

Transmission Line Management Plan

TransGrid TL25/26 Towers 39 – 42

Longwalls 28 and 29

Mandalong Mine

MEMS-EP-9000-TLMP-9053

October 2020

Centennial Coal Company Limited ABN 30 003 714 538

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	Mr Mathew Sprott Director Resource Assessments	Department of Planning, Infrastructure and Environment - Resource Assessments	Rev. 1 – 06/10/2020
	Mr Matthew Montgomery Manager Infrastructure	Subsidence Advisory NSW (SA NSW)	Rev. 1 – 06/10/2020

1 BACKGROUND

1.1 Introduction

Mandalong Mine is a modern underground longwall operation located on the western side of Lake Macquarie near Morisset and west of the M1 Motorway. The Mine is situated approximately 130 km north of Sydney and 35 km from the Port of Newcastle, suppling up to 6.5 million tonnes of coal to the domestic power and export markets.

Centennial Mandalong Pty Ltd (Centennial Mandalong) is the operator of Mandalong Mine and is a wholly owned subsidiary of Centennial Coal Company Limited which is also a wholly owned subsidiary of by Banpu Public Company Limited.

Mandalong Mine commenced longwall mining in 2005 and operates narrow longwall panels in the West Wallarah Seam that utilise the bridging effect of the overlying massive conglomerate and sandstone strata to provide reduced levels of subsidence. This design is proven and provides subsidence impacts below safe, serviceable and repairable (SSR) criteria for dwellings and minimises the impacts to the Mandalong valley flood plain, natural features and built features.

Centennial Mandalong comprises the underground workings and surface infrastructure of:

- The Mandalong Mine underground workings including longwall panels, development units and surface infrastructure located near Morisset;
- The Cooranbong Entry Site, consisting of the Cooranbong Colliery underground workings and surface infrastructure located near Dora Creek;
- The Delta Entry Site, which encompasses an entry and coal delivery system, located near Wyee at the Vales Point Rail Unloader Facility; and
- The new surface facilities site, referred to as the Mandalong South Surface Site located off Mandalong Road. The surface facilities are currently being constructed.

Mandalong Mine operates under Development Consent SSD-5144 which was granted on 12 October 2015 by the NSW Planning Assessment Commission under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act), and provided for extension of the mining area with a production limit of 6.5 million tonnes per annum of thermal coal from the West Wallarah and Wallarah-Great Northern Seams using a combination of longwall and continuous miner methods until 31 December 2040.

Centennial Mandalong is proposing to modify (Modification 9) Mandalong Mine's State significant development (SSD) 5144 consent under Section 4.55(2) of the EP&A Act. The modification is proposing amendments to the existing approved mine layout, including reorientating some of the approved longwalls (LW30-33) on the western side of the mains to a north-east to south-west alignment, removing longwalls (34-37) that will not be developed and renumbering the longwalls accordingly. These changes are required to mitigate the impact on the mine's viability attributable to a geological fault and igneous sill located to the west of the current longwall panels. The revised mine design has been developed to ensure no greater impacts than those presently approved under SSD-5144 will occur.

This Transmission Line Management Plan has been developed in accordance with the current requirements of Condition 6, Schedule 4 of SSD-5144 for the extraction of Longwalls 28 and 29 and in accordance with Mining Lease (ML1722) requirements issued under the Mining Act 1992 to extract longwall panels within the West Wallarah Seam. The Extraction Plan and Transmission Line Management Plan have been prepared generally in accordance with the Department of Planning & Environment, *Draft Guidelines for the Preparation of Extraction Plans V5* (2015) and the Department of Industry - Resources Regulator, *Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation* (2017).

The area applicable to this extraction plan is defined in detail in Section 3.1

1.2 Project Description

The topography of the Mandalong valley and the Extraction Plan area ranges from the broad flat floodplain of Morans Creek to the foothills of the Watagan Mountain range. The land affected by longwall mining is a combination of natural bushland of the Watagan Ranges together with cleared areas of the floodplain. Properties located within the valley and Extraction Plan area are typically 17 ha to 40 ha rural residential properties bordered to the west by Olney State Forest.

Within the Extraction Plan area there are 11 private properties and seven properties owned by Centennial Coal. The privately owned properties and six affected dwellings are managed by individual Property Subsidence Management Plans (PSMP) as required by SSD-5144 Schedule 4 Condition 6 (h).

Local roads, power lines, transmission lines, telecommunication networks and other associated infrastructure are also included in the area of potential subsidence influence. This infrastructure is managed by the Built Features Management Plan and supporting individual infrastructure management plans developed for Public Roads, Telstra Communications, Ausgrid Powerlines and TransGrid Transmission Lines.

2 Purpose

The purpose of the Transmission Line Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on TransGrid 330kV Transmission Line No. 25/26 Towers 39 to 42. The four towers will be affected by the extraction of LW28 and LW29.

TransGrid are currently retro-fitting concrete cruciform footings on Towers 39, 40, 41 and 42 to protect them from the impacts of subsidence from LW28 and LW29. The construction works commenced in August 2020 and are scheduled for completion during March 2021.

Tension Tower 43 is located to the south-west of LW28 and LW29 and positioned outside the 26.5° angle draw from the longwall panels.

3 Scope

3.1 Extraction Plan Area

The Transmission Line Management Plan applies to the management of risks relating to the development of subsidence from the extraction of LW25-31, located within Centennial Mandalong

Mining Leases (ML1543, ML1722 and ML1744) and Development Consent SDD-5144. The Extraction Plan Area is defined by a minimum 26.5° angle of draw or 20mm limit of subsidence at the Upper 95% Confidence Limits from the extents of proposed extraction LW25-31 as shown in **Figure 1**.

Note that LW30 and LW31, will not be mined in the locations approved in Extraction Plan LW25-31.

3.2 TransGrid Transmission Line No. 25/26

Transmission lines and towers within the Extraction Plan Area are under the care and control of TransGrid. The transmission line network location and mine workings are shown in **Figure 1**.

Transmission Line No. 25/26 is a double circuit line that is constructed in a steel lattice tower structure arrangement. The transmission line supplies electricity form Vales Point Power Station to Sydney.

A feasibility study and Scoping Study Report were completed by TransGrid during 2018 and 2019 confirmed that eight towers along TL25/26 affected by the proposed mining in LW28 to LW37 (original mine layout) would require the retrofitting of cruciform footings and installation of sheaves on Towers 39, 40, 41, 42, 44, 45, 46 and 47. Tension Tower 43 is located outside the 26.5° angle of draw of longwall mining.

This management plan is to manage the subsidence effects for Towers 39 to 42. A further management plan will be developed to manage subsidence impacts to Towers 44 to 47 located over the proposed reorientated LW33.

The position of the TL25/26 and towers is shown in Figure 1.



Figure 1 – TransGrid Transmission Lines and Mine Workings

4 Consultation and Plan Development

The Transmission Line Management Plan has been prepared and developed in consultation with key stakeholders as required by Development Consent SSD-5144. The Transmission Management Plan and the completed cruciform footing mitigation works has been prepared and developed in consultation with TransGrid, RR and SA NSW. A summary of the consultation for the Transmission Line Management Plan TL25/26 Towers 39 - 42 is presented in **Table 1** and copy of the correspondence included in **Appendix 5**.

The process for consultation, communication and the provision of information pertaining to this management plan will be managed according to Centennial Mandalong's **HSMC-SC-Information and Communications Arrangements** and **HSMS-SE-6592-Consultation Arrangements**.

Stakeholder	Date	Consultation Type and Summary of	Section
		Aspects/Issues	Addressed
TransGrid	2018-2020	Ongoing consultation during the feasibility study,	Section 3.2
		design works, and construction of the mitigation works on TL25/26.	Section 4
TransGrid	2/09/2020	Mr Mohammad Shayeem – TransGrid Project	Section 4
		Manager for TL25/26 mitigation work confirmed as	
		the TransGrid representative to assist development	
		of this management plan.	
TransGrid	9/09/2020	Provide TransGrid with the draft management plan	Section 4
		for review.	
TransGrid	11/09/2020	Mr Mohammad Shayeem provided edits and	Section 4
		comments to draft Management Plan.	
TransGrid	14/09/2020	Management Plan updated with TransGrid's	Section 4
		requested changes and provided for final review.	
TransGrid	15/09/2020	Mr Mohammand Shayeem provided email	Section 4
		confirming the "Transmission Line Management Plan	Appendix 5
		TL25/26 Towers 39 to 42" is acceptable to TransGrid	
NSW Resources	15/09/2020	Final Draft of management plan provided for	Section 4
Regulator		Resources Regulator review.	
NSW Resources	2/10/2020	Resources Regulator acknowledgement of	Section 4
Regulator		consultation requirements fulfilled as per SSD-5144	Appendix 5
		S4 Condition6 (g).	

Table 1 – Overview of Stakeholders Consulted Specifically for the Management Plan

5 Regulatory Requirements

Centennial Mandalong activities at its operations are conducted in accordance with relevant legislation and requirements of statutory authorities. Legislative and regulatory requirements are generally recognised through the imposition of conditions on the development consent, licences, mining approvals and Work Health and Safety legislation.

5.1 Development Consent

Development Consent SSD-5144 provides a number of conditions relating to the preparation of the Built Features Management Plans. These conditions are summarised in **Table 2** below, together with the notation of the section of this document in which each matter is addressed.

Schedule 4 Condition 4 Performance Measures – Built Features The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7, to the satisfaction of the Secretary. Section 6 Schedule 4 Condition 5 Performance Measures Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 7 is to be settled by the Secretary, following consultation with DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent. Section 6 Schedule 4 Condition 6 (g) Extraction Plan (g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected built features, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which: addresses in appropriate detail all items of key public infrastructure (with particular consideration to tension/angle/suspension towers on transmission lines), and other public infrastructure; has been prepared following appropriate consultation with the owner/s of potentially affected feature/s; recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all 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 and effectiveness during extraction which may impact the infrastructure; Section 12 Schedule 4 (o) Trigger Ac	Condition	Development Consent Condition	Section Addressed
Condition 4The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7, to the satisfaction of the Secretary.and Table 6Schedule 4 Condition 5Performance Measures Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 7 is to be settled by the Secretary, following consultation with DRE. Any decision by the Secretary, following consultation with DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.Section 6Schedule 4 Condition 6 (g)Extraction Plan (g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected built features, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:Extraction Plan LW25-31•addresses in appropriate detail all items of key public infrastructure (with particular consultation to tension/angle/suspension towers on transmission lines), and other public infrastructure;Transmission Line No. 25/26 Towers 39 to 42.•has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;Kanagement Plan LW25-31•in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing of compliance and effectiveness during extraction which may impact the infrastructure;Section 12•condition 6 (n) and provides for annual auditing of compliance and effectiveness during extraction which may	Schedule 4	Performance Measures – Built Features	Section 6
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dlu dlu	Condition 6 (o)	and 7 which contain:	and
appropriate triggers to warn of the development of an Appendix 1		 appropriate triggers to warn of the development of an 	Appendix 1
increasing risk of exceedance of any performance measures;		increasing risk of exceedance of any performance measures;	
 specific actions to respond to high risk exceedance of any 		 specific actions to respond to high risk exceedance of any 	
performance measure to ensure that the measure is not		performance measure to ensure that the measure is not	
exceeded; and		exceeded; and	
an assessment of remediation measures that may be		an assessment of remediation measures that may be	
required if exceedances occur and the capacity to implement		required if exceedances occur and the capacity to implement	
Che measures; Contingency Plan that provides for: Contingency Plan that provides for:	Schodula 1	Ine measures;	Section 12
Condition 6 (n) • adaptive management where monitoring indicates that there and	Condition 6 (n)	 adaptive management where monitoring indicates that there 	and

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Table 2 - E	Development	Consent	Conditions	SSD-5144

Condition Development Consent Condition		Section Addressed
	has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely; and	Appendix 1
an assessment of the remediation measures that may be required if exceedances occur and the capacity to implement the measures;		
Statement of	Subsidence Monitoring and Management	This Plan
Commitments	As part of the development of each Extraction Plan, Centennial Mandalong will update the Public Safety Management Plan and Built Features Management Plans in consultation with the relevant	Built Features Management Plan
	infrastructure owners.	

5.2 Mining Leases

The Extraction Plan Area for LW25-31 is associated with three mining leases held by Centennial Mandalong; ML1543, ML1722 and ML1744.

The section of TL25/26 affected by the Extraction Plan is located wholly within ML1722. **Table 3** summaries the relevant conditions relating to the Extraction Plan and preparation of the Transmission Line Management Plan.

	Mining Lease No. 1443 and 1543	Section Addressed
ML1722	Extraction Plan	Extraction Plan
Condition 6	(a) In this condition:	LW25-31
Condition 6	 (a) In this condition: (i) approved Extraction Plan means a plan, being: A. an extraction plan or subsidence management plan approved in accordance with the conditions of a relevant development consent and provided to the Secretary; or B. a subsidence management plan relating to the mining operations subject to this lease: I. submitted to the Secretary on or before 31 December 2014; and II. approved by the Secretary. (ii) relevant development consent means a development consent or project approval issued under the Environmental Planning & Assessment Act 1979 relating to the mining operations subject to this lease. (b) The lease holder must not undertake any underground mining operations that may cause subsidence except in accordance with an approved Extraction Plan. (a) The lease holder must ensure that the approved Extraction Plan provides for the effective management of risks associated with any subsidence resulting from mining operations carried out under this lease. (b) The lease holder must notify the Secretary within 48 hours of any: (i) incident caused by subsidence which has a potential to expose any person to health and safety risks; (ii) significant deviation from the predicted nature, magnitude, distribution, timing and duration of subsidence effects, and of the potential impacts and consequences of those deviations on built features; A. built features; 	Extraction Plan LW25-31 Built Features Management Plan LW25-31 Public Safety Management Plan LW25-31 Subsidence Monitoring Program LW25-31
	C. subsidence monitoring	

Table 3 – Summary of ML1722 conditions relating to Transmission Lines

5.3 Work Health and Safety Legislation

Mandalong Mine has developed a Safety Management System framework (MS-1001) 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 and AS/NZS 4804:2001.

The following Work, Health and Safety (WHS) requirements have been considered for the Extraction Plan principally within the context of subsidence related risks to public safety, including to private property and public infrastructure and in reference to *Managing Risks of Subsidence Guide: WHS (Mines and Petroleum Sites) Legislation* (NSW Department of Industry - Resources Regulator, 2017).

Work Health and Safety legislation relating to the management of risk to health and safety from mine subsidence is addressed in **Table 4**.

Work Health and Safety Legislation Clause	Requirement	Section Addressed
WHS Regulation 2017 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 7 Section 8 Extraction Plan Appendix 4 -Risk Assessments
WHS Regulation 2017 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 6.1 Section 7 Section 9 Section 11
WHS Regulation 2017 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 6.1 Section 7 Section 9 MS-1001
WHS Regulation 2017 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 	Section 9 Section 10 Volume 3 of LW25-31 EP

Table 4 - Summary of WHS Legislation Relating to Mine Subsidence

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	(c) installed, set up and used correctly.	
WHS Regulation 2017 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 representative, and (b) the duty holder has not adequately reviewed the control measure in response to the circumstance. 	Section 11 Section 15 Extraction Plan Appendix 4 -Risk Assessments
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 9	 Management of risks to health and safety (cl 617 model WHS Regs) (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. (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 (c) 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)	Section 7 MS-1001

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	management plan—forms part of the plan.	
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 10	 Review of control measures (cl 618 model WHS Regs) (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, (c) 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 of a request made to 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. 	Section 11 Section 15 MS-1001 Section 14
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 23 Identification of principal mining hazard management plan	 The mine operator of a mine must identify all principal mining hazards associated with mining operations at the mine. 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. The mine operator, in conducting a risk assessment under subclause (2), must: 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. 	Centennial Risk Management System – consistent with AS/NZS ISO 31000:2009 Risk Assessments in Appendix 4 Extraction Plan Subsidence WHS No. 1001025001 Built Features LW25-31 No. 1001172002 Environment LW25-31 No. 1001172001 PSMPs LW25-31 No. 1001172003
WHS Regulation (Mines and	(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	Extraction Plan LW25-31
2014 Clause 24	(2) A principal mining hazard management plan must:(a) provide for the management of all aspects of risk control in relation to the	and Public Safety Management Plan
Preparation of principal mining	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.	and Transmission Line Management Plan

Work Health and Safety Legislation Clause	Requirement	Section Addressed
hazard management plan	 (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: (a) the matters set out in Schedule 1 in respect of the principal mining hazard, and (b) any other matter relevant to managing the risks associated with the principal 	
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 67 Subsidence	 mining hazard at the mine. (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 (e) 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 6.1 Extraction Plan Appendix 4 - Risk Assessments Section 9 Section 10 Section 13 Section 14 TARPs
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 128 Duty to notify regulator of certain incidents	 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: high potential incident means any of the following: (m) any indication from monitoring data of the development of subsidence which 	Appendix 1 TARPs Section 14 Public Safety Management Plan and Land Management Plan

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	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.	
WHS Regulation (Mines and Petroleum Sites) 2014 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. 	Extraction Plan - Appendix 1 (Ditton Geotechnical Services, 2018) Extraction Plan and Volume 3 (Component Plans)
WHS Regulation (Mines and Petroleum Sites) 2014 Schedule 3 Clause 16 High Risk Activities	 Secondary extraction or pillar extraction, splitting or reduction The following are identified as high risk activities: secondary extraction by longwall mining, shortwall mining or miniwall mining, pillar extraction, pillar splitting, pillar reduction. The waiting period for any such activity is 3 months. The information and documents that must be provided in relation to any such activity are as follows: details of the authoritative sources used in determining that the proposed method of work can be done safely, 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, 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, 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, details of how the risks to the health and safety of workers and other persons from subsidence caused by the activity will be managed. 	Extraction Plan LW25-31 High Risk Activity Notification for LW25-31

5.4 Extraction Plan Guidelines

The Extraction Plan and Transmission Line Management Plan have been prepared generally in accordance with the Department of Planning & Environment, *Draft Guidelines for the Preparation of Extraction Plans V5* (2015). **Table 5** provides a summary of the guidelines requirements for key component plans together with the notation of the section of this document in which each matter is addressed.

Extraction Plan Guideline Requirement – Key Component Plans	Section Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan	Section 1 Section 3
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan	Section 6
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation)	Section 6 Section 6.1
Proposing performance indicators to establish compliance with these performance measures and statutory requirements;	Section 6 TARPS
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance. It should be noted that a full description of such features, sites and values would commonly have been provided and considered in a recent environmental impact assessment. Consequently, this section can be relatively brief, and focus on the presentation of appropriate figures and/or graphical plans;	Section 8
Describe all currently predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan;	Section 8
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the Applicant's commitments;	Section 9 Section 10.2 TARPS in Appendix 1
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites);	Section 10.1
Fully describing the proposed monitoring of subsidence impacts and environmental consequences;	Section 10.2
Describe the proposed monitoring of the success of remediation measures following implementation;	Section 10.2
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences;	Section 11 TARPS in Appendix 1
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions or which exceed performance measures;	Section 11 Section 12 TARPS in Appendix 1
Listing responsibilities for implementation of the plan; and	Section 13
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	Appendix 1

Table 5 – Extraction Plan Guideline Requirements for Key Component Plans

6 Performance Measures and Indicators

6.1 Mine Design

Mandalong Mine is designed to provide reduced levels of subsidence by using "sub-critical" longwall panels (180m void width) combined with 43.3m to 46m wide and nominally 100m long chain pillars that utilise the bridging effect of the overlying massive conglomerate and sandstone strata. This design is proven and provides subsidence impacts below safe, serviceable and repairable (SSR) criteria for dwellings and also minimises the impacts to the flood plain, natural features and the transmission towers managed by this plan.

6.2 Subsidence Prediction

Subsidence predictions and potential impacts from the extraction of LW25-31 on surface and subsurface features present within the Extraction Plan Area has been prepared by Ditton Geotechnical Services (2018) and subsequent updated predictions are based on the following methodology:

- (i) The development of a geotechnical model of the overburden and immediate roof-pillar-floor system using available borehole log and testing data.
- (ii) Prediction of maximum subsidence effect parameters for the proposed longwalls.
- (iii) Review of Mandalong Mine's subsidence data and impacts associated with LWs 1 23.
- (iv) Prediction of first and final subsidence effect profiles and final contours and assessment of the potential impacts to existing and proposed features or developments.
- (v) Prediction of post-mining surface levels.
- (vi) Potential surface cracking widths and their general location.
- (vii) Prediction of sub-surface heights of continuous and discontinuous fracturing above the proposed longwall panels.
- (viii) Potential ponding depth locations.
- (ix) Potential surface gradient changes and erosion / slope stability impacts.
- (x) Valley Closure and Uplift potential along watercourses.
- (xi) Far-field horizontal displacements and strains.
- (xii) Predicted impacts and management strategies required for the environment, developments and Aboriginal and European Heritage sites.

Two empirically based prediction models (ACARP, 2003 and SDPS^{*}) have been used to generate subsidence profiles and contours above the proposed longwall panels after mining is complete. **Surfer 8**^{*}software has then been used to generate subsidence, tilt, horizontal displacement, and strain contours above the panels from the SDPS^{*} output files.

The subsidence predictions models used in this study are summarised below:

• ACARP, 2003 - An empirical model that was originally developed for predicting maximum single and multiple longwall panel subsidence, tilt, curvature and strain in the Newcastle Coalfield. The model database included measured subsidence parameters and overburden geology data, which have been back analysed to predict the subsidence reduction potential (SRP) of massive lithology in terms of 'Low', 'Moderate' and 'High' SRP categories.

The model database also includes chain pillar subsidence, inflexion point distance, goaf edge subsidence and angle of draw prediction models, which allow subsidence profiles to be generated for any number of panels and a range of appropriate confidence limits. The Upper 95% Confidence Limit (U95%CL) has been adopted in this study for predictions of the Credible Worst-Case values.

The model has been updated by Ditton Geotechnical Services (DgS) since 2007 to allow the original **ACARP**, **2003** model to be applied to other Australian Coalfields and improve its robustness over a greater range of mining geometries and geologies.

 SDPS[®], 2007 - A US developed (Virginia Polytechnical Institute) influence function model for subsidence predictions above longwalls or pillar extraction panels. The model requires calibration to measured subsidence profiles to reliably predict the subsidence and differential subsidence profiles required to assess impacts on surface features.

The model also includes a database of percentage of hard rock (i.e. massive sandstone / conglomerate) that effectively reduces subsidence above super-critical and sub-critical panels due to either bridging or bulking of collapsed material. This is consistent with the **ACARP**, **2003** models prediction methodology.

Pre-feasibility studies of appropriate panel widths and set-back distances required to minimise or limit surface impacts to manageable levels have been undertaken by Centennial Mandalong and DgS prior to the preparation of the predictions. The outcomes of the preliminary analysis have resulted in the mining geometry and layout adopted.

Based on regression analysis techniques, curves of 'best fit' have been used to estimate Mean and Credible Worst-Case (Upper 95% Confidence Limits) for the subsidence effects due to the proposed longwalls. The curves are based on measured subsidence data in the NSW Coalfields and key mining geometry parameters (refer **ACARP**, **2003**). The Mandalong mining experience to-date has also been reviewed against the database (LW1-27).

The prediction method allows specialist consultants to assess the potential range of impacts to a given feature in a probabilistic manner. Impact Management Plans and strategies can then be developed that allows appropriate Trigger Action Responses and mine planning adjustments or mitigation measures necessary to deliver satisfactory outcomes to stakeholders.

6.3 **Performance Measures**

6.3.1 SSD-5144

As outlined in **Section 6.1**, the primary objective of the mine design is to prevent any significant mine induced risk to built features by providing low levels of subsidence, that allows built features including private dwellings to remain safe, serviceable and repairable.

The Transmission Line Management Plan aims to ensure the performance measures for "330 kV power supply infrastructure" in SSD-5144 Schedule 4 Condition 4 Table 7 are not exceeded. The performance measures are shown in **Table 6**.

Key Public Infrastructure	
M1 Motorway	Always safe and serviceable.
Main Northern Railway	
330 kV power supply infrastructure	Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Other Built Infrastructure	
Power lines and power poles	Always safe.
Telecommunications infrastructure	Serviceability should be maintained wherever
Privately-owned residences	practicable.
	Loss of convisionability must be fully
Local Roads	compensated
Other built features and improvements	
(including access roads, farm dams,	Damage must be fully repairable, and must be fully
swimming pools, tracks and fences)	repaired or else replaced or fully compensated.
Public Safety	
Public Safety	Negligible additional risk.

Table 6 - Subsidence Impact Performance Measures SSD-5144

Notes:

- Key public infrastructure is shown in Figure 2 of Appendix 2 and in Figure 1 of Appendix 5
- Other built infrastructure is shown in Figure 1 of Appendix 5.
- The Applicant will be required to define more detailed performance indicators for each of these performance measures in the Built Features Management Plan, Property Subsidence Management Plans and Public Safety Management Plan (see condition 6 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators 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. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.
- Requirements regarding safety or serviceability do not preclude 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 Mine Subsidence Compensation Act 1961.

6.4 **Performance Indicators**

To establish compliance with the performance measured outlined in **Section 6.3**, Centennial Mandalong has established a subsidence and environmental monitoring program developed in consultation with the TransGrid and the RR. Trigger Action Response Plans (TARPs) have also been established and provided in **Appendix 1**. These documents establish the appropriate subsidence monitoring, parameters and associated trigger levels to demonstrate that subsidence performance satisfies the Subsidence Performance Measures set in **Table 6** and infrastructure requirements.

The Performance Indicators have been established for each built feature. The TARPS provide the trigger values as outlined in **Table 7**.

Performance Indicator	Tigger	Action / Response
Level 1 Low	Operations within prediction and approved impact.	Continued operations and monitoring as normal.
Level 2 Medium	Operations within approved impacts but exceed or potentially exceed predictions.	Review and investigation processes are engaged, with adaptive management as required.
Level 3 High	Operations exceed approved impact. The approved Performance Measures of Development Consent SSD-5144 and other relevant approvals.	Adaptive Management fully engaged

Table 7 – Performance Indicators

7 Risk Management

Centennial Mandalong has adopted the Stature Risk Assessment Program which was developed to ensure consistency in all risk assessments across the Centennial Coal operations. The Stature Risk Assessment Program sets out a consequences table and risk ranking matrix for managing identified risks consistent with AS/NZS ISO 31000:2009.

All operational processes undertaken at the Centennial Mandalong operations are subject to the risk assessment process prior to implementation. The process for risk and change management is undertaken according to the methodology and tools contained within HSMS-SE-1024-Risk Management Arrangements and HSMS-SE-1082- Change Management System.

Centennial Mandalong completed a WRAC Risk Assessment (No. 1001172002) for Built Features affected by subsidence from the secondary extraction of LW25-31, including TransGrid 330kV transmission lines. A full copy of the risk assessment is included within the Extraction Plan LW25-31 Appendix 4.

7.1 Identified Risks

Mandalong Mine has well established Infrastructure Management Plans, which have been developed and refined since the commencement of longwall mining in 2005. Potential hazards to public safety and the TransGrid power supply network from the impact of mine subsidence can include:

- Potential for increased or decreased tensions in various spans which could cause tower or conductor failure due to tilting or horizontal movement of towers;
- Potential for buckling of the tower or induced stresses in the tower members lessening the tower's ability to carry the normal transmission line loads due to differential movement of tower legs;
- Potential reduction of clearance between line conductors and tower which could place line at risk of tripping under extreme conditions due to tilting; and
- Potential interruption of service to customers.

Subsidence predictions for the TransGrid TL25/26 towers 39 to 42 were prepared by Ditton Geotechnical Services (2016) and provided to TransGrid for the assessment of subsidence impacts and design of the new towers. Revised subsidence predictions for the Extraction Plan LW25-31 have also been provided by Ditton Geotechnical Services (2018). Further predictions prepared by Ditton Geotechnical Services (2020) have been provided to TransGrid for the proposed consent Modification 9 that now places Towers 41 and 42 over first-workings as opposed to Longwall 30.

Consistent with the initial subsidence predictions, worst-case (Upper 95% confidence limits) transient and final subsidence, tilt and strain at each of the TransGrid towers have been made for LW28-29 as detailed in **Table 8**.

Tower #	Closest LW# (nearest distance relative to LW goaf	Cover H (m) [x/H]	Final Tower Subsidence S _{max} (m)	Maximum Tilt T _{max} (mm/m)	Maxi To Horiz Displac HD _{max} Model	mum tal ontal cement (mm) Model 2	Tower Horiz. Disp. MGA Grid Bearing (000°)	Maxi Horiz Stra Er (mn Model 1	mum contal ain^ nax n/m) Model 2	Tower Leg Spread over 10 m (mm)
	limits)						(/			
38	(268m W)	311 [0.86]	0.000	0.0	18	60	326 (NW)	0.30	0.63	3.0 - 6.3
39	LW28 (77 m NE)	334 [0.23]	0.016	0.8	49	57	331 (NW)	0.38	0.44	3.8 - 4.4
40	LW29 (12 m W)	326 [0.04]	0.154	4.9	64	201	248 (WSW)	1.63	1.57	16.3 - 15.7
41	LW29 (60 m N)	310 [0.19]	0.084	1.4	45	154	037 (NE)	1.06	1.26	10.6 - 12.6
42	LW29 (125 m N)	305 [0.41]	0.052	0.7	43	112	306 (NW)	0.89	0.99	8.9 - 9.9
43	LW29 (239 m N)	311 [0.77]	0.006	0.3	17	69	340 (NNW)	0.40	0.69	4.0 - 6.9

Table 8 – Final and Transient Subsidence Effects on TL25/26 Towers

Source: (Ditton Geotechnical Services, 2020)

Bold - Tension Tower; * - Cruciform footing to be retrofitted to tower. ^ - Maximum Tensile strain is positive and includes far-field affects. Maximum strain refers to major principal strain for U95%CL. Minor principle strain = $\pm - 0.25$ x major principle strain. A bay length of 11.9 m was used to estimate leg spread for the tension towers with 10 m for the suspension towers.

The risk assessment team also considered the tolerance of built features to subsidence impact. Two case studies were modelled:

- 1. Maximum subsidence prediction (mean); and
- 2. Credible Worst-Case (Upper 95% Confident Limits).

In the case of the transmission towers, the Credible Worse-Case values were adopted as shown in **Table 9**.

Table 9 – Subsidence Sensitivities

Prediction	Cause
Maximum Predicted Subsidence (Mean)	Expected geotechnical conditions
Maximum Predicted Subsidence (Credible Worst-Case, U95% CL)	Geotechnical conditions worse than anticipated

7.2 Risk Assessment Outcome

A risk ranking (low, moderate, significant, high or extreme) was assigned to each risk/hazard. The risk ranking for TransGrid towers with cruciform footings was assessed as **Low** at the maximum predicted subsidence (Credible Worst-Case, Upper 95% Confidence Limits). No additional control measures were identified.



Figure 2 – Maximum Predicted Vertical Subsidence, Transmission Towers and Mine Plan

8 Transmission Towers and Predicted Impacts

8.1 Towers 39 to 42

TransGrid is responsible for the care and maintenance of the 330kV and high voltage power supply network within Mandalong. The Transmission Line Management Plan TransGrid Towers TL25/26 Towers 39-42 (MEMS-EP-9000-TLMP-9053) has been prepared for LW25-31 Extraction Plan and developed in consultation with TransGrid, based on the subsidence predictions prepared by Ditton Geotechnical Services (2016), (2018) and (2020) as detailed in **Table 8**.

The updated subsidence predictions provided by Ditton Geotechnical Services for the Extraction Plan LW25-31 (Subsidence Predictions and Impact Assessment for Longwalls 25 to 31 at Mandalong Mine MAN-003/1, 2018) are consistent with the original predictions provided by Ditton Geotechnical Services (2016). Due to geological constraints a revised mine layout is required, with both Longwalls 30 and 31 removed and replaced with first workings. Revised predictions for mining up to Longwall 29 are provided by Ditton Geotechnical Services (2020), resulting in a reduction in predicted subsidence at Towers 41 and 42, now located above first workings.

8.1.1 Predicted Impacts

Subsidence impact to TL25/26 suspension towers 39 to 42 from mining Longwalls 28 and 29 are mitigated by the retro-fitting of concrete cruciform footings on the towers. The cruciform footings have been engineered and designed by TransGrid to allow the towers to remain always safe and serviceable and be repairable as specified in SSD-5144 subsidence performance measures as shown in **Table 6**.

TL25/26 tension tower 43 is located outside the 26.5^o angle of draw and not impacted by subsidence from LW28-29, although they it be included in the subsidence monitoring program.

9 Management Measures

The management strategy implemented is the industry standard for managing subsidence effects on high voltage transmission lines. The cruciform footings have been designed and engineered by TransGrid to minimise the impacts of subsidence on the towers, allowing the transmission line and towers to remain always safe and serviceable and be repairable as required the performance measures detailed in **Table 6 - Subsidence Impact Performance Measures SSD-5144**.

Subsidence monitoring and visual inspections will be conducted at the towers before, during and after the completion of mining as detailed in **Section 10.2**.

10 Monitoring Program

The Mandalong Mine Subsidence Monitoring Program consists of conventional subsidence monitoring, visual inspections and aerial LIDAR surveys, developed in order to:

- Demonstrate mine development and extraction is undertaken as per approved designs;
- Provide information to demonstrate statutory compliance and obligations are satisfied;
- Targeted monitoring of sensitive surface and built features;
- Meet stakeholder monitoring requirements to minimise impact to infrastructure;
- Provide data to manage the risks associated with both conventional and non-conventional subsidence.
- Provide appropriate and timely subsidence information to assess against triggers established in the TARPs, including data for trend analysis to inform adaptive management;
- To provide data for future monitoring systems for ongoing mining within Mandalong mining leases.

The Subsidence Monitoring Program is scheduled in the Centennial Compliance Database. The compliance database allows for surveys, inspections and notifications to be scheduled on either time or productions schedule (longwall face position). The required actions are assigned to the relevant role to ensure the subsidence monitoring program is achieved.

10.1 Baseline Monitoring

10.1.1 Detail Aerial Mapping

An aerial LIDAR survey was undertaken in April 2020, providing the pre-mining landform for the Extraction Plan area and post mining landform for Longwalls 1 to 25. The LIDAR surveys provide surface mapping with a vertical accuracy of 0.15m. Aerial LIDAR surveys of the whole mining area are conducted approximately every three years.

10.1.2 Conventional Subsidence Monitoring

Centennial Mandalong has a well-established conventional subsidence line monitoring program, with currently over 70km of crosslines and centrelines established over the whole mining area. The monitoring lines typically consist of buried star pickets with cast iron covers, nominally spaced at 10m intervals.

Within the Extraction Plan area, three crosslines one centreline will be established:

- Crossline 21 Mandalong Rd pavement and easement from LW25-29
- Crossline 22 Transmission Line No.24 easement from LW25-28;
- Crossline 23 Centennial property from LW28-31; and
- LW25 Centreline Centennial property LW25 (Chainage 570m to Main Headings)

The monitoring point spacing, survey methods and scheduled visual inspections allow for the detection of both conventional and non-conventional subsidence movements due to any potential changes in geological conditions and mining within steep slope areas within the Extraction Plan Area.

10.2 Subsidence Monitoring

10.2.1 Subsidence Monitoring Zones

Mandalong Mine has developed three subsidence monitoring zones to accommodate the development of subsidence from the narrow longwall panels and the bridging effect of the overlying massive strata that provides the reduced levels of subsidence. Unique to Mandalong Mine and as a result of the bridging massive strata, subsidence develops later than in typical longwall operations, with the majority of subsidence realised after the longwall face has retreated approximately 500m.

Additional subsidence also develops over the longwall panel following the extraction of the next adjacent longwall panel. This is due to the compression of the intervening chain pillar and strata. The additional subsidence contributed is typically in the order of 0.30m and is dependent on the geotechnical conditions and the depth of cover. Tilts and strains typically remain relatively unchanged and may be reduced as a result of the decreased vertical subsidence differential between the maingate chain pillar and the centre of the longwall panel. In areas with higher depth of cover over 300m some additional minor settlement may occur following the extraction of the adjacent two to three longwall panels.

Accordingly, with 28 longwall panels now completed, Mandalong has developed three subsidence monitoring zones which define required monitoring activities in actively subsiding and stable areas of the mine as follows below. Full details of proposed monitoring activities within each zone are described within the Subsidence Monitoring Program for each Extraction Plan progressively approved by the mine.

10.2.1.1 Active Subsidence Zone for Visual Monitoring

The "Active Subsidence Zone" for visual monitoring inspections is defined as:

- 100m in advance of the current longwall face position; and
- the following 500m of longwall extraction (i.e. 500m behind the face position).

10.2.1.2 Active Longwall Zone for Crossline Monitoring

The "Active Longwall Subsidence Zone" includes the nominated crosslines for the current longwall panel and the three previous longwall panels.

10.2.1.3 Stable Longwall Subsidence Zone for Crossline Monitoring

The "Stable Longwall Subsidence Zone" represents the stable non-subsiding areas beyond the three previous longwall panels, defined as being from the start of the nominated crosslines up to the Active Longwall Subsidence Zone.

10.2.2 Monitoring Setup for Towers 39, 40, 41 and 42 (Cruciform Footings)

Monitoring is to include:

- A survey mark is to be placed at each end of the concrete footings (four points). Measurements will be recorded to determine level, tilt and strain. **Figure 3** shows the typical location of steel pins within a cruciform footing.
- The strain measurements are to be measured between each adjacent leg (within the footing).
- Four monitoring pegs will be placed in the ground adjacent to each tower leg to monitor ground movement at the tower (Figure 4).
- One survey peg is to be established in line with the transmission line to enable the tower to be monitored for both longitudinal and transverse tilt.
- Earthwire peak is also to be monitored during the tower survey to determine both longitudinal and transverse tilt.
- A least two survey stations (bench marks) are to be located outside the influence of subsidence and 26.5° angle of draw (AOD) from Longwall 25 to 29.



Figure 3 – Typical placement of survey pins in concrete cruciform footing



Figure 4 – Typical placement of ground pegs around footing

10.2.2.1 Monitoring Schedule Tower 39

Monitoring of Tower 39 (Longwalls 28B and 29) will be undertaken using conventional surveys. These surveys will consist of:

- Installation of monitoring prior to Longwall 28B chainage 100m (AOD);
- Initial survey at Longwall 28B AOD chainage 100m;
- Resurvey at Longwall 28B chainage 0m and one month after longwall completion;
- Resurvey at Longwall 29 chainage 0m and one month after longwall completion (full subsidence) or after no further changes in monitoring data; and
- Additional surveys as requested by TransGrid or required by TARP.

10.2.2.2 Monitoring Schedule Tower 40

Monitoring of Tower 40 (Longwalls 28B and 29) will be undertaken using conventional surveys. These surveys will consist of:

- Installation of monitoring prior to Longwall 28B chainage 320m (AOD);
- Initial survey at Longwall 28B AOD chainage 320m;
- Resurvey at Longwall 28B chainage 0m (full subsidence) and one month after longwall completion;
- Resurvey at Longwall 29 chainage 0m and one month after longwall completion or after no further changes in monitoring data; and
- Additional surveys as requested by TransGrid or required by TARP.

10.2.2.3 Monitoring Schedule Tower 41

Monitoring of Tower 41 (Longwall 29) will be undertaken using conventional surveys. These surveys will consist of:

- Installation of monitoring prior to Longwall 29 chainage 810m (AOD);
- Initial survey at Longwall 29 AOD chainage 810m;

- Resurvey at Longwall 29 chainages 650m (goaf in line with tower);
- Resurvey at Longwall 29 chainage 0m (full subsidence) or after no further changes in monitoring data; and
- Additional surveys as requested by TransGrid or required by TARP.

10.2.2.4 Monitoring Schedule Tower 42

Monitoring of Tower 42 (Longwall 29) will be undertaken using conventional surveys. These surveys will consist of:

- Installation of monitoring prior to Longwall 29 chainage 1000m (AOD);
- Initial survey at Longwall 29 AOD chainage 1000m;
- Resurvey at Longwall 29 chainages 650m (goaf square) and 300m (full subsidence);
- Resurvey at Longwall 29 chainage 0m or after no further changes in monitoring data; and
- Additional surveys as requested by TransGrid or required by TARP.

10.2.3 Monitoring Setup for Tension Towers 43

Tension Tower 43 is positioned outside the 26.5° AOD of LW28 and LW29. Monitoring is to include:

- A survey pin to be placed at each end of the concrete footing (four points). Measurements will be recorded to determine level, tilt and strain.
- The strain measurements are to be measured between each adjacent leg.
- Four monitoring pegs will be placed adjacent to each tower leg to monitor ground movement at the tower.
- One survey peg is to be established in line with the transmission line to enable the tower to be monitored for both longitudinal and transverse tilt.
- Earthwire peak is also to be monitored during the tower survey to determine both longitudinal and transverse tilt.
- A least two survey stations (benchmarks) are to be located outside the influence of subsidence and 26.5° angle of draw (AOD) from proposed longwalls.

10.2.3.1 Monitoring Schedule Tension Tower 43

Monitoring of Tower 43 will be undertaken using conventional surveys. These surveys will consist of:

- Installation of monitoring prior to Longwall 29 chainage 1500m (start of longwall);
- Initial survey at Longwall 29 chainage 1500m;
- Resurvey at Longwall 29 chainages 1200m (goaf square) and 650m;
- Additional strain measurements (only) between tower leg footings at weekly intervals if measurement above TARP Level 1- Low;
- Resurvey at Longwall 29 chainage 300m (full subsidence) or after no further changes in monitoring data; and
- Additional surveys as requested by TransGrid or required by TARP.

Table 10 provides the monitoring program summary for Towers 39 to 43.

10.2.4 Survey Standards

All surveys are to be carried out in accordance with the LW25-31 Subsidence Monitoring Program.

Standard 1 – EDM differential levelling and strain measurement

- EDM differential levelling will be conducted with reference to the quality as defined in SP1 of 6mm * vk (km)
- EDM strain measurements will be conducted with reference to the quality as defined in SP1, relative uncertainty target accuracy <u>+</u> 2mm per strain bay distance.
- Survey equipment specification 1" total station theodolite, distance measurement <u>+</u> 2mm + 2 ppm.

Standard 2 – Digital Level differential levelling and strain measurement

- Digital Level differential levelling will be conducted with reference to the quality as defined in SP1 of 6mm * √k (km)
- Strain measurements by standardised steel band. Target accuracy <u>+</u> 2mm per strain bay distance.

Feature	Location	Monitoring Method	Parameter	Monitoring Frequency and Duration
TransGrid Transmission Line No. 25/26	Tower 39 Suspension Tower	Cruciform footing Survey mark at each of the four ends of the concrete footing.	Vertical subsidence, tilt and strain.	 <u>Baseline</u> Prior to mining within LW28 angle of draw (chainage 100m).
	Located over Maingate 28 Affected by LW28	Ground pegs Star picket within cast iron cover positioned adjacent to each tower leg.	Earthwire peaks monitored to determine both longitudinal and transverse tilt.	 <u>During Mining</u> LW28B chainage 100m (angle of draw). LW28B chainage 0m (end of longwall). LW29 chainage 0m (end of longwall).
	and LW29	Visual Inspection	Presence of mine-induced damage – surface cracking. Risk to public safety. Transmission Line –tilting of tower, buckling of tower members; change in conductor	 <u>Post Mining</u> One month after completion of mining LW28 and LW29.
	Tower 40	Cruciform footing Survey mark at each of the four ends	Vertical subsidence, tilt and strain.	Baseline • Prior to mining within LW28B angle of draw
	Suspension Tower	of the concrete footing.	Earthwire peaks monitored to determine both	(chainage 320m).
	Located near LW29 finish line	Ground pegs Star picket within cast iron cover positioned adjacent to each tower leg.	longitudinal and transverse tilt.	 <u>During Mining</u> LW28B chainage 320m (angle of draw). LW28B chainage 0m (end of longwall). LW29 chainage 0m (end of longwall).
		Visual Inspection	Presence of mine-induced damage – surface cracking. Risk to public safety.	 <u>Post Mining</u> One month after completion of mining LW28B and LW29.
			Transmission Line –tilting of tower, buckling of tower members; change in conductor sag/tension; ground clearance.	

Table 10 – TransGrid TL25/26 Towers 39 to 43 Subsidence Monitoring Summary

Feature	Location	Monitoring Method	Parameter	Monitoring Frequency and Duration
TransGrid Transmission Line No. 25/26	Tower 41 Suspension Tower	Cruciform footing Survey mark at each of the four ends of the concrete footing.	Vertical subsidence, tilt and strain. Earthwire peaks to be monitored to determine	 <u>Baseline</u> Prior to mining within LW29 angle of draw (chainage 810m).
	Located over South-West Mains and adjacent to LW29	Ground pegs Star picket within cast iron cover positioned adjacent to each tower leg.	both longitudinal and transverse tilt.	 <u>During Mining</u> LW29 chainage 810m (angle of draw). LW29 chainage 650m (LW face in line with tower).
	Affected by LW29	Visual Inspection	Presence of mine-induced damage – surface cracking.	LW29 chainage 300m (full subsidence)
			Risk to public safety.	 Post Mining LW29 chainage 0m (end of longwall)
			Transmission Line –tilting of tower, buckling of tower members; change in conductor sag/tension; ground clearance.	
	Tower 42	Cruciform footing Survey mark at each of the four ends	Vertical subsidence, tilt and strain.	Baseline Prior to mining within LW29 angle of draw
	Tension Tower	of the concrete footing.	Earthwire peaks monitored to determine both	(chainage 970m).
	Located overGrSouth-West MainsStaand adjacent topoLW29legAffected by LW29Vis	Ground pegs Star picket within cast iron cover positioned adjacent to each tower leg.	longitudinal and transverse tilt.	 <u>During Mining</u> LW29 chainage 1000m (angle of draw). LW29 chainage 650m (goaf square) LW29 chainage 300m (full subsidence).
		Visual Inspection	Presence of mine-induced damage – surface cracking.	 <u>Post Mining</u> LW29 chainage 0m (end of longwall).
			Transmission Line –tilting of tower, buckling of tower members; change in conductor sag/tension; ground clearance.	

Feature	Location	Monitoring Method	Parameter	Monitoring Frequency and Duration
TransGrid Transmission	Tower 43	Cruciform footing	Vertical subsidence, tilt and strain.	<u>Baseline</u>
Line No. 25/26		Survey mark at each of the four ends		 Prior to mining LW29 (chainage 1500m).
	Tension Tower	of the concrete footing.		
			Earthwire peaks monitored to determine both	During Mining
	Located outside	Ground pegs	longitudinal and transverse tilt.	 LW29 chainage 1200m (goaf square and
	the angle of draw	Star picket within cast iron cover		development of subsidence).
	LW29	positioned adjacent to each tower		 LW29 chainage 650m (full subsidence)
		leg.		
		Visual Inspection	Presence of mine-induced damage – surface	Post Mining
			cracking.	• LW29 chainage 0m (end of longwall).
			Risk to public safety.	
			Transmission Line –tilting of tower, buckling of tower members; change in conductor sag/tension; ground clearance.	

11 Adaptive Management

In addition to the conservative narrow longwall panel design specifically to provide reduced levels of subsidence and impact, Centennial Mandalong developed an adaptive management approach designed to avoid repetition of any unpredicted subsidence and or environmental consequences. This system involves the monitoring and evaluation of impacts to the transmission line against the performance indicators defined in **Section 6.4** and contingency plan (TARP) in the event that a performance indicator is exceeded.

11.1 Measures to be Implemented to Remediate Impacts

Concrete cruciform footings have been established on the Transmission Line No. 25/26 Towers 39 to 42 to manage the impact of subsidence from LW28-29. Sheaves have also been installed on the earthwires and optical fibre cables.

12 Contingency Plans

Trigger Action Response Plans (TARP) have been developed using performance indicators for the TransGrid 330kV transmission line towers. In the event that subsidence monitoring and or visual inspections identify that a performance indicator has been exceeded, Centennial Mandalong will implement the contingency measures as detailed in the TARP in **Appendix 1**.

13 Roles and Responsibilities

The responsibility for implementation, monitoring and review of the Transmission Line Management Plan lies with the Mining Approvals Coordinator. The roles and responsibilities for the Transmission Line Management Plan are outline in **Table 11**.

Position	Responsibility
Mine Manager	 Authorisation of the Transmission Line Management Plan Ensuring that sufficient resources are available to implement this plan
Mining Approvals Coordinator	 Ensuring that sumclent resources are available to implement this plan. Implementation, monitoring and review of this plan, including: Ensure that the Subsidence Monitoring Program, required inspections, mining notifications are scheduled into the Centennial Compliance Database prior to the commencement of each longwall panel. Ensuring subsidence monitoring and inspections are conducted at the required schedule and persons conducting monitoring/inspections are trained in the requirements of this plan. Consulting with the landowners, infrastructure owners and relevant government departments including TransGrid, DPIE, DRE, DRG and SA NSW. Review and assess the subsidence monitoring results against the performance measures. Notification of any exceedance of performance indicators in accordance with the TARPs and management plan. Coordinating any remedial work as required. Preparation and submission of formal reporting requirements outlined in this plan.
Subsidence Surveyor	 Establishment of subsidence monitoring in accordance with the Subsidence Monitoring Program. Ensure all subsidence surveys are conducted in accordance with the approved Subsidence Monitoring Program. Review and assess subsidence monitoring results. Notify the Mining Approvals Coordinator of any identified public safety issues. Provide the monitoring results to the Mining Approvals Coordinator, DRE, TransGrid, SA NSW and Ditton Geotechnical Services.
Survey Department	 When required, conduct inspections within the applicable subsidence zone to the standard required, using the subsidence inspection checklist. Promptly notify the Mining Approvals Coordinator of any issue identified during a subsidence inspection.

Table 11 – Roles and Responsibilities

14 Reporting

Reporting will be completed in accordance with the *Guidelines for the Preparation of Extraction Plans* (NSW Department of Planning & Environment, 2015), as summarised in **Table 12**.

Report	Trigger	Requirements	Stakeholders
Six Monthly Report	Every six months during mining of LW25 to 31.	 Summary of all impacts; Any revisions to the TARP; Assessment of compliance with performance measures and indicators; and Summary of environmental monitoring results. 	
Incident Reporting	Any occasion or incident in accordance with consent condition, WHS Regulations or TARP.	 In accordance with requirements of: Development Consent Schedule 6 Condition 10; or WHS Regulation (Mines and 	RR
		 Petroleum Sites) Clause 128; or TARP. 	DPIE
Bi-Monthly Subsidence	If a new impact is identified, compile after monthly	Distinguish impact: • within predictions;	TransGrid
Reporting	subsidence.	those which exceed predictions but remain within performance measures and/or performance indicators; and	DgS
		 those which exceed performance 	SA NSW
Annual	Annual Report required	 measures and/or performance indicators. Report to include: full description; location identification using aerial photos with longwall layout superimposed; photos of the impact; and preliminary characterisation of the impact in accordance with the relevant TARP(s). 	CCC
Review	under development consent SSD-5144.	 six-monthly reports of impacts and environmental monitoring results; monitoring results; and summary of subcidence impacts 	DPIE
Community Consultative Committee (CCC)	CCC meetings are typically held three times per year.	Subsidence and environmental performance is included as an agenda item at each meeting.	CCC
Mining Notifications	One month prior to mining beneath Transmission towers 39, 40, 41 and 42.	Scheduled date that the transmission towers will be affected by subsidence and within the Active Subsidence Zone.	TransGrid

Table 12 - Reporting Requirements

15 Audit and Review

Audit and review procedures are outlined in Centennial Mandalong's Safety Management System that comply with the NSW Work Health and Safety (Mines and Petroleum Sites) Regulations. These procedures are utilised to manage audit and review functions of the Built Features Management Plan. Refer Document **HSMS-SE-1028- System Evaluation**.

15.1 Audit

The requirements of the TransGrid Management Plan are to be audited annually for compliance and effectiveness during the extraction of LW25-31.

Any non-conformances or deficiencies found during the audit are to be brought to the attention of the System Coordinator so that corrective actions can be outlined. These corrective actions are to be allocated and carried out accordance with **HSMS-SE-1029** - **Corrective Action Procedure**.

15.2 Review

The Transmission Line Management Plan will be reviewed annually or in the event that one of the following occurs:

- Stakeholders raise issues that necessitates a review;
- Where unpredicted impacts or consequences have required implementation of contingency actions under this plan;
- Monitoring, incident or audit processes demonstrate a review is required;
- Where triggered by a TARP;
- With each new Extraction Plan;
- Where triggered by circumstances in either Clause 10 or Clause 128 of WHS (Mines and Petroleum Sites) Regulation or Clause 38 WHS Regulation; and
- Change in mine design or layout.

16 Document Control

An integrated Document Control Procedure is incorporated into Centennial Mandalong's Safety Management System.

Documents, data and records pertaining to this plan will be managed according to HSMS-SE-1025-Information Control.

17 References

- Ditton Geotechnical Services. (2016). Subsidence Effects Predictions for Modified TL24 Easement Transmission Towers - MAND-001/7.
- Ditton Geotechnical Services. (2018). Subsidence Predictions and Impact Assessment for Longwalls 25 to 31 at Mandalong Mine MAN-003/1.
- Ditton Geotechnical Services. (2020). Subsidence Assessment for Proposed Modification LW28 & 29 MAN-003/8.
- NSW Department of Industry Resources Regulator. (2017). *Managing Risk of Subsidence, Guide:* WHS(Mines and Petroleum Sites) Legislation.
- NSW Department of Planning & Environment. (2015). Draft Guidelines for the Preparation of Extraction Plans V5.

Appendix 1 Trigger Action Response Plans

	Transmission Line 25/26	Vales Point to Sydney - 330kV D	ouble Circuit – Suspension Tower 39
Management Period	Monitoring	Trigger	Response
Baseline studies prior to mining LW28B	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 Documentation of pre- mining conditions. 	 Document and Report to: o TransGrid; o Principal Subsidence Engineer – RR
	Level 1 – LOW	Operations with prediction and approve	ed impact
	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 No observable surface deformations <4 mm separation between tower legs Vertical subsidence < 0.020m Tilt < 1 mm/m 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - DRE
	Level 2 – ADVISORY	Operations within approved impact but	exceed or potentially exceed predictions
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 39 	 Observable surface deformations; and / or Separation between tower legs (4 to 8 mm); 	 Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: TransGrid Principal Subsidence Engineer - RR
During mining	 Earth Peaks Monitoring 	 Vertical subsidence > 0.040m Tilt > 2.2mm/m (original design parameters 2018) Subsidence greater than predicted maximum (Upper 95% CL) 	Continue consultation with TransGrid.
	Level 3 – HIGH	Operations exceed approved impact	
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 39 Earth Peaks Monitoring 	 Observable surface or tower deformations; and / or Separation between tower legs (>8mm); Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: TransGrid; Principal Subsidence Engineer – RR Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; TransGrid and Centennial to undertake visual inspections accordingly; Liaise with TransGrid regarding any remediation action/s plan Report monitoring data to Principal Subsidence Engineer - RR within 48 hrs Centennial to review mining options and Extraction Plan
Post mining	 Survey of monitoring lines/points Survey of tower legs on TL25/26 - Tower 39 Earth Peaks Monitoring 	 Check against subsidence predictions and baseline survey 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer – RR

	Transmission Line 25/26	6 Vales Point to Sydney - 330kV D	ouble Circuit – Suspension Tower 40
Management Period	Monitoring	Trigger	Response
Baseline studies prior to mining LW28B	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 Documentation of pre- mining conditions. 	 Document and Report to: o TransGrid; o Principal Subsidence Engineer – DRE o SA NSW
	Level 1 – LOW	Operations with prediction and approve	ed impact
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 40 Earth Peaks Monitoring 	 No observable surface deformations <4 mm separation between tower legs Vertical subsidence < 0.154m Tilt < 5mm/m 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - RR
	Level 2 – ADVISORY	Operations within approved impact but	exceed or potentially exceed predictions
During mining	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 40 Earth Peaks Monitoring 	 Observable surface deformations; and / or Separation between tower legs (4 to 8 mm); Vertical subsidence > 0.154m Tilt > 5mm 	 Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: TransGrid Principal Subsidence Engineer - RR Continue consultation with TransGrid.
		Subsidence greater than predicted maximum (Upper 95% CL).	
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 40 Earth Peaks Monitoring 	 Observable surface or tower deformations; and / or Separation between tower legs (>8mm); Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: TransGrid; Principal Subsidence Engineer – Department of Industries Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; TransGrid and Centennial to undertake visual inspections accordingly; Liaise with TransGrid regarding any remediation action/s plan Report monitoring data to Principal Subsidence Engineer - DRE within 48 hrs Centennial to review mining options and Extraction Plan
Post mining	 Survey of monitoring lines/points Survey of tower legs on TL25/26- Tower 40 Earth Peaks Monitoring 	Check against subsidence predictions and baseline survey	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer – DRE SA NSW

	Transmission Line 25/26	6 Vales Point to Sydney - 330kV D	ouble Circuit – Suspension Tower 41
Management Period	Monitoring	Trigger	Response
Baseline studies prior to mining LW29	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 Documentation of pre- mining conditions. 	Document and Report to: TransGrid; Principal Subsidence Engineer – RR SA NSW
	Level 1 – LOW	Operations with prediction and approve	ed impact
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 41 Earth Peaks Monitoring 	 No observable surface deformations <4 mm separation between tower legs Vertical subsidence < 0.084m Tilt < 1.5mm/m 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - DRE
	Level 2 – ADVISORY	Operations within approved impact but	t exceed or potentially exceed predictions
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 41 Earth Peaks Monitoring 	 Observable surface deformations; and / or Separation between tower legs (4 to 8 mm); Vertical subsidence > 0.084m 	 Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: TransGrid Principal Subsidence Engineer - RR Continue consultation with TransGrid.
During mining		 Tilt > 1.5mm Subsidence greater than predicted maximum (Upper 95% CL). 	
	Level 3 – HIGH	• Observable surface or tower	Notify Koy Stakeholders, as appropriate, immediately following awareness of
	footing monitoring marks	deformations: and / or	the trigger/s being met:
	 Survey of tower legs on TL25/26 - Tower 41 	 Separation between tower legs (>8mm); 	 TransGrid; Principal Subsidence Engineer – RR
	Earth Peaks Monitoring	 Subsidence greater than predicted maximum (Upper 95% CL). 	 Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; TransGrid and Centennial to undertake visual inspections accordingly; Liaise with TransGrid regarding any remediation action/s plan Report monitoring data to Principal Subsidence Engineer – RR within 48 hrs Centennial to review mining options and Extraction Plan
Post mining	 Survey of monitoring lines/points Survey of tower legs on TL25/26 - Tower 41 Earth Peaks Monitoring 	 Check against subsidence predictions and baseline survey 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer – RR

	Transmission Line 25/26	S Vales Point to Sydney - 330kV D	ouble Circuit – Suspension Tower 42
Management Period	Monitoring	Trigger	Response
Baseline studies prior to mining LW29	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 Documentation of pre- mining conditions. 	 Document and Report to: o TransGrid; o Principal Subsidence Engineer – RR o SA NSW
	Level 1 – LOW	Operations with prediction and approv	ed impact
	 Survey of ground and cruciform footing monitoring marks Earth Peaks Monitoring 	 No observable surface deformations <4 mm separation between tower legs Vertical subsidence < 0.052m Tilt < 1mm/m 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - RR
	Level 2 – ADVISORY	Operations within approved impact but	t exceed or potentially exceed predictions
During mining	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 42 Earth Peaks Monitoring 	 Observable surface deformations; and / or Separation between tower legs (4 to 8 mm); Vertical subsidence > 0.052m Tilt > 1mm/m Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: TransGrid Principal Subsidence Engineer - RR Continue consultation with TransGrid.
	Level 3 – HIGH	Operations exceed approved impact	
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 Tower 42 Earth Peaks Monitoring 	 Observable surface or tower deformations; and / or Separation between tower legs (>8mm); Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: TransGrid; Principal Subsidence Engineer – RR Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; TransGrid and Centennial to undertake visual inspections accordingly; Liaise with TransGrid regarding any remediation action/s plan Report monitoring data to Principal Subsidence Engineer - DRE within 48 hrs Centennial to review mining options and Extraction Plan
Post mining	 Survey of monitoring lines/points Survey of tower legs on TL25/26 - Tower 42 Earth Peaks Monitoring 	 Check against subsidence predictions and baseline survey 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer – RR

	Transmission Line 25/	/26 Vales Point to Sydney - 330kV	/ Double Circuit –Tension Tower 43
Management Period	Monitoring	Trigger	Response
Baseline studies prior to mining LW29 Located outside AOD of LW29.	 Survey of ground and footing monitoring marks Survey of tower legs on TL25/26 - Tower 43 Earth Peaks Monitoring 	 Documentation of pre- mining conditions. 	 Document and Report to: o TransGrid; o Principal Subsidence Engineer – RR
	Level 1 – LOW	Operations with prediction and approv	ed impact
	 Survey of ground and footing monitoring marks Survey of tower legs on TL25/26 - Tower 43 Earth Peaks Monitoring 	 No observable surface deformations <4 mm separation between tower legs Vertical subsidence < 20mm Tilt < 0.3mm/m 	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - RR
	Level 2 – ADVISORY	Operations within approved impact but	t exceed or potentially exceed predictions
During mining	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 43 Earth Peaks Monitoring 	 Observable surface deformations; and / or Separation between tower legs (4 to 8 mm); Vertical subsidence > 20mm Tilt >0.3mm/m Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: TransGrid Principal Subsidence Engineer - DRE Continue consultation with TransGrid.
	Level 3 – HIGH	Operations exceed approved impact	
	 Survey of ground and cruciform footing monitoring marks Survey of tower legs on TL25/26 - Tower 43 Earth Peaks Monitoring 	 Observable surface or tower deformations; and / or Separation between tower legs (>8mm); Subsidence greater than predicted maximum (Upper 95% CL). 	 Notify Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: TransGrid; Principal Subsidence Engineer – RR Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; TransGrid and Centennial to undertake visual inspections accordingly; Liaise with TransGrid regarding any remediation action/s plan Report monitoring data to Principal Subsidence Engineer - DRE within 48 hrs Centennial to review mining options and Extraction Plan
Post mining	 Survey of monitoring lines/points Survey of tower legs on TL25/26 - Tower 43 Earth Peaks Monitoring 	Check against subsidence predictions and baseline survey	 Centennial to provide subsidence monitoring to: TransGrid Principal Subsidence Engineer - RR

Appendix 2 Subsidence Monitoring Plans



Appendix 3 Key Personnel List

Mandalong Mine	Contact	Phone No.	Mobile No.	Email
Mining Approvals Coordinator	Phil Enright	49730948	0439 409 781	phil.enright@centennialcoal.com.au
Subsidence Surveyor	Mark Harrower	49730955	0447 234 185	mark.harrower@centennialcoal.com.au
Technical Service Superintendent	Brendan Newham	49730932	0438 401 275	Brendan.Newham@centennialcoal.com.au
Environmental Coordinator	Jeff Dunwoodie	49730947	0448 490 023	jeffrey.dunwoodie@centennialcoal.com.au
Mine Manager	Richard Gelson	49730911		richard.gelson@centennialcoal.com.au
Purchasing Coordinator Emergency Order No. Procedure MAN6257	Amy Hancock	49730939	0414 713 711	amy.hancock@centennialcoal.com.au
Control Room (24hr)	Control Room Operators	49730901 or 49730902	0428 247 788	mandalong.control@centennialcoal.com.au
TransGrid				
Project Manager – Works Delivery	Mohammad Shayeem	9620 0239	0418 170 650	Mohammad.Shayeem@transgrid.com.au
Designer	Sunil Palikhe	9284 3144		Sunil.Palikhe@transgrid.com.au
TransGrid System Operation		9620 0121		system.operator@transgrid.com.au
TransGrid Maintenance Group		9620 0350		eq:transmissionLines.and Easements Maintenance @transgrid.com.au
TransGrid Emergency Number		1800 027 253		
Subsidence Advisory NSW				
Emergency Service	24hr Emergency Service	1800 248 083		
Department of Regional NSW - Resources Regulator				
Principal Subsidence Engineer	Gang Li	49316644	0409227986	gang.li@planning.nsw.gov.au

Appendix 4 Inspection Check List

SUBSIDENCE INS	PECTION CHECKLI	ST
Date & Time		
Longwall Number		
Face Position (chainage)		
Road or Area Inspected		
Inspected by:		
Inspection Zone (Face chainage	- 500m) to (Face	chainage +100m)
INSPECTION ITEM	CHECKED	COMMENTS
Surface cracking		
Surface humps (compression)		
Step change in road pavement		
Damage to roadside drainage channels		
Warning Signage		
Powerline / Transmission Line – poles, towers, insulators, conductors, reduced conductor clearance.		
Rock mass stability		
Dams		
Other		

SUBSIDENCE INSPECTION CHECKLIST

Where to Inspect

500 metres behind and 100 metres in front of the current face position.

Cover the full subsidence bowl out to the 26.5° angle of draw.

What to look for

- Surface cracking edges of extraction void and travelling abutments particularly in rock outcrop areas.
- Surface humps (compression) near centre of extracted panels and travelling abutment
- Step change in land surface associated with cracking
- Serviceability of the road and drainage devices
- Damage to poles, insulators or conductors
- Damage to transmission tower, tilting or buckling
- Increase or decrease in conductor tension
- Reduced conductor clearance
- Rock mass stability boulders and cuttings.
- Any effect that may cause a safety risk to road users. If unsure report immediately.

Actions if there is damage to infrastructure or surface

Immediately notify the:

- Mine Manager
- Mining Approvals Coordinator
- Subsidence Surveyor
- Lake Macquarie City Council Emergency Response phone number
- Subsidence Advisory NSW Emergency Service phone number
- Ausgrid Emergency Service phone number

If road repairs or remediation work is required these will be undertaken by LMCC or by their approved contractor.

Appendix 5 Correspondence



RE: Transmission Line Management Plan TL25/26 Towers 39-42Ray Ramage to: Phil Enright 02/10/2020 03:32 PM Cc: "Gang Li", "Phil Steuart" From: "Ray Ramage" <ray.ramage@planning.nsw.gov.au> To: "Phil Enright" <phil.enright@centennialcoal.com.au> Cc: "Gang Li" <gang.li@planning.nsw.gov.au>, "Phil Steuart" <phil.steuart@planning.nsw.gov.au>

Hi Phil,

For the purposes of Development Consent SSD-5144 Schedule 4 Condition 6 (g) and your communications with the consenting authority (DPIE) I acknowledge receipt of the Transmission Line Management Plan for TL25/26 Towers 39-42.

Please note that risks to health and safety due to subsidence, including those resulting from subsidence impacts to the transmission line, will be regulated by the Resources Regulator under relevant provisions of WHS laws. In particular, Clause 33 of the Work Health and Safety (Mines and Petroleum Sites) Regulation relating to High Risk Activities and Clause 67 of the same regulation relating specifically to Subsidence.

Regards

Ray RamageSenior Mine Safety Officer (Subsidence Engineering)NSW Resources Regulator | Department of Regional NSWT 02 40636485 | M 0422 551 293 | E ray.ramage@planning.nsw.gov.au8 Hartley Drive, Thornton NSW 2322



Regional





From: Phil Enright <phil.enright@centennialcoal.com.au>
Sent: Friday, 2 October 2020 9:00 AM
To: Ray Ramage <ray.ramage@planning.nsw.gov.au>
Subject: Fw: Transmission Line Management Plan TL25/26 Towers 39-42

HI Ray,

Just touching base to see how your department is progressing with the review of the Transmission Line Management Plan.

Mining beneath Towers 39 and 40 is scheduled to commence in December 2020. Following the Resource Regulator review, I need to submit to DPIE for approval.

Regards

Phil Enright Mining Approvals Coordinator

p: +61 (0) 2 4973 0948 | f: +61 (0) 2 4973 0999 | m: +61 (0) 439 409 781 | Internal: 3948



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----- Forwarded by Phil Enright/CentennialCoal on 02/10/2020 08:56 AM -----

From: Phil Enright/CentennialCoal

To.	ray ramage@planning nsw goy au
10.	iu).iunugo@planning.notgot.uu

Date:	15/09/2020 11:05 AM
Subject:	Transmission Line Management Plan TL25/26 Towers 39-42

Ray,

As discussed recently, TransGrid is currently constructing concrete cruciform footings on four towers on Transmission Line 25/26 (double circuit line) that will be impacted by subsidence form Longwalls 28 and 29.

A Transmission Line Management Plan TransGrid TL25/26 Towers 39-42 has been developed in consultation with TransGrid. A email from Mr Mohammad Shayheem confirming that TransGrid is satisfied with the management plan is included in Section 4 and Appendix 5.

Development Consent SSD-5144 Schedule 4 Condition 6 (g) requires that a Built Features Management Plan to be prepared in consultation with the Resource Regulator.

Please find attached final draft of the management plan.

If you have any questions or require further information, please don't hesitate to contact me.

[attachment "Mandalong Mine TransGrid TL25-26 Tower 39-42 Management Plan Final Draft 15092020.pdf" deleted by Phil Enright/CentennialCoal]



RE: Transmission Line Management Plan TL25/26 Towers 39 to 42Mohammad Shayeem to: 'Phil Enright' 15/09/2020 10:06 AM Cc: "'P0021028@tbupload.com'" From: "Mohammad Shayeem" <Mohammad.Shayeem@transgrid.com.au> To: "'Phil Enright'" <phil.enright@centennialcoal.com.au> Cc: "'P0021028@tbupload.com'" <P0021028@tbupload.com> History:This message has been replied to.

Hi Phil,

Thanks. All good. The "Transmission Line Management Plan TL25/26 Towers 39 to 42" is acceptable to TransGrid.

Regards, Mohammad Shayeem Project Manager | Works Delivery

TransGrid | Wirra Crescent, off University Drive, Newcastle, NSW, 2298 T: (02) 9620 0239 M: 0418 170 650 E: Mohammad.Shayeem@transgrid.com.au W: www.transgrid.com.au

From: Phil Enright <phil.enright@centennialcoal.com.au>
Sent: Monday, 14 September 2020 10:54 AM
To: Mohammad Shayeem <Mohammad.Shayeem@transgrid.com.au>
Subject: RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Hi Mohammad,

Please find attached final draft of the management plan for your review.

Designer name update on page 52 and copy of email correspondence with TransGrid included in Appendix 5.

Regards

Phil Enright Mining Approvals Coordinator

p: +61 (0) 2 4973 0948 | f: +61 (0) 2 4973 0999 | m: +61 (0) 439 409 781 | Internal: 3948



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From: "Mohammad Shayeem" <<u>Mohammad.Shayeem@transgrid.com.au</u>>

RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Hi Phil,

Subject:

Just one item as below to be amended.

Page 52: Designer name & details to be changed. It would be Sunil Palikhe, Ph: 02 9284 3144, email: <u>Sunil.Palikhe@transgrid.com.au</u>.

Please also include Appendix – 5: Correspondence with TransGrid as requested below and provide me the plan for final review.

Regards, Mohammad Shayeem Project Manager | Works Delivery

TransGrid | Wirra Crescent, off University Drive, Newcastle, NSW, 2298 T: (02) 9620 0239 M: 0418 170 650 E: Mohammad.Shayeem@transgrid.com.au W: www.transgrid.com.au

From: Phil Enright <<u>phil.enright@centennialcoal.com.au</u>
Sent: Friday, 11 September 2020 2:54 PM
To: Mohammad Shayeem <<u>Mohammad.Shayeem@transgrid.com.au</u>
Subject: RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Mohammad,

My apologies, now corrected.

Note that I will also include copies of correspondence between TransGrid, Centennial and the Resource Regulator in Appendix 5.

Once you are satisfied with the management plan, would you be able to provide confirmation please, either by email or letter. I need to include this in the management to confirm that TransGrid has been consulted and agree with the management plan.

Regards

Phil Enright Mining Approvals Coordinator

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 From:
 "Mohammad Shayeem" <<u>Mohammad.Shayeem@transgrid.com.au</u>>

 To:
 "Phil Enright" <<u>phil.enright@centennialcoal.com.au</u>>

 Date:
 11/09/2020 02:34 PM

 Subject:
 RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Hi Phil,

Thanks. It appears Appendix -2 - Subsidence Monitoring Plans has been removed and Key personnel table has been put in there. Please have a look. It was ok in previous revision.

Regards,

Mohammad Shayeem Project Manager | Works Delivery

TransGrid | Wirra Crescent, off University Drive, Newcastle, NSW, 2298 T: (02) 9620 0239 M: 0418 170 650 E: Mohammad.Shayeem@transgrid.com.au W: www.transgrid.com.au

From: Phil Enright <<u>phil.enright@centennialcoal.com.au</u>
Sent: Friday, 11 September 2020 12:59 PM
To: Mohammad Shayeem <<u>Mohammad.Shayeem@transgrid.com.au</u>
Subject: RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Mohammad,

Thanks for the prompt response.

I have made edits as detailed, with the exception of the TARP for Tower 38 which I suggest removal as we are not proposing to monitoring the tower as is located well outside the 26.5⁰ angle of draw.

Please find attached revision for your review.

Regards

Phil Enright Mining Approvals Coordinator

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From:	"Mohammad Shayeem" < <u>Mohammad.Shayeem@transgrid.com.au</u> >
To:	"Phil Enright" < <u>phil.enright@centennialcoal.com.au</u> >
Date:	11/09/2020 09:47 AM
Subject:	RE: Transmission Line Management Plan TL25/26 Towers 39 to 42

Hi Phil,

Please find my comments in the attached plan, summarised as below:

Page 1: Remove **Towers** Page 43-48: Some typos associated with TL 25/26 and Str. No. Page 52: Designer name & details to be changed

Regards, Mohammad Shayeem Project Manager | Works Delivery

TransGrid | Wirra Crescent, off University Drive, Newcastle, NSW, 2298

T: (02) 9620 0239 M: 0418 170 650

E: Mohammad.Shayeem@transgrid.com.au W: www.transgrid.com.au

From: Phil Enright <<u>phil.enright@centennialcoal.com.au</u>
Sent: Wednesday, 9 September 2020 9:43 AM
To: Mohammad Shayeem <<u>Mohammad.Shayeem@transgrid.com.au</u>
Subject: Transmission Line Management Plan TL25/26 Towers 39 to 42

Mohammad,

Mandalong Mine is required by conditions of development consent SSD-5144 to prepare a Transmission Line Management Plan before mining and subsidence affecting any high voltage transmission lines.

Attached is a draft management plan for managing and monitoring subsidence impacts to TL25/26 Towers 39-42 currently being retro-fitted with cruciform footings.

The management plan is similar to the current management plan approved for mining beneath TL24, that was prepared in consultation with TransGrid.

It would be appreciated if you could review the management plan and provide any comments or edits.

Once the management plan is agreed on, it needs to be provided to the Department of Planning, Industry and

Environment and the Resource Regulator for approval.

If you have any questions, please don't hesitate to give me a call.

Regards

Phil Enright

Mining Approvals Coordinator

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Centennial Mandalong

12 Kerry Anderson Drive Mandalong NSW 2264 PO Box 1000 Toronto NSW 2283 Telephone 1800 730 919 Facsimile 49 730 999