




SIMEC


SIMEC Mining:

**Tahmoor North Western Domain
Longwalls West 3 and West 4**

Management Plan for Potential Impacts to Endeavour Energy Infrastructure



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References:-

AS/NZS 4360:1999 Risk Management

AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines

MSO (2017) Managing risks of subsidence – Guide | WHS (Mines and Petroleum Sites) Legislation, NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations, February 2017.

MSEC (2021) Tahmoor Coal - Longwalls W3 and W4 - Subsidence Predictions and Impact Assessments for Natural and Built Features due to the extraction of the proposed Longwalls W3 and W4 in support of the Extraction Plan Application. (Report No. MSEC1112, Revision A, March 2021), prepared by Mine Subsidence Engineering Consultants.

Endeavour Energy (2019) Endeavour Energy Network: Results of On Site Audit Endeavour Energy Assets for SIMEC Mining - Tahmoor Colliery Longwalls West 1 and West 2, Endeavour Energy, May 2019.

Tahmoor Coal (2020) Risk Assessment Report – Infrastructure. Tahmoor North – Western Domain, Longwalls West 3 and West 4, September 2020.

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Drawings referred to in this report are included in Appendix A at the end of this report.

Drawing No.	Description	Revision
MSEC1173-00-01	Monitoring plan	02
MSEC1173-06-01	Electrical Infrastructure	B
MSEC1173-06-02	Critical power poles	B

1.1. Background

Tahmoor Coal owns and operates Tahmoor Mine, an existing underground coal mine that is located approximately 80 km south-west of Sydney in the Southern Coalfield of NSW. Tahmoor Coal is a wholly owned entity within the SIMEC Mining Division of the GFG Alliance group. Tahmoor Coal has previously mined 34 longwalls to the north and west of the mine's current location.

Longwalls West 1 and West 2 (LW W1-W2) were the first two longwalls to be mined in the Western Domain, located northwest of the Main Southern Railway and between the townships of Thirlmere and Picton.

Longwalls West 3 and West 4 (LW W3-W4) are the final two longwalls to be mined in the Western Domain. Electrical infrastructure owned by Endeavour Energy is located within this area.

A summary of the dimensions of Longwall W3-W4 is provided in Table 1.1.

Table 1.1 Longwall dimensions

Longwall	Overall void length including the installation heading (m)	Overall void width including the first workings (m)	Overall tailgate chain pillar width (m)
LW W3	1552	283	39
LW W4	1004	285	44

This Management Plan provides detailed information about how the risks associated with mining beneath the infrastructure will be managed by Tahmoor Coal and Endeavour Energy.

The Management Plan is a live document that can be amended at any stage of mining, to meet the changing needs of Tahmoor Coal and Endeavour Energy.

1.2. Endeavour Energy's electrical assets potentially affected by LW W3-W4

A map showing the locations of Endeavour Energy's electrical infrastructure in relation to LW W3-W4 is shown in Drawing No. MSEC1173-06-01.

The electrical infrastructure comprises 11 kilovolt (kV) and low voltage powerlines that generally follow the local roads. The powerlines are partly located above the southern ends of LW W1-W3 and directly above the northern end of LW W3. The total length of powerlines located directly above LW W3-W4 is approximately 300 m. Powerlines are also located to the east of LW W3-W4 along Thirlmere Way, Rumker Street (Nth) and Connellan Crescent.

The 11 kV powerline along Thirlmere Way and Rumker Street (Nth) and the section of the low voltage powerline above the southern end of LW W2 comprise aerial conductors supported by timber poles. The powerlines along Stonequarry Creek Road, Carramar Close, Attunga Close and Booyong Close are buried.

Endeavour Energy's on-site audit prior to the commencement of LW W1 found the existing assets to be in a good state of repair and in serviceable order.

1.3. Consultation

1.3.1. Consultation with Endeavour Energy

Tahmoor Coal regularly consults with Endeavour Energy in relation to mine subsidence effects from mining. This includes consultation during the development of subsidence management plans for previous Longwalls 22 to 32 and LW W1 -W2, and regular reporting of subsidence movements and impacts.

Details regarding consultation and engagement are outlined below:

- Consultation with Ben Logue (Endeavour Energy) on 28 February 2019 requesting Endeavour Energy assessment of critical poles for LW W1-W2 Management Plan.
- Provision of draft Results of On Site Audit of Endeavour Energy assets, dated 9 May 2019.
- Feedback on Site Audit provided to Endeavour Energy on 22 May 2019.
- Provision of final Results of On Site Audit of Endeavour Energy assets, dated 23 May 2019.
- Meeting with Endeavour Energy, David Talbert (Tahmoor Coal), April Hudson (Tahmoor Coal), Matthew Montgomery (Subsidence Advisory NSW) in August 2019 to discuss the draft Subsidence Management Plan for LW W1-W2.

- Email from Luke Moss (Endeavour Energy) on 30 June 2021 confirming no change to Endeavour Energy assessment of critical poles for LW W3-W4 Management Plan.
- Email from Bradley Ham with review of Revision A of the LW W3-W4 Management Plan, with inclusion of ground substation DS24257 as a critical asset to be monitored.

Tahmoor Coal will continue to consult regularly with Endeavour Energy during the extraction of LW W3-W4 in relation to mine subsidence effects from mining.

1.3.2. Consultation with Government Agencies & Key Infrastructure Stakeholders

Government agencies including the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations, Subsidence Advisory NSW and key infrastructure stakeholders including Wollondilly Shire Council, Sydney Water, Telstra and Jemena have also been consulted as part of the Subsidence Management Plan (SMP) approval process.

1.4. Limitations

This Management Plan is based on the predictions of the effects of mining on surface infrastructure as provided in Report No. MSEC1112 by Mine Subsidence Engineering Consultants (MSEC, 2021). Predictions are based on the planned configuration of LW W3-W4 at Tahmoor Coal (as shown in Drawing No. MSEC1173-06-01), along with available geological information and data from numerous subsidence studies for longwalls previously mined in the area.

Infrastructure considered in this Plan has been identified from site visits and aerial photographs and from discussions between Tahmoor Coal representatives and Endeavour Energy representatives.

The impacts of mining on surface and sub-surface features have been assessed in detail. It is recognised, however, that the prediction and assessment of subsidence can be relied upon only to a certain extent. The limitations of the prediction and assessment of mine subsidence are discussed in report MSEC1112 by Mine Subsidence Engineering Consultants.

As discussed in the report, there is a low probability that ground movements and their impacts could exceed the predictions and assessments. However, if these potentially higher impacts are considered prior to mining, they can be managed. This Management Plan will not necessarily prevent impacts from longwall mining, but will limit the impacts by establishing appropriate procedures that can be followed should evidence of increased impacts emerge.

1.5. Objectives

The objectives of this Management Plan are to establish procedures to measure, control, mitigate and repair potential impacts that might occur to electrical infrastructure.

The objectives of the Management Plan have been developed to:

- Ensure the safe and serviceable operation of all surface infrastructure. Public and workplace safety is paramount. Ensure that the health and safety of people who may be present on public property or Endeavour Energy property are not put at risk due to mine subsidence;
- Avoid disruption and inconvenience, or, if unavoidable, keep to minimal levels;
- Monitor ground movements and the condition of infrastructure during mining;
- Initiate action to mitigate or remedy potential significant impacts that are expected to occur on the surface;
- Provide a plan of action in the event that the impacts of mine subsidence are greater than those that are predicted;
- Establish a clearly defined decision-making process to ensure timely implementation of risk control measures for high consequence but low likelihood mine subsidence induced hazards that involve potential serious injury or illness to a person or persons that may require emergency evacuation, entry or access restriction or suspension of work activities;
- Provide a forum to report, discuss and record impacts to the surface. This will involve Tahmoor Coal, Endeavour Energy, relevant government agencies as required, and consultants as required; and
- Establish lines of communication and emergency contacts.

1.6. Scope

The Management Plan is to be used to protect and monitor the condition of the Endeavour Energy infrastructure identified to be at risk due to mine subsidence and to ensure that the health and safety of people who may be present on public property or Endeavour Energy property are not put at risk due to mine subsidence.

The major items at risk are:

- Powerlines;
- Power poles; and
- Ground substation DS24257 at Stonequarry Estate Wastewater Treatment Plant.

The powerlines and power poles are shown in Drawing No. MSEC1173-06-01.

The Management Plan only covers the electrical infrastructure that is located within the limit of subsidence, which defines the extent of land that may be affected by mine subsidence as a result of mining LW W3-W4 only. The management plan does not include other electrical infrastructure owned by Endeavour Energy which lies outside the extent of this area.

1.7. Proposed mining schedule

It is planned that LW W3-W4 will extract coal working south from the northern end. This Management Plan covers longwall mining until completion of mining in LW W4 and for sufficient time thereafter to allow for completion of subsidence effects. The current schedule of mining is shown in Table 1.2.

Table 1.2 Schedule of mining

Longwall	Start Date	Completion Date
LW W3	September 2021	March 2022
LW W4	April 2022	August 2022

Please note the above Schedule is subject to change due to unforeseen impacts on mining progress. Tahmoor Coal will keep Endeavour Energy informed of changes.

1.8. Definition of Active Subsidence Zone

As a longwall progresses, subsidence begins to develop at a point in front of the longwall face and continues to develop after the longwall passes. The majority of subsidence movement typically occurs within an area 150 metres in front of the longwall face to an area 450 metres behind the longwall face.

This is termed the “active subsidence zone” for the purposes of this Management Plan, where surface monitoring is generally conducted. The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 metres in front and 450 metres behind the active longwall face, as shown by Fig. 1.1.

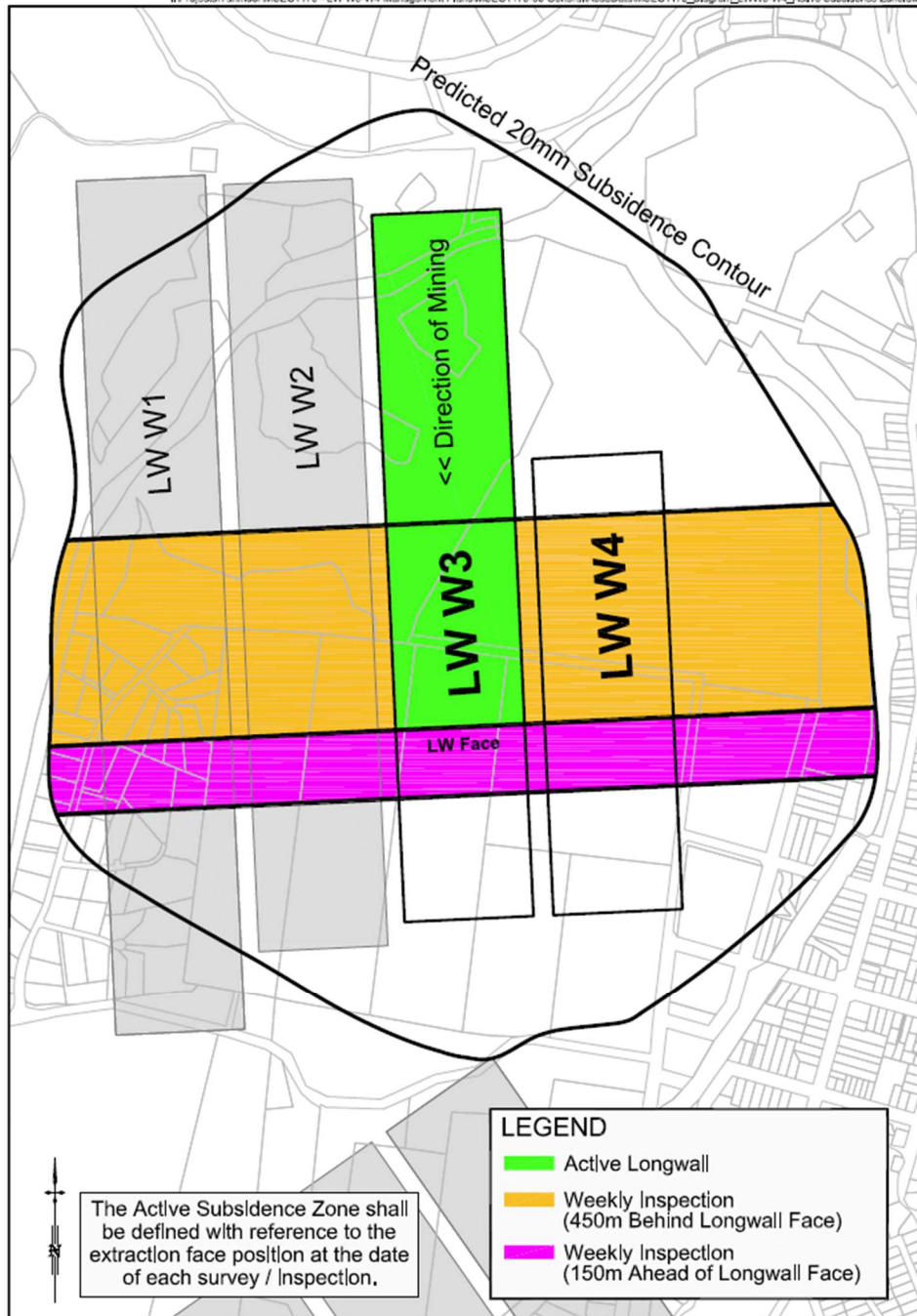


Fig. 1.1 Diagrammatic Representation of Active Subsidence Zone

1.9. Compensation

The *Coal Mine Subsidence Compensation Act 2017* (MSC Act) is administered by Subsidence Advisory NSW (Mine Subsidence Board).

Currently, under the *Coal Mine Subsidence Compensation Act 2017*, any claim for mine subsidence damage needs to be lodged with Subsidence Advisory NSW. Subsidence Advisory NSW staff will arrange for the damage to be assessed by an independent specialist assessor. If the damage is attributable to mine subsidence, a scope will be prepared and compensation will be determined. For further details please refer to *Guidelines – Process for Claiming Mine Subsidence Compensation* at www.subsidenceadvisory.nsw.gov.au.

2.1. NSW Work Health & Safety Legislation

All persons conducting a business or undertaking (PCBUs), including mine operators and contractors, have a primary duty of care to ensure the health and safety of workers they engage, or whose work activities they influence or direct. The responsibilities are legislated in *Work Health and Safety Act 2011* and the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and associated Regulations (collectively referred to as the 'WHS laws').

The *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* commenced on 1 February 2015 and contains specific regulations in relation to mine subsidence.

As outlined in the Guide by the NSW Department of Trade & Investment Mine Safety:

"a PCBU must manage risks to health and safety associated with mining operations at the mine by:

- *complying with any specific requirements under the WHS laws*
- *identifying reasonably foreseeable hazards that could give rise to health and safety risks*
- *ensuring that a competent person assesses the risk*
- *eliminating risks to health and safety so far as is reasonably practicable*
- *minimising risks so far as is reasonably practicable by applying the hierarchy of control measures, any risks that it is are not reasonably practical to eliminate*
- *maintaining control measures*
- *reviewing control measures.*

The mine operator's responsibilities include developing and implementing a safety management system that is used as the primary means of ensuring, so far as is reasonably practicable:

- *the health and safety of workers at the mine, and*
- *that the health and safety of other people is not put at risk from the mine or work carried out as part of mining operations."*

Detailed guidelines have also been released by the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations (MSO, 2017).

The risk management process has been carried out in accordance with guidelines published by the NSW Department of Planning & Environment, Resources Regulator, Mine Safety Operations (MSO, 2017). The following main steps of subsidence risk management have been and will be undertaken, in accordance with the guidelines:

1. identification and understanding of subsidence hazards
2. assessment of risks of subsidence
3. development and selection of risk control measures
4. implementation and maintenance of risk control measures, and
5. continual improvement and change management.

Each of the above steps have been or will be conducted together with the following processes.

1. consultation, co-operation and co-ordination, and
2. monitoring and review.

This Management Plan documents the risk control measures that are planned to manage risks to health and safety associated with the mining of LW W3-W4 in accordance with the WHS laws.

2.2. General

The method of assessing potential mine subsidence impacts in the Management Plan is consistent with the Australian/New Zealand Standard for Risk Management. The Standard defines the terms used in the risk management process, which includes the identification, analysis, assessment, treatment and monitoring of potential mine subsidence impacts. In this context:-

2.2.1. Consequence

'The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.'¹ The consequences of a hazard are rated from very slight to very severe.

2.2.2. Likelihood

'Used as a qualitative description of probability or frequency.'² The likelihood can range from very rare to almost certain.

2.2.3. Hazard

'A source of potential harm or a situation with a potential to cause loss.'³

2.2.4. Method of assessment of potential mine subsidence impacts

The method of assessing potential mine subsidence impacts combines the likelihood of an impact occurring with the consequence of the impact occurring. In this Management Plan, the likelihood and consequence are combined via the SIMEC Risk Matrix to determine an estimated level of risk for particular events or situations. A copy of the Risk Matrix is included in the Appendix of this Management Plan.

The identified risks were also assessed prior to the commencement of LW W3 using Endeavour Energy's Risk Criteria, which is attached to the Appendix.

¹ AS/NZS 4360:1999 – Risk Management pp2

² AS/NZS 4360:1999 – Risk Management pp2

³ AS/NZS 4360:1999 – Risk Management pp2

3.1. Maximum predicted conventional subsidence parameters over Study Area

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC1112, which was prepared in support of Tahmoor Coal's Extraction Plan for LW W3-W4. A summary of the maximum predicted total subsidence parameters over the Study Area due to the extraction of LW W3-W4, are provided in Table 3.1.

Table 3.1 Maximum predicted conventional subsidence parameters for LW W3-W4

Longwall	Maximum predicted subsidence (mm)	Maximum predicted tilt (mm/m)	Maximum predicted hogging curvature (1/km)	Maximum predicted sagging curvature (1/km)
LW W3	950	5.0	0.06	0.10
LW W4	1025	5.0	0.06	0.10

The values provided in the above table are the maximum predicted conventional subsidence parameters which occur within the Study Area.

3.2. Comparison of measured and predicted subsidence for LW W1-W2

Predictions using MSEC's Incremental Profile Method have been continually tested and refined during the mining of previous Longwalls 22 to 32, as described in Report No. MSEC1112.

In this case, LW W1-W2 have been extracted in a new longwall series, which is located to the north of the completed LW 32.

LW W1

Observed subsidence above single panels is typically more variable than above subsequent longwall panels in a series. The variations are due to different strengths of the overburden strata above the panel, which is supported on all four sides of the longwall.

A study on observed subsidence above previously extracted single panels at Tahmoor Mine was conducted by MSEC, with results provided in Report No. MSEC1112.

Ground surveys during the mining of LW W1 have found that subsidence has been substantially less than predicted (approximately 50%). The experience is new for Tahmoor Mine but it has been previously observed for nearby longwalls at Appin Colliery, including LW901 and the southern section of LW703.

A comparison between measured and predicted profiles of vertical subsidence along the Picton-Mittagong Loop Line are provided in Fig. 3.1 after the extraction of LW W1.

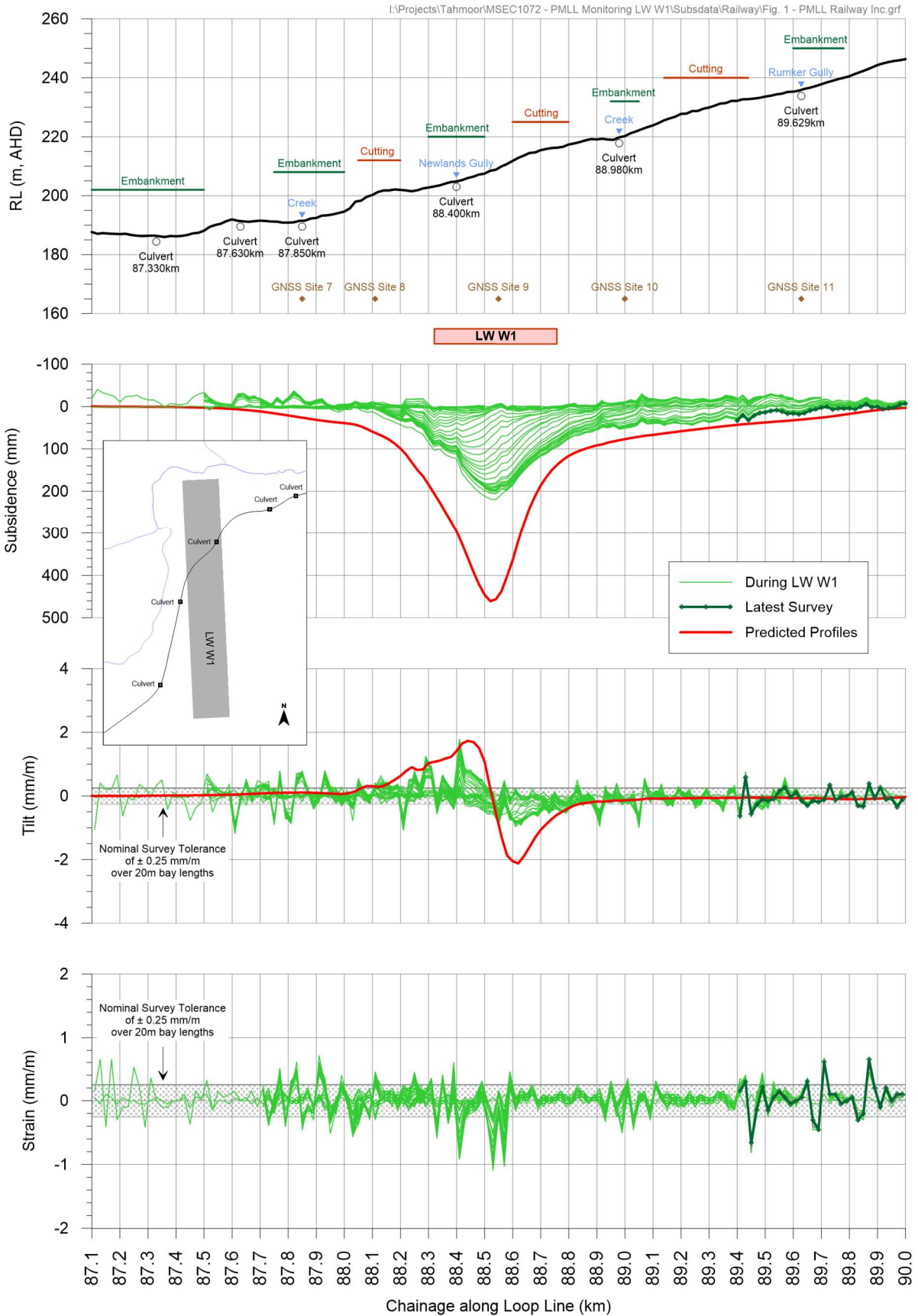


Fig. 3.1 Observed subsidence along Picton-Mittagong Loop Line during the mining of LW W1

LW W2

As of 1 June 2021, subsidence surveys above LW W2 have measured less subsidence than predicted. Observed subsidence along the Picton-Mittagong Loop Line after the extraction of LW W2 is shown in Fig. 3.2. Observed subsidence along the LW W1 W2 crossline after the extraction of LW W2 is shown in Fig. 3.3.

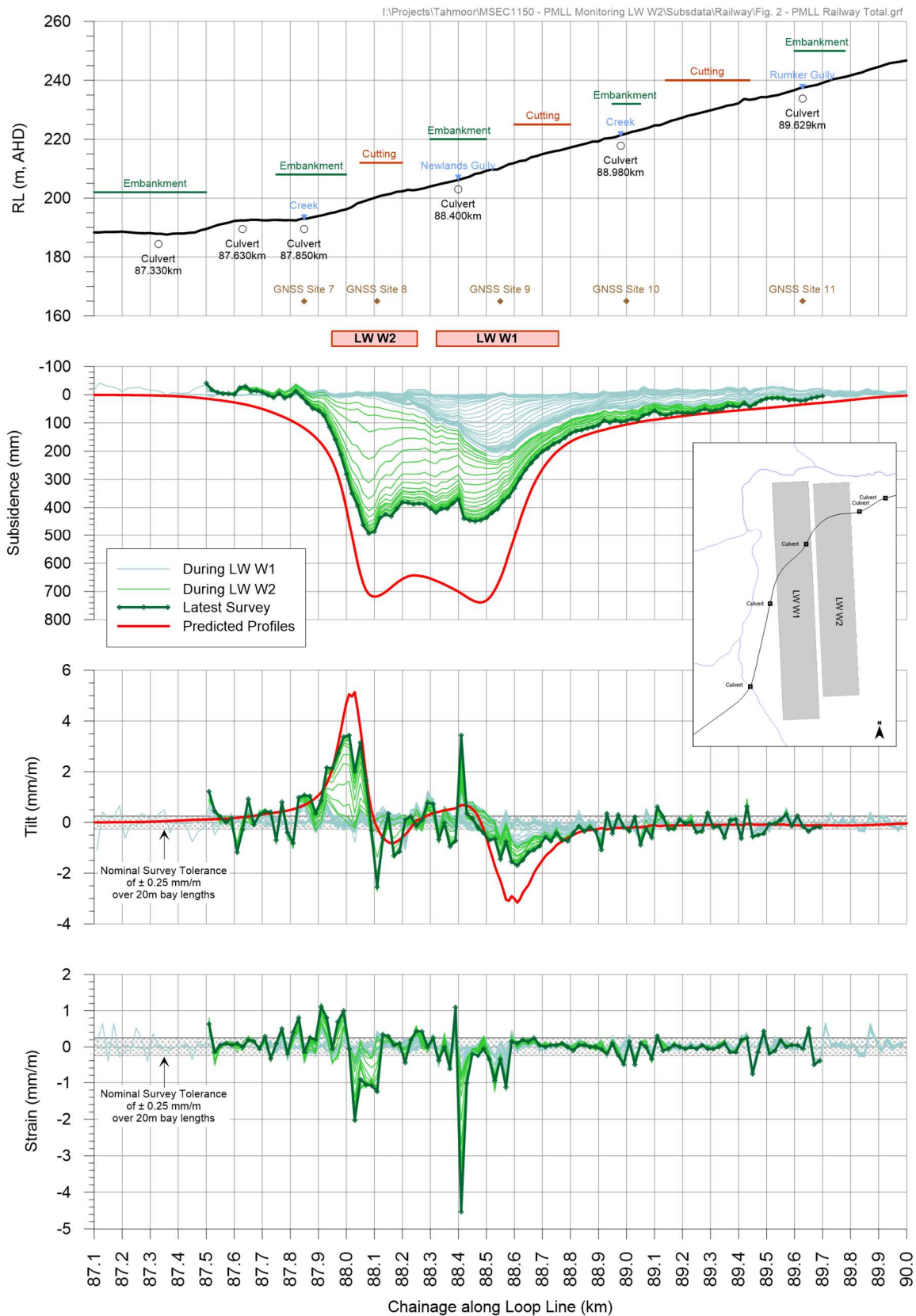


Fig. 3.2 Observed subsidence along Picton-Mittagong Loop Line during the mining of LW W1-W2

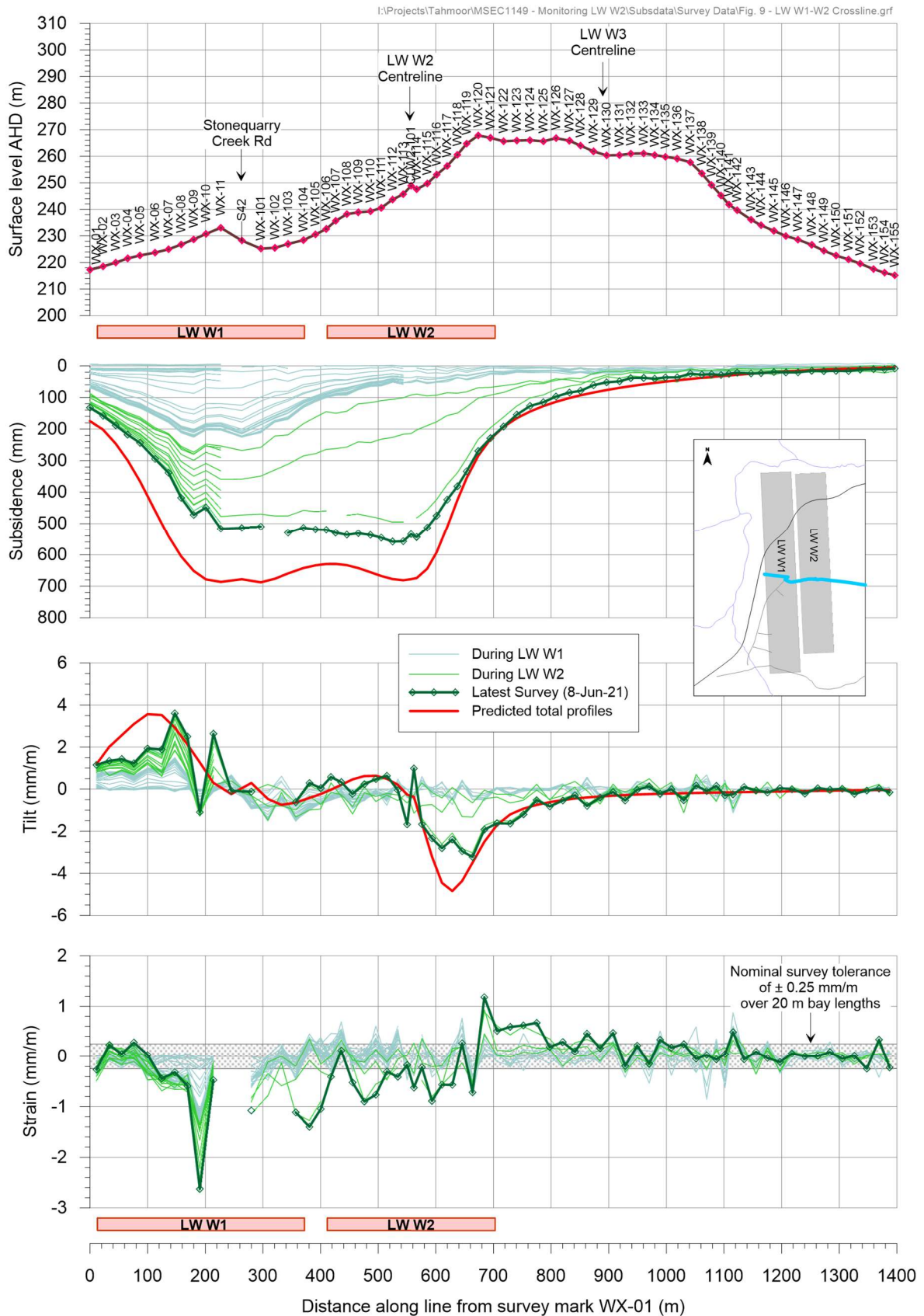


Fig. 3.3 Observed subsidence along LW W1-W2 crossline during the mining of LW W1-W2

Whilst observed subsidence above LW W1 and LW W2 was less than predicted, subsidence due to the extraction of LW W3-W4 may not follow the same pattern, and may return to normal levels. Subsidence may also be greater than predicted.

It is therefore planned to monitor the development of subsidence during the extraction of LW W3-W4 to compare observations with predictions. Measures have been developed in this Management Plan to manage potential impacts on Endeavour Energy's electrical infrastructure, even when actual subsidence is substantially greater than the magnitudes that have been predicted above LW W3-W4.

3.3. Predicted strain

The prediction of strain is more difficult than the predictions of subsidence, tilt and curvature. The reason for this is that strain is affected by many factors, including ground curvature and horizontal movement, as well as local variations in the near surface geology, the locations of pre-existing natural joints at bedrock, and the depth of bedrock. Survey tolerance can also represent a substantial portion of the measured strain, in cases where the strains are of a low order of magnitude. The profiles of observed strain, therefore, can be irregular even when the profiles of observed subsidence, tilt and curvature are relatively smooth.

In previous MSEC subsidence reports, predictions of conventional strain were provided based on the best estimate of the average relationship between curvature and strain. Similar relationships have been proposed by other authors. The reliability of the strain predictions was highlighted in these reports, where it was stated that measured strains can vary considerably from the predicted conventional values.

Adopting a linear relationship between curvature and strain provides a reasonable prediction for the conventional tensile and compressive strains. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones and locations that are predicted to experience sagging or concave curvature are expected to be net compressive strain zones. In the Southern Coalfield, it has been found that a factor of 15 provides a reasonable relationship between the predicted maximum curvatures and the predicted maximum conventional strains.

At a point, however, there can be considerable variation from the linear relationship, resulting from non-conventional movements or from the normal scatters which are observed in strain profiles. When expressed as a percentage, observed strains can be many times greater than the predicted conventional strain for low magnitudes of curvature. In this report, therefore, we have provided a statistical approach to account for the variability, rather than providing a single predicted conventional strain.

The data used in the analysis of observed strains included those resulting from both conventional and non-conventional anomalous movements, but did not include those resulting from valley-related effects, which are discussed separately in the impact assessments for the natural and built features provided in Chapters 5 and 6. The strains resulting from damaged or disturbed survey marks have also been excluded.

3.3.1. Analysis of strains measured in survey bays

For features that are in discrete locations, such as building structures, farm dams and archaeological sites, it is appropriate to assess the frequency of the observed maximum strains for individual survey bays.

Predictions of strain above goaf

The survey database has been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of Longwalls 22 to 32 and LW W1-W2 at Tahmoor Mine, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as "*above goaf*".

A histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf at Tahmoor Mine is provided in Fig. 3.4. A number of probability distribution functions were fitted to the empirical data. It was found that a *Generalised Pareto Distribution (GPD)* provided a good fit to the raw strain data, and this is also shown in this figure.

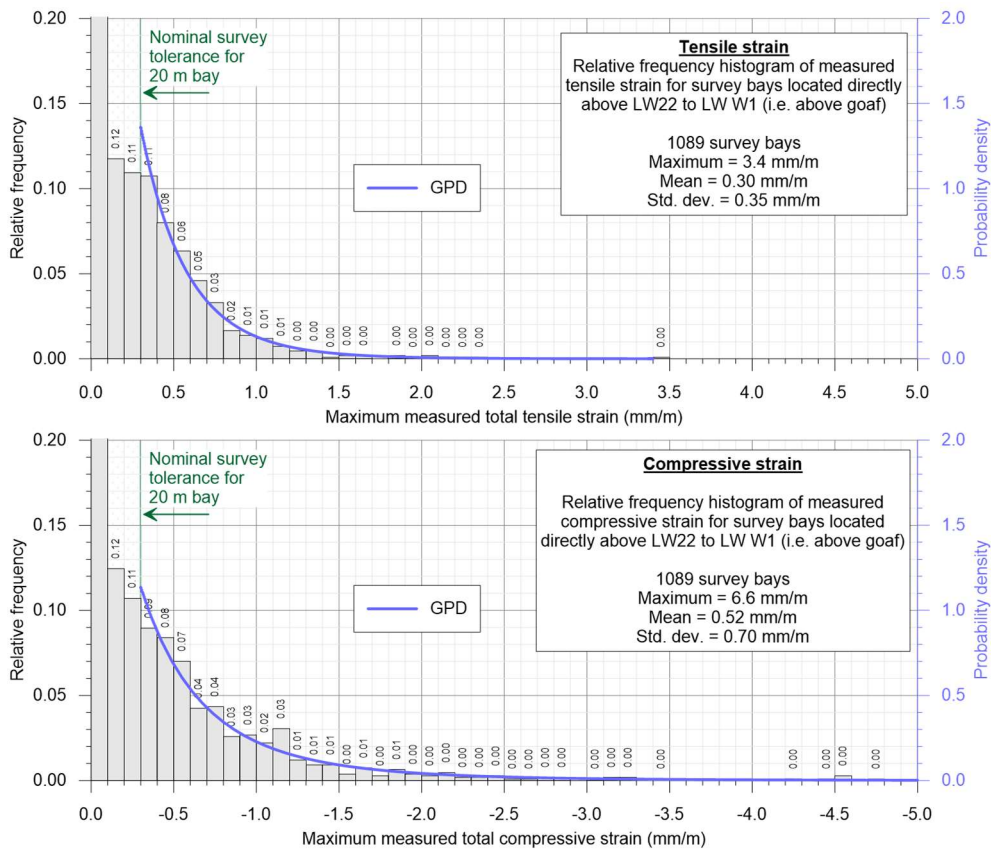


Fig. 3.4 Distributions of the maximum measured tensile and compressive strains during the extraction of previous longwalls for surveys bays located above goaf

The 95 % confidence levels for the maximum total strains that the individual survey bays above goaf experienced at any time during mining were 1.0 mm/m tensile and 1.7 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above goaf experienced at any time during mining were 1.5 mm/m tensile and 3.3 mm/m compressive.

Predictions of strain above solid coal

The survey database has also been analysed to extract the maximum tensile and compressive strains that have been measured at any time during the extraction of previous longwalls at the mine, for survey bays that were located outside and within 250 m of the nearest longwall goaf edge, which has been referred to as “above solid coal”.

A histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal at Tahmoor Mine is provided in Fig. 3.5. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

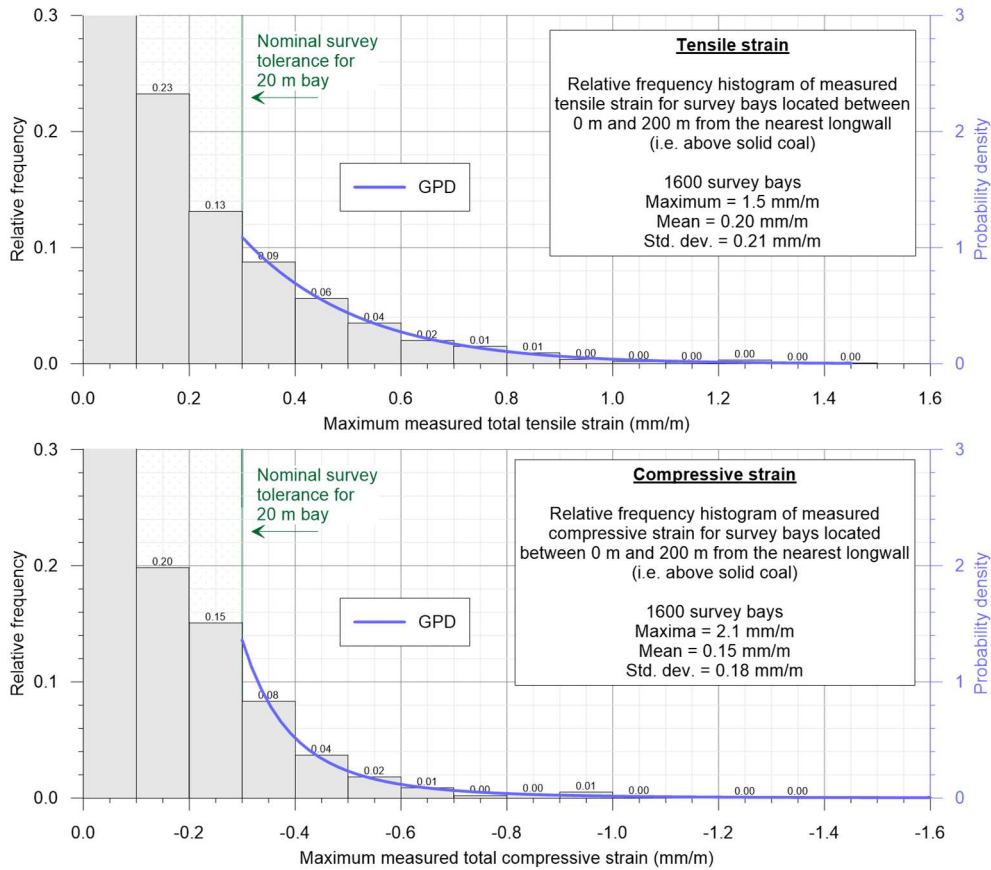


Fig. 3.5 Distributions of the maximum measured tensile and compressive strains during the extraction of previous longwalls for survey bays located above solid coal

The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 0.6 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 1.0 mm/m tensile and 0.8 mm/m compressive.

3.3.2. Analysis of strains measured along whole monitoring lines

For linear features such as roads, cables and pipelines, it is more appropriate to assess the frequency of the maximum strains measured along whole monitoring lines, rather than for individual survey bays. That is, an analysis of the maximum strains measured anywhere along the monitoring lines, regardless of where the strain occurs.

A histogram of maximum observed total tensile and compressive strains measured anywhere along the monitoring lines, at any time during or after the extraction of the previous longwalls at the mine, is provided in Fig. 3.6.

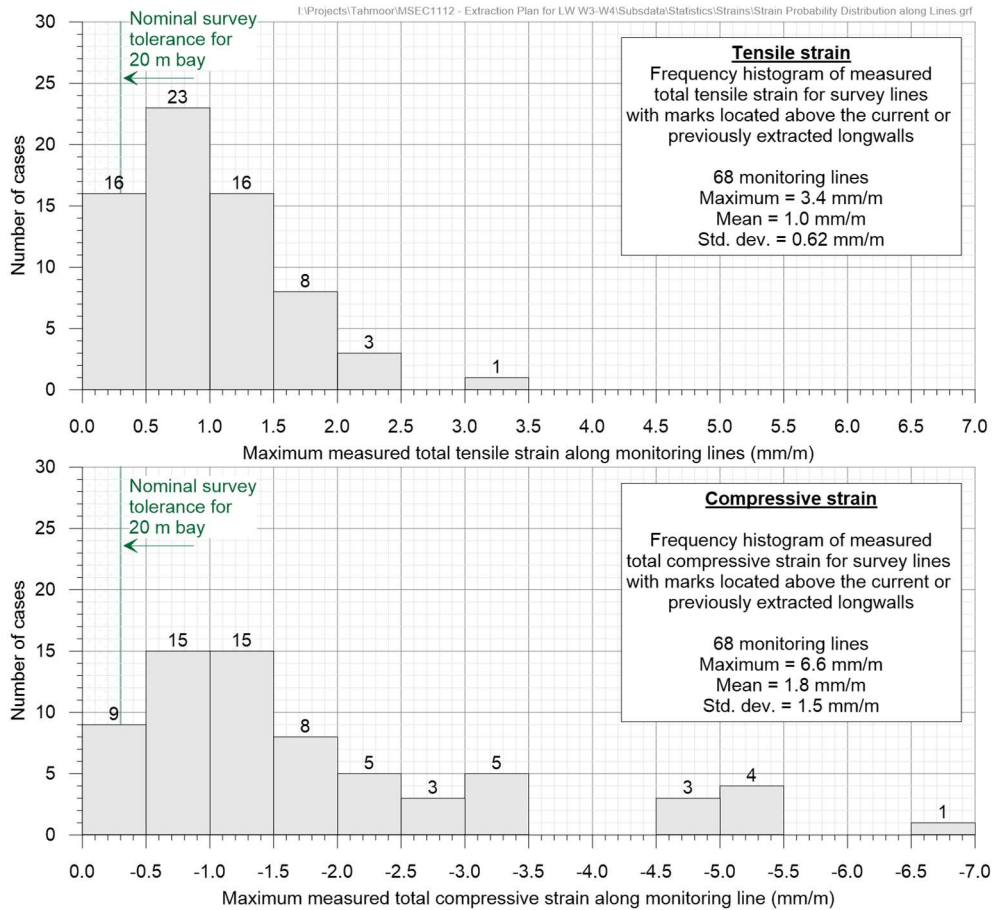


Fig. 3.6 Distributions of maximum measured tensile and compressive strains along the monitoring lines during the extraction of previous longwalls at the mine

It can be seen from the above figure, that 39 of the 68 monitoring lines (i.e. 57 %) had recorded maximum total tensile strains of 1.0 mm/m or less, and that 63 monitoring lines (i.e. 93 %) had recorded maximum total tensile strains of 2.0 mm/m or less. It can also be seen, that 47 of the 68 monitoring lines (i.e. 69 %) had recorded maximum compressive strains of 2.0 mm/m or less, and that 60 of the monitoring lines (i.e. 88 %) had recorded maximum compressive strains of 4.0 mm/m or less.

3.4. Managing public safety

The primary risk associated with mining beneath Endeavour Energy infrastructure is public safety. Tahmoor Coal has previously directly mined beneath or adjacent to more than 2000 houses and civil structures, commercial and retail properties, the Main Southern Railway and local roads and bridges. It has implemented extensive measures prior to, during and after mining to ensure that the health and safety of people have not been put at risk due to mine subsidence. People have not been exposed to immediate and sudden safety hazards as a result of impacts that have occurred due to mine subsidence movements.

Emphasis is placed on the words “immediate and sudden” as in rare cases, some structures have experienced severe impacts, but the impacts did not present an immediate risk to public safety as they developed gradually with ample time to repair the structure.

In the case of this Subsidence Management Plan, the potential for impacts on public safety has been assessed on a case by case basis. The assessments include an on-site audit of assets by Endeavour Energy (2019) prior to the commencement of LW W1 and a review of the audit by Endeavour Energy prior to the commencement of LW W3.

3.4.1. Subsidence Impact Management Process for Infrastructure

Tahmoor Coal has developed and acted in accordance with agreed subsidence management plans to manage potential impacts during the mining of Longwalls 22 to 32 and LW W1-W2. The management strategy has been reviewed and updated based on experiences gained during the mining of these longwalls and the strategy for LW W3-W4 includes the following process:

1. Regular consultation with Endeavour Energy before, during and after mining;
2. Site-specific investigations;
3. Implementation of mitigation measures following inspections by Endeavour Energy; and
4. Surveys and inspections during mining within the active subsidence area:
 - Detailed visual inspections and vehicle-based inspections along the streets;
 - Ground surveys along streets; and
 - Specific surveys of critical power poles as identified by Endeavour Energy.

A flowchart illustrating the subsidence impact management process prior to, during and after Endeavour Energy infrastructure experiences mine subsidence movements is shown in Fig. 3.7.

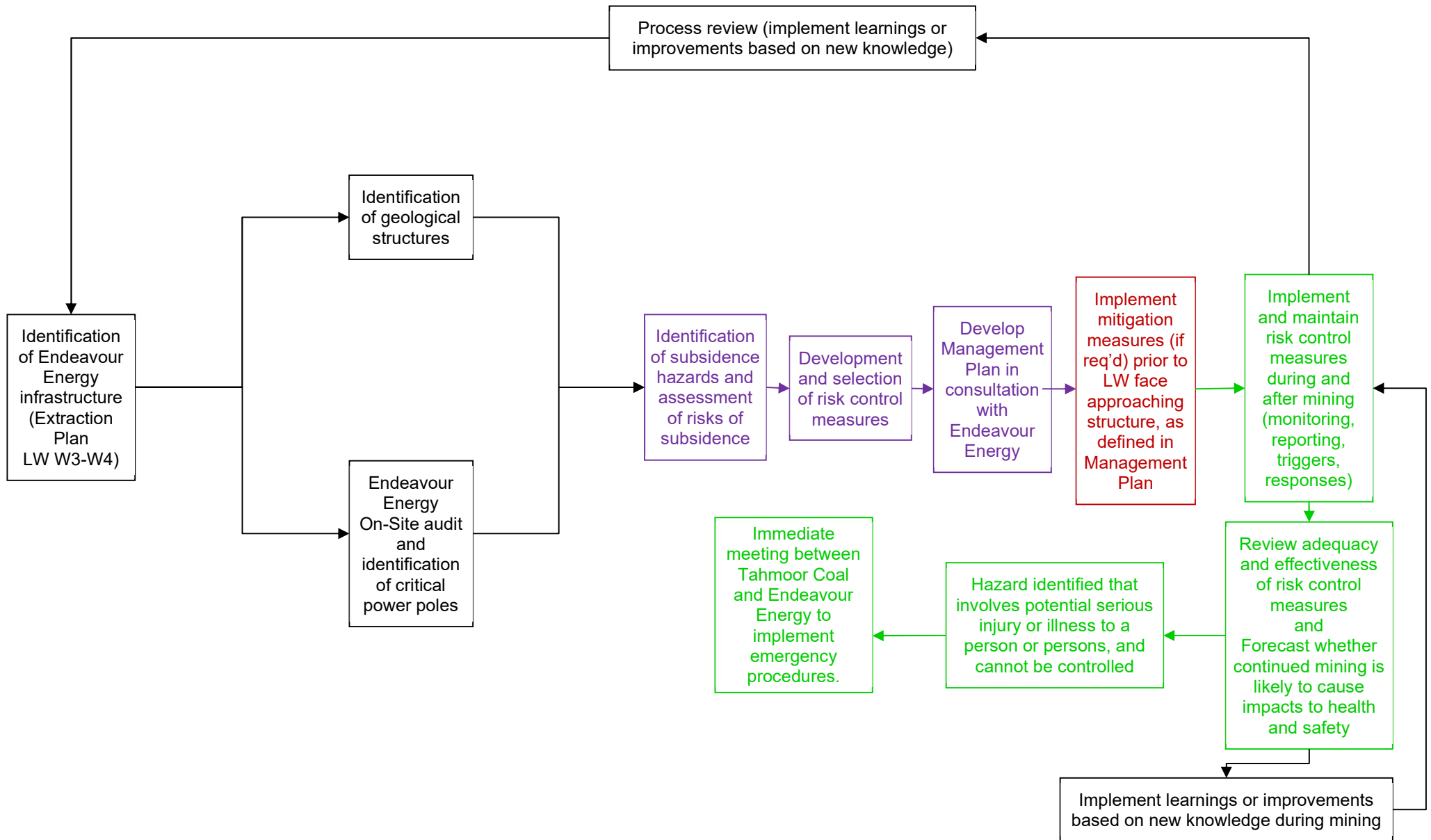


Fig. 3.7 Flowchart for Subsidence Impact Management Process

3.5. Summary of potential impacts

A summary of potential impacts on Endeavour Energy's infrastructure is provided in Table 3.2. The summary is consistent with the risk assessment undertaken by Tahmoor Coal (2020), and was separately assessed according to Endeavour Energy's Risk Criteria (Endeavour Energy, 2019). The results of the risk assessment are included in the Appendix.

Table 3.2 Summary of potential mine subsidence impacts

Risk	Likelihood	Consequence	Level of Potential Impact
Tahmoor Coal Assessment			
Adverse impacts power poles	RARE	MODERATE	LOW
Adverse impacts on consumer cables to houses	RARE	NEGLIGIBLE	LOW
Endeavour Energy Assessment			
Damage to Endeavour Energy Assets	UNLIKELY	MINOR	LOW

Additional information on each potential impact is provided below.

3.6. Identification of subsidence hazards that could give rise to risks to health and safety

Clause 34 of the Work Health and Safety Regulation (2017) requires that the duty holder (in this case Tahmoor Coal), in managing risks to health and safety, must identify reasonably foreseeable hazards that could give rise to risks to health and safety.

This section of the Management Plan summarises hazards that have been identified in Chapter 3, which could give rise to risks to health and safety of people in the vicinity of electrical infrastructure.

Using the processes described in Section 3.4 of this Management Plan, mine subsidence hazards have been identified, investigated and analysed in a systematic manner by examining each aspect of the infrastructure, as described in Section 3.7 of this Management Plan. Each of the aspects below could potentially experience mine subsidence movements that give rise to risks to the health and safety of people:

- 11kV powerlines along streets; and
- Low voltage powerlines.

The following mine subsidence hazards were identified that could give rise to risks to health and safety due to the extraction of LW W3-W4:

- Loss of conductor clearance below Endeavour Energy standards (refer Section 3.7); and
- Tensile pulling of consumer lines at house connections (refer Section 3.7).

The identification and risk assessment process took into account the location of infrastructure relative to LW W3-W4 and the associated timing and duration of the subsidence event, as described in Section 1.8 of this Management Plan.

Whilst mine subsidence predictions and extensive past experiences from previous mining at Tahmoor Mine were taken into account, the identification and risk assessment process recognised that there are uncertainties in relation to predicting subsidence movements, and uncertainties in how mine subsidence movements may adversely impact Endeavour Energy infrastructure, as discussed in Section 1.4 and Chapter 3 of this Management Plan. In this case, creeks have been mapped that intersect powerlines.

Tahmoor Coal has considered the outcomes of the hazard identification and risk assessment process when developing measures to manage potential impacts on the health and safety of people, and potential impacts on Endeavour Energy infrastructure in general. These are described in Chapter 4 of this Management Plan.

3.7. Powerlines

There are a number of powerlines that are located directly above or adjacent to LW W3-W4, as shown in Drawing No. MSEC1173-06-01.

As shown in Drawing No. MSEC1173-06-01, a network of 11kV and LV powerlines are located directly above and adjacent to the extracted LW W1-W2. The powerlines generally follow the local streets including Thirlmere Way, Stonequarry Creek Road, Carramar Close, Attunga Close and Booyong Close, and are buried. An 11kV powerline runs through the Queen Victoria Memorial Home property to the southwest of LW W3. Another powerline crosses Stonequarry Creek, with a pole located in a rockbar near the commencing end of LW W3. The powerlines are supported by single pole structures.

The 11 kV powerline along Thirlmere Way and the section of the low voltage powerline above the southern end of LW W3 comprise aerial conductors supported by timber poles. Powerlines are also located to the east of LW W3-W4 along Thirlmere Way, Rumker Street (Nth) and Connellan Crescent.

3.7.1. Predicted subsidence movements

The powerlines located above and adjacent to LW W3-W4 generally follow the alignments of the local roads.

The predicted profiles of conventional subsidence, tilt and curvature for the 11kV powerline along Thirlmere Way is shown in Fig. 3.8. The predicted profiles of conventional subsidence, tilt and curvature for the 11kV powerline along Stonequarry Creek Road is shown in Fig. 3.9.

A summary of the maximum predicted conventional subsidence, tilt and curvature for each of the powerlines, after the extraction of LW W3-W4, is provided in Table 3.3 for Thirlmere Way and Table 3.4 for Stonequarry Creek Road. The values are the maximum predicted parameters anywhere along the sections of powerlines located within the predicted limit of vertical subsidence for LW W3-W4.

Table 3.3 Maximum predicted total conventional subsidence, tilt and curvature for Thirlmere Way

Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
After LW W3	100	< 0.5	0.01	< 0.01
After LW W4	100	< 0.5	0.01	< 0.01

Table 3.4 Maximum predicted total conventional subsidence, tilt and curvature for Stonequarry Creek Road

Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
After LW W3	750	3.0	0.03	0.05
After LW W4	775	3.0	0.03	0.05

3.7.2. Potential subsidence impacts on powerlines

Longwalls 22 to 32 have directly mined beneath approximately 44 km of electrical cables and over 1100 power poles and no significant impacts have been recorded. Whilst no impacts have been recorded, minor changes in tension of some aerial cables has been observed.

LW W1-W2 have mined directly beneath the Stonequarry Estate buried powerlines with no impacts observed. There were also no impacts observed the aerial powerlines that are located directly above LW W2.

It is possible, but unlikely, that minor adverse impacts could occur to the electrical infrastructure that is located directly above or immediately adjacent to LW W3-W4. It is expected that the impacts would be relatively minor and that these could be readily repaired.

Tahmoor Coal has developed and selected risk control measures in consultation, co-ordination and co-operation with Endeavour Energy in accordance with WHS legislation. The controls have been successfully implemented during the mining of Longwalls 22 to 32 and LW W1-W2.

In this instance, there are no reasonably practicable controls which could eliminate, substitute or isolate the identified risks, nor engineering controls that could put in place a structure or item that prevents or minimises risks. Tahmoor Coal has identified controls that will manage potential issues associated with damage to electrical infrastructure during the extraction of LW W3-W4 by implementing the following measures:

- Regular ground surveys along streets located within the active subsidence zone;
- Regular surveys of critical power poles identified by Endeavour Energy;
- Regular visual inspections along streets and electrical infrastructure located within the active subsidence zone;
- Regular consultation with the community to report potential impacts;
- Adjustment of powerlines to rectify adverse tilts or reduction in conductor clearance heights if triggered by monitoring results;
- Repair of buried powerlines if damaged; and
- In the worst case, repair of damaged powerlines.

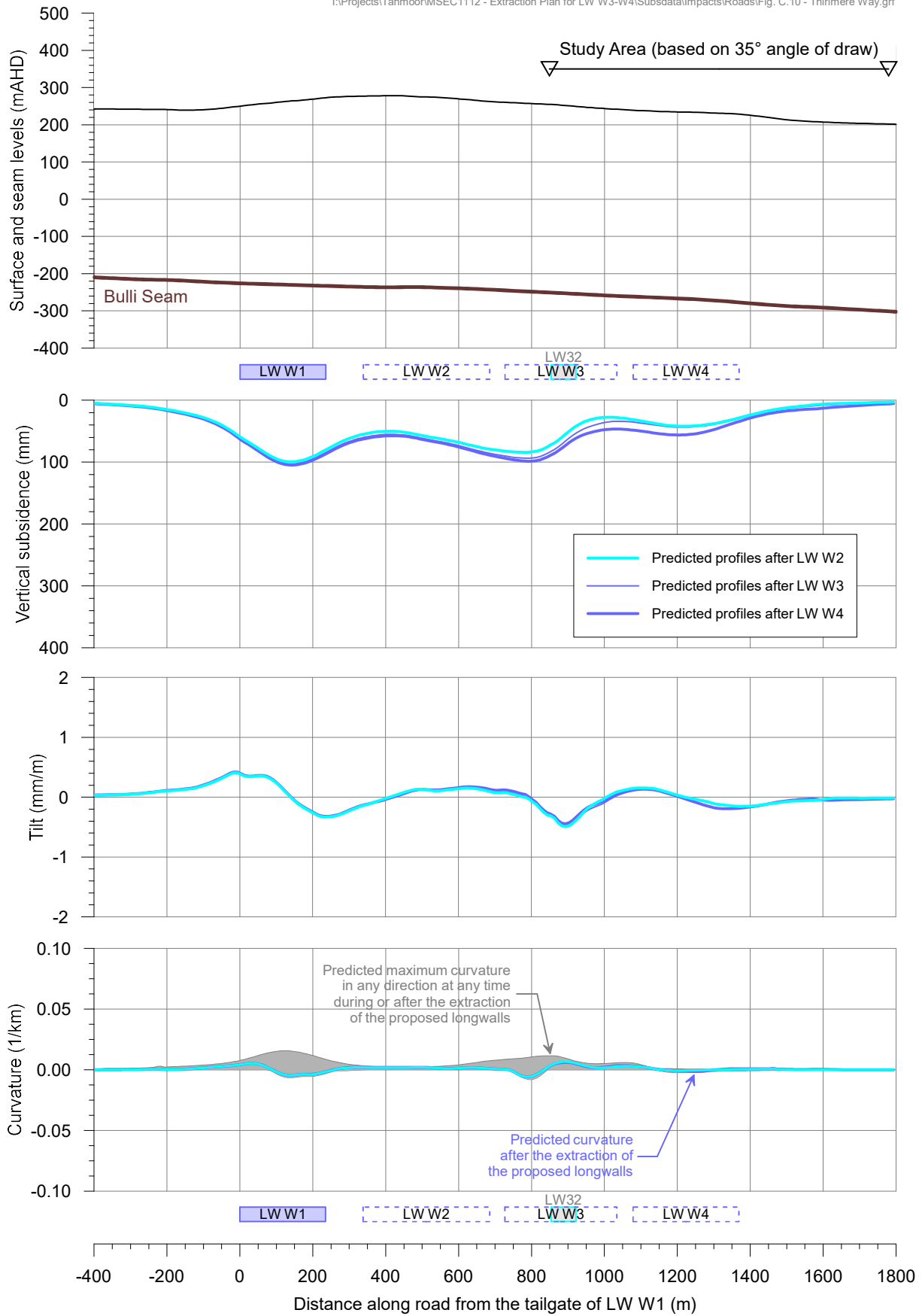


Fig. 3.8 Predicted profiles of total subsidence, tilt and curvature for the powerline along Thirlmere Way after the mining of LW W3-W4

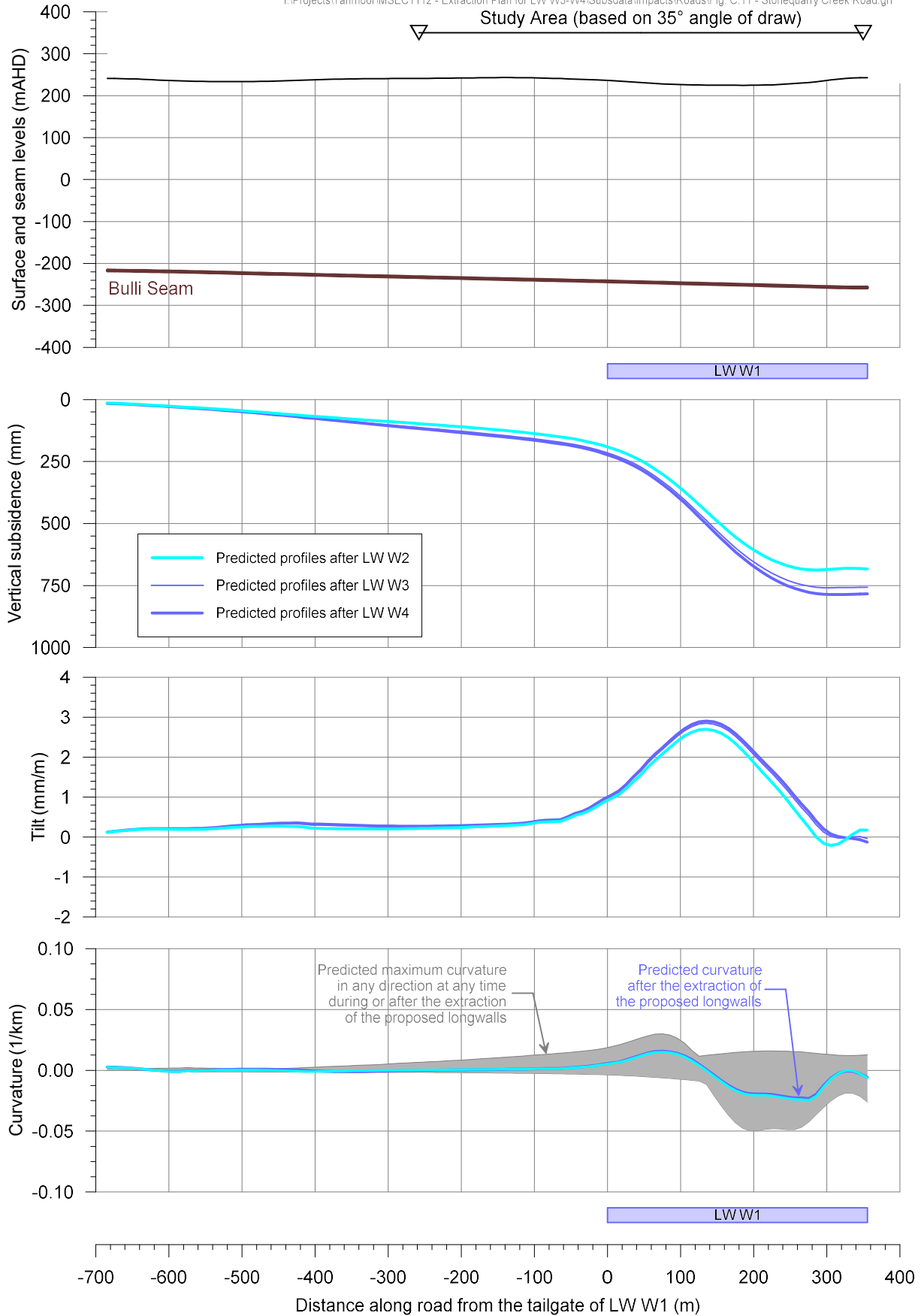


Fig. 3.9 Predicted profiles of total subsidence, tilt and curvature for the powerline along Stonequarry Creek Road after the mining of LW W3-W4

3.7.3. Power poles

An inspection of power poles located within the mining area for LW W1-W2 was conducted by Endeavour Energy on 9 May 2019. The accompanying report concluded that the electricity infrastructure is generally in a good state of repair and in serviceable order. Experience has shown that power poles have remained safe and serviceable during and after mining.

The poles recommended for monitoring during LW W1-W2 are listed in Table 3.5, and are shown in Drawing No. MSEC1173-06-02. Endeavour Energy has recommended that Tahmoor Coal monitor the same poles for LW W3-W4.

Table 3.5 Summary of poles recommended for monitoring during LW W1-W2

Sub No.	Pole No.	Street Name	Type	Position relative to LWs
10205	631136	Barkers Lodge Road	Pole Sub	Northwest of LW W3
22756	287337	Thirlmere Way	Pole Sub	Southwest of LW W3
10210	630726	Thirlmere Way	Pole Sub	Southwest of LW W3
10179	630737	Thirlmere Way	Pole Sub	West of LW W3
12090	630765	Thirlmere Way	Pole Sub	Southwest of LW W3
21465	271719	Thirlmere Way	Pole Sub	South of LW W3

3.7.4. Ground substation DS24257

Ground substation DS24257 is located north east of the Stonequarry Estate Wastewater Treatment Plant (WTP). The substation is located directly above LW W3 and its location is shown in Drawing No. MSEC1173-06-01. A photograph is provided in Fig. 3.10.



Photograph courtesy Building Inspection Services

Fig. 3.10 Ground substation DS24257

The substation is mounted on a concrete plinth, with buried cables entering and exiting the substation on the western side. Small pillar boxes and an electrical meter box are located near the substation.

Predictions of subsidence, tilt and strain are shown in Table 3.6.

Table 3.6 Maximum predicted total conventional subsidence, tilt and curvature at Ground Substation DS24257

Longwall	Maximum predicted total subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (1/km)	Maximum predicted total sagging curvature (1/km)
After LW W3	425	4.0	0.03	0.05
After LW W4	450	4.5	0.03	0.05

The substation has a relatively small footprint and is unlikely to be adversely affected by the mining of LW W3 and W4, even if actual movements are substantially greater than prediction. Similarly-sized substations have experienced mining-induced movements without adverse impacts. It is possible, however, that adverse impacts could occur, such as at the connection between the buried cables and the substation if the slab and cable conduit move relative to each other.

Endeavour Energy has requested that the substation be monitored during the mining of LW W3. Survey marks will be placed on the substation plinth and in the ground around the substation. Surveys and visual inspections will be conducted on a weekly basis during the period of active subsidence.

4.1. Infrastructure Management Group (IMG)

The Infrastructure Management Group (IMG) is responsible for taking the necessary actions required to manage the risks that are identified from monitoring the infrastructure and to ensure that the health and safety of people who may be present on public property or Endeavour Energy property are not put at risk due to mine subsidence. The IMG develops and reviews this management plan, collects and analyses monitoring results, determines potential impacts and provides advice regarding appropriate actions. The members of the IMG are highlighted in Chapter 8.

4.2. Development and selection of risk control measures

Tahmoor Coal has developed and selected risk control measures in consultation, co-ordination and co-operation with the infrastructure owner in accordance with WHS legislation. In accordance with Clauses 35 and 36 in Part 3.1 of the Work Health and Safety regulation (2017) and the guidelines (MSO, 2017), a hierarchy of control measures has been considered and selected where reasonably practicable, using the following process:

1. Eliminate risks to health and safety so far as is reasonably practicable, and
2. If it is not reasonably practicable to eliminate risks to health and safety – minimise those risks so far as is reasonably practicable, by doing one or more of the following:
 - (a) substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk
 - (b) isolating the hazard from any person exposed to it,
 - (c) implementing engineering controls.
3. If a risk then remains, minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls.
4. If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by ensuring the provision and use of suitable personal protective equipment.

A combination of the controls set out in this clause may be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.

There are primarily two different methods to control the risks of subsidence, namely:

- Method A – Selection of risk control measures to be implemented prior to the development of subsidence, (Items 1 and 2 above), and
- Method B – Selection of risk control measures to be implemented during the development of subsidence (Items 3 and 4 above).

Method A and B risk control measures are described in Section 4.3 to Section 4.6. Prior to selecting Method B risk control measures, Tahmoor Coal has investigated and confirmed that the measures are feasible and effective for the site-specific conditions during the extraction of LW W3-W4.

4.3. Selection of risk controls for electrical infrastructure

Based on the above assessments, Tahmoor Coal considered Method A risk control measures, in accordance with the process described in Section 4.2.

Elimination

In this instance, no reasonably practicable controls could be identified that would eliminate the identified risks.

Substitution

In this instance, no reasonably practicable controls could be identified that will change the environment so the hazards could be substituted for hazards with a lesser risk.

Isolation

In this instance, no reasonably practicable controls could be identified to isolate a hazard from any person exposed to it.

Engineering Controls

In this instance, no reasonably practicable engineering controls could be identified to put in place a structure or item that prevents or minimises risks.

Administrative Controls

The following Administrative Controls were identified and selected that will put in place procedures on site to minimise the potential of impacts on the health and safety of people in relation to mining-induced damage to electrical infrastructure:

- Implementation of a Monitoring Plan and Trigger Action Response Plan (TARP)
As described in the Management Plan, Tahmoor Coal and Endeavour Energy have developed and implemented a management strategy of detecting early the development of potential adverse subsidence movements in the ground, so that contingency response measures can be implemented before impacts on safety and serviceability develop. The TARP includes the following:
 - Identification of critical power poles to be monitored prior to the commencement of LW W3-W4 (complete);
 - Local 2D surveys along local roads as shown in Drawing No. MSEC1173-00-01. These include streets along which powerlines and power poles are located, including Thirlmere Way, Stonequarry Creek Road, Carramar Close, Attunga Close, Booyong Close and Connellan Crescent;
 - Surveys of critical power poles within the active subsidence zone;
 - Visual inspections along the streets, including poles, conductors, conductor clearances and house connections within the active subsidence zone;
 - Additional surveys and/or inspections, if triggered by monitoring results;
 - Regular consultation with the community to report potential impacts; and
 - Follow Endeavour Energy procedures to monitor and respond to impacts.

4.4. Monitoring measures

A number of monitoring measures will be undertaken during mining.

4.4.1. Ground Surveys along streets and centrelines of LW W3-W4

A survey line has been installed along the centreline of LW W3, and a survey line will be installed along the centreline of LW W4, as shown in Drawing No. MSEC1173-00-01, subject to approval for access by landowners.

The purpose of the survey lines is to establish the general magnitude and shape of surface subsidence along the centrelines of LW W3-W4. The observed subsidence movements will be used to provide early subsidence information to inform Tahmoor Coal and affected stakeholders prior to built surface features experiencing active subsidence, the majority of which are located at the northern to southern end of LW W3. The information will assist Tahmoor Coal and affected stakeholders in considering whether any additional measures are required to manage potential impacts on the built features.

The information will also be used by Tahmoor Coal as part of its ongoing review of subsidence effects on natural features.

The survey lines will consist of pegs spaced nominally every 20 metres, where access is available, noting that the centrelines pass through private property and building structures. Surveys will measure levels and horizontal distances between adjacent pegs.

Survey lines have been installed along Barkers Lodge Road, Thirlmere Way, Stonequarry Creek Road, Carramar Close, Attunga Close, Booyong Close, and Connellan Crescent, as shown in Drawing No. MSEC1173-00-01. The survey pegs will be surveyed during the period of active subsidence of these features during the extraction of LW W3-W4.

The surveys measure changes in height and changes in horizontal distances between adjacent pegs.

4.4.2. Surveys of critical power poles

Six power poles were identified by Endeavour Energy for surveys during the mining of LW W1-W2. Their locations are shown in Drawing No. MSEC1173-00-01. The same poles have been identified as critical with respect to LW W3-W4. Tahmoor Coal will also survey Pole No. 762531, which is located in the middle of the rockbar on Stonequarry Creek. The power poles will be surveyed for level at the base and vertical offset (tilt).

4.4.3. Survey of ground substation DS24257

Survey marks will be placed on four corners of the substation plinth and four marks in the ground around it. The marks will be surveyed for level and changes in distance between them (local 3D).

4.4.4. Visual inspections

Visual inspections will be undertaken during the period of active subsidence by an experienced inspector appointed by Tahmoor Coal who is familiar with mine subsidence impacts. The inspector will undertake the following:

- Visual inspections along streets within the active subsidence zone; and
- Visual inspections of ground substation DS24257, power poles, changes in tension or sag of conductors, conductor clearances and house connections.

4.4.5. Changes to monitoring frequencies

Monitoring frequencies will continue while Endeavour Energy infrastructure is experiencing active subsidence due to the extraction of LW W3-W4. As a general guide, monitoring is likely to continue until the longwall has moved away from the property by a distance of approximately 450 metres. Monitoring, however, may continue if ongoing adverse impacts are observed.

4.5. Triggers and responses

Trigger levels have been developed by Tahmoor Coal based on engineering assessments and consultation with Endeavour Energy.

Trigger levels for each monitoring parameter are described in the risk control procedures in Table 4.1.

Immediate responses, if triggered by monitoring results, may include:

- Increase in survey and inspection frequencies if required by the IMG;
- Additional surveys and inspections; and
- Repair of impacts that create a serious public safety hazard.

The risk control measures described in this Management Plan have been developed to ensure that the health and safety of people in the vicinity of electrical infrastructure are not put at risk due to mine subsidence. It is also an objective to avoid disruption to services, or if unavoidable, keep disruption and inconvenience to minimal levels.

With respect to the extraction of LW W3-W4, no potential hazards have been identified that could reasonably give rise to the need for an emergency response. Of the potential hazards identified in Section 3.6, only a reduction in conductor clearance height could possibly give rise to the need for an emergency response. The likelihood is considered extremely remote and would require substantial differential subsidence movements to develop before such an event occurs.

As discussed in Section 3.1, mine subsidence movements will develop gradually and there will be ample time to identify the development of potentially adverse differential subsidence movements early, consider whether any additional management measures are required, and repair or adjust affected surface features, in close consultation with Endeavour Energy.

As documented in Section 4.6, Tahmoor Coal and the IMG will review and assess monitoring reports and consider whether any additional management measures are required on a weekly basis. If potentially adverse differential subsidence movements are detected, it is anticipated that a focussed inspection will be undertaken in the affected area, and a decision will likely be made to increase the frequency of surveys and/or inspections. Additional management measures may also be implemented. It is therefore expected that, as a potential adverse situation escalates, Tahmoor Coal will be present on site on a more frequent basis to survey or inspect the affected site, and that Endeavour Energy will be consulted on a more frequent basis.

Notwithstanding the above, if a hazard has been identified that involves potential serious injury or illness to a person or persons on public property or in the vicinity of electrical infrastructure, and cannot be controlled, the immediate response is to remove people from the hazard. If such a situation is observed or is forecast to occur by either Tahmoor Coal or by people on public property, Tahmoor Coal and Endeavour Energy will immediately meet and implement emergency procedures.

4.6. Subsidence Impact Management Procedures

The procedures for the management of potential impacts are provided in Table 4.1.

Table 4.1 Risk Control Procedures during the extraction of Tahmoor Coal LW W3-W4

INFRASTRUCTURE	HAZARD / IMPACT	RISK	TRIGGER	CONTROL PROCEDURE/S	FREQUENCY	BY WHOM?
Electrical Infrastructure	Impacts to infrastructure	Refer On-Site Audit from Endeavour Energy in Appendix	None	Install Initial Goaf GNSS unit (located approximately 100 m inside the commencing end of LW W3-W4)	Prior to commencement of LW W3, install GNSS unit above start position of LW W3. Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW W3. Prior to commencement of LW W3, relocate GNSS unit above start of LW W4. Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW W3.	Tahmoor Coal (Unit Zero)
				2D survey lines along centrelines of LW W3-W4	Baseline survey above LW W3 complete. Monthly survey for pegs located above LW W3 within active subsidence zone after 20 mm of vertical subsidence is measured by the Initial Goaf GNSS unit, or the length of the extraction of LW W3 exceeds 200 m, whichever occurs first. Install and baseline survey above LW W4 for at least 600 m of extraction prior to commencement of LW W4. Install and baseline survey remaining pegs prior to LW W4 approaching within 400 m of pegs. Monthly survey for pegs located within active subsidence zone after 20 mm of vertical subsidence is measured by the Initial Goaf GNSS unit, or the length of the extraction of LW W3 and LW W4 exceeds 200 m, whichever occurs first. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)
				2D survey line across LW W1-W4	Baseline survey complete. Monthly survey during LW W3 and LW W4 during period of active subsidence and continue if ongoing adverse movements are observed.	Tahmoor Coal (SMEC)
				Conduct visual inspections of ground substation DS24257, power poles, conductors, conductor clearances, house connections and local roads within active subsidence zone	Weekly within active subsidence zone during period of active subsidence and continue if ongoing adverse movements are observed.	Tahmoor Coal
				Conduct survey along Barkers Lodge Road	Baseline survey complete. End of LW W3 and LW W4.	Tahmoor Coal (SMEC)
				Conduct surveys along Connellan Crescent	Install and baseline survey prior to LW W3 approaching within 400m of street. Weekly surveys within active subsidence zone during the mining of LW W3-W4 and continue if adverse movements are observed. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)
				Conduct surveys along Stonequarry Creek Road <i>Survey extending to the south to include pegs within the active subsidence zone, then reducing extent to the north beyond active subsidence zone unless ongoing adverse movements are observed</i>	Baseline surveys complete. Weekly surveys within active subsidence zone during the mining of LW W3-W4 and continue if adverse movements are observed. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)
				Conduct surveys along Booyong Close	Baseline surveys complete. Weekly surveys within active subsidence zone during the mining of LW W3-W4 and continue if adverse movements are observed. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)
				Conduct surveys along Attunga Close	Baseline surveys complete. Weekly surveys within active subsidence zone during the mining of LW W3-W4 and continue if adverse movements are observed. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)
Conduct surveys along Thirlmere Way	Baseline survey complete. Weekly surveys within active subsidence zone during the mining of LW W3-W4 and continue if adverse movements are observed. Full length at end of LW W3-W4.	Tahmoor Coal (SMEC)				

INFRASTRUCTURE	HAZARD / IMPACT	RISK	TRIGGER	CONTROL PROCEDURE/S	FREQUENCY	BY WHOM?
				Conduct pole surveys measuring subsidence at base and vertical offset or tilt of selected critical poles as shown in Table 3.5	Baseline survey of poles identified for LW W3-W4 complete. Monthly for each pole within active subsidence zone and for next 3 months after leaving active subsidence zone End of LW W3 and LW W4 for all poles within limit of subsidence for panels	Tahmoor Coal (SMEC / MSEC)
				Conduct pole surveys measuring subsidence at base and vertical offset or tilt of Pole No. 762531 in rockbar on Stonequarry Creek.	Baseline survey prior to start of LW W3. Monthly after 200m of extraction of LW W3 until length of extraction exceeds 800m and continue if adverse movements are observed. Full length at end of LW W3 and W4.	Tahmoor Coal (SMEC / MSEC)
				Conduct surveys of ground substation DS24257 and ground around it (level and local easting and northing)	Install and baseline survey prior to start of LW W3. Weekly after 20 mm of vertical subsidence is measured by the Initial Goaf GNSS unit, or the length of the extraction of LW W3 exceeds 200 m, whichever occurs first.	Tahmoor Coal (SMEC / MSEC)
				Analyse and report results to IMG, including information on the position of the longwall face	Weekly during LW W3 after 20 mm of vertical subsidence is measured by the Initial Goaf GNSS unit, or the length of the extraction of LW W3 exceeds 200 metres, whichever occurs first.	Tahmoor Coal
			Impacts observed to ground substation DS24257, power poles, buried cables or conductor clearance heights	Notify all stakeholders, including Endeavour Energy, Tahmoor Coal, Subsidence Advisory NSW and Resources Regulator	Within 24 hours	Tahmoor Coal
				Repair impact.	As per Endeavour Energy procedures	Endeavour Energy
				Infrastructure Management Group (IMG) meets to consider whether any additional management measures should be undertaken, including: - increasing the frequency of surveys and visual inspections in vicinity of impact site; - investigating for potential of damage occurring to nearby Endeavour Energy infrastructure.	As agreed between Tahmoor Coal and Endeavour Energy	IMG
Electrical Infrastructure	Impacts to infrastructure	Refer On-Site Audit from Endeavour Energy in Appendix	A hazard has been identified that involves potential serious injury or illness to a person or persons on public property or, or in vicinity of electrical infrastructure and cannot be controlled	IMG, Tahmoor Coal and Endeavour Energy meet to decide whether any additional management measures are required, including: - emergency evacuation of hazardous area - demarcation to prevent people entering hazardous area	Immediately	Tahmoor Coal and Endeavour Energy
				Notify IMG of trigger exceedance and any management decisions undertaken (incl Subsidence Advisory NSW, Resources Regulator)	Within 24 hours of decision	Tahmoor Coal

5.1. Consultation, co-operation and co-ordination

Substantial consultation, co-operation and co-ordination has taken place between Tahmoor Coal and Endeavour Energy prior to the development of this Management Plan, as detailed in Section 1.3.1.

The following procedures will be implemented during and after active subsidence of the property to ensure the continued effective consultation, co-operation and co-ordination of action with respect to subsidence between Tahmoor Coal and Endeavour Energy:

- Reporting of observed impacts to Tahmoor Coal either during the weekly visual inspection or at any time directly to Tahmoor Coal.
- Distribution of monitoring reports, which will provide the following information on a weekly basis during active subsidence:
 - Position of longwall;
 - Summary of management actions since last report;
 - Summary of consultation with Endeavour Energy since last report;
 - Summary of observed or reported impacts, incidents, service difficulties, complaints;
 - Summary of subsidence development;
 - Summary of adequacy, quality and effectiveness of management process;
 - Any additional and/or outstanding management actions; and
 - Forecast whether there will be any subsidence impacts to the health and safety of people due to the continued extraction of LW W3-W4.
- Convening of meetings between Tahmoor Coal and Endeavour Energy at any time as required, as discussed in Section 5.2.
- Arrangements to facilitate timely repairs, if required.
- Immediate contact between Tahmoor Coal and Endeavour Energy if a mine subsidence induced hazard has been identified that involves potential serious injury or illness to a person or persons on public property or Endeavour Energy property and may require emergency evacuation, entry restriction or suspension of work activities.

5.2. IMG meetings

The IMG undertakes reviews and, as necessary, revises and improves the risk control measures to manage risks to health and safety, and potential impacts to Infrastructure.

The reviews are undertaken weekly during the period of active subsidence based on the results of the weekly surveys and visual inspections and summarised in the monitoring reports, as described in Section 5.1.

The purpose of the reviews are to:

- Detect changes, including the early detection of potential impacts on health and safety and impacts to Endeavour Energy infrastructure;
- Verify the risk assessments previously conducted;
- Ensure the effectiveness and reliability of risk control measures; and
- Support continual improvement and change management.

IMG meetings may be held between Tahmoor Coal and Endeavour Energy for discussion and resolution of issues raised in the operation of the Management Plan. The frequency of IMG Meetings will be as agreed between Tahmoor Coal and Endeavour Energy.

IMG Meetings will discuss any incidents reported in relation to the relevant infrastructure, the progress of mining, the degree of mine subsidence that has occurred, and comparisons between observed and predicted ground movements.

It will be the responsibility of the meeting representatives to determine whether the incidents reported are due to the impacts of mine subsidence, and what action will be taken in response.

In the event that a significant mine subsidence impact is observed, any party may call an emergency IMG Meeting, with one day's notice, to discuss proposed actions and to keep other parties informed of developments in the monitoring of the infrastructure.

6.0 AUDIT AND REVIEW

This Management Plan has been agreed between parties and can be reviewed and updated to continually improve the risk management systems based on audit, review and learnings from the development of subsidence during mining and manage changes in the nature, likelihood and consequence of subsidence hazards.

The review process will be conducted to achieve the following outcomes:

- Gain an improved understanding of subsidence hazards based on ongoing subsidence monitoring and reviews, additional investigations and assessments as necessary, ongoing verification of risk assessments previously conducted, ongoing verification of assumptions used during the subsidence hazard identification and risk assessment process, ongoing understanding of subsidence movements and identified geological structures at the mine;
- Revise risk control measures in response to an improved understanding of subsidence hazards;
- Gain feedback from stakeholders in relation to managing risks, including regular input from business or property owners;
- Ensure on-going detection of early warnings of changes from the results of risk assessments to facilitate corrective or proactive management actions or the commencement of emergency procedures in a timely manner; and
- Ensure timely implementation of a contingency plan in the event that the implemented risk control measures are not effective.

Some examples where review may be applied include:

- Observation of greater impacts on surface features due to mine subsidence than was previously expected;
- Observation of fewer impacts or no impacts on surface features due to mine subsidence than was previously expected; and
- Observation of significant variation between observed and predicted subsidence.

Should an audit of the Management Plan be required during that period, an auditor shall be appointed by Tahmoor Coal to review the operation of the Management Plan and report at the next scheduled Plan Review Meeting. The Management Plan shall be audited for compliance with ISO 31000, or alternative standard agreed with Endeavour Energy.

7.0 RECORD KEEPING

Tahmoor Coal will keep and distribute minutes of any IMG Meeting.

8.0 CONTACT LIST

Organisation	Contact	Phone	Email / Mail
NSW Department of Planning and Environment – Resources Regulator	Gang Li	(02) 4063 6429 0409 227 986	gang.li@planning.nsw.gov.au
	Phil Steuart	(02) 4063 6484	phil.steuart@planning.nsw.gov.au
	Ray Ramage	(02) 4063 6485 0442 551 293	ray.ramage@planning.nsw.gov.au
Subsidence Advisory NSW	Matthew Montgomery	(02) 4677 1967 0425 275 564	matthew.montgomery@finance.nsw.gov.au
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay*	(02) 9413 3777 0416 191 304	daryl@minesubsidence.com
SIMEC Mining Tahmoor Coal Project Manager	Ross Barber*	(02) 4640 0028 Mob: 0419 466 143	ross.barber@simecgfg.com
SIMEC Mining Tahmoor Coal Approvals Specialist	April Hudson*	(02) 4640 0022 0466 380 992	April.Hudson@simecgfg.com
Endeavour Energy	Emergency Contact	131 003	
Endeavour Energy	Mehran Azimi* (Senior Engineer Mains Design)	0403 168 466	Mehran.Azimi@endeavourenergy.com.au
Endeavour Energy	Justin Byrnes* (Senior Engineer Mains Design)	(02) 9853 6484	Justin.Byrnes@endeavourenergy.com.au

* denotes member of Infrastructure Management Group

APPENDIX A. Drawings and Supporting Documentation

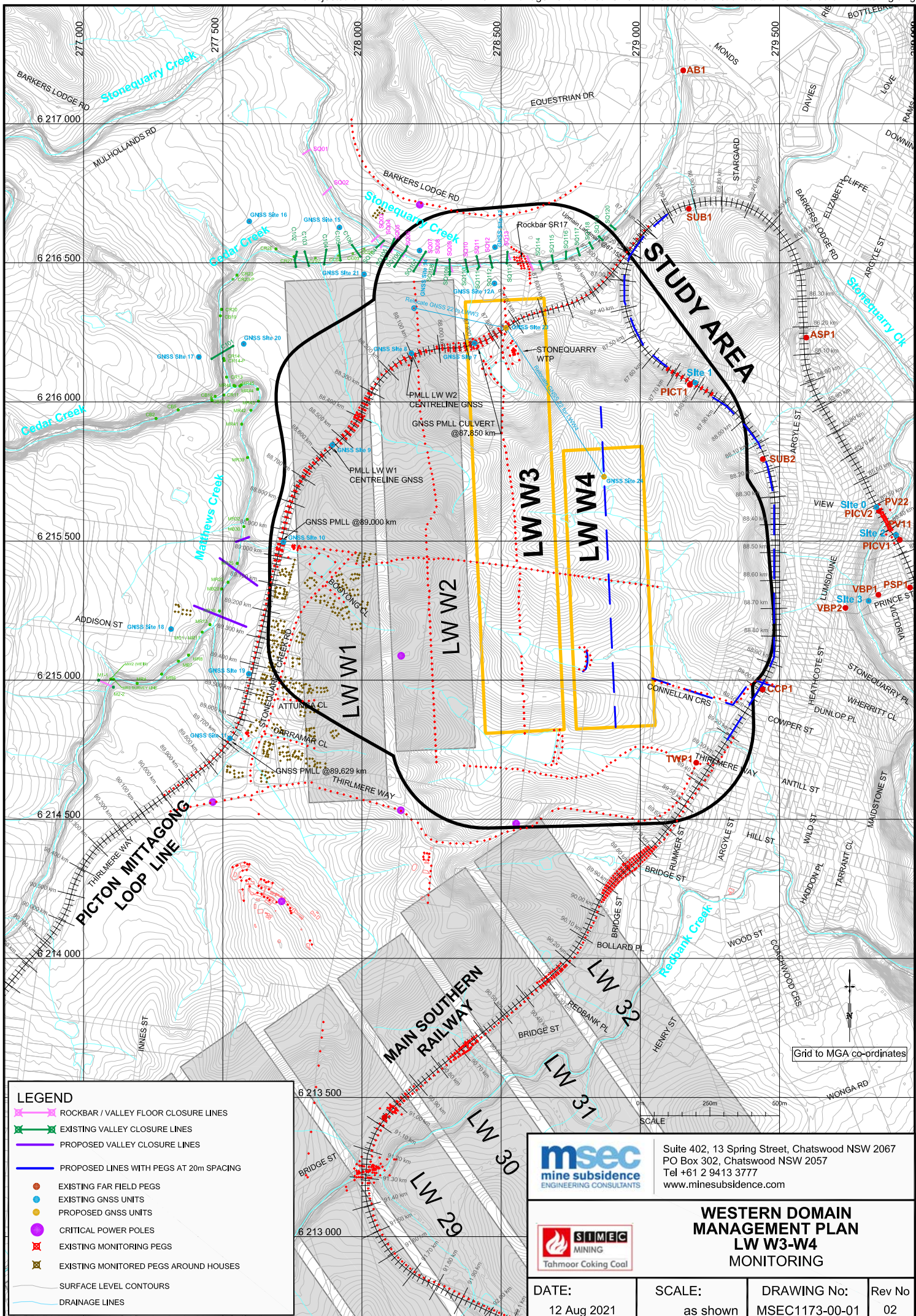
The following supporting documentation is provided in Appendix A.

Drawings

<i>Drawing No.</i>	<i>Description</i>	<i>Revision</i>
MSEC1173-00-01	Monitoring plan	02
MSEC1173-06-01	Electrical Infrastructure	B
MSEC1173-06-02	Critical power poles	B

Supporting Documentation

Endeavour Energy (2019)	Endeavour Energy Network: Results of On Site Audit Endeavour Energy Assets for SIMEC Mining - Tahmoor Colliery Longwalls West 1 and West 2, Endeavour Energy, May 2019.
Tahmoor Coal (2020)	Risk Assessment Report – Infrastructure. Tahmoor North – Western Domain, Longwalls West 3 and West 4, September 2020.



LEGEND

- ROCKBAR / VALLEY FLOOR CLOSURE LINES
- EXISTING VALLEY CLOSURE LINES
- PROPOSED VALLEY CLOSURE LINES
- PROPOSED LINES WITH PEGS AT 20m SPACING
- EXISTING FAR FIELD PEGS
- EXISTING GNSS UNITS
- PROPOSED GNSS UNITS
- CRITICAL POWER POLES
- ✕ EXISTING MONITORING PEGS
- ✕ EXISTING MONITORED PEGS AROUND HOUSES
- SURFACE LEVEL CONTOURS
- DRAINAGE LINES

msec
mine subsidence
ENGINEERING CONSULTANTS

Suite 402, 13 Spring Street, Chatswood NSW 2057
PO Box 302, Chatswood NSW 2057
Tel +61 2 9413 3777
www.minesubsidence.com

**WESTERN DOMAIN
MANAGEMENT PLAN
LW W3-W4
MONITORING**

DATE: 12 Aug 2021	SCALE: as shown	DRAWING No: MSEC1173-00-01	Rev No: 02
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**WESTERN DOMAIN
 MANAGEMENT PLAN LW W3-W4**

ENDEAVOUR ENERGY

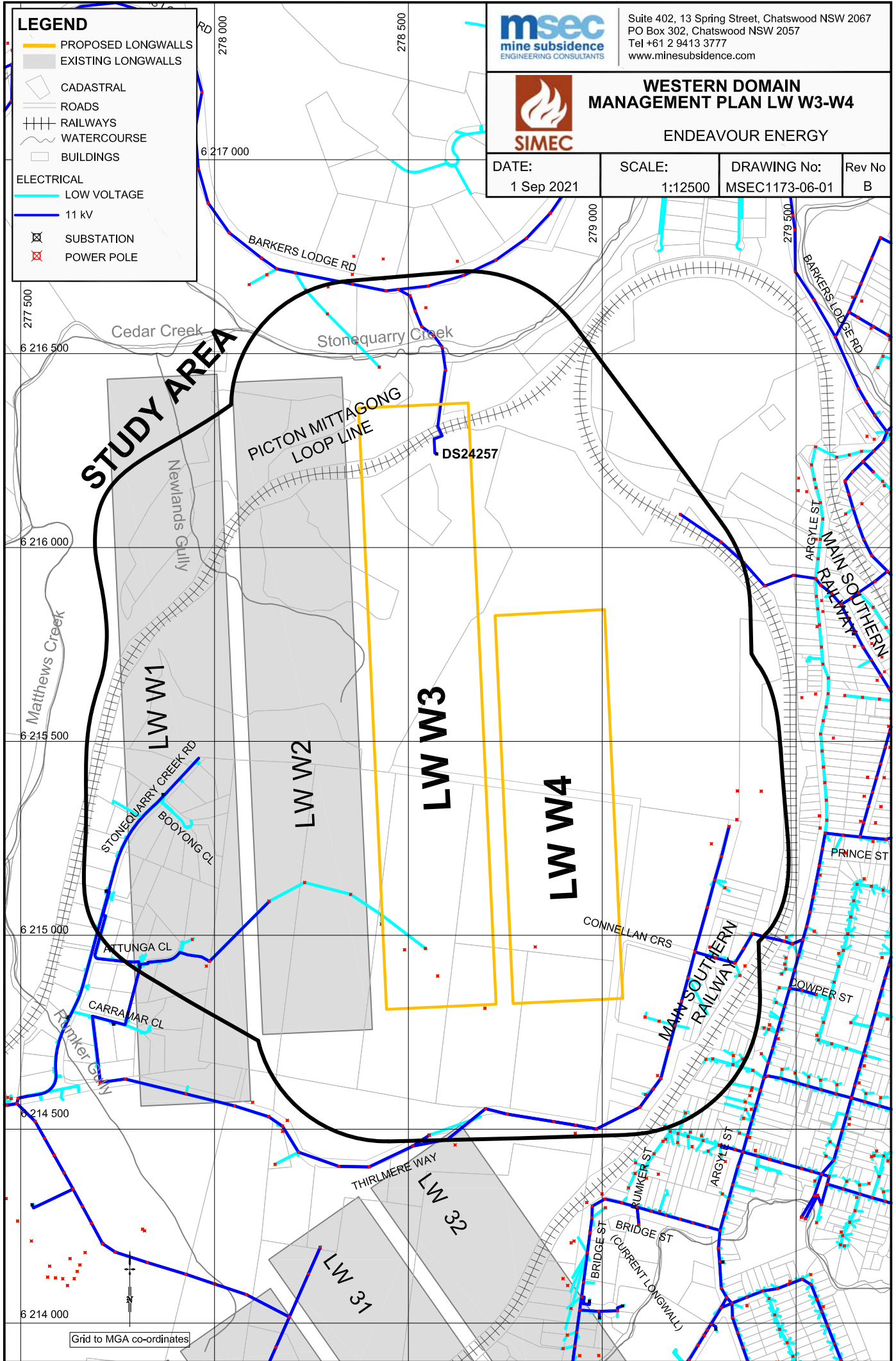
DATE: 1 Sep 2021	SCALE: 1:12500	DRAWING No: MSEC1173-06-01	Rev No B
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LEGEND

- PROPOSED LONGWALLS
- EXISTING LONGWALLS
- CADASTRAL
- ROADS
- RAILWAYS
- WATERCOURSE
- BUILDINGS




ELECTRICAL

- LOW VOLTAGE
- 11 kV
- ⊠ SUBSTATION
- ⊠ POWER POLE



Grid to MGA co-ordinates

LEGEND:

-  Powerlines
-  Substation
-  Critical Power Poles



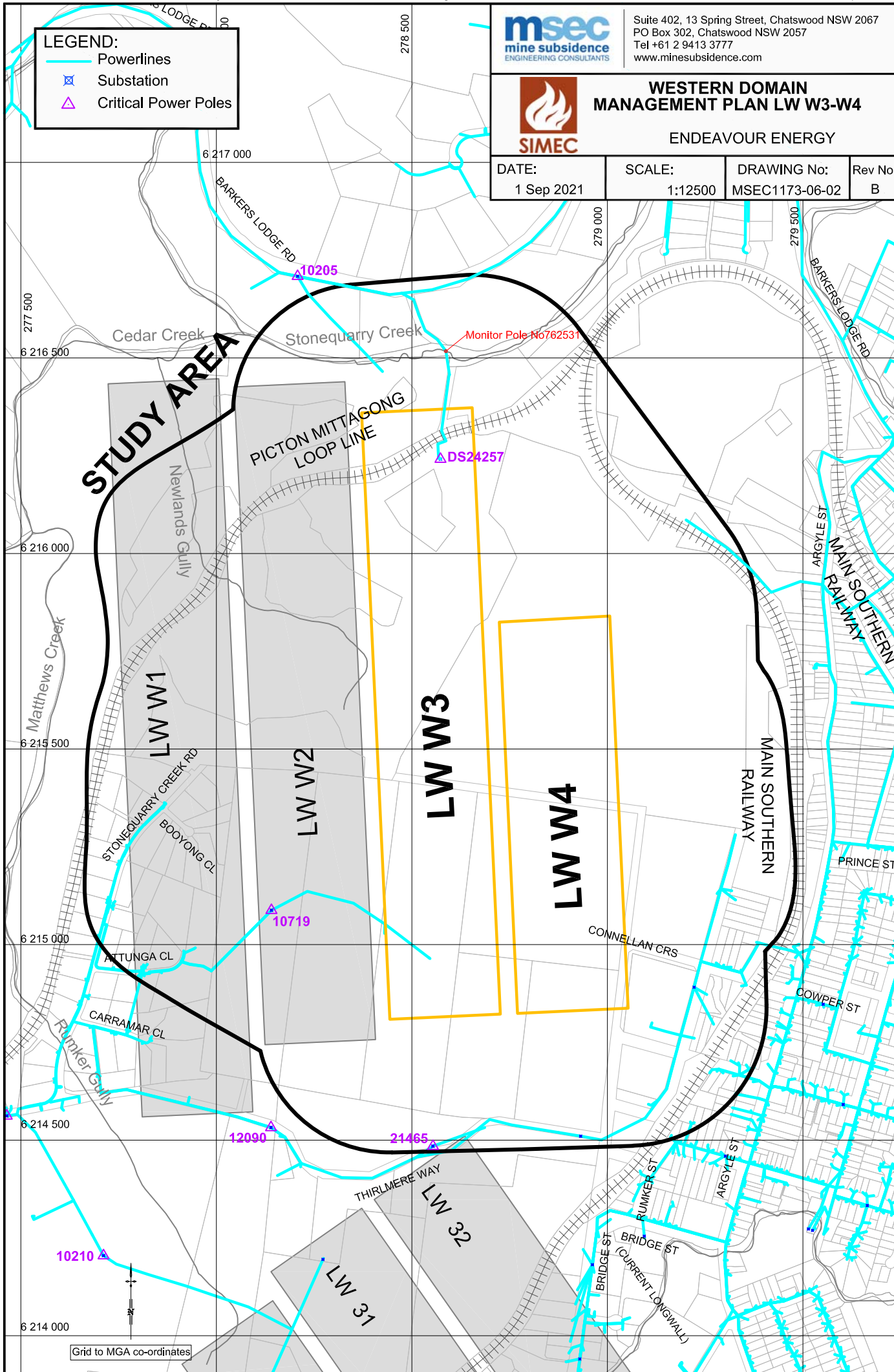
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**WESTERN DOMAIN
 MANAGEMENT PLAN LW W3-W4**

ENDEAVOUR ENERGY

DATE: 1 Sep 2021	SCALE: 1:12500	DRAWING No: MSEC1173-06-02	Rev No B
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Grid to MGA co-ordinates



Tahmoor Coal – Tahmoor Colliery
PO Box 100
Tahmoor, NSW 2573

Attention: Ms April Hudson

Endeavour Energy Network

Results of On Site Audit Endeavour Energy Assets For SIMEC Mining – Tahmoor Colliery Longwalls West 1 and West 2

(On Site Audit conducted on Thursday 9th May, 2019)



Pole No.	Asset	Location	Photo Number
PL631136	Pole Substation 10205	Bakers Lodge Rd, Picton	1



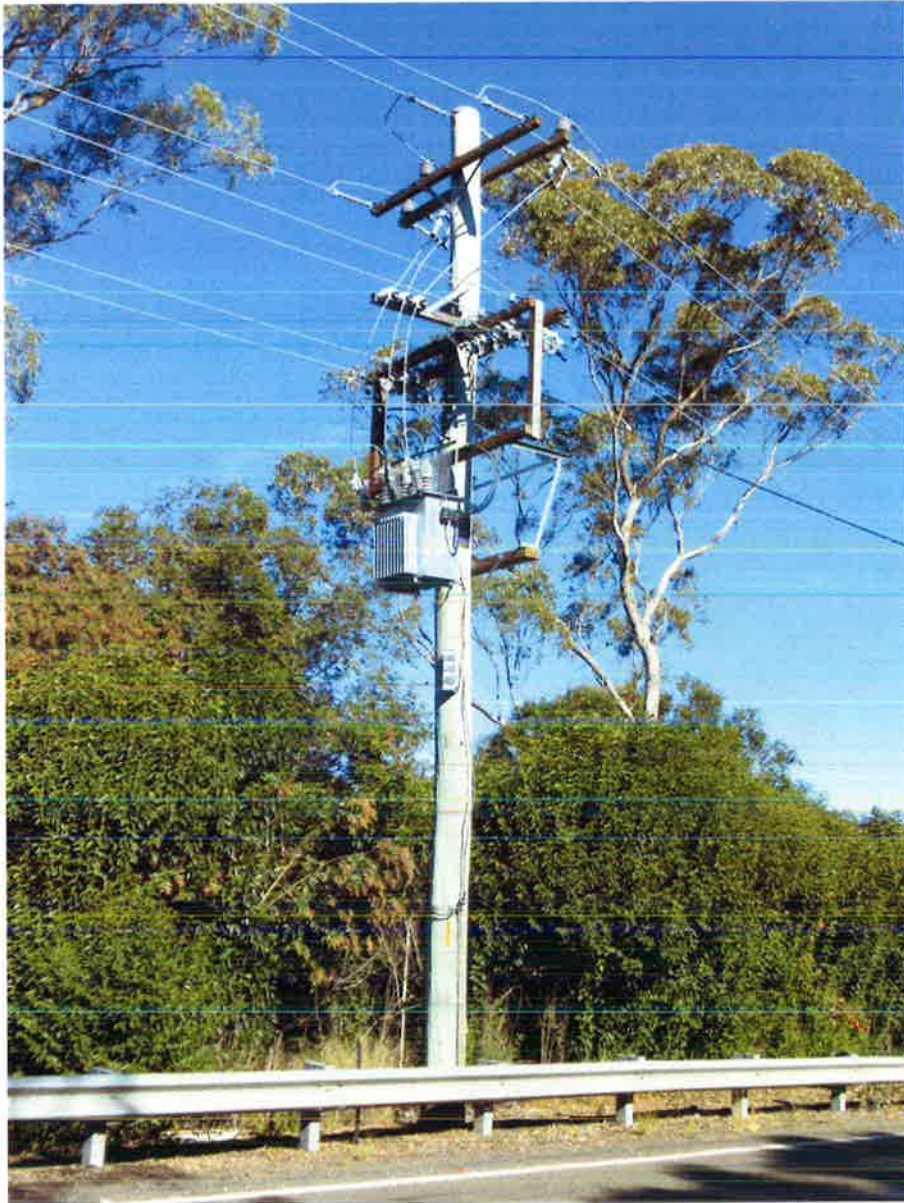
Pole No.	Asset	Location	Photo Number
PL287337	Pole Substation 22756	Thirlmere Way, Picton	2



Pole No.	Asset	Location	Photo Number
PL630726	Pole Substation 10210	Thirlmere Way, Picton	3



Pole No.	Asset	Location	Photo Number
PL630737	Pole Substation 10719	Thirlmere Way, Picton	4



Pole No.	Asset	Location	Photo Number
PL630765	Pole Substation 12090	Thirlmere Way, Picton	5



Pole No.	Asset	Location	Photo Number
PL271719	Pole Substation 21465	Thirlmere Way, Picton	6

**Asset Status / Condition Audit For Tahmoor Coal
Tahmoor Colliery, Longwalls West 1 and West 2
(LW W1-W2)
(On Site Audit conducted on Thursday 9th May, 2019)**

Scope:

The inspection was carried out to determine the condition of existing Endeavour Energy Assets which may potentially be adversely impacted by works carried out at the above mentioned sites, prior to commencement of those works.

Areas considered during the inspection process include:

- Stability of pole foundations
- Ground clearance
- Alignment of poles
- Electrical clearances to structures
- Identification of “critical poles” for the purpose of regular monitoring

Observations:

Endeavour Energy’s assets constructed over the above sites were visually inspected. The attached photographs show that the poles are generally in good order above ground and that they are vertical in both the traverse and longitudinal directions to the lines.

The inspection has indicated that there is no compromising of clearances to ground or structures evident, and insulator swing angles were also minimal, indicating very little, if any, relative movement of the structures since installation.

The attached photographs confirm the observations made above.

Conclusion:

Site inspection has indicated no evidence to suggest any compromise of the integrity of the inspected distribution lines in the affected mining zone. The lines were found to be in a good state of repair and in serviceable order.

We note that our site audit, while extensive, was not exhaustive and therefore we reserve the right to identify other critical structures or issues in the future.



23rd May, 2019
SIMEC Mining - Tahmoor Colliery
PO Box 100
Tahmoor, NSW 2573

Attention: Ms April Hudson

Dear Madam,

SIMEC Mining, PROPOSED LONGWALLS WEST 1 AND WEST 2, TAHMOOR COLLIERY.

In order to assist SIMEC Mining in their application to the Department of Mineral Resources, for approval to mine Longwalls West 1 and West 2 Tahmoor Colliery, Endeavour Energy has conducted an on-site audit in this location with the following results.

Our on-site audit indicates Endeavour Energy's existing assets to be in a good state of repair and in serviceable order. History has also shown that similar projects in other locations have resulted in no significant undue influence on Endeavour's assets due to subsidence.

Given the above, and the "prediction of subsidence parameters" from Tahmoor Coal- Tahmoor Colliery (by Mine Subsidence Engineering Consultants Pty Ltd), it is considered unlikely that Tahmoor Coal's proposal will result in any significant or unmanageable adverse effect on Endeavour Energy's assets in the Picton (Longwalls West 1 and West 2) area.

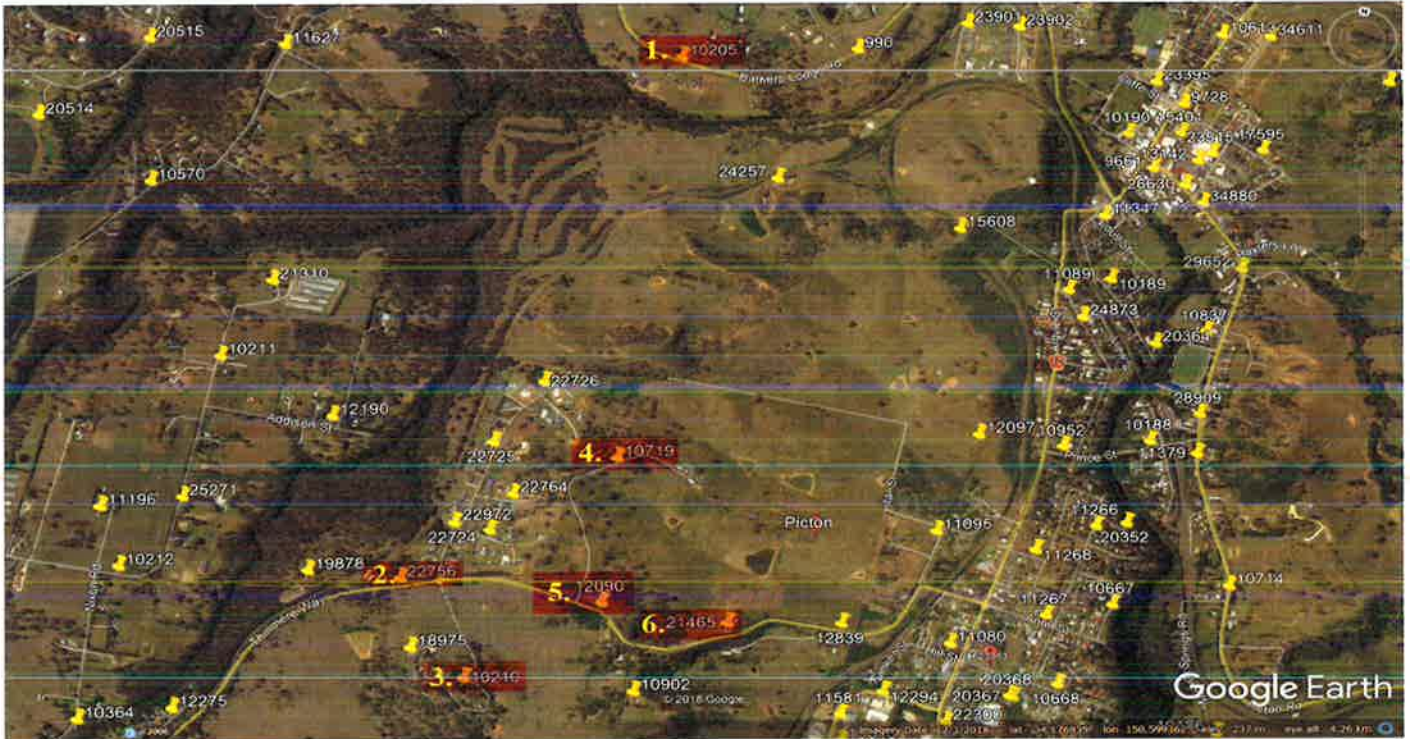
However, as a means of assisting with Endeavour Energy's ongoing risk management, it is important that should subsidence impact our assets we have some quantitative information to assist with our evaluations. We believe that it is appropriate that a number of our assets, which have been identified as "critical poles", should be monitored to assess any impact of the proposed mining.

It is requested, at a minimum, that SIMEC Mining - Tahmoor Colliery arrange for the following:

- Monitoring of subsidence at the base of the identified Endeavour Energy "critical poles"
- Monitoring of the relative tilt in two directions of each of the identified Endeavour Energy "critical poles" to detect any movement.
- Report of any visual change in the tension or sag of the power lines within the subsidence region. Endeavour Energy would require the monitoring identified above to be undertaken on the following "critical poles" listed over page.

Contact name: Shane Worthington • Direct phone: (02) 9853 7553 • Email: shane.worthington@endeavourenergy.com.au
51 Huntingwood Drive Huntingwood NSW 2148. PO Box Seven Hills NSW 1730.
Endeavour Energy ABN 59 253 130 878 www.Endeavourenergy.com.au

ENDEAVOUR ERNERGY IDENTIFIED CRITICAL POLES				
	Pole No.	Asset	Location	Photo Number
1	PL631136	Pole Substation 10205	Bakers Lodge Rd, Picton	1
2	PL287337	Pole Substation 22756	Thirlmere Way, Picton	2
3	PL630726	Pole Substation 10210	Thirlmere Way, Picton	3
4	PL630737	Pole Substation 10179	Thirlmere Way, Picton	4
5	PL630765	Pole Substation 12090	Thirlmere Way, Picton	5
6	PL271719	Pole Substation 21465	Thirlmere Way, Picton	6



Please send the results of these observations in report format by email to:

Mr Shane Worthington
Regional Services - Central
Endeavour Energy
Email address: shane.worthington@endeavourenergy.com.au

The initial report should be sent prior to commencement of works and updated reports submitted on a monthly basis over a period up to 3 months after extraction has been completed.

Subject to your agreement with the requested monitoring, reporting regime and the responsibility for any proven damage to Endeavour Energy assets in the forecast subsidence period, we endorse your application to proceed as planned.

If you have any queries or wish to further this matter further, please contact Shane Worthington by email or phone 02 9853 7553.

Yours faithfully,

Shane Worthington
Project Officer
Regional Services - Central
Endeavour Energy

KNOWN HAZARDS REGISTER – DAMAGE TO ENDEAVOUR ENERGY ASSETS

Risk	Hazardous event	Causes	Consequences
<p>Damage to Endeavour Energy Assets</p>	<p>Damage to Endeavour Energy assets caused by ground subsidence</p>	<p>Ground subsidence as a result of long wall mining</p>	<p>Loss of life or injury Loss of property Damage to property Increased customer dissatisfaction Loss of supply Loss of network assets Environmental impact Reputation media damage Legal liability (including financial)</p>

Recommendation

To approve Endeavour Energy's attached Audit of Assets, Risk Assessment and Conditions to be incorporated into SIMEC Mining Tahmoor Colliery's Subsidence Management Plan for proposed Longwalls West 1 and West 2 at Picton.

Prepared



Shane Worthington
Project Officer
Regional Services – Central
Endeavour Energy

Endorsed



Sanja Milosavljevic
Distribution Manager Hoxton Park
Network – Central Region
Endeavour Energy

Approved



~~David Campbell~~ Kieran Shandor
Regional Manager
Network – Central Region
Endeavour Energy

Acting

RISK REGISTER – DAMAGE TO ENDEAVOUR ENERGY ASSETS

Mining: Longwalls West 1 and West 2

Location: Picton

Mining Company: SIMEC Mining Tahmoor Colliery

Risk	Hazardous event	Prevention Controls	Control Effectiveness (1-5)	Mitigation Controls	Control Effectiveness (1-5)	Residual Risk Assessment (E, H, M, L)	Control Accountability
Damage to Endeavour Energy Assets	Damage to Endeavour Energy assets caused by ground subsidence	Complete Worksite Hazard and Risk Assessment as per Company Procedure (Health and Safety) GSY 1066.	4	<p>Working in a Mine Subsidence Area</p> <ol style="list-style-type: none"> When performing a Worksite Hazard and Risk Assessment, pay attention to ground conditions. If in any doubt, walk access tracks to check for cracking prior to driving into subsidence areas. If in a remote area, ensure people know where staff are working, and an expected time of arriving home. If in a remote area, it may be preferable that staff are not in a mine subsidence area alone. 	4	LOW – D2 Unlikely / Minor ALARP	Endeavour Energy
		Endeavour Energy's Network within the defined ground subsidence area has been audited to verify the condition and integrity of the network, and record made for future reference. <u>Critical assets</u> (most susceptible to impact by subsidence) have been identified, photographed, and condition recorded. Oil containing assets (Transformer tanks, etc.) are considered "critical assets".	3	Assets to be patrolled regularly for visual inspection. Critical assets are to be monitored monthly by survey to detect signs of movement. (Tahmoor Coal and contracted agencies). Monthly reports are to be forwarded to Endeavour Energy (survey results). Endeavour Energy is notified immediately on irregularities noted during visual inspection.	4		
				Incident Management	3		Tahmoor Coal Mine Subsidence Engineering Consultants Pty Ltd

Major Project Risk Assessment: Tahmoor Underground - Extraction Plan LW W3-W4

Step 2: Assess Type; Key Elements-These change depending on TYPE of Risk Assessment	Step 3: Identify the risks, causes and potential consequences	Step 4: Identify the existing controls to manage the identified risks	Step 5: Determine RCE	Steps 6, 7 & 8: Determine the Expected Consequence / Likelihood applicable to the Expected Consequence / Current level of risk	Step 10: PMC	Step 11: Treat the Risks
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Type of Risk Assessment	Key Element (CURA Context/Category)	Sub Key Element (If applicable)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Expected Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Potential Maximum Category	Treatment plans/tasks (Description)	Task Owner	Due Date	Comments
Major Project	Built Infrastructure	Endeavour Energy Infrastructure	Adverse impacts to power poles	Reduction in clearance heights and / or excessive tilting of power poles	Subsidence	* Successful completion of management plan for LW 22-W2 (AC) * Previous ground survey, pole survey and visual inspection as part of LW 22 - W2 management (AC) * Previous consultation, coordination and cooperation with Endeavour Energy (AC) * Management Plans prepared for previous longwalls (AC)	2	Health & Safety	3	E	6	3	Health & Safety	Complete Endeavour Energy Management Plan including TARP	April Hudson	01-Sep-21	
Major Project	Built Infrastructure	Endeavour Energy Infrastructure	Adverse impacts to consumer cables to houses	Loss of serviceability, emergency repair of powerline	Subsidence	* Previous ground survey, pole survey and visual inspection as part of LW 22-W2 management (AC) * Previous consultation, coordination and cooperation with Endeavour Energy (AC)	2	Property Damage	1	E	1	1	Property Damage	Complete Endeavour Energy Management Plan including TARP	April Hudson	01-Sep-21	

2	2	2	2	2	Subtotal CountA (ignoring hidden values)	2	2	2	2	2	2	2	2				
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