Land Management Plan

Longwalls 30 and 31

Mandalong Mine

MEMS-EP-9000-LMP-9020

June 2021

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1 BACKGROUND

1.1 Introduction

Mandalong Mine is an existing underground longwall coal mine located on the western side of Lake Macquarie near Morisset, approximately 35 km southwest of Newcastle. Centennial Mandalong Pty Ltd is the operator of the mine and is a wholly owned subsidiary of Centennial Coal Company Pty Limited.

Development Consent for Mandalong Mine (SSD-5144) was approved on 12 October 2015 and permits extraction of 6.5 million tonnes of run-of-mine (ROM) coal per calendar year until 31 December 2040.

An Extraction Plan is required to be developed and approved prior to undertaking secondary extraction. This Extraction Plan, prepared for Longwalls 30 and 31 (LW30-31), describes the applicable regulatory framework, mine planning, management and monitoring measures to be implemented to protect all surface/subsurface natural and built features in addition to administering public safety measures associated with secondary extraction.

This Land Management Plan (in support of the LW30-31 Extraction Plan) has been developed in accordance with the current requirements of Condition 6, Schedule 4 of SSD-5144 for the extraction of LW30-LW31, and in accordance with Mining Leases (ML1722 and ML1744) requirements issued under the Mining Act 1992 to extract longwall panels within the West Wallarah Seam.

The Extraction Plan and Land 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 Extraction Plan area comprises a surface area of approximately 209 hectares. Across the Extraction Plan area the ground surface elevation ranges from 40 m to 240 m. Due to the elevated topography, alluvium is limited in this area. The depth of cover above the West Wallarah Seam in this area ranges from approximately 285 m to 500 m.

The existing surface environment of the Extraction Plan area includes creeks, native bushland, steep slopes and archaeological heritage items.

There are nine private properties, one property owned by Central Coast Council, one owned by Centennial Coal and one Crown Land lot. A small area of Olney State Forest is located at the southern extent of the Extraction Plan Area. Of the nine privately owned properties, four dwellings will be affected by subsidence. Local roads, power 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 (Crown), Telstra Communications and Ausgrid Powerlines.

2 Purpose

The purpose of the Land Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on landscape features and agricultural resources that will potentially be affected by the secondary extraction of LW30-31.

3 Scope

3.1 Extraction Plan Area

This Land Management Plan applies to the management of risks relating to the development of subsidence from the extraction of LW30-31, located within Centennial Mandalong Mining Leases (ML1722 and ML1744) and the SSD-5144 approved mining area. The Extraction Plan Area is defined by a minimum 26.5^{o} angle of draw or 20mm limit of subsidence at the Upper 95% Confidence Limits from the extents of proposed extraction LW30-31 (**Figure 1**).

Landscape features on private property are also documented and managed separately by individual Property Subsidence Management Plans (PSMP). Refer to the Extraction Plan LW30-31 document for a detailed summary of the PSMPs.

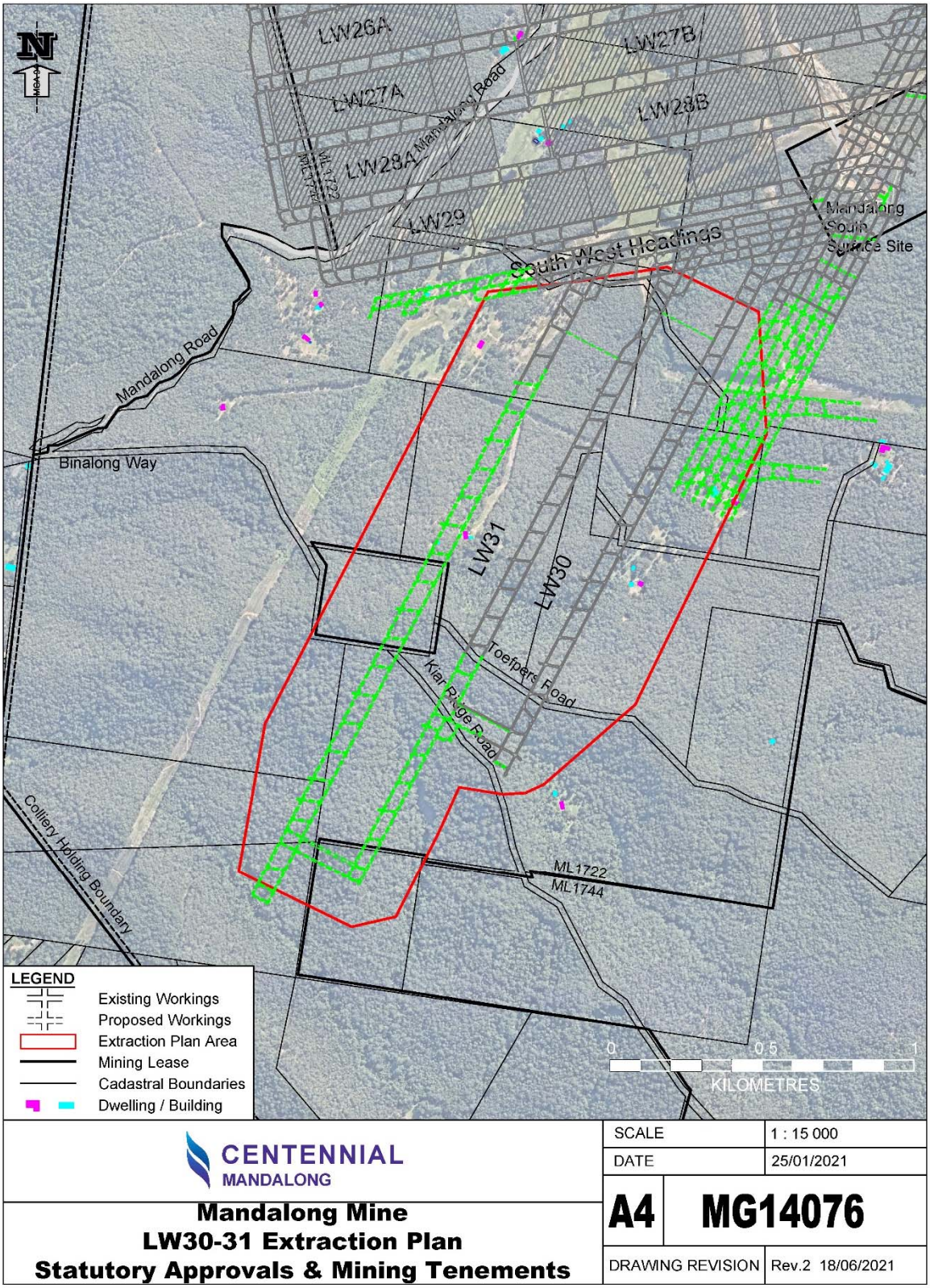

Figure 1 –Extraction Plan Area LW30-31

3.2 Landscape Features

The landscape features managed by the Land Management Plan are steep slopes and agricultural land. The other landscape features located within the EP Area are detailed in **Table 1** along with their relevant management plan and monitoring programs.

Table 1 – Landscape Features within Extraction Plan Area and Relevant Management Plans

Landscape Feature	Identification and Assessment	Management and Monitoring
Steep Slopes and Rock Outcrops	Land and Agricultural Resource Assessment Extraction Plan LW30-31 (SLR, 2020). Subsidence Predictions and Impact Assessment for LW30-31 (Ditton Geotechnical Services, 2021).	**Land Management Plan** Public Safety Management Plan Property Subsidence Management Plans (PSMP) Subsidence Monitoring Program
Agricultural Land	Land and Agricultural Resource Assessment Extraction Plan LW30-31 (SLR, 2020).	**Land Management Plan** Property Subsidence Management Plans (PSMP) Subsidence Monitoring Program
Surface water Creeks and water courses (Buttonderry Creek and Morans Creek and tributaries)	Centennial Mandalong Flood Impact Assessment LW30-33 (Umwelt, 2020b).	Water Management Plan Property Subsidence Management Plans (PSMP) Flood path inspections Subsidence Monitoring Program
Groundwater	Groundwater Model Update (GHD, 2020a)	Water Management Plan Subsidence Monitoring Program
Cultural Heritage Sites	Mandalong Mod 9 Modification Report (EMM, 2020). Subsidence Predictions and Impact Assessment for LW30-31 (Ditton Geotechnical Services, 2021).	Heritage Management Plan (Umwelt, 2021).
Surface Infrastructure power lines, communications, access roads, fire trails, State survey control.	Subsidence Predictions and Impact Assessment for LW30-31 (Ditton Geotechnical Services, 2021).	Built Features Management Plan.
Biodiversity including aquatic and terrestrial flora and fauna, threatened species, EEC and GDE.	Biodiversity Management Plan (RPS, 2020).	Biodiversity Management Plan

4 Consultation and Plan Development

The majority of the EP Area which covers approximately 209 hectares is freehold land. Individual PSMPs have been prepared and developed in consultation with the each of the private property landowners. The consultation details with private property owners are detailed in Section 3.2 of their PSMP. Crown land is limited to Yambo Trig Reserve, being Lot 175 DP 755271 reserved under R1002616 for Trigonometrical Purposes and various Crown Roads, being Toefpers Road, Kiar Ridge Road and the unnamed roads located in the north east. Landownership is shown in **Figure 2**. Details regarding impacts and remediation of the Yambo Trig station are addressed in the Built Features Management Plan.

A summary of the consultation for the Land Management Plan is presented in **Table 2** and copy of the correspondence included in **Appendix 2**.

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**.

Table 2 – Overview of Stakeholders Consulted Specifically for the Management Plan

Stakeholder	Date	Consultation Type and Summary of Aspects/Issues	Section Addressed
Forestry Corporation	Ongoing	Ongoing consultation and notification for mining beneath Olney State Forest from LW25 onwards.	Section 4
Central Coast Council (CC Council)	23/09/2020	Meeting between Centennial Mandalong and Central Coast Council representatives. Provided information on the mining operation, subsidence, MOD9 LW30-33, proposed Extraction Plan, proposed mining within Central Coast LGA and Buttonderry Waste Facility.	Section 4 Appendix 2
CC Council	2/11/2020	Email to CC Council to provide information on proposed Extraction Plan and draft Access Agreement for subsidence monitoring on property MS0120.	Section 4 Appendix 2
CC Council	3/11/2020	CC Council acknowledged email and forwarded the draft access agreement to the appropriate department.	Section 4 Appendix 2
LMCC	5/11/2020	Phone call from Centennial Mandalong to LMCC to enquire where the Council's responsibility for Toefpers Road and Kiar Ridge Road extended to. J. Marshall from the Property Section confirmed that LMCC responsibility only extended to the sealed section of the roads ending at State Forest, outside the proposed mining area.	Section 4 Appendix 2
Crown Lands - DPIE	6/11/2020	Phone call from Centennial Mandalong to Mr Mark Grace to discussed proposed mining beneath Toefpers Road and Kiar Ridge Road. Confirmed that roads were Crown Roads on private property. Minor tracks consistent with fire trails were within the Crown Road easements. Centennial Mandalong provided overview of proposed mining LW30-31 and timeframes. Discussion on mining approvals and the Department responsibility in relation to Crown Roads. Explained that the process was similar to mining beneath the crown road, Chapman Road in Extraction Plan LW24-24A.	Section 4 Appendix 2

Stakeholder	Date	Consultation Type and Summary of Aspects/Issues	Section Addressed
		Centennial to provide some additional information on the location of mining and subsidence.	
CC Council	8/12/2020	Centennial Mandalong enquire regarding status of proposed access agreement for subsidence monitoring.	Section 4 Appendix 2
CC Council	21/12/2020	CC Council provided person responsible for dealing with access agreements, Section Manager – Natural Assets and Biodiversity.	Section 4 Appendix 2
CC Council	4/01/2021	Email for Centennial Mandalong Section Manager – Natural Assets and Biodiversity to provide information on proposed Extraction Plan and draft access agreement for subsidence monitoring.	Section 4 Appendix 2
Crown Lands - DPIE	19/02/2021	Centennial Mandalong provided a draft copy of the Land Management Plan for review.	Section 4 Appendix 2
Forest Corporation	19/02/2021	Centennial Mandalong provided a draft copy of the Land Management Plan for review.	Section 4 Appendix 2
CC Council	19/02/2021	Centennial Mandalong provided a draft copy of the Land Management Plan for review.	Section 4 Appendix 2
Forest Corporation	19/02/2021	Email from Forest Corporation confirming they are satisfied with the Land Management Plan.	Section 4 Appendix
Resource Regulator	23/02/2021	Meeting with Senior Mine Safety Officer (Subsidence Engineering) and site inspection of Extraction Plan Area LW30-31. Provided overview and discussion on Built Features Management Plan, Public Safety Management Plan, Property Subsidence Management Plans and Subsidence Monitoring Program.	Section 4
Crown Lands - DPIE	4/03/2021	Crown Lands – DPIE email confirming they are satisfied with draft Land Management Plan. Revised Management Plan to include received comments and clarification from Crown Lands – DPIE	Section 4 Appendix 2
Crown Lands - DPIE	4/03/2021	Crown Lands – DPIE email raised issue of Yambo Trig in relation to subsidence impacts.	Section 8.4 of the Built Features Management Plan
CC Council	9/03/2021	CC Council provided letter confirming a review of the Land Management Plan has been completed. Enquiry on management of natural values on council property. Centennial provided letter explaining that the natural environment was managed by the Biodiversity Management Plan also prepared for the Extraction Plan. A copy of the Biodiversity Management Plan was provided to CC Council.	Section 4 Appendix 2

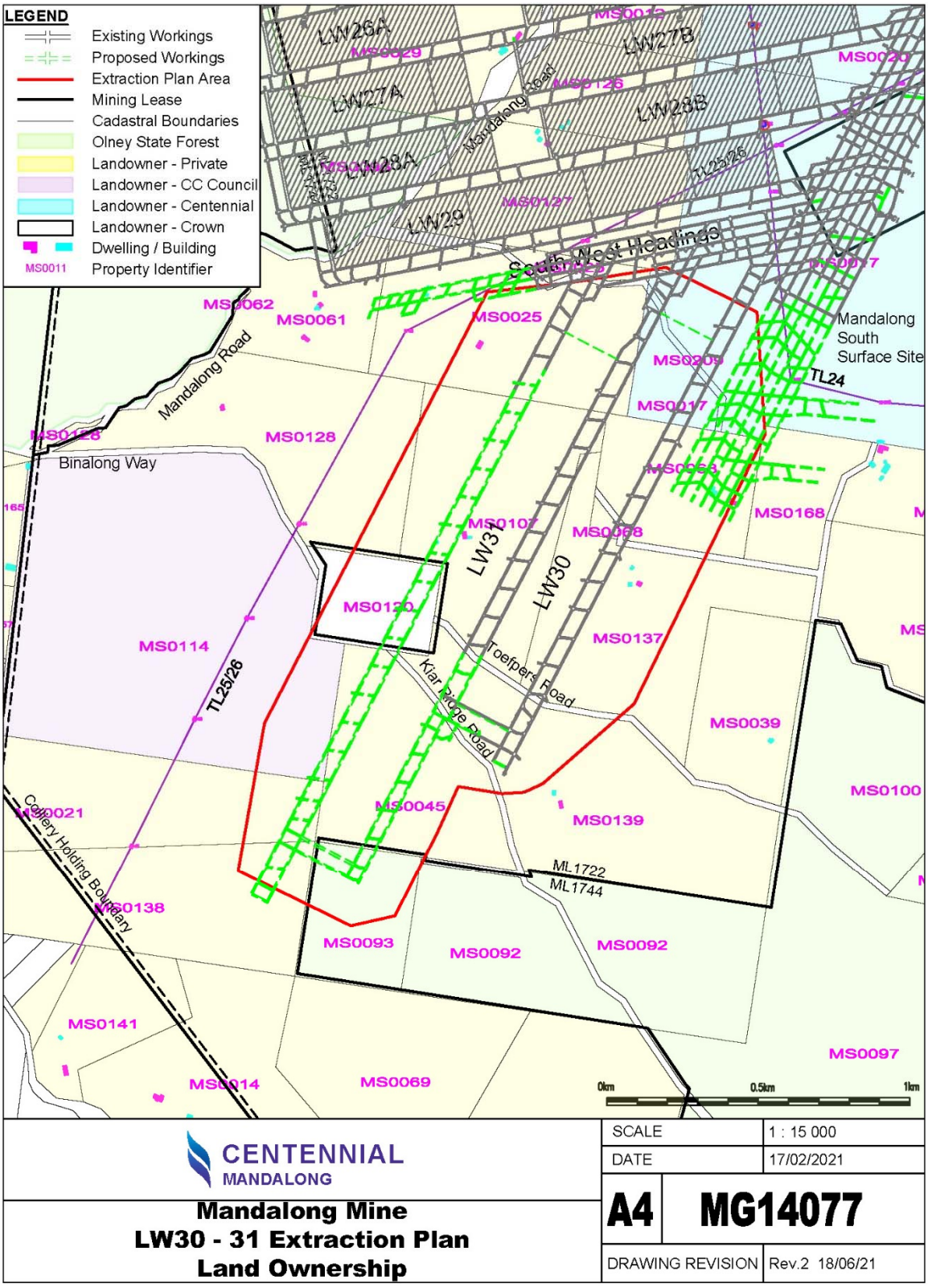

Figure 2 – Land Ownership

5 Regulatory Requirements

Centennial Mandalong operations are conducted in accordance with the 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.

The Water Management Act 2000 and Guidelines such as 'riparian corridors on waterfront land' and 'in stream works on waterfront land' are addressed in the Centennial Coal Regional Water Management Plan Northern Operations (GHD, 2016).

The requirements of the Noxious Weeds Act 1993 are addressed in the Centennial Coal Northern Operations Regional Biodiversity Management Plan (RPS, 2016).

5.1 Development Consent

Development Consent SSD-5144 provides a number of conditions relating to the preparation of the Land Management Plan. These conditions are summarised in **Table 3** below, together with the notation of the section of this document in which each matter is addressed.

Table 3 - Development Consent Conditions SSD-5144

Consent Condition	Section Addressed
Schedule 4 Condition 6 Extraction Plan (h) include a Property Subsidence Management Plan for each privately–owned property affected by the proposed second working, prepared in consultation with the landowner, which includes: • a detailed subsidence impact assessment for the property, including (where relevant): • slope stability assessments at the properties shown in Figure 2 of Appendix 5, or at any other property as nominated by the Secretary, which must: • be undertaken at least 12 months prior to undermining the property; • be undertaken in consultation with DRE, by a suitably qualified geotechnical expert; • recommend measures to manage and/or mitigate the risks and impacts associated with slope instability and rock roll-out at the residence, and the risk to the safety of persons; and • include a timeframe for the implementation of the recommended measures; • soil erosion assessment, which recommends measures to avoid, mitigate and otherwise respond to increased soil erosion (including tunnel erosion) impacts; and • appropriate measures, commitments and timeframes to mitigate, repair, replace or otherwise compensate the impacts to the property; Steep slopes and rock outcrops	Individual PSMPs Section 8 Section9 Public Safety Management Plan
(k) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed action	This Document

Consent Condition	Section Addressed
(o) Trigger Action Response Plan addressing all features in Tables 6 and 7 which contain: • appropriate triggers to warn of the development of an increasing risk of exceedance of any performance measures; • specific actions to respond to high risk exceedance of any performance measure to ensure that the measure is not exceeded; and • an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Appendix 1
(p) include a Contingency Plan that expressly provides for: • adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely; and • an assessment of the remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Section 12
Schedule 4 Condition 7 The Application must ensure that the management required under conditions 6 (g) – (q) above include: (a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since the date of commencement of this consent; and (b) a detailed description of the measures that would be implemented to remediate predicted impacts.	Section 8 and Section 9 of this document for Landscape Features

5.2 Mining Leases

The Extraction Plan Area for LW30-31 is associated with two mining leases held by Centennial Mandalong; ML1722 and ML1744. **Table 4** summaries the relevant conditions relating to the Extraction Plan for LW30-31 and preparation of the Land Management Plan.

Table 4 – Summary of Mining Lease conditions relating to Landscape Features

Mining Lease	Mining Lease Condition	Section Addressed
ML1722 and ML1744 Condition 6	**Extraction Plan** (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 and the health and safety of any person; or (iii) significant failure or malfunction of a monitoring device or risk control measure set out in the approved Extraction Plan addressing: A. built features; B. public safety; or C. subsidence monitoring.	Extraction Plan LW30-31 Built Features Management Plan LW30-31 Public Roads Management Plan LW30-31 Public Safety Management Plan LW30-31 Subsidence Monitoring Program LW30-31

5.3 Extraction Plan Guidelines

The Extraction Plan and Land 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 guideline's requirements for key component plans together with the notation of the section of this document in which each matter is addressed.

Table 5 - Extraction Plan Guideline Requirements for Key Component Plans

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 8
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
Proposing performance indicators to establish compliance with these performance measures and statutory requirements;	Section 6 TARPS in Appendix 1
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 Section 10.2
Fully describing the proposed monitoring of subsidence impacts and environmental consequences;	Section 10
Describe the proposed monitoring of the success of remediation measures following implementation;	Section 10
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.

5.4 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 6**.

Table 6 – Summary of WHS Legislation Relating to Mine Subsidence

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 2011 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	Section 9 Section 10 Volume 3 of LW30-31 EP

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	(b) suitable for the nature and duration of the work, and (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 of a member of the work group represented by the health and safety representative, and (b) the duty holder has not adequately reviewed the control measure in response to the circumstance.	Section 11 Section 0 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) if kept by a mine operator—forms part of the safety management system of the mine and the records of the mine, or	Section 7 MS-1001

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	(b) if kept by a contractor who has prepared a contractor health and safety 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 under subclause (3) by another person conducting a business or undertaking at the mine. (3) A person conducting a business or undertaking at the mine who is not the mine operator of the mine must immediately notify the mine operator of a request made to the person under clause 38 (4) of the WHS Regulations. (4) A health and safety representative for workers at the mine may request a review of a control measure under clause 38 (4) of the WHS Regulations as if the circumstances referred to in subclause (1) were included as a circumstance in clause 38 (4) (a) of the WHS Regulations.	Section 11 Section 14 Section 0 MS-1001
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 23 Identification of principal mining hazard management plan	(1) The mine operator of a mine must identify all principal mining hazards associated with mining operations at the mine. (2) The mine operator must conduct, in relation to each principal mining hazard identified, a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with the principal mining hazard. (3) The mine operator, in conducting a risk assessment under subclause (2), must: (a) use investigation and analysis methods that are appropriate to the principal mining hazard being considered, and (b) 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 LW30-31 No. 1001284061 Environment LW30-31 No. 1001284063 PSMP LW30-31 No. 1001285007
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 24	(1) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine in accordance with this clause and Schedule 1. (2) A principal mining hazard management plan must: (a) provide for the management of all aspects of risk control in relation to the principal mining hazard, and	Extraction Plan LW30-31 and Public Safety Management Plan and

Work Health and Safety Legislation Clause	Requirement	Section Addressed
Preparation of principal mining hazard management plan	(b) so far as is reasonably practicable, be set out and expressed in a way that is readily understandable by persons who use it.. (3) A principal mining hazard management plan must: (a) describe the nature of the principal mining hazard to which the plan relates, and (b) describe how the principal mining hazard relates to other hazards associated with mining operations at the mine, and (c) describe the analysis methods used in identifying the principal mining hazard to which the plan relates, and (d) include a record of the most recent risk assessment conducted in relation to the principal mining hazard, and (e) describe the investigation and analysis methods used in determining the control measures to be implemented, and (f) describe all control measures to be implemented to manage risks to health and safety associated with the principal mining hazard, and (g) describe the arrangements in place for providing the information, training and instruction required by clause 39 of the WHS Regulations in relation to the principal mining hazard, and (h) refer to any design principles, engineering standards and technical standards relied on for control measures for the principal mining hazard, and (i) set out the reasons for adopting or rejecting each control measure considered. (4) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine: (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 mining hazard at the mine.	Public Roads Management Plan
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 67 Subsidence	(1) In complying with clause 9, the mine operator of an underground coal mine must manage risks to health and safety associated with subsidence at the mine. (2) Without limiting subclause (1), the mine operator must ensure that: (a) so far as is reasonably practicable, the rate, method, layout, schedule and sequence of mining operations do not put the health and safety of any person at risk from subsidence, and (b) monitoring of subsidence is conducted, including monitoring of its effects on relevant surface and subsurface features, and (c) any investigation of subsidence and any interpretation of subsidence information is carried out only by a competent person, and (d) all subsidence monitoring data is provided to the regulator in the form and at the times required by the regulator, and (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 Section 9 Section 10 Section 13 TARPs Extraction Plan Appendix 4 - Risk Assessments
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 128 Duty to notify regulator of certain incidents	(1) The operator of a mine or petroleum site must take all reasonable steps to ensure that the regulator is notified in accordance with this clause after becoming aware of an incident (other than a notifiable incident) arising out of the carrying out of mining operations or petroleum operations at the mine or petroleum site, but only if the incident: (a) results in illness or injury that requires medical treatment within the meaning of clause 13 of Schedule 9, or (b) is a high potential incident. (5) In this clause: *high potential incident* means any of the following: (m) any indication from monitoring data of the development of subsidence which	Appendix 1 TARPs Public Safety Management Plan and Built Features Management Plan Land Management Plan

Work Health and Safety Legislation Clause	Requirement	Section Addressed
	may result in any incident referred to in clause 179 (a) (xvi) - a failure of ground, or of slope stability control measures, or 179 (a) (xvii) - rock falls, instability of cliffs, steep slopes or natural dams, occurrence of sinkholes, development of surface cracking or deformations or release of gas at the surface, due to subsidence.	Section 14
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, 2021) 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** (1) The following are identified as high risk activities: (a) secondary extraction by longwall mining, shortwall mining or miniwall mining, (b) pillar extraction, (c) pillar splitting, (d) pillar reduction. (2) The waiting period for any such activity is 3 months. (3) The information and documents that must be provided in relation to any such activity are as follows: (a) details of the authoritative sources used in determining that the proposed method of work can be done safely, (b) engineering plans showing the manner and sequence of extraction, endorsed by the individual nominated to exercise the statutory function of mining engineering manager at the mine, (c) information about the land above or in the vicinity of the proposed activity including land use and details of who owns or occupies any land that may be affected by subsidence, (d) in the case of a pillar extraction, details of the procedures for the recovery of buried and immobile mining plant in or around a goaf, (e) details of how the risks to the health and safety of workers and other persons from subsidence caused by the activity will be managed.	Extraction Plan LW30-31 and High Risk Activity Notification for LW30-31

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 to 200m) combined with 43m to 53m wide 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 built features managed by this plan.

6.2 Subsidence Prediction

Subsidence predictions and potential impacts from the extraction of LW30-31 on surface and subsurface features present within the Extraction Plan Area has been prepared by Ditton Geotechnical Services (2021) 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 LW1-27a/b.

(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

This Land Management Plan provides the management strategies, controls and monitoring programs to be implemented for the management of potential impacts and environmental consequences on land and landforms affected by subsidence from the extraction of LW30-31. The Land Management Plan aims to ensure the performance measures in SSD-5144 Schedule 4 Condition 1 Table 6 are not exceeded. The performance measures are shown in **Table 7**.

Table 7 - Subsidence Impact Performance Measures - Land

Land	Performance Criteria
Steep slopes and rock outcrops	No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Agriculture	No loss of agricultural productivity greater than minor.

6.4 Performance Indicators

To establish compliance with the performance measures outlined in **Section 6.3**, Centennial Mandalong has established a subsidence and environmental monitoring program developed in consultation with the affected landowners. 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 7**.

The Performance Indicators have been established for each landscape feature. The TARPS provide the trigger values as outlined in **Table 8**.

Table 8 – Performance Indicators

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.	Adaptive management fully engaged

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 has completed a WRAC Risk Assessment (No. 1001284063) for the impact of subsidence from LW30-31 on environmental features including land. A full copy of the risk assessment is included within the Extraction Plan LW30-31 Appendix 4.

7.1 Identified Risks

Mandalong Mine has well established environmental and infrastructure management plans, which have been developed and refined since the commencement of longwall mining in 2005. The risks to landscape features from the development of mine subsidence in the extraction plan area includes:

- Steep slopes and rock outcrops
- Floodplain
- Creeks and water courses
- Groundwater
- Agricultural land use

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

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

This enabled a form of sensitivity analysis of the subsidence predictions to be made as outlined 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

Subsidence predictions and assessment was provided by Ditton Geotechnical Services (2021). The maximum predicted subsidence values for LW30-31 are:

- Final maximum panel subsidence ranges from 0.98 m (mean) to 1.33 m (U95% CL).
- Final maximum chain pillar subsidence ranges from 0.62 m to 1.12 m.
- Maximum panel tilt ranges from 6 to 15 mm/m (mean) and 9 to 22 mm/m (U95% CL).

- Maximum panel compressive strains range from 3 to 6 mm/m (mean) and from 5 to 9 mm/m (U95% CL).
- Maximum panel tensile strains range from 3 to 5 mm/m (mean) and from 4 to 7 mm/m (U95% CL).

Figure 3 shows the maximum vertical subsidence (U95% CL).

7.1.1 Steep Slopes and Rock Outcrops

Potential hazards to steep slopes and rock outcrops and public safety from mine subsidence can include:

- Potential for surface cracking;
- Potential for rock fall; and
- Potential landslide.

7.1.2 Agricultural Land

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

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

7.1.3 Floodplain

Potential hazards to the floodplain from the impact of mine subsidence can include:

- Potential for remnant ponding;
- Potential for increased flooding to land;
- Potential for increased flood hazards to dwellings and property access; and
- Potential for change of flood paths causing erosion.

7.1.4 Creeks and Watercourses

Potential hazards from of mine subsidence on creeks and water courses can include:

- Potential for increased or decreased grades altering flow conveyance capacity;
- Potential for increased erosion; and
- Potential for out of channel ponding.

7.2 Risk Assessment Outcomes

A risk ranking (low, moderate, significant, high or extreme) was assigned to each risk/hazard. Refer to Appendix 4 in Extraction Plan LW30-31.

The risk assessments undertaken for the Extraction Plan and subsequently identified control measures are placed to ensure the potential for these risks to occur is appropriately controlled to provide minimum impact to land and no additional risk to public safety.

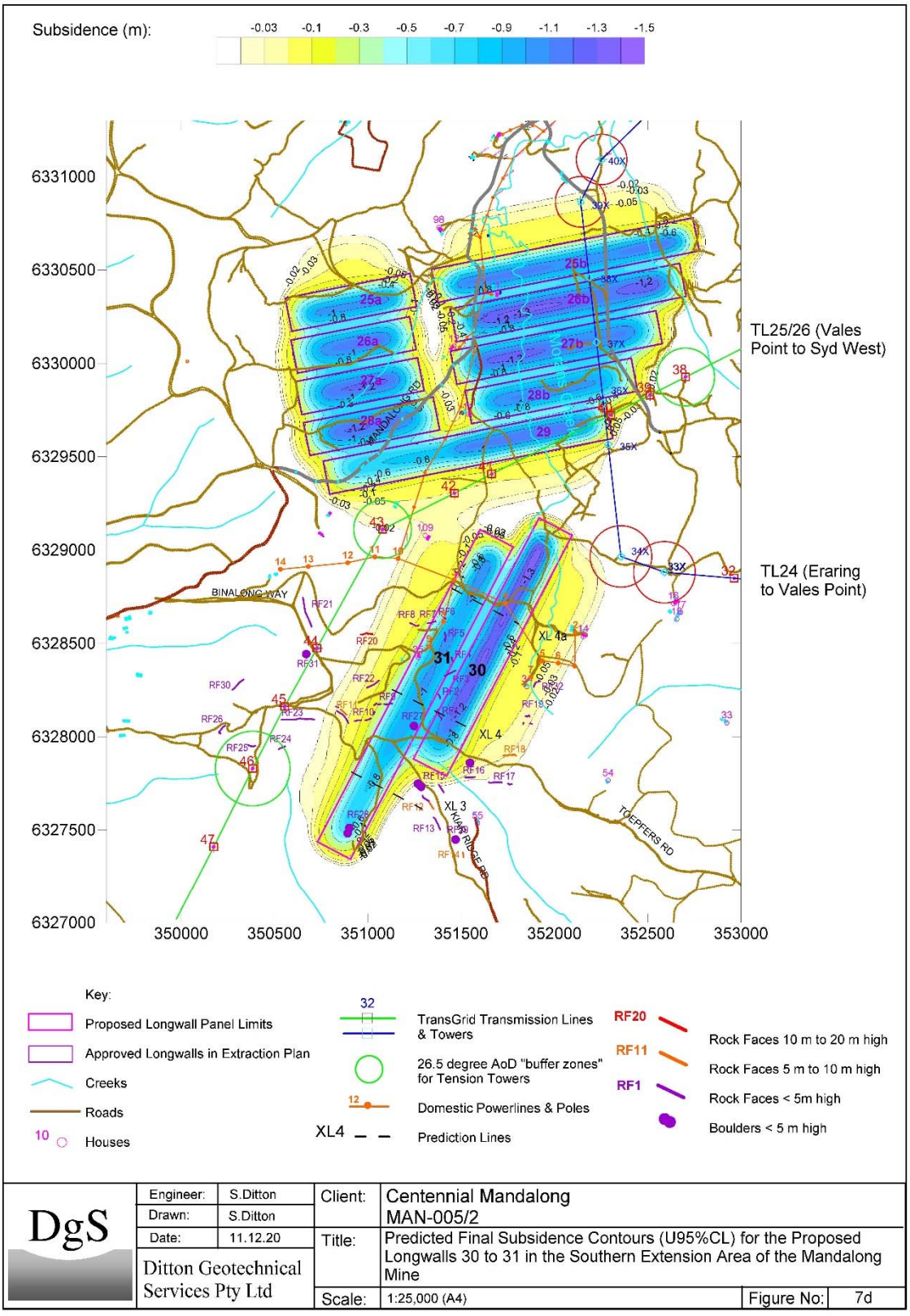

Figure 3 – Maximum Predicted Vertical Subsidence (U95% CL)

8 Landscape Features and Predicted Impacts

The EP Area is typified by relatively elevated densely timbered ridgelines surrounded by flat, low lying areas. Elevations on these ridgelines reach up to 240 m Australian Height Datum (AHD). Limited relatively flat-lying areas have been cleared for property development.

Surface slopes range from 2° to 5° in the flat, low lying areas and from 5° to 35° on the ridges. There are several sandstone and pebbly sandstone rock outcrops/faces along the upper slopes of the ridges that typically range between 2 m and 5 m high with some between 5 m and 10 m high. Sandstone boulders from 1 m to 5 m high were noted on the slopes below the rock faces and on the ridge crests. Several caves and/or overhangs between 6 m and 14 m wide and 4 m to 15 m deep exist in the rock faces and boulders. The presence of mature trees on the steep slopes will provide significant natural reinforcement of the soils and reduce the likelihood of landslip development during and after mine subsidence. The location of the steep slopes (coloured green) are shown in **Figure 4**.

The lithology is interbedded sandstone, siltstone, mudstone, and pervasive conglomerate units (Munmorah Conglomerate). Sandstone, siltstone, carbonaceous mudstone and coal form the immediate roof, while the floor will consist of competent tuffaceous sandstone and siltstone. A detailed review of the geology and geomorphic features and potential subsidence effects has been assessed by Ditton Geotechnical Services (Subsidence Predictions and Impact Assesment for Proposed LW30 and 31 MAN-005/2, 2021).

The EP Area is located in the Lake Macquarie catchment with three first order streams associated with Morans, Mannering and Buttonderry Creeks which drain north or south towards Lake Macquarie. Shallow incised stream sections and intermittent sandstone rock bars exist in the elevated ephemeral gully reaches or creek tributaries.

8.1 Slope Instability and Erosion

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

- Cracking and tilting of steep slopes and/or road-side cuttings;
- General instability of steep slopes due to deep or shallow translational sliding along mudstone / claystone bedding planes.

8.1.1 Subsidence Effect Predictions

The proposed longwalls will cause subsidence, tilting and bending of the surface supporting the steep slopes and rock outcrops. Final worst-case subsidence predictions range from 0.98 m to 1.33 m above LW30 to 31.

The predicted post mining surface slope gradient changes for the proposed mining layout are presented in **Figure 5**. The predictions of maximum tilt and strain indicate the slopes may be subject to tilts of 6 to 22 mm/m and tensile strains of 3 to 7 mm/m.

8.1.1.1 Surface Cracking

The following surface impacts are predicted above relatively flat or mildly sloping terrain up to 18° due to the proposed LW30 and 31 and the predicted tensile strains of 3 mm/m to 7 mm/m and compressive strains from 3 mm/m to 9 mm/m:

- tensile crack widths of 20 mm to 70 mm
- compressive shearing or heaving between 30 mm to 90 mm

Tensile cracks of similar magnitudes to those mentioned above will probably develop up to 50 m behind the advancing goaf edge of the longwall panels. The majority of these cracks are likely to be transient, and some may partially close in the central areas of the panels where permanent compressive strains develop after mining is completed.

Cracks of up to 100 mm wide have been detected on the steep slopes and ridges above the longwall 25 and 26 to-date after subsidence of up to 1.2 m. Wider cracking may increase above the assessment area due to interaction of near surface topography and geology with differential subsidence profiles.

The predicted impacts to the steep slopes include:

- crack widths of 100 mm to 320 mm on steep slopes and ridges.
- uplift and closure of between 20 mm and 90 mm in the central limits of the proposed longwalls or along creek beds with shallow bedrock exposures.
- crack depths of between 5 m and 10 m in relatively flat terrain and up to 20 m on ridge crests in steep terrain.
- compressive strain peaks and resultant heaving / shearing is also likely to occur on the down-slope side of panels beneath steep slopes and of similar magnitude to the impacts in the tension zones.

Surface cracking is likely to be wider (and deeper) on the steep slopes above the proposed longwalls however, due to rigid-body rotation effects during subsidence development.

8.1.1.2 Cliff Lines

There are no cliff lines within or surrounding the EP Area.

8.1.1.3 Rock Fall and Rollouts

The predicted subsidence and associated tilt and strains could result in minor cracking along the existing rock faces or rock outcrops on steep slopes and along watercourses. It is considered that the release of sandstone boulders down slope and impact a residence or person is ‘very unlikely’ to occur due to the absence of overhangs and cliff lines in the EP Area (Ditton Geotechnical Services, 2021).

Four houses located in the EP Area (No. 34, 35, 55 and 109) where identified and listed as potentially vulnerable to rock rollout in the EIS subsidence assessment (Ditton Geotechnical Services, 2013). Following site inspections and detailed analysis by Ditton Geotechnical Services (2021), it was assessed the potential for rock rollout impacting houses was ‘very unlikely’.

- House No. 109 (MS0025) is located 350 m downslope of a 3 m to 5 m high rock face above LW31 rib side. The slope consists of a 150 m long steep rocky section of 35^{o} and a 150 m length firm soil slope of 10^{o}. Both slopes have a dense cover of mature trees. There is also a cleared 50 m section of firm soil slope (5^{o}) and farm dam between the house and the surrounding bushland.

- House No. 55 (MS0139) is located 150 m below an 80 m long steep rocky slope of 25^{o} with a dense cover of mature trees and a 70 m length section of firm soil slope of 10^{o} with a sparse tree cover.
- House No. 34 (MS0137) is located 388 m below a 3 m to 5 m high rockface and 200 m long rocky slope. An incised water course is located 260 m downslope of the rock face and is between the house and the steep slopes above LW30. The watercourse will protect the property from any rock rollout events.
- House No. 35 (MS01070) is not exposed to any rock faces or steep rocky slopes following inspection of the site.

8.1.1.4 Deep-seated Land Sliding

Ditton Geotechnical Services (2021) assessment of the likelihood of en-masse sliding (i.e. a deep landslip) on the ridges or hills over basal mudstone beds cracked and tilted by subsidence, have been assessed based on the Landslide Risk Assessment Guideline presented in AGS, 2007.

Ditton Geotechnical Services concluded that the steep slopes in their current, pre-mining condition have a 'Low' sliding potential over an extreme range of climatic conditions (i.e. dry to perched water tables) with an FoS ranging from 2.29 to 5. This is confirmed by the absence of slope features that are indicative of existing or past deep-seated slope instability.

The subsided slopes for the same climatic conditions and range of expected tilts and strains are also assessed to have 'Low' sliding potential (FoS ranges from 1.56 to 3.9) during worst-case conditions with unrepaired, water filled cracks.

Another important factor is the alignment of the tensile cracking in relation to the slope crests. Cracks that are sub-parallel to the slope crests will have a greater potential impact on slope instability than cracks which are perpendicular to the slope crests. The stability analysis has assumed that the cracks are longitudinal and continuous along the length of the northern and south facing slopes.

Based on the proposed east-west longwall orientation, it has been assumed that the transient cracking that occurs behind the longwall face will be perpendicular or at a high angle to the east and west facing slopes. The potential for slope instability or erosion to develop will be minimised if large cracks (> 100 mm wide) can be sealed in a reasonably timely manner to prevent water ingress and on-going erosion.

8.1.1.5 Erosion of Slopes and Creek Beds

The potential for terrain adjustment due to erosion and deposition of soils after subsidence has also been broadly assessed by Ditton Geotechnical Services (2021). The rate of soil erosion is expected to increase in areas with exposed dispersive/reactive soils and slopes > 18°, where these slopes are subjected to the estimated tilt increases of 1°. Areas with slopes < 18° are expected to have low erosion rate increases, except for the creek channels, which would be expected to re-adjust to any changes in gradient.

In general, head-cuts in creek channels with alluvial sediments would be expected to develop above chain pillars between the panels and on the side where gradients increase. Sediment would be expected to accumulate where gradients decrease.

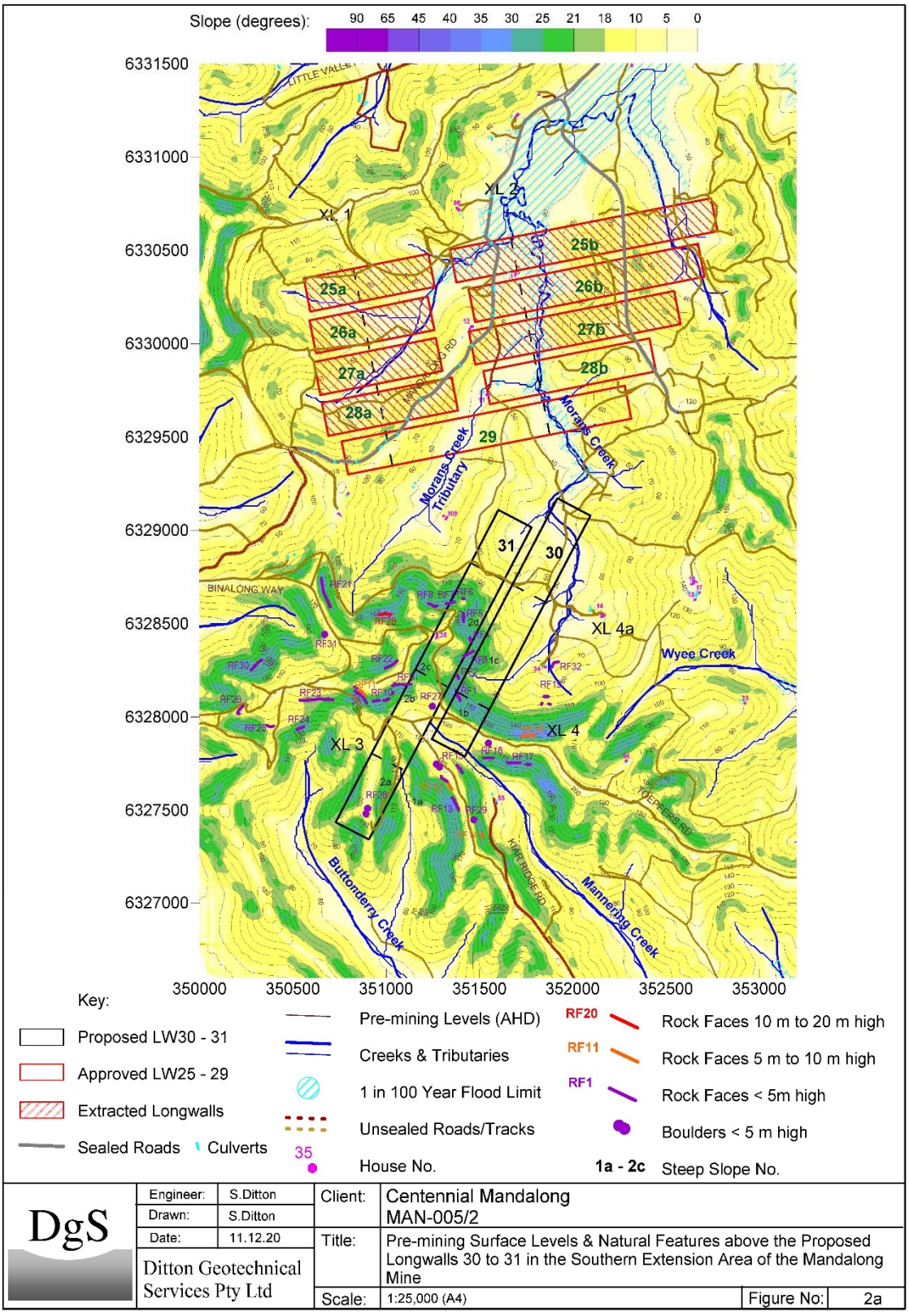

Figure 4 – Surface Gradients and Surface Features

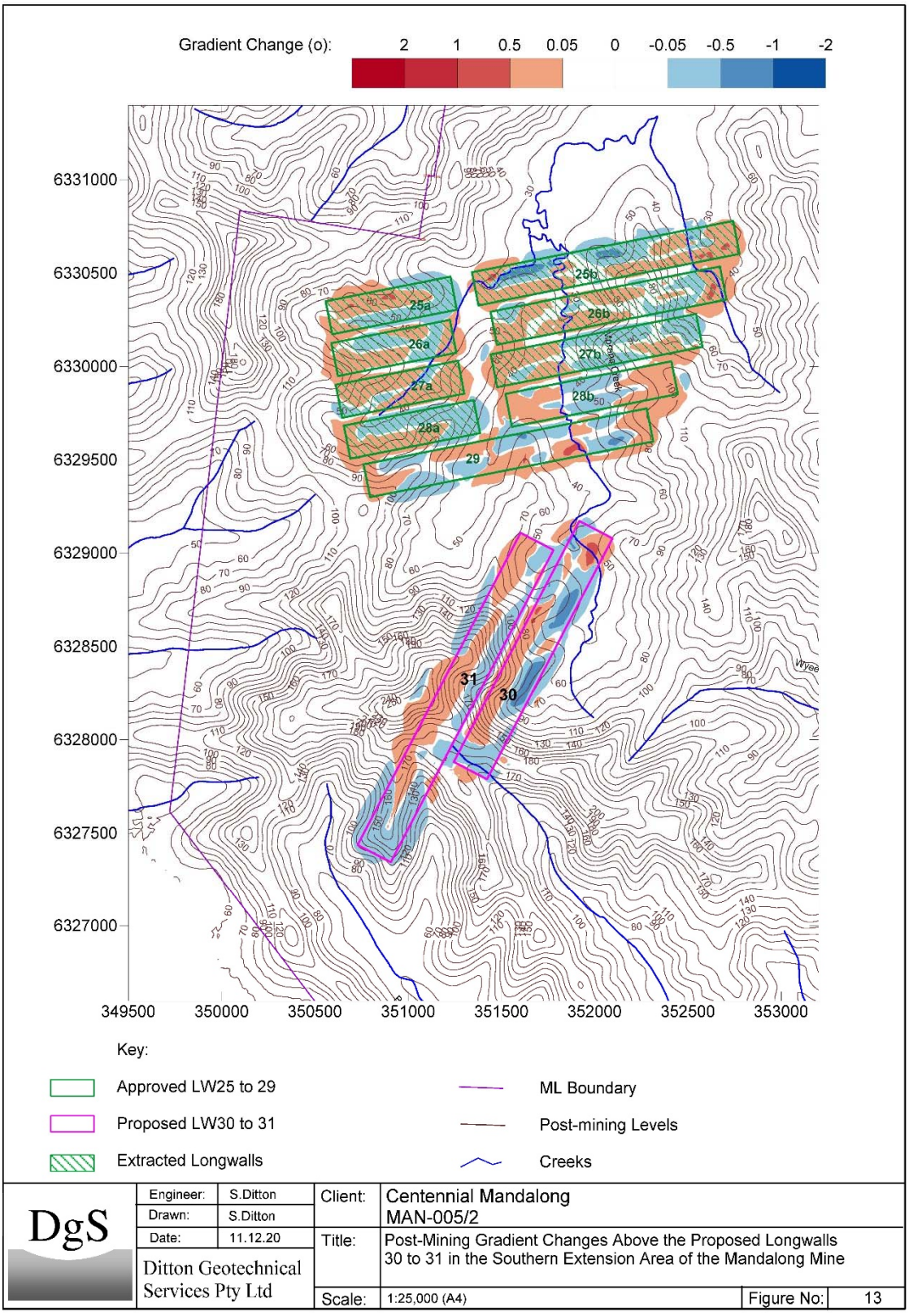

Figure 5 – Post mining gradient changes over LW30-31

8.2 Agriculture

Within the EP Area, there are nine private properties, one property owned by Central Coast Council, one owned by Centennial Coal and one Crown Land lot. A small area of Olney State Forest is located at the southern extent of the Extraction Plan Area. The properties are typically 40 Ha rural residential properties. The majority of agricultural land use is for hobby farms and small grazing areas and no intensive cropping activities are conducted.

A Land and Agricultural Resource Assessment was conducted by SLR (2020) to assess the broader angle of draw associated with LWs 30-33 approved under Mod 9 (study area). This included the impact of subsidence from the extraction of LW30-31 on agricultural land. A summary of the assessment is outlined below.

8.2.1 Surface Water

The EP Area lies within the broader catchment of Lake Macquarie, with the southern portion of the EP Area within the Wyong River catchment (Umwelt, 2020). The drainage channels associated with LWs 30-31 include Buttonderry Creek and Morans Creek. All drainage channels within the EP Area are considered intermittent watercourses with limited or zero flow during low rainfall periods, suggesting that the number of users dependent on flows from these watercourses is limited (Umwelt, 2020).

8.2.2 Groundwater

The Water Management Plan LW30-31 (GHD, 2020b) confirms the groundwater sources within the EP Area are predominantly within the Quaternary alluvium, weathered and/or fractured sandstone and coal seams.

Due to the relatively high silt and clay content of the alluvium, the groundwater sources are generally low yielding and are classified as 'less productive' according to the NSW Aquifer Interference Policy (NOW, 2012), as the yields are generally less than five litres per second and/or the total dissolved solids concentration is typically greater than 1,500 milligrams per litre.

GHD's (2020) search of the NSW Water Register for groundwater licences within a five kilometre radius of the EP Area found 140 registered groundwater bores. The majority (64) are registered as monitoring or test bores, one bore is registered for monitoring/town water supply, 13 did not have a registered use, with the remainder (62) being registered for domestic, irrigation and/or stock use. The registered domestic and stock bores that were identified primarily extract groundwater from the Triassic sandstone and conglomerate formations with yields generally less than one litre per second.

Six Centennial monitoring bores (GW201648, GW201649, GW201650, GW201651, GW201652, GW20165 MSGW03A, MSGW03B, MSGW03C, MSGW04A, MSGW04B and MSGW04C) are located within one kilometre of LW30 to LW31. None of the bores are used for agricultural purposes.

8.2.3 Soil Landscape Units

There are four Soil Landscape Units contained within the broader Mod 9 area as summarised in **Table 10** and shown in **Figure 6**. A summary of the key agricultural features for each soil landscape unit are summarised below:

- The majority of the study area (84%) is highly to severely constrained for cultivation.
- The Mandalong Soil Landscape Unit is highly to severely constrained for any agricultural enterprises, which covers 43% of the study area.
- Agricultural land best suited to grazing enterprises includes the Gorokan and Woodburys Bridge, which covers 16% of the study area.
- Agricultural land suited to both cultivation and grazing enterprises is associated with the Yarramalong Soil Landscape Unit, which covers 12% of the study area. It should be noted that localised areas within the Yarramalong Soil Landscape Unit have high to severe limitations for cultivation due to waterlogging.

Table 10 - Soil Landscape Units

Soil Landscape	Mod 9 Area		Agricultural Limitation Rating	
Unit	**Hectares**	**%**	**Grazing**	**Cultivation**
Mandalong	141	43	High – Severe	High – Severe
Watagan	135	41	High – Severe	High – Severe
Gorokan	54	16	Low	High – Severe
Woodbury's Bridge	<1.0	<1.0	Moderate	High – Severe
Total	**330**	**100**		

Source: (SLR, 2020)

8.2.3.1 Dominant Soil Types and Inherent Fertility

The dominant soil types with the study area were assessed by SLR (2020) using the previous studies *Soil and Land Resource Assessment Mandalong Southern Extension Project* (GSSE, 2013) *Soil and Land Resource Assessment Mandalong Transmission Line TL24 Relocation Project* (SLR, 2017a) and determined using the Australian Soil Classification (ASC) System (Isbell, 2002). The key assessment points are listed below:

- Three major soil orders are present across the study area, Chromosols, Kurosols and Sodosols (**Table 11**).
- Chromosols are soils with a strong texture contrast between the A horizon and a B horizon which is non-sodic and not strongly acidic. A Eutrophic Brown Chromosol comprises 41% of the study area.
- Kurosols are soils with a strong texture contrast between the A horizon and strongly acidic B horizons. Many Kurosols have unusual subsoil chemical attributes such as high magnesium, sodium and aluminium. A Natric Brown Kurosol comprises 43% of the study area.
- Sodosols are soils that have a strong texture contrast between the topsoil and subsoil horizons and contain sodic subsoil. A Mesonatric Brown Sodosol comprises 16% of the study area.

Kurosols range from moderately low to moderate inherent fertility, depending on ASC Great Group classification, with a Natric Kurosol (moderately low) occurring within the study area. The Sodosol has moderately low inherent fertility and the Chromosol has moderately high inherent fertility (Office of Environment & Heritage (OEH), 2013).

Table 11 – Dominant Soil Types and Inherent Fertility

Australian Soil Classification	Inherent Fertility	Hectares	%
Eutrophic Brown Chromosol	Moderately High	135	41
Natric Brown Kurosol	Moderately Low	141	43
Mesonatric Brown Sodosol	Moderately Low	54	16
	Total	**330**	**100**

8.2.3.2 Acid Sulfate Soils

The likelihood of acid sulfate soils occurring within the study area is very low due to its position away from the coast and potential acid sulfate landform type. This is supported by the Lake Macquarie City Council (2012) Local Government acid sulfate soil maps. Furthermore, none of the Soil Landscape Units mapped within the study area have acid sulfate soil potential.

8.2.3.3 Vegetation and Land Use

Assessment of recent aerial images shows that the majority of the study area remains under native vegetation (approximately 85%), as shown in **Figure 7**. A site inspection of adjoining LW25-31 is September 2018 by SLR's Senior Agronomist, in conjunction with a desktop assessment, has shown that small scale cattle and horse grazing of native grass species such as kangaroo grass (*Themeda australis*), Poa tussock (*Poa labillardierei*) and red grass (*Bothriochloa* spp.) is the dominant agricultural enterprise. No intensive cropping activities were observed at the time of the inspection and assessment.

Grazing within the study area appears to be commonly used as a grass and vegetation management tool rather than an income generating agricultural enterprise. Overall farm size is considered small and many would be classified as hobby farms with a very low potential to produce significant agricultural income. Approximately 15 hectares of potential grazing land is currently available for agricultural (**Figure 7**).

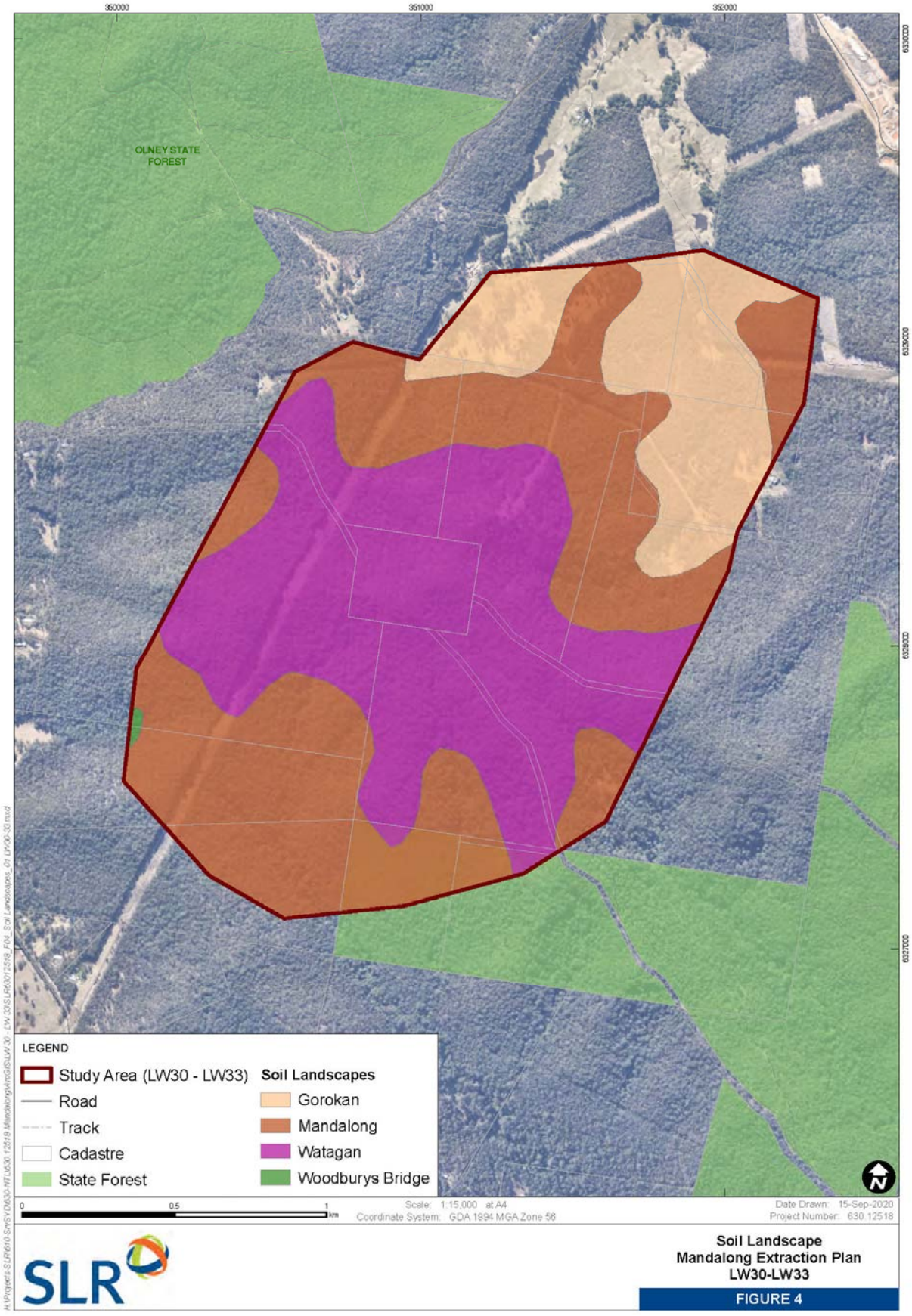

Figure 6 – Soil Landscape Units

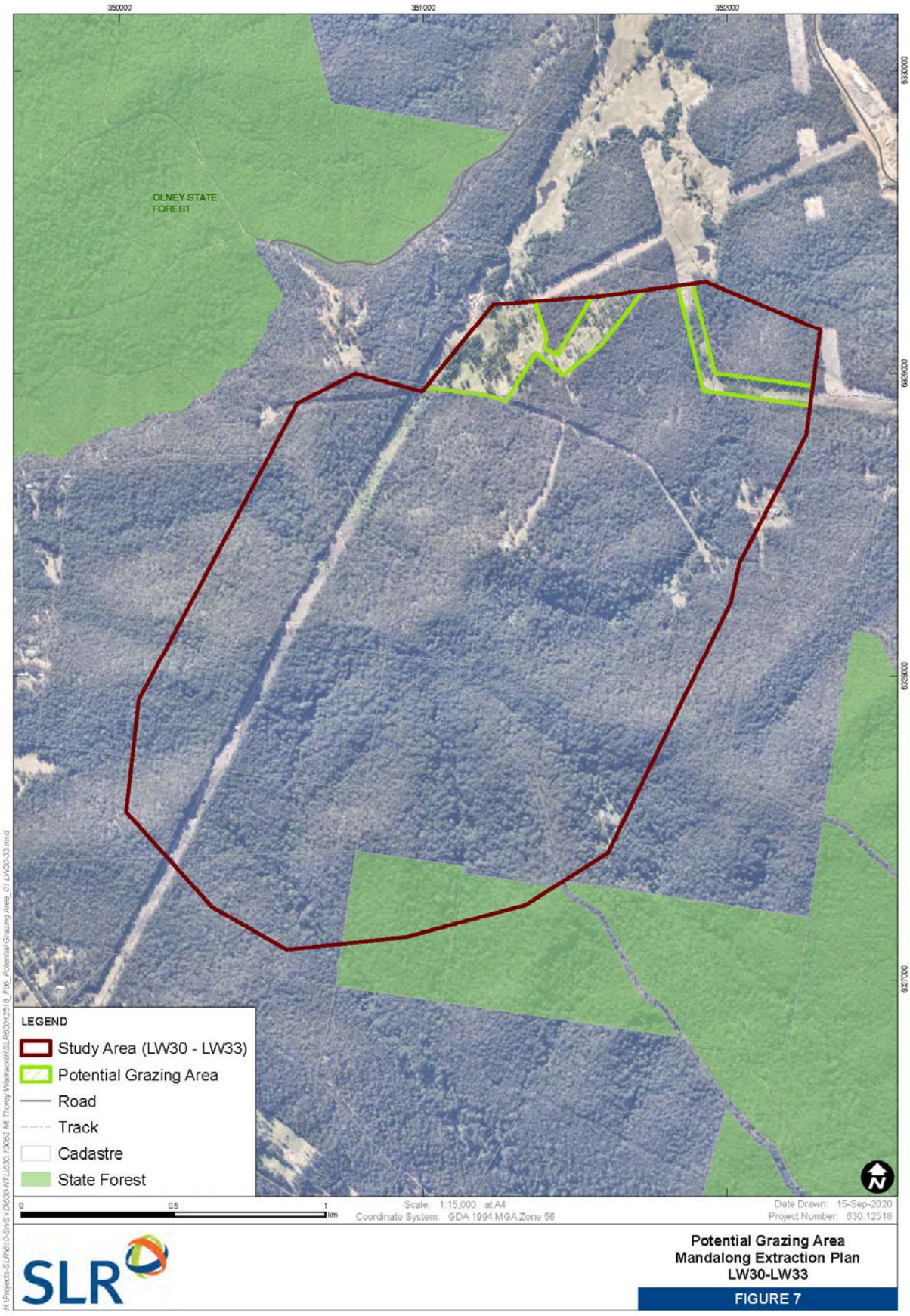

Figure 7 – Potential Grazing Area

8.2.3.4 Land and Soil Capability Classification and Assessment

The LSC classification applied to the study area was in accordance with the OEH guideline *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 12** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards.
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

Table 12 – Land and Soil Capability

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

The study area has been classified by SLR (2020) into LSC Classes 5 and 7.

Classes 5 and 7 comprised 54 hectares 276 hectares of land within the study area respectively, as shown in **Figure 8**. The limitations associated with each LSC Class are discussed below and the land area of each LSC Class is detailed in **Table 13**.

Table 13 – Land and Soil Capability Areas

LSC Class	Agricultural Capability Rating	Hectares	%
5	Moderately Low	54	16
7	Very Low	276	84
	Total	**330**	**100**

LSC Class 5 Land

Class 5 land is represented by a Brown Sodosol. This classification indicates a moderate to low land capability, with severe limitations to high impact land management uses such as cropping. This land is generally more suitable for grazing with some limitations, or very occasional cultivation for pasture establishment. The limiting factor for LSC Class 5 within the EP Area is slope with sodic subsoil. It covers 16% of the study area.

LSC Class 7 Land

Class 7 land is represented by a Brown Kurosol. This classification indicates very low capability land, with extremely severe limitations for most land uses. It is generally unsuitable for any type of cropping or grazing due to its limitations. LSC Class 7 covers 84% of the study area. The limiting factor for the LSC Class 7 land is shallow soil and steep slope.

Within the study area, 84% of the land area is considered to have low to very low agricultural capability according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012), whilst the remainder has a moderately low agricultural capability.

Biophysical Strategic Agricultural Land

According to the assessment parameters given within the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH, 2013), there is no Biophysical Strategic Agricultural Land (BSAL) within the study area, also with the sodicity and slope being the limiting factors for the two LSC Classes it is highly improbable that there would be and BSAL within the study area.

This is supported by the *Soil and Land Resource Assessment Mandalong Southern Extension Project* (GSSE, 2013) and the *Biophysical Strategic Agricultural Land Assessment Mandalong Transmission Line TL24 Relocation Project* (SLR, 2017b) undertaken directly to the north and also overlapping into the study area, which found no qualifying BSAL.

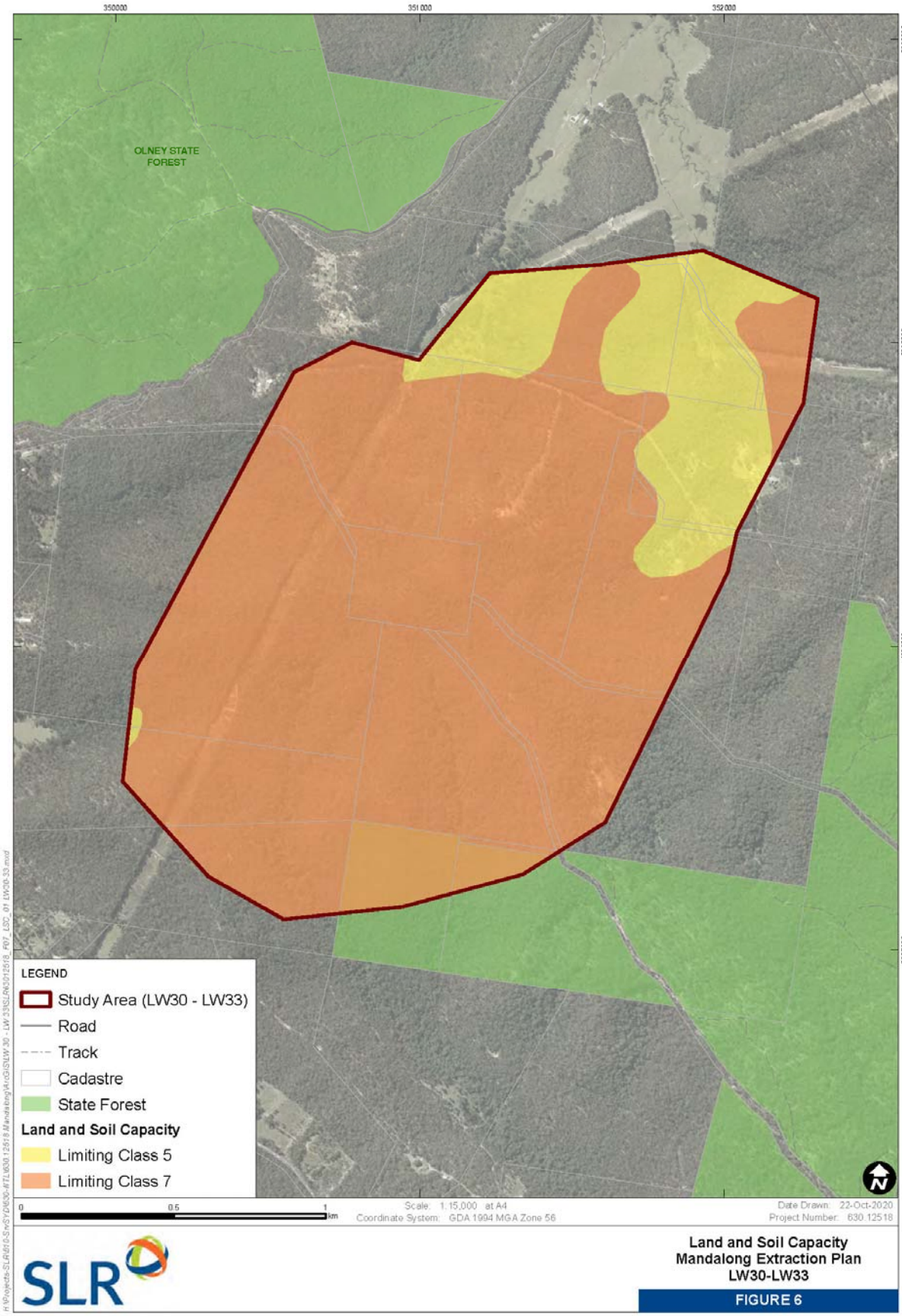

Figure 8 – Land and Soil Capability

8.2.4 Subsidence Effect Prediction

The potential impact to agricultural resources is from subsidence. Ditton Geotechnical Services (2021) predicts maximum vertical subsidence over LW30 to LW31 to range from 0.98m to 1.33m, maximum tilts 6 mm/m to 15 mm/m, combined with maximum tensile strains 5 mm/m and compressive strains 6 mm/m.

8.2.4.1 Remnant Ponding

The potential for remnant ponding to occur from vertical subsidence developed from the extraction of LW30 to 33 (approved under Mod 9) has been assessed by Umwelt (Umwelt, 2020a). Umwelt's analysis indicates that the total remnant ponding area for the pre-mining landform within the Study Area is approximately 128 ha. Of this total area, the remnant ponding area for the pre-mining landform within the catchments of Morans Creek and Buttonderry Creek is 16 ha. Within Longwalls LW30 to 33 the remnant ponding for the pre-mining landform is 2.25 ha. **Table 14** presents a comparison of the remnant ponding within the subsidence affected area for the pre-mining, approved and proposed landforms.

Table 14 – Changes in remnant ponding for Morans Creek and Buttonderry Creek within the subsidence affected area

Landform	Total area of predicted remnant ponding (ha)	Change in area from pre-mining (ha)	Total area of predicted remnant ponding within LW30-33 (ha)	Change in area from pre-mining (ha) – within LW30-33
Pre-mining (2015 LiDAR)	16.0	-	2.25	-
Approved (2015 LiDAR)	17.5	1.5 (+9.4%)	2.31	0.06 (2.7%)
Proposed – Modification 9 (2020 (LiDAR)	10.2	-5.8 (-36.2%)	0.73	-1.52 (-67.6%)

As can be seen in the table above, an assessment of the proposed landform indicates changes to remnant ponding in the area to be undermined as follows:

- Compared to the pre-mining scenario, a decrease in total remnant ponding area of 5.8 ha is predicted (i.e. a decrease of 36.2%)
- Compared to the pre-mining scenario, a decrease of 1.52 ha in remnant ponding within LW30-33 (i.e. a decrease of 67.6%)
- Compared to the approved mining scenario, a decrease in total remnant ponding area of 7.3 ha is predicted
- Compared to the approved mining scenario, a decrease of 1.58 ha in remnant ponding within LW30-33.

The analysis indicates that potential impacts on remnant ponding are confined to existing flow paths, with no predicted impact on access routes to, or within, properties (and residences) within the study area. Where potential increases to remnant ponding are predicted or subsequently observed, local drainage works may be required to alleviate the increased ponding.

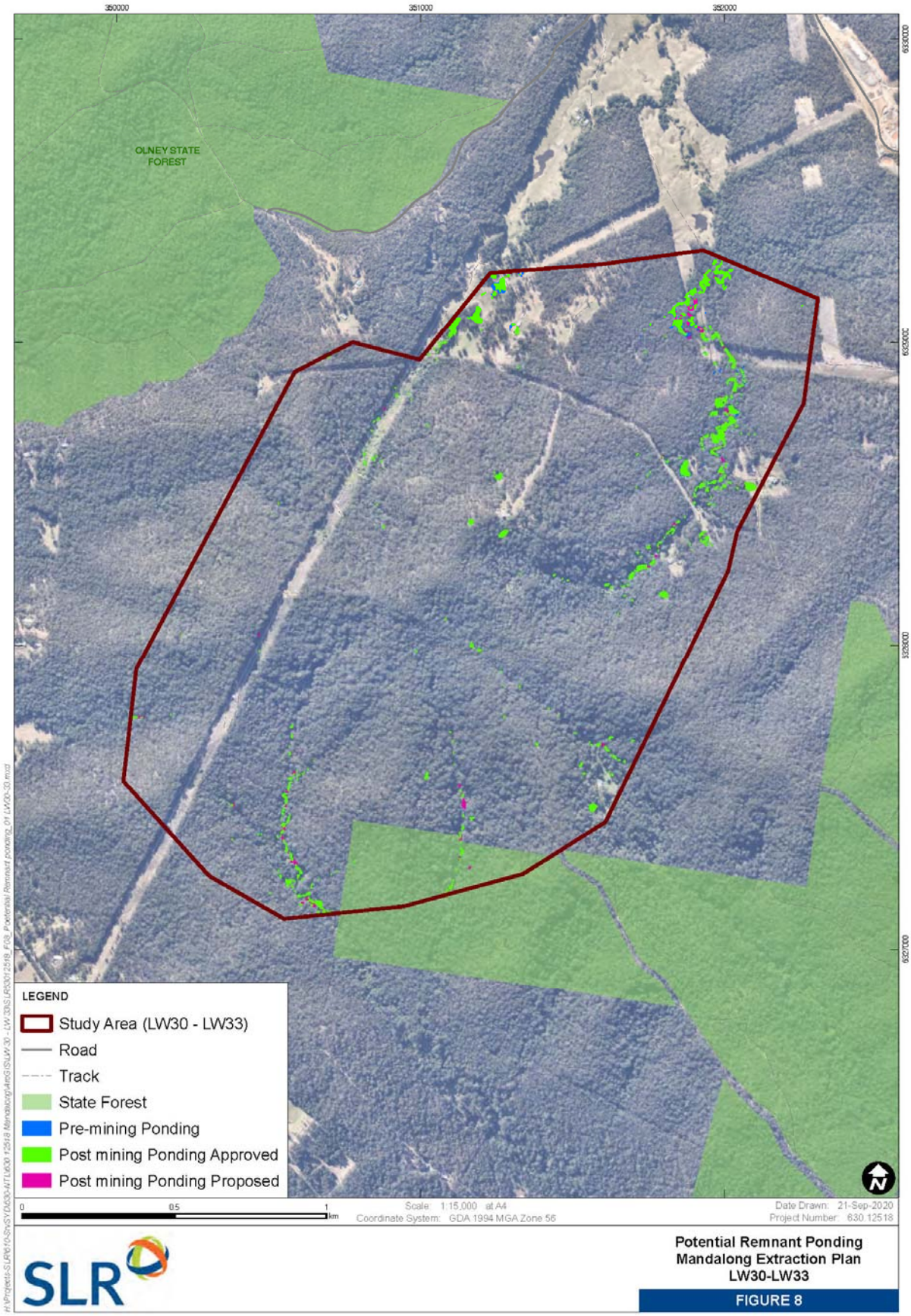

Figure 9 – Potential Remnant Ponding

8.2.4.2 Surface Water Resources

Analysis of the Morans Creek long section, velocities and tractive stresses for pre-mining, approved and proposed landforms indicates that key impacts regarding LW30-33 (approved under Mod 9) include steeper downward grades in the direction of flow between chainages 100 to 400 m of Morans Creek (near the southern chain pillar of Longwall 29).

Analysis of the Buttonderry Creek long section for the proposed landform indicates a negligible change in longitudinal grade compared to the approved landform.

Steep downward grades result in increased flow velocities and tractive stresses on the bed material between chainages 100 to 400 m for the proposed landform.

Since predicted tractive stresses are “marginally stable” for the pre-mining landform and “unstable” for the proposed landform, it is likely that scouring will occur between chainages 100 to 400 m.

The most likely location for increased scouring for the proposed landform is near chainage 212 m where the greatest increase in predicted tractive stress occurs relative to the pre-mining and approved landforms.

Increased ponding between chainages 350 to 450 m (over Longwall 29) and near chainages 1550 to 1650 m (over Longwall 25B) is likely due to steeper upwards slopes in the direction of flow relative to the approved landform and the pre-mining landform.

Watercourse stabilisation works should be undertaken if increased bed and bank scouring is observed during monitoring of subsidence and watercourse stability.

For the proposed subsided landform, compared to the approved landform there are areas where remnant ponding increases and areas where remnant ponding decreases. Overall the total area of remnant ponding is predicted to decrease by 7.3 ha relative to the approved landform, and over Longwalls LW30 to 33 there is a predicted to be a decrease in remnant ponding of 1.58 ha. Areas where there are predicted to be minor increases in remnant ponding include on Morans Creek along the third order section near Longwall 25B, along the first and second order tributaries near Longwall 26A, along a second order section at the northern end of Longwall 30, along a third order section to the north of Longwall 25B near the study area boundary, and minor increases along Buttonderry Creek and a second order watercourse to the north of Buttonderry Creek.

Compared to the pre-mining scenario a decrease in total remnant ponding area of 5.8 ha is predicted, and a 1.52 ha decrease is predicted within the subsidence affected area of Longwalls LW30 to 33. Given the predictions by Umwelt (2020a) and GHD (2020b), and the fact that all drainage channels within the EP Area are considered intermittent watercourses with limited dependence by users, impact on surface water resources relied upon by agriculture will be negligible.

Drainage mitigation works should be undertaken if increases in remnant ponding are identified during monitoring of subsidence and watercourse stability.

8.2.4.3 Alluvial Ground Water Resources

The alluvium throughout the study area forms an unconfined shallow aquifer with a water table typically ranging in depth from less than 1 m up to about 3 m below ground level (bgl) and an aquifer thickness less than 20 m. The alluvial groundwater is moderately acidic to slightly alkaline, brackish to saline, extremely hard and of sodium chloride type (GHD 2013).

Due to the relatively high silt and clay content of the alluvium, the groundwater yields are relatively low (typically less than 1 L/s). As a result of the low yield and relatively poor water quality, there are very few registered private alluvial groundwater bores throughout the study area. The environmental value of the alluvial groundwater is considered to be generally 'primary industry' (specifically stock watering), with the saline groundwater generally only suitable for stock watering (GHD 2013). The review of registered private bores in Section 3.2.3 identified limited use of alluvial groundwater in the vicinity of Mandalong Mine for irrigation and domestic use.

Groundwater monitoring bores MSGW03A and MSGW04A, which are located within the alluvium, will allow for the assessment of potential change during the mining of LW30 to 31 due to proximity to the longwalls. The extraction of LW30-31 is expected to have a negligible impact on groundwater resources relied upon by agriculture.

8.2.4.4 Farm Dams

There are several farm dams within the proposed mining area that may be subsided by up to 1 m.

Non-engineered farm dams and water storages will be susceptible to surface cracking and tilting (storage level changes) due to mine subsidence. The tolerable tilt and strain values for the dams would depend upon the materials used, construction techniques, foundation type and likely repair costs to re-establish the dam's function and pre-mining storage capacity.

The expected phases of tensile and compressive strain development may result in breaching of the dam walls or water losses through the floor of the dam storage area. Loss or increase of storage areas may also occur due to the predicted tilting. Damage to fences around the dams may also occur and require repairing.

It should be noted that farm dams have been subsided by underground coal mines elsewhere in NSW and any damage has been effectively managed. The dams were reinstated in a timely manner and an alternative supply of water was provided by the Mine during the interim period.

8.2.4.5 Olney State Forest

The majority of the surface of the proposed mining area is private land holdings with some Forestry Corporation of NSW (Olney State Forest) areas to the south of LW30 and 31.

9 Management Measures

The primary management strategy being implemented is impact avoidance through the sub-critical longwall design and bridging overburden to provide reduced levels of subsidence. Monitoring will be undertaken to confirm that mine design measures to prevent impact are adequate and will provide data for trend analysis to enable adaptive management if required.

9.1 Steep Slopes and Rock Outcrops

As described in **Section 8.1**, mining is not expected to result in any significant surface cracking or movement of rock outcrops. The management strategy for steep slopes and rock outcrops is to monitor the features prior to, during and post-secondary extraction. Weekly visual inspections of steep slope areas, rock outcrops and access tracks will be conducted when located within the active subsidence zone.

The monitoring program is summarised in **Section 10.2.1** and documented in the Subsidence Monitoring Program.

9.2 Agricultural Land

9.2.1 Remnant Ponding

Potential remnant ponding on private property is documented in the landowners PSMP. In the event that remnant ponding occurs on a property, remediation will be undertaken in consultation with the landowner. Earthworks that disturb dispersible soils (sodic soils) will be treated with gypsum at the rates outlined in **Section 9.2.4**.

9.2.2 Surface Water and Groundwater Resources

A comprehensive groundwater and surface water monitoring program has been developed by Mandalong Mine. The Water Management Plan LW30-31 (GHD, 2020b) provides the details of the groundwater and surface water monitoring programs. Monitoring includes groundwater level and quality and surface water quality, flow and watercourse stability.

Groundwater monitoring for water quality (pH and EC) and water levels will occur on a monthly basis. Monthly and annual reporting will analyse the groundwater data to detect any trends.

Groundwater monitoring bores MSGW03A, MSGW03B, MSGW03C, MSGW04A, MSGW04B and MSGW04C will allow for the potential change during the mining of LW25 to 31 due to the proximity of the longwalls. MSGW04A (alluvium) and MSGW04B (sandstone) are located over LW26 and will allow for the assessment of potential change during the mining of LW30-31.

The predicted subsidence related changes to stream channel condition are assessed in the Mandalong Mine Flood Path Condition Report for each reach above a longwall panel, by using the photographic monitoring points to define the pre-mining channel condition and subsidence induced changes to stream characteristics. This monitoring will continue for LW30-31. Flood path inspections are conducted at six monthly intervals and following major flood events.

The Water Management Plan LW30-31 TARPS provide the appropriate action and response where surface water or groundwater is impacted by mining.

9.2.3 Farm Dams

Farm dams located on private property are managed by PSMPs. In consultation with the landowner, subsidence monitoring will be established on farm dams prior to mining to monitor subsidence impact. A SA NSW pre-mining inspection will also be conducted on farm dams to record the pre-mining condition.

Post mining inspections and surveys will be undertaken following the completion of subsidence. Any necessary remediation will be arranged by Centennial in consultation with the landowner and SA NSW. Centennial will provide alternate water supply if needed or requested by the landowner.

9.2.4 Dispersible Soils

Where potential impacts have been identified gypsum will be applied for any remediation earthworks where sodic subsoils (exchangeable sodium is greater than 5%) are exposed. The application of gypsum will minimise the potential for tunnel erosion to occur on disturbed subsoil. The recommended application rates are shown in **Table 15**, taken from SOILpak (NSW DPI, 2000).

Table 15 - Gypsum Application Rates for Dispersible Soils

Exchangeable Sodium (ESP)	Gypsum Rate per Hectare	Gypsum Rate per Square Metre
5 to 10%	2 to 5 tonnes	0.2 to 0.5 kilograms
Greater than 10%	5 tonnes	0.5 kilograms

10 Monitoring Program

The Mandalong Mine Subsidence Monitoring Program consists of conventional subsidence monitoring, visual inspections, environmental monitoring 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 appropriate and timely subsidence information to assess against triggers established in the TARPs; and
- 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 Detailed Aerial Mapping

An aerial LIDAR survey was undertaken in April 2020, providing the pre-mining landform for the EP 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 80km 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 will be established:

- Crossline 23 – located on Centennial property, located over LW28-30;
- Crossline 24 – located along Toepfers Road and Kiar Ridge Fire Trail over LW30-31; and
- Crossline 25 – located along a private access road over LW31.

Subsidence monitoring will also be installed on private property, including dwellings, buildings, farm dams and drainage paths. The monitoring will be established with the permission and in consultation with the landowner.

10.1.3 Groundwater Monitoring

Mandalong Mine has a substantial and established (1999) groundwater bore monitoring network, consisting of more than 50 nested boreholes of varying depths, measuring groundwater level and water quality in the alluvium and porous and fractured rocks. Groundwater monitoring bores

MSGW03A, MSGW03B, MSGW03C, MSGW04A, MSGW04B and MSGW04C will allow for the potential change during the mining of LW30 to 31 due to the proximity of the longwalls.

10.2 Subsidence Monitoring

10.2.1 Steep Slopes and Rock Outcrops

Weekly visual inspections will be conducted when steep slopes and rock outcrops are located within the active subsidence zone of each longwall. The active zone is defined as 100m in front of the longwall face and 500m behind the longwall face. Visual inspections will continue at monthly intervals for the following six months or until the feature is influenced by the next longwall panel. The results of the visual inspections will be recorded on the subsidence inspection checklist sheet and filed. **Table 16** provides the monitoring program for steep slopes.

10.2.2 Agricultural Land

The majority of agricultural land is located on private property. Monitoring will be conducted in consultation with each landowner. Each PSMP documents the property inventory and land use.

10.2.2.1 Farm Dams

Farm dams located on private property are managed by PSMPs. In consultation with the landowner, subsidence monitoring will be established on farm dams prior to mining to monitor subsidence impact. An SA NSW pre-mining inspection will also be conducted on farm dams.

Post mining inspections and surveys will be undertaken following the completion of subsidence. Any necessary remediation will be arranged by Centennial in consultation with the landowner and SA NSW.

10.2.2.2 Remnant Ponding

The potential for remnant ponding on private property is documented in a landowner's PSMP. A monitoring program and any required remediation will be developed and implemented in consultation with the landowner.

To manage and monitor remnant ponding, Plan MG12274 is used as a management tool to document existing and predicted ponding. The plan also details, land use, monitoring, planned remediation methods and remediation status of ponded areas.

Remnant ponding is reported on at each CCC meeting and in the Annual Review.

10.2.2.3 Dispersible Soils

The sodic nature of the soil types found within the EP Area leave them prone to dispersion and tunnel erosion if left exposed for prolonged periods to water movement or rainfall.

Existing areas of tunnel erosion are documented in PSMPs. Prior to mining, photographic records will be maintained for each property. Post mining photographs will be used to monitor any increase in erosion that may be attributed to mining.

Table 16 – Monitoring Program Summary

Feature	Location	Monitoring Method	Parameter	Frequency
Steep slopes and Rock faces Land Management Plan Public Safety Management Plan PSMP	Steep slopes and Rock Face 1 to Rock Face 20 Refer Figure 2a, Ditton Geotechnical Services (2021)	Visual Inspection	Presence of mine-induced damage – surface cracking and rock falls, damage to tracks and drainage	Baseline Prior to mining LW30-31 *Active Zone* Weekly visual inspection of steep slopes along public and private access roads. Post Mining Visual inspection following completion of each LW panel.
Agricultural Land Land Management Plan PSMP	Private property Farm dams and drainage paths	Visual inspection Conventional monitoring PSMP	Vertical subsidence, tilt and strain.	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
Potential Remnant Ponding Land Management Plan PSMP	Private properties	Visual inspection PSMP NearMap aerial photography Plan MG12274	Increase or decrease in existing ponding New ponding locations	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
Dispersible Soils Land Management Plan PSMP	Private Property	Visual and photographic monitoring	Increase in erosion	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
	Earthworks for subsidence repair	Sodic subsoils where exchangeable sodium is <5	Remnant ponding or drainage repairs.	Post rehabilitation, 6 and 12 months

Feature	Location	Monitoring Method	Parameter	Frequency
Groundwater Water Management Plan LW30-31	Mandalong Groundwater Bore Monitoring Network	Water Level (bgl), Water quality parameters	Water Level (bgl), Water quality parameters	Monthly Quarterly
Water Courses Water Management Plan	Morans Creek tributaries Buttonderry Creek tributaries	Flood Path Monitoring – Visual inspection	Erosion, flow conveyance, ponding	Six monthly Flood Path Inspection After flood event

11 Adaptive Management

In addition to the conservative sub-critical panel design specifically designed 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 landscape features against the performance indicators defined in **Section 6.4** and contingency plan (TARP) in the event that a performance indicator is exceeded.

12 Contingency Plans

Trigger Action Response Plans (TARP) have been developed using performance indicators for landscape features. 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 for the specific landscape feature (refer **Appendix 1**).

13 Roles and Responsibilities

The responsibility for implementation, monitoring and review of the Land Management Plan lies with the Mining Approvals Coordinator. The roles and responsibilities for the Land Management Plan are outline in **Table 17**.

Table 17 – Roles and Responsibilities

Position	Responsibility
Mine Manager	• Authorisation of the Land Management Plan • Ensuring that sufficient resources are available to implement this plan.
Mining Approvals Coordinator	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 private landowners and relevant government departments including landowner, SA NSW, DPIE and RR. • 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. • Review and audit of the Land Management 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, RR and SA NSW.
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.
Environment and community Coordinator	• Consulting with the private landowners and relevant government departments including landowners, DPIE and RR. • Notification of any exceedance of performance indicators in accordance with the TARPs and management plans. • Coordinating any remedial work as required. • Preparation and submission of formal reporting requirements outlined in this plan.

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 18**.

Table 18 – Reporting Requirements

Report	Trigger	Requirements	Stakeholders
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 Petroleum Sites) Clause 128; or • TARP.	RR DPIE Ditton Geotechnical Services SA NSW CCC
Bi-Monthly Subsidence Impact Reporting	If a new impact is identified, compile after monthly subsidence.	Distinguish impact: • within predictions; • those which exceed predictions but remain within performance measures and/or performance indicators; and • those which exceed performance 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).	
Annual Review	Annual Report required under development consent SSD-5144.	Report to include: • six-monthly reports of impacts and environmental monitoring results; • monitoring results; and • summary of subsidence impacts.	RR DPIE CCC
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 Notification	One month notification prior to each longwall undermining Olney State Forest, CC Council and private property.	Notification to include scheduled dates that land will be affected by subsidence and within Active Longwall Subsidence Zone.	Forestry Corporation Crown Lands - DPIE CC Council Landowner

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 Land Management Plan. Refer Document **HSMS-SE-1028- System Evaluation**.

15.1 Audit

The requirements of the Land Management Plan are to be audited during the implementation of the plan to identify any issues that may affect its integrity and effectiveness and at least one month prior to a review so non-compliances and corrective actions can be identified during the review process.

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 Land Management Plan will be reviewed every three years 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; 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**.

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SLR. (2020). *Centennial Mandalong Land and Agricultural Resource Assessment LW30-LW33.*

Umwelt. (2020a). *Flood Impact Assessment Mandalong Southern Extension Project Modification 9.*

Umwelt. (2020b). *Flood Impact Assessment - Full Subsidence Over Longwalls 1 to 33.*

Umwelt. (2021). *Heritage Management Plan for LWs 30-31.*

Appendix 1 – Trigger Action Response Plans

Monitoring and Controls	Trigger	Action
Creeks and watercourses		
• **Centennial** to conduct flood modelling and assessment to identify and potential changes to overland flow paths, channel alignments and remnant ponding. • **Centennial** to conduct property inventory and detail predicted impacts from subsidence in PSMP. • **Centennial** to monitor creek in accordance with the **Water Management Plan - Extraction PlanLW30-31**. • **Centennial** to establish subsidence monitoring and observation points along creek line in consultation with landowner to assess subsidence, subsidence impact and grade changes to creek. • **Centennial** to conduct six monthly flood path inspections along the creek line and report in the Flood Path Condition Report. • **Centennial** to conduct post-mining surveys following the development of subsidence (majority of subsidence developed when LW face is 800m past feature). • **Centennial** to provide pre and post mining subsidence monitoring results to Landowner and RR. • **Centennial** to provide monitoring results in the Annual Review. **CONTROLS** **Flood Modelling and Assessment LW30-31 (Umwelt, 2020)** determined there was no expected change in channel alignment or significant remnant ponding along Morans Creek and tributaries.	**LEVEL 1 – LOW** **Operation within prediction and approved impact** • Development of subsidence (Upper 95% Confidence Limits) and impact as predicted. • Minor change to creek line gradients not affecting flows. • Negligible change to channel alignment. • Negligible change to existing ponding within creek channel.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner** and **RR.** • **Centennial** to assess subsidence impact against Flood Modelling Assessment LW30-33. • **Centennial** to continue to monitor as per **Water Management Plan LW30-31**.
	LEVEL 2 – MEDIUM **Operations within approved impact but exceed or potentially exceed predictions** • Development of subsidence exceeding or potentially exceeding prediction (Upper 95% Confidence Limits). • Vertical subsidence results are greater than predicted. • Potential increase or decrease in ponding within channel. • One or more areas of instabilities in watercourses.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner** and **RR.** • **Centennial** to monitor and investigate as per **Water Management Plan LW30-31.** • **Centennial** to assess subsidence impact against Flood Modelling Assessment LW30-33. • **Centennial** to investigate and assess if remediation measures are necessary in consultation with **geomorphic specialist** and **Landowner.** • Report investigations, monitoring and any remediation measures in Annual Review.
	LEVEL 3 – HIGH **Operations exceed approved impact** • Development of subsidence and impact greater than expected. • Vertical subsidence results are greater than predicted (Upper 95% Confidence Limits). • Change in creekline grades resulting in: • Observable change in channel alignment. • Observable erosion along creekline. • Observable cracking on stream bed or banks. • Increase or decrease in ponding above approved impact. • Significant increase or decrease in ponding above approved impact. • One or more areas of instabilities in watercourses causing sediment loads to migrate and impact riparian vegetation. • Trend in declining biodiversity from mining related impacts.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner** and **RR.** • **Centennial** to monitor and investigate as per **Water Management Plan LW30-31** and **Extraction Plan**. • **Centennial** to investigate and assess possible remediation measures in consultation with **geomorphic specialist**, **DPIE-Water** and **Landowner.** • **Centennial** to undertake remediation where it is determined the appropriate option in consultation with **Landowner** and **DPIE-Water.** • **Centennial** to notify **DPE** as per S4 Condition 2 SSD-5144. • **Centennial** to notify **external stakeholders including government agencies** in accordance with Incident Reporting S6 Condition 10. • **Centennial** to report investigations, monitoring and any remediation measures in Annual Review. • **Centennial** to review results and predictions as per Extraction Plan.

Monitoring	Trigger	Action
Farm Dams		
• **Centennial** to conduct property inventory and detail predicted impacts from subsidence in PSMP. • **Centennial** to arrange pre-mining inspection of dam and drainage paths • **Centennial** to arrange inspection of dam by a structural / civil engineer if considered necessary due to size, location or potential risk to property, occupants or public. • **Centennial** to establish subsidence monitoring on dam and survey drainage paths if necessary (surface contours available LIDAR data). • **Centennial** to conduct post-mining surveys following the development of subsidence (majority of subsidence developed when LW face is 800m past dam). • **Centennial** to provide pre and post mining subsidence monitoring results to **Landowner**, **RR** and **SA NSW**.	**LEVEL 1 – LOW** **Operation within prediction and approved impact** • Development of subsidence (U95% Confidence Limits) and impact as predicted. • Tensile Strain < 4mm/m • Not likely to impact dam seal. • Drainage paths may need to be regraded. • Possible minor reduction in dam capacity from tilting.	• **Centennial** to conduct subsidence monitoring on dam and provide results to the **Landowner, RR** and **SA NSW**. • **Centennial** to assist landowner with any claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs to dam and drainage paths in consultation with **Landowner.**
	LEVEL 2 – MEDIUM **Operations within approved impact but exceed or potentially exceed predictions** • Development of subsidence exceeding or potentially exceeding prediction (Upper 95% Confidence Limits). • Tensile Strain 4 mm/m to 10 mm/m. • Possible minor leakage to dam structure, requiring resealing of dam. • Reduction of storage capacity from tilting requiring: o reshaping of dam to restore capacity. o drainage paths to be regraded.	• **Centennial** to conduct subsidence monitoring on dam and provide results to the **Landowner, RR** and **SA NSW**. • **Centennial** to assist landowner with any SA NSW claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs to dam and drainage paths in consultation with the **Landowner**. • **Centennial** to provide alternate water supply if required.
	LEVEL 3 – HIGH **Operations exceed approved impact** • Development of subsidence or impact greater than expected (Upper 95% Confidence Limits). • Substantial surface cracking greater than predicted. • Loss of freeboard or cracking causing dam failure.	• **Centennial** to conduct subsidence monitoring on dam and provide results to the **Landowner, RR** and **SA NSW**. • **Centennial** to arrange structural inspection by structural / civil engineer to provide assessment of the dam's integrity and safety if the size or the location of the dam causes a risk to the occupants, public or property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs to dam and drainage paths in consultation with the **Landowner**. • **Centennial** to provide alternate water supply. • **Centennial** to review results and predictions as per Extraction Plan.

Monitoring and Controls	Trigger	Action
Land Use Impacts		
• **Centennial** to conduct flood modelling and assessment to identify potential changes to flooding. • **Centennial** to conduct property inventory and detail predicted impacts from subsidence in PSMP. • **Centennial** to arrange Land and Agricultural Resource Assessment and detail predicted land impacts from subsidence in PSMP. • **Centennial** to arrange **SA NSW** pre-mining inspection of property and improvements to record pre-mining condition. • **Centennial** to establish subsidence monitoring on property in consultation with **Landowner**. • **Centennial** to conduct post-mining surveys following the development of subsidence (majority of subsidence developed when LW is completed or LW face is 800m past feature). • **Centennial** to provide pre and post mining subsidence monitoring results to **Landowner**, **RR** and **SA NSW**.	**LEVEL 1 – LOW** **Operation within prediction and approved impact** • Development of subsidence and impact as predicted. • Vertical subsidence within predicted range (U95% CL). • Negligible change to flood free agricultural land for stock storage or stock access. • Negligible impact to agricultural productivity or use of the land or an enterprise. • Negligible change to existing ponding or remnant ponding • No or minor impact to buildings or improvements. • Negligible increase in soil or tunnel erosion.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW**. • Review subsidence results and observed impacts against Land and Agricultural Resource Assessment and **Land Management Plan**. • **Centennial** to assist landowner with any claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs in consultation with **Landowner**.
	LEVEL 2 – MEDIUM **Operations within approved impact but exceed or potentially exceed predictions** • Development of subsidence exceeding or potentially exceeding prediction (Upper 95% Confidence Limits). • Impact to landuse from subsidence or increased flooding or ponding within predicted or approved impacts • Minor increase in ponding or changes to drainage systems that can be remediated.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW**. • Review subsidence results and observed impacts against Land and Agricultural Resource Assessment and **Land Management Plan.** • **Centennial** to assist landowner with any claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs in consultation with **Landowner**. • **Centennial** to ensure adequate water supply is available.
	LEVEL 3 – HIGH **Operations exceed approved impact** • Development of subsidence and impact greater than expected. • Significant impact and change to property functionality or agricultural productivity greater than predicted and approved. • Change to flood free land for stock storage or stock access greater than predicted or approved.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW**. • Review subsidence results and observed impacts against pre-mining agricultural assessment and **Land Management Plan**. • **Centennial** to commence negotiations with **Landowner** as per the Land Acquisition process (S5-Condition 3 & 4). • **Centennial** to notify **DPIE** as per S4 Condition 2 SSD-5144. • **Centennial** to notify **external stakeholders including government agencies** in accordance with Incident Reporting S6 Condition 10 (environmental impact). • **Centennial** to review results and predictions as per Extraction Plan.

Monitoring and Controls	Trigger	Action
Property Access Roads		
• **Centennial** to conduct flood modelling and assessment to identify potential changes to flooding as per DC Schedule 4 Condition 6(h). • **Centennial** to conduct property inventory and detail predicted impacts from subsidence in PSMP. • **Centennial** to arrange **SA NSW** pre-mining inspection of property and improvements to detail pre-mining condition. • **Centennial** to establish subsidence monitoring / inspection sites on property access if an increase in flood hazard is predicted. To be arranged in consultation with **Landowner**. • **Centennial** to conduct post-mining surveys following the development of subsidence (majority of subsidence developed when LW is completed or LW face is 800m past feature). • **Centennial** to provide pre and post mining subsidence monitoring results to **Landowner**, **RR** and **SA NSW**. **CONTROLS** **Flood Modelling and Assessment LW30-31 (Umwelt 2020)** determined that there was no predicted increase in flood hazard category on the access road at both the 1 year and 100 year ARI Storm Events.	**LEVEL 1 – LOW** **Operation within prediction and approved impact** • Development of subsidence and impact as expected. • Subsidence within predicted range (U95% CL). • Negligible visible impact on gravel access roads. • Possible hairline cracking on sealed roads. • No change to flood hazard category.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW**. • **Centennial** to assist landowner with any SA NSW claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs in consultation with **Landowner**.
	LEVEL 2 – MEDIUM **Operations within approved impact but exceed or potentially exceed predictions** • Development of subsidence exceeding or potentially exceeding prediction (Upper 95% Confidence Limits). • Minor cracking to gravel access roads, but remaining safe, serviceable and repairable. • Tensile cracking or minor compression humps may develop on sealed roads. Repairs may be required to reseal pavement. • No change to flood hazard category.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW**. • **Centennial** to assist landowner with any SA NSW claim for damage to access road. • **Centennial** to arrange prompt repairs to access roads to make safe and allow access to the property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs in consultation with the **Landowner**.
	LEVEL 3 – HIGH **Operations exceed approved impact** • Development of subsidence and impact greater than predicted • Tensile cracks and/or compression humps develop on access roads that need repairing to ensure public safety. • Tensile cracks and/or compression humps develop on sealed roads. • Repairs required, reshaping road, restoring drainage and resealing pavement.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **Landowner, RR** and **SA NSW.** • **Centennial** to arrange prompt temporary repairs to make road safe and allow access to property. • **Centennial** to assist landowner with any SA NSW claim for damage to property. • **SA NSW** to conduct post mining inspections and arrange any necessary repairs in consultation with the **Landowner**. • **Centennial** to reassess flood hazard using actual subsidence data to determine if there is an increase in flood hazard at 1 year and 100 year ARI Storm Events. • If flood modelling indicates an increase in flood hazard, **Centennial** to commence negotiations and carry out works as agreed by **Landowner** to provide suitable access to the property. • **Centennial** to notify **external stakeholders including government agencies** in accordance with Incident Reporting S6 Condition 10. • **Centennial** to review results and predictions as per Extraction Plan.

Monitoring and Controls	Trigger	Action
Steep Slopes		
• **Centennial** to conduct pre mining steep slope inspection and assessment by Geotechnical Engineer. • **Centennial** to conduct subsidence monitoring and inspections as per the Public Safety Management Plan and Subsidence Monitoring Program. • **Centennial** to conduct weekly visual inspections when steep slopes are within active subsidence zone. • **Centennial** to provide pre and post mining subsidence monitoring results to **RR** and **Landowners**.	**LEVEL 1 – LOW** **Operation within prediction and approved impact** • Development of subsidence and impact as expected. • Subsidence within predicted range (Upper 95% Confidence Limits). • Negligible visible impact on gravel access roads. • Negligible impact to steep slopes. • Negligible indications down slope rock or bolder movements. • No rock mass instability. • Minor opening of rock joints that does not cause dislodgement of rocks.	• **Centennial** to conduct weekly visual inspections of land when steep slope zones are located in active subsidence zone and along pubic access roads. • **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **RR** and **Landowner**.
	LEVEL 2 – MEDIUM **Operations within approved impact but exceed or potentially exceed predictions** • Development of subsidence exceeding or potentially exceeding prediction (Upper 95% Confidence Limits). • Cracking to gravel access roads, but remaining safe, serviceable and repairable. • Cracking to surface not requiring major repairs or posing further risk to public safety. • Opening of rock joints not likely to cause dislodgement of rocks.	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **RR** and **Landowner**. • **Centennial** to inspect and erect warnings signs or barricades as per Public Safety Management Plan. • **Centennial** to notify Landowner • **Centennial** to arrange repairs to access roads or areas of potential rock instability in consultation with landowner. • **Centennial** to notify Principal Subsidence Engineer of higher than expected subsidence. • **Centennial** to arrange a Geotechnical Engineer to inspect any areas of suspected rock mass instability in consultation with **Landowner**. • **Centennial** to review results and predictions as per Extraction Plan.
	LEVEL 3 – HIGH **Operations exceed approved impact** • Development of subsidence and impact greater than expected. • Surface cracking visible that may be dangerous to public safety. • Opening of rock joints that may cause dislodgement of rocks. • Rock fall and rollouts • Overhang collapse • Landslide • Risks to public safety	• **Centennial** to conduct post mining inspection and subsidence monitoring and provide results to the **RR** and **Landowner**. • **Centennial** to inspect and erect warnings signs or barricades as per Public Safety Management Plan. • **Centennial** to notify **Landowner**. • **Centennial** to notify Principal Subsidence Engineer of higher than expected subsidence and impact. • **Centennial** to notify **DPIE** as per S4 Condition 2 SSD-5144. • **Centennial** to arrange immediate repairs to dangerous surface cracking (eg backfilling) any necessary repairs in consultation with the **Landowner** and **RR**. • **Centennial** to arrange a Geotechnical Engineer to inspect any areas of suspected rock mass instability. • **Centennial** to notify **external stakeholders including government agencies** in accordance with Incident Reporting S6 Condition 10. • **Centennial** to review results and predictions as per Extraction Plan.

Appendix 2 – Correspondence

19 February 2021

Mr S Mallyon
Land Administrator | Forest Stewardship
Forestry Corporation
PO Box 168
Wauchope NSW 2446

Dear Scott

Centennial Mandalong – Land Management Plan LW30-31 for Review

Centennial Mandalong is currently preparing and Extraction Plan for Longwalls 30 and 31 (LW30-31) in accordance with the conditions for consent for the Mandalong Southern Extension Project (SSD-5144).

In accordance with Condition 6(k) of Schedule 4 of SSD-5144, a draft copy of the Extraction Plan LW30-31 – Land Management Plan has been enclosed for your review and comment.

The Land Management Plan has been prepared by Phil Enright, being a suitably qualified and experienced person whose appointment was approved by the Secretary of the Department of Planning, Industry & Environment on 22 October 2020.

Any feedback on the draft Land Management Plan LW30-31 is requested to be provided by Friday 5 March 2021.

If you would like any further information regarding the Land Management Plan or operation of Mandalong Mine, please call telephone number 4973 0948 or 0439409781.

Yours sincerely

Phil Enright
Mining Approvals Coordinator
phil.enright@centennialcoal.com.au

Encl. 1

Centennial Mandalong Pty Limited
ABN 74 101 508 892

PO Box 1000
Toronto NSW 2283
T. +61 02 4973 0900
E: info@centennialcoal.com.au
www.centennialcoal.com.au

RE: Review of draft Mandalong Mine Land Management Plan LW30-31Scott Mallyon
to: Phil Enright 19/02/2021 11:58 AM
Cc: "Kim Drysdale"
From: "Scott Mallyon" <Scott.Mallyon@fcnsw.com.au>
To: "Phil Enright" <phil.enright@centennialcoal.com.au>
Cc: "Kim Drysdale" <Kim.Drysdale@fcnsw.com.au>
History:This message has been replied to.

HI Phil

I've reviewed the Land Management Plan and on behalf of FCNSW I don't see any issues with the proposed works. Should you need anything further please do not hesitate to contact me

Regards
Scott

SCOTT MALLYON
Manager, Forest Occupancy and Materials
Forestry Corporation of NSW
Maher Street, Wauchope, NSW, 2446
M: 0447 744 436 | E: scott.mallyon@fcnsw.com.au |
W: www.forestrycorporation.com.au

From: Phil Enright <phil.enright@centennialcoal.com.au>
Sent: Thursday, 18 February 2021 12:52 PM
To: Scott Mallyon <Scott.Mallyon@fcnsw.com.au>
Cc: Kim Drysdale <Kim.Drysdale@fcnsw.com.au>
Subject: Review of draft Mandalong Mine Land Management Plan LW30-31

Hi Scott,

Please find attached letter and draft Land Management Plan for Longwalls 30 and 31 for your review and feedback.

The management plan is an update to the current Land Management Plan prepared for the previous Extraction Plan LW25-31. The current document was reviewed by Jude Parr.

It is planned to submit the Extraction Plan LW30-31 and its component management plans to the Department of Planning, Industry and Environment for approval in early March. Longwall 30 is scheduled to commence extraction in June 2021.

It would be appreciated if you could provide any feedback or an email / letter to confirm that the Forestry Corporation is satisfied with the Management Plan.

A copy of the correspondence will be included in the Management Plan appendix to confirm that the Forestry Corporation has been consulted.

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

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

18 February 2021

Mr M Grace
Natural Resource Management Project Officer
NSW Department of Industry | Lands & Forestry Division
PO Box 2215
Dangar NSW 2309

Dear Mark

Centennial Mandalong – Land Management Plan LW30-31 for Review

Centennial Mandalong is currently preparing and Extraction Plan for Longwalls 30 and 31 (LW30-31) in accordance with the conditions for consent for the Mandalong Southern Extension Project (SSD-5144).

In accordance with Condition 6(k) of Schedule 4 of SSD-5144, a draft copy of the Extraction Plan LW30-31 – Land Management Plan has been enclosed for your review and comment.

The Land Management Plan has been prepared by Phil Enright, being a suitably qualified and experienced person whose appointment was approved by the Secretary of the Department of Planning, Industry & Environment on 22 October 2020.

Any feedback on the draft Land Management Plan LW30-31 is requested to be provided by Friday 5 March 2021.

If you would like any further information regarding the Land Management Plan or operation of Mandalong Mine, please call telephone number 4973 0948 or 0439409781.

Yours sincerely

Phil Enright
Mining Approvals Coordinator
phil.enright@centennialcoal.com.au

Encl. 1

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APP259810

Mandalong Mine draft Land Management Plan LW 30-31

Phil Enright to: Mark Grace 18/02/2021 01:46 PM

Hi Mark,

Following our conversation in November last year, you clarified that sections of Toefpers Rd and Kiar Ridge Road to be impacted by subsidence from Longwalls 30 and 31 were both Crown Roads.

As part of the Extraction Plan for Longwalls 30 and 31 (LW30-31), the Crown Roads are included in two relevant management plans, the Land Management Plan and Public Roads Management Plan.

Note that the draft Public Roads Management Plan will be provided for your review later next week. It will also contain more detail on management measures in relation to public safety, road repairs and notification of affected landholders.

Please find attached letter and draft Land Management Plan for LW30-31 for your review and feedback.

The Land Management Plan is an update to the current Land Management Plan prepared for the previous Extraction Plan LW25-31.

It is planned to submit the Extraction Plan LW30-31 and its component management plans to the Department of Planning, Industry and Environment for approval in early March. Longwall 30 is scheduled to commence extraction in June 2021.

It would be appreciated if you could provide any feedback or an email / letter to confirm that DPI - Lands and Forestry is satisfied with the Management Plan.

A copy of the correspondence will be included in the Management Plan appendix to confirm that DPI - Lands and Forestry has been consulted.

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

APP259810_Review of Draft Land Management Plan LW30-31 - DPI Lands and Water.pdf

Mandalong Mine Land Management Plan LW30-31 Rev0.pdf

Crown Lands comments - Mandalong Mine draft Land Management Plan LW30-31Mark Grace to: Phil Enright 04/03/2021 04:49 PM
Cc: "Colin Frew"
From: "Mark Grace" <mark.grace@crownland.nsw.gov.au>
To: "Phil Enright" <phil.enright@centennialcoal.com.au>
Cc: "Colin Frew" <colin.frew@crownland.nsw.gov.au>
History:
This message has been replied to and forwarded.

Hi Phil

Thanks for providing the Department of Planning, Environment and Planning – Crown Lands (the Department) with the opportunity to comment on the draft Land Management Plan for longwalls 30-31.

I have reviewed the draft Land Management Plan and provide the following comments:

- Crown Land within the project boundary appears to be restricted to the Yambo Trig Reserve, being Lot 175 DP 755271 reserved under R1002616 for Trigonometrical Purposes, and various Crown Roads, being Toefpers Road, Kiar Ridge Road and the unnamed roads located in the north east quadrant
- The Crown reserve referred to above is not part of the Olney State Forest – the reference to Crown land being part of the Olney State Forest on page 5 should be amended
- Yambo Trig may still be part of the NSW survey network. If it is the trig station is at high risk of impact from subsidence, as it may affect the height and position of the permanent survey mark. The Plan should provide specific details about potential impacts on the trig station, whether these impacts are acceptable to the relevant survey agency (Spatial Services NSW), monitoring (e.g. accurate surveys rather than reliance on visual inspection), mitigation measures, and remediation of the mark if it does move
- Kiah Ridge Road appears to be the only registered (essential) fire trail on Crown land/roads within the project area
- Any formed roads and the access track to the Yambo Trig survey mark should be treated as “property access roads”
- Any repairs, temporary or otherwise, to the Kiah Ridge fire trail must be done in consultation with Crown Lands and the NSW RFS to ensure that the road is repaired to the appropriate fire trail standard, i.e. Category 9

Notwithstanding the above comments the Department is satisfied with the draft Land Management Plan.

If you have any questions please call me.

Regards

Mark

Mark Grace
Natural Resource Management Project Officer
Crown Lands | Department of Planning, Industry and Environment
T 02 4937 9331 | **E** mark.grace@crownland.nsw.gov.au
516 High Street Maitland NSW 2320 | PO Box 2215 Dangar NSW 2309
www.dpie.nsw.gov.au

Re: Crown Lands comments - Mandalong Mine draft Land Management Plan LW30-31

Phil Enright to: Mark Grace 05/03/2021 01:54 PM
Cc: "Colin Frew"

Hi Mark,

Thank you for reviewing the Land Management Plan. We have updated the document to address all the comments provided. I will forward the final version shortly.

The relevant comments have also been addressed in the Public Roads Management Plan and Built Features Management Plan.

Please note that Centennial is currently addressing the subsidence impacts to Yambo Trig Station in accordance with the 'Surveyor-General's Direction No. 11 - Preservation of Survey Infrastructure'.

"Mark Grace"	Hi Phil Thanks for providing the Department o...	04/03/2021 04:49:29 PM

18 February 2021

Mr L Melican
Section Manager
Natural Assets and Biodiversity
Central Coast Council
PO Box 21
Gosford NSW 2250

Email: Larry.Melican@centralcoast.nsw.gov.au

Dear Larry

Centennial Mandalong – Land Management Plan LW30-31 for Review

Centennial Mandalong is currently preparing and Extraction Plan for Longwalls 30 and 31 (LW30-31) in accordance with the conditions for consent for the Mandalong Southern Extension Project (SSD-5144).

In accordance with Condition 6(k) of Schedule 4 of SSD-5144, a draft copy of the Extraction Plan LW30-31 – Land Management Plan has been enclosed for your review and comment.

As detailed in previous meetings and correspondence, one Council property, Lot 175 DP 755271 is located within the zone of subsidence from the proposed mining.

The Land Management Plan has been prepared by Phil Enright, being a suitably qualified and experienced person whose appointment was approved by the Secretary of the Department of Planning, Industry & Environment on 22 October 2020.

Any feedback on the draft Land Management Plan LW30-31 is requested to be provided by Friday 5 March 2021.

If you would like any further information regarding the Land Management Plan or operation of Mandalong Mine, please call telephone number 4973 0948 or 0439409781.

Yours sincerely

Phil Enright
Mining Approvals Coordinator
phil.enright@centennialcoal.com.au

Encl. 1

Centennial Mandalong Access Agreement - Central Coast Council

Phil Enright to: Emily Goodworth 02/11/2020 11:08 AM

Hi Emily,

I would like to follow up on our meeting between Central Coast Council and Centennial on 23 September.

As discussed at the meeting, Mandalong Mine is preparing a mining application (Extraction Plan) to mine Longwalls 30 to 33 which requires approval by the Department of Planning, Industry and Environment (DPIE).

A requirement of the Extraction Plan is to conduct subsidence monitoring over the mining area, typically pre and post mining surveys for each longwall block. The monitoring typically comprises of star pickets placed at 10m intervals running perpendicular to the longwall panels.

A section of the proposed monitoring line is located within Central Coast property Lot 9 DP 262720 off Buangi Road, Durren Durren as shown on the attached plan (MG14220).

Centennial and Central Coast Council currently have an access agreement for the property to conduct exploration drilling, environmental monitoring and surveys (see attached).

Centennial would like to enter into another new access agreement to install the proposed subsidence monitoring and conduct ongoing surveys during and after mining. The activities would also include ecology and Aboriginal heritage monitoring.

The standard Centennial access agreement for subsidence monitoring has an annual compensation payment ($2000) as opposed to a $100 daily access fee. A draft access agreement is also attached for the Council's consideration.

It would be appreciated if we could discussed the proposed monitoring, access agreement and the Extraction Plan application.

MG14220.pdf Access Agreement Subsidence Monitoring Central Coast Council - Subsidence Monitoring.docx

Executed Access Agreement 08 11 2019 - 08 11 2021.pdf

Centennial Mandalong Access to Central Coast Council Land

James Marshall to: Larry.Melican 04/01/2021 10:57 AM
Cc: Phil Enright

Hi Larry

Centennial met with Central Coast Council on 28 September and part of the discussion related to our Mandalong Mine and the preparation of a mining application (Extraction Plan) to mine Longwalls 30 to 33 which requires approval by the Department of Planning, Industry and Environment (DPIE).

We have been advised that you are the appropriate contact.

A requirement of the Extraction Plan is to conduct subsidence monitoring over the mining area, typically pre and post mining surveys for each longwall block. The monitoring typically comprises of star pickets placed at 10m intervals running perpendicular to the longwall panels.

A section of the proposed monitoring line is located within Central Coast property Lot 9 DP 262720 off Buangi Road, Durren Durren as shown on the attached plan (MG14220).

Centennial and Central Coast Council currently have an access agreement for the property to conduct exploration drilling, environmental monitoring and surveys (see attached).

Centennial would like to enter into another new access agreement to install the proposed subsidence monitoring and conduct ongoing surveys during and after mining. The activities would also include ecology and Aboriginal heritage monitoring.

The standard Centennial access agreement for subsidence monitoring has an annual compensation payment ($2000) as opposed to a $100 daily access fee. A draft access agreement is also attached for the Council's consideration.

It would be appreciated if we could discussed the proposed monitoring, access agreement and the Extraction Plan application as soon as practical.

Please feel free to contact me to discuss.

Cheers

James

MG14220.pdf Access Agreement Subsidence Monitoring Central Coast Council - Subsidence Monitoring.docx

Executed Access Agreement 08 11 2019 - 08 11 2021.pdf

Regards

James Marshall
Group Manager Stakeholder Engagement

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Review of draft Mandalong Mine Land Management Plan LW 30-31

Phil Enright to: Larry.Melican 18/02/2021 02:22 PM
Cc: James Marshall, "Emily Goodworth"

Hi Larry

Please find attached letter and draft Land Management Plan for Longwalls 30 and 31 for your review and feedback.

As noted in the letter, Council owns one property located within the Extraction Plan Area and zone of subsidence.

It is planned to submit the Extraction Plan LW30-31 and its component management plans to the Department of Planning, Industry and Environment for approval in early March. Longwall 30 is scheduled to commence extraction in June 2021.

It would be appreciated if you could provide any feedback or an email / letter to confirm that Central Coast Council is satisfied with the Management Plan.

A copy of the correspondence will be included in the Management Plan appendix to confirm that Council has been consulted.

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

APP259821_Review of Draft Land Management Plan LW30-31 - CC Council.pdf

Mandalong Mine Land Management Plan LW30-31 Rev0.pdf

Filed in Library APP259821
CCC Response_Mandalong Land Management PlanCentral Coast Council to: phil.enright@centennialcoal.com.au 08/03/2021 03:19 PM
From: "Central Coast Council" <Ask@centralcoast.nsw.gov.au>
To: "phil.enright@centennialcoal.com.au" <phil.enright@centennialcoal.com.au>
History:
This message has been replied to and forwarded.

1 Attachment

CCC Response_Mandalong Land Management Plan .pdf

Dear Mr Enright,

Thank you for your enquiry regarding the above matter.

On behalf of Scott Cox, Director Environment and Planning – please find response attached.

Kind Regards,
Central Coast Council

Central Coast Council
P.O. Box 21 Gosford NSW 2250 , P.O. Box 20 Wyong NSW 2259
t: 1300 463 954
e: Ask@centralcoast.nsw.gov.au

8 March 2021

Mr Phil Enright
Centennial Mandalong Pty Ltd
PO Box 1000
TORONTO NSW 2283

phil.enright@centennialcoal.com.au

Dear Mr Enright,

Centennial Mandalong – Draft Land Management Plan LW30-31

I refer to your letter dated 18 February 2021 about the Mandalong Southern Extension Project, its potential impact on Council owned land and the Draft Land Management Plan LW30-31 for Council's review.

Figure 2 of the Draft Land Management Plan LW 30-31 correctly identifies that Council land (Lot 9 DP 262720) is within the extraction plan area, and the proposed workings area affects the south-eastern corner of the Council land. Your letter however refers to Lot 175 DP 755271 which Council does not own or have management responsibilities for.

The Council land at 9 Buangi Road, Durren Durren (Lot 9 DP 262720) is managed by Council for its natural values, including maintaining ecological processes, biodiversity, the protection of native vegetation and the retention of habitat for native species.

The draft trigger action response plans in Appendix 1 include monitoring and controls as well as identifying the trigger points and actions for steep slopes, creeks and watercourses, property access roads, land use impacts and farm dams. The Land Use Impacts Section of Appendix 1 is relevant to managing the potential impacts on productive agricultural land, however they do not consider the significant natural values of affected, including the Council owned land at 9 Buangi Road, Durren Durren

Council requests that the Draft Land Management Plan LW 30-31 include monitoring and controls, trigger points and actions to minimise the potential impacts of mine subsidence on the natural values including biodiversity on the Council owned land at 9 Buangi Road, Durren Durren.

Should you require any further information please contact Council's Section Manager, Natural Assets and Biodiversity, Larry Melican email larry.melican@centralcoast.gov.au or 0418 216 472.

Yours sincerely,

Scott Cox
Director
Environment and Planning

D14508184

Central Coast Council
P 1300 463 954 I **E** ask@centralcoast.nsw.gov.au I

9 March 2021

Mr L Melican
Section Manager
Natural Assets and Biodiversity
Central Coast Council
PO Box 21
Gosford NSW 2250

Email: Larry.Melican@centralcoast.nsw.gov.au

Dear Larry

Centennial Mandalong – Land Management Plan LW30-31 for Review

Thank you for reviewing the draft Land Management Plan prepared in accordance with the requirements of the Mandalong Southern Extension Project (SSD-5144) for the Extraction Plan for Longwalls 30 and 31.

Your review noted that the Land Management Plan does not consider the significant natural values affected by mining. A separate Biodiversity Management Plan has been prepared in accordance with the Mine's development Consent (SSD-5144) Schedule 4 Condition 6 (j) to address the natural environment. A copy of the management plan is enclosed.

Once the Extraction Plan for Longwalls 30 and 31 is approved by the Department of Planning, Industry and Environment, the final copy of the Land and Biodiversity Management Plans will be provided to Central Coast Council.

If you would like any further information regarding the Land Management Plan, Biodiversity Management Plan or operation of Mandalong Mine, please call telephone number 4973 0948 or 0439409781.

Yours sincerely

Phil Enright
Mining Approvals Coordinator
phil.enright@centennialcoal.com.au

Encl. 1

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APP259821

Re: CCC Response_Mandalong Land Management Plan

Phil Enright to: Central Coast Council 09/03/2021 10:20 AM
Cc: Larry.Melican

Dear Scott

Thank you for your review of the Mandalong Mine Land Management Plan for Extraction Plan Longwalls 30 and 31.

Please find attach response to your letter and a copy of the Biodiversity Management Plan also prepared for the Extraction Plan Longwalls 30 and 31.

LW30-31 Mandalong Extraction Plan BMP.pdf

Letter Draft Land Management Plan LW30-31 - CC Council 09032021.pdf

"Central Coast Council"	Dear Mr Enright, Thank you for your en...	08/03/2021 03:19:06 PM

Centennial Mandalong

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