*No*	*IA*	*NA*
Jerrys Plains East	*05/12/2019 21:22*	*4.7*	*D*	*35*	*No*	*IA*	*NA*
Long Point Road	*05/12/2019 21:00*	*3.1*	*D*	*35*	*No*	*IA*	*NA*
HVGC	*05/12/2019 23:43*	*3.0*	*E*	*55*	*No*	*32*	*NA*

Notes:
1. Atmospheric data is sourced from the HVO Cheshunt (or MTW Charlton Ridge for Long Point) AWS using logged meteorological data;
2. Noise criteria apply for wind speeds up to 3 metres per second (at a height of 10m), or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;
3. Site-only LAeq,15minute attributed to HVO South Pit Area, including modifying factors if applicable;
4. Bold results in red indicate exceedance of relevant criterion; and
5. NA in exceedance column means atmospheric conditions outside specified in approval and so criterion is not applicable.

Table 7: LA1, 1 minute HVO South - Impact Assessment Criteria – December 2019

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class[1]	Criterion dB (A)	Criterion Applies?[2]	HVO South $L_{A1,\ 1min}$ dB[3,4]	Exceedance[4,5]
Knodlers Lane	*05/12/2019 21:00*	*5.5*	*D*	*45*	*No*	*32*	*NA*
Maison Dieu	*05/12/2019 21:49*	*3.4*	*D*	*45*	*No*	*35*	*NA*
Shearers Lane	*05/12/2019 21:28*	*4.0*	*D*	*45*	*No*	*39*	*NA*
Kilburnie South	*05/12/2019 23:13*	*3.6*	*E*	*45*	*No*	*IA*	*NA*
Jerrys Plains Village	*05/12/2019 21:44*	*3.4*	*D*	*45*	*No*	*IA*	*NA*
Jerrys Plains East	*05/12/2019 21:22*	*4.7*	*D*	*45*	*No*	*IA*	*NA*
Long Point Road	*05/12/2019 21:00*	*3.1*	*D*	*45*	*No*	*IA*	*NA*
HVGC	*05/12/2019 23:43*	*3.0*	*E*	*NA*	*No*	*39*	*NA*

Notes:
1. Atmospheric data is sourced from the HVO Cheshunt (or MTW Charlton Ridge for Long Point) AWS using logged meteorological data;
2. Noise criteria apply for wind speeds up to 3 metres per second (at a height of 10m), or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;
3. Site-only LA1,1minute attributed to HVO South Pit Area;
4. Bold results in red indicate exceedance of relevant criterion; and
5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval and so criterion is not applicable.

Table 8: LAeq, 15 minute HVO North – Impact Assessment Criteria – December 2019

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class[1]	Criterion dB (A)	Criterion Applies?[2]	HVO North L_{Aeq} dB[3,4]	Exceedance[4,5]
Knodlers Lane	*05/12/2019 21:00*	*3.4*	*D*	*35*	*No*	*IA*	*NA*
Maison Dieu	*05/12/2019 21:49*	*3.2*	*D*	*35*	*No*	*IA*	*NA*
Shearers Lane	*05/12/2019 21:28*	*3.1*	*D*	*35*	*No*	*IA*	*NA*
Kilburnie South	*05/12/2019 23:13*	*2.5*	*D*	*39*	*Yes*	*IA*	*Nil*
Jerrys Plains	*05/12/2019 21:44*	*3.2*	*D*	*36*	*No*	*IA*	*NA*
Jerrys Plains	*05/12/2019 21:22*	*2.8*	*D*	*39*	*Yes*	*IA*	*Nil*
Long Point	*05/12/2019 21:00*	*3.1*	*D*	*35*	*No*	*IA*	*NA*
HVGC	*05/12/2019 23:43*	*2.4*	*D*	*NA*	*Yes*	*IA*	*Nil*

Notes:
1. Atmospheric data is sourced from the HVO Corporate (or MTW Charlton Ridge for Long Point) AWS using logged meteorological data;
2. Noise emission limits apply under all meteorological conditions, except during periods of rain or hail, when average winds speed at microphone heights exceeds 5 metres per second, when wind speeds greater than 3 metres per second are measured at 10m above ground level, or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;
3. Site-only LAeq,15minute attributed to HVO North Pit Area, including modifying factors if applicable;
4. Bold results in red indicate exceedance of criteria; and
5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval and so criterion is not applicable.

Table 9: LAeq,15 minute HVO North - Land Acquisition Criteria – December 2019

Location	Date and Time	Wind Speed (m/s)[1]	Stability Class[1]	Criterion dB (A)	Criterion Applies?[2]	HVO North L_{Aeq} dB[3,4]	Exceedance[4,5]
Knodlers Lane	*05/12/2019 21:00*	*3.4*	*D*	*41*	*No*	*IA*	*NA*
Maison Dieu	*05/12/2019 21:49*	*3.2*	*D*	*41*	*No*	*IA*	*NA*
Shearers Lane	*05/12/2019 21:28*	*3.1*	*D*	*41*	*No*	*IA*	*NA*
Kilburnie South	*05/12/2019 23:13*	*2.5*	*D*	*41*	*Yes*	*IA*	*Nil*
Jerrys Plains Village	*05/12/2019 21:44*	*3.2*	*D*	*41*	*No*	*IA*	*NA*
Jerrys Plains East	*05/12/2019 21:22*	*2.8*	*D*	*41*	*Yes*	*IA*	*Nil*
Long Point Road	*05/12/2019 21:00*	*3.1*	*D*	*41*	*No*	*IA*	*NA*
HVGC	*05/12/2019 23:43*	*2.4*	*D*	*NA*	*Yes*	*IA*	*Nil*

Notes:
1. Atmospheric data is sourced from the HVO Corporate (or MTW Charlton Ridge for Long Point) AWS using logged meteorological data;
2. Noise emission limits apply under all meteorological conditions, except during periods of rain or hail, when average winds speed at microphone heights exceeds 5 metres per second, when wind speeds greater than 3 metres per second are measured at 10m above ground level, or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;
3. Site-only LAeq,15minute attributed to HVO North Pit Area, including modifying factors if applicable;
4. Bold results in red indicate exceedance of relevant criterion; and
5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval and so criterion is not applicable.

Table 10: LA1, 1 Minute HVO North - Impact Assessment Criteria – December 2019

Location	*Date and Time*	*Wind Speed (m/s)[1]*	Stability Class[1]	*Criterion dB (A)*	*Criterion Applies?[2]*	*HVO North $L_{A1, 1min}$ dB[3,4]*	*Exceedance[4,5]*
Knodlers Lane	*05/12/2019 21:00*	*3.4*	*D*	*46*	*No*	*IA*	*NA*
Maison Dieu	*05/12/2019 21:49*	*3.2*	*D*	*46*	*No*	*IA*	*NA*
Shearers Lane	*05/12/2019 21:28*	*3.1*	*D*	*46*	*No*	*IA*	*NA*
Kilburnie South	*05/12/2019 23:13*	*2.5*	*D*	*46*	*Yes*	*IA*	*Nil*
Jerrys Plains Village	*05/12/2019 21:44*	*3.2*	*D*	*46*	*No*	*IA*	*NA*
Jerrys Plains East	*05/12/2019 21:22*	*2.8*	*D*	*46*	*Yes*	*IA*	*Nil*
Long Point Road	*05/12/2019 21:00*	*3.1*	*D*	*46*	*No*	*IA*	*NA*
HVGC	*05/12/2019 23:43*	*2.4*	*D*	*NA*	*Yes*	*IA*	*Nil*

Notes:
1. Atmospheric data is sourced from the HVO Corporate (or MTW Charlton Ridge for Long Point) AWS using logged meteorological data;
2. Noise emission limits apply under all meteorological conditions, except during periods of rain or hail, when average winds speed at microphone heights exceeds 5 metres per second, when wind speeds greater than 3 metres per second are measured at 10m above ground level, or during stability class G conditions. Criterion may or may not apply due to rounding of meteorological data values;
3. Site-only LA1,1minute attributed to HVO North Pit Area;
4. Bold results in red indicate exceedance of relevant criterion; and
5. NA in criterion column indicates no criterion is applicable at this location. NA in exceedance column means atmospheric conditions outside specified in approval and so criterion is not applicable.

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5.2 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 penalty has been assessed. During December 2019 no penalties were applied. The assessment for low frequency noise is shown in Table 11.

Table 11: Low Frequency Noise Assessment – December 2019

Location	*Date and Time*	*Measured Site Only LA_{eq} dB (Sth/Nth)*	*Site Only LC_{eq} dB[1] (Sth/Nth)*	*Site-Only LCeq – LAeq dB[1,2] (Sth/Nth)*	*Result Max exceedance of ref spectrum dB[1,3] (Sth/Nth)*	*Penalty dB(A) [1] (Sth/Nth)*
Knodlers Lane	*05/12/2019 21:00*	*IA/28*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Maison Dieu	*05/12/2019 21:49*	*IA/29*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Shearers Lane	*05/12/2019 21:28*	*IA/32*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Kilburnie South	*05/12/2019 23:13*	*IA/IA*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Jerrys Plains Village	*05/12/2019 21:44*	*IA/IA*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Jerrys Plains East	*05/12/2019 21:22*	*IA/IA*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
Long Point Road	*05/12/2019 21:00*	*IA/IA*	*No/No*	*NA/NA*	*NA/NA*	*NA/NA*
HVGC	*05/12/2019 23:43*	*IA/32*	*No/No*	*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;
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; and

5.2.1 Real Time Noise Monitoring

HVO utilises a network of real-time directional noise monitors to manage noise impacts on a continuous basis. Noise alarms are in place at five monitoring locations (Knodlers Lane, Maison Dieu, Jerrys Plains, Moses Crossing, and Long Point), which alert HVO staff to elevated noise levels likely to be attributable to HVO. Noise alarms are investigated and responded to with the appropriate level of operational modification. Changes in response to a noise alarm can include replacing equipment with quieter (noise attenuated) units, changing or relocating tasks, and shutting down equipment. It should be noted that this assessment does not compliment or conflict with attended noise monitoring detailed in Section 5.1, and that real time monitoring data includes non-mine noise sources such as dogs, cows, or more commonly, road traffic.

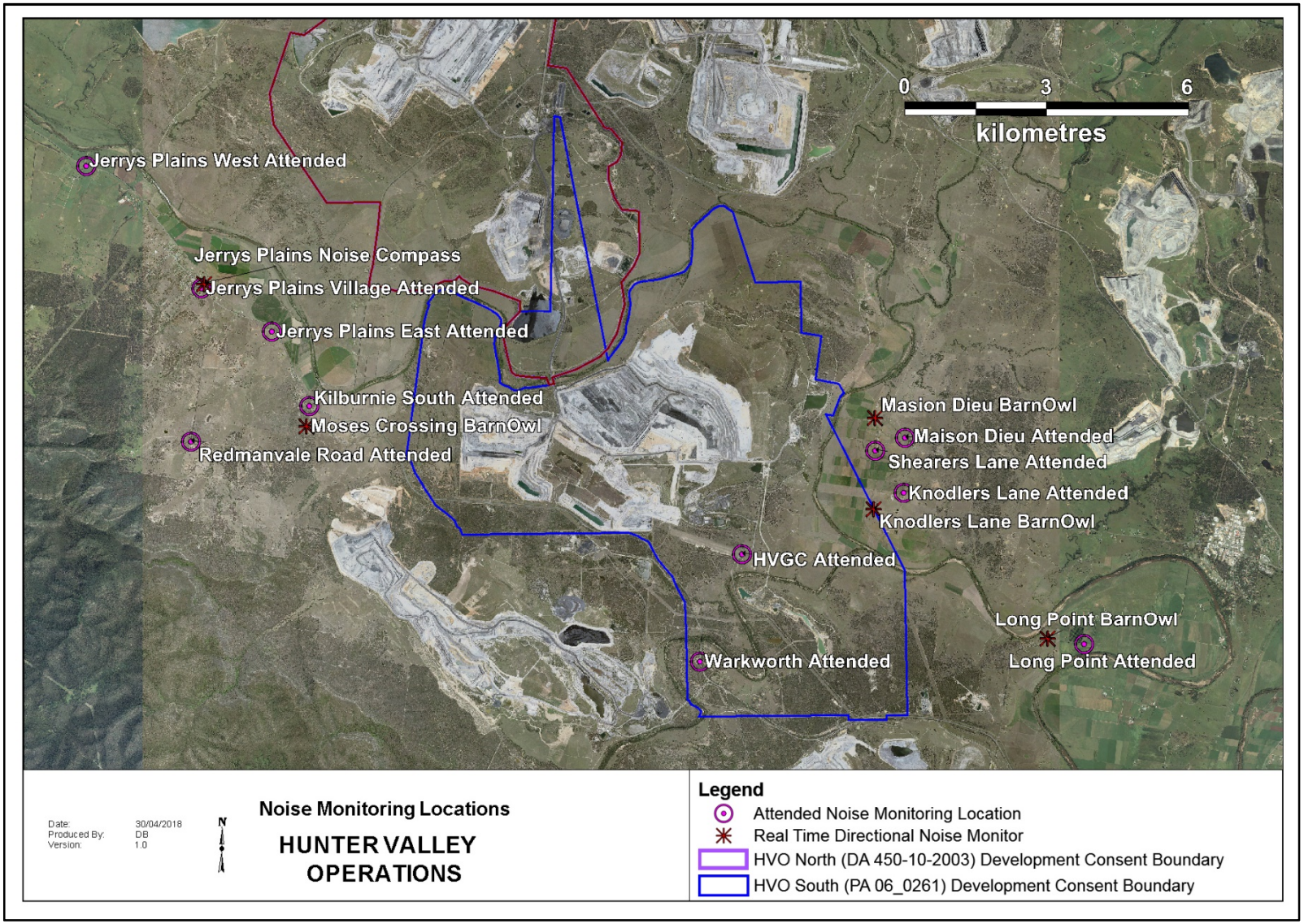

Figure 84: Noise Monitoring Location Plan

6.0 OPERATIONAL DOWNTIME

During December, a total of 1437 hours of equipment downtime was logged in response to real time monitoring and visual inspections for environmental reasons such as dust, noise and meteorological conditions. Operational downtime by equipment type is shown in Figure 85.

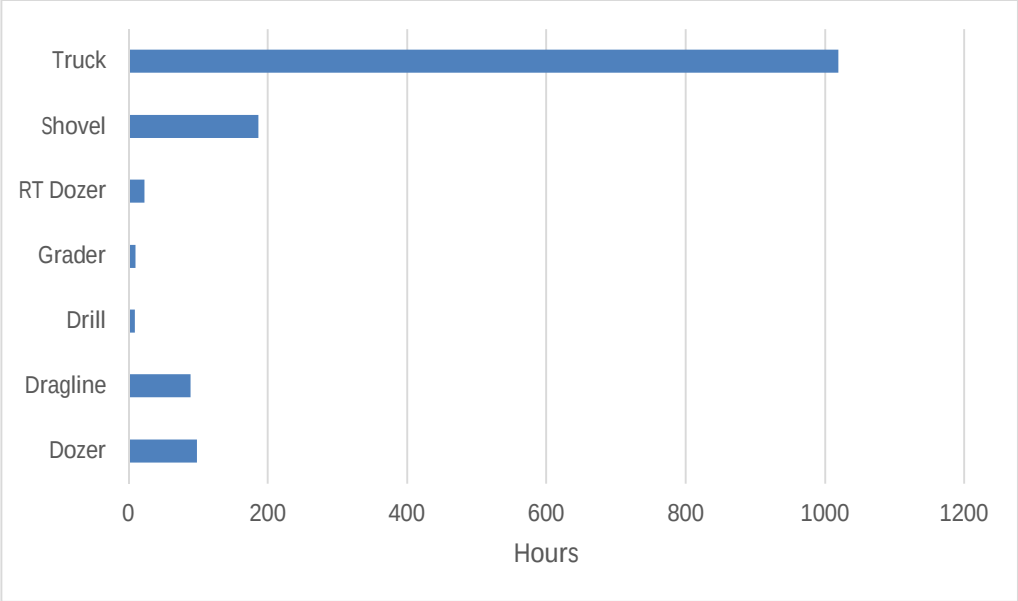

Figure 85: Operational Downtime by Equipment Type – December 2019

7.0 REHABILITATION

During December, no land was released, 2.36 Ha of land was bulk shaped and 13.58 Ha of land was rehabilitated. Year to date progress can be viewed in Figure 86.

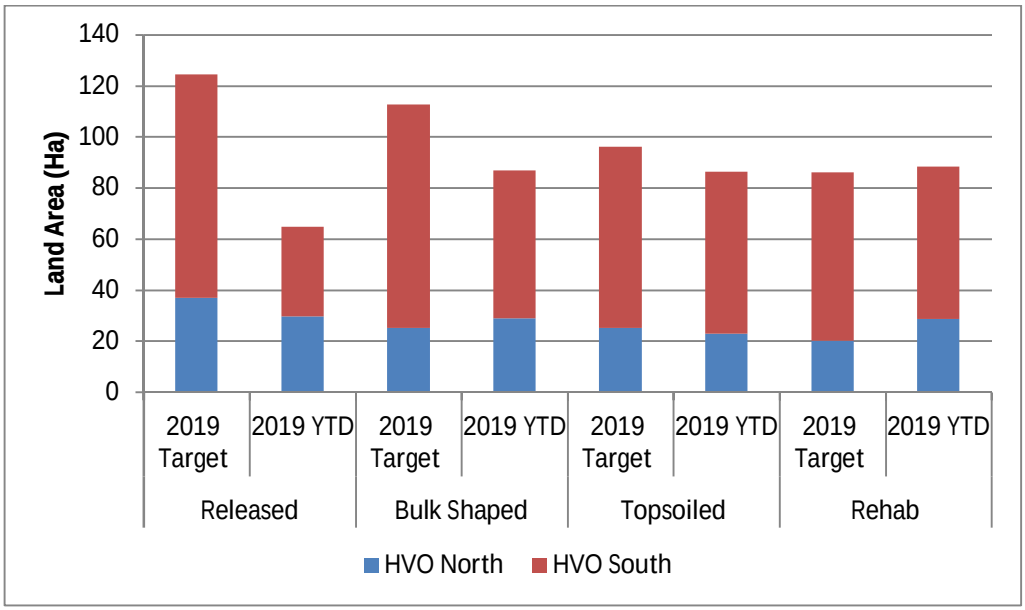

Figure 86: Rehabilitation YTD – December 2019

8.0 COMPLAINTS

No complaints were received during December 2019. A total of 9 complaints were received for 2019. Details of complaints received are shown in Table 12 below.

Table 12: Complaints Summary 2019

Month	Noise	Dust	Blast	Lighting	Other	Total
January	-	-	-	-	-	-
February	-	-	-	-	-	-
March	-	*1*	-	-	-	*1*
April	-	*1*	-	-	-	*1*
May	-	*2*	-	-	-	*2*
June	-	*1*	-	-	*1*	*2*
July	-	-	-	-	-	-
August	-	-	-	-	*1*	*1*
September	-	-	-	-	-	-
October	-	*1*	*1*	-	-	*2*
November	-	-	-	-	-	-
December	-	-	-	-	-	-
Total	***0***	***6***	***1***	***0***	***2***	***9***

9.0 ENVIRONMENTAL INCIDENT

During the reporting period there were no reportable environmental incidents.

APPENDIX A: METEOROLOGICAL DATA

Table 13: Meteorological Data - HVO Corporate Meteorological Station – December 2019

Date	Air Temp Max (°C)	Air Temp Min (°C)*	Relative Humidity Max (%)	Relative Humidity Min (%)*	Solar Radiation Maximum (W/Sq. M)	Wind Dir. Avg (°)	Wind Speed Avg (m/sec)	Rainfall (mm)
1/12/2019	28.6	-	95.1	-	458.4	196.3	4.7	0
2/12/2019	19.3	-	68.3	-	144.3	274.2	8.2	0
3/12/2019	25.1	-	45.0	-	93.6	277.6	6.6	0
4/12/2019	29.5	-	28.3	-	492.4	276.6	6.0	0
5/12/2019	33.0	-	33.8	-	209.7	278.3	4.3	0
6/12/2019	33.1	-	20.9	-	274.7	265.3	5.0	0
7/12/2019	30.9	-	93.1	-	233.7	132	2.6	0
8/12/2019	30.1	-	99.2	-	422.9	117.6	4.5	0
9/12/2019	34.3	-	95.4	-	344.4	136.4	2.6	0
10/12/2019	38.8	-	98.7	-	380.3	191.5	3.1	0
11/12/2019	27.6	-	84.6	-	249.9	113.9	4.7	0
12/12/2019	26.2	-	88.1	-	234.1	107.8	4.4	0
13/12/2019	23.0	-	89.7	-	233.1	112.5	4.0	0
14/12/2019	31.6	-	90.1	-	270.1	187.4	3.0	0
15/12/2019	32.8	-	94.8	-	267.1	189.6	2.6	0
16/12/2019	24.6	-	82.9	-	216.1	151.6	4.5	0
17/12/2019	25.9	-	93.4	-	227.6	111.9	4.1	0
18/12/2019	31.5	-	98.1	-	318.8	113.4	2.4	0
19/12/2019	38.1	-	50.26	-	315.2	210.1	4.1	0
20/12/2019	29.7	-	92.4	-	269.7	113.9	4.8	0
21/12/2019	41.0	-	100	-	332.2	199.6	3.2	0
22/12/2019	23.3	-	78.8	-	193.4	112.6	5.8	0
23/12/2019	21.6	-	97.8	-	512.5	121.4	4.2	0.2
24/12/2019	29	-	98.3	-	524.3	114.5	5.6	0
25/12/2019	29.3	-	100	-	651.8	114.1	4.5	0
26/12/2019	32.2	-	93.3	-	376.3	122	3.3	0
27/12/2019	32.6	-	85.9	-	224.9	117.8	3.7	0
28/12/2019	36.4	-	93.9	-	302.6	135.1	2.0	0
29/12/2019	39.6	-	69.3	-	326.3	181.9	2.1	0
30/12/2019	39.6	-	79.8	-	328.3	180	1.9	0
31/12/2019	39.9	-	59.3	-	323	273.7	4.1	0

* Data not available