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Tahmoor Coal Pty Ltd

LAND MANAGEMENT PLAN

**Tahmoor North Western Domain
Longwalls West 1 and West 2**

July 2019


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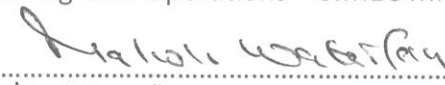
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PREPARED BY: April Hudson
Approvals Coordinator
Tahmoor Coking Coal Operations – SIMEC Mining


APPROVED BY: Ron Bush
Environment and Community Manager
Tahmoor Coking Coal Operations – SIMEC Mining

Signature: 
Date: 11/7/19
.....

APPROVED BY: Malcolm Waterfall
Mining Engineering Manager
Tahmoor Coking Coal Operations – SIMEC Mining

Signature: 
Date: 11.04.19
.....

APPROVED BY: Peter Vale
General Manager
Tahmoor Coking Coal Operations – SIMEC Mining

Signature: 
Date: 11.7.19
.....

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1 Introduction

1.1 Background

The Tahmoor Coal Mine (**Tahmoor Mine**) is an underground coal mine located approximately 80 kilometres (**km**) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (**NSW**) (refer to **Figure 1-1**). Tahmoor Mine produces up to three million tonnes of Run of Mine (**ROM**) coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla and Newcastle for Australian domestic customers and export customers.

The Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (**Tahmoor Coal**) since Tahmoor Mine commenced in 1979 using bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal, trading as Tahmoor Coking Coal Operations (**TCCO**), is a subsidiary within the SIMEC Mining Division (**SIMEC**) of the GFG Alliance (**GFG**).

Tahmoor Coal has previously mined 31 longwalls to the north and west of the Tahmoor Mine's current pit top location. Tahmoor Coal is currently mining Longwall 32 in accordance with Development Consents and Subsidence Management Plan Approval.

Tahmoor Coal proposes to extend underground coal mining to the north-west of the Main Southern Railway (referred to as the 'Western Domain') which will include Longwalls West 1 (**LW W1**) to West 4 (**LW W4**) at Picton and Thirlmere. The first two longwalls to be mined are LW W1 and Longwall West 2 (**LW W2**) (collectively referred to as **LW W1-W2**), which will be the focus of this Extraction Plan. The Western Domain is within Mining Lease (**ML**) 1376 and ML 1539, as illustrated in **Figure 1-2** of the Extraction Plan Main Document.

1.2 Purpose

This Land Management Plan (**LMP**) has been prepared to support an Extraction Plan for the secondary extraction of coal from LW W1-W2. This LMP has been designed to identify the monitoring and management measures for landscape features, with specific focus on cliffs, minor cliffs, rock outcrops, steep slopes, and agricultural land within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved.

1.3 Scope

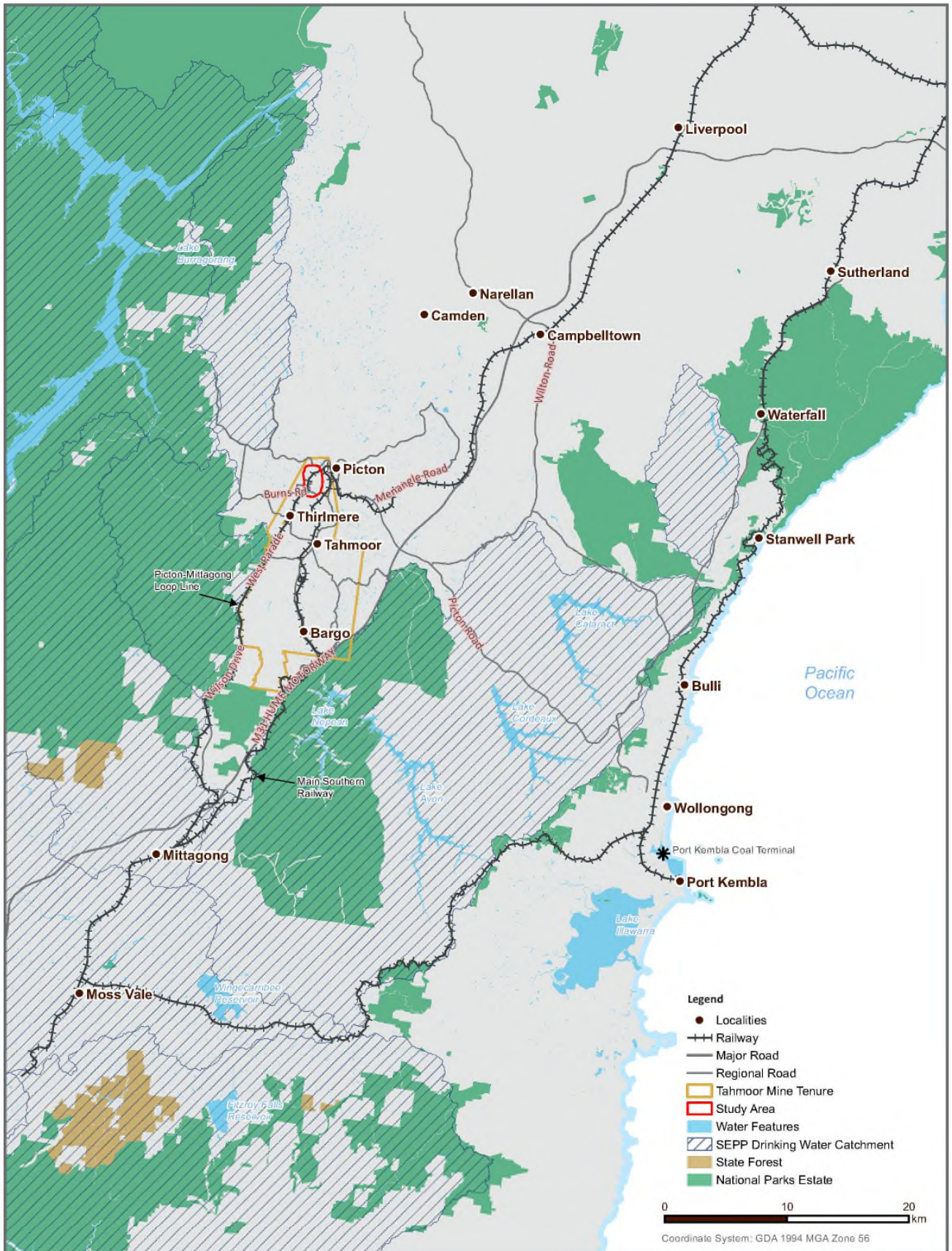
The Study Area applicable to this LMP consists of a combination of the Predicted 20 millimetre (**mm**) Total Subsidence Contour and the 35° Angle of Draw Line as shown on **Figure 1-2**. Relevant environmental features within a 600 metre (**m**) buffer from extraction that could be susceptible to far-field or valley related movements have also been included for consideration.

This LMP:

- Addresses specific requirements set by DA 67/98 Condition 13H(vii)(e) (refer to **Section 2.1**);
- Addresses related regulatory requirements (refer to **Section 2.2**);
- Addresses the monitoring and management of potential subsidence-related impacts to landscape features and agricultural resources (refer to **Section 5**); and
- Provides a Trigger Action Response Plan (**TARP**) to be implemented to manage and protect landscape features and agricultural resources within the Study Area (refer to **Appendix A**).

This LMP has been prepared based on the contents of the following technical reports:

- Geotechnical Assessment (Douglas Partners, 2019) (**Appendix B**);
- Land and Agricultural Resource Assessment (SLR, 2019) (**Appendix C**); and
- Subsidence Predictions and Impact Assessment (MSEC, 2019) (**Volume 1**).



DOCUMENT FILE PATH

REGIONAL CONTEXT
Tahmoor North Western Domain Longwalls West 1 and West 2
SIMEC Extraction Plan



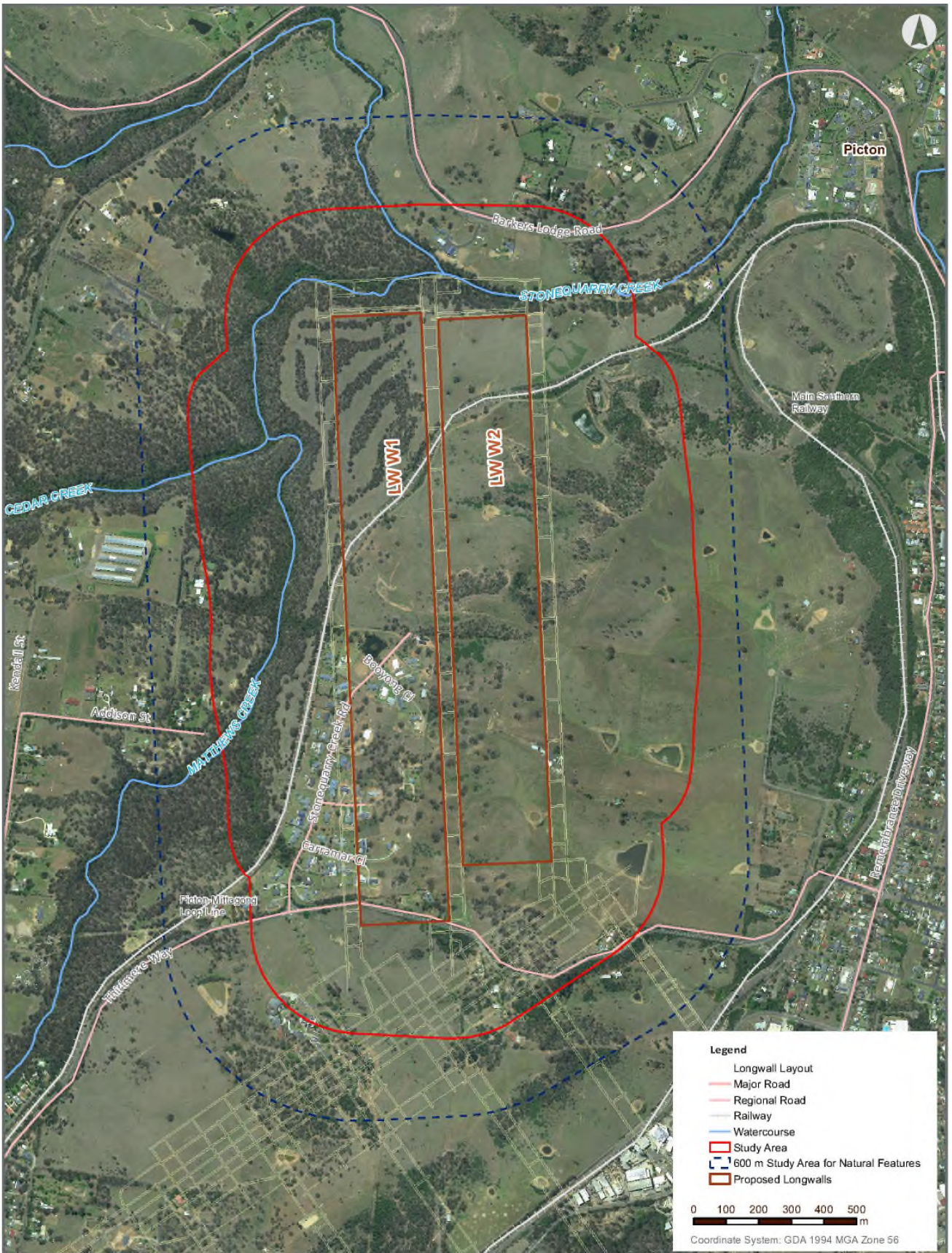
FIGURE 1-1
 Date: 27/05/2019

Data Sources:
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EXTRACTION PLAN STUDY AREA
Tahmoor North Western Domain Longwalls West 1 and West 2
SIMEC Extraction Plan

FIGURE 1-2
 Date: 4/07/2019

Data Sources:
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 Aerial Imagery: © Photomapping Services (November 2018)

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2 Regulatory Requirements

2.1 Project Approval

2.1.1 Development Consent

Tahmoor Coal’s operations are conducted in accordance with applicable Commonwealth and State environmental, planning, mining safety, and natural resource legislation. A register of relevant environmental legislative and regulatory requirements is maintained by Tahmoor Coal in a compliance database.

The proposed LW W1-W2 will be operating in the Tahmoor North mining area under Development Consents DA 57/93 and DA 67/93, as discussed further in **Section 3.2.1** of the Extraction Plan Main Document.

DA 67/98 provides the conditional planning approval framework for mining activities in the Western Domain to be addressed within an Extraction Plan and supporting management plans. Conditions relevant to this LMP from DA 67/98 are detailed in **Table 2-1**.

Table 2-1 Key Conditions from DA 67/98 regarding Landscape Features and Agricultural Resources

Condition	Condition Requirement	Section(s) Addressed						
Performance Measures – Built Features								
13E	<p>The Applicant must ensure that extraction of Longwall 33 and subsequent longwalls does not cause any exceedances of the performance measures in Table 2.</p> <p><i>Notes</i></p> <ul style="list-style-type: none"> The Applicant will be required to define more detailed performance measures in the Built Features Management Plans or Public Safety Management Plan. Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes. Requirements under this condition may be met by measures undertaken in accordance with the <i>Coal Mine Subsidence Compensation Act 2017</i>. 	Section 5.1, Section 6, Appendix A						
Excerpt from Table 2	<table border="1"> <thead> <tr> <th>Feature</th> <th>Performance Measure</th> </tr> </thead> <tbody> <tr> <td colspan="2">Public Safety</td> </tr> <tr> <td>• Public Safety</td> <td>• Negligible additional risk.</td> </tr> </tbody> </table>	Feature	Performance Measure	Public Safety		• Public Safety	• Negligible additional risk.	
	Feature	Performance Measure						
	Public Safety							
• Public Safety	• Negligible additional risk.							
13F	<p>Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 2 is to be settled by the Secretary, following consultation with the Resources Regulator. Any decision by the Secretary shall be final.</p>	Noted.						

Condition	Condition Requirement	Section(s) Addressed
Extraction Plan		
13H(vi)	describe in detail the performance indicators to be implemented to ensure compliance with the performance measures in Table 1 and Table 2, and manage or remediate any impacts and/or environmental consequences;	Section 5.1, Section 5.2 and Section 6
13H(vii)(e)	Land Management Plan which has been prepared in consultation with any affected public authorities, which provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on land in general, with a specific focus on cliffs, minor cliffs, rock face features, steep slopes and agricultural land.	Section 2.3, Section 6
13H(vii)(h)	Trigger Action Response Plan/s addressing all features in Table 1 and Table 2, which contain: <ul style="list-style-type: none"> • appropriate triggers to warn of increased risk of exceedance of any performance measure; and • specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded; • an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures; and • adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 or Table 2, or where any such exceedance appears likely; an 	Section 6.3, Section 6.5, Appendix A
13H(vii)(i)	Contingency Plan that expressly provides for: <ul style="list-style-type: none"> • adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 and Table 2, or where any such exceedance appears likely; and • an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; and • includes a program to collect sufficient baseline data for future Extraction Plans. 	Section 5.3, Section 6.4, Section 6.5, Appendix A

2.1.2 Extraction Plan Guideline

This LMP has been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015), as illustrated in **Table 2-2**.

Table 2-2 Extraction Plan Guideline Requirements for Key Component Plans

Extraction Plan Guideline Content Requirements for Key Component Plans	Section(s) Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan.	Section 3
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan.	Section 2.1.1
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation).	Section 2, Section 5, Section 6

Extraction Plan Guideline Content Requirements for Key Component Plans	Section(s) Addressed
Proposing performance indicators to establish compliance with these performance measures and statutory requirements.	Section 5.1
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance.	Section 3
Describe all currently-predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan.	Section 4
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the Applicant's commitments.	Section 6
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites).	Section 3
Fully describing the proposed monitoring of subsidence impacts and environmental consequences.	Section 5.2
Describe the proposed monitoring of the success of remediation measures following implementation.	Section 6.4, Appendix A
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences.	Section 6.5
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions or which exceed performance measures.	Section 6.4, Appendix A
Listing responsibilities for implementation of the plan.	Section 7.3
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	Appendix A

2.2 Relevant Legislation

There is no specific legislation that regulates subsidence impacts in relation to cliffs, minor cliffs, rock face features, steep slopes, or agricultural land.

2.3 Risk Management

Tahmoor Coal manages risks by following a risk management process, which involves the four steps:

- Identify hazards – find out what could cause harm;
- Assess risks if necessary – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening;
- Control risks – eliminate the risk or, if this is not possible, minimise the risk through risk control measures; and
- Review – review control measures to ensure they are working as planned.

The framework utilised for the risk assessment is the risk management process outlined within AS/NZS ISO 31000.

A Risk Assessment for LW W1 – W2 Environmental Features Risk Assessment was held on 6 June 2019 and is further outlined within the Public Safety Management Plan.

The risks to landscape features from the development of mine subsidence in the Study Area includes:

- Cliffs, minor cliffs and rock outcrops;
- Steep slopes;
- Agricultural land.

Creeks, groundwater and flooding risks are further considered within the Water Management Plan. Aboriginal sites associated with rockface features (rock overhangs) are further considered within the Heritage Management Plan.

Potential hazards to cliffs, minor cliffs and rock outcrops from mine subsidence can include:

- Potential for surface cracking;
- Potential for rock fall or toppling; and
- Potential for collapse.

Potential hazards to steep slopes from mine subsidence can include:

- Potential for surface cracking; and
- Potential landslide.

Potential hazards from the impact of mine subsidence on agricultural land can include:

- Potential impact to land use from flooding;
- Potential for remnant ponding reducing available land;
- Potential impact on water resources - surface water and ground water;
- Potential change in grade of drainage lines; and
- Potential increase in erosion / tunnel erosion on earthworks.

2.4 Consultation

The NSW Department of Primary Industries – Agriculture and the NSW Department of Industry – Crown Lands Division were consulted during the preparation of this LMP. A summary of consultation undertaken is provided in **Section 2.1.2** of the Extraction Plan Main Document, and a copy of the incoming correspondence is also provided in **Appendix C** of the Extraction Plan Main Document.

3 Existing Environment

3.1 Climate

Climate data for the Study Area has been obtained from the nearest Bureau of Meteorology (BOM) weather station located at Picton, approximately one km to the north-west of the Study Area (Picton Council Depot, BOM Station 068052, Monthly Climate Statistics).

Picton BOM Station has recorded an average annual rainfall of 801 mm, of which approximately 475 mm (60%) falls between November and April, with an average of 70.8 rain days in any given year, as outlined within **Table 3-1**. Mean monthly maximum temperatures range between 29.3°C and 16.8 C, with January being the warmest month. Mean monthly minimum temperatures range between 15.4 C and 1.7°C, with July being the coldest month.

Table 3-1 Picton Climate Data (BoM, 2019)

Climate Data	Average (Mean)	Annual Range
Minimum temperature	23.4°C	1.7°C – 15.4°C
Maximum temperature	8.8°C	16.8°C – 29.3°C
Annual rainfall	800.9 mm	70.8
Wettest month	February 89.3 mm	6.8
Driest month	September 43.6 mm	5.1

The BOM classifies the region as a temperate climate zone. The region can be susceptible to occasional heavy showers and thunderstorms due to easterly troughs during warmer months. Summer winds are generally from the south or south-east, with a tendency for afternoon north-easterly winds. During winter, winds are predominantly from the south or south-west.

3.2 Topography

Topography in the region is varied, ranging from gently undulating plateaus, ridges and low hills in the upland areas, to a rugged landscape of deeply dissected valleys and gorges within the Hawkesbury Sandstone (SLR, 2019).

The Study Area is bounded by Matthews Creek, Cedar Creek and Stonequarry Creek. The highest point of topography within the Study Area is at 286 m Australian Height Datum (AHD) at the southernmost corner of the Study Area. The surface topography is moderately hilly with valleys and ridges with the lowest level being 166 mAHD at Stonequarry Creek at the north of the Study Area. The surface area is primarily used for rural residential and residential development with properties used for housing, pet farms, stock grazing and orchards. Potable water is obtained generally from the town water supply and several farm dams and one groundwater bore are located within the Study Area (SLR, 2019).

The Study Area has elevations decreasing from 225 mAHD to 175 mAHD towards Stonequarry Creek. Stonequarry Creek flows from the north of LW W1-W2 and then down to the south-east as it follows the drop in local topography to its confluence with the Nepean River at approximately 100 mAHD to 150 mAHD. Surface levels on relatively flat land to the north of the Study Area are the location of vegetated creek lines running from the west to the north-east. Surface elevations of the low points are approximately 180 mAHD (SLR, 2019).

3.3 Geology

The Study Area is located within the southern area of the Permo-Triassic Sydney Basin. The main coal bearing sequence is the Illawarra Coal Measures, which contains four workable seams. The upper most seam, located in the north-western part of the Illawarra Coalfield, is the Bulli Coal Seam. Overlying the Bulli Coal Seam is the Hawkesbury Tectonic Stage which is comprised of three stratigraphic units, namely the Narrabeen Group, Hawkesbury Sandstone Group and the Wianamatta Group. The Narrabeen Group overlies the Illawarra Coal Measures and is comprised of interbedded sandstones and claystone units up to 310 m thick (SLR, 2019).

Overlying the Narrabeen Group is the Hawkesbury Sandstone which is comprised of a series of bedded sandstones up to 185 m thick. The Wianamatta Group overlies the Hawkesbury Sandstone, and is comprised of shales and siltstones and is relatively thin in comparison (SLR, 2019).

3.4 Cliffs, Steep Slopes, and Rock Face Features

Tahmoor Coal has extensive experience directly mining beneath or adjacent to cliffs and steep slopes. Tahmoor Coal has implemented extensive subsidence and mitigation 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.

Douglas Partners (2019) define cliffs and steep slopes as:

- Cliff – slope appears vertical and ranges between 64° and 84°;
- Extreme Slope – need rope access to climb slope and ranges between 45° and 64°;
- Very Steep Slope – can climb by clutching at vegetation and ranges between 27° and 45°;
- Steep Slope – walkable with effort and ranges between 18° and 27°;
- Moderate Slope – walkable and ranges between 10° and 18°; and
- Gentle Slope - easy walking and ranges between 0° and 10°.

The cliffs and minor cliffs within the Study Area are located outside the extents of LW W1-W2 (refer to **Figure 3-1**). Natural steep slopes are located on the side of ridges above the proposed longwalls consists of Wianamatta Shale and along the banks of Matthews, Cedar and Stonequarry Creeks where the near surface lithology is part of the Hawkesbury Sandstone (Douglas Partners, 2019).

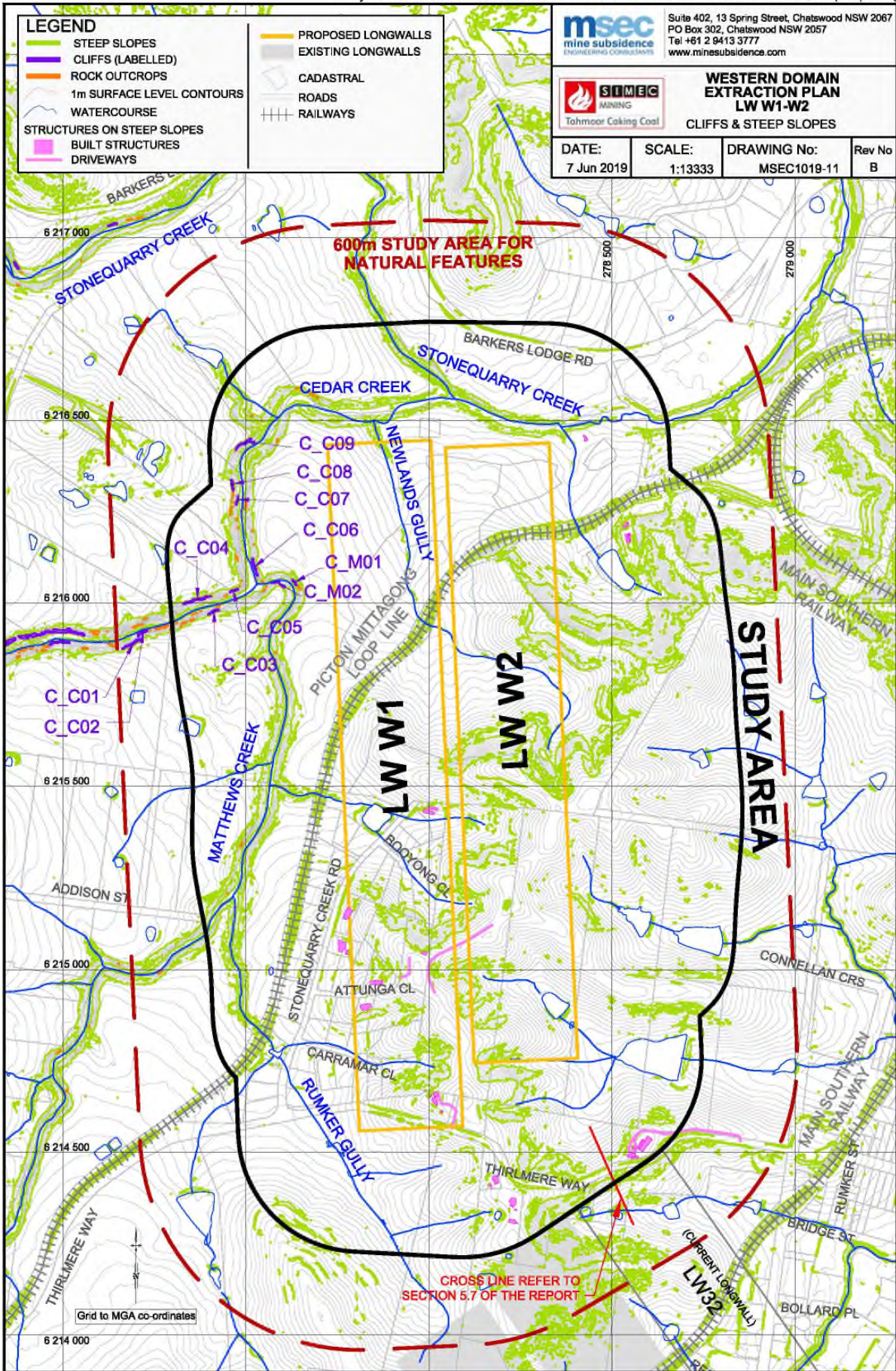


Figure 3-1 Steep Slopes, Cliffs and Rock Outcrops in the Study Area (MSEC, 2019)

3.5 Soils

The soils within the Study Area consist of six Soil Landscape Units (SLU) and are summarised in **Table 3-2**.

Agricultural land best suited to grazing land covers 75% of the Study Area, with about 25% of the soils within the Study Area are moderately constrained for cultivation or highly to severely constrained for any agricultural land (SLR, 2019).

Table 3-2 Soil Landscape Units (Soil Landscapes of the Wollongong – Port Hacking 1:100,000 Sheet (Hazelton & Tille, 1990))

Soil Landscape	Study Area		Agricultural Limitation Rating	
	Unit	Hectares	%	Unit
Hawkesbury	31	9	High – Severe	High – Severe
Picton	14	4		
Sub Total	45	13		
Lucas Height	39	12	Moderate	High
Sub Total	39	12		
Blacktown	125	37	Low	Moderate
Luddenham	88	26		
Monkey Creek	40	12		
Sub Total	253	75		
Hawkesbury	31	9		

Full descriptions of the six Soil Landscape Units within the Study Area are presented in **Appendix A**.

Four Australia Soil Classification (ASC) soil types are present in the Study Area and include:

- Dermosols that have moderately high inherent fertility and comprise 70% of the Study Area;
- Kurosols that have moderate inherent low fertility and comprise 15% of the Study Area;
- Sodosol that have a moderately low inherent fertility and comprise 14% of the Study Area; and
- Rudosol and Tenosol that have low inherent fertility and comprises 1% of the Study Area.

No acid sulfate soils have been mapped as occurring within the Study Area, and none of the SLU mapped within the Study Area have acid sulfate soil potential (SLR, 2019).

3.6 Land Use

The majority of the Study Area comprises of cleared pastoral land (approximately 70%) with the remaining land comprised of thick native vegetation along riparian zones and small areas used for rural residential land (SLR, 2019).

The agricultural use of the land is small scale cattle and horse grazing of improved native grass species (refer **Figure 3-2**). Overall farm size is considered small and many would be classified as hobby farms with a very low potential to produce significant agricultural income. A small number of poultry farms, orchards and commercial vegetable gardens also exist adjacent to the Study Area. No intensive cropping activities exist within the Study Area, however, least three protected cropping businesses exist to the south of the Study Area (SLR, 2019).

3.7 Biophysical Strategic Agricultural Land

No Biophysical Strategic Agricultural Land (**BSAL**) exists within the Study Area. The nearest BSAL is located between Douglas Park and Camden, approximately 20 km to the north-east of the Study Area (SLR, 2019).

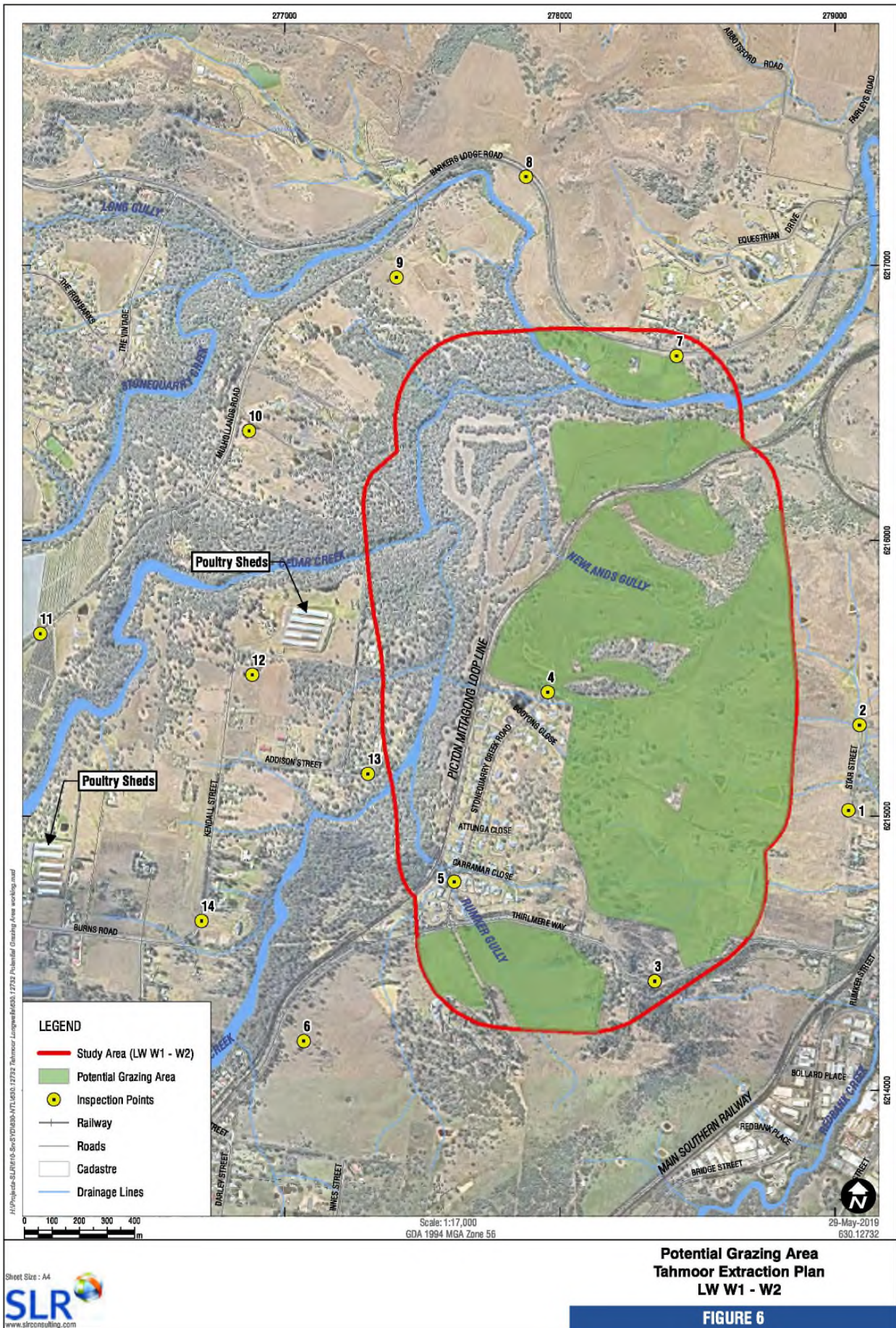


Figure 3-2 Agricultural Land in the Study Area (SLR, 2019)

4 Predicted Subsidence Impacts and Environmental Consequences

4.1 Cliffs, Minor Cliffs and Rock Outcrops

Subsidence can trigger slope failure in the form of local rock face instability due to tilting and bending of the rock mass beds. Overhangs and jointed planes are particularly susceptible to collapse leading to rock falls and toppling failures. The cliffs along Matthews Creek and Cedar Creek are susceptible to natural rock falls caused by undercutting of shale beds. Weathering of sandstone beds have also contributed to localised overhang development (Douglas Partners, 2019).

The predicted subsidence and associated tilt and strains could result in minor cracking along the existing rock faces or rock outcrops and along watercourses. The release of sandstone boulders down slope to impact a person is 'very unlikely' to occur due to the cliffs within the LW W1 – W2 Extraction Plan Study Area have been categorised as having an insignificant risk of falls, with less than 3% of cliff lines predicted to be impacted by subsidence (Douglas Partners, 2019).

4.2 Steep Slopes

Potential impacts to land due to mine subsidence that could occur above the proposed longwalls includes:

- Cracking and tilting of steep slopes; and
- General instability of steep slopes due to deep or shallow translational sliding along bedding planes.

Surface cracking could occur on the slopes and although surface cracking from subsidence is uncommon at Tahmoor Mine, the occurrence of cracking is can be influenced by near surface lithology and differential subsidence effects (Douglas Partners, 2019).

The subsidence impacts will take place over a broad area and coupled with the depth of overburden and localised changes in slope, will be between insignificant to minor on the steep slopes. The geotechnical assessment (Douglas Partners, 2019) has concluded that there will be between a low to moderate assessed pre and post mining risk to property, and hence public safety within the LW W1–W2 Study Area.

4.3 Agricultural Land

The majority of agricultural land use is for grazing and no intensive cropping activities are conducted. Potential remnant ponding as a result of longwall subsidence may temporarily remove small areas of land from potential grazing, however, the small isolated nature of this potential subsidence impact would be considered to have negligible impact to the economic and potential agricultural productivity of the agricultural land (SLR, 2019).

There is no land which will be permanently removed from agriculture as a result of LW W1 – W2 (SLR, 2019).

The majority of rural structures within the Study Area are of lightweight construction and are anticipated to tolerate mining induced tilt. It has been found from past longwall mining experience that tilts of the magnitudes predicted for LW W1-W2 generally have limited adverse impacts on rural structures. Some minor serviceability impacts could occur at the higher levels of tilt, including door swing and issues with roof and pavement drainage. These serviceability impacts can generally be remediated using normal building maintenance techniques (MSEC, 2019).

Farm fences are generally flexible in construction and can usually tolerate mine subsidence movements. Impacts to fences may include tension loss and changes to post alignment. The most vulnerable section of farm fences are gates particularly long gates or those with latches as they are less tolerant to differential horizontal movements and tilts between the gate posts and the ground (MSEC, 2019).

5 Subsidence Monitoring Program

5.1 Performance Measures and Indicators

Performance measures referring directly to the management of land resources were not specified in DA 67/98. However, the performance measure for public safety from Table 2 of DA 67/98 Condition 13E is relevant to steep slopes, cliffs and rock outcrops, and is listed in **Table 5-1**.

Table 5-1 Subsidence Performance Measures and Performance Indicators for Landscape Features

Feature	Subsidence Performance Measures	Subsidence Performance Indicators
Public safety	Negligible additional risk	This performance indicator will be considered to be triggered if: <ul style="list-style-type: none">Subsidence impacts to landscape features result in the collapse of cliffs, rock outcrops or steep slopes in proximity to members of the public.

For the purpose of this Extraction Plan and associated documents, 'negligible' is defined as being 'so small and insignificant as to not be worth considering'. A negligible impact is viewed with regards to a long term context, causing little or no impact. If a short term impact causes a greater than negligible impact, the impact can still be considered negligible if the impacts are of a limited duration and are considered negligible when considered over the long term.

It is anticipated that the above performance measures will be achieved during and after mining of LW W1-W2.

5.2 Monitoring Program

A monitoring program for cliffs, steep slopes, rock face features, and agricultural land has been compiled in **Table 5-2**.

The aim of the monitoring program is to identify where there is a risk of impact to cliffs, steep slopes, rock face features, and agricultural land as a result of mining activities. The monitoring program provides for the opportunity to record the condition of the site during the following three phases:

- Prior to Mining – baseline survey of the condition of the site before the commencement of mining, also referred to as the baseline check;
- During Mining – monitoring of the condition of the site during active subsidence to establish whether there has been any change to the site or if changes have occurred from the effects of subsidence; and
- Post Mining – monitoring of the condition of the site after mining to identify whether there has been any change to the site in the period since mining, and to determine if the conditions have stabilised.

If an impact is identified to have occurred or is likely to occur, the TARP (refer to **Appendix A**) should then be referred to for the identification of appropriate mitigation strategies.

Table 5-2 Monitoring Program for Landscape Features (Douglas Partners, 2019)

Feature	Monitoring Component / Location	Monitoring		
		Prior to Mining	During Mining	Post Mining
Cliffs and rock face features	Identified rock outcrops along cliff lines within the Study Area.	Visual Inspection baseline one month before active subsidence period by geotechnical engineer.	Monthly visual inspection during active subsidence period by geotechnical engineer.	Quarterly visual inspection for 12 month following active subsidence period by geotechnical engineer.
Steep Slopes	Identified steep slopes within the Study Area.	Visual Inspection baseline one month before active subsidence period by geotechnical engineer.	Monthly visual inspection during active subsidence period by geotechnical engineer.	Quarterly visual inspection for 12 month following active subsidence period by geotechnical engineer.
Agricultural Land	Identified agricultural land within the Study Area	Visual Inspection baseline one month before active subsidence period by Tahmoor Coal.	Monthly visual inspection during active subsidence period by Tahmoor Coal.	Quarterly visual inspection for 12 month following active subsidence period by Tahmoor Coal.

5.3 Baseline Monitoring for Future Extraction Plans

To assist in the preparation of future Extraction Plans, monitoring of cliffs, steep slopes, rock face features, and agricultural land as outlined in **Table 5-3** would provide sufficient baseline data to assist the preparation of the Extraction Plan for LW W3-W4. Monitoring data collected during the mining of LW W1-W2 would be used in the review of observed subsidence impacts for future Extraction Plans.

6 Subsidence Management Strategies

6.1 Mine Design Considerations

Tahmoor Coal previously submitted a Subsidence Management Plan Application (SMP Application) for Longwalls 31 to 37 (LW31-37) in the Bulli Coal Seam in December 2014, which included longwalls in the Western Domain. The current mine plan is a revision of this SMP Application mine plan, which was reviewed based on many factors including feedback received from the community following submission of the SMP Application in 2014 and additional information gathered from underground conditions, which influenced the orientation of the proposed longwalls (MSEC, 2019). The current mine design has been designed specifically in response to the sensitive surface features of the environment in order to avoid significant impact. Further discussion of mine design considerations is provided in **Section 3.6.1** of the Extraction Plan Main Document.

The current mine plan proposes to continue underground mining operations by the underground mining operations through the extraction of LW W1-W2 in the Western Domain, to the north of the currently active longwall series. The proposed LW W1-W2 are located to the west of the township of Picton, between Matthews, Cedar and Stonequarry Creeks, the Main Southern Railway and the currently active longwall series (refer to **Figure 1-2**).

6.2 Management and Mitigation Measures

6.2.1 Agricultural Land

Whilst the majority of impacts on agricultural land and resources have been assessed as negligible, as a matter of best practice, Tahmoor Coal has adopted a number of mitigation measures to further minimise these impacts.

Gypsum will be applied for any remediation earthworks where sodic subsoils (exchangeable sodium is greater than 5) are exposed. The application of gypsum will minimise the potential for tunnel erosion to occur on disturbed subsoil.

Tahmoor Coal will remediate any damage to farm fencing as a result of fence tensioning or farm gate levels, in consultation with relevant landowner stakeholders.

6.2.2 Surface Deformation or Surface Cracking

In response to observed subsidence impacts causing surface deformations or surface cracking, Tahmoor Coal will implement the following management measures:

- Install warning signs in the immediate area if the cracking is consider a public safety risk;
- Install danger tape in the immediate area if the cracking is consider a public safety risk;
- Plan and undertake site rehabilitation as soon as practical to remove any ongoing public safety risks. Site rehabilitation measures could include:
 - Backfilling or grout filling of surface cracking;
 - Re-profiling of compression humps;
 - Infilling of pot holes or subsidence related undulations developed; and
 - Securing of unstable structures or natural features, such as rock masses.

6.3 Trigger Action Response Plan

A TARP has been developed using the performance indicators for management of landscape features and agricultural land as a result of LW W1-W2 mining (refer to **Appendix A**). Where performance indicators indicate that a level of risk has been triggered greater than a normal level (Levels 2 and 3, with escalating corresponding risk), a response in the form of management / corrective actions is required to be implemented as outlined in the TARP.

6.4 Contingency Plan

In the event that performance measures are considered to have been exceeded or are likely to be exceeded, a response will be undertaken in accordance with the TARP provided in **Appendix A**. This response is a contingency plan that describes the management / corrective actions which can be implemented where required to remedy the exceedance.

If the event that a Corrective Management Action Plan is required in accordance with the TARP, this plan will be prepared in accordance with **Section 3.6.3** of the Extraction Plan Main Document. The success of remediation measures that has been implemented for any TARP exceedance would be reviewed as part of any Corrective Action Management Plan, the Annual Review (refer to **Section 6.1.5** of the Extraction Plan Main Document), and the End of Panel Report for each longwall.

6.5 Adaptive Management Strategy

An Adaptive Management Strategy has been proposed to review mining-induced ground movement and impacts on the streams in proximity to LW W1 (particularly Cedar Creek and Stonequarry Creek) to inform considerations for the amendment of the commencing position of LW W2. This strategy is discussed in more detail in **Section 3.6.4** of the Extraction Plan Main Document.

While impacts to landscape features will be considered as part of the overall Adaptive Management Strategy, there are no adaptive management strategies proposed specifically to manage impacts to landscape features or agricultural land.

7 Review and Improvement

This section of the LMP describes the key elements of implementation relevant to the management of landscape features and agricultural land. A description of general reporting requirements, reviews and key responsibilities that are applicable to extraction of LW W1-W2 are discussed in the Extraction Plan Main Document.

7.1 Reporting Requirements

Generic reporting requirements for the LW W1-W2 Extraction Plan are discussed in **Section 6.1** of the Extraction Plan Main Document. There are no reporting requirements specific to the management of landscape features and agricultural resources identified for the extraction of LW W1-W2.

7.2 Review and Auditing

Generic review and auditing requirements for the LW W1-W2 Extraction Plan are discussed in **Section 6.2** of the Extraction Plan Main Document. There are no review or auditing requirements specific to the management of landscape features and agricultural resources identified for the extraction of LW W1-W2.

7.3 Roles and Responsibilities

Generic roles and responsibilities applicable for the implementation of the LW W1-W2 Extraction Plan are discussed in **Section 6.3** of the Extraction Plan Main Document. There are no roles and responsibilities specific to the implementation of landscape features and agricultural resources management measures identified for the extraction of LW W1-W2.

8 Document Information

This section provides a compiled list of references, related documents, terms, and abbreviations used in this document. In addition, this section provides the change information for this document.

8.1 References

Bureau of Meteorology (2019), BoM Website accessed June 2019, www.bom.gov.au

Department of Planning and Environment (DPE) (2015), Guidelines for the Preparation of Extraction Plans V5.

Douglas Partners (2019), Report on Geotechnical Assessment, Extraction Plan Longwall West 1 and West 2, prepared for Tahmoor Coal.

Hazelton & Tille (1990), Soil Landscapes of the Wollongong – Port Hacking 1:100,000 Sheet

SLR (2019), Tahmoor Extraction Plan LW W1-W2 Land and Agricultural Resource Assessment, prepared for Tahmoor Coal, document 630.12732-R01-v0.1.

8.2 Glossary of Terms

The Extraction Plan Main Document provides a compiles Glossary of Terms in **Section 8.3**.

8.3 Abbreviations

Abbreviations used in this document are provided below in **Table 8-1**.

Table 8-1 Abbreviations

Abbreviation	Definition
AHD	Australian Height Datum
ASC	Australian Soil Classification
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
GFG	GFG Alliance
km	Kilometre/s
LMP	Land Management Plan
LW	Longwall
LW W1	Longwall West 1
LW W1-W2	Longwalls West 1 to West 2
LW W2	Longwall West 2
LW W3-W4	Longwalls West 3 to West 4
LW W4	Longwall West 4
m	Metre/s
mm	Millimetre/s

Abbreviation	Definition
ML	Mining Lease
ROM	Run of Mine
SIMEC	SIMEC Mining Division
SLU	Soil Landscape Units
SMP Application	Subsidence Management Plan
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TCCO	Tahmoor Coking Coal Operations

8.4 Change Information

Table 8-2 provides the details of document history of this Extraction Plan.

Table 8-2 Document History

Version	Date Reviewed	Reviewed By	Change Summary
1.0	July 2019	Ron Bush	New document

Appendix A – Trigger Action Response Plan

Trigger Action Response Plan – Land Management Plan

Feature	Management	
	Trigger	Action
Cliff line damage or instability	Normal	
	<ul style="list-style-type: none"> Surface cracking < 5 cm wide on top of cliff line, minor visible cracking on cliff face, or rock fall of isolated blocks. 	<ul style="list-style-type: none"> Continue monitoring.
	Within Prediction	
	<ul style="list-style-type: none"> Surface cracking 5 – 10 cm wide on top of cliff line, substantial visible cracking on rock face, or rock fall of isolated blocks. 	<ul style="list-style-type: none"> Continue monitoring. Erect warning signs and danger tape in immediate area. Geotechnical engineer inspection to determine need for further action/investigation.
Exceeds Prediction		
<ul style="list-style-type: none"> Surface cracking > 10cm wide, major damage to cliff face or rock fall of > 100m³. 	<ul style="list-style-type: none"> Convene Tahmoor Coal Environmental Response Group to review response. Increase monitoring by geotechnical engineer during active subsidence period to weekly. Erect warning signs and danger tape in immediate area. Geotechnical engineer inspection to determine need for further action/investigation. Notify Regulator and other stakeholders. 	

Feature	Management	
	Trigger	Action
Steep slope damage or instability	Normal	
	<ul style="list-style-type: none"> Surface cracking < 5 cm wide on slope, or rock fall of isolated blocks. 	<ul style="list-style-type: none"> Continue monitoring.
	Within Prediction	
	<ul style="list-style-type: none"> Surface cracking 5 – 10 cm wide on slope, small rock fall. 	<ul style="list-style-type: none"> Continue monitoring. Repair cracks at the completion of the active subsidence period. Erect warning signs and danger tape where necessary.
Exceeds Prediction		
<ul style="list-style-type: none"> Surface cracking > 10 cm wide, substantial rock fall, tree fall. 	<ul style="list-style-type: none"> Convene Tahmoor Coal Environmental Response Group to review response. Increase monitoring by geotechnical engineer during active subsidence period to weekly. Repair cracks at the completion of the active subsidence period. Erect warning signs and danger tape where necessary. Geotechnical engineer inspection to determine need for further action/investigation. Notify Regulator and other stakeholders. 	

Feature	Management	
	Trigger	Action
Surface cracking	Normal	
	<ul style="list-style-type: none"> Surface cracking < 5 cm. 	<ul style="list-style-type: none"> Continue monitoring. Repair cracks at the completion of the active subsidence period.
	Within Prediction	
	<ul style="list-style-type: none"> Surface cracking 5 – 10 cm. 	<ul style="list-style-type: none"> Continue monitoring. Repair cracks at the completion of the active subsidence period. Erect warning signs where necessary.
Exceeds Prediction		
<ul style="list-style-type: none"> Surface cracking > 10 cm wide, substantial rock fall, tree fall. 	<ul style="list-style-type: none"> Convene Tahmoor Coal Environmental Response Group to review response. Increase monitoring by geotechnical engineer during active subsidence period to weekly. Repair cracks at the completion of the active subsidence period. Repair cracks > 10 cm in width with excavation, grouting and re-compaction where practical. Erect warning signs where necessary. Geotechnical engineer inspection to determine need for further action/investigation. Notify Regulator and other stakeholders. 	

Feature	Management	
	Trigger	Action
Agricultural land	Normal	
	<ul style="list-style-type: none"> • Development of subsidence and impact as predicted. • Vertical subsidence within predicted range. • Negligible impact to agricultural productivity or use of the land. • Negligible change to ponding. • No or minor impact to buildings or improvements. • Negligible increase in soil or tunnel erosion. 	<ul style="list-style-type: none"> • Continue monitoring. • Repair any subsidence impacts at the completion of the active subsidence period.
	Within Prediction	
	<ul style="list-style-type: none"> • Development of subsidence exceeding or potentially exceeding prediction. • Impact to agricultural land from subsidence or increased flooding or ponding within predicted impacts. • Minor increase in ponding or changes to drainage systems that can be remediated. 	<ul style="list-style-type: none"> • Monthly monitoring by Tahmoor Coal during active subsidence period. • Repair any subsidence impacts at the completion of the active subsidence period.
Exceeds Prediction		
<ul style="list-style-type: none"> • Development of subsidence and impact greater than expected. • Significant impact and change to agricultural land functionality or agricultural productivity greater than predicted and approved. 	<ul style="list-style-type: none"> • Convene Tahmoor Coal Environmental Response Group to review response. • Increase monitoring by geotechnical engineer during active subsidence period to weekly. • Repair any subsidence impacts at the completion of the active subsidence period with excavation, re-levelling and re-compaction where required. • Erect warning signs where necessary. • Notify Regulator and other stakeholders. 	

Appendix B – Geotechnical Assessment

Appendix C – Land and Agricultural Resource Assessment