



GUJARAT NRE MINERALS LIMITED

ENVIRONMENT, SUBSIDENCE AND SAFETY MANAGEMENT PLAN (ESSMP)

NRE Wongawilli Colliery

LW's 11, 12, 15, 16, 19 & PE1

July 2009

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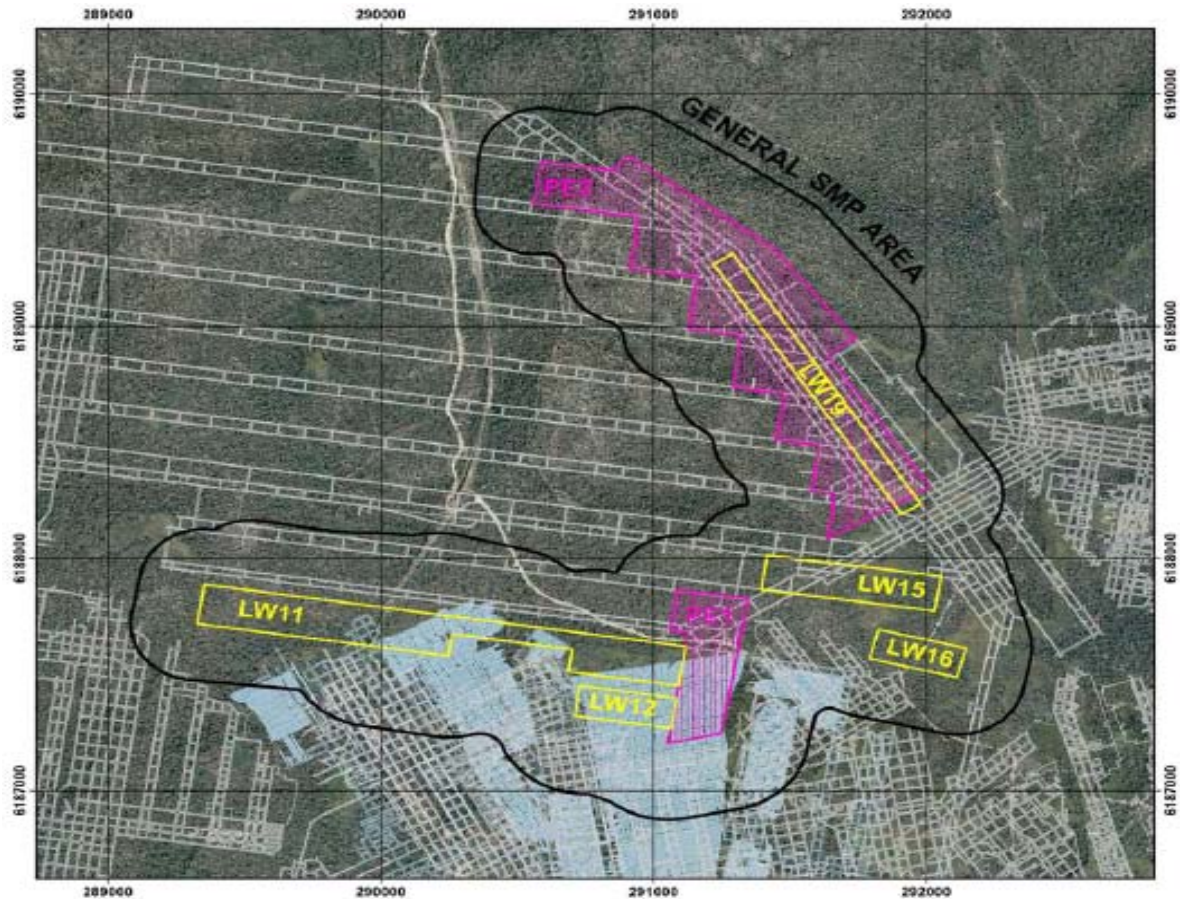
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1. INTRODUCTION

Gujarat NRE Minerals Limited will be undertaking underground coal mining operations using workings formally utilised by Elouera Mine to extract coal from the Wongawilli Seam using longwall mining and pillar extraction techniques. The mining areas are located adjacent to previous Elouera workings and within the Cordeaux and Avon Catchments of the Sydney Catchment Authority (SCA) Special Areas (**Figure 1.0**).

Figure 1.0 Proposed mining areas within the application area.



The application area includes Longwall's 11, 12, 15, 16, 19 and Pillar Extraction area 1, which are located adjacent to previously mined areas using longwall techniques. A Subsidence Management Plan (SMP) has been submitted and approved with key stakeholder consultation.

The approved application considers:

- the area on the surface enclosed by the 35° angle of draw from the limit of proposed mining; and
- other specific surface and sub-surface features outside this area that may be affected by mining induced ground movements and far field effects.

Natural and manmade features and infrastructure have been identified within the vicinity of mining, including natural vegetation and small watercourses, swamps, threatened species, cliffs, steep slopes, rock cuttings, Fire Roads, 4WD tracks and electrical services.

This report outlines the environmental, safety and subsidence monitoring and management proposed for the application area in accordance with the conditions of the approved SMP and needs to be considered in conjunction with the written report.

The specific details on the expected nature and magnitude of mining related impacts upon surface features identified within the application area is covered in section 10 (pgs 21-49) of the written report. Mining activities will be undertaken in accordance with the SMP to

achieve the outcomes as specified in condition 13 of the approved SMP conditions (i.e. negligible impact on surface features).

These management and monitoring plans have been developed and based upon advice provided by I&I NSW, DECCW, SCA and OoW, on the SMP application. Further and ongoing consultation with Government agencies together with monitoring results will allow for these plans to be amended as required.

Table 1.0 outlines the compliance of the conditions referred to in the approved SMP.

The monitoring program outlined in this report is designed to:

- provide data which allows validation of mining related impacts and impact predictions, particularly assessing areas of uncertainty;
- identify any unexpected surface movements or impacts due to mining;
- gain knowledge to support future mining, including refinement of impact predictions;
- ensure response management actions and contingencies plans are implemented, should trigger levels be reached; and
- allow for advances to the science of impact assessment and monitoring as well as changing technology associated with mining.

Planning for the extraction of Longwall's 11, 12, 15, 16, 19 and Pillar extraction area 1 has been conducted in consultation with key stakeholders such as SCA, I&I NSW, DECCW and WCC. NRE Wongawilli will endeavour to maintain regular communicative channels with relevant stakeholders and owners of infrastructure. Other agencies will be consulted as required. The occurrence of any impacts greater than predicted will be communicated to appropriate stakeholders within 24 hours of detection.

Existing community consultation developed by NRE Wongawilli Colliery will continue. Notifications of approvals are sent to relevant stakeholders.

Table 1.0 – Compliance of the conditions referred to in the approved SMP for LW's 11-19 and PE1.

SMP Condition/ Description		ESSMP Reference	Comment
➤ The ESSMP must include the information requested below			
1 – 6	These are general conditions that outline obligations for the leaseholder (Gujarat NRE) to undertake.	N/A	
7	SMP approval notification	Section 1 – Introduction (pg 1-2)	Letters sent to all stakeholders as required on Thursday 23 rd July, 2009 including WCC, LALC, Transgrid, SCA, DSC, MSB, DECCW, OoW and DoP.
8 – 11	These are general conditions that outline obligations for the leaseholder (Gujarat NRE) to undertake.	N/A	
12	The requirement to implement a <u>subsidence monitoring programme</u> and be approved prior to start of mining	<ul style="list-style-type: none"> Section 3 – Subsidence Monitoring (pg 4); and Appendix 1 (pg 12-14) 	Plan submitted to Principal Subsidence Engineer on 29 th July, 2009
13	The requirement to implement an <u>Environmental Management Plan (EMP)</u> to include the following: <ul style="list-style-type: none"> i. Surface Water; ii. Ground Water; iii. Swamps; iv. Threatened species, populations or ecological communities and be approved prior to start of mining	<ul style="list-style-type: none"> Appendix 2 (pg 15-35) <ul style="list-style-type: none"> i. Section 2.2 and 2.5; ii. Section 2.4 and 2.5; iii. Section 2.6; and iv. Section 2.7 Section 4 – Environmental Management (pg 5-7) 	Plan submitted to Director Environment Sustainability on 29 th July, 2009
14	The requirement to implement a <u>Public Safety Management Plan (PSMP)</u> and be approved prior to start of mining	<ul style="list-style-type: none"> Section 5 – Public Safety Management (pg 7); and Appendix 3 (pg 36) 	Public safety is also addressed within the <u>subsidence monitoring programme</u> and the <u>Environmental Management Plan (EMP)</u> . Plan submitted to Director Mine Safety Operations on 29 th July, 2009
15	Incident reporting	Section 6 - Reporting (pg 8)	
16	The requirement to prepare and maintain a Subsidence Management Status Report	Section 6 - Reporting (pg 8)	
17	The requirement to prepare and submit an End of Panel Report following the completion of each longwall panel	Section 6 - Reporting (pg 8-9)	
18	Access to information	Section 6 - Reporting (pg 8)	
19	The provision of managing/remediating Survey Control Marks	Section 4.1 – Man Made Features Management (pg 5-6)	

2. ENVIRONMENT, SUBSIDENCE AND SAFETY MANAGEMENT PLAN (ESSMP)

2.1. ESSMP OBJECTIVES

This Environment, Subsidence and Safety Management Plan (ESSMP) has been developed to demonstrate the Colliery's capability to manage potential subsidence impacts from the extraction of NRE Wongawilli Longwalls (LW's) 11, 12, 15, 16, 19 and Pillar Extraction Area 1 (PE1), consistent with government policies and community expectations. The monitoring and management plans developed within this document are an integral part of NRE Wongawilli's *Monitoring Program* and have been developed to demonstrate compliance with the SMP approved conditions.

The SMP presents the proposed management solutions and action plans developed as a result of the subsidence impact and risk assessments undertaken and discussed in detail within the *Written Report*. This ESSMP supplements the approved SMP documents to extract coal by longwall and pillar extraction mining methods from LW's 11, 12, 15, 16, 19 and PE1 at NRE Wongawilli Colliery.

The purpose of the ESSMP is to provide the required systems and strategies for the most adequate protection, of those significant aspects that are natural and manmade features. The areas of significance requiring monitoring and management are identified as follows:

- Subsidence;
- Environmental;
- Safety; and
- Incident/s and Reporting

The areas of significance outlined above form part of the larger document below. The appropriateness of this ESSMP relative to the level of potential subsidence impacts evaluated within the Written Report, addressing in detail the impact and the sensitivity of the features affected, is considered to be sufficient.

Therefore, this SMP is considered adequate and relevant to the nature, magnitude, extent and causes of the expected subsidence impacts arising from the proposed mining.

3. SUBSIDENCE MONITORING

The area overlying the proposed Mining Area is wholly within the Metropolitan Catchment Area "Special Area 1" and has no impact on privately owned or occupied lands. There are no significant private or public operating activities within the proposed mining area.

The proposed mining footprint "in part" traverses the formation of the Maldon – Dombarton Rail line. Apart from this development the remainder of the subject area is traversed by minor Fire Trails and a privately owned power transmission line, which services the Wongawilli No1 Ventilation Shaft.

Ongoing management of the Subsidence Management process will be regularly reported to the major stakeholders in accordance with the conditions of the approved SMP, using already established communication and reporting mechanisms.

The Subsidence Consultation Process (SCP) aims to ensure that the appropriate information is communicated using existing consultation mechanisms where they are appropriate and additional measures will be implemented as required.

The *Subsidence Monitoring Programme* is provided in **Appendix 1** attached to this ESSMP.

4. ENVIRONMENTAL MANAGEMENT

This section summarises the results of pre-mining base-line monitoring of environmental values in areas of environmental sensitivity that may be impacted by the proposed mining.

Base-line monitoring programs for water quality, surface water flows, water dependent ecosystems and climatic conditions, as well as a range of ecological parameters have been defined and have been used for the development of this ESSMP.

Monitoring and management of areas identified to be impacted significantly will be implemented and extended, where necessary, to include new plans to manage impacts associated with the approved mining area.

The following key areas have been identified to be impacted significantly:

- Man Made Features; and
- Natural Features.

Triggers and response plans for manmade and natural features are included in this management plan.

The monitoring program outlines the above key areas and is provided in the Environmental Management Plan (EMP) attached as **Appendix 2** to this **ESSMP**.

The plans will be reviewed after each longwall is extracted to ensure they remain current and satisfy all the relevant stakeholders, as well as Gujarat NRE.

When developing these specific management plans, risk management principles such as those documented in the *Risk Management Handbook for the Mining Industry* are used as a guidance tool.

4.1. MAN MADE FEATURES MANAGEMENT

Management Plans have been developed to confirm that the subsidence impacts in the approved mining Area during and after extraction are within the predicted parameters and as such are not significant.

The management plans are based on the predicted subsidence and define the monitoring required to manage subsidence and implement remediation measures if required. The type and frequency of monitoring has been developed based on the timing and duration of the predicted subsidence event, in consultation with key stakeholders.

The key items of infrastructure that we identified as requiring monitoring and management are:

- the ***Fire Roads and 4WD tracks*** that exist within SCA land;
- the Transgrid ***330 kV transmission line***;
- the ***Archaeological sites*** identified within the written report; and
- the ***Survey Marks*** as identified in the MSEC subsidence predictions report.

Following the recommendations of the subsidence predictions report, the ***Fire Roads and 4WD tracks*** that exist within SCA land, were deemed features of low significance in respect of impacts due to mining.

The towers supporting the ***330 kV transmission line*** owned and operated by Transgrid are >100m from the boundary of the Application Area and >400m from the edge of the nearest longwall panel, *Subsidence predictions at the tower legs of the nearest tower (37-6) are predicted to be negligible.*

Nevertheless, monitoring of subsidence to confirm predictions will be undertaken prior, during and after extraction of the longwall and should levels higher than predicted occur, Transgrid will be immediately advised so that remediation measures can be implemented as required. Transgrid also requires this monitoring data for its tension analysis.

Monitoring of **Archaeological sites** within the Application Area for which subsidence predictions are recognised, will be undertaken as outlined in the EMP.

It has been identified that six (6) **Survey Control Marks** are located within the approved mining area and are detailed as follows:

<u>Mark</u>	<u>MGA Easting</u>	<u>MGA Northing</u>
SS 24901	290280	6187630
SS 24902	289810	6187330
SS 40790	290190	6187680
SS 40791	290550	6187640
PM 6164	291485	6187570
TS10841 (Flying Fox)	290880	6187045

It will be determined upon completion of subsidence whether these marks have sustained any functionality impacts due to mining and as required by the relevant stakeholder will be fully restored should such impacts occur, to the satisfaction of the Department of Lands and in compliance with condition 19 of the approved SMP conditions.

4.2. NATURAL FEATURES MANAGEMENT

In addition to the monitoring and management identified for manmade features, the Environmental Management Plan (EMP) also covers the key features of the natural environment, namely:

- Cliffs and Steep Slopes;
- Water, Upland Swamps and Ecology;
- Threatened Species.

This management plan monitors the environment and provides a basis for identifying change and the requirements for remediation.

4.2.1. CLIFFS AND STEEP SLOPES

The safety of Cliffs and steep slopes will be managed using measures such as monitoring of areas posing safety risks. Given the very low levels of predicted localised impacts to these areas, monitoring will be limited to observation and photographic evidence before, during and after extraction as required.

In the event that mining related impacts cause rock masses to become unstable and/or slumping of soil on steep slopes, access to these areas will be secured to ensure safety. Timely notification of mining progress and such remediation events will be provided to all relevant stakeholders, including operators and managers of the area, to ensure safety of all personnel that may enter the approved mining area.

4.2.2. WATER, UPLAND SWAMPS AND ECOLOGY

The EMP outlines management measures designed to ensure any mining related impacts on water (being ground water and surface water), terrestrial flora and fauna, upland swamps and aquatic ecology, are not significant. The plan embraces and extends the data collected from additional related sources. This data assists in providing suitable and useful information from which to assess the impacts of mining within the approved mining Area.

4.2.3. THREATENED SPECIES

To ensure that any mining related impacts to Threatened Species are reduced the Environmental Management Plan (EMP) encompasses the Flora and Fauna impact assessment recommendations.

This management strategy ensures that habitats and biota are protected before, during and after extraction using monitoring and field experts to ensure any mining related impacts on threatened species are mitigated. The frequency of observations and field monitoring is outlined in the EMP.

Timely notification of mining progress and mining related impacts, should this be required, will be provided to all relevant stakeholders.

5. PUBLIC SAFETY MANAGEMENT

It has been identified that there exists no buildings, structures or infrastructure within the approved mining area. It is therefore determined that no prevention or mitigation measures require implementation to address hazards or safety risks associated with impacts due to mining in this regard.

Also, as the approved mining area is within the Restricted Area of the Sydney Catchment Authority (SCA) public access to the mining area is already limited under SCA terms.

In the case of inadvertent access to the area and considering that the predicted maximum total subsidence of 1300mm and 750mm, may occur at rocky outcrops and cuttings (namely the Abandoned Maldon-Dombarton Railway Corridor) respectively, within this area, the increase of hazards to the public will be addressed. In any event, rocky outcrops and cuttings will be monitored on a regular basis before, during and after extraction providing baseline data, ensuring coverage of mining related impacts during and after mining. Signs are expected to be erected at those locations of rock outcrops and cuttings as required.

There also exists a number of 4WD tracks and Fire trails within the application area that have been predicted to incur minimal strains due to mining. Regular monitoring of these 4WD tracks and Fire trails before, during and after extraction will ensure coverage of any mining related surface impacts. In the event that such minor mining related impacts should occur, the hazard will be addressed.

Should observations show deterioration in surface conditions arising from mining within the application area, safety and remediation measures will be implemented to include timely notification of all relevant stakeholders.

The type and frequency of monitoring in the Public Safety Management Plan has been determined through consultation with key stakeholders.

The Public Safety Management Plan (PSMP) attached as **Appendix 3** to this **ESSMP**, outlines the monitoring to be undertaken considering the above key aspects

6. REPORTING

This section identifies the requirements for incident and ongoing management reporting as required by the approved Subsidence Management Plan. The management of reporting includes the following:

- Incident/s;
- Subsidence Management Status Report; and
- End of Panel report.

6.1. INCIDENT REPORTING

To ensure that an occurrence of an incident within the approved mining area is correctly administered, notification within 24 hours of becoming aware of it will be reported to the Principal Subsidence Engineer, Director Environmental Sustainability, MSB, OoW, SCA and Government agencies with a regulatory role.

The following occurrences as such, require notification:

- Any significant unpredicted and/or higher-than-predicted subsidence and/or abnormalities in the development of subsidence;
- Any exceedances of predicted impacts on groundwater resources and/or natural environment that may have been caused (whether partly or wholly) by subsidence;
- Any observed subsidence impacts adverse to the serviceability and/or safety of infrastructure and other built structures that may be affected by longwall mining;
- Any significant subsidence-induced cracking and/or ground deformations observed in any surface areas within the approved mining area; and
- Any trigger response action as specified in the Subsidence Monitoring Program, Environmental Management Plan and Public Safety Management Plan.

6.2. SUBSIDENCE MANAGEMENT STATUS REPORT

This report is to be prepared and maintained during mining. It is to be updated every 14 days to reflect the changes, if any, of the information contained within. This status report will also be submitted every 4 months to the Principal Subsidence Engineer, Director Environmental Sustainability, MSB and SCA.

The report must include, but not be limited to, the following:

1. the position of the longwall panel being extracted;
2. a summary of any subsidence actions undertaken;
3. a summary of any comments, advice and feedback from stakeholder consultation concerning the SMP approval and a summary of any responses delivered by the Leaseholder;
4. a summary of any observed and/or reported subsidence impacts, incidents, complaints relating to the approved mining area and a summary of any responses delivered by the Leaseholder;
5. a summary of subsidence development based on monitoring information compared with any defined triggers and/or predicted subsidence;
6. a summary of the adequacy, quality and effectiveness of the implemented management processes; and
7. a statement regarding any additional and/or outstanding management actions to be undertaken or the need for early responses or emergency procedures, to ensure adequate management of any potential subsidence impacts due to longwall mining.

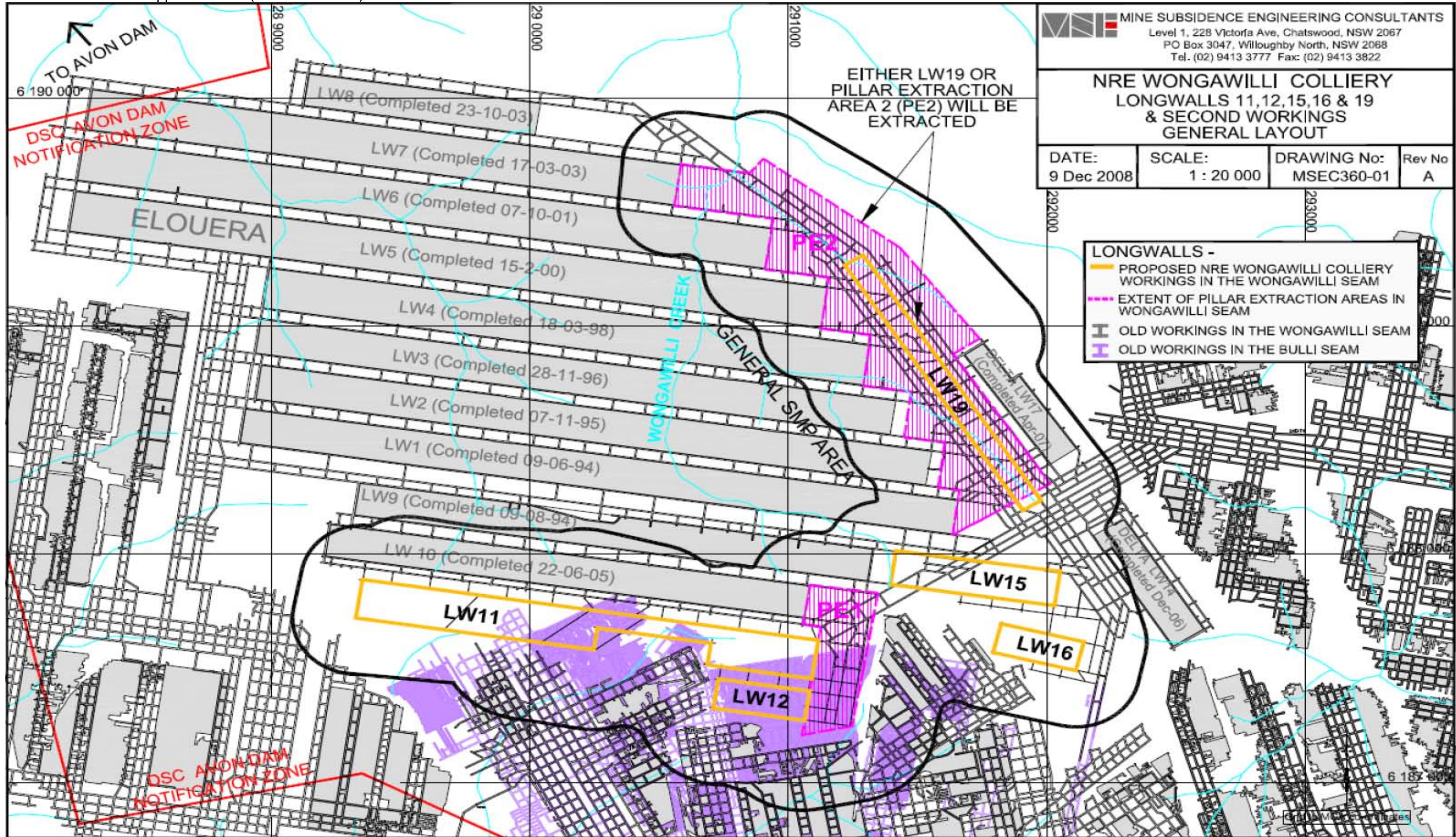
6.3. END OF PANEL REPORT

A report is to be prepared to the satisfaction of the Director Environmental Sustainability titled “End of Panel Report” and is to be submitted within four (4) months of the completion of each longwall panel.

This report must include the following:

1. a summary of the subsidence and environmental monitoring results for the applicable longwall panel;
2. include an analysis of these monitoring results against relevant:
 - a. impact assessment criteria;
 - b. monitoring results from previous panels; and
 - c. predictions in the SMP;
3. identify any trends in the monitoring results over the life of mining activity; and
4. describe what actions were taken to ensure adequate management of any potential subsidence impacts due to longwall mining.

It is expected that the End of Panel Report will be provided to all relevant agencies (viz. I&I NSW, SCA, DSC, MSB, DECCW, OOW and DoP) within three (3) months of initial report submission. This report will also be made available for viewing on the website.



APPENDICES

Appendix 1

SUBSIDENCE MONITORING PROGRAMME

NRE Wongawilli Colliery

LW's 11, 12, 15, 16, 19 & PE1

The area overlying the proposed Mining Area is wholly within the Metropolitan Catchment Area “Special Area 1” and has no impact on privately owned or occupied lands. There are no significant private or public operating activities within the proposed mining area.

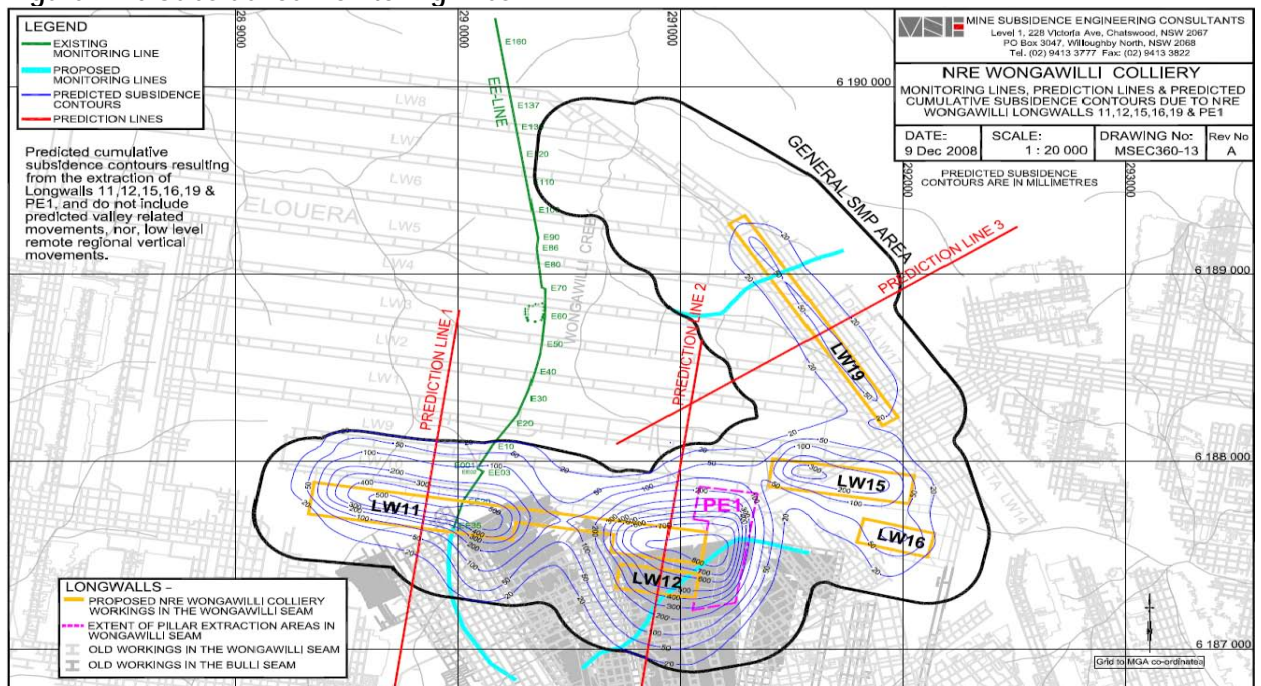
The proposed mining footprint “in part” traverses the formation of the Maldon – Dombarton Rail line. Apart from this development the remainder of the subject area is traversed by minor Fire Trails and a privately owned power transmission line, which services the Wongawilli No1 Ventilation Shaft.

The subsidence monitoring lines shown in **Figure A1.0** are indicative of what was proposed and have been derived from the subsidence prediction report produced by Mine Subsidence Engineering Consultants (MSEC). The surveyed lines, which are the layout of monitoring points, are shown in **Figure A1.1** (as attached). At this stage these lines above LW's 11, 12 and PE1 have been installed. Further monitoring lines above LW19 will be installed on a needs basis following a review of data collected from LW's 11 and 12 extraction and also in consultation with Principal Subsidence Engineer.

The extension of EE Line and establishment of EF Line will involve the establishment of monitoring stations at nominally 15m centres, such marks being either star pickets driven to ground level or bolts drilled and anchored into rock faces as conditions dictate.

These marks will be measured to determine level values for each station and the distance between each station will be measured to allow determination of horizontal strain between adjoining marks.

Figure A1.0 Subsidence Monitoring lines.



The origin of vertical datum will be based on the existing EE line to provide a continuous datum when viewing the historical data sets from previous monitoring.

Measurements will be undertaken using a Trimble S8 Total Station – with a stated accuracy of 1mm plus ppm for distance measurement and 1” of arc for angular measurement.

The results from subsidence monitoring will report the parameters of total and incremental subsidence and variation in Horizontal strain.

Table A1.0 outlines the nature and frequency of monitoring and the actions proposed to manage impacts resulting from subsidence monitoring.

Table A1.0 - Subsidence Monitoring and Management

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none"> • 2D Survey once prior to mining: <ul style="list-style-type: none"> ○ Total subsidence; ○ Incremental subsidence; ○ Variation in horizontal strain. • Report as appropriate 	Documentation of pre-mining conditions	Document and report as appropriate
During mining	<ul style="list-style-type: none"> • 2D Survey required only if regular visual inspections indicate impacts appear to fall outside predictions 	Major surface cracking (>10mm)	<ul style="list-style-type: none"> • Notify Principal Subsidence Engineer - I&I NSW; • Undertake subsidence survey and review against predictions; • Review mining options
Post mining	<ul style="list-style-type: none"> • 2D Survey on completion of each longwall block of: <ul style="list-style-type: none"> ○ Total subsidence; ○ Incremental subsidence; ○ Variation in horizontal strain. • Survey measurement comparison with predictions • Reported in Survey Reports 	<ul style="list-style-type: none"> • Check against predictions within MSEC report to enable ongoing modeling of predictions 	<ul style="list-style-type: none"> • Report to Principal Subsidence Engineer – I&I NSW, within four (4) months after completion of each longwall block; • Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions

Note: Where impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

Also, the Subsidence Management Status Report will be implemented to include the above subsidence monitoring data.

Figure A1.1 Subsidence monitoring points/lines - surveyed.



Appendix 2

ENVIRONMENTAL MANAGEMENT PLAN

NRE Wongawilli Colliery

LW's 11, 12, 15, 16, 19 & PE1

1. MONITORING OF MAN MADE FEATURES

The key items of infrastructure requiring monitoring and management is the Transgrid **330 kV transmission line** (see **Figure A1.0a**) and the **Fire Roads and 4WD tracks** that exist within SCA land that also includes the disused Maldon Dombarton rail line. The aim of monitoring that exists for this EMP is to collect baseline and impact data that adequately addresses requirements of the NRE Wongawilli SMP (See **Table A1.0a** and **Table A1.0b**).

The proposed and ongoing monitoring program will specifically:

- visually monitor surface ground movements;
- undertake regular observational monitoring for impact and serviceability;
- compare actual movements and impacts with predicted movements and impacts;
- satisfy the objectives of the SMP;
- satisfy the objectives of agreed management plans between NRE and relevant stakeholders; and
- meet the expectations of stakeholders, including the community and government.

Ongoing discussions with infrastructure owners are underway and appropriate management and monitoring plans have been developed where determined necessary. Appropriate plans, where required, are being implemented. These plans include trigger points for appropriate actions and remediation works and are detailed below.

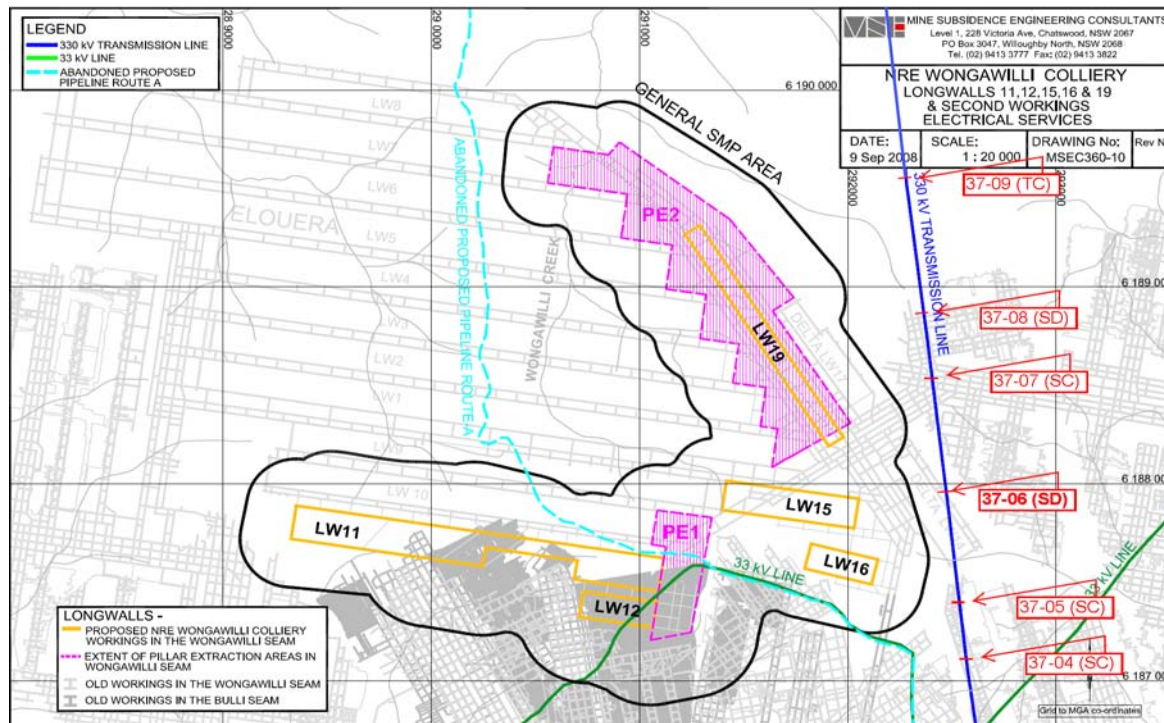
Regular meetings will occur between NRE and infrastructure owners as required. Owners will be notified of impacts greater than predicted or when trigger levels outlined in agreed management plans are reached. This notification will be immediate if emergency response is required or generally within 24 hrs of identification where a non-emergency response is required.

Table A1.0a – Transmission Line Monitoring and Management (Tower 37-6)

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none">• Observation of tower condition• Survey measurement for later comparison• Once prior to mining	Documentation of pre-mining conditions	<ul style="list-style-type: none">• Report condition to TransGrid and MSB• Reported in SMP Reports
During mining	<ul style="list-style-type: none">• Observation (this is managed by Transgrid)	Observation of unsafe tower conditions	<ul style="list-style-type: none">• Report condition to TransGrid and MSB• Survey• Transgrid to undertake remediation as required

Post mining	<ul style="list-style-type: none"> • Observation of tower condition • Survey measurement for later comparison - once following mining • Visual inspections 	Observation of unsafe tower conditions	<ul style="list-style-type: none"> • Report condition to TransGrid and MSB • Reported in SMP Reports • Transgrid to undertake remediation as required
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Figure A1.0a Electrical Services and Tower Sites



The measurements to be considered in the survey of the towers are vertical subsidence, (absolute) horizontal displacement of the base of the tower, the tilt of the earth wire peak and the horizontal spread between legs (k-points).

Note: the specific monitoring outlined above will be addressed and implemented prior to the extraction of LW's 19, 15 and 16, as there is nil predicted impacts relating to this infrastructure in regard to extraction of LW's 11 and 12.

Table A1.0b – Fire Road and 4WD Track Monitoring and Management

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none"> • Observation of road condition • Once prior to mining • Reported in SMP Reports 	Documentation of pre-mining conditions	Report condition to SCA
During mining	<ul style="list-style-type: none"> • Observation of area within 200m of roads • Fortnightly during extraction • Reported in AEMR 	Minor cracking (i.e. <10mm)	Notification to SCA within 24 hrs, using photographic record
		Major cracking or traffic impedance (i.e. >10mm)	<ul style="list-style-type: none"> *Notification to SCA immediately, then to I&I NSW and MSB *Make area safe as soon as practicable including warning signs *Proposal for rectification within 1 week upon approval from SCA *Completion of works following approval from SCA *Additional daily monitoring
Post mining	<ul style="list-style-type: none"> • Observation of road • Monthly following mining for 6 months • Reported in AEMR 	Minor cracking	As above
		Mitigation works unsuccessful	As above

Note: Where impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

1.1. EUROPEAN AND INDIGENOUS ARCHAEOLOGY MONITORING

European and Indigenous monitoring follows the outline below:

- undertake updated database searches for European and Indigenous Heritage;
- assess previous work for adequacy of coverage and after considering the subsidence predictions, define a survey area to adequately survey the study area;
- re-survey sites previously identified and any new sites to determine site significance;
- prepare a report detailing the sites of archaeological significance and apply the subsidence predictions to determine the potential impacts;
- undertake geotechnical assessments of sites that may be subject to mining related impacts to determine the likelihood of such features being impacted; and
- determine a management and monitoring program based on the impact assessment.

Note: It has been determined through assessment that the indigenous archaeological sites identified within the application area, possess no historical or heritage significance.

The predicted strains associated with mining related impacts on the identified archaeological sites are expected to be of low significance, as they are predominantly small in size compared to the application area. Considering this however, these sites will undergo monitoring for potential impacts by undertaking the actions outlined in **Table A1.1**.

These sites are identified as follows (see **Figure A1.1**):

- Native Dog Creek Shelter; 52 – 2 – 0966 / 3096 (shelter with art);
- Browns Road 1; 52 – 2 – 1616 (shelter with art and deposit);
- Browns Road Site 15; 52 – 2 – 1630 (shelter with art);
- Browns Road site 21; 52 – 2 – 1635 (shelter with art and deposit);
- Upper Avon 27; 52 – 2 – 1763 (shelter with art); and
- Wongawilli 1 (shelter with art).

A Cultural Heritage Management Plan (CHMP) has been developed to address the impacts to these sites and has been discussed extensively between consultants (BIOSIS) and representatives of DECCW. This CHMP is implemented to supplement a 'section 90' permit in accordance with similar previously approved plans located in the local area. Further and ongoing consultation with DECCW and consultants (BIOSIS) will be progressed as required.

Figure A1.1 Archeological Sites

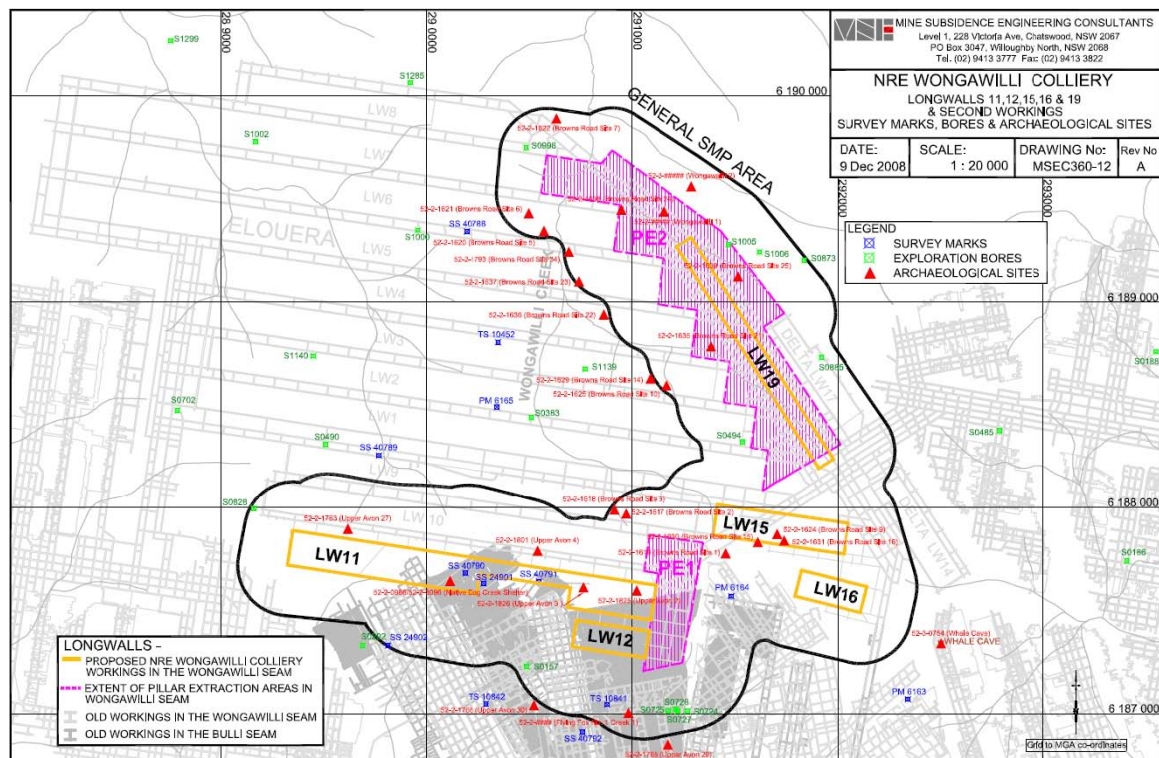


Table A1.1 – Cultural Heritage Monitoring and Management

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none"> Record heritage items as identified as significant once prior to mining 	Documentation of pre-mining conditions	<ul style="list-style-type: none"> Obtain a Section 90 permit that includes the six(6) sites as above Take into account impact assessment and SMP
During mining	<ul style="list-style-type: none"> Observation of sites once relating to the area of mining as above 	<ul style="list-style-type: none"> Check against predictions within MSEC report Observation of unstable conditions or damage 	<ul style="list-style-type: none"> Implement a Cultural Heritage Management Plan (CHMP) Report impacts as required Notify DECCW, I&I NSW, SCA
Post mining	<ul style="list-style-type: none"> Observation of significant site Once per site following mining Reported in AEMR 	Observation of unstable conditions or damage	<ul style="list-style-type: none"> Report impacts as required Reported in End of Panel report Notify DECCW, I&I NSW, SCA Review and undertake remediation options as appropriate

2. MONITORING OF NATURAL FEATURES

The significant aspects of natural features that require monitoring within the application area include the following:

- Cliffs and Steep Slopes;
- Water;
- Swamps;
- Threatened Species; and
- Aquatic Ecology.

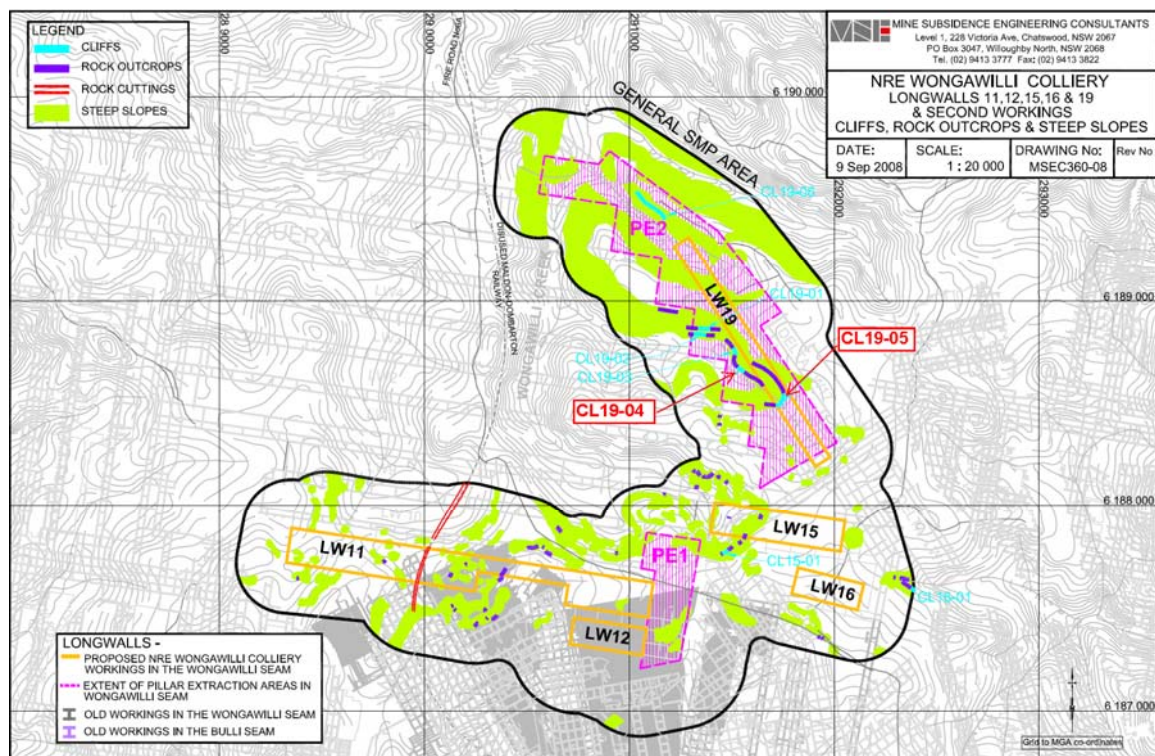
The monitoring of these key items will contribute to baseline assessments and impact monitoring, during mining. In the unlikely event that impacts are observed, the program will support development of any mitigation or rehabilitation plans required.

2.1. CLIFFS AND STEEP SLOPES MONITORING

There are a number of cliff lines and steep slopes identified within the application area. One of the prime objectives of this plan is to prevent injuries as a result of cliff instability that may be induced by mining related impacts. Regular monitoring of ground movement and rock face stability in potentially unstable areas, as well as implementing appropriate controls where necessary, will achieve this. It is expected that with the restricted access to SCA areas already enforced, the probability of people being in the vicinity of any rock fall is reduced. Given the low levels of use of the area and the rugged terrain, it is considered that there is a very low level of risk from rock falls.

Cliff lines as identified in the written report will be subject to regular inspection as detailed in **Table A2.1** that includes CL19-04 and CL19-05 (see **Figure A2.1** below). This monitoring will be activated prior to and in association with mining of LW 19.

Figure A2.1 Cliffs and Steep Slopes



Results obtained from monitoring associated with this plan will be used to determine ongoing monitoring requirements, appropriate controls and responses relating to potential surface instability associated with coal extraction within the application area. This will contribute to an improved understanding of the effects of mining on steep slopes and cliffs, and assist the management of the area to minimise risk to members of the public, SCA and monitoring personnel.

Table A2.1 outlines the nature and frequency of monitoring and the actions proposed to manage impacts on cliff formations.

Table A2.1 – Cliff and Steep Slopes Monitoring & Management

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none"> • Observation and document of cliff and steep slope condition including CL19-02, CL19-03, CL19-04 and CL19-05. • Once prior to mining 	Documentation of pre-mining conditions	<ul style="list-style-type: none"> *Take into account impact assessment and SMP *Nature of potential impacts detailed in written report *Reported in SMP Reports
During mining	<ul style="list-style-type: none"> • Observation of cliffs and steep slopes including only CL19-04 and CL19-05. • Monthly during extraction 	Observation of minor cracking (<10mm)	<ul style="list-style-type: none"> *Notification to SCA within 24 hrs, using photographic record and I&I NSW *Warning sign/s erection *Reported in AEMR
		Observation of major cracking (>10mm) and unstable conditions	<ul style="list-style-type: none"> *Notification to SCA immediately then I&I NSW *Make area safe immediately including erection of warning sign/s and barrier fencing *Reported in AEMR *Review mining options
		Major cliff collapse or steep slope movement	<ul style="list-style-type: none"> *Notification to SCA immediately then I&I NSW *Make area safe immediately including warning sign/s erection and barrier fencing *Proposal for rectification within 1 week *Completion of works following approval from SCA *Additional monitoring *Reported in AEMR
Post mining	<ul style="list-style-type: none"> • Observation and document of cliffs and steep slopes including CL19-02, CL19-03, CL19-04 and CL19-05. • Monthly following mining for 6 months 	As above	As above
		Mitigation works unsuccessful	As above

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

2.2. WATER MONITORING

The Project Area consists of five longwall mining blocks and two pillar extraction areas that are located within the catchments of Native Dog Creek, Bellbird Creek, Flying Fox Creek #1, Wongawilli Creek and its tributaries as well as the upper reaches of the Cordeaux River as shown in **Figure A2.2a** and **Figure A2.2c**.

The water courses are ephemeral and are composed of “feeder creeks” in natural depressions that drain into creeks and swamps within and surrounding the application area. The creeks vary from 0.5 - 1m in width and are less than 0.5m deep with alluvial sediments contained in the drainage lines along with interspersed sandstone outcrops.

Baseline monitoring of stream water quality in the ephemeral tributaries directly overlying, or draining from the proposed workings in Panels 11,12, 15, 16, 19 as well as PE1 as shown in **Figure A2.2b**, indicates that for selective parameters, the ephemeral streams vary in chemistry as follows:

- pH of 4.19 - 6.77
- sulfate up to 11mg/L
- total aluminium up to 1.13mg/L
- zinc up to 0.05mg/L
- salinity of 48 - 198µS/cm
- total iron up to 6mg/L
- manganese up to 0.12mg/L, and

Figure A2.2a Environmental sampling locations

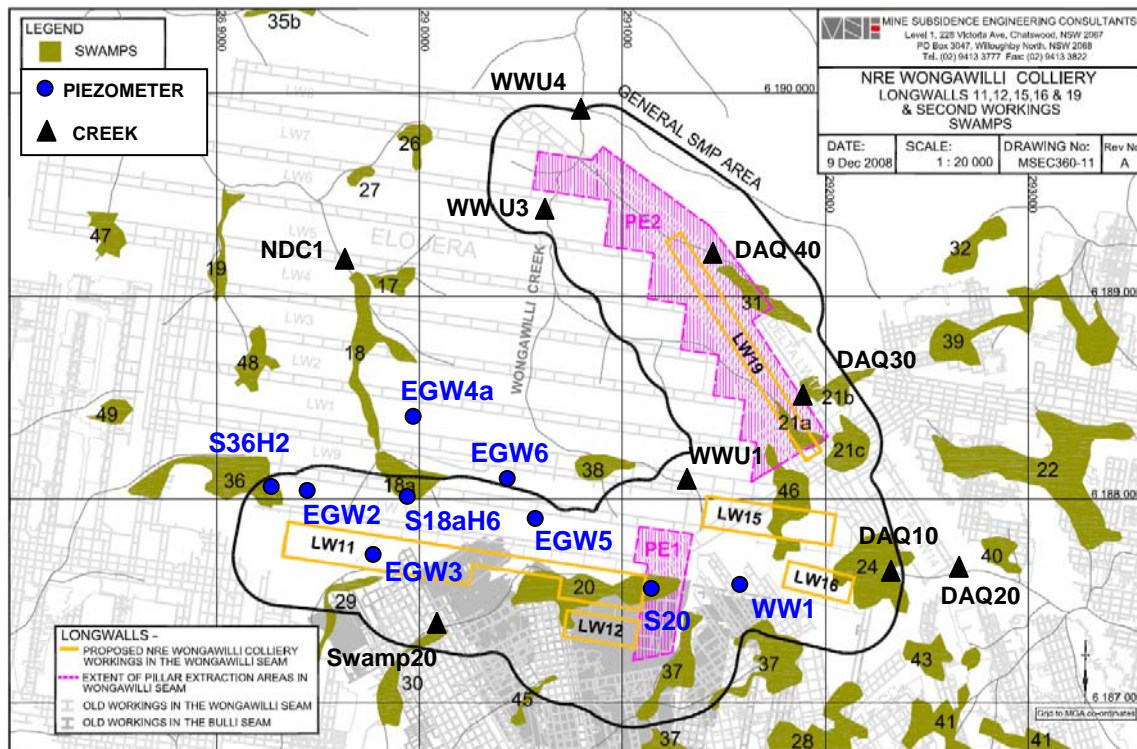


Figure A2.2b Water Chemistry Plots

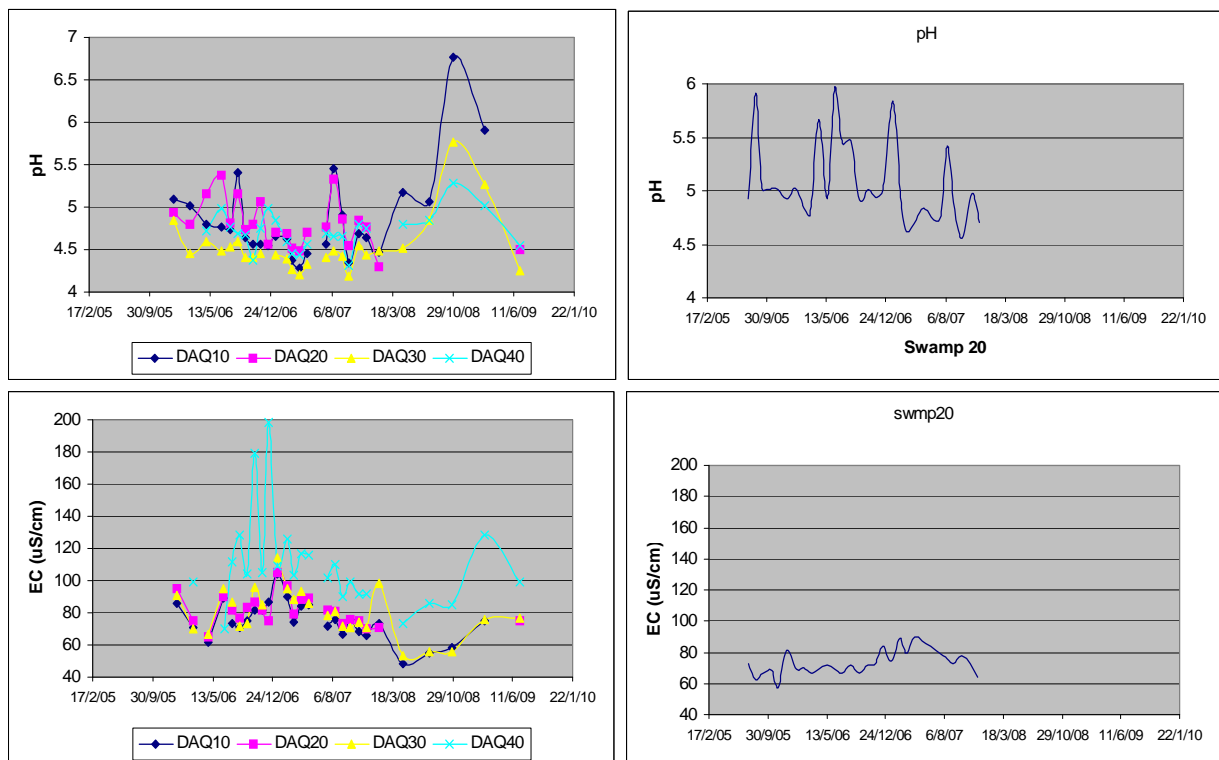
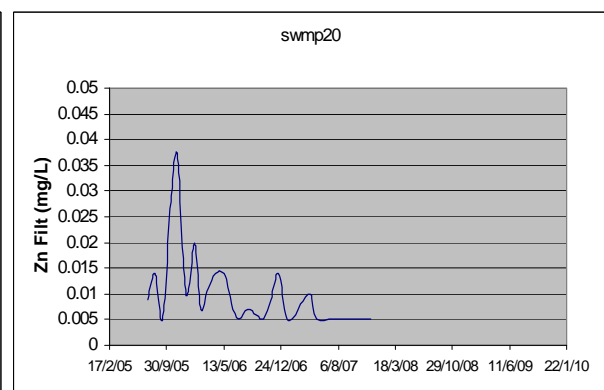
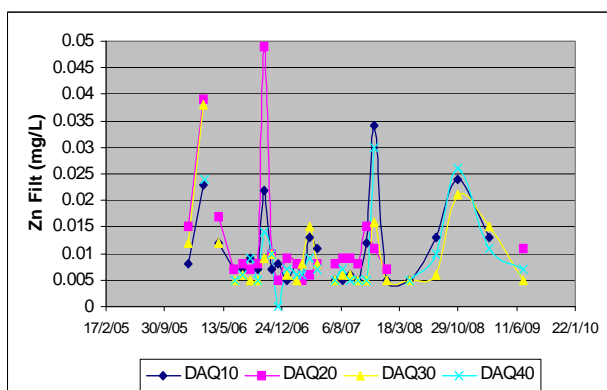
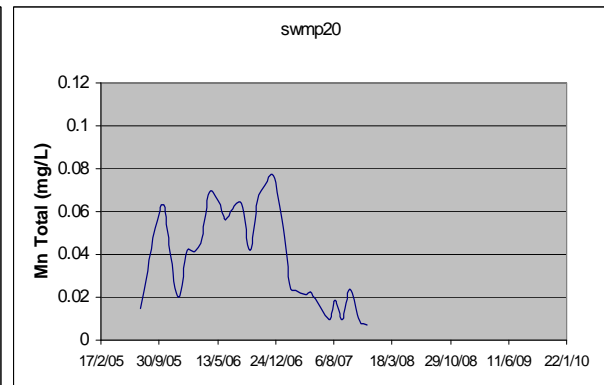
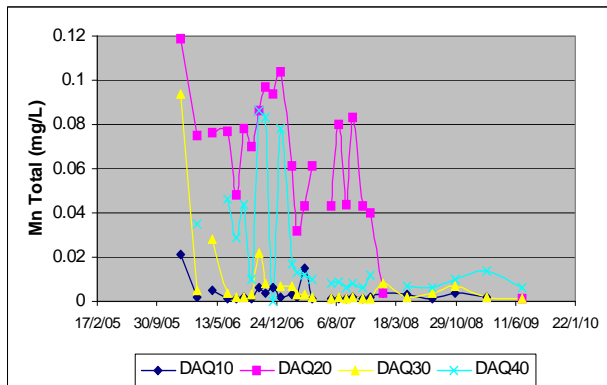
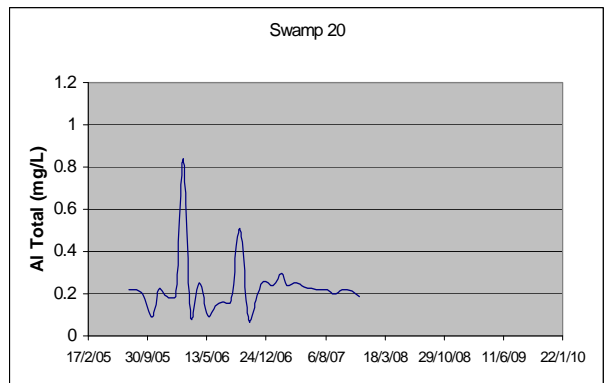
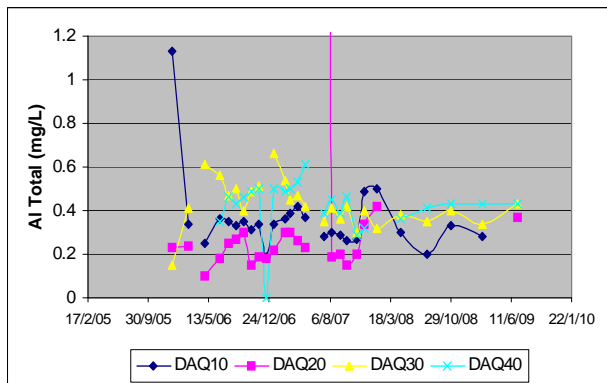
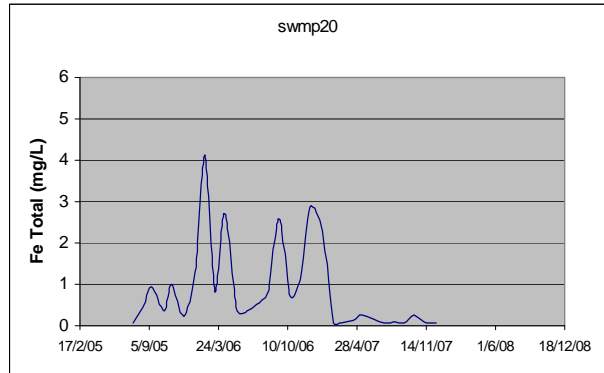
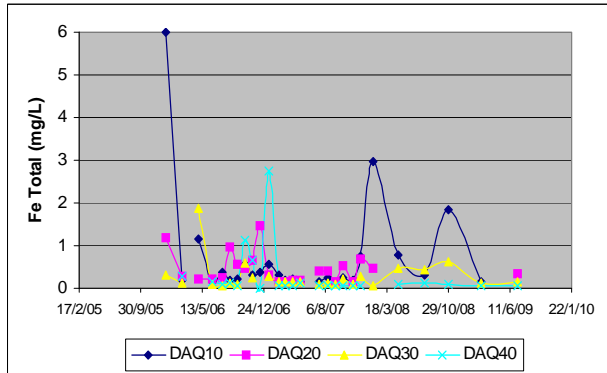
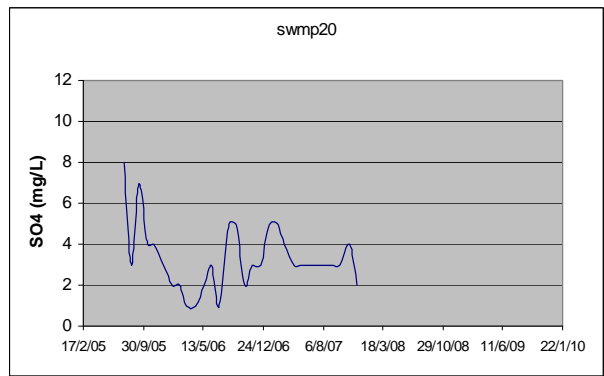
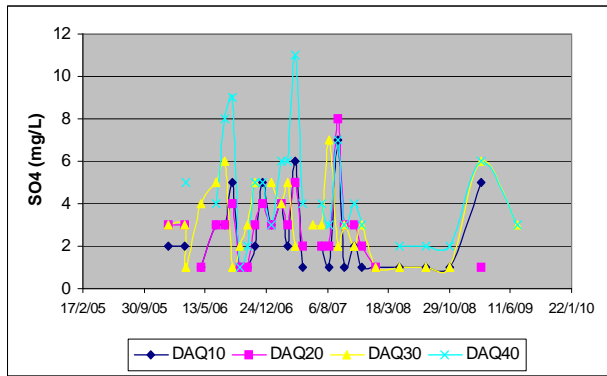


Figure A2.2b Water Chemistry Plots can't



These baseline parameters are used as the basis for the definition of stream water quality triggers for the proposed workings as discussed in the Trigger Action Response Plan (TARP) **Table A2.2a**.

Figure A2.2c Aerial Plan of Monitoring Locations

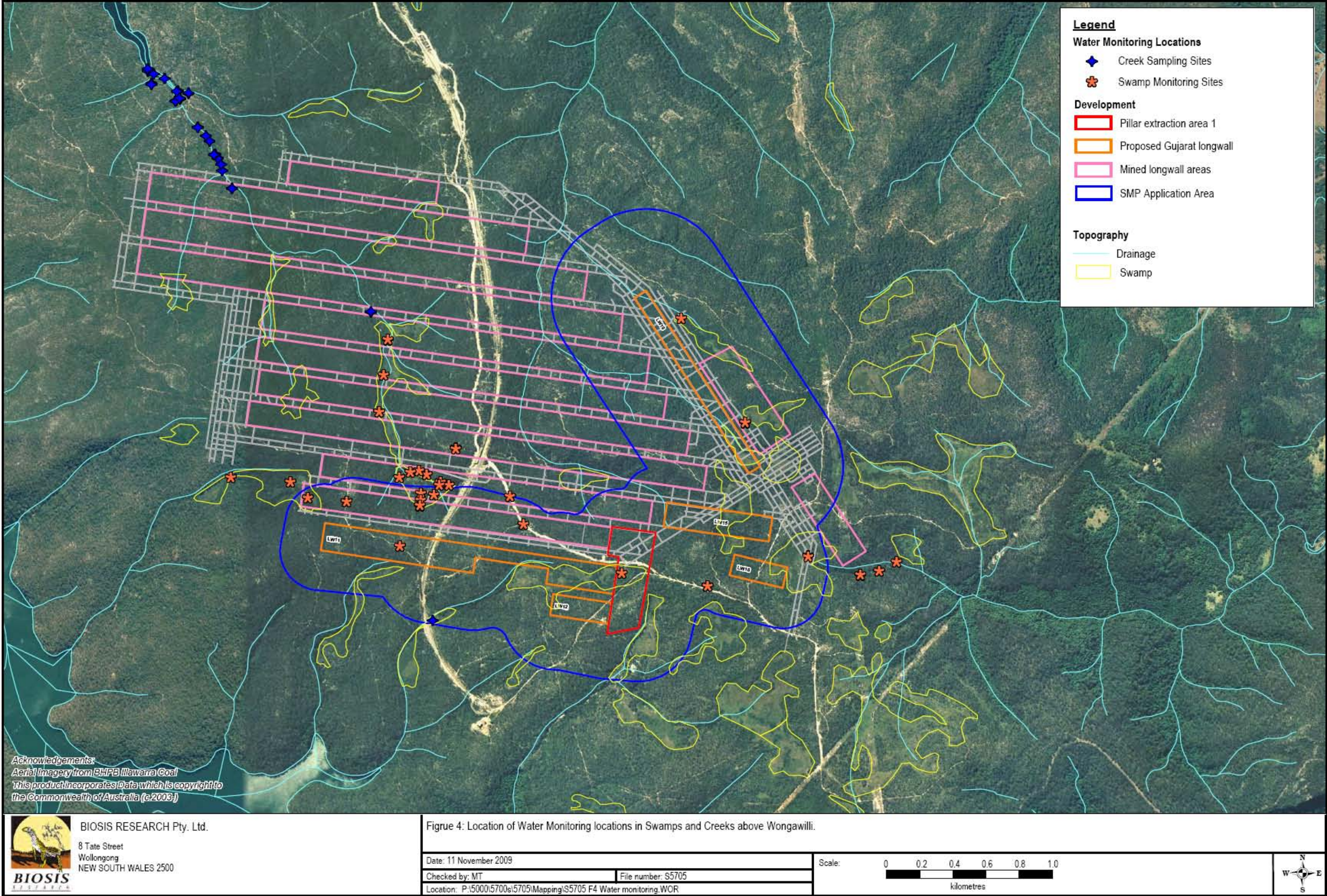


Table A2.2a Stream Water Quality and Flow Monitoring

Streams									
ASPECT	MONITORING				TRIGGER				
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING	PURPOSE
Stream Water Quality and Flow	Swamp 20 DAQ10 DAQ20 DAQ30 DAQ40	<ul style="list-style-type: none"> • <u>Field analysis:</u> EC, pH, temp • <u>Laboratory analysis:</u> TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Cs, Rb, Sr (filtered) • Observable iron or salinity staining • Photo points • Water flow in creek • Areas of increased flooding • Erosion of stream banks 	<p>Field water quality, flow and laboratory analysis: monthly for at least 2 months prior to undermining the stream</p> <p>Field water quality and flow:</p> <ul style="list-style-type: none"> • Weekly along with bi-monthly laboratory analysis <u>during active undermining of stream</u> overlying an individual panel or pillar area • Monthly along with bi-monthly laboratory analysis <u>for duration of the individual panel or pillar extraction area</u> • Bi-monthly along with four monthly laboratory analysis <u>after individual panel / pillar area has fully subsided for 1 year</u> <p>If NO trigger exceedances noted after 1 year following the development of full subsidence of an individual stream, monitoring can modify to 6 monthly field, flow and laboratory analysis</p> <p>If NO trigger exceedances noted monitoring can discontinue at the end of all extraction in Panels 11, 12, 15, 16, 19 , PE1</p>	<p>To provide pre-mining baseline water quality, stream flow and bed / bank stability data to compare with post-mining</p> <p>To identify any water quality, stream flow or bed / bank instability impact due to mining</p> <p>To identify any flow-on impacts from changes in stream water level or quality</p>	<p>1. Observable increase from baseline in iron hydroxide precipitation (e.g. orange staining in water or on banks/bed) from comparison with pre-mining monitoring and photographs.</p> <p>Based on the baseline monitoring conducted since July 2005 the following triggers will be used:</p> <p>EC > 200uS/cm 4.2 > pH > 6.77 Fe (Tot) > 6mg/L Mn (tot) > 0.1mg/L Al (tot) > 0.7mg/L Zn (filt) > 0.04mg/L SO4 (filt) > 8mg/L Dissolved oxygen / ORP / temperature (see notes)</p>	<ul style="list-style-type: none"> • Repeat water quality sampling and initiate laboratory water quality sampling on a monthly basis • Contract hydrologist investigate and report on changes identified • Inform SCA, DECCW & I&I NSW of results of investigation • Prepare and implement a site mitigation/action plan in consultation with key agencies and in accordance with Section 54 of the Water Management Act • Report in the End of Panel Report 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> • Inform SCA / DECCW within 24 hours • Investigation initiated within 1 week • Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion • Commence preparation of mitigation/action plan within 1 week if required • Report within 6 months of longwall completion 	<p>Ensure appropriate stream water flow and water quality</p> <p>Identify, investigate and report on impacts to ephemeral stream water quality and flow</p> <p>Investigate any mitigation measures required and implement in consultation with key agencies</p>
					<p>2. Observation of loss of flow connectivity within a flowing ephemeral stream (related to rainfall), compared to the flow regimes evident prior to the extraction of LW's 11-19.</p>	<ul style="list-style-type: none"> • Repeat water quality sampling and initiate laboratory water quality sampling on a monthly basis • Contract hydrologist investigate and report on changes identified • Inform SCA, DECCW & I&I NSW of results of investigation • Prepare and implement a site mitigation/action plan in consultation with key agencies and in accordance with Section 54 of the Water Management Act • Report in the End of Panel Report 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> • Inform SCA / DECCW within 24 hours • Investigation initiated within 1 week • Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion • Commence preparation of mitigation/action plan within 1 week if required • Report within 6 months of longwall completion 	
					<p>3. Observation of areas of flooded stream in excess of baseline conditions – identified by extended flooding within a terrestrial habitat and from comparison of pre-mining and post-mining photographs</p>	<ul style="list-style-type: none"> • Survey area to identify whether earthworks are required • Contract hydrologist investigate and report on changes identified • Inform SCA / DECCW of results of investigation • Prepare and implement a site mitigation/action plan in consultation with key agencies and in accordance with Section 54 of the Water Management Act if required • Report in the End of Panel Report 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> • Inform SCA / DECCW within 24 hours • Investigation initiated within 1 week • Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion • Commence preparation of mitigation/action plan within 1 week if required • Report within 6 months of longwall completion 	
					<p>4. Observation of erosion of stream bed and banks in excess of baseline conditions identified from comparison of pre-mining and post-mining photographs</p>	<ul style="list-style-type: none"> • Contract hydrologist investigate and report on changes identified • Inform SCA, DECCW & I&I NSW of results of investigation • Prepare and implement a site mitigation/action plan in consultation with key agencies and in accordance with Section 54 of the Water Management Act • Report in the End of Panel Report 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> • Inform SCA / DECCW within 24 hours • Investigation initiated within 1 week • Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion • Commence preparation of mitigation/action plan within 1 week if required • Report within 6 months of longwall completion 	

NOTE: Stated notification and investigation timeframes are from when triggers have been confirmed by the Environmental Coordinator.

Impacts to vegetation, water quality, flow or pool level to streams, will be addressed through the development of site specific mitigation and management plans which may include the following actions:

- Grouting and rehabilitation of areas where required, with appropriate government approvals. This would be triggered by identification of surface water flow being lost from the catchment to deep storage or the mine workings or loss of a significant permanent pool.
- Minor earthworks to prevent erosions such as overland flow diversion works, establishment of banks, smoothing and re-contouring, with appropriate government approvals.
- Revegetation works such as planting, seeding, mulching, weed control and plant maintenance, with appropriate government approvals.
- The field monitoring parameters of dissolved oxygen (DO) and oxidation reduction potential (ORP) are highly variable due to the upland streams being ephemeral and can have very low dissolved oxygen and low to negative ORP values, purely due to anaerobic ponding of water after extended dry periods. As such, no triggers have been specified for these values
- Field monitored water temperature varies significantly with the season and climatic conditions at any one time, as well as the highly variable nature of the ephemeral flow in the upland streams. Therefore, no trigger level has been specified.

Field water quality (pH, EC, ORP, DO and Temp) and laboratory analyses, monitoring intervals and flow and stream bed and bank stability will be monitored at locations outlined in **Table A2.2b** and as discussed in the TARP **Table A2.2a**.

Table A2.2b – Stream Water Monitoring Sites

Site	Identifier	Easting	Northing
Native Dog Creek	NDC1	289631	6189182
Wongawilli Creek	WWU1	291300	6188150
	WWU3	290550	6189400
	WWU4	290800	6189900
	DAQ30	292271	6187686
	DAQ40	292700	6187595
Cordeaux River (upper reaches)	DAQ10	291891	6188505
	DAQ20	291505	6189142
Bellbird Creek	Swamp 20	290100	6187300

Table A2.2c – Other Water Monitoring Sites

	Mining Area	Site Name	Easting	Northing
Groundwater_Piezo	NREWW	EGW2	289483	6188020
Groundwater_Piezo	NREWW	EGW3	289806	6187746
Groundwater_Piezo	NREWW	EGW4a	290142	6188346
Groundwater_Piezo	NREWW	EGW5	290551	6187879
Groundwater_Piezo	NREWW	EGW6	290470	6188051

The monitoring interval and period will be determined on whether the individual monitoring location has not yet been undermined, is being actively undermined by a longwall or pillar extraction area, or has been undermined.

Note: the monitoring programme may require modification depending on the outcome and interpretation of ongoing monitoring in agreement with SCA and DECCW.

Water quality parameters to be monitored have been determined to reflect adequately any mining related impacts to these areas and are outlined in **Table A2.2d**.

Table A2.2d – Water Quality Parameters

LABORATORY ANALYSIS	FIELD ANALYSIS	UNITS
	pH	
	Specific conductivity	
	Temperature	Deg C.
	Dissolved oxygen	% Saturation
	Turbidity	NTU
	Oxidation Reduction potential	mV
	Groundwater depth	mbgl / mAHD
	Stream Flow	ML/day or visual assessment
pH		
Conductivity @ 25°C		µS/cm
Total Dissolved Solids (TDS)		mg/L
Total Suspended Solids (TSS)	(surface waters only)	mg/L
Calcium		mg/L
Magnesium		mg/L
Sodium		mg/L
Potassium		mg/L
Alkalinity as CaCO ₃		mg/L
Sulphate		mg/L
Chloride		mg/L
Iron (total and filtered)		mg/L
Aluminum		mg/L
Arsenic		mg/L
Barium		mg/L
Copper		mg/L
Manganese (total and filtered)		mg/L
Nickel		mg/L
Lead		mg/L
Lithium		mg/L
Selenium		mg/L
Strontium		mg/L
Zinc		mg/L
Total Nitrogen as N		mg/L
Total Phosphorus as P		mg/L
Dissolved Organic Carbon		mg/L

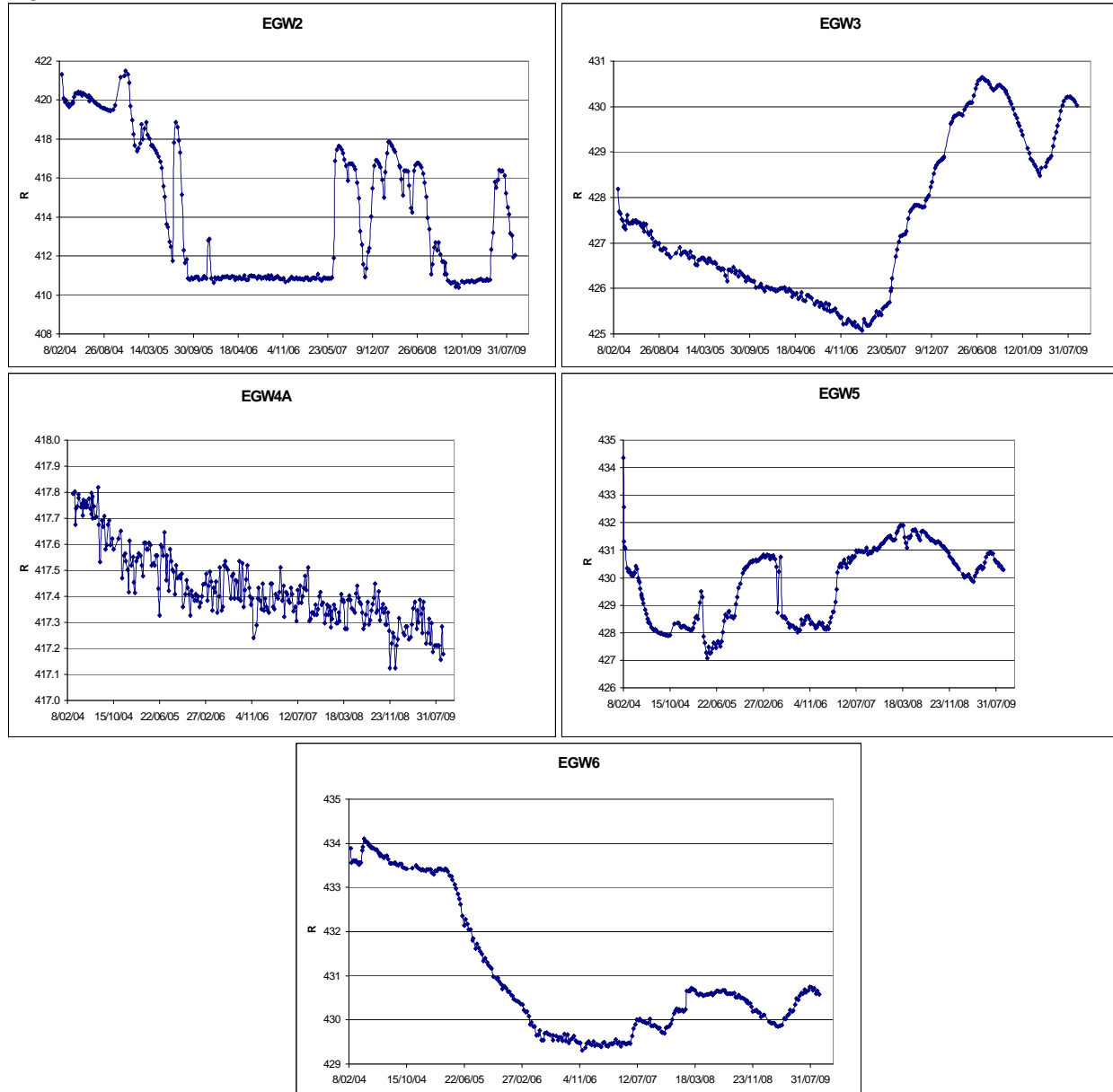
2.3. MONITORING OF MINE WATER INFLOW

The monitoring program for any potential anomalous water inflow to the underground mine workings is outlined in the TARP **Table A2.3**.

2.4. MONITORING OF HAWKESBURY SANDSTONE PEIZOMETERS

Water levels within the upper Hawkesbury Sandstone in the bores adjacent to or over the proposed workings show a high variability in direct response to rainfall recharge as shown in **Figures A2.4**.

Figure A2.4 – Piezometer Water Level Plots



The response to undermining can be seen in piezometers EGW2 and EGW5 over the old longwall mining area (LW 10). Piezometers EGW4A and EGW6, which were installed over Longwall 9 after it was extracted, along with EGW3, which overlies the currently unmined area over the proposed Longwall 11, indicates a natural variability in groundwater levels in the Hawkesbury Sandstone of up to 5.5m.

The “natural” variability in Hawkesbury Sandstone water levels observed in EGW3, 4A and 6 are used as a basis in defining the groundwater level trigger for the proposed workings as discussed in the TARP **Table 2.4a**.

Table A2.3 Mine Water Inflow Monitoring

Mine Water Inflow									
ASPECT	MONITORING				TRIGGER				
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING	PURPOSE
Mine Water Inflow	Active mining areas – Longwalls 11, 12, 15, 16, 19 and Pillar Extraction areas PE1 Mined goaf areas – old Elouera Panels	<ul style="list-style-type: none">• Groundwater make increasing as measured by mine dewatering monitoring• Inflow event from mining area• Water sample of any inflow event (Laboratory Analysis for major Cations & Anions as well as Stable Isotopes) for comparison to surface waters	<ul style="list-style-type: none">• Daily statutory mine inspections• Mine dewatering monitored throughout the mining process by flow meter of water pumped into and discharged from the mine.	To identify potential connectivity to the surface water or large groundwater inflows To provide data for surface impact investigations To establish baseline information for surface water or groundwater inflow	1. Increase in water discharge of > 1ML/day for 7 successive days from active longwall or pillar extraction areas, which are suspected to be as a result of mine subsidence. <u>Note:</u> the typical discharge from U/G is 6ML/day	<ul style="list-style-type: none">• Engage contract hydrogeologist to investigate and report on changes identified• Inform relevant agencies of results of investigation• Report in Subsidence Management Status Report• Report in End of Panel Report	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none">• Investigation initiated within 1 week• Results of investigation reported to SCA, DECCW & IIN within 1 week of completion• Monthly updates of investigation progress, if required by SCA / DECCW• EoP Report within 6 months of longwall 11 , 12, 15, 16, 19 and PE1 completion	Identify, report and respond to surface to mine connectivity
					2. Inflow event from mining area requiring notification to the mining inspectorate	<ul style="list-style-type: none">• Engage contract hydrogeologist to investigate and report on changes identified• Inform SCA, DECCW & IIN of investigation outcomes• Report in Subsidence Management Status Report• Report in End of Panel Report		<ul style="list-style-type: none">• Investigation initiated within 1 week• Results of investigation reported to SCA, DECCW & IIN within 1 week of completion• Monthly updates of investigation progress, if required by SCA / DECCW• EoP Report within 6 months of longwall 11 , 12, 15, 16, 19 and PE1 completion	
					3. Water Chemistry or age indicates connectivity to the surface NB: this trigger must be derived from a hydrogeologist's investigation report	<ul style="list-style-type: none">• Inform SCA, DECCW & IIN of this change• Commence preparation of mitigation/action plan within the timeframe agreed with relevant government agencies• Report in Subsidence Management Status Report• Report in the End of Panel Report		<ul style="list-style-type: none">• Inform SCA, DECCW & IIN within 24hrs• Commence preparation of mitigation/action plan within timeframe agreed with relevant agencies• Monthly updates of investigation progress• EoP Report within 6 months of longwall 11 , 12, 15, 16, 19 and PE1 completion	

NOTE: Previous mine inflow / pump out monitoring will be used to establish baseline flows to ensure suitable % variation triggers for subsequent workings. Stated notification and investigation timeframes are from when triggers have been confirmed by the Environmental Coordinator.

Table A2.4a Hawkesbury Sandstone Piezometer Monitoring

Hawkesbury Sandstone Piezometers									
ASPECT	MONITORING				TRIGGER				
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING	PURPOSE
Piezometer Water Quality and Water Levels	3 bores (EGW2, EGW3, EGW5, WW1) NB: this is a continuation of BHPB-IC Elouera monitoring.	Field analysis: EC, pH, temp, Laboratory analysis: TDS, Na, K, Ca, Mg, F, Cl, SO ₄ , HCO ₃ , NO ₃ , Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Cs, Rb, Sr (filtered) Groundwater level using pressure transducer.	Field water quality <ul style="list-style-type: none"> monthly during LW11, 12, 15, 16, 19 or PE1 extraction; bi-monthly at all other times Laboratory analysis <ul style="list-style-type: none"> every 2 months during LW11, 12, 15, 16, or PE1 extraction; every 4 months at all other times Water level – minimum 12 hourly intervals during extraction of all workings. Conduct pre mining baseline assessment prior to mining Panels 11, 12, 15, 16, 19 and PE1, in EGW2, 3 and 5 Conduct end of Panel /PE1 assessment following full development of subsidence in Panels 11 and 12 If NO trigger exceedances effects noted after 1 year following the development of full subsidence of an adjacent or overlying panel, monitoring can extend to 4 monthly field and laboratory analysis and can cease at the end of extraction in the Project Area If NO trigger exceedances noted after 1 year following the development of full subsidence of an adjacent or overlying panel, water level monitoring can discontinue when Panels 11, 12, 15, 16, 19, PE1 are completed	To provide pre-mining baseline water quality and groundwater level data to compare with post-mining after completion of Panels 11, 12, 15, 16 and 19 as well as PE1, and subsequently at the completion of all mining To identify physical and/or chemical water quality and water level impacts related to mining	Water Quality 2 std deviation change, or distinctive diversion over at least 4 months from baseline levels for pH, EC, Fe, Mn, Al, Zn and SO ₄	<ul style="list-style-type: none"> Repeat water quality sampling of impacted and adjacent bores if triggers exceeded, as required If trigger is exceeded for at least 4 months, engage hydrogeologist to investigate and report on any identified adverse changes to water level / water quality Inform SCA, DECCW & I&I NSW of investigation outcomes Investigation of possible mitigation measures in consultation with SCA / DECCW Prepare and implement a site mitigation/action plan in consultation with SCA / DECCW if appropriate Report in SMP / End of Panel reports to inform relevant agencies of results of monitoring 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> Investigation initiated within 1 week Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required Monthly updates of investigation progress, if required by SCA / DECCW EoP Report within 6 months of longwall 11, 12, 15, 16, 19 and PE1 completion 	Inform stakeholders of baseline assessment and monitoring Identify, investigate and report on impacts to groundwater quality and levels
					Water level continuous >5m water level reduction over a minimum 2 month period	<ul style="list-style-type: none"> Engage hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge Inform SCA, DECCW & I&I NSW of investigation outcomes Investigation of possible mitigation measures in consultation with SCA / DECCW Prepare and implement a site mitigation/action plan in consultation with SCA / DECCW if necessary Report in End of Panel reports ongoing to inform relevant agencies of results of monitoring 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> Investigation initiated within 1 week Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required EoP Report within 6 months of longwall / panel completion 	

Field water quality (pH, EC and Temp) and laboratory analyses as outlined in **Table A2.2d**, as well as the Hawkesbury Sandstone groundwater levels, will be monitored at locations shown in **Table A2.4b** and as outlined in the TARP **Table A2.4a**. Water levels will be automatically monitored within installed piezometers at least twice daily using pressure transducers and data loggers.

Table A2.4b Upper Hawkesbury Sandstone Piezometer Monitoring Locations

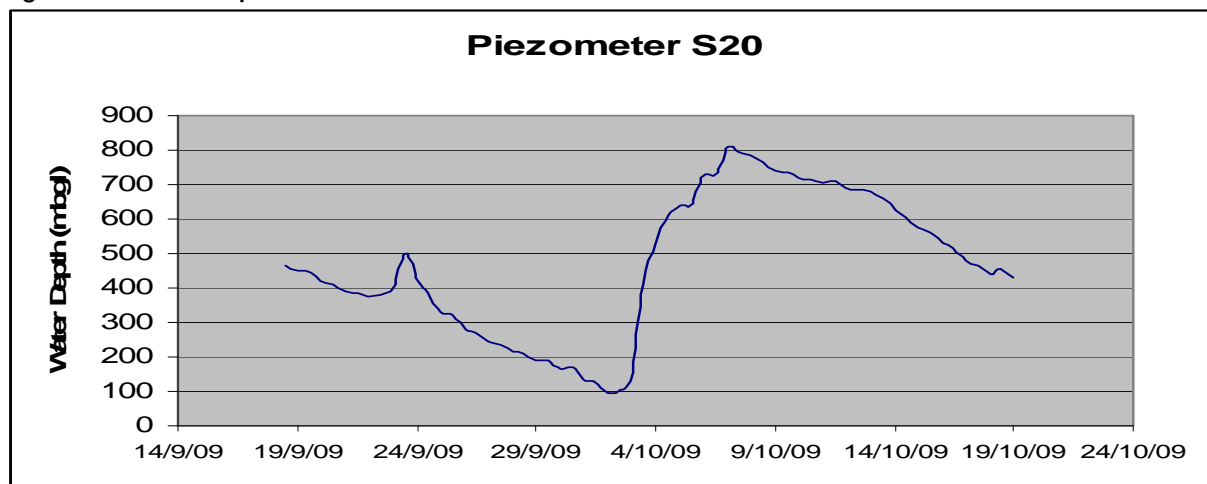
PIEZOMETER	EAST	NORTH
WW1	291601	6187638
EGW2	289483	6188020
EGW3	289806	6187746
EGW4a	290142	6188346
EGW5	290551	6187879
EGW6	290470	6188051

2.5. MONITORING OF UPLAND SWAMPS

Initial field monitoring, along with a resistivity profile geophysical survey conducted within Swamp 20, which overlies the proposed PE1, Longwall 11 and 12, indicates that it comprises shallow (<1.5m deep) sandy clay / organic alluvial sediments, a groundwater pH of approximately 5.81 and a salinity of 203 μ S/cm.

Piezometer S20, where the Quaternary swamp alluvium is 0.57m deep, has a water level that is highly responsive to rainfall and varies from out flowing at surface, to dry at the sandstone interface as show in **Figure A2.5a** below.

Figure A2.5a Swamp 20 Groundwater Levels



Monitoring in two nearby swamp piezometers in Swamp 18 (S18aH6) and Swamp 36 (S36H2) installed over the previously extracted and subsided Longwall 10, also indicates a highly responsive ‘water level to rainfall’ recharge. As shown in **Figure A2.5b**.

Figure A2.5b Swamp 18 and 36 Groundwater Levels

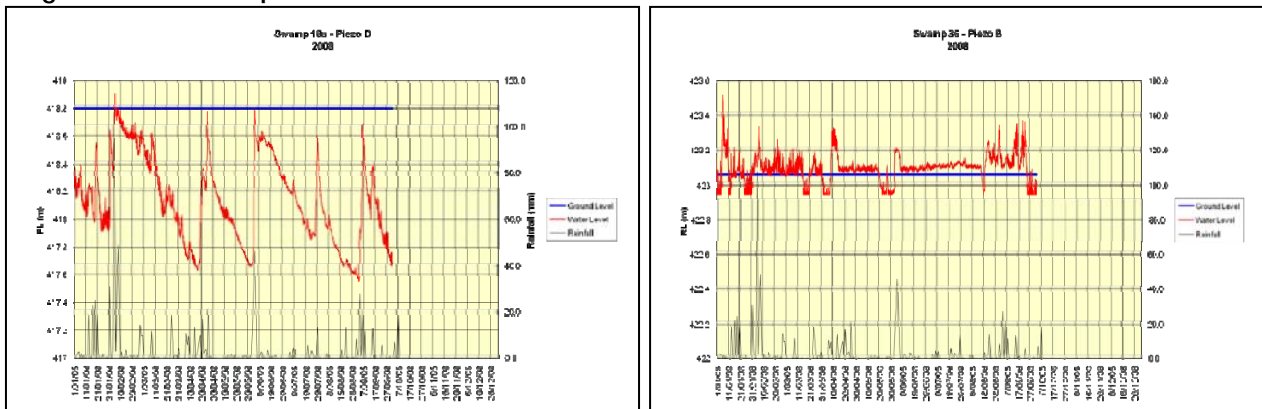
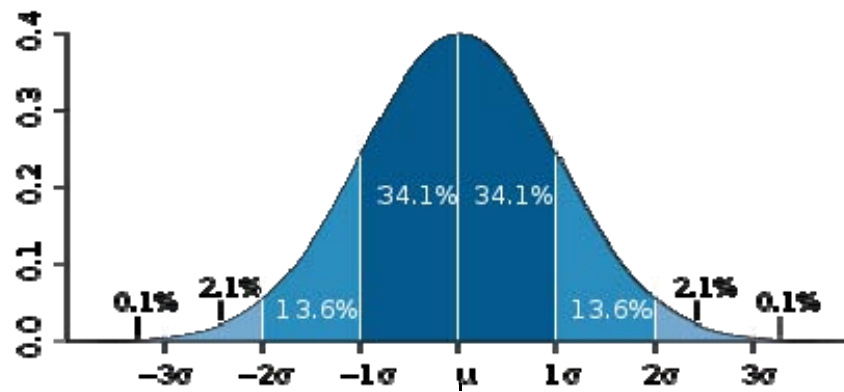


Table A2.5a Swamp Monitoring

Swamp Piezometers									
ASPECT	MONITORING				TRIGGER				
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING	PURPOSE
Piezometer Water Quality and Water Levels	Swamp 20, 21A, 24, 31 and 46	Field analysis: EC, pH, temp, Laboratory analysis: TDS, Na, K, Ca, Mg, F, Cl, SO ₄ , HCO ₃ , NO ₃ , Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Cs, Rb, Sr (filtered) Groundwater level using pressure transducer.	Field water quality <ul style="list-style-type: none"> monthly during LW11, 12, 15, 16, 19 or PE1 extraction where the swamp is being actively undermined; bi-monthly at all other times Laboratory analysis <ul style="list-style-type: none"> every 4 months during LW11, 12, 15, 16, 19 or PE1 extraction; every 6 months at all other times Water level – 1 hourly intervals for Swamp 20 during extraction of all workings. Conduct pre mining assessment in swamp piezometers prior to extracting Panels 11, 12, 15, 16, 19 and PE1. Conduct end of Panel / pillar extraction monitoring following full development of subsidence in each separate area of workings If NO trigger exceedances noted after 1 year following the development of full subsidence of an individual swamp, water quality monitoring can extend to <u>6 monthly</u> field and laboratory analysis and can cease at the end of extraction in the Project Area If NO trigger exceedances noted after 1 year following the development of full subsidence of an overlying swamp, water level monitoring will discontinue when Panels 11, 12, 15, 16, 19, PE1 are completed	To provide pre-mining baseline water quality and groundwater level data to compare with post-mining after completion of LW panels 11, 12, 15, 16 and 19 as well as PE1, and subsequently at the completion of all mining To identify physical and/or chemical water quality and water level impacts related to mining	Water Quality <u>2 std deviation</u> change*, or distinctive diversion over at least 2 months from baseline levels for pH, EC, Fe, Mn, Al, Zn and SO ₄ * see standard deviation explanation below.	<ul style="list-style-type: none"> Repeat water quality sampling of impacted piezometer if triggers exceeded, as required If trigger is exceeded for at least 4 months, engage hydrogeologist to investigate and report on any identified adverse changes to water level / water quality Inform SCA, DECCW & I&I NSW of investigation outcomes Investigation of possible mitigation measures in consultation with SCA / DECCW Prepare and implement a site mitigation/action plan in consultation with SCA / DECCW if appropriate Report in SMP / End of Panel reports to inform relevant agencies of results of monitoring 	NRE Wongawilli Colliery (Environmental Coordinator)	<ul style="list-style-type: none"> Investigation initiated within 1 week Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required Monthly updates of investigation progress, if required by SCA / DECCW EoP Report within 6 months of longwall 11, 12, 15, 16, 19 and PE1 completion 	Inform stakeholders of baseline assessment and monitoring Identify, investigate and report on impacts to groundwater quality and levels
					Water level <ul style="list-style-type: none"> notable continuous increase in rate of water level decline over a minimum 2 month period compared to baseline rate of decline, OR <ul style="list-style-type: none"> rapid water level reduction without subsequent recovery after sufficient rainfall recharge, compared to pre mining status over a minimum 2 month period 	<ul style="list-style-type: none"> Engage hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge Inform SCA, DECCW & I&I NSW of investigation outcomes Investigation of possible mitigation measures in consultation with SCA / DECCW Prepare and implement a site mitigation/action plan in consultation with SCA / DECCW if necessary Report in End of Panel reports ongoing to inform relevant agencies of results of monitoring 		<ul style="list-style-type: none"> Investigation initiated within 1 week Results of investigation reported to SCA, DECCW & I&I NSW within 1 week of completion Commence preparation of mitigation/action plan within 1 week if required EoP Report within 6 months of longwall / panel completion 	



Standard Deviation is typically defined as the average difference of the scores from the mean of distribution (i.e. how far they are away from the mean). As shown above a '2 standard deviation' (2 sd) equates to scores/results falling within 47.7% either side of the average. So, a 2 sd change is identified when the result falls outside this 95 percentile range.

Field water quality (pH, EC and Temp) and laboratory analyses as outlined in **Table A2.2d**, as well as swamp alluvium groundwater levels will be monitored at locations shown in **Table A2.5b** and as outlined in the TARP **Table A2.5a**. Water levels will be automatically monitored within installed piezometers at hourly intervals (Swamp 20) using pressure transducers and data loggers.

Table A2.5b Upland Swamp Piezometer Locations

SWAMP	IDENTIFIER	EAST	NORTH
Swamp 20	S20	291144	6187583
Swamp 21A	S21A	TBA	TBA
Swamp 24	S24	TBA	TBA
Swamp 46	S46	TBA	TBA

The monitoring interval and period will be determined on whether the individual monitoring location has not yet been undermined, is being actively undermined by a longwall or pillar extraction workings area, or has been undermined.

Note: the monitoring programme may require modification depending on the outcome and interpretation of ongoing monitoring in agreement with SCA and DECCW.

2.6. MONITORING OF SWAMPS AND DRAINAGE LINES

The application area consists of five (5) longwall mining blocks and one (1) pillar extraction block, that are located in an area supporting surface features such as ephemeral drainage depressions and swamps. Generally, these swamps are associated with the headwaters of a number of creeks within the application area.

Shallow aquifers have been identified associated with drainage lines and upland swamps in the area. Monitoring of groundwater is being conducted in upland swamps and associated drainage lines in the area shown in **Figure A2.6**. Surface monitoring of the drainage lines and swamps is outlined in **Table A2.6**.

The swamp monitoring is a detailed program that has been undertaken in a large number of swamps in the area in association with previously approved mining areas, since winter 2003. Swamp monitoring and Riparian zones monitoring for flora and fauna is expected to include vegetation transects, vegetation quadrats, amphibians and invertebrates in Swamps 20, 21A, 24 and 46. Further and continued monitoring of these features will be implemented and discussed within the appropriate annual reports.

It is recognised that the potential for timely and effective remediation may be limited due to terrain and related environmental conditions. There exists the potential to restrict or curtail mining in PE1 to reduce impacts on swamp 20. This as an option, will be considered upon the completion of LW's 11 and 12 and the related monitoring program.

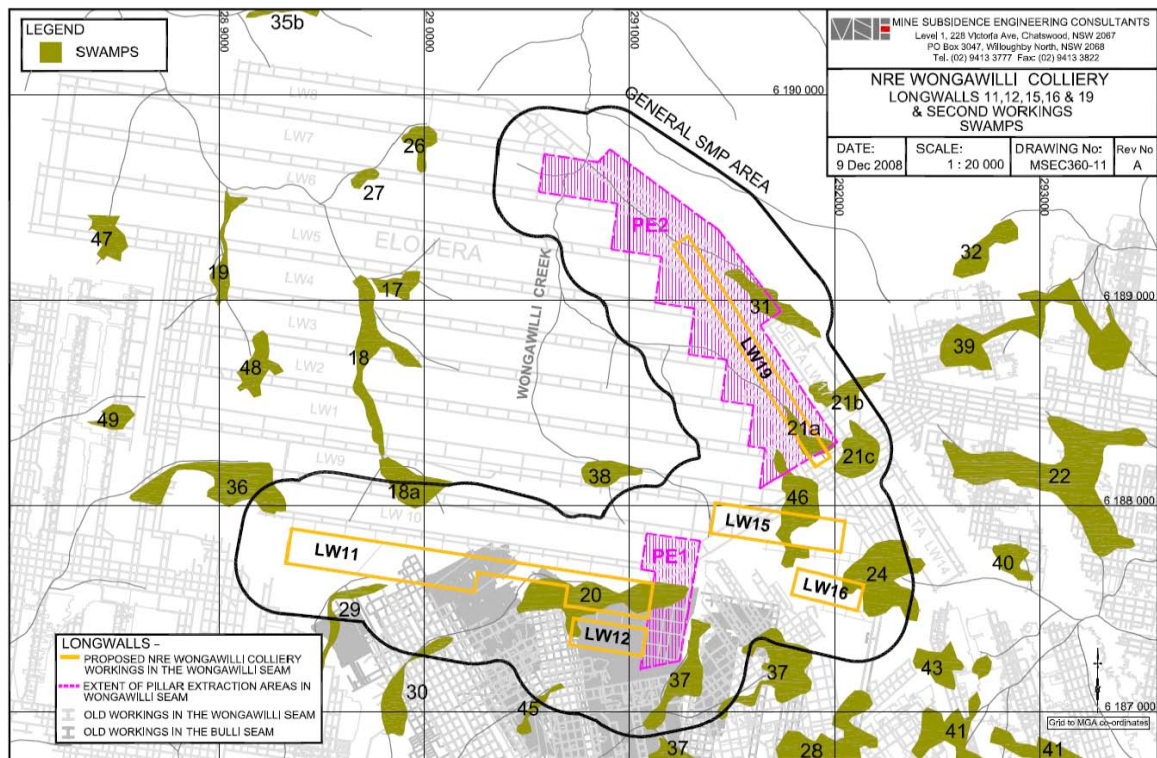
To further support swamp monitoring the installation of shallow piezometers in swamps 20, 21a, 24 and 46 will be undertaken subject to agreement with the land owner (SCA) and in consideration of environmental impacts that may occur with this programme. In addition to further enhance the data gathered on groundwater and potential impacts due to mining, a vibrating wire piezometer will be installed in the vicinity of PE1. The exact location and specific nature of this piezometer will be determined through direct discussion and consultation with the land owner (SCA) to ensure related environmental impacts are minimised.

Table A2.6 – Drainage Lines & Swamp Monitoring Program

Management Period	Monitoring Proposed	Trigger	Response
Note: Swamps to be monitored include #20, #21a, #24 and #46			
Baseline studies prior to mining	<ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Twice per year 	Documentation of pre-mining conditions	<ul style="list-style-type: none"> *Report to SCA *Additional studies as required
During mining (likely to be a small No. of observations)	<ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Bi monthly (Note: monitoring of swamps is also covered in section 2.2 relating to peizo's) 	*Minor cracking (<10mm)	<ul style="list-style-type: none"> *Report to SCA *Additional studies as required *Photographic record Review of swamp piezo data
		<ul style="list-style-type: none"> *Major cracking (>10mm) *Water loss *Flora/Fauna changes *Increased erosion 	<ul style="list-style-type: none"> *Notification to SCA *Remediation options developed in consultation with SCA, which may include further mining limitations *Proposal for rectification within one month *Completion of works following approval from SCA *Additional monitoring
Post mining	<ul style="list-style-type: none"> • Observation of swamp and drainage depressions including presence/absence of water • subsidence fracturing • changes in flora/fauna • Twice per year 	*Minor cracking (<10mm)	As above
		*Mitigation works unsuccessful	As above

If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA.

Figure A2.6 Swamp locations



2.7. MONITORING OF TERRESTRIAL FLORA AND FAUNA

Terrestrial flora and fauna assessments for the application area are largely habitat based assessments and follow the outline below:

- undertake threatened species database searches for a 10km radius of the study area;
- apply subsidence predictions to the study area noting sites or locations that may exhibit greater surface impacts;
- undertake a habitat level assessment and survey of the study area including detailed assessment of any area of habitat features that may exhibit surface impacts due to subsidence; and
- report conclusions of the study area and impact assessment.

Monitoring of terrestrial habitats and biota will be undertaken in the general area of mining extraction shown in **Figure A2.7**, where required. Observational assessment of the threatened species will specifically include, Little Johns Tree Frog, the Red-crowned Toadlet and the Giant Burrowing Frog. It is also expected that ridge tops monitoring will include vegetation quadrat surveys and invertebrates observations.

The monitoring of terrestrial flora and fauna is outlined in **Table A2.7**. Discussions will be included in annual reports.

Table A2.7 – Terrestrial Flora & Fauna Monitoring Program

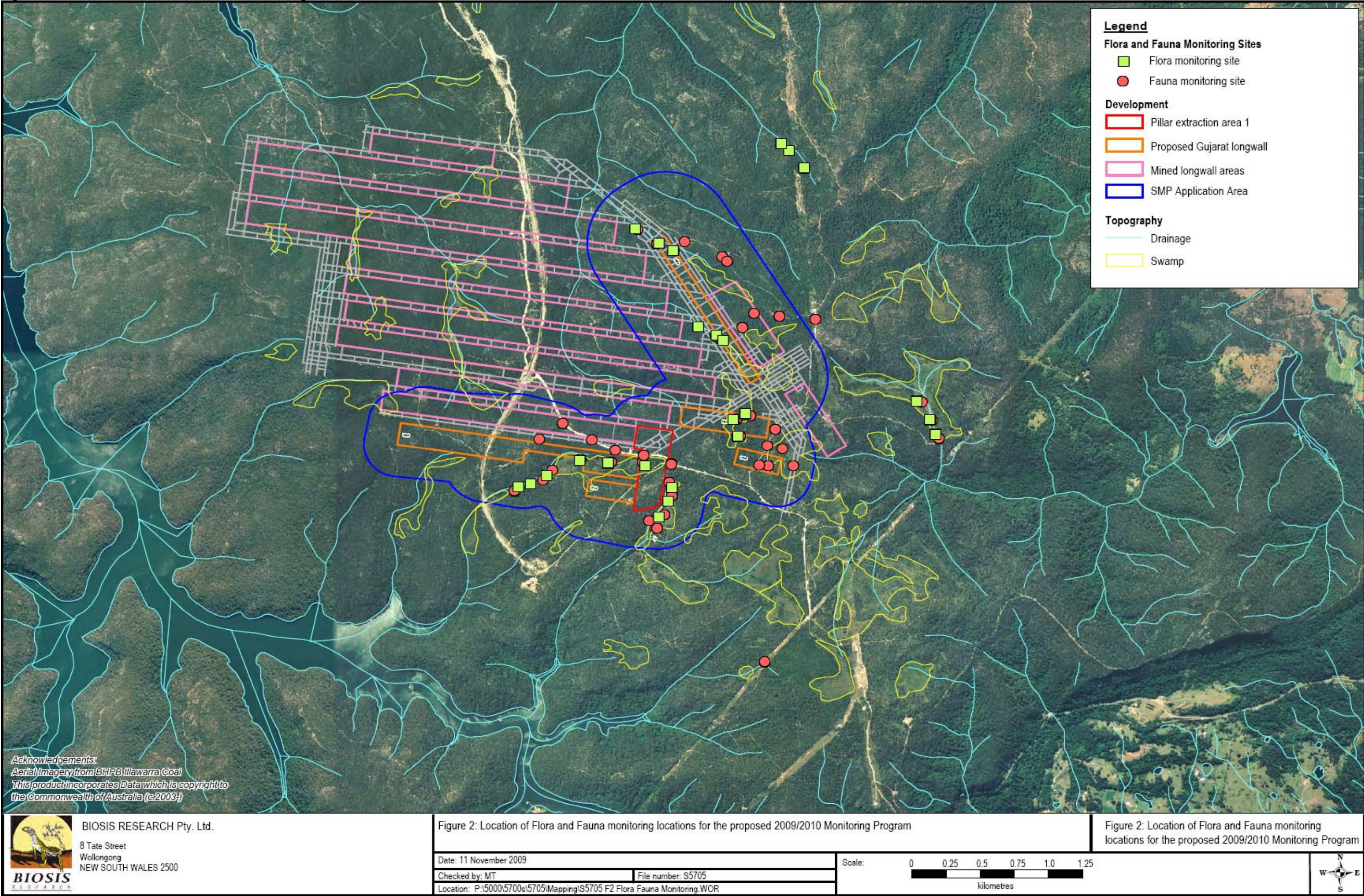
Management Period	Monitoring Proposed	Trigger	Response
Note: This monitoring program also includes threatened species as identified above.			
Baseline studies prior to mining	<ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Once prior to mining ▽ • Reported in SMP Reports 	Documentation of pre-mining conditions	Take into account impact assessment and SMP
During mining	<ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Bi-Annually during entire extraction period • Reported in AEMR 	Observation of mining related impacts to surface	Notification to SCA/NPWS within 24 hrs, using photographic record
		Major impacts to threatened species to include: <ul style="list-style-type: none"> • Their habitat; and/or • A decline in numbers from baseline; and/or • Change in species diversity. 	<ul style="list-style-type: none"> *Notification to SCA/NPWS immediately *Proposal for threatened species management within 1 week *Completion of management task following approval from SCA/NPWS *Additional monitoring
Post mining	<ul style="list-style-type: none"> • Observation of identified threatened species • Amphibian monitoring • Swamp and riparian vegetation monitoring • Ridge tops • Annually for 1 year post extraction period • Reported in AEMR 	As above	As above
		Management task unsuccessful	As above

▽ The southern coal field enquiry recommends that two years of baseline data be acquired, however, this is not available.
If impacts are identified, monitoring and mitigation will continue until determined unwarranted in consultation with SCA/NPWS.

2.8. MONITORING OF AQUATIC ECOLOGY

Monitoring of freshwater aquatic habitats and biota is undertaken within the general area of mining extraction. There is no substantial aquatic habitat in the vicinity of Longwall and Pillar Extraction mining areas that can be monitored on a meaningful basis. Observational monitoring of the area will include assessments of impacts to aquatic biota and habitat. This will be undertaken in accordance with the extensive water quality monitoring program as outlined above.

Figure A2.7 Aerial Plan of Flora and Fauna Monitoring Locations



Appendix 3

PUBLIC SAFETY MANAGEMENT PLAN

NRE Wongawilli Colliery

LW's 11, 12, 15, 16, 19 & PE1

The areas of significance, albeit low, identified to be impacted by mining within the approved mining area may include the following:

- Cliffs and Steep Slopes;
- Fire roads 4WD tracks; and
- Rocky outcrops and cuttings.

The monitoring of these key items will be undertaken as part of regular and routine assessments within the approved mining area. In the unlikely event that impacts are observed, the program will support development of any mitigation or rehabilitation plans required and should also include the following:

- Warning signs to be erected;
- Notify of any entry restrictions in consultation with key stakeholders;
- Unstable identified areas to be secured as appropriate; and
- Timely notification of mining to the community and key stakeholders where management of public safety is required.

Table A3.0 – Public Safety Monitoring Program

Management Period	Monitoring Proposed	Trigger	Response
Baseline studies prior to mining	<ul style="list-style-type: none"> • Observation of: <ul style="list-style-type: none"> – Cliffs and steep slopes; – Fire roads; – 4WD tracks; – Rocky outcrops and cuttings • Once prior to mining • Reported in SMP Reports 	Documentation of pre-mining conditions	Report condition to SCA
During mining	<ul style="list-style-type: none"> • Observations as above • Fortnightly during extraction • Reported in AEMR 	Minor cracking (<10mm)	Notification to SCA within 24 hrs, using photographic record
		Major cracking, noticeable instability or traffic impedance (>10mm)	<ul style="list-style-type: none"> *Notification to SCA immediately *Make area safe as soon as practicable *Proposal for rectification within 1 week *Completion of works following approval from SCA *Additional monitoring
Post mining	<ul style="list-style-type: none"> • Observations as above • Monthly following mining for 6 months • Reported in AEMR 	Minor cracking (<10mm)	As above
		Mitigation works unsuccessful	As above

Note: The land potentially impacted by LW's 11, 12, 15, 16, 19 and PE1 does not contain any houses or buildings.