

NRE Wongawilli Colliery Nebo Longwalls N1-N6

SUBSIDENCE MONITORING PLAN





GUJARAT NRE Wonga Pty Ltd
NRE Wongawilli Colliery

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GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
NRE	Gujarat NRE Wonga Pty Ltd
DoPI	Department of Planning & Infrastructure
DRE	Division of Resources and Energy
ROM	Run of Mine
Mtpa	Million tonnes per annum
OEH	Office of Environment and Heritage
SCA	Sydney Catchment Authority
AHD	Australian Height Datum
DSC	Dam Safety Committee
SMP	Subsidence Management Plan



1 INTRODUCTION

1.1 Project Background

Gujarat NRE Wonga Pty Ltd (NRE) owns NRE Wongawilli Colliery, an underground longwall extraction mine that commenced operations in 1912. Currently, the Colliery is operated by Gujarat NRE Coking Coal Ltd and is capable of producing approximately 2Mtpa of predominately coking coal from the Wongawilli seam.

NRE received Project Approval of the Part3A Project Application MP 09_0161 on 2 November 20011 from the Department of Planning and Infrastructure for longwall extraction mining activities within Longwalls N1 to N6. NRE intends to extract coal from Longwalls N1 to N6 within the General Application Area (**Figure 1**).

The longwalls are wholly contained within the Sydney Catchment Authority (SCA) controlled Metropolitan Special Area, which is used to provide drinking water to Sydney and Wollongong. Longwall N3 is partially located within the Dam Safety Committee (DSC) Notification Area for Cordeaux reservoir. The extraction is located >500m from the full supply level of the reservoir and no complications are anticipated. NRE recieved endorsement from the DSC and has been issued conditions regarding the extraction of Longwall N3 within the DSC Notification Area.

1.2 Purpose and Scope

This monitoring plan details the monitoring to be undertaken of subsidence effects, subsidence impacts and environmental consequences from the extraction of Longwalls N1- N6 in the Nebo area. It also details the actions required to ensure that the appropriate responses to the monitoring results are implemented.

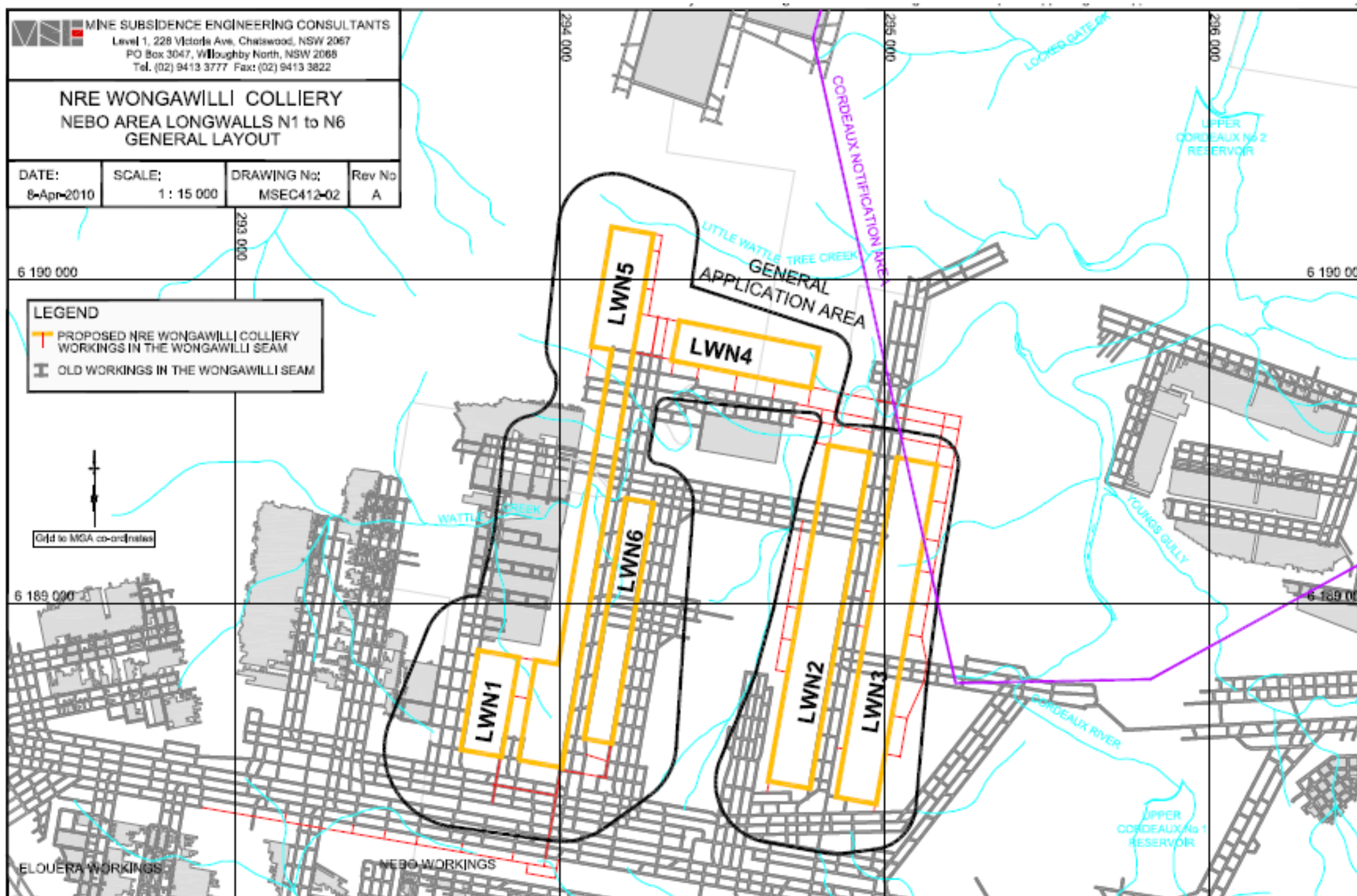
The purpose of this Plan is to:

- Provide data to assist with the management of the risks associated with subsidence, conventional or un-conventional.
- Validate the subsidence predications.
- Analyse the relationship between predicted and resulting subsidence effects and environmental consequences.
- Inform the Contingency Plan and adaptive management process.

The plan is applicable to all surface features that may be affected by mine subsidence due to the extraction of Longwalls N1 to N6, defined as the General Application Area in the Nebo Longwalls N1-N6 Subsidence Management Plan (**Figure 1**).

A summary of the monitoring of environmental consequences is included in this Plan, however further details are provided in the specific sub plans relevant to that feature within the Nebo Longwalls N1-N6 Extraction Plan.

Figure 1 –Nebo Area Longwalls N1 to N6 General Layout





1.3 Distribution

Copies of this Plan will be distributed to:

- Division of Mineral Resources (DRE)
- Sydney Catchment Authority (SCA)
- Office of Environment and Heritage (OEH)
- Department of Planning and Infrastructure (DoPI)
- NSW Office of Water (NOW)
- Wollongong City Council (WCC)

NRE will make this Plan publicly available on the NRE website and will be responsible for its maintenance. A hard copy will also be kept at the Wongawilli Colliery.

Any revisions undertaken will be the responsibility of NRE and any notifications sent accordingly. NRE will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on NRE's computer system, website, and hard copy at the Wongawilli Colliery.

1.4 Report Structure

The remainder of this Management Plan is structured as follows:

- Section 2:** Outlines the statutory requirements applicable to the Plan.
- Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.
- Section 4:** Details the performance measures and indicators that will be used to assess the Project.
- Section 5:** Describes the monitoring program.
- Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.
- Section 7:** Describes the protocols for the handling of incidents, complaints and non-conformances
- Section 8:** Details how the Plan will be implemented, managed, reviewed and updated and managed.



2 STATUTORY REQUIREMENTS

2.1 Approval

On 2 November 2011, NRE was granted Project Approval by the NSW Minister for Planning and Infrastructure under Section 75J of the *Environmental Planning & Assessment Act 1979 (EP&A Act)* to continue mining its operations at the Wongawilli Colliery.

Condition 7, Schedule 3 of the Project Approval requires the preparation of a Subsidence Monitoring Plan as a component of an Extraction Plan for second workings. Approval condition 7(h) states:

Extraction Plan

7. The Proponent shall prepare and implement an Extraction Plan for any second workings on site, to the satisfaction of the Director General. The plan must:

...
(h) include the following to the satisfaction of DRE:
...

- *A Subsidence Monitoring Program to:*
 - *provide data to assist with the management of the risks associated with subsidence;*
 - *validate the subsidence predictions;*
 - *monitor the integrity of the overlying strata, particularly the Cordeaux Crinanite; and*
 - *analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and*
 - *Inform the contingency plan and adaptive management process;*

In addition, **Condition 2, Schedule 6** of the Project Approval outlines the requirements that are applicable to the preparation and performance of this Management Plan. **Table 2.1** indicates where each component of the condition is addressed within this Plan.

Table 2.1 – Management Plan Requirements

Project Approval Condition	Plan Section
Condition 2, Schedule 6	
The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3
(b) a description of:	
• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 2
• any relevant limits or performance measures/criteria;	Section 4
• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 4
(c) a description of the measures that would be implemented to comply with	



Project Approval Condition	Plan Section
the relevant statutory requirements, limits, or performance measures/criteria;	Section 6
(d) a program to monitor and report on the: - impacts and environmental performance of the project; - effectiveness of any management measures (see c above);	Section 5
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.3
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 8
(g) a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and	Section 7
(h) a protocol for periodic review of the plan.	Section 8

2.2 Licences and Leases

In addition to the requirements of the Project Approval and the SMP Approval, all activities at or in association with the Gujarat NRE Wongawilli Colliery will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

Table 2.2 - Licences, Permits and Leases

Licence/Approval	Document No.	Issue Date/Expiry Date
Consolidated Coal Lease	766	27/6/2005 – 9/10/2015
Mining Lease	1596	3/2/2012 – 7/10/2029
Mining Lease	1565	2/8/2006 – 9/10/2015
EPA Licence Wongawilli Colliery	1086	Current
EPA License Avondale Colliery	12442	Current
Mining Operations Plan (MOP)		01/9/2011 – 30/9/2013
Water Extraction License	10BL602990	16/1/13 -

2.3 Relevant Legislation and Guidelines

NRE will conduct the Project consistent with the SMP Approval conditions and any other legislation that is applicable. The following Acts may be applicable to the conduct of the Project:

- *Mining Act, 1992*



-
- *Contaminated Land Management Act, 1997*
 - *Dangerous Goods Act, 1975*
 - *Noxious Weeds Act, 1993*
 - *Road and Rail Transport (Dangerous Goods) Act, 1997*
 - *Roads Act, 1993*
 - *Protection of the Environment Operations Act, 1997*
 - *Threatened Species Conservation Act, 1995*
 - *Sydney Water Catchment Management Act, 1998*
 - *Coal Mine Health and Safety Act, 2002*
 - *Crown Lands Act, 1989*
 - *Dams Safety Act, 1978*
 - *Energy and Utilities Administration Act, 1987*
 - *Fisheries Management Act, 1994*
 - *Water Act, 1912*
 - *Water Management Act, 2000.*

Relevant licences or approvals required under these Acts will be obtained as required.



3 IMPACT ASSESSMENT

3.1 Baseline Data

Details of the existing surface features within the General Application Area are provided in the Nebo Longwalls N1-N6 Extraction Plan (NRE, 2012) and the Nebo Area Environmental Assessment (ERM, 2010).

The surface land overlying the proposed extraction area lies wholly within crown land, declared as a Special Area which is controlled by the SCA. The surface topography comprises of steep to very steep ridges, plateaus, gently undulating crests and sandstone gorges incised by the deep valleys of tributaries to Cordeaux Dam. All streams and drainage are directed towards Cordeaux Dam, via Wattle Creek, Little Wattle Tree Creek and their tributaries. Surface elevations range from 370 m to 500 m AHD.

Known surface, natural and man-made features in the Study Area which may experience subsidence effects or impacts (or outside the Study Area but which may experience far-field subsidence effects) are:

- Declared Special Metropolitan Catchment lands controlled and managed by SCA
- Creeks and Streams (Wattle Creek and Little Wattle Tree Creek)
- Groundwater resources
- Upland swamps (Swamps 39 and 22)
- Threatened and protected species
- Natural vegetation
- Cliffs and steep slopes
- Heritage sites
- Roads (dirt roads and fire trails)
- Electricity transmission lines
- Exploration boreholes
- Survey control marks.
- Upper Cordeaux reservoirs No.1 and No.2 (dam walls and water levels)

The Study Area is not in an MSB Subsidence Area. Further, as all of the land is within the Special Area there are no known Public Amenities; Farm Lands/Facilities; Industrial/Commercial/Business Establishments; or Residential establishments within the Study Area.

3.2 Potential Impacts

Both the Nebo Longwalls N1-N6 Extraction Plan (NRE 2012) and the Nebo Area Environmental Assessment (ERM 2010) provide the predicted subsidence effects and subsidence impacts from the proposed mining on these features for the SMP application.

The Nebo Longwalls N1-N6 Extraction Plan (NRE 2012) also provides details of the proposed monitoring, mitigation and management measures to be employed by the Colliery to manage subsidence impacts.



3.2.1 Risk Assessments

Risk Assessments have been undertaken to determine key potential impacts from the extraction of Nebo Longwalls N1 to N6. The results of these assessments as relevant to the extraction of Longwalls N1 to N6 are presented below. The results of these Risk Assessments and supporting investigations by specialist consultants have informed the level of monitoring proposed in this Monitoring Plan.

Olsen Environmental Consulting. March 2010. Nebo Longwalls Wongawilli Colliery. Failure Mode and Effects Analysis Report.

This Assessment was undertaken using the Failure Mode and Risk and Effect Analysis (FMEA) which is a recognised methodology described in the NSW Department of Primary Industries document MDG 1010, *"Risk Management Handbook for the Mining Industry"*.

The primary objectives of the FMEA were to identify:

- Environmental effects that would require additional study in order to quantify and minimise potential impact; and
- Any relevant environmental effects that had not as yet been considered in the FMEA process.

The full risk assessment (the FMEA Report) is provided in *Annex C* of the Nebo Area Environmental Assessment (ERM 2010). A summary of the results of this risk assessment is provided in **Table 3.1** (it is noted that no failure mode received a risk ranking higher than Low-Medium during this process).



Table 3.1 - LW's N1-N6 Risk Assessment (FMEA)

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Level of Assessment
Landform and Topography		Alterations to landform from subsidence	Low	As no major changes in landform or topography are predicted no action is required
Land Use		Changes to land use	Low	As the Project does not involve any changes to land use no action is required
Subsidence		Vertical subsidence of ground surface, ground tilts and strains and non conventional subsidence effects, with associated environmental impacts	Low	A subsidence report including predictions of likely subsidence effects include ground surface, ground tilts and strains and non conventional subsidence effects will be prepared
Infrastructure	Subsidence Impacts	Disruptions / impacts on electrical transmission lines and fire trails above the mining area.	Low	Standard monitoring and management practices will be implemented. Management plans will be prepared in consultation with infrastructure owners.
Surface Water		Effects on volumetric stream flow into Upper Cordeaux No. 2 Dam.	Low	A surface water assessment will be prepared. Implement a subsidence monitoring plan to confirm subsidence predictions. Develop response if required.
		Stream water quality adversely affected.		
		Stream connectivity interrupted due to subsidence.		
		Integrity of pools interrupted due to mine subsidence		
Groundwater	Underground Operations	Adverse effects on stream flow due to loss of shallow groundwater seepage	Low	Undertake groundwater impact assessment to understand effects. Subsidence monitoring to confirm predictions.
		Adverse effect on main stream flow out of area due to loss of groundwater		
	Mine Water Management	Additional groundwater inflow into mine workings		Monitor groundwater inflow
Air Quality		Adverse impacts of dust on surrounding residences	Medium	Quantify existing air quality and proposed Project emissions. Predict future dust levels at sensitive receivers by air dispersion modelling. Assess acceptability of predicted particulate matter concentrations.



				Identify any additional management, mitigation and monitoring measures required.
Greenhouse Gas		GHG emissions level 1,2 and 3 to be considered	Medium	Calculate Scope 1, 2 and 3 GHG emissions. Impact assessment. Identify GHG reduction and energy conservation measures.
Acoustics	Operational Noise	Noise levels at sensitive receivers near the Wongawilli Site	Medium	Undertake an acoustic impact assessment to understand the level of noise generated by the proposed surface operations at the Wongawilli pit top. Assessment to be based on the INP to produce noise contours and develop appropriate mitigation measures.
		Train traffic noise levels at residences surrounding the site and haul route.	Medium	Calculate train noise levels at residences near the haul route. Assess predicted noise levels against DECCW guidelines. Identify any additional management, mitigation and monitoring measures required.
Ecology	Aquatic Ecology	Adverse impact on aquatic species including the Threatened Species potentially occurring in the area (Macquarie Perch, Adams Emerald Dragonfly and Sydney Hawk Dragonfly) due to subsidence impacts on streams, creeks and dams.	Low	An assessment will be prepared to determine impacts on aquatic habitat in the Nebo area. Subsidence monitoring during mining to confirm subsidence predictions.
	Terrestrial Ecology	Damage due to the vegetation community, identified as an Upland Swamp – sedgeland/heathland community located southwest of the Nebo area, through water loss as a result of mining induced subsidence	Low	An assessment will be undertaken to determine the impact on threatened flora and fauna. Subsidence monitoring during mining to confirm minimum subsidence predictions.
		Damage to threatened fauna and flora species that have been identified in the area (including Rosenberg's Goanna, Koala, Powerful Owl, Emu Wren and the Giant Dragonfly). POTENTIAL damage includes such things as death of individuals, loss of communities, loss of roost sites and loss of breeding habitat.		
Aboriginal Heritage		Impacts to Aboriginal heritage items or values as a result of subsidence	Low	An assessment will be undertaken to determine the impact on Aboriginal heritage items. Subsidence monitoring to confirm predictions.



Non-indigenous heritage	Impacts to heritage values of heritage listed items and potential heritage items at the Wongawilli pit top	Low	The proposed works will not impact on non-indigenous heritage. No monitoring is required.
Traffic and Transport	Impacts on the safety and capacity of the surrounding rail and road networks due to transport and vehicle movement	Low	The proposed works will not increase traffic and transport. The existing situation will be documented.
Visual	Adverse impact on visual amenity of sensitive receivers	Low	No new above ground structures will be constructed. There will be no change to the visual environment; therefore detailed assessment is not required.
Waste Management	Continued general waste generation and increased waste rock generation	Low	Standard waste management practices will be implemented. This EA will assess the effectiveness of waste rock disposal methods.
Socio-economic Considerations	Social and economic benefits to the local and regional community and government through employment and revenue generation.	Low (beneficial)	The Project will have a positive economic impact on the local community. Ongoing community liaison through established processes of regular meetings and distribution of newsletters.
	Adverse impacts to amenity of nearby residents.	Low	Mitigation measures provided in this report will be implemented to reduce adverse impacts on residents' amenity.

4. PERFORMANCE MEASURES AND CRITERIA

Performance Criteria for the purposes of this Monitoring Plan are set out in **Condition 1 & 4, Schedule 3** of the Project Approval and are replicated in **Table 4.1**.

NRE will also monitor if the recorded subsidence impacts have the predicted environmental consequences. A summary of this monitoring is provided in **Table 5.2** and detailed in **Appendix A**.

Table 4.1 provides the Performance Criteria for the project.

Table 4.1 - Subsidence Impact Performance Criteria

Aspect	Performance Measure
Water Resources	
Catchment yield to the Upper Cordeaux Reservoirs (No. 1 and No. 2) and Avon Reservoir	Negligible reduction to the quality or quantity of water resources reaching the reservoirs No connective cracking between the surface and the mine
Upper Cordeaux Reservoirs (No. 1 and No. 2) and Avon Reservoir	Negligible leakage from the reservoirs Negligible reduction in the water quality of reservoirs
Watercourses	
Wattle Creek, Little Wattle Tree Creek, Cordeaux River, Gallaghers Creek	Negligible environmental consequences, including: • <i>negligible</i> diversion of flows or changes in the natural drainage behaviour of pools; • <i>negligible</i> gas releases and iron staining; and • <i>negligible</i> increase in water cloudiness
Other watercourses	No greater subsidence impact or environmental consequences than predicted in the EA
Upland Swamps (No. 22 and No. 3)	Negligible environmental consequences including: • <i>negligible</i> change in the size of swamps; • <i>negligible</i> change in the functioning of swamps; • <i>negligible</i> change to the composition or distribution of species within swamps; and • <i>negligible</i> drainage of water from swamps. Or redistribution of water within swamps.
Land	
Illawarra Escarpment State Conservation Area, Metropolitan Special Area	Negligible environmental consequences
Cliffs	Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within the longwall mining area)
Biodiversity	
Threatened species, threatened	Negligible environmental consequences



populations, or endangered ecological communities	
Heritage Features	
Aboriginal heritage sites	Negligible impact or environmental consequences
Non-Aboriginal heritage sites (including 'Historic 1', 'Historic 2' and 'Historic 3')	Negligible loss of heritage value
Built Features	
Key public infrastructure; including SCA infrastructure (Avon Dam, Upper Cordeaux No. 1 and No. 2 dams, water supply pipelines), high pressure gas pipelines, electricity transmission lines, fibre optic networks	Always safe and serviceable Damage that does not affect safety or serviceability must be fully repairable, and must be repaired.
Gas distribution pipelines, electricity distribution lines, roads, fire trails, other public infrastructure, other built features	Always safe Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be repairable, and must be fully repaired or else replaced or fully compensated.
Public Safety	
Public safety	No additional risk

Specific performance criteria relating to environmental consequences are detailed in the appropriate Management Plan for that surface feature. In addition to this Monitoring Plan, the following Management Plans have been prepared in support of the SMP for Nebo Longwalls N1-N6.

- Water Management Plan
- Biodiversity Management Plan
- Heritage Management Plan
- Built Features Management Plan
- Public Safety Management Plan
- Land Management Plan
- Electricity Transmission Lines Management Plan

Environmental management will be undertaken in accordance with the process described in **Figure 2**.

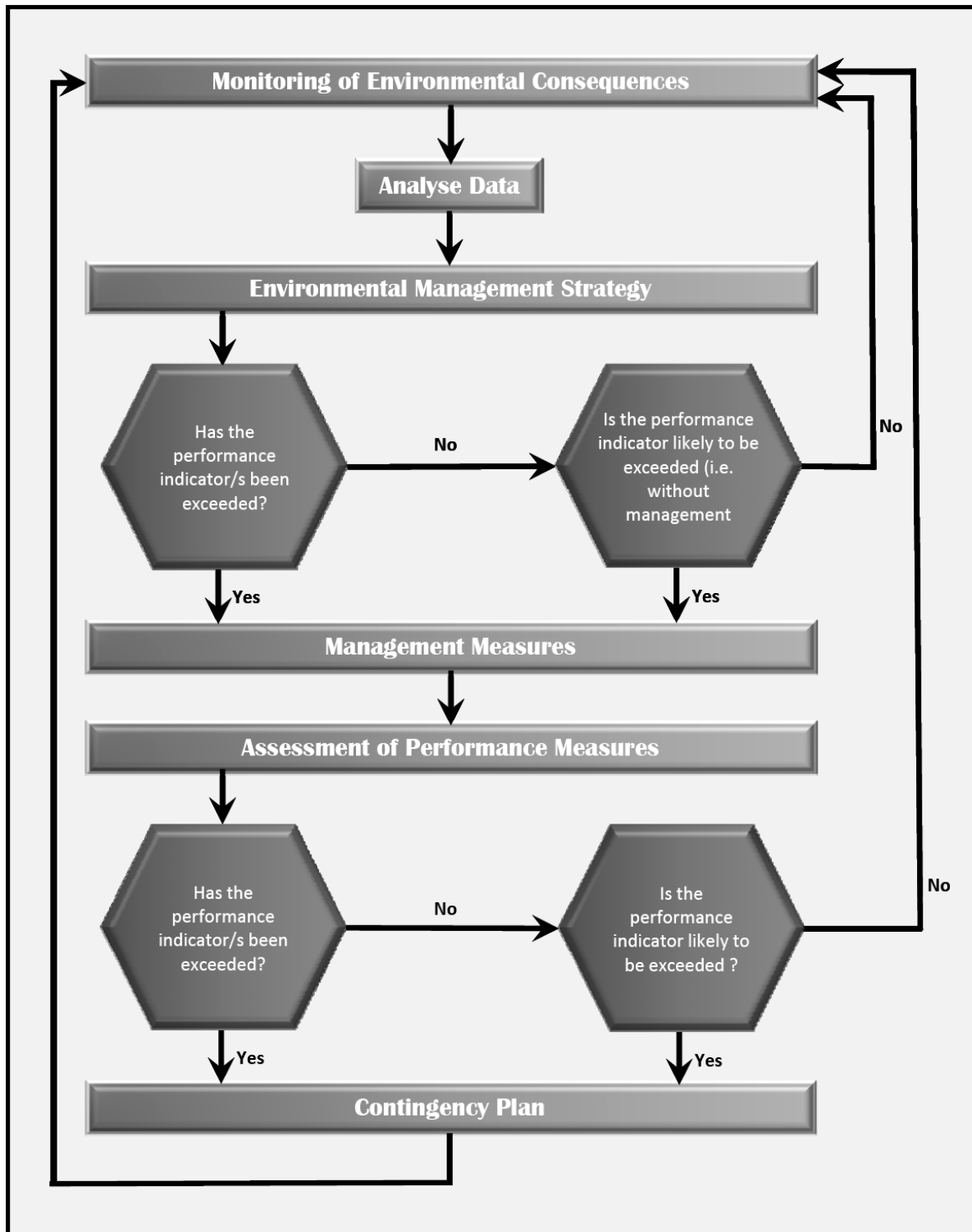


Figure 2 – Environmental Management Process



5 MONITORING AND REPORTING

5.1 Overview

The subsidence monitoring program consists of subsidence survey monitoring to quantify subsidence parameters and subsidence impact monitoring to monitor and identify subsidence impacts to sensitive surface features.

Table 5.1 outlines the nature and frequency of monitoring and the actions proposed to manage impacts due to the extraction of Nebo Longwalls N1- N6. A Monitoring Plan, in the form of a TARP, is attached as **Appendix A**. Plans showing the monitoring locations are provided in **Appendix B**. An outline of the monitoring methods and accuracy is provided in **Appendix C** in accordance with **Schedule 2 Condition 12** of the SMP approval.

During the completion of this revision, Subsidence Lines NM1 and NM4 have not been installed. Subsidence Line locations have been inspected and lines will be installed as shown in **Appendix B** with high confidence of little variation.

5.2 Subsidence Monitoring

Subsidence monitoring lines will be established across the surface of Longwalls N1 to N6 to enable comparison with predicted subsidence parameters. Subsidence monitoring line locations are shown on **WON-01-0583 Rev0** in **Appendix B**.

Surveys will be undertaken in accordance with the survey standards indicated in **Table 5.1**. The survey standards, detailing the methods and accuracy for subsidence monitoring are detailed in **Appendix C**. Measurements will be undertaken using a Trimble S8 Total Station (or equivalent) with a stated accuracy of 1mm plus ppm for distance measurement and 1" of arc for angular measurement.

Monitoring of far-field subsidence associated with secondary extraction will also be undertaken. NRE will develop a program to investigate the occurrence and nature of far-field effects in the locality. Initially, far-field survey marks will be installed at the locations as shown on **WON-01-0583 Rev0** in **Appendix B** and in accordance with the survey standards as indicated in **Table 5.1**.



Table 5.1 - Subsidence Monitoring and Management

Management Period	Monitoring Proposed	Trigger	Response
Subsidence Monitoring Line NM1			
Baseline studies prior to mining	• 2D survey once prior to extraction of Longwall N4 or N5 2D Level Accuracy: +/- 5 mm • 3D survey once prior to extraction of Longwall N4 or N5 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: - o NRE; and - o Principal Subsidence Engineer – DRE
During mining	• Vehicle based visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5. •	• No observable surface deformations • Surface cracking <10 mm	• Document and Report in: - o Status Reports - o End of Panel Reports
	• Vehicle based visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5	• Observable surface deformations • Major surface cracking (>10mm)	• Notify Principal Subsidence Engineer – DRE and DoPI • Undertake 2D survey within 2 weeks and review against predictions • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Review mining options
Post mining	• 2D survey at the completion of extraction of each Longwall N4 and N5 2D Level Accuracy: +/- 5 mm • 3D survey at the completion of extraction of each Longwall N4 and N5. 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Check against subsidence predictions to enable ongoing modelling of predictions	• Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.



Management Period	Monitoring Proposed	Trigger	Response
<i>Subsidence Monitoring Lines NM2 and NM3</i>			
Baseline studies prior to mining	• 2D survey once prior to extraction of Longwalls N2 or N3 2D Level Accuracy: +/- 5 mm • 3D survey once prior to extraction of Longwall N2 or N3 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: - o NRE; and - o Principal Subsidence Engineer – DRE
During mining	• Vehicle based visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5	• No observable surface deformations • Surface cracking <10 mm	• Document and Report in: - o Status Reports - o End of Panel Reports
	• Vehicle based visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5	• Observable surface deformations • Major surface cracking (>10mm)	• Notify Principal Subsidence Engineer – DRE and DoPI • Undertake 2D survey within 2 weeks and review against predictions • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Review mining options
Post mining	• 2D survey at the completion of extraction of each Longwall N2 and N3 2D Level Accuracy: +/- 5 mm • 3D survey at the completion of extraction of each Longwall N2 and N3 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Check against subsidence predictions to enable ongoing modelling of predictions	• Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.



Management Period	Monitoring Proposed	Trigger	Response
<i>Subsidence Monitoring Line NM4</i>			
Baseline studies prior to mining	• 2D survey once prior to extraction of Longwall N1, N5 or N6 2D Level Accuracy: +/- 5 mm • 3D survey once prior to extraction of Longwall N1, N5 or N6 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: - o NRE; and - o Principal Subsidence Engineer – DRE
During mining	• Walk in visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5	• No observable surface deformations • Surface cracking <10 mm	• Document and Report in: - o Status Reports - o End of Panel Reports
	• Walk in visual observational monitoring of subsidence line fortnightly during extraction of Longwall N4 and N5	• Observable surface deformations • Major surface cracking (>10mm)	• Notify Principal Subsidence Engineer – DRE and DoPI • Undertake 2D survey within 2 weeks and review against predictions • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Review mining options
Post mining	• 2D survey at the completion of extraction of each Longwall N1, N5 and N6 2D Level Accuracy: +/- 5 mm • 3D survey at the completion of extraction of each Longwall N1, N5 and N6 3D Level Accuracy: +/- 5 mm 3D Position Accuracy: +/- 50 mm	• Check against subsidence predictions to enable ongoing modelling of predictions	• Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.



Management Period	Monitoring Proposed	Trigger	Response
Regional 3D Points			
Baseline Studies	3D point survey prior to longwall extraction in the approved area 3D Level Accuracy: +/- 25 mm 3D Position Accuracy: +/- 35 mm	Documentation of pre-mining conditions	- Within 48hrs following collection of data, document and report to: - NRE; and - Principal Subsidence Engineer – DRE
Post Mining	3D point survey; at the completion of extraction for each longwall <u>3D Position Accuracy:</u> +/- 25 mm <u>3D Level Accuracy:</u> +/- 35 mm	Check against subsidence predictions to enable ongoing modelling of predictions	- Undertake survey and review against predictions; - Document actual movement against predictions; - Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data - Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.



5.3 Subsidence Impact Monitoring

Subsidence impact monitoring of sensitive surface features is described in **Table 5.2**. A Monitoring Plan, in the form of a TARP, is attached as **Appendix A**. All subsidence impact monitoring is detailed in the relevant Management Plans:

- Built Features Management Plan
- Public Safety Management Plan
- Water Management Plan
- Biodiversity Management Plan
- Land Management Plan
- Heritage Management Plan

5.4 Reporting

Results of monitoring activities will be reported to NRE's Environment & Community Department on a regular basis during active mining to ensure that any remedial actions can be taken as soon as possible after an impact is identified and confirmed which may affect public safety.

NRE will prepare and maintain a Subsidence Status Report and submit and publish End of Panel Reports in accordance with **Condition 17, 18 and 19, Schedule 2** of the Nebo Longwalls N1-N6 SMP Approval. Reporting will be also made available in accordance with the requirements of **Condition 7, Schedule 6** of the Project Approval



Table 5.2 - Subsidence Impact Monitoring and Management

Aspect/Feature	Monitoring Frequency	Monitoring Measures
Built Features		
Upper Cordeaux 1 and 2 Dam Walls	Once prior to extraction, 6-monthly during extraction and once annually post extraction.	Visual inspections, along with subsidence surveys completed by SCA to monitor level of subsidence impact on dam walls due to longwall extraction.
Cordeaux Reservoir Stored Waters	6-monthly surveys prior, during and post extraction (for 1 year).	Surveys of lake foreshore for changes in water level due to longwall extraction completed by SCA.
33 kV Transmission Lines	Once prior to extraction, fortnightly during extraction and once post extraction. (Weekly visual inspection of transmission poles, line and easement during extraction when Avon Dam supply level below gravity feed operation)	Tower position and condition surveyed prior to extraction and then vehicle based visual observation by NRE for subsidence impact during longwall extraction. Survey post extraction.
Fire Roads and 4wd Tracks	Once prior to extraction, fortnightly during extraction and monthly post extraction for 6 months.	Vehicle based visual observation or road and track conditions for damage due to longwall extraction.
Public Safety		
Condition of rock outcrops, steep slopes, Fire Roads and 4wd Tracks	Once prior to extraction, fortnightly during extraction and monthly post extraction (for 6 months).	Vehicle based visual observation for safe condition of surface features during longwall extraction
Water Management		
Rainfall	Daily	Monitoring for analysis of rainfall-runoff relationship
Stream Water Quality	- Monthly for 2 months prior to extraction - Weekly during active undermining of stream channel. - Monthly during longwall extraction 2-monthly post longwall extraction (for 1 year)	Field, laboratory and photo point analysis of stream water quality at Sites WC1, WC2, WC3, WC4 and LWTC1. Trigger levels have been determined by baseline site monitoring and in accordance with the ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Implementation of TARP for observations outside of the trigger levels.
Stream Flow – Automated Water Level	6-hourly, with 2-monthly downloads of stream level prior to extraction 1-hourly, with weekly downloads of stream level at WC1, WC2 and WC3 for 1 month before & after Longwall N5 undermines Wattle Creek 2-hourly, with 2-monthly downloads of stream level post extraction (for 1 year)	Automated stream level monitoring at Sites WC1, WC2, WC3, WC4 and LWTC1.
Stream Flow – Standing Water Level	2-monthly monitoring - Weekly at WC1, WC2 and WC3 for 1 month before & after Longwall N5 undermines Wattle Creek	Manual measures against surveyed benchmark at sites WC1, WC2, WC3, WC4 and LWTC1



Stream Flow – Flow	• 2-monthly monitoring • 1-monthly during Longwall N5 extraction (for 1 year)	Manual measurement of stream flow at Sites WC1 and WC3
Flooding	• Monthly for 2 months prior to extraction • Weekly during extraction of Longwall N5 • 2-monthly post extraction (for 1 year)	Photo point monitoring of Wattle Creek and Little Wattle Tree Creek.
Erosion of Stream Bed and Banks	• Monthly for 2 months prior to extraction • Monthly during extraction of Longwall N5 • 2-monthly post extraction (for 1 year)	Photo point monitoring of Wattle Creek and Little Wattle Tree Creek.
Groundwater Quality	• 2-monthly field sampling and 4-monthly laboratory sampling prior to and post extraction • 1-monthly field sampling and 2-monthly laboratory sampling during extraction	Field and laboratory analysis of groundwater quality at Sites Nebo 1S, 1D, 2S, 2D, 3 and 4. Trigger levels have been determined by baseline site monitoring. Implementation of TARP for observations outside of the trigger levels.
Groundwater Level	• 12-hourly, with 2-monthly downloads and dip meter prior and post extraction (until mining in Nebo complete) • 12-hourly, with monthly downloads and dip meter during extraction.	Vibrating wire and open standpipe piezometers at Sites Nebo 6, 7, 8, 8A, WW11, WW20B. Dip meter in all standpipe groundwater monitoring sites.
Inflow / Hydraulic Connectivity into Mine Workings	Daily of inflow and discharge, with water quality analysis of any anomalous inflow	Monitoring of pump out rates from active longwall extraction area.
Biodiversity Management		
Aquatic Ecology	Seasonal sampling undertaken in Autumn and Spring prior to and during extraction. Seasonal monitoring to continue for a minimum of 1 year post extraction. Water quality monitoring monitored as per Water Management Plan	AUSRIVAS macroinvertebrate sampling of impact and reference sites. Establishment of pre extraction habitat condition and species number/composition. Comparison of survey results during extraction to baseline.
Terrestrial Ecology	Seasonal sampling undertaken in Autumn and Spring prior to and during extraction. Seasonal monitoring to continue for a minimum of 1 year post extraction.	Establishment of pre extraction habitat condition and species number/composition. Comparison of survey results during extraction to baseline.
Terrestrial Ecology - Amphibians	Targeted sampling in Winter prior to and during extraction. Targeted sampling in Winter to continue for a minimum of 1 year post extraction.	Establishment of pre extraction amphibian number/species composition. Comparison of survey results during extraction to baseline.
Riparian Vegetation	Seasonal sampling undertaken in Autumn and Spring prior to and during extraction. Seasonal monitoring to continue for a minimum of 1 year post extraction.	Species inventory and modified Braun Blanquette cover abundance for each species.
Upland Swamps	Prior to extraction and once post extraction. During extraction monitoring based on trigger actions	Monitoring of swamp habitat against pre extraction conditions.



<i>Land Management</i>		
Steep Slopes and Rock Outcrops	Once prior to extraction, monthly during extraction and monthly post extraction (for 6 months).	Vehicle based visual observation of cracking, collapse and/or movement during extraction against pre extraction conditions.
<i>Heritage Management</i>		
Heritage Sites; Cordeaux River Historic Site 1 and Cordeaux River Historic Site 3	Cordeaux River Historic Site 1 monitored within 1 month of passing mid way point and within 3 months of extraction of each Longwalls N2 and N3. Cordeaux River Historic Site 3 monitored within 1 month of passing mid way point and within 3 months of extraction of Longwall N4.	Monitoring of subsidence impacts at historic sites against pre extraction conditions.



6 MITIGATION AND MANAGEMENT STRATEGIES

6.1 General

Mitigation and management strategies to reduce subsidence effects, subsidence impacts and environmental consequences are detailed in the relevant and respective Management Plans.

These methods will be specific to the impact observed and developed in consultation with the appropriate stakeholders when and if impacts occur that have been definitively assessed as being directly related to the extraction of Nebo Longwalls N1 to N6.

6.2 Trigger Action Response Plan

The Trigger Action Response Plan (ARP), as presented in **Appendix A** has been designed to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- Trigger levels from monitoring to assess performance; and
- Triggers that flag implementation of contingency measures.

6.3 Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in **Section 4** of this Plan, NRE will implement the following Contingency Plan:

- The observation will be reported to NRE's Environment and Community Manager within 24 hours.
- The observation will be recorded.
- NRE will report any exceedance of the performance measure to the DRE and other relevant stakeholder as soon as practicable after NRE becomes aware of the exceedance.
- NRE will assess the exceedances referred to in the TARP (outlined in **Section 6.2**) of this document) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s.
- The Environment and Community Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary.
- NRE will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- NRE will continue to monitor performance with the new action plan in place and, if successful will formalise these actions as part of a revised Management Plan.



Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

If either, it is not reasonable or feasible to remediate the impact or remediation measures implemented by NRE have failed to satisfactorily remediate the impact; NRE will provide a suitable offset to compensate for the impact, to the satisfaction of the Director-General of DoPI in accordance with **Condition 3, Schedule 3** of the Project Approval.



7 INCIDENTS, COMPLAINTS AND NON-CONFORMANCES

7.1 Incidents and Ongoing Management Reporting

An incident is defined as a set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in the SMP Approval.

Incidents will be managed through established NRE procedures as detailed in the Environmental Management Strategy.

NRE will notify the appropriate stakeholders of any incident in accordance with the requirements of the **Condition 16, Schedule 2** of the Nebo Longwalls N1-N6 SMP Approval. Within 24 hours of becoming aware of an occurrence NRE will notify the following:

- the Principal Subsidence Engineer;
- Director, Environmental Sustainability and Land Use;
- The Mine Subsidence Board;
- NSW Office of Water;
- Sydney Catchment Authority;
- the operators of all infrastructure detailed by **Condition 14, Schedule 2**;
- other relevant stakeholders and any Government Agency with a regulatory role if they request such notification, of the following:
 - o Any significant unpredicted and/or higher-than-predicted subsidence and/or abnormalities in the development of subsidence;
 - o Any exceedance of predicted impacts on groundwater resources and/or the natural environment that may have been caused (whether partly or wholly) by subsidence;
 - o Any observed subsidence impacts adverse to the serviceability and/or safety of infrastructure and other built structures that may be affected by longwall mining;
 - o Any significant subsidence-induced cracking and/or ground deformations observed in any surface areas within the Application Area.

7.2 Complaints Handling

Complaints will be managed through established NRE procedures as detailed in the Environmental Management Strategy.

As required by **Condition 10, Schedule 6** of the Project Approval a copy of a complaints register (updated on a monthly basis) will be kept on the NRE website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Environmental Management Report (AEMR)

7.3 Non-Conformance Protocol

NRE will manage and report non-compliances relevant against statutory requirements in accordance with an established protocol developed as a component of the Environmental Management Strategy.



Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with NRE Wongawilli Colliery, and will be promoted through direct consultation and direction of the Mine's Operations Manager.

Regular inspections and/or internal audits will be undertaken as required by suitably qualified personnel under the direction of the Environment and Community Manager, to identify any remediation/rectification work required, and areas of actual or potential non-compliance.

A review of NRE Wongawilli Colliery's compliance with all conditions of the Project Approval, mining leases and all other approvals and licenses will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on the Gujarat NRE website.



8 PLAN ADMINISTRATION

8.1 Roles and Responsibilities

Environment and community management is regarded as part of the responsibilities of all Colliery personnel. The roles and function of the main personnel responsible for the implementation of environmental and community management including the plans, procedures and action plans contained in this EMS are outlined in ***NREG EMS PROC002 Environmental Roles and Responsibilities***.

8.2 Resources Required

In accordance with the ***NRE 001 NRE Environmental Policy*** Management shall ensure that the appropriate resources are made available to achieve the implementation of this Plan.

It is the role of the Environment and Community Manager to ensure that these requirements are communicated to NRE Management.

8.3 Training

All training and inductions conducted are to be undertaken as per the ***NRE 012 Training procedures***.

8.3.1 Staff Training

Staff training will be undertaken as detailed in the EMS. This consists of three levels of training applicable to different types of staff:

- Level 1 – High level training on environmental requirement – Management
- Level 2 – Operational level training – Project Managers, Supervisors, Surface Personnel
- Level 3 – Basic environmental awareness – Underground staff

8.3.2 Inductions

All contractors and associated subcontractors will be required to participate in site induction prior to the commencement of work. As a minimum, the induction is to include:

- An overview of the Cardinal Rules, Environment Policy and EMS requirements.
- Environmental incident and community compliant reporting requirements.
- Environmental emergency contact details.

In the event that there are specific environmental management requirements relating to a contractor's work activities, details of these requirements are to be issued to the contractor in writing as a part of the induction.

Records, which detail the attendees, content of the induction/training as well as any additional information provided, will be maintained.



In addition to the induction program, training will be provided as deemed necessary to contractors to provide them with the knowledge, skills and awareness to minimise environmental impact. At a minimum this should include:

- Contractors whose activities are not directly supervised by Colliery personnel.
- Contractors whose activities are ongoing and have the potential to result in an environmental incident (e.g. stockpile contractors).

8.4 Record Keeping and Control

Environmental records are to be managed in accordance with the ***NRE 010 Document and Data Control procedure***.

All records of the EMS will be stored so that they are readily retrievable and suitably protected from deterioration or loss. Archiving will be managed in accordance with the ***NRE 010 Document and Data Control procedure***.

A master copy of each EMS document including all appendices and supporting information is to be held in the office of the E&C Department.

8.5 Access to Information

In accordance with ***Condition 19, Schedule 2*** of the Nebo Longwalls N1-N6 SMP Approval within 3 months of the submission of an End of Panel Report or the approval of a plan, programme or strategy required under the SMP Approval (or any subsequent revision of these documents), NRE will:

- a) Provide a copy of these document/s to all relevant agencies;
- b) Ensure that a copy of the relevant documents is made publicly available at the Russel Vale No.1 Colliery office; and
- c) Put a copy of the relevant document/s on the NRE website.

8.6 Plan Revision

This Plan will be reviewed regularly as mining progresses and updated as required. Specifically it is anticipated that this Plan may require to be updated as a consequence of:

- The findings of an annual review
- The findings of an incident report
- The findings of an audit
- Any modification to the conditions of approval (unless the conditions require otherwise)

The revision status of this plan is indicated on the title page of each copy. Revisions to any documents listed within this Plan will not necessarily constitute a revision of this document. The distribution of controlled copies is described in ***Section 1.3***.



9 REFERENCES

ERM 2010. NRE Wongawilli Colliery Nebo Area Environmental Assessment.

NRE Wongawilli Colliery Nebo Longwalls N1-N6 Extraction Plan, March 2013 – Revision 2

Olsen Environmental Consulting. March 2010. Nebo Longwalls Wongawilli Colliery. Failure Mode and Effects Analysis Report.

Appendix A – Monitoring Program and TARPS

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Subsidence Effects - Survey Monitoring	Subsidence Line NM1	2D and 3D survey of NM1 once prior to extraction of Longwall N4 or N5 to document: - Total subsidence; - Incremental subsidence; - Variation in horizontal strain 2D and 3D survey of NM1 on completion of each Longwall N4 and N5. - Comparison of survey measurements with predictions - Report to E&C Manager in Survey Reports. - Revise Subsidence Predictions (Total subsidence; Incremental subsidence; Variation in horizontal strain.) <i>Strain Accuracy: +/- 0.3mm/m</i> <i>2D Level Accuracy: +/- 5 mm;</i> <i>3D Level Accuracy: +/- 5 mm</i> <i>3D Position Accuracy: +/- 50 mm</i> <i>3D Relative Accuracy: +/- 30mm</i>	- Baseline studies prior to extraction - During Extraction (Trigger Based from visual observations) - Once Post Mining	- No observable surface deformations 3D data are within predictions - Tilts are <2mm/m <50mm closure	- Within 48 hours following collection of data, document and report to: - NRE; and - Principal Subsidence Engineer - DRE	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Surveyor
	- Subsidence Line NM2 - Subsidence Line NM3	2D and 3D survey of NM2 and NM3 once prior to extraction of Longwall N2 or N3 to document: - Total subsidence; - Incremental subsidence; - Variation in horizontal strain 2D and 3D survey of NM2 and NM3 on completion of each Longwall N2 and N3. - Comparison of survey measurements with predictions - Report to E&C Manager in Survey Reports. - Revise Subsidence Predictions (Total subsidence; Incremental subsidence; Variation in horizontal strain.) <i>Strain Accuracy: +/- 0.3mm/m</i> <i>2D Level Accuracy: +/- 5 mm;</i> <i>3D Level Accuracy: +/- 5 mm</i> <i>3D Position Accuracy: +/- 50 mm</i> <i>3D Relative Accuracy: +/- 30mm</i>		- Observable surface deformations; and/or - Surface cracking (<10mm); and/or - Tilts (2 – 4mm/m); and/or - Creek closure (50-150mm)	- Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: - NRE; - SCA - Infrastructure owners; and - Principal Subsidence Engineer - DRE; - Continue consultation with electrical infrastructure owners and develop specific action plans to be implemented should they be required by red triggers being activated below; - Within 48hrs following collection of data document and report to Principal Subsidence Engineer – DRE; and - Report monitoring data and any necessary actions to Key Stakeholders within 7 days of becoming aware of the impact/s.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
	Subsidence Line NM4	2D and 3D survey of NM4 once prior to extraction of Longwalls N1, N5 or N6 to document: - Total subsidence; - Incremental subsidence; - Variation in horizontal strain 2D and 3D survey of NM4 on completion of each Longwall N1, N5 and N6. - Comparison of survey measurements with predictions - Report to E&C Manager in Survey Reports. - Revise Subsidence Predictions (Total subsidence; Incremental subsidence; Variation in horizontal strain.) <i>Strain Accuracy: +/- 0.3mm/m</i> <i>2D Level Accuracy: +/- 5 mm</i> <i>3D Level Accuracy: +/- 5 mm</i> <i>3D Position Accuracy: +/- 50 mm</i> <i>3D Relative Accuracy: +/- 30mm</i>		- Observable surface deformations; and/or - Surface cracking (>10mm); and/or - Tilts (> 4mm/m); and/or - Creek closure > 150mm	- Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: - NRE;; - SCA - Infrastructure owners; and - Principal Subsidence Engineer - DRE; - Undertake additional 2D and 3D survey at relevant subsidence line and check other relevant monitoring data and review against predictions; - Within 48hrs following collection of data document and report to Principal Subsidence Engineer – DRE - Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s. - Review Mining Options	
	Far Field Points R1 to R9	3D survey of far field 3D points FF1 to FF9 once prior to mining to document: - Total subsidence; - Incremental subsidence; - Variation in horizontal strain 3D survey of far field 3D points R1 to R9 on completion of each longwall. <i>Strain Accuracy: +/- 0.3mm/m</i> <i>3D Level Accuracy: +/- 5 mm</i> <i>3D Position Accuracy: +/- 50 mm</i> <i>3D Relative Accuracy: +/- 30mm</i>				
Transmission Lines	33kV Transmission Poles	<u>Prior to Mining</u> - Vehicle based visual observational monitoring of 33kV line and easement – once prior to mining - Tilt survey of poles once prior to mining within 250 metres of transmission line in longwall N2 to document: <u>During Mining</u> - Fortnightly vehicle based visual observational monitoring of 33kV line and easement	- Baseline tilt survey and inspection - Tilt survey and inspection during extraction if triggered from fortnightly visual observations; - Tilt survey and inspection post extraction	- No observable surface deformations - Survey data within predictions	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - Infrastructure Owner - SCA - Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: - NRE - SCA - Infrastructure Owner - Principal Subsidence Engineer - DRE - Continue consultation with electrical infrastructure owners SCA and develop contingency action plans (CMA) which can	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Surveyor

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		- Weekly visual inspection of transmission poles, line and easement during extraction when Avon Dam supply level below gravity feed operation Post Mining - Vehicle based visual observational monitoring of 33kV line and easement for 1 year following extraction. - Tilt survey of poles at completion of longwall N2. - Tilt survey of poles at completion of mining.		- Observable surface deformations; and/or - Unsafe pole conditions	be implemented should they be required if red triggers below are activated; - Within 48 hours following collection of data, document and report to Principal Subsidence Engineer – DRE; and - Within 7 days of becoming aware of impacts report any necessary actions to Key Stakeholders. - Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the impact/s: - NRE - SCA - Infrastructure Owner - Principal Subsidence Engineer – DRE - Undertake additional tilt surveys and 3D survey at relevant subsidence line and check other relevant monitoring data and review against predictions - Undertake visual inspections; - Liaise with infrastructure owners regarding any actions required; - Within 48 hours following collection of data, document and report to Principal Subsidence Engineer – DRE; - Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impacts; and - Review mining operations	
Dam Walls	Upper Cordeaux 1 and 2 Dam Walls	Prior to Mining - Visual inspection by SCA prior to mining - Annual subsidence surveys by SCA along Upper Cordeaux 1 and 2 Dam walls During Mining - Visual inspection by SCA prior to mining 6 monthly subsidence surveys by SCA along Upper Cordeaux 1 and 2 Dam walls Post Mining - Visual inspection by SCA up to 1year post mining - Annual subsidence surveys by SCA along Upper Cordeaux 1 and 2 Dam walls up to 1 year post mining	- Prior to mining - During mining (6 monthly) - Post mining (Annual for 1 year)	- Negligible change in RL between surveys - Negligible upsidence or differential vertical movement between any two adjacent marks between surveys - Negligible horizontal movement or differential horizontal movement between any two adjacent marks between surveys - Negligible closure between surveys - Negligible cracking <10mm change in RL between surveys <10mm upsidence or <2mm differential vertical movement between any two adjacent marks between surveys <20mm horizontal movement or <2mm differential horizontal movement between any two adjacent marks between surveys <2mm closure between surveys - Crack widths <3mm differential movement in 3 dimensions (Upper Cordeaux No.2 Dam)	Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - DSC - Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - DSC - Organise additional monitoring as agreed with SCA and as per DSC Management Plans - Organise 6 monthly 3D crack monitoring where agreed with SCA - Completion of any required works following approval from SCA	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - SCA - Contract Surveyor

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
				>10mm change in RL between surveys >10mm upsidence or >2mm differential vertical movement between any two adjacent marks between surveys >20mm horizontal movement or >2mm differential horizontal movement between any two adjacent marks between surveys >2mm closure between surveys - Crack widths >3mm differential movement in 3 dimensions (Upper Cordeaux No.2 Dam)	- Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - DSC - Make area safe as soon as practicable including warning signs - Organise additional monitoring as agreed with SCA and as per DSC Management Plans - Proposal for rectification within 1 week upon approval from SCA - Organise 6 monthly 3D crack monitoring where agreed with SCA - Completion of any required works following approval from SCA	
Stored Waters	Upper Cordeaux 1 and 2 Dam water storages	<u>Prior to Mining</u> Survey of lake foreshores by SCA	- Prior to mining - During mining (6 monthly) - Post mining (6 monthly for 1 year)	- Negligible change in RL - Negligible horizontal movement	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - SCA
		<u>During Mining</u> 6 monthly survey of lake foreshores by SCA		< 20 mm change in RL <20 mm horizontal movement	- Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - Organise additional monitoring as agreed with SCA and as per DSC Management Plans - Liaise with the SCA and develop appropriate strategies and management plans.	
		<u>Post Mining</u> 6 monthly survey of lake foreshores by SCA for 1 year post mining		>20 mm change in RL >20 mm horizontal movement	- Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - Organise additional monitoring as agreed with SCA and as per DSC Management Plans - Liaise with the SCA and develop appropriate strategies and management plans.	
Rainfall	- Wongawilli Colliery - SCA Cordeaux No.2 Dam	Continuous	- Prior to mining - During mining - Post mining	Negligible departure from standard rainfall-runoff relationship in extraction area creeks	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Hydrologist

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
				Significant departure from standard rainfall-runoff relationship in extraction area creeks	- Visual inspection of creek lines for cracking or water loss identified - Contract hydrologist investigate and report on changes identified - Inform SCA, DoPI, OEH & DRE 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 if required	
Flooding	- Wattle Creek - Little Wattle Tree Creek	Prior to Mining Photo point recording for 2 months prior to extraction	- Prior to mining - During mining - Post mining	No change in flood extent variability compared to baseline period	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - Continue monitoring program	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Hydrologist - Contract Ecologist
		During Mining - Weekly photo point recording of Wattle Creek while mining within 100m of Wattle Creek main channel. 2 monthly photo point recording of Wattle Creek and Little Wattle Creek during extraction		Temporary increase in flood extent over less than 2 months compared to the baseline variability at any site	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - OEH - Continue monitoring program	
		Post Mining 2 monthly photo point recording for 1 year post mining		- Long term reduction in flood extent over more than 2 months compared to the baseline variability at any site, i.e.: - Increased extent of flooded stream reach in excess of baseline conditions – identified by increased flooding within the terrestrial habitat compared to baseline variability	- Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - OEH - Notify contract hydrology and ecology specialists immediately to conduct investigation and report on changes identified - Site visit with stakeholders - Take photographic record immediately - Review monitoring program within 2 weeks and implement additional monitoring if required - 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 on mitigation as soon as practicable - Report in AEMR	
Erosion of Stream Bed and Banks	- Wattle Creek - Little Wattle Tree Creek	Prior to Mining - Photo point recording for 2 months prior to undermining stream During Mining - Monthly photo point recording	- Prior to mining (2 months) - During mining (monthly) - Post mining (2 monthly)	No change in stream, bed or bank erosion compared to baseline period	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - Continue monitoring program	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Hydrologist - Contract Ecologist

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		during active undermining of all order streams. Post Mining 2 monthly photo point recording for 1 year post mining		Minor increase in stream, bed or bank stability compared to baseline period – i.e. small cracks with no observable change in stream stability	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - OEH - Continue monitoring program	
				Major decrease in stream, bed or bank stability compared to baseline period – i.e. cracks or other physical damage with permanent change in stream stability	- Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the trigger: - NRE; - SCA - Principal Subsidence Engineer - DRE; - OEH - Notify contract hydrology and ecology specialists immediately to conduct investigation and report on changes identified - Site visit with stakeholders - Take photographic record immediately - Review monitoring program within 2 weeks and implement additional monitoring if required - 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 on mitigation as soon as practicable - Report in AEMR	
Inflow into Workings	Wongawilli Colliery	Prior to Mining - Daily volumetric flow monitoring of mine inflow and discharge - Water quality analysis of any anomalous inflow events	- Prior to mining - During mining - Post mining	Negligible change in water discharge during and following mining	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - DSC - Continue monitoring program	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Hydrologist
		During Mining - Daily monitoring of mine inflow and discharge - Water quality analysis of any anomalous inflow event, with the sampling method and assessment parameters to be defined depending on what is being investigated – i.e. major/minor elements, isotopes, algae etc.		Increase in water discharge of <1ML/day for 7 consecutive days from active extraction areas, which are suspected to be as a result of mine subsidence and excluding elevated inflows due to high rain events over the entire Wongawilli workings	- Report in regular reporting to: - NRE; - Principal Subsidence Engineer – DRE; - SCA - DSC - Continue monitoring program	
		Post Mining - Daily monitoring of mine inflow and discharge - Water quality analysis of any anomalous inflow event until mining area decommissioned, with the sampling method and assessment parameters to be defined depending on what is being investigated – i.e. major/minor elements, isotopes, algae etc.		Increase in water discharge of >1ML/day for 7 consecutive days from active extraction areas, which are suspected to be as a result of mine subsidence and excluding elevated inflows due to high rain events over the entire Wongawilli workings	- Engage hydrologist to investigate and report on changes identified - Inform the following of the investigation: - NRE - Principal Subsidence Engineer - DRE - SCA - DSC - Investigation initiated within one week of trigger exceedance being observed - Monthly updates of investigation process to relevant stakeholders - Report on mitigation as soon as practicable to relevant stakeholders	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
					Report in AEMR	
Fire Road & 4WD Tracks	Fire Roads in the locality of the longwalls.	Prior to Mining Vehicle based baseline visual observation once prior to mining.	During Mining	Minor cracking (i.e. <10mm)	- Notification to SCA within 24 hrs, using photographic record. - Determine appropriate mitigation with SCA - Report in 4 monthly Status Report and End of Panel Report	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract personnel as required.
		During Mining 2 weekly vehicle based visual observation Post Mining - Vehicle based visual observation monthly for 6 months after mining		Major cracking or traffic impedance (i.e. >10mm)	- Notification to SCA immediately, then to DRE 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.	
Steep Slopes & Rock Outcrops	Steep slopes and rock outcrops in the locality of the longwalls Note: there are no cliffs identified in the area.	Prior to Mining - Vehicle based and walk in (<i>along survey line NM4 only</i>) baseline visual observation once prior to mining of: - Cliffs and Steep Slopes; - Rocky outcrops and cuttings	- Prior to mining - During mining - Post mining	Minor cracking (i.e. <10mm)	- Notification to SCA within 24 hrs, using photographic record. - Determine appropriate mitigation with SCA - Report in 4 monthly Status Report and End of Panel Report	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract personnel as required.
		During Mining 2 weekly vehicle based and walk in (<i>along survey line NM4 only</i>) visual observation of: - Cliffs and Steep Slopes; - Rocky outcrops and cuttings Post Mining - Vehicle based and walk in (<i>along survey line NM4 only</i>) visual observation monthly for 6 months after mining of: - Cliffs and Steep Slopes; - Rocky outcrops and cuttings		- Major cliff/rock collapse or steep slope movement - Major cracking or traffic impedance (i.e. >10mm)	- Notification to SCA immediately, then to DRE 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.	
Heritage	Cordeaux River Historic Site 1 and Site 3	- Baseline archival recording prior to mining - Impact assessment recording within one month of mining passing heritage site during extraction of Longwalls N2 and N4 - Impact assessment recording,	- Prior to mining - During mining - After the completion of all subsidence movements at the site.	No Change in site condition observed	- No further mitigation or management required. - Report in regular reporting.	- NRE Wongawilli Colliery (E & C Manager) - Contract Archaeologist
				- Change in site condition within performance criteria: - If a change is observed but no threat to heritage values is identified then the monitoring	- Site inspection to document and photograph any observed changes / impacts. - Inform OEH and SCA in writing.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		within three months after extraction of each Longwall N2 and N4 Final assessment recording at the end of mining		program should continue.		
				- Change in site condition observed that exceeds performance criteria: - If a change is observed then an appropriate mitigation strategy should be developed in consultation with a heritage specialist and the SCA to avoid or minimize impacts to heritage values.	- Within 1 week undertake site inspection to document and photograph any observed changes / impacts; - Within 1 week of completion of investigation inform; - Director .Environmental Sustainability and Land Use; - Principal Subsidence Engineer DRE - OEH - SCA - As required by OEH or If remediation or mitigation actions are required and may affect the archaeological values at an individual site, undertake ongoing consultation with OEH; - Use appropriate specialists to undertake physical remediation activities; and - Provide monthly updates of investigation progress if required by SCA/OEH; - If subsidence movement above the predicted maximum occurs, then site inspections of Dendrobium 5 and Wanyambilli Hill 1 should occur in consultation with Registered Aboriginal stakeholders.	
Terrestrial Ecology	Upland Swamps (39 and 22)	Prior to Mining - Upland Swamp ecological baseline characterisation prior to extraction of Longwall N1, N5 or N6 to document baseline condition. During Mining - Upland Swamp ecological assessment against baseline to be conducted if: - Amber/Red Triggers observed for Subsidence Effects – Survey Monitoring during Longwall N1, N5 or N6 extraction - Amber/Red Triggers observed for Aquatic Ecology during Longwall N1, N5 or N6 extraction - Amber/Red Triggers observed for Surface Water during Longwall N1, N5 or N6 extraction - Amber/Red Triggers observed for Groundwater during Longwall N1, N5 or N6 extraction Post Mining - Upland Swamp ecological assessment against baseline completed after mining	- Prior to mining - During mining. - Post mining (minimum 1 year)	Upland Swamps - Negligible change from baseline observations to; - Drainage - Composition or distribution of species - Vegetation recorded during baseline observations Threatened Frog Species - Negligible changes in flow or natural drainage behaviour of pools, as illustrated by no observable mining induced change - Negligible environmental consequences for threatened frog species, as illustrated by no changes in parameters monitored and no impact habitat for threatened species Riparian Vegetation - No change as compared to baseline observed	- Continue monitoring. - Report in End of Panel Report, AEMR & Annual Review as required.	- NRE Wongawilli Colliery (E & C Manager) - Contract Ecologist

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		completed for 1 year				
	Threatened frog breeding habitat along Wattle Tree Creek and Little Wattle Tree Creek	Prior to Mining - Threatened Frog Species 2 year baseline monitoring as follows: - Targeted nocturnal monitoring in winter each year along the length of creek line for Wattle Creek and little Wattle Tree Creek. During Mining - Threatened Frog Species monitoring as follows: - Targeted nocturnal monitoring in winter each year during extraction along the length of creek line for Wattle Creek and Little Wattle Tree Creek. Post Mining - Threatened Frog Species monitoring for minimum 1 year post mining as follows: - Targeted nocturnal monitoring in winter each year along the length of creek line for Wattle Creek and Little Wattle Tree Creek.	- Prior to mining (2 years baseline). - During mining. - Post mining (minimum 1 year)	Upland Swamps - Negligible change in drainage of water, as illustrated by a short term reduction greater than variability observed in similar swamps. - Negligible change to the composition or distribution of species, as illustrated by a short term statistically significant difference change from baseline observations - Minimal dieback recorded during observational monitoring. Dieback restricted to single area Threatened Frog Species - Negligible changes in flow or natural drainage behaviour of pools, as illustrated by pool level/flow decline <20% during mining compared to baseline for > 2 months - Negligible impacts to changes in general condition of streams, as illustrated by no observable change in stream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions - Negligible environmental consequences for threatened frog species, as illustrated by a short term (one year duration first year after mining commences) significant statistical difference between control and impact sites or between before and after mining at the control sites Riparian Vegetation - Survey results within baseline variability	- Continue monitoring - Within one week of potential impact being detected inform SCA, OEH & DRE - Within 1 month of impact detection review monitoring program, including frequency and location, and determine if additional monitoring is required - Report in annual and End of Panel reports to inform relevant agencies of results of monitoring; - Report in End of Panel Report, AEMR & Annual Review as required.	
	Riparian Vegetation	Prior to Mining - Species inventory and modified Braun Blanquette cover Abundance for each species – once prior to mining During Mining - Species inventory and modified Braun Blanquette cover Abundance for each species – autumn and spring during extraction	- Prior to mining (once). - During mining. - Post mining (1 year)	Upland Swamps - Change to the composition or distribution of species, as illustrated by a long term (greater than one year) significant statistical difference change from baseline observations; - Significant dieback recorded during observational monitoring. Dieback not restricted to single area.	- Within 1 week of impact being detected engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts - Within 1 week inform SCA, OEH & DRE of investigation outcomes ; - Within 1 week of completion of investigation report results to OEH, SCA & DRE - Within 1 week, if necessary, commence preparation and implementation of a site mitigation/action plan and monitoring plan consultation with SCA/ OEH & DRE if necessary - Report in End of Panel, AEMR and Annual Review as	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		<u>Post Mining</u> - Species inventory and modified Braun Blanquette cover - Abundance for each species – autumn and spring for 1 year		<u>Threatened Frog Species</u> - Re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for >2 months, considering rainfall / runoff variability; - Observable increases stream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions - Change to the composition or distribution of species, as illustrated by significant statistical difference between control and impact sites or between before and after mining at the control sites or a significant reduction in population numbers - Significant impacts to breeding habitat for threatened species at risk from subsidence effects (Giant Burrowing Frog, Littlejohn's Tree Frog, Stuttering Frog) spanning the annual lifecycle of these species <u>Riparian Vegetation</u> - Observed deterioration in vegetation health against baseline surveys - Significant change/decline in cover abundance against baseline surveys - Statistically significant change in species composition against baseline surveys	required.	
Aquatic Ecology	- Impact monitoring of water quality and aquatic macroinvertebrates at LWC – AQ1 to LWC – AQ2 and WAC-AQ1 to WAC-AQ6 Creek Sites - Control monitoring of water quality and macroinvertebrates at KCT-AQ1, KEC-AQ1, MEC-AQ1 and	<u>Prior to Mining</u> - Aquatic macroinvertebrate 2 year baseline monitoring as follows: - AUSRIVAS monitoring in spring and autumn of all sites - Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at all sites well as data from Water Monitoring Program - Photo point monitoring of creeks in autumn and spring at all sites as well as data from Water Monitoring Program	- Prior to mining (2 years baseline). - During mining. - Post mining (minimum 2 years)	- Negligible changes in flow or natural drainage behavior of pools, as illustrated by no observable mining induced change - Negligible environmental consequences for creeks, as illustrated by no significant changes in water quality or data collected during macroinvertebrate sampling - Negligible environmental consequences for threatened fish species	- Continue monitoring. - Report in Status Reports, End of Panel Report, AEMR or Annual Review as required	- NRE Wongawilli Colliery (E & C Manager) - Contract Ecologist
				Negligible changes in flow or natural drainage behavior of pools, as illustrated by pool level / flow decline < 20% during mining compared to baseline for >2 months	- Continue monitoring - Within one week of potential impact being detected inform SCA, OEH & DRE - Within 1 month of impact detection review monitoring program, including frequency and location, and determine if additional monitoring is required	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
	MGC-AQ1 Creek Sites	<u>During Mining</u> - Aquatic macroinvertebrate monitoring as follows: - AUSRIVAS monitoring in spring and autumn at all Sites - Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at all sites as well as relevant data from the Water Management Plan - Photo point monitoring of creeks in autumn and spring at all sites as well as data from Water Monitoring Program <u>Post Mining</u> - Aquatic macroinvertebrate monitoring for two years post mining as follows: - AUSRIVAS monitoring in spring and autumn at all sites - Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at all sites as well as relevant data from the Water Management Plan - Photo point monitoring of creeks in autumn and spring at all sites as well as data from Water Monitoring Program		- Negligible impacts to changes in general condition of streams, as illustrated by no observable change to instream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions - Negligible environmental consequences for creeks, as illustrated by a 1 year reduction in aquatic habitat, as shown by: - Water quality data exceeding upper or lower limits of baseline monitoring - Change in OES50Taxa Score; or - Change in AUSRIVAS Band	- Report in annual and End of Panel reports to inform relevant agencies of results of monitoring; - Report in Status Reports, End of Panel Report, AEMR & Annual Review as required.	
				<u>Macroinvertebrates</u> - Re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for >2 months, considering rainfall / runoff variability; - Observable increases stream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions - Reduction in aquatic habitat at impact sites only for an extended timeframe of > 2 years as shown by: - Water quality data exceeding upper or lower limits of baseline monitoring; - Change in OE50Taxa Score - Change in AUSRIVAS Band	- Within 1 week of impact being detected engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts - Within 1 week inform SCA, OEH & DRE of investigation outcomes ; - Within 1 week of completion of investigation report results to OEH, SCA & DRE - Within 1 week, if necessary, commence preparation and implementation of a site mitigation/action plan and monitoring plan consultation with SCA/ OEH & DRE - Within 1 month of impact detection review monitoring program, including frequency and location, and modify if necessary. This may include addition of flora monitoring along creeks where stream flow has reduced. - If mitigation / remediation measures are unsuccessful determine whether offsets will be required, and develop an offset strategy - Report in End of Panel, AEMR and Annual Review as required.	
Public Safety	See the following sections in this TARP - Cliffs, Steep Slopes & Rock outcrops - Fire Road & 4WD Tracks - Transmission Lines	See the following sections in this TARP - Cliffs, Steep Slopes & Rock outcrops - Fire Road & 4WD Tracks - Transmission Lines	See the following sections in this TARP - Cliffs, Steep Slopes & Rock outcrops - Fire Road & 4WD Tracks - Transmission Lines	As per relevant TARP	As per relevant TARP	As per relevant TARP
				As per relevant TARP	As per relevant TARP	
				As per relevant TARP	As per relevant TARP	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Surface Water	Sites WC1-WC4 and LWTC1	<u>Prior To Mining</u> - Stream surface water quality at WC1-WC4 and LWTC1 including - Monthly manual field water quality analysis for EC, pH, DO, ORP, temp for 2 months prior to longwall extraction - Monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity for 2 months prior to longwall extraction - Monthly photo point recording of Wattle Creek and Little Wattle Tree Creek for observable iron hydroxide staining for two months prior to longwall extraction for each longwall. - Monthly stream flow monitoring at WC1 and WC3 for 2 months prior to active undermining of Wattle Creek main channel - Automated stream water level monitoring at WC1-WC4 including: - Automatic 6 hourly level recording with 2 monthly download - Automatic 1 hourly level recording for 1 month before active undermining of Wattle Creek main channel.	- Baseline studies prior to mining - During Mining - Post Mining	No observable mining induced changes	- Continue monitoring program - Discuss in End of Panel Report, AEMR and Annual Review as required.	- NRE Wongawilli Colliery (E & C Manager) - NRE Environmental Monitoring Team - Contract Hydrologist
		<u>During Mining</u> - Stream surface water quality at WC1-WC4 and LWTC1 including - Monthly manual water quality analysis EC, pH, DO, ORP, temp at all sites during longwall extraction - Weekly manual water quality field analysis EC, pH, DO, ORP, temp at WC1-WC3 when mining is within 100m of Wattle Creek main channel; 2-Monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃,		<u>Surface Water Quality</u> - Short term effect (<2 months) within baseline variability or temporary reduction over minimum 2 month period, i.e. - EC > 250uS/cm - pH >1.5 drop from minimum baseline value - Fe (Tot) > 10mg/L - Mn (tot) > 0.2mg/L - Al (tot) > 0.2mg/L - Zn (filt) > 0.2mg/L - SO₄ (filt) > 15mg/L - Observable increase in stream Fe hydroxide precipitation compared to baseline <u>Stream Flow/Water Level</u> - Stream flow/water level within baseline variability or temporary reduction over < 2month period for pool levels and stream flow, considering rainfall/runoff variability; - Fracturing of bedrock in directly undermined channels - Pool level/flow decline >20% during mining compared to baseline for >2 months	<u>Surface Water Quality</u> - Continue monitoring program - Review monitoring frequency - Discuss in end of panel report or AEMR as required. <u>Stream Flow/Water Level</u> - For variation in stream flow/water level < 2 months then continue monitoring program, discuss in End of Panel Report, AEMR or Annual Review as required. - For variation in stream flow/water level > 2 months then continue monitoring program, review monitoring frequency, discuss in End of Panel Report, AEMR or Annual Review as required.	
				<u>Surface Water Quality</u> - Significant reduction compared to baseline and predicted impacts over >2mths,i.e. - EC > 300uS/cm - pH >1.5 drop from minimum baseline value - Fe (Tot) > 10mg/L - Mn (tot) > 0.2mg/L - Al (tot) > 0.2mg/L - Zn (filt) > 0.2mg/L - SO₄ (filt) > 15mg/L > 2 STD deviation reduction in water quality at downstream monitoring site compared to baseline & significant Fe OOH precipitate compared to baseline visual observations <u>Stream Flow/Water Level</u> - Fracturing of bedrock in stream reach not directly undermined	- Immediately inform: - DRE Director of Environmental Sustainability and Land Use; and - Principal Subsidence Engineer – DRE - Notify technical specialists - Immediately rrecord photographically; - Within 2 weeks collect laboratory samples within 2 weeks and analyse for standard analytes - Within 1 month review sampling program and continue review as required - Within 1 month of trigger exceedance being noted instigate investigation including: - Engaging a technical specialist to investigate and report on the cause of trigger - Undertake site inspection with SCA, DP&I, OEH & DRE dependant on availability. - Prepare and implement a site mitigation/action plan in consultation with SCA, DP&I, OEH & DRE including approvals from key agencies if required - as required - Report on mitigation as soon as practicable. - Undertake additional post remediation works and monitoring	



Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity at all sites during longwall extraction - o Monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity at WC1-WC3 when mining is within 100m of Wattle Creek main channel. • Weekly photo point recording of Wattle Creek for observable iron hydroxide staining while mining within 100m of Wattle Creek main channel. • Monthly photo point recording of Wattle Creek and Little Wattle Tree Creek for observable iron hydroxide staining during longwall extraction • Weekly visual observations for observable iron hydroxide staining during active undermining of all streams • Monthly stream flow monitoring at WC1 and WC3 during active undermining of Wattle Creek main channel • Weekly stream flow monitoring at WC1 and WC3 while mining within 100m of main channel of Wattle Creek • Stream water level monitoring at WC1-WC4 including: - o Automatic 1-hourly water level recording with weekly download at WC1-WC3 while mining within 100m of main channel of Wattle Creek - o Automatic 6 hourly level recording with monthly download during longwall extraction Post Mining • Stream surface water quality monitoring at WC1-WC4 and LWTC1 including - o 2 monthly manual field water quality analysis of EC, pH, DO, ORP, temp for 1 year after end of		• re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for > 2mths, considering rainfall / runoff variability	• as required • Report in End of Panel Report, AEMR & Annual Review as required	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		- mining; - o 2 monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity for 1 year after end of mining • 2 monthly photo point recording of Wattle Creek and Little Wattle Tree Creek for observable iron hydroxide staining for 1 year after mining. • 2 monthly stream flow monitoring at WC1 & WC3 for 1 year after mining • Stream water level monitoring at WC1-WC4 including: - o Automatic 6 hourly water level recording with 2 monthly downloads for 1 year after mining				
Groundwater	Groundwater quality Open Standpipe Piezometers Nebo 1S, 1D, 2S, 2D, 3 and 4 Groundwater Levels Vibrating Wire Piezometers Nebo 6, 7, 8, 8A, WW11 and WW20B Open Standpipe Piezometers Nebo 1S, 1D, 2S, 2D, 3 and 4	Prior to Mining • Groundwater quality including: - o 2 monthly manual field water quality analysis for EC & pH - o 4 monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Groundwater level monitoring including: - o Automatic 12 hourly level recording with 2 monthly download and manual dip meter measurement During Mining • Groundwater quality including - o Monthly manual field water quality analysis for EC & pH - o 2 monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO₄, HCO₃, NO₃, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Groundwater level monitoring including: - o Automatic 12 hourly level recording with	• Baseline studies prior to mining • During Mining • Post Mining	• No observable change	• Continue monitoring • Report in End of Panel Report, AEMR & Annual Review as required	• NRE Wongawilli Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Hydrologist
				• Short term increase in salinity or reduction in pH outside of baseline variability, with the effect not persisting after a significant rainfall recharge event • Up to 10m water level reduction < 2 months • Up to 10m water pressure reduction for < 2 months	• Immediately inform: - o DRE Director Environmental Sustainability and Land Use; - o Principal Subsidence Engineer DRE • Discuss the requirement or need and the potential cost/benefit of a mitigation/action plan with stakeholders • Continue monitoring program • Report in End of Panel Report, AEMR & Annual Review as required	
				• Increase in salinity or reduction in pH outside of baseline variability, with the effect persisting after a significant rainfall recharge event • >10m water level reduction for > 2 months • >10m water pressure reduction for > 2 months	• Immediately inform: - o DRE Director Environmental Sustainability and Land Use; - o Principal Subsidence Engineer DRE • Discuss the requirement or need and the potential cost/benefit of a mitigation/action plan with stakeholders	



Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		monthly download and manual dip meter measurement <u>Post Mining</u> • Groundwater quality including - o 2 monthly manual field water quality analysis for EC & pH for 1 year after end of mining - o 4 monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) for 1 year after end of mining • Groundwater level monitoring for a minimum of 1 year post mining including: - o Automatic 12 hourly level recording with 2 monthly download and manual dip meter measurement				

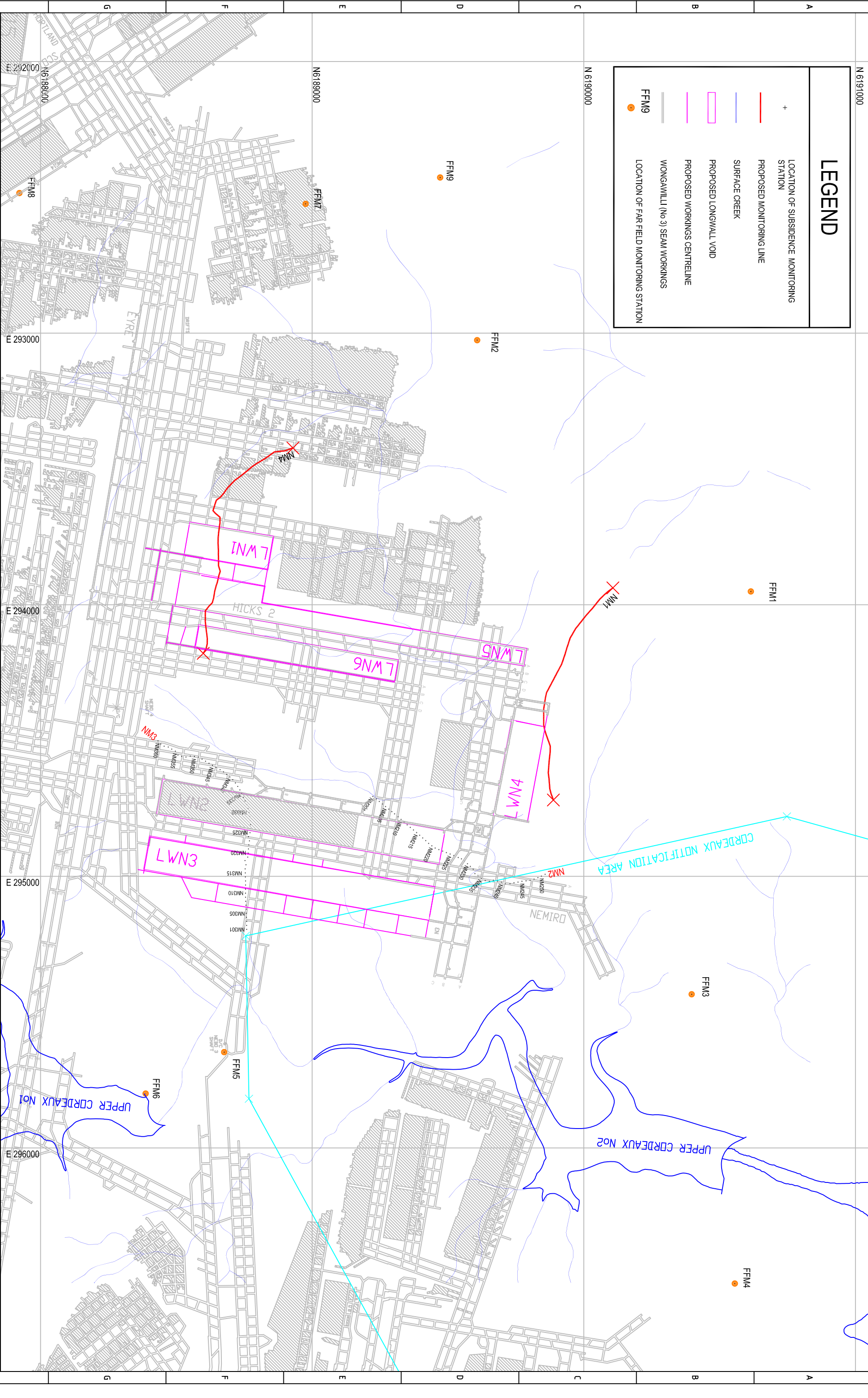


Appendix B – Plans

12111023

LEGEND

- LOCATION OF SUBSIDENCE MONITORING STATION
- PROPOSED MONITORING LINE
- SURFACE CREEK
- PROPOSED LONGWALL VOID
- PROPOSED WORKINGS CENTRELINE
- WONGAWILLI (No 3) SEAM WORKINGS
- FFM9
- LOCATION OF FAR FIELD MONITORING STATION



REV		DESCRIPTION	DATE	DRN	CKD	REV	DESCRIPTION		DATE	DRN	CKD
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

NRE		WONGAWILLI COLLIERY	
GUJARAT NRE WONGA PTY LTD		ABN 77 111 928 762	
WONGAWILLI ROAD, WEST DAPTO NSW 2530		SCALE 1:12500 @ A3	

NAME	DATE	TITLE NEBD LONGWALLS N1 TO N6 - LOCATION OF INSTALLED SUBSIDENCE MONITORING STATIONS and PROPOSED MONITORING LINES
DRN	SM	
CKD		
APP	D. CLARKSON	DRAWING NUMBER WON-01-0583
SCALE	1:12500 @ A3	REV 0

LEGEND

APPLICATION PROPOSED WORKINGS			
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M71 - 2280) - (1/09/07)		
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M67 - 2277) - (01/01/06)		
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M66 - 2204/08)		
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M71 - 2280) - (1/02/12)		
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M62 - 1719) - (06/03/03)		
	NEBO COLLECTOR EXTRACTION APPROVAL AREA OUTLINE - (REF: M64 - 1514) - (01/03/06)		
ENDNOTES:			
NEBO COLLECTOR WORKINGS DERIVED FROM OLD PLANS			
NEBO COLLECTOR WORKINGS DERIVED FROM UNDESIGNED			
CONCEPTUAL DRAINAGE AND RESTRICTION ZONES IDENTIFIED			
FROM NEBO COLLECTOR ISSUANCE PLANS (ET 150)			
CERTIFICATION OF ACCURACY			
SIGNATURE OF MANAGER		DATE	
P. CHANDRA		Date	
MANAGER OF MINING ENGINEERING			

APPLICATION AREA CORNERS		
A	E 294 012	N 6:190 379
B	E 294 432	N 6:190 285
C	E 294 437	N 6:190 002
D	E 295 261	N 6:189 753
E	E 295 145	N 6:188 179
F	E 293 391	N 6:188 284
G	E 293 498	N 6:188 935
H	E 293 794	N 6:189 068

[illegible]

PLAN 3

LEGEND

DYKE

FAULT

CORDEAUX DAM NOTIFICATION AREA

○ 330M BOREHOLE

— 40m SPOT DEPTH OF COVER

SEAM THICKNESS - SEE NOTE BELOW

SPON. COAL & OUTFBURST - SEE NOTE BELOW

ENDORSEMENTS:

NEED COLLETRY WORKINGS DIGITISED FROM OLD PLANS

GEOLOGICAL DATA DIGITISED FROM NEED COLLETRY ISS

MINE PLANS (RT 158)

CERTIFICATION OF ACCURACY

CERTIFICATION OF MANAGER

S. Mann

P. Connors

REGISTERED MINING SURVEYOR

MANAGER OF MINING ENGINEERING

DATE

NOTES: SEAM APPROX. 10m THICK - NO SIGNIFICANT VARIATION

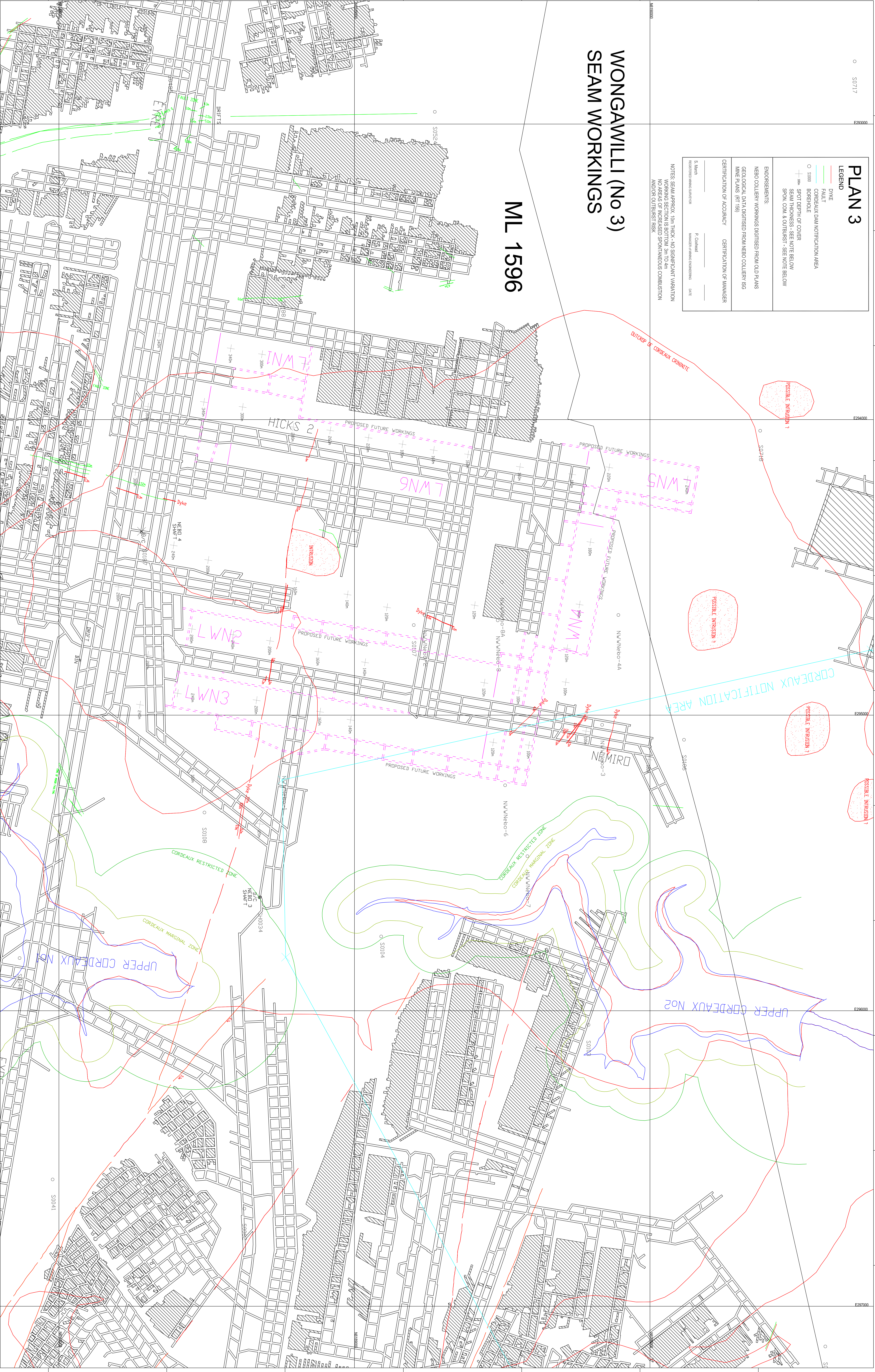
NO WORKING SECTIONS BOTTOM AND TO THE RIGHT

NO AREAS OF INCREASED SPONTANEOUS COMBUSTION

AND/OR OUTFBURST RISK

WONGAWILLI (No 3)
SEAM WORKINGS

ML 1596



NRE Wongawilli Colliery
Gujarat NRE FCGL
Wongawilli Road, West Dapto NSW 2530
ABN 77 111 928 762

Name	Date
DRN SM	20/01/11
CKD	
APP	
SCALE	1:4000

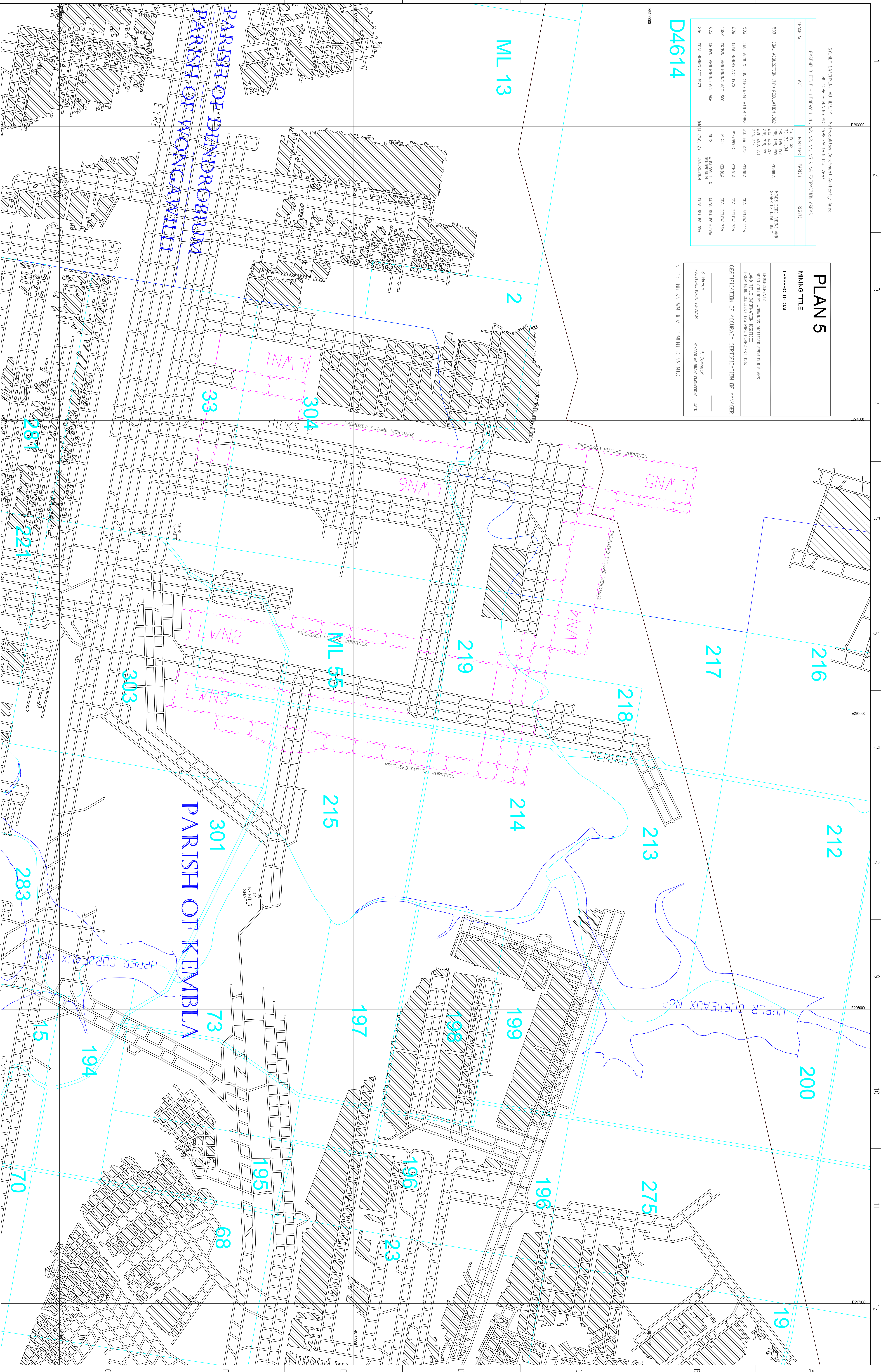
Title	SM	APP	SCALE
SMP APPLICATION -	DRN	APP	SCALE
PLAN 3	SM	APP	SCALE
LWN1, N2, N3, N4, N5 & N6	CKD	APP	SCALE
WON-01-0427	APP	APP	SCALE
REV 0	APP	APP	SCALE

LEASEHOLD TITLE - LONGWALL NO. N2, N3, N4, N5 & N6 EXTRACTION AREAS			
LEASE NO.	ACT	PORTIONS	RIGHTS
583	COAL ACQUISITION (123) REGULATION 1982	70, 72, 194, 195, 196, 197, 198, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000	MINES, MINING AND STAMPS OF COAL, OIL & GAS
583	COAL ACQUISITION (123) REGULATION 1982	23, 68, 275	COAL, BELOW 100m
238	COAL MINING ACT 1973	214(2)(9)(4)	KEMBLA
1382	COAL MINING ACT 1986	N155	KEMBLA
623	COAL MINING ACT 1986	N13	KEMBLA
216	COAL MINING ACT 1973	D4614 (INCL. 2)	DEMONSTRATION

PLAN 5
MINING TITLE -
LEASEHOLD COAL
ENDORSEMENTS: NEED COLLIERY WORKINGS DIGITISED FROM OLD PLANS LAND TITLE INFORMATION DIGITISED FROM NEED COLLIERY OLD PINE PLANS OF 1863
CERTIFICATION OF ACCURACY CERTIFICATION OF MANAGER
S. March REGISTERED MINING SURVEYOR
P. Crawford MANAGER OF MINING ENGINEERING
DATE

NOTE - NO KNOWN DEVELOPMENT CONSENTS

D4614



Appendix C – Monitoring Methods and Accuracy

Gujarat NRE Wongawilli Colliery Subsidence Monitoring Program Nebo Longwalls N1-N6

Asset Description	Asset Type	Monitoring Description	Frequency / Survey Type	Survey Methodology
Subsidence Survey Lines (<i>Sydney Catchment Authority</i>)	Subsidence Lines NM1, NM2, NM3 and NM4 (Appendix B)	Marks placed at 10m nominal centres as shown on plan WON-01-0539 Rev0 to monitor subsidence resulting from Longwalls N1-N6 extraction	2D and 3D survey prior to start (staged) 2D and 3D survey completed on subsidence line post extraction of each Longwall 2D survey to occur if cracking >10mm is identified during extraction	Static GNSS at Control points to fix ground measurements using Trimble S8 Total Station (1" angular accuracy, EDM 1mm +1ppm) – or similar instrument. <u>Accuracy Expectation</u> 3D Absolute Position +/- 50mm 3D Relative +/- 30mm Levels +/- 5mm 2D Accuracy +/- 5mm
Electricity Transmission Lines (<i>Sydney Water Asset</i>)	Sydney Water 33 kV Power Line - 11 Poles (Appendix B)	Relative survey to measure base of poles for tilts or closure at each pole	Prior to start of Longwall N2	Relative survey - Poles +/- 3mm Horz. - +/- 5mm Vert.
Regional “Far Field” 3D Monitoring (<i>Various Asset Owners</i>)	Various Locations (Appendix B)	3D survey of 9 Stations surrounding extraction area	- Prior to commencement of extraction - At completion of each longwall	Static GNSS observations referenced to CORSnet base station at Wollongong. <u>Accuracy Expectation</u> Position +/- 25mm Height +/- 35mm