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Tahmoor Coal Pty Ltd

EXTRACTION PLAN

Tahmoor North Western Domain
Longwalls West 1 and West 2

Volume 1

July 2019

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Document Control

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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 (refer to **Figure 1-2**). Tahmoor Coal is currently mining Longwall 32 in accordance with Development Consents and Subsidence Management Plan Approval.

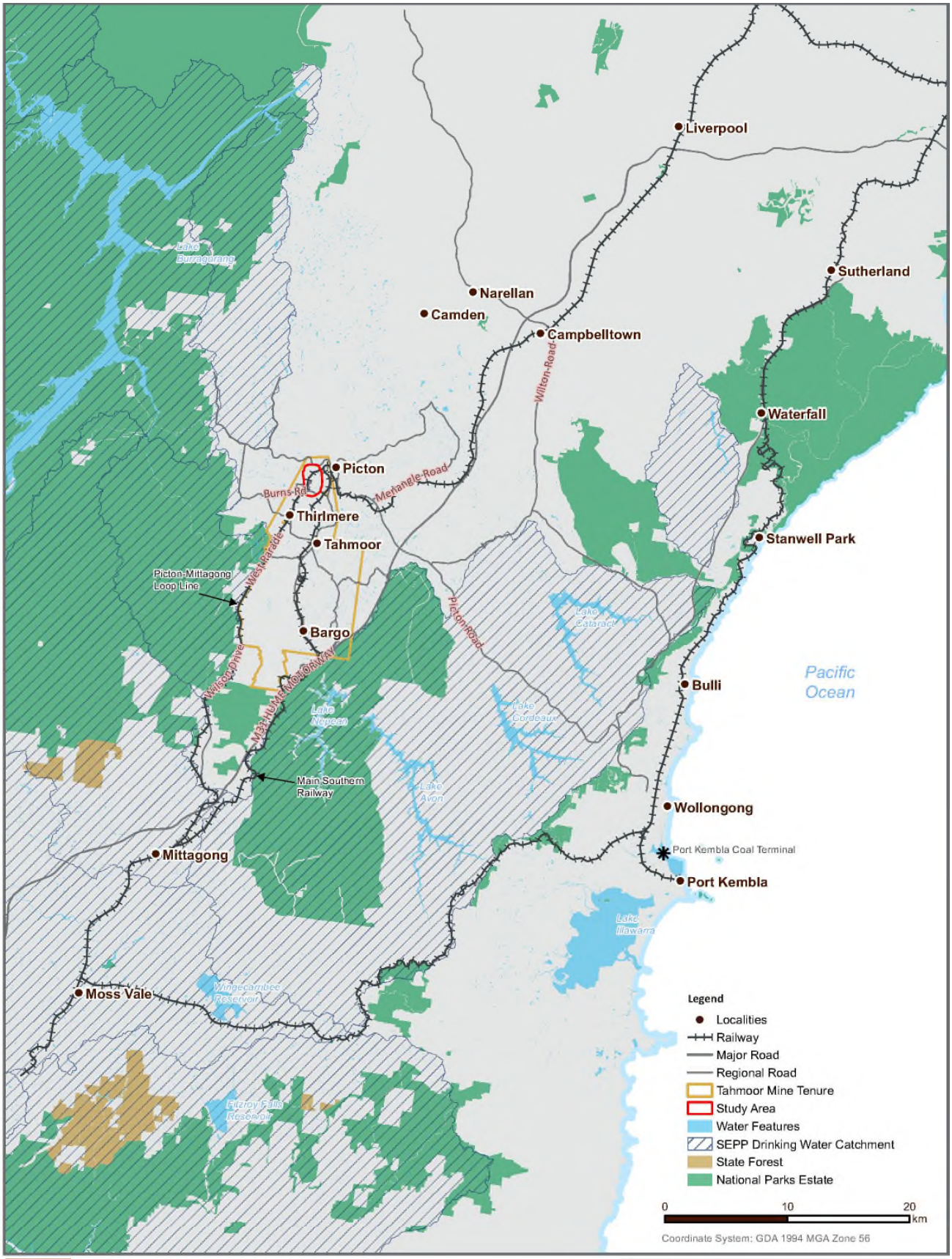
Tahmoor Coal proposes to extend underground coal mining to the north-west of the Main Southern Railway (referred to as the 'Western Domain') which will include Longwalls West 1 (**LW W1**) to West 4 (**LW W4**) at Picton and Thirlmere. The first two longwalls to be mined are LW W1 and Longwall West 2 (**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**.

Tahmoor Mine operates in the Tahmoor North mining area under the following Development Consents:

- DA 57/93 granted on 7 September 1994 by the Land and Environment Court of New South Wales under Section 77(3)(d) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The development application was supported by an Environmental Impact Statement (**EIS**) titled *Tahmoor North Coal Project* (Kembla Coal and Coke, 1993) for the extension of mining operations to the north of the then mined area. Under DA 57/93, mining was prohibited in some areas within the application area, including areas under urban land and rail lines. DA 57/93 has since been modified on one occasion relating to modification for heritage approval condition (Mod 1); and
- DA 67/98 granted on 25 February 1999 by the then Minister for Urban Affairs and Planning under Section 101(8) of the EP&A Act. The development application was supported by an EIS titled *Tahmoor North Underground Extension* (Olsen Environmental Consulting, 1998) to mine the majority of those areas of Tahmoor North that were excluded from DA 57/93. DA 67/98 has since been modified on four occasions relating to modification for:
  - Additional areas to be subsided and heritage approval condition (Mod 1);
  - Modification for Redbank Tunnel subsidence management (Mod 2);

- Modification for the subdivision of land relating to the Redbank Tunnel Rail Deviation (Mod 3); and
- Modification to allow subsidence to occur within an area where subsidence was not permitted under Condition 6(i) of DA 67/98 (Mod 4).

The four modifications to DA 67/98 were made in order to maintain the relevance of the approval conditions to changes in legislation and policy, industry practice, as well as environmental and community values. In September 2018, additional conditions (13A to 13J) were added to DA 67/98 to make provision to report on and measure the impacts of subsidence on natural, built and heritage features in the landscape. Under condition 13H of this modified section is the request to prepare an Extraction Plan for all longwalls after and including Longwall 33 (referred to here as LW W1).



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REGIONAL CONTEXT

Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan

FIGURE 1-1

Date: 27/05/2019

Data Sources:
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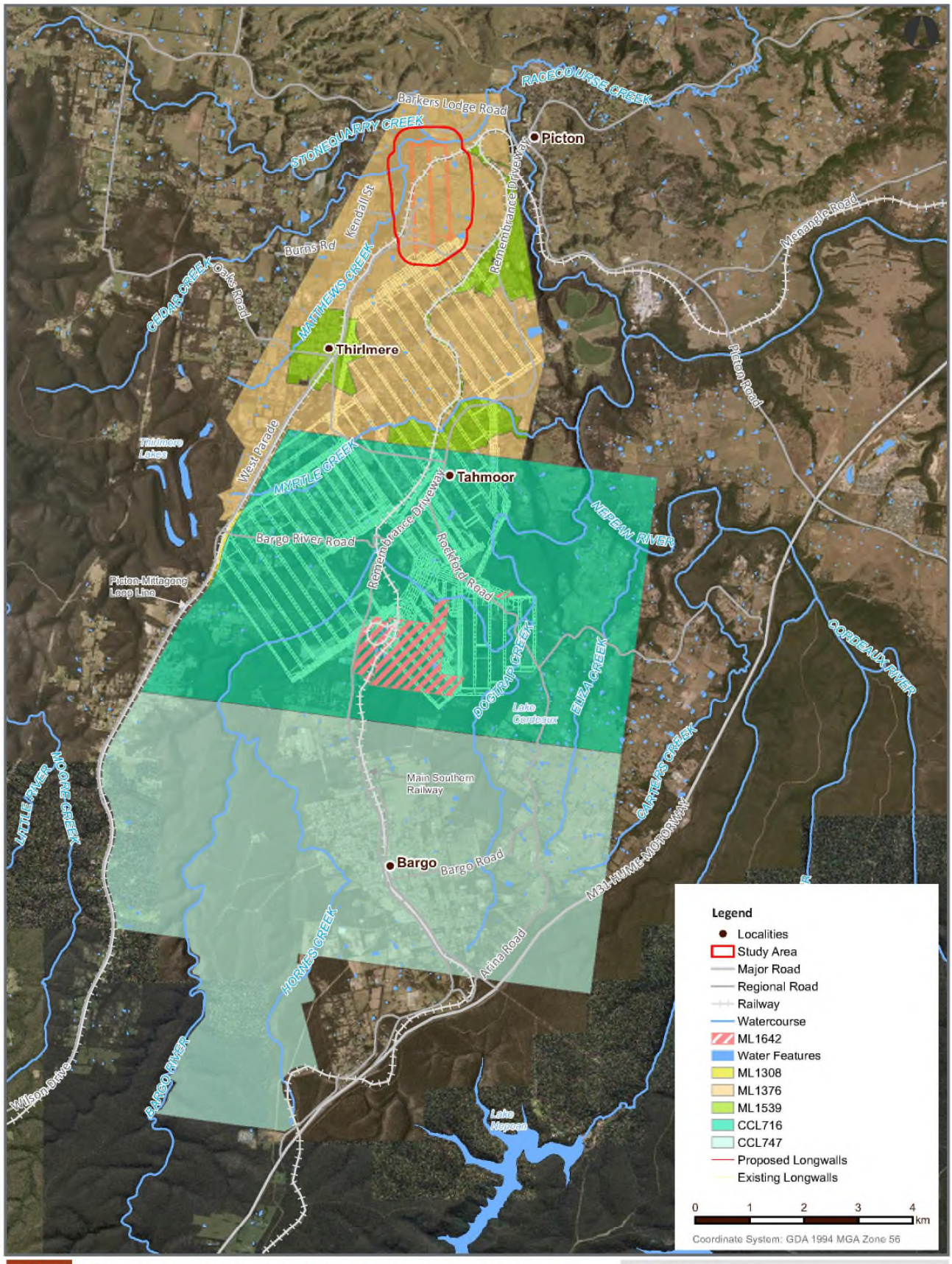

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TAHMOOR MINING AREA AND TENURE

Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan

FIGURE 1-2

Date: 27/05/2019

Data Sources:
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Aerial Imagery: NSW DFSI MapServer (2019)

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1.2 Purpose

This Extraction Plan has been prepared to seek approval for secondary extraction of coal from LW W1-W2. This Extraction Plan has been prepared in accordance with the Development Consent DA 57/93 (as modified) and DA 67/98 (as modified). Specifically, Condition 13H of DA 67/98 requires an Extraction Plan approval for any second workings. This Extraction Plan has been prepared to also comply with the requirements of the relevant ML 1376 and ML 1539 issued under the *Mining Act 1992*.

The Extraction Plan and related documents have been prepared generally in accordance with the NSW Department of Planning and Environment (**DPE**) *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). Additionally, the Public Safety Management Plan (**PSMP**) has also been prepared to address the requirements of the *Work Health and Safety Regulation 2017 (*WHS Regulation) and *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (*WHSMP Regulation), and the Department of Industry – Resources Regulator's *Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation* (Department of Industry – Resources Regulator, 2017).

A compliance register showing how the Extraction Plan complies with the relevant approvals, legislation and guidelines has been included in **Section 3.2** of this Extraction Plan.

The key purpose of this Extraction Plan is to outline the monitoring and management measures to be implemented to manage potential subsidence related impacts ensure the protection of all surface / subsurface natural and built features and the protection of public safety within the Extraction Plan Study Area during extraction of LW W1-W2. This Study Area is defined in **Section 3.1**.

Full details of the proposed monitoring and management measures are provided in the supporting component management plans for the Extraction Plan, as provided in **Volumes 2-4**, and outlined in **Section 4** of this document. The document structure for this Extraction Plan is outlined in **Section 1.4**.

1.3 Scope

The Study Area applicable to this Extraction Plan is defined in **Section 3.1**.

A further two longwalls are planned in the Western Domain (LW W1-W2) and a separate Extraction Plan will be prepared for these longwalls.

This Extraction Plan Main Document has the following structure:

- **Section 1** – Introduction: This section provides background to the Extraction Plan, the purpose and scope of this Extraction Plan Main Document, and the document structure of the Extraction Plan;
- **Section 2** – Development: This section outlines stakeholders consulted as part of the preparation of this Extraction Plan, outlines the process of updating subsidence predictions, and outlines the Extraction Plan team;
- **Section 3** – Overview: This section provides an introduction to the LW W1-W2 Extraction Plan:
  - Describes the Study Area covered by the Extraction Plan and the environmental and built features in the Study Area;

- Addresses specific requirements set by DA 67/98 Condition 13H, including detailed performance indicators for subsidence performance measures;
- Addresses Work Health and Safety legislation specifically in relation to subsidence as a principal mining hazard in relation to the safety of 'other persons';
- Addresses other regulatory requirements, approvals, leases, licences and guidelines relevant to the preparation of the Extraction Plan;
- Describes all key proposed and existing mining parameters, and any special features;
- Outlines potential subsidence effects, subsidence impacts and environmental consequences of LW W1-W2;
- Describes the subsidence management measures that will be implemented to ensure compliance;
- Outlines the adaptive management approach and contingency plans in the event of exceedances of performance measures and predicted environmental consequences;

- **Section 4** – Key Component Plans: This section outlines the individual management plans intended to manage particular environmental or built features within the Extraction Plan Study Area;
- **Section 5** – Subsidence Monitoring Program: This section details the subsidence monitoring program for potential subsidence impacts and environmental consequences;
- **Section 6** – Implementation: This section describes the key elements of implementation, including reporting requirements, reviews and key responsibilities;
- **Section 7** – Graphical Plans: This section lists the graphical plans that have been prepared for the LW W1-W2 Extraction Plan Study Area, which include detailed mine plans of LW W1-W2; and
- **Section 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, and a summary of the distribution of this document to stakeholders.

1.4 Document Structure

The Extraction Plan for LW W1-W2 comprises five volumes as outlined in **Table 1-1**. These essentially comprise a main text document, supporting management plans, graphical plans, and technical studies.

Table 1-1 Extraction Plan Structure

Volume	Contents
Volume 1	Extraction Plan Main Report (this document) Appendices related to Main Report (refer to Table of Contents)
Volume 2	Key Component Plans: • Water Management Plan: - Surface Water Technical Report; - Flood Impact Study; - Groundwater Technical Report; - Baseline Private Bore Assessment; • Land Management Plan: - Geotechnical Assessment; and - Land and Agricultural Resource Assessment.
Volume 3	Key Component Plans: • Biodiversity Management Plan: - Aquatic Biodiversity Technical Report; and - Terrestrial Biodiversity Technical Report. • Heritage Management Plan: - Aboriginal Heritage Technical Report; and - Historical Heritage Technical Report.
Volume 4	Key Component Plans: • Built Features Management Plan; • Public Safety Management Plan; and • Subsidence Monitoring Program.
Volume 5	AO Graphical Plans

2 Extraction Plan Development

2.1 Stakeholder Identification and Engagement

Tahmoor Coal has a long history of successful engagement with the local community in which it operates, striving to sustain positive relationships through a process of ongoing consultation and interaction.

A three-phase approach for consultation is adopted at Tahmoor Coal, which includes:

- Phase One: Ongoing throughout the lifecycle of the Tahmoor Mine and involve keeping residents informed about current and future mining, distributing monthly newsletters, free confidential counselling services, periodic Community Information Sessions, and ensuring that contact numbers for Tahmoor Coal Representatives are available;
- Phase Two: Specific to the LW W1-W2 Extraction Plan, and ensures that the broader community is aware of Tahmoor Coal's intention to submit an Extraction Plan for these Longwalls through the provision of opportunities to visualise mine plans and discuss the process of the Extraction Plan; and
- Phase Three: Community consultation during the extraction period for LW W1-W2.

This section provides an overview of the stakeholder engagement process applied, the various engagement activities undertaken, a summary of findings from these activities, and references to where these findings have been incorporated and addressed in this Extraction Plan.

2.1.1 Identification of Key Stakeholders

Consultation has been completed in accordance with DA 67/98 Condition 13H, which outlines relevant stakeholders to be consulted in the development of the Extraction Plan and key component plans. The purpose of this consultation was to provide stakeholders with an overview of the proposed development and to seek input during the development of key component plans and other documents prepared in support of the LW W1-W2 Extraction Plan described in **Section 4** of this document.

Table 2-1 provides an overview of stakeholders that have been consulted with during the preparation of this Extraction Plan primarily in accordance with the consultation requirements of DA 67/98.

Table 2-1 Stakeholders Consulted during the preparation of the LW W1-W2 Extraction Plan

DA 67/98 Condition	Component	DA 67/98 Consultation Requirements	Additional Stakeholders Consulted
Condition 13H(ii)	Preparation of Extraction Plan	• NSW Department of Planning and Environment – Division of Resources and Geoscience (DRG) • NSW Department of Planning and Environment – Resources Regulator (Resources Regulator) • NSW Office of Environment and Heritage (OEH) • Dams Safety Committee (DSC) • WaterNSW • NSW Department of Industry (DoI)	• DPE • Subsidence Advisory NSW (SA NSW) • Resources Regulator (Environment) • Resources Regulator (Subsidence) • DoI Water • DoI Crown Land
Condition 13H(iv)	Consultation for the development of the mine design	• Resources Regulator	• Resources Regulator (Subsidence)
Condition 13H(vii)(a)	Preparation of Subsidence Monitoring Program	• Resources Regulator	• Resources Regulator (Subsidence)
Condition 13H(vii)(b)	Preparation of Built Features Management Plan	• Resources Regulator • Relevant infrastructure owners • Landowners	• Wollondilly Shire Council (WSC) • Endeavour Energy • NSW Roads and Maritime Service (Roads and Maritime) • NSW Office of the National Rail Safety Regulator (ONRSR) • NSW Department of Finance, Services and Innovation – Spatial Services (Spatial Services)
Condition 13H(vii)I	Preparation of Water Management Plan	• NSW Environment Protection Authority (EPA) • DoI • Resources Regulator • WaterNSW	• DoI Water • Resources Regulator (Environment) • NSW Industry – Land & Water – Natural Resources Access Regulator – East (NRAR)
	Preparation of Flood Management Protocol	• WSC • NSW State Emergency Services (SES) • Landowners	-
Condition 13H(vii)(d)	Preparation of Biodiversity Management Plan	• OEH	-

DA 67/98 Condition	Component	DA 67/98 Consultation Requirements	Additional Stakeholders Consulted
Condition 13H(vii)I	Preparation of Land Management Plan	• Affected public authorities	• NSW Department of Primary Industries – Agriculture (DPI Agriculture) • DoI Crown Lands
Condition 13H(vii)(f)	Preparation of Heritage Management Plan	• OEH • Relevant stakeholders for heritage items	• Registered Aboriginal Parties (RAPs)
Condition 13H(vii)(g)	Preparation of Public Safety Management Plan	• Resources Regulator	-
Condition 13I	Approval of Extraction Plan	• DPE	-

In addition, consultation with the following stakeholders was also completed

- Resource Regulator in accordance with WHS legislation;
- SA NSW as required for:
  - Pre-mining dwelling inspections and condition reports; and
  - Remediation of subsidence impacts to improvements and infrastructure;
- Tahmoor Colliery Community Consultative Committee (**TCCCC**) in accordance with DA 67/98 Condition 47.

Due to recent government department name changes to the DoI Water, it should also be noted that NRAR was consulted.

2.1.2 Results and Outcomes of Consultation

Stakeholder engagement has been undertaken with local and State Governments, industry regulators, the local Aboriginal community, affected landowners, and the wider local community during the preparation of this Extraction Plan.

A summary of consultation completed to date during the preparation of this Extraction Plan is provided in **Table 2-2**. Where possible, face to face meeting were held with the relevant agencies identified for consultation in DA 67/98 Condition 13H.

Following the preparation of draft management plans for the various infrastructure in the Study Area, infrastructure owners with infrastructure located in or near the Study Area will be consulted to review and endorse the relevant infrastructure management plans that outline the management of their infrastructure during LW W1-W2 extraction. Tahmoor Coal has completed such consultation with infrastructure owners as part of previous longwalls and has well established relationships with infrastructure owners in the local area, who are familiar with the process and structure of the management plans.

The following infrastructure owners will be consulted regarding the corresponding infrastructure management plan:

- Endeavour Energy (electrical) – Endeavour Energy Management Plan;
- Sydney Water (potable water) – Sydney Water Potable Water Management Plan;
- Property owner of Stonequarry Wastewater Treatment Plant – Stonequarry Wastewater Treatement Plant Management Plan;
- Jemena (gas) – Jemena Management Plan;
- Telstra (telecommunications) – Telecommunications Management Plan;
- NBNCo (telecommunications) – Telecommunications Management Plan;
- WSC (local roads, culverts and bridges) – Wollondilly Shire Council Management Plan;
- Australian Rail Track Corporation (**ARTC**) (Main Southern Railway) – Main Southern Railway Management Plan;
- Railcorp and Transport Heritage NSW – Picton-Mittagong Heritage Railway Management Plan;
- Property owner of Mill Hill – Mill Hill Management Plan; and
- Property manager of Queen Victoria Memorial Home – Queen Victoria Memorial Home Management Plan.

Table 2-2 Summary of Key Issues Raised and Outcomes of Consultation Undertaken for LW W1-W2 Extraction Plan

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Government Agencies					
NSW Department of Planning and Environment (DPE)	26/02/2019	Meeting	A meeting was held between representatives of DPE (Jessie Evans and Andrew Rode) and representatives of Tahmoor Coal at the DPE Sydney Office. The meeting was an opportunity to outline the proposed longwalls in the Western Domain, upcoming Development Consent Modification 5 proposal, LW W1-W2 timeframes, proposed structure of the Extraction Plan. In addition, this meeting was an opportunity to discuss the preparation requirements of the Extraction Plan and consultation requirements. A printed copy of the prepared presentation was provided to DPE.	DPE required confirmation that the Modification 5 proposal to the Development Consent would be a Section 4.55(2) submission. DPE confirmed that a modification application for the increase in subsidence impact area was sufficient.	Tahmoor Coal confirmed this was correct.
				DPE required confirmation that the area of Modification 5 was not in a prohibited area for subsidence.	Tahmoor Coal confirmed this was not the case.
				DPE noted that the modified orientation of the LW W1-W2 mine plan may result in delays in mining commencement.	Tahmoor Coal noted that this has been accounted for and first workings have already commenced.
				DPE required confirmation that new residential dwellings along Stonequarry Creek Road have been designed with consideration of subsidence effects.	Tahmoor Coal noted that they have been advised regarding this development, and it is their understanding that the new residential dwellings have been designed according to the SA NSW Guidelines.
				DPE advised that the provision of the Extraction Plan 3-6 months to DPE prior to the start of mining was sufficient for Extraction Plan assessment.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				DPE advised that Infrastructure Management Plans are required to be submitted to DPE prior to mining, however do not need to be signed off by DPE. DPE advised that the plans can be submitted to DPE prior to sign-off by the relevant infrastructure owner, however a signed off version of the plan must be submitted prior to mining.	Tahmoor Coal noted that they are intending to submit Infrastructure Management Plans with the submission of the Extraction Plan, however some plans may be delayed and submitted later.
				DPE clarified that consultation with WaterNSW is only required if the Study Area is within or near Sydney Water drinking catchment areas. DPE advised to consult with WaterNSW regardless via letter initially.	Tahmoor Coal consulted with WaterNSW via letter on 29 April 2019.
				DPE requested to be added to the mailing list for updates on mining at Tahmoor Mine.	Tahmoor Coal has added DPE to the Tahmoor Coal Mailing List.
				DPE confirmed that they have no preference regarding the naming convention used for longwalls in the Western Domain, as long as naming is consistent.	Tahmoor Coal noted that LW W1-W2 would be the longwall names used going forward.
				DPE confirmed that an adequacy review for Extraction Plans is not normally completed, however a review for the Extraction Plan for LW W1-W2 may be completed as it will be the first prepared by Tahmoor Coal.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				DPE confirmed that an AHIP (if required) may be submitted prior to the approval of the Extraction Plan.	Noted.
	1/03/2019	Letter via email	A letter seeking approval of suitably qualified and experienced persons to prepare the Extraction Plan was sent to DPE (Jessie Evans).	Approval of suitably qualified and experienced persons to prepare the Extraction Plan received from DPE on 6/3/2019.	Noted.
NSW Department of Planning & Environment – Resources Regulator (Subsidence)	21/02/2019	Meeting	A meeting was held between representatives of the Resources Regulator (Subsidence) (Ray Ramage and Allan Blakeney) and representatives of Tahmoor Coal at the Tahmoor Mine. The meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan and the proposed subsidence monitoring program for the LW W1-W2 Study Area. A printed copy of the prepared presentation was provided to DRE.	DRE inquired about the state of the Picton-Mittagong Loop Line due to infrequent use.	Tahmoor Coal advised that this issue will be addressed in the PSMP which will form part of the Extraction Plan.
	21/02/2019	Site inspection	A site inspection of the Extraction Plan Study Area was conducted with representatives of the Resources Regulator (Subsidence) (Ray Ramage and Allan Blakeney) following the meeting at the Tahmoor Mine.	No issues raised.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
	19/05/2019	Letter via email	A letter was sent to the Resources Regulator (Ray Ramage) with information on the first workings of Tahmoor Mine for LW W1 as required by Condition 13G(4) of DA 67/98.	Response received (29 May 2019) noting contents of the letter.	Noted.
	24/05/2019	Meeting and Site Inspection	Meeting held at Thirlmere Rail Museum with following site inspection of Picton-Mittagong Loop Line rail corridor and culverts. Meeting was with representatives of Resources Regulator (Subsidence) (Gang Li and Allan Blakeney), ONRSR (Ian Cochran and Bruce Weston), Transport Heritage NSW (David Horner and John Thorogood), and Tahmoor Coal Rail Management Group (David Talbert, Ron Bush, Kevin Golledge, Graeme Robinson, Daryl Kay, John Matherson, Allan Pidgeon, Mark Delaney, Chris Bloor).	Discussion regarding rail line operations, rail corridor and infrastructure condition, subsidence impacts, potential mitigation measures, subsidence monitoring, access arrangements, Tahmoor Coal's Rail Management Group, risk management and preparing of a Rail Management Plan.	Noted and will be detailed within specific Infrastructure Management Plan for the Picton-Mittagong Loop Line.
NSW Department of Planning & Environment – Resources Regulator (Environment)	27/02/2019	Meeting	A meeting was held between representatives of Resources Regulator (Environment) (Greg Kininmonth, Will Mitry, and Chris Hammersey) and representatives of Tahmoor Coal at the Resources Regulator's Wollongong Office. This meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan.	No issues raised.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
	23/05/2019	Letter via email	A letter was received from the Resources Regulator (Greg Kininmonth) in response to a letter sent to DPE on 29/04/2019 to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	Resources Regulator recommended that consideration should be given to increase the stand-off distance from creek lines to avoid/minimise impacts or investigate other longwall layout configurations.	The current mine plan is considered to appropriately balance requirements of resource recovery, minimisation of environmental impact, and consideration of community and Government agency concern. MSEC (2019) outlined that the maximum predicted total valley closure for Matthews, Cedar and Stonequarry Creeks due to the extraction of LW W1-W2 is 180 mm, and the predicted rate of impact for the pools along these creeks due to LW W1-W2 extraction is less than 10 %. MSEC predictions for LW W1-W2 have been reviewed by a Subsidence Geotechnical Report prepared by SCT (2019; Appendix B). Section 5.3.3 of the Subsidence Predictions Report (MSEC, 2019; Appendix A) discusses three case studies with similar stand-off distance from creek lines and the observed subsidence impacts in support of the current mine plan and predicted subsidence impacts. An adaptive management strategy will be implemented at 1,000 of LW W1 extraction to review the commencing position of LW W2 based on observed subsidence impacts and environmental consequences (refer to Section 3.6.4).

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				Resources Regulator noted that if the creeks in the Western Domain are likely to be impacted, demonstrated progress of remediation of Myrtle Creek and Redbank Creek would provide additional confidence that Tahmoor Coal can effectively remediate creek impacts.	Noted.
				Resources Regulator advised to start collecting baseline data for groundwater and surface water to help inform the subsidence monitoring program and the development of completion criteria for rehabilitation.	Surface water monitoring of the creeks in the Western Domain commenced in December 2018, and groundwater monitoring in the Western Domain commenced in March 2019.
NSW Department of Planning & Environment – Division of Resources and Geosciences (DRG)	29/04/2019	Letter via email	A letter was sent to NSW Department of Planning & Environment – Division of Resources and Geosciences (Alex Love) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	DRG responded via email that there is some concern regarding recovery in the Western Domain and requested preliminary data about recovery.	Tahmoor Coal responded that a Coal Resource Recovery Plan will be included in the Extraction Plan which will detail the resource (geology, tonnage, quality, yield etc), extraction method and mining schedule. Tahmoor Coal noted that this document is currently being prepared and provided an opportunity for DRG to nominate specific information to be included in the document. DRG did not have any requests for the inclusion of specific information.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Subsidence Advisory NSW (SA NSW)	22/02/2019	Meeting	A meeting was held between representatives of Subsidence Advisory NSW (Matthew Montgomery, Brendan Killen, Shane McDonald, Melanie Fityus, and John Johnstone) and representatives of Tahmoor Coal at the Tahmoor Mine. This meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan.	No issues raised.	Noted.
NSW Office of Environment and Heritage (OEH)	21/03/2019	Meeting	A meeting was held between representatives of OEH (Martin Krogh, Meagan Hinds) and representatives of Tahmoor Coal at the OEH Hurstville Office. The meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan and the proposed subsidence monitoring program for the LW W1-W2 Study Area. A printed copy of the prepared presentation was provided to OEH representatives.	OEH sought clarification regarding the naming of the longwalls in the Extraction Plan.	Tahmoor Coal confirmed this would be LW W1-W2.
				OEH stated photogrammetry on Matthews Creek would be highly valuable and would recommend as it would allow more information for approval.	Noted.
				OEH required confirmation of the approving authority.	Tahmoor Coal advised that DPE were the approving authority with input from other key Government agencies.
				OEH inquired into the parameters of the longwall and the distance to the creeks.	This information was provided in the meeting by Tahmoor Coal.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				OEH stated that the mine plan for LW W1-W2 was an improvement on the previous mine plan presented in the SMP for LW31-37, however there are still perceived issues due to the proximity (approximately 100 m) to Cedar Creek and Stonequarry Creeks. In particular, the proximity of the corner of LW W2 to Stonequarry Creek is perceived to be an issue. Pulling the longwalls back further would reduce the subsidence effects of upsidence and valley closure to the creeks.	Tahmoor Coal advised that a review of subsidence impacts following the first 1,000 metres (**m**) of mining of LW W1 would be completed, and appropriate adaptive management strategies (if required) would be implemented for LW W2.
				OEH noted that adaptive management strategies following mining would be too late to mitigate impacts the influences of LW W1 on the creeks to the north of the longwall.	An adaptive management strategy will be implemented at 1,000 of LW W1 extraction to review the commencing position of LW W2 based on observed subsidence impacts and environmental consequences (refer to Section 3.6.4). The implementation of this adaptive management (if required) has the potential to decrease the subsidence impacts to Stonequarry Creek.
				OEH noted that the justification behind mining in proximity to the creeks would need to be sound.	Tahmoor Coal confirmed justification would be provided in the Extraction Plan. The current mine plan is considered to appropriately balance requirements of resource recovery, minimisation of environmental impact, and consideration of community and Government agency concern.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
					MSEC (2019) outlined that the maximum predicted total valley closure for Matthews, Cedar and Stonequarry Creeks due to the extraction of LW W1-W2 is 180 mm, and the predicted rate of impact for the pools along these creeks due to LW W1-W2 extraction is less than 10 %. MSEC predictions for LW W1-W2 have been reviewed by a Subsidence Geotechnical Report prepared by SCT (2019; Appendix B). Section 5.3.3 of the Subsidence Predictions Report (MSEC, 2019; Appendix A) discusses three case studies with similar stand-off distance from creek lines and the observed subsidence impacts in support of the current mine plan and predicted subsidence impacts.
				OEH inquired if the key component plans would be provided as part of the Extraction Plan.	Tahmoor Coal confirmed this would be the case.
				OEH inquired if sensors would be placed in existing groundwater bores.	Tahmoor Coal confirmed this would be the case where the bores are open and accessible.
				OEH inquired if the baseline studies for ecology (amphibian, riparian vegetation and macroinvertebrate) are publicly available.	Tahmoor Coal advised that a copy of the baseline ecology reports would be provided as part of the Extraction Plan.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
	21/03/2019	Phone call	A discussion between OEH (Samantha Gibbons) and EMM (Pamela Chauvel) via phone regarding the preparation of the Aboriginal Heritage Technical Report and consultation requirements for the local Aboriginal community.	OEH stated that, since DPE is the consent authority for the Extraction Plan, OEH has no role in providing comment and that it will be up to DPE to decide whether they are satisfied with the consultation undertaken for the AHTR.	Noted.
				OEH reiterated that if AHIPs are required, a supporting Aboriginal Cultural Heritage Assessment (ACHA) must be completed in accordance with the OEH guidelines.	EMM confirmed they are currently preparing an ACHA for LW W1–W4 in accordance with the OEH guidelines on the behalf of Tahmoor Coal.
NSW Office of the National Rail Safety Regulator (ONRSR)	24/05/2019	Meeting and Site Inspection	Meeting held at Thirlmere Rail Museum with following site inspection of Picton-Mittagong Loop Line rail corridor and culverts. Meeting was with representatives of Resources Regulator (Subsidence) (Gang Li and Allan Blakeney), ONRSR (Ian Cochran and Bruce Weston), Transport Heritage NSW (David Horner and John Thorogood), and Tahmoor Coal Rail Management Group (David Talbert, Ron Bush, Kevin Golledge, Graeme Robinson, Daryl Kay, John Matherson, Allan Pidgeon, Mark Delaney, Chris Bloor).	Discussion regarding rail line operations, rail corridor and infrastructure condition, subsidence impacts, potential mitigation measures, subsidence monitoring, access arrangements, Tahmoor Coal's Rail Management Group, risk management and preparing of a Rail Management Plan.	Noted and will be detailed within specific Infrastructure Management Plan for the Picton-Mittagong Loop Line.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Department of Industry – Water (DoI Water)	29/04/2019	Letter via email	A letter was sent to NSW Department of Industry – Water to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	The email provided for general enquiries (water.enquiries@industry.nsw.gov.au) bounced, and a letter of consultation was sent to NRAR.	No response received. Refer to NRAR consultation section.
NSW Industry – Land & Water – Natural Resources Access Regulator – East (NRAR)	29/04/2019	Letter via email	A letter was sent to NRAR (Marcus Leslie) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	An email response was received from NRAR (Ellie Randall) on 8 May 2019 stating that NRAR has no comments on the preparation of the Extraction Plan.	Noted.
WaterNSW	29/04/2019	Letter via email	A letter was sent to WaterNSW (Clay Preshaw) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls. Tahmoor Coal noted that the Study Area is outside of the Sydney Drinking Water Catchment Area, however outlined how surface water flow and water quality in local waterways would be considered in the Extraction Plan.	Two email responses were received from WaterNSW on 29 April 2019 (Ravi Sundaram) and 6 May 2019 (Peter Dupen) stating that as the Study Area is located outside the Sydney Drinking Water Catchment area, WaterNSW has no comments on the project.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Dams Safety Committee (DSC)	29/04/2019	Letter via email	A letter was sent to DSC (Chris Salkovic) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, an overview of the longwalls, and an outline of how dams would be considered in the Extraction Plan.	A letter response sent via email was received from the Dams Safety Committee on 7 May 2019. This letter stated that LW W1-W2 does not lie within the DSC Notification Area, and DSC has no requirements for the LW W1-W2 Extraction Plan.	Noted.
NSW Environment Protection Authority (EPA)	29/04/2019	Letter via email	A letter was sent to NSW EPA (Andrew Couldridge) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, and an overview of the longwalls.	A response via email was received from the EPA (Andrew Couldridge) on 14 May 2019 which stated that as the proposed activity does not include works that require modification of surface facilities or changes to the licence, the EPA has no comments to provide on the Extraction Plan.	Noted.
NSW Department of Primary Industries – Agriculture (DPI Agriculture)	14/03/2019	Letter via email	A letter was sent to DPI Agriculture to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, an overview of the longwalls, and an outline of how agricultural lands would be considered in the Extraction Plan.	A letter response sent via email was received from DPI Agriculture (Wendy Goodburn) dated 30 April 2019. This letter outlined that the Tahmoor North longwalls are in close proximity to poultry and protected cropping industries and have the potential to cause impacts of subsidence and water interference. DPI Agriculture noted that the proposed Land and Agricultural Resource Assessment should address aspects associated with impacts and interference to those businesses.	A Land and Agricultural Resource Assessment (SLR, 2019) has been prepared and provides consideration of the poultry and protected cropping industries in proximity to LW W1-W2.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
NSW Roads and Maritime Services (Roads and Maritime)	29/04/2019	Letter via email	A letter was sent to Roads and Maritime (Joanne Parrott) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, an overview of the longwalls, and an outline of how local roads would be considered in the Extraction Plan.	A letter response sent via email was received from Roads and Maritime (Chris Millet) on 13 May 2019. This letter noted that LW W1-W2 do not appear to directly impact Roads and Maritime infrastructure. However, Roads and Maritime noted that further consultation may be required if subsidence impacts and/or far field effects occur on Roads and Maritime assets and infrastructure, as well impacts of additional traffic generated by the proposed extension of longwall mining operations.	Consideration of Roads and Maritime infrastructure has been considered in the Wollondilly Shire Council Management Plan, which addresses impacts to local roads. It is not anticipated that additional traffic will be generated by the mining of LW W1-W2.
NSW State Emergency Services (SES)	14/03/2019	Letter via email, and phone call	A letter was sent to SES (Garry Barnott-Clement and Ngaire McCarthy) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, an overview of the longwalls, and an outline of how flooding potential would be considered in the Extraction Plan.	SES (Garry Barnott-Clement) confirmed that Ngaire McCarthy is the appropriate person to respond to this correspondence. A copy of the letter was forwarded to Ngaire McCarthy on 2 May 2019, and a follow-up email was sent on 13 June 2019. An email from Ngaire McCarthy dated 18 June 2019 noted that SES have no further comments on the Extraction Plan.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				A phone call was received on 14 June 2019 from Ngaire McCarthy, and during the call back, it was asked if Tahmoor Coal has an emergency management plan for evacuations and vertical rescue. This request for a copy of the Emergency Management Plan was mentioned in the email dated 18 June 2019 from SES.	Tahmoor Coal responded that we have an Emergency Management Plan (document TAH-HSEC-00168) for underground workings, and this document was sent to SES on 27 June 2019. A flood impact assessment was completed by WRM (2019) for LW W1-W2 and determined that there would be a negligible increase in flood risk as a result of the proposed mining in the Western Domain. The PSMP and Water Management Plan (WMP) will therefore not be including emergency management procedures as flood risk is not likely to increase as a result of mining.
NSW Department of Industry – Crown Lands Division (Crown Lands)	14/03/2019	Letter via email	A letter was sent to Crown Land (Chris Reynolds) to introduce the Extraction Plan for LW W1-W2. Tahmoor Coal provided a figure of the Extraction Plan Study Area, an overview of the longwalls, and an outline of how Crown Land would be considered in the Extraction Plan.	A follow-up email was sent on 13 June 2019. As of the date of publication of this Extraction Plan, no response to the letter of consultation have been received from Crown Lands.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Infrastructure Owners					
Wollondilly Shire Council (WSC)	22/03/2019	Meeting	A meeting was held between representatives of Wollondilly Shire Council (David Henry and Bruce Devonport) and representatives of Tahmoor Coal at the Wollondilly Shire Council at Picton. The meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan and the proposed subsidence monitoring program for the LW W1-W2 Study Area. In addition, Tahmoor Coal noted that WSC input into the Flood Management Protocol would be required. A printed copy of the prepared presentation was provided to WSC.	WSC expressed concern regarding the proximity of the longwalls to the creeks, particularly Stonequarry Creek due to it's high profile and public interest in the community.	Tahmoor Coal replied that the revised mine plan has been designed to reduce impacts to the creeks, and Tahmoor Coal is comfortable with the potential impacts given the proximity to the creeks.
				WSC noted that the appropriate person to review and provide input into the required Flood Management Protocol is Ian Berthon, who prepared the recent 2016 Flood Study.	Tahmoor Coal replied that a copy of the protocol would be provided once drafted for Ian Berthon's input.
Endeavour Energy	28/02/2019	Email and phone calls	Email to Endeavour Energy (Ben Logue and David Olley) to advise that the Extraction Plan for LW W1-W2 is being prepared and a Critical Poles Audit is required. Tahmoor Coal provided Extraction Plan Study Area and location of known Endeavour Energy poles. Tahmoor Coal followed up initial email with a phone calls on 5, 7 and 11 March 2019.	Endeavour Energy (Ben Logue) returned email and phone calls on 11 March 2019 and advised that the Critical Poles Audit will be prepared.	Tahmoor Coal received Critical Poles Audit from Endeavour Energy on 13 May 2019.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
	22/5/2019	Phone calls and emails	Gus Warren (SMEC) contacted Endeavour Energy (Shane Worthington) on behalf of Tahmoor Coal to discuss pole monitoring requirements. The Critical Poles Audit stated that it was a requirement for monitoring of the coordinates at the base and top of each identified critical pole. SMEC noted that this was contrary to previous monitoring methods (a level to a mark on the base of the pole, and measurement of the tilt of the pole in two directions) and sought confirmation.	Endeavour Energy (Shane Worthington) confirmed via phone that monitoring as per what has been completed in the past was sufficient. Tahmoor Coal requested on 22 May 2019 via email that the outcomes of this consultation be incorporated into the Critical Poles Audit. Endeavour Energy (Ben Logue) confirmed via email on 23 May 2019 that the Critical Poles Audit was currently being updated to reflect this consultation.	Tahmoor Coal received the updated Critical Poles Audit from Endeavour Energy on 5 June 2019.
NSW Department of Finance, Services and Innovation – Spatial Services (Spatial Services)	25/6/2019	Meeting	A meeting was held between representatives of Spatial Services (Joel Edwards, Vittorio Sussanna and Jerom Vanderstappen) and representatives from both Tahmoor Coal and South 32 at the South 32 Cordeaux Colliery Office. The meeting was held to discuss the management of permanent survey marks and the process of submitting a 'Preservation of Survey Infrastructure' (POSI) application.	Spatial Services noted that future active longwalls require a POSI application to be submitted using the Application to Remove or Replace Survey Marks form and following Procedure for Mining Projects. A quarterly report is to be provided to indicate the general survey mark movement.	Agreed.
				Spatial Services noted that a strategy for rehabilitation of survey marks for the post long term subsidence is required to be submitted.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				Spatial Services noted that a separate subsidence management plan will not be required for the management of survey marks, and the POSI application would be sufficient.	Permanent Survey Marks and the requirements for POSI applications would be considered in the Built Features Management Plan (BFMP).
Community and Landowners					
Tahmoor Colliery Community Consultative Committee (TCCCC)	14/03/2019	Meeting	A meeting was held with the TCCCC and representatives of Tahmoor Coal at the Tahmoor Mine. This meeting was an opportunity to provide the TCCCC with a quarterly update of activities at Tahmoor Mine. As part of this update, the scope of the proposed LW W1-W2 Extraction Plan was discussed. Meeting minutes are available on the Tahmoor Coal website.	Clarification was sought regarding how close the longwalls were from the creeks (Stonequarry Creek, Cedar Creek, Matthews Creek).	Tahmoor Coal advised that the longwalls are about 100 m from the creeks, however the direction of mining (away from the creeks) and orientation of the longwalls near the creeks is likely to lessen any impacts and there is unlikely to be any significant impacts to the creeks. Adaptive management strategies will be included in the Extraction Plan (refer to Section 3.6.4).
				Clarification was sought regarding the extent of longwalls planned in the Western Domain, and the consideration of other than the four that Tahmoor Mine has approved.	Tahmoor Coal advised that other longwalls in the Western Domain are still being considered, however are yet to be confirmed.
	6/06/2019	Meeting	A meeting was held with the TCCCC and representatives of Tahmoor Coal at the Tahmoor Mine. This meeting was an opportunity to provide the TCCCC with a quarterly update of activities at Tahmoor Mine. As part of this update, an update on the progress of the LW W1-W2 Extraction Plan was presented.	It was noted that a significant Aboriginal heritage site was located in the vicinity of Stonequarry Creek. Clarification was sought regarding the distance to and the likely impact to Stonequarry Creek.	Tahmoor Coal noted that the update of the mine plan since the 2014 SMP Application has resulted in setback from the creek. In addition, even though mining commences in proximity to the creeks, the direction of mining (away from the creeks) would reduce the level of impact compared to a situation where mining would be towards the creeks.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
			Meeting minutes are available on the Tahmoor Coal website.		Furthermore, Tahmoor Coal would review subsidence impacts following the first 1,000 m of mining of LW W1, and appropriate adaptive management strategies (if required) would be implemented for LW W2 to further reduce impacts to Stonequarry Creek (particularly the Aboriginal grinding groove site).
				Clarification was sought regarding whether or not Stonequarry Creek was in the subsidence zone.	Tahmoor Coal confirmed that Stonequarry Creek was located within the predicted subsidence zone.
				Clarification was sought regarding the extent of environmental consequences in the Western Domain in comparison to that observed at Redbank Creek as a result of mining.	Tahmoor Coal confirmed that the environmental consequences observed at Redbank Creek are not likely to be observed in creeks in the Western Domain as a result of LW W1-W2 extraction. Subsidence impacts would be lessened as a result of the mine plan (eliminating mining directly beneath the creeks) and mining away from the creeks. In addition, the adaptive management strategy would further reduce impacts to Stonequarry Creek.
				Clarification was sought regarding the anticipated impacts to dams in the Study Area.	Tahmoor Coal is currently coordinating a geotechnical assessment, and preliminary findings indicate that there will be no risk of dam burst. Tahmoor Coal will abide by a 'make good' policy in the unlikely event that subsidence impacts occur.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
				Clarification regarding the likely commencement of LW W1 mining was sought.	Tahmoor Coal indicated that early November was likely at this stage.
Aboriginal heritage stakeholders (RAPs)	15/03/2019	Letter via email	EMM Heritage Consultants, on behalf of Tahmoor Coal, sent a letter via email on 15 March 2019 to 10 Aboriginal groups about the Aboriginal Heritage Technical Report (**AHTR**) for LW W1–W2. The letter provided an overview of the proposed Extraction Plan, background information, the objectives of the AHTR, and the AHTR assessment methods and indicative timeline. The letter also requested any relevant cultural information that may inform the significance of places or Aboriginal objects within the study area. The 10 Aboriginal groups consisted of Cubbitch Barta Native Title Claimants (Cubbitch Barta), Tharawal Local Aboriginal Land Council (TLALC), Googbah, Gulgah, Biamanga, Murramarang, Didge Ngunawal Clan, Cullendullas, Yurandaali Cultural Services, and Yulay Cultural Services.	No formal responses were received from the 10 Aboriginal groups. Representatives from Cubbitch Barta and TLALC attended field work along Matthews Creek on 28 March 2019.	A copy of the AHTR will be provided to the ten Aboriginal parties upon submission to DPE. A log of consultation undertaken including letters and relevant correspondence is included in Appendix C of the AHTR. An Aboriginal Cultural Heritage Assessment (ACHA) report is currently being prepared for LW W1–W4, and will result in wider consultation and further opportunity for Aboriginal heritage stakeholders to provide cultural input into the assessment of the LW W1-W4 extraction area.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Bradcorp Holdings Pty Ltd (Bradcorp)	26/02/2019	Meeting	A meeting was held between a representative of Bradcorp (Grahame Kelly) and representatives of Tahmoor Coal at the Bradcorp Office in Sydney. This meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan and to discuss the Land Access Agreement.	Details of the proposed Land Access Agreement were discussed.	Noted.
	30/04/2019	Letter via email	Bradcorp (Grahame Kelly) was sent a Resident Information Pack and letter containing information about LW W1-W2.	No response received.	Noted.
Tesrol Clearview Pty Ltd (Tesrol)	14/02/2019	Meeting	A meeting was held between a representative of Tesrol (Nigel Fox) and representatives of Tahmoor Coal at Tahmoor Mine. This meeting was an opportunity to outline the proposed LW W1-W2 Extraction Plan and to discuss the Land Access Agreement.	Details of the proposed Land Access Agreement were discussed.	Noted
	30/04/2019	Letter via email	Tesrol (Nigel Fox) was sent a Resident Information Pack and letter containing information about LW W1-W2.	No response received.	Noted.

Stakeholder	Date	Type of Consultation	Description of Consultation	Summary of Comments	Tahmoor Coal Response
Other landowners of private property within the Study Area of LW W1-W2	29/04/2019	Letter	A letter of consultation was sent to all landowners of private property within the LW W1-W2 Study Area on 29 April 2019. This letter included a Resident Information Pack and letter containing information about LW W1-W2. This included an offer to landowners for the completion of a Pre-Mining Inspection.	Responses to this correspondence have been received with requests for PMIs.	PMIs have been scheduled where requested. Door knocking of residences in the LW W1-W2 Study Area was completed in June 2019 and another session scheduled in August 2019. A repeat of this letter of consultation is scheduled to be sent to landowners in August 2019.
	13/06/2019	Community Information Day	A Community Information Day was held by Tahmoor Coal representatives at the Picton Bowling Centre from 1 pm to 7 pm on 13 June 2019 to allow public discussion of LW W1-W2. This information session was advertised in the Wollondilly Advertiser (29 May 2019 and 5 June 2019), District Reporter (7 June 2019), and Macarthur Chronical (11 June 2019). A letter was also sent to all landowners on the mailing list informing them of the session.	A total of 16 members of the community attended the session. The key issues raised included: • Pre-Mining Inspection requests; • Hazard Inspection requests; • Impacts to property; • What is subsidence and how may it impact my property; • Questions regarding mining near the creeks; • LW32 update; • Tahmoor South Project update; • Development approvals (Extraction Plan approval) SA NSW representatives were also in attendance at the session.	All questions from members of the community were answered by representatives of Tahmoor Coal or SA NSW at the session. Further Community Information Session is scheduled to be held on 17 October 2019 and 20 February 2020.
				Representatives from the retired miners group also requested that Tahmoor Coal give a presentation at one of their meeting about current and future mining operations at Tahmoor Mine.	Tahmoor Coal provided the representatives with contact details to organise this presentation.

2.2 Subsidence Background

2.2.1 History of Subsidence Predictions for the Western Domain

The Western Domain lies within ML 1376 and ML 1539, for which the EIS documents prepared by Kembla Coal and Coke (1993) and Olsen Environmental Consulting (1998) were approved, respectively.

A subsidence monitoring program was established at Tahmoor Mine in 1984, and this data was used alongside calculations using the incremental profile method to predict subsidence related impacts for future Tahmoor North Longwalls (Olsen Environmental Consulting, 1998). Although predictions were made for all proposed longwalls, Olsen Environmental Consulting identified that within the time between the extraction of the first and last longwalls at Tahmoor North, substantial changes in the understanding of subsidence and how it is predicted could occur. Therefore, the nature of the impacts to environmental features due to subsidence in the EIS was general.

Tahmoor Coal (then owned by Glencore) submitted a Subsidence Management Plan Application (SMP Application) for Longwalls 31 to 37 in December 2014 (Glencore, 2014). Of these proposed longwalls, LW33-37 were located in the Western Domain. Mine Subsidence Engineering Consultants (**MSEC**) prepared Report No. MSEC647 (Rev A), which provided subsidence predictions and impact assessments on natural and built features due to the proposed extraction of these longwalls in support of the SMP Application (MSEC, 2019).

The SMP Application was not approved completely, with only LW31 and LW32 being individually approved for extraction.

The SMP Application was placed on public exhibition to provide Government agencies, community members and other relevant stakeholders the opportunity to submit feedback on the report. A number of submissions were made against the SMP Application, and a summary is provided in **Table 2-3**.

Table 2-3 Submissions made regarding the SMP Application for Longwalls 31-37

Source of Submission	Date of Submission	Submission Summary	Tahmoor Coal Response
Office of Environment and Heritage (OEH)	21/04/2015	OEH made the following key comments regarding the SMP Application: • an adequate or comprehensive review of impacts likely to occur as a result of proposed mining was not provided; • a proposal regarding the remediation of affected areas was not included; • the effect on ecological and social values associated with higher order streams likely to be impacted by mining was not considered; and • the monitoring program outlined in the original SMP Application was inadequate and poorly designed considering the scale of likely impacts. OEH made the following recommendations:	Noted.
		• Longwalls to be reconfigured so as to not pass directly below 3rd – 5th order streams (including Cedar, Stonequarry, Matthews and Redbank Creeks)	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
		• Impact to above creeks is remediated so that flows and pool holding capacity is equivalent to pre-mining activity.	Appendix D Master TARP includes action for a Corrective Management Action Plan in the event that subsidence predictions for impacts to creeks are exceeded.
		• A review of the potential downstream effects of loss of flow to Stonequarry Creek, particularly in relation to Picton STP discharges.	Section 4.1.1 of the WMP (Volume 2).
		• A review of the cumulative flow loss from all streams already affected and those likely to be affected by future Tahmoor mining in the Upper Nepean River	Section 4.2.2 of the WMP (Volume 2).
		• Statistically rigorous experimental monitoring design and assessment program with adequate baseline data for stream flow, pool levels, groundwater and biological communities.	Section 3, Section 5, Section 6 and Appendix A of the WMP (Volume 2); Section 3, Section 5, Section 6 and Appendix A of the Biodiversity Management Plan (BMP) (Volume 3).
Martin Krogh – Principal Scientist	26/02/2015	In addition to the comments made by OEH, Martin Krogh (Principal Scientist Major Assessments) from OEH made the following additional recommendations:	See below.

Source of Submission	Date of Submission	Submission Summary	Tahmoor Coal Response
Major Assessments (OEH)		• Shortening of LW33 so that is does not pass directly beneath, or within the angle of draw, the junction of Cedar and Stonequarry Creeks.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
		• LW34 is shortened so that it does not pass directly beneath, or within the angle of draw, of Cedar Creek.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
DPI Office of Water	08/04/2015	DPI Water made the following recommendations:	See below.
		• Preparation and submission of a Groundwater Monitoring and Modelling Plan (GWMMP) to the Office of Water for Approval. The GWMMP must meet the requirements of the *NSW Aquifer Interference Policy (2012)* and modelling guidelines prepared by the Office of Water (*Groundwater Monitoring and Modelling Plans – Information for prospective mining and petroleum exploration activities*).	Groundwater Technical Report (Volume 2), which will be provided as part of the Extraction Plan to relevant government authorities for review.
		• Model must be numerical and consider impact predictions, baseline conditions, and potential losses of infrastructure following mining subsidence.	Section 4.2 of the Groundwater Technical Report (Volume 2).
		• Explicitly address NSW AIP in the revised Environmental Management Plan.	Sections 2.1.2 and 4.3.3 of the Groundwater Technical Report (Volume 2)
		• Consultation with Office of Water regarding notification procedures in relation to groundwater impacts.	Appendix A of the WMP (Volume 2).
		• Refer to obligations and entitlements outlined in the relevant water sharing plan/s.	Section 2.2.1 of the WMP (Volume 2).
		• Classification of Stonequarry Creek as ephemeral to be revised, available data suggests this is incorrect.	Section 3.2.1.3 of the WMP (Volume 2).
		• Mitigation measures to be proposed regarding changes to cease to pump levels/ zero flow days for present, licensed water users at Stonequarry Creek.	Appendix A of the WMP (Volume 2).
		• Environmental flows for Stonequarry Creek Management Zone of the Upper Nepean River – Upstream Warragamba Water Source to be included in TARP.	Appendix A of the WMP (Volume 2).

Source of Submission	Date of Submission	Submission Summary	Tahmoor Coal Response
		• Clarification of the development of the stream flow database and defined flow reduction triggers for the TARP prior to the approval of the application, or at least six months prior to the commencement of LW33.	Section 3.1.2 and Appendix A of the WMP (Volume 2).
		• Review of risks to impacts on geomorphic features such as cliffs and rock outcrops associated with gorges on Cedar and Stonequarry Creek.	Subsidence Predictions Report (Appendix A), LMP (Volume 2), and Geotechnical Assessment (Volume 2).
		• Revised TARP to include appropriate mitigation and repair measures for damage caused to watercourses.	Appendix A of the WMP (Volume 2).
		• Extraction within the gorges of Redbank, Matthews, Cedar and Stonequarry Creeks only to be undertaken once subsidence predictions for LW28-30 is complete and validated.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
		• Validation of impact predictions for shale/clay bedded watercourses (Rumkers and Newlands Gully's) to be undertaken following the passing of each longwall.	Section 4 and Section 5 of the WMP (Volume 2).
		• Effectiveness of mitigation methods for shale/clay bedded watercourses presented prior to the extraction of subsequent longwalls beneath the watercourse.	Potential impacts from mining are unlikely to have discernible impacts on the tributaries, and mitigation measures are not required for these features.
		• Review of fluvial geomorphology for any river reaches undermined by LW 31-37. Demonstration of effectiveness of management and mitigation methods is to be explicit and recommendations for future mining subsidence presented.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, and will not mine under any river reaches.
Wollondilly Shire Council	19/03/2015	Wollondilly Shire Council made the following recommendations:	See below.
		• SMP Application to include a discussion on the features and potential impacts of intended mining operations on the Bargo River from a catchment context.	Section 4 of the WMP (Volume 2).
		• Provide a detailed description of the properties and behaviour of the groundwater environment in a lateral and vertical direction.	Section 3.2 of the WMP (Volume 2).
		• Provide a conceptual and computerised model of groundwater behaviour that is informed by extensive groundwater monitoring undertaken at various depths.	Section 4 of the Groundwater Technical Report (Volume 2).
		• Inclusion of an assessment of potential impacts to farm dams based on the scientifically rigorous assessment of subsidence requested by council.	Geotechnical Assessment (Volume 2).
		• Collection of additional baseline data to adequately inform a detailed groundwater assessment and modelling prior to consideration of approval.	Baseline Private Bore Assessment (Volume 2).

Source of Submission	Date of Submission	Submission Summary	Tahmoor Coal Response
		• Detailed assessment of potential subsidence related impacts to surface and groundwater in a context that is consistent with current and scheduled scientific research.	Section 4 of the WMP (Volume 2).
Rivers SOS	20/04/2015	Rivers SOS recommended that the mine plan is redesigned to avoid tributaries and creeks, notably Redbank, Matthews, Cedar and Stonequarry Creeks.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
Fisheries NSW	15/04/2015	Stonequarry and Cedar Creek are considered key fish habitats. In order to assess any physico-chemical impacts to the flow of these watercourses, Fisheries has requested:	See below.
		• A longitudinal section through the area to be impacted by LW33 and monitoring program to detect any subsidence impacts;	Subsidence Monitoring Program (Volume 4).
		• Development of methods for remediation of potential blockages (physical or chemical) if they are found to exceed natural blockages that exist in the system prior to mining activity.	Blockage to fish passage as a result of mining activities is not likely to exceed natural blockages that exist in Stonequarry Creek and Cedar Creek. During periods of low flow, flow within the creeks is disconnected, and mining activities are not likely to result in blockage to fish passage in medium to high flow.
NSW Trade and Investment, Division of Resources and Energy – Environmental Sustainability Unit (ESU)	28/04/2015	ESU requested for Tahmoor Coal to provide justification for undermining Stonequarry Creek. Justification should include scenarios for set back and direct undermining with an assessment of social, economic and environmental impacts with consideration of concerns raised by other Government agencies.	Western Domain Mine Plan revised to avoid passing directly below 3rd order and higher streams, which includes Matthews Creek, Cedar Creek and Stonequarry Creek.
		ESU noted that there was no discussion in the SMP Application regarding the use of water resources from creeks by adjacent landowners and the associated measures of compensation to be offered if subsidence leads to flow diversion and loss of pool holding capacity.	Section 4.2.3 of the WMP (Volume 2).
		ESU recommended that Tahmoor Coal provides information on the extent of predicted pool loss within creeks. In particular, details pertaining to the distance from areas of longwall extraction that drainage is likely to occur. To be summarised and presented on a map.	Section 4.1 of the WMP (Volume 2).

Source of Submission	Date of Submission	Submission Summary	Tahmoor Coal Response
		ESU recommended that pre-mining hydrological investigation be undertaken for all creeks noted in original SMP Application as being impacted. This should include information on: • Pre-mining ground/strata characterisation; • Surface/groundwater interactions for the streams; • Baseline monitoring of shallow aquifers; • Baseline stream mapping; • Predicted areas of pool loss; and • Post-impact remediation objectives and performance criteria.	Surface Water Technical Report (Volume 2), Groundwater Technical Report (Volume 2) and WMP (Volume 2).
Community submission	17/5/2015	Residents concerned regarding impacts to dwelling, dams, water and gas infrastructure as a result of LW30, LW31 and LW32.	Not relevant to the proposed longwalls in the Western Domain.
Community submission	18/3/2018	Two submissions raised concerning Stonequarry Creek drying out due to proposed mining and that the archaeological sites along Stonequarry Creek will be impacted.	Section 4.1 of the WMP (Volume 2) and Section 4.1 of the Heritage Management Plan (HMP) (Volume 3).
Community submission	14/4/2015	Resident raised concerns over subsidence impacts to dwelling, and requested a pre-mining inspection and an independent valuation prior to mining.	Consultation with residents in the LW W1-W2 Study Area has commenced, and requests for pre-mining inspections and other requests have been met.
Community submission	1/5/2015	Resident raised concerns over subsidence impacts to dwelling.	Consultation with residents in the LW W1-W2 Study Area has commenced, and requests for pre-mining inspections have been met.

The current mine plan is a revision of this SMP Application mine plan. This review was based on many factors including feedback received from the community and NSW Government agencies following submission of the SMP Application in 2014 and geotechnical, operational and mining conditions.

The current mine plan includes four longwalls (LW W1-W4) located in the Western Domain, with. LW W1 will be the first longwall to be mined in this new series of longwalls in the Western Domain. The mine design review resulted in re-orientation of longwalls in the Western Domain from a north-west to south-east orientation to a north to south orientation to avoid mining directly under streams of third order or above (Matthews Creek, Cedar Creek and Stonequarry Creek).

A comparison between the longwalls proposed in the previous 2014 SMP Application and the current layout of LW W1-W2 is provided in **Figure 2-1**. The key differences are listed below:

- LW W1-W2 do not mine directly beneath Matthews, Cedar and Stonequarry Creeks, whilst the previously proposed LWs 33 to 37 were located directly beneath the creeks. The change in mine plan will substantially reduce the severity and extent of mining-induced impacts on the creeks; and
- LW W1-W2 and future planned LW W3 and LW W4 will progressively extract each longwall from west to east, whilst the previously proposed LWs 33 to 37 were sequenced in the opposite direction.

From a mine subsidence perspective, the change in direction will reduce the impact of transient subsidence effects on houses within the Stonequarry Estate, and will also allow Tahmoor Coal to track mining-induced movements as the mine extends towards the Picton Railway Tunnel on the Main Southern Railway, which is a substantial and significant item of civil infrastructure

To support this Extraction Plan for LW W1-W2, MSEC have revised the subsidence predictions for the proposed longwalls and prepared the report *MSEC1019 Tahmoor Coking Coal Operations – Longwalls W1 and W2, Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of the Proposed Longwalls W1 and W2 in Support of the Extraction Plan Application* (hereafter referred to as the 'Subsidence Predictions Report') (MSEC, 2019; refer to **Appendix A**).

As discussed in **Section 5.3.4** of the Subsidence Predictions Report (MSEC, 2019), the maximum predicted total valley closure for Matthews, Cedar and Stonequarry Creeks due to the extraction of LW W1-W2 is 180 mm, and the predicted rate of impact for the pools along these creeks due to LW W1-W2 extraction is less than 10 %. Tahmoor Coal considers that these current subsidence predictions are acceptable, and that the current mine plan appropriately balances the requirements of resource recovery, minimisation of environmental impact, and consideration of community and Government agency concern.

If the measured mining induced movements were to be in excess of the predicted values, a review of the model will be undertaken and would include the review of subsidence values and impacts to any surface features within the Extraction Plan Study Area.

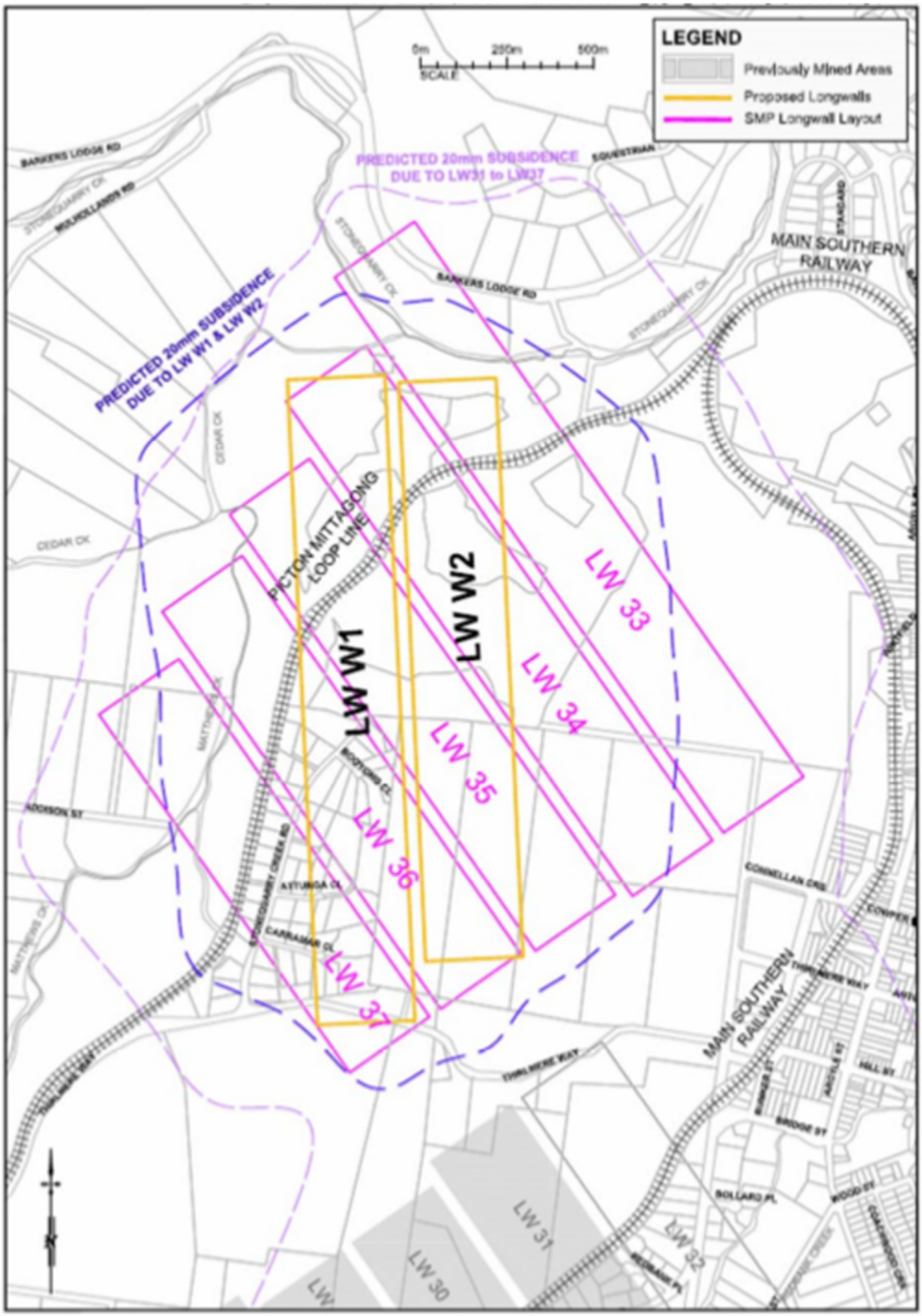


Figure 2-1 Comparison between Mine Layouts for LW W1-W2 and LWs 33 to 37 (MSEC, 2019)

2.2.2 Current Methods and Models used by MSEC

The following sections outline the methods and models used by MSEC to provide revised subsidence predictions for the proposed longwalls (MSEC, 2019; refer to **Appendix A**). Particular note has been made regarding the process of review of the methods and models used to make predictions of subsidence effects, subsidence impacts and environmental consequences.

Incremental Profile Method

The predicted conventional subsidence parameters for the proposed longwalls have been determined using the Incremental Profile Method (**IPM**), which has been developed by MSEC. The method is an empirical model based on a large database of observed monitoring data from previous mining within the Southern, Newcastle, Hunter and Western Coalfields of NSW. Subsidence predictions made using the IPM use the database of observed incremental subsidence profiles, the longwall geometries, local surface and seam information and geology. The predictions can be further tailored to local conditions where observed monitoring data is available close to the mining area (MSEC, 2019).

The use of the IPM at the Tahmoor Mine has been continually reviewed and refined based on the latest available ground movement monitoring data. The subsidence model has been reviewed after the completion of each longwall as part of the End of Panel reports. Initially, the subsidence predictions for the longwalls at Tahmoor Mine were based on the standard model for the Southern Coalfield. In 2009, the IPM was refined using the extensive monitoring data that had been collected during the extraction of LW22 to LW25 at the mine (MSEC, 2019).

A detailed review of the IPM was carried out in 2014, based on the monitoring data that had been collected during the extraction of LW22 to LW28. It was found that the calibrated IPM generally provided reliable predictions at the Tahmoor Mine. However, exceedances occurred in the areas of increased subsidence above LW24A and above the south-eastern ends of LW25 to LW27. The IPM has again been reviewed based on the latest monitoring data, and details of this review are provided in **Section 3.6** of **Appendix A**.

Numerical Model

A numerical model has been developed by MSEC for the Tahmoor Mine using Universal Distinct Element Code (**UDEC**). This method is a two-dimensional Discrete Element Method (**DEM**) comprising deformable elements that interact via compliant contacts (Itasca, 2015). The numerical modelling has been undertaken to supplement the predictions obtained using the empirical IPM. The UDEC model has been derived from the base model that was developed for the Southern Coalfield for mining in the Bulli Coal Seam (Barbato, 2017). The numerical model has been updated for the local stratigraphy relevant to LW W1-W2, and has been calibrated for the local mining conditions of LW W1-W2 using the available ground monitoring data (MSEC, 2019).

2002 ACARP Method

The predicted upsidence and closure movements for the longwalls at Tahmoor Mine have been obtained using the empirical method outlined in Australian Coal Association Research Program (**ACARP**) Research Project No. C9067 (Waddington and Kay, 2002), referred to as the 2002 ACARP method. A comparison between the measured and predicted valley related effects for previously extracted longwalls at Tahmoor Mine has been provided in **Section 3.9** of **Appendix A**.

Prediction of Strains

A linear relationship between curvature and strain provides a reasonable prediction for conventional tensile and compressive strains. In the Southern Coalfields, it has been found that a factor of 15 provides a reasonable relationship between the predicted maximum curvature and the predicted maximum conventional strains. This method is effective for predicting typical values when the ground subsides regularly with no localised or elevated strains due to near-surface geological structures or valley closure effects. The maximum strains can be much greater than these typical values and there can be considerable variation from the linear relationship.

The Subsidence Predictions Report (MSEC, 2019) therefore provided a statistical approach to account for the variability, instead of just providing a single predicted conventional strain. The range of potential strains above the proposed longwalls has been determined using monitoring data from the previously extracted longwalls at the mine. The range of strains measured during the extraction of these longwalls should, therefore, provide a reasonable indication of the range of potential strains for the proposed longwalls. The data used in the analysis of observed strains included those resulting from both conventional and nonconventional anomalous movements, however did not include those resulting from valley related effects.

Ground Stain

Ground strain comprises two components, being normal strain and shear strain, which can be interrelated using Mohr's Circle. The magnitudes of the normal strain and shear strain components are, therefore, dependent on the orientation in which they are measured. The maximum normal strains (i.e. principal strains) are those in the direction where the corresponding shear strain is zero.

Normal strains along monitoring lines can be measured using 2D and 3D techniques, by taking the change in horizontal distance between two points on the ground and dividing by the original horizontal distance between them. This provides the magnitude of normal strain along the orientation of the monitoring line and, therefore, this strain may not necessarily be the maximum (i.e. principal) strain.

Shear deformations are more difficult to measure, as they are the relative horizontal movements perpendicular to the direction of measurement. However, 3D monitoring techniques provide data on the direction and the absolute displacement of survey marks and, therefore, the shear deformations perpendicular to the monitoring line can be determined. Shear deformations perpendicular to monitoring lines can be described using various parameters, including horizontal tilt, horizontal curvature, horizontal mid-ordinate deviation, angular distortion and shear index.

Horizontal mid-ordinate deviation has been used as the measure for shear deformation, which is defined as the differential horizontal movement of each survey mark, perpendicular to a line drawn between two adjacent survey marks.

2.3 Extraction Plan Team

In accordance with Condition 13H(i) of DA 67/98, Tahmoor Coal sought the endorsement of qualified and experienced persons to prepare the Extraction Plan from the Secretary of DPE. On 6 March 2019, the Director of Resource Assessments (as nominated by the Secretary) endorsed Ron Bush (Tahmoor Coal's Environment and Community Manager) and April Hudson (Tahmoor Coal's Approvals Coordinator) for the preparation of the Extraction Plan and its relevant sub-components. DPE noted that the Extraction Plan would be informed by technical report from specialists.

A copy of the letter of endorsement from DPE is provided in **Appendix C**.

Table 2-4 provides a list of specialists who assisted in the preparation of the Extraction Plan, the key component plans, sub-management plans and other supporting documents.

Table 2-4 Extraction Plan Team

DA 67/98 Condition	Management Plan and Supporting Documents	Company	Prepared By
Condition 13H	Extraction Plan Main Document	Tahmoor Coal	April Hudson
Condition 13H(vii)(a)	Subsidence Monitoring Program	MSEC	Daryl Kay
		Tahmoor Coal	April Hudson
	Subsidence Geotechnical Report	SCT	Ken Mills
Condition 13H(vii)(b)	Built Features Management Plan	MSEC	Daryl Kay
		Tahmoor Coal	April Hudson
	Infrastructure Management Plans for the following built infrastructure: • Endeavour Energy Management Plan • Sydney Water Potable Water Management Plan • Stonequarry Wastewater Treatment Plant Management Plan • Jemena Management Plan • Wollondilly Shire Council Management Plan • Main Southern Railway Management Plan • Picton-Mittagong Heritage Railway Management Plan • Built Structure Management Plan • Queen Victoria Memorial Home Management Plan • Mill Hill Management Plan	MSEC	Daryl Kay
	Telecommunications Management Plan	Comms Network Solutions	Colin Dove
Condition 13H(vii)I	Water Management Plan	Tahmoor Coal	April Hudson
	Surface Water Technical Report	Hydro Engineering & Consulting	Tony Marszalek, Camilla West

DA 67/98 Condition	Management Plan and Supporting Documents	Company	Prepared By
	Flood Impact Study	WRM	David Newton
	Groundwater Technical Report	HydroSimulations	Will Minchin, Braiya White
	Baseline Private Bore Assessment	GeoTerra	Andrew Dawkins
Condition 13H(vii)(d)	Biodiversity Management Plan	Tahmoor Coal	April Hudson
	Aquatic Biodiversity Technical Report	Niche Environment & Heritage	Matthew Russell
	Terrestrial Biodiversity Technical Report	Niche Environment & Heritage	Luke Baker
Condition 13H(vii)I	Land Management Plan	Tahmoor Coal	Ron Bush
	Geotechnical Assessment	Douglas Partners	Roshan Nair, John Braybrooke
	Land and Agricultural Resource Assessment	SLR	Murray Fraser
Condition 13H(vii)(f)	Heritage Management Plan	Tahmoor Coal	April Hudson
	Aboriginal Heritage Technical Report	EMM	Ryan Desic, Pamela Chauvel
	Historical Heritage Technical Report	EMM	Pamela Chauvel, Pamela Kottaras
Condition 13H(vii)(g)	Public Safety Management Plan	Tahmoor Coal	Ron Bush
Condition 13H(vii)(h)	Trigger Action Response Plans	Tahmoor Coal	April Hudson
Condition 13H(vii)(i)	Contingency Plans (part of the TARPs)	Tahmoor Coal	April Hudson

3 Extraction Plan Overview

3.1 Extraction Plan Study Area

3.1.1 Definition of Study Area

The Extraction Plan Study Area is defined as the surface area that is likely to be affected by the extraction of LW W1-W2 from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (**mm**) subsidence contour resulting from the extraction of LW W1-W2; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW W1-W2.

The Study Area is illustrated in **Figure 3-1**.

An expansion of the Study Area to 600 m from extraction has also been defined by MSEC (2019) (refer to **Figure 3-1**). Relevant features within this 600 m buffer could be susceptible to far-field or valley related movements have been included for consideration in the Subsidence Predictions Report (MSEC, 2019) and within this Extraction Plan and associated documents. The 600 m buffer for natural features has been included based on recommendations in the independent inquiry report titled *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfields – Strategic Review* (NSW Department of Planning (**DoP**), 2008).

3.1.2 Environmental Features in the Study Area

Topography within the Study Area is generally undulating with rises in the south-east falling to low slopes in the north. A small ridgeline rises above LW W1-W2 with a high point of approximately 286 m above Australian Height Datum (**AHD**). The surface falls towards the three dominant drainage channels – Matthews Creek, Cedar Creek, and Stonequarry Creeks – to the north-western part of the Study Area, and towards Redbank Creek in the south-eastern part of the Study Area. The minimum surface level in the Study Area is approximately 166 m AHD at Stonequarry Creek in the north-western part of the Study Area (SLR, 2019; MSEC, 2019).

Matthews Creek, Cedar Creek, and Stonequarry Creek are located in the northern and western sections of the Study Area, and are located in the catchment of the Hawkesbury-Nepean River. Matthews Creek is situated on the western side of the Study Area and flows north into Cedar Creek, which subsequently flows north then east into Stonequarry Creek in the northern section of the Study Area. Stonequarry Creek flows east through the Study Area before flowing south-east to its confluence with the Nepean River. All three dominant drainage channels are considered low flow or intermittent channels, and the Study Area also includes a number of intermittent tributaries and numerous small farm dams (GeoTerra, 2019; SLR, 2019).

The surface lithology above the proposed LW W1-W2 generally comprises the Wianamatta Group, with the Hawkesbury Sandstone exposed at Matthews Creek, Cedar Creek, and Stonequarry Creek (MSEC, 2019). The landscape of the Study Area includes a number of cliffs, rock outcrops and steep slopes.

The Study Area is generally cleared for small scale rural production, while native vegetation is present predominantly in the riparian zones of the Study Area.

The Study Area does not include any Drinking Water Catchment Areas, Declared Special Areas, sea, lake, shoreline, natural dams, rivers, springs, escarpments, land prone to flooding or inundation, National Parks, State Forests, areas of significant geological interest, or other natural features considered significant in the Study Area (MSEC, 2019).

Table 3-1 provides a summary of the environmental features within the Extraction Plan Study Area and the Key Component Plans and associated documents that discuss and manage these features.

Table 3-1 Environmental and Built Features within the LW W1-W2 Extraction Plan Area and Relevant Management Plans

Feature	Identification and Assessment (other than in Subsidence Prediction and Impact Assessment Report (MSEC, 2019)	Management and Monitoring (other than in Subsidence Monitoring Program)
Natural and Heritage Features		
Waterways	• Surface Water Technical Report (HEC, 2019)	• WMP
Floodplains	• Flood Impact Study (WRM, 2019)	• WMP
Groundwater	• Groundwater Technical Report (HydroSimulations, 2019) • Baseline Private Bore Assessment (GeoTerra, 2019)	• WMP
Steep slopes, rock outcrops, cliffs	• Geotechnical Assessment (Douglas Partners, 2019)	• LMP
Land and soil capability	• Land and Agricultural Resource Assessment (SLR, 2019)	• LMP
Aquatic ecology	• Aquatic Biodiversity Technical Report (Niche, 2019a) • Aquatic Ecology Baseline Monitoring Report (Niche, 2019b)	• BMP
Terrestrial ecology	• Terrestrial Biodiversity Technical Report (Niche, 2019c) • Terrestrial Ecology Baseline Monitoring Report (Niche, 2019d)	• BMP
Aboriginal heritage	• Aboriginal Heritage Technical Report (EMM, 2019a)	• HMP
Historical heritage	• Historical Heritage Technical Report (EMM, 2019b)	• HMP • BFMP • Queen Victoria Memorial Home Management Plan • Mill Hill Management Plan
Built Features (infrastructure and building owner in brackets)		
Electrical infrastructure (Endeavour Energy)	• Endeavour Energy Management Plan	• BFMP • Endeavour Energy Management Plan
Potable water infrastructure (Sydney Water)	• Sydney Water Potable Water Management Plan	• BFMP • Sydney Water Potable Water Management Plan

Feature	Identification and Assessment (other than in Subsidence Prediction and Impact Assessment Report (MSEC, 2019)	Management and Monitoring (other than in Subsidence Monitoring Program)
Stonequarry Wastewater Treatment Plant and associated infrastructure (Bradcorp)	• Stonequarry Wastewater Treatment Plan Management Plan	• BFMP • Stonequarry Wastewater Teatment Plan Management Plan
Gas infrastructure (Jemena)	• Jemena Management Plan	• BFMP • Jemena Management Plan
Telecommunications infrastructure (Telstra and NBNCo)	• Telecommunications Management Plan	• BFMP • Telecommunications Management Plan
Local roads, bridges and culverts (Wollondilly Shire Council)	• Wollondilly Shire Council Management Plan	• BFMP • Wollondilly Shire Council Management Plan
Permanent survey control marks (Spatial Services)	• BFMP	• BFMP
Main Southern Railway (ARTC)	• Main Southern Railway Management Plan	• BFMP • Main Southern Railway Management Plan
Picton-Mittagong Loop Line (Rail Transport Museum)	• Picton-Mittagong Railway Management Plan	• BFMP • Picton-Mittagong Railway Management Plan
Dwellings, driveways, pools, rural structures (privately owned)	• Built Structures Management Plan	• BFMP • Built Structures Management Plan
Farm dams (privately owned)	• Surface Water Technical Report (HEC, 2019) • Land and Agricultural Resource Assessment (SLR, 2019) • Geotechnical Assessment (Douglas Partners, 2019)	• WMP
Groundwater bores (privately owned)	• Baseline Private Bore Assessment (GeoTerra, 2019) • Groundwater Technical Report (HydroSimulations, 2019)	• BFMP • WMP

3.1.3 Land Use and Built Features in the Study Area

The Study Area is located within the Wollondilly Shire Council Local Government Area, and the predominant land uses within the Study Area include rural residential, small scale cattle and horse grazing. A small number of poultry farms, orchards and commercial vegetable gardens also exist within or adjacent to the Study Area. However, no poultry farms or protected cropping businesses have been observed in the Study Area (SLR, 2019).

The following properties are noted within and near the Extraction Plan Study Area:

- 132 private properties;
- Two properties owned by Wollondilly Shire Council;
- Two properties owned by RLS Lifecare Limited associated with the Queen Victoria Memorial Hospital;
- Land owned by State Rail Authority of New South Wales associated with the Picton-Mittagong Loop Line; and
- Crown Land primarily associated with road corridors.

Lot and DPs for properties within and near the Study Area are illustrated in **Figure 3-2**.

A number of built features have been identified within the vicinity of the proposed longwalls. These built features include:

- The Main Southern Railway;
- Picton Mittagong Loop Line;
- Public roads, drainage culverts, and bridges;
- Potable water infrastructure;
- Sewer infrastructure;
- Gas infrastructure;
- Electrical infrastructure;
- Telecommunications infrastructure;
- Rural property and structures (built structures, pools, septic tanks, farm dams);
- Groundwater bores; and
- Survey control marks.

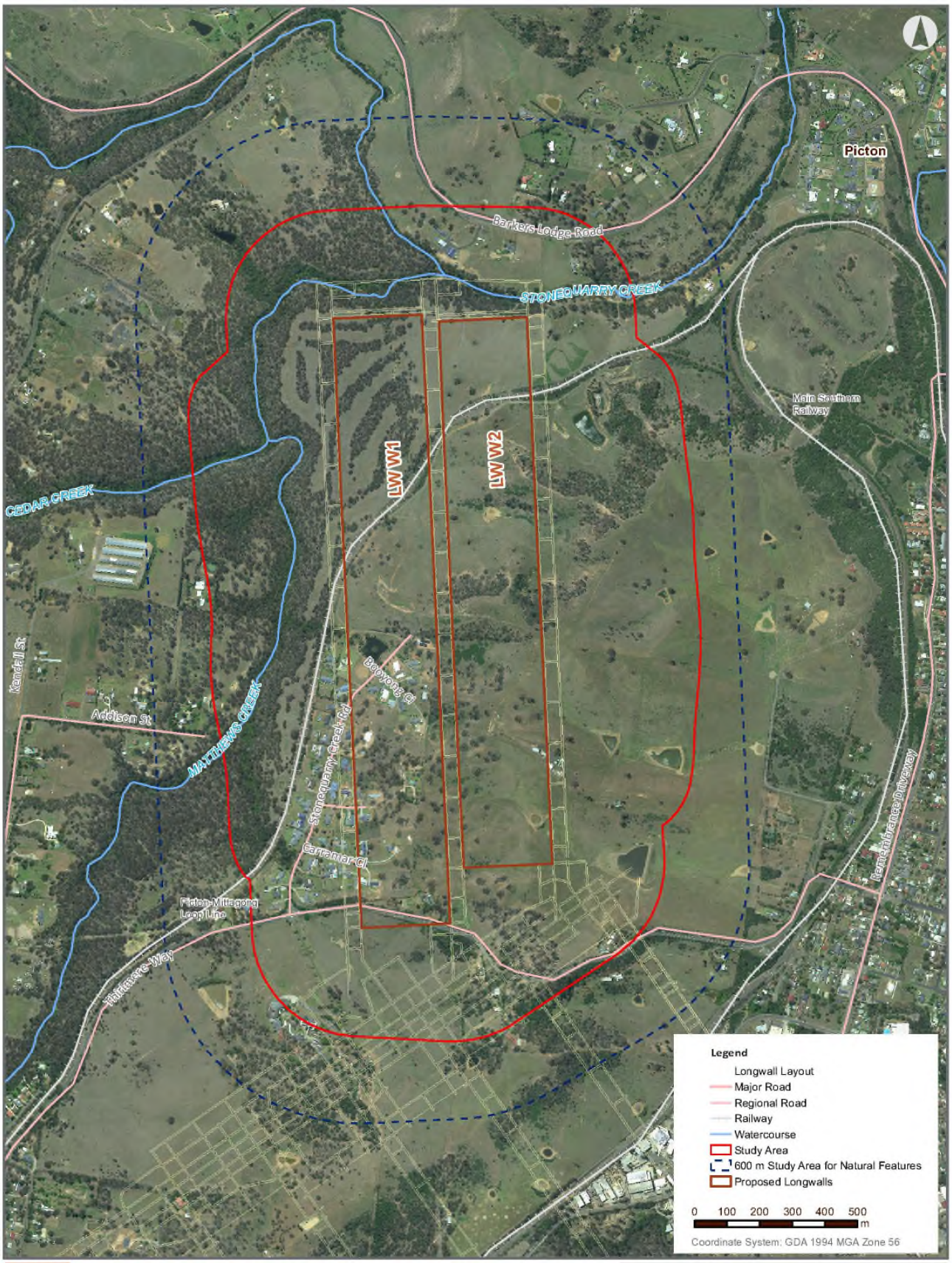
The Study Area does not include agricultural utilisation or agricultural sustainability of farm land, tanks, gas or fuel storages, poultry sheds, glass houses, hydroponic systems, irrigation systems, industrial, commercial or business establishments, liquid fuel pipelines, reservoirs, air strips, places of worship, schools, shopping centres, community centres, office buildings, swimming pools, bowling greens, ovals or cricket grounds, race courses, golf courses, tennis courts, bridges, items of architectural significance, flats, units or caravan parks in the Study Area (MSEC, 2019).

There are 25 recorded Aboriginal heritage sites within the Study Area, of which rockshelters represent 17 sites, scattered artefacts represent five sites, one grinding groove site, one scarred tree, and one isolated find (**Figure 4-6**). Several historical heritage sites have been identified within the Study Area, including:

- Queen Victoria Memorial Hospital;
- Harmony House;
- Mill Hill Miller's House and archaeological relics;
- Rural landscape of Thirlmere Way; and
- Five sandstone and brick culverts associated with the Picton-Mittagong Loop Line.

An additional four historical heritage items (Picton Tunnel on the Main Southern Railway, Mushroom Tunnel, and two brick culverts along the Picton-Mittagong Loop Line) are outside of the Study Area, however could be impacted by differential horizontal movements over the lengths of the structure or far-field movements.

Table 3-1 provides a summary of the built features within the Extraction Plan Study Area and the Key Component Plans and associated documents that discuss and manage these features.



EXTRACTION PLAN STUDY AREA

Tahmoor North Western Domain Longwalls West 1 and West 2
Extraction Plan

FIGURE 3-1

Date: 4/07/2019

Data Sources:
© NSW DFSI (2019); © NSW Mining (2019); © SIMEC (2019)
Aerial Imagery: © Photomapping Services (November 2018)

LAND OWNERSHIP IN STUDY AREA

Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan

FIGURE 3-2

Date: 27/05/2019

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

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The source data may contain inconsistencies or omissions, may not be to scale, may not be current and may present indicative information only. SIMEC Mining does not warrant the accuracy or completeness of the contents of this webmap.

3.2 Approvals and Licensing Requirements

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.

Tahmoor Mine currently operates under a number of approvals relevant to this Extraction Plan, including:

- Development Consent granted by Wollondilly Shire Council in 1975 following an EIS in 1975 allowing for the development of a mine and associated mine infrastructure;
- Development Consent granted in 1976 (and subsequent minor modifications) to allow for a coal preparation plant, and reject emplacement;
- Development Consent (DA 57/93) (and subsequent minor modification) granted by the Land and Environment Court in 1994 for an expansion of underground coal mining into the Tahmoor North area, continued operation of the existing Tahmoor Mine surface facilities including the coal preparation plant and the reject emplacement area;
- Development Consent (DA 67/98) (and subsequent minor modification) granted by the Minister for Urban Affairs and Planning in 1999 for the expansion of underground mining into those areas of Tahmoor North in which mining was classified as prohibited development;
- Consolidated Coal Lease 716, ML 1376 and ML 1539;
- Tahmoor Mine Operations Plan (**MOP**); and
- Environmental Protection Licence (**EPL**) 1389 under the *Protection of the Environment Operations Act 1997*.

These approvals constitute Tahmoor Coal's licences to conduct underground mining operations by longwall and bord and pillar mining methods within the Bulli Coal Seam.

Applicable conditions from development consent DA 57/93 and DA 67/98, Consolidated Coal Lease and Mining Leases, EPL 1389 and relevant Work Health and Safety Legislation are outlined in the following sections below. Each component management plan prepared in support of the Extraction Plan also includes these details as well as where each plan addresses the *Draft Guidelines for the Preparation of Extraction Plans V5* (NSW Department of Planning & Environment, 2015) and WHS Legislation.

Statutory approvals areas and mining tenement boundaries applicable to the LW W1-W2 Extraction Plan Study Area are detailed on **Figure 1-2** and A0 Graphical Plan 5 (refer to **Volume 5** of this Extraction Plan).

3.2.1 Project Approval

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 Extraction Plan from DA 67/98 are detailed in **Table 3-2**. It should be noted that Longwall 33 as used in DA 67/98 is now referred to as LW W1.

Table 3-2 DA 67/98 Condition Requirements for Extraction Plans

<table>
<tr><th>Condition</th><th colspan="2">Condition Requirement</th><th>Section Addressed</th></tr>
<tr><td colspan="4">SUBSIDENCE
Performance Measures – Natural and Heritage Features etc.</td></tr>
<tr><td>13A</td><td colspan="2">The Applicant must ensure that extraction of Longwall 33 and subsequent longwalls does not cause any exceedances of the performance measures in Table 1.
Note: The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent.</td><td rowspan="13">Section 3.4.2, Section 3.5, Section 3.6, Section 5
Appendix D – Master TARP
Appendix E – Coal Resource Recovery Plan
Volumes 2-4 – Key Component Plans and Supporting Documents</td></tr>
<tr><td rowspan="12">Table 1</td><td>Feature</td><td>Performance Measure</td></tr>
<tr><td colspan="2">Biodiversity</td></tr>
<tr><td>Threatened species, threatened populations, or endangered ecological communities</td><td>• Negligible environmental consequences.</td></tr>
<tr><td colspan="2">Heritage Sites</td></tr>
<tr><td>Heritage sites show in the figures in Appendix 7*</td><td>• Negligible subsidence impacts or environmental consequences.
• Negligible loss of heritage value.</td></tr>
<tr><td>Other Aboriginal and heritage sites</td><td>• Negligible subsidence impacts or environmental consequences.</td></tr>
<tr><td colspan="2">Mine workings</td></tr>
<tr><td>First workings</td><td>• To remain long term stable and non-subsiding.</td></tr>
<tr><td>Second workings</td><td>• To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.</td></tr>
<tr><td colspan="2">Note: The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent.</td></tr>
<tr><td>13B</td><td colspan="2">Measurement and monitoring of compliance with performance measures and performance indicators in this consent is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans and monitoring programs. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.</td><td>Section 3.6, Section 5
Appendix D – Master TARP
Volumes 2-4 – Key Component Plans and Supporting Documents</td></tr>
</table>

<table>
<tr><th>Condition</th><th>Condition Requirement</th><th>Section Addressed</th></tr>
<tr><td colspan="3">Additional Offsets</td></tr>
<tr><td>13C</td><td>If the Applicant exceeds the performance measures in Table 1 and the Secretary determines that:
it is not reasonable or feasible to remediate the subsidence impact or environmental consequence; or
remediation measures implemented by the Applicant have failed to satisfactorily remediate the subsidence impact or environmental consequence,
then the Applicant must provide a suitable offset to compensate for the subsidence impact or environmental consequence, to the satisfaction of the Secretary.</td><td>Noted.
Performance measures in Table 1 of DA 67/98 are not anticipated to be exceeded.</td></tr>
<tr><td>13D</td><td>The offset must give priority to like-for-like physical environmental offsets, but may also consider payment into any NSW Offset Fund established by OEH, or funding or implementation of supplementary measures such as:
actions outlined in threatened species recovery programs;
actions that contribute to threat abatement programs;
biodiversity research and survey programs; and/or
rehabilitating degraded habitat.
Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence</td><td>Noted.
Performance measures in Table 1 of DA 67/98 are not anticipated to be exceeded.</td></tr>
<tr><td colspan="3">Performance Measures – Built Features</td></tr>
<tr><td>13E</td><td>The Applicant must ensure that extraction of Longwall 33 and subsequent longwalls does not cause any exceedances of the performance measures in Table 2.
Notes
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 Coal Mine Subsidence Compensation Act 2017.</td><td rowspan="6">Section 3.5, Section 3.6, Section 5
Appendix D – Master TARP
Volumes 2-4- Key Component Plans and Supporting Documents</td></tr>
<tr><td>Table 2</td><td><table><tr><th>Feature</th><th>Performance Measure</th></tr><tr><td colspan="2">Key Public Infrastructure</td></tr><tr><td>Main Southern Railway;
Picton-Mittagong Loop Line; and
Electricity transmission lines and towers.</td><td>Always safe and serviceable.
Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.</td></tr><tr><td colspan="2">Other Infrastructure</td></tr><tr><td>Electricity distribution lines, poles and associated towers;</td><td>Always safe.</td></tr></table></td></tr>
</table>

Condition	Condition Requirement		Section Addressed
	• Unsealed roads and road culverts, fire trails, fences and other built features; and • Other public infrastructure.	• Serviceability should be maintained wherever practicable. • Loss of serviceability must be fully compensated. • Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.	
	• Privately-owned residences.		
	• Other privately-owned built features and improvements, including farm dams, swimming pools, tennis courts, roads, tracks and fences		
	Public Safety		
	Public Safety	• Negligible additional risk.	
	Notes: • 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 *Coal Mine Subsidence Compensation Act 2017*.		
13F	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		Noted.
First Workings			
13G	The Applicant may carry out first workings within the underground mining area approved mine plan, other than in accordance with an approved Extraction Plan, provided that the Resources Regulator is satisfied that the first workings are designed to remain stable and non-subsiding in the long term, except insofar as they may be impacted by approved second workings. Notes: • The intent of this condition is not to require an additional approval for first workings, but to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long term stability, with negligible resulting direct subsidence impacts. • DRG should be consulted when designing first workings in order to provide comment on matters relating to coal resource recovery.		Section 3.4.2 Appendix C – Letters of Consultation Appendix E – Coal Resource Recovery Plan
Extraction Plan			
13H	The Applicant must prepare an Extraction Plan for all second workings in Longwall 33 and subsequent longwalls to the satisfaction of the Secretary. Each Extraction Plan must:		This document

Condition	Condition Requirement	Section Addressed
13H(i)	be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Secretary;	Section 2.3 Appendix C – Letters of Consultation
13H(ii)	be prepared in consultation with DRG, Resources Regulator, OEH, DSC, WaterNSW and DoI;	Section 2.1 Appendix C – Letters of Consultation
13H(iii)	include detailed plans of existing and proposed first and second workings and overlying surface features, including any applicable adaptive management measures;	Section 7 Volume 5 – Graphical Plans
13H(iv)	include adequate consideration of mine roof and floor conditions, pillar width to height ratio, final pillar design dimensions and the long-term stability of pillars which has been undertaken in consultation with the Resources Regulator;	Section 2.1.2, Section 3.3 Appendix E – Coal Resource Recovery Plan
13H(v)	provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent;	Section 3.5 Appendix A – Subsidence Predictions Report
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 3.4.2, Section 3.5, Section 3.6, Section 5, Appendix D – Master TARP Appendix E – Coal Resource Recovery Plan Volumes 2-4 – Key Component Plans and Supporting Documents
13H(vii)	include a:	See below
13H(vii)(a)	Subsidence Monitoring Program which has been prepared in consultation with the Resources Regulator to:	Section 5 Volume 4 – Subsidence Monitoring Program
	• describe the ongoing conventional and non-conventional subsidence monitoring program;	
	• provide data to assist with the management of risks associated with conventional and non-conventional subsidence;	
	• validate the conventional and non-conventional subsidence predictions;	
	• analyse the relationship between the predicted and resulting conventional and non-conventional subsidence effects and predicted and resulting impacts under the plan and any ensuring environmental consequences; and	
	• inform the adaptive management process;	
13H(vii)(b)	Built Features Management Plan which has been prepared in consultation with the Resources Regulator, to manage the potential subsidence impacts of the proposed underground workings on built features, and which:	Section 4.7 Volume 4 – BFMP
	• has been prepared in consultation with the owners of potentially affected features;	

Condition	Condition Requirement	Section Addressed
	• addresses in appropriate detail all items of key public infrastructure (with particular consideration of transmission lines and towers (including angle towers), other public infrastructure and all classes of other built features;	
	• recommends appropriate pre-mining mitigation measures to reduce subsidence impacts;	
	• recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner; and	
	• in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure;	
13H(vii)I	Water Management Plan which has been prepared in consultation with EPA, DoI, Resources Regulator and WaterNSW, which provides for the management of potential impacts and environmental consequences of the proposed underground workings on watercourses and aquifers, including:	Section 4.3 Volume 2 – WMP
	• detailed baseline data on: - surface water flows and quality in watercourses and/or water bodies that could be affected by subsidence; and – groundwater levels, yield and quality in the region, including for privately-owned licensed bores;	
	• surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;	
	• a surface water monitoring program to monitor and report on: - stream flows and quality; - stream and riparian vegetation health; and - channel and bank stability;	
	• a groundwater monitoring program to monitor and report on: - springs, their discharge quantity and quality, as well as associated groundwater dependent ecosystems; - groundwater inflows to the underground mining operations; - the height of groundwater depressurization; - background changes in groundwater yield/quality against mine-induced changes, in particular, on groundwater bore users in the vicinity of the site; - permeability, hydraulic gradient, flow direction and connectivity of the deep and shallow groundwater aquifers;	
	• a flood management protocol to: - identify secondary access routes for those properties that could potentially be adversely impacted by 1% AEP flood events; - regularly consult with landowners that would not have either a primary or secondary access route during 1% AEP flood events;	

Condition	Condition Requirement	Section Addressed
	- provide up-to-date information (including subsidence and flooding predictions) to the State Emergency Service and Council regarding privately-owned residences that could be adversely affected by lack of access during 1% AEP flood events; and - work with landowners, State Emergency Service and Council to develop evacuation plans to ensure landowners know what to do in the event of emergency as a result of a 1% AEP flood event;	
	• a description of any adaptive management practices implemented to guide future mining activities in the event of greater than predicted impacts on aquatic habitat;	
	• a program to validate the surface water and groundwater models for the development, and compare monitoring results with modelled predictions; and	
	• a plan to respond to any exceedances of the surface water and groundwater assessment criteria;	
13H(vii)(d)	Biodiversity Management Plan which has been prepared in consultation with OEH, which establishes a baseline data for the existing habitat on the site, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of potential impacts and environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, EECs and groundwater dependent ecosystems	Section 4.5 Volume 3 – BMP
13H(vii)I	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 enterprises	Section 4.4 Volume 2 – LMP
13H(vii)(f)	Heritage Management Plan which has been prepared in consultation with OEH and relevant stakeholders for heritage items which provides for the management of potential environmental consequences of the proposed second workings on heritage items;	Section 4.6 Volume 3 – HMP
13H(vii)(g)	Public Safety Management Plan which has been prepared in consultation with the Resources Regulator, which ensures public safety and manages access on the site;	Section 4.8 Volume 4 – PSMP
13H(vii)(h)	Trigger Action Response Plan/s addressing all features in Table 1 and Table 2, which contain:	Section 3.6.2 Appendix D – Master TARP
	• appropriate triggers to warn of increased risk of exceedance of any performance measure; and	Section 3.6.2 Appendix D – Master TARP
	• specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded;	Section 3.6.3 Appendix D – Master TARP
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures; and	Section 3.6.3

Condition	Condition Requirement	Section Addressed
	• 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; and	Section 3.6.4
13H(vii)(i)	Contingency Plan that expressly provides for:	Section 3.6.3 Appendix D – Master TARP
	• 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	Section 3.6.4
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; and	Section 3.6.3
	• includes a program to collect sufficient baseline data for future Extraction Plans.	Section 5.4 Volume 4 – Subsidence Monitoring Program
13I	The Applicant must not undertake second workings following the extraction of Longwall 32 except in accordance with an Extraction Plan approved by the Secretary and must implement Extraction Plans as approved by the Secretary. Notes: • The preparation and implementation of Extraction Plans may be staged, with each plan covering a defined area of underground workings. In addition, these plans are only required to contain management plans that are relevant to the specific underground workings that are being carried out. • The burden of proof that any declines in performance of privately-owned registered bores and wells were not due to mining impacts rests with the Applicant.	Noted.
Payment of Reasonable Costs		
13J	The Applicant must pay all reasonable costs incurred by the Department to engage a suitably qualified, experienced and independent person/s to review the adequacy of any aspect of an Extraction Plan.	Noted.

Note: * As there is no Appendix 7 in DA 67/98 Modification 4, it is interpreted that this refers to Aboriginal heritage sites listed on the Aboriginal Heritage Information Management System, *Wollondilly Local Environmental Plan 2011*, State Heritage Register, and the Australian Heritage Database.

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.

In addition to the requirements in DA 67/98 specific to the preparation of this Extraction Plan, **Table 3-3** also provides a summary of additional requirements listed in DA 57/93 and DA 67/98 that are applicable to this Extraction Plan.

Table 3-3 Additional Development Consent Requirements for this Extraction Plan

Condition	Condition Requirement	Tahmoor Coal Response / Section Addressed
DA 57/93		
51	The applicant shall:	See below.
	(a) Set up and participate in a community liaison programme upon gaining development consent, in order to provide periodically updated information on the progress of mining and explaining. Predicted and measured mining induced subsidence effects on residences and land;	An ongoing community consultation program has been established.
	(b) Prior to commencement of longwall mining, in any approval granted by the Department of Mineral Resources, negotiate with the Mine Subsidence Board and the Council as to the most appropriate means to provide a community information service to respond to queries on subsidence, to provide expert advice on specific housing and land within approved mining areas, and the provision of general advice on subsidence effects, the rights of owners of improvements in making a claim for compensation for subsidence or vibration induced damage to improvements and the rights of review and appeal concerning Mine Subsidence Board decisions; and	Communication with WSC, SA NSW and the TCCCC is ongoing through subsidence management planning, impact investigation and repair. Resident Information Packs have been distributed to all properties providing general advice of on subsidence effects, the rights of owners of improvements in making a claim for compensation for subsidence or vibration induced damage to improvements rights of review and appeal concerning SA NSW decisions.
	(c) Provide a representative for an annual liaison meeting of government agencies and council to discuss the results of subsidence monitoring, future mining proposals and study technical issues relevant to subsidence damage.	A representative is available to attend any annual liaison meeting.
52	The applicant shall carry out subsidence monitoring according to the requirements of the Department of Mineral Resources and taking into consideration the advice of the annual liaison meeting. The applicant shall report the results of subsidence monitoring into an annual environmental management plan report and such results shall be publicly accessible through the council.	Managed through the Extraction Plan process. Subsidence monitoring results will be summarised in the Tahmoor Colliery Annual Review and made available on the Tahmoor Coal website.

Condition	Condition Requirement	Tahmoor Coal Response / Section Addressed
DA 67/98		
8	The Applicant shall ensure that all statutory requirements, including all relevant legislation, Regulations, Australian Standards, Codes, Guidelines and Notices, Conditions and Directions of the Council and relevant government agencies are met and approvals obtained.	All known conditions and regulatory requirements are dealt with in this Extraction Plan.
14	The Applicant shall prepare and implement a plan to monitor and manage any subsidence impacts on septic tanks or package sewage treatment plants. The plan must be prepared to the satisfaction of the Secretary and in consultation with Council. The Applicant must implement the plan as approved by the Secretary.	Addressed in the BFMPs.
15(i)	The Applicant must notify each relevant landowner/occupier under whose property it intends to commence first workings at least one (1) month prior to commencement of such workings; and	Landowners were notified regarding first workings for LW W1 on 4 January 2018.
15(ii)	The Applicant must notify in writing each landowner/occupier within a 35 degree angle of draw of its intentions to proceed with second workings at least three (3) months prior to making an application to DRG for approval of a Subsidence Management Plan or application to the Secretary for the approval of an Extraction Plan.	This notice has been provided to all landholders / residents in the LW W1-W2 Study Area. Refer to Section 2.1.2
16	If determined necessary by DRG or the Secretary, the Applicant shall cause a pre-mining structural inspection to be carried out on substantial improvements on land identified by the DRG or the Secretary at least one month prior to commencement of second workings taking place that may cause subsidence impacts on the relevant property. These inspections must: • be conducted with the consent of the landowner/occupier and in consultation with SA NSW; • include a report prepared on the structural integrity of all buildings in their entirety (including roofs, ceilings, openings, foundations and household sewage treatment and disposal systems); • be conducted by an independent and technically qualified person; • include permanent reference marks on each corner of all substantial improvements with level tied to Australian Height Datum to a stable point in the area; and • include soil sampling for moisture content and soil type as appropriate. A copy of the inspection report shall be provided to the landowner/occupier upon completion.	Community members are encouraged to have pre-mining inspections undertaken by Tahmoor Coal and/or SA NSW prior to commencement of subsidence. Tahmoor Coal will also undertake structural inspections of all structures identified as possibly prone to major subsidence impacts. Subsidence management plans for structures take into account mitigation, monitoring and management of subsidence impacts and management plans developed in consultation with SA NSW.

Condition	Condition Requirement	Tahmoor Coal Response / Section Addressed
17	Where a pre-mining structural inspection under Condition 16 involves a building identified in the Wollondilly Heritage Study the report must be prepared with the assistance of a qualified heritage expert. The Secretary may also require such a report on a building which is not identified in the Wollondilly Heritage Study be prepared with the assistance of a qualified heritage expert if the Secretary is satisfied, on the basis of available information, that the building may be older than 50 years and have heritage significance. Prior notice of such inspections must be provided to the Secretary by the Applicant to enable a decision to be made. Note: Structural inspections by the Applicant are in addition to any premining surveys conducted by the Mine Subsidence Board.	All identified local heritage items in the LEP and state heritage items from the State Heritage Register have been inspected by qualified heritage experts as part of the SMP Application process.
29	Prior to commencement of mining the Applicant must comply with the statutory requirements of NPWS in relation to works affecting Aboriginal sites.	If necessary, Tahmoor Coal will apply for an Aboriginal Heritage Impact Permit from OEH prior to subsidence affecting the identified objects or sites.
30	If the Applicant becomes aware of any heritage or archaeological material that may be affected by mining or subsidence, all work likely to affect the material must cease immediately and the relevant authorities consulted about an appropriate course of action prior to recommencement of work. The relevant authorities may include NPWS, OEH, the Heritage Office, and the Local Aboriginal Land Council. Any necessary permits or consents must be obtained and complied with prior to recommencement of work	Managements measures have been included in the HMP if potential or actual archaeological objects or sites are identified.
31	The Applicant must provide funding to Council for independent counselling services for landowners who may request support on stress-related matters resulting from the development. These counselling services shall be available to landowners from two years prior to mining of longwall panels that affect the landowner's property and until three years after completion of mining of longwall panels that affect the landowner's property.	Free confidential counselling service currently available to all residents and landowners impacted by mining to the satisfaction of Wollondilly Shire Council. Ongoing to completion of mine closure.

There were no relevant commitments from the Statement of Commitments in Appendix 3 of DA 67/98 for this Extraction Plan.

3.2.2 Mining Lease Conditions

The LW W1-W2 Extraction Plan Study Area is associated with two approved ML held by Tahmoor Coal: ML 1376 and ML 1539 (refer to **Figure 1-2**).

ML 1376 was granted on 28 August 1995 following the receipt of development consent in 1994 from the Land and Environment Court (DA 57/93). This ML covers the DA 57/93 Application Area, which is predominantly rural area. This ML expired in 28 August 2016 and a request for renewal has been submitted, this ML still remains current until the new ML is issued.

ML 1539 was granted on 16 June 2003 following the receipt of development consent in 1999 from the Minister for Urban Affairs and Planning (DA 67/98). This ML covers the DA 67/98 Application Area, which consists predominantly of railway land and certain urban areas. This ML will expire on 15 June 2024.

Table 3-4 outlines the mining lease conditions relating directly to subsidence management from ML 1376 and ML 1539.

Table 3-4 Mining Lease Conditions Relevant to this Extraction Plan

Mining Lease	Condition Number	Condition Requirement	Tahmoor Coal Response / Section Addressed
Methods of Operation / Extraction of Coal			
ML 1376	1	The registered/lease holder shall extract as large a percentage of the coal in the subject area as is possible consistent with the, provisions of the *Coal Mines Regulation Act 1982* and the regulations thereunder and shall comply with any direction which may be given in this regard by the Minister.	The maximum amount of coal will be extracted as allowed by safety, geological, financial and Extraction Plan constraints. Addressed in the Coal Resource Recovery Plan.
ML 1539	1		
Barriers			
ML 1376	2	The lease holder shall not work or cause to be worked any seam of coal within the subject area without leaving, if the Minister so directs, a barrier of such width or a protective pillar or pillars of such size or sizes against any surface improvements or any feature whether natural or artificial.	Coal barriers will be maintained in accordance with Minister's directions. Addressed in the Coal Resource Recovery Plan.
ML 1376	3	The lease holder unless with the consent of the Minister and subject to such conditions as the Minister may impose shall not work or cause to be worked any seam of coal by underground methods within the barrier defined as follows:- The land in the subject area within the zone adjacent to the Main Southern Line or the Mittagong – Picton Loop Line of the State Railway enclosed by an angle of draw of 35^0 from the vertical plane of the boundary parallel to and thirty (30) m horizontally distant from either side of the railway lands, such angle of draw being measured outwards from the point on the vertical plane of the said boundary at the surface or at the level of the horizontal plane of the railway track, whichever may be the higher, to the floor of the coal seam in which mining operations are being carried out.	Coal will be extracted from beneath the Picton-Mittagong Loop Line in accordance with DA 67/98 and approved Extraction Plan requirements.
ML 1539	11		

Mining Lease	Condition Number	Condition Requirement	Tahmoor Coal Response / Section Addressed
Management and Rehabilitation of Lands (General)			
ML 1376 ML 1539	10 19	The lease holder shall observe any instruction given or which may be given by the Minister with a view to minimising or preventing public inconvenience or damage to public or private property.	Instructions can be given through the Extraction Plan process and will be complied with. Addressed in the: • BFMP; and • LMP.
ML 1376	11	Subject to any specific condition of this authority providing for rehabilitation or any particular part of the subject area affected by mining or activities associated therewith, the lease holder shall: • Shape and revegetate to the satisfaction of the Minister, any part of the subject area that may, in the opinion of the Minister have been damaged or deleteriously affected by mining operations and ensure such areas are permanently stabilized, and, • Reinstate and make safe, including sealing and/or fencing, any excavation within the subject area.	Instructions can be given through the Extraction Plan process and will be complied with. Addressed in the: • BFMP; and • LMP.
ML 1376 ML 1539	12 20	If required to do so by the Minister and within such time as may be stipulated by the Minister the lease holder shall carry out to the satisfaction of the Minister surveys of structures, buildings and pipelines on adjacent land holdings to determine the effect of operations on any such structures, buildings and pipelines.	Instructions can be given through the Extraction Plan process and will be complied with. Addressed in the: • Subsidence Monitoring Program; and • BFMP
ML 1376 ML 1539	14 23	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister any lands within the subject area which may have been disturbed by the lease holder.	Such a direction can be given through the Extraction Plan process. Addressed in the: • BFMP; • WMP; • LMP; • BMP; and • HMP.
ML 1376	16	If so directed by the Minister the lease holder shall rehabilitate to the satisfaction of the Minister and within such time as may be allowed by the Minister any lands within the subject area which may have been disturbed by mining or prospecting operations whether such operations were or were not carried out by the lease holder.	Such a direction can be given through the Extraction Plan process. Addressed in the: • BFMP; • WMP; • LMP; • BMP; and • HMP.

Mining Lease	Condition Number	Condition Requirement	Tahmoor Coal Response / Section Addressed
Roads			
ML 1376 ML 1539	31 31	The lease holder shall pay to Wollondilly Shire Council, Department of Land and water Conservation or the Chief Executive, Roads and Traffic Authority the cost incurred by such Councilor Department or Chief Executive of making good any damage caused by operations carried on by or under the authority of the lease holder to any road adjoining or traversing the surface or the excepted surface, as the case may be of the subject area. PROVIDED HOWEVER that the amount to be paid by the lease holder as aforesaid shall be reduced by such sum of money if any as may be paid to the said Council the Department of Land and Water Conservation or the Chief Executive, Roads and Traffic Authority as the case may be from the Mine Subsidence Compensation Fund constituted under the *Mine Subsidence Compensation Act 1961*, in settlement of a claim for compensation for the same damage.	All man-made surface improvements are covered by the SA NSW and will be repaired as required. Tahmoor Coal will cover financial losses such as business interruption, vegetation replacement, soil erosion etc as part of the Mining Act's compensable loss provisions. Addressed in the BFMP.
Catchment Areas			
ML 1376	33	The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent the contamination, pollution, erosion or siltation of any stream or watercourse or catchment area and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution or siltation of any stream watercourse or catchment area.	Addressed in the WMP.
Transmission Lines, Communication Lines and Pipelines			
ML 1376 ML 1539	35 41	The lease holder shall as far as is practicable so conduct operations as not to interfere with or impair the stability or efficiency of any transmission line, communication line or pipeline traversing the surface or the excepted surface of the subject area and shall comply with any direction given or which may be given by the Minister in this regard.	The BFMP provides for the management of electrical infrastructure, telecommunications infrastructure, gas infrastructure, potable water infrastructure, and sewerage infrastructure.
Aboriginal Place or Relic			
ML 1376 ML 1539	36 43	The lease holder shall not knowingly destroy, deface or damage any aboriginal place or relic within the subject area except in accordance with an authority issued under the *National Parks and Wildlife Act 1974*, and shall take every precaution in drilling, excavating or disturbing the land against any such destruction, defacement or damage.	Addressed in the HMP.

Mining Lease	Condition Number	Condition Requirement	Tahmoor Coal Response / Section Addressed
Special Conditions			
ML 1376	47	Prior to the commencement of "second working" extraction lease holder shall give three (3) months written notice of intention to carry out such mining to the owners of overlying land on which there are substantial improvements.	This notice has been provided to all landholders / residents in the LW W1-W2 Study Area. Refer to Section 2.1.2
ML 1539	57		

3.2.3 Environmental Licences

Tahmoor Mine operates under EPL 1389, which is concerned with pit top operations and permits coal works, mining for coal and sewerage treatment processing by small plants.

An Annual Return stating Tahmoor Mine's compliance with the conditions of EPL 1389 and summarising monitoring results and complaints is completed and submitted to the EPA by 28 February of each year. Each Annual Review is lodged via the EPL portal.

3.2.4 Work, Health and Safety Legislations

Tahmoor Coal has developed a Health and Safety Management Plan (TAH-HSEC-00189) that integrates plans, policies and procedures that enables a systematic approach to establishing and maintaining effective systems to manage health and safety consistent with WHS legislation.

Tahmoor Mine has planned so that LW W1-W2 will meet all the requirements of the following Work Health and Safety (WHS) Legislation:

- *Work Health and Safety Act 2011 (*WHS Act);
- *Work Health and Safety Regulation 2017* (WHS Regulation);
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013* (WHSMP Act); and
- *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (WHSMP Regulation).

The WHS Act and WHS Regulations came into force on 1 January 2012. The WHS Act, is the primary piece of legislation dealing with the health and safety of workers in NSW. The WHSMP Act and WHSMP Regulations apply to all mining workplaces in NSW and commenced on 1 February 2015. These laws support the WHS Act and WHS Regulation and provide additional provisions for work health and safety issues unique to mines and petroleum sites.

This Extraction Plan has been prepared to address the relevant requirements of the WHS legislation, principally within the context of subsidence related risks to public safety with regards to private property and public infrastructure.

Details regarding the compliance with the relevant requirements of the WHS Regulations and WHSMP Regulations are provided in **Table 3-5**, as well as being discussed in the PSMP.

WHS Requirements for Persons Conducting a Business or Undertaking

In accordance with Section 19 of the WHS Act, 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, so far as is reasonably practicable. PCBUs must also ensure, so far as is reasonably practicable, the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.

Under Clause 9(1) of the WHSMP Regulation, a PCBU at a mine, including the Mine Operator, must manage risks to health and safety associated with the mining operations in accordance with Part 3.1 of the WHS Regulation. Specifically, Clause 67(1) of the WHSMP Regulation requires the operator of an underground coal mine to (in complying with Clause 9) manage risks to health and safety associated with subsidence at the mine. Clause 67(2) of the WHSMP Regulation outlines specific requirements regarding subsidence including monitoring, investigation and reporting.

The Mine Operator's responsibilities include developing and implementing the Health and Safety Management Plan (TAH-HSEC-00189) that is used as the primary means of ensuring, so far as is reasonably practicable that the above discussed PCBU duty of care.

Details regarding the compliance with the relevant requirements of the WHS Regulations and WHSMP Regulations are provided in **Table 3-5**, as well as being discussed in the PSMP.

Subsidence as a Principal Hazard

According to Clause 5 of the WHSMP Regulation provides the definition of a principal hazard as:

> *"…any activity, process, procedure, plant, structure, substance, situation or other circumstance*
> *relating to the carrying out of:*
>
> *(a) mining operations that have a reasonable potential to result in multiple deaths in a single incident or a series of recurring incidents in relation to any of the following:*
> *(vi) subsidence,"*

In accordance with Table 1 in Condition 13A of DA 67/98, all first workings for Longwalls 33 (equivalent to LW W1) and subsequent longwalls are required to be designed to remain stable and non-subsiding in the long-term, except insofar as they may be impacted by approved second workings. While it is not considered that there is reasonable potential for a subsidence incident to cause multiple deaths, Tahmoor Coal has prepared this Extraction Plan generally in accordance with the relevant WHS legislation and guidelines as outlined further below and detailed in **Table 3-5** and the PSMP.

Under Clauses 23(1) and 23(2) of the WHSMP Regulation, the Mine Operator must identify all principal mining hazards associated with mining operations and conduct a risk assessment in relation to each principal hazard identified that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with each principal hazard. Tahmoor Coal has prepared a risk assessment to identify and assess principal hazards and controls in relation to subsidence as discussed further in **Section 4.2**, **Table 3-5**, and the PSMP.

Table 3-5 Work Health and Safety Legislation Compliance

WHS Legislation and Clause	Condition Requirement	Section Addressed
WHS Regulations		
Clause 34	**Duty to identify hazards** A duty holder, in managing risks to health and safety, must identify reasonably foreseeable hazards that could give rise to risks to health and safety.	Section 4.2 PSMP
Clause 35	**Managing risks to health and safety** A duty holder, in managing risks to health and safety, must: (a) eliminate risks to health and safety so far as is reasonably practicable, and (b) if it is not reasonably practicable to eliminate risks to health and safety, minimise those risks so far as is reasonably practicable.	Section 3.6 Section 6 of WMP, LMP, BMP and HMP.
Clause 36	**Hierarchy of control measures** (1) This clause applies if it is not reasonably practicable for a duty holder to eliminate risks to health and safety. (2) A duty holder, in minimising risks to health and safety, must implement risk control measures in accordance with this clause. (3) The duty holder must minimise risks, so far as is reasonably practicable, by doing 1 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. (4) If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls. (5) 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. Note. 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.	Section 4.2, Section 3.6 PSMP Section 6 of WMP, LMP, BMP and HMP.
Clause 37	**Maintenance of control measures** A duty holder who implements a control measure to eliminate or minimise risks to health and safety must ensure that the control measure is, and is maintained so that it remains, effective, including by ensuring that the control measure is and remains: (a) fit for purpose, and (b) suitable for the nature and duration of the work, and (c) installed, set up and used correctly.	Section 3.6 Section 6 of WMP, LMP, BMP and HMP.

WHS Legislation and Clause	Condition Requirement	Section Addressed
Clause 38	**Review of control measures** (1) A duty holder must review and as necessary revise control measures implemented under this Regulation so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health or safety. (2) Without limiting subclause (1), the duty holder must review and as necessary revise a control measure in the following circumstances: (a) the control measure does not control the risk it was implemented to control so far as is reasonably practicable, (b) before a change at the workplace that is likely to give rise to a new or different risk to health or safety that the measure may not effectively control, (c) a new relevant hazard or risk is identified, (d) the results of consultation by the duty holder under the Act or this Regulation indicate that a review is necessary, (e) a health and safety representative requests a review under subclause (4). (3) Without limiting subclause (2) (b), a change at the workplace includes: (a) a change to the workplace itself or any aspect of the work environment, or (b) a change to a system of work, a process or a procedure. (4) A health and safety representative for workers at a workplace may request a review of a control measure if the representative reasonably believes that: (a) a circumstance referred to in subclause (2) (a), (b), (c) or (d) affects or may affect the health and safety of a member of the work group represented by the health and safety representative, and (b) the duty holder has not adequately reviewed the control measure in response to the circumstance.	Section 4.2, Section 3.6 PSMP Section 6 of WMP, LMP, BMP and HMP.
WHSMP Regulations		
Clause 9	**Management of risks to health and safety (cl 617 model WHS Regulations)** (1) A person conducting a business or undertaking at a mine must manage risks to health and safety associated with mining operations at the mine in accordance with Part 3.1 of the WHS Regulations. (2) A person conducting a business or undertaking at a mine must ensure that a risk assessment is conducted in accordance with this clause by a person who is competent to conduct the particular risk assessment having regard to the nature of the hazard.	Section 4.2 PSMP

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(3) In conducting a risk assessment, the person must have regard to: (a) the nature of the hazard, and (b) the likelihood of the hazard affecting the health or safety of a person, and I the severity of the potential health and safety consequences. (4) Nothing in subclause (3) limits the operation of any other requirement to conduct a risk assessment under this Regulation. (5) A person conducting a business or undertaking at a mine (who is the mine operator of the mine or who is a contractor) must keep a record of the following: (a) each risk assessment conducted under this clause and the name and competency of the person who conducted the risk assessment, (b) the control measures implemented to eliminate or minimise any risk that was identified through any such risk assessment. (6) A person conducting a business or undertaking at a mine is not required to keep a record of a risk assessment if: (a) the risk assessment is one that an individual worker is required to carry out before commencing a particular task, and (b) the person keeps a record of risk assessments that addresses the overall activity being undertaken (of which the task forms a part) such as risk assessments carried out in relation to the development of the safety management system for the mine or for a principal mining hazard management plan. (7) The record kept under subclause (5): (a) if kept by a mine operator—forms part of the safety management system of the mine and the records of the mine, or (b) if kept by a contractor who has prepared a contractor health and safety management plan—forms part of the plan.	

WHS Legislation and Clause	Condition Requirement	Section Addressed
Clause 10	**Review of control measures (cl 618 model WHS Regulations)** (1) A person conducting a business or undertaking at a mine must review and as necessary revise control measures implemented under clause 9 in the following circumstances: (a) an audit of the effectiveness of the safety management system for the mine indicates a deficiency in a control measure, (b) a worker is moved from a hazard or assigned to different work in response to a recommendation contained in a health monitoring report provided under Part 3, I an incident referred to in clause 128 occurs, (d) any other incident occurs that is required to be notified to the regulator under the WHS laws. (2) The mine operator of a mine must ensure that a control measure that is the subject of a request by a health and safety representative under clause 38 (4) of the WHS Regulations is reviewed and as necessary revised, whether the request is made to the mine operator or notified to the mine operator under subclause (3) by another person conducting a business or undertaking at the mine. (3) A person conducting a business or undertaking at the mine who is not the mine operator of the mine must immediately notify the mine operator of a request made to the person under clause 38 (4) of the WHS Regulations. (4) A health and safety representative for workers at the mine may request a review of a control measure under clause 38 (4) of the WHS Regulations as if the circumstances referred to in subclause (1) were included as a circumstance in clause 38 (4) (a) of the WHS Regulations.	Section 4.2, Section 6.1, Section 6.2 PSMP
Clause 23	**Identification of Principal Mining Hazard Management Plan** (1) The mine operator of a mine must identify all principal mining hazards associated with mining operations at the mine. (2) The mine operator must conduct, in relation to each principal mining hazard identified, a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with the principal mining hazard. (3) The mine operator, in conducting a risk assessment under subclause (2), must:	Section 4.2 PSMP

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(a) use investigation and analysis methods that are appropriate to the principal mining hazard being considered, and consider the principal mining hazard individually and also cumulatively with other hazards at the mine.	
Clause 24	**Preparation of Principal Mining Hazard Management Plan** (1) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine in accordance with this clause and Schedule 1. (2) A principal mining hazard management plan must: (a) provide for the management of all aspects of risk control in relation to the principal mining hazard, and (b) so far as is reasonably practicable, be set out and expressed in a way that is readily understandable by persons who use it. (3) A principal mining hazard management plan must: (a) describe the nature of the principal mining hazard to which the plan relates, and (b) describe how the principal mining hazard relates to other hazards associated with mining operations at the mine, and (c) describe the analysis methods used in identifying the principal mining hazard to which the plan relates, and (d) include a record of the most recent risk assessment conducted in relation to the principal mining hazard, and (e) describe the investigation and analysis methods used in determining the control measures to be implemented, and (f) describe all control measures to be implemented to manage risks to health and safety associated with the principal mining hazard, and (g) describe the arrangements in place for providing the information, training and instruction required by clause 39 of the WHS Regulations in relation to the principal mining hazard, and (h) refer to any design principles, engineering standards and technical standards relied on for control measures for the principal mining hazard, and (i) set out the reasons for adopting or rejecting each control measure considered. (4) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine:	The Principal Mining Hazard Management Plan for subsidence will be revised and updated to include LW W1-W2 prior to the commencement of extraction.

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(a) the matters set out in Schedule 1 in respect of the principal mining hazard, and any other matter relevant to managing the risks associated with the principal mining hazard at the mine.	
Clause 67	**Subsidence** (1) In complying with clause 9, the mine operator of an underground coal mine must manage risks to health and safety associated with subsidence at the mine. (2) Without limiting subclause (1), the mine operator must ensure that: (a) so far as is reasonably practicable, the rate, method, layout, schedule and sequence of mining operations do not put the health and safety of any person at risk from subsidence, and (b) monitoring of subsidence is conducted, including monitoring of its effects on relevant surface and subsurface features, and (c) any investigation of subsidence and any interpretation of subsidence information is carried out only by a competent person, and (d) all subsidence monitoring data is provided to the regulator in the form and at the times required by the regulator, and so far as is reasonably practicable, procedures are implemented for the effective consultation, co-operation and co-ordination of action with respect to subsidence between the mine operator and relevant persons conducting any business or undertaking that is, or is likely to be, affected by subsidence.	Section 3.3, Section 4.2, Section 5, Master TARP (Appendix D) PSMP
Clause 128	**Duty to notify regulator of certain incidents** (1) The operator of a mine or petroleum site must take all reasonable steps to ensure that the regulator is notified in accordance with this clause after becoming aware of an incident (other than a notifiable incident) arising out of the carrying out of mining operations or petroleum operations at the mine or petroleum site, but only if the incident: (a) results in illness or injury that requires medical treatment within the meaning of clause 13 of Schedule 9, or (b) is a high potential incident. (5) In this clause:	Section 6.1, Master TARP (Appendix D) PSMP

WHS Legislation and Clause	Condition Requirement	Section Addressed
	High potential incident means any of the following: (m) any indication from monitoring data of the development of subsidence which may result in any incident referred to in clause: • 179 (a) (xvi) – a failure of ground, or of slope stability control measures, or • 179 (a) (xvii) – rock falls, instability of cliffs, steep slopes or natural dams, occurrence of sinkholes, development of surface cracking or deformations or release of gas at the surface, due to subsidence.	
Schedule 1 Subsidence Clause 3C	**Principal Hazard Management Plans – additional matters to be considered** *Subsidence* The following matters must be considered in developing the control measures to manage the risks of subsidence: (a) the characteristics of all relevant surface and subsurface features, (b) the characteristics of all relevant geological, hydrogeological, hydrological, geotechnical, topographic and climatic conditions, including any conditions that may cause elevated or abnormal subsidence or the formation of sinkholes, (c) the characteristics of any previously excavated or abandoned workings that may interact with any proposed or existing mine workings, (d) the existence, distribution, geometry and stability of significant voids, standing pillars or remnants within any old pillar workings that may interact with any proposed or existing mine workings, (e) the predicted and actual nature, magnitude, distribution, timing and duration of subsidence, (f) the rate, method, layout, schedule and sequence of mining operations.	Subsidence Predictions Report (Appendix A) Master TARP (Appendix D)
Schedule 3 Clause 16	**High Risk Activities** *Secondary extraction or pillar extraction, splitting or reduction* (1) The following are identified as high risk activities: (a) secondary extraction by longwall mining, shortwall mining or miniwall mining, (b) pillar extraction, I pillar splitting, (d) pillar reduction. (2) The waiting period for any such activity is 3 months. (3) The information and documents that must be provided in relation to any such activity are as follows: (a) details of the authoritative sources used in determining that the proposed method of work can be done safely,	A High Risk Activity Notification, as required by WHS Regulation, will be submitted separately to this Extraction Plan, prior to the commencement of secondary extraction.

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(b) engineering plans showing the manner and sequence of extraction, endorsed by the individual nominated to exercise the statutory function of mining engineering manager at the mine, (c) information about the land above or in the vicinity of the proposed activity including land use and details of who owns or occupies any land that may be affected by subsidence, (d) in the case of a pillar extraction, details of the procedures for the recovery of buried and immobile mining plant in or around a goaf, (e) details of how the risks to the health and safety of workers and other persons from subsidence caused by the activity will be managed.	

Principal Hazard Management Plan

Under Clause 24 of the WHSMP Regulation, the Mine Operator must prepare a Principal Hazard Management Plan for each principal hazard associated with mining operations in accordance with Clause 24 and Schedule 1. The Principal Hazard Management Plan for subsidence will be revised and updated to include LW W1-W2 prior to the commencement of secondary extraction of LW W1.

High Risk Activity

A Mine Operator must give notice of a High Risk Activity to the regulator and ensure that the requirements of Clause 33 and Schedule 3 of the WHSMP Regulation are complied with. In Schedule 3 of the WHSMP Regulation, there are three High Risk Activities that relate to subsidence:

- Clause 16 – Secondary extraction or pillar extraction, splitting or reduction;
- Clause 17 – Shallow depth of cover mining; and
- Clause 28 – Highwall mining.

Mining of LW W1-W2 involves secondary extraction, therefore it is considered a High Risk Activity under Schedule 3, Clause 16 of the WHSMP Regulation. A High Risk Activity Notification, as required by WHS Regulation, will be submitted separately to this Extraction Plan, prior to the commencement of secondary extraction of LW W1.

Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation

To assist Mine Operators in complying with their obligations under the WHS laws relevant to subsidence, the NSW Department of Industry – Resources Regulator released the document Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation (Department of Industry – Resources Regulator, 2017). This Extraction Plan has been prepared in accordance with the requirements of the Guideline.

Section 2.2.2 of the Managing Risks of Subsidence Guideline lists the surface and subsurface features which could give rise to risks to health and safety, if the features are affected by subsidence. The surface and subsurface features include:

- Public utilities (e.g. highways, railways, tunnels, bridges, air strips, electrical transmission infrastructure or pressurised gas pipelines);

- Public amenities (e.g. shopping centres, hospitals, churches, sport facilities, child care centres or schools);
- Built features other than public utilities and amenities (e.g. dwellings, factories, workshops, privately owned gas storages or surface mining voids or facilities); and
- Natural features (e.g. cliffs, steep slopes, natural caves or dams or surface of land), where subsidence may result in hazardous conditions due to instability of rock or soil masses, rock falls, landslide, fractures, sinkholes, inundation, gas release or pollution of drinking water.

A summary of the relevant natural and built features that may pose a risk to public safety, the WHS risk assessment undertaken, and the management and monitoring of subsidence in relation to public safety is addressed in the PSMP.

3.2.5 Extraction Plan Guidelines

This Extraction Plan has been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015), as summarised in **Table 3-6**.

Table 3-6 Relevant Extraction Plan Guideline Requirements

Extraction Plan Guideline	Section Detail	Section Addressed
1. Title block	A title block should be included at the beginning of the Extraction Plan, which contains the: • name of the applicant company; • name of mine; • development consent and mining lease reference numbers; • Extraction Plan title, date and reference number; and • the signature(s) of person(s) taking responsibility for the accuracy and comprehensiveness of the information contained within the plan, including an authorised representative of the lease holder and the mine manager (for the purposes of relevant safety legislation).	Page ii
2. Development of the Plan	The process of development of the Extraction Plan should be described. Most importantly, this section should address consultation undertaken by the Applicant with affected agencies and other key stakeholders, such as the owners and/or operators of both publicly and privately-owned land and infrastructure and the mine's Community Consultative Committee. This section should also describe the process of reviewing and updating the predictions of subsidence effects, subsidence impacts and environmental consequences used in previous environmental impact assessment or environmental management plan documentation relied upon by the Applicant (eg the predictions in any previous Environmental Impact Statement and/or the predictions in any previous Extraction Plan or SMP Application).	Section 2

Extraction Plan Guideline	Section Detail	Section Addressed
3. Overview	The overview section is an essential introduction to the Extraction Plan. It should accurately describe: • Mine planning and design; • Subsidence predictions; • Performance objectives and other regulatory requirements; and • Subsidence management strategies and measures.	Section 3
4. Key component plans:	The main body of the Extraction Plan primarily comprises a set of six key component plans. It is appropriate that these are presented in a particular order, even if some of the later plans deserve a particular priority due to local circumstances (eg the Built Features or Heritage Management Plans). The preferred order for these component plans is as follows: • Water Management Plan; • Land Management Plan; • Biodiversity Management Plan; • Heritage Management Plan; • Built Features Management Plan; and • Public Safety Management Plan. All six key component plans should give appropriate consideration to risk assessment and risk management.	Section 4 Volumes 2-4 – Key Component Plans and Supporting Documents
5. Subsidence Monitoring Program	The key component plans should be followed by a Subsidence Monitoring Program. This program should address two purposes. The first is to set out the program for monitoring the *subsidence effects* associated with the proposed coal extraction. The second is to summarise and consolidate the various environmental monitoring programs presented in each of the key component plans. These environmental monitoring programs should be directed towards monitoring the *subsidence impacts* and environmental consequences of mine subsidence.	Section 5 Volume 4 – Subsidence Monitoring Program
6. Implementation	This section of the Extraction Plan should address all key elements of how the plan is going to be implemented, including reporting, regular review and key responsibilities. This section should follow the structure set out below: • Reporting Framework; • Review of the Extraction Plan; • Review of other Management Plans; and • Key Responsibilities.	Section 6
7. Graphical Plans	The following plans are required as part of the application: • Plan 1 • Plan 2 • Plan 3 • Plan 4 (not required) • Plan 5 • Plan 6 • Plan 7	Section 7 Volume 5 – Graphical Plans

Extraction Plan Guideline	Section Detail	Section Addressed
8. Attachments to the Extraction Plan	All other material necessary to support the Extraction Plan should be included as Attachments or Appendices.	Appendices A-E

3.3 Mine Planning and Design

3.3.1 Proposed Mining Method

First workings (primary extraction or development mining) for LW W1-W2 utilises continuous miners and shuttle cars to develop roadways, which form the longwall panels. First workings for LW W1 commenced in March 2018.

Development mining equipment required for first workings includes, but is not limited to:

- Continuous miners;
- Shuttle cars;
- Breaker feeders;
- Auxiliary fans;
- Graders;
- Underground personnel transporters; and
- Underground load haul dumps.

Second workings (secondary extraction or longwall mining) for LW W1-W2 will utilise longwall retreat mining method to extract coal from the Bulli Coal Seam. Longwall mining is supported by continuous miner development operations. Each panel will progress in a direction towards the main headings, working north to south.

Longwall mining equipment required for second workings includes, but is not limited to:

- Longwall shearer – to cut coal from the face of the seam;
- Face conveyor – to collect sheared coal and carry it to a coal sizer and stage loader;
- Panel conveyor – to transfer the coal to a trunk conveyor in one of the main headings; and
- Hydraulic roof supports – to temporarily hold up the roof strata to provide a working space for the shearing machinery and face conveyor. After each slice of coal is removed, the hydraulic roof supports, face conveyor and shearing machinery are moved forward and the roof immediately above the seam is allowed to collapse into the void that is left as the face retreats (the goaf).

ROM coal from Tahmoor Mine is conveyed to the surface via a series of conveyor belts and discharged to the ROM Stockpile area, where the coal is reclaimed and transferred to the Coal Handling Preparation Plant (**CHPP**). At the CHPP, the ROM coal is processed by crushing, washing, sizing and dewatered and then transferred to the product coal stockpile by conveyor. Product Coal is reclaimed and transferred by conveyors to the Rail Load Out Bin, and then loaded into rail coal wagons for transport to either Port Kembla or the Port of Newcastle by rail.

Coal is mined from within the Bulli Coal Seam, producing hard coking coal for steel product coal. Product coal is marketed to Australian domestic customers and export customers.

3.3.2 Mine Design

Variations to the Approved Mine Plan

As discussed in **Section 1.1,** the Western Domain mine plan has been refined over time since the approved 1993 EIS (Kembla Coal and Coke, 1993) and the approved 1998 EIS (Olsen Environmental Consulting, 1998).

The mine plan for the Western Domain presented within the 2014 LW 31-37 SMP Application (Glencore, 2014) was further reviewed and refined during 2017. This mine design review resulted in re-orientation of longwalls in the Western Domain from a north-west to south-east orientation to a north to south orientation to avoid mining directly under streams of third order or above.

These design changes were implemented to reduce subsidence-related impacts to Matthews Creek, Cedar Creek and Stonequarry Creek, which are located along the western and northern areas of the Western Domain. According to the current mine plan, these creeks are located approximately 82 m from the closest edge of LW W1 and approximately 55m from the closest edge of LW W2. The mine plan design minimises subsidence impact risks to surface water, aquatic habitat, and Aboriginal heritage sites located along these creeks.

Mining Geometry

LW W1-W2 will be the first two longwalls of a series of four (4) longwalls in the Western Domain. LW W1-W2 are to be developed to the north from the main headings, are orientated in a north to south direction, and will be mined from north to south (**Figure 3-1**). LW W1 will be mined first, followed by LW W2.

The proposed layout for LW W1-W2 is within the footprint of the Limit of Subsidence as assessed in the 1998 EIS (Olsen Environmental Consulting, 1998).

The proposed dimensions of LW W1-W2 are outlined in **Table 3-7**. Detailed mine layout drawings are provided in **Volume 5** of this Extraction Plan including the Plans 1 to 7, as required under the *Draft Extraction Plan Guidelines V5 (*DPE, 2015).

The LW W1-W2 panels will be 283 m in width (272 m excluding first workings), with a length of 1875 km for LW W1 and 1685 km for LW W2 (including first workings). The mining height of the longwalls is anticipated to be 2.1 m and will be kept constant for the length of the longwall.

Table 3-7 Geometry of LW W1-W2

Longwall Panel Parameters	Units	LW W1	LW W2
ROM Coal Extracted	tonnes	1,934,761	1,676,406
Gate Road Width	m	5.2	5.2
Gate Road Height	m	2.7	2.7
Maingate (MG) Chain Pillar Width	m	39	39
Tailgate (TG) Chain Pillar Width	m	39	39
Pillar Width/Height Ratio		14.4	14.4
Tailgate (TG) Chain Pillar Length	m	125	125
Longwall Void Width	m	283	283
Longwall Extraction Width	m	272	272
Longwall Void Length	m	1,875	1,685
Longwall Extraction Length	m	1,866	1,676
Longwall Extraction Height	m	2.1	2.1
Coal Seam thickness	m	1.88	1.96
Minimum Depth of Cover	m	470	470
Maximum Depth of Cover	m	500	510

A further two longwalls are planned in the Western Domain (LW W3-W4) and a separate Extraction Plan will be prepared for these longwalls.

3.3.3 Geological Information

Detailed information on the geology, stratigraphy, lithology, geological structure and geotechnical considerations are outlined in the Coal Resource Recovery Plan contained within **Appendix E**.

It is noted that no significant geological structures have been identified within the Western Domain from underground workings by Tahmoor Coal.

3.3.4 Existing Workings

Tahmoor Coal has extracted coal from the Bulli Coal Seam through the operation of Tahmoor Mine since 1979. Tahmoor Mine has included the following longwall series:

- Longwalls 1 to 9 – mined from 1987 to 1992, with widths from 170 m to 200 m (void width) and length up to 1640 m;
- Longwalls 10 to 21 – mined from 1992 to 2004, with widths from 230 m to 235 m (void width) and lengths up to 2675 m; and
- Longwall 22 to 32 – mined from 2005 to present, with widths from 283 m to 285 m (void width) and lengths up to 3580 m. This longwall series was orientated in a north-west to south-east direction, and progressively mined from west to east. LW32 is currently being mined and is the last of this longwall series.

The mine is comprised of a five heading mains development configuration and numerous two heading gate road developments to establish the main and tailgates for the corresponding headwalls. Long-term mains development pillars are designed to be long-term stable and not cause subsidence, resulting in serviceable roads for the life of the mine. Gate road pillars are designed to exceed one-tenth of the overburden depth and are serviceable up until extraction.

Existing workings for both development and secondary extraction are identified in **Figure 3-1** and AO Graphical Plans 1-7 in **Volume 5**.

LW W1-W2 are located in the Western Domain and will form part of a new longwall series to the north-west of the existing and previously mined longwalls of Tahmoor Mine.

Tahmoor Mine is surrounded by numerous operating and discontinued coal mines that also target the Bulli Coal Seam. These mines include South32's Bulli Seam Operations, Tower Mine, Russell Vale Mine, and Cordeaux Mine. South32's Dendrobium Mine is situated to the south-east of Tahmoor Mine and targets the deeper Wongawilli Coal Seam (HydroSimulations, 2019).

3.3.5 Mine Schedule

An indicative mining schedule for development and secondary extraction within the LW W1-W2 Extraction Plan Study Area is provided in **Table 3-8**.

Mining of LW W1-W2 is scheduled to commence in October 2019. The two panels are anticipated to be extracted within one year and seven months, and each panel is anticipated to be extracted over a seven to ten-month period.

Development rates are budgeted to average between 8 m to 14 m per continuous miner shift, depending on geological conditions and support regime. Longwall extraction will typically produce in the order of 250 tonnes per shift. Tahmoor Coal operates seven days a week, 24 hours a day on a roster basis.

Table 3-8 Mine Schedule for LW W1-W2

Longwall Panel	Estimated Start Date	Estimated Duration (days)	Estimated Completion Date
Longwall West 1	17/10/2019	207	11/8/2020
Longwall West 2	8/09/2020	225	21/04/2021

3.3.6 Resource Recovery

Tahmoor Coal is proposing to use the longwall mining method to extract coal from the two longwall panels and the development of the main headings. Expected longwall resource recovery from the Extraction Plan Study Area is presented in **Table 3-9**.

The Bulli Coal Seam has an average thickness of 1.88 m for LW W1 and 1.96 m for LW W2.

Longwall equipment is able to cut up to a maximum seam height of 2.1 m, therefore the full seam thickness will be mined. The total recoverable reserve from the extraction area is 3,853,247 tonnes for LW W1-W2.

Table 3-9 Estimated Individual Panel Tonnages and Recovery

Longwall	Development tonnes (t)	Longwall tonnes (t)	Total tonnes (t)	Recovery
LW W1	235,905	1,934,761	2,170,666	100% of Extraction Plan Area with 68% Yield
LW W2	155,994	1,676,406	1,682,581	100% of Extraction Plan Area with 72% Yield

The proposed extraction of LW W1-W2 has no detrimental impact on the potential to mine economically recoverable coal in the remainder of the lease areas. Tahmoor Mine's overall longwall planning strategy targets summarized resource recovery within the identified constraints and the geotechnical and geological characteristics of the lease areas.

3.4 Subsidence Predictions

3.4.1 Overview

Key parameters used in the description, prediction and assessment of surface movements resulting from underground mining are subsidence, tilt, strain, curvature, valley closure, and upsidence. A glossary of subsidence terms is provided in **Section 8.3** of this Extraction Plan Main Document.

Subsidence predictions for the extraction of LW W1-W2 have been presented in the Subsidence Predictions Report by MSEC (2019; refer to **Appendix A**). The following sections provide a summary of the information contained in the report (MSEC, 2019) to provide the maximum predicted conventional subsidence parameters resulting from the extraction of the proposed LW W1-W2 in the Bulli Coal Seam.

The predicted subsidence, tilt and curvature have been obtained using the Incremental Profile Method, which has been calibrated for local conditions. The predicted strains have been determined by analysing the strains measured at Tahmoor Mine and other mines in the NSW Coalfields where the longwall width-to-depth ratios and extraction heights are similar to those for the proposed longwalls. A summary of subsidence predictions methods used to predicted subsidence parameters for the extraction of LW W1-W2 is provided in **Section 2.2.2**, and are discussed in further detail in the Subsidence Predictions Report (MSEC, 2019; **Appendix A**).

The maximum predicted subsidence parameters and the predicted subsidence contours describe and show the conventional movements. These predicted subsidence parameters do not include non-conventional movements such as valley related upsidence and closure movements, nor the effects of faults and other geological structures. Such effects have been addressed separately in the Subsidence Predictions Report for each environmental and built feature provided in Chapters 5 and 6 of **Appendix A**.

Subsidence impact predictions have been used in the various Key Component Plans and associated documents to determine the appropriate management of the relevant environmental and built features. **Table 3-1** provides a summary of the environmental and built features considered and the relevant Key Component Plans and associated documents that discuss and manage these features.

3.4.2 First Workings

The underground workings proposed are consistent with the proven success of the pillar geometries previously employed at Tahmoor Mine over a period of 30 years. Roof statigraphy and floor conditions are well understood and controlled by the established roadway reinforcement systems. Coal strength, from the pillar stability point of view, is expected to be undiminished in the Extraction Plan Study Area, and is complemented by rib bolting where necessary.

The parameters used for first workings at Tahmoor Coal Mine are width of 5.2 m and height of 3.5 m. The design parameters for first workings utilised at Tahmoor Mine are below the criteria for a High Risk Activity notification, as outlined within Schedule 3, Part 2, Clause 12 of the WHSMP Regulations.

The first workings for LW W1-W2 are expected to be long term stable and non-subsiding in accordance with the requirements of DA 67/98 Condition 13A Table 1. Further information on first workings is provided in the Coal Resource Recovery Plan (**Appendix E**).

3.4.3 Subsidence Prediction

A summary of the maximum predicted values of incremental vertical subsidence, tilt and curvature resulting from the proposed longwalls are provided in **Table 3-10**. The incremental parameters represent the additional movements due to the extraction of each of the proposed longwalls. The predicted incremental vertical subsidence contours are shown in Drawings Nos. MSEC1019-25 to MSEC1019-26 in **Appendix A**.

Table 3-10 Maximum Predicted Increment Conventional Subsidence, Tilt and Curvature for the Proposed Longwalls

Longwall	Maximum Predicted Incremental Vertical Subsidence (mm)	Maximum Predicted Incremental Tilt (mm/m)	Maximum Predicted Incremental Hogging Curvature (km^{-1})	Maximum Predicted Incremental Sagging Curvature (km^{-1})
LW W1	475	3.0	0.03	0.06
LW W2	650	5.0	0.06	0.11

A summary of the maximum predicted values of total vertical subsidence, tilt and curvature resulting from the extraction of the proposed longwalls is provided in **Table 3-11**. The predicted total parameters represent the accumulated movements due to the extraction of all proposed longwalls within each of the mining areas. The predicted total vertical subsidence contours are shown in Drawings Nos. MSEC1019-27 to MSEC1019-29 of **Appendix A**.

Table 3-11 Maximum Predicted Total Conventional Subsidence, Tilt and Curvature for the Proposed Longwalls

Longwall	Maximum Predicted Total Conventional Subsidence (mm)	Maximum Predicted Total Conventional Tilt (mm/m)	Maximum Predicted Total Conventional Hogging Curvature (km^{-1})	Maximum Predicted Total Conventional Sagging Curvature (km^{-1})
LW W1	475	3.0	0.03	0.06
LW W2	750	5.5	0.06	0.11

The maximum predicted total vertical subsidence of 750 mm represents 36 % of the proposed mining height of 2.1 m. The maximum predicted total tilt is 5.5 mm/m (i.e. 0.55 %, or 1 in 180) and it occurs adjacent to the main gate of LW W2. The maximum predicted total curvatures are 0.06 km^{-1} hogging and 0.11 km^{-1} sagging, which represent minimum radii of curvature of 17 km and 9 km, respectively.

The predicted conventional subsidence parameters vary across the mining area. To illustrate this variation, the predicted profiles of vertical subsidence, tilt and curvature have been determined along two prediction lines. The predicted profiles of total vertical subsidence, tilt and curvature along Prediction Lines 1 and 2 are shown in Figs. C.01 and C.02, respectively, in **Appendix A**. The locations of these prediction lines are shown in Drawings Nos. MSEC1019-25 to MSEC1019-30 in **Appendix A**.

The proposed LW W1-W2 will be extracted in a new series from the current series of LWs 22 to 32, separated by a barrier of unmined coal, except for development headings. Additional vertical settlement has been observed at Tahmoor Mine in locations above solid intact coal between previously extracted areas. While observed subsidence may exceed predictions above the coal barrier between proposed LW W1-W2 and current series of LWs 22 to 32, subsidence monitoring has shown that it is usually accompanied by relatively low conventional tilts, curvature and strains (less than 0.5 mm/m and usually within survey tolerance).

3.4.4 Strain Prediction

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 maximum strains measured in individual survey bays.

Strain Measured in Survey Bays

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 the previous longwalls at the mine, for survey bays that were located directly above goaf or the chain pillars that are located between the extracted longwalls, which has been referred to as “above goaf”.

The 95 % confidence levels for the maximum total strains that the individual survey bays above goaf experienced at any time during mining were 1.0 mm/m tensile and 1.8 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 were 1.6 mm/m tensile and 3.4 mm/m compressive.

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 the previous longwalls at the mine, for survey bays that were located outside and within 250 m of the nearest longwall goaf edge, which has been referred to as “above solid coal”.

The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 0.7 mm/m tensile and 0.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining were 1.0 mm/m tensile and 0.8 mm/m compressive.

Strain Measured along Whole Monitoring Lines

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

A total of 33 of the 61 monitoring lines (i.e. 54 %) had recorded maximum total tensile strains of 1.0 mm/m, or less, and that 57 monitoring lines (i.e. 93 %) had recorded maximum total tensile strains of 2.0 mm/m, or less. In addition, 40 of the 61 monitoring lines (i.e. 66 %) had recorded maximum compressive strains of 2.0 mm/m, or less, and that 54 of the monitoring lines (i.e. 89 %) had recorded maximum compressive strains of 4.0 mm/m, or less.

Shear Strains

The 95 % and 99 % confidence levels for the maximum total horizontal mid-ordinate deviation that the individual survey marks located above goaf experienced at any time during mining were 23 mm and 39 mm, respectively.

3.5 Performance Measures and Indicators

3.5.1 Performance Measures

Performance objectives in relation to the subsidence impacts are outlined in DA 67/98. Performance measures relating to natural and heritage features are provided in Table 1 of DA 67/98 Condition 13A, and are presented in **Table 3-12**. Performance measures relating to built features are provided in Table 2 of DA 67/98 Condition 13E, and are also presented in **Table 3-12.** These objectives have been used when developing the management strategies incorporated in this Extraction Plan.

Table 3-12 Subsidence Impact Performance Measures from DA 67/98

Feature	Performance Measures
Biodiversity	
• Threatened species, threatened populations, or endangered ecological communities	• Negligible environmental consequences.
Heritage Sites	
• Heritage sites show in the figures in Appendix 7*	• Negligible subsidence impacts or environmental consequences. • Negligible loss of heritage value.
• Other Aboriginal and heritage sites	• Negligible subsidence impacts or environmental consequences.
Mine workings	
• First workings	• To remain long term stable and non-subsiding.
• Second workings	• To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.
Key Public Infrastructure	
• Main Southern Railway; • Picton-Mittagong Loop Line; and • Electricity transmission lines and towers.	• Always safe and serviceable. • Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Other Infrastructure	
• Electricity distribution lines, poles and associated towers; • Unsealed roads and road culverts, fire trails, fences and other built features; and • Other public infrastructure.	• Always safe. • Serviceability should be maintained wherever practicable. • Loss of serviceability must be fully compensated. • Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
• Privately-owned residences	

• Other privately-owned built features and improvements, including farm dams, swimming pools, tennis courts, roads, tracks and fences	
Public Safety	
• Public Safety	• Negligible additional risk.

Note: * As there is no Appendix 7 in DA 67/98 Modification 4, it is interpreted that this refers to Aboriginal heritage sites listed on the Aboriginal Heritage Information Management System, *Wollondilly Local Environmental Plan 2011*, State Heritage Register, and the Australian Heritage Database.

3.5.2 Performance Indicators

To establish compliance with the performance measures outlined in **Table 3-12**, Tahmoor Coal has developed subsidence and environmental monitoring programs in consultation with stakeholders as detailed in **Section 5** of this Extraction Plan, and within the key component plans.

Trigger Action Response Plans (**TARP**) have been developed as part of the monitoring of performance indicators for the relevant management plans to establish an appropriate response if a performance indicator is triggered. These TARPs provide a clear defined trigger with an appropriate process and response for each trigger level, as outlined in **Table 3-13**. The TARPs are discussed further in **Section 3.6.2** and a Master TARP consolidating all the aspects is provided in **Appendix D**.

Table 3-13 Performance Indicators and TARP Risk Management Scenarios

Performance	Trigger	Action / Response
Level 1 Normal	Operations within prediction impacts.	Continued operations and monitoring as normal.
Level 2 Within Prediction	Operations within predicted impacts but exceeds or potentially exceeds predictions.	Review and investigation processes are engaged, with management / corrective actions as required.
Level 3 Exceeds Prediction	Operations exceed predicted impact.	Review and investigation processes are engaged, and management /corrective actions fully engaged.

3.6 Subsidence Management Strategies

Subsidence management at Tahmoor Mine follows the risk hierarchy approach of risk elimination (impact avoidance), substitution and mitigation, engineering controls, management and monitoring.

Subsidence management and mitigation strategies for each relevant environmental and built feature are described within the relevant management plans developed in support of the Extraction Plan outlined in **Section 4**. Further to detailed discussion in mine design (refer **Section 2.2**), the following sections provide addition discussion on impact avoidance measures, adaptive management processes, and contingency management using TARPs.

3.6.1 Avoidance

Impact avoidance (risk elimination) is the highest level of risk management control under the risk hierarchy and is the starting point for mine design wherever practicable.

There are two management strategies for avoiding or minimising the impacts to sensitive surface features as a result of mining. These are:

- Avoid mining under sensitive surface features; and/or
- Mine design under the sensitive surface features with a sub-critical void width.

As discussed in **Section 2.2**, the mine plan for LW W1-W2 has been modified since the 2014 SMP Application to avoid mining directly under streams of third order or above (Matthews Creek, Cedar Creek and Stonequarry Creek). This modification was achieved by re-orientation the longwalls in the Western Domain from a north-west to south-east orientation to a north to south orientation.

In addition, the longwalls in the Western Domain will be progressively extracted from west to east as opposed to the previously proposed sequence of east to west. From a mine subsidence perspective, the change in direction will reduce the impact of transient subsidence effects on houses within the Stonequarry Estate. In addition, this change in sequence will allow Tahmoor Coal to track mining-induced movements as the mine extends towards the Picton Railway Tunnel on the Main Southern Railway, which is a substantial and significant item of civil infrastructure.

No changes were made to pillar width as part of the latest mine plan revision.

3.6.2 Trigger Action Response Plans

Tahmoor Coal has developed TARPs for each relevant component management plan prepared to support the LW W1-W2 Extraction Plan (refer to key component plans discussed in **Section 4** of this Extraction Plan). A Master TARP consolidating all aspects from the management plans is provided in **Appendix D**.

The TARPs have been developed using the performance indicators for subsidence impacts relevant to each component management plan. The TARPs outline the assigned level of risk for each performance indicator, as described in **Table 3-13**. 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.

3.6.3 Contingency Plans

In the event that performance measures are considered to have been exceeded or are likely to be exceeded as a consequence of mining activities, a response will be undertaken in accordance with the TARPs outlined in **Appendix D**. This response is a contingency plan that describes the management / corrective actions which can be implemented where required to remedy the exceedance.

The contingency plan in the event of an exceedance of performance indicators may include:

- Management actions;
- Corrective actions;
- Preventative actions;
- Further investigations; and
- Implementation of a Corrective Management Action Plan.

If a Corrective Management Action Plan (**CMAP**) is required in accordance with the TARP, this document will be prepared in consultation with key Government agencies. The CMAP will include the following key elements:

- Investigation of the impact and root cause analysis;
- Review of monitoring data and extent of environmental consequences;
- Technical review into remediation methodology options;
- Establishment of remediation success criteria;
- Development of remediation strategy;
- Development of post-remediation review; and
- Project management administration, controls, scheduling and reporting.

The success of remediation measures that has been implemented for any TARP exceedance would be reviewed as part of any CMAP, the Annual Review (refer to **Section 6.1.5**), and the End of Panel (**EOP**) Report for each longwall.

3.6.4 Adaptive Management

As discussed in **Section 2.2.1**, the primary reason for the revision of mine design following consultation for the 2014 SMP Application was to reduce subsidence impacts to Matthews, Cedar and Stonequarry Creeks. The revised subsidence predictions (MSEC, 2019) for the current mine plan have estimated a maximum predicted total closure of 180 mm for the creeks and a 10 % predicted rate of impact for the pools along the creeks as a result of LW W1-W2 extraction.

The following adaptive management framework has been developed by Tahmoor Coal to avoid any unpredicted subsidence impacts and/or environmental consequences. With regard to LW W1-W2, this framework concerns impacts to the creeks. While Tahmoor Coal considers that the current subsidence predictions to be acceptable, further reduction of subsidence impacts and environmental consequences to the creeks as a result of LW W1-W2 extraction is desirable.

As discussed by MSEC (2019), impacts to the creeks are more likely to occur near the commencing ends of LW W1-W2 (Cedar Creek and Stonequarry Creek) and along the tailgate of LW W1 (Cedar Creek and Matthews Creek). The likelihood of fracturing and surface flow diversions is noted to increase with increasing proximity of the creeks to the proposed longwalls.

The starting position of LW W1 has been determined using mining and subsidence parameters. Any impacts to Stonequarry Creek near the commending end of LW W2 could be reduced by amending the commencing position of LW W2 so that it is further in distance from Stonequarry Creek.

Tahmoor Coal has committed to implementing a detailed monitoring program to measure and record mining induced ground movements and impacts on the streams during the mining of LW W1. A review of these observations will be undertaken after the LW W1 face has mined a sufficient distance such that the majority of mining-induced movements have occurred (after approximately 1000 m of extraction). If impacts on Cedar and Stonequarry Creek near the commencing end of LW W1 are greater than anticipated, Tahmoor Coal will consider amending the commencing position of LW W2 to further reduce the potential for impacts on Stonequarry Creek. A similar review will be undertaken during the extraction of LW W2 prior to confirming the commencing position of future LW W3.

The review will consider the observations of subsidence impacts and environmental consequences during the following monitoring activities:

- Ground monitoring;
- Visual inspection along creeks;
- Pool Level monitoring;
- Water quality monitoring; and
- Macroinvertebrate monitoring.

Criterial that will trigger the adaptive management strategy for LW W2 (and LW W3) has not yet been set, however the review of the above information will depend on the location and magnitude of the subsidence impacts and environmental consequences observed. Key criteria that will be taken into consideration during the review are likely to include:

- Exceedance of maximum valley closure predictions along Stonequarry Creek (30 mm maximum estimated valley closure) and the east-west section of Cedar Creek (180 mm maximum estimated valley closure);
- Extent of lowering of pool water level above the 10% design criteria;
- Cracking (or other subsidence impacts) to rockshelters along Cedar Creek (north of LW W1); and
- Cracking of grinding groove site along Stonequarry Creek.

This strategy will be undertaken in consultation with DPE, OEH and other relevant Government agencies.

4 Key Component Plans

4.1 Overview of Environmental Management

4.1.1 Environmental Management Strategy Framework

Tahmoor Coal has developed an Environmental Management Strategy Framework (**EMSF**) (TAH-HSEC-00173), which provides the strategic context for environmental management at Tahmoor Mine. The EMSF forms part of the broader Health, Safety, Environment and Community (**HSEC**) management systems at Tahmoor Mine and outlines how Tahmoor Coal manages environmental and community aspects, impacts and performance. The EMSF provides a framework for the standards, plans and procedures implemented to ensure operations are managed in accordance with best practice Environmental Standard

Environmental impacts at Tahmoor are managed through a combination of environmental procedures, forms and other documents to satisfy legislative and stakeholder requirements. **Figure 3-1** provides an overview of the EMSF and the documents which are part of the strategic framework for environmental management at Tahmoor Mine.

4.1.2 Overview of Key Component Plans of this Extraction Plan

The overall framework for subsidence monitoring and management of impacts of this Extraction Plan is provided in the Subsidence Monitoring Program (MSEC, 2019). This document outlines the monitoring program for the measurement of actual subsidence, and the inspection program for environmental consequences of subsidence to compare against predicted impacts to determine if actions have been triggered.

The Extraction Plan is supported by a set of individual management plans intended to manage particular environmental or built features within the Extraction Plan Study Area. The individual management plans, which have been prepared to specifically address DA 67/98 Condition 13H(vii), include:

- Water Management Plan – to manage potential environmental consequences to surface water and groundwater as a result of secondary extraction;
- Land Management Plan – to manage potential environmental consequences to landscape features and agricultural enterprises as a result of secondary extraction;
- Biodiversity Management Plan – to manage potential environmental consequences to aquatic and terrestrial biodiversity as a result of secondary extraction;
- Heritage Management Plan – to manage potential environmental consequences to Aboriginal and historical heritage as a result of secondary extraction;
- Built Features Management Plan – to manage potential environmental consequences to built feature as a result of secondary extraction. A number of sub-plans are currently in preparation to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction; and
- Public Safety Management Plan – to ensure public safety in the Extraction Plan Study Area.

If a subsidence impact or environmental consequence occurs, the required action(s) are provided in the master Trigger Action Response Plan (TARP) in **Appendix D** or the individual management plan to which the trigger refers to.

Figure 4-1 provides an overview of the environmental management plans and other environmental management documents that have been prepared to manage environmental impact resulting from LW W1-W2 extraction.

Table 3-1 provides a summary of environment and built features within the Extraction Plan Study Area and in which key component plans they are managed. The location of these features is illustrated in **Appendix E** of the Subsidence Predictions Report (MSEC, 2019) (**Appendix A**)**.**

It should be noted that:

- All environmental and built features are discussed in the Subsidence Prediction and Impact Assessment Report (MSEC, 2019);
- All monitoring measures for these features are summarised in the Subsidence Monitoring Program (MSEC, 2019); and
- The Built Features Management Plan is an umbrella document for the management of built infrastructure, and a number of sub-plans are currently in preparation to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction.

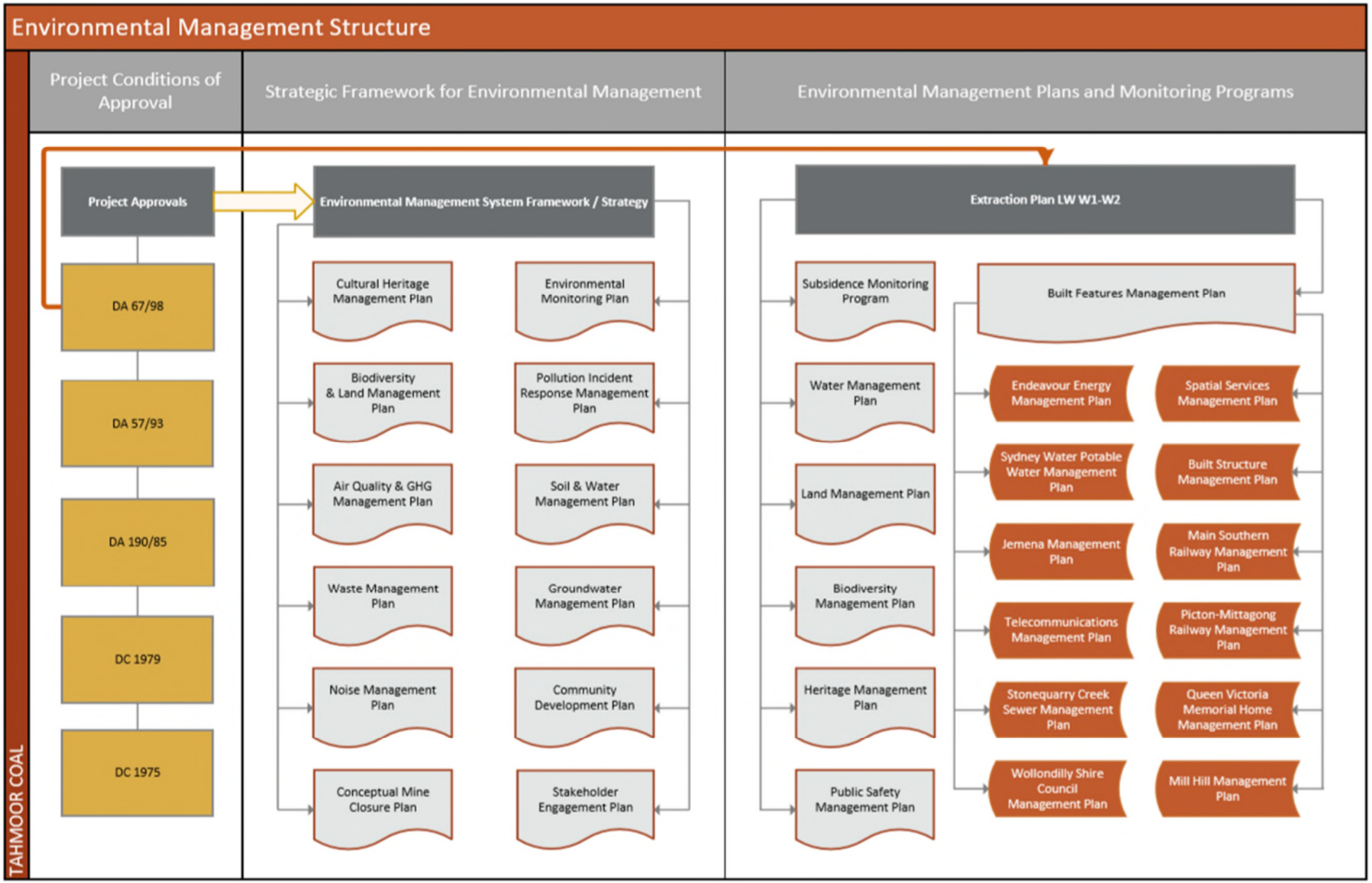

Figure 4-1 Overview of Environmental Management Structure for Tahmoor Coal

4.2 Risk Assessments

4.2.1 Completed Risk Assessments

Tahmoor Coal has completed three risk assessments regarding LW W1-W2 to date with the purpose of identifying environmental, social and safety risks associated with secondary extraction of the proposed longwalls. The risk assessments completed were:

- General Risk Assessment for LW33-34 (now referred to as LW W1-W2) held on 12 February 2019 to determine the major risks to the environment and community associated with secondary extraction of LW W1-W2, including the consideration of:
  - Approval of Extraction Plan for LW W1-W2;
  - Compliance for Aboriginal heritage, particularly if an Aboriginal Heritage Impact Permit (AHIP) is required;
  - Compliance for Historical heritage structures;
  - Compliance for waterways;
  - Impact to environmental features;
  - The Picton-Mittagong Loop Line Railway;
  - Subsidence impacts to the environment;
  - Management of infrastructure;
  - Impacts to land owners; and
  - Impacts to rural properties.
- Risk Assessment for infrastructure held on 26 April 2019 to determine the major infrastructure risks associated with secondary extraction of LW W1-W2, including the consideration of:
  - Management of infrastructure owned by Endeavour Energy (electrical), Sydney Water (potable water only), Stonequarry Wastewater Treatment Plant (sewer), Jemena (gas), Telstra (telecommunications), NBNCo (telecommunications), Wollondilly Shire Council (roads, culverts and bridges), Spatial Services (survey control marks);
  - Impacts to rural properties and structures such as built structures, pools, septic tanks, and farm dams; and
  - Historical heritage buildings including Queen Victoria Memorial Home and Mill Hill.
- Risk Assessment for environmental features held on 6 June 2019 to determine the major risks to environmental features associated with secondary extraction of LW W1-W2, including the consideration of subsidence impact to:
  - Waterways, flooding, groundwater;
  - Landscape features including cliffs, rock face features, steep slopes, agricultural capability;
  - Aquatic and terrestrial ecology; and
  - Aboriginal heritage and historical heritage.

All risk assessments were completed by members of the Environment and Community Department of Tahmoor Coal relevant technical specialists, and facilitated by a Tahmoor Coal internal facilitator. A copy of the risk assessment reports are appended to the PSMP (**Volume 4**).

The primary objectives of the risk assessments were to:

- Ensure the required approvals for the proposed longwalls are obtained in a timely manner to enable mining to commence;
- Ensure all environmental risks are appropriately eliminated or managed according to environmental legislation requirements;
- Ensure the safe and serviceable operation of all surface infrastructure and structures in the Study Area;
- Ensure the required infrastructure management plans for the proposed longwalls are approved and in place in a timely manner to manage infrastructure impacts during mining;
- Ensure that the health and safety of people who may be present in the Study Area are not put at risk due to mine subsidence; and
- Assist in the establishment of procedures to measure, monitor, control, mitigate and repair infrastructure in the Study Area.

An addition risk assessment focusing on the Picton-Mittagong Loop Line Railway is scheduled to be held in July 2019.

4.2.2 Risk Assessment Methodology

The risk assessment process is completed to satisfy Tahmoor Coal's requirements in relation to WHS and in compliance to Mining regulations and conditions and is completed in consultation with key stakeholders.

All risk assessments for LW W1-W2 were completed in accordance with:

- Risk Management (TAH-HSEC-00229) standard prepared by Tahmoor Coal, which details the 12 Step Risk Management Process for managing risk and the risk matrix used to categorise risks;
- WRAC Workplace Risk Assessment and Controls (TAH-HSEC-00014) standard prepared by Tahmoor Coal, which details the methodology for use during the risk assessment;
- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines; and
- Risk Management Handbook for the Mining Industry (MDG1010).

Risks were identified and assessed through the review of known surface and sub-surface features within the Extraction Plan Study Area. Risk assessment also drew upon the experience and results of previous risk assessments completed for previous longwalls at Tahmoor Mine.

Management of the identified risks followed the 12 Step Risk Management Process as detailed in the Risk Management (TAH-HSEC-00229) standard, and a risk ranking (low, medium, and high) was assigned to each risk according to risk classifications as detailed in the Tahmoor Coal Risk Management (TAH-HSEC-00229) standard.

4.2.3 Identification of Potential Risks

The General Risk Assessment identified a total of 19 potential risks/hazards, which included:

- 13 medium risks and six low risks;
- Nine risks associated with legal and compliance consequences, six risks associated with financial consequences, two risks associated with health and safety consequences, one risk associated with environmental consequences, and one risk associated with community and reputation consequences;

- Seven areas of identified risk were considered to be satisfactorily managed by existing controls and did not require any further control; and
- 12 areas of identified risk were considered to require additional control.

The Risk Assessment for infrastructure identified a total of 29 potential risks/hazards, which included:

- 13 medium risks and 16 low risks;
- 20 risks associated with property damage consequences, seven risks associated with health and safety consequences, and two risks associated with environmental consequences;
- One area of identified risk was considered to be satisfactorily managed by existing controls and did not require any further control; and
- 28 areas of identified risk were considered to require additional control.

The Risk Assessment for environmental features identified a total of 28 potential risks/hazards, which included:

- 10 medium risks and 18 low risks;
- 23 risks associated with environmental consequences, three risks associated with health and safety consequences, and two risks associated with property damage consequences;
- Two areas of identified risk were considered to be satisfactorily managed by existing controls and did not require any further control; and
- 26 areas of identified risk were considered to require additional control.

A program for implementation of the proposed risk control measures and procedures was identified during each risk assessment, and detailed in the risk assessment reports appended to the PSMP (**Volume 4**).

4.3 Water Management Plan

A WMP for LW W1-W2 has been prepared to identify the monitoring and management measures for surface water and groundwater resources within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved. The WMP focused on watercourses, farm dams, and groundwater. Three watercourses associated 3rd or higher stream order are located in the Study Area – Matthews Creek, Cedar Creek, and Stonequarry Creek.

The WMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)(c) (refer to **Table 2-1** of the WMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), and regulatory requirements (refer to **Section 2.2** of the WMP). The WMP was prepared in consultation with the EPA, DoI Water, NRAR, Resources Regulator, WaterNSW, SES and WSC (refer to **Section 2.1.1**).

The WMP provides information on (but not limited to) the following:

- Baseline data for surface water (water level, streamflow and water quality), and groundwater levels (**Section 3** of the WMP);
- Predicted subsidence impacts and environmental consequences to surface water and groundwater resources (**Section 4** of the WMP);
- Performance measures and performance criteria for surface water and groundwater (**Section 5.1** of the WMP);

- Surface water monitoring measures relating to daily rainfall, pool water level, streamflow, stream water quality, private dams, channel and bank stability, stream and riparian vegetation health, and flooding (**Table 5-3** of the WMP);
- Groundwater monitoring measures relating to groundwater level and water quality (**Table 5-3** of the WMP);
- Water management measures for surface water and groundwater resources (excluding dams, which are discussed in the LMP) (**Section 6.2** of the WMP);
- Program to validate groundwater models for the development; and
- TARPs to be implemented to manage and protect surface water and groundwater resources (excluding dams, which are discussed in the LMP) (**Appendix A** of the WMP).

Watercourses within the LW W1-W2 Study Area are identified on **Figure 4-2**. A summary of water monitoring measures is provided in **Section 5.3**, and surface water and groundwater TARP actions are consolidated in **Appendix D**.

The following documents were prepared to support the WMP:

- Surface Water Technical Report (HEC, 2019) – provides details of baseline data, monitoring and management measures, and TARPs for surface water resources in the LW W1-W2 Study Area;
- Flood Impact Study (WRM, 2019) – provides a flood impact assessment for LW W1-W2 for the 1% Annual Exceedance Probability (**AEP**) and the Probable Maximum Flood (**PMF**) events;
- Groundwater Technical Report (HydroSimulations, 2019) – provides details of baseline data, monitoring and management measures, and TARPs for groundwater resources in the LW W1-W2 Study Area;
- Baseline Private Bore Assessment (GeoTerra, 2019) – provides a description of existing private groundwater bores in the Study Area, bore yields and serviceability of accessible bores, groundwater quality from accessible bores, and an assessment of potential impacts to these bores as a result of LW W1-W2 extraction; and
- Geotechnical Assessment (Douglas Partners, 2019) – provides an overview of farm dams in the LW W1-W2 Study Area, as well as an assessment of likely impacts to these features and consequence impacts to built features as a result of LW W1-W2 extraction.

The WMP and supporting documents are provided in **Volume 2** of this Extraction Plan.

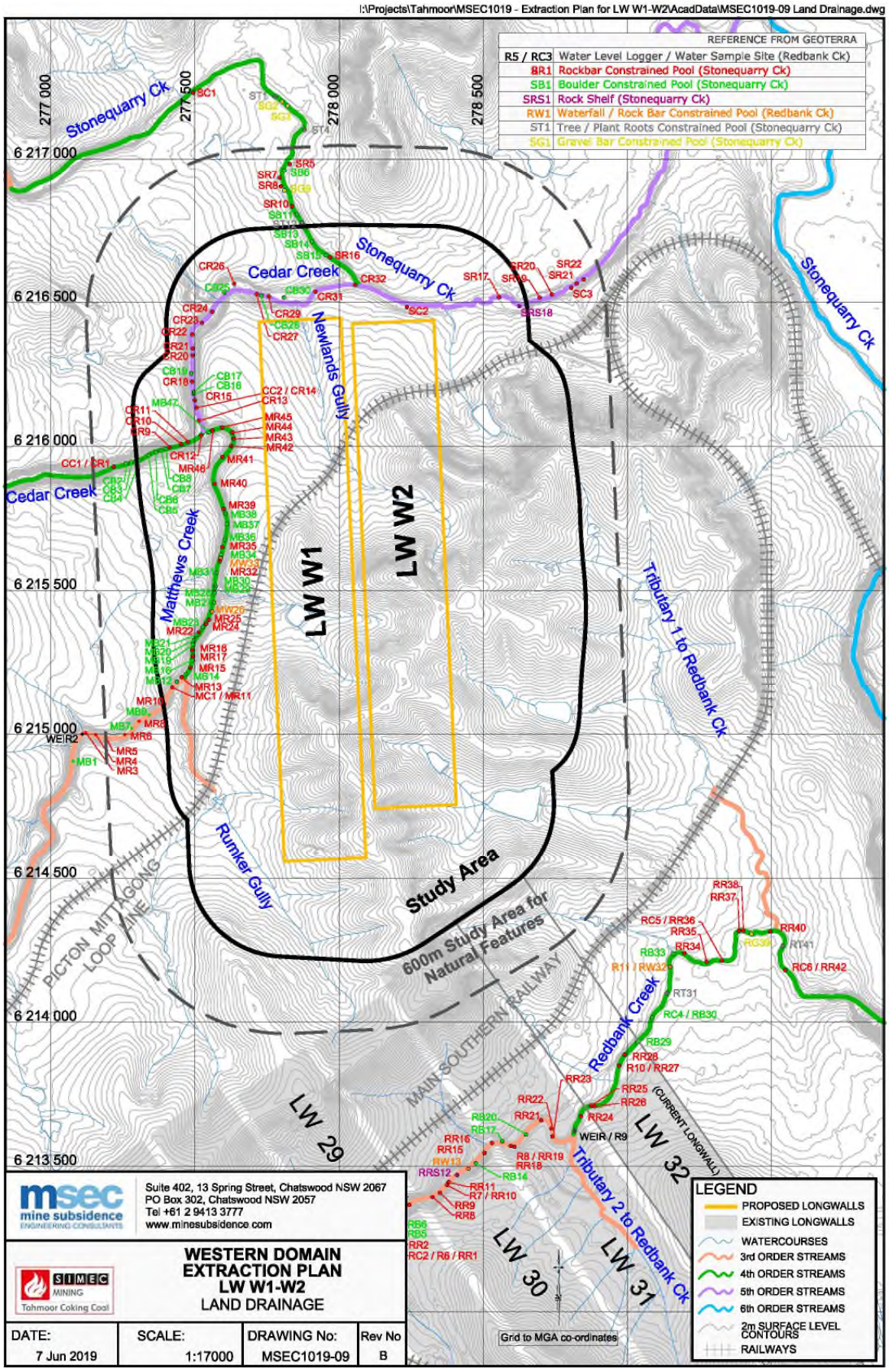

Figure 4-2 Western Domain Extraction Plan LW W1-W2 – Land Drainage (MSEC, 2019)

4.4 Land Management Plan

A LMP for LW W1-W2 has been prepared to identify the monitoring and management measures for landscape features and agricultural resources within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved. The LMP focused on cliffs, minor cliffs, rock face features, steep slopes and agricultural enterprises.

It should be noted that landscape features of floodplains, creeks and watercourses, and groundwater are discussed in the WMP.

The LMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)I (refer to **Table 2-1** of the LMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), and other regulatory requirements (refer to **Section 2.2** of the LMP). The LMP was prepared in consultation with the DPI Agriculture and DoI Crown Lands (refer to **Section 2.1.1**).

The LMP provides information on (but not limited to) the following:

- Baseline data for landscape features and agricultural enterprises (**Section 3** of the LMP);
- Predicted subsidence impacts and environmental consequences to landscape features and agricultural enterprises (**Section 4** of the LMP);
- Performance measures and performance criteria for landscape features (**Section 5.1** of the LMP);
- Monitoring measures for landscape features (**Table 5-3** of the LMP);
- Management measures for landscape features (**Section 6.2** of the LMP); and
- TARPs to be implemented to manage landscape features (**Appendix A** of the LMP).

Cliffs, steep slopes and rock outcrops within the LW W1-W2 Study Area are identified on **Figure 4-3**. A summary of landscape and agricultural monitoring measures is provided in **Section 5.3**, and landscape and agricultural TARP actions are consolidated in **Appendix D**.

The following documents were prepared to support the LMP:

- Geotechnical Assessment (Douglas Partners, 2019) – provides an overview of steep slopes, cliffs, rock outcrops in the LW W1-W2 Study Area, as well as an assessment of likely impacts to these features and consequence impacts to built features as a result of LW W1-W2 extraction; and
- Land and Agricultural Resource Assessment (SLR, 2019) –provides an overview of the landscape, land and soil capability, and agricultural enterprises in the LW W1-W2 Study Area, as well as an assessment of likely impacts to these features as a result of LW W1-W2 extraction.

The LMP and supporting documents are provided in **Volume 2** of this Extraction Plan.

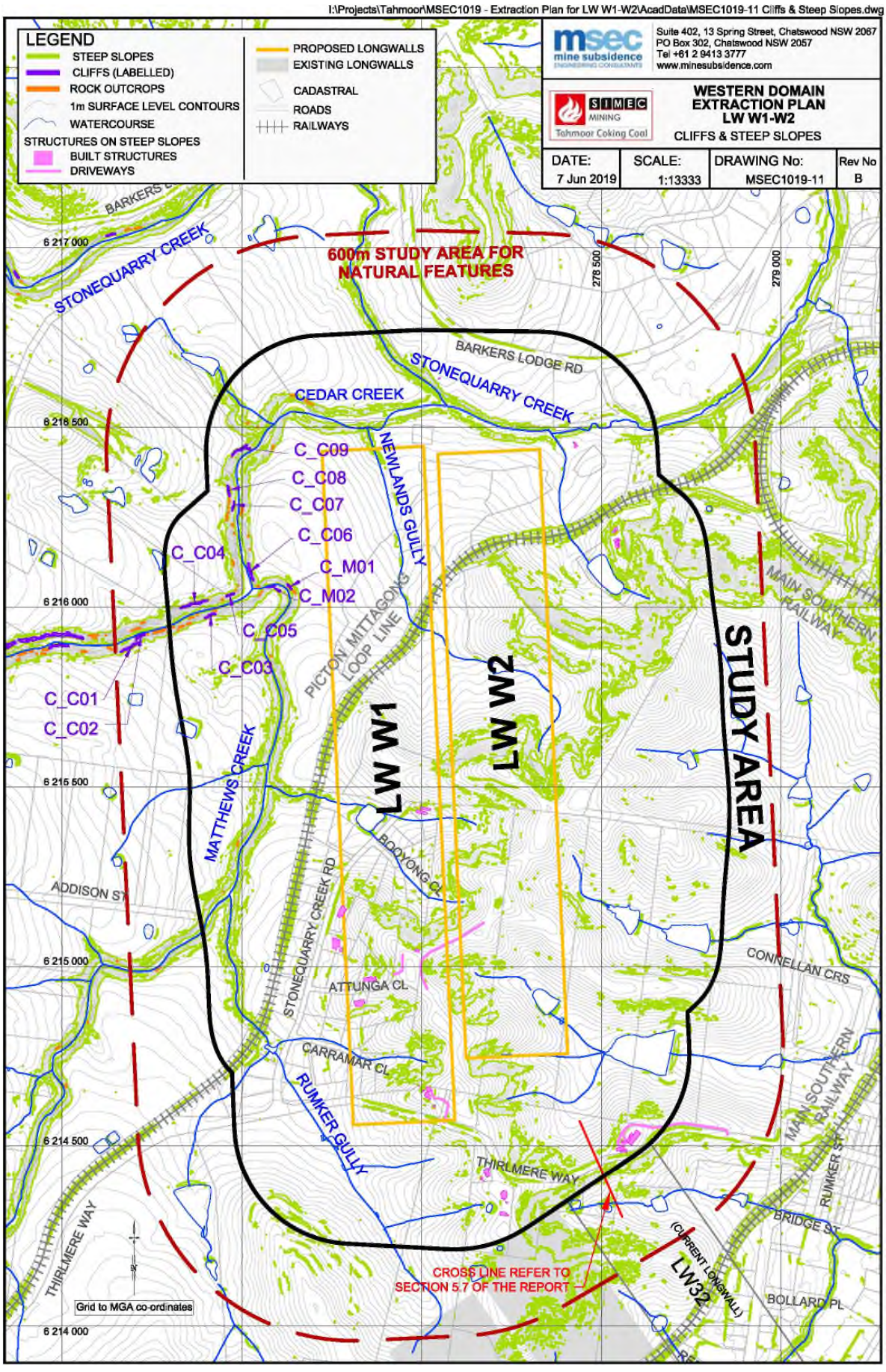

Figure 4-3 Western Domain Extraction Plan LW W1-W2 – Cliffs, Steep Slopes and Rock Outcrops (MSEC, 2019)

4.5 Biodiversity Management Plan

A BMP for LW W1-W2 has been prepared to identify the monitoring and management measures for aquatic and terrestrial biodiversity within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved. The BMP focused on aquatic and terrestrial biodiversity, with particular focus on threatened species, populations and their habitats, and Endangered Ecological Communities (**EECs**). It should be noted that there are no groundwater dependent ecosystems present in the Study Area.

The BMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)(d) (refer to **Table 2-1** of the BMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), and regulatory requirements (refer to **Section 2.2** of the BMP). The BMP was prepared in consultation with the OEH (refer to **Section 2.1.1**).

The BMP provides information on (but not limited to) the following:

- Baseline data for terrestrial vegetation communities (including threatened ecological communities, riparian vegetation, and vegetation condition), threatened flora and fauna, watercourses and stream morphology (including water table depth), aquatic biodiversity (**Section 3** of the BMP);
- Predicted subsidence impacts and environmental consequences to aquatic and terrestrial biodiversity (**Section 4** of the BMP);
- Performance measures and performance criteria for aquatic and terrestrial biodiversity (**Section 5.1** of the BMP);
- Biodiversity monitoring measures relating to aquatic biodiversity (water quality, aquatic habitats, macroinvertebrates) and terrestrial biodiversity (amphibian, riparian vegetation, and photo point monitoring) (**Table 5-3** of the BMP);
- Biodiversity management measures for aquatic and terrestrial biodiversity, with a specific focus on threatened species, populations and their habitats, and EECs (**Section 6.2** of the BMP); and
- TARPs to be implemented to manage and protect aquatic and terrestrial biodiversity (**Appendix A** of the BMP).

A summary of biodiversity monitoring measures is provided in **Section 5.3**, and biodiversity TARP actions are consolidated in **Appendix D**.

No threatened species or Threatened Ecological Communities were recorded in the Study Area during the monitoring surveys.

The following documents were prepared to support the BMP:

- Aquatic Biodiversity Technical Report (Niche, 2019a) –provides details of baseline data, monitoring and management measures, and TARPs for aquatic biodiversity in the LW W1-W2 Study Area;
- Aquatic Ecology Baseline Monitoring Report (Niche, 2019b) – provides baseline data for control and impacts sites associated with the Western Domain;
- Terrestrial Biodiversity Technical Report (Niche, 2019c) –provides details of baseline data, monitoring and management measures, and TARPs for terrestrial biodiversity in the LW W1-W2 Study Area; and
- Terrestrial Ecology Baseline Monitoring Report (Niche, 2019d) – provides baseline data for control and impacts sites associated with the Western Domain.

The BMP and supporting documents are provided in **Volume 3** of this Extraction Plan.

4.6 Heritage Management Plan

A HMP for LW W1-W2 has been prepared to identify the monitoring and management measures for Aboriginal and historical heritage items within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved. The HMP focused on Aboriginal and historical heritage items listed on heritage databases, and Aboriginal and historical heritage items identified in the Study Area during site investigations.

The HMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)(f) (refer to **Table 2-1** of the HMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), and regulatory requirements (refer to **Section 2.2** of the HMP). The HMP was prepared in consultation with the OEH and RAPs (refer to **Section 2.1.1**).

The HMP provides information on (but not limited to) the following:

- Baseline data for Aboriginal and historical heritage items (**Section 3** of the HMP);
- Predicted subsidence impacts and environmental consequences to Aboriginal and historical heritage items (**Section 4** of the HMP);
- Performance measures and performance criteria for Aboriginal and historical heritage items (**Section 5.1** of the HMP);
- Aboriginal and historical heritage monitoring measures (**Table 5-3** of the HMP);
- Management measures for Aboriginal and historical heritage items (**Section 6.2** of the HMP); and
- TARPs to be implemented to manage and protect Aboriginal and historical heritage (**Appendix A** of the HMP).

Aboriginal and historical heritage items located within the LW W1-W2 Study Area are identified on **Figure 4-4**. A summary of heritage monitoring measures is provided in **Section 5.3**, and heritage TARP actions are consolidated in **Appendix D**.

A survey targeting land in the LW W1-W4 Study Area where outcropping sandstone is predicted to occur, in conjunction with baseline recordings of all rockshelters within the LW W1-W2 Study Area, was completed by EMM over four days (25-28 March 2019) in consultation with representatives from the RAP. The LW W1-W2 Study Area contains a total of 17 rockshelters, six isolated finds / artefact scatters, one modified tree, and one grinding groove site. Five additional rockshelter sites are also located outside of the Study Area but within the 600 m longwall buffer for LW W1-W2.

Three locally listed heritage items (the Queen Victoria Memorial Hospital, Harmony House, and Mill Hill) exist within the Study Area, two of which (the Queen Victoria Memorial Hospital and Harmony House) are also listed on the Department of Health S170 register. Rural landscape – Thirlmere Way is linked to the Department of Health S170 group record for The Queen Victoria Memorial Hospital Precinct. In addition, two locally listed heritage items (brick arch Picton Rail Tunnel and the stone arch Mushroom Tunnel) are located outside the Study Area but within the 600 m longwalls buffer for LW W1-W2.

A site inspection of the Loop Line was completed by EMM on 29 March 2019 and focused on the section of the Picton-Mittagong Loop Line directly above the northern ends of LW W1–W2. Three sandstone and two brick culverts were recorded on the Loop Line within the Study Area. Two additional brick culverts were recorded outside the Study Area but within the 600 m longwall buffer for LW W1-W2. These historical heritage items have local significance as individual items and as a group, however are currently unlisted on historical heritage registers (EMM, 2019b).

The following documents were prepared to support the HMP:

- Aboriginal Heritage Technical Report (EMM, 2019a) –provides details of baseline data, monitoring and management measures, and TARPs for Aboriginal heritage items in the LW W1-W2 Study Area and the surrounding area; and
- Historical Heritage Technical Report (EMM, 2019b) –provides details of baseline data, monitoring and management measures, and TARPs for historical heritage items in the LW W1-W2 Study Area and the surrounding area.

The HMP and supporting documents are provided in **Volume 3** of this Extraction Plan.

4.7 Built Features Management Plan

A BFMP for LW W1-W2 has been prepared to identify the monitoring and management measures for all built features within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved. The BFMP focused on the management of infrastructure (electrical, potable water, sewer, gas, telecommunications, roads, culverts, bridges, rail, and survey control marks), rural properties and structures (built structures, pools, septic tanks, and farm dams), and historical heritage buildings (e.g. Queen Victoria Memorial Home and Mill Hill).

The BFMP provides information on the key infrastructure items within the Study Area and which Infrastructure Management Plan to refer to with regards to monitoring and management of potential subsidence-related impacts for each built feature resulting from the extraction of LW W1-W2. Built features within the LW W1-W2 Study Area are also identified in **Section 6** of the Subsidence Predictions Report (MSEC, 2019; refer to **Appendix A** of this document).

The BFMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)(b) (refer to **Table 2-1** of the BFMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), the Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation (Department of Industry – Resources Regulator, 2017), and other regulatory requirements (refer to **Section 2** of the BFMP).

The BFMP was prepared in consultation with the Resources Regulator, Wollondilly Shire Council, Endeavour Energy, RMS and ONRSR (refer to **Section 2.1.1**).

A number of sub-plans for individual built features are currently being prepared. Further consultation with relevant stakeholders and infrastructure owners will be completed following the drafting of sub-plans for infrastructure management (refer to **Section 2.1.1**).

A series of sub-plans are currently being prepared for infrastructure, as summarised in **Table 3-1.** Each sub-plan will include a summary of potential risks, impact predictions and assessment, appropriate management and monitoring measures, and a detailed TARP for the infrastructure. The contents of each sub-plan will be prepared in consultation with the infrastructure owner and other relevant stakeholders. Following approval and signature by the infrastructure owner, each sub-plan will be submitted to DPE for approval.

This Extraction Plan will be updated to include monitoring and management measures and TARP actions following the completion of these sub-plans for infrastructure and built features. An updated copy of this Extraction Plan will be provided to the Secretary of DPE prior to the commencement of LW W1 mining.

The BFMP is provided in **Volume 4** of this Extraction Plan.

4.8 Public Safety Management Plan

A PSMP for LW W1-W2 has been prepared to address all potential safety hazards to the public through the provision of management strategies, controls and monitoring programs to be implemented to manage potential risks from subsidence related impacts as a result of LW W1-W2 secondary extraction. Features located within the Extraction Plan Study Area that could pose a hazard to public safety are summarised in **Table 3-1.**

The PSMP was prepared to address the requirements listed in DA 67/98 Condition 13H(vii)(g) (refer to **Table 2-1** of the PSMP), the Draft Guidelines for the Preparation of Extraction Plans V5 (DPE, 2015), the Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation (Department of Industry – Resources Regulator, 2017), requirements of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (Clause 23 and 24), and other regulatory requirements (refer to **Section 2.2** of the PSMP). Regulatory requirements applicable to the PSMP to manage subsidence related risks to public safety are outlined further in **Section 2.2** of the PSMP.

Risk assessments undertaken in support of the development of the PSMP are detailed in **Section 4.2** of this Extraction Plan Main Document, and **Section 2.3** of the PSMP.

The PSMP was prepared in consultation with the Resources Regulator (refer to **Section 2.1.1**).

The PSMP provides information on (but not limited to) the following:

- Potential subsidence-related public safety hazards (**Section 3** of the PSMP);
- Performance measures for public safety (**Section 4.1** of the PSMP).

Features identified within the Extraction Plan Study Area relevant to public safety are managed under a number of supporting plans in addition to the PSMP, as noted in **Table 3-1**. TARPs associated with these aspects are outlined in **Appendix D** of the Extraction Plan Main Document.

The following documents were prepared to support the PSMP:

- Geotechnical Assessment (Douglas Partners, 2019); and
- Subsidence Prediction and Impact Assessment Report (MSEC, 2019).

The PSMP and supporting documents are provided in **Volume 4** of this Extraction Plan.

5 Subsidence Monitoring Program

5.1 Monitoring Strategy and Approach

5.1.1 Subsidence Monitoring Program for LW W1-W2

An integrated Subsidence Monitoring Program (MSEC, 2019; refer to **Volume 4**) has been developed for LW W1-W2 as a component of this Extraction Plan in accordance with DA 67/98 Condition 13H(vii)(a). The Subsidence Monitoring Program sets out the program for the monitoring of subsidence movements and effects associated with second workings of LW W1-W2 and provides consolidated summaries for the monitoring of subsidence impacts and environmental consequences to environmental and built features.

The purpose of the Subsidence Monitoring Program is to:

- Demonstrate mine development and extraction are undertaken as per the mine design;
- Provide information to demonstrate that statutory performance measures are met;
- Target monitoring of environmental and built features within the Extraction Plan Study Area;
- Meet stakeholder monitoring requirements for environmental features;
- Meet infrastructure owners monitoring requirements for built features;
- Provide appropriate information required to assess against triggers within the relevant TARPs, including data for trend analysis to inform adaptive management; and
- Provide a suitable basis for future Extraction Plans and associated monitoring programs required for ongoing mining in the Western Domain.

The Subsidence Monitoring Program is designed to ensure that a clear and concise monitoring program of all subsidence related effects, impacts and environmental consequences is implemented. The Subsidence Monitoring Program includes:

- A detailed program for subsidence movement and effects monitoring for LW W1-W2 using subsidence monitoring lines to measure both conventional and non-conventional vertical subsidence, tile and strain (tensile and compressive);
- A consolidated summary of built features monitoring as detailed within the BFMP and supporting sub-plans; and
- A consolidated summary of environmental monitoring for management of water (surface and groundwater), land, biodiversity, and heritage (Aboriginal and historical) as detailed in the management plans for this Extraction Plan.

The Subsidence Monitoring Program is scheduled in the Tahmoor Coal Compliance Database (**CMO Database**). The compliance database allows for surveys, inspections and notifications to be scheduled, and the required actions are assigned to the relevant role to ensure the subsidence monitoring program is achieved.

5.1.2 Summary of Monitoring in this Extraction Plan

The following sections provide a summary and re-presentation of monitoring details from the Subsidence Monitoring Program and other relevant management plans and sub-plans for the monitoring of subsidence effects (**Section 5.2**), subsidence impacts and environmental consequences (**Section 5.3**) associated with the extraction of LW W1-W2.

Full detail pertaining to subsidence monitoring methodology can be found in the Subsidence Monitoring Program (**Volume 4**) and the relevant management plans and sub-plans discussed in the sections below.

5.2 Subsidence Effects Monitoring

The Subsidence Monitoring Program include a monitoring program to evaluate subsidence effects as a result of LW W1-W2 extraction has been prepared in accordance with DA 67/98 Condition 13H(vii)(i) and the DPE *Guidelines for the Preparation of Extraction Plans* V5 (DPE, 2015).

As a longwall progresses, subsidence begins to develop at a point in front of the active longwall face and continues to develop after the longwall passes. This is termed the 'active subsidence zone' for the purposes of this Extraction Plan. 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 m in front of the active longwall face and 450 m behind the active longwall face or following 500 m of longwall extraction. The active subsidence zone is illustrated in **Figure 5-1**.

Tahmoor Coal proposes to establish a monitoring network to monitor subsidence movements as a result of LW W1-W2. This network will include components of the previously established monitoring network used for the monitoring of previous longwalls to the south of the Western Domain. The layout of monitoring lines and points is illustrated in **Figure 5-2** as well as on A0 Plan 7 (**Volume 5**)**,** and is discussed further in the Subsidence Monitoring Program (**Volume 4**).

The combined monitoring network will consist of the following:

- Centrelines, including 2 lines over maingate pillars;
- Crosslines, including numerous lines over Matthews, Cedar and Stonequarry Creeks;
- Monitoring points for key items including railway infrastructure associated with the Picton-Mittagong Loop Line, and the Queen Victoria Memorial Home and Mill Hill Homestead; and
- Monitoring on private properties, dwellings, buildings and dams.

Centrelines will be installed along the centrelines of LW W1-W2, as shown in **Figure 5-2**, subject to approval for access by landowners.

The purpose of the survey lines is to establish the general magnitude and shape of surface subsidence along the centrelines of LW W1-W2. The observed subsidence movements will be used to provide early subsidence information to inform Tahmoor Coal and affected stakeholders prior to built surface features experiencing active subsidence, the majority of which are located at the central to southern end of LW W1-W2. The information will assist Tahmoor Coal and affected stakeholders in considering whether any additional measures are required to manage potential impacts on the built features.

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

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

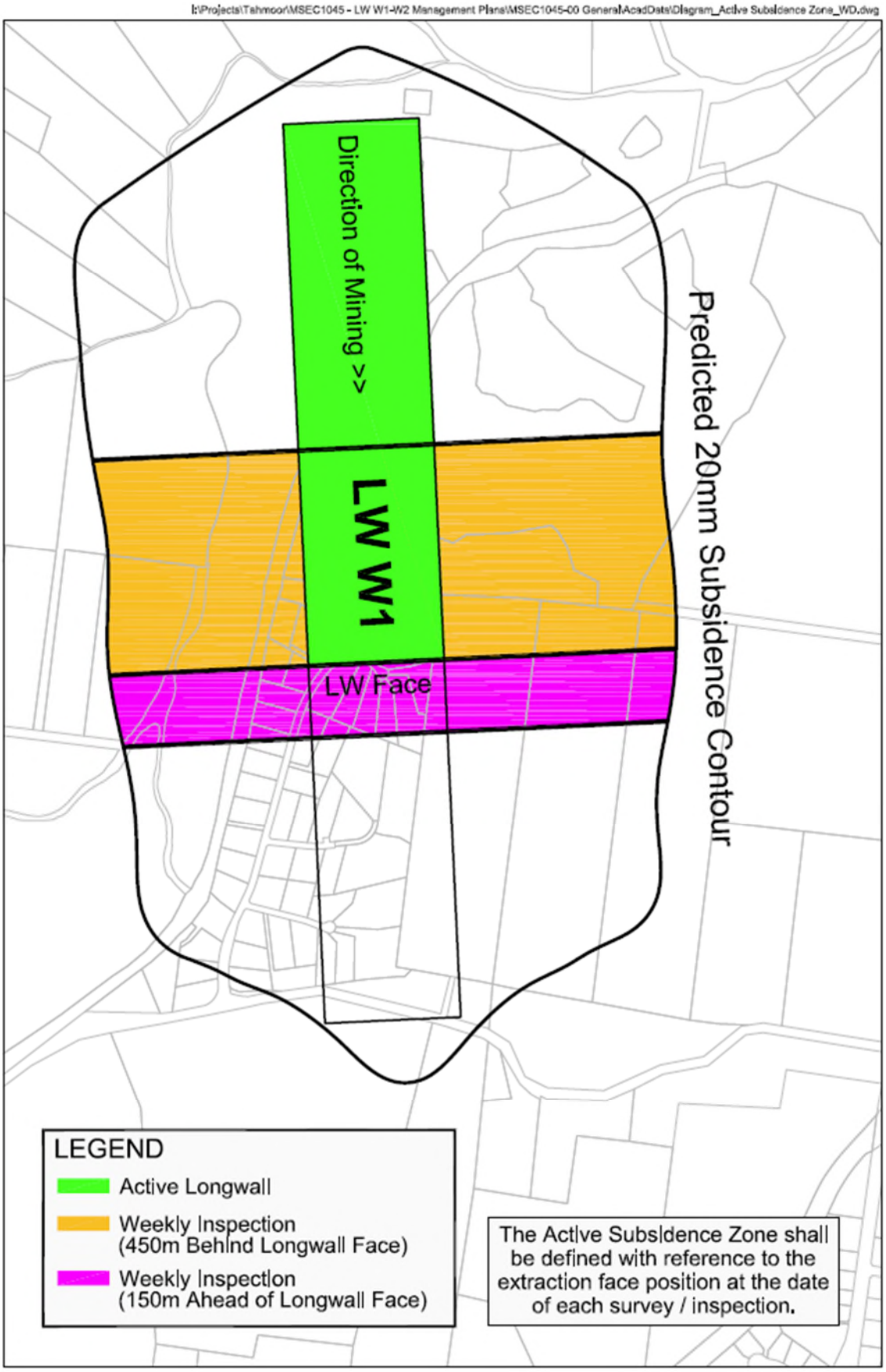

Figure 5-1 Diagrammatic representation of 'active subsidence zone'

A GNSS unit is proposed to be installed approximately 100 m inside the commencing end of LW W1 to monitor the development of initial subsidence, which is expected to occur after the length of extraction exceeds approximately 200 m. Monthly ground surveys along the centreline will commence after 20 mm of vertical subsidence is measured by the GNSS unit, or the length of the extraction of LW W1 and LW W2 exceeds 200 m, whichever occurs first.

At the completion of LW W1, the GNSS unit will be transferred to the centreline of LW W2 to detect the initial subsidence from the extraction of LW W2.

A survey line will also be installed along a cross line that follows a property boundary that is approximately square to the proposed longwall panels. The installation of the survey line is subject to approval for access by landowners as it is located on private land.

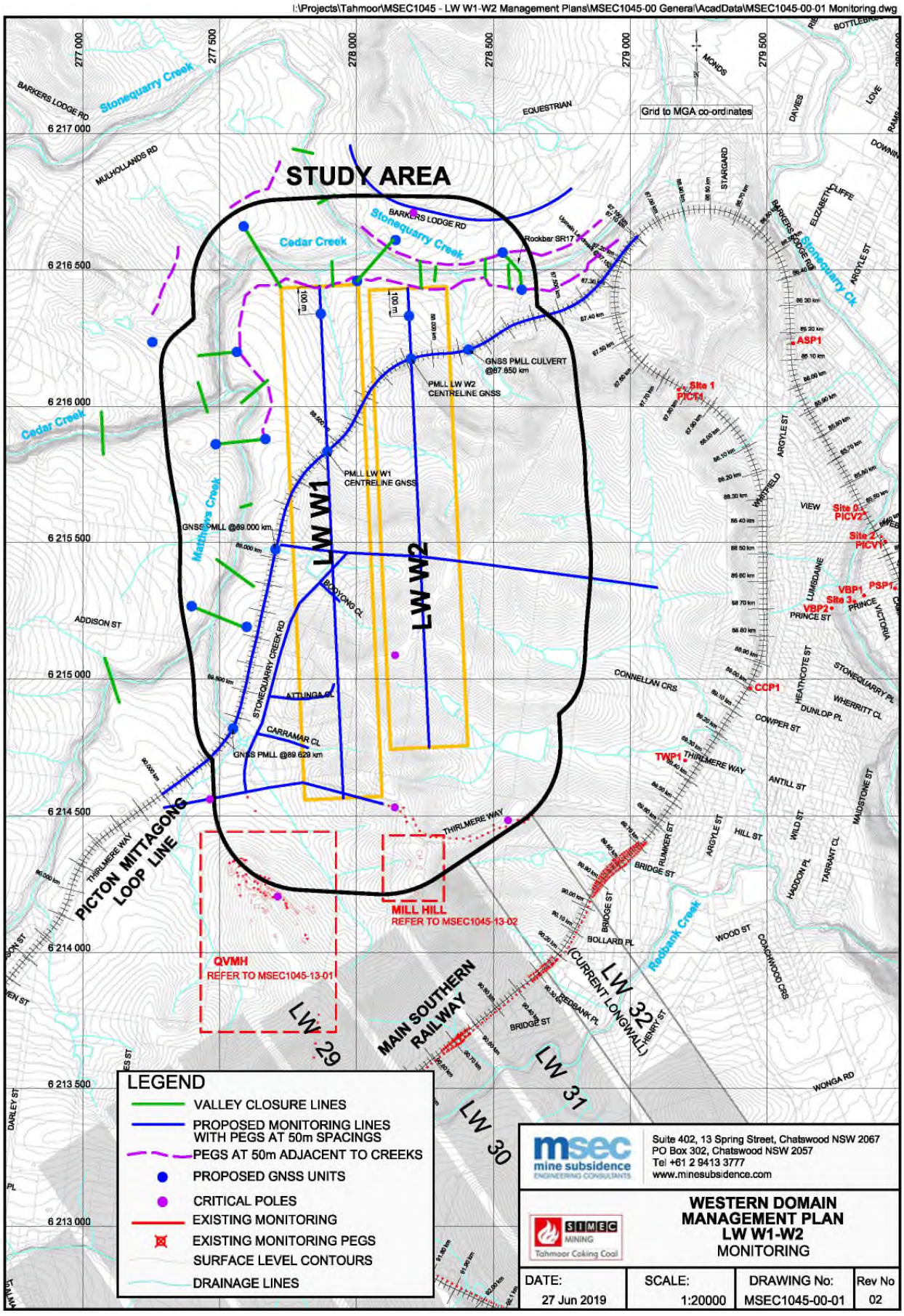

Figure 5-2 Proposed Monitoring Locations for LW W1-W2 Extraction Plan Study Area (provided by MSEC)

5.3 Subsidence Impacts and Environmental Consequences Monitoring

A monitoring program to evaluate subsidence impacts and environmental consequences as a result of LW W1-W2 extraction has been prepared in accordance with DA 67/98 Condition 13H(vii)(i) and the DPE *Guidelines for the Preparation of Extraction Plans* V5 (DPE, 2015).

5.3.1 Monitoring of Built Features

Built infrastructure in the Study Area, as described in **Section 4.7** of this Extraction Plan, are monitored and managed in accordance with dedicated supporting plans (sub-plans) developed for each type of built infrastructure specifically in consultation with the relevant stakeholders. The sub-plans for built infrastructure are managed collectively by the over-arching BFMP.

Monitoring of built features will include:

- Local roads and main infrastructure:
  - Survey lines along Wollondilly Shire Council local roads, Sydney Water potable water pipelines, Jemena gas pipelines, Endeavour Energy electrical infrastructure, telecommunications infrastructure, and privately-owned sewerage infrastructure. Survey lines will consist of pegs spaced nominally every 20 m, with survey measuring levels and horizontal distances between adjacent pegs;
  - Visual inspections along local roads;
  - Optical Time Domain Reflectometer (OTDR) monitoring for optical fibre cables;
  - Monthly survey monitoring of six critical electrical poles;
- Structures:
  - Specific ground surveys for selected properties, including Queen Victoria Memorial Home and Mill Hill;
  - Visual inspections of residential structures that are either: located on or adjacent to steep slopes, are in poor existing condition (based on the hazard identification inspections), have previously reported impacts, or where recommended by the Structures Response Group;
  - Visual inspections of pool fences and gates;
  - Visual inspections of commercial, industrial and business establishments, public amenities and public utilities;
  - Baseline asbestos air monitoring at Queen Victoria Memorial Home;
  - Visual inspections for structures at Queen Victoria Memorial Home where more than 20 mm of subsidence has been measured;
  - Monthly visual inspections of structures and dams at the Mill Hill property.
- Picton-Mittagong Loop Line:
  - Ground surveys along rail corridor;
  - Ground surveys at culverts and embankments;
  - Ground surveys at railway cuttings;
  - GNSS monitoring;
  - Track geometry monitoring;
  - Visual inspection;

- Main Southern Railway:
  - Continue monitoring at key items of railway infrastructure as part of far field monitoring program, which will include absolute 3D surveys, continuous GNSS monitoring, and baseline structural surveys.

A consolidated summary of the monitoring of built features is presented in **Section 3** of the Subsidence Monitoring Program, and location of built features monitoring is illustrated in **Figure 5-2**.

5.3.2 Monitoring of Environmental Features

Monitoring and evaluation of subsidence performance measures and potential mining related impacts on surface water, groundwater, surface water, landscape features, flora and fauna, Aboriginal and European heritage, are described in detail in the Section 5.2 of each of the WMP, LMP, BMP and HMP.

Monitoring of environmental features will include:

- Creeks:
  - Ground surveys of valley closure lines, with a pair of pegs placed on or near the crests of the valleys where there are adequate lines of sight available;
  - GNSS monitoring;
  - 3D survey lines;
  - Surface water monitoring at 8 sites on Matthews Creek, 10 sites on Cedar Creek, and 5 sites on Stonequarry Creek. This monitoring will include water level and water quality monitoring;
  - Visual monitoring;
- Rockbar SR17 on Stonequarry Creek:
  - Ground survey line, with pegs spaced nominally 10 m apart;
  - GNSS monitoring;
  - Baseline 3D photogrammetry survey;
- Cliffs, steep slopes and rock face features:
  - Visual monitoring;
- Groundwater:
  - Monitoring of groundwater levels and quality;
- Biodiversity:
  - Bi-annual monitoring of amphibians, riparian vegetation, and aquatic biodiversity;
- Aboriginal heritage sites:
  - Visual inspection;
- Historical heritage sites:
  - Monitoring as per built features monitoring; and
  - Visual inspection.

The location of the proposed biodiversity monitoring is illustrated in **Figure 5-3**, and the location of surface water monitoring and groundwater monitoring is illustrated in **Figure 5-4** and **Figure 5-5**, respectively.

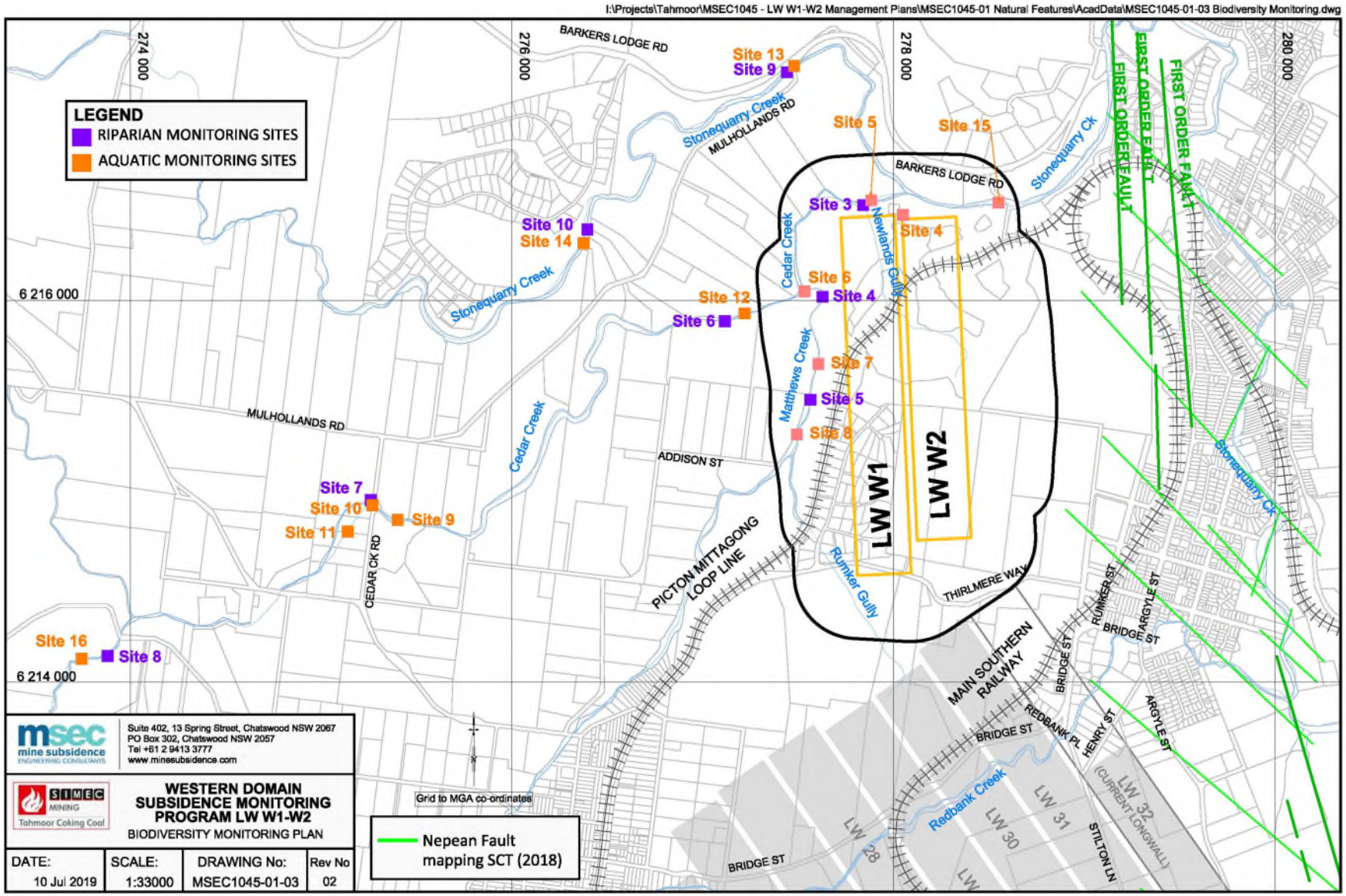

Figure 5-3 Biodiversity Monitoring Program (prepared by MSEC with data from Niche)

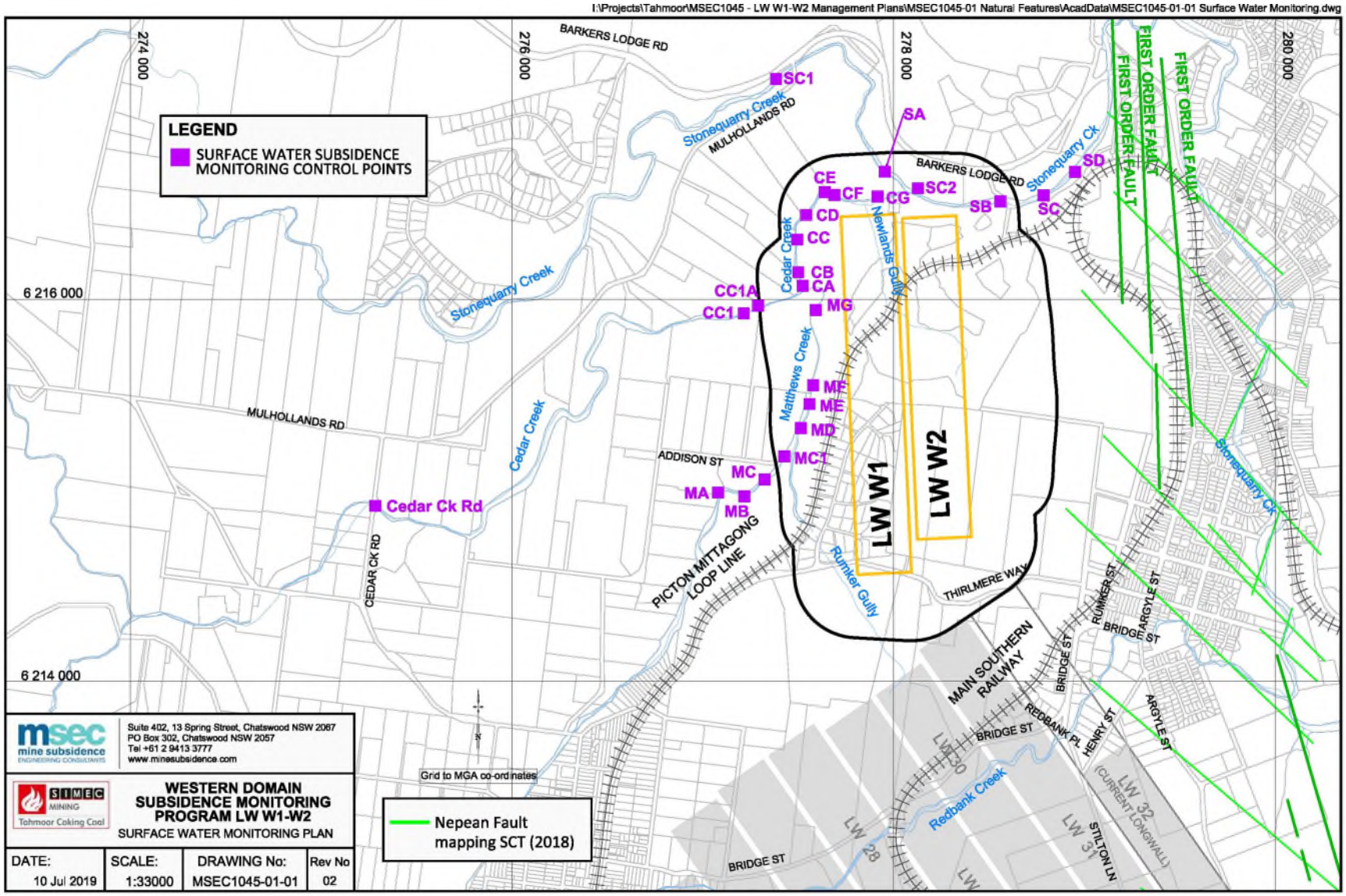

Figure 5-4 Surface Water Monitoring Program (prepared by MSEC)

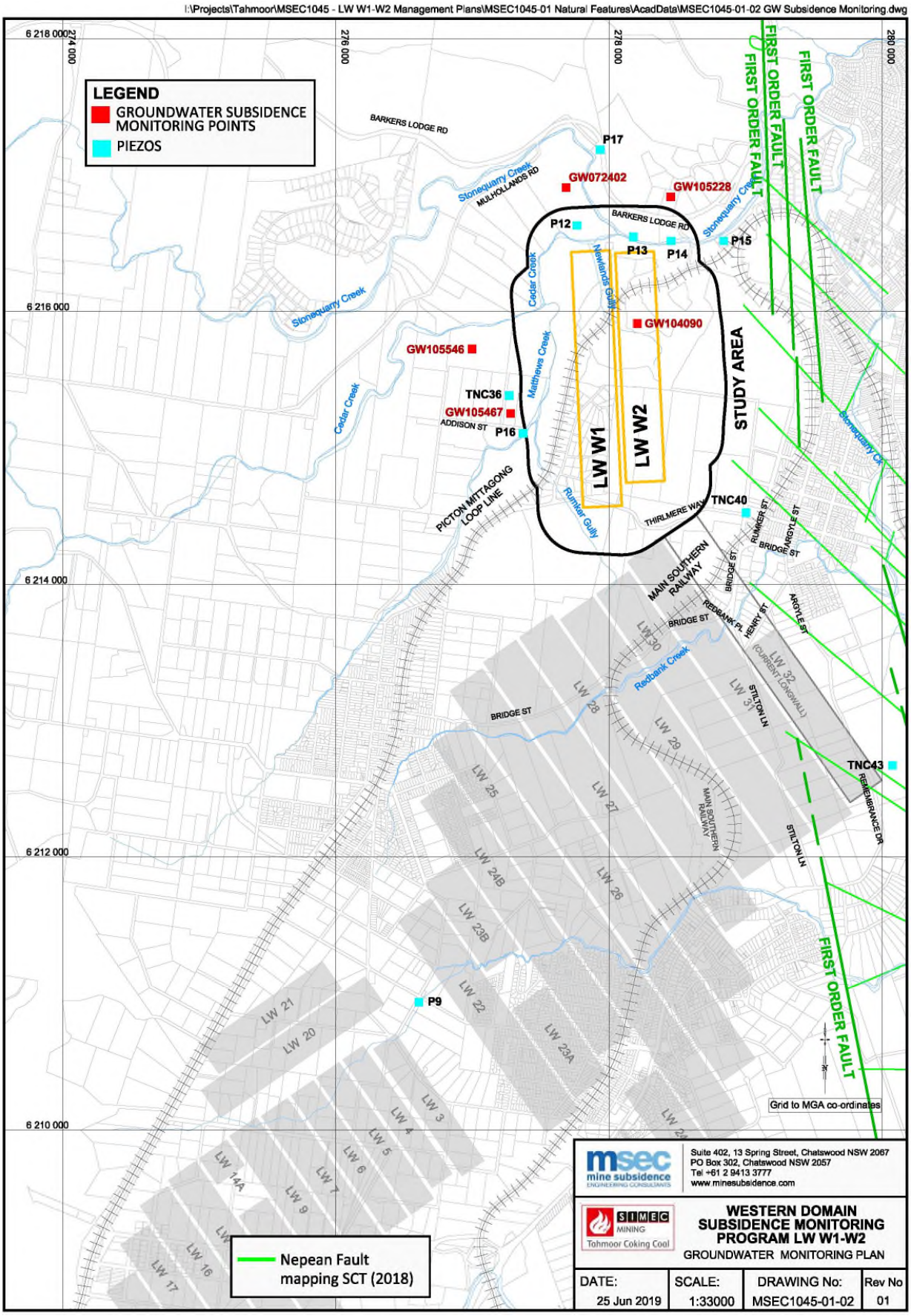

Figure 5-5 Groundwater Monitoring Program (prepared by MSEC)

5.4 Baseline Monitoring to Support Future Extraction Plans

Tahmoor Coal is planning to extract a further two longwalls (LW W3-W4) in the Western Domain, and an Extraction Plan is planned to be lodged for these longwalls in accordance with DA 67/98 Condition 13H.

A monitoring program to collect sufficient baseline data for the future Extraction Plan is summarized in **Table 5-1**, in accordance with DA 67/98 Condition 13H(vii)(i) and the DPE *Guidelines for the Preparation of Extraction Plans* V5 (DPE, 2015). This monitoring program has been consolidated from the various key component plans and Tahmoor Coal considers the implementation of this monitoring program adequate to collect sufficient baseline data for the future LW W3-W4 Extraction Plan. Monitoring data collected during the mining of LW W1-W2 would be used in the review of observed subsidence impacts and environmental consequences for future Extraction Plans.

Table 5-1 Baseline Monitoring Program to Support Future Extraction Plans

Aspect of Future Extraction Plan	Existing and Proposed Monitoring Programs	Tahmoor Coal Document Reference
Subsidence	• Subsidence monitoring undertaken in accordance with the Subsidence Monitoring Program. • A significant amount of baseline data has been collected during the extraction of the previous longwall panels to the south of the Western Domain.	Subsidence Monitoring Program
Surface Water	• The waterways that will be affected by LW W3-W4 will primarily be Stonequarry Creek and tributaries of Redbank Creek. • Surface water monitoring (flow and quality) will be undertaken in accordance with the WMP. This data will be provide sufficient surface water data for Stonequarry Creek. • Continuation of water flow and quality monitoring at RC6 (coordinates 279542mE, 6214187mN in GDA94 Zone 56) which is located downstream of the confluence of an unnamed tributary (3rd order tributary flowing south from the Western Domain) and Redbank Creek. • Establishment of a monitoring location (coordinates 279420mE, 6214737mN in GDA94 Zone 56) downstream of the confluence of two tributaries and upstream of the majority of Picton urban development will be investigated for water level and water quality monitoring. However, it is noted that this site may not be suitable as a monitoring site due to the ephemeral nature of the tributaries.	WMP
Groundwater	• Groundwater monitoring (groundwater level and quality) undertaken in accordance with the WMP. • A significant amount of baseline groundwater data has been collected during the extraction of the previous longwall panels to the south of the Western Domain.	WMP
Landscape	• Monitoring of impacts to cliffs, steep slopes and rock face features in accordance with the LMP.	LMP

Aspect of Future Extraction Plan	Existing and Proposed Monitoring Programs	Tahmoor Coal Document Reference
Biodiversity	• Biodiversity monitoring of aquatic habitat, macroinvertebrates, riparian vegetation, and amphibians in accordance with the BMP.	BMP
Aboriginal Heritage	• Monitoring of Aboriginal heritage items in accordance with the HMP. • Baseline data for Aboriginal heritage has been collected to complete the Aboriginal Cultural Heritage Assessment Report. • Baseline assessments of all Aboriginal heritage sites within the future Extraction Plan Study Area will be undertaken in accordance with the methodology outlined in the HMP.	HMP
Historical Heritage	• Monitoring of historical heritage items in accordance with the HMP. • Baseline monitoring of all historical heritage sites within the future Extraction Plan Study Area will be undertaken in accordance with the methodology outlined in the HMP.	HMP

6 Implementation

6.1 Reporting

6.1.1 Summary of Reporting

Reporting for the Extraction Plan is undertaken in accordance with the specific requirements of relevant approvals and licences including DA 57/93 and DA 67/98, and generally in accordance with the DPE *Guidelines for the Preparation of Extraction Plans* V5 (DPE, 2015) and the requirements of the WHSMP Regulation.

Reporting requirements are summarised in **Table 6-1** including which government stakeholders will receive copies of each report and the method of distribution. Further details of the reporting requirements are provided in the following sections.

Table 6-1 Reporting Requirements

Report	Trigger	Requirements	Distribution	Distribution Method	Responsibility
Incident Reporting (Letter Report) Refer to Section 6.1.2 for further details	Any occasion or incident in accordance with DA 57/93, DA 67/98, WHS Regulations (Mines and Petroleum Sites) Clause 128, or as triggered by the TARP.	Detailed report to be provided to DPE on the incident within seven days of the incident (and to EPA where potential or actual material harm to environment). Any additional notifications and reporting as per relevant approved TARP, including actions being undertaken to prevent recurrence. Includes non-compliance with any statutory requirements or exceedance of performance measures.	• DPE (Manager Mining Projects); • DPE Resources Regulator (Subsidence – Subsidence Executive Officer); • DPE Resources Regulator (Environment); • DPE DRG; • SA NSW; • NRAR; • EPA; • WSC; • TCCCC; • Relevant infrastructure owner (Endeavour Energy, Sydney Water, Stonequarry Wastewater Treatment Plant, Jemena, Telstra, NBN, ARTC, Rail Transport Museum, Spatial Services)	Electronic copy sent by email	Environment and Community manager
Bi-Monthly Subsidence Impact Reporting Refer to Section 6.1.3 for further details	If a new impact is identified, compile after monthly subsidence inspections, according to Section 6 of the Extraction Plan Guidelines.	Summary of impacts that are: • Within predictions; • Exceed predictions but remain within performance measures and/or performance indicators; and • Exceed performance measures and/or performance indicators. Report to include: • Full description of impact; • Location of impacts using aerial photos with longwall layout superimposed; • Photos of the impact; and • Preliminary characterisation of the impact in accordance with the relevant TARP(s).	• DPE (Manager Mining Projects); • DPE Resources Regulator (Subsidence – Subsidence Executive Officer); • DPE Resources Regulator (Environment); • DPE DRG; • SA NSW; • NRAR; • EPA • WSC • TCCCC • Infrastructure owner (Endeavour Energy, Sydney Water, Stonequarry Wastewater Treatment Plant, Jemena, Telstra, NBN, ARTC, Rail Transport Museum, Spatial Services)	Electronic copy sent by email	Environment and Community Manager

Report	Trigger	Requirements	Distribution	Distribution Method	Responsibility
Six Monthly Subsidence Impact Reporting Refer to Section 6.1.4 for further details	Every six months during mining of LW W1-W2, according to Section 6 of the Extraction Plan Guidelines.	Report to include: • Summary of all impacts, including a revised characterisation according to the relevant TARP(s); • Any proposed actions resulting from triggers being met in the TARP, or other actions; • Assessment of compliance with performance measures and indicators; and • A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and pool level data, piezometer readings, etc.	• DPE (Manager Mining Projects); • DPE Resources Regulator (Subsidence – Subsidence Executive Officer); • DPE Resources Regulator (Environment); • DPE DRG; • SA NSW; • NRAR; • EPA • WSC • TCCCC	Electronic copy sent by email	Environment and Community Manager
Annual Review Refer to Section 6.1.5 for further details	Annual Report required by 31 March of each year under development consent.	In accordance with the requirements of DA 67/98 Condition 45. Report to include: • Six-monthly reports of impacts and environmental monitoring results; • Monitoring results; and • Summary of subsidence impacts.	• DPE (Manager Mining Projects); • DPE Resources Regulator (Subsidence – Subsidence Executive Officer); • DPE Resources Regulator (Environment); • WSC • TCCCC	Electronic copy sent by email	Environment and Community Manager
Annual Return Refer to Section 6.1.6 for further details	Annual Return required by 28 February of each year under EPL 1389.	In accordance with the requirements of EPL 1389. Report to include: • Statement f Compliance; and • Monitoring and complaints summary.	• EPA	Lodged to EPA portal	Environment and Community Manager

Report	Trigger	Requirements	Distribution	Distribution Method	Responsibility
Tahmoor Colliery Community Consultative Committee (TCCCC) Refer to Section 6.1.7 for further details	TCCCCC meetings are held quarterly.	Agenda to include subsidence and environmental performance for Tahmoor Mine.	• TCCCC	Presented at meeting	Environment and Community Team

6.1.2 Incident Reporting

In accordance with Condition 48 of DA 67/98, Tahmoor Coal will notify the Secretary of the DPE and any other relevant agencies of any incident resulting from the extraction of LW W1-W2 that has caused, or has the potential to cause, significant risk of material harm to the environment as soon as practicable after becoming aware of the incident.

Within seven days of the incident, Tahmoor Coal shall provide the DPE and any relevant agencies with a detailed report on the incident that includes:

- Date, time and nature of the incident;
- Identification of the likely cause of the incident;
- Description of the response action that has been undertaken to date; and
- Description of the proposed management measures to address the incident.

For any other incident associated with the development or the trigger of relevant TARP(s), Tahmoor Coal shall notify the Secretary and any other relevant agencies or infrastructure owners as soon as practicable after Tahmoor Coal becomes aware of the incident. Tahmoor Coal will implement further actions required under the TARP(s) as soon as practicable in consultation with the relevant stakeholders.

Incident report will also be undertaken to satisfy Clause 128 of the WHSMP Regulation regarding duty to notify regulator of certain incidents, as detailed in **Section 3.2.4** of this Extraction Plan. This includes reporting of a high potential incident as defined by any of the following:

- Clause 128 (m) – any indication from monitoring data of the development of subsidence which may result in any incident referred to in clause:
- Clause 179 (a) (xvi) – a failure of ground, or of slope stability control measures; or
- Clause 179 (a) (xvii) – rock falls, instability of cliffs, steep slopes or natural dams, occurrence of sinkholes, development of surface cracking or deformations or release of gas at the surface, due to subsidence.

All incidents will be reported in the End of Panel Report and Annual Review.

Incident reporting and all external notification will be undertaken in accordance with **Section 4.6** of the Tahmoor Coal Environmental Management System Framework (TAH-HSEC-00173), and in accordance with the Tahmoor Coal Pollution Incident Response Management Plan (PIRMP, TAH-HSEC-00155). A record of all incidents and non-compliance investigations is maintained in the CMO Compliance Software.

6.1.3 Bi-monthly Subsidence Impact Reporting

Tahmoor Coal will undertake bi-monthly subsidence impact reporting in accordance with the DPE Guidelines (2015). Reports will be prepared only if a new impact from mining is observed, following regular monthly inspections.

The reports will clearly distinguish between impacts that are within predictions, those that exceed predictions but remain within performance measures and/or performance indicators, and those which exceed performance measures and/or performance indicators. The reports will include a full description of the impact, location identification of the impact using aerial photos with longwall layout superimposed, photos of the impact, and preliminary characterisation of the impact in accordance with the relevant TARP(s).

6.1.4 Six-monthly Subsidence Impact Reporting

Tahmoor Coal will undertake six-monthly subsidence impact reporting in accordance with the DPE Guidelines (2015). This reporting will form the basis for inclusion in annual review reporting and will include a discussion of all impacts and environmental monitoring results during extraction of LW W1-W2 including:

- A comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);
- Any proposed actions resulting from triggers being met in the TARP, or other actions;
- An assessment of compliance with all relevant performance measures and indicators; and
- A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and level data, piezometer readings.

6.1.5 Annual Review

An Annual Review is required to be completed by 31 March each year in accordance with Condition 45 of DA 67/98 and the MOP, and to the satisfaction of the Secretary of the DPE. The Annual Review includes the following:

- A description of the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the next year;
- A comprehensive review of the monitoring results and complaints records of the Tahmoor Mine over the past calendar year, which includes a comparison of these results against:
  - Relevant statutory requirements, limits or performance measures/criteria;
  - Requirements of any plan or program required under this consent;
  - Monitoring results of previous years;
  - Relevant predictions in the documents listed in condition 1(i) of Schedule 2;
- Identification of any non-compliance over the past year, and a description of what actions were (or are being) taken to ensure compliance;
- Identification of any trends in the monitoring data over the life of the Tahmoor Mine;
- Identification of any discrepancies between the predicted and actual impacts of the Tahmoor Mine, and analysis of the potential cause of any significant discrepancies;
- A description of what measures will be implemented over the next year to improve the environmental performance of the Tahmoor Mine; and
- An assessment of the performance of the mine against the conditions of the consent and other licences and approvals relating to the mine.

Six-monthly reporting undertaken as described in **Section 6.1.3** will form the basis for subsidence impact reporting components for future Annual Reviews as per the DPE Guidelines (2015), and the Annual Review will also include a summary of environmental effects monitoring as required by the DPE Guidelines (2015).

The Annual Review is completed in accordance with the post-approval requirements for State significant mining developments and incorporates reporting requirements of the DRE.

The Annual Review is also undertaken in accordance with the requirements of the MOP for ML 1376 and ML 1539. Additionally, the Annual Review is required as part of the Tahmoor Coal Environmental Management System Framework (TAH-HSEC-00173).

All Annual Review are made publicly available on the Tahmoor Coal website.

6.1.6 Annual Return

An Annual Return stating Tahmoor Mine's compliance with the conditions of EPL 1389 and summarising monitoring results and complaints is completed and submitted to the EPA by 28 February of each year. Each Annual Review is lodged via the EPL portal.

6.1.7 Community Consultative Committee

The TCCCC was established in 2003 in response to the requirement for DA 67/98 Condition 47 to establish and operate a Community Consultative Committee in general accordance with DPE *Community Consultative Committee Guidelines: State Significant Projects (2016)*. The TCCCC meets on a quarterly basis and provides a forum whereby the community can communicate with Tahmoor Coal and be kept up to date with the progress of the mine. Some of the information reported at the TCCCC includes:

- Progress at the mine and operational issues;
- Subsidence monitoring and environmental performance; and
- Community complaints and the response to complaints.

A record of consultation with the TCCCC during the preparation of this Extraction Plan is provided in **Table 2-2**.

6.1.8 Online Publications

In accordance with Conditions 49 and 52 of DA 67/98, Tahmoor Coal makes the following documents publicly available on the Tahmoor Coal website:

- All relevant statutory approvals for the Tahmoor Mine;
- All approved strategies, plans and programs required under DA 67/98 following approval by the DPE;
- A comprehensive summary of the monitoring results of the Tahmoor Mine;
- A complaints register updated on a monthly basis;
- Minutes of TCCCC meetings;
- Annual Review documents;
- Independent Environmental Audits of the Tahmoor Mine, and Tahmoor Coal's response to the recommendations in the audits; and
- Any other matter required by the Secretary.

This Extraction Plan and associated documents will be uploaded to the Tahmoor Coal website following approval by DPE.

6.1.9 Complaints Management

Complaints will be managed in accordance with the Tahmoor Coal's *Community Complaint and Enquiry Procedure* (TAH-HSEC-00120).

6.2 Review and Auditing

6.2.1 Review of Extraction Plan

This Extraction Plan will be reviewed annually or at the end of each panel, or in the event that the following occurs:

- Stakeholders raise issues that necessitate a review;
- Relevant statutory changes affect management requirements (e.g. modification to related approvals or licences);
- Significant change in mine design or layout;
- Unpredicted subsidence impacts or environmental consequences have required implementation of contingency actions under this Extraction Plan;
- Completion of Aboriginal Cultural Heritage Assessment for LW W1-W2;
- Development Consent requirements trigger a review;
- Circumstances in either Clause 10, Clause 38 and/or Clause 128 of the WHSMP Regulation (refer to **Section 3.2.4** of this Extraction Plan for further detail); and
- Monitoring, incident or audit processes demonstrate that a review is warranted.

Regular review of the Extraction Plan and/or any associated documents is required by Condition 46 of DA 67/98. In particular, Tahmoor Coal is required to review, and if necessary revise, the strategies, plans, and programs of this Extraction Plan within 3 months of the submission of:

- Annual Review under DA 67/98 Condition 45 (refer to **Section 6.1.4** of this Extraction Plan);
- Incident Report under DA 67/98 Condition 48 (refer to **Section 6.1.2** of this Extraction Plan);
- Audit Report under DA 67/98 Condition 50 (refer to **Section 6.2.4** of this Extraction Plan); and
- Any modification to the conditions of DA 67/98 (unless the conditions require otherwise).

Amendments to the Extraction Plan will be undertaken in consultation with relevant stakeholders. Following changes (or as otherwise required above) a copy of the amended Extraction Plan will be forwarded to the Secretary of the DPE for approval.

It is anticipated that any future Extraction Plans prepared for subsequent longwalls in the Western Domain will be stand-alone documents to this Extraction Plan, and will absorb any ongoing monitoring, rehabilitation and reporting requirements relevant to LW W1-W2.

6.2.2 Review of Other Management Plans

The Key Component Plans prepared in support of this Extraction Plan (refer to **Section 4**) are also subject to individual review requirements in accordance with DA 67/98 as detailed within each plan (refer to **Volumes 2-4** of this Extraction Plan). Amendments to the Key Component Plans will be undertaken in consultation with relevant stakeholders. Following changes (or as otherwise required above) a copy of the amended Key Component Plan(s) will be forwarded to the Secretary of the DPE for approval.

The review of other management plans that apply more broadly to the whole mine site, such as the *Mining Operations Plan* (TAH-HSEC-00026) and the *Environmental Management System Framework* (TAH-HSEC-00173), may be required following the completion of this Extraction Plan. The process for review of these documents will be in according to Tahmoor Coal's *Document and Record Control* (TAH-HSEC-00124).

6.2.3 Response Groups

Tahmoor Coal operates three response groups made up of Tahmoor Coal Staff and relevant technical specialists, that consist of the following:

- Environmental Response Group (**ERG**);
- Structural Response Group (**SRG**); and
- Rail Response Group (**RRG**).

The response groups are responsible for taking the necessary actions required to manage the risks that are identified from monitoring of natural and built features to ensure that the health and safety of people and the environment are not put at risk due to mine subsidence. Each response group assists in the development and review management plans, collects and analyses monitoring results, determines potential impacts, and provides advice regarding appropriate actions relevant to the area of interest.

Each response group is made up of a group of key members, and the response group may invite other specialist consultants and stakeholders depending on the topic of conversation.

6.2.4 Environmental Auditing

The requirements of this Extraction Plan are to be audited during the implementation of the plan to identify any issues that may affect its integrity and effectiveness. At least one month prior to a scheduled review, an audit should be completed so that non-compliances and corrective actions can be effectively identified during the review process.

Any non-conformances or deficiencies found during the audit are to be brought to the attention of the Environment and Community Manager so that corrective actions can be outlined. Corrective actions are allocated within Tahmoor Coal's CMO Compliance Management Software.

Independent Environmental Audits of the operation are undertaken every three years by 30 September of the year in accordance with Conditions 50 and 51 of DA 67/98.

Additionally, auditing will be undertaken in accordance with:

- *Health and Safety Management Plan* (TAH-HSEC-00189); and
- *Environmental Management System Framework* (EMSF; TAH-HSEC-00173).

6.2.5 Document Control

This Extraction Plan includes Document Control details as part of the document quality assurance and control (QA/QC). This Extraction Plan includes the following Document Control information:

- Document details including author(s), revision numbers, dates and status (refer to Document Control table at start of this Extraction Plan, and **Section 8.5**);
- Revision, approval and authorisation details (refer to Document Control table at the start of this Extraction Plan, and **Section 8.5**); and
- Distribution details including the provision to external stakeholders (refer to **Section 8.6** of this Extraction Plan).

All revisions of this Extraction Plan are stored on Tahmoor Coal's Document Control Software Intelex, and are updated in accordance with Tahmoor Coal's *Document and Record Control* (TAH-HSEC-00124) and *Change Management* (TAH-HSEC-00171) documents.

6.3 Roles and Responsibilities

The responsibility for implementation, monitoring and review of the Extraction Plan lies with Tahmoor Coal. The roles and responsibilities for the LW W1-W2 Extraction Plan are outlined below in **Table 6-2**.

Table 6-2 Roles and Responsibilities

Position	Responsibilities
General Manager	• Approve the Extraction Plan and associated documents; • Approve revised versions of the Extraction Plan and associated documents as required; and • Ensure sufficient resources are available to implement and execute the requirements of this Extraction Plan.
Mining Engineering Manager	• Approve the Extraction Plan and associated documents; • Approve revised versions of the Extraction Plan and associated documents as required; and • Ensure underground mining activities are conducted in accordance with the Extraction Plan.
Environment and Community Manager	• Approve the Extraction Plan and associated documents; • Approve reports as required by this Extraction Plan; • Approve revised versions of the Extraction Plan and associated documents as required; • Liaise with Government agencies and infrastructure owners in relation to subsidence matters, subsidence predictions and monitoring program of this Extraction Plan; • Project reporting; • Ensure the effective implementation of strategies designed to reduce impacts from excavation of LW W1-W2; • Ensure the Subsidence Monitoring Program and this Extraction Plan are implemented; • Ensure monitoring required under the Subsidence Monitoring Program and this Extraction Plan are carried out within specified timeframes, are adequately checked and processed, and are prepared to the required standard; • Monitor and review subsidence monitoring survey results; • Ensure any potential or actual issues, triggers and non-conformances are reported in accordance with the Extraction Plan, other legal requirements and corporate standards;

Position	Responsibilities
	• Implement subsidence management actions required by the Extraction Plan in the event that the TARPs are triggered; • Review and approve reports as required by this Extraction Plan; • Review and approve revised versions of the Extraction Plan and associated documents in accordance with the review requirements outlined in this Extraction Plan and other legal requirements and operational standards; and • Coordinate external audits, corporate reporting and management.
Community Coordinator	• Liaise with land owners, landholders and managers in relation to potential environmental consequences of subsidence and in relation to access for the Subsidence Monitoring Program and any remediation works; • Notify and liaise with the Community in relation to mining timing and monitoring performance; • Consult with relevant stakeholders during the review process of this Extraction Plan; • Maintain the complaints register; and • Install and maintain signage.
Approvals Coordinator	• Prepare and coordinate this Extraction Plan and associated documents; • Prepare and coordinate reports as required by this Extraction Plan; • Review and audit the Extraction Plan as required; • Prepare subsequent revisions of this Extraction Plan and associated documents as required; • Review and assess subsidence monitoring results against predictions; • Investigate any exceedances; • Report any exceedances to the Environment and Community Manager; • Assist the Environment and Community Manager in the implementation of the Subsidence Monitoring Program and this Extraction Plan; • Assist the Environment and Community Manager in monitoring and reviewing subsidence monitoring survey results; • Notify the Environment and Community Manager of any exceedance of performance indicators in accordance with the TARPs; and • Assist in the implementation of subsidence management actions required by the Extraction Plan.
Environmental Coordinator and/or Subsidence Coordinator	• Assist in the preparation and coordination of reports as required by this Extraction Plan; • Assist in the review and audit of this Extraction Plan and associated documents as required; • Assist in the revision of this Extraction Plan and associated documents as required; • Review and assess subsidence monitoring results against predictions; • Investigate any exceedances; • Report any exceedances to the Environment and Community Manager; • Assist the Environment and Community Manager in the implementation of the Subsidence Monitoring Program and this Extraction Plan; • Assist the Environment and Community Manager in monitoring and reviewing subsidence monitoring survey results; • Notify the Environment and Community Manager of any exceedance of performance indicators in accordance with the TARPs; and • Assist in the implementation of subsidence management actions required by the Extraction Plan.
Surveyor	• Coordinate with the Environment and Community Manager to gain access for subsidence monitoring; • Establish subsidence monitoring in accordance with the Subsidence Monitoring Program; and • Undertake subsidence effects monitoring in accordance with the Subsidence Monitoring Program to the required survey standard within the specified timeframes.

Position	Responsibilities
Mine Subsidence Engineer	• Ensure monitoring data are adequately checked, processed and recorded; • Provide monitoring results to the Environment and Community Manager, relevant agencies and infrastructure owners; • Review and assess subsidence monitoring results against predictions; • Investigate any exceedances; • Report any exceedances to the Environment and Community Manager; • Notify the Environment and Community Manager of any identified public safety issues; and • Review the Subsidence Monitoring Program and other documents as required.
All employees and contractors	• Comply with all requirements of this Extraction Plan; • Undertake all works in accordance with this Extraction Plan and associated documents, and all other Tahmoor Coal systems; and • Report all potential environmental incidents to their supervisor immediately.

7 Graphical Plans

7.1 Graphical Plans required Guidelines

Table 7-1 lists the graphical plans have been prepared for the LW W1-W2 Extraction Plan Study Area in accordance with the *Draft Guidelines for the Preparation of Extraction Plans V5 (*DPE, 2015). The A0 size graphical plans are provided in **Volume 5.**

It is noted that given there are no existing or proposed workings in other seams above or below the proposed working seam, Plan 4 is not required.

Table 7-1 Graphical Plans

Plan Number	Plan Title	Plan Reference Number
Plan 1	Workings and Dimensions	TCC-2089-1
Plan 2	Surface Features	TCC-2089-2
Plan 3	Bulli Seam Geological Data	TCC-2089-3
Plan 4	Existing and Proposed Workings in Seams Above and/or Below	Not required
Plan 5	Mining Titles and Land Ownership	TCC-2089-5
Plan 6	Geological Sections	TCC-2089-6
Plan 7	Subsidence Monitoring	TCC-2089-7
Plan 8	Aerial Photography	TCC-2089-8

8 Document Information

8.1 References

Barbato (2017). Development of improved methods for the prediction of horizontal movement and strain at the surface due to longwall coal mining. James Barbato. PhD thesis, University of New South Wales. http://www.unsworks.unsw.edu.au/UNSWORKS:unsworks_search_scope:unsworks_47542

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Niche (2019a), Tahmoor North – Western Domain Longwalls West 1 and West 2, Aquatic Biodiversity Technical Report, prepared for Tahmoor Coal.

Niche (2019b), Tahmoor North – Western Domain, Aquatic Ecology Baseline Monitoring Report, prepared for Tahmoor Coal.

Niche (2019c), Tahmoor North – Western Domain Longwalls West 1 and West 2, Terrestrial Biodiversity Technical Report, prepared for Tahmoor Coal.

Niche (2019d), Tahmoor North – Western Domain, Terrestrial Ecology Baseline Monitoring Report, prepared for Tahmoor Coal.

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WRM (2019), Matthew Creek Flood Impact Study for LW W1-W2, Prepared for Tahmoor Coking Coal Operations, May 2019, document 1072-05-B1.

8.2 Related Documents

Related documents directly related to or references from this document are provided below in **Table 8-1**.

Table 8-1 Related Documents

Document Title	Document Number
Environmental Management System Framework	TAH-HSEC-00173
Mining Operations Plan 2012-2019	TAH-HSEC-00026
Document and Record Control	TAH-HSEC-00124
Change Management	TAH-HSEC-00171
Risk Management	TAH-HSEC-00229
WRAC Workplace Risk Assessment and Controls	TAH-HSEC-00014
Health and Safety Management Plan	TAH-HSEC-00189
Emergency Management Plan	TAH-HSEC-00168
Extraction Plan LW W1-W2 Coal Resource Recovery Plan	TAH-HSEC-00243
Extraction Plan LW W1-W2 Water Management Plan	TAH-HSEC-00244
Extraction Plan LW W1-W2 Land Management Plan	TAH-HSEC-00247
Extraction Plan LW W1-W2 Biodiversity Management Plan	TAH-HSEC-00246
Extraction Plan LW W1-W2 Heritage Management Plan	TAH-HSEC-00242
Extraction Plan LW W1-W2 Built Features Management Plan	TAH-HSEC-00250
Extraction Plan LW W1-W2 Public Safety Management Plan	TAH-HSEC-00245
Extraction Plan LW W1-W2 Subsidence Monitoring Program	TAH-HSEC-00249

8.3 Glossary of Terms

Terms references to this document are provided below in **Table 8-2**.

Table 8-2 Glossary of Terms

Term	Definition
Adaptive management	Monitoring subsidence impacts and subsidence effects and, based on the results, modifying the mine plan as mining proceeds to ensure that the effects, impacts and/or associated environmental consequences remain within the predicted and designated ranges and in compliance with the conditions of the Project Approval.
Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence)
Aquifer	A sub-surface rock formation containing water in recoverable quantities.
Block	A dimensional delineation of the mineral deposit; as in “a block of coal” or a “coal blocked out for extraction”.
Built features	Includes any building or work erected or constructed on land, including dwellings and infrastructure such as a formed road, street, path, walk, or driveway; any pipeline, water sewer, telephone, gas or other infrastructure service main.
Chain pillar	A block of coal left unmined between the longwall extraction panels.

Term	Definition
Cliffs	Continuous rockfaces having minimum heights of 10 m, minimum lengths of 20 m and minimum slopes of 2 to 1, i.e. having minimum angles to the horizontal of 63o
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of mm, is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.
Coal face	The current working place for coal extraction.
Coal Preparation Plan (CPP)	Processing plant where coal is sized, washed and prepared for the market.
Coal seam	Naturally formed underground layer of coal.
Continuous miner	The electric powered cutting machine used to remove coal from the active mining face and load it into the shuttle car.
Conveyor	The means of transporting coal from the coal face to the underground bin or surface. It consists of a belt being driven by a motor over a roller assembly.
Cover depth (H)	The depth of coal seam from the ground surface in m. Cover depth is normally provided as an average over the area of the panel.
Critical area	The area of extraction at which the maximum possible subsidence of one point on the surface occurs.
Curvature	Second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided bythe average length of those sections. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of 1/km (km-1), but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually in km. Curvature can be either hogging (i.e. convex) or sagging (e.g. concave).
Development	The operations involved in preparing the coal seam for extraction.
Downcast	A shaft or other mine opening down to the underground workings in which fresh air from the surface passes.
Drift	An inclined access opening from the surface to the coal seam.
Exploration	The search for mineral deposits and the work done to prove or establish the extent of a mineral deposit.
Extracted seam	The thickness of coal that is extracted. The extracted seam thickness is thickness normally given as an average over the area of the panel.
Effective extracted seam thickness (T)	The extracted seam thickness modified to account for the percentage of coal left as pillars within the panel.
Face length	The width of the coalface measured across the longwall panel.
Far-field movements	The measured horizontal movements at pegs that are located beyond the longwall panel edges and over solid unmined coal areas. Far-field horizontal movements tend to be bodily movements towards the extracted goaf area and are accompanied by very low levels of strain.
First workings	The driving of headings (underground roadways) into the solid coal seam prior to the commencement of extraction. First workings do not result in surface subsidence.
Gate road	An underground roadway leading to a working place in longwall mining.
Goaf	The void created by the extraction of the coal into which the immediate roof layers collapse.

Term	Definition
Goaf end factor	A factor applied to reduce the predicted incremental subsidence at points lying close to the commencing or finishing ribs of a panel.
Headings	An underground roadway formed in the direction of a development panel.
Horizontal displacement	The horizontal movement of a point on the surface of the ground as it settles above an extracted panel. Displacement is described by various parameters including horizontal tilt, horizontal curvature, mid-ordinate deviation, angulardistortion and shear index.
Incremental subsidence	The difference between the subsidence at a point before and after a panel is mined. It is therefore the additional subsidence at a point resulting from the excavation of a panel.
Inflection point	The point on the subsidence profile where the profile changes from a convex curvature to a concave curvature. At this point the strain changes sign andsubsidence is approximately one half of S max.
Longwall	A system of mining coal in which the seam is extracted on a broad front or long face using a coal shearer and the roof is supported by hydraulic roof supports.
Minor cliffs	Continuous rockfaces having heights between 5 m and 10 m, minimum lengths of 20 m and a minimum slope of 2 to 1.
Mitigation measures	Subsidence management measures which aim to reduce subsidence impacts, usually implemented prior to or during mining.
Overlap adjustment factor	A factor that defines the ratio between the maximum incremental subsidence of a panel and the maximum incremental subsidence of the panel if it were the first panel in a series.
Panel or longwall panel	The plan area of coal extraction, or a block of coal to be mined by longwalls defined by gate roads and coal seam thickness.
Panel length (L)	The longitudinal distance along a panel measured in the direction of mining from the commencing rib to the finishing rib.
Panel width (Wv)	The transverse distance across a panel, usually equal to the face length plus the widths of the roadways on each side.
Panel centre line	An imaginary line drawn down the middle of the panel.
Pillar	A block of coal left unmined.
Pillar width (Wpl)	The shortest dimension of a pillar measured from the vertical edges of the coal pillar, i.e. from rib to rib.
Remediation measures	Subsidence management measures which aim to repair any adverse effects of subsidence, usually implemented after mining.
Risk	The chance of something happening that will have an impact on objectives. It is measures in terms of consequence and likelihood.
Run of mine (ROM)	Raw coal production; the unprocessed mined coal that is conveyed to the CPP. ROM may consist of coal and rock.
Safe, serviceable and Repairable	Safe means no danger to users who are present; serviceable means available for its intended use; repairable means damaged components can be repaired economically.
Second workings	Extraction of coal by longwall mining that may result in surface subsidence.
Shaft	A vertical opening connecting the surface with the underground workings.
Shear deformations	The horizontal displacements that are measured across monitoring lines and these can be described by various parameters including; horizontal tilt,horizontal curvature, mid-ordinate deviation, angular distortion and shearindex.

Term	Definition
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Sub-critical area	An area of panel smaller than the critical area.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but, 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of mm. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Subsidence effects	The deformations of the ground mass surrounding a mine, sometimes referred to as 'components' or 'parameters' of mine subsidence induced ground movements, including vertical and horizontal displacements, tilts,curvatures, strains, upsidence and closure.
Subsidence impacts	The physical changes or damage to the fabric or structure of the ground, its surface and environmental features, or built structures that are caused by the subsidence effects. These impacts considerations can include tensile and shear cracking of the rock mass, localised buckling of strata, bed separation, rock falls, collapse of overhangs, failure of pillars, failure of pillar floors,dilation, slumping and also include subsidence depressions or troughs.
Subsidence consequences	The knock-on results of subsidence impacts, i.e. any change in the amenity or function of a natural feature or built structure that arises from subsidence impacts. Consequence considerations include public safety, loss of flows, reduction in water quality, damage to artwork, flooding, draining of aquifers, the environment, community, land use, loss of profits, surface improvements and infrastructure. Consequences related to environmental features are referred to as environmental consequences.
Super-critical area	An area of panel greater than the critical area.
Tilt	The change in the slope of the ground as a result of differential subsidence,and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the firstderivative of the subsidence profile. Tilt is usually expressed in units of mm/m. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 %, or 1 in 1000.
Total subsidence, tilts, curvatures and strains	Accumulated parameters after the completion of each longwall.
Travelling subsidence, tilts, curvatures and strains	Transient movements as the longwall extraction face mines directly beneath a given point.
Upcast	A shaft or other mine opening through which air returns to the surface after ventilating the underground workings.
Uplift	An increase in the level of a point relative to its original position.

Term	Definition
Upsidence	Upsidence results from the dilation or buckling of near-surface strata at ornear the base of the valley. The term uplift is used for the cases where the ground level is raised above the pre-mining level, i.e. when the upsidence is greater than the subsidence. The magnitude of upsidence, which is typically expressed in the units of mm, is the difference between theobserved subsidence profile within the valley and the conventionalsubsidence profile which would have otherwise been expected in flat terrain.
Vertical displacement	Vertical downward movements of the ground surface caused by underground coal mining.
Valley related movements	Valley bulging movements are a natural phenomenon, resulting from the formation and ongoing development of the valley. The potential for these natural movements are influenced by the geomorphology of the valley. Valley related movements can be caused by or accelerated by mine subsidence as the result of a number of factors, including the redistribution of horizontal in situ stresses and down slope movements. Valley related movements are normally described by the parameters upsidence, closure, compressive strains and tensile strains.

8.4 Abbreviations

Abbreviations used in this document are provided below in **Table 8-3**.

Table 8-3 Abbreviations

Abbreviation	Definition
ACARP	Australian Coal Association Research Program
ACHA	Aboriginal Cultural Heritage Assessment
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information System
AHTR	Aboriginal Heritage Technical Report
AR	Annual Review
ARI	Average Recurrence Interval
ARTC	Australian Rail Track Corporation
BFMP	Built Features Management Plan
Bgl	Below Ground Level
BMP	Biodiversity Management Plan
Bradcorp	Bradcorp Holdings Pty Ltd
CMAP	Corrective Management Action Plan
CMO Database	Tahmoor Coal Compliance Database
DA	Development Application
DC	Development Consent
DEM	Discrete Element Method
DoI	NSW Department of Industry
DoI Crown Lands	NSW Department of Industry – Crown Lands Division
DoI Water	NSW Department of Industry – Water (formerly DPI Office of Water)

Abbreviation	Definition
DoP	NSW Department of Planning (former)
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries (part of DT & I)
DPI Agriculture	NSW Department of Primary Industries – Agriculture
DRE	NSW Department of Planning and Environment – Resources Regulator
DRG	NSW Department of Planning and Environment – Resources and Geoscience
DSC	Dams Safety Committee
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMSF	Environmental Management Strategy Framework
EOP	End of Panel report
EPA	NSW Environment Protection Authority
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ERG	Environmental Response Group
ESU	NSW Trade and Investment, Division of Resources and Energy – Environmental Sustainability Unit
GFG	GFG Alliance
HMP	Heritage Management Plan
HSEC	Health, Safety, Environment and Community
IPM	Incremental Profile Method
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	Metres
MG	Main Gate
mm	Millimetre
ML	Mining Lease
MOP	Mining Operations Plan 2012-2019 (TAH-HSEC-00026)
MSD	Mine Subsidence District
MSEC	Mining Subsidence Engineering Consultants
Mt	Million tonnes

Abbreviation	Definition
Mtpa	Million tonnes per annum
NPWS	NSW National Parks and Wildlife Service
NRAR	NSW Industry – Land & Water – Natural Resources Access Regulator – East
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
ONRSR	NSW Office of the National Rail Safety Regulator
PAC	Planning and Assessment Commission
PMF	Probable Maximum Flood
QA/QC	Quality assurance and control
RAPs	Registered Aboriginal Parties
Resources Regulator	NSW Department of Planning and Environment – Resources Regulator
Roads and Maritime	NSW Roads and Maritime Service
ROM	Run of Mine
RRG	Rail Response Group
SA NSW	Subsidence Advisory NSW (formerly the Mine Subsidence Board)
SES	NSW State Emergency Services
SIMEC	SIMEC Mining Division
SMP Application	2014 Subsidence Management Plan Application
Spatial Services	NSW Department of Finance, Services and Innovation – Spatial Services
SRG	Structural Response Group
SSR	Safe Serviceable and Repairable
Tahmoor Mine	Tahmoor Coal Mine
Tahmoor Coal	Tahmoor Coal Pty Ltd
TARP	Trigger Action Response Plan
TCCCC	Tahmoor Colliery Community Consultative Committee
TCCO	Tahmoor Coking Coal Operations
Tesrol	Tesrol Clearview Pty Ltd
TG	Tailgate
tph	Tonnes per hour
TSS	Total Suspended Solids
UDEC	Universal Distinct Element Code
Western Domain	The area to the north-west of the Main Souther Rail within ML 1376 and ML 1539
WHS Act	*Work Health and Safety Act 2011*
WHS Regulation	*Work Health and Safety Regulation 2017*
WHSMP Act	*Work Health and Safety (Mines and Petroleum Sites) Act 2013*
WHSMP Regulation	*Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*
WMP	Water Management Plan
WSC	Wollondilly Shire Council

8.5 Change Information

Table 8-4 provides the details of document history of this Extraction Plan.

Table 8-4 Document History

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

8.6 Document Distribution

This Extraction Plan and associated document have been distributed according to **Table 8-5**.

Table 8-5 Distribution List for Extraction Plan

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Appendix A – Subsidence Prediction and Impact Assessment Report (MSEC, 2019)

Appendix B – Subsidence Geotechnical Report (SCT, 2019)

Appendix C – Letters of Consultation

Appendix D – Master Trigger Action Response Plan

Appendix E – Coal Resource Recovery Plan (TAH-HSEC-243)