msec mine subsidence ENGINEERING CONSULTANTS

SIMEC MINING

Tahmoor Coking Coal

SIMEC Mining:

Tahmoor Coking Coal Operations - Longwall 32

Management Plan for Potential Impacts to Endeavour Energy Infrastructure

Endeavour Energy

 | REPORT NUMBER: MSEC945-06 | REVISION A

AUTHORISATION OF MANAGEMENT PLAN

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DOCUMENT REGISTER

Date	Report No.	Rev	Comments
Mar-06	MSEC286-0406	A	Draft for Submission to Endeavour Energy (formerly Integral Energy)
May-06	MSEC286-0406	B	Agreed plan
Aug-06	MSEC286-0406	C	Chapter 1 amended
Sep-08	MSEC286-0406	D	Updated for Longwall 25
May-10	MSEC446-06	A	Updated for Longwall 26
Sep-12	MSEC567-06	A	Updated for Longwalls 27 to 30
Oct-12	MSEC567-06	B	Updated after consultation with Endeavour Energy
Jun-17	MSEC862-06	A	Updated for Longwall 31
Aug-18	MSEC945-06	A	Updated for Longwall 32

References:-

AS/NZS 4360:1999 Risk Management

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

Glencore (2014) Glencore Coal Assets Australia Risk Management Matrix, Glencore, September 2014.

Glencore (2018) Environmental Risk Assessment: Tahmoor Underground – Longwall 32 Surface and Subsurface Infrastructure – Electrical Infrastructure, Tahmoor Coking Coal Operations, May 2018.

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 (2014) Tahmoor Colliery Longwalls 31 to 37 - Subsidence Predictions and Impact Assessments for Natural and Built Features in support of the SMP Application. (Report MSEC647, Revision A, December 2014), prepared by Mine Subsidence Engineering Consultants.

SCT (2018a) Structure determinations of the Nepean Fault adjacent to Tahmoor Mine, SCT Operations, Report No. TAH4817, May 2018.

SCT (2018b) Investigation into the Potential Impact of the Nepean Fault on Longwall 32 Subsidence, SCT Operations, Report No. TAH4821, May 2018.

Endeavour Energy (2018) Endeavour Energy Network: Result of On Site Audit Endeavour Energy Assets for SIMEC Mining - Tahmoor Colliery Longwall 32, Endeavour Energy, July 2018.

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Tables

Tables are prefaced by the number of the chapter in which they are presented.

Figures

Figures are prefaced by the number of the chapter or the letter of the appendix in which they are presented.

Drawings

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

Drawing No.	*Description*	*Revision*
MSEC945-00-01	Monitoring over Longwall 32	C
MSEC945-06-01	Electrical Infrastructure	A
MSEC945-06-02	Critical Power Poles	A

1.1. Background

Tahmoor Coking Coal Operations is located approximately 80 km south-west of Sydney in the township of Tahmoor NSW. It is managed and operated by SIMEC Mining. Tahmoor Coking Coal Operations has previously mined 30 longwalls to the north and west of the mine's current location. It is currently mining Longwall 31.

Longwall 32 is a continuation of a series of longwalls that extend into the Tahmoor North Lease area, which began with Longwall 22. The longwall panels are located between the Bargo River in the south-east, the township of Thirlmere in the west and Picton in the north. Longwall 32 is located beneath the rural area between Tahmoor, Thirlmere and Picton, including part of the South Picton industrial area. Electrical infrastructure owned by Endeavour Energy is located within this area.

A summary of the dimensions of Longwall 32 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)
Longwall 32	2378	283	39

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

1.2. Endeavour Energy's electrical assets potentially affected by Longwall 32

A map showing the locations of Endeavour Energy's electrical infrastructure in relation to Longwall 32 is shown in Drawing No. MSEC945-06-01.

As shown in Drawing No. MSEC945-06-01, the majority of the powerlines are low voltage. A 66kV powerline follows the alignment of Remembrance Drive before it heads west through property owned by Sydney Water's Picton Water Recycling Plant. A number of 11kV powerlines are potentially affected by the extraction of Longwall 32, including powerlines on Bridge Street, Henry Street, Remembrance Drive and Thirlmere Way.

1.3. Consultation

1.3.1. Consultation with Endeavour Energy

Tahmoor Coking Coal Operations 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 31, and regular reporting of subsidence movements and impacts.

Details regarding consultation and engagement are outlined below:

- A risk assessment was held on 10 May 2018, which was attended by representatives from Endeavour Energy and Tahmoor Coking Coal Operations.
- Email to David Olley (Endeavour Energy) on 9 May 2018 requesting Endeavour Energy assessment of critical poles for Longwall 32 Management Plan.
- Email from Ben Logue (Endeavour Energy) on 24 July 2018 to Belinda Clayton (Tahmoor Coking Coal Operations) with the Critical Pole Audit Report for Longwall 32.
- Meeting with Endeavour Energy, Ron Bush (Tahmoor Coking Coal Operations), Belinda Clayton (Tahmoor Coking Coal Operations), Matthew Montgomery (Subsidence Advisory NSW) in August 2018 to discuss the draft Subsidence Management Plan for Longwall 32.

Tahmoor Coking Coal Operations will continue to consult regularly with Endeavour Energy during the extraction of Longwall 32 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. MSEC647 by Mine Subsidence Engineering Consultants (MSEC, 2014). Predictions are based on the planned configuration of Longwall 32 at Tahmoor Coking Coal Operations (as shown in Drawing No. MSEC945-06-01), 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 Coking Coal Operations and Endeavour Energy representatives.

The impacts of mining on surface and sub-surface features have been assessed in detail. However, it is recognised 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 MSEC647 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.
- Disruption and inconvenience should be avoided or, if unavoidable, kept 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 Coking Coal Operations, Endeavour Energy, relevant government agencies as required, and consultants as required.
- 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 resent 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

The powerlines and power poles are shown in Drawing No. MSEC945-06-01 and the critical power poles are shown in Drawing No. MSEC945-06-02.

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 Longwall 32 only. The management plan does not include other electrical infrastructure owned by Endeavour Energy which lies outside the extent of this area.

This Management Plan does not include Endeavour Energy Picton Field Service Centre on Bridge Street. A separate management plan was developed in consultation with Endeavour Energy in relation to this property prior to the influence of Longwalls 30 and 31, and an updated management plan will be prepared for Longwall 32.

1.7. Proposed Mining Schedule

It is planned that Longwall 32 will extract coal working northwest from the south-eastern end. This Management Plan covers longwall mining until completion of mining in Longwall 32 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
Longwall 32	September 2018	September 2019

Please note the above Schedule is subject to change due to unforeseen impacts on mining progress. Tahmoor Coking Coal Operations 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.

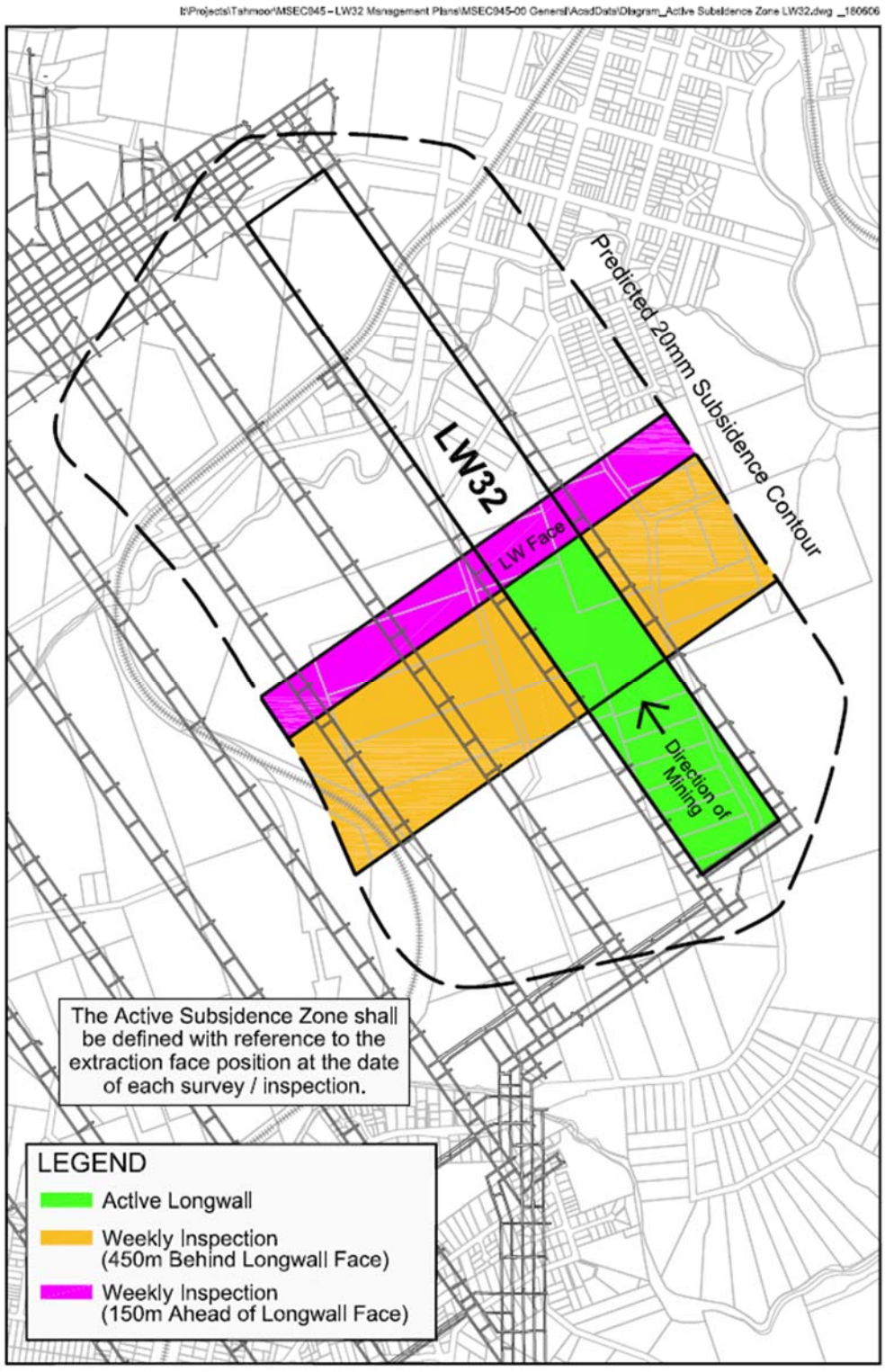

Fig. 1.1 Diagrammatic Representation of Active Subsidence Zone

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 Longwall 32 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 Glencore Coal Assets Australia 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 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

Predicted mining-induced conventional subsidence movements were provided in Report No. MSEC647, which was prepared in support of Tahmoor Coking Coal Operations' SMP Application for Longwalls 31 to 37, and includes predictions due to the extraction of Longwall 32. A summary of the maximum predicted incremental subsidence parameters due to the extraction of Longwall 32 only and the maximum predicted total conventional subsidence parameters due to the extraction of Longwalls 22 to 32, are provided in Table 3.1.

Table 3.1 Maximum Predicted Conventional Subsidence Parameters due to the Extraction of Longwall 32

Longwall	Maximum Predicted Subsidence (mm)	Maximum Predicted Tilt (mm/m)	Maximum Predicted Hogging Curvature (1/km)	Maximum Predicted Sagging Curvature (1/km)
Increment due to LW32 only	700	5.5	0.06	0.12
Total after extraction of LWs 22 to 32	1,225	6.0	0.09	0.13

The values provided in the above table are the maximum predicted conventional subsidence parameters which occur within the general longwall mining area, including the predicted movements resulting from the extraction of Longwalls 22 to 32.

The location of the maximum predicted total subsidence is not directly above Longwall 32. Predicted maximum total subsidence directly above Longwall 32 is approximately 800 mm.

3.2. Observed subsidence during the mining of Longwalls 22 to 31

The extraction of longwalls at Tahmoor Coking Coal Operations has generally resulted in mine subsidence movements that were typical of those observed above other collieries in the Southern Coalfield of NSW at comparable depths of cover.

However, observed subsidence was greater than the predicted values over Longwalls 24A and the southern parts of Longwalls 25 to 27. Monitoring during the mining of Longwalls 28 to 31 has found that subsidence behaviour has returned to normal levels.

Survey Peg ST14 on Stilton Lane is located above the centreline of Longwall 31. As shown in Fig. 3.1, subsidence developed at an equivalent magnitude to pegs located above previously extracted Longwalls 28 to 30.

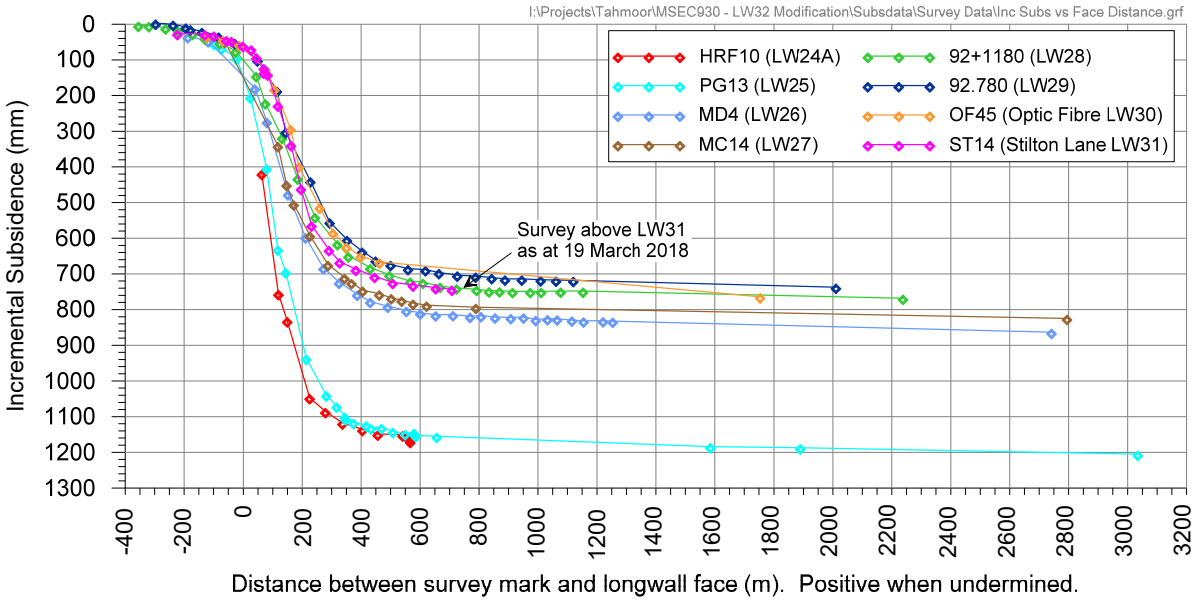

Fig. 3.1 Observed development of subsidence of survey pegs above the centrelines of Longwalls 24A to 31

Ground surveys will continue to be undertaken above Longwall 32. The survey results will be checked against predictions to confirm whether subsidence continues to develop in a normal manner during the mining of Longwall 32.

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 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, 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 maximum predicted curvatures and the maximum predicted 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, instead of just providing a single predicted conventional strain.

The data used in an analysis of observed strains included those resulting from both conventional and non-conventional anomalous movements, but did not include those resulting from valley related movements, which are addressed separately in this report. The strains resulting from damaged or disturbed survey marks have also been excluded.

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. Confidence levels have been determined from the empirical strain data using the fitted GPDs. In the cases where survey bays were measured multiple times during a longwall extraction, the maximum tensile strain and the maximum compressive strain were used in the analysis (i.e. single tensile strain and single compressive strain measurement per survey bay).

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 28 at Tahmoor Coking Coal Operations, 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*".

The histogram of the maximum observed total tensile and compressive strains measured in survey bays above goaf at Tahmoor Coking Coal Operations is provided in Fig. 3.2. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

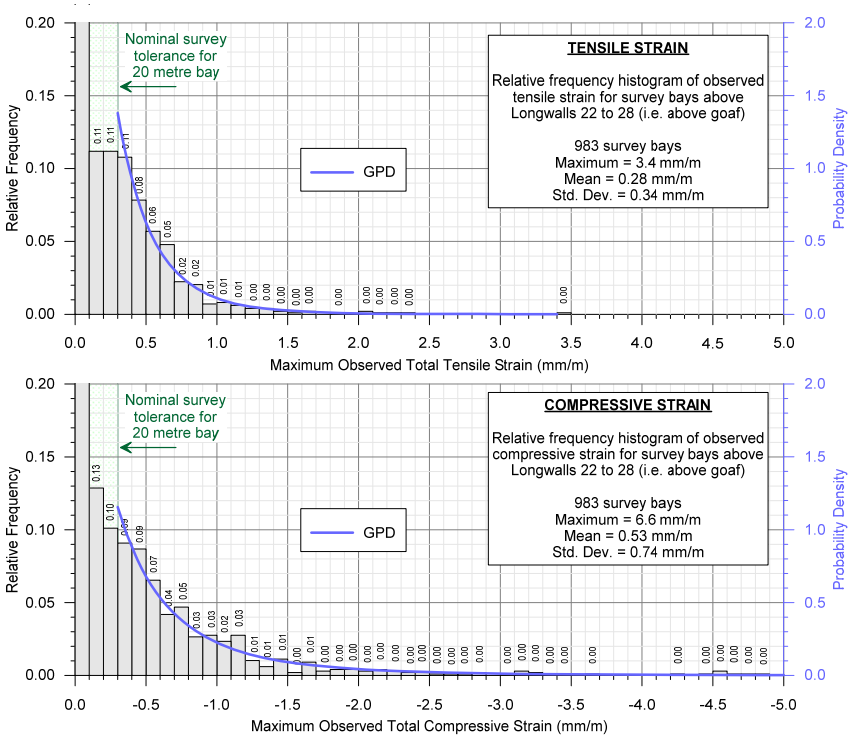

Fig. 3.2 Distributions of the measured maximum tensile and compressive strains for surveys bays located above goaf

The 95 % confidence levels for the maximum total strains that the individual survey bays *above goaf* experienced at any time during mining are 0.9 mm/m tensile and 1.8 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 are 1.5 mm/m tensile and 3.5 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 Longwalls 22 to 28 at Tahmoor Coking Coal Operations, for survey bays that were located outside and within 200 metres of the nearest longwall goaf edge, which has been referred to as "*above solid coal*".

The histogram of the maximum observed tensile and compressive strains measured in survey bays above solid coal at Tahmoor Coking Coal Operations is provided in Fig. 3.3. The probability distribution functions, based on the fitted GPDs, have also been shown in this figure.

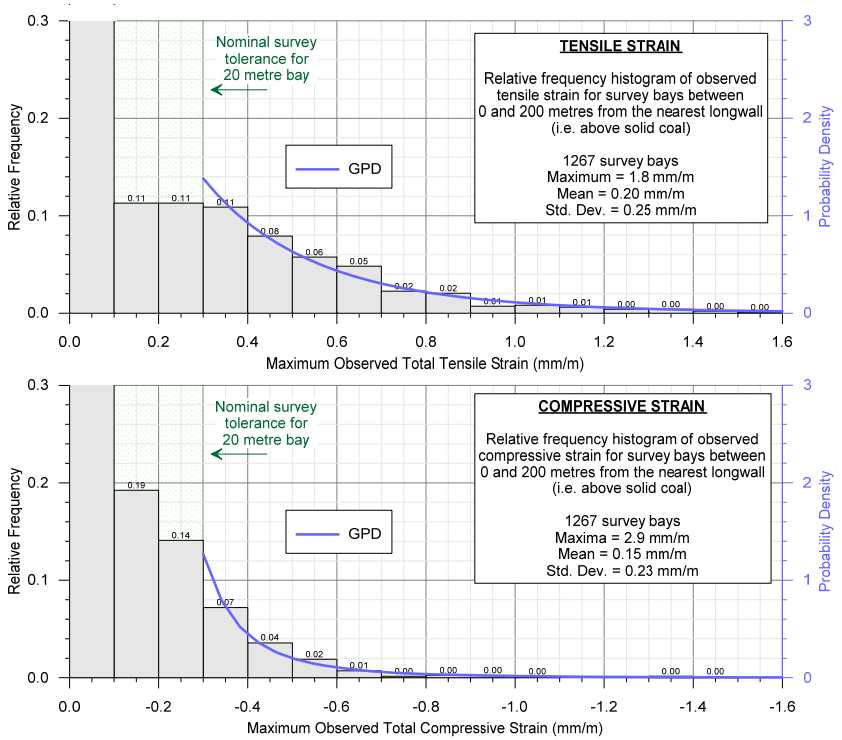

Fig. 3.3 Distributions of the measured maximum tensile and compressive strains for survey bays located above solid coal

The 95 % confidence levels for the maximum total strains that the individual survey bays *above solid coal* experienced at any time during mining are 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 are 1.1 mm/m tensile and 0.9 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 observed strains 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 actually occurs.

The histogram of maximum observed total tensile and compressive strains measured anywhere along the monitoring lines, at any time during or after the extraction of Longwalls 22 to 28 at Tahmoor Coking Coal Operations, is provided in Fig. 3.4.

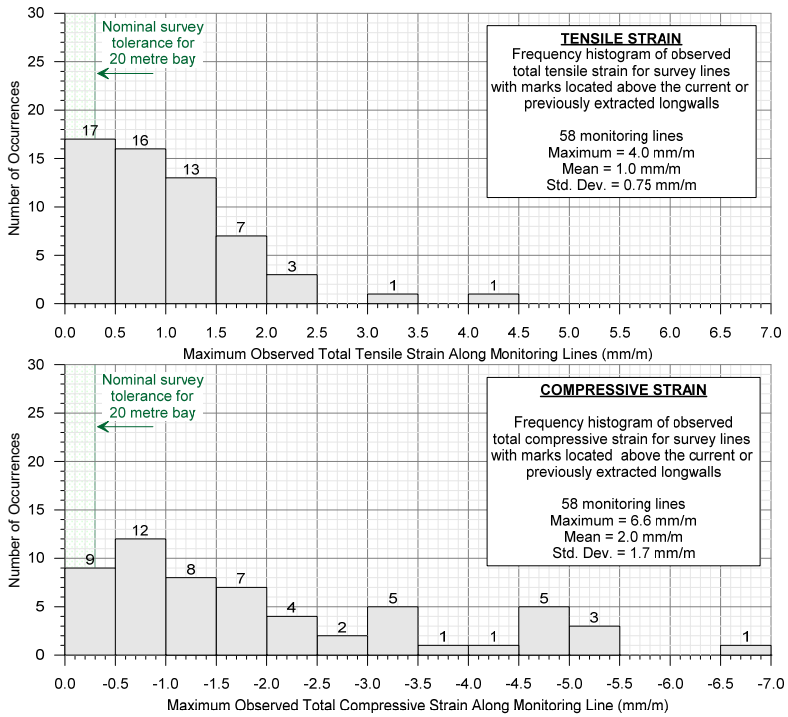

Fig. 3.4 Distributions of measured maximum tensile and compressive strains anywhere along the monitoring lines

It can be seen from Fig. 3.4, that 33 of the 58 monitoring lines (i.e. 57 %) had recorded maximum total tensile strains of 1.0 mm/m, or less, and that 53 monitoring lines (i.e. 91 %) had recorded maximum total tensile strains of 2.0 mm/m, or less. It can also be seen from this figure, that 36 of the 58 monitoring lines (i.e. 62 %) had recorded maximum compressive strains of 2.0 mm/m, or less, and that 48 of the monitoring lines (i.e. 83 %) had recorded maximum compressive strains of 4.0 mm/m, or less.

3.4. Geological structures

3.4.1. Identification of geological structures

Longwall 32 will be extracted alongside the Nepean Fault, which is a well-known geological feature that is an extension of the Lapstone Monocline.

Tahmoor Coking Coal Operations commissioned an engineering geologist from SCT (2018a) to undertake site inspections and mapping of the Nepean Fault. This work has provided detailed information on the nature and location of Nepean Fault, and second order geological structures associated with the fault.

The Nepean Fault is mapped as "*an en-echelon distribution of first order faults with major offsets. Ramps are developed between these en-echelon fault surfaces. Numerous first order north-south faults, each of limited extent, step across the area investigated.*" (SCT, 2018a). The commencing end of Longwall 32 is located within the fault ramp area between two of the first order faults.

SCT (2018a) further advise that the fault is sub-vertical from surface to seam, based on site investigations and geological information gathered by Tahmoor Coking Coal Operations since 2014. The cross-section provided by SCT (2018a) has been reproduced in Fig. 3.5.

In addition to the mapped first order faults, SCT has mapped second order faults, which are described as "*mainly conjugate sets of strike slip faults and splay faults being observed between the en-echelon first order faults*."

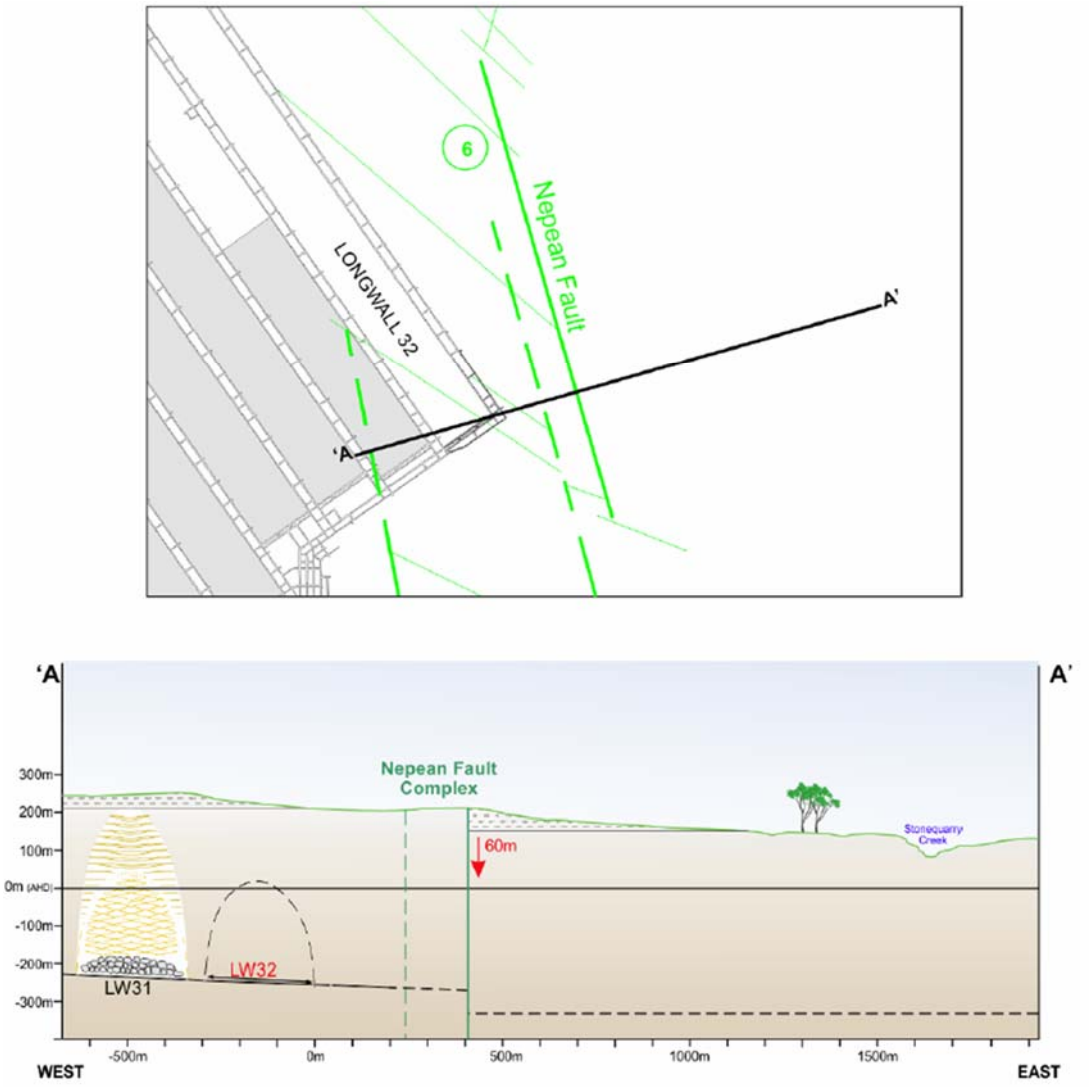

Fig. 3.5 Cross-section of Nepean Fault near Longwall 32 by SCT (2018a)

The geological structures as mapped by SCT (2018a) have been overlaid with surface features within and adjacent to Longwall 32. These are shown in Drawings Nos. MSEC945-06-01 and MSEC945-06-02.

It can be seen that the built areas within Tahmoor and Picton are located near a mapped first order Nepean Fault, which follows the escarpment along the western bank of Stonequarry Creek. Drawings Nos. MSEC945-06-01 and MSEC945-06-02 show that the 66kV powerline and an 11KV powerline crosses the mapped first order fault near the commencing end of Longwall 32. A survey line has been installed along these power lines to monitor potential subsidence movements.

Endeavour Energy 's powerlines also cross mapped second order geological structures, of which one intersects Remembrance Drive directly above Longwall 32. Survey lines have been installed along the streets to monitor subsidence movements.

A cross-section has been produced in Fig. 3.6 to show the location of the Nepean Fault and Longwall 32. Predicted subsidence profiles due to the extraction of Longwalls 31 and 32 are also shown in Fig. 3.6. It can be seen from Fig. 3.6 that the first order Nepean Fault structure is located away from Longwall 32.

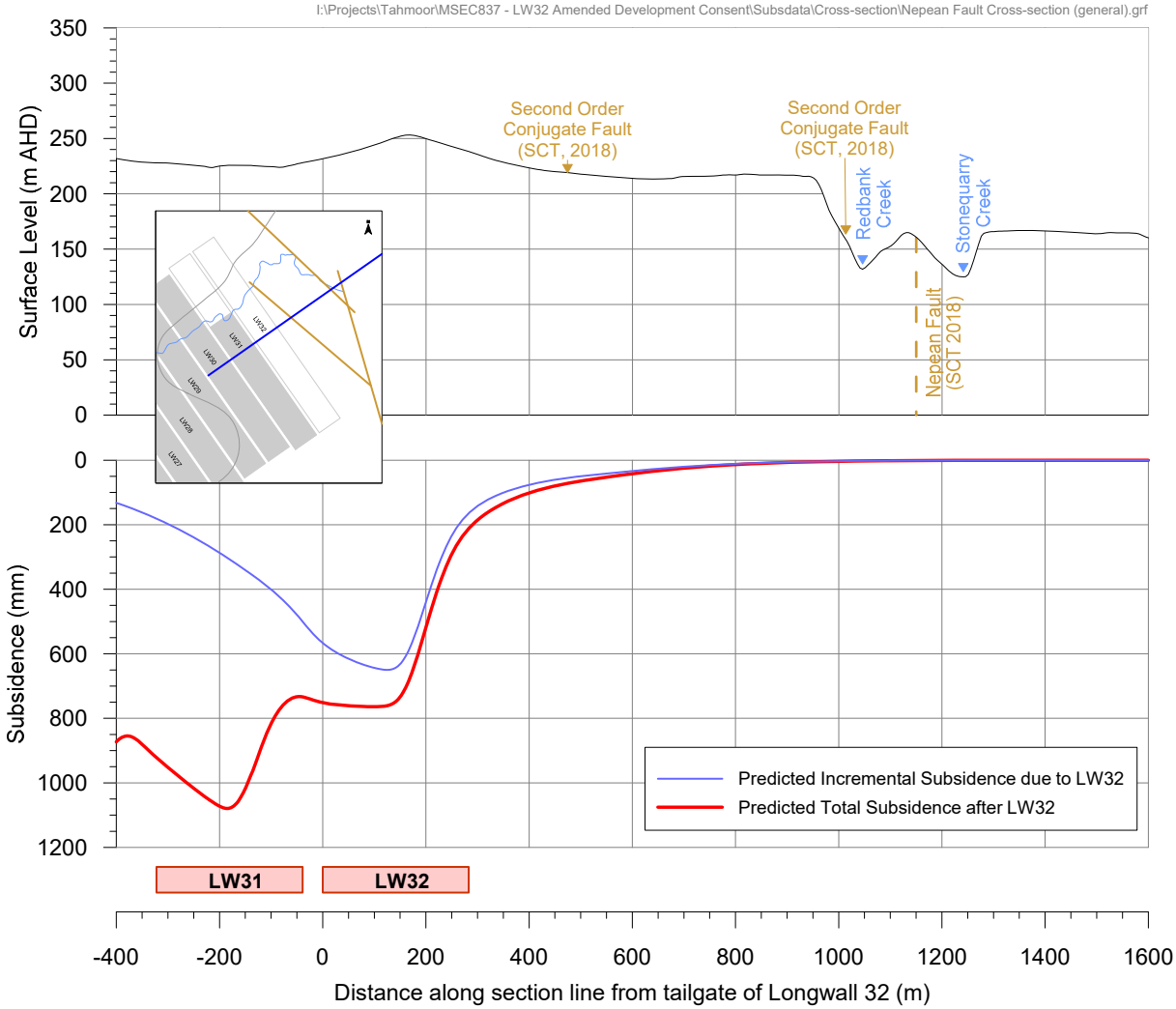

Fig. 3.6 Cross-section showing the mapped geological structures by SCT (2018a), and predicted subsidence profiles

3.4.2. Experience of subsidence movements between previously extracted longwalls and Nepean Fault at Tahmoor Coking Coal Operations

Tahmoor Coking Coal Operations has surveyed subsidence along many streets during the mining of previous Longwalls 24A to 31. Some of these monitoring lines are located over solid, unmined coal, between the extracted longwalls and the Nepean Fault.

None of the survey lines cross first order faults, though two survey lines (Stilton Dam Line and Remembrance Drive East Line) cross mapped second order conjugate faults.

A study has been completed to ascertain whether irregular subsidence have occurred along the survey lines. The information provides an indication of the likelihood of irregular movements during the extraction of Longwall 32.

The locations of the survey lines relative to the Nepean Fault and associated geological structures is shown in Fig. 3.7.

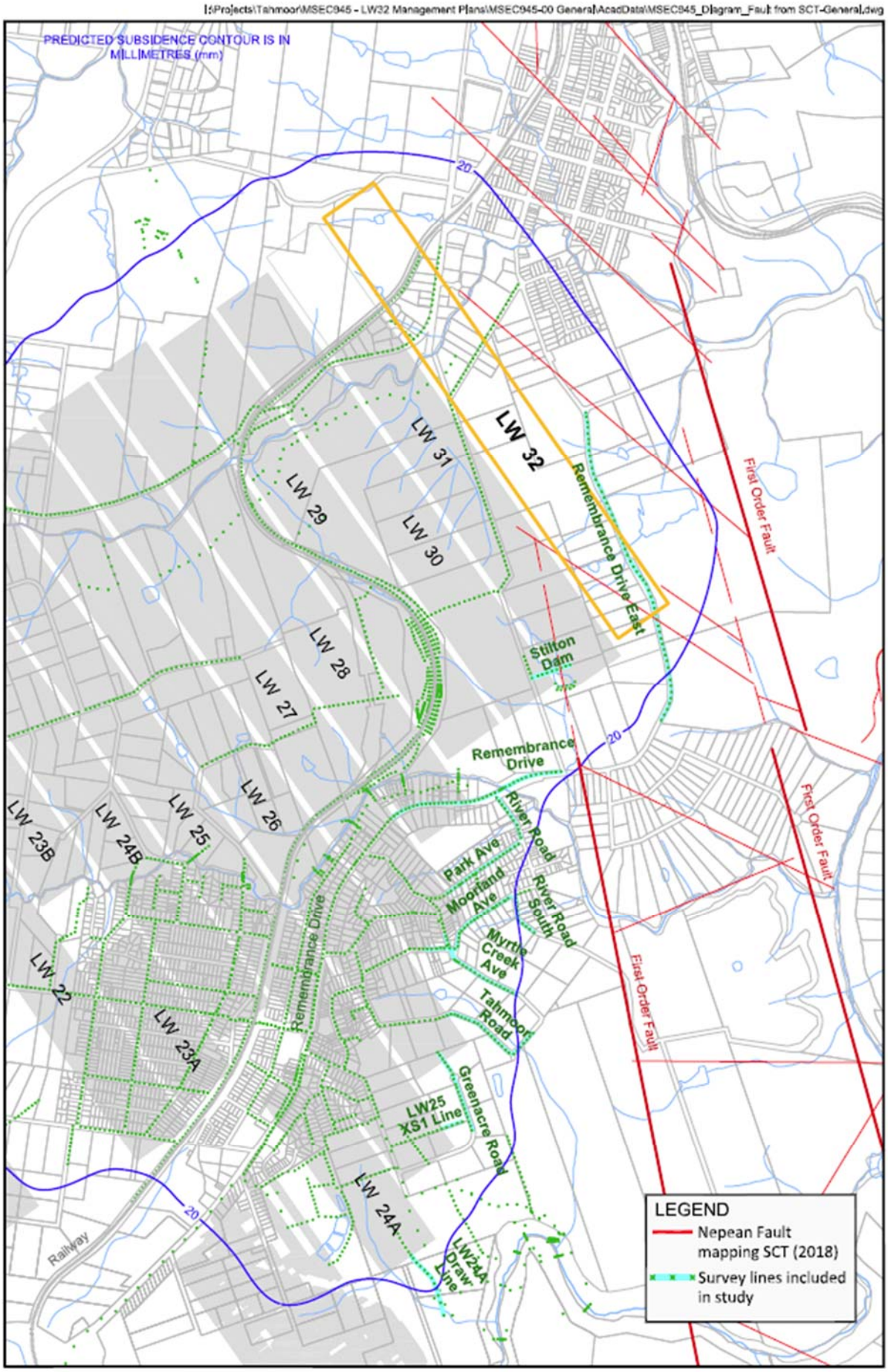

Fig. 3.7 Locations of ground survey lines in relation to the mapped geological structures by SCT (2018a)

The monitoring lines examined included.

- 900-Line, due to the extraction of LWs 12 and 13 (not shown in Fig. 3.7),
- LW24 Draw Line, due to the extraction of LWs 24A and 25
- LW25-XS1 Line, due to the extraction of LWs 25 and 26
- Greenacre Drive, due to the extraction of LWs 25 and 26
- Tahmoor Road Line, due to the extraction of LWs 25 to 27
- Myrtle Creek Avenue, due to the extraction of LWs 25 to 28
- Moorland Road, due to the extraction of LWs 25 to 28
- River Road South, due to the extraction of LWs 27 and 28
- Park Avenue, due to the extraction of LWs 25 to 28
- River Rd, due to the extraction of LWs 26 to 28
- Remembrance Drive, due to the extraction of LWs 24A to 30
- Remembrance Drive, due to the extraction of LWs 24A to 27
- Stilton Dam Northern Line, due to the extraction of LWs 29 to 31 (refer Fig. 3.10)
- Remembrance Drive East, due to the extraction of LW31 (refer Fig. 3.11)

The study found no increased subsidence, tilt or strains were measured along the survey lines that were located over unmined, solid coal areas between the extracted longwalls and the Nepean Fault.

A histogram of the maximum observed tensile and compressive strains measured along the selected survey lines for survey bays located over solid coal between previously extracted longwalls at Tahmoor and the Nepean Fault is provided in Fig. 3.8.

It can be seen from Fig. 3.8 that observed ground strains have been, on average, within survey tolerance. A pair of outlying data points are labelled in Fig. 3.8.

Pegs RE77 and RE78 are located within the base of Myrtle Creek, which is the main watercourse in the area. Whilst Myrtle Creek has experienced a small amount of valley closure at this location due to the mining of Longwalls 29 and 30, it can be seen from Fig. 3.9 that measured strains across the base of the Creek have varied greatly over time. The main reason for the variations is that the pegs are spaced only 3 metres apart, meaning that survey tolerance has a much greater influence on the measured result. Most survey bays in the Southern Coalfield are spaced apart by nominally 20 metres. The second reason is that variations have occurred after periods of heavy rainfall, where the pegs have been affected by swelling of the natural soils.

Pegs MD29 to MD30 appear to have been disturbed by construction works. The changes occurred after the completion of Longwall 26. The pegs, however, are located approximately 35 metres from the commencing end of Longwall 27, as shown in Fig. 3.9, but they experienced no changes during the mining of this longwall.

Notwithstanding these outliers, the statistics demonstrate that observed ground strains have been very small for survey pegs over solid coal, beyond the edges of the extracted longwalls at Tahmoor Coking Coal Operations.

Two survey lines (Stilton Dam Line and Remembrance Drive East Line) cross mapped second order conjugate faults. As shown in Fig. 3.10 and Fig. 3.11, observed subsidence, tilt and strain have been very low at these intersections. A very small bump was, however, observed along the Remembrance Drive East Line approximately 20 metres from the intersection point. Ground strains remained within survey tolerance at this location.

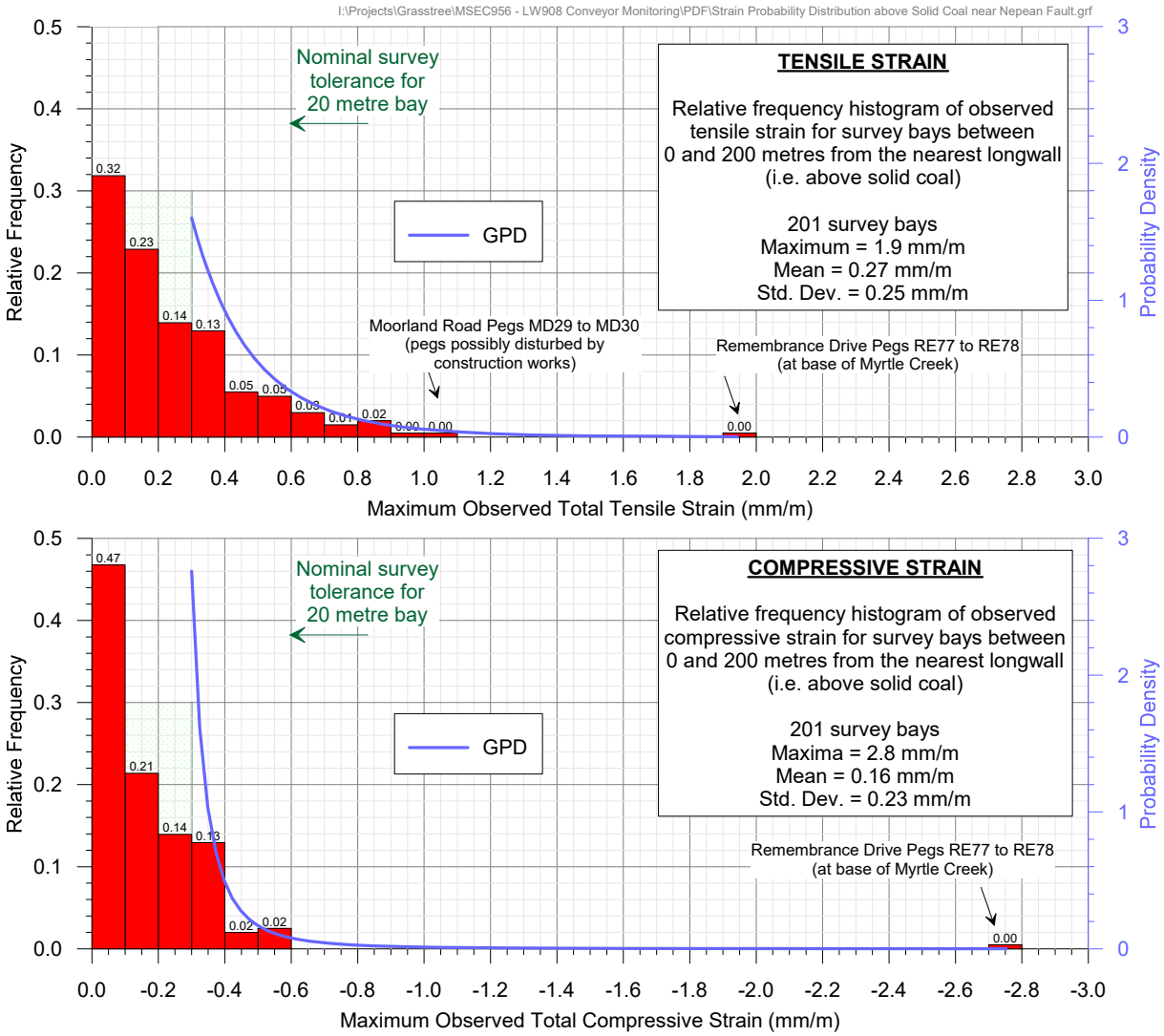

Fig. 3.8 Distributions of the Measured Maximum Tensile and Compressive Strains for Bays Located over Solid Coal between previously extracted longwalls at Tahmoor Coking Coal Operations and the Nepean Fault

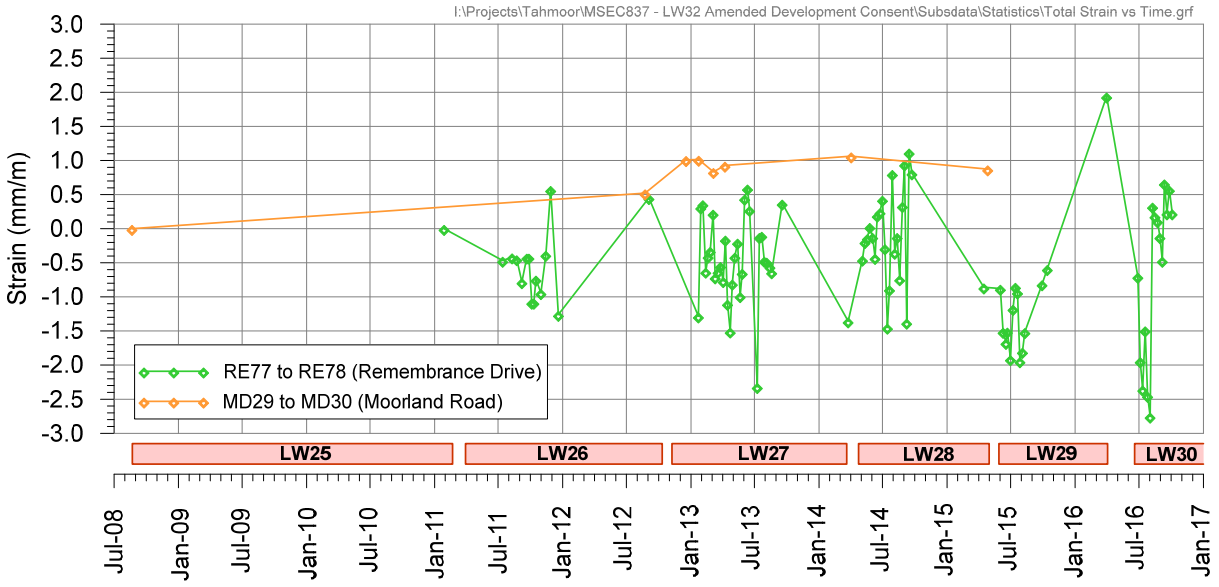

Fig. 3.9 Observed ground strains at selected sites during the mining of Longwalls 25 to 30

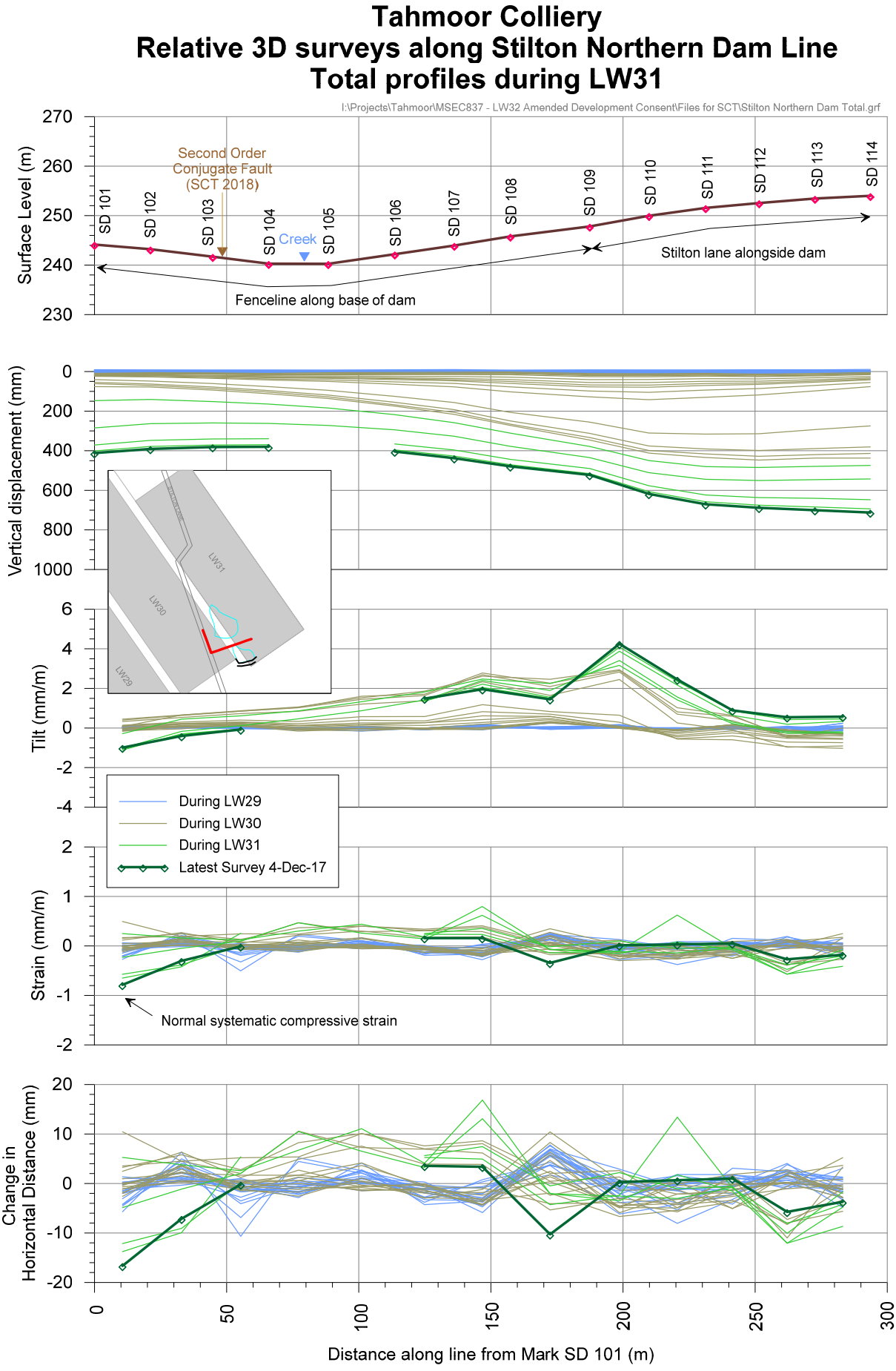

Fig. 3.10 Observed total subsidence profiles along the Stilton Northern Dam Line during the mining of Longwalls 29 to 31

Tahmoor Colliery - Longwall 31
Incremental Subsidence Profiles along Remembrance Drive East

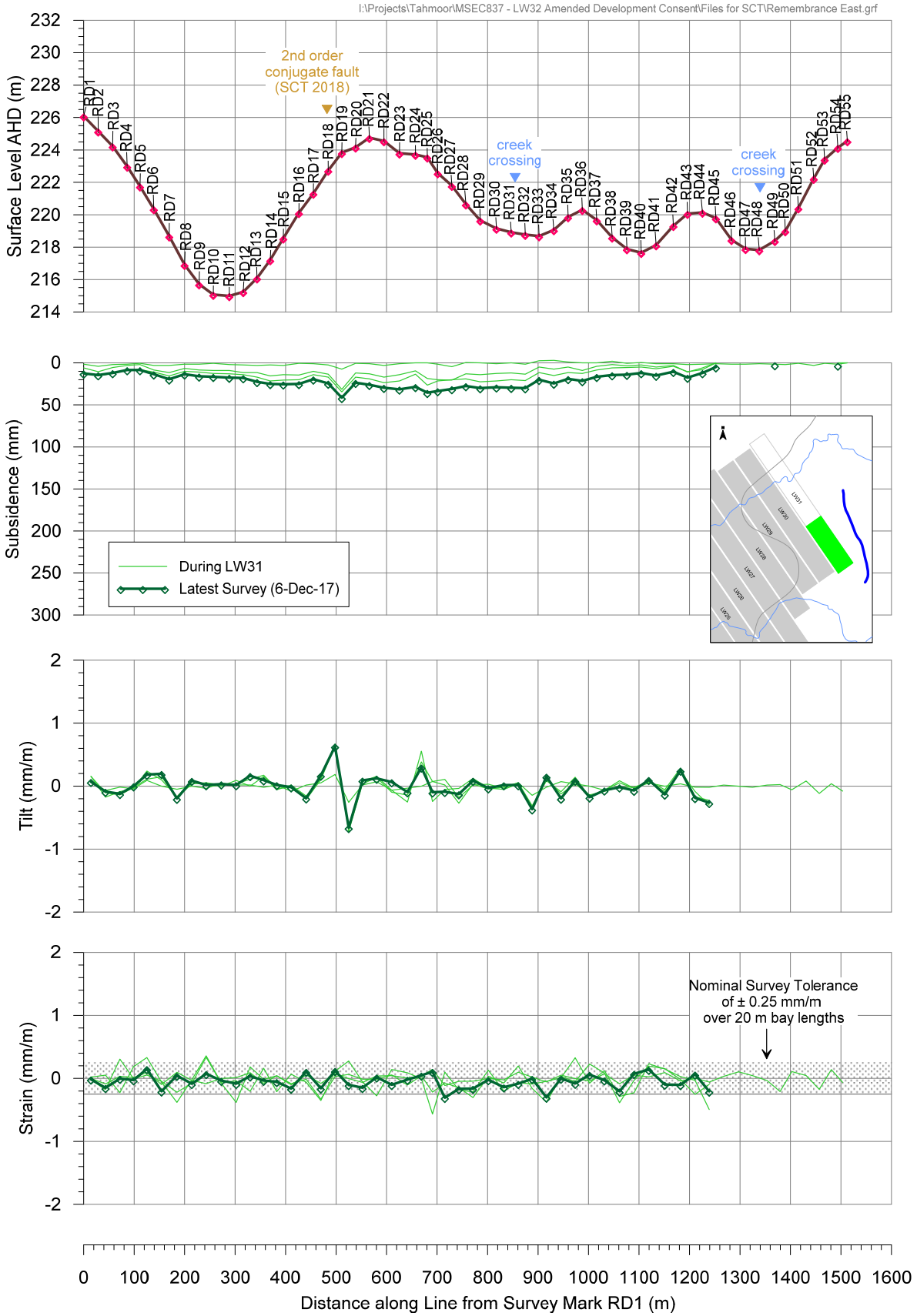

Fig. 3.11 Observed total subsidence profiles along the Remembrance Drive East Line during the mining of Longwalls 31

3.4.3. Potential effects of the Nepean Fault and associated geological structures on the development of subsidence during the extraction of Longwall 32

SCT (2018b) has undertaken a thorough and systematic review of subsidence outcomes that could reasonably be considered to be potentially significant. The following potential outcomes were investigated:

1. *"The potential for greater than predicted (abnormal) subsidence over the LW32 panel to cause greater subsidence beyond the panel edges.*
2. *The potential for unconventional subsidence movements occurring beyond the edge of LW32, including at or across the Nepean Fault.*
3. *The potential for mining-induced stress changes near the Nepean Fault to cause the fault plane to be mobilised.*
4. *The potential for movements that might occur quickly than conventional subsidence because of the presence of the fault and increase normal mining induced micro-seismic activity due to the isolating effect of the fault."*

SCT (2018b) concluded that "*none of the potential outcomes could reasonably be considered to have potential to be significant*". The conclusion is based on the following reasons (SCT, 2018b):

- The mapped planes of the first order Nepean Fault are remote from Longwall 32. Any differential vertical movement that may occur at the location of the Nepean Fault would be limited to less than a few tens of millimetres.
- Whilst increased subsidence was previously observed above the commencing ends of Longwalls 24A to 28, increased subsidence was not observed beyond the panel edges. Recent observations, including those during the mining of Longwall 31 indicate that subsidence has returned to normal levels.
- The Nepean Fault and associated fault structures are mapped as being sub-vertical. The geological structures that are recognised to be associated with unconventional subsidence are typically sub-horizontal i.e. bedding planes.
- Whilst mining induced stress changes are expected to occur on the fault because of longwall mining, they are not of a nature that would allow the fault plan to be destabilised and slip. This is because the stresses acting on the fault plane are not such that the fault is in limiting equilibrium, i.e. on the verge of instability.
- The high stresses and absence of massive strata in the Southern Coalfield of NSW mean that fracturing and downward movement occurs gradually and incrementally as the longwall retreats. Micro-seismic activity occurs regularly and so has low magnitude.

The conclusions by SCT (2018b) are supported by the results of the subsidence studies at Tahmoor Coking Coal Operations, as described in Section 3.4.2.

SCT (2018b) also advises that "*unconventional subsidence unrelated to the Nepean Fault may occur within the subject area during mining of LW32. Unconventional subsidence movements are observed at Tahmoor from time to time and therefore, may occur within the subject area*." MSEC concurs with this view, noting that the observed frequency of impacts beyond the edges of the longwalls have been infrequent and have been relatively slight in nature.

In addition to the subsidence study, an analysis of reported impacts during the mining of previous longwalls at Tahmoor Coking Coal Operations have recorded very few impacts beyond the panel edges, including in locations between the extracted longwalls and the Nepean Fault.

3.4.4. Potential effects of geological structures on the development of subsidence during the extraction of Longwall 32

Whilst the potential for significant differential movements is considered to be relatively low beyond the edges of Longwall 32, it is possible, however, that significant differential movements could occur at sites located directly above Longwall 32, including where second order geological structures associated with the Nepean Fault have been identified. Whilst no impacts have been observed at the Stilton Lane dam site in Fig. 3.10, differential movements have been observed where other geological structures have intersected the surface.

A recent example occurred at a low angle fault that intersected the Main Southern Railway in a railway cutting at Tahmoor, which was located directly above Longwall 29. The site was monitored extensively during the mining of Longwalls 28 to 31. This included three monitoring lines along the railway cutting, and survey prisms along the railway track.

The results of observed changes in vertical alignment of the pegs along the railway cutting are shown in Fig. 3.12. It can be seen that the most significant changes occurred during the mining of Longwall 29. The changes, however, developed gradually over time, allowing the railway track to be adjusted such that trains could continue to travel through the site.

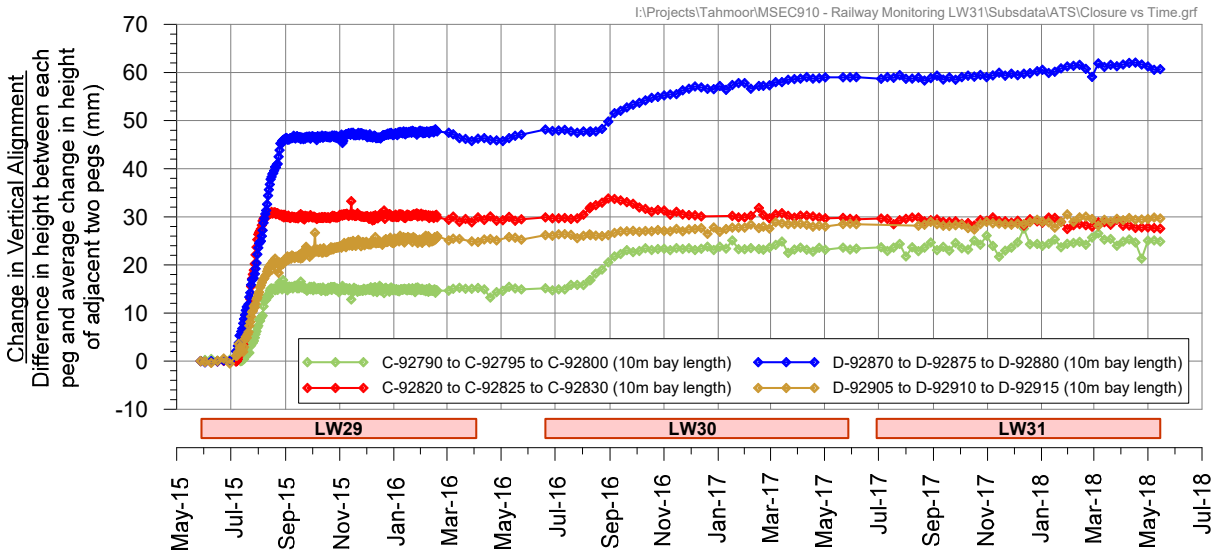

Fig. 3.12 Changes in vertical alignment across a geological fault within a railway cutting during the mining of Longwalls 29 to 31 at Tahmoor Coking Coal Operations

The observations of the gradual development of differential movements have been consistently observed during the mining of previous longwalls at Tahmoor Coking Coal Operations. While some sites have experienced severe impacts, the subsidence movements developed gradually, allowing time to repair before they became unsafe. This is discussed further in the next section.

3.5. Managing Public Safety

The primary risk associated with mining beneath Endeavour Energy infrastructure is public safety. Tahmoor Coking Coal Operations has previously directly mined beneath or adjacent to more than 1900 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 (2018) and an engineering geologist for geological structures.

3.5.1. Subsidence Impact Management Process for Infrastructure

Tahmoor Coking Coal Operations has developed and acted in accordance with a subsidence management plan to manage potential impacts during the mining of Longwalls 22 to 31. The management strategy has been reviewed and updated based on experiences gained during the mining of Longwalls 22 to 31 and the strategy for Longwall 32 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.
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
   - 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. 3.13.

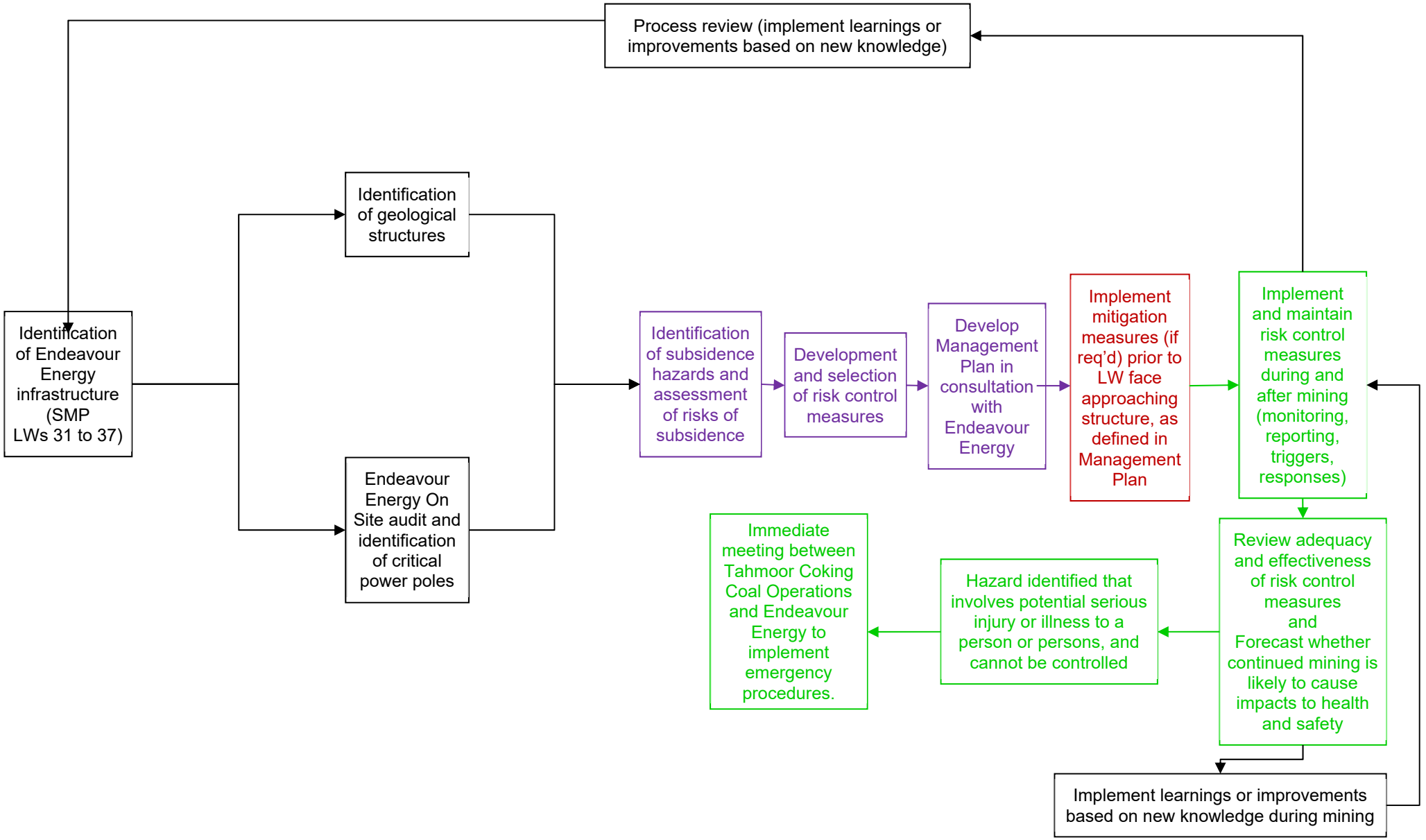

Fig. 3.13 Flowchart for Subsidence Impact Management Process

3.6. 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 Coking Coal Operations (Glencore, 2018), and was reassessed according to Endeavour Energy's Risk Criteria. 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
Powerlines			
Adverse impacts on the 66 kV, 11 kV and LV powerlines	RARE	MODERATE	LOW
Adverse impacts on consumer cables to houses	UNLIKELY	SLIGHT	LOW

Additional information on each potential impact is provided below.

3.7. 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 Coking Coal Operations), 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 rise to risks to health and safety of people in the vicinity of electrical infrastructure.

Using the processes described in Section 3.5 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 3.8 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.

- 66kV powerline along Remembrance Drive and through the Picton Water Recycling Plant
- 11kV powerlines along streets
- 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 Longwall 32.

- Loss of conductor clearance below Endeavour Energy standards (refer Section 3.8)
- Tensile pulling of consumer lines at house connections (refer Section 3.8)

The identification and risk assessment process took into account the location of infrastructure relative to Longwall 32 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 Coking Coal Operations 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 and geological structures have been mapped that intersect powerlines.

Tahmoor Coking Coal Operations 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 property in general. These are described in Chapter 4 of this Management Plan.

3.8. Powerlines

There are a number of powerlines that are located directly above or adjacent to Longwall 32, as shown in Drawings Nos. MSEC945-06-01 and MSEC945-06-02.

- 66 kV powerlines along Remembrance Drive / Argyle Street

  The 66kV powerline is a single pole line that runs along Remembrance Drive before turning east across property owned by Sydney Water's Picton Water Recycling Plant. The powerline crosses the mapped first order Nepean Fault. A photograph of the 66kV powerline and the adjacent 11kV powerline is shown in Fig. 3.14.

Fig. 3.14 66kV Powerline (left) and 11kV Powerline (right) within Sydney Water's Picton Water Recycling Plant

- 11 kV powerlines and LV powerlines

  As shown in Drawing No. MSEC945-06-01, a network of 11kV and LV powerlines are located directly above and adjacent to Longwall 32. The powerlines generally run along streets including Remembrance Drive, Henry Street, Bridge Street and Thirlmere Way. One 11KV powerline runs across Redbank Creek between Redbank Place and Stilton Lane. The powerlines are supported by single pole structures.

3.8.1. Predicted subsidence movements

The powerlines located above and adjacent to Longwall 32 generally follow the alignments of the local roads and, therefore, they will collectively experience the full range of predicted subsidence movements, as described in Section 3.1. A discussion on the expected range of tensile and compressive strains during the mining of Longwall 32 is provided in Section 3.3.

The predicted profiles of conventional subsidence, tilt and curvature for the 66kV powerline along Remembrance Drive is shown in Fig. 3.15. The predicted profiles of conventional subsidence, tilt and curvature for the 11kV powerline along Bridge Street is shown in Fig. 3.16. The predicted total profiles after the completion of Longwall 32 are shown in cyan. The predicted incremental profiles due to the extraction

of Longwall 32 only are shown in black. The predicted total profiles after the completion of Longwall 32 are shown in blue.

A summary of the maximum predicted conventional subsidence, tilt and curvature for each of the powerlines, after the extraction of Longwall 32, is provided in Table 3.3. The values are the maximum predicted parameters anywhere along the sections of powerlines located within the predicted limit of vertical subsidence for Longwall 32.

Table 3.3 Maximum predicted total conventional subsidence, tilt and curvature for the powerlines

Location	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)
Bridge Street	1225	4.5	0.08	0.13
Remembrance Drive	300	1.0	0.06	0.01
Thirlmere Way	80	0.5	0.01	0.01

Bridge Street will also experience transient tilts and curvatures as the extraction face of Longwall 32 mines directly beneath it. The maximum predicted transient movements orientated across the alignment of Bridge Street are 3.5 mm/m tilt, 0.06 km^{-1} hogging curvature and 0.08 km^{-1} hogging curvature.

3.8.2. Potential subsidence impacts on powerlines

Longwalls 22 to 31 have directly mined beneath approximately 41 km of electrical cables and 1058 power poles and no significant impacts have been recorded. This includes the 66kV powerline, which has experienced full subsidence movements during the mining of Longwalls 22 to 28. Whilst no impacts have been recorded, minor changes in tension of some aerial cables has been observed.

It is possible, but unlikely, that minor adverse impacts could occur to the electrical infrastructure that is located directly above or immediately adjacent to Longwall 32. It is expected that the impacts would be relatively minor and that these could be readily repaired.

Whilst differential subsidence movements could occur across mapped geological structures associated with the Nepean Fault, they are unlikely to adversely affect the single pole 66kV and 11kV powerlines. A survey line has been established along these powerlines across the fault to monitor potential differential movements during the mining of Longwall 32.

Tahmoor Coking Coal Operations has developed and selected risk control measures in consultation, co-ordination and cooperation with Endeavour Energy in accordance with WHS legislation. The controls have been succesfully implemented during the mining of Longwalls 22 to 31.

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 Coking Coal Operations has identified controls that will manage potential issues associated with damage to pipelines resulting in damage to electrical infrastructure during the extraction of Longwall 32 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 located within the active subsidence zone
- Regular consultation with the community to report potential impacts.
- Adjusting powerlines to rectify adverse tilts or reduction in conductor clearance heights if triggered by monitoring results
- In the worst case, repair of damaged powerlines.

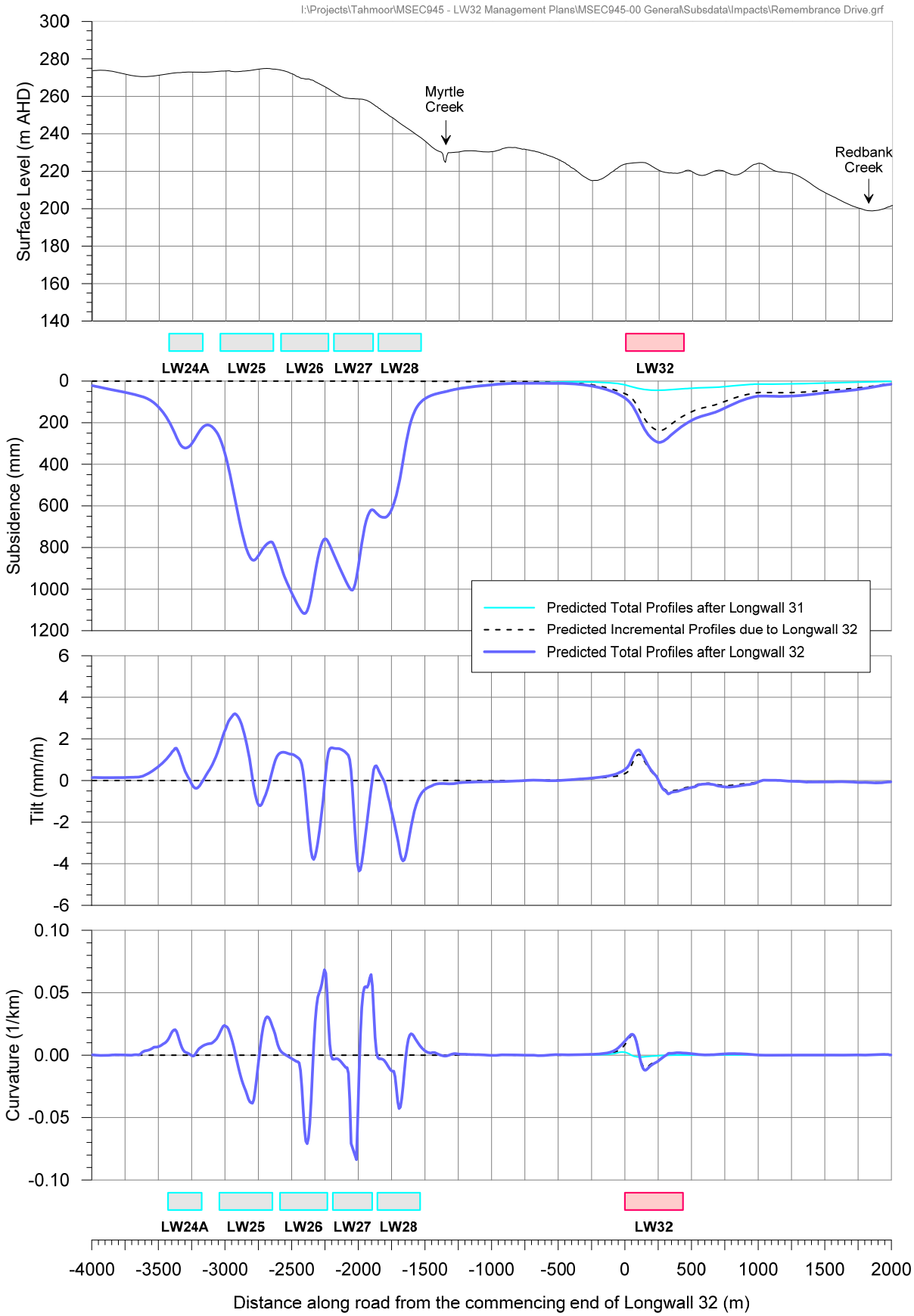

Fig. 3.15 Predicted profiles of total subsidence, tilt and curvature for the powerline along Remembrance Drive due to the mining of Longwalls 22 to 32

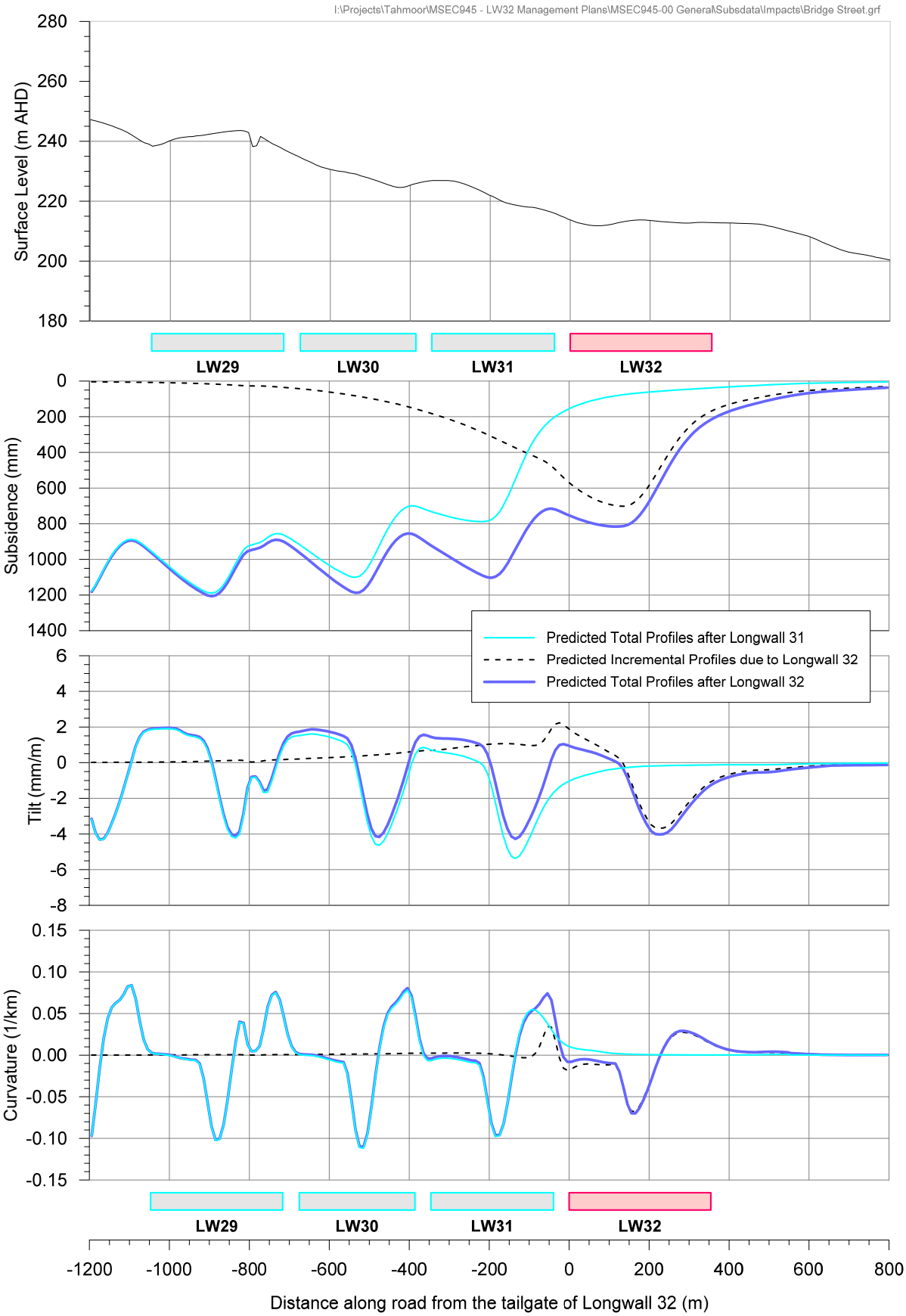

Fig. 3.16 Predicted profiles of total subsidence, tilt and curvature for the powerline along Bridge Street due to the mining of Longwalls 22 to 32

3.8.3. Power poles

An inspection of power poles located within the mining area for Longwall 32 was conducted by Endeavour Energy on 17 July 2018. 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 Longwall 32 are listed in Table 3.4, and are shown in Drawing No. MSEC945-06-02.

In addition to the poles identified for Longwall 32, Tahmoor Coking Coal Operations will continue to monitor subsidence movements at poles that were selected for monitoring during the mining of Longwall 31. The poles are also shown in Drawing No. MSEC945-06-02.

Table 3.4 Summary of poles recommended for monitoring during Longwall 32

Sub No.	Pole No.	Street Name	Type	Position relative to LWs
Poles selected by Endeavour Energy for monitoring during the mining of Longwall 32				
11581	725341	Bridge Street	Pole Sub	Near side of LW32
10965	628607	Remembrance Driveway	Pole Sub	Near side of LW32
29188	214850	Remembrance Driveway	Pole Sub	Near side of LW32
20102	737270	Remembrance Driveway	Pole Sub	Above LW32
22844	289373	Remembrance Driveway	Pole Sub	Near start of LW32
Poles selected by Endeavour Energy for monitoring during the mining of Longwall 31				
12016	628485	Stilton Lane	Pole Sub	Above LW30
-	628482	Stilton Lane	HV Pole	Above LW30
-	628623	Stilton Lane	HV Pole	Above LW31
10209	798027	Stilton Lane	Pole Sub	Above LW31
-	805777	Stilton Lane	HV Pole	Above LW32
-	628573	Stilton Lane	ABS Pole	Above LW32
-	805778	Henry Street	HV Pole	Above LW32
12089	628632	Henry Street	Pole Sub	Above LW32
-	628565	Bridge Street	HV Pole	Above LW32
3915	623338	Bridge Street	Pole Sub	Above LW32
20823	230469	Bridge Street	Pole Sub	Above LW31
-	623346	Bridge Street	HV Pole	Above LW32
11338	623341	Bridge Street	Pole Sub	Above LW31
18638	623348	Redbank Place	Pole Sub	Above LW32

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 8.0

4.2. Development and Selection of Risk Control Measures

Tahmoor Coking Coal Operations 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 risk control measures are described in Section 4.3.

Method B risk control measures are described in Section 4.3 to Section 4.6. Prior to selecting Method B risk control measures, Tahmoor Coking Coal Operations has investigated and confirmed that the measures are feasible and effective for the site-specific conditions during the extraction of Longwall 32.

4.3. Selection of Risk Controls for Electrical Infrastructure

Based on the above assessments, Tahmoor Coking Coal Operations 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 safety of people travelling along Thirlmere Way.

- Implementation of a Monitoring Plan and Trigger Action Response Plan (TARP)
  As described in the Management Plan, Tahmoor Coking Coal Operations and Endeavour Energy has 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 the safety and serviceability develop. The TARP includes the following:
    - Identification of critical power poles to be monitored prior to the commencement of Longwall 32.
    - Local 2D surveys along local roads as shown in Drawing No. MSEC945-00-01. These include Remembrance Drive, Bridge Street and Henry Street.
    - Local 2D surveys along 66kV and 11kV powerlines that traverse the Nepean Fault on Sydney Water's Picton Water Recycling Plant.
    - Visual inspections along the streets within the active subsidence zone.
    - Additional surveys and/or inspections, if triggered by monitoring results.
    - In the unlikely event that subsidence movements are delayed during the early stages of extraction of Longwall 32, additional management measures may be implemented along Remembrance Drive, including an increase in monitoring and reporting, provision of labour, equipment and materials on site to respond if adverse movements develop.
    - Regular consultation with the community to report potential impacts.
    - 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

Survey marks have been placed along streets within the areas above and adjacent to Longwall 32., as shown in Drawing No. MSEC945-00-01. The survey pegs will be surveyed during the period of active subsidence of these features during the extraction of Longwall 32.

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

4.4.2. Visual Inspections

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

- Visual inspections along streets within the active subsidence zone.
- Visual inspections to identify changes in tension or sag.

4.4.3. Changes to Monitoring Frequencies

Monitoring frequencies will continue while Endeavour Energy infrastructure is experiencing active subsidence due to the extraction of Longwall 32. 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 Coking Coal Operations 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.
- Repair of impacts that create a serious public safety hazard.
- Provide electricity… .

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 Longwall 32, 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 3.7, 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 Coking Coal Operations 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 Coking Coal Operations 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 Coking Coal Operations or by people on public property, Tahmoor Coking Coal Operations 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 Coking Coal Operations Longwall 32

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 A	None	Conduct visual inspections for changes to power poles along local roads within active subsidence zone	Weekly from start of LW32	Tahmoor Coking Coal Operations
				Ground surveys across the PWRP property and Nepean Fault	Installation and baseline survey complete Monthly absolute 3D Weekly 2D from start of LW32 until 800m unless ongoing adverse changes observed	Tahmoor Coking Coal Operations
				Conduct surveys along Remembrance Drive / Argyle Street *Initial extent from Survey Peg RD1 to Peg RD32 and then extend to the north to include pegs within the active subsidence zone. After 800 m of extraction, reduce extent to the south beyond active subsidence zone unless ongoing adverse movements are observed*	Weekly from start of LW32 until 2200 m of extraction unless ongoing adverse movements are observed	Tahmoor Coking Coal Operations (SMEC)
				Conduct surveys along Henry Street / Stilton Lane, Bridge Street, Redbank Place, Bollard Place, Wonga Street, Wood Street and Coachwood Crescent	Weekly for pegs located within active subsidence zone	Tahmoor Coking Coal Operations (SMEC)
				Conduct pole surveys that measure subsidence at base and vertical offset or tilt of selected critical poles.	Monthly for each pole within active subsidence zone and for next 3 months after leaving active subsidence zone End of Longwall for all poles within limit of subsidence for panels	Tahmoor Coking Coal Operations (SMEC / MSEC)
				Analyse and report results to IMG, including information on the position of the longwall face	Weekly from start of LW32	Tahmoor Coking Coal Operations
			Impacts observed to power poles or conductor clearance heights	Notify all stakeholders, including Endeavour Energy, Tahmoor Coking Coal Operations, Subsidence Advisory NSW and Resources Regulator	Within 24 hours	Tahmoor Coking Coal Operations
				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 Coking Coal Operations and Endeavour Energy	IMG
			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 Coking Coal Operations 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 Coking Coal Operations 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 Coking Coal Operations

5.1. Consultation, Co-operation and Co-ordination

Substantial consultation, co-operation and co-ordination has taken place between Tahmoor Coking Coal Operations 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 Coking Coal Operations and Endeavour Energy.

- Reporting of observed impacts to Tahmoor Coking Coal Operations either during the weekly visual inspection or at any time directly to Tahmoor Coking Coal Operations.
- 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 Longwall 32.
- Convening of meetings between Tahmoor Coking Coal Operations 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 Coking Coal Operations 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 structures on the property.

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;
- Ensuring the effectiveness and reliability of risk control measures; and
- Supporting continual improvement and change management.

IMG meetings may be held between Tahmoor Coking Coal Operations 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 Coking Coal Operations 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.
- 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.
- 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 Coking Coal Operations to review the operation of the Management Plan and report at the next scheduled Plan Review Meeting.

7.0 RECORD KEEPING

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

8.0 CONTACT LIST

Organisation	Contact	Phone	Email / Mail	Fax
NSW Department of Planning and Environment – Resources Regulator	Phil Steuart	(02) 4063 6484	phil.steuart@planning.nsw.gov.au	-
	Gang Li	(02) 4063 6429 0409 227 986	gang.li@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	(02) 4677 2040
Mine Subsidence Engineering Consultants (MSEC)	Daryl Kay*	(02) 9413 3777 0416 191 304	daryl@minesubsidence.com	-
SIMEC Mining Tahmoor Coking Coal Operations Environment and Community Manager	Ron Bush	(02) 4640 0156 0437 266 998	Ron.Bush@glencore.com.au	(02) 4640 0140
SIMEC Mining Tahmoor Coking Coal Operations Community Coordinator	Belinda Clayton*	(02) 4640 0133 0436 331 630	Belinda.L.Clayton@glencore.com.au	(02) 4640 0140
Endeavour Energy	Emergency Contact	131 003		
Endeavour Energy	Benjamin Logue* (Design Services Manager)	0410 419 744 (02) 9853 7805	Benjamin.logue@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

Drawing No.	*Description*	*Revision*
MSEC945-00-01	Monitoring over Longwall 32	C
MSEC945-06-01	Electrical Infrastructure	A
MSEC945-06-02	Critical Power Poles	A

Supporting Documentation

Glencore (2014) Glencore Coal Assets Australia Risk Management Matrix, Glencore, September 2014.

Glencore (2018) Environmental Risk Assessment: Tahmoor Underground – Longwall 32 Surface and Subsurface Infrastructure – Electrical Infrastructure, Tahmoor Coking Coal Operations, May 2018.

Endeavour Energy (2018) Endeavour Energy Network: Result of On Site Audit Endeavour Energy Assets for SIMEC Mining - Tahmoor Colliery Longwall 32, Endeavour Energy, July 2018.

I:\Projects\Tahmoor\MSEC945 - LW32 Management Plans\MSEC945-00 General\AcadData\MSEC945-00-01 Monitoring LW32.dwg

msec mine subsidence ENGINEERING CONSULTANTS
Suite 402, 13 Spring Street, Chatswood NSW 2067
PO Box 302, Chatswood NSW 2057
Tel +61 2 9413 3777
www.minesubsidence.com

SIMEC MINING Tahmoor Coking Coal

TAHMOOR COKING COAL OPERATIONS

TAHMOOR NORTH - LW32

MONITORING OVER LW32

DATE:	SCALE:	DRAWING No:	Rev No
4 Jul 2018	as shown	MSEC945-00-01	C

277 500 278 000 278 500 279 000 279 500 280 000 280 500

0m 250m 500m
SCALE

6 214 600
6 214 500
6 214 000
6 213 500
6 213 000
6 212 500
6 212 000
6 211 500
6 211 000

Refer Embankment 89.80km diagram for details (MSEC943-10)

WEATHERBOARD COTTAGE

THIRLMERE WAY

ARGYLE ST

RUMKER ST

BRIDGE ST

FAIRLEY RESIDENCE

Refer Mill Hill for details (MSEC945-13-02)

Refer individual diagrams for details of Commercial area (MSEC945-19)

BOLLARD PL

WOOD ST

COACHWOOD CR

Refer Embankment 90.252km diagram for details (MSEC943-09)

Refer Picton High School for details (MSEC945-12)

REDBANK PL

HENRY ST

Refer Embankment 90.676km diagram for details (MSEC943-08)

Refer Wonga Rd industrial properties for details (MSEC945-19)

WONGA RD

PREDICTED 20mm SUBSIDENCE CONTOUR DUE TO LW32

Refer Bridge St Cutting & Overbridge 91.00km diagram for details (MSEC943-07)

Refer Redbank Creek Culvert diagram for details (MSEC943-06)

LW 31

LW 32

35° ANGLE OF DRAW LW32

STILTON LN

LW 28

LW 29

LW 30

BRIDGE ST

REMEMBRANCE DRIVEWAY

Refer Railway diagram for details (MSEC943-03)

Refer Heritage Items - Koorana Homestead for details (MSEC945-13-01)

MAIN SOUTHERN RAILWAY

LW 27

Refer Deviation Overbridge 92.41km diagram for details (MSEC943-05)

Refer Deviation Cutting diagram for details (MSEC943-05)

Dam removed 2016

Refer Picton Water Recycling diagram for details (MSEC945-18)

LW 26

Refer No155 Stilton Lane diagram for details (MSEC45-15)

Myrtle Creek Bridge

MYRTLE CREEK

LEGEND

- Existing Monitoring Lines
- Surveys During LW32
- Critical Power Poles
- Specific Structure Inspections

Refer to Management Plans for Timing & Frequencies

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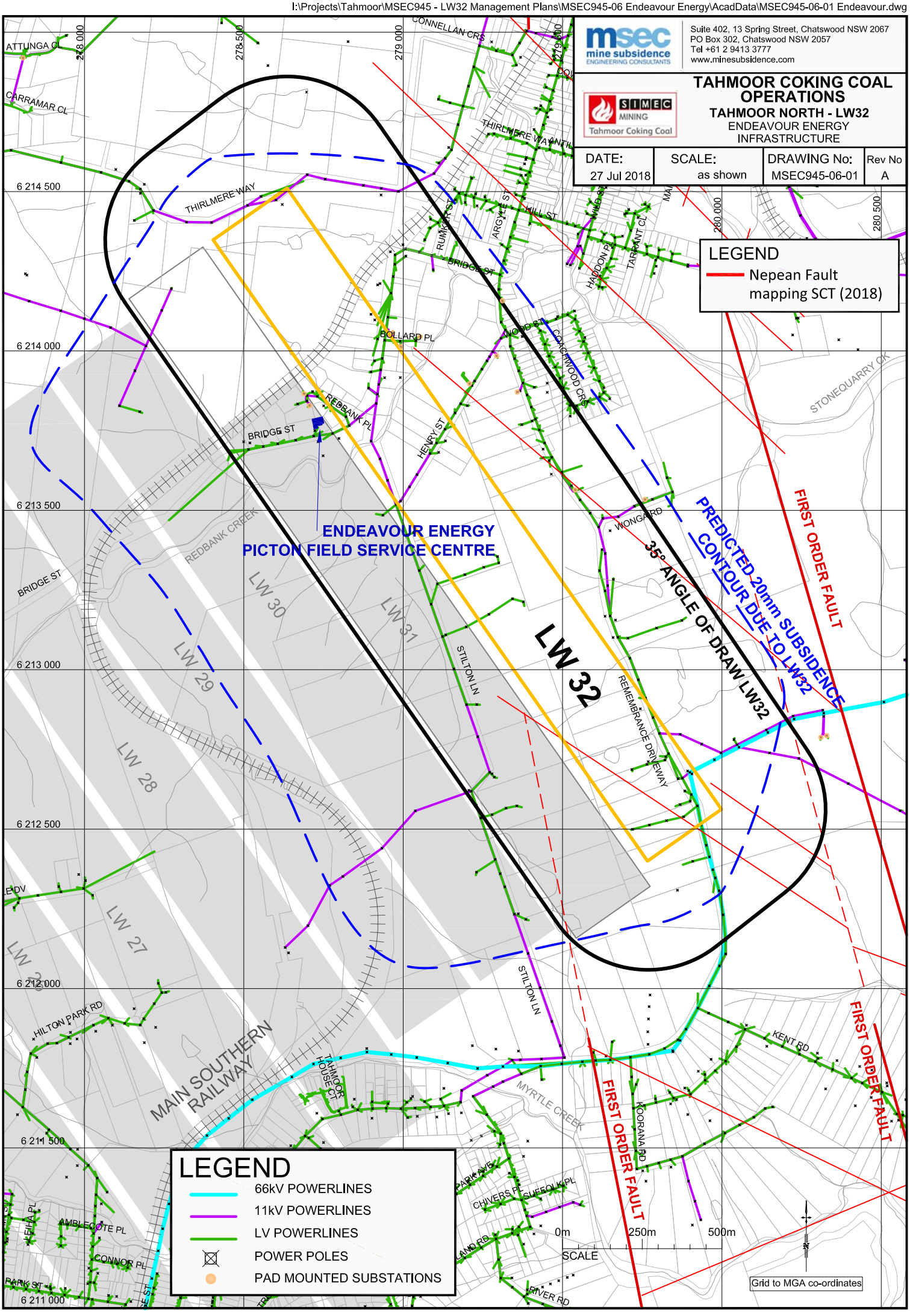

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SIMEC MINING Tahmoor Coking Coal

TAHMOOR COKING COAL OPERATIONS

TAHMOOR NORTH - LW31

ENDEAVOUR ENERGY
CRITICAL POWER POLES

DATE:	SCALE:	DRAWING No:	Rev No
27 Jul 2018	as shown	MSEC862-06-02	A

LEGEND
Nepean Fault mapping SCT (2018)

LEGEND
CRITICAL POWER POLES

LW 32
LW 31
LW 30
LW 29
LW 28
LW 27
LW 26

35° ANGLE OF DRAW LW32
PREDICTED 20mm SUBSIDENCE CONTOUR DUE TO LW32
FIRST ORDER FAULT
FIRST ORDER FAULT
FIRST ORDER FAULT

11581
230469
623338
628565
623348
623346
623341
628632
628573
805777
805778
798027
10965
29188
20102
628623
628482
628485
22844

CONNELLAN CRS
THIRLMERE WAY
RUMKER ST
ARGYLE ST
HILL ST
WILD ST
HADDON PL
TARRANT CL
BRIDGE ST
BOLLARD PL
WOOD ST
COACHWOOD CRS
REDBANK PL
HENRY ST
STONEQUARRY CK
WONGA RD
REMEMBRANCE DRIVEWAY
STILTON LN
REDBANK CREEK
MYRTLE CREEK
KENT RD
KOORANA RD
HILTON PARK RD
MAIN SOUTHERN RAILWAY
TAHMOOR HOUSE CT
PARK AVE
CHIVERS PL
SUFFOLK PL
YORK ST
AMBLECOTE PL
CONNOR PL
CYCLEWAY
LEIHA PL
PARK ST

Grid to MGA co-ordinates

Appendix A - Glencore Coal Assets Australia Risk management Matrix

GLENCORE COAL ASSETS AUSTRALIA RISK MATRIX

CONSEQUENCE [potential foreseeable outcome of the event]

	Health & Safety	Environment	Financial Impact	Image & Reputation / Community	Legal & Compliance
5 Catastrophic	• Multiple fatalities • Multiple cases of permanent total disability / health effects	• Environmental damage or effect (permanent; >10 years) • Requires major remediation	• >$600M investment return • >$100M operating profit • >$20M property damage	• Negative media coverage at international level • Loss of multiple major customers or large proportion of sales contracts • Loss of community support • Significant negative impact on the share price	• Major litigation / prosecution at Glencore corporate level • Nationalisation / loss of licence to operate
4 Major	• Fatality or permanent incapacity / health effects	• Long-term (2 to 10 years) impact • Requires significant remediation	• $60-600M investment return • $20-100M operating profit • $2-20M property damage	• Negative media coverage at national level • Scrutiny from government and NGOs • Complaints from multiple “final” customers • Loss of major customer • Loss of community support • Negative impact on share price	• Major litigation / prosecution at Division level
3 Moderate	• Lost time / disabling injury / occupational health effects / multiple medical treatments	• Medium-term (<2 years) impact • Requires moderate remediation	• $6-60M investment return • $2-20M operating profit • $200K-2M property damage	• Negative media coverage at local / regional level over more than one day • Complaint from a “final” customer • Off-spec product • Community complaint resulting in social issue	• Major litigation / prosecution at Operation level
2 Minor	• Medical Treatment Injury (MTI) / occupational health effects • Restricted Work Injury (RWI)	• Short-term impact • Requires minor remediation	• $600K-6M investment return • $200K-2M operating profit • $10-200K property damage	• Complaint received from stakeholder or community • Negative local media coverage	• Regulation breaches resulting in fine or litigation
1 Negligible	• First Aid Injury (FAI) / illness	• No lasting environmental damage or effect • Requires minor or no remediation	• <$600K investment return • <$200K operating profit • <$10K property damage	• Negligible media coverage	• Regulation breaches without fine or litigation

LIKELIHOOD [of the event occurring <u>with that consequence</u>]

Basis of Rating	E - Rare	D - Unlikely	C - Possible	B - Likely	A – Almost Certain
LIFETIME OR PROJECT OR TRIAL OR FIXED TIME PERIOD OR NEW PROCESS / PLANT / R&D	Unlikely to occur during a lifetime OR Very unlikely to occur OR No known occurrences in broader worldwide industry	Could occur about once during a lifetime OR More likely <u>NOT</u> to occur than to occur OR Has occurred at least once in broader worldwide industry	Could occur more than once during a lifetime OR As likely to occur as not to occur OR Has occurred at least once in the mining / commodities trading industries	May occur about once per year OR More likely to occur than not occur OR Has occurred at least once within Glencore	May occur several times per year OR Expected to occur OR Has occurred several times within Glencore
5 Catastrophic	**15 (M)**	**19 (H)**	**22 (H)**	**24 (H)**	**25 (H)**
4 Major	**10 (M)**	**14 (M)**	**18 (H)**	**21 (H)**	**23 (H)**
3 Moderate	**6 (L)**	**9 (M)**	**13 (M)**	**17 (H)**	**20 (H)**
2 Minor	**3 (L)**	**5 (L)**	**8 (M)**	**12 (M)**	**16 (M)**
1 Negligible	**1 (L)**	**2 (L)**	**4 (L)**	**7 (M)**	**11 (M)**

Consequence Category	Consequence Type	Ownership	Action
Cat. 5	**Catastrophic Hazard**	Divisional / Functional / Operational / Asset Leadership	• Quantitative or semi-quantitative risk assessment required. • Capital expenditure will be justified to achieve ALARP ('As Low As Reasonably Practicable'). • Catastrophic Hazard Management Plans (CHMP) must be implemented where practical, Crisis Management Plans (CMP) tested and Catastrophic Event Recovery Plans (CERP) developed.
Cat. 4 (Health & Safety consequence)	**Fatal Hazard**	Divisional / Functional / Operational / Asset Leadership	• Glencore SafeWork Fatal Hazard Protocols or appropriate management plans must be applied. • Capital expenditure will be justified to achieve ALARP.
Risk Rank	**Risk Rating**	**Ownership**	**Action**
17 to 25	**High Risk**	Divisional / Functional / Operational / Asset Leadership	• Install additional HARD and SOFT controls to achieve ALARP. • Capital expenditure will be justified to achieve ALARP.
7 to 16	**Medium Risk**	Operational / Asset Leadership	• install additional HARD and SOFT controls if necessary to achieve ALARP. • Capital expenditure may be justified.
1 to 6	**Low Risk**	Operational / Asset Leadership	• Install additional controls if necessary to achieve ALARP. • Capital expenditure is not usually justified.

Table 3-3 - Risk Control Effectiveness (RCE)

RCE	Guide
Poor or no existing controls	• Significant control gaps or no credible control; • Either controls do not treat root causes, are non-existent or, if they exist, they are ineffective; • Management has no confidence that any degree of control is being achieved due to poor control design; • Very limited or no operational effectiveness.
Require improvement	• Most controls are designed correctly and are in place and effective; • Controls may only treat some of the root causes of the risk, and/or are not currently effective and/or there may be an over-reliance on “reactive” controls; • Management has doubts about operational effectiveness and reliability; • More work is required to improve operating effectiveness.
Satisfactory	• Controls are well designed and appropriate for the risk; • Controls are largely “preventative” and address the root causes; • Management believes that they are effective and reliable at all times; • Nothing more to be done except review and monitor the existing controls.

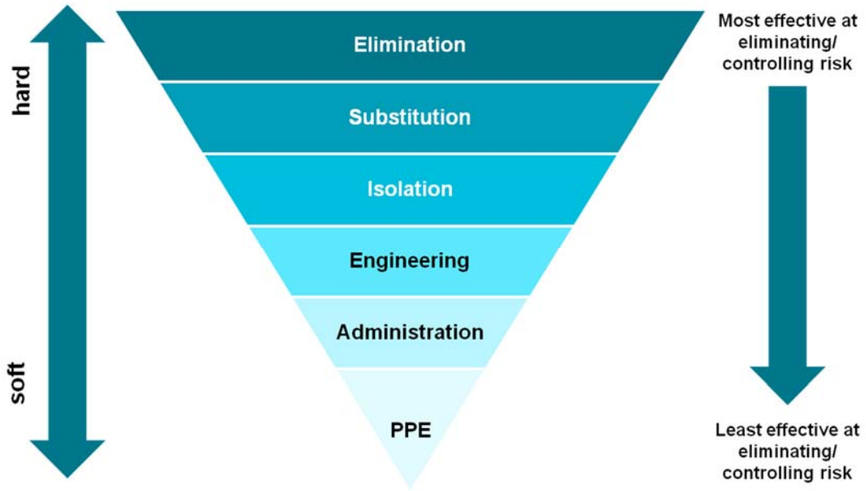


Figure 3-4 – Hierarchy of control

Table 3-4 - Priority for risk treatment authority for continued toleration of risk (applicable for risk assessment level 3 and 4)

Current risk rank	Action	Timing for authority	Authority for continued toleration of current level of risk
23 to 25	The activity must be stopped immediately until action to reduce the level of risk to less than 23 is undertaken or authority to continue is received.	Immediately to within 24 hours.	CE/COO Notification to CE prior to granting of authority to continue
17 to 22	The activity must be stopped immediately until action to reduce the level of risk to less than 17 is under taken or authority to continue is received.	The activity must be stopped immediately until action to reduce the level of risk to less than 17 is under taken or authority to continue is received.	Directors/COO Notification to COO prior to granting of authority to continue
10 to 16	Take action to reduce the level of risk to less than 10 or authority to continue is received.	Within 1 month.	General Managers / Operations Managers / Project Managers
7 to 9	Take action to reduce the level of risk to less than 7 or authority to continue is received.	Within 1 month.	Superintendents/ Managers / Project Team
1 to 6	Tolerable risk unless circumstances change	Ongoing control as part of a management system.	N/A

Environmental Risk Assessment: Tahmoor Underground - Longwall 32 Surface and Subsurface Infrastructure

	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					
Appendix B	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	Date Assessment carried out	Action# (CURA/ Xstrasafe)
Tahmoor Underground	Equipment	Powerlines	Endeavour Energy Infrastructure	Adverse impacts on the 66 kv, 11 kv and LV powerlines	Loss of reduction in clearance heights requiring emergency repair of powerline	Subsidence	Ground survey along streets refer Dwg. MSEC945-00-01 Rev B - every 200m of extraction (AC) Power pole surveys of critical poles - monthly (AC) Visual inspections - weekly (AC) TARP including repair of powerlines if required (AC) Analysis and reporting in line with surveys to Endeavour Energy (AC) Consultation, coordination and cooperation with Endeavour Energy (AC) Survey line installed along 66kV as it crosses over the fault (EC)	2	Health & Safety	3	E	6	3	Health & Safety	Infrastructure Management Plan for LW32 (including TARP). Endeavour Energy to conduct audit for all power poles to assess pre-mining condition. Tahmoor to conduct a photographic baseline survey of all power poles	Belinda Clayton	31-Jul-18		10-May-18	
Tahmoor Underground	Equipment	Powerlines	Endeavour Energy Infrastructure	Adverse impact on the consumer cables to houses	Loss of serviceability, emergency repair of powerline	Subsidence	Ground survey along streets refer Dwg. MSEC945-00-01 Rev B - every 200m of extraction (AC) Power pole surveys of critical poles - monthly (AC) Visual inspections - weekly (AC) TARP including repair of powerlines if required (AC) Analysis and reporting in line with surveys to Endeavour Energy (AC) Consultation, coordination and cooperation with Endeavour Energy (AC)	2	Health & Safety	2	E	3	2	Health & Safety	Infrastructure Management Plan for LW32 (including TARP).	Belinda Clayton	31-Jul-18		10-May-18	
						Subtotal CountA (ignoring hidden values)													

18th July, 2018
SIMEC Mining - Tahmoor Colliery
PO Box 100
Tahmoor, NSW 2573

Attention: Ms Belinda Clayton

Dear Madam,

SIMEC Mining, PROPOSED LONGWALL 32, TAHMOOR COLLIERY.

In order to assist SIMEC Mining in their application to the Department of Mineral Resources, for approval to mine Longwall 32 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 unduly 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 (Longwall 32) 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 coordinates at the base and top 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: Benjamin Logue • Direct phone: (02) 9853 7805 • Email: Benjamin.logue@endeavourenergy.com.au
51 Huntingwood Drive Huntingwood NSW 2148. PO Box 811 Seven Hills NSW 1730.
Endeavour Energy ABN 59 253 130 878 www.Endeavourenergy.com.au

ENDEAVOUR ENERGY IDENTIFIED CRITICAL POLES				
	Pole No	**Asset**	**Location**	**Photo Number**
1	PL725341	Pole Substation 11581	Bridge St Picton	1
2	PL628607	Pole Substation 10965	Remembrance DWY Picton	2
3	PL214850	Pole Substation 29188	Remembrance DWY Picton	3
4	PL737270	Pole Substation 20102	Remembrance DWY Picton	4
5	PL289373	Pole Substation 22844	Remembrance DWY Picton	5

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

Mr Benjamin Logue
Regional Services -Central
Endeavour Energy
Email address: Benjamin.logue@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 discuss this matter further, please contact Benjamin Logue by email or phone 02 98537805.

Yours faithfully,

Benjamin Logue
Project Officer
Regional Services- Central
Endeavour Energy

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 Longwall 32 at Picton.

Recommended

Benjamin Logue
Project Officer
Regional Services – Central
Endeavour Energy

Endorsed

Sean Brady
Regional Services Manager
Network- Central Region
Endeavour Energy

Approved

David Campbell
Manager
Network - Central Region
Endeavour Energy

RISK REGISTER - DAMAGE TO ENDEAVOUR ENERGY ASSETS

Mining: Longwall 32

Location: Picton

Mining Company: SMEC Mining_Tahmoor Colliery

Risk	Hazardous event	Preventive 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) CSY 1066 Reference: Hazard Alert No. 25/07	4	Working in a Mine Subsidence Area 1. When Performing a Worksite Hazard and Risk Assessment, pay particular attention to ground conditions 2. If in any doubt walk access tracks to check for cracking prior to driving into subsidence areas 3. If in a remote area, ensure people know where staff are working, and an expected time of arriving home 4. If in a remote area it may be preferable that staff are not in a mine subsidence area alone	4	LOW - 02 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 Critical assets (most susceptible to impact by subsidence) have been identified, photographed, and condition recorded. Ok. Contained assets (Transformer tanks etc.) are only deemed as "critical assets"	3	Assets to be patrolled regularly for visual inspection. Critical assets are monitored monthly by survey to detect signs of movement. (Tahmoor Coal and contracted agencies). Monthly reports are forwarded to Endeavour Energy (survey results). Endeavour Energy is notified immediately on irregularities noted during visual inspection	4		Tahmoor Coal Mine Subsidence Engineering Consultants Pty Ltd
				Incident Management	3		

KNOWN HAZARDS REGISTER - DAMAGE TO ENDEAVOUR ENERGY ASSETS

Risk	Hazardous event	Causes	Consequences
Damage to Endeavour Energy Assets	Damage to Endeavour Energy assets caused by ground subsidence	Ground subsidence as a result of long wall mining	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 loss)

Endeavour Energy

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

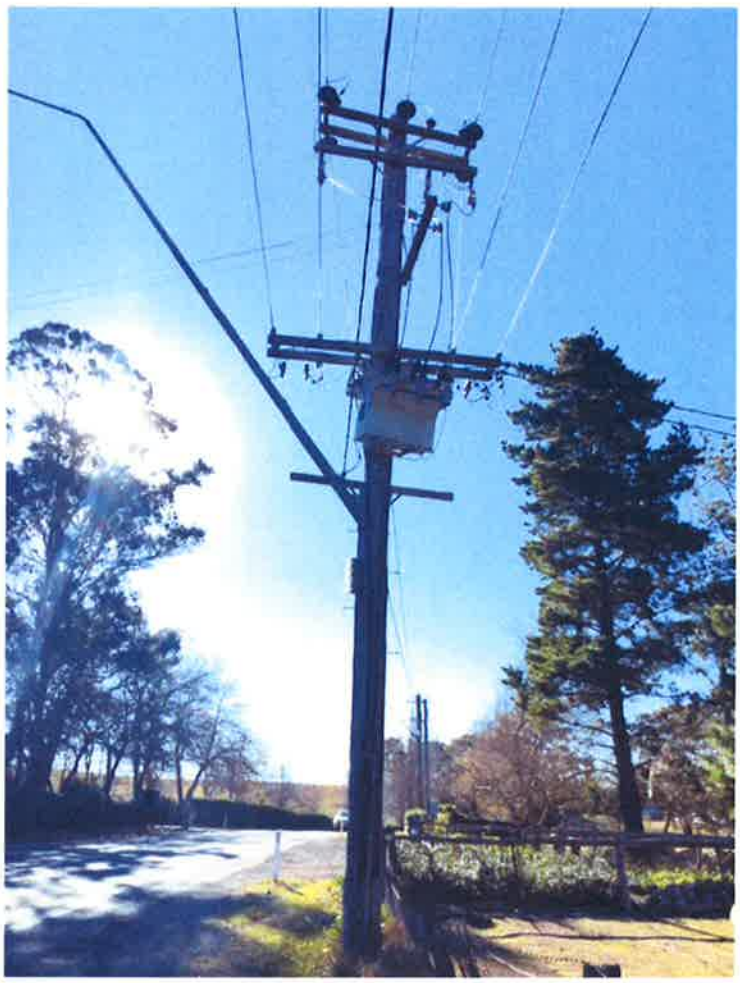
Attention: Ms Belinda Clayton

Endeavour Energy Network

Results of On Site Audit Endeavour Energy Assets For SIMEC Mining – Tahmoor Colliery Longwall32

(On Site Audit conducted on Tuesday 17th July, 2018)

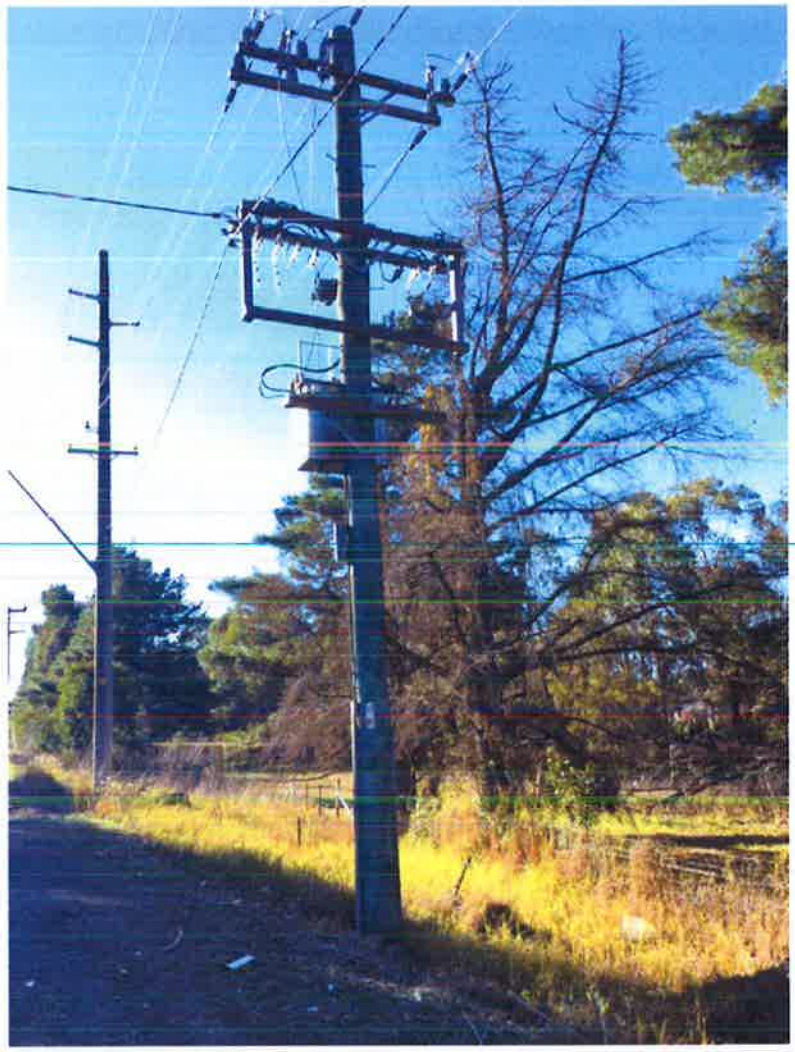
Pole No	Asset	Location	Photo number
PL725341	Pole Substation 11581	Bridge St Picton	1



Pole No	Asset	Location	Photo number
PL628607	Pole Substation 10965	Remembrance DWY Picton	2

Pole No	Asset	Location	Photo number
PL214850	Pole Substation 29188	Remembrance DWY Picton	3

Pole No	Asset	Location	Photo number
PL737270	Pole Substation 20102	Remembrance DWY Picton	4



Pole No	Asset	Location	Photo number
PL289373	Pole Substation 22844	Remembrance DWY Picton	5

Asset Status I Condition Audit For Tahmoor Coal
Tahmoor Colliery, Longwall 32
(On Site Audit conducted on Tuesday 17th July, 2018)

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 included:-

- 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 s ites 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 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 effected mining zone. The lines were found to be in a good state of repair and in serviceable order.

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