METROPOLITAN COAL

SIX MONTHLY REPORT




1 JANUARY TO 30 JUNE 2016

Peabody ENERGY

METROPOLITAN COAL

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1 JANUARY TO 30 JUNE 2016

Project No. MET-08-08
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1 INTRODUCTION

Metropolitan Coal is wholly owned by Peabody Energy Australia Pty Ltd (Peabody), and is located adjacent to the township of Helensburgh and approximately 30 kilometres north of Wollongong in New South Wales (NSW) (Figure 1).

Metropolitan Coal was granted approval for the Metropolitan Coal Project (the Project) by the Minister for Planning under section 75J of the NSW *Environmental Planning and Assessment Act, 1979* on 22 June 2009. A copy of the Project Approval is available on the Peabody website (http://www.peabodyenergy.com).

The Project comprises the continuation, upgrade and extension of underground coal mining operations and surface facilities at Metropolitan Coal. The underground mining longwall layout is shown on Figure 1.

The Metropolitan Coal Environmental Management Structure is shown on Figure 2. In accordance with Condition 6, Schedule 3 of the Project Approval, Metropolitan Coal prepares Extraction Plans for specific mining domains as mining progresses. In accordance with Condition 9(c), Schedule 3 of the Metropolitan Coal Longwalls 23-27 Extraction Plan Approval, this Six Monthly Report has been prepared to report on impacts and environmental monitoring results associated with the Longwalls 23-27 Extraction Plan.

Condition 9(c), Schedule 3 states:

Monitoring and Reporting Requirements

9. The Proponent shall implement a monitoring and reporting procedure that contains the following elements:

...

c) six-monthly reporting of all impacts and environmental monitoring results, including:

- *a comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);*
- *any proposed actions resulting from Triggers being met in the TARP, or other actions;*
- *assessment of compliance with all relevant performance measures and indicators;*
- *a comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and pool level data, piezometer readings, etc;*

...

Notes:

- *The Director-General may agree to a lesser frequency for the bi-monthly and six-monthly reporting set out above, if subsidence impacts and environmental consequences at the mine are relatively rare and benign in character.*
- *There is no need to include results of the monitoring of subsidence effects within bi-monthly and six-monthly reports to P&I. However, a summary of subsidence effects monitoring results should be included in the Annual Review.*
- *Other regular reports may be required by other agencies for their own purposes, such as reports to the Dams Safety Committee and regular reports assessing impacts of mining close to sensitive built features. P&I expects to receive copies of reports of these types.*

While Condition 9(c), Schedule 3 of the Project Approval is specific to the Metropolitan Coal Longwalls 23-27 Extraction Plan, Metropolitan Coal has also included reporting of impacts and environmental monitoring results associated with Longwalls 20-22 in this Six Monthly Report.

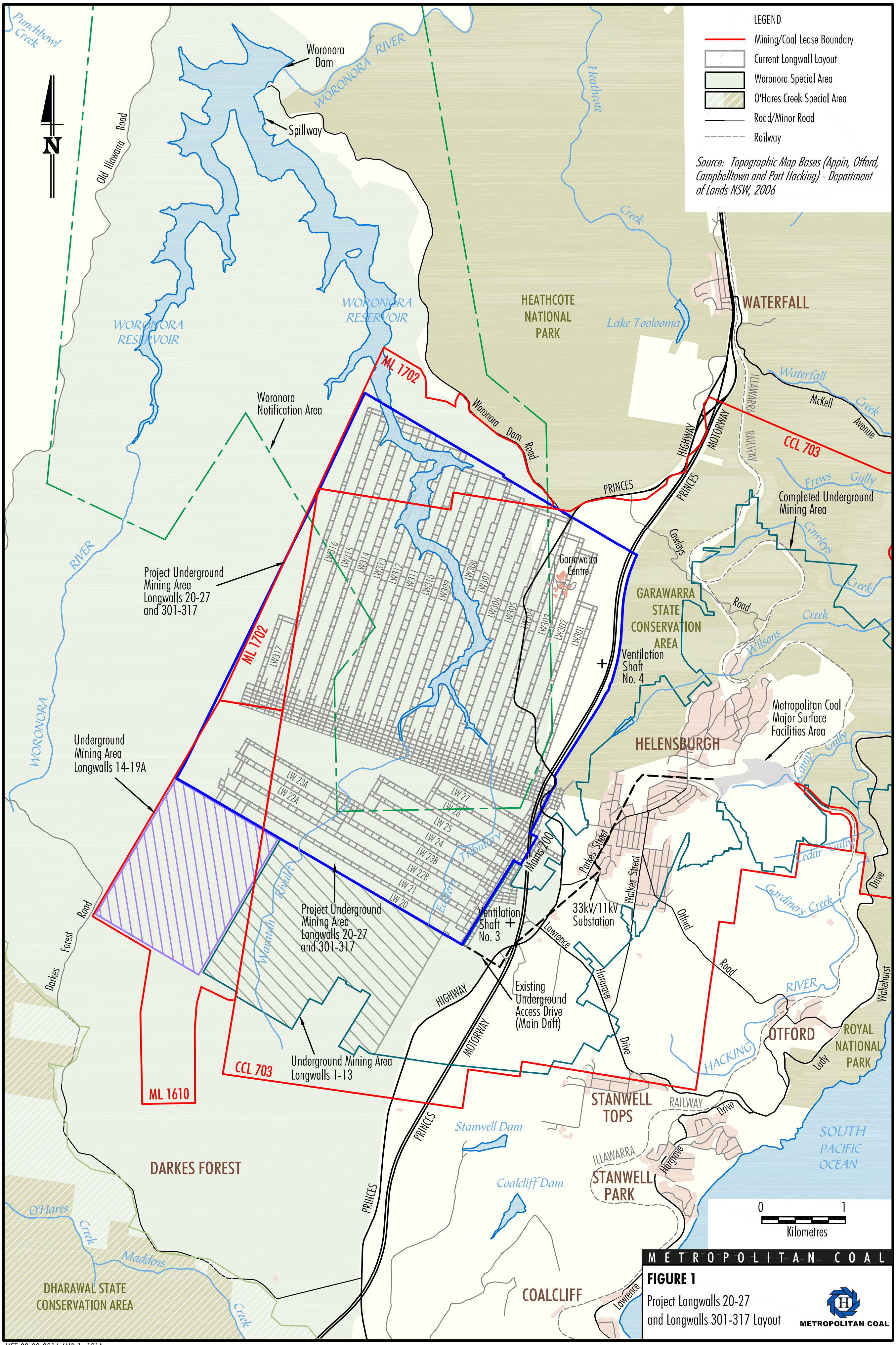

FIGURE 1

Project Longwalls 20-27 and Longwalls 301-317 Layout

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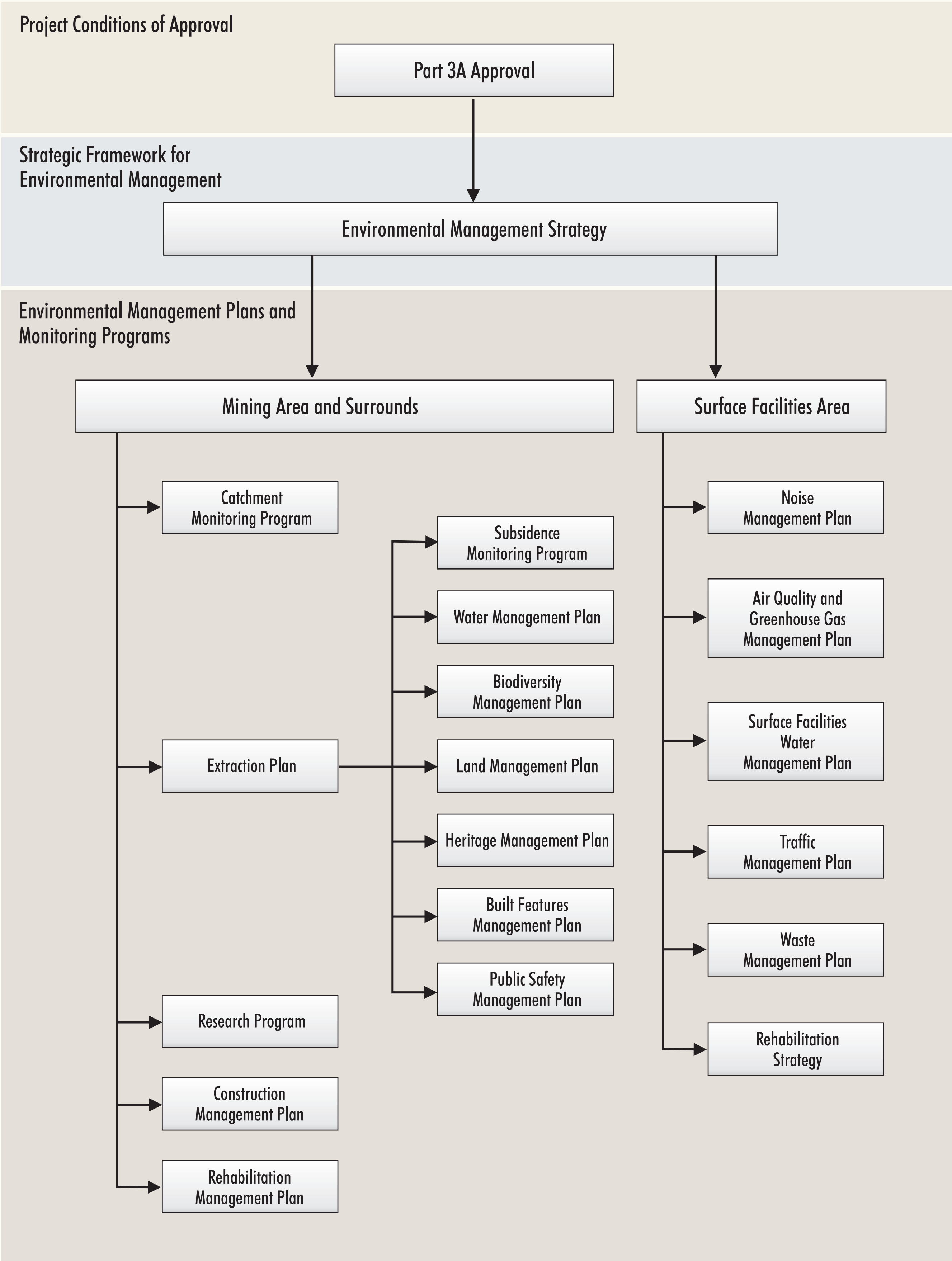

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FIGURE 2
Environmental Management Structure

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This report presents data for the period 1 January to 30 June 2016. The status of longwall development at the end of the reporting period is shown on Figure 3. During the reporting period Longwall 25 extraction was completed in April 2016 and Longwall 26 extraction commenced in May 2016.

2 WATER MANAGMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Water Management Plans were prepared to manage the potential environmental consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on watercourses (including the Woronora Reservoir), aquifers and catchment yield in accordance with Condition 6, Schedule 3 of the Project Approval.

Hydro Engineering & Consulting (2016) and HydroSimulations (2016) have reviewed the environmental performance of the Project in relation to surface water and groundwater in the underground mining area and surrounds for the reporting period. The reports prepared in support of this Metropolitan Coal 2016 Six Monthly Report, 1 January to 30 June 2016 are provided in Appendices A and B, respectively.

2.1 STREAM FEATURES

On the Waratah Rivulet, no new cracking was observed during the reporting period. The cracking previously observed on the Waratah Rivulet at Pools G1 and H, and between Pools N and O, remains unchanged. On the Eastern Tributary, new cracking was observed at Pool ETN (a sandstone block had detached from the bank, and a crack was observed on the streambed approximately 3 m long and 10 mm wide) and at Pool ETO (a number of cracks were observed in the middle and downstream sections of the pool). The cracking previously observed at Pools ETZ and ETAE on the Eastern Tributary remains unchanged. No new cracking or change in existing cracking was observed along Tributaries A and B during the reporting period.

A number of pools ceased to flow or were dry in the upper reaches of the Eastern Tributary during the reporting period including Pools ETG, ETJ, ETL, ETM, ETN, ETU, ETV and ETW as a result of the cracking and dilation of bedrock and associated diversion of surface flow and leakage of water through rock bars. Since 2012 sections of Tributary B have been mostly dry with no surface flow.

Iron staining and/or water discolouration (green opacity) was noted at a number of rock bars and/or pools on Waratah Rivulet, Eastern Tributary, Tributary A and Tributary B. There was no change in the extent or nature of iron staining on the Waratah Rivulet between the full supply level of the Woronora Reservoir and Pool P.

Iron staining was observed on the Eastern Tributary, including in the reach between the full supply level of the Woronora Reservoir and the maingate of Longwall 26. An Eastern Tributary Performance Indicator Iron Staining Register was developed to record the results of the visual inspections and to assist in the assessment of the performance indicator. The current register (as at June 2016) is provided in Appendix C. Iron staining was observed at Boulderfield ETAF, Rock bar ETAF(2), Pool ETAH, Rock bar ETAH and Rock bar ETAK, over a total stream length of approximately 100 m. The performance indicator, *Visual inspection of the Eastern Tributary between the full supply level of the Woronora Reservoir and Pool ETAF does not show significant changes in the extent or nature of iron staining to more than 30% of the Eastern Tributary that isn't also occurring in the Woronora River (control site),* was not exceeded during the reporting period.

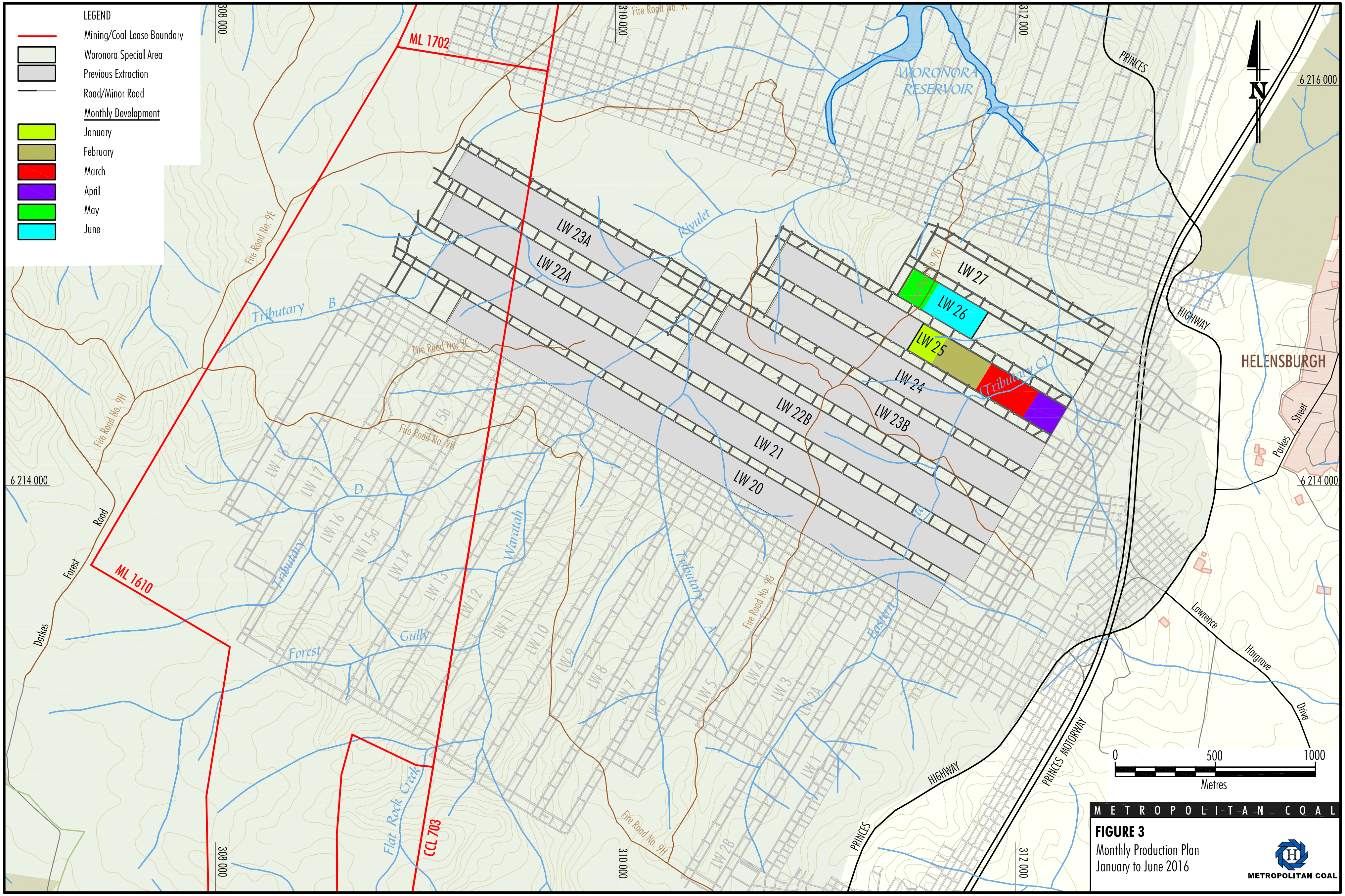

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FIGURE 3

Monthly Production Plan
January to June 2016

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During the reporting period, gas releases in the Waratah Rivulet were observed for the first time in Pool J (29 February to 11 April 2016) and Pool W (from 20 January to 23 May 2016). Gas releases were also observed for the first time on the Eastern Tributary in Pool ETAL (from 14 January to 29 March 2016) and Pool ETAM (from 14 January to 30 June 2016). Gas releases were also observed in pools on the Waratah Rivulet previously identified with gas releases (at Pools K, L and P). Gas releases were observed at Pool K in February 2016 and gas releases continued to be observed at Pools L and P throughout the reporting period. The gas releases were predominantly comprised of methane. No environmental effects resulting from the gas releases (such as riparian vegetation dieback or dead fish) have been observed.

The performance indicator, *No gas releases observed at Pools Q to W on the Waratah Rivulet,* was exceeded for Pool W during the reporting period. As a result, an assessment was made against the performance measure for the Waratah Rivulet, between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (emphasis added), *Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, <u>and</u>* ***<u>minimal gas releases</u>****)*[1] by Associate Professor Barry Noller (The University of Queensland). The assessment concluded the performance measure in relation to gas releases had not been exceeded (The University of Queensland, 2016) and is provided in Appendix D. The assessment by Associate Professor Barry Noller will be subject to peer review in accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Water Management Plans and reported in the 2016 Annual Review.

The visual and photographic surveys conducted within three months of the completion of each longwall provide a detailed photographic record of stream features. A detailed photographic record of the Waratah Rivulet, Eastern Tributary, Tributary A and Tributary B was conducted within three months of Longwall 25 completion.

Monitoring to date indicates the subsidence impact performance measures for the Waratah Rivulet and Eastern Tributary have not been exceeded.

2.2 SURFACE WATER FLOW

Stream flow data is analysed to assess whether a statistically significant reduction in the quantity of water entering Woronora Reservoir in the post-mine period relative to the pre-mine period has occurred, that has not also occurred in the control catchment(s). The quantity of water entering the Woronora Reservoir is not considered to be significantly different post-mining compared to pre-mining if the median (of the ratio of 14 day sums of monitored flow) does not fall below the 20^{th} percentile of the baseline data. Chart 1 indicates that the 12 month sliding median has not fallen below the 20^{th} percentile value.

Surface water flow monitoring at the Waratah Rivulet, Woronora River (Figure 4) and O'Hares Creek gauging stations indicates there has been a negligible reduction in the quantity of water resources reaching the Woronora Reservoir.

[1] The performance indicator for the Eastern Tributary, *Gas releases observed over less than 30% of the between the full supply level of the Woronora Reservoir and Pool ETAF,* was not exceeded, however consideration of the gas releases at Pools ETAL and ETAM was given in the assessment conducted for Pool W.

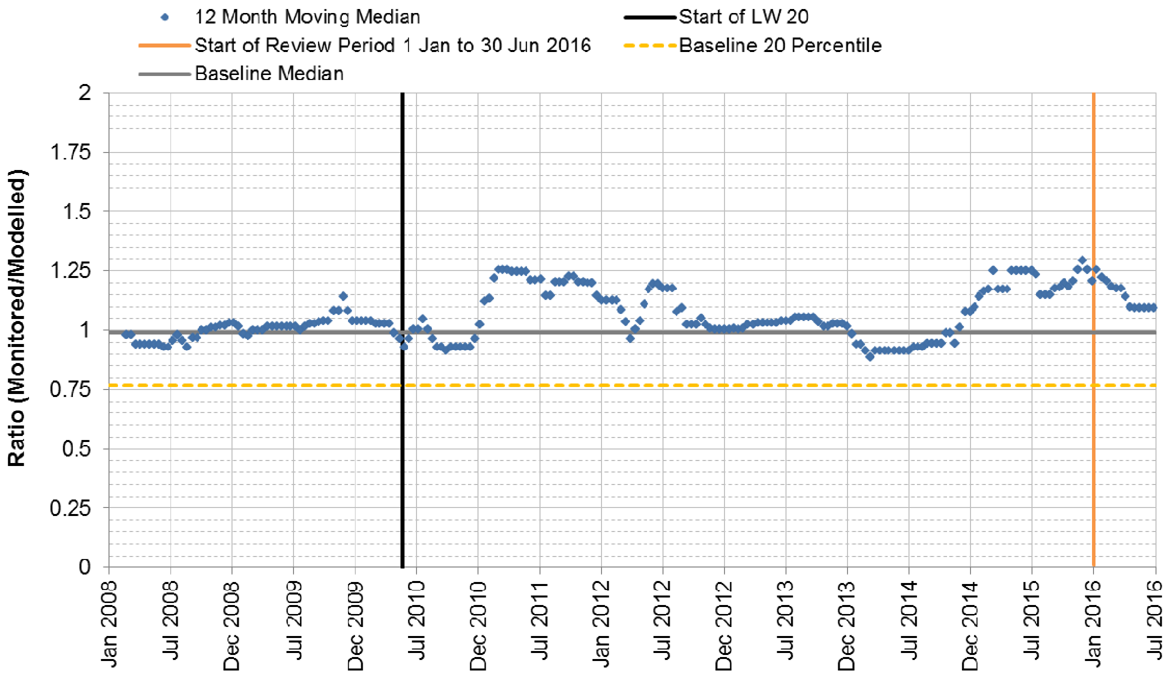


Chart 1 One Year Sliding Median for the Ratios of the 14 Day Sums of Monitored and Modelled Flow Rates at Waratah Rivulet (GS 2132102)

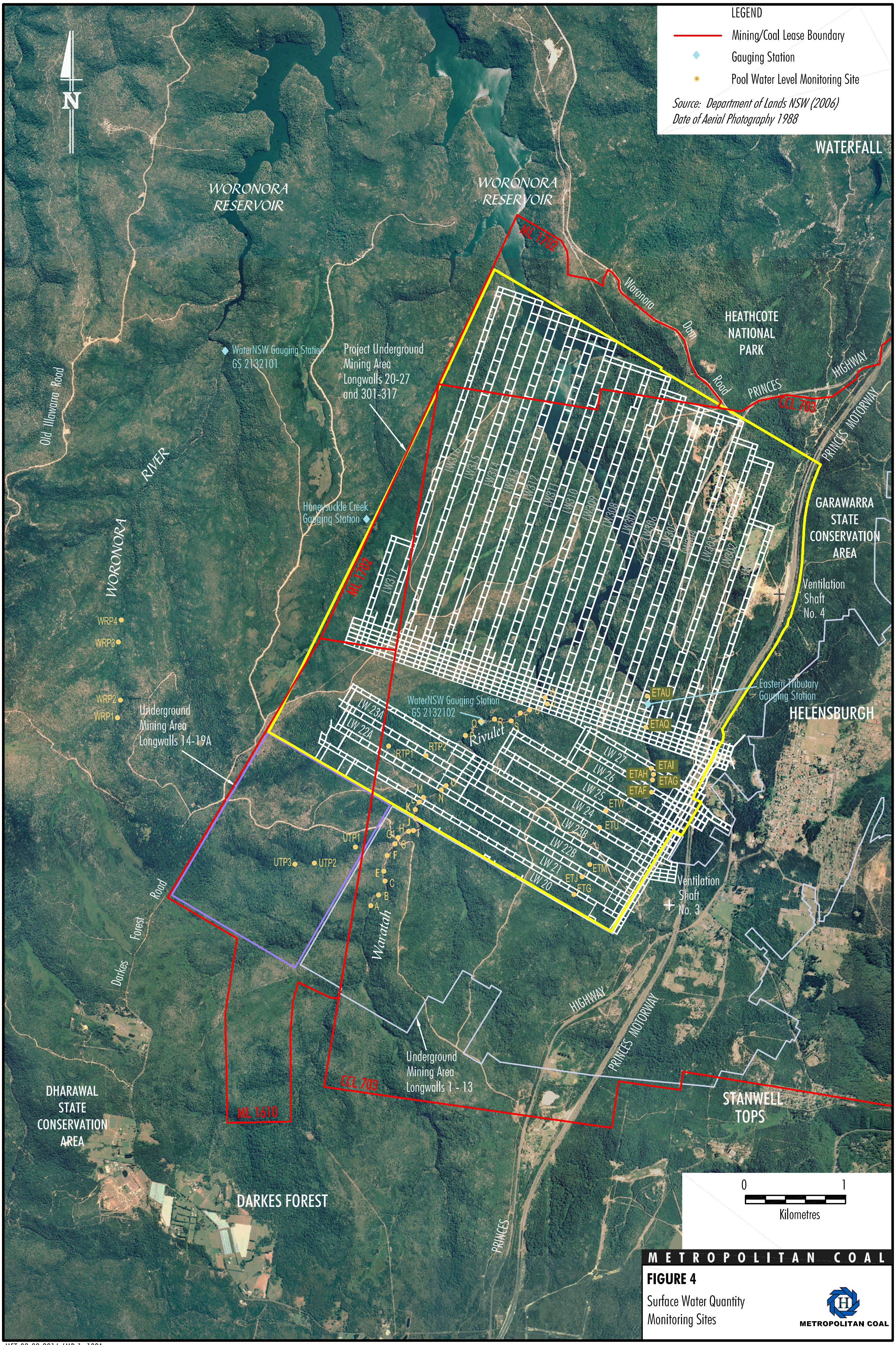
2.3 POOL WATER LEVELS

The water level in a number of pools on the Waratah Rivulet, Eastern Tributary, Tributary B and Woronora River (Figure 4) has been either manually monitored on a daily basis or monitored using a continuous water level sensor and logger.

During the reporting period, all pools with water level meters on the Waratah Rivulet and Eastern Tributary remained above their cease to flow levels or exhibited natural behaviour (i.e. pools that do not have 'solid' rock-bar controls), with the exception of Pools ETG, ETJ, ETM, ETU and ETW on the Eastern Tributary (Figure 4 and Charts 2, 3, 4, 5 and 6 respectively). Pool RTP1 on Tributary B is typically dry with overflow events limited to significant, wet periods (Chart 7). Pool RTP2 on Tributary B has regularly fallen below its cease to flow level, however generally overflows during and following rainfall events (Chart 8). Since 2012 sections of Tributary B have been mostly dry with no surface flow.

The water level in Pool P on the Waratah Rivulet fell below historically recorded water levels during the reporting period, however analysis of recession rates and the shape of the water level hydrograph indicate pool water levels were consistent with natural behaviour. Metropolitan Coal's visual inspections indicate Pool P water levels appeared consistent with natural behaviour on all inspection occasions. It appears there has been a change in the datum levels associated with a change in water level logger housing.

Similarly, recorded water levels fell below historical records at Pool V on two occasions (4 April 2016 and 19 April 2016) during the reporting period. The recorded water level falls were both instantaneous (i.e. occurred in one recorded time interval) and appear to be water level sensor faults with water levels recovering to normal levels on both occasions. Pool water levels were otherwise consistent with natural behaviour (i.e. the pool did not cease to overflow the rock bar). Metropolitan Coal's visual inspections indicate Pool V was overflowing on all inspection occasions.



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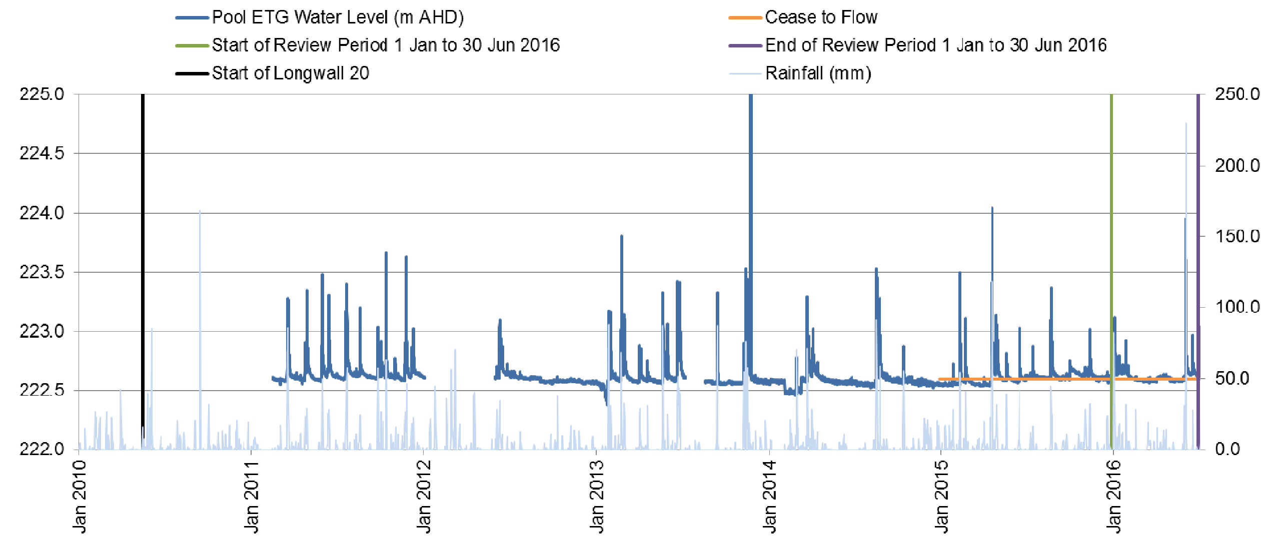

Chart 2 Pool ETG Eastern Tributary

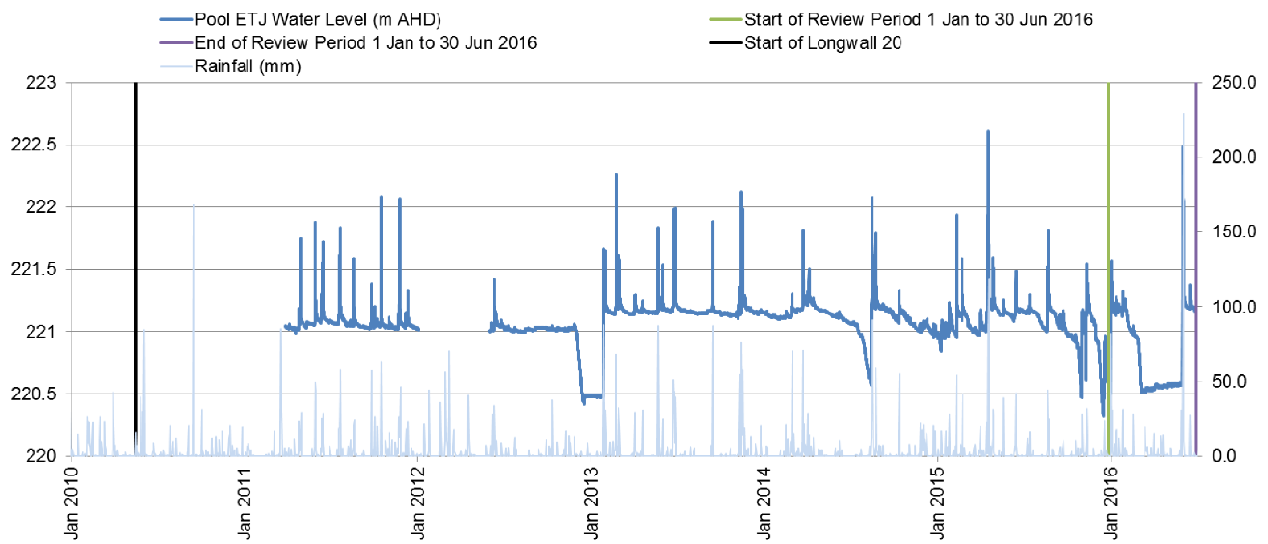

Chart 3 Pool ETJ Eastern Tributary

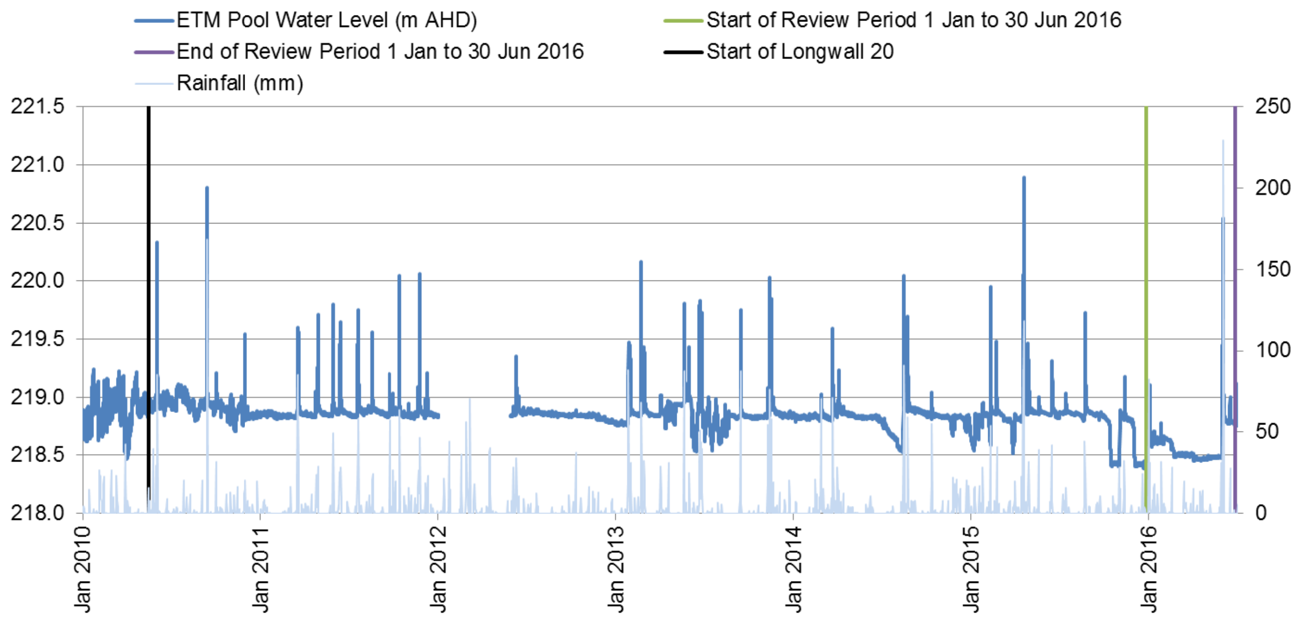

Chart 4 Pool ETM Eastern Tributary

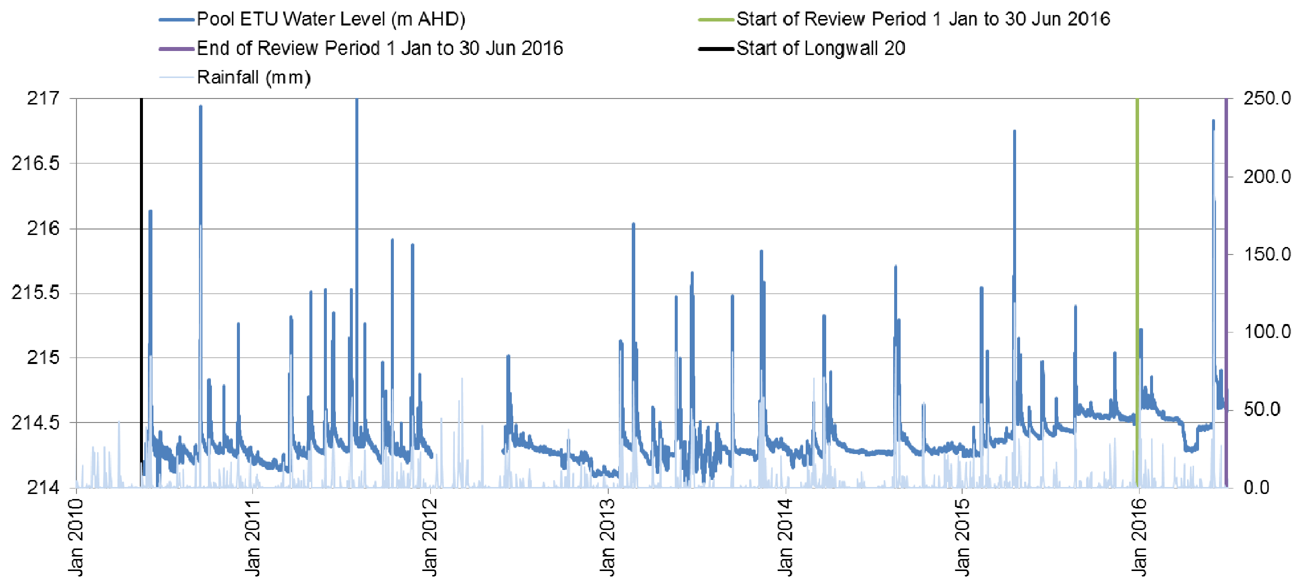

Chart 5 Pool ETU Eastern Tributary

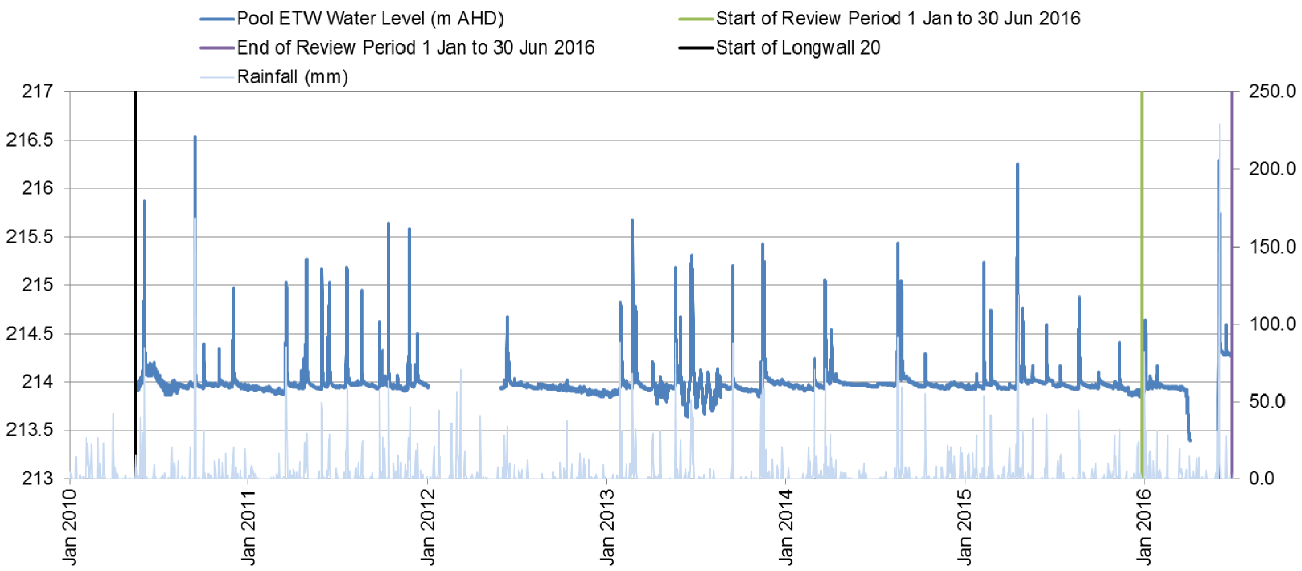

Chart 6 Pool ETW Eastern Tributary

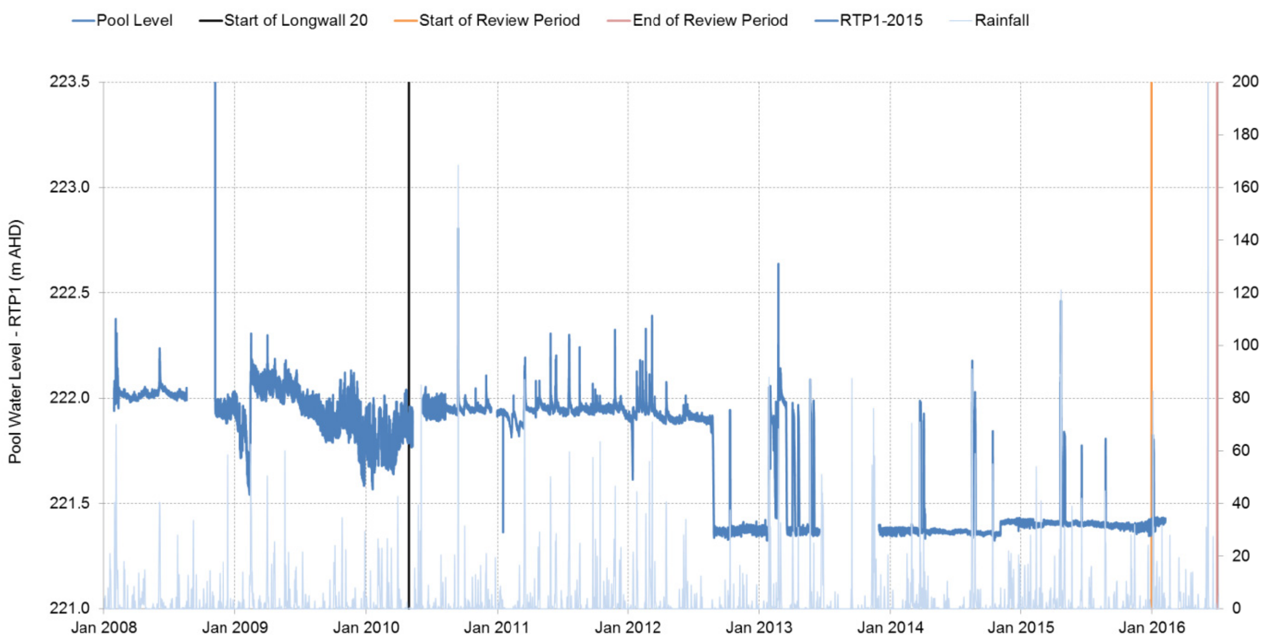

Chart 7 Pool RTP1

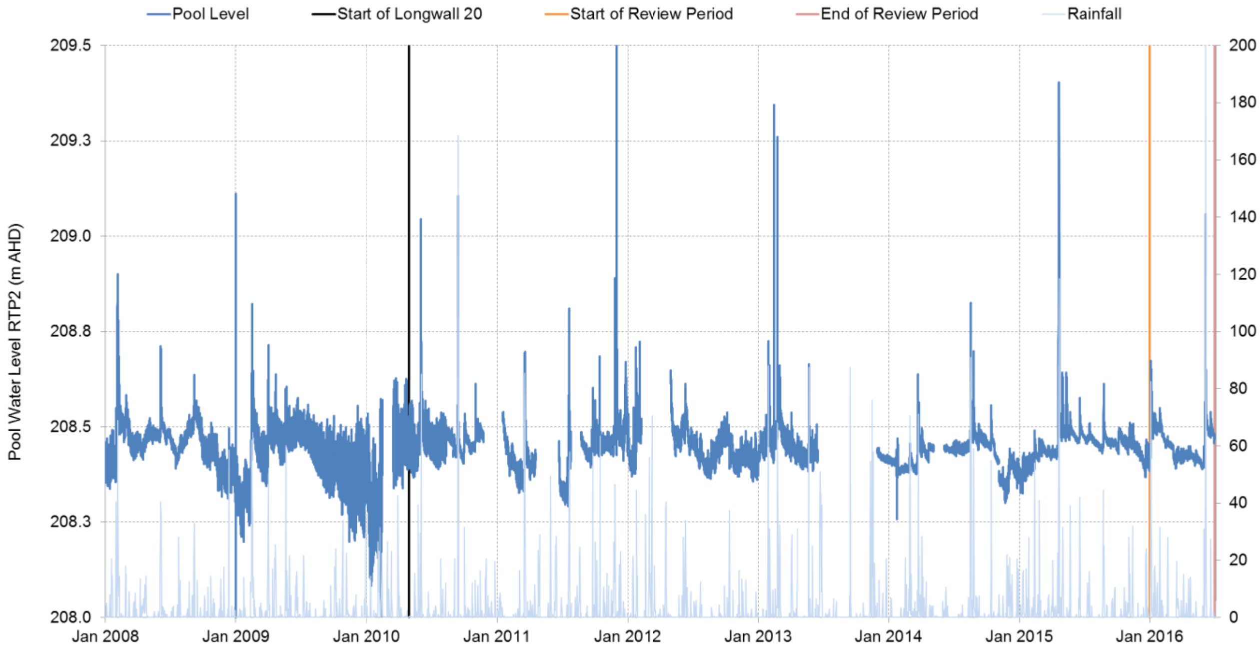

Chart 8 Pool RTP2

To date, mining has not resulted in the diversion of flows or change to the natural drainage behaviour of pools on the Waratah Rivulet downstream of the maingate of Longwall 23 (i.e. Pools P to W) or on the Eastern Tributary downstream of the maingate of Longwall 26 (i.e. Pools ETAG to ETAU).

2.4 STREAM WATER QUALITY

Surface water quality sampling has been conducted monthly at the following sites on Waratah Rivulet (sites WRWQ2, WRWQ6, WRWQ8, WRWQ9, WRWQM, WRWQN, WRWQP, WRWQR, WRWQT, WRWQW), Eastern Tributary (sites ETWQF, ETWQJ, ETWQN, ETWQU, ETWQW, ETWQAF, ETWQAH, ETWQAQ, ETWQAU), Tributary B (site RTWQ1), Tributary D (site UTWQ1), Far Eastern Tributary (site FEWQ1), Honeysuckle Creek (site HCWQ1), Bee Creek (site BCWQ1) and the Woronora River (WOWQ1 and WOWQ2) in accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Water Management Plans (Figure 5).

Water quality patterns at the abovementioned monitoring sites over the reporting period have generally been consistent with earlier data. Trends in the monitoring data to date for key parameters (pH, electrical conductivity, dissolved iron, dissolved manganese and dissolved aluminium) are summarised in Table 1 and shown on Charts 9 to 33.

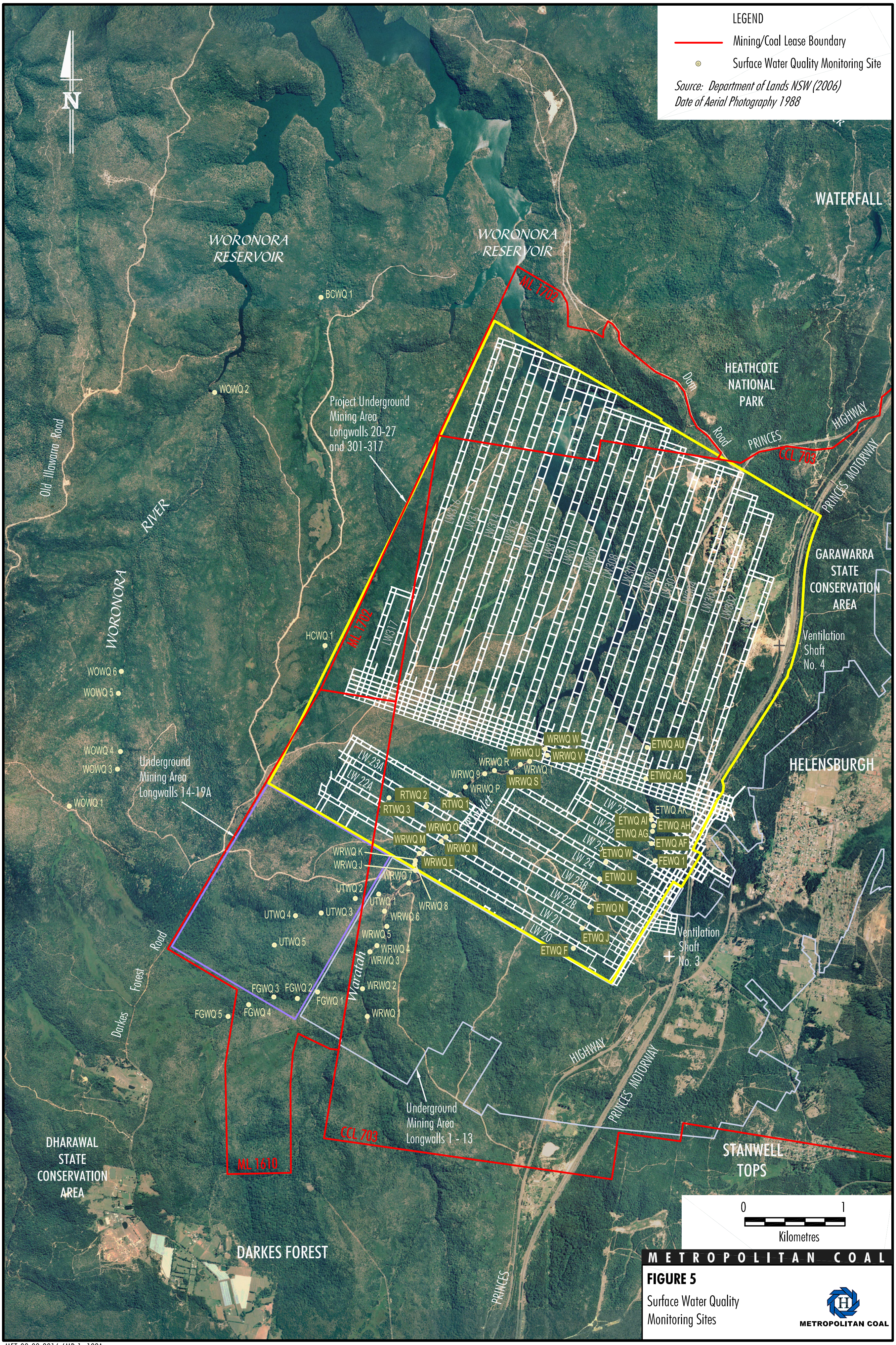

FIGURE 5
Surface Water Quality Monitoring Sites

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Table 1
Summary of Results for Key Water Quality Parameters

Stream(s)	pH	Electrical Conductivity	Dissolved Iron	Dissolved Manganese	Dissolved Aluminium
Waratah Rivulet (sites WRWQ2, WRWQ6, WRWQ8, WRWQ9, WRWQM, WRWQN, WRWQP, WRWQR, WRWQT and WRWQW) (Charts 9 to 18)	• Upstream sites (e.g. sites WRWQ2 and WRWQ6) - slightly acidic to near neutral pH values. • Downstream sites (e.g. sites WRWQ8, WRWQR and WRWQT) - higher (slightly alkaline) pH values.	• Some higher concentrations recorded in January 2016 (e.g. 383 µS/cm at WRWQW; 361 µS/cm at WRWQP; 346 µS/cm at WRWQT and 353 µS/cm at WRWQ9). • A spike was also recorded at WRWQ 6 in February 2016 (570 µS/cm). • Concentrations were otherwise generally low and consistent with earlier values.	• Typically low (below 0.5 mg/L) during the reporting period. • Slightly higher concentrations (up to 0.7 mg/L were recorded at some downstream sites in June 2016.	• Relatively low at upstream sites during the reporting period. • Slightly elevated values were recorded at two downstream sites (WRWQP, 0.148 mg/L and WRWQ9, 0.134 mg/L) in March 2016.	• A spike was recorded in January 2016 at WRWQ 2 (0.16 mg/L) and WRWQ 6 (0.12 mg/L). • An elevated value was also recorded at WRWQW (0.19 mg/L) in June 2016.
Woronora River (sites WOWQ1 and WOWQ2, control stream) (Charts 19 to 23)	• High variability in pH, typically slightly acidic.	• Elevated concentrations recorded at WOWQ1 and WOWQ2 in January (308 µS/cm and 316 µS/cm, respectively) and March 2016 (318 µS/cm and 671 µS/cm, respectively).	• Generally low and similar to values recorded on Waratah Rivulet.	• Typically low, with more elevated concentrations occurring in the summer months.	• Typically low concentrations.
Eastern Tributary (sites ETWQF, ETWQJ, ETWQN, ETWQU, ETWQW, ETWQAF, ETWQAH, ETWQAQ and ETWQAU) (Charts 24 to 28)	• Variable but typically near neutral pH values.	• A slight upward trend in concentrations at most sites during the review period.	• Evidence of seasonal effects. • Some relatively elevated concentrations were recorded in 2015. Concentrations were lower during the reporting period.	• Concentrations were elevated at sites ETWQU, ETWQW and ETWQAF during the reporting period. • A spike in concentration (0.508 mg/L) was also recorded at ETWQU in May 2016.	• Typically low concentrations.

Table 1 (Continued)
Summary of Results for Key Water Quality Parameters

Stream(s)	pH	Electrical Conductivity	Dissolved Iron	Dissolved Manganese	Dissolved Aluminium
Bee Creek (site BCWQ1, control stream), Honeysuckle Creek (site HCWQ1, control stream), Far Eastern Tributary (site FEWQ1), Tributary B (site RTWQ1) and Un-named Tributary (site UTWQ1) (Charts 29 to 33)	• Bee Creek and Honeysuckle Creek - variable to slightly acidic pH levels. • Far Eastern Tributary, Tributary B and Tributary D - near neutral pH levels. • Tributary B - an upward trend in pH to near neutral values from mid-2012.	• Generally low, with the exception of Tributary B. • Tributary B - variable and periodically elevated since late 2013; this trend has continued. • A higher value was recorded at BCWQ 1 in January 2016 (365 µS/cm).	• Generally low, with periodic small spikes recorded mostly during summer months.	• Generally low, with periodic small spikes recorded mostly during summer months. • Tributary B - an upward trend in concentrations recorded since mid-2012, however were low during the reporting period. [A similar trend was observed while mining occurred beneath the Un-named Tributary].	• Low concentrations at Tribuary B, Un-named Tributary and Far Eastern Tributary. • Bee Creek and Honeysuckle Creek - higher (in relation to other tributary sites) over the period of record. This trend continued during most of the reporting period.

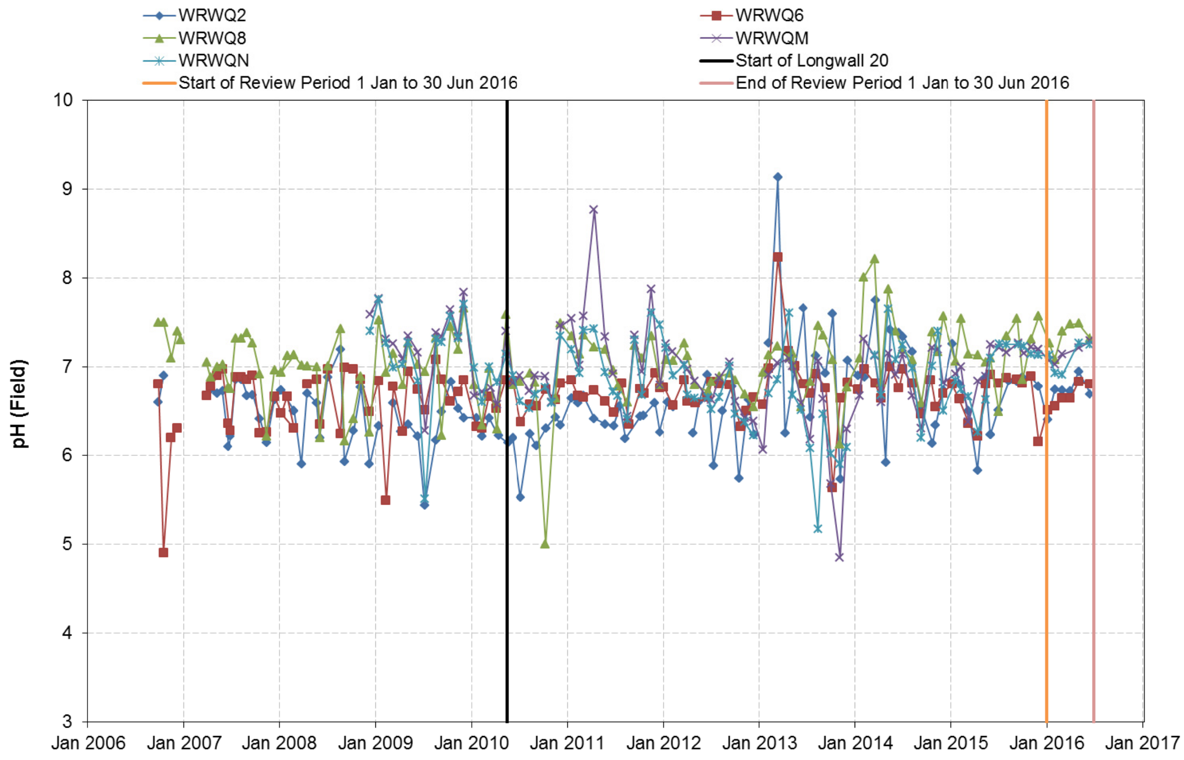

Chart 9 pH Levels Waratah Rivulet – Upper to middle reach sites

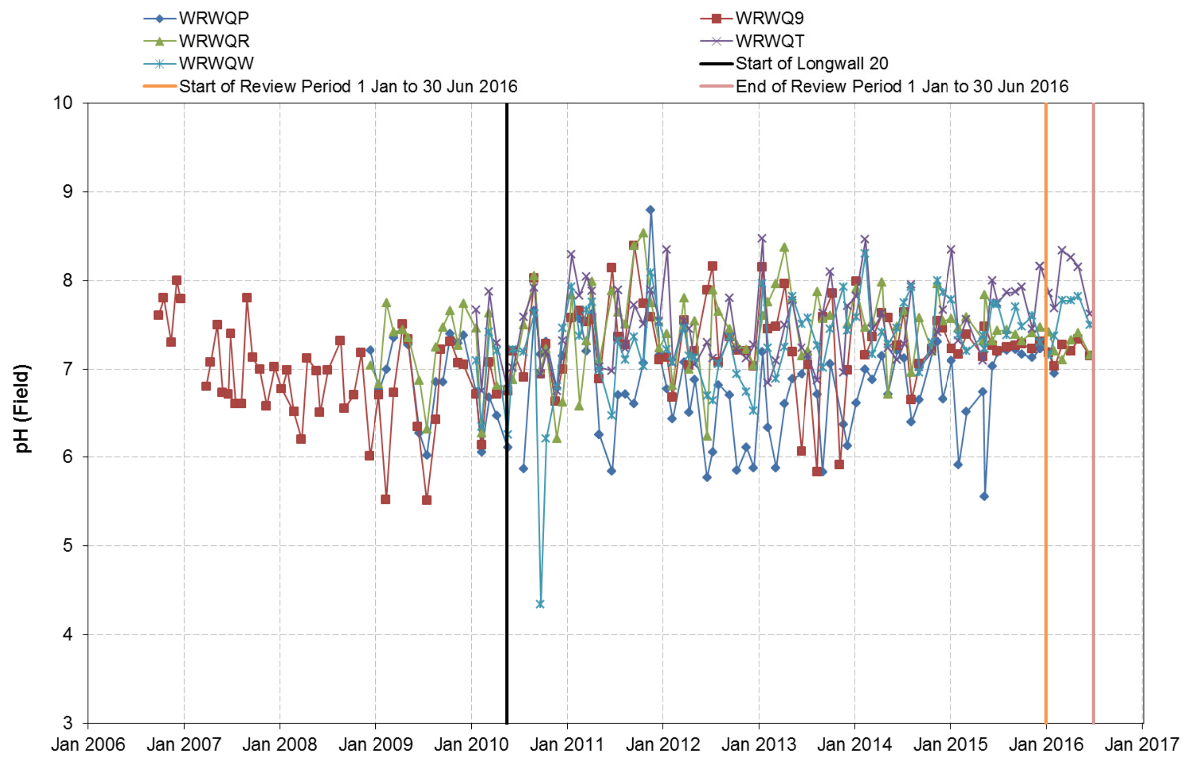

Chart 10 pH Levels Waratah Rivulet – Lower reach sites

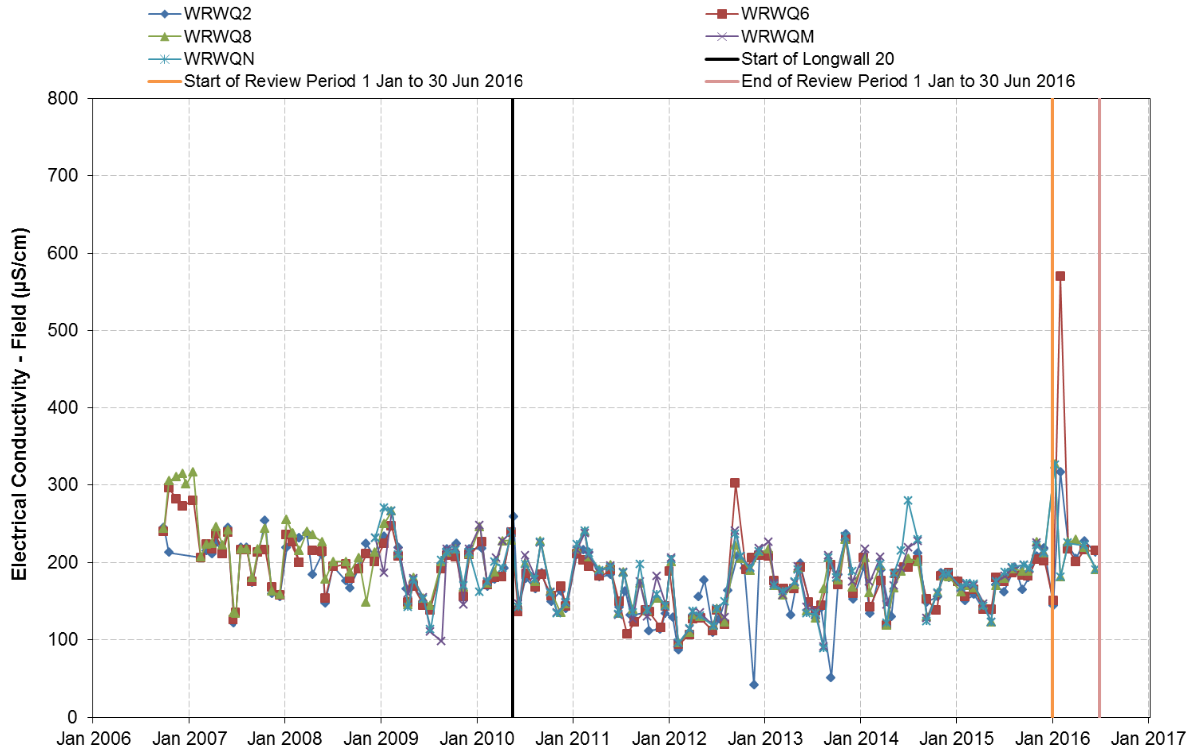

Chart 11 Electrical Conductivity (EC) Waratah Rivulet – Upper to middle reach sites

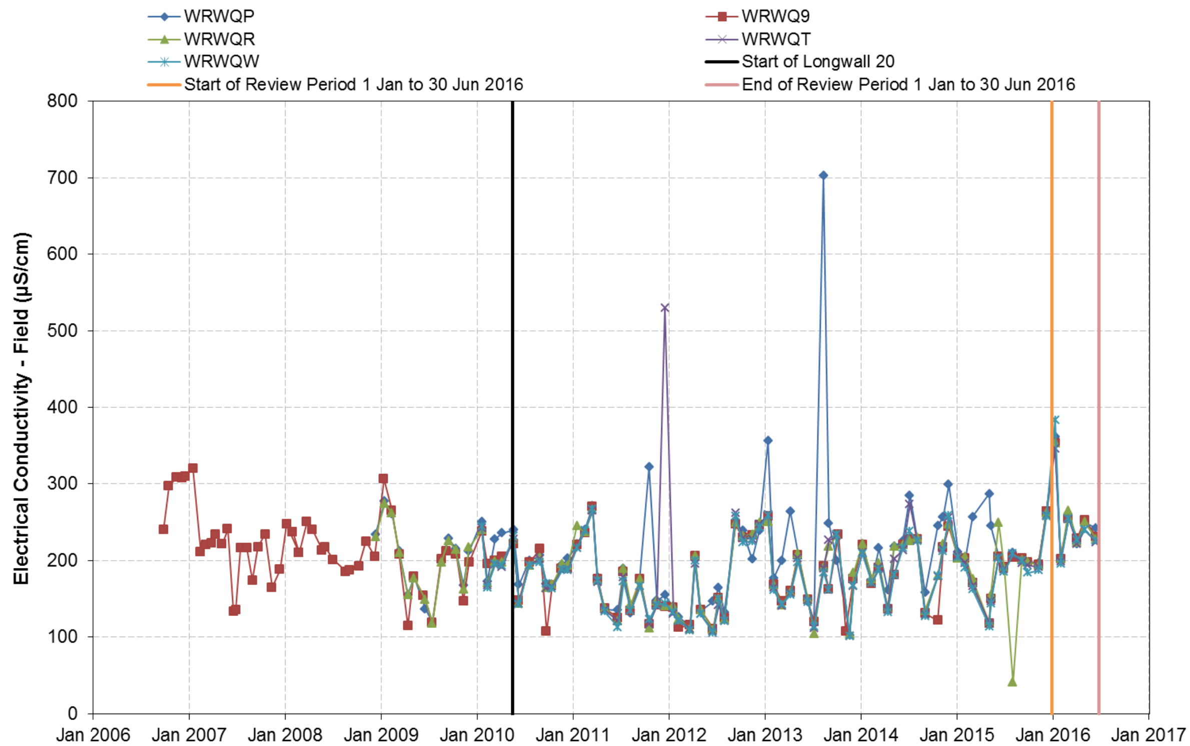

Chart 12 Electrical Conductivity (EC) Waratah Rivulet – Lower reach sites

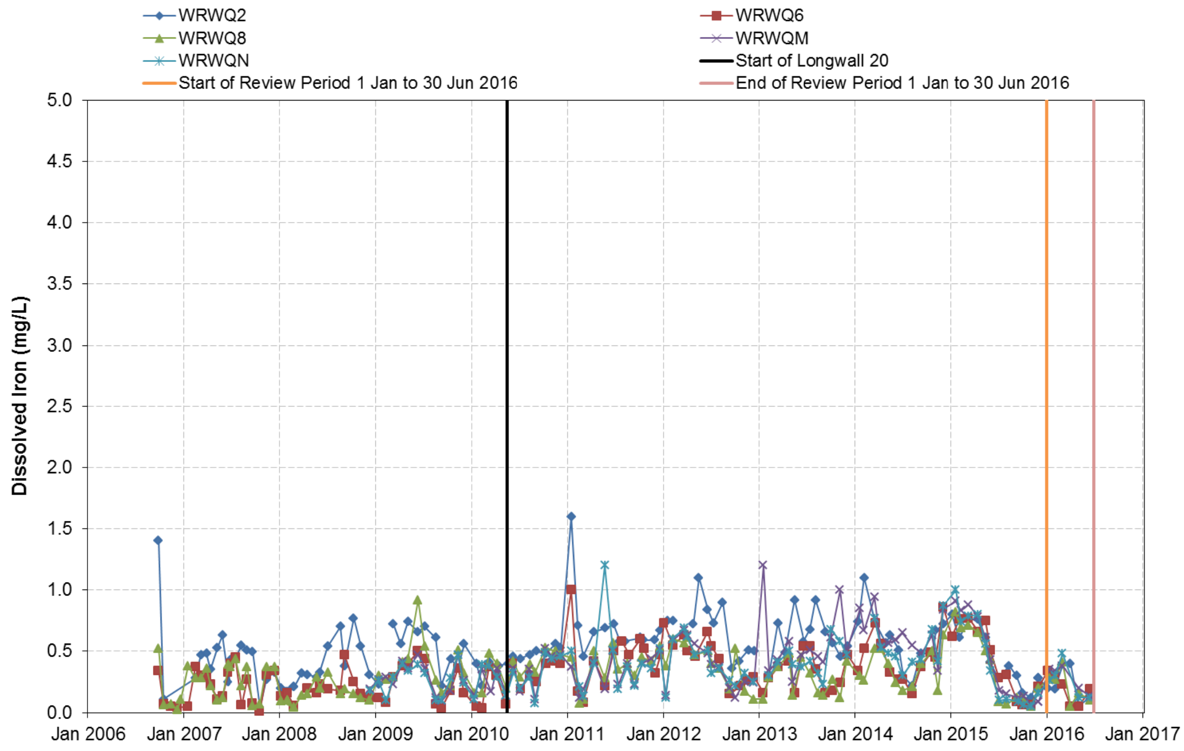

Chart 13 Dissolved Iron Waratah Rivulet – Upper and middle reach sites

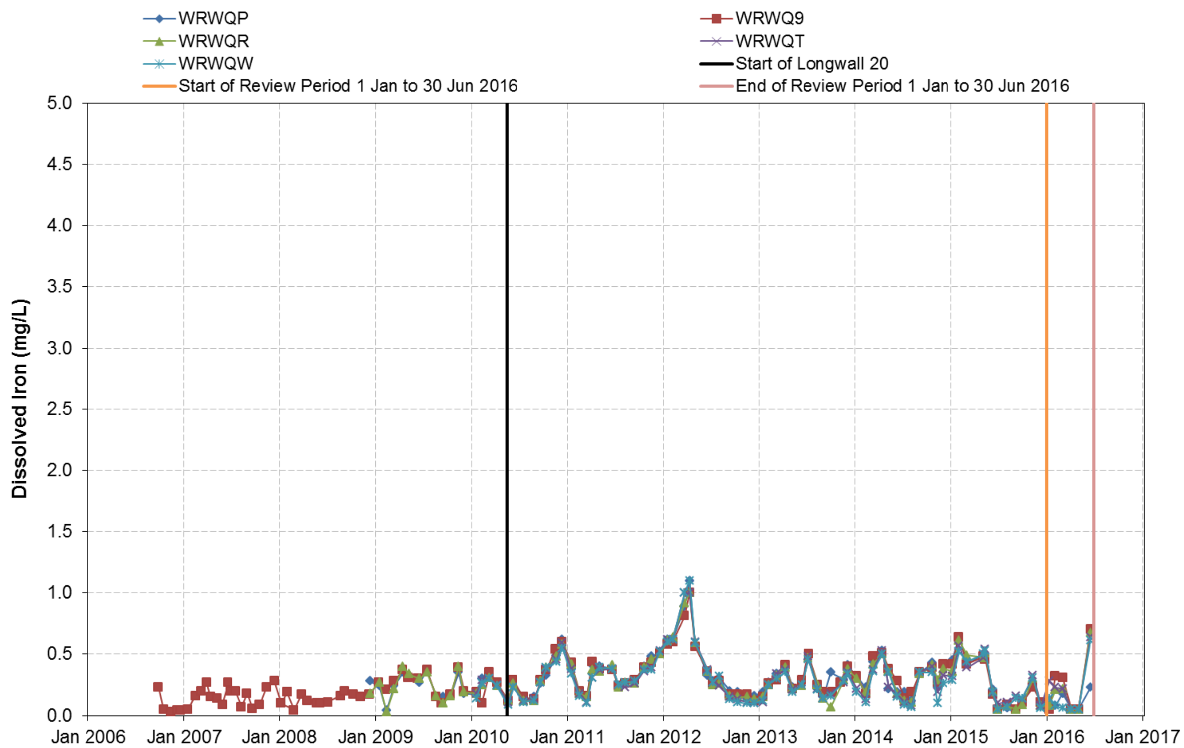

Chart 14 Dissolved Iron Waratah Rivulet – Lower reach sites

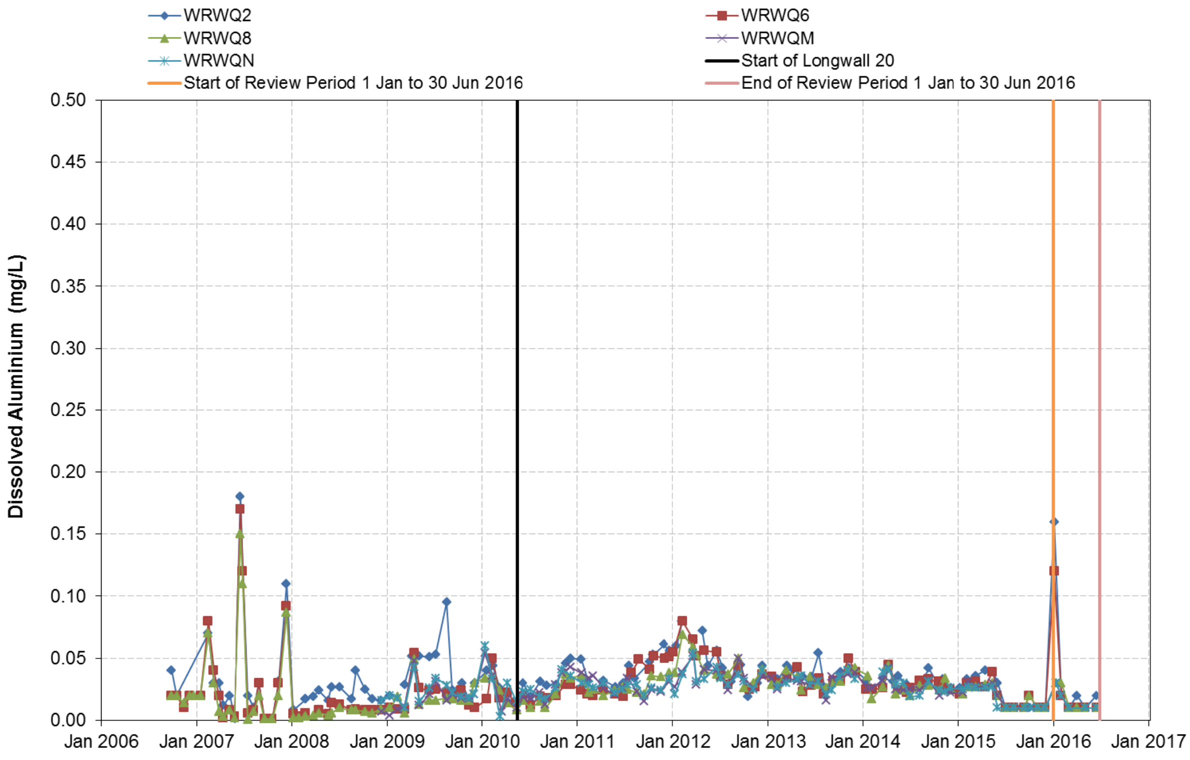

Chart 15 Dissolved Aluminium Waratah Rivulet – Upper to middle reach sites

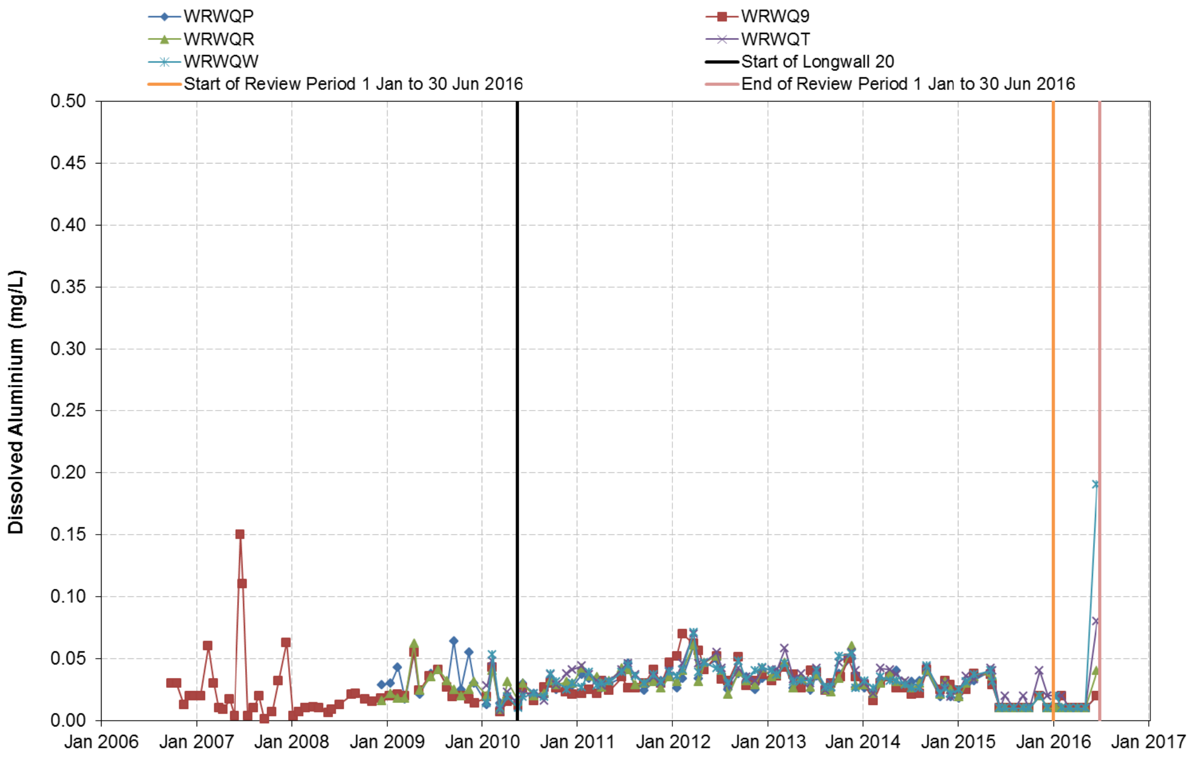

Chart 16 Dissolved Aluminium Waratah Rivulet – Lower reach sites

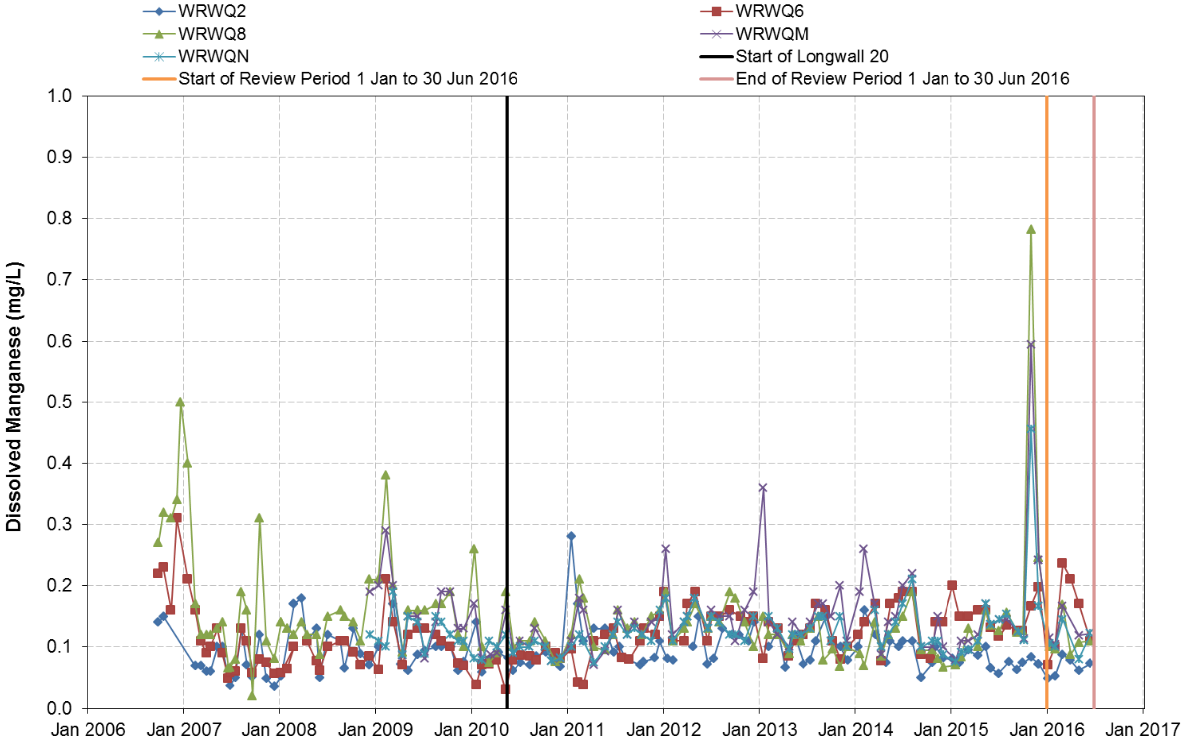

Chart 17 Dissolved Manganese Waratah Rivulet – Upper to middle reach sites

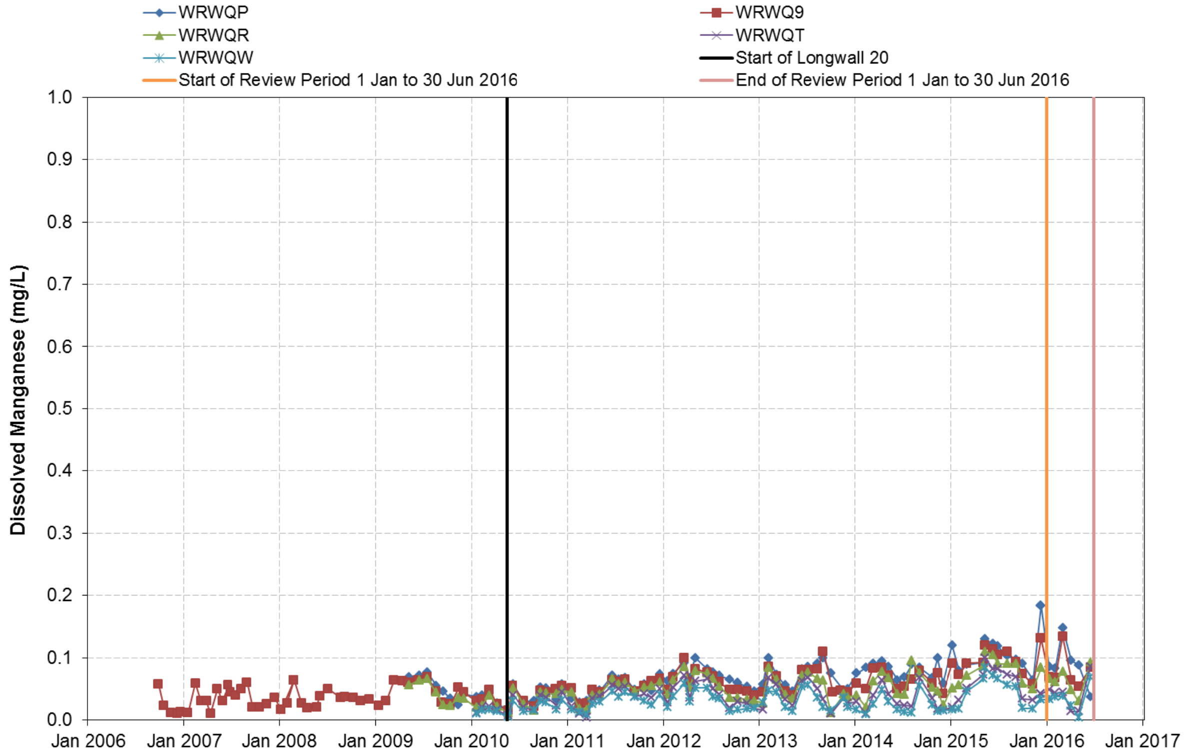

Chart 18 Dissolved Manganese Waratah Rivulet – Lower reach sites

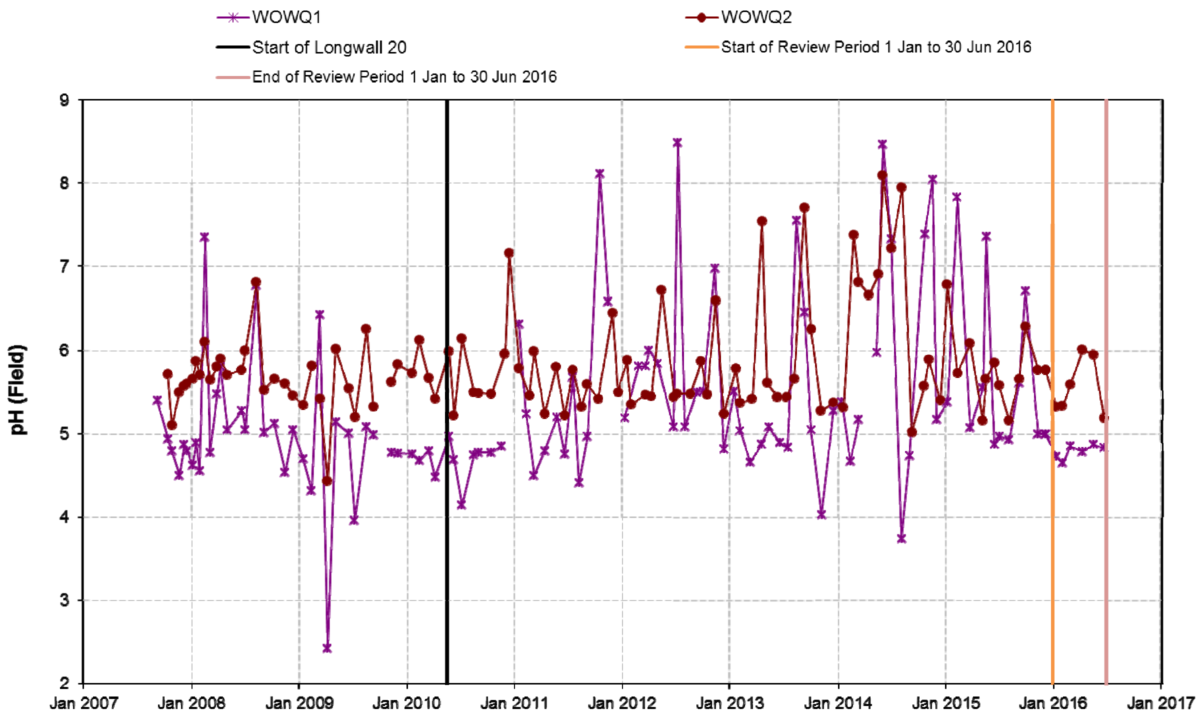

Chart 19 pH Levels Woronora River

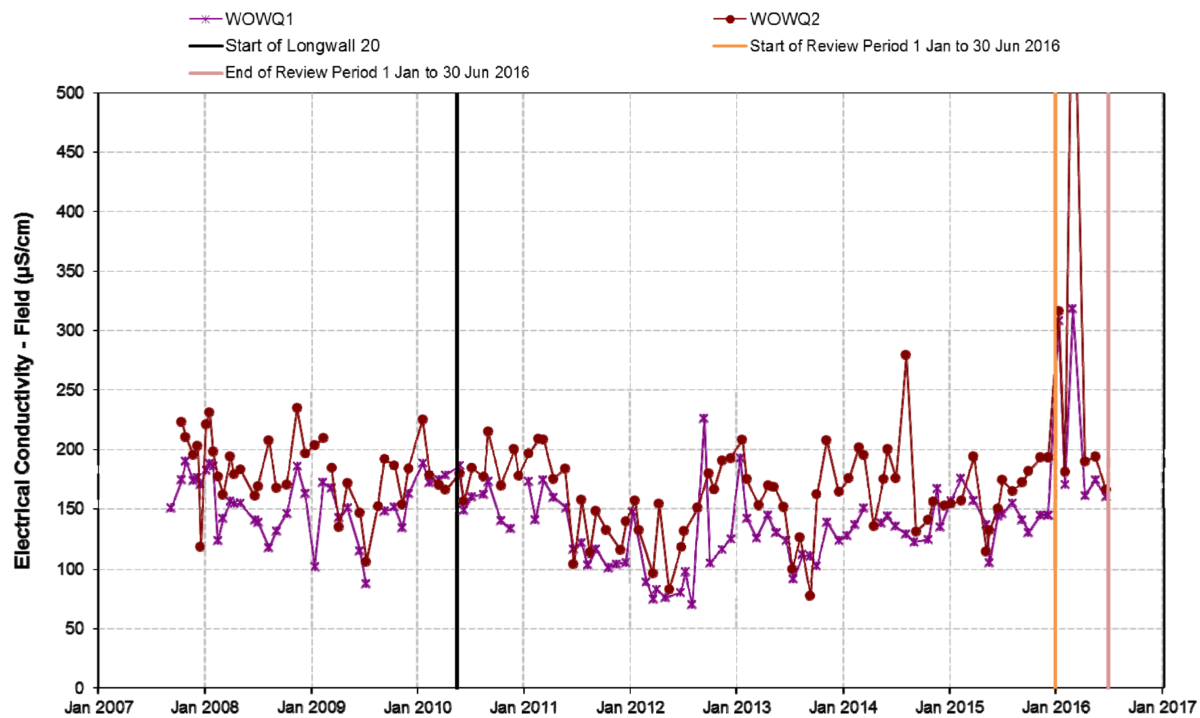

Chart 20a Electrical Conductivity (EC) Woronora River

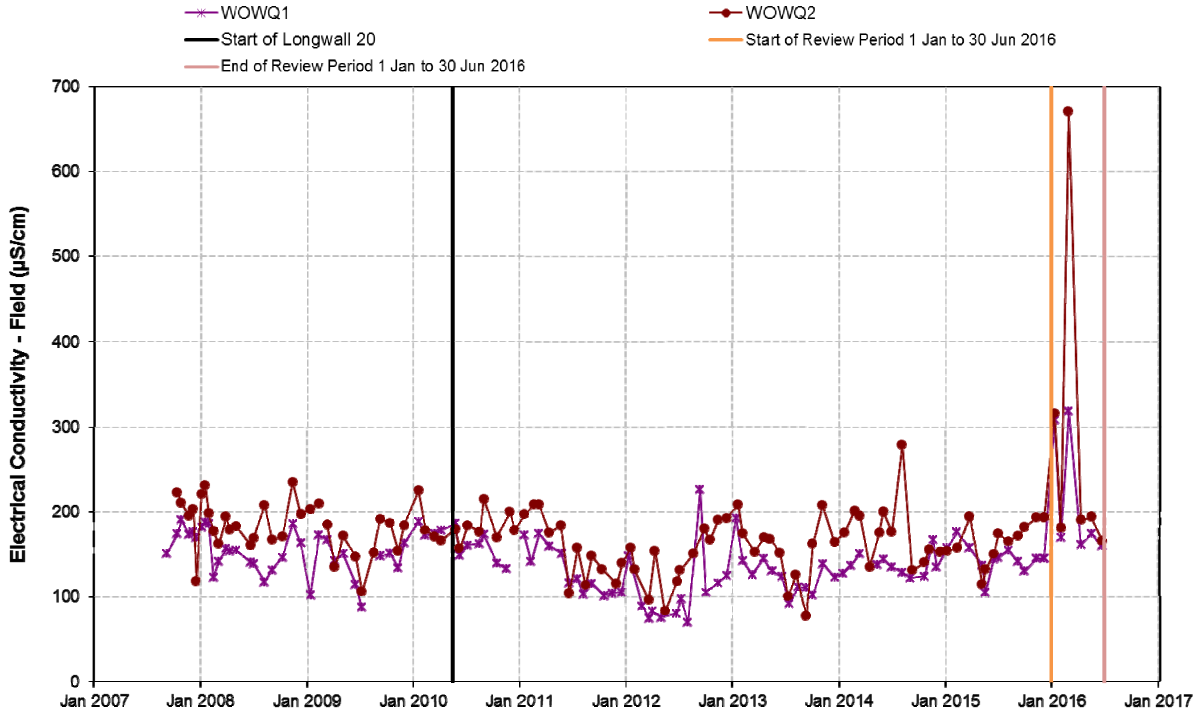

Chart 20b Electrical Conductivity (EC) Woronora River

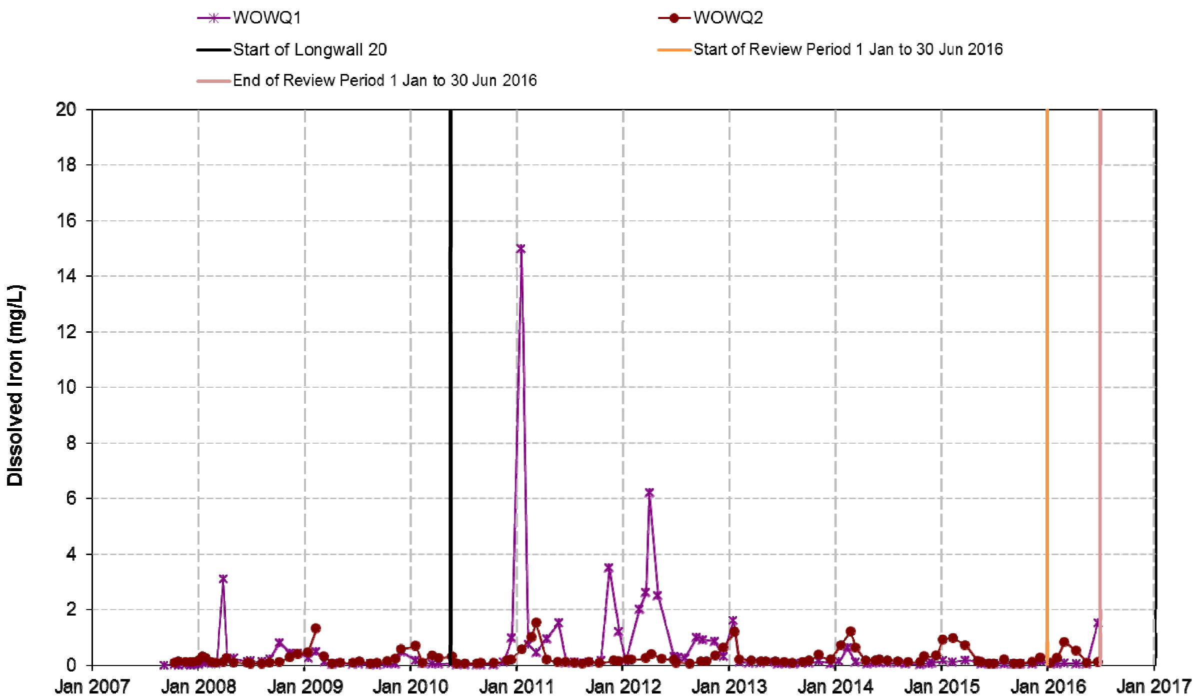

Chart 21 Dissolved Iron Woronora River

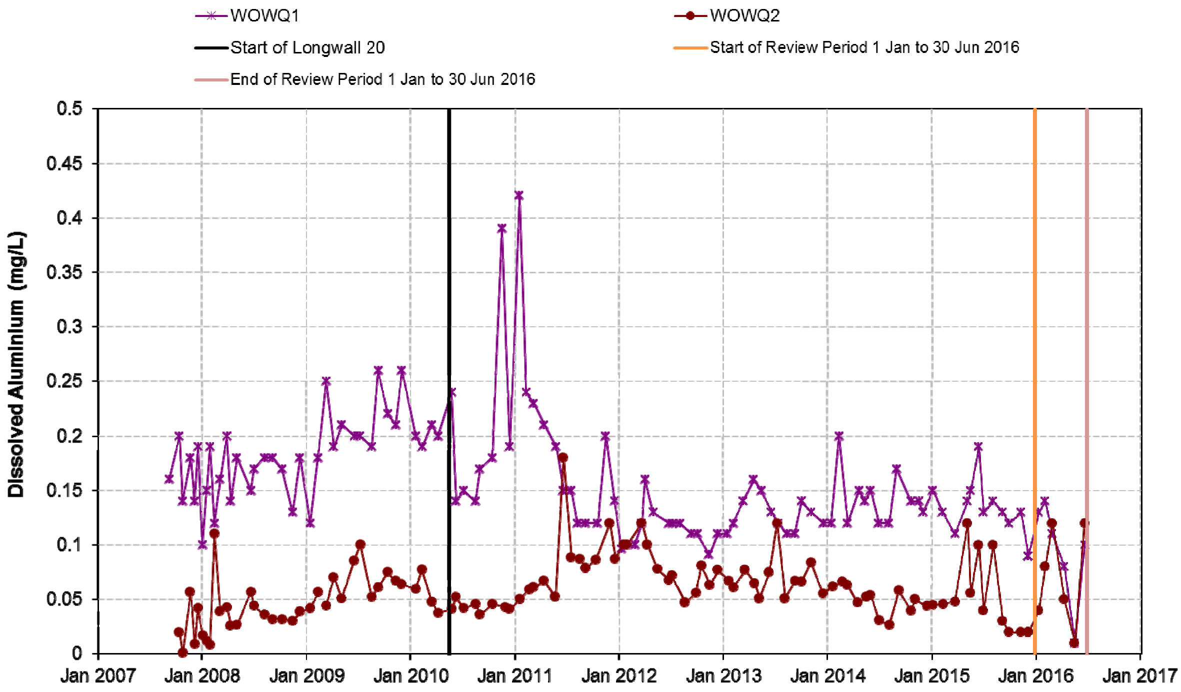

Chart 22 Dissolved Aluminium Woronora River

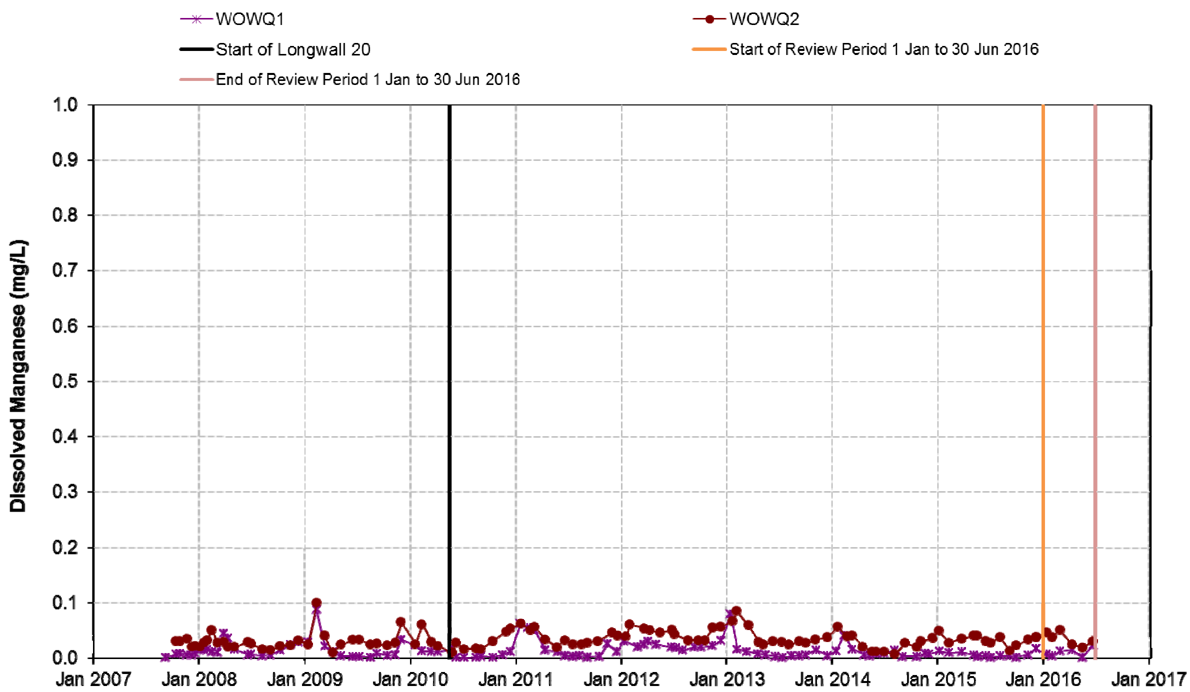

Chart 23 Dissolved Manganese Woronora River

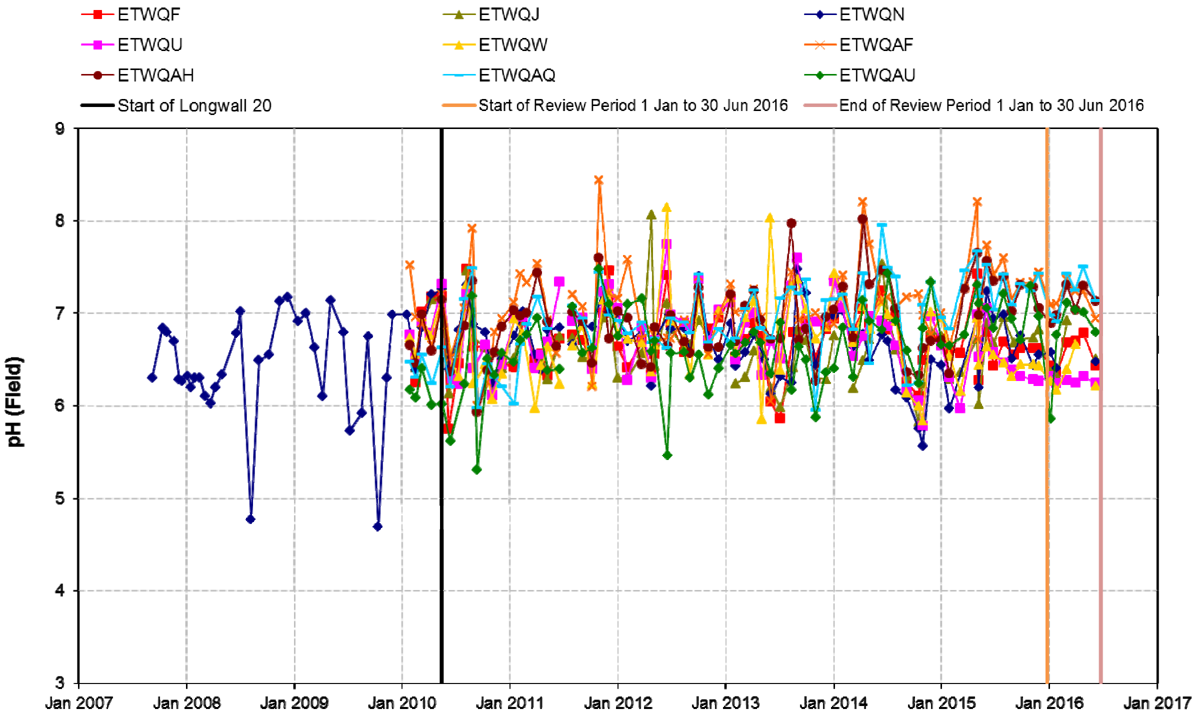

Chart 24 pH Levels Eastern Tributary

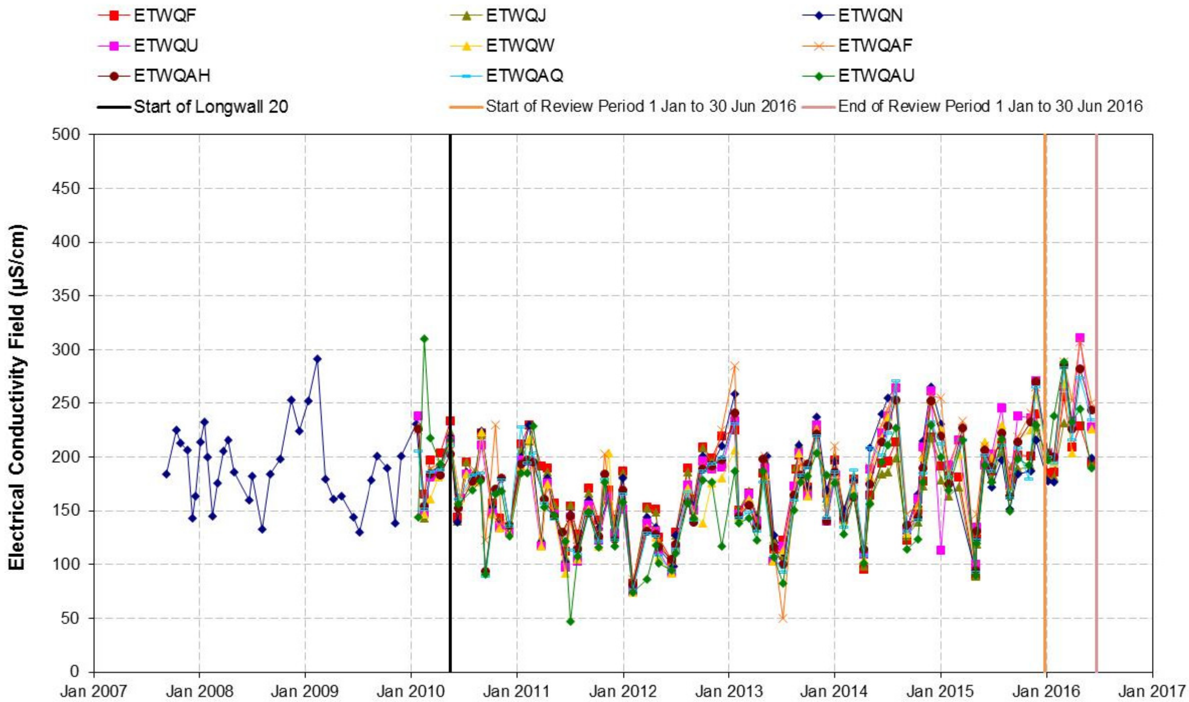

Chart 25 Electrical Conductivity (EC) Eastern Tributary

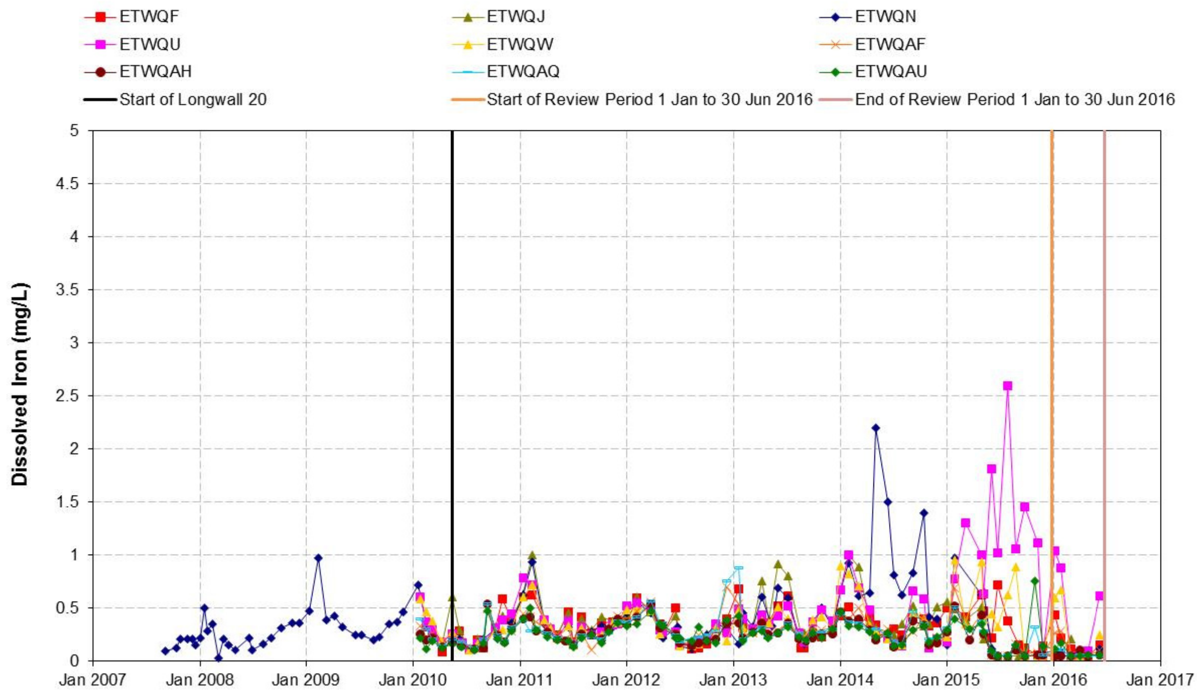

Chart 26 Dissolved Iron Eastern Tributary

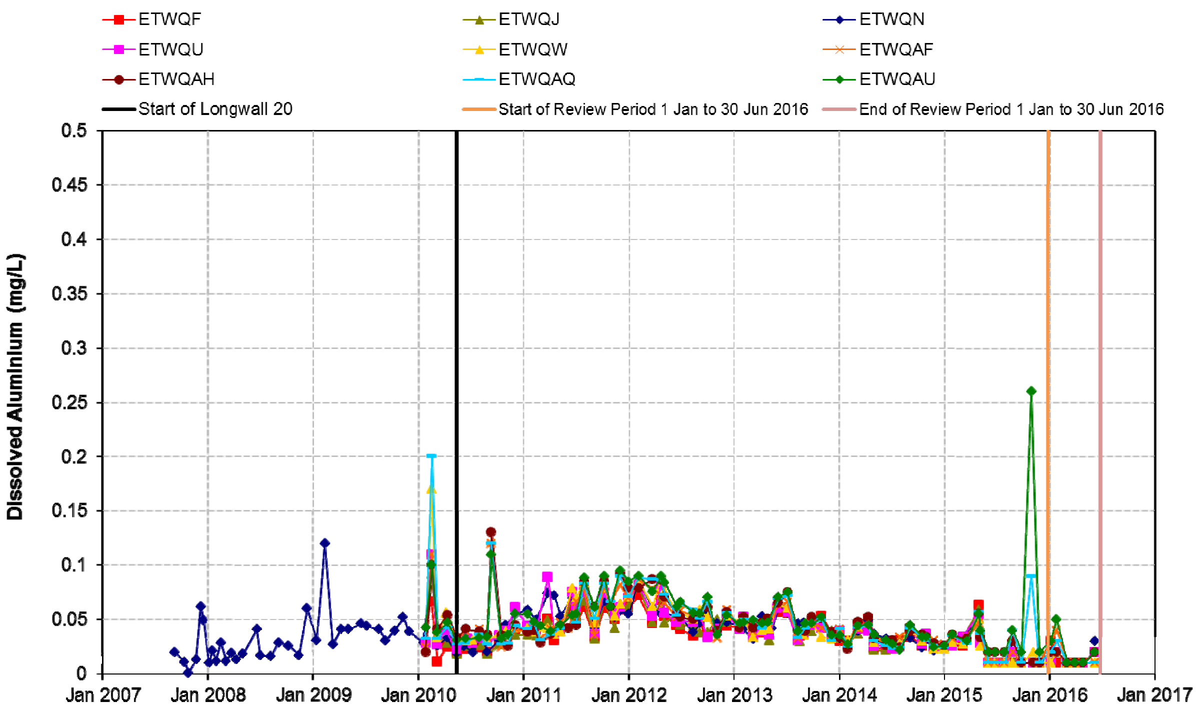

Chart 27 Dissolved Aluminium Eastern Tributary

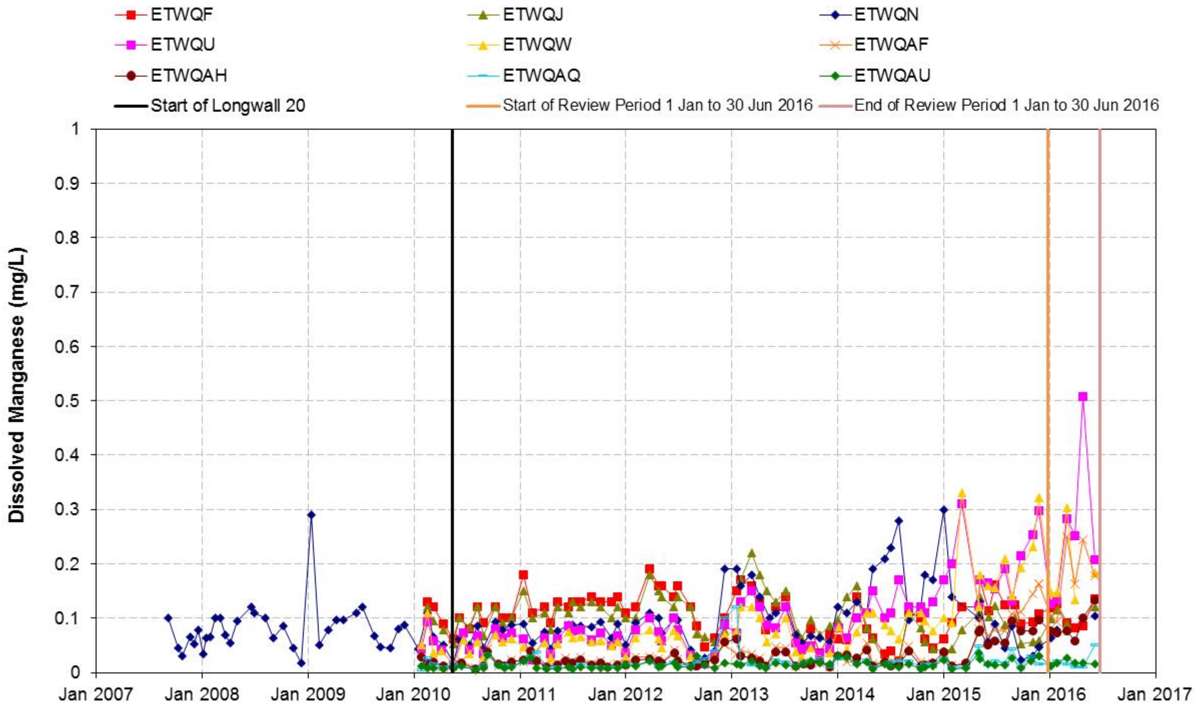

Chart 28 Dissolved Manganese Eastern Tributary

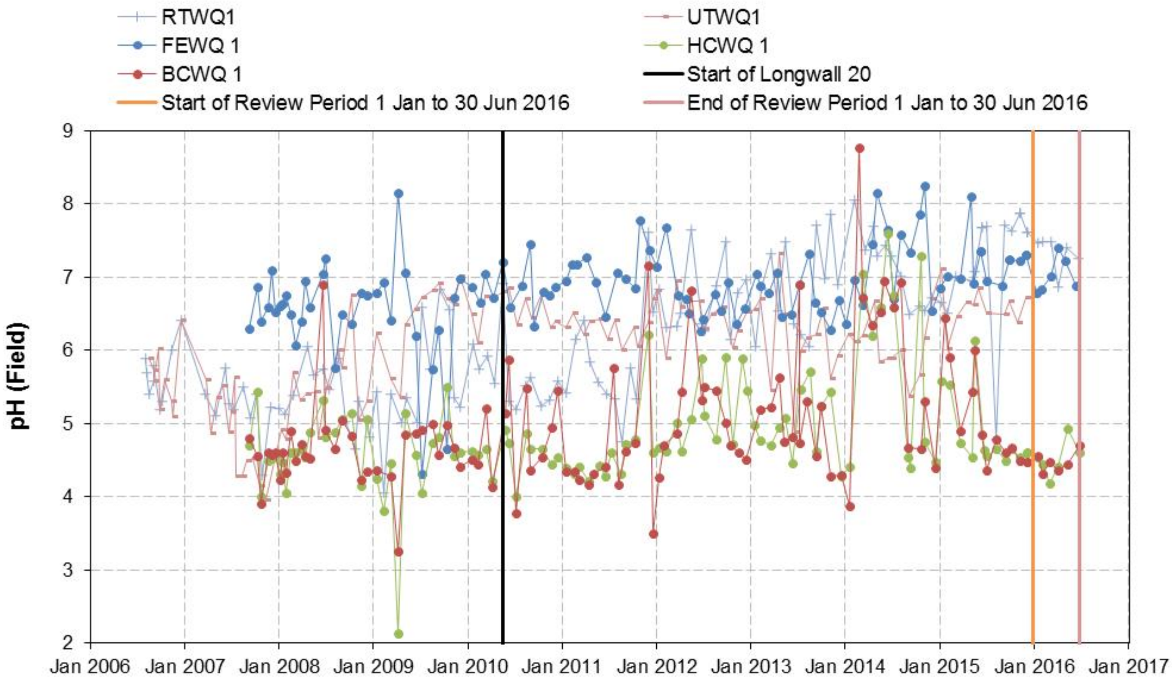

Chart 29 pH Levels Tributary B, Tributary D, Far Eastern Tributary, Bee Creek and Honeysuckle Creek

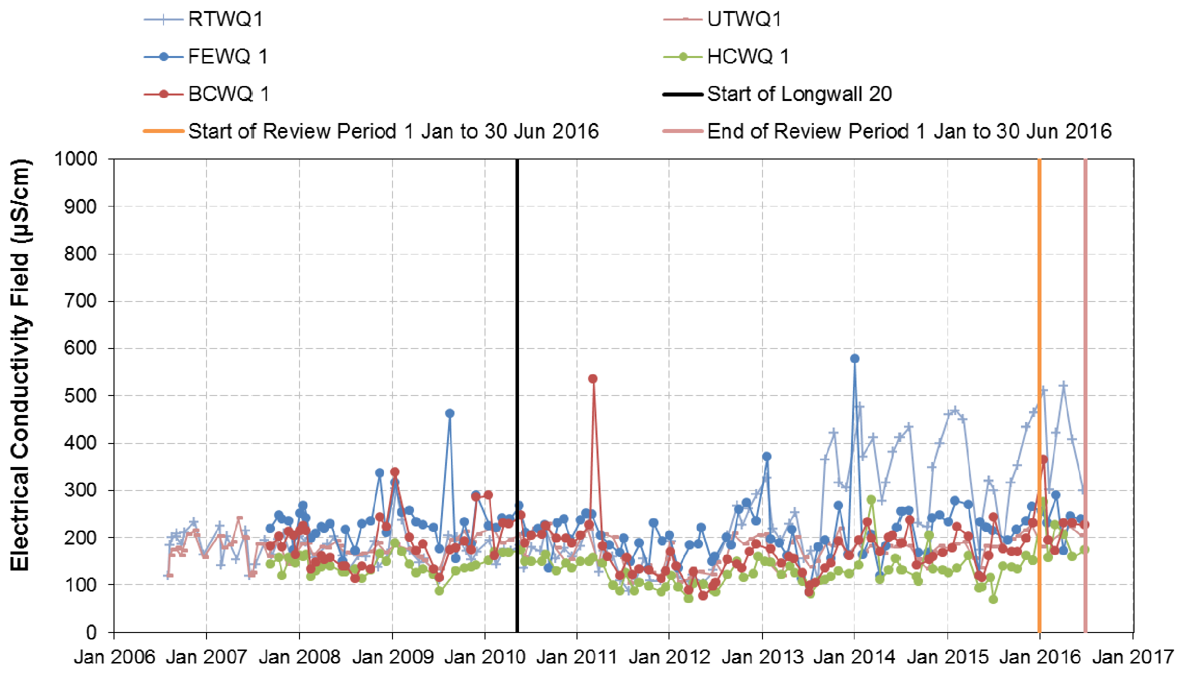

Chart 30 Electrical Conductivity (EC) Tributary B, Tributary D, Far Eastern Tributary, Bee Creek and Honeysuckle Creek

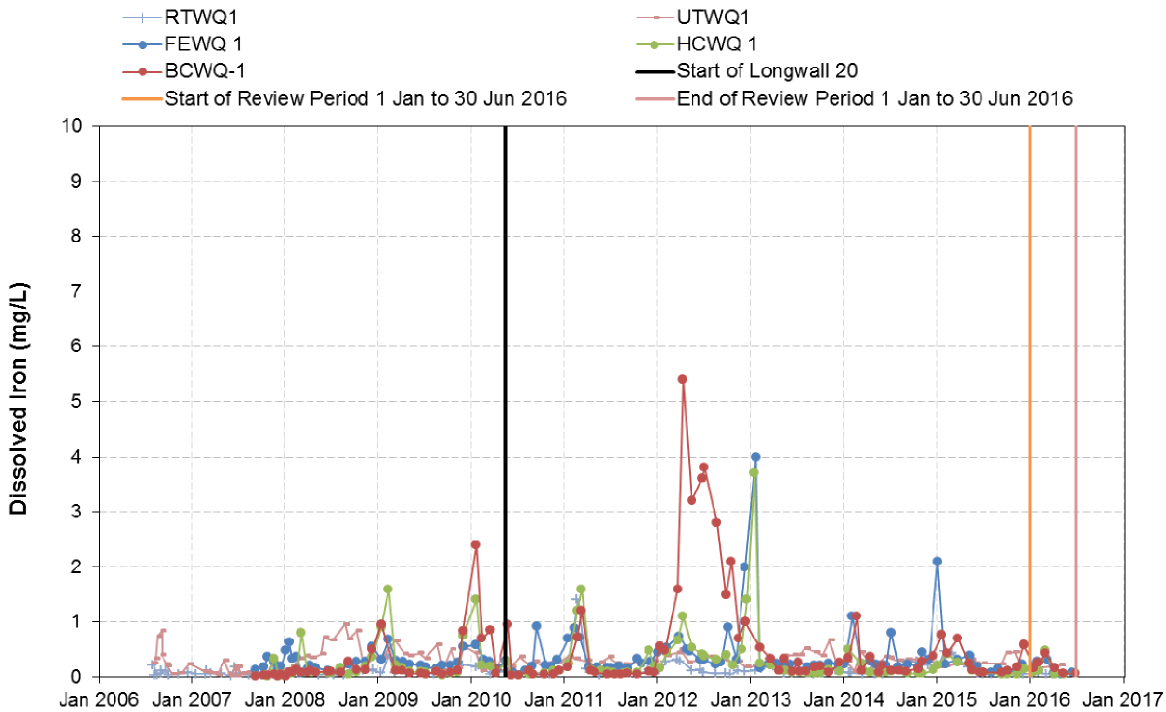

Chart 31 Dissolved Iron Tributary B, Tributary D, Far Eastern Tributary, Bee Creek and Honeysuckle Creek

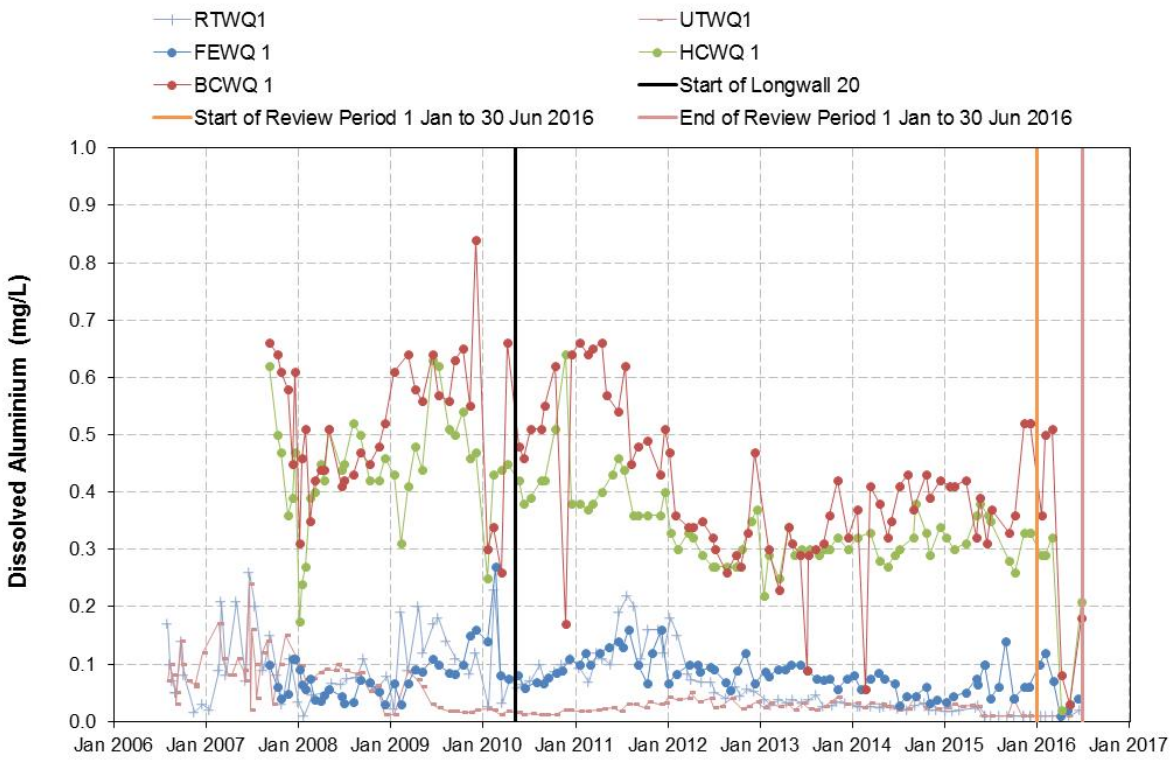

Chart 32 Dissolved Aluminium Tributary B, Tributary D, Far Eastern Tributary, Bee Creek and Honeysuckle Creek

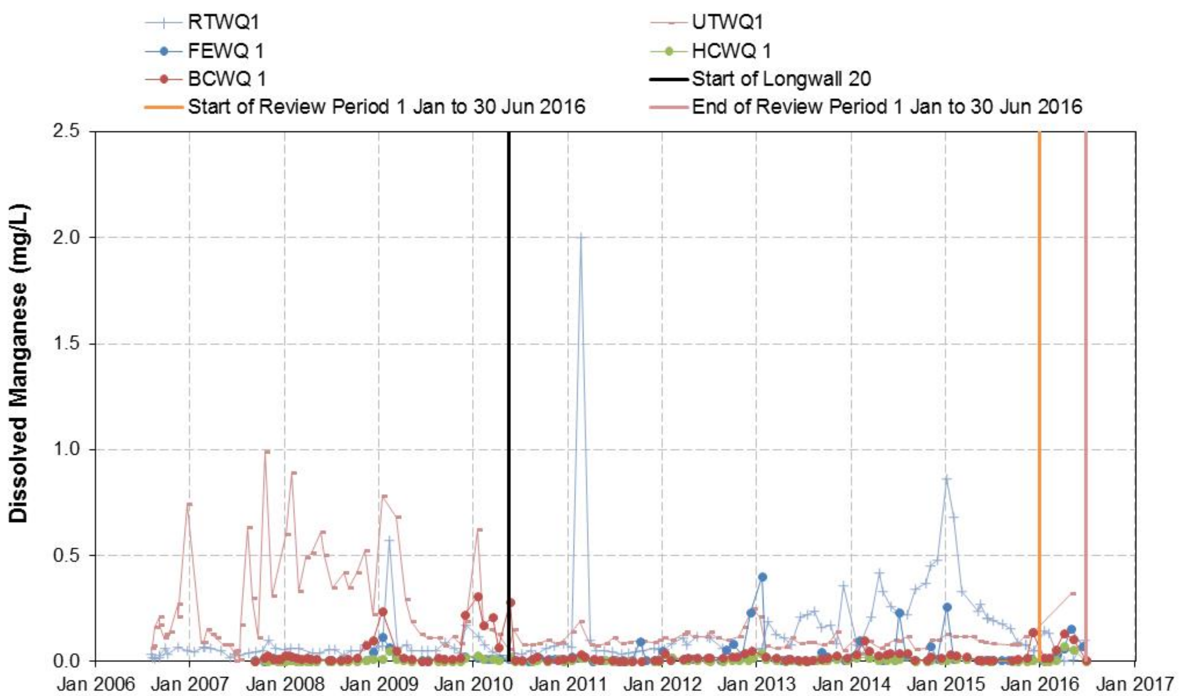

Chart 33 Dissolved Manganese Tributary B, Tributary D, Far Eastern Tributary, Bee Creek and Honeysuckle Creek

Water quality data has been analysed for key water quality parameters of relevance to water supply and the effects of subsidence, namely iron, manganese and aluminium at site WRWQ9 on Waratah Rivulet, site ETWQ AU on Eastern Tributary and at control site WOWQ2 on the Woronora River.

The performance indicator, *Changes in the quality of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations that are not also occurring at control site WOWQ2,* is considered to have been exceeded if data analysis indicates a significant change in the quality of water post mining of Longwall 20. Specifically if[2]:

- any water quality parameter exceeds the adjusted baseline mean plus two standard deviations for two consecutive months; or
- over a three month period the water quality parameter exceeds the adjusted mean plus two standard deviations in the first month, the adjusted mean plus one standard deviation in the next month and the adjusted mean plus two standard deviations in the third month; or
- the six month mean of the water quality parameter exceeds the adjusted baseline mean plus one standard deviation for two consecutive assessment periods (i.e. over two six monthly reports); and
- there was not a similar exceedance of the trigger at the control site.

There was no exceedance of the performance indicator as a result of the assessment methods for dissolved iron or dissolved aluminium at site WRWQ9 on Waratah Rivulet or site ETWQ AU on Eastern Tributary. There was also no exceedance of the performance indicator as a result of the assessment methods for dissolved manganese at site WRWQ9 or site ETWQ AU, with the exception of the six month mean exceeding the adjusted baseline mean plus one standard deviation for two consecutive assessment periods at site WRWQ9 (Chart 34).

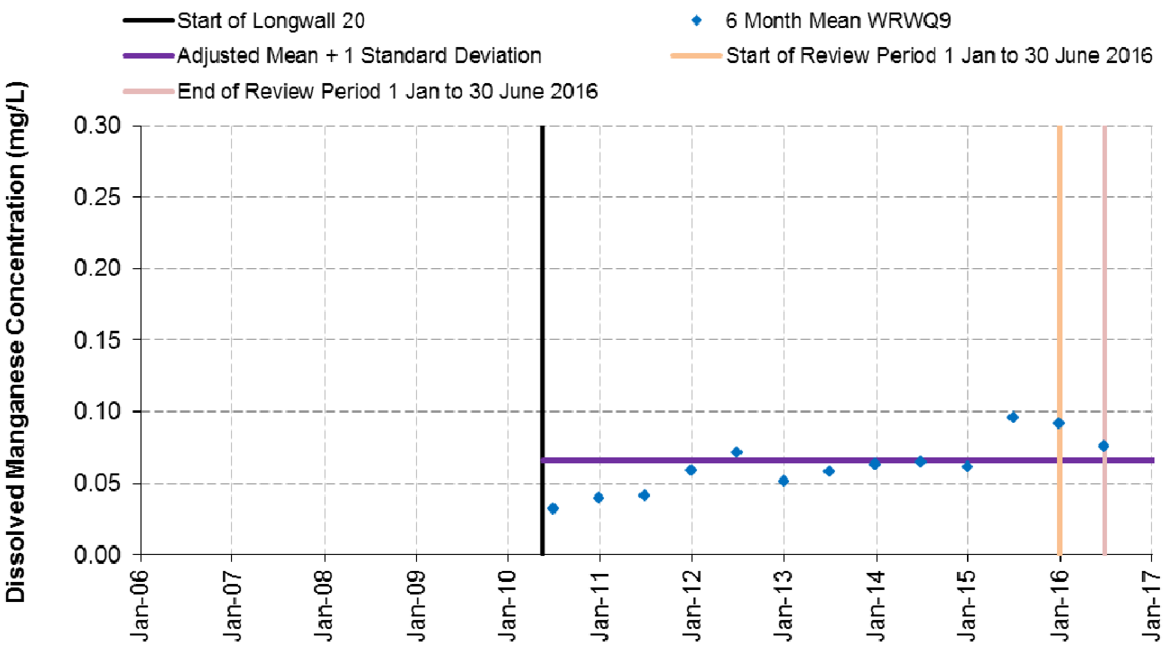

Chart 34 Six Monthly Means of Dissolved Manganese Concentrations in Waratah Rivulet at WRWQ9

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2 Note each 'mean' is calculated as a geometric mean.

There was no exceedance of this measure at the control site on Woronora River at site WOWQ2 during the review period. As a result, an assessment was made against the subsidence impact performance measure, *Negligible reduction to the quality of water resources reaching the Woronora Reservoir.*

The assessment undertaken by Hydro Engineering & Consulting (2016) is provided in the report in Appendix A. Assessment of the monitoring data indicates there has been a negligible reduction to the quality of water resources reaching the Woronora Reservoir. The assessment by Hydro Engineering & Consulting will be subject to peer review in accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Water Management Plans and reported in the 2016 Annual Review.

2.5 WORONORA RESERVOIR WATER QUALITY

Metropolitan Coal has sourced water quality data for the Woronora Reservoir from WaterNSW in accordance with a data exchange agreement. Results in relation to total iron, aluminium and manganese levels from 0 m to 9 m below the reservoir surface for Woronora Reservoir throughout the period of record are presented in Charts 35, 36 and 37.

Water quality data in the Woronora Reservoir is analysed annually and assessed against the following performance indicator:

> *Changes in the quality of water in the Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations.*

The performance indicator is considered to have been exceeded if data analysis indicates a significant change in the quality of water post-mining, specifically if the current year's duration exceedance curve for a water quality parameter in Woronora Reservoir (total iron, total manganese and total aluminium) is above the baseline 20 year average recurrence interval (ARI) exceedance curve for any range of the duration percentages from 0% to 75%.

The performance indicator was met during the 2015 Annual Review reporting period, and will be assessed for the 2016 Annual Review.

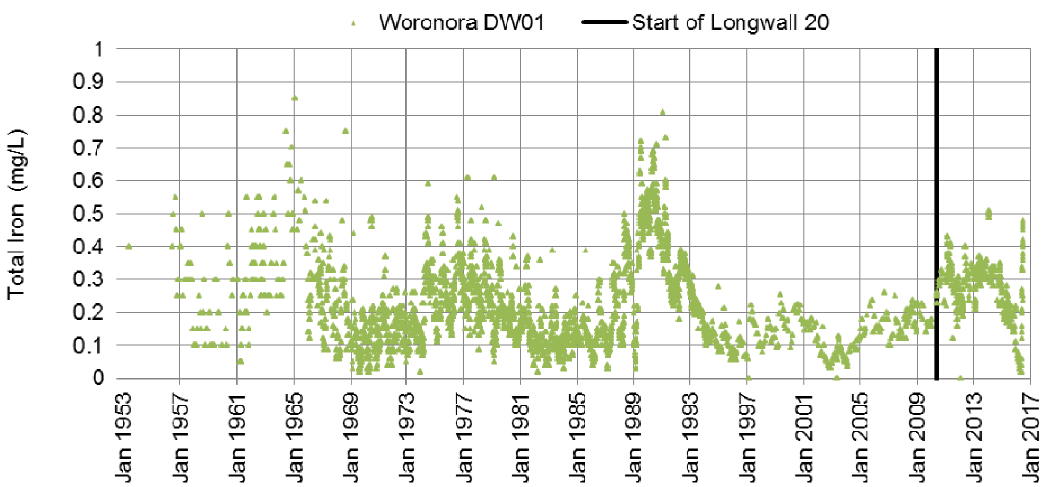


Chart 35 Total Iron Concentration Woronora Reservoir

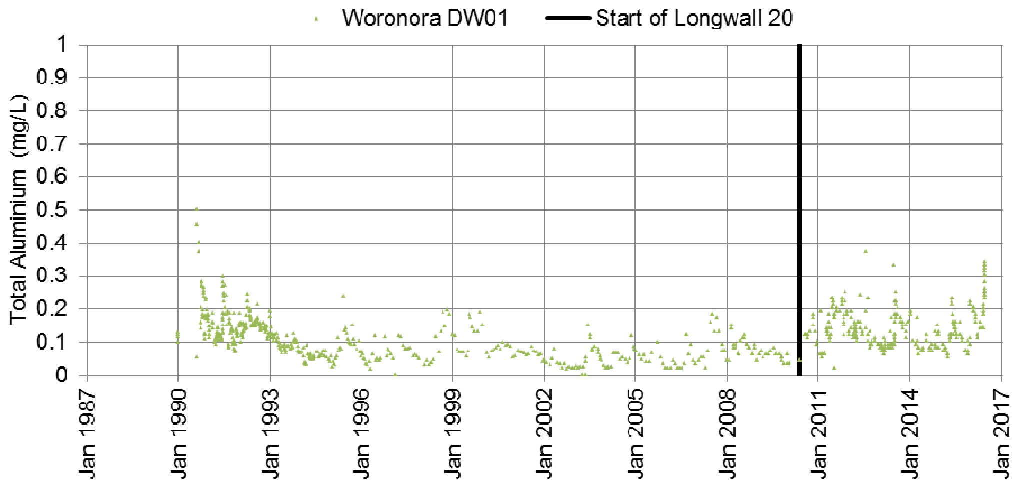


Chart 36 Total Aluminium Concentration Woronora Reservoir

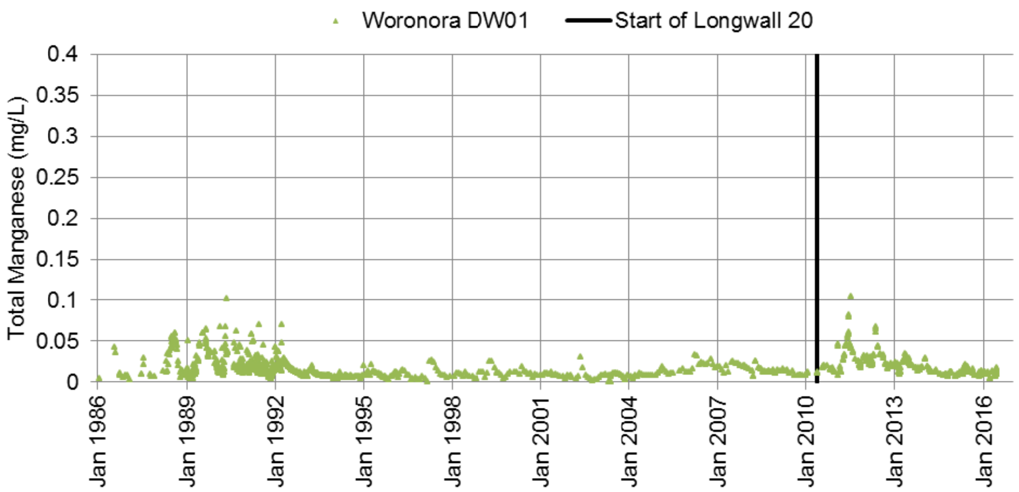


Chart 37 Total Manganese Concentration Woronora Reservoir

2.6 SWAMP GROUNDWATER LEVELS

Groundwater monitoring of upland swamps for Longwalls 20-22 and 23-27 has involved the use, where practicable, of paired piezometers, one swamp substrate piezometer (at approximately 1 m depth) and one sandstone piezometer (at a depth of approximately 10 m) (Figure 6). Specifically, paired piezometers have been monitored in Swamp 25 overlying Longwalls 20-22, Swamps 28, 30, 33 and 35 overlying Longwalls 23-27, and in control swamps 101, 137a, 137b and Bee Creek Swamp (Figure 6). At Swamp 20 and at control swamp Woronora River Swamp 1, multiple piezometers have been monitored (i.e. one swamp substrate piezometer to a depth of approximately 1 m and two sandstone piezometers to depths of approximately 4 and 10 m) (Figure 6).

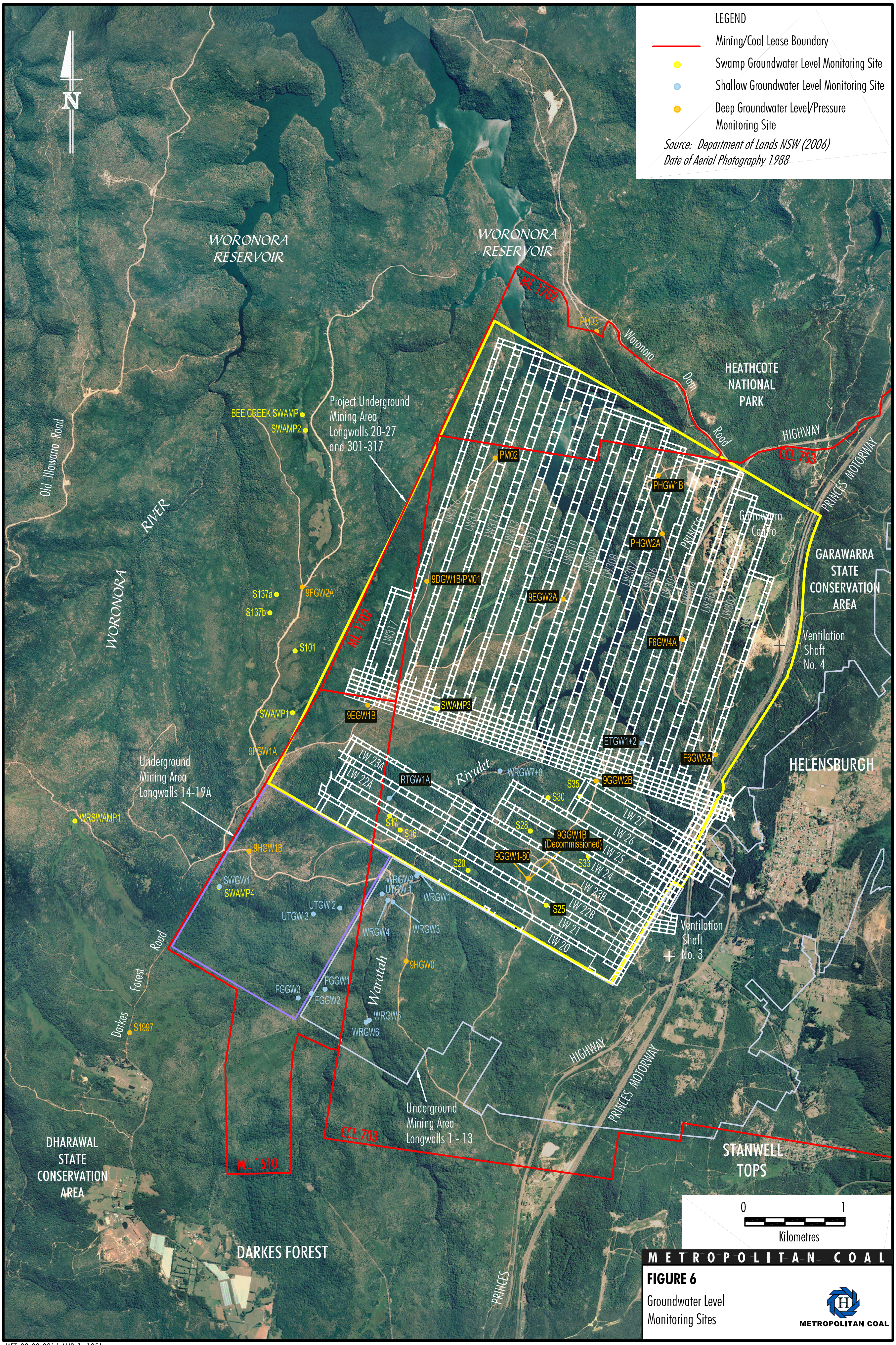


FIGURE 6

Groundwater Level Monitoring Sites

MET-08-08-2016 6MR-1_105A

Swamp 20

Consistent with previous reporting, Swamp 20 substrate water levels previously changed from being permanently saturated to being periodically saturated as a result of the passing of Longwall 21 (Chart 38 and Appendix B). This trend continued to be observed throughout the reporting period (Chart 38).

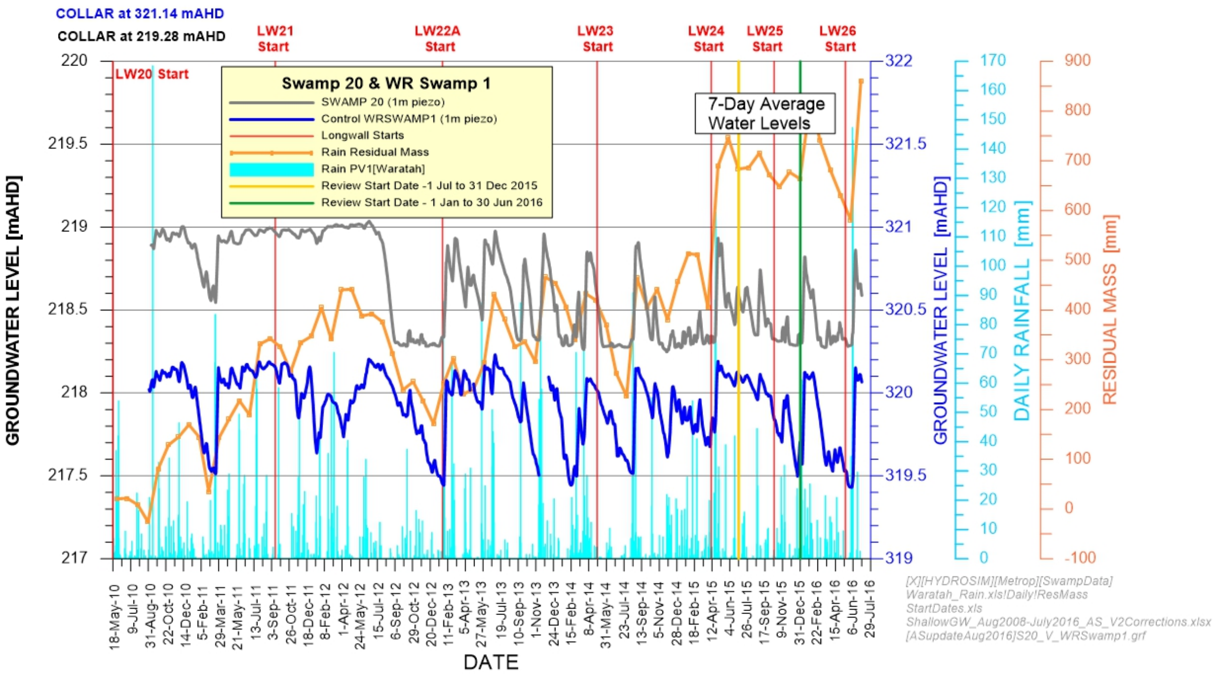


Chart 38 Comparison of Piezometer Responses at Swamp 20 and Woronora River 1 Control Swamp

Swamp 25

The substrate piezometer in Swamp 25 remains dry from 12 February to 5 June 2016 in response to the rainfall deficit, before rising again with the high rainfall in June 2016, the behaviour being very similar to that at control Swamp 101 (Chart 39). The swamp substrate hydrograph fluctuates within the historical bandwidth with no obvious mining effect. The mine-related groundwater effects in the sandstone beneath Swamp 25 have previously been reported.

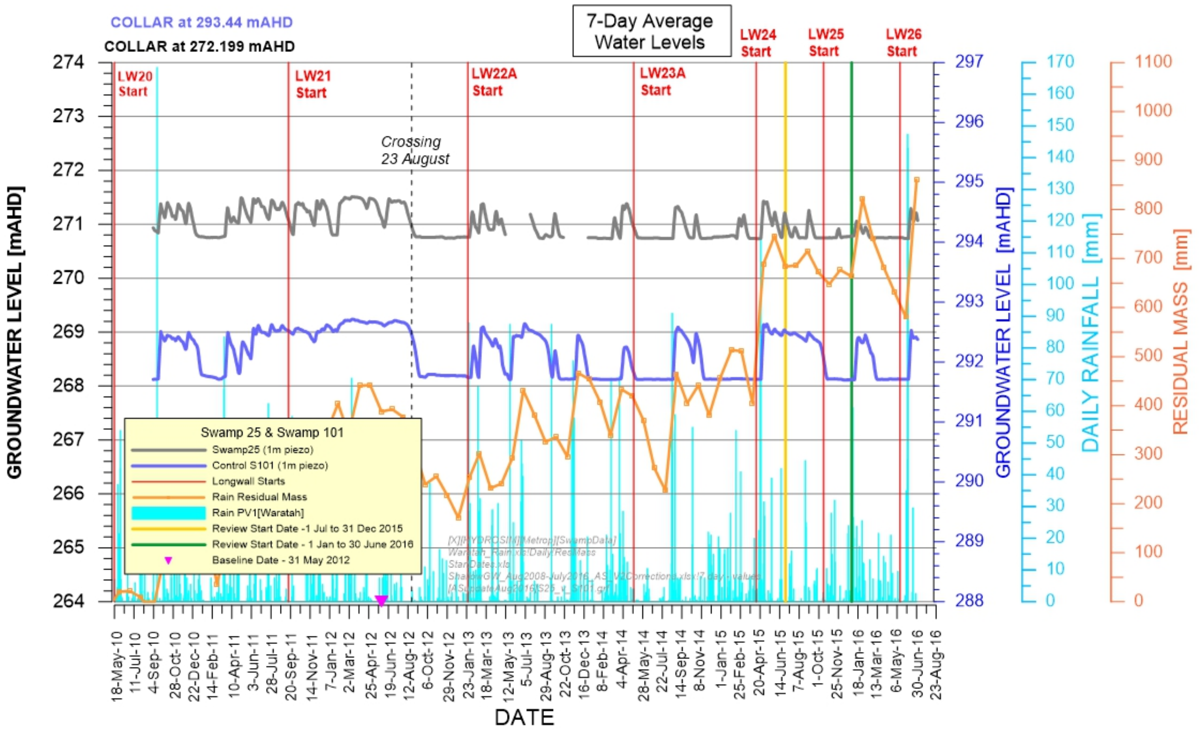


Chart 39 Comparison of Piezometer Responses at Swamp 25 and Control Swamp 101

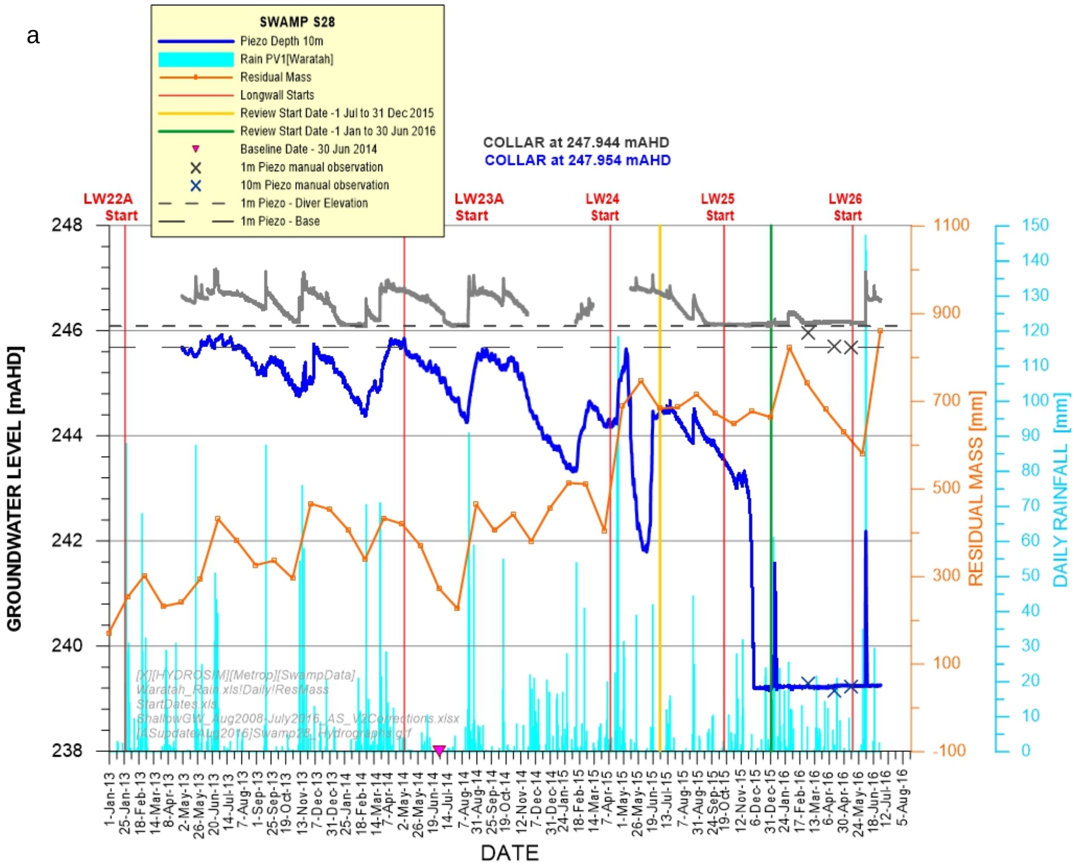
Swamp 28

Drops in sandstone piezometer water levels at Swamp 28 as a result of mining were identified for the first time in the last reporting period (as described in the 2015 Annual Review).

The groundwater level in the substrate of Swamp 28 drops to the base of the datalogger in September 2015 (Chart 40a). Groundwater levels in the substrate increase in response to rainfall events in February 2016 and June 2016, and remain saturated until the end of the monitoring period (Chart 40a).

To assess whether there is a mining effect on the substrate water levels, the Swamp 28 (1 m) hydrograph was compared with the responses at the two relevant control swamps (137a and 137b) in Chart 40(b). Unlike the control swamps, the water level recovery in Swamp 28 has been incomplete during the reporting period, being about 40% of full recovery for the January-February 2016 rain events and about 70% for June 2016. As nearby swamp responses (at Swamps 30, 33 and 35) show full recovery at these times, Swamp 28 is considered to have an impact from mining of Longwall 25, although no effect occurred when Longwall 24 passed directly underneath the monitoring site.

a



b

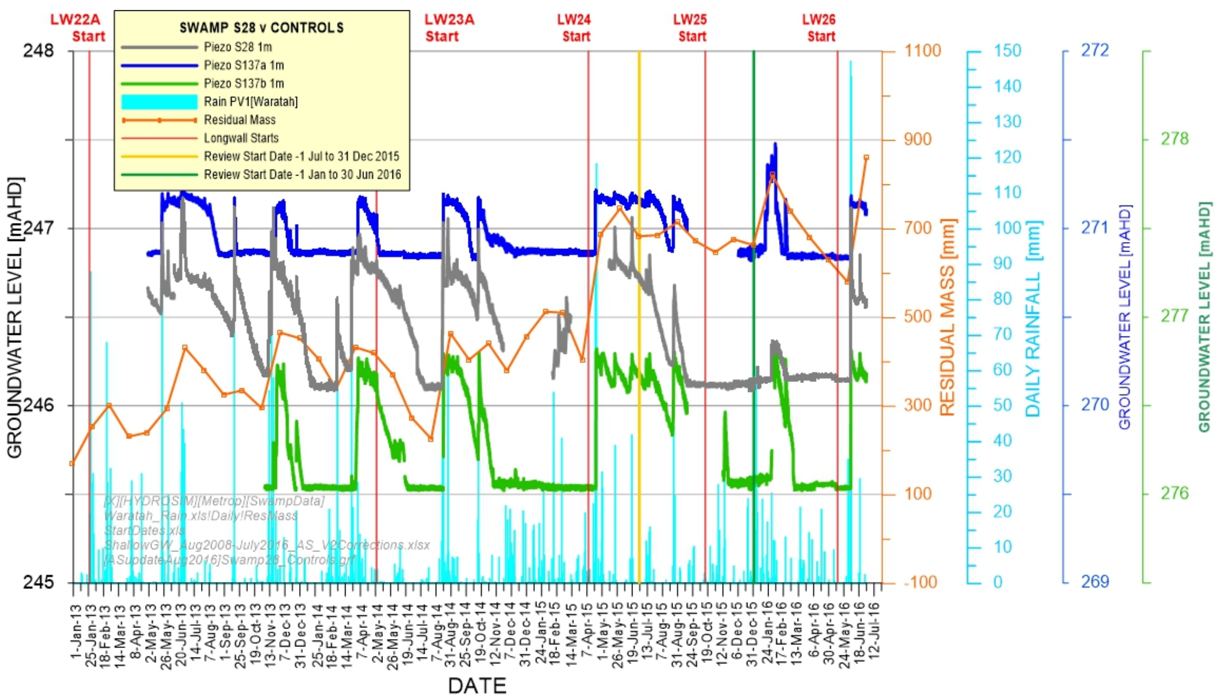


Chart 40 a) Groundwater Hydrographs at Swamp 28 b) Groundwater Hydrographs at Swamp 28 and Two Control Swamps (137a and 137b)

Swamp 30

At Swamp 30, the groundwater level in the sandstone declined rapidly by 1.25 m in December 2015 (Chart 41a). The decline corresponded with the passage of Longwall 25 past Swamp 30, making it possible that it is also associated with mine subsidence. From December 2015 to April 2016, the groundwater level in the sandstone at Swamp 30 declined by about 2.5 m coinciding with the passage of Longwall 25, interrupted by a small rise due to rainfall in January 2016. As the declines were steeper and stronger than previous recessions associated with low rainfall, and larger than those observed in the control swamps during the same period, the effect can be attributed to mining.

The water level in the substrate piezometer drops below the datalogger producing a flat line response from February 2016 (Chart 41a). Manual water level records indicate that the swamp goes dry from April 2016, and water levels recover with the high rainfall in June 2016. However, the behaviour is not significantly different from past behaviour. To assess whether there is a mining effect on the substrate water levels, the Swamp 30 (1 m) hydrograph was compared with the responses at the two relevant control swamps (137a and 137b) in Chart 41b. The strong correlation between different sites in terms of the timing and amplitudes of groundwater responses indicates no mining effect on the substrate at Swamp 30.

Swamp 33

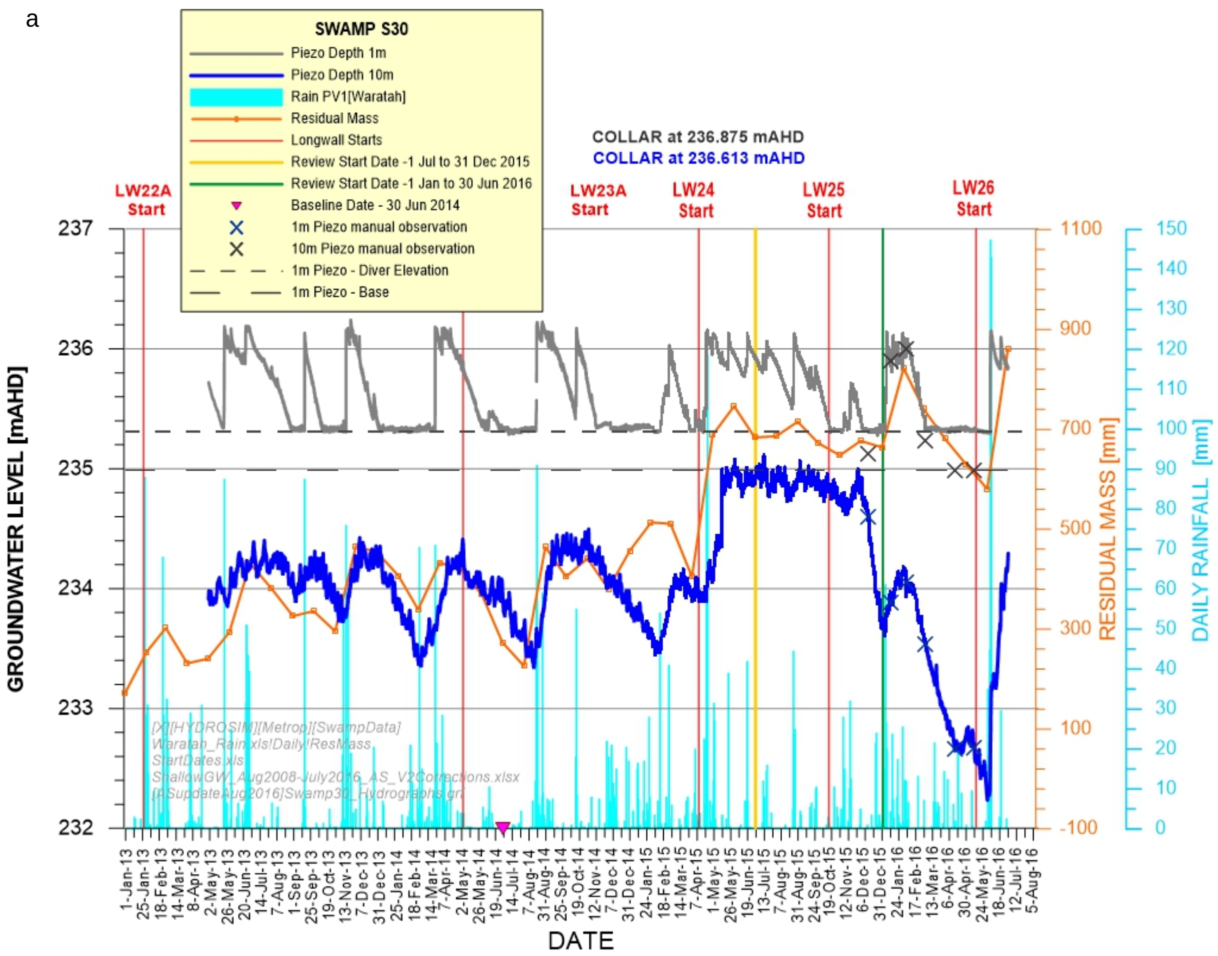
Drops in sandstone piezometer water levels at Swamp 33 as a result of mining were identified for the first time in the last reporting period (as described in the 2015 Annual Review).

The groundwater level in the swamp substrate is below the elevation of the datalogger for most of the reporting period, with the exception of short duration saturation coinciding with rainfall events (Chart 42a). However, the behaviour is not significantly different from past behaviour. To assess whether there is a mining effect on the substrate water levels, the Swamp 33 (1 m) hydrograph was compared with the responses at the two relevant control swamps (137a and 137b) in Chart 42b. The strong correlation between different sites in terms of the timing and amplitudes of groundwater responses indicates that a mining effect is unlikely on the substrate at Swamp 33. As there is a local rain effect in February-March 2015 at Swamp 33 that is not evident at the control sites, exact agreement with control sites cannot be expected.

Swamp 35

Groundwater levels at Swamp 35 remain unaffected by mining. Longwall 25 passed within 200 m of the swamp in December 2015 (Chart 43a). There was a decrease in groundwater level in the sandstone of 1.2 m in late November – early December 2015, but this decrease also coincides with a period of low rainfall and decline of similar magnitude at control swamps. The observed response is therefore consistent with natural responses to low rainfall rather than mining. Water levels in the sandstone and the substrate increase with the high rainfall in June 2016 in this reporting period. A comparison of the Swamp 35 (1 m) hydrograph with the responses at the two relevant control swamps (137a and 137b) in Chart 43a confirms the absence of any mining effect.

a



b

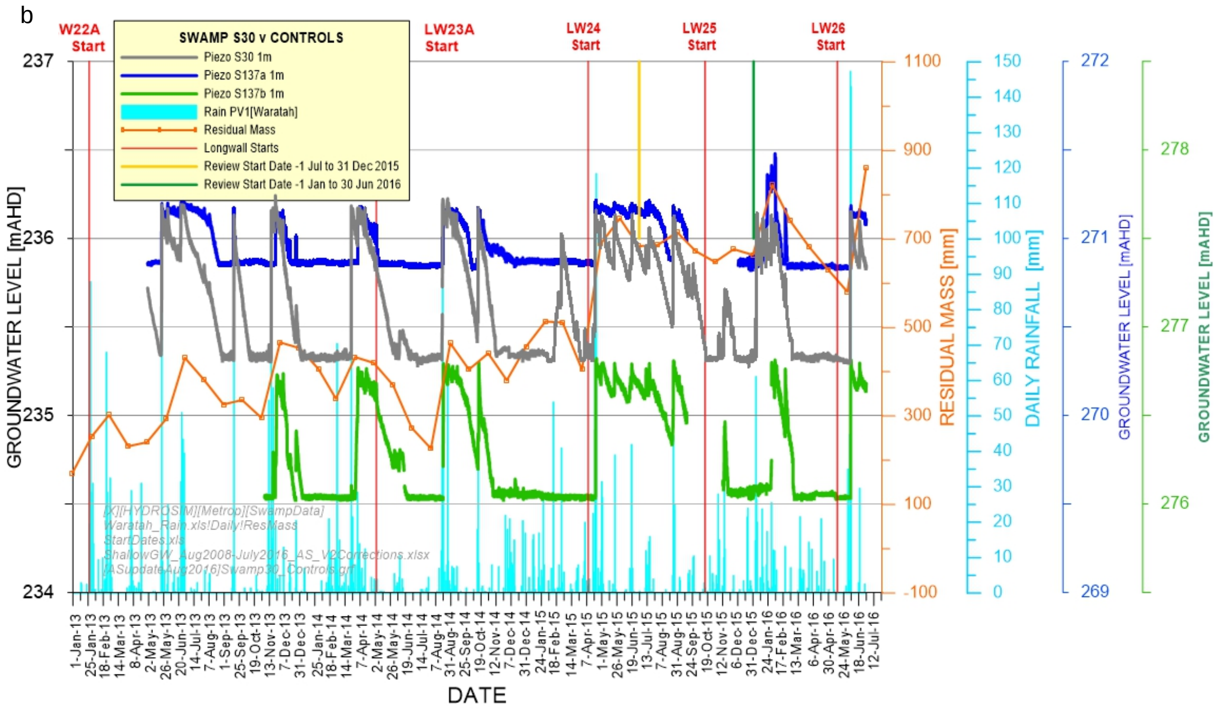
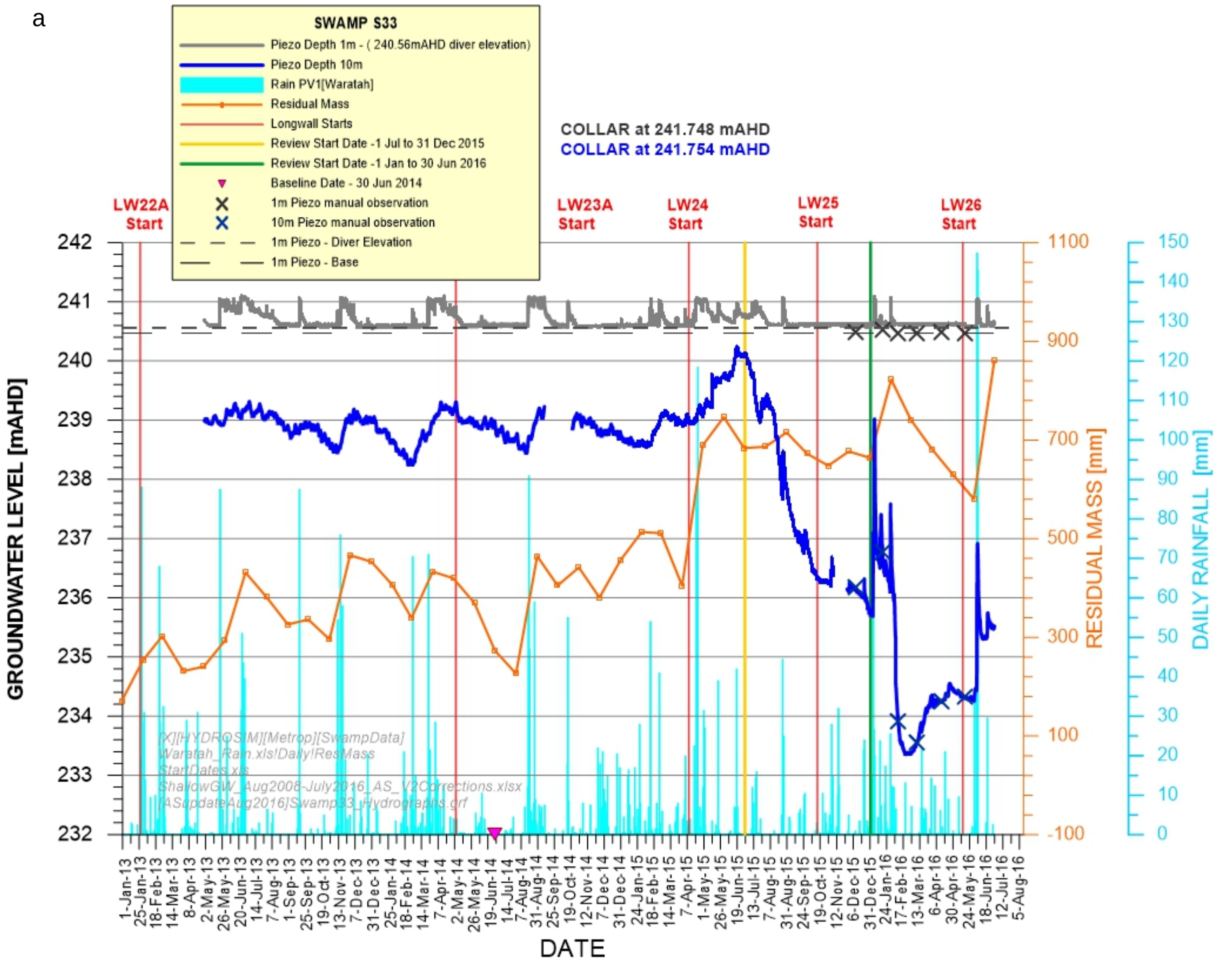


Chart 41 a) Groundwater Hydrographs at Swamp 30 b) Groundwater Hydrographs at Swamp 30 and Two Control Swamps (137a and 137b)

a



b

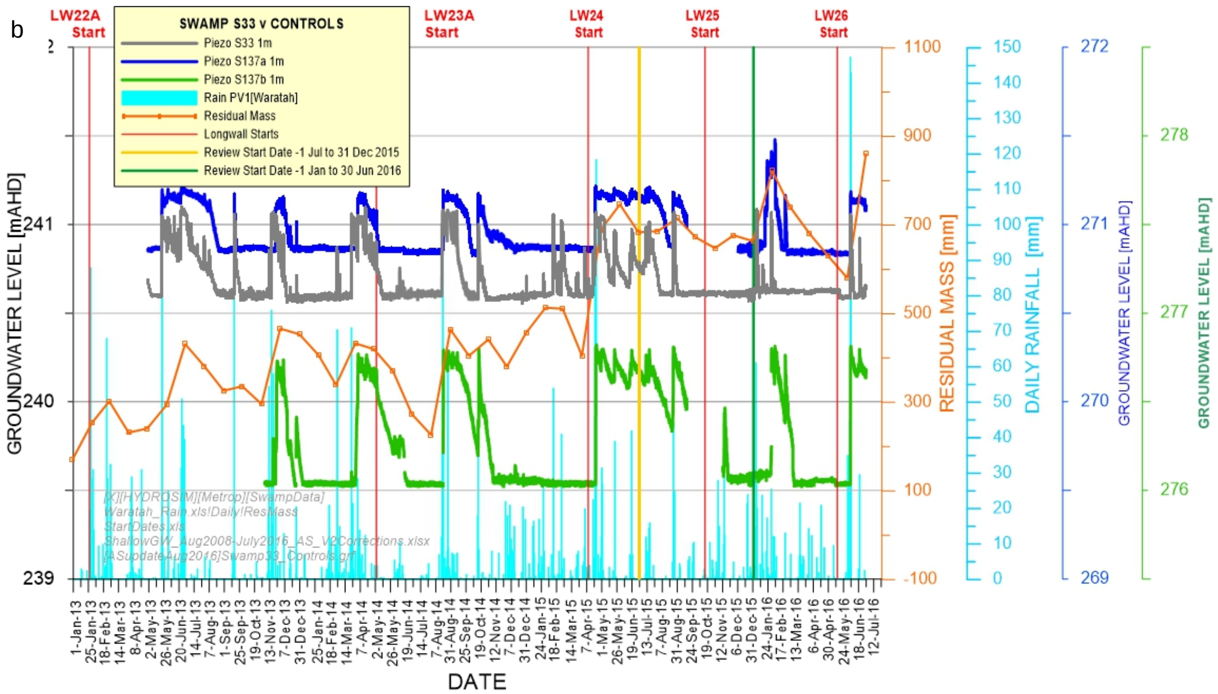
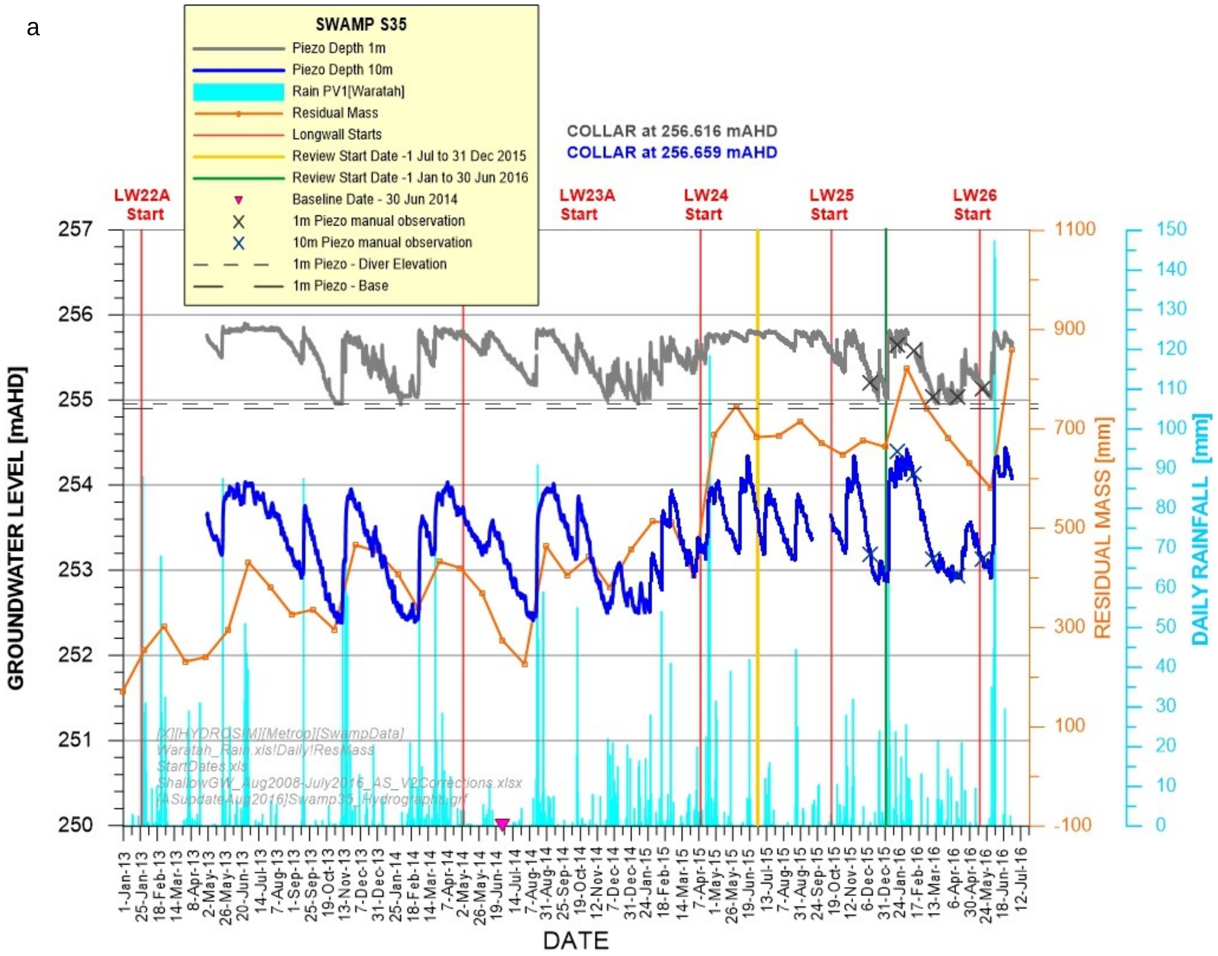


Chart 42 a) Groundwater Hydrographs at Swamp 33 b) Groundwater Hydrographs at Swamp 33 and Two Controls (137a and 137b)

a



b

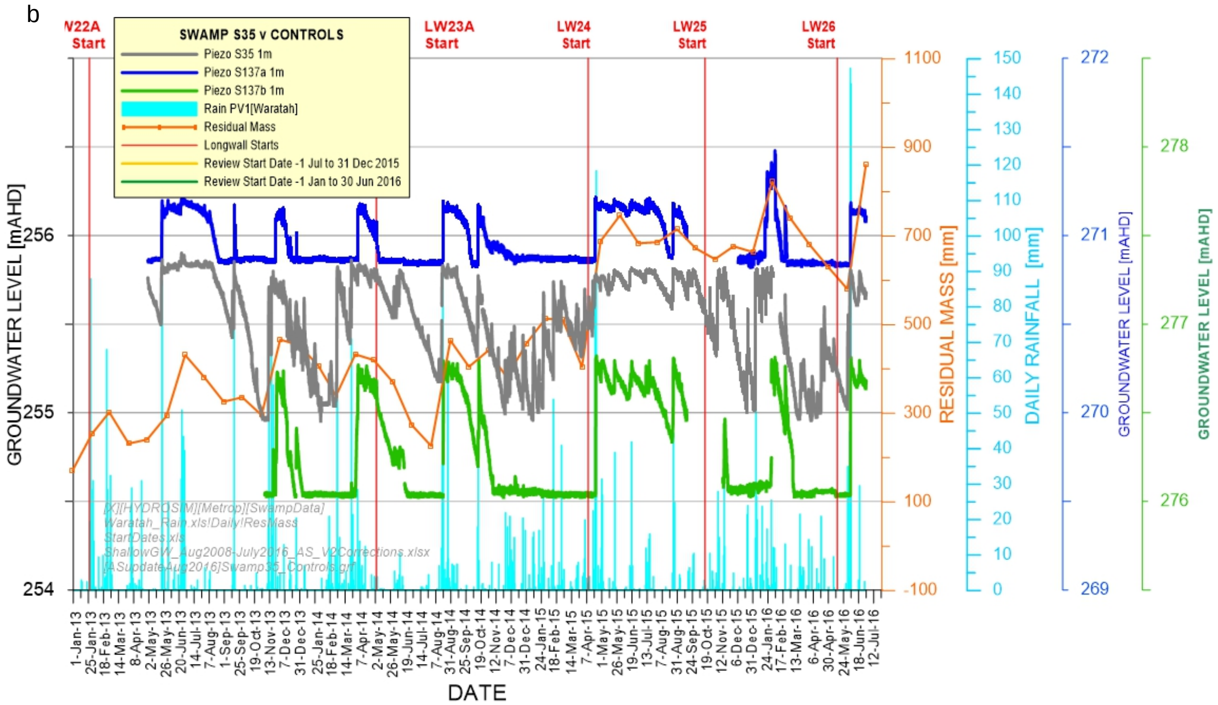


Chart 43 a) Groundwater Hydrographs at Swamp 35 b) Groundwater Hydrographs at Swamp 35 and Two Control Swamps (137a and 137b)

2.7 SHALLOW GROUNDWATER LEVELS

Continuous water level monitoring of shallow groundwater levels has been conducted at sites WRGW1, WRGW2 and WRGW7 along Waratah Rivulet and sites ETGW1 and ETGW2 on the Eastern Tributary (Figure 6 and Charts 44, 45 and 46).

At the time of passage of the Longwall 21 mining face past the piezometer sites WRGW1 and WRGW2 on the Waratah Rivulet (March 2012), the groundwater levels dropped by about 1 m (Chart 44). Since March 2012, groundwater levels recorded in WRGW1 and WRGW2 have fluctuated in response to seasonal rainfall variations with a seasonal (dry) minimum that is approximately 0.75 m below previous levels. Throughout the reporting period, the water levels at sites WRGW1 and WRGW2 have correlated closely with rainfall trends (as indicated by the residual mass curve on Chart 44) and show a general declining trend in groundwater level until June 2016 when groundwater levels increase in response to above average rainfall.

Shallow groundwater levels at sites WRGW7, ETGW1 and ETGW2 correlate with rainfall trends and remained unaffected by mining during the reporting period (Charts 45 and 46).

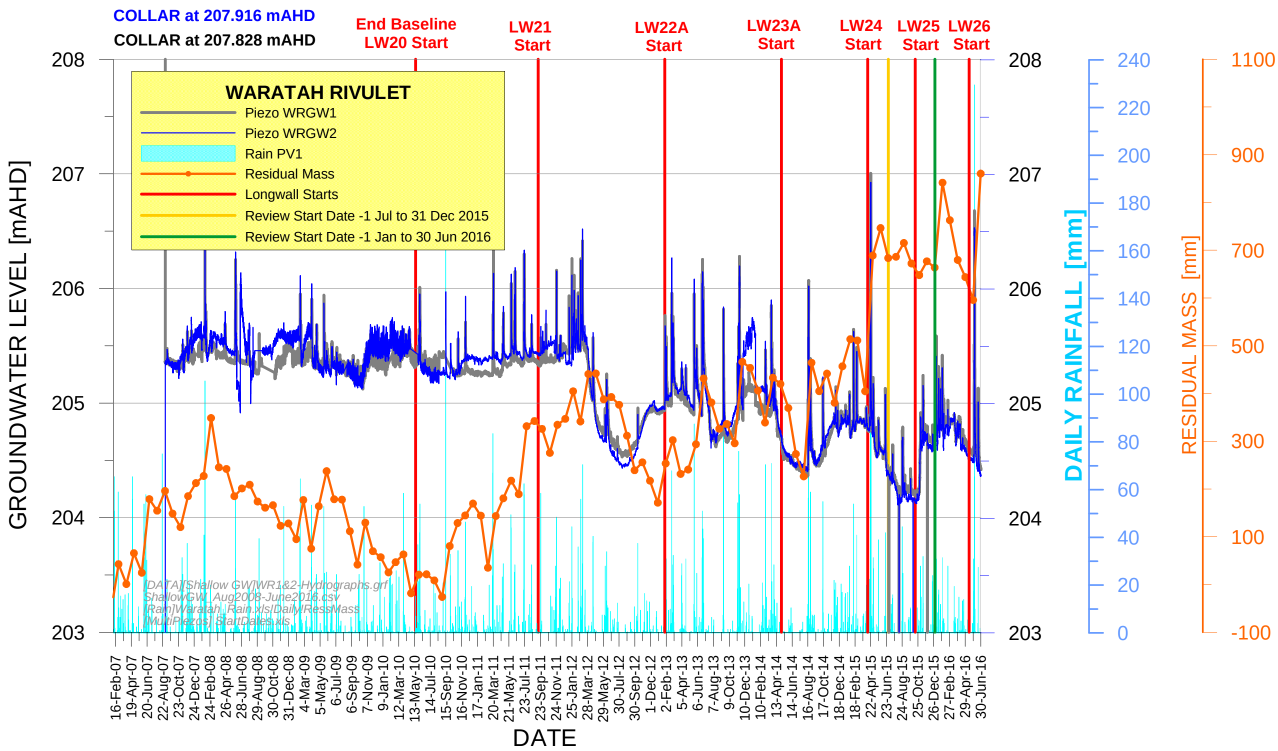


Chart 44 Shallow Groundwater Hydrographs on Waratah Rivulet at WRGW1 and WRGW2

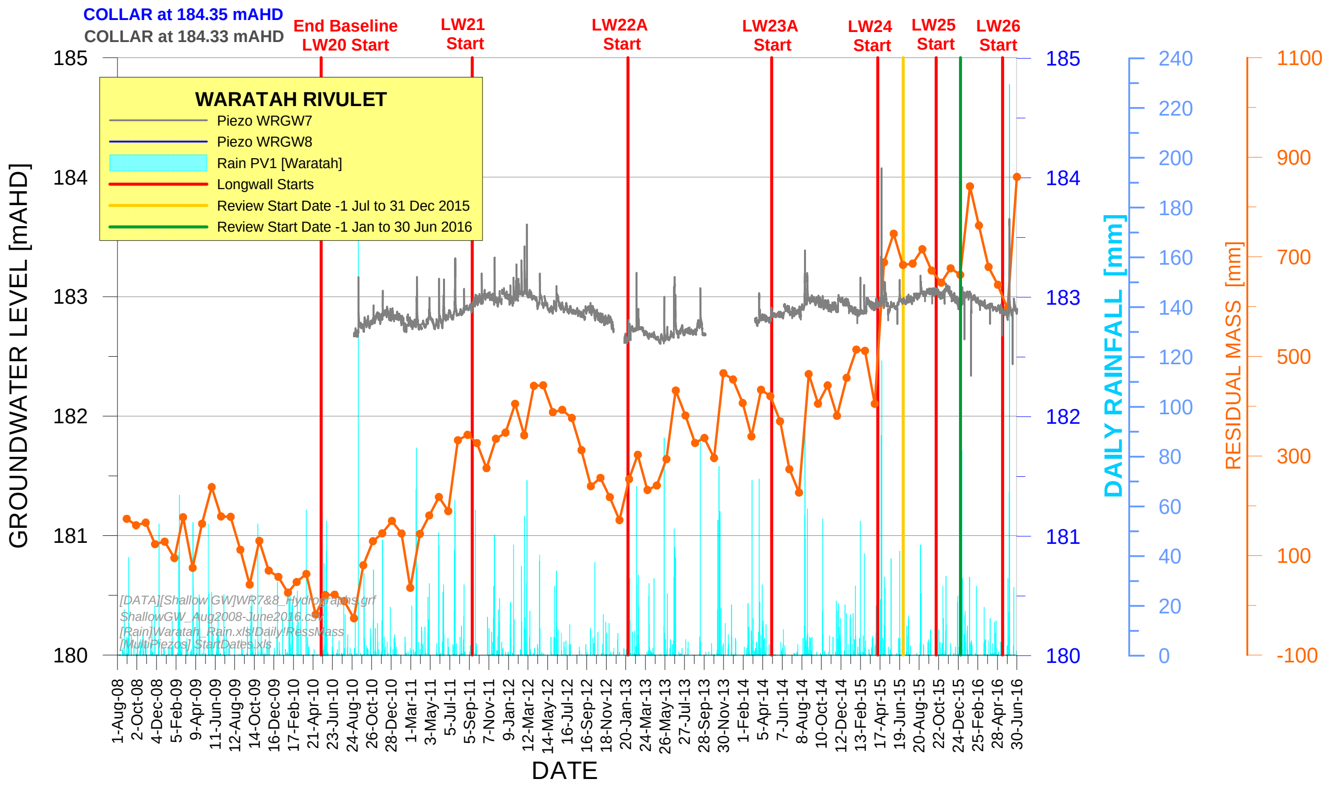


Chart 45 Shallow Groundwater Hydrographs on Waratah Rivulet at WRGW7

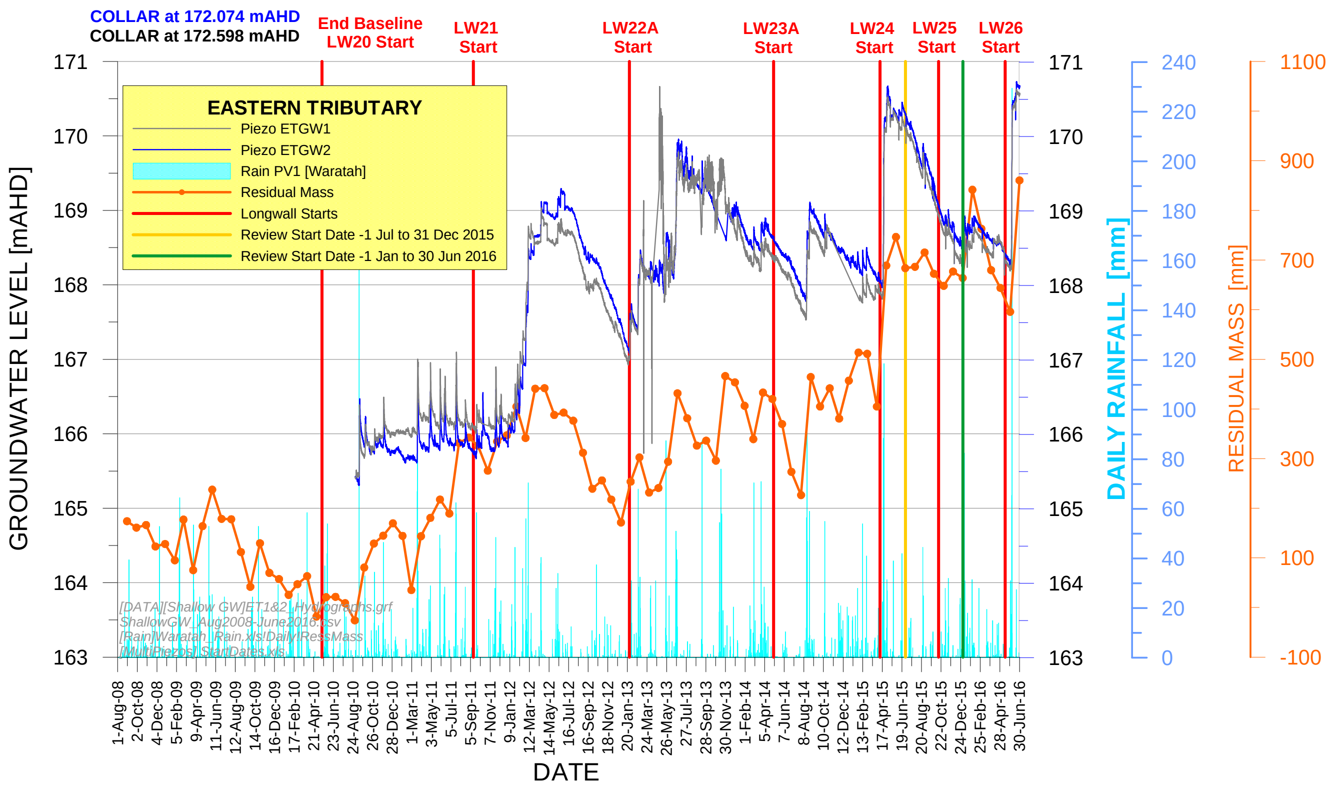


Chart 46 Shallow Groundwater Hydrographs on Eastern Tributary at ETGW1 and ETGW2

2.8 DEEP GROUNDWATER LEVELS/PRESSURES

Immediately above a mined coal seam, rocks collapse into the void created by the removal of coal to form a caved zone and a fractured zone develops above the caved zone. This causes aquifer properties to change (e.g. permeability and porosity) and results in a higher vertical permeability as a result of mining.

A three-dimensional numerical model of groundwater flow was developed for the mine and its surroundings prior to the commencement of Longwall 20. Since then, the model has been recalibrated and refined in the upper layers (Hawkesbury Sandstone) and extended from 13 to 15 layers. The groundwater model has been updated progressively as new multi-level piezometric data became available from the monitoring program. Model outputs have been examined every six months for review of environmental performance. Transient calibration has been undertaken during the reporting period to incorporate Metropolitan Coal updates to the geological model. The revised model includes an update of the topographical surface and geological interfaces, the addition of two model layers below the Bulli seam and updated estimates of the fractured zone height. A report is currently being prepared for the updated model.

Continuous groundwater level/pressure monitoring has been conducted at bores 9HGW0 (Longwall 10 Goaf Hole), 9EGW1B, 9FGW1A, 9GGW1-80, 9GGW2B, 9HGW1B, PM02, PM01, 9EGW2A, PM03, PHGW1B, PHGW2A, F6GW3 and F6GW4 (Figure 6). The time-series head variations and vertical head differences for these bores have been examined (Charts 47 to 60).

The monitoring sites closest to Longwalls 23-27 are bore 9EGW1B (approximately 300 m north of Longwall 23A) and bore 9GGW2B (above Longwall 27 headings) (Figure 6).

The time-series record for bore 9EGW1B on Chart 48 shows fairly stable heads that decline with depth. The deepest piezometer (542 m in Coal Cliff Sandstone) retains about 360 m pressure head, which has been declining slowly since the commencement of Longwall 20 due to far-field depressurisation. Groundwater pressures were relatively stable or increased slightly during the reporting period in all other piezometers.

The time-series record for bore 9GGW2B is shown on Chart 51[3,4]. Groundwater pressures increased by approximately 5 m in most of the piezometers in the upper part of the stratigraphy from January-June 2015. During the July-December 2015 reporting period, piezometers within and below the lower Hawkesbury Sandstone (i.e. at 80 m and deeper) show depressurisation corresponding with the end of Longwall 24 and the start of Longwall 25. Depressurisation is evident in the Bulli Coal Seam from late July 2015 whereas depressurisation is somewhat delayed in the lower Hawkesbury and Bulgo Sandstone (starting October 2015), and delayed further in the Stanwell Park Claystone, Wollombi Claystone and Scarborough Sandstone (starting in December 2015). Depressurisation continues through the current reporting period to the end of June 2016.

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[3] As the hydrographs show inconsistent head variations with depth, some of the piezometers are unreliable.

[4] The sensor at 106 m depth in the Hawkesbury Sandstone shows an increase in pressure during the reporting period which is inconsistent with the other sensors.

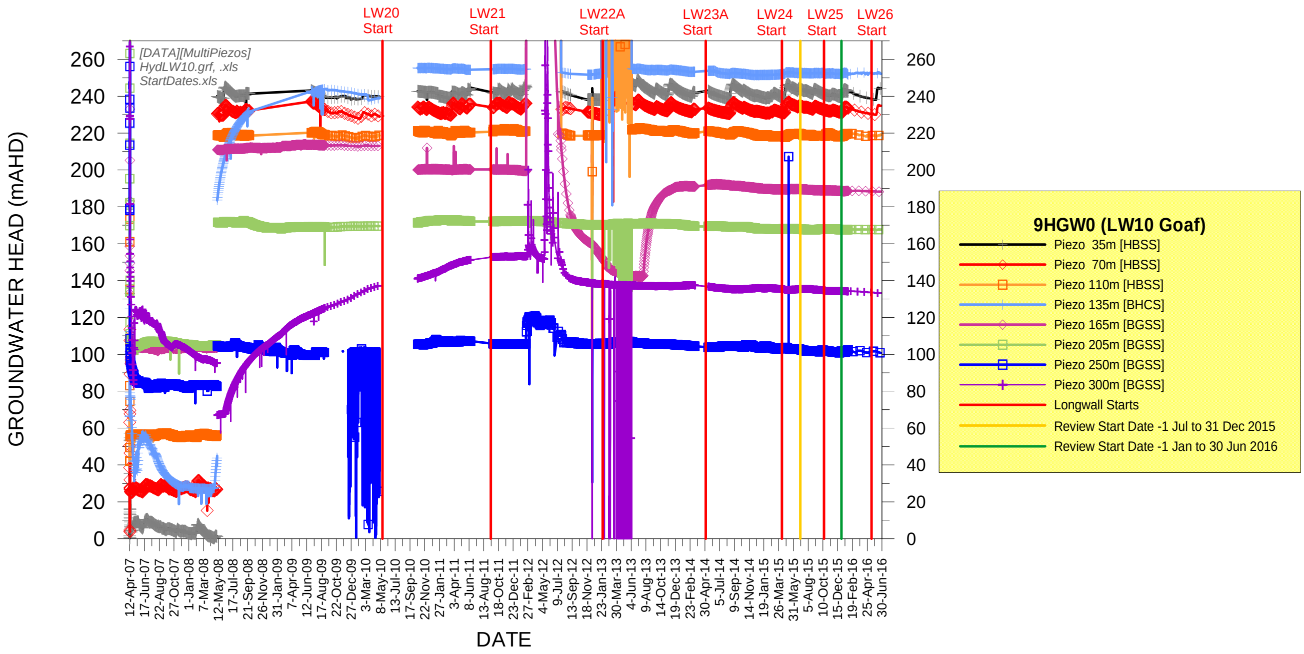


Chart 47 Time Variations in Potentiometric Heads at 9HGW0

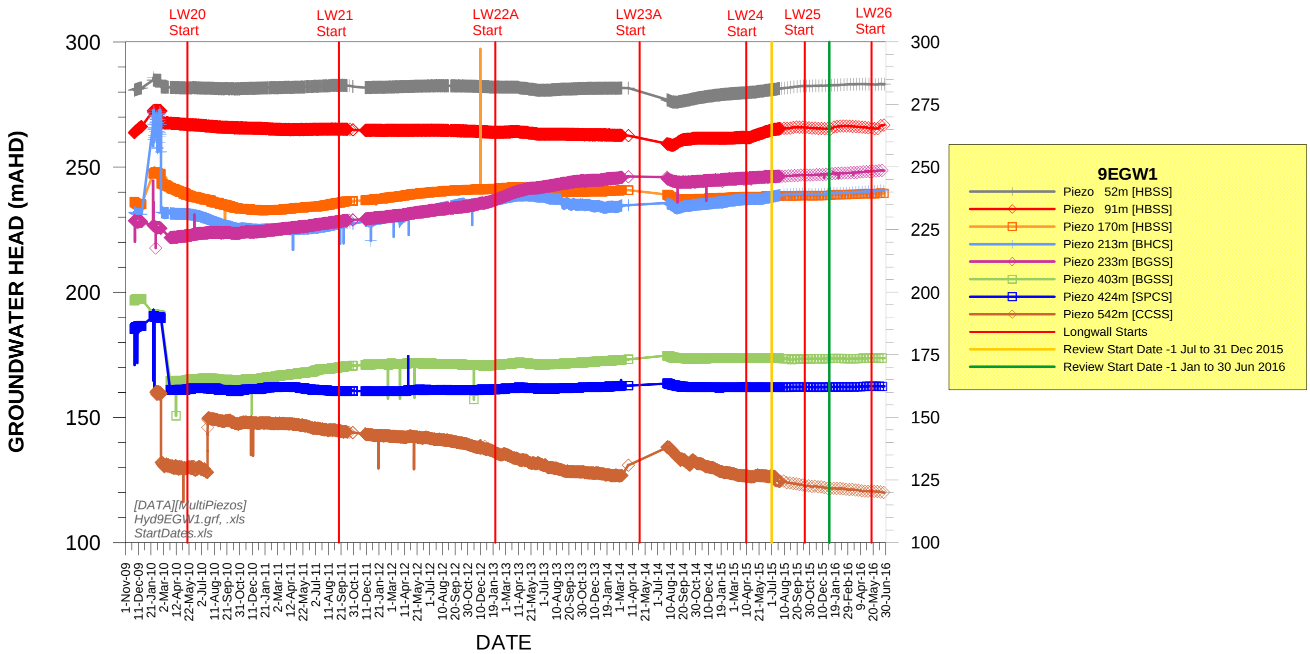
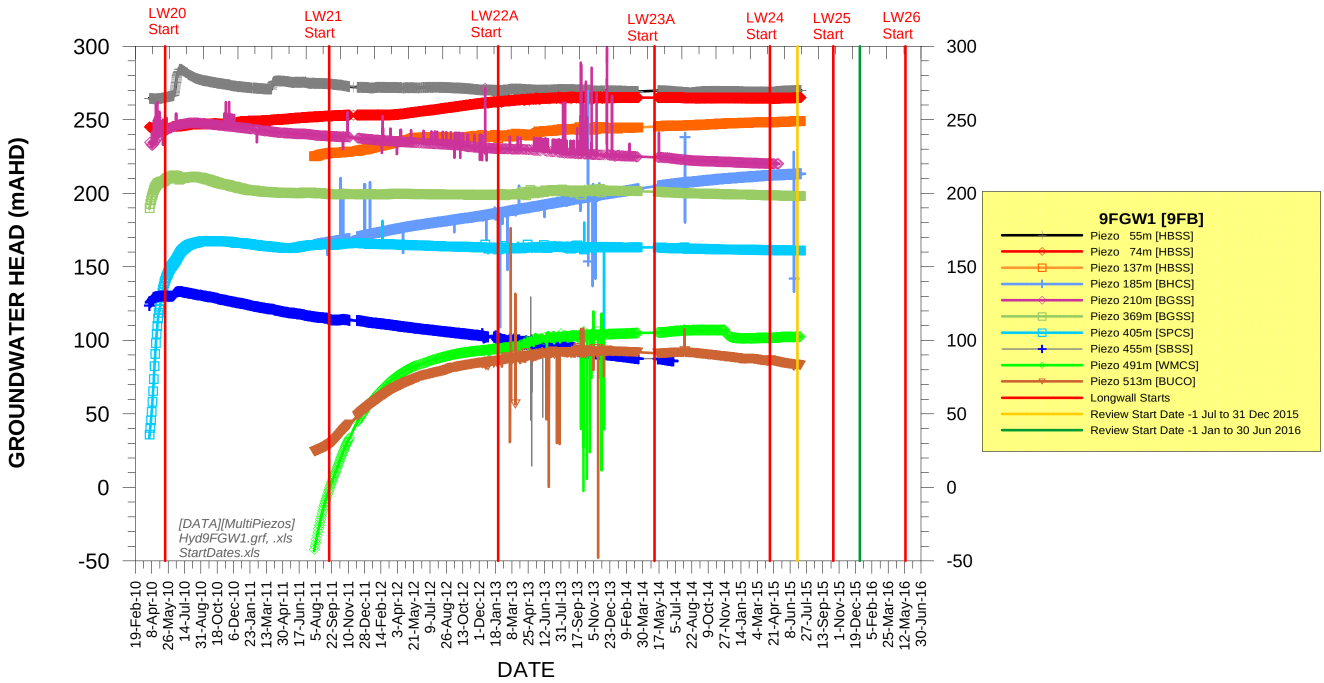


Chart 48 Time Variations in Potentiometric Heads at 9EGW1B



Note that a connection failure prevented upload of data for sensors in 9FGW1A. The equipment supplier has been notified.

Chart 49 Time Variations in Potentiometric Heads at 9FGW1A

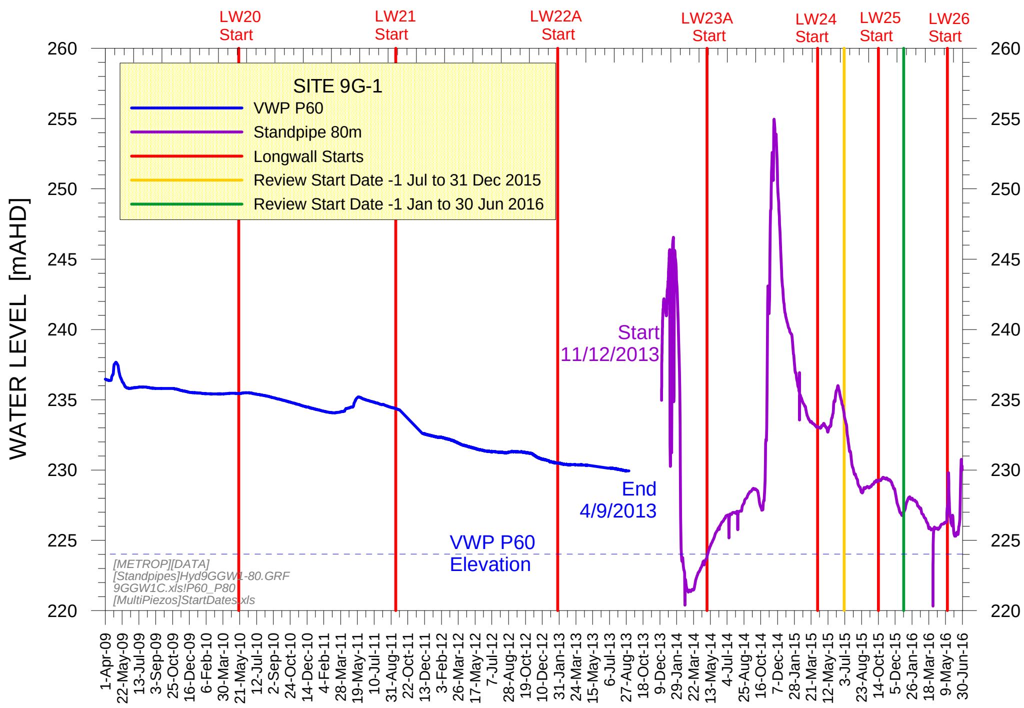


Chart 50 Time Variations in Water Table at Standpipe 9GGW1-80 and Decommissioned Vibrating Wire Piezometer 9GGW1-60

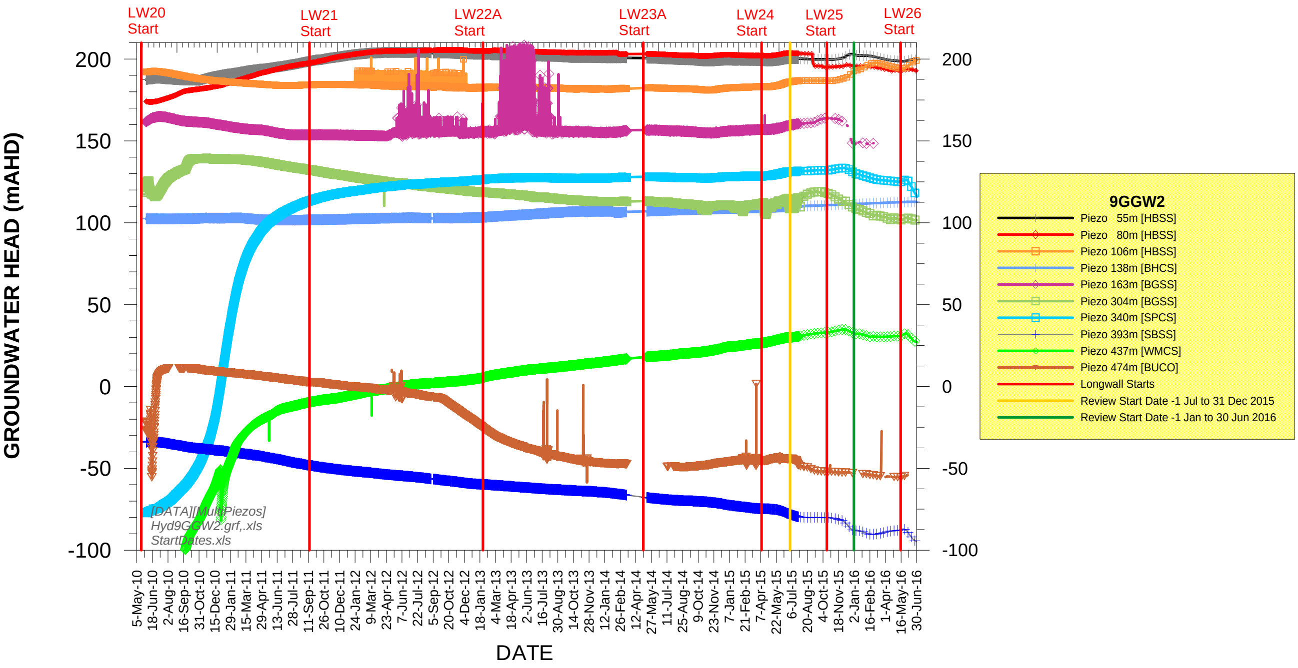


Chart 51 Time Variations in Potentiometric Heads at 9GGW2B

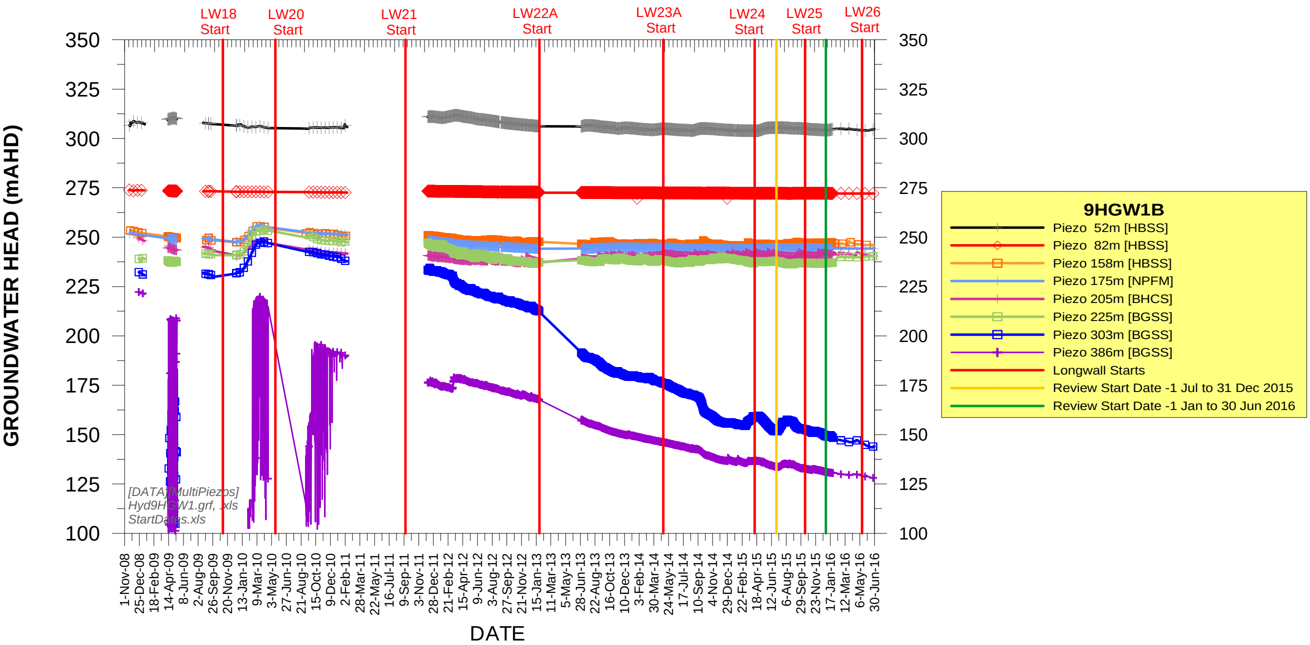


Chart 52 Time Variations in Potentiometric Heads at 9HGW1B

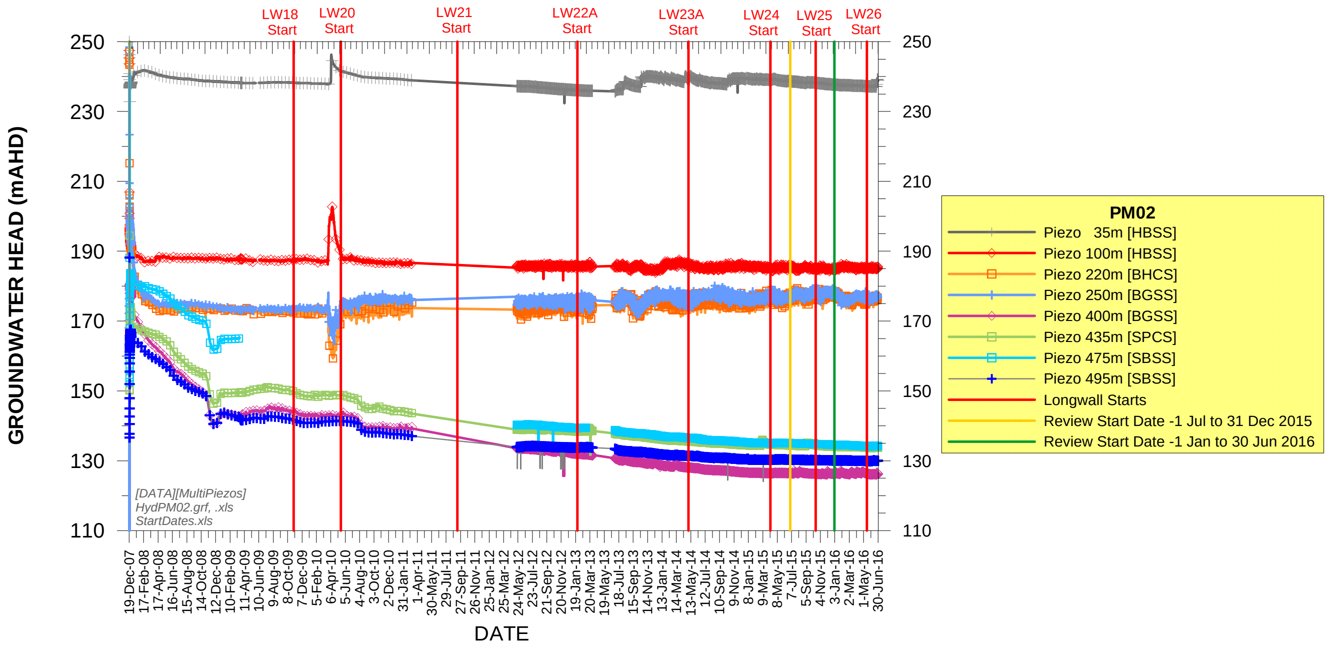


Chart 53 Time Variations in Potentiometric Heads at PM02

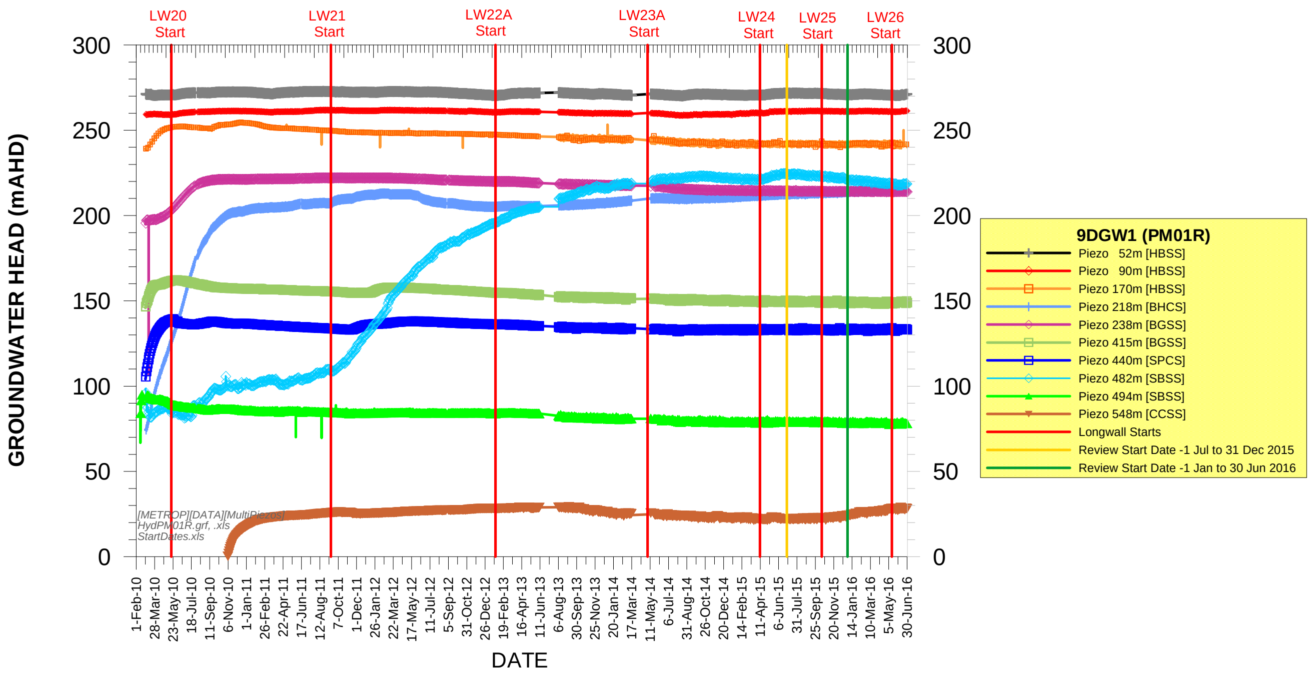


Chart 54 Time Variations in Potentiometric Heads at PM01

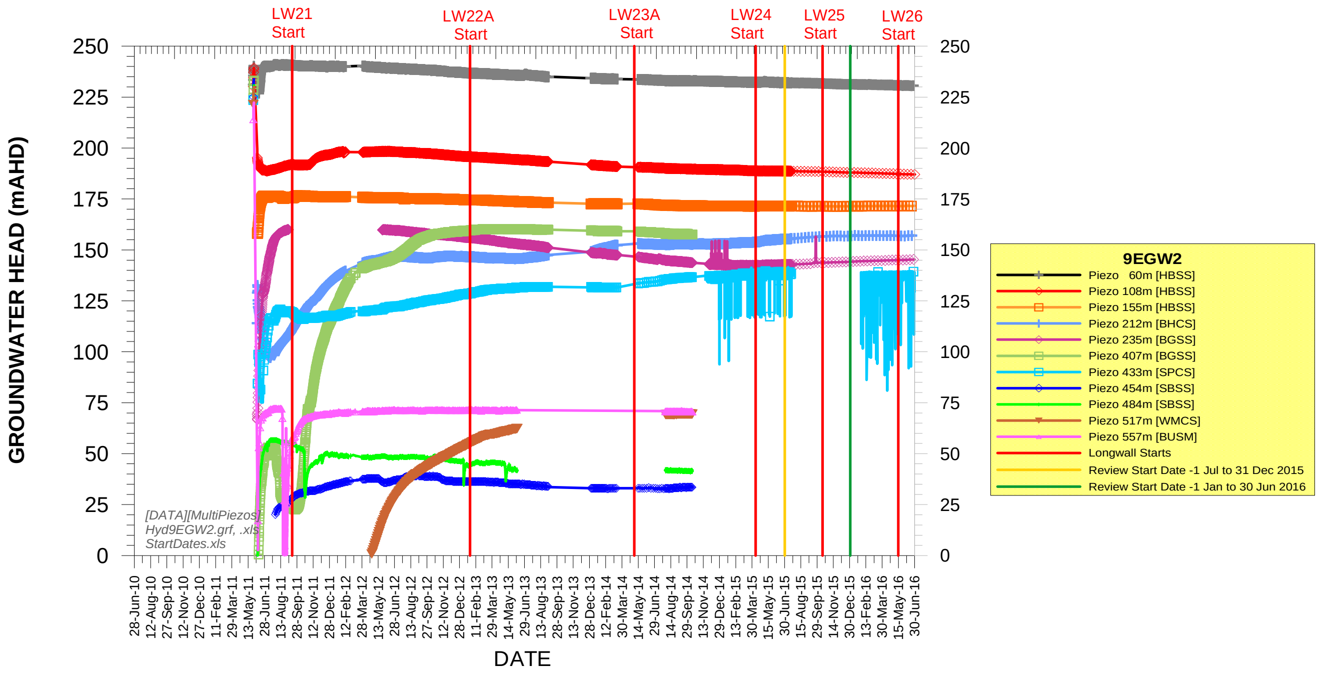


Chart 55 Time Variations in Potentiometric Heads at 9EGW2A

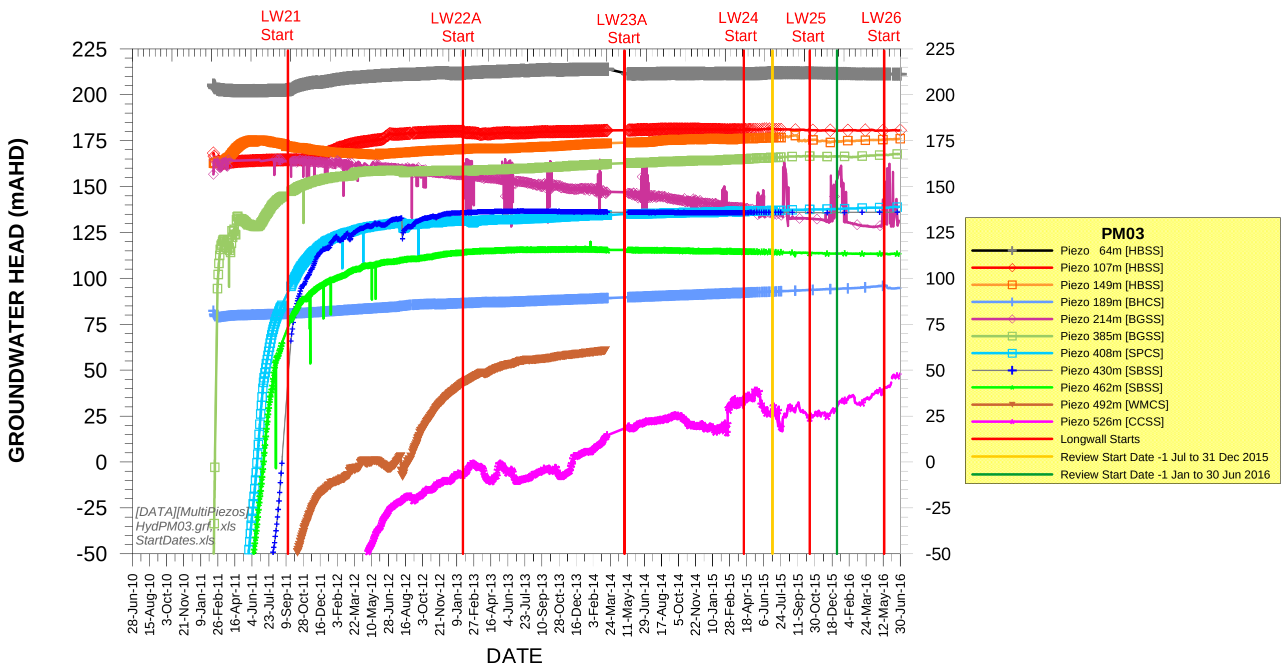
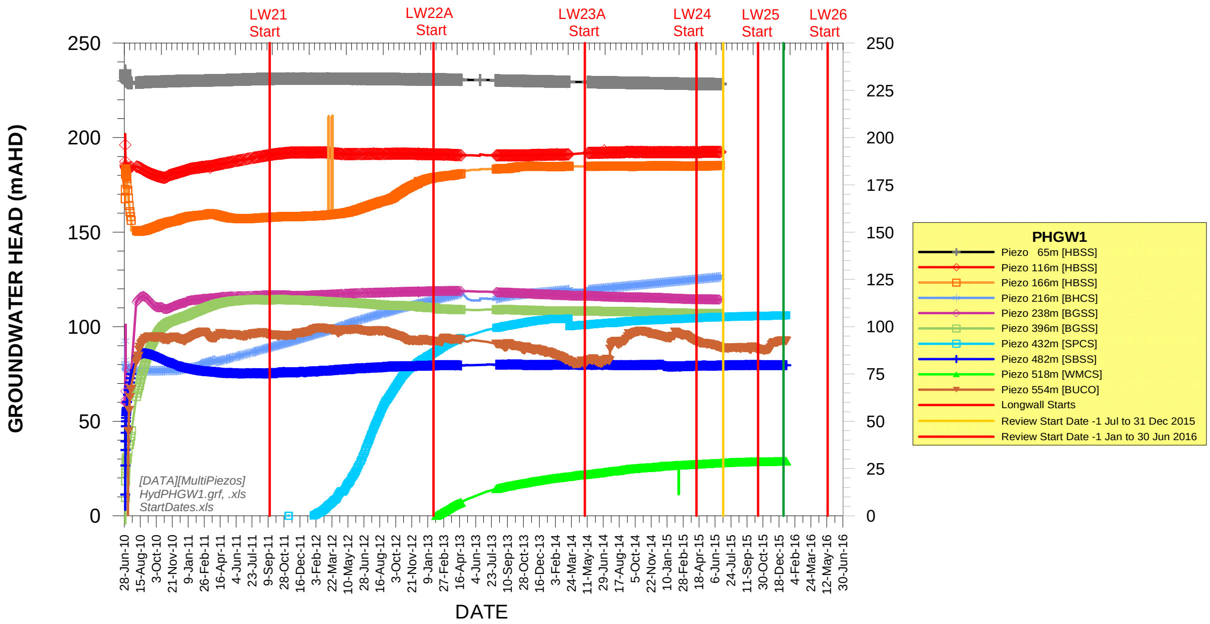
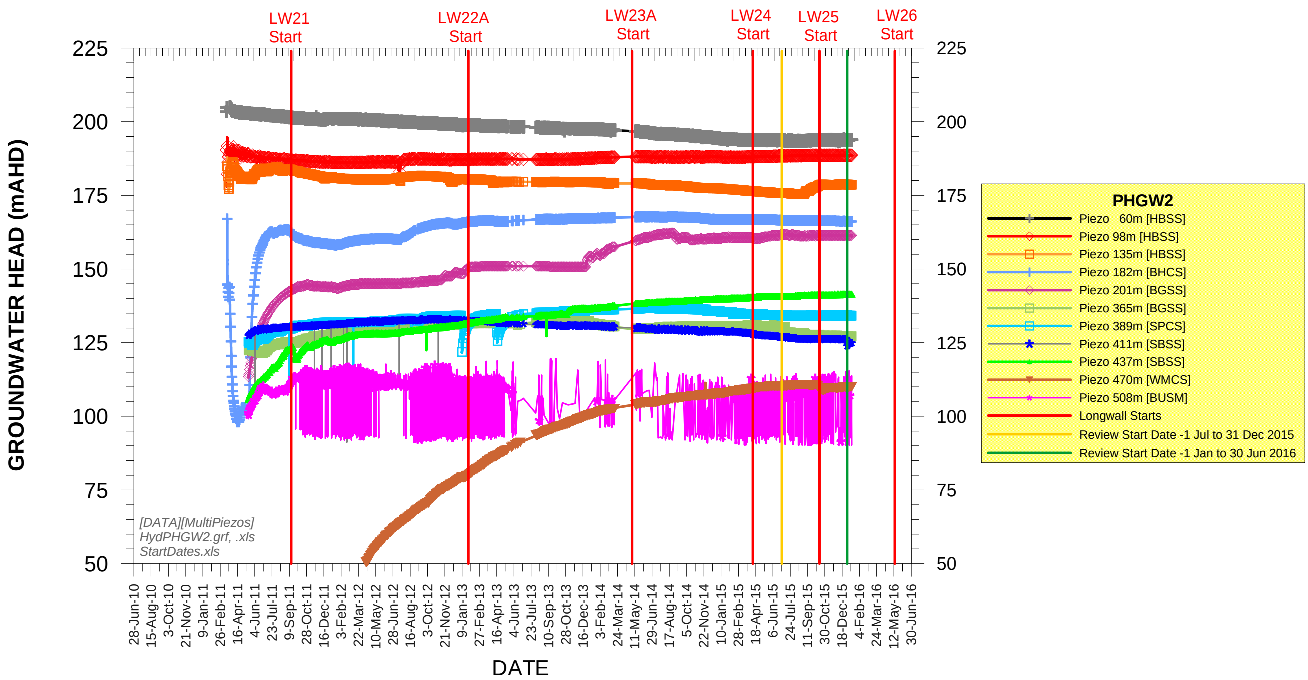


Chart 56 Time Variations in Potentiometric Heads at PM03



Note that a connection failure prevented upload of data for sensors in PHGW1B. The equipment supplier has been notified.

Chart 57 Time Variations in Potentiometric Heads at PHGW1B



Note that a connection failure prevented upload of data for sensors in PHGW2A. The equipment supplier has been notified.

Chart 58 Time Variations in Potentiometric Heads at PHGW2A

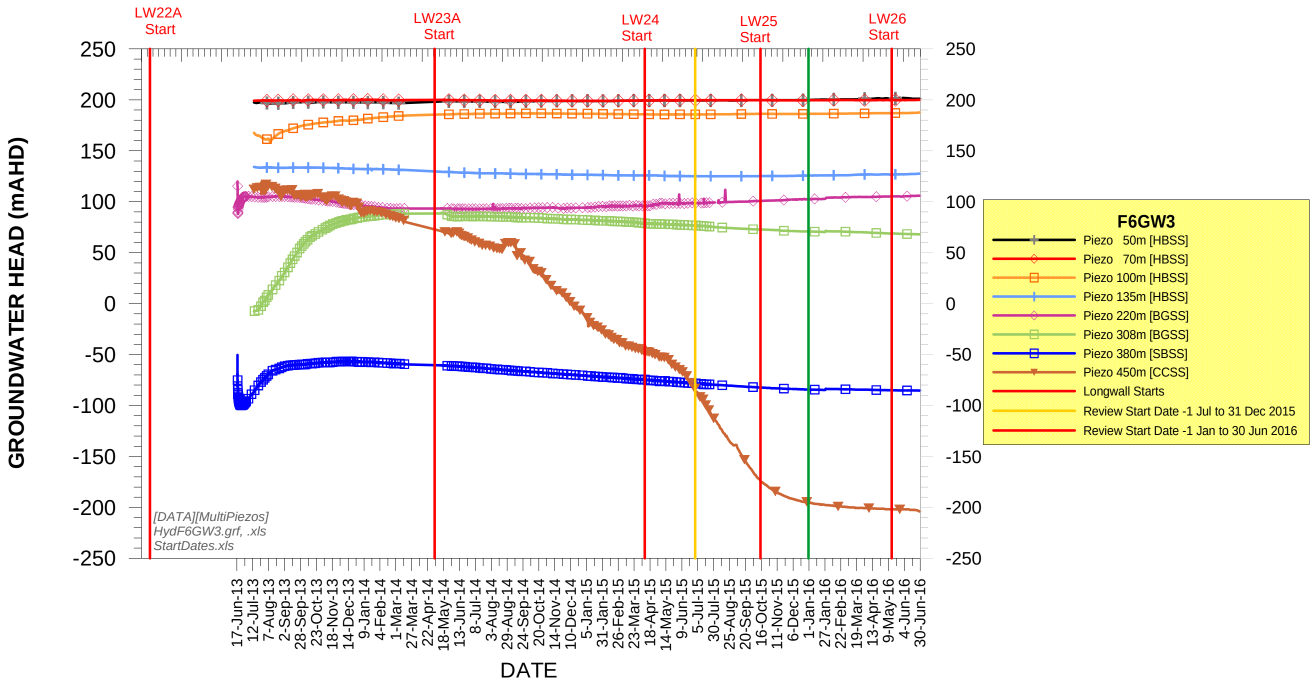
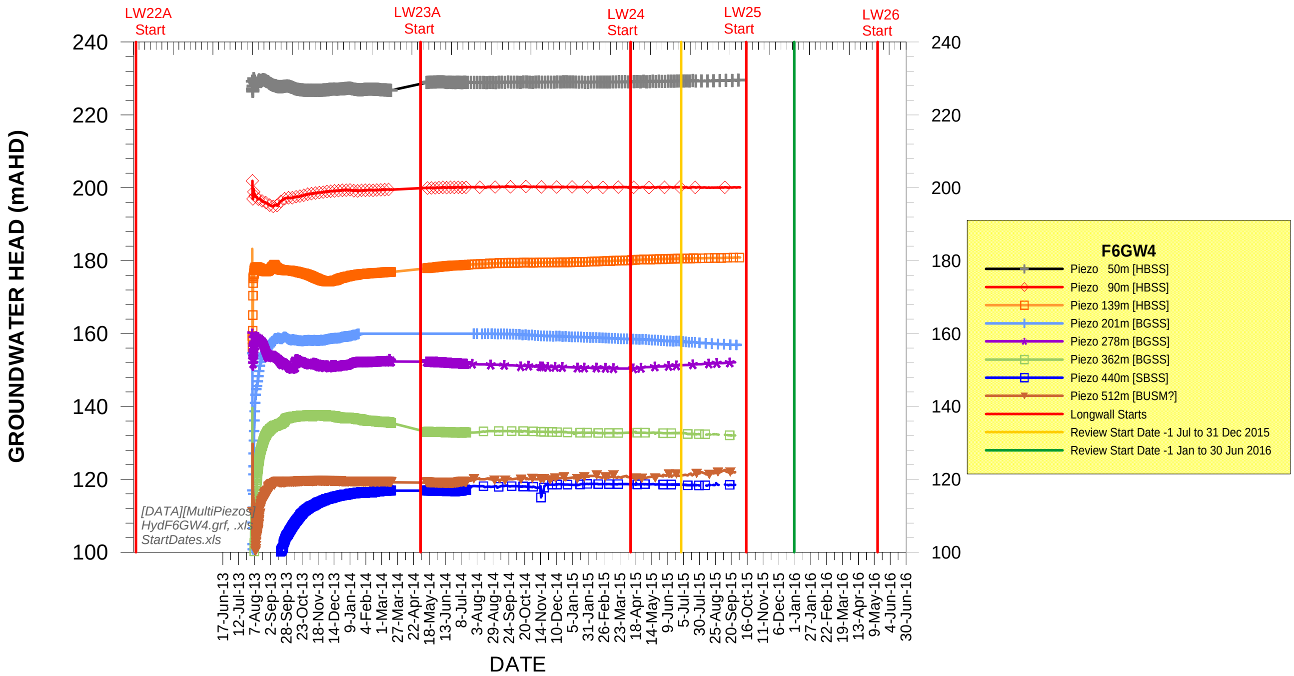


Chart 59 Time Variations in Potentiometric Heads at F6GW3



Note that a connection failure prevented upload of data for sensors in F6GW4. The equipment supplier has been notified.

Chart 60 Time Variations in Potentiometric Heads at F6GW4

The water tables measured at Bores 9FGW1A and 9GGW1-80 at the 55 m and 80 m piezometers, respectively, are compared to the water levels of streams crossed by a transect along Longwall 22. The transect on Chart 61 provides an illustration of relative ground and water levels on transect A-A' along Longwall 22 through indicator sites 9FGW1A and 9GGW1-80. The transect from west to east crosses Tributary B (twice), Waratah Rivulet, Tributary A and the Eastern Tributary.

Due to a telemetry malfunction, data were not available after 11 July 2015 for site 9FGW1A. At site 9GGW1-80, the water level at the end of the reporting period was about 5 m higher than Eastern Tributary (to its east) but nearly 23 m higher than Tributary A (to its west). The monitoring results indicate that a hydraulic gradient is maintained between piezometers and the floor levels of the nearest streams (Chart 61).

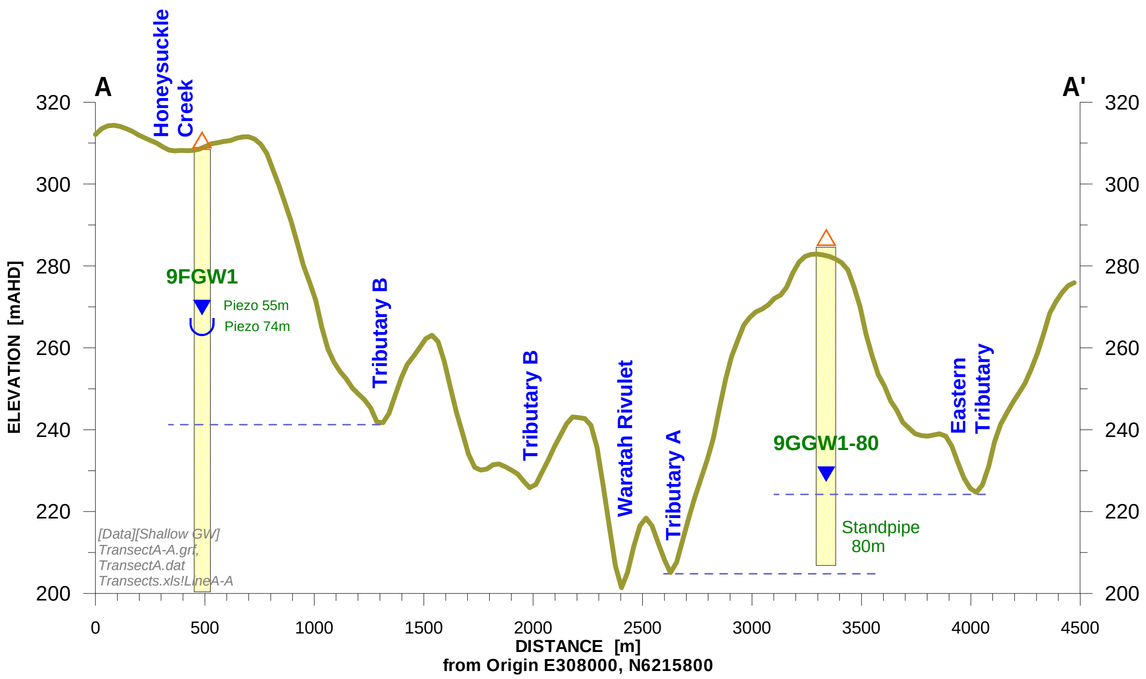


Chart 61 Topographic Transect A-A' along Longwall 22 and Hawkesbury Sandstone Water Levels (9GGW1-80 at 30 June 2016 and 9FGW1A at 11 July 2015)

The groundwater levels measured at Bores 9GGW2B and PM02 at the 55 m and 35 m piezometers, respectively, are compared to the Woronora Reservoir at the level of the regional water table. Chart 62 indicates that the seven day average groundwater levels have not fallen below the reservoir water level (i.e. a hydraulic gradient exists from the bores to the Woronora Reservoir).

The vertical potentiometric head profiles at Bores 9GGW2B and 9FGW1A also support the assessment of no connective cracking between the surface and the mine.

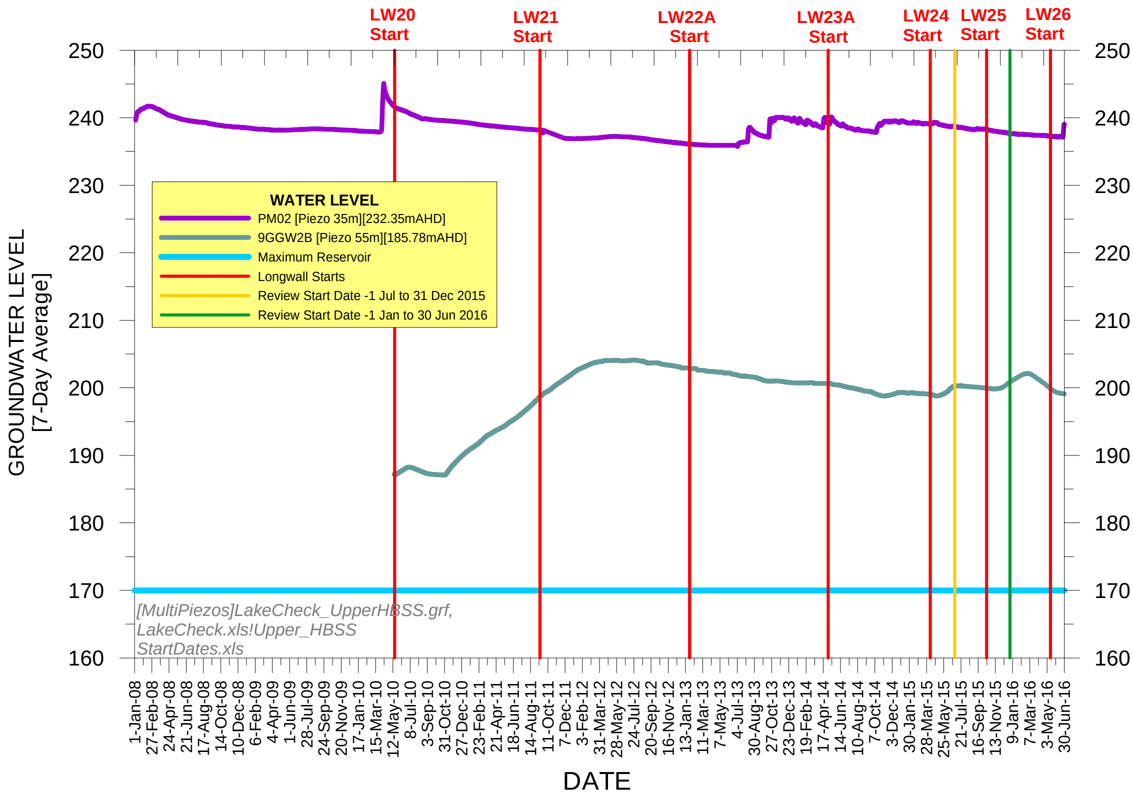


Chart 62 Seven Day Average Shallow Hawkesbury Sandstone Groundwater Levels at PM02 and 9GGW2B

2.9 GROUNDWATER QUALITY

Groundwater quality monitoring on Waratah Rivulet (at sites WRGW1 to WRGW7, Figure 7 and Charts 63, 64 and 65) and Eastern Tributary (at sites ETGW1 and ETGW2, Figure 7 and Charts 66, 67 and 68) during the reporting period indicates iron concentrations have remained below 10 mg/L at the Waratah Rivulet sites. Manganese concentrations at the Waratah Rivulet sites have typically been less than 1 mg/L and aluminium concentrations have been low. pH at the Waratah Rivulet sites has been generally acidic and usually between pH 5.5 and 7, however a pH 8.3 was measured at WRGW7 during the reporting period. The observations are consistent with those reported previously.

Higher iron concentrations (17.1 mg/L and 15.4 mg/L) were recorded at ETGW1 in January 2016 and April 2016, respectively (Chart 66). However, iron concentrations at ETGW2 were consistent with, or lower, than previously recorded concentrations. Manganese concentrations were low at both sites on the Eastern Tributary. Higher manganese concentrations (0.71 mg/L and 0.65 mg/L) were recorded in January 2016 and April 2016 at ETGW1, respectively, and were higher than the previously recorded manganese concentrations at this site (Chart 67). Aluminium was at or below 0.05 mg/L in all samples. The groundwater at the Eastern Tributary sites is generally acidic, predominantly between pH 5.7 and pH 6.2 in the reporting period (Chart 68).

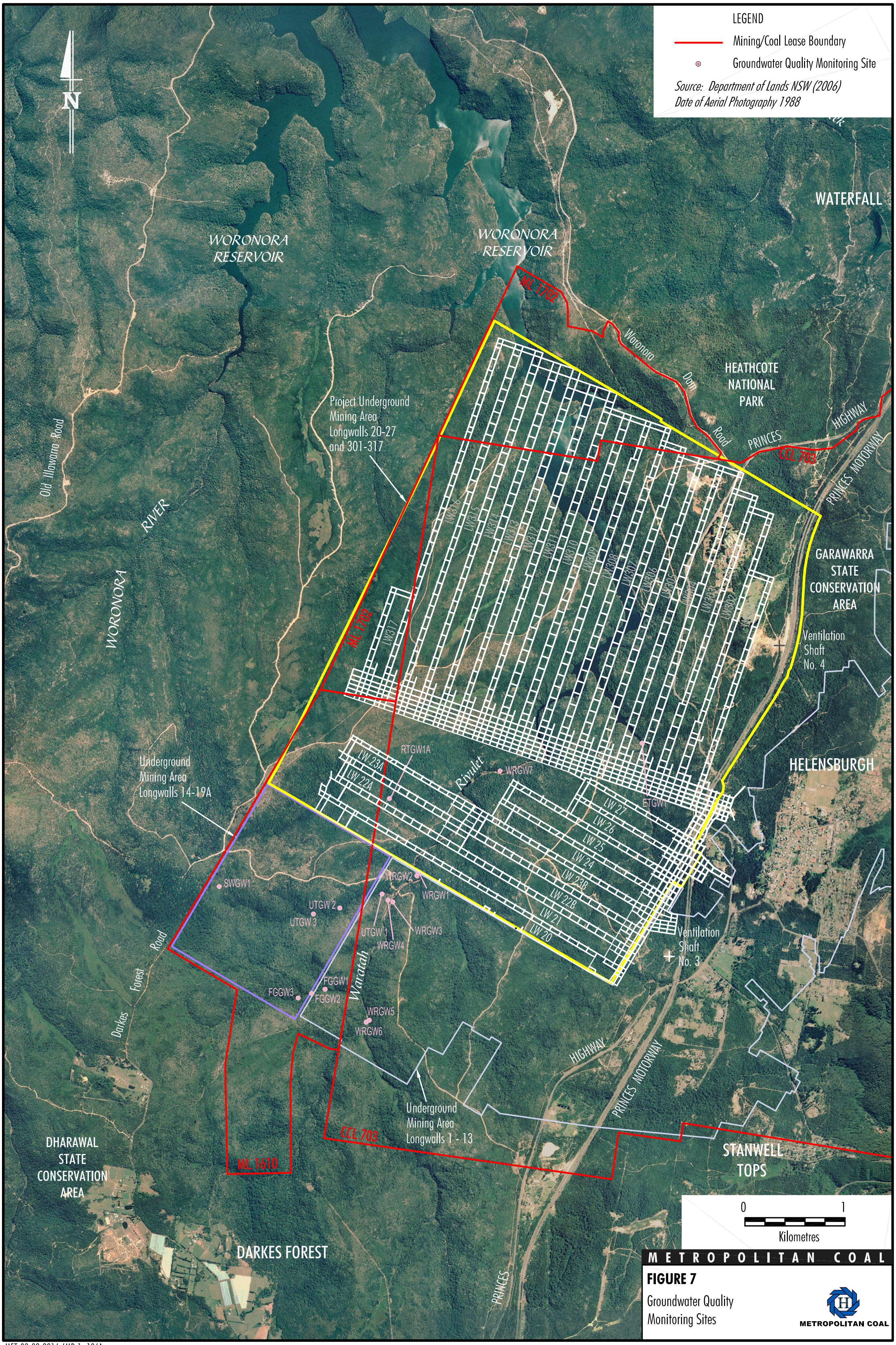


FIGURE 7
Groundwater Quality Monitoring Sites

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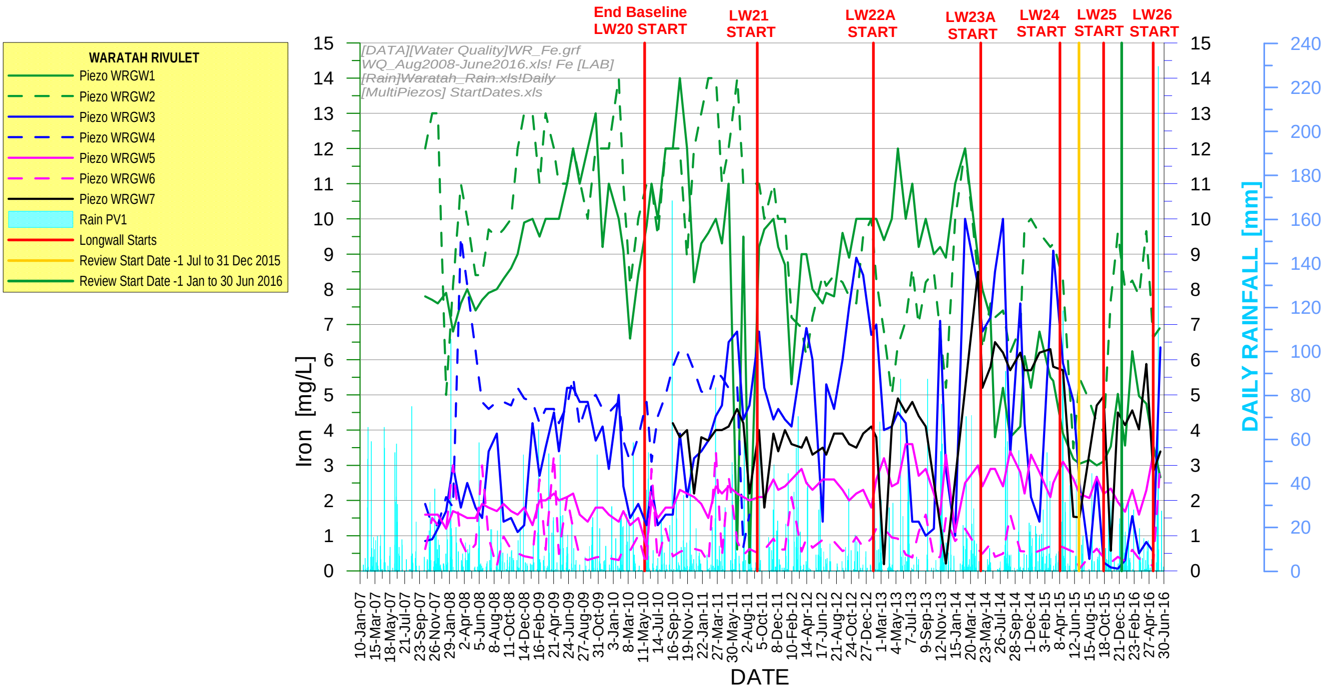

Chart 63 Iron Concentrations at WRGW1 to WRGW7 on Waratah Rivulet

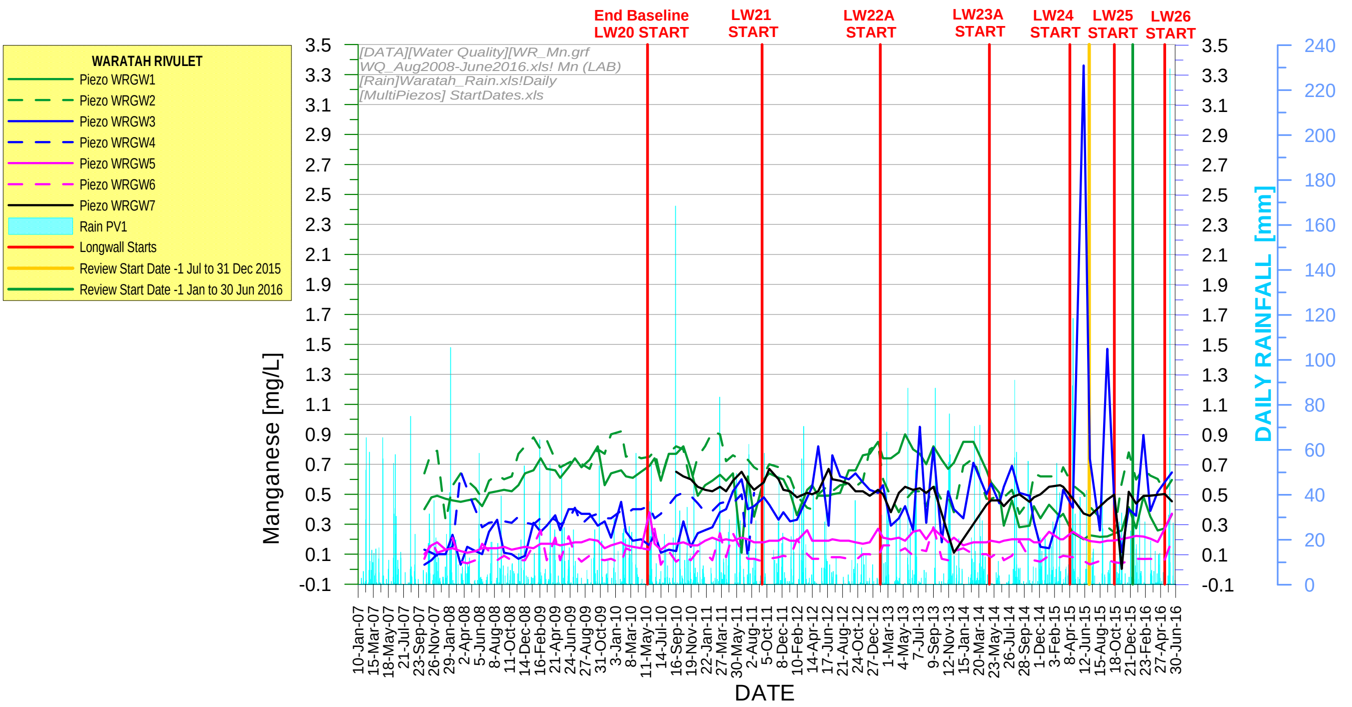

Chart 64 Manganese Concentrations at WRGW1 to WRGW7 on Waratah Rivulet

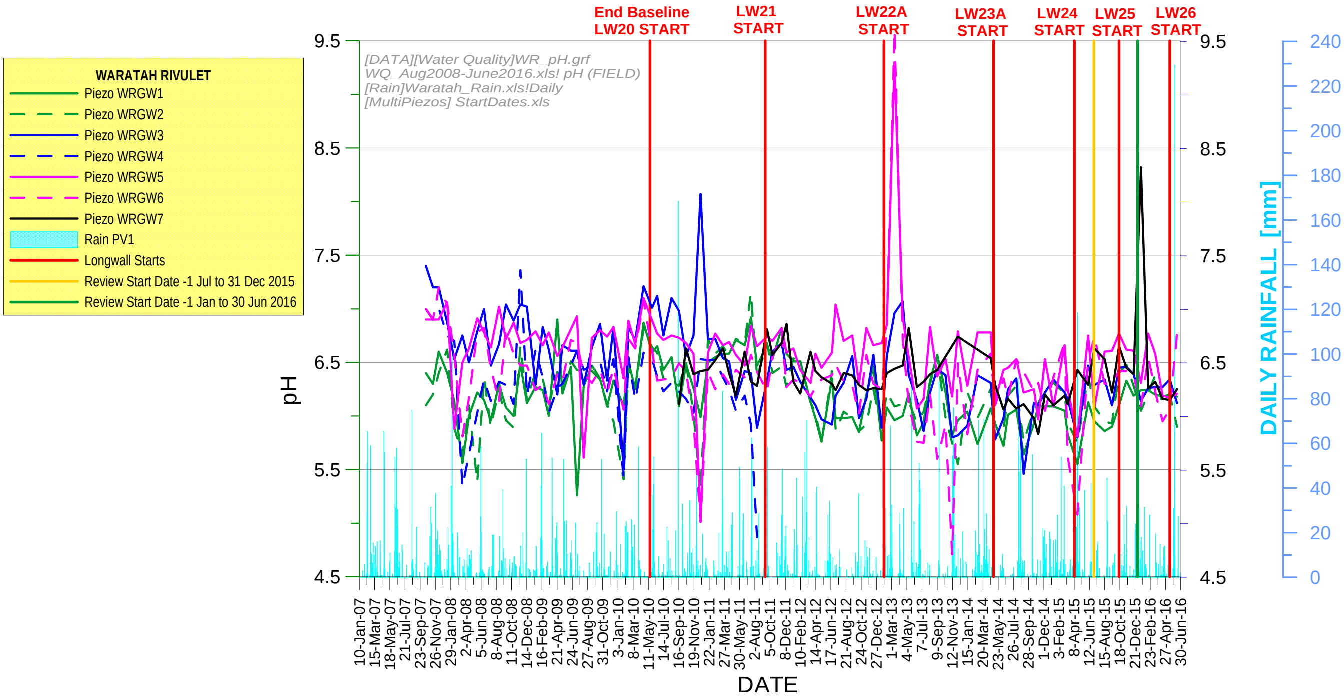

Chart 65 pH Levels at WRGW1 to WRGW7 on Waratah Rivulet

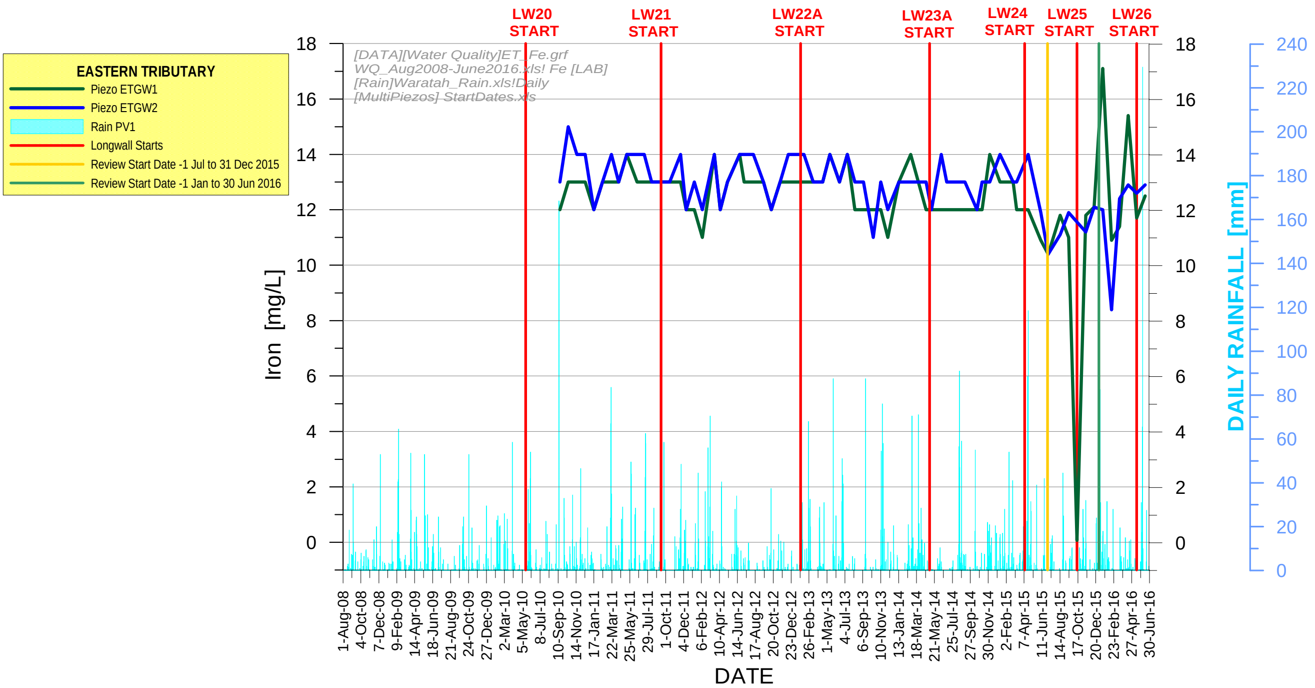

Chart 66 Iron Concentrations at ETGW1 and ETGW2 on Eastern Tributary

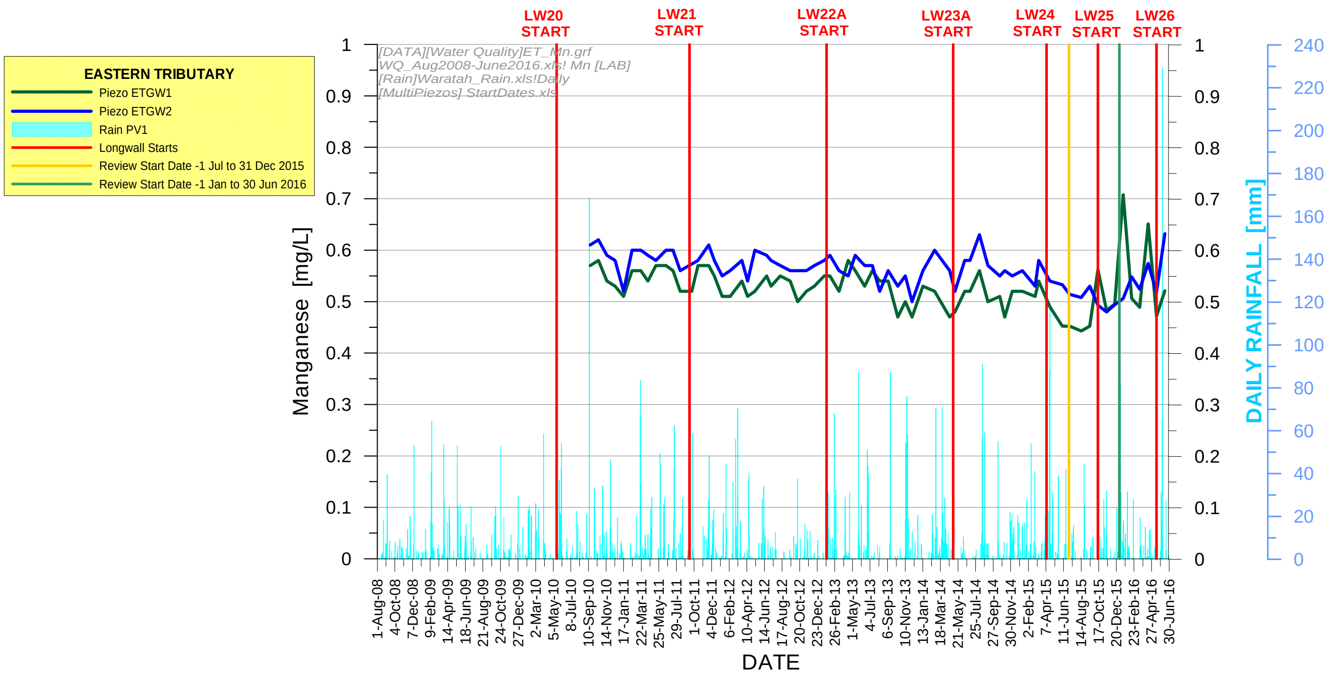

Chart 67 Manganese Concentrations at ETGW1 and ETGW2 on Eastern Tributary

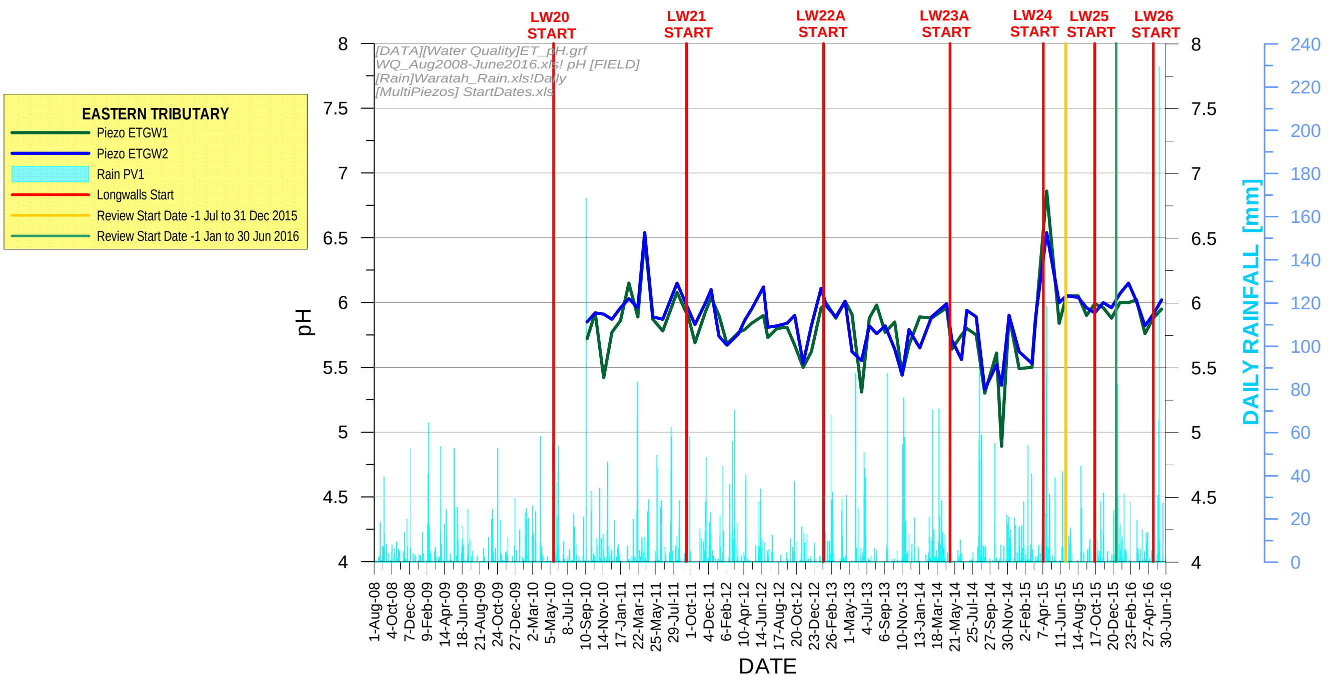

Chart 68 pH Levels at ETGW1 and ETGW2 on Eastern Tributary

2.10 INSPECTIONS OF MINE WORKINGS

Mine inspections did not identify any abnormal water flows from the goaf, geological structure, or strata generally during the reporting period.

2.11 MINE WATER MAKE

The inferred water make (i.e. groundwater that has seeped into the mine from the strata) is calculated from the difference between total mine inflows and total mine outflows. Given the large fluctuations in daily water usage and the cycle period for water entering the mine, a 20 day average is used to provide a more reliable estimate of water make. On the basis of groundwater predictions, the 20 day average daily mine water make is assessed against a subsidence impact performance indicator for mine water make of no more than 2 megalitres per day (ML/day). The 20 day average mine water make was less than 2 ML/day during the reporting period (Chart 69).

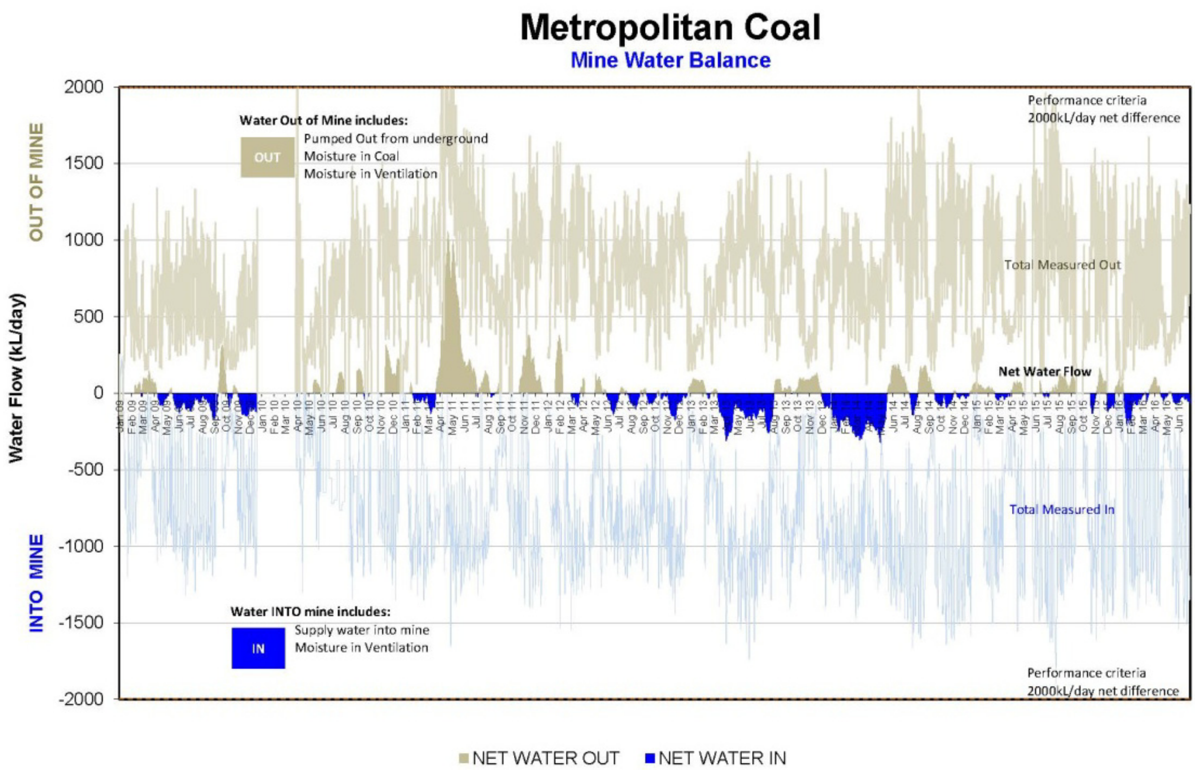

Chart 69 Estimated Daily Mine Water Make

3 BIODIVERSITY MANAGEMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Biodiversity Management Plans have been prepared to manage the potential environmental consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on aquatic and terrestrial flora and fauna, with a specific focus on swamps, in accordance with Condition 6, Schedule 3 of the Project Approval.

3.1 UPLAND SWAMP VEGETATION MONITORING

Upland swamp vegetation monitoring is conducted at a number of swamps overlying or adjacent to Longwalls 20-27 and at a number of control swamps (Figures 8 and 9).

The results of the Longwalls 20-22 and Longwalls 23-27 upland swamp vegetation monitoring programs (up to and including the spring 2015 survey) can be summarised as follows:

- No cracking of exposed bedrock areas or swamp sediments was observed in either longwall or control swamps, other than those recorded during the baseline surveys. Areas in which active erosion was observed were all minor and limited to access tracks, drainage lines and areas of bare earth without vegetation cover. At Swamp 20, iron-stained groundwater seepage has been observed since spring 2012 on the terminal rocky step and a small rocky step. In spring 2015 iron-stained seeps were recorded at the terminal step only.
- The vegetation structure, dominant species and estimated cover abundance for each stratum has been variable across all seasons with variations recorded between sites, seasons and strata. Within the variability of this dataset, a general trend towards increasing height and cover abundance of vegetation structural layers has occurred across all seasons particularly within the tallest structural layer and is a recognised pattern as a consequence of time since fire. No notable changes in vegetation structure, dominant species or estimated cover/abundance which could be attributed to impacts associated with the mining have been recorded within longwall or control swamps.
- Fluctuations in species cover/abundance have been recorded across all sites. No patterns of increasing or decreasing cover/abundance have been identified in relation to individual species across sites or groups of species (i.e. swamp indicator species, generalist species, shrubs, ground covers) within sites.
- Visual inspections across all upland swamps identified that vegetation at both longwall and control sites was generally in good condition in spring 2015 with no unusual areas of vegetation senescence observed. Some isolated dieback and senescence of scattered individuals were recorded throughout most longwall and control swamps.
- Species richness within Restioid Heath/Banksia Thicket sites in spring 2015 was variable with small fluctuations observed across longwall and control sites (Charts 70 and 71). Analysis of species richness within Restioid Heath/Banksia Thicket sites using analysis of variance (ANOVA) did not detect significant differences between longwall and control sites in any season including spring 2015.
- Species richness within individual Tea Tree Thicket sites in spring 2015 was also within the range of previous seasons at all sites (Charts 70 and 72). At longwall Swamps 20 and 28, there was no change in species richness in spring 2015 compared to autumn 2015. A small increase in species richness from autumn 2015 was observed at the control sites (Woronora River 1, Woronora River South Arm and Dahlia Swamp).

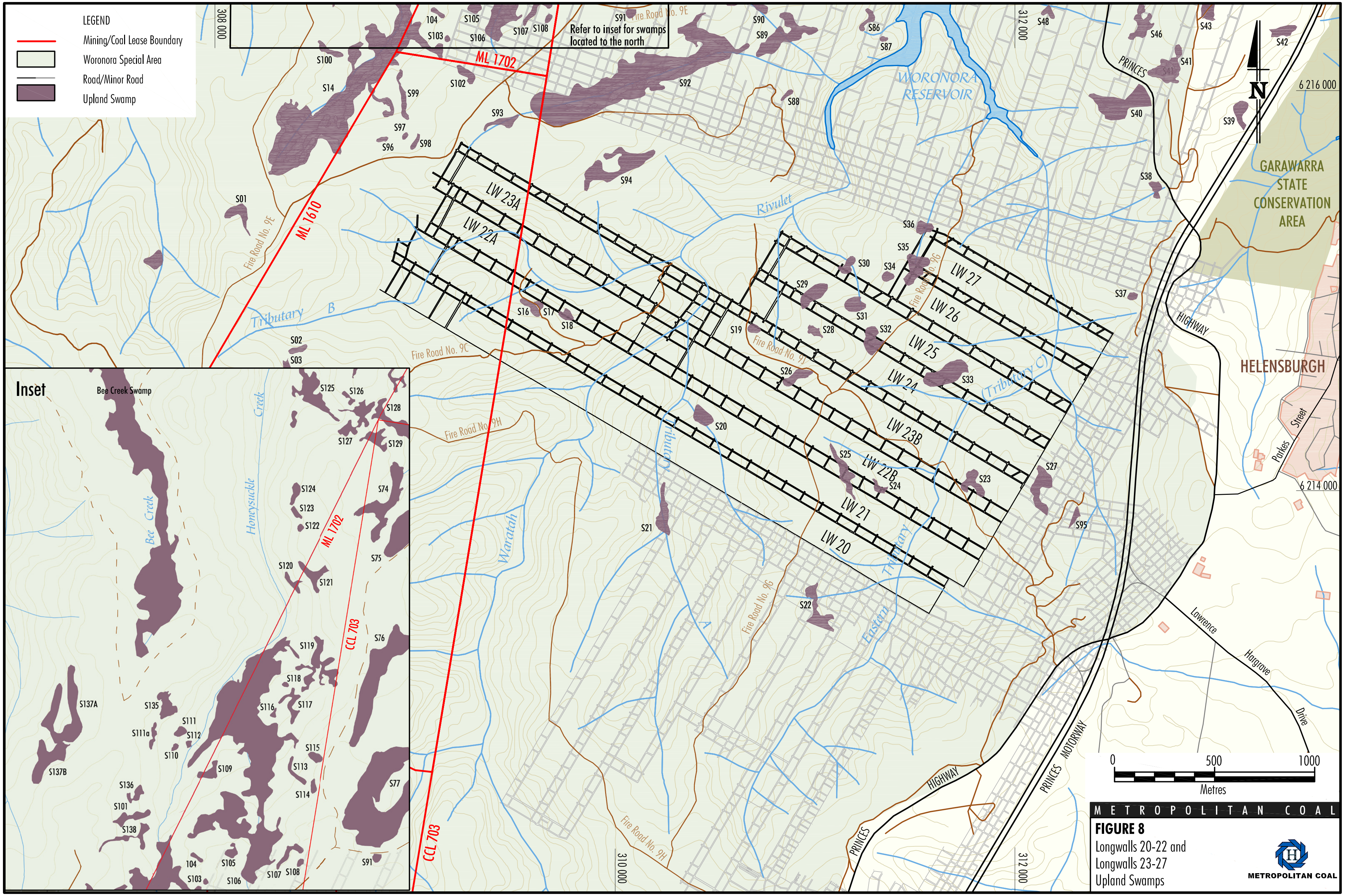

FIGURE 8
Longwalls 20-22 and Longwalls 23-27 Upland Swamps

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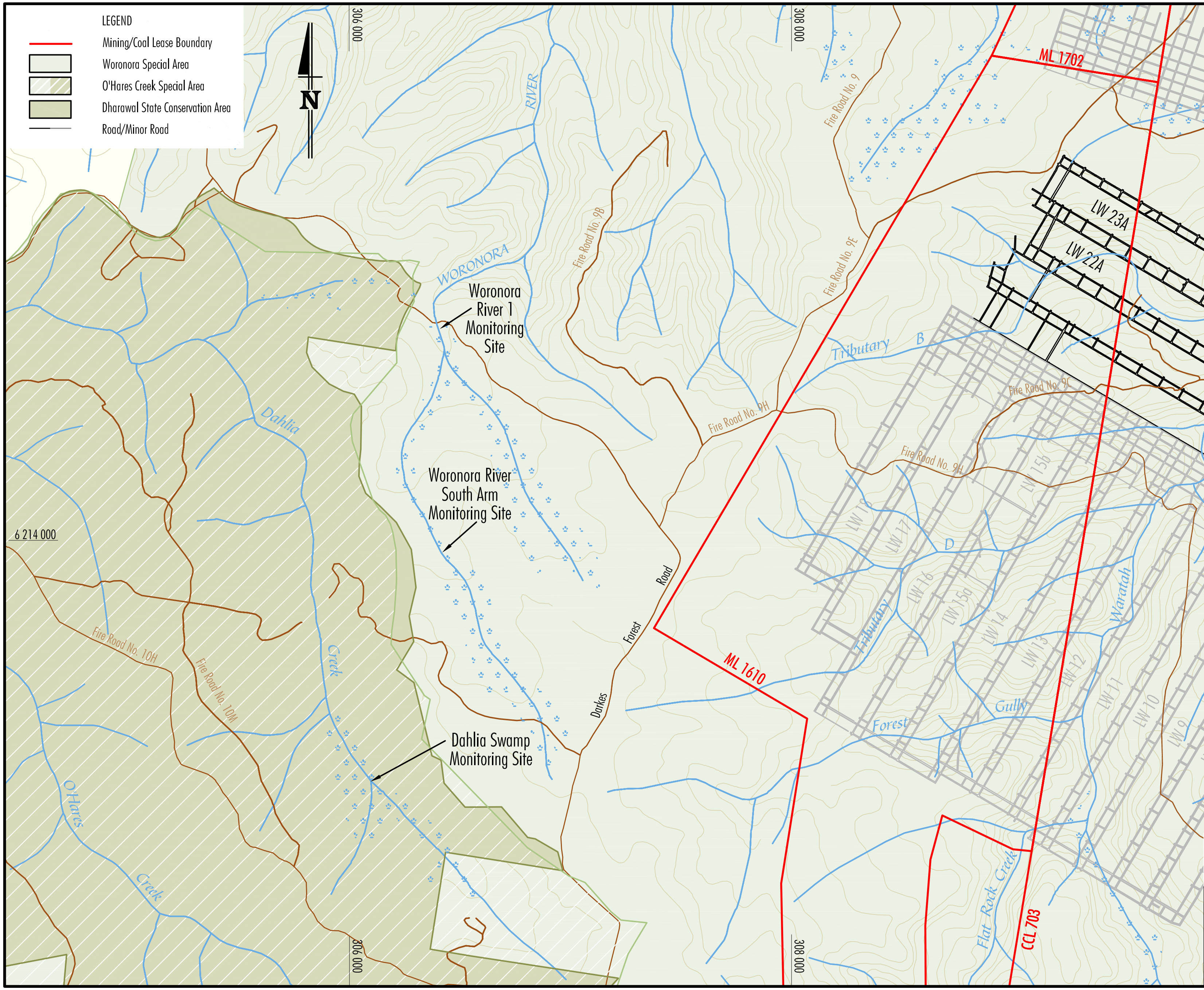

METROPOLITAN COAL

FIGURE 9

Location of Woronora River 1, Woronora River South Arm and Dahlia Swamp Vegetation Monitoring Sites

METROPOLITAN COAL

MET-08-08-2016 6MR-1_109A

- Analysis of quadrat/transect data indicates that the vegetation in upland swamps overlying longwall mining has not experienced changes significantly different to changes in control swamps.
- For Longwalls 20-22, monitoring of indicator species in the Restioid Heath/Banksia Thicket swamps identified similar mortality rates for *Epacris obtusifolia* and *Sprengelia incarnata* across both longwall and control sites. While the differences in mortality rates for *Pultenaea aristata* at longwall and control sites are larger, they have been similar across all seasons. The observed mortality is attributed to natural factors including predation, competition with other vegetation and abiotic factors. For the Tea Tree Thicket swamps (Swamp 20 and controls), few individuals of the indicator species (*Banksia robur, Callistemon citrinus* and *Leptospermum juniperinum*) for Longwalls 20-22 have died. All tagged indicator species recorded as dead have been within control swamps.
- For Longwalls 23-27, monitoring of indicator species identified higher mortality rates and lower mean vegetation condition within longwall sites compared to control sites for *Epacris obtusifolia, Pultenaea aristata* and *Banksia robur* in spring 2015. Similar differences were observed during the baseline monitoring period and following the commencement of mining, indicating that the increased mortality and lower mean vegetation condition does not appear to be related to the mining of Longwalls 23-27.
- The upland swamp vegetation performance indicator, *The vegetation in upland swamps is not expected to experience changes significantly different to changes in control swamps*, has not been exceeded.

The spring 2015 Longwalls 20-22 and Longwalls 23-27 Vegetation Monitoring Reports prepared by Eco Logical Australia Pty Ltd are provided in Appendices E and F, respectively.

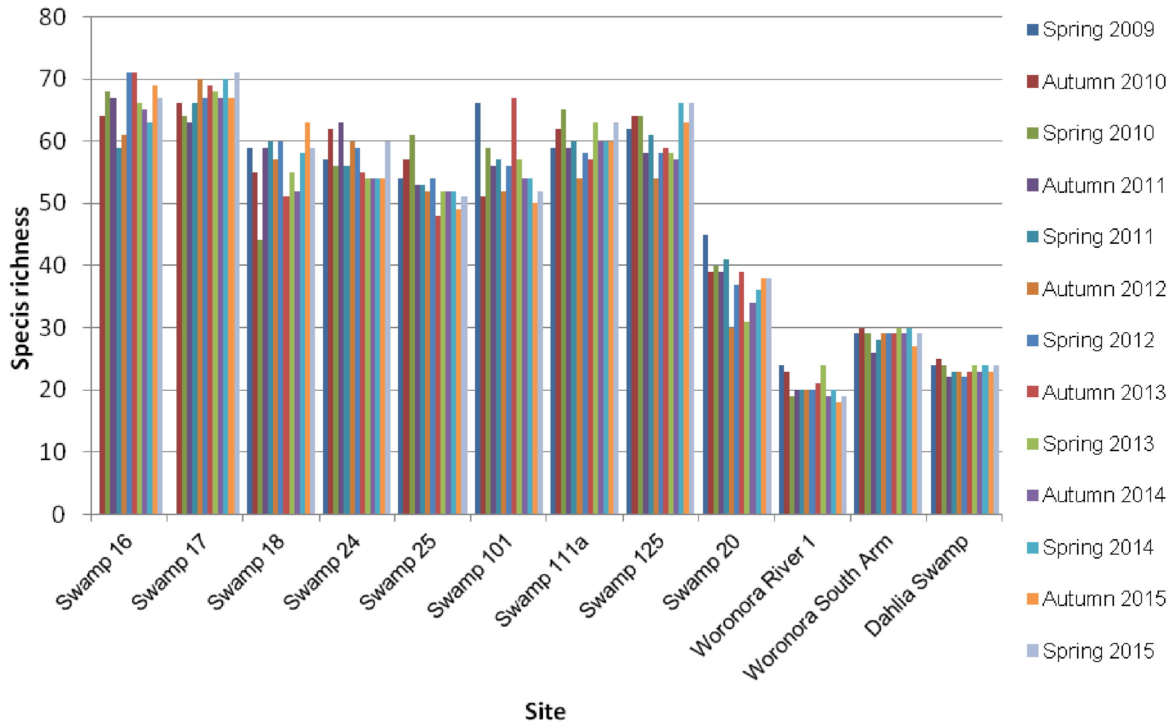

Chart 70 Species Richness in Longwalls 20-22 Upland Swamp Sites, Spring 2009 – Spring 2015

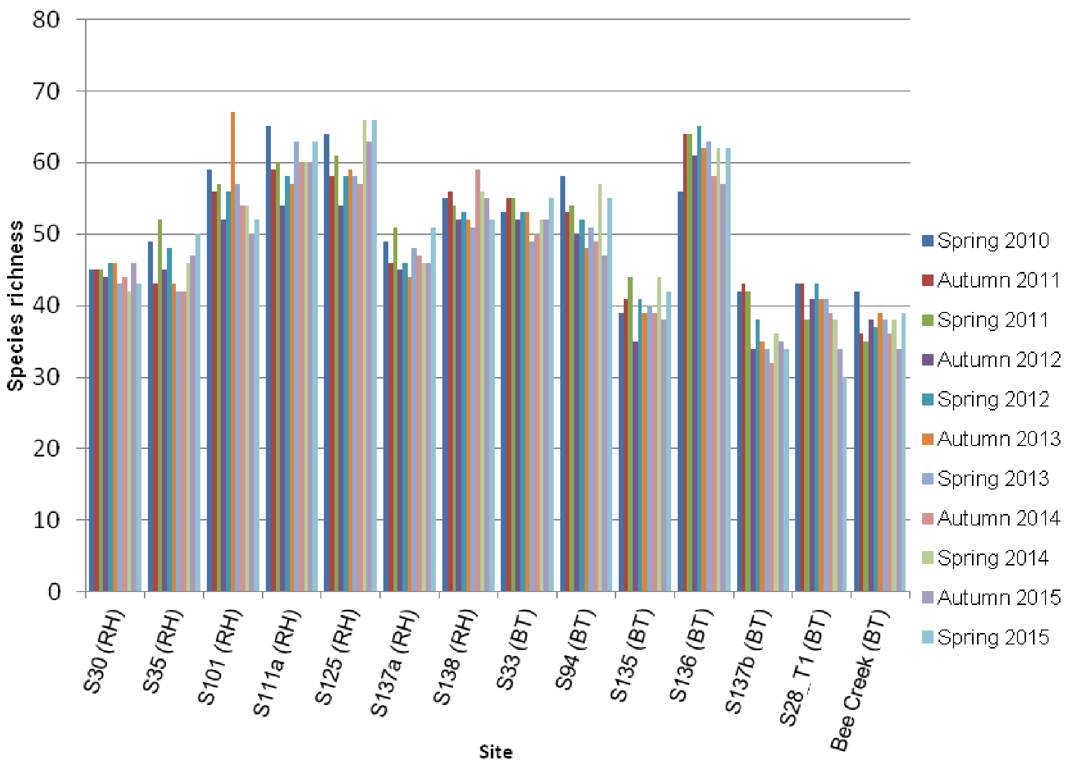

Chart 71 Species Richness within Longwalls 23-27 Upland Swamp Sites Supporting Restioid Heath And Banksia Thicket, Spring 2010 – Spring 2015

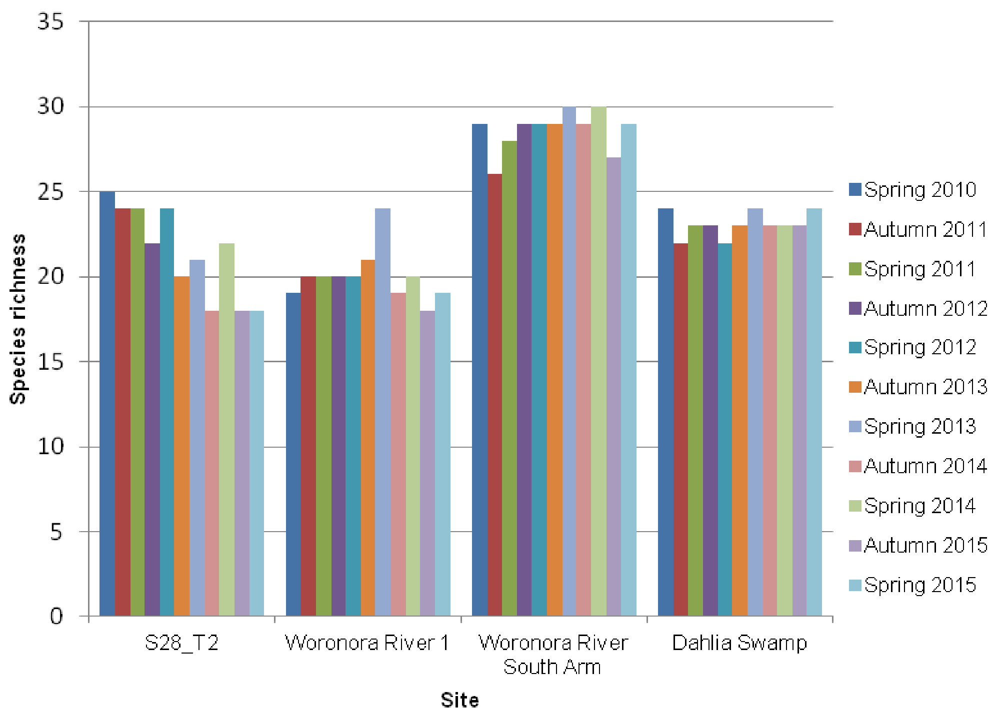

Chart 72 Species Richness within Longwalls 23-27 Upland Swamp Sites Supporting Tea Tree Thicket, Spring 2010 – Spring 2015

3.2 UPLAND SWAMP GROUNDWATER MONITORING

Swamp substrate water levels are assessed against the following upland swamp groundwater performance indicator:

> *Surface cracking within upland swamps resulting from mine subsidence is not expected to result in measurable changes to swamp groundwater levels when compared to control swamps or seasonal variations in water levels experienced by upland swamps prior to mining*.

As described in Section 2.6, the swamp substrate water levels of Swamps 25, 30, 33 and 35 remained perched during the reporting period (consistent with previous monitoring results).

Swamp 20 substrate water levels previously changed from being permanently saturated to being periodically saturated as a result of the passing of Longwall 21 (Chart 38 and Appendix B). As a result the upland swamp groundwater performance indicator continued to be exceeded at Swamp 20 during the reporting period.

A mining effect to the substrate water levels of Swamp 28 was also identified during the reporting period based on the incomplete recovery of substrate water levels following rainfall events (Chart 40 and Appendix B). As a result the upland swamp groundwater performance indicator was exceeded at Swamp 28 during the reporting period.

The exceedance of the performance indicator at Swamp 20 and Swamp 28 have triggered assessments against the performance measure, *Negligible impact on threatened species and populations*. The Swamp 20 assessments by FloraSearch and Cenwest Environmental Services are provided in Appendices G and H, respectively. The Swamp 28 assessments will be reported in the next Six Monthly Report and 2016 Annual Review.

3.3 RIPARIAN VEGETATION MONITORING

Riparian vegetation monitoring is conducted at a number of sites on the Waratah Rivulet and Eastern Tributary, overlying Longwalls 20-27 and downstream of Longwalls 20-27 (Figure 10).

The Spring 2015 Longwalls 20-22 and Longwalls 23-27 Vegetation Monitoring Reports prepared by Eco Logical Australia Pty Ltd are provided in Appendices E and F, respectively.

The results of the Longwalls 20-22 and Longwalls 23-27 riparian vegetation monitoring programs (up to and including the spring 2015 survey) can be summarised as follows:

- Vegetation at riparian monitoring sites was generally observed in good condition, with the exception of sites MRIP02 on Waratah Rivulet and between sites MRIP05 and MRIP09 on the Eastern Tributary. Within the riparian sites (i.e. excluding sites MRIP02, MRIP05 and MRIP09), dieback was limited to isolated and scattered individuals observed with dieback, and flood impacts (e.g. flood-swept and prone vegetation).
- Species richness in spring 2015 was generally similar to previous seasons with values within the range of previous seasons for individual sites, with the exception of longwalll sites MRIP02, MRIP05 and control site MRIP04, where species richness was below the range previously recorded for these sites (Charts 73 and 74). Analysis of this data (ANOVA) identified that throughout the monitoring period control sites had significantly lower species richness compared to the longwall sites including marginal differences in spring 2015.

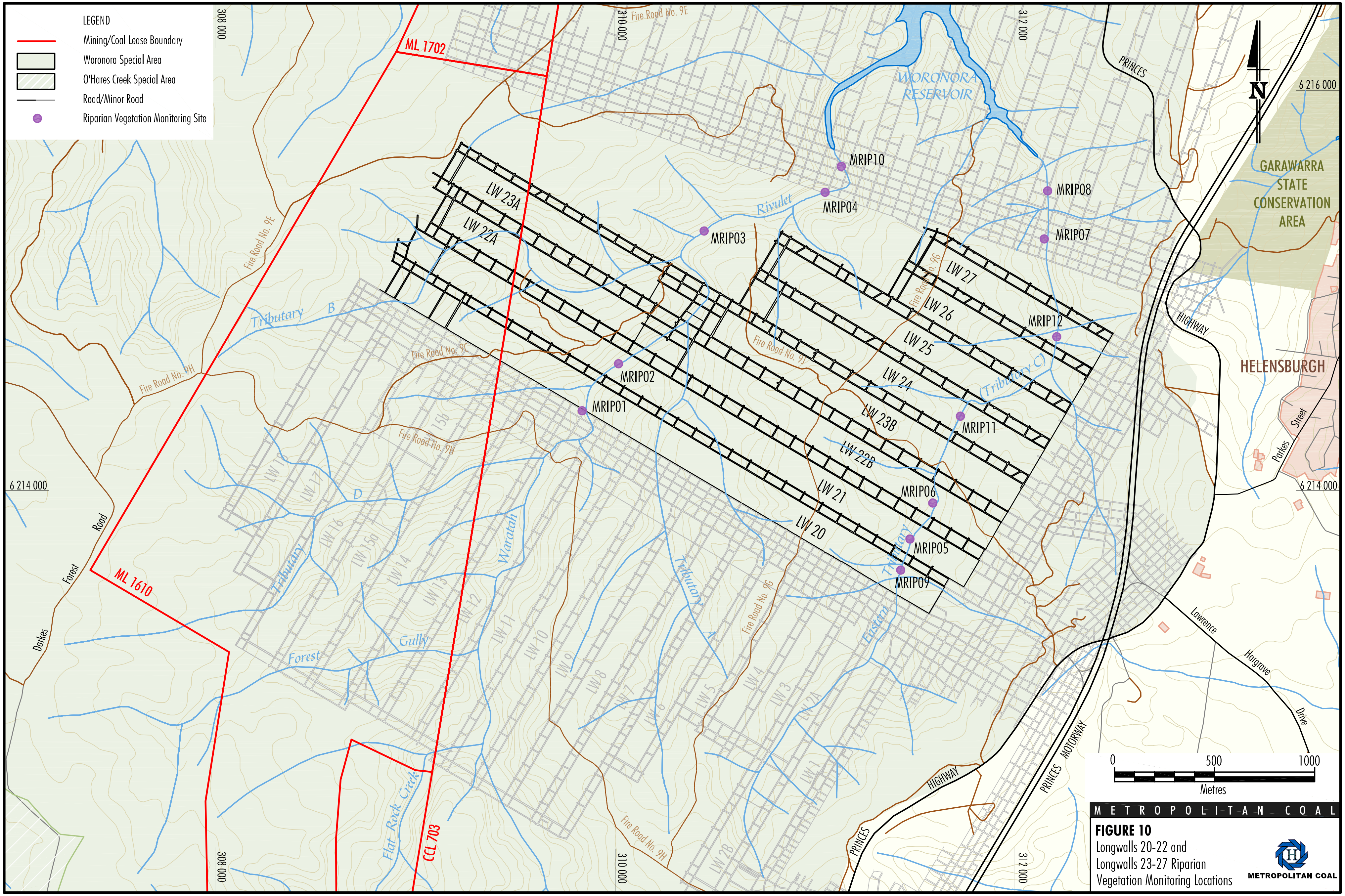

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FIGURE 10
Longwalls 20-22 and Longwalls 23-27 Riparian Vegetation Monitoring Locations

METROPOLITAN COAL

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- Increased ponding at site MRIP02 on the Waratah Rivulet and between sites MRIP05 and MRIP09 on the Eastern Tributary from subsidence has resulted in prolonged inundation of streamside vegetation causing vegetation dieback. Vegetation dieback was first observed at site MRIP02 in spring 2012 and between sites MRIP09 and MRIP05 in autumn 2014.
- The riparian vegetation performance indicator, *Impacts to riparian vegetation are expected to be localised and limited in extent, similar to the impacts previously experienced at Metropolitan Coal*, continued to be exceeded at site MRIP02 on Waratah Rivulet and between sites MRIP09 and MRIP05 on the Eastern Tributary, with vegetation dieback observed greater than 50 cm from the Waratah Rivulet/Eastern Tributary. The extent and level of dieback in spring 2015 is consistent with that observed in previous surveys, with at least some of the dieback being the result of flooding during the autumn 2015 monitoring period.
- Continued exceedance of the performance indicator triggered an assessment against the performance measure, *Negligible impact on threatened species and populations*. Assessments conducted by Dr. Colin Bower (FloraSearch, 2015, 2016) and Dr. David Goldney (Cenwest Environmental Services, 2015, 2016) for threatened flora or threatened fauna, respectively, concluded that the impact performance measure had not been exceeded. The October 2015 threatened flora and fauna assessments were provided in the Metropolitan Coal 2015 Annual Review. The September 2016 threatened flora and fauna assessments are provided in Appendices G and H, respectively.

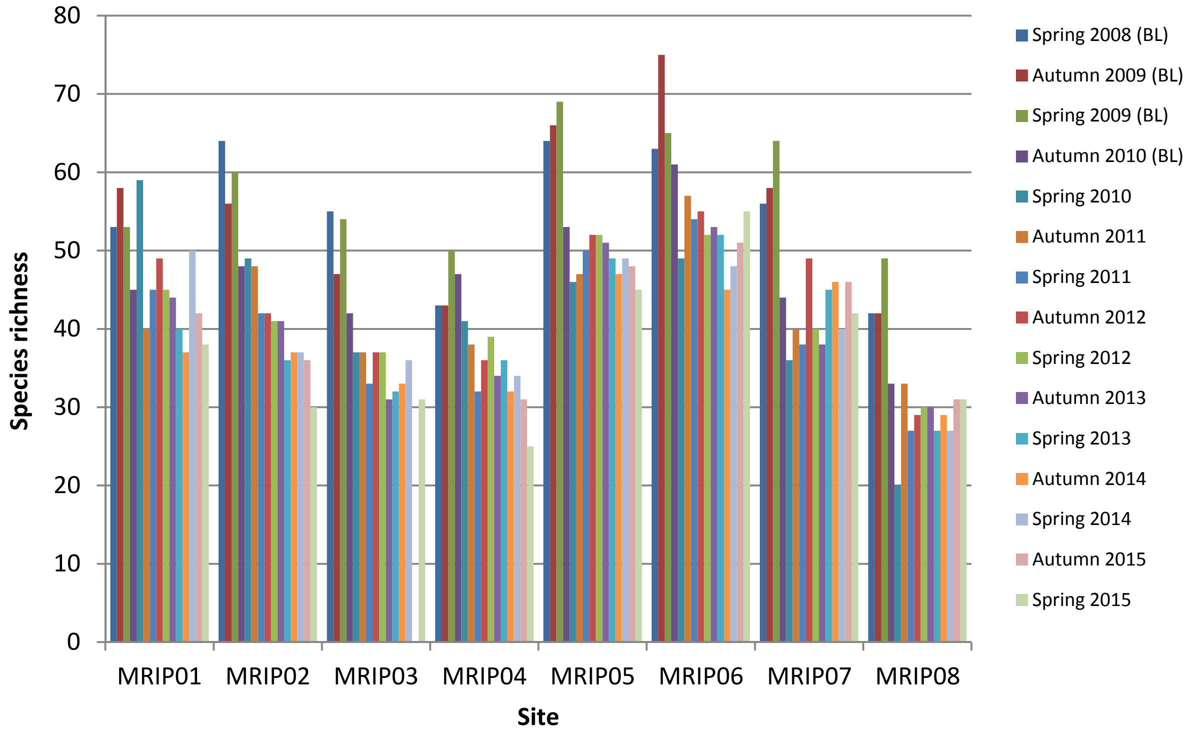

Chart 73 Species Richness Within Riparian Monitoring Sites Across All Seasons - Longwalls 20-22 Monitoring Program

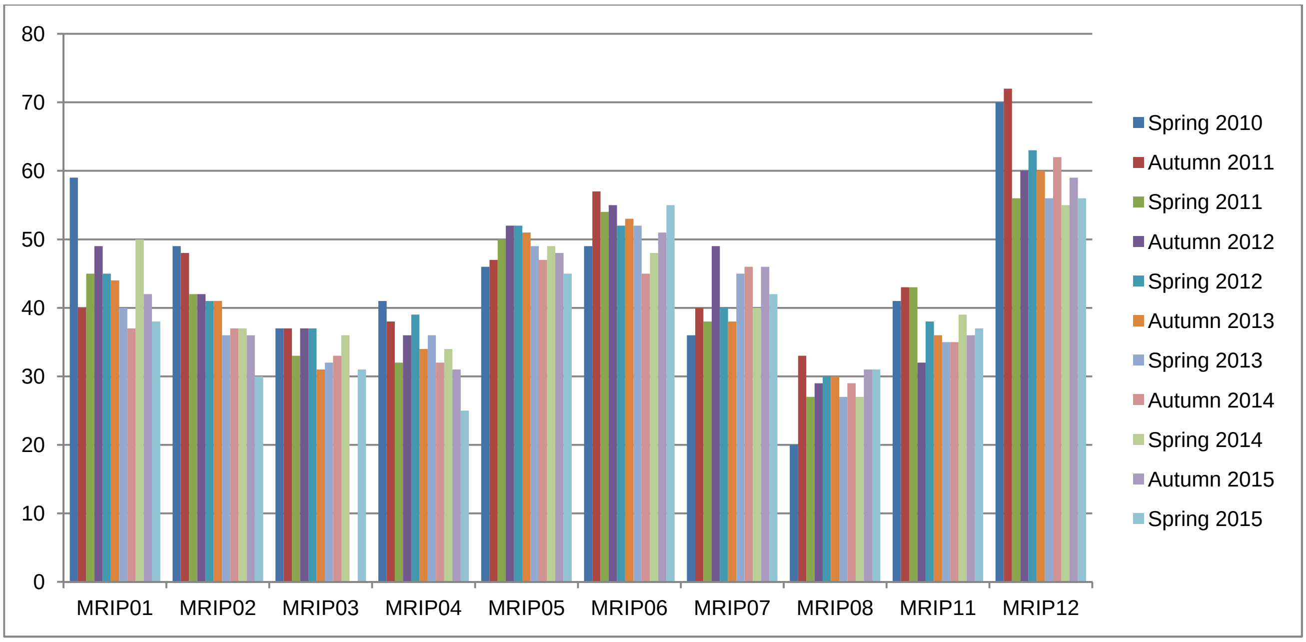

Chart 74 Species Richness Within Riparian Monitoring Sites Across All Seasons-Longwalls 23-27 Monitoring Program

3.4 AQUATIC BIOTA AND THEIR HABITATS

The aquatic ecology monitoring programs for Longwalls 20-22 and Longwalls 23-27 have been designed to monitor subsidence-induced impacts on aquatic ecology (referred to as stream monitoring) and the response of aquatic ecosystems to the implementation of potential future stream remediation works (referred to as pool monitoring). The locations of the monitoring sites are shown on Figure 11.

The Spring 2015 Longwalls 20-22 and Longwalls 23-27 Aquatic Ecology Monitoring Reports prepared by Bio-Analysis Pty Ltd are provided in Appendices I and J, respectively.

Multivariate and univariate statistical procedures (Permutational Multivariate Analyses of Variance [PERMANOVA] and Plymouth Routines in Multivariate Ecological research [PRIMER] software packages) were used to examine temporal and spatial patterns in macroinvertebrates and macrophytes sampled within the study area. Specifically, PERMANOVA's were used to test hypotheses related to differential changes e.g. (before-vs-after commencement of mining) in multivariate and univariate (e.g. total number of taxa, total abundance and abundances of the most important taxonomic groups identified from the samples) estimates occurring in streams or pools subject to mining (i.e. potential 'impact' streams) in comparison to independent streams or pools that are not subject to mine subsidence (i.e. control places).

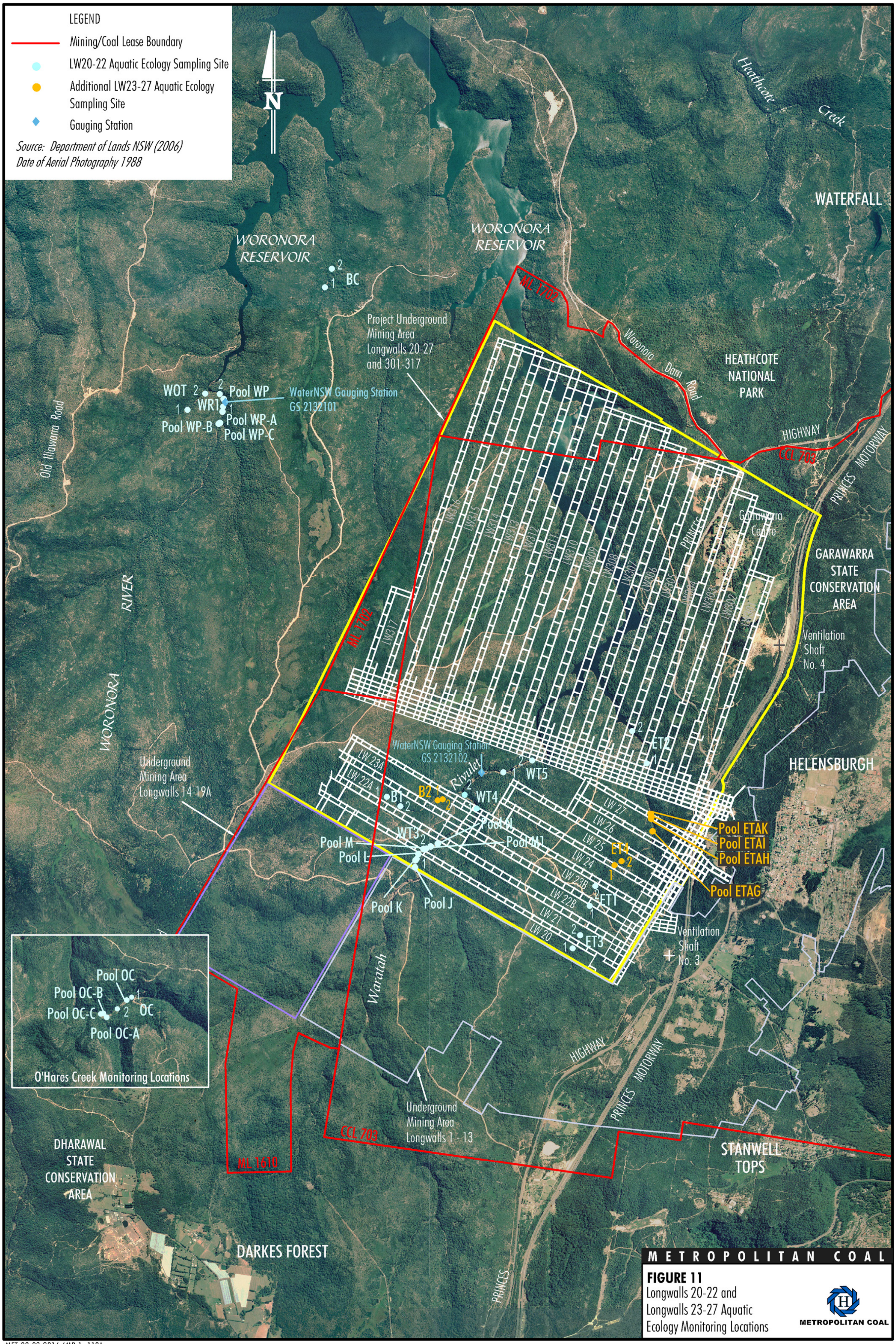

FIGURE 11
Longwalls 20-22 and Longwalls 23-27 Aquatic Ecology Monitoring Locations

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Stream Monitoring Program

Eastern Tributary

In spring 2015, cracking of the stream substratum, draining of pools, loss of surface flow and iron flocs were observed at Locations C1, C3 and C4. There was no evidence of subsidence impacts (i.e. cracking of the stream substratum or iron staining/iron floc) at Location C2.

Multivariate analyses of the monitoring data before-vs-after commencement of mining indicates that any effect of longwall mining on assemblages of aquatic macroinvertebrates and macrophytes at Locations C1, C2, C3 and C4 are within the range of natural variability in these assemblages as measured by the control locations. However, the spring 2015 results indicate significantly fewer Atyidae were collected at Locations C1 and C2 from before-to-after commencement of mining of Longwall 20, whereas no equivalent change was measured at the control locations. Univariate analyses also indicate a significant increase in mean numbers of Leptophlebiidae at Location C1 in relation to the control locations when comparing the before-to-after mining periods for Longwalls 23-27.

Waratah Rivulet

To date, analyses comparing temporal changes in components of assemblages of macroinvertebrates at locations sampled along the Waratah Rivulet (Locations WT3, WT4 and WT5) with control locations have not detected significant changes from before-to-after commencement of mining of the Longwalls 20-22 underground mining area.

A significant increase in mean cover of macrophytes was measured at Location WT4 compared to control locations from before-to-after mining in autumn 2015, but not spring 2015.

Tributary B

A considerable drop in water level was noted in a large pool at Location B1 in spring 2012. By autumn 2013, the pool had almost completely emptied and there was no surface flow along the study reach due to subsidence associated with mining of the Longwalls 20-22 underground mining area. Quantitative sampling of aquatic macroinvertebrates was not carried out at Location B1 on Tributary B in spring 2015, autumn 2015, spring 2014 or spring 2013 due to insufficient habitat available for sampling.

Multivariate analyses found macroinvertebrate assemblages at Location B1 differed significantly from before-to-after spring 2012, in relation to the control locations. A significant decrease in mean diversity and numbers of Atyidae occurred at Location B1 from before-to-after spring 2012 but not at the control locations. There was a significant decline in mean total cover of macrophytes at Location B1 from before-to-after spring 2012, but not at the control locations. Considerable dieback of macrophytes, particularly the fern, *Gleichenia dicarpa*, has occurred at Location B1 since spring 2012.

Multivariate analyses indicate a significant difference in the structure of assemblages of aquatic macroinvertebrates at Location B2 from before-to-after mining of Longwalls 23-27 in spring 2014, autumn 2015 and spring 2015. Univariate analyses detected significantly fewer Leptophlebiidae at Location B2 before-vs-after mining in relation to the control locations in spring 2014, autumn 2015 and spring 2015. Analyses examining changes in aquatic macrophytes found no evidence of impacts at Location B2 that could be related to mining activities within the Longwalls 23-27 underground mining area.

Pool Monitoring Program

Pools on Waratah Rivulet

To date, multivariate analyses comparing temporal and spatial patterns of change in assemblages of aquatic macroinvertebrates and macrophytes in large pools (J, M1 and N) and small pools (K, L and M) sampled on the Waratah Rivulet with the control pools have not detected significant differences in the structure of assemblages of macroinvertebrates or their main components (i.e. Leptophlebiidae and Atyidae) when comparing the before-to-after mining periods.

Univariate analyses, however, indicate there has been a significant increase in mean diversity of macroinvertebrates in two of the large pools sampled (Pools J and M1) and the small pools (K, L and M) in relation to the control pools since the commencement of Longwalls 20-22.

Additional analyses examining patterns of change in Pool N before-to-after spring 2012 (following the decline in pool water level observed in spring 2012) detected a significant decrease in mean diversity and cover of macrophytes in Pool N from before-to-after spring 2012 in relation to the control pools in autumn 2015 and spring 2015.

Any effect of subsidence on aquatic macrophytes in Pools J, M1, K, L and M on the Waratah Rivulet appears to be within the range of natural variability as measured by the control locations.

Pools on Eastern Tributary

Analyses indicated significant differences in the structure of aquatic macroinvertebrate assemblages in Pool ETAH before-to-after mining compared to control locations in autumn 2015 but not spring 2015. However, univariate analyses for Pool ETAH have consistently found no significant differences in the key macroinvertebrate indicators that could be associated with mining of the Longwalls 23-27 area. There have been no detectable impacts to macrophytes at Pool ETAH, in relation to the control locations, that could be associated with mining.

Analyses examining changes in aquatic macroinvertebrates and macrophytes in small (Pool's ETAG, ETAI and ETAK) pools on the Eastern Tributary found no evidence of impacts that could be related to mining activities within the Longwalls 23-27 underground mining area.

3.5 AMPHIBIAN SURVEYS

Monitoring programs have been developed for Longwalls 20-22 and Longwalls 23-27 to monitor amphibian species, with a focus on the habitats of the Giant Burrowing Frog (*Heleiporus australiiacus*) and Red-crowned Toadlet (*Pseudophryne australis*) associated with tributaries. The locations of the monitoring sites are shown on Figure 12.

The Spring-Summer 2015 Longwalls 20-22 and Longwalls 23-27 Amphibian Monitoring Reports prepared by Cenwest Environmental Services are provided in Appendices K and L, respectively.

A Poisson regression analysis has been used to analyse the amphibian survey results obtained to date (i.e. to spring/summer 2015). No adverse impact from mining has been detected for any frog species including the Giant Burrowing Frog and Red-crowned Toadlet, at the 95% confidence level.

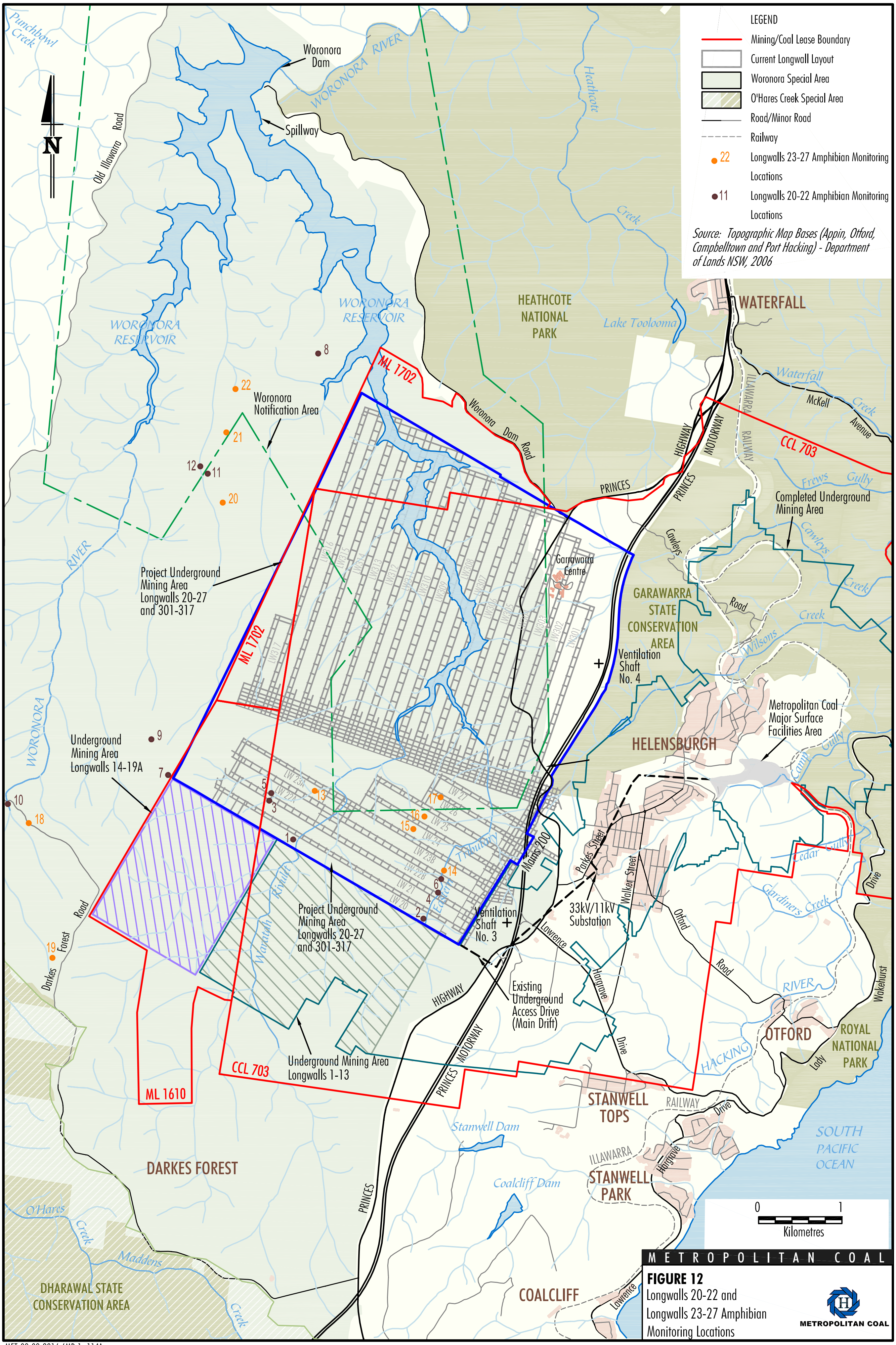

FIGURE 12
Longwalls 20-22 and Longwalls 23-27 Amphibian Monitoring Locations

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4 LAND MANAGEMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Land Management Plans were prepared to manage the potential environmental consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on cliffs, overhangs, steep slopes and land in general, in accordance with Condition 6, Schedule 3 of the Project Approval.

4.1 STEEP SLOPES AND LAND IN GENERAL

Opportunistic visual inspections for subsidence impacts on steep slopes and land in general are conducted by Metropolitan Coal and its contractors as part of routine works conducted in the catchment. No additional surface tension cracks to those reported previously were observed during the reporting period.

4.2 CLIFFS AND OVERHANGS

Visual inspections are conducted monthly for the period of time Longwalls 23-27 extraction is within 400 m of sites COH2, COH3, COH4, COH5, COH6, COH6a, COH7, COH8, COH9, COH10, COH14, COH15 and COH16 (Figure 13) and following the completion of each longwall to record evidence of subsidence impacts. Mining of Longwalls 25 and 26 was not within 400 m of any identified cliffs or overhangs during the reporting period.

Previously, a small rock fall was recorded in December 2013 at site COH2 (Figure 13). No additional rock falls at the cliff or overhang sites were recorded during the reporting period.

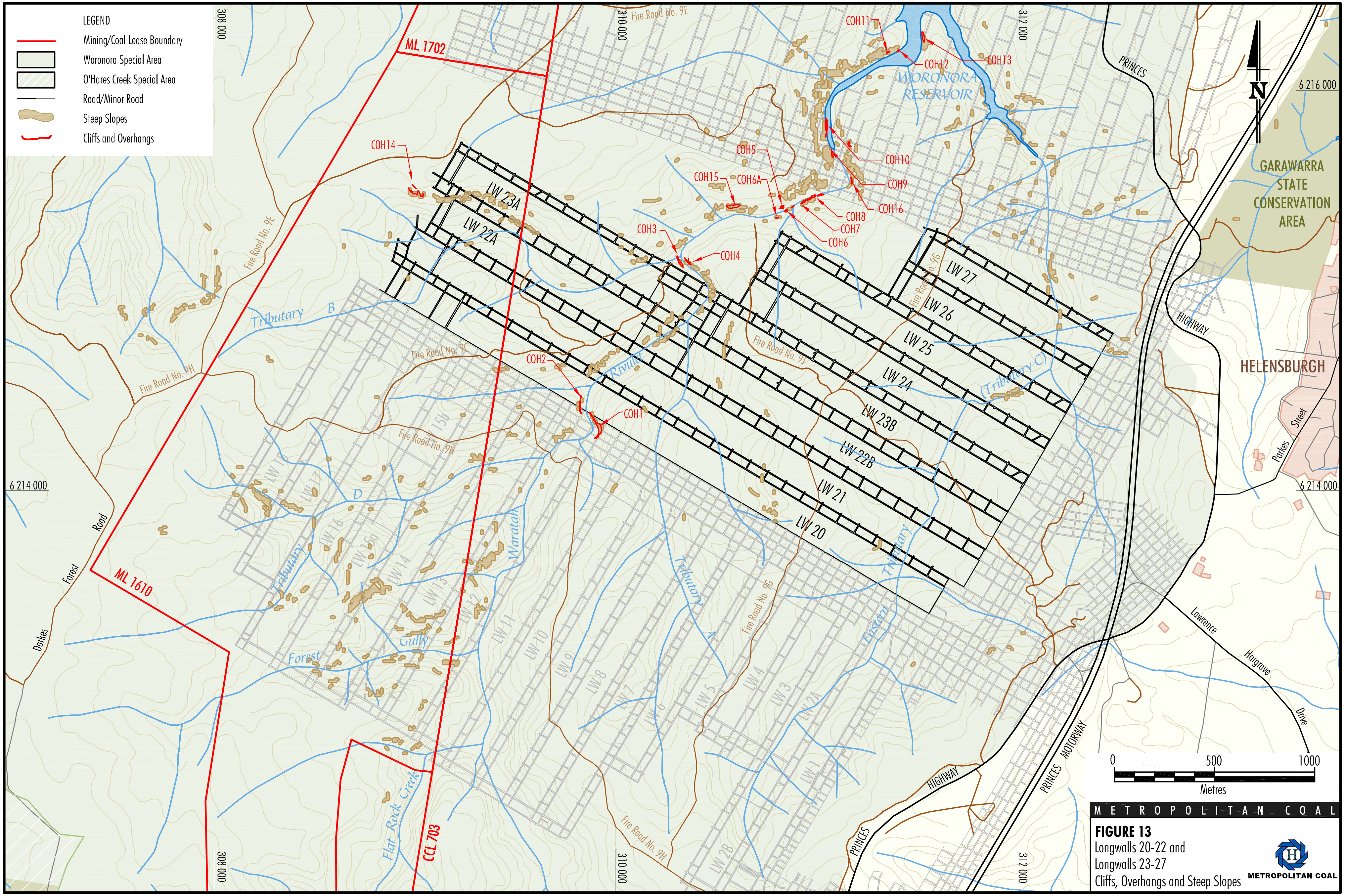
5 HERITAGE MANAGEMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Heritage Management Plans were prepared to manage the potential environmental consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on Aboriginal heritage sites or values in accordance with Condition 6, Schedule 3 of the Project Approval.

A monitoring program has been implemented to monitor the impacts and consequences of mine related subsidence on Aboriginal heritage sites located within the 35^{o} angle of draw of Longwalls 20-22 and Longwalls 23-27 (Figure 14). The Aboriginal heritage sites monitoring program is carried out by an archaeologist (with experience in rock art recording and management) and Aboriginal stakeholder representatives.

Six heritage sites (FRC 15, FRC 176, FRC 281, FRC 283, FRC 284 and MET 1) were determined by the Longwalls 20-22 Rounds 1, 2 and 3 and Longwalls 23-27 Round 1 Aboriginal heritage surveys to have changes due to mining induced subsidence from Longwalls 20-22 and Longwalls 23-27 (as reported in the Metropolitan Coal 2015 Annual Review).

The second round of monitoring for Longwalls 23-27 (Round 2) was conducted in February and March 2016 following the completion of Longwall 24, by Niche Environment and Heritage Pty Ltd (2016). The Round 2 monitoring report is provided in Appendix M. No new changes due to mining induced subsidence were observed by the Round 2 survey.



METROPOLITAN COAL

FIGURE 13
Longwalls 20-22 and
Longwalls 23-27
Cliffs, Overhangs and Steep Slopes

MET-08-08-2016 6MR-1_115A

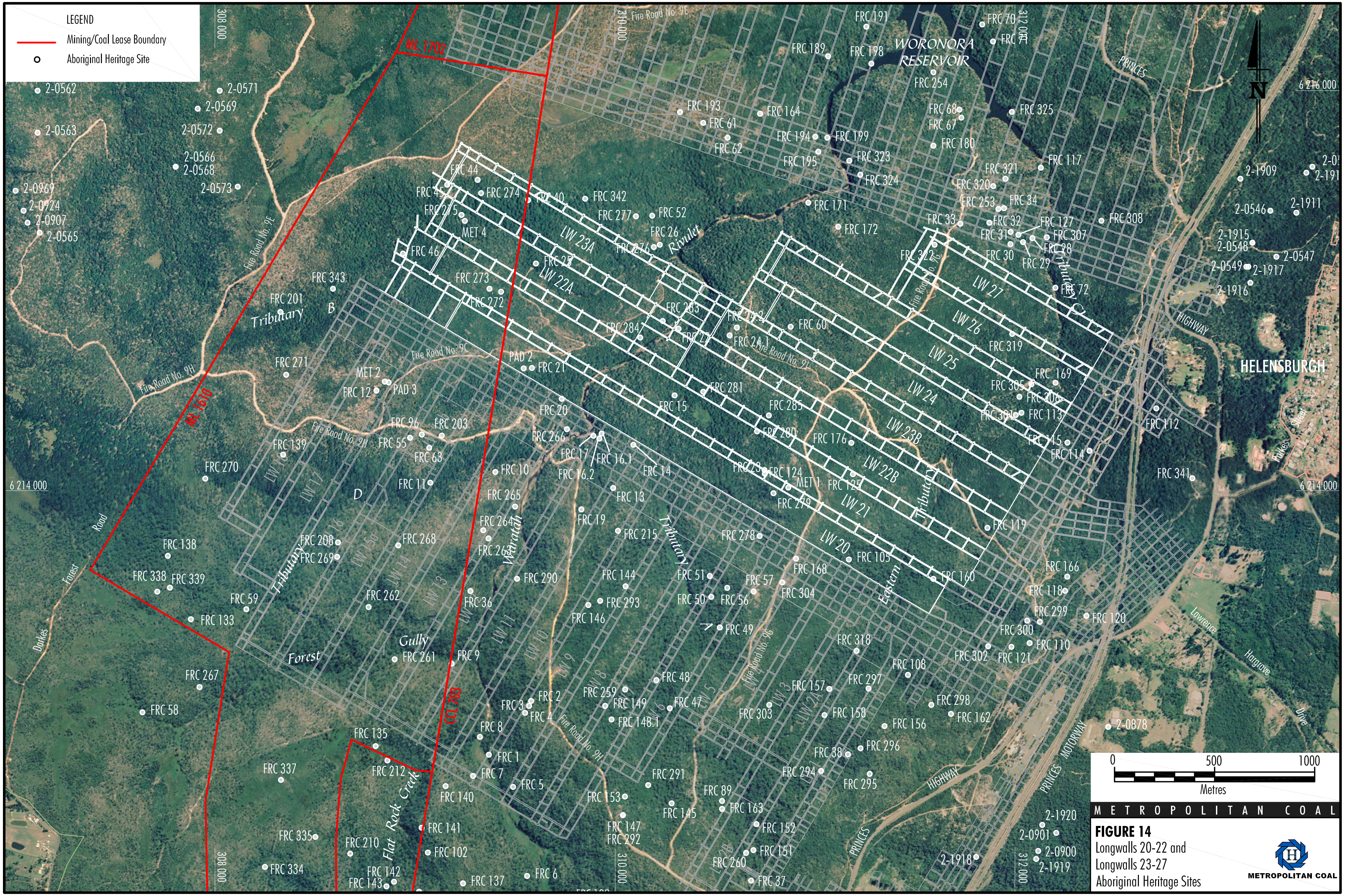


FIGURE 14
Longwalls 20-22 and Longwalls 23-27
Aboriginal Heritage Sites

MET-08-08-2016 6MR-1_117A

In accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Heritage Management Plans, Aboriginal heritage site monitoring results are used to assess the Project against the Aboriginal heritage subsidence impact performance measure:

> *Less than 10% of Aboriginal heritage sites within the mining area are affected by subsidence impacts.*

For the purpose of measuring performance against the Aboriginal heritage subsidence impact performance measure, sites are considered to be "affected by subsidence impacts" if they exhibit one or more of the following consequences that cannot be attributed to natural weathering or deterioration:

- overhang collapse;
- cracking of sandstone that coincides with Aboriginal art or grinding grooves; and
- rock fall that damages Aboriginal art.

The mining area is defined by the Project Approval and is shown on Figure 1 of this report (labelled Project Underground Mining Area Longwalls 20-27 and 301-317). Of the sites at which changes due to mining induced subsidence have occurred, site FRC 281 has been affected by subsidence impacts as a result of cracking of sandstone that coincides with Aboriginal art. This means that less than 1% of sites within the mining area have been affected, which is within the approved performance measure.

6 BUILT FEATURES MANAGEMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Built Features Management Plans were developed to manage the potential environmental consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on built features in accordance with Condition 6, Schedule 3 of the Project Approval.

As indicated in the Metropolitan Coal 2015 Annual Review, the Metropolitan Coal Longwalls 20-22 Built Features Management Plan has effectively been discontinued as the appropriate monitoring for built features has been incorporated into the Metropolitan Coal Longwalls 23-27 Built Features Management Plan.

A monitoring program has been implemented to monitor subsidence impacts on infrastructure owned by Endeavour Energy, Nextgen, TransGrid, Optus, Telstra, Roads and Maritime Services, RailCorp, Sydney Water and Wollongong City Council. Analysis of measured subsidence was conducted at the end of Longwall 25 by Mine Subsidence Engineering Consultants (MSEC). MSEC concluded that subsidence measurements for built features were similar to or less than those predicted. No subsidence impact to any built feature was evident over the reporting period.

The Project Approval requires Metropolitan Coal not to exceed the following built features subsidence impact performance measure:

> *Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing.*

The built features subsidence impact performance measure was not exceeded during the reporting period.

The Project Approval also requires Metropolitan Coal not to exceed the heritage subsidence impact performance measure for items of heritage or historical significance at the Garrawarra Centre. The Garrawarra Complex is located more than 2.5 km from Longwalls 23-27 and at this distance no measurable systematic or non-systematic subsidence movements were indicated.

7 PUBLIC SAFETY MANAGEMENT

The Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Public Safety Management Plans were prepared to manage the potential consequences of the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Extraction Plans on public safety within the underground mining areas in accordance with Condition 6, Schedule 3 of the Project Approval.

Monitoring of cliffs and overhangs, steep slopes and land in general has been conducted for subsidence impacts in accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Land Management Plans, and of infrastructure items in accordance with the Metropolitan Coal Longwalls 20-22 and Longwalls 23-27 Built Features Management Plans. No subsidence impacts were identified during the reporting period that were considered to pose a risk to public safety.

Further, no safety incidents were reported by visitors, personnel or contractors to Metropolitan Coal in the underground mining area during the reporting period.

8 ASSESSMENT OF ENVIRONMENTAL PERFORMANCE

During the reporting period, five performance indicators were exceeded, as summarised in Table 2. No Project-related exceedances of performance measures associated with underground mining of Longwalls 20-22 or Longwalls 23-27 occurred during the reporting period.

Table 2
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan#	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
WATER MANAGEMENT							
Surface Water Flow	*Changes in the quantity of water entering Woronora Reservoir is not significantly different post-mining compared to pre-mining, that is not also occurring in the control catchment(s)*	✓	✓	No	Continue monitoring	*Negligible reduction to the quantity of water resources reaching the Woronora Reservoir*	No
Water Quality Reaching Woronora Reservoir	*Changes in the quality of water entering Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations that are not also occurring at control site WOWQ2*	✓	✓	Yes	Assessment against the performance measure conducted by Hydro Engineering & Consulting. Continue monitoring	*Negligible reduction to the quality of water resources reaching the Woronora Reservoir*	No. Assessment to be subject to peer review.
Connective Cracking	*Visual inspection does not identify abnormal water flow from the goaf, geological structure, or the strata generally*	✓	✓	No	Continue monitoring	*No connective cracking between the surface and the mine*	No
	The 20-day average mine water make does not exceed 2 ML/day	✓	✓	No	Continue monitoring		No
	Significant departures from the predicted envelope of vertical potentiometric head profiles at Bores 9GGW2B and 9FGW1A do not occur	✓	×	No	Continue monitoring		No
	Significant departure from the predicted envelope of the vertical potentiometric head profile at Bore 9GGW2B does not occur	×	✓	No	Continue monitoring		No
	The water tables measured at Bores 9FGW1A and 9GGW1-80 are higher than the water levels of streams crossed by a transect along Longwall 22 (i.e. a hydraulic gradient exists from each bore to the nearest watercourse)	✓	✓	No	Continue monitoring		No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan[#]	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
WATER MANAGEMENT (Continued)							
Leakage from the Woronora Reservoir	*The groundwater head of Bores 9GGW2B and PM02 is higher than the water level of Woronora Reservoir (i.e. a hydraulic gradient exists from the bores to the Woronora Reservoir)*	✓	✓	No	Continue monitoring	*Negligible leakage from the Woronora Reservoir*	No
Water Quality of Woronora Reservoir	*Changes in the quality of water in the Woronora Reservoir are not significantly different post-mining compared to pre-mining concentrations*	✓	✓	No	Continue monitoring	*Negligible reduction in the water quality of Woronora Reservoir*	No
Waratah Rivulet Environmental Consequences	*No change to the natural drainage behaviour of Pool P. Specific indicators include: no new cracking in the stream bed of Pool P or rock bar; continual flow through/below the rock bar of Pool P such that water is ponded upstream; and continual surface water flow along the length of Pool P*	✓	×	No	Continue monitoring	*Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases) on the Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)*	No
	No change to the natural drainage behaviour of Pools P, Q, R, S, T, U, V and W. Specific indicators include: no new cracking in the stream bed of pools or rock bars (where relevant); continual flow over/ through/below the rock bars/terminal boulder fields of pools such that water is ponded upstream; and continual surface water flow along the length of the pools	×	✓	No	Continue monitoring		No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan[#]	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
WATER MANAGEMENT (Continued)							
Waratah Rivulet Environmental Consequences (Continued)	*Analysis of water depth data for Pool P (when mining is within 400 m of Pool P) indicates the water depth is at or above the pool's previous minimum (i.e. when mining is beyond 400 m of Pool P)*	✓	×	Yes (the water level in Pool P fell below historically recorded water levels during the reporting period)	Analysis of recession rates and the shape of the water level hydrograph indicate pool water levels were consistent with natural behaviour. There has been a change in the datum levels associated with a change in water level logger housing. Continue monitoring	*Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases) on the Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)*	No
	Analysis of water depth data for Pools P, T and V (when mining is within 400 m of the pools) indicates the water depth is at or above the pool's previous minimum (i.e. when mining is beyond 400 m of the pools)	×	✓	Yes (Pool P, as above)	As above		No
	Analysis of water depth data for Pools Q, R and S on Waratah Rivulet indicates the water depths are above that required to maintain water over the downstream rock bar	✓	✓	No	Continue monitoring		No
	Visual inspection of the Waratah Rivulet between the full supply level of the Woronora Reservoir and Pool P does not show significant changes in the extent or nature of iron staining that isn't also occurring in the Woronora River (control site)	×	✓	No	Continue monitoring		No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan#	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
WATER MANAGEMENT (Continued)							
Waratah Rivulet Environmental Consequences (Continued)	*Visual observations of gas releases in Pool P on the Waratah Rivulet indicate the gas releases have increased beyond those observed up to 17 April 2014*	✓	✓	No	Continue monitoring	*Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases) on the Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P)*	No
	No gas releases observed at Pools Q to W on the Waratah Rivulet	×	✓	Yes	Assessment against the performance measure conducted by Associate Professor Barry Noller Continue monitoring		No Assessment to be subject to peer review
Eastern Tributary Environmental Consequences	*No change to the natural drainage behaviour of at least 70% of Pools ETAF to ETAU. Specific indicators include: no new cracking in the stream bed of pools or rock bars (where relevant); continual flow over/through/below the rock bar of pools/terminal boulder fields such that water is ponded upstream; and continual surface water flow along the length of pools*	×	✓	No	Continue monitoring	*Negligible environmental consequences over at least 70% of the stream length (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases) on the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26*	No
	Analysis of water depth data for Pool ETAI on the Eastern Tributary (when mining is within 400 m of the pool) indicates the water depth is at or above the pool's previous minimum (i.e. when mining is beyond 400 m of the pool)	×	✓	No	Continue monitoring		No
	No significant change to the extent or nature of iron staining over more than 30% of the Eastern Tributary between maingate 26 and full supply level	×	✓	No	Continue monitoring		No
	Gas releases observed over less than 30% of the Eastern Tributary between maingate 26 and full supply level.	×	✓	No	Continue monitoring		No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan[#]	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
BIODIVERSITY MANAGEMENT							
Upland Swamps Vegetation Monitoring	*The vegetation in upland swamps is not expected to experience changes significantly different to vegetation in control swamps*	✓	✓	No	Continue monitoring	*Negligible impact on threatened species and populations*	No
Upland Swamps Groundwater Monitoring	*Surface cracking within upland swamps resulting from mine subsidence is not expected to result in measurable changes to swamp groundwater levels when compared to control swamps or seasonal variations in water levels experienced by upland swamps prior to mining*	✓	✓	Yes – performance indicator exceeded for Swamp 20 (Longwalls 20-22 upland swamps)	Assessment against the performance measure conducted by FloraSearch (threatened flora) and Cenwest Environmental Services (threatened fauna) Continue monitoring		No
				Yes – performance indicator exceeded for Swamp 28 (Longwalls 23-27 upland swamps)	Assessments to be conducted against the performance measure		Assessments to be conducted
Riparian Vegetation	*Impacts to riparian vegetation are expected to be localised and limited in extent, similar to the impacts previously experienced at Metropolitan Coal*[1]	✓	✓	Yes – performance indicator exceeded at site MRIP02 on the Waratah Rivulet and between sites MRIP09 and MRIP05 on the Eastern Tributary	Assessment against the performance measure conducted by FloraSearch (threatened flora) and Cenwest Environmental Services (threatened fauna) Continue monitoring		No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan[#]	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
BIODIVERSITY MANAGEMENT (Continued)							
Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC	*Subsidence effects at the occurrences of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC situated approximately 400 m to the east of Longwalls 20-22 are expected to be negligible*	✓	✗	No	Continue monitoring		No
	Subsidence effects at the occurrences of the Southern Sydney Sheltered Forest on Transitional Sandstone Soils in the Sydney Basin Bioregion EEC situated approximately 300 to 500 m to the east of Longwalls 23-27 are expected to be negligible	✗	✓	No	Continue monitoring		No
Aquatic Biota	*The aquatic macroinvertebrate and macrophyte assemblages in streams and pools are not expected to experience long-term impacts as a result of mine subsidence*	✓	✓	No[2]	Continue monitoring		No
Amphibian Monitoring	*The amphibian assemblage is not expected to experience changes significantly different to the amphibian assemblage at control sites*	✓	✓	No	Continue monitoring		No
LAND MANAGEMENT							
Steep Slopes and Land in General	*Steep slopes and land in general are expected to experience surface tension cracking no greater than 0.1 m wide and 25 m in length*	✓	✓	No	Continue monitoring	-	-
Cliffs and Overhangs	-	✓	✓	-	-	*Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining-induced rock fall*	No

Table 2 (Continued)
Assessment of Environmental Performance – Underground Mining Area and Surrounds

Monitoring Components	Subsidence Impact Performance Indicator(s)	Longwalls 20-22 Extraction Plan*	Longwalls 23-27 Extraction Plan#	Subsidence Impact Performance Indicator Exceeded?	Resulting Actions	Subsidence Impact Performance Measure	Subsidence Impact Performance Measure Exceeded?
HERITAGE MANAGEMENT							
Aboriginal Heritage Sites	-	✓	✓	-	-	*Less than 10% of Aboriginal heritage sites within the mining area are affected by subsidence impacts*	No
BUILT FEATURES MANAGEMENT							
Built Features	-	✓	✓	-	-	*Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing*	No
	-	✓	✓	-	-	*Negligible damage (fine or hairline cracks that do not require repair), unless the owner of the item and the appropriate heritage authority agree otherwise in writing*	No
PUBLIC SAFETY MANAGEMENT							
Public Safety	*Public safety will be ensured in the event that any hazard to the general public arising from subsidence effects becomes evident*	✓	✓	No	Continue monitoring	*Safe, serviceable and repairable, unless the owner and the MSB agree otherwise in writing*	No

* Performance indicator applicable to Longwalls 20-22 (✓) Yes; (×) No.

Performance indicator applicable to Longwalls 23-27 (✓) Yes; (×) No.

[1] This indicator is exceeded if visual inspections identify vegetation dieback greater than 50 cm from the stream.

[2] This performance indicator will be assessed after the completion of Longwall 26 (for Longwalls 20-22) and after the completion of Longwall 303 (for Longwalls 23-27), and after one year of the completion of stream remediation (for relevant pools).

APPENDIX A

METROPOLITAN COAL SURFACE WATER REVIEW

1 JANUARY TO 30 JUNE 2016

AVAILABLE ON CD

APPENDIX B

METROPOLITAN COAL SIX MONTHLY REVIEW - JUNE 2016

GROUNDWATER MONITORING AND ENVIRONMENTAL PERFORMANCE ASSESSMENT

AVAILABLE ON CD

APPENDIX C

EASTERN TRIBUTARY PERFORMANCE INDICATOR

IRON STAINING REGISTER - JUNE 2016

AVAILABLE ON CD

APPENDIX D

POOL W GAS RELEASE ASSESSMENT AGAINST SUBSIDENCE IMPACT PERFORMANCE MEASURE

AVAILABLE ON CD

APPENDIX E

METROPOLITAN COAL LONGWALLS 20-22

VEGETATION MONITORING REPORT – SPRING 2015

AVAILABLE ON CD

APPENDIX F

METROPOLITAN COAL LONGWALLS 23-27

VEGETATION MONITORING REPORT – SPRING 2015

AVAILABLE ON CD

APPENDIX G

METROPOLITAN COAL SWAMP 20 AND RIPARIAN VEGETATION THREATENED FLORA ASSESSMENTS, SEPTEMBER 2016

AVAILABLE ON CD

APPENDIX H

METROPOLITAN COAL SWAMP 20 AND RIPARIAN VEGETATION THREATENED FAUNA ASSESSMENTS, SEPTEMBER 2016

AVAILABLE ON CD

APPENDIX I

METROPOLITAN COAL LONGWALLS 20-22

AQUATIC ECOLOGY MONITORING REPORT – SPRING 2015

AVAILABLE ON CD

APPENDIX J

METROPOLITAN COAL LONGWALLS 23-27

AQUATIC ECOLOGY MONITORING REPORT – SPRING 2015

AVAILABLE ON CD

APPENDIX K

METROPOLITAN COAL LONGWALLS 20-22

AMPHIBIAN MONITORING REPORT – SPRING/SUMMER 2015

AVAILABLE ON CD

APPENDIX L

METROPOLITAN COAL LONGWALLS 23-27

AMPHIBIAN MONITORING REPORT – SPRING/SUMMER 2015

AVAILABLE ON CD

APPENDIX M

LONGWALLS 23-27 ROUND 2 MONITORING OF ABORIGINAL HERITAGE SITES

AVAILABLE ON CD