



VOLUME 1

Extraction Plan Main Report (MW13-16)

**Pt Hatteras Panel & Pillar Mining Zone
Extraction Plan (MW13-16)**

Airly Mine (SSD_5581)

October 2021

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DOCUMENT CONTROL / TITLE BLOCK

EXTRACTION PLAN DETAILS	Title:	Extraction Plan Main Report: Pt Hatteras Panel & Pillar Mining Zone Extraction Plan (MW13-16)
	Applicant:	Centennial Airly Mine
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REVISION

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Plan 3 (AM02775): Geological and Seam Data
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APPENDIX 1	Airly Mine Water Management Plan
APPENDIX 2	Land Management Plan for MW13-16 (MW13-16 LMP)
APPENDIX 3	Biodiversity Management Plan for MW13-16 (MW13-16 BMP)
APPENDIX 4	Western Region Aboriginal Cultural Heritage Management Plan
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APPENDIX 7	Subsidence Monitoring Program for MW13-16 (MW13-16 SMP)
APPENDIX 8	Master Trigger Action Response Plan for MW13-16 (MW13-16 Master TARP)

1 INTRODUCTION

1.1 Background

Airly Mine is an existing underground coal mine located approximately 40 kilometres (km) northwest of Lithgow in New South Wales, 170km northwest of Sydney and 4 km to the northeast of Capertee, as illustrated on **Figure 1.1**. The mine is partly located within the Mugii Murum-ban State Conservation Area (SCA). Centennial Airly Pty Limited (Centennial Airly) is the operator of the mine and is a wholly owned subsidiary of Centennial Coal Company Pty Limited.

Development Consent for the Airly Mine Extension Project (MEP) was approved on 15 December 2016 subject to the Conditions in Schedules 2 to 6 of State Significant Development 5581 (SSD_5581). The consent allows extraction of 1.8 million tonnes of run-of-mine (ROM) coal per calendar year for a period of 20 years, which is supplied to both domestic and international markets.

As per commitments within the Environmental Impact Statement (EIS) for SSD_5581, Airly Mine is implementing a conservative and staged approach to mining¹. In 2019, Airly Mine introduced mining using the miniwall mining method within the *Panel and Pillar Mining Zone*. Miniwall mining began in less sensitive areas in the centre of Mt Airly with significant setbacks to key sensitive features. The detailed EIS and post-approvals processes involved multiple expert review including via the Independent Expert Panel (IEP) established for the mine.

Nine (9) miniwall panels have been extracted under Mt Airly to date without significant impact to sensitive surface features such as cliffs and pagodas, including those directly above secondary extraction. However, observed subsidence on Mt Airly surpassed the predicted maximum subsidence of 125 mm and some associated surface cracks were identified. Accordingly, in consultation with regulators and the IEP, Airly Mine have undertaken extensive modelling and mine design revisions aimed to reduce subsidence levels to be consistent with EIS predictions (i.e., maximum vertical subsidence <125mm).

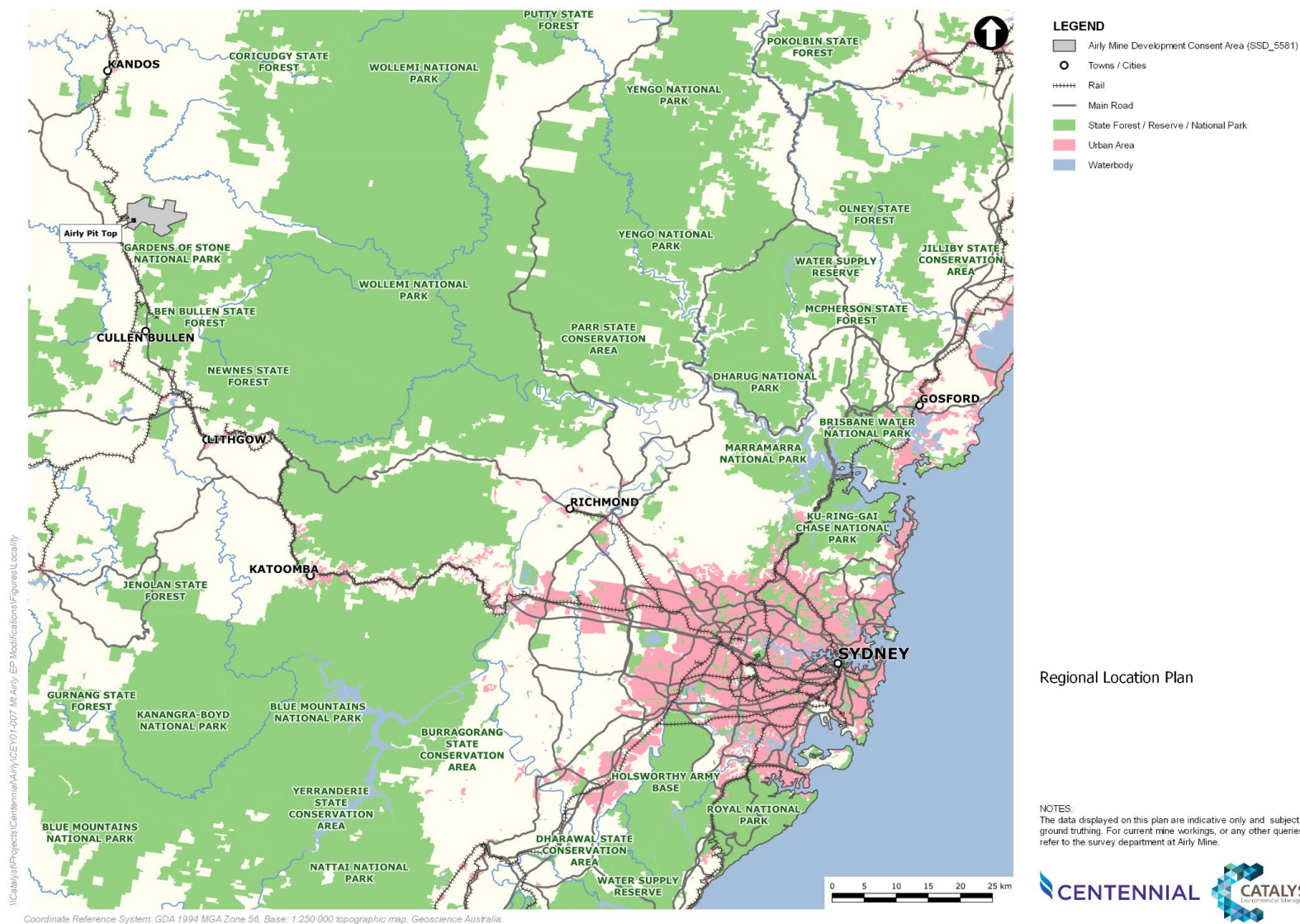
The *Point Hatteras Panel and Pillar Mining Zone Extraction Plan* as detailed in this *Extraction Plan Main Report (the EP Main Report)* and the supporting component plans, continues the conservative and staged approach to mining being implemented by Airly Mine, with secondary extraction proposed in four miniwall panels (MW13 to MW16). The miniwall panels are located within the *Panel and Pillar Mining Zone* as detailed within SSD_5581.

The proposed mine design has significantly larger pillar widths between each panel (increased from 29.5m to 70m) compared with previous mining beneath Mt Airly. Conservative setbacks to key sensitive features located within the *Cliff Line Zone of First Workings* will continue to be implemented for the Pt Hatteras PPMZ Extraction Plan, and extensive monitoring and management measures are proposed to demonstrate the subsidence modelling and effectiveness of the revised mining and monitoring systems. The *Extraction Plan Area (EP Area)* is further defined in **Section 1.3**.

An Extraction Plan is required to be approved prior to secondary extraction to meet Condition 7 in Schedule 3 of SSD_5581. This Extraction Plan will describe the applicable regulatory framework, mine planning, management and monitoring measures to be implemented to ensure the protection of all surface/subsurface natural and built features and the protection of public safety from subsidence associated with secondary extraction within the Extraction Plan Area.

¹ Airly Mine has five (5) mining zones approved under development consent SSD_5581 as shown in Figure 2 in Appendix 3 of SSD_5581. These zones provide design criteria for different mining methods based on the differing levels of environmental sensitivity of surface features and depth of cover across the Airly mining leases. Section 8 of the Airly Mine EIS (2014) provides further details on the definitions of each of these approved mining zones if required.

Figure 1.1: Locality Plan



Regional Location Plan

1.2 Purpose & Scope

The purpose of this *EP Main Report* and the supporting component plans is to:

- Provide detailed plans of the project;
- Address all regulatory and related requirements² using a risk based and consultative approach;
- Detail the mine planning and design associated with panel and pillar extraction mining activities, located within the Extraction Plan Area
- Outline potential subsidence effects, subsidence impacts and environmental consequences due to the project;
- Address the key performance measures and objectives for mine design, environmental management and regulatory, with associated indicators;
- Describe the measures that will be implemented to ensure compliance with the subsidence impact performance measures and investigate, mitigate, manage and remediate potential subsidence impacts and environmental consequences; and
- Detail a monitoring and contingency plan for potential subsidence impacts and environmental consequences outside of predictions, including detailed performance indicators for subsidence impact performance measures.

This *EP Main Report* and the supporting component plans have been developed using a risk-based approach and in accordance with:

- Relevant requirements listed under *Condition 7 in Schedule 3* of SSD_5581, which requires an Extraction Plan to be approved prior to carrying out any second workings).
- *(Draft) Guidelines for the Preparation of Extraction Plans*, NSW Department of Planning and Environment 2015; and
- *Managing Risks of Subsidence Guideline*, NSW Department of Industry, Resources Regulator (NSWRR), 2017; and
- *Consultation with all relevant key stakeholders* (potentially affected by subsidence) and the Independent Expert Panel (IEP) established by NSW Department of Planning, Industry and Environment (DPIE) for the project.

² Further details regarding all requirements addressed by this report are provided in Section 2.1 and

1.3 Extraction Plan Area

Four miniwalls are proposed for extraction in the Point Hatteras area of the Airly mining leases being miniwalls MWs 13, 14, 15 and 16. The miniwall panels are located within the *Panel and Pillar Mining Zone* as detailed within SSD 5581. Centennial Airly has applied a 26.5 degree Angle of draw around all cliffs mapped within the *Cliff Line Zone of First Workings*. No secondary extraction will occur within the 26.5 degree angle of draw of cliffs within the *Cliff Line Zone of First Workings*.

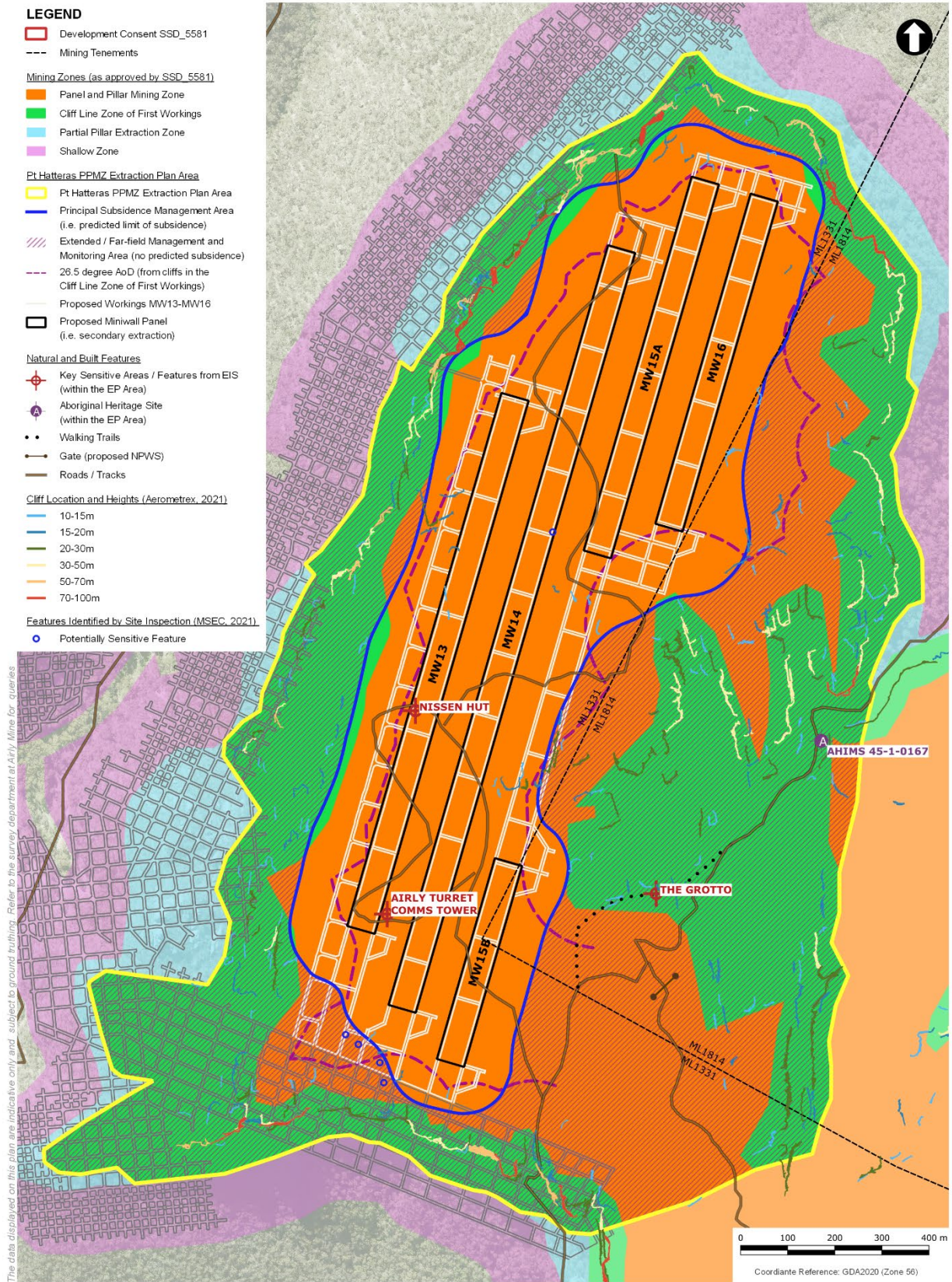
The Extraction Plan Area (EP Area) is comprised of two key components as defined below and illustrated on **Figure 1.2**. The proposed overall EP Area boundary includes an Extended / Far Field Monitoring and Management Area which is beyond the predicted extent of subsidence and involves monitoring and management of sensitive features, primarily the cliffs and pagodas contained within the *Cliff Line Zone of First Workings* surrounding Point Hatteras as a precautionary approach to demonstrate the mining methods.

Table 1.1: Extraction Plan Area

EP Area Components	Defining Comments
Near-Field / Principal Subsidence Management Area <i>(Secondary Extraction Area)</i>	- Approved area of secondary extraction in accordance with the development consent SSD_5581 - The proposed miniwall extraction (second workings) within the Panel and Pillar Mining Zone associated with miniwall panels MW13-MW16 No second workings within 26.5 degree setback from the tops of cliffs located within the <i>Cliff Line Zone of First Workings</i> to all miniwall panels i.e. MW13-MW16 Predicted 20mm limit of vertical subsidence - Located within parts of both Mining Lease ML1331 and ML1814
Extended / Far Field Monitoring and Management Area	Monitoring and management area only for this Extraction Plan, no proposed mining within this Extraction Plan³ - This area lies entirely beyond the 26.5 degree setback from the tops of cliffs located within the <i>Cliff Line Zone of First Workings</i> to all panels MW13-MW16 - Conservatively monitors sensitive features located beyond the <i>Near-field / Principal Subsidence Management Area</i> for potential subsidence effects further afield - Primarily comprises cliffs and pagodas contained within the <i>Cliff Line Zone of First Workings</i> surrounding Point Hatteras

³ Parts of the Extended / Far-field Monitoring and Management Area overlap with areas of first workings (only) under the previously approved Cliff Line Zone of First Workings Extraction Plan (ML1331). Mining in the Extended / Far-field Monitoring and Management Area will be managed in accordance with the previously approved Extraction Plan.

Figure 1.2: Extraction Plan Area



1.4 Relevant Features and Component Plans

The natural and built features relevant to the Pt Hatteras PPMZ Extraction Plan are identified in the checklist provided in *Attachment A – Identification of Natural and Built Features Checklist*.

Table 1.2 provides a summary of the natural and built features within the EP Area along with the related Component Plan that the respective features are managed through. The relevant features within the EP Area are illustrated on **Figure 1.3**.

Table 1.2: Relevant Features within the EP Area and Related Management Plans

Key Features Managed and Monitored	Section	Component Plan
Surface Water (quality, flow and stream stability, erosion & sediment control) Groundwater (including downstream alluvial and facultative ecosystems) Monitoring of aquatic ecology <i>Note: no privately owned bores within (or potentially affected by) the EP Area.</i>	4.1	Airly Mine Water Management Plan (WMP) <i>(whole of site/consent area) – refer Appendix 1</i>
Cliffs, Minor Cliffs and Pagodas Mugii Murum-ban SCA General Surface Area, including steep slopes and rock outcrops The deeply incised canyons/gorge including an area known as the Grotto	4.2	Land Management Plan for MW13-16 (MW13-16 LMP) – refer Appendix 2
Habitat Threatened flora and fauna Endangered Ecological Communities (EEC) Groundwater Dependent Ecosystems (GDE) Aquatic ecosystems	4.3	Biodiversity Management Plan for MW13-16 (MW13-16 BMP) – refer Appendix 3
Aboriginal Heritage Site (AHIMS 45-1-0167)	4.4	Western Region Aboriginal Cultural Heritage Management Plan ⁴ <i>(whole of site/consent area) – refer Appendix 4</i>
Nissen Hut Airly Turret Emergency Communications Tower Survey Marks Tracks and Trails, Fences & Gates Abandoned remnants of historical gold and diamond mining activity Mine owned infrastructure	4.5	Built Features Management Plan for MW13-16 (MW13-16 BFMP) – refer Appendix 5
Public Safety / Safety of ‘others’ associated with <i>potential</i> for subsidence. Publicly accessible sections of the EP Area within Mugii Murum-ban State Conservation Area including tracks and trails and general SCA surface area.	4.6	Public Safety Management Plan for MW13-16 (MW13-16 PSMP) – refer Appendix 6
Details the monitoring program for the EP Area for all Key Features Includes baseline monitoring, as well as during and post mining requirements	4.7	Subsidence Monitoring Program for MW13-16 (MW13-16 SMP) – refer Appendix 7

The scope of management plans for the Extraction Plan was developed in consultation with DPIE.⁵

⁴ A dedicated Heritage Management Plan (Condition 7i (vi)) is not considered relevant to the current Extraction Plan and is not proposed to be submitted, as there are no known Historic or Aboriginal & Cultural Heritage sites located within the Principal Subsidence Management Area of the proposed EP Area (i.e. area of secondary extraction, 20mm subsidence line). Notwithstanding, these aspects will still be diligently managed via the Western Region Aboriginal Cultural Heritage Management Plan and Master TARP to be submitted with the EP Application

⁵ See Attachment D – Stakeholder Consultation

LEGEND

- Development Consent SSD_5581
- Mining Tenements

Pt Hatteras PPMZ Extraction Plan Area

- Pt Hatteras PPMZ Extraction Plan Area
- Principal Subsidence Management Area (i.e. predicted limit of subsidence)
- Extended / Far-field Management and Monitoring Area (no predicted subsidence)
- 26.5 degree AoD (from cliffs in the Cliff Line Zone of First Workings)
- Proposed Workings MW13-MW16
- Proposed Miniwall Panel (i.e. secondary extraction)

Natural and Built Features

- Mugii Murum-ban State Conservation Area
- Key Sensitive Areas / Features from EIS (within the EP Area)
- Aboriginal Heritage Site (within the EP Area)
- Permanent Survey Marks (within the EP Area)
- Groundwater Monitoring Bores (within the EP Area)
- GNSS Monitoring Station / CORS Network
- Walking Trails
- Gate (proposed NPWS)
- Roads / Tracks
- Watercourses (LPI)
- 1st Order Stream Section (within the EP Area)
- 2nd Order Stream Section (within the EP Area)

Cliff Location and Heights (Aerometrex, 2021)

- 10-15m
- 15-20m
- 20-30m
- 30-50m
- 50-70m
- 70-100m

Features Identified by Site Inspection (MSEC, 2021)

- Potentially Sensitive Feature

Map Labels:

- GM01, GM02, GM03, GM04, GM05, GM06, GM07, GM08, GM09, GM10, GM11, GM12, GM13, GM14, GM15, GM16, GM17, GM18, GM19, GM20, GM21, GM22, GM23, GM24, GM25, GM26, GM27, GM28
- ARP07, ARP08, ARP09, ARP12
- MW13, MW14, MW15A, MW16
- NISSEN HUT, THE GROTTO
- AIRLY TURRET COMMS TOWER
- GENOWAN CREEK
- ML1331, ML1814
- PM 109839, PM 109840
- ML1814, ML1931
- 700 TAY
- GENOWAN TRAIL
- 700 TAY
- 700 TAY

Scale: 0 100 200 300 400 m

Coordinate Reference: GDA2020 (Zone 56)

Disclaimer: The data displayed on this plan are indicative only and subject to ground truthing. Refer to the survey department at Arly Mine for queries.

1.5 Land Ownership and Land Use

The EP Area (**Figure 1.2**) is almost wholly located within Mugii Murum-ban SCA, except for a small Lot owned by Lithgow City Council where the Airly Turret Communications Tower is located.

Mugii Murum-ban SCA is 3,650 hectares and is bounded to the south by the Glen Davis Road and Gardens of Stone National Park, and to the north by Capertee National Park. Land to the east and west is largely cleared farming land, with some remnant bushland. Lands not included in the park include Airly Gap Trail and a number of partially cleared private properties along Airly Gap Trail and at the base of the Genowlan mesa (OEH, 2015).

Mugii Murum-ban SCA is dominated by two prominent mesas which are major visual features of the Capertee Valley. The area also contains extensive and intricate pagoda clusters, numerous deep gorges, canyons and unusual rock formations. These features combine to create an extremely scenic landscape and is a focal point of environmental protection that requires low impact, non-intrusive monitoring and management.

Mugii Murum-ban SCA lies within the South Eastern Highlands Bioregion. It is part of a large and relatively contiguous system of protected bushland, stretching from the Hunter Valley in the north to the Wollondilly River in the south, and including nearby Capertee, Gardens of Stone and Wollemi national parks (OEH, 2015). The park contains a great diversity of ecosystems, supporting several threatened plants and animals. In addition, the park contains four relatively pristine sub catchments which are important in maintaining water quality in creek and river systems in the area (OEH, 2015).

The area is of particular significance to the Wiradjuri Aboriginal People and also contains numerous significant historic heritage sites. The park also contains important mineral deposits and is recognised in particular as having economically significant deposits of coal (OEH, 2015).

Prior to gazettal, the area now encompassing Mugii Murum-ban SCA had no formal visitation management and therefore there are minimal visitor facilities. The park is currently used for four-wheel driving, bushwalking, heritage tourism, picnicking, birdwatching, camping and cycling. Information on park visitation is limited, but suggests up to 200 four-wheel drive vehicles may enter the park each year. The main public entry point to the park is via the Airly Gap Trail, a two-wheel drive public road off Glen Davis Road. Public vehicle access is also provided to the park via the four-wheel drive Genowlan Trail (OEH, 2015). The park is considered most suitable for dispersed, self-reliant, nature-based recreation utilising existing visitor nodes and routes.

The sensitive and rugged terrain above the mine is primarily comprised of the *Mugii Murum-ban State Conservation Area* (SCA) managed by NPWS.

The management of Mugii Murum-ban SCA is the responsibility of the National Parks and Wildlife Service (NPWS). NPWS also currently manage portions of Crown Land (excluding Crown Roads and reserves) under licence from the Division of Crown Lands (NSW DTIRIS), which are in the process of formal transition into the SCA.

Land ownership relative to the EP Area is illustrated in **EP A0 Plan 5 - Mining Titles and Land Ownership**.

1.6 Document Structure

The Pt Hatteras Panel & Pillar Mining Zone Extraction Plan (MW13-16) is comprised of three volumes. An overview of the Extraction Plan and its supporting component plans and studies is provided below.

VOLUME 1 Extraction Plan Main Report (this document)

Section 1	Provides an overall context and introduction to the Extraction Plan
Section 2	Includes details on the development of the Extraction Plan, including details of the legal requirements which apply and have been addressed, review of relevant risk assessments and consultation with relevant agencies and other stakeholders within the EP Area
Section 3	Includes an overview of the mine planning and design, overall subsidence predictions related to that mine design, potential impacts from the predicted subsidence, and demonstration of the subsidence predictions meeting the performance objectives
Section 4	Provides an overview and details of subsidence management measures including plans prepared to address impacts to relevant environmental and/or built features. The individual management plans are contained in Appendices to the Extraction Plan
Section 5	Addresses the key elements of how the Extraction Plan is implemented, including trigger action response plans and the adaptive management approach, reporting, review, and key responsibilities
Section 6	Lists the reference documents referred to in this Extraction Plan

Attachments A to H contain additional detail and relevant technical reports to support this Extraction Plan.

Attachment A	Identification of Natural and Built Features Checklist
Attachment B	Subsidence Compliance and Obligations Register
Attachment C	Subsidence and Environmental Risk Assessment
Attachment D	Stakeholder Consultation
Attachment E	Technical Report: Pillar Width Modelling (SCT, 2021)
Attachment F	Technical Report: Subsidence Predictions and Impact Assessment Report (MSEC, 2021)
Attachment G	Technical Report: Baseline Biodiversity Assessment (RPS, 2021)
Attachment H	Technical Report: Baseline Heritage Assessment (RPS, 2021)

VOLUME 2 Graphical Plans

Volume 2 contains graphical plans prepared in accordance with the *(Draft) Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015) and *Managing Risks of Subsidence Guideline* (NSW RR, 2017).

Plan 1	Existing and Future Workings (AM02772)
Plan 2	Surface Features (Natural and Built) (AM02692)
Plan 3	Geological and Seam Data (AM02775)
Plan 4	Existing Workings in Other Seams (AM02776)
Plan 5	Mining Titles and Land Ownership (AM02777)
Plan 6	Geological Sections (AM02778)
Plan 7	Subsidence Monitoring (AM02779)
Plan 8	Extraction Plan Area (AM02780)

VOLUME 3 Component Management Plans (as appendices)

Volume 3 contains the key component management and monitoring plans which have been provided as of Appendices 1 to 8 of the Extraction Plan.

Appendix 1	Airly Mine Water Management Plan
Appendix 2	Land Management Plan for MW13-16 (MW13-16 LMP)
Appendix 3	Biodiversity Management Plan for MW13-16 (MW13-16 BMP)
Appendix 4	Western Region Aboriginal Cultural Heritage Management Plan
Appendix 5	Built Features Management Plan for MW13-16 (MW13-16 BFMP)
Appendix 6	Public Safety Management Plan for MW13-16 (MW13-16 PSMP)
Appendix 7	Subsidence Monitoring Program for MW13-16 (MW13-16 SMP)
Appendix 8	Master Trigger Action Response Plan for MW13-16 (MW13-16 Master TARP)

2 DEVELOPMENT OF THE EXTRACTION PLAN

2.1 Legal and Other Requirements

This Extraction Plan and the supporting management plans have considered all relevant regulatory approvals, leases, licences and guidelines, including the key requirements of Condition 7 in Schedule 3 of SSD_5581, the *(Draft) Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015) and the *Managing Risks of Subsidence Guideline* (NSW RR, 2017).

Airly Mine operates under a number of legislative and regulatory requirements and approvals, the relevant requirements to this Extraction Plan include:

- The conditions of the Development Consent (SSD_5581)
- Mining Leases (i.e. ML 1331 and ML 1814)
- WHS requirements⁶ in relation to subsidence
- Other relevant licences and permits, including conditions attached to the Environment Protection Licence (EPL No. 12374) and EPBC Approval (referral 2013/7076), and
- Other relevant State and Commonwealth environmental, planning, mining, safety, and natural resource legislation and guidelines.

Centennial Airly maintains a register of all legislative and regulatory requirements in a compliance database. Applicable requirements of development consent, EIS/Statement of Commitments, and other related approvals, leases, licences and guidelines are presented in *Attachment B – Relevant Legal and Other Requirements*.

The following sections provide an overview of the key related regulatory conditions to the development of this Extraction Plan and supporting sub-plans under Development Consent SSD_5581 and NSW Work Health and Safety legislation as relevant to Mines and Petroleum sites.

2.1.1 Development Consent (SSD_5581)

The consent provides the conditional planning approval framework for mining activities to be addressed within an Extraction Plan and supporting management plans under Condition 7 in Schedule 3, as detailed in **Table 2.1**⁷.

Table 2.1: Development Consent Extraction Plan Requirements

Clause	Condition Requirement	Section	Detail
Schedule 3, Condition 7 (Extraction Plan)			
7.	Prior to carrying out any first workings within the Cliff Line Zone and Zone of First Workings (refer Figure 2 in Appendix 3), or second workings, the Applicant must prepare an Extraction Plan for the relevant workings to the satisfaction of the Secretary. Each Extraction Plan must:	-	Pt Hatteras Panel & Pillar Mining Zone Extraction Plan (MW13-16) (Volumes 1, 2 and 3)
7.(a)	Be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the secretary	2.4	-

⁶ WHS requirements include the Work Health and Safety Act 2011 (WHS Act), Work Health and Safety Regulation 2017 (WHS Regulation), Work Health and Safety (Mines and Petroleum Sites) Act 2013 (WHSMP Act), and the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (WHSMP Regulation)

⁷ Development Consent condition requirements relevant to Performance Measures (as described in Schedule 3 of SSD_5581) are detailed separately in Section 3.3.

Clause	Condition Requirement	Section	Detail
7.(b)	Provide a detailed justification for any proposed divergence from the advice of the IEP or DRE;	2.3	Attachment D – <i>Stakeholder Consultation</i>
7.(c)	Include detailed plans of existing and proposed first and second workings and overlying surface features, including the identification of appropriate setback distances between cliffs, steep slopes, and pagodas and second workings and any applicable adaptive management measures	This document	Volume 2 - <i>Graphical Plans</i>
7.(d)	Include adequate consideration of mine roof and floor conditions, pillar width to height ratio, final pillar design dimensions and the long-term stability of pillars, following consultation with the IEP;	2.3 and 3	Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)
7.(e)	Give express consideration to the design parameters underpinning the advice in the IPRP's report, and if the proposed mine layout diverges from these parameters, provide a detailed justification for the proposed divergence, following consultation with the IEP;	2.3 and 3	Attachment E – Technical Report: Pillar Width Modelling (SCT, 2021)
7.(f)	Provide an assessment of the likely stability of cliff lines, pagodas, and steep slopes, in consultation with the IEP;	3.2 and 4.2	Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) Appendix 2 - <i>MW13-16 LMP</i>
7.(g)	Provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent, in consultation with the IEP	3.2	Attachment E – Technical Report: Pillar Width Modelling (SCT, 2021) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)
7.(h)	Describe in detail the performance indicators and measures that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and manage or remediate any impacts and/or environmental consequences to meet the rehabilitation objectives in condition 27 of Schedule 4, following consultation with the IEP.	4	Appendix 8 - <i>MW13-16 Master TARP</i> Volume 3 - <i>Component Management Plans</i>
7.(i) 7.(i) (i)	Include a: Subsidence Monitoring Program which has been prepared in consultation with the IEP, Resources Regulator, and BCD to: • Monitor the subsidence effects and subsidence impacts of the development • Develop effective remote monitoring techniques for the development • Monitor pillar loads underground to develop an understanding of the loading conditions on pillars in the vicinity of cliff lines, pagodas, and steep slopes • Provide data to assist with the management of risks associated with subsidence • Validate the subsidence predictions • Analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and ensuing environmental consequences; and • Inform the contingency plan and adaptive management processes.	4.7	Appendix 7 - <i>MW13-16 SMP</i>

Clause	Condition Requirement	Section	Detail
7.(i) (ii)	Built Features Management Plan, which has been developed in consultation with Resources Regulator, to manage the potential subsidence impacts of the proposed underground workings on built features, and which: - Has been prepared in consultation with the owners of potentially affected features; - Addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features; - Recommends appropriate pre-mining mitigation measures to reduce subsidence impacts; and - Recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner.	4.5	Appendix 5 - MW13-16 BFMP
7.(i) (iii)	Water Management Plan which has been developed in consultation with BCD and the Water Division , which provides for the management of potential subsidence impacts and/or environmental consequences of the proposed underground workings on watercourses and aquifers, including: - Detailed baseline data on: - surface water flows and quality in Gap and Genowlan Creeks; - Airly Village Spring and the Grotto; - Groundwater levels, yields and quality in the region. - Surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or quality; - A surface water monitoring program to monitor and report on: - stream flows and quality; - stream and riparian vegetation health; - channel and bank stability - A groundwater monitoring program to monitor and report on: - springs, their discharge quantity and quality, as well as any associated Groundwater Dependent Ecosystems; - groundwater inflows to the underground mine operations; - the height of groundwater depressurisation; - background changes in groundwater yield/quality against mine-induced changes, in particular on groundwater bore users; - permeability, hydraulic gradient, flow direction and connectivity of the deep and shallow groundwater aquifers; - A description of any adaptive management implemented to guide future mining activities in the event of greater than predicted impacts on aquatic habitat; - A program to validate the surface water and groundwater models for the development, and compare the monitoring results with modelled predictions; and - A plan to respond to exceedance of any of the surface and groundwater assessment criteria.	4.1	Appendix 1 - Airly Mine WMP
7.(i) (iv)	Biodiversity Management Plan which has been developed in consultation with DoEE and BCD , which provides for the management of potential impacts and/or environmental consequences of proposed first and second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species populations and their habitats, Endangered Ecological Communities (EEC) and Groundwater Dependent Ecosystems (DGE's), including but not limited to: <i>Pultenaea</i> sp. Genowlan Point - Genowlan Point <i>Allocasuarina nana</i> Heathland <i>Prostanthera stricta</i> (Mount Vincent Mint-bush) and <i>Eucalyptus cannonii</i> (Capertee Stringybark)	4.3	Appendix 3 - MW13-16 BMP

Clause	Condition Requirement	Section	Detail
7.(i) (v)	Land Management Plan which has been prepared in consultation with the IEP, Resources Regulator, BCD and any affected public authorities, to manage the potential Impacts and/or environmental consequences of the proposed underground workings on land In general, with a specific focus on cliffs, pagoda formations, steep slopes and gorges	4.2	Appendix 2 - MW13-16 LMP
7.(i) (vi)	Heritage Management Plan which has been prepared in consultation with Heritage Division and relevant Aboriginal stakeholders, to manage the potential environmental consequences of the proposed workings on Aboriginal and Historic Heritage and includes all requirements under condition 19 of Schedule 4.	4.4	Appendix 4 - Western Region ACHMP
7.(i) (vii)	Public Safety Management Plan which has been prepared in consultation with the IEP, Resources Regulator and BCD to ensure public safety and manage access on the site	4.6	Appendix 6 - MW13-16 PSMP
7.(i) (viii)	include Trigger Action Response Plans, or equivalent, to prevent greater than predicted subsidence impacts and environmental consequences that may result from mine subsidence	5.1	Appendix 8 - MW13-16 Master TARP
7.(i) (ix)	include a contingency plan that expressly proves for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 1 and 2, or where such exceedances appear likely;	5.2	Appendix 8 - MW13-16 Master TARP
7.i) (x)	Proposes appropriate revisions to the Rehabilitation Management Plan required under Condition 27 in Schedule 4;	5.3	Appendix 7 - MW13-16 SMP
7.i) (xi)	include a program to collect sufficient baseline data for future Extraction Plans	4.7	Appendix 7 - MW13-16 SMP
	The Applicant must implement the approved Extraction Plan for the development	5.5.1	-
	<i>Notes:</i> <i>This condition does not apply to first or second workings which are covered by an Extraction Plan or SMP approved, or under assessment, as at the date of this development consent.</i> <i>In accordance with Condition 4 in Schedule 6, the preparation and implementation of Extraction Plans may be staged, with each plan covering a defined area of underground workings. In addition, these plans are only required to contain management plans that are relevant to the specific underground workings that are being carried out.</i> <i>Due to the sensitive and rugged terrain of the Mugii Murum-ban State Conservation Area, the Applicant may propose remote subsidence monitoring techniques.</i>	- 1.3 4.7	- Volume 1 – Extraction Plan Main Report (this document) Appendix 7 - MW13-16 SMP

The development consent also contains conditions to be addressed for the preparation of any management plans which are required under SSD_5581, as such all management plans including this EP Main Report have been prepared in accordance with Condition 2 in Schedule 6, as detailed in **Table 2.2**.

Table 2.2: Development Consent Management Plan Requirements

Clause	Condition Requirement	Section	Detail
Schedule 6			
Condition 2 (Management Plan Requirements)			
2.	The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	-	Volume 1 – <i>Extraction Plan Main Report (this document)</i> , and Volume 3 – <i>Component Management Plans</i>
2.(a)	Detailed baseline data;	4	
2.(b)	A description of: - The relevant statutory requirements (including any relevant approval, licence or lease conditions); - Any relevant limits or performance measures/criteria; - The specific performance indicators or triggers that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures.	2.1 3.3 4	
2.(c)	A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria.	4	
2.(d)	A program to monitor and report on the: - Impacts an environmental performance of the development; - Effectiveness of any management measures (see c) above);	4	
2.(e)	A contingency plan to manage any unpredicted impacts and consequences	5.1	
2.(f)	A program to investigate and implement ways to improve the environmental performance of the development over time	5.4 and 0	
2.(g)	A protocol for managing and reporting any: - Incidents; - Complaints; - Non-compliance with statutory requirements; and - Exceedances of the impact assessment criteria and/or performance criteria; and	5.4	
2.(h)	A protocol for periodic review of the plan.	0	

2.1.2 Work, Health and Safety Laws (subsidence related)

Airly Mine operates in accordance with its Safety Management System which integrates plans, policies and procedures that enables a systematic approach to establishing and maintaining effective systems to manage health and safety consistent with WHS laws and relevant standards.

WHS laws have been considered for the Extraction Plan principally within the context of subsidence related risks to public safety, including to public infrastructure and in reference to *Managing Risks of Subsidence Guideline* (NSW RR, 2017).

An outline of key relevant WHS requirements is provided in the sections below:

Management of Risks to Health and Safety

Under clause 9(1) of the WHSMP Regulation, a PCBU at a mine, including the mine operator, *must manage risks to health and safety associated with mining operations* at the mine in accordance with Part 3.1 of the Work Health and Safety Regulation 2011 (WHS Regulation). Specifically, under clause 67(1) of the WHSMP Regulation, the mine operator of an underground coal mine *must, in complying with clause 9, manage risks to health and safety associated with subsidence⁸ at the mine.*

⁸ The WHSMP Regulation defines subsidence as meaning “the deformation or displacement of any part of the ground surface or subsurface strata caused by the extraction of minerals”. Such deformation or displacement has potential to cause hazardous conditions, which must be controlled to ensure, so far as is reasonably practicable, that the health and safety of workers and other persons is not put at risk from subsidence.

Clause 67(2) sets out specific requirements in relation to subsidence as:

“..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 manner and 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.*

These requirements have been considered and are addressed throughout the Pt Hatteras Panel & Pillar Mining Zone Extraction Plan for MW13-16 (Volumes 1, 2 and 3).

Potential Risks to the Safety of Others

Section 19 of the Work Health and Safety Act 2011 (WHS Act) requires that all persons conducting a business or undertaking (PCBUs), including mine operators under the Work Health and Safety (Mines and Petroleum Sites) Act 2013, *must ensure, so far as is reasonably practicable,..... that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.*

In particular, the following is noted for public safety and

Public Safety: Feedback from detailed stakeholder consultation since the MEP EIS (pre 2014) and the dedicated *Subsidence and Environmental Risk Assessment* undertaken for the Pt Hatteras PPMZ EP, provide key supporting information in the management of public safety which informed development the MW13-16 PSMP. Appropriate monitoring to support the MW13-16 PSMP and the MW13-16 Master TARP for the identified potential risks has been considered during development of the MW13-16 SMP.

Centennial Personnel and Contractor Safety: The safety of Centennial personnel and contractors engaged by the mine working in the EP Area are managed under the Airly Mine Safety Management System. This includes (but is not limited to) detailed safety communication, training and induction processes for all personnel and contractors, a dedicated *Contractor Management Plan* and supporting *Contractor Work Authorisation Permit* process.

High Risk Activity

The proposed workings are defined as a High Risk Activity in relation to subsidence in Schedule 3 of the WHSMP Regulation. As such, Airly Mine must give notice of a High Risk Activity to the regulator and ensure that the requirements of Clause 33 and Schedule 3 of the WHSMP Regulation are complied with. Airly Mine is preparing a High Risk Activity Notification for the EP Area for submission to the NSW Resource Regulator (Mines Safety) concurrently with the Extraction Plan.

Key documents from this Extraction Plan, including the MW13-16 PSMP, MW13-16 SMP and MW13-16 Master TARP and supporting specialist subsidence reports, will also be included as part of a High Risk Activity notification submitted to the NSW Resource Regulator for the EP Area.

Subsidence as a Principal Hazard

Under Clause 24 of the WHSMP Regulation, the mine operator must prepare a Principal Hazard Management Plan (PHMP) for each principal hazard associated with mining operations at the mine in accordance with clause 24 and Schedule 1.

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

“..a principal hazard is any activity, process, procedure, plant, structure, substance, situation or other circumstance relating to the carrying out of:

- a) Mining operations that have a reasonable potential to result in multiple deaths in a single incident or a series of recurring incidents in relation to any of the following:*

..... (vi) subsidence,.... “

The primary design criteria used by Centennial Airly to achieve the performance outcomes, from a surface subsidence perspective, are limiting long-term subsidence nominally to not more than 125mm with minimal associated tilts and strains. The mine design factors are discussed in **Section 3.1** and assessed in the specialist *Airly Mine MW13 to MW16 – Subsidence Predictions and Impact Assessments for the Natural and Built Features over and near the Proposed MWs 13 to 16 in Support of the Extraction Plan Application MSEC1195* (MSEC, 2021). The report also specifically considered key factors noted in the *Managing Risks of Subsidence Guideline* (NSW RR, 2017) including factors for potential greater than predicted subsidence movements.

Given these design factors and detailed investigations assessing relevant risks, it is considered that there is no reasonable potential to cause multiple deaths from such a system. Accordingly, panel and pillar mining within the EP Area is not considered a principal hazard under the above WHS legislation and guidelines (including Clause 24(3)). Notwithstanding, the Public Safety Management Plan for MW13-16 has been prepared generally in accordance with the relevant WHS requirements and guidelines, and is intended to manage potential risks from subsidence, particularly in the context of protection of the “safety of others” (public safety).

Managing Risks of Subsidence Guideline

This Extraction Plan has been prepared in accordance with the *Managing Risks of Subsidence Guideline* (NSW RR, 2017) which provides practical guidance to assist the mine operator of an underground coal mine in:

- Complying with their obligations under the; and
- Identifying and controlling hazards that may cause harm to people from subsidence through the development and implementation of a principal hazard management plan (PHMP) or risk management in accordance with a High Risk Activity (HRA) notification.

Attachment B – Relevant Legal and Other Requirements lists key recommended factors to be considered in the management of subsidence risks to ‘other persons’ (including for Principal Hazard Management Plans) in accordance with the new guidelines. This includes HRA components of the guidelines considered for the MW13-16 PSMP. These have been specifically included in *Subsidence and Environmental Risk Assessment* undertaken for the Extraction Plan⁹, supported by specific technical assessments of these aspects in supporting specialist reports such as those in *Attachment F – Technical Report: Subsidence Assessment* (MSEC, 2021).

⁹ See Section 2.2 Risk Assessment and Attachment C – Subsidence and Environmental Risk Assessment

2.2 Risk Assessment

Centennial Airly has undertaken a dedicated ***Subsidence and Environmental Risk Assessment*** (*Stature RA Number: 1001295012*¹⁰) directly in support of this Extraction Plan which provide a risk framework basis for development of the component management plans.

The *Pt Hatteras Panel and Pillar Extraction Plan MW13-MW16* risk assessment was completed on the 4 August 2021 with key staff from the Airly Mine including the Technical Services Manager, Statutory Mine Surveyor, Mining Engineer / Compliance Manager and Environment and Community Officer, as well as the General Manager of Technical Services for Centennial and the Lead Consultant for the EP Project Team from Catalyst Environmental Management. The Pt Hatteras Panel and Pillar Extraction Plan MW13-MW16 risk assessment was facilitated by the Mining Engineer / Compliance Manager and has been reviewed by key EP Project Team members for Heritage, Ecology and Subsidence.

The risk assessment included consideration of current revised subsidence predictions for the highly conservative mine plan prepared for the Extraction Plan (refer **Section 3.1**), and feedback from consultation with the IEP, DPIE and the NSW Resources Regulator.

Risks were identified and assessed through the review of known surface and sub-surface features within the EP Area. The risk assessment also specifically assessed key heads of consideration required by the Managing Risks of Subsidence Guideline (NSW RR, 2017).

A risk ranking (low, moderate, significant, high or extreme) was assigned to each risk/hazard in consideration of the Maximum Reasonable Consequence (MRC) for the given controls. There were 57 potential risks scenarios assessed during the Risk Assessment; one ranked as high, 10 moderate, 43 low and three were assessed as not applicable.

A copy of the risk assessment is included in *Attachment C – Subsidence and Environmental Risk Assessment*. Additional details regarding the management and monitoring of subsidence related impacts to land within the EP Area have been detailed in **Section 4**.

¹⁰ Centennial Airly has adopted the Stature Risk Assessment Program which was developed to ensure consistency in all risk assessments across the Centennial 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.

2.3 Stakeholder Identification and Engagement

2.3.1 Identification of Key Stakeholders

During development of this Extraction Plan and its component plans, substantial consultation has been undertaken with key stakeholders. Stakeholder analysis undertaken during preparation of this Extraction Plan included:

- Risk-based consideration of key environmental and built features within the proposed EP Area;
- Stakeholders prescribed for consultation for this Extraction Plan within the Development Consent;
- Stakeholders identified within previous Environmental Assessments;
- Existing and known stakeholders to Airly Mine, including the Community Consultative Committee; and
- Identified landowners/users relevant to the EP Area.

Key Stakeholders identified for consultation are outlined in **Table 2.3**.

Table 2.3: Key Stakeholders

Group	Stakeholder
NSW Government Agency	• Department of Planning, Industry and Environment (DPIE) • Independent Expert Panel (IEP) as required by SSD_5581 • National Parks and Wildlife Services (NPWS) • NSW Resource Regulator • Environmental Protection Authority (EPA) • Water NSW
Local Government Authority	• Lithgow City Council
Airly Turret Emergency Communications Tower Users	• NSW Rural Fire Service (RFS) • NSW Telco Authority (TA) • Catalyst ONE (Consultants engaged by TA) • NSW Police Force (NSWPF) • NPWS • Water NSW
Community	• Airly Mine Consultative Committee (CCC) • Occupants / Users of Nissen Hut (<i>under Permissive Occupancy</i>)

It is noted that following review of updated/current land ownership for the EP Area (including SCA / crown lands under lease), the following additional stakeholders were confirmed not applicable to the current EP Area:

- *NSW Department of Industry – Division of Lands and Forestry ('Crown Lands') – no crown lands within EP Area (now gazetted into the SCA where applicable);*
- *Telstra (Network Integrity Services) - (buried cable is outside the EP Area)*
- *Private land owners (none within EP Area)*

2.3.2 Consultation Required by Consent Conditions

Condition 7 in Schedule 3 of SSD_5581 requires the preparation of this Extraction Plan in consultation with key relevant stakeholders as detailed in **Table 2.4**.

Table 2.4: Development Consent Required Consultation

Condition	Consultation Requirement
7.(i) (i)	Subsidence Monitoring Program which has been prepared in consultation with the IEP, DRE, and BCD
7.(i) (ii)	Built Features Management Plan , which has been developed in consultation with Resources Regulator.
7.(i) (iii)	Water Management Plan which has been developed in consultation with BCD and the Water Division
7.(i) (iv)	Biodiversity Management Plan which has been developed in consultation with DoEE and BCD
7.(i) (v)	Land Management Plan which has been prepared in consultation with the IEP, Resources Regulator, BCD and any affected public authorities
7.(i) (vi)	Heritage Management Plan which has been prepared in consultation with Heritage Division and relevant Aboriginal stakeholders
7.(i) (vii)	Public Safety Management Plan which has been prepared in consultation with the IEP, Resources Regulator and BCD

Copies of management plans (component plans) have been provided for consultation with the various stakeholders in accordance with SSD_5581 and identified during the preparation of this Extraction Plan. Any further stakeholder feedback will be reviewed and addressed as necessary.

2.3.3 Consultation Required by Mining Lease and Work, Health and Safety Legislation

A summary of consultation requirements required under both the mining leases and Work, Health and Safety Legislation is included in the various Key Component Plans to outline how each matter has been addressed.

2.3.4 Results and Outcomes of Consultation

The outcomes of consultation undertaken for the project is provided in Attachment D – Stakeholder Consultation, including copies of relevant correspondence such as project presentations delivered by the mine to key stakeholders and relevant formal correspondence received from key stakeholders.

Stakeholder feedback provided has been reviewed and addressed as necessary as part of the development and review of this Extraction Plan and key component plans.

2.4 EP Project Team Endorsement

This Extraction Plan has been prepared by Centennial Airly with assistance from the following team outlined in **Table 2.5**. The appointment of the suitably qualified and experienced persons was endorsed by the Secretary of the DPIE (see *Attachment D – Stakeholder Consultation*).

Table 2.5: Extraction Plan Project Team

Name	Position	Company	Role
Anthony Reid & Craig Bagnall	Lead Consultant and Project Management	Catalyst Environmental Management	Assist preparation of Extraction Plan Main Report and key component management plans (incl. Subsidence Monitoring Program, Public Safety Management Plan, Built Features Management Plan, Land Management Plan, AO Plans, EP Risk Assessment). Assist specialist report scoping and review of supporting documents and component management plans.
Yvette Heritage	Director, Principal Geotechnical Engineer	SCT Operations	Mine Design, Subsidence Predictions
Don Kay	Managing Director	MSEC	Subsidence Impact Assessment, Cliff Stability Assessment
Ian Gilmore, Dr Stuart Gray	Hydrogeologist. Technical Director - Hydrogeology	GHD	Water Management Plan
Benjamin Slack	Senior Heritage Consultant	RPS	Specialist heritage consultant responsible for baseline assessment of heritage, assessment of heritage risks (in the project risk assessment) and recommendations of appropriate management of heritage risks in the EP Area.
Mark Aitkens, Hayden Beck & Tara Boreham	Principal Ecologist, Senior Ecologist and Ecologist	RPS	Specialist ecology/biodiversity consultants responsible for baseline assessment of Biodiversity, assessment of biodiversity risks (in the project risk assessment) and the Biodiversity Management Plan.
Michael Nicholson		Michael Nicholson Consulting	Subsidence Monitoring Expert consultant assisting components of the Subsidence Monitoring program, including supply and installation of the GPS/GNSS continuous subsidence monitoring system.
David Byrne		Aerometrex	Consultant surveyors assisting components of the Subsidence Monitoring Program including cliff and pagoda monitoring via 3D photogrammetry (stereo vertical and oblique).
Phil Fletcher	Technical Services Manager (Airly Mine)	Centennial Airly	Centennial Project Manager for the Extraction Plan. Mine engineering, planning and design, scoping of subsidence and cliff stability assessments, and subsidence monitoring. Assist preparation of Subsidence Monitoring Program, Extraction Plan, Public Safety Management Plan, Land Management Plan, EP Risk Assessment.
Peter Corbett	General Manager Technical Services	Centennial Airly	Technical review of mine engineering, planning and design, scoping of subsidence and cliff stability assessments, and subsidence monitoring.
James Wearne	Group Manager Approvals	Centennial Airly	Project direction, QA review of Extraction Plan and EP Risk Assessment.
Brett Haddon	Mine Surveyor (Airly Mine)	Centennial Airly	QA review of Extraction Plan Main Report and key component management plans and implementation role

3 SUBSIDENCE ASSESSMENT

3.1 Mine Planning and Design

3.1.1 Geology and Stratigraphy

Roof, floor and coal seam strata conditions plan an important role in the selection of appropriate mining systems in an underground mine. Strata competency is determined by the strength properties of the rock masses, the type and amount of geological structure (such as faults, jointing and seam undulations) and the stress environment of the strata (Golder Associates, 2014).

The underground mining environment at Airly Mine is detailed in the Geotechnical Reference Report (Golder Associates 2018). Aspects relevant to Panel and Pillar mining have been reproduced and summarised in various subsidence specialist reports, most recently in the specialist subsidence reports supporting this Extraction Plan prepared by SCT (2021) and MSEC (2021). An overview of these conditions is provided below.¹¹

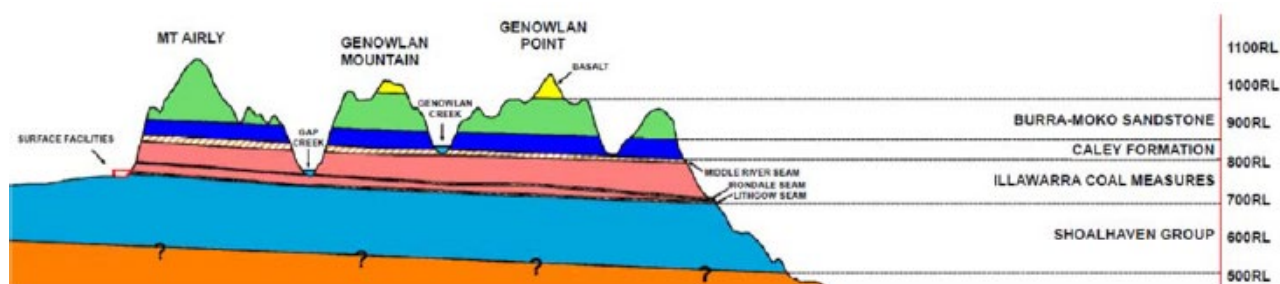
Overview of Geologic Sequence and Coal Resources

Airly mine is located on the western margin of the Sydney Basin and (as noted earlier) covers the Mount Airly / Genowlan Mountain plateau. Triassic Narrabeen Group strata cover most of the upper half of the plateau and form rugged escarpments. Small, isolated outliers of Tertiary basalt cap the highest points of the plateau. Much of the plateau surface and the massive vertical cliffs in the area are formed in the Narrabeen Group (notably the Burra-Moko Head Sandstone). The weather of these lower strength beds causes undermining of the Grose Sandstone and the formation of the cliffs (Golder Associates, 2014a).

The underlying Permian Illawarra Coal Measures outcrop around the perimeter of the topographically elevated plateau, and in the north-south trending 'Airly Gap' which separates Mount Airly in the west from Genowlan Mountain in the east.

An overview of the typical stratigraphy within the western coalfields and at Airly Mine is shown in **Figure 3.1** and **Table 3.1**. The target coal seams are above surrounding ground level.

Figure 3.1 Cross-section of the Mt Airly and Genowlan mesas showing typical stratigraphy



(source: Golder Associates, 2014a)

¹¹ See Attachment E – Technical Report: Pillar Width Modelling (SCT, 2021) and Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) for more detailed information.

Table 3.1: Generalised stratigraphic column for the western coalfield

Period	Group	Sub-group	Formation
Tertiary			Flood basalt
Triassic	Narrabeen	Grose	Burra-Moko Head Sandstone
			Caley Formation
Permian	Late	Wallerawang	Middle River Seam
		Charbon	Moolarben Seam
			Baal Bone Formation
			Upper Irondale Seam
			Irondale Seam
			Long Swamp Formation
		Cullen Bullen	Lidsdale Seam
			Lithgow Seam
			Marangaroo Conglomerate
		Nile	Gundangaroo Formation
			Coorongoba Creek Sandstone
			Mount Marsden Claystone
	Early	Shoalhaven	Berry Siltstone
			Snapper Point Formation
Lower Devonian			Shales, tuffs and limestones

(source: Golder Associates, 2014a)

Coal Seams

The Illawarra Coal Measures contain the coals seams located in the Airly lease. The coal measures consist of a weak interbedded sandstone, siltstone, mudstone, tuff, claystone and coal sequence. Above the coal measures is a sandstone unit to the surface (SCT, 2021a).

Of the available coal seams, the only coal seam deemed to be of any significant economic importance for current mining operations is a lower section of the coalesced Lithgow/Lidsdale Seam. In the Airly Mine the combined Lithgow and Lidsdale seam is 4.8 to 5.9 metres (m) thick, averaging 5.4m and thinning to the south-east.

All the existing and proposed workings at Airly Mine are in the Lithgow Seam. The Lithgow Seam (plies LT1 to LT3) constitutes the base of the combined seam and averages 3.4 m in thickness (Golder Associates, 2018).

The normal mining height at Airly is 2.8m from the Lithgow Seam floor, although the drivage height in the Panel and Pillar Zone increased to 3m with the introduction of the Joy 12CM30 continuous miner. Extraction on the miniwall will remain at 2.8m.

The planned development and extraction height places the roof horizon approximately midway between the LW1 claystone and the lower LW2 claystone band, the latter being ~0.1m thick. This results in a roof bolt horizon typically comprised of 0.3m to 0.4m of LT3 top coal, overlain by 0.4m of LW1 claystone and the Lidsdale Seam with its dirt bands (Golder Associates, 2018).

Roof & Overburden

The Lidsdale Seam is typically capped by a carbonaceous mudstone band ~0.6m thick and silty in parts with a Uniaxial Compressive Strength (UCS) of 20 to 30MPa. The first 10m of overlying roof is comprised typically of interbedded siltstones and sandstones, with occasional thin mudstone and coal bands. Rock strength tends to improve with height into the roof; UCS values of ~30MPa are typical to a height of ~3m above the seam with some weaker strata interbedded, then strength increases to 40MPa at heights between ~3m to 10m (Golder Associates, 2018).

The remainder of the Permian overburden, which varies in thickness from 60m to 140m (averaging 100m), is composed of interbedded mudstone, siltstone and sandstone units with thin coal seams. Material strengths are typically of the order of 30 to 40 MPa (Golder Associates, 2018).

The Triassic capping overburden is up to 200 m thick and is dominated by thickly bedded to massive sandstones varying from fine grained to conglomeratic, with occasional thin claystone and mudstone beds and lenses. The sandstone UCS is typically around 30MPa, with pronounced weaker and stronger bands. Generally, the fine-grained units are better cemented and therefore stronger than the coarse-grained sandstone conglomerate units.

Despite the substantial investigations during preparation of the EIS (2014) through to the original Mt Airly PPMZ Extraction Plan (2019), geotechnical characterisation of the deposit had not identified roof or floor materials that would be considered unusually weak and that might otherwise necessitate the adoption of alternative / more conservative pillar design criteria. However, extraction of the first four panels on Mt Airly provided significant insight into the importance of roof strata especially above the pillars.¹²

Floor and Underlying Strata

The floor of the Lithgow Seam is the “Marangaroo Conglomerate”, which is typically comprised of siltstone grading downward into sandstone. The immediate 1m to 2m of floor is predominantly a silty sandstone with a UCS of 20 to 50MPa. The floor has very little sensitivity to moisture. This stronger immediate floor is underlain by weaker, medium to coarse grained sandstone beds of the Marangaroo Conglomerate with UCS values of typically 10 to 30MPa (Golder Associates, 2018).

Appreciable floor heave has been experienced at deeper Lithgow Seam mines. Due to the depths at Airly Mine, less than 310m, no significant issues are expected regarding the floor bearing capacity (Golder Associates, 2018). Experience to date with miniwall at depths of up to 280m has not shown any evidence of floor heave in either maingate or tailgate roadways. No significant issues are expected regarding the floor bearing capacity for the proposed workings of the EP Area.

Geological Structures

The location of all known geological structures (primarily faulting) is illustrated on **EP A0 Plan 3 - Geological and Seam Data**.

The geological structures at the Airly Mine has been studied intensively over the last decade from the perspectives of highwall stability assessments, support design, cliff stability assessment and mining layout design. Sources of structural data include:

- Surface and underground mapping,
- LiDAR survey results,
- Aerial / satellite photography,
- Exploration borehole logging, including acoustic scanner logs,
- Underground borescope logging and
- Aeromagnetic survey interpretation (SRK, 2012 and 2017).

Detailed review of all available information from the above studies to date in relation to geological structures was considered in the specialist report by Strata² (2020) The following comments are made regarding geological structure.

- Seam dip is very gradual, averaging around 1° to the ENE.

¹² See Section 3.2 Subsidence Predictions for further discussion on the impact of roof strength on mine design

- The primary joint strike direction is between N-S and NNW-SSE.
- The secondary joint strike direction is approximately NE-SW.
- These joint directions are consistent with acoustic scanner results.
- There are also signs from aerial photography of lineaments striking between E-W and WNW-ESE.
- Multiple cleat directions are evident. The main (approximately conjugate) cleat pair strikes at 058° (NE/ENE) and 161° (SSE). A secondary cleat pair strikes at 015° (NNE) and 112° (ESE).
- The main joint and cleat sets are typically sub-vertical (i.e. dip at 80 to 90°).
- Normal faults strike N/NE and have typical dip angles of 30° to 40°. Dip is almost entirely to the ESE.
- Occasionally, normal faults striking NNW-SSE have also been encountered. Fault throws are typically <1m, often with evidence of strike-slip movement.
- Having reviewed the acoustic scanner logs and compared surface exposures to underground mapping, it appears that dip angle increases above the seam (i.e. there is no evidence of low to mid-angle normal faults in the overburden).
- A series of low angle (10-30° dip) reverse / thrust faults were encountered in Airly Gap, striking N /NNE and with downthrows to the east and west. The faults typically have throws of <1.5m and are anomalous for the mine as a whole, with no known incidences to the west. Most importantly, based on surface exposures and a review of the acoustic scanner results, there is no evidence of such structures within the Panel and Pillar Mining Zone. None have been found to date and there is no influence from the Airly Gap Lineament Zone in the modification area.

The potential impact of major geological structures on the subsidence estimates and stability of chain pillars in the panel and pillar mining zone has also been addressed in the subsidence specialist report for the Extraction Plan by MSEC (2021).¹³

Depth of Cover and Considerations

The depth of cover (DOC) at Airly Mine (including beyond the EP Area) ranges from 20m at the sub-crop to a maximum of 310m under Genowlan Mountain. Panel and pillar mining via miniwall is proposed from a minimum DOC of 160m. This minimum depth of cover for mining is to prevent excessive sag subsidence from developing due to the reduction in spanning capacity of the thinner sandstone layer as depth decreases. The depth of cover over the proposed miniwalls MW13-16 ranges from approximately 200m to a maximum of 310m.

At depths of less than 300m a major horizontal stress magnitude of less than 15MPa could be expected which is a moderate level in the Australian mining context (Golder Associates, 2014). In the Panel and Pillar Mining Zone beneath Mt Airly, horizontal stress relief has been suggested by the IEP to be a factor in horizontal movements of the overburden toward the goaf (but not in vertical subsidence which is driven by strata compression around the pillars).

Given the isolated mesa topography and the associated potential for horizontal stress relief, as well as the available borehole breakout data (Golder Associates, 2018), it is considered that the magnitude of the major horizontal stress is likely to-be <7MPa. This is reflected in underground mining conditions experienced to date (no significant roof buckling/guttering or floor heave), indicating a low horizontal stress environment. These moderate levels of horizontal stress at Airly Mine facilitate safe mining methods which rely on long term pillar stability, avoiding surface impacts.

¹³ See Section 3.2 Subsidence Predictions for further discussion on

3.1.2 Proposed Mining Geometry and Parameters

The mine design has been specifically developed in response to the sensitive surface environment to avoid significant impact. As a result, Airly Mine operates in specific mining zones using low-impact underground mining methods that limit void widths and leaves sufficiently large pillars to support the overburden and prevent subsidence impacts.

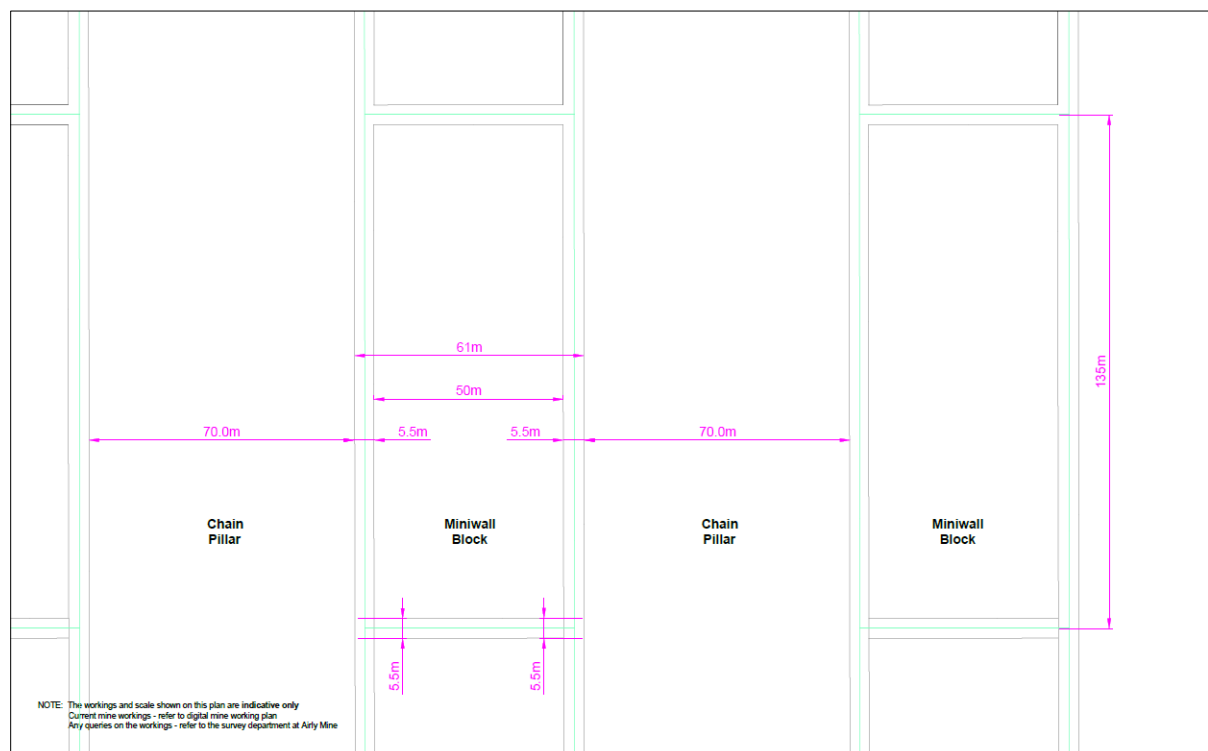
The mechanism for increased subsidence in the Panel and Pillar Mining Zone beneath Mt Airly was previously investigated by SCT (2021a) using a numerical rock failure modelling approach simulating miniwall caving and subsidence. The subsidence mechanism was found to be rock failure and softening of the strata above the narrow pillars, compressing under the abutment load. This earlier work provided an understanding of the mechanisms for subsidence, a method to control subsidence (pillar size and extraction height) and a calibrated model for predictive purposes (within assumptions and limitations) (SCT, 2021b).

Miniwall panels 13 to 16 are consistent with the modelled design by SCT (2021b) and have been designed based on the following:

- Each panel will have panel void widths of 61m
- The minimum chain pillar widths between the panels will be 70m (for the 4 adjacent panels only)
- The cover depths over the miniwalls range from approximately 200m to 310m
- The average cover depth is approximately 280m
- The Lithgow seam thickness ranges from 3.5 m to 3.8 m
- The extraction height will be 2.8m
- The first workings roadways will be nominally 5.4m wide and 3.0m high
- The pillar sizes have a width to height ratio (W/H) of approximately 25

Figure 1.3 illustrates the proposed panels in the landscape. The typical layout for the EP Area is shown on **Figure 3.2**.

Figure 3.2: Typical Panel and Pillar Layout for the EP Area



(source: supplied by Centennial Airly)

3.1.3 Mining Method and Sequence

The proposed workings within the EP Area will be developed using panel and pillar (miniwall) mining methods employing continuous miners to develop narrow width panels, supported by interpanel pillars of sufficient size to be long term stable after extraction is complete.

Extraction is done using longwall type cutting equipment but with a very small number of shields due to the very narrow nature of the extraction block. The intent of the system design to provide support the surface that results in minimal subsidence movement, whilst providing a safe and productive mining system.

The retreat of miniwall extraction is from the north to south beneath the surface features. The sequence of miniwall extraction will begin moving from west to east with MW13 being mined first and progressing to MW14. Airly Mine then proposes to extract MW16 in the far east of the EP Area, prior to coming back to the west to extract MW15. This extraction sequence will allow subsidence and geology data collected from mining of MW13 and MW14, as well as development of MW15 to be fully assessed and provide additional confidence that subsidence predictions can be met prior to extracting MW15.

It is also noted that MW15 will be mined in two blocks, MW15A to the north and MW15B to the south. This “step-around” will ensure that no second workings are undertaken within 26.5 degree angle of draw of cliffs in the Cliff Line Zone of First Workings.

3.1.4 Mine Schedule and Resource Recovery

Miniwall mining within the EP Area will commence following the completion of mining in the Mt Airly PPMZ EP Area, which is expected to be completed in November 2021.

The EP Area includes four miniwall panels which are currently scheduled to be extracted in less than 15 months. Secondary extraction is currently scheduled to commence in MW13 in December 2021 and complete MW15B in February 2023. The proposed panels comprising the EP Area will be developed and extracted according to the schedule in **Table 3.2**¹⁴.

Overall expected resource recovery from the EP Area (including development and secondary extraction) is **1,468,209 tonnes**. The tonnages listed have been based on a design working height of 2.8m during miniwall extraction. The specific gravity of the coal (relative coal density) is 1.48. All recovery percentages are approximate only and may vary depending on final panel layout and geological restrictions.

Panels proposed to mined within the EP Area are illustrated on **EP A0 Plan 1 - Existing and Future Workings**.

¹⁴ The target start and finish dates are provided as an indication only, are pending approval and subject to change based on potential future operational requirements

Table 3.2: Indicative Mining Schedule proposed for Miniwall Panels MW13-MW16

Miniwall	Mine Plan	Stage	Recovery (tonnes)	Target Start (month)	Target Finish (month)
MW13	TG213	Development	24,620	16/03/21	7/09/21
	IR213	Development	3,610	20/09/21	19/11/21
	MG213	Development	53,361	20/09/21	19/11/21
	MW213 Extraction	Secondary Extraction	248,623	24/01/22	25/03/22
MW14	IR214	Development	3,640	29/11/21	10/06/22
	MG214	Development	121,584	29/11/21	10/06/22
	MW214 Extraction	Secondary Extraction	344,058	04/07/22	16/09/22
MW15	IR215	Development	3,603	28/02/22	30/09/22
	MG215	Development	133,789	28/02/22	30/09/22
	MW215A Extraction	Secondary Extraction	175,306	05/12/22	27/01/23
	MW215B Extraction	Secondary Extraction	93,834	13/02/23	07/03/23
MW16	IR216	Development	3,608	27/06/22	16/09/22
	MG216	Development	55,449	27/06/22	16/09/22
	MW216 Extraction	Secondary Extraction	151,430	10/10/22	11/11/22
Total Expected Recovery in EP Area (MW13-MW16)		Development	466,810		
		Secondary Extraction	1,001,399		
		Total	1,468,209		
Total Available Resource in EP Area (MW13-MW16)		Total	14,270,000		

3.2 Subsidence Predictions

3.2.1 Review of Subsidence Predictions

The Airly Mine EIS in 2014, presented an approach to mining throughout the lease which employed different mining methods in different areas, each targeted to suit each specific area, referred to as 'mining zones'. A key objective of the approach was to minimise risk of surface impacts by limiting subsidence through appropriate mine design. Sensitive high cliffs and escarpments located on the external parts of the Mount Airly, and Genowlan Mountain mesas were protected by a Cliff Line Zone (CLZ) of First Workings (i.e. no secondary extraction).

The Panel and Pillar Mining Zone (PPMZ), located in the centres of the mesas, were designed with miniwall extraction of narrow panels (around four times narrower than conventional longwalls) and large chain pillars that were designed to limit subsidence. The 2014 EIS report, which was prepared by Golder Associates, predicted the maximum subsidence over the PPMZ areas of the mine, after the extraction of 61 m wide miniwall panel widths and 29.5 m chain pillars, would be less than 125 mm, tilts would be less than 2.5 mm/m and strains would be less than 2 mm/m. It was assessed that, at these low subsidence values, no surface cracking, rock falls or cliff impacts were expected (MSEC, 2021).

An updated subsidence prediction report was provided by Strata² (March 2019) for the introduction of miniwall mining on the Airly leases (within the Mt Airly PPMZ Extraction Plan), which advised that the maximum short-term subsidence over the whole Airly mine was likely to be 70 mm and the long-term maximum subsidence was predicted to be 110 mm. This Strata² report confirmed the 2014 EIS advice that, at these low subsidence values, no surface cracking, rock falls or cliff impacts were expected (MSEC, 2021).

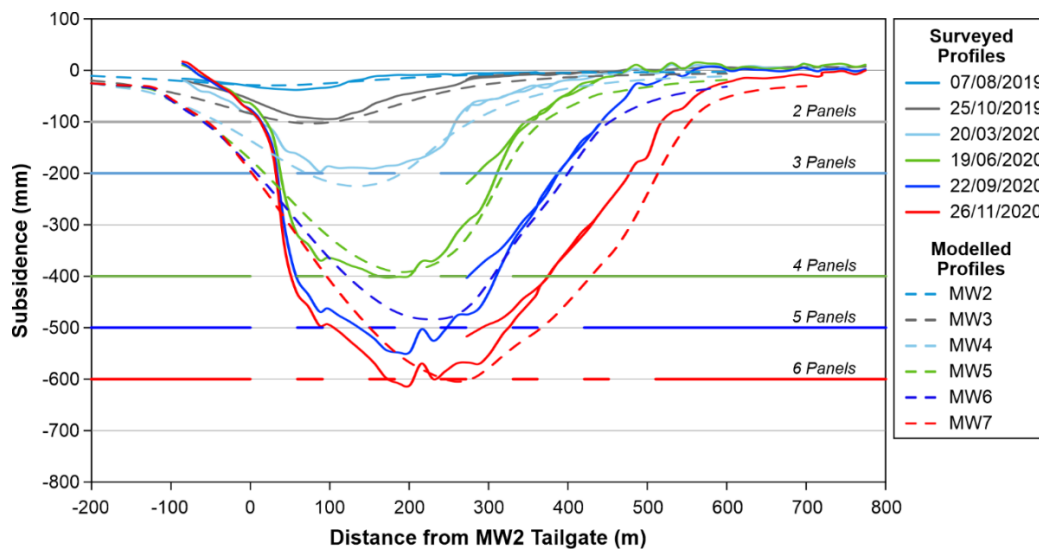
Whilst the mine design built on successful experience in other locations, especially Clarence Colliery, the miniwall mine design was considered unique in a mesa environment and high confidence/accuracy subsidence monitoring was undertaken over the initial panel and pillar mining areas (MSEC, 2021).

Nine (9) miniwall panels have been extracted under Mt Airly to date without significant impact to sensitive surface features such as cliffs and pagodas, including those directly above secondary extraction. However, observed subsidence on Mt Airly surpassed the predicted maximum subsidence of 125 mm and some associated surface cracks were identified. Accordingly, in consultation with regulators and the IEP, Airly Mine have undertaken extensive modelling and mine design revisions aimed to reduce subsidence levels to be consistent with EIS predictions (i.e., maximum vertical subsidence <125mm), including:

- Subsidence numerical modelling (UDEC) calibrated against observed subsidence to date (MSEC, 2020a)
- Review of geotechnical issues related to the update of the Extraction Plan for Mini Walls 7 to 9 (Strata², 2020)
- IEP technical review of subsidence analysis (e.g., horizontal movements) and preliminary recommendations (adopted by Airly)
- Updated UDEC numerical modelling to include faulting and revised subsidence predictions and cliff stability assessment for MW8-9 modification (MSEC & UNSW, 2020b)
- Modelling Investigation of Subsidence Mechanism (FLAC numerical modelling) and Pillar Size Assessment (to limit the vertical subsidence above MW11-12, in the Mt Airly PPMZ EP Area, to 125mm) (SCT, 2021a), and
- Updated FLAC numerical modelling and revised subsidence predictions for the Point Hatteras region of Genowlan Mountain (i.e., MW13-16) (SCT, 2021b).

SCT (2021a) investigated the mechanism producing subsidence from miniwall mining in the Mt Airly PPMZ EP Area. After calibrating against the Mount Airly observed subsidence ground movements, SCT were able to simulate the caving and subsidence observed over Mt Airly using a numerical modelling approach in FLAC 2D for Centennial Airly to match the available strata responses that were observed over MWs 2 to 9 (SCT, 2021a), as shown in **Figure 3.3**.

Figure 3.3: Surveyed and Modelled Subsidence Comparison (for previous Mt Airly EP Area)



(source: SCT, 2021b)

The modelling assessment also assessed the effect of pillar width on subsidence, effect of depth and stress on subsidence and recommendations for pillar size for MW10-12. The SCT (2021a) modelling indicated that the mechanism for increased subsidence at Airly Mine is the fracturing and compression of strata above the chain pillars. This fracturing of strata is primarily a function of weak strata, abutment load, reduced confinement due to the adjacent goaf voids and pillar width. Fracturing of the strata reduces the stiffness of the strata and results in increased compression from the abutment load. This increased compression of the strata manifests as increased surface subsidence (SCT, 2021a). The modelling indicated that surface subsidence can be controlled by increasing pillar width which reduces the fracturing of the strata above the chain pillars (SCT, 2021a). The surface subsidence is also sensitive to extraction height. The pillar size recommendations are based on an extraction height of 2.8m.

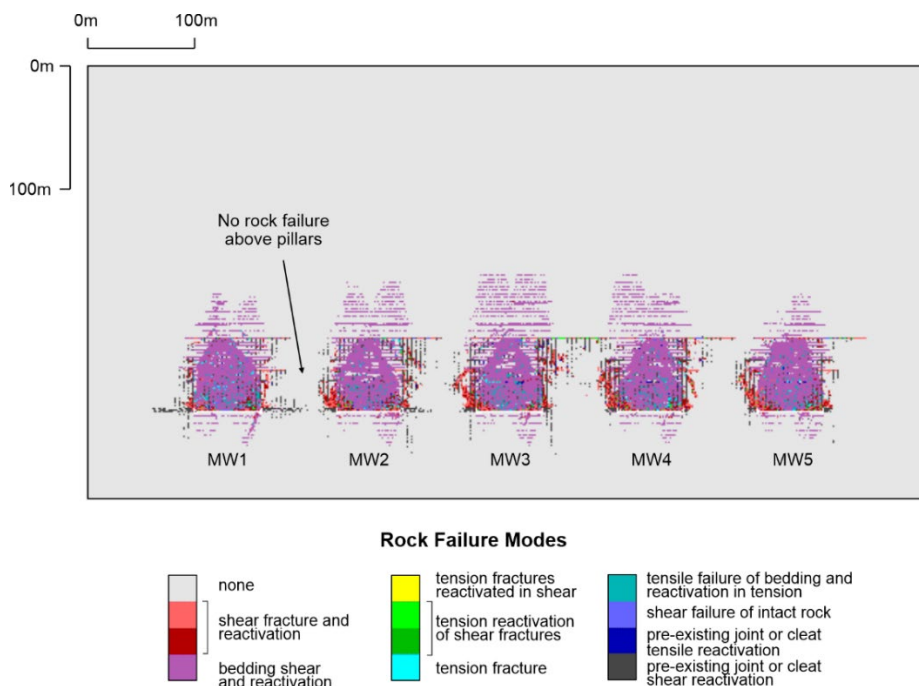
Recommendations from the SCT (2021a) report for pillar sizes for MW10-12 have been implemented by Airly Mine. A comparison of the measured vertical subsidence data following the extraction in miniwall panel MW10 against the SCT model predictions has confirmed that measured subsidence levels are within the range predicted by the SCT subsidence model. These results indicate the SCT modelling can be relied on with a reasonable confidence for predicting subsidence from miniwall mining at Airly Mine. Validation to date is based on 30m pillars, where monitoring of MW11 extraction will provide the first larger pillar to validate the modelled reduction in subsidence.

After successfully calibrating against the measured data over Mount Airly, SCT were then asked to use this FLAC 2D model to recommend a revised mine design that would restrict the maximum subsidence over the EP Area of MWs 13 to 16 to less than the EIS prediction of 125 mm.

Various pillar sizes of 40-120m were modelled, including pillar size combinations (e.g. 40m, 80m, 40m, 80m, 40m). The subsidence for the combination pillar designs were largely controlled by the first pillar size, as this first pillar effectively set the starting subsidence level for the additional panels (SCT, 2021b). This modelling assessment indicated that a consistent pillar width of 70m and extraction height of 2.8m, for 4-5 miniwalls, was the most appropriate mining geometry for the 61m wide panels for the depth range at Point Hatteras (approximately 200-300m) (SCT, 2021b).

Figure 3.4 shows the rock failure model output for the 70m pillar design and 2.8m extraction height. The model output shows that there is no significant fracturing of the strata above the pillars. This indicates that the abutment load is anticipated to be loaded elastically onto the pillars. The rock failure model represented a conservative seam depth of 280m to ensure the potential rock failure for the upper range of depth of cover has been assessed (SCT, 2021b).

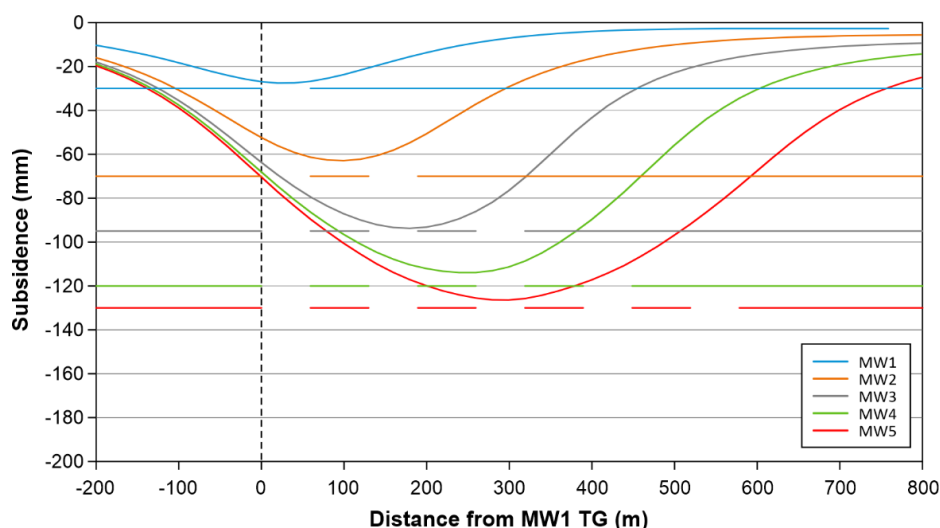
Figure 3.4: Rock failure mode for 70m pillar design for five miniwall panels



(source: SCT, 2021b)

Figure 3.5 shows the modelled cumulative subsidence profiles for the 70m pillar design for five adjacent miniwalls. These profiles show a subsidence profile responding to a combination of the elastic loading of the strata and small levels of sag subsidence. The subsidence profiles in **Figure 3.5** present the maximum vertical subsidence for inside the extent of the longwall panels (SCT, 2021b). SCT note that the modelled subsidence outside the panels overestimates the vertical subsidence due to model boundary effects. SCT suggest that empirical datasets should be referred to for angle of draw estimates and subsidence estimates outside the panels.

Figure 3.5: Modelled cumulative subsidence profiles for the 70m pillar design for five miniwall panels



(source: SCT, 2021b)

The FLAC 2D modelling indicated that the maximum subsidence, after MWs 13 to 16 are extracted, will be 115 mm, if the extracted seam thickness does not exceed 2.8 m, the miniwall panel widths are kept at 61 m and the solid chain pillar widths between these miniwalls are increased from 29.5 m (as designed for the EIS) to 70 m. SCT note that a subsidence tolerance of +/-20mm should be applied to the modelled subsidence, based on survey accuracy.

The modelling suggests the 115mm plus 20mm tolerance may produce a maximum subsidence of 135mm. However, the caving and subsidence model had a depth of 280m, representing the upper range in strata depth and therefore upper range in abutment load. The model estimates of surface subsidence are therefore considered conservative and representative for the area of anticipated maximum subsidence.

Airly Mine will monitor the incremental subsidence for each panel extracted to validate the model and to ensure the subsidence is within the progressive modelled subsidence. There may be opportunity to revise pillar widths and extraction height for future panels if the progressive subsidence is significantly less than the model estimations. In the less likely scenario that the subsidence is greater than modelled, or at the upper end of survey error, the staged monitoring allows for redesign of the ensuing panels.

The mine layout for MW13-16 has been designed according to the geometry and parameters modelled by SCT (2021b).¹⁵

3.2.2 Predicted Subsidence Effects and Subsidence Impacts

This Extraction Plan has relied on the most recently updated predictions of subsidence effects, subsidence impacts and environmental consequences. Centennial Airly, engaged MSEC to prepare a *Subsidence Assessment* to support the Extraction Plan, as well as a *Cliff Assessment and Site Inspection Report* for all cliffs within proximity to the extraction areas (including cliffs within the Cliff Line Zone of First Workings) based on the subsidence prediction work provided by SCT (SCT, 2021b).

The subsidence and cliff assessments are documented in the following report:

- *MSEC (2021). MSEC1195 Airly Mine MW13 to MW16 – Subsidence Predictions and Impact Assessments for the Natural and Built Features over and near the Proposed MWs 13 to 16 in Support of the Extraction Plan Application.*

The primary management strategy being implemented by Airly Mine for the Extraction Plan is impact avoidance through the implementation of a conservative mine design, with significantly larger pillar widths between each miniwall, to have minimal subsidence effects and prevent subsidence impacts.

Conservative setbacks to key sensitive features within the Cliff Line Zone of First Workings continue to be implemented for this Extraction Plan (i.e. 26.5 degree Angle of Draw). Extensive monitoring and management measures are proposed to demonstrate the subsidence modelling and effectiveness of the revised mining and monitoring systems.

The following sections provide brief overviews of conventional and non-conventional mine subsidence movements.¹⁶

Subsidence Prediction Method

The profiles of vertical subsidence for MW13 to MW16 have been determined by SCT (2021b) based on a FLAC numerical model. MSEC has not developed a separate prediction model for the proposed miniwalls. The predicted subsidence contours have been developed by MSEC based on the 2D profiles of vertical subsidence provided by SCT using the method outlined below.

¹⁵ See Attachment E – Technical Report: Pillar Width Modelling (SCT, 2021) for further detail on the Pillar Width Modelling Assessment

¹⁶ See Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) for further discussions and details, including the methods that have been used to predict these movements

MSEC were supplied with modelling undertaken by SCT (2021b), using the FLAC 2D programme including the predicted subsidence profiles over one to five mini wall panels, along with the mine layout which was developed in accordance with the recommendations from SCT and located the edges of MWs 13 to 16 to be further than a 26.5 degrees AoD from the edge of the top of the major external cliffs.

After determining where the miniwall panel edges were to be, preliminary 20 mm, 50 mm and 100 mm predicted subsidence contour lines were prepared by MSEC.

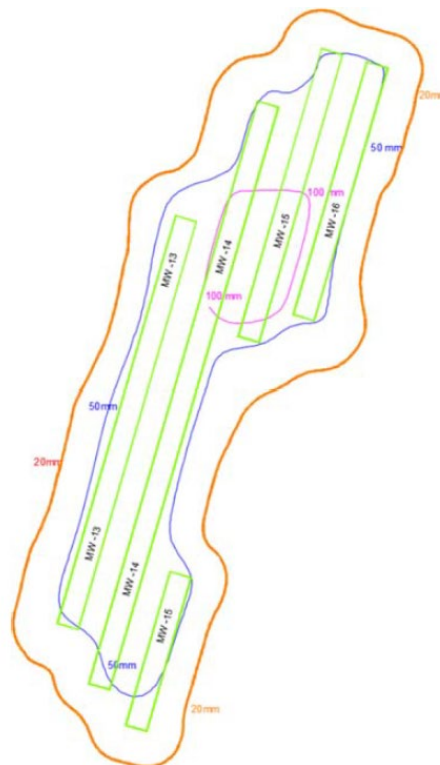
The 50mm and 100 mm predicted subsidence contours lines have been located based on the SCT modelling profiles¹⁷, depending on whether one, two, three or four miniwall panels are to be extracted.

In their report SCT (2021b) advised that the modelled subsidence profiles present the maximum vertical subsidence for inside the extent of the mined miniwalls and the modelled subsidence profiles outside the panels overestimates the vertical subsidence due to model boundary effects. SCT recommended that empirical datasets from comparable subsidence levels should be used for setting the AoD estimates and subsidence predictions outside the panel edges.

Therefore, a review reviews of measured AoDs over Mount Airly was undertaken by MSEC which found the average measured AoD was 17 degrees (and ranged between -1.4 and 32.8 degrees). Despite this review of observed angles of draw from the early Mount Airly panels, the 20mm predicted subsidence contour line has been located based on 26.5 degrees from the edges of the mined panels. This AoD is larger than observed angles of draw from the early Mount Airly panels and is therefore considered to be a conservative estimate of the maximum extent of subsidence within the EP Area.

Figure 3.6 shows the resulting predicted 20 mm, (the orange-coloured line), 50mm and 100 mm subsidence contours lines over MWs 13 to 16.

Figure 3.6: Predicted subsidence contour levels (using 26.5 degrees AoD as 20mm)



(source: MSEC, 2021)

¹⁷ See Figure 3.5

Predicted Conventional Subsidence Movements

The maximum predicted conventional subsidence effects due to the mining of the proposed MWs 13 to 16 are shown in **Table 3.3**. The predicted total subsidence effects represent the cumulative movements including the mining of adjacent and nearby completed miniwalls and workings.

Table 3.3: Maximum predicted conventional subsidence effects

After Miniwall	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km ⁻¹)	Maximum predicted total sagging curvature (km ⁻¹)
MW13	30	<0.3	<0.01	<0.01
MW14	70	0.4	0.01	0.01
MW15	100	0.6	0.02	0.02
MW16	115	0.8	0.03	0.03

The maximum predicted tilt and curvatures have been derived from the predicted subsidence contours for MWs 13 to 16 and a review of the monitoring data for MW2 to MW9. The measured tilts and curvatures above the existing miniwalls are greater than the values obtained from the predicted subsidence contours for the proposed longwalls and, therefore, the measured values have been adopted (MSEC, 2021).

The maximum predicted total vertical subsidence of 115 mm occurs in the northern part of the proposed mining area, where the depth of cover is greatest, and it represents approximately 4 % of the proposed mining height of 2.8 m (MSEC, 2021).

The maximum predicted total tilt is 0.8 mm/m (i.e., < 0.1 %, or 1 in 1250). The maximum predicted total conventional curvatures for the proposed miniwalls are 0.03 km⁻¹ hogging and sagging, which represents a minimum radius of curvature of 33 km (MSEC, 2021).

The maximum predicted strains for the proposed MW13 to MW16 are less than 1 mm/m tensile and compressive based on the 95 % confidence levels (MSEC, 2021).

The predicted conventional subsidence effects vary across the EP Area as the result of, amongst other factors, variations in the depths of cover, mining heights and overburden geology (MSEC, 2021).

Predicted Far-Field Movements

The predicted far-field horizontal movements due the proposed MW13 to MW16 are expected to be small and could only be detected by precise surveys. Such movements tend to be bodily movements towards the mining area and are accompanied by very low levels of strain, generally in the order of survey tolerance (i.e., less than 0.3 mm/m). Potential impacts of far-field horizontal movements on the natural and built features within the vicinity of the proposed miniwalls are not expected to be significant (MSEC, 2021).

Non-conventional Ground Movements

Non-conventional ground movements could occur within the EP Area, due to near surface geological conditions, steep topography and valley-related effects.¹⁸ These non-conventional movements are often accompanied by elevated tilts and curvatures that are likely to exceed the conventional predictions.

In most cases, it is not possible to predict the exact locations or magnitudes of the non-conventional anomalous movements due to near surface geological conditions. For this reason, MSEC (2021) based the strain predictions on a statistical analysis of measured strains in the NSW coalfields, including both conventional and non-conventional anomalous strains. In addition to this, the impact assessments for the

¹⁸ See Section 3.4 of Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) for discussion on non-conventional subsidence effects

natural and built features include historical impacts resulting from previous longwall mining which have occurred as the result of both conventional and non-conventional subsidence movements.

3.2.3 Potential Environmental Consequences and Impacts for Built Features

The predictions and subsequent environmental consequences for the Extraction Plan are detailed in MSEC (2021)¹⁹, in the following key sections:

- Section 5 Descriptions, Subsidence Predictions & Impact Assessments for the Natural Features, and
- Section 6 Descriptions, Subsidence Predictions & Impact Assessments for the Built Features

The Key Component Plans have been developed in consideration of the subsidence effects on the built and natural environment and with respect to the approved performance criteria under SSD_5581.

The main findings from this report are as follows:

- **Cliffs:** MSEC have undertaken site inspections (“ground truthing”) of the cliffs that are located over Point Hatteras on Genowlan Mountain and over and near MWs 13 to 16 to supplement the extensive aerial photogrammetry and cliff identification work that was undertaken previously Aerometrex. MSEC advised that these visual inspections supported the photographic analysis that was undertaken by Aerometrex and there were no cliff features that would be particularly sensitivity to subsidence movements.

MSEC completed a detailed review on the potential factors that influence mining induced cliff falls and concluded that, (considering the very low levels of subsidence predicted over the identified internal cliffs and rock features located near and over MWs 13 to 16), there was only an extremely low probability that cliff instabilities would occur at the identified and listed cliffs, which were mostly relatively short, isolated cliffs located over solid unmined coal areas beyond the edges of the mini wall panels.

MSEC further advised that because natural rock falls have been reported to occur regularly, it is not possible to guarantee that there would be no rock falls reported during the period of mining. However, there should only be occasional falls of small slabs of rock and, because of the very low levels of subsidence being predicted at the identified internal cliffs and rock features, there should be little chance of exceedance of these development approval conditions for cliffs.

Hence, as the predicted levels of subsidence over Genowlan Mountain based on the proposed Extraction Plan Layout for MWs 13 to 16 are similar to those provided in the 2014 EIS, i.e., the maximum predicted subsidence is less than 125 mm with no surface cracking, and the assessed levels of potential impact for the cliffs, are similar to those based on the EIS Layout.

- **Steep slopes:** The steep slopes and rock outcrops within the Principal Subsidence Management Area are throughout the Genowlan Mountain mesa. Potential impacts on these features generally occur from increased horizontal movements in the downslope direction, potentially resulting in tension cracks appearing at the tops and on the sides of the steep slopes and outcrops, compression ridges forming at the bottoms of the steep slopes, and buckling of the bedrock at the bottoms of the rock outcrops. However, given that the predicted levels of subsidence over these steep slopes and rock outcrops are very low and not greater than 115 mm, it is unlikely that the steep slopes and rock outcrops will be adversely impacted by the proposed mini wall extraction.
- **Drainage lines:** The upper reaches of Genowlan Creek are located above the proposed mining area. There are also other unnamed drainage lines that are located across the proposed mining area.

¹⁹ See Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)

These drainage lines are generally ephemeral, although there are some groundwater seeps from the perched aquifers.

Since the maximum predicted subsidence is only 115 mm over these miniwalls, the predicted post-mining grades along Genowlan Creek and the other drainage lines are similar to the pre-mining natural grades. It is unlikely, therefore, that there would be adverse changes in ponding or scouring resulting from the mining related subsidence or tilt.

It is expected that no fracturing of the bedrock is likely to be observed over the miniwalls and beneath the sections of the streams that are located directly above and adjacent to the proposed miniwalls. Surface water flow diversions are unlikely to occur along the sections of the streams that are located directly above and adjacent to the proposed miniwalls.

- **Conservation Areas:** Most of the surface areas over the Point Hatteras area of Genowlan Mountain are located within the Mugii Murum-ban State Conservation Area that has significant natural and cultural heritage values and contains significant mineral resources. Two threatened ecological communities have been identified on Genowlan Point which is near Point Hatteras. Given the predicted low levels of subsidence over the Point Hatteras area of mesa the proposed extraction should not cause physical impacts (such as surface cracking) that could potentially change the environment or habitat for this natural vegetation.²⁰
- **Built features:**
 - There are **unsealed roads and tracks** located directly above the proposed mining area. It is expected that the potential effects of the low predicted subsidence levels would be negligible and unnoticeable on these roads, and these roads could be maintained in safe and serviceable condition throughout the mining period using normal road maintenance techniques.
 - A **telecommunications tower** on the Airly Turret between the proposed MWs 13 and 14. The RFS have advised that the existing 20m high tower is due to be upgraded and replaced soon by a 30 m high tower. The predicted levels of subsidence and tilt at the telecommunications tower are similar to those provided in the 2014 EIS.

Given that the predicted levels of subsidence and tilts at this telecommunications equipment are very low and, noting that the changes in tilt that may be caused by subsidence after each mini wall is extracted is so low that it may not be noticeable, it is unlikely that the existing or the new upgraded telecommunications tower and its equipment will be impacted by the proposed mini wall extraction.
 - Remnants of previous historic mining activity, a **Nissen hut and other built items**, including a dam and abandoned adits, are located over MWs 13 and 14. Given that the low predicted levels of subsidence tilts and strains at these features, it is unlikely that they will be impacted by the proposed mini wall extraction.
 - **Registered Survey Marks** are located directly above the proposed miniwalls could experience the full range of predicted subsidence effects. Other registered survey marks located further outside the proposed mining area could experience small far-field horizontal movements. It may be necessary on the completion of the proposed miniwalls, when the ground has stabilised, to re-establish any state survey control marks that are required for future use.

²⁰ See Attachment G – Technical Report: Biodiversity (RPS, 2021) and MW13-16 BMP (Appendix 3) for further discussion on the natural vegetation and potential for subsidence related impacts

3.3 Performance Objectives

Performance objectives in relation to the subsidence impacts are presented below. These objectives have been used when developing the management strategies incorporated in this Extraction Plan and supporting component plans.

3.3.1 Performance Measures for Mine Design and Underground Mining Control

The primary objective of the mine design is to prevent any significant mine induced risk to surface features by providing low levels of subsidence. This minimises potential for environmental impacts and allows built features to remain safe, serviceable and repairable. Accordingly, adherence to the final mine design during implementation (mining) will be monitored as part of Underground Mining Controls²¹. The minimum performance measures for mine design parameters have been used as Condition Red trigger levels within the MW13-16 Master TARP.

The minimum performance measures for mine design parameters for the current EP Area are based on the commitments in the Consent, EIS or most recent subsidence assessments. The mine design parameters which will be monitored as underground mining control are detailed below in **Table 3.4**.

Table 3.4: Underground Mine Design Requirements – Panel and Pillar Mining Zone

Design/Control Aspect	Minimum Performance Measure for the current EP
Mining System Type(s)	Minerwall panels (sub-critical, partial extraction)
Final Pillar Stability	Long Term Stable
Design Cover Depth Range	160-310m
Nominal Mining Height (m) ^a	<3.0m
Nominal Maximum Roadway Width (m) ^a	5.5m
Nominal Maximum Void Width for narrow panel extraction (m) ^a	61m
Formation of Pillars (Centres)	Final pillars 70m solid interpanel pillars
Nominal Chain Pillar Width to Height Ratio (average across panel) ^a	>9
Minimum Pillar System Factor Of Safety (FOS)	≥1.6
Predicted Maximum Panel Subsidence (mm)	Maximum ≤125mm
Setbacks ^b from cliffs identified in the Cliff Line Zone of First Workings	No second workings within an angle of draw of 26.5 degrees of the crest of any cliffs ^c <i>EIS assessments undertaken for 8 degrees AOD.</i>

a) on average across panel system as mined

b) in accordance with Condition 1 in Schedule 3 of SSD_5581

c) cliffs as defined by Aerometrex (2021) and inspected by MSEC (2021) based on definitions of consent SSD_5581

²¹ See Section 4.7 for a summary of underground mining control monitoring and MW13-16 SMP (Appendix 7) for details

3.3.2 Performance Measures for Natural and Heritage Features and Built Features

Performance measures for subsidence for the Airly Mine are outlined in the following tables:

- Performance measures relating to natural and heritage features are shown in **Table 3.5**.²²
- Performance measures relating to built features and public safety are shown in **Table 3.6**.²³

Table 3.5: Subsidence Impact Performance Measures – Natural and Heritage Features

Water Resources	Performance Measure	Where Addressed
Gap and Genowlan Creeks	Wherever depth of cover is < 40 m, no first or second workings within 20 m of the edge of the creek bed, measured horizontally in the seam Negligible environmental consequences to water quality and to bed and bank stability No greater environmental consequences than predicted in the EIS to water flows (including baseflow)	• Section 3 (proposed mining geometry and parameters and mine design performance measures, including long term stable pillar systems) • Only upper ephemeral tributaries of Gap and Genowlan Creeks in EP Area (1st and 2nd order) • Airly Mine Water Management Plan (WMP), including dedicated TARP • Section 4.1
All other Watercourses	No greater subsidence impacts or environmental consequences than predicted in the EIS.	• As above for Gap and Genowlan Creeks
Land	Performance Measure	Where Addressed
The Grotto	Negligible subsidence impacts or environmental consequences	• The Grotto is not located within the near field / active extraction area • There are no mine workings proposed beneath The Grotto (MW16 designed to avoid this area) • Section 4.2 • Section 3 (proposed mining geometry and parameters and mine design performance measures) • MW13-16 LMP
Cliffs within a 26.5 degree angle of draw of the Airly underground mine workings.	No greater subsidence Impacts or environmental consequences than predicted In the EIS (<i>le occasional rock falls, displacement or dislodgment of boulders or slabs of less than 30 m³, or fracturing, that do not Impact Aboriginal heritage, EECs or public safety</i>), that in total do not Impact more than 2% of the total area of such cliffs.	• Section 4.2 • Section 3 (proposed mining geometry and parameters and mine design performance measures) • Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) • MW13-16 LMP • MW13-16 SMP • MW13-16 Master TARP
Pagodas within a 26.5 degree angle of draw of the Airly underground mine workings (other than pagodas affected by the New Hartley Potential Interaction zone).	No greater subsidence Impacts or environmental consequences than predicted in the EIS (<i>le occasional rock falls, displacement or dislodgment of boulders or slabs of less than 30 m³, or fracturing, that do not impact Aboriginal heritage, EECs or public safety</i>), that in total. do not impact more than 2% of the total area of such pagodas	• As above for cliffs
<i>Pagodas within a 26.5 degree angle of draw of the New Hartley interaction zone</i>	<i>No greater subsidence Impacts or environmental consequences than predicted In the EIS</i>	• Not applicable • <i>The New Hartley interaction zone is not within the EP Area</i>

²² Table 1, Condition 2 in Schedule 3 of Development Consent SSD_5581

²³ Table 2 Condition 3 in Schedule 3 of Development Consent SSD_5581

Land (continued)	Performance Measure	Where Addressed
Minor cliffs	No greater subsidence Impacts or environmental consequences than predicted In the EIS.	As above for cliffs
Steep slopes	No greater subsidence Impacts or environmental consequences than predicted In the EIS.	- Section 4.2 - Section 3 (proposed mining geometry and parameters and mine design performance measures) - MW13-16 LMP - MW13-16 Master TARP
All other land not covered by a performance measure above	No greater subsidence Impacts or environmental consequences than predicted In the EIS.	As above for steep slopes
Biodiversity	Performance Measure	Where Addressed
Threatened species, threatened populations, EECs and Groundwater Dependent Ecosystems (GDEs), with the exception of those listed below	Negligible environmental consequences	- No EEC or GDE in the EP Area. - MW13-16 BMP, referencing existing site monitoring program within the site BMP. - Section 4.3 - MW13-16 Master TARP
<i>Pultenaea</i> sp. Genowlan Point population and Genowlan Point <i>Allocasurina nana</i> Heathland community	No environmental consequences	- Not applicable to this Extraction Plan. - Genowlan Point is not within the EP Area
Heritage Sites	Performance Measure	Where Addressed
Aboriginal Heritage sites identified in Appendix 5 (of the development consent)	Negligible environmental consequences.	- No Aboriginal Heritage sites within near field / active extraction area - Section 4.4 - MW13-16 Master TARP
Non-Aboriginal Heritage sites identified in Appendix 6 (of the development consent)	<i>Negligible environmental consequences.</i> <i>Wherever depth of cover is <30, no second workings to occur within a setback distance defined by half the depth of cover from site 3 and site 24, measured horizontally in the seam.</i>	Not applicable - No Non-Aboriginal Heritage sites within the EP Area - Section 4.4
Mine Workings	Performance Measure	Where Addressed
First workings beneath any feature where performance measures in this table require no or negligible environmental consequences and to all first workings beneath cliffs	To remain long-term stable and non-subsiding	- Section 3 (proposed mining geometry and parameters and mine design performance measures) - MW13-16 SMP - MW13-16 Master TARP
Second workings	To be carried out only in accordance with an approved Extraction Plan	Pt Hatteras Panel & Pillar Mining Zone Extraction Plan (MW13-16) (Volumes 1, 2 and 3)

Notes:

- These performance measures apply to all mining taking place after the date of development consent.
- The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent (see condition 5 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.

Table 3.6: Subsidence Impact Performance Measures – Built Features and Public Safety

Built Features	Performance Measure	Where Addressed
Emergency services communication tower and associated sheds and infrastructure	- Always safe and serviceable - Damage must be fully repairable and must be fully repaired.	- Section 4.5 - Section 3 (proposed mining geometry and parameters and mine design performance measures) - Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) - MW13-16 BFMP - MW13-16 SMP - MW13-16 Master TARP
State Survey Mark (SSM) at Genowlan Trig Station, Telstra Copper Cable, Nissen Hut and Outbuilding	- Always safe and serviceable, unless otherwise agreed with the owner - Damage must be fully repairable and must be fully repaired.	As above for Emergency services communication tower and associated sheds and infrastructure
"Stone Cottage"	- No second workings to occur within a setback distance defined by half the depth of cover from the building, measured horizontally in the seam, unless otherwise agreed with the owner - Always safe and serviceable, unless otherwise agreed with the owner - Damage must be fully repairable, and must be fully repaired, unless otherwise agreed with the owner	Not applicable - The New Hartley interaction zone is not within the EP Area
Other features including walking trails and 4WD tracks, fences and gates	- Use should be maintained wherever practicable in consultation with BCD. - Damage must be fully repairable and must be fully repaired.	As above for Emergency services communication tower and associated sheds and infrastructure
Public Safety	Performance Measure	Where Addressed
Public Safety	Negligible additional risk, in consultation with the Resources Regulator and BCD	- Section 4.6 - Section 3 (proposed mining geometry and parameters and mine design performance measures) - Attachment C – Subsidence and Environmental Risk Assessment (EP Area) - Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021) - MW13-16 PSMP - MW13-16 SMP - MW13-16 Master TARP

Notes:

- These performance measures apply to all mining taking place after the date of this consent.
- The Applicant will be required to define more detailed performance indicators for each of these performance measures in the Built Features Management Plans or Public Safety Management Plan (see condition 7 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.
- Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.

3.3.3 Performance Indicators

To establish compliance with the performance measures outlined in **Sections 3.3.1 and 3.3.2**, Airly Mine has established performance indicators for each feature, via escalating triggers and levels of investigation in accordance with the performance indicator levels described in **Table 3.7**.

The MW13-16 Master TARP details the parameters and associated trigger levels developed for the Extraction Plan, and the MW13-16 SMP established the appropriate monitoring to demonstrate that subsidence performance satisfies the performance measures for the Airly Mine.

Table 3.7: Performance Indicators & TARP Risk Management Scenarios

Performance Indicator	General Description	Action / Response
Level 1: Condition Green	Operations within predictions, and within approved impacts.	Continued operations and monitoring as normal.
Level 2: Condition Amber	Operations within approved impacts but potentially exceed / exceed predictions.	Review and investigation processes are engaged, with adaptive management as required.
Level 3: Condition Red	Operations exceed approved impact. <i>The approved Performance Measures (criteria thresholds) of Development Consent (and any other relevant approvals) are listed in Condition Red.</i>	Adaptive Management measures are fully engaged as per the MW13-16 Master TARP and relevant sections of the Extraction Plan and the MW13-16 SMP.

3.4 Subsidence Management Strategies

Potential environmental consequences during the mining of MW13-16 will be managed in accordance with the relevant requirements of Project Approval (SSD_5581) and other approvals, through:

- **Avoidance/Mine Design** – the layout of MW13-16 has been developed to meet the subsidence impact performance measures (**Section 3.1**).
- **Subsidence Monitoring** – visual and survey monitoring and reporting will be conducted to confirm predictions of subsidence effects and potential subsidence impacts and environmental consequences (**Section 4.7**).
- **Management Measures and Remediation** – implementation of management measures and/or remediation, as required, to address subsidence impacts and/or environmental consequences (in consideration of the potential impacts of the unmitigated impact, including the potential for self-healing or long-term degradation, and the potential impacts of the remediation) (**Section 4**).
- **Trigger Action Response Plan (Contingency Plans)** – implementation of Trigger Action Response Plans in the event an exceedance of a subsidence impact performance measure or if an unexpected impact is detected (**Section 5.1**), including consideration of identified potential contingency measures.
- **Adaptive Management** – adaptive management will be implemented where appropriate by reviewing and evaluating the effectiveness of management strategies, and adjusting management strategies to improve performance, particularly following an exceedance of a subsidence (**Section 5.2**).
- **Reporting and Review** – procedures for investigations of incidents (including all exceedances of performance measures) and appropriate response, as well as procedures for quality assurance and review of the management system (**Sections 5.4 and 0**).

4 SUBSIDENCE MONITORING AND MANAGEMENT

Centennial has developed an integrated, holistic approach to subsidence management for key risks within its operations at a regional, site and EP Area level to provide an appropriate and systematic management approach.

- Regional management plans provide a framework for strategic management under which site plans and EP Area plans are established in accordance with consent conditions.
- Site management plans typically cover all aspects of mining operations (including surface operations and non-subsidence related aspects) as required by other conditions of the development consent.
- Management Plans for individual EP Areas (key component plans) are developed specifically to address Condition 7 (Extraction Plan) in Schedule 3 of SSD_5581 which has a specific focus in terms of both location and context as well as environmental management of subsidence and underground mining operations specifically related to the EP Area.

The following sections provide a summary of the risk-based approach in developing each management plan prepared to address the management of potential subsidence-related impacts within the EP Area. A copy of each management plan is supplied as Volume 3 of this Extraction Plan. Centennial Airly have undertaken a dedicated subsidence and environmental risk assessment for the EP Area including reference to related risk assessments and supporting studies²⁴ and has consulted with key stakeholders to determine the content of relevant component plans.²⁵

The key component plans submitted as part of this Extraction Plan are set out in the following sections:

- Airly Mine Water Management Plan – See Section 4.1;
- Land Management Plan for MW13-16 – See Section 4.2;
- Biodiversity Management Plan for MW13-16 – See Section 4.3;
- Western Region Aboriginal Cultural Heritage Management Plan – See Section 4.4;
- Built Features Management Plan for MW13-16 – See Section 4.5;
- Public Safety Management Plan for MW13-16 – See Section 4.6; and.
- Subsidence Monitoring Program for MW13-16 – See Section 4.7.

The plans have been developed in consultation with government agencies and stakeholders as required under Development Consent SSD_5581 as summarised in **Table 4.1**.

²⁴ See Section 2.2 Risk Assessment and Attachment C – Subsidence and Environmental Risk Assessment (EP Area)

²⁵ See Section 2.3 Stakeholder Identification and Engagement and Attachment D – Stakeholder Consultation

Table 4.1: Component Plans, Consultation and Status at time of EP Submission

Management Plan	Summary of Consultation				Status at EP Submission
	Consultation Required ^a	Comments Invited from ^b	Comments Received by	Comments / Issues Raised	
Airly Mine Water Management Plan	BCD and the Water Division	Existing Airly Mine WMP prepared originally in 2017 (consulted EPA, OEH, Water NSW and DPI Water). Revised with DPIE in 2021.	N/A	As detailed in Appendix A and Appendix B in the Airly Mine WMP	Final
Land Management Plan for MW13-16	IEP, Resources Regulator and BCD	IEP Resources Regulator BCD	N/A to date	Feedback not yet received as at submission	Final ^c
Biodiversity Management Plan for MW13-16	DoEE and BCD	DoEE BCD	N/A to date	Feedback not yet received as at submission	Final ^c
Western Region Aboriginal Cultural Heritage Management Plan	Heritage Division and relevant Aboriginal stakeholders	Existing Western Region ACHMP prepared originally in 2015 (consulted DPE, OEH, Registered Aboriginal Parties and LCC). Revised with DPIE in 2021.	N/A	As detailed in Attachment 8 and Attachment 8A in the Western Region ACHMP	Final
Built Features Management Plan for MW13-16	Resources Regulator	Resources Regulator Airly Turret Communications Tower Users Occupants / Users of Nissen Hut	N/A to date	Feedback not yet received as at submission	Final ^c
Public Safety Management Plan for MW13-16	IEP, Resources Regulator and BCD	IEP Resources Regulator BCD	N/A to date	Feedback not yet received as at submission	Final ^c
Subsidence Monitoring Program for MW13-16	IEP, Resources Regulator and BCD	IEP Resources Regulator BCD	N/A to date	Feedback not yet received as at submission	Final ^c

a) in accordance with Condition 7 in Schedule 3 of development consent SSD_5581

b) Management Plans to be distributed to relevant agencies concurrently with submission to DPIE

c) documents submitted as final subject to any further edits warranted following any ongoing stakeholder feedback and DPIE/IEP assessment

4.1 Water Management Plan

The Airly Mine Water Management Plan (WMP) (GHD, 2021) has been developed to meet broader relevant approvals and licensing requirements for the mine beyond the EP Areas including surface operations in accordance with the following:

- Specific water components of the conditions of development consent, particularly Condition 13 in Schedule 4 of SSD_5581;
- Statements of Commitment of the EIS for SSD_5581;
- EPBC referral approval (2013/7076);
- EPL12374; and
- Water Access Licences.

In consultation with DPIE, Airly Mine has submitted the WMP to also meet the requirements for the Water Management Plan required for the Extraction Plan in accordance with Condition 7 (i) iii in Schedule 3 of SSD_5581. The site WMP was developed in consultation with relevant stakeholders and was originally finalised during 2017. The most recent revision of the WMP was developed in consultation with relevant stakeholders and in consideration of the mine design for the EP Area.

The purpose of the WMP is to detail monitoring and management measures to be implemented for surface and groundwater values (including creek geomorphic stability, aquatic ecology and stygofauna) within the Airly Mine Development Consent Area, including the EP Area. The WMP provides information on (but not limited to) the following:

- Surface water monitoring, including for:
 - Surface water quality,
 - flow monitoring and stream health monitoring, including geomorphic condition and
 - watercourse stability as well as aquatic ecology monitoring
- Groundwater monitoring, including for:
 - water quality and levels in the established groundwater piezometer network,
 - underground water transfers and
 - stygofauna monitoring
- Baseline data for the above surface and groundwater
- Identification of registered groundwater bores
- Impact Assessment and Performance Criteria for surface and groundwater (including stream health)
- Water management measures for surface and groundwater
- Detailed Trigger Action Response Plans

Surface water features are confined to the small ephemeral upper drainage lines located within the EP Area (primarily first order and one second order), which are illustrated on **Figure 1.3**. Aquifers and groundwater systems are outlined in the WMP. No Groundwater Dependent Ecosystems (GDE's) have been identified within the EP Area. Facultative²⁶ ecosystems do occur, however these are primarily in the Extended Monitoring and Management Area. Regardless, no significant impact to the surface or sub-surface in these areas (including no expected cracking) results in no predicted impacts for these features.

The WMP presents a broader environmental monitoring program within the Development Consent Area including the current EP Area, rather than monitoring specifically required or proposed for the EP Area.

²⁶ These vegetation communities occur within shallow aquifer zones, and whilst not strictly considered GDE's there is potential to have some reliance on groundwater on a seasonal basis or only during extended drought periods.

Surface and groundwater features and monitoring locations under the WMP and related *MW13-16 SMP* are illustrated in the WMP. The water features managed by the WMP located within the EP Area are detailed in **Table 4.2** along with their relevant management plan and monitoring programs.

Table 4.2: Water Features Performance Measures, Indicators, Monitoring and Management

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Gap and Genowlan Creeks	Negligible environmental consequences to water quality and to bed and bank stability	Watercourse quality within or below trigger values developed with reference to historical monitoring data	Undertake surface water quality monitoring in accordance with section 4.2.1 of the WMP.	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
	No greater environmental consequences than predicted in the EIS to water flows (including baseflow)	Watercourse flow volumes within or above historical monitoring data	Undertake surface water quality monitoring in accordance with section 4.2.2 of the WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
Groundwater	Consistent with hydrogeological model predictions	Groundwater level above trigger values (i.e. drawdown less than predicted)	Undertake groundwater quality monitoring in accordance with section 4.4.1 of the WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		Groundwater quality within or below trigger values	Undertake groundwater quality monitoring in accordance with section 4.4.1 of the WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		Groundwater inflows consistent with predictions	Undertake groundwater quality monitoring in accordance with section 4.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		No complaints regarding groundwater access or quality	A record of any complaints in relation to pollution arising from any site activities must be kept as per the Western Operations Regional Management Plan	Mine Maintains a public community complains register that is updated and published on the website monthly

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Stream Health	Negligible environmental consequences to bed and bank stability for Gap and Genowlan Creeks.	Bed and bank stability maintained or improved	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		Erosional processes do not occur as a result of subsidence	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		Change in stream gradient does not vary beyond predictions of subsidence modelling	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		No connective cracking between the surface and underground workings	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
		Riparian, channel and environmental scores relating to riparian and instream vegetation within historical range and/or consistent with reference sites	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix E)

4.2 Land Management Plan

The Land Management Plan for MW13-16 (MW13-16 LMP) has been developed as a key component of the Extraction Plan in accordance with Condition 7.(i)(v) in Schedule 3 of Development Consent SSD_5581, and is contained in Volume 3 of this Extraction Plan.

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 that will be potentially affected by the secondary extraction of MW13-16.

The landscape features managed by the Land Management Plan are cliffs, minor cliffs and pagodas, the general surface area of the Mugii Murum-ban SCA (which includes steep slopes and rock outcrops) and the deeply incised canyons/gorges, including the area known as the Grotto.

The land features managed by the MW13-16 LMP for the EP Area are detailed in **Table 4.3** along with their relevant management plan and monitoring programs.

Table 4.3: Land Performance Measures, Indicators, Monitoring and Management

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
The Grotto	Negligible subsidence impacts or environmental consequences	Presence/absence of mine-induced damage or change to features (no significant rock falls or surface cracking) Watercourse flow volumes within or above historical monitoring data	3D oblique photogrammetry Stereo vertical photogrammetry Targeted GNSS Monitoring Stations Surface water flow and quality	Integrated Subsidence Monitoring Program In accordance with WMP Trigger Action Response Plans (WMP Appendix E)
Cliffs within a 26.5 degree angle of draw of the Airly underground mine workings	No greater subsidence impacts or environmental consequences than predicted in the EIS (<i>i.e. occasional falls, displacement or dislodgment of boulders or slabs of less than 30m³, or fracturing, that do not impact Aboriginal heritage, EECs or public safety</i>), that in total do not impact more than 2% of the total area of such cliffs.	Presence/absence of mine-induced damage or change to features (significant rock falls and surface cracking) Various Parameters relevant to each method	3D oblique photogrammetry Stereo vertical photogrammetry Targeted GNSS Monitoring Stations Targeted visual surface inspections	Integrated Subsidence Monitoring Program Safety Warning Signage (in consultation with NPWS) MW13-16 Master Trigger Action Response Plans (see Appendix 8)
Pagodas within a 26.5 degree angle of draw of the Airly underground mine workings (other than pagodas affected by the New Hartley interaction zone)				
Minor Cliffs				
Steep slopes				
All other land not covered by a performance measure above	No greater subsidence impacts or environmental consequences than predicted in the EIS			

4.3 Biodiversity Management Plan

The Biodiversity Management Plan for MW13-16 (MW13-16 BMP) has been developed as a key component of the Extraction Plan in accordance with Condition 7.(i)(iv) in Schedule 3 of SSD_5581, and is contained in Volume 3 of this Extraction Plan.

The Biodiversity Management Plan was informed by a Baseline Ecology Assessment developed by RPS for the EP Area with the purpose of reviewing the relevant biodiversity information within the region.²⁷

The purpose of the Biodiversity Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on aquatic and terrestrial flora and fauna²⁸ affected by the secondary extraction of MW13-16.

The biodiversity features managed by the MW13-16 BMP for the EP Area are detailed in **Table 4.4** along with their relevant management plan and monitoring programs.

Table 4.4: Biodiversity Performance Measures, Indicators, Monitoring and Management

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Threatened species, threatened populations, EECs and Groundwater Dependent Ecosystems (GDEs), with the exception of those listed below	Negligible environmental consequences	Evidence of subsidence impacts compared to baseline records	Terrestrial Ecology monitoring is undertaken in accordance with the Airly Mine BMP (site wide management plan) Aquatic Ecology monitoring is undertaken in accordance with Section 4.5.2 of the WMP	Integrated Subsidence Monitoring Program In accordance with BMP / WMP Trigger Action Response Plans (BMP / WMP Appendix E) MW13-16 Master Trigger Action Response Plans (see Appendix 8)

²⁷ See Attachment H – Technical Report: Biodiversity (RPS, 2021)

²⁸ With a specific focus on threatened species populations and their habitats, Endangered Ecological Communities (EEC) and Groundwater Dependent Ecosystems (DGE's)

4.4 Heritage Management Plan

As agreed in consultation with DPIE, a dedicated Heritage Management Plan (Condition 7i (vi)) is not considered relevant to the current Extraction Plan and is not proposed to be submitted, as there are no known Historic or Aboriginal & Cultural Heritage sites located within the Principal Subsidence Management Area of the proposed EP Area (i.e. area of secondary extraction, 20mm subsidence line). The following section outlines the Baseline Heritage Assessment undertaken for the project and relevant Aboriginal heritage monitoring and management provisions from the existing approved Western Region Aboriginal Cultural Heritage Management Plan.

Heritage Management regarding both Historic and Aboriginal Heritage for the Point Hatteras PPMZ is required to meet the conditions outlined in Condition 18-19 in Schedule 4 of SSD_5581 as well as the appropriate planning instruments, as follows:

- **Schedule 4 Condition 18:** Unless otherwise authorised under the National Parks and Wildlife Act 1974, the Applicant must ensure that the development does not cause any direct or indirect impact on identified Aboriginal sites.
- **Schedule 4 Condition 19:** Requires that an ACHMP include measures for protecting, monitoring and/or managing Aboriginal and historic heritage items, managing the discovery of previously unidentified Aboriginal items on site, conserving the sites outside the surface disturbance area, maintaining and managing reasonable access for Aboriginal stakeholders to heritage items on site, ongoing consultation with the Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage on site.
- The appropriate monitoring outlined in the Western Region Aboriginal Cultural Heritage Management Plan (ACHMP), as per SSD_5581.

The ACHMP has been prepared to provide Centennial with a consistent approach to Centennial's consultation with the local Aboriginal communities regarding Aboriginal cultural heritage matters as well as identifying consistent minimum standards and processes for Aboriginal cultural heritage identification, monitoring and management across Centennial's western operations, including the project area.

As outlined in the ACHMP, a Baseline Recording is required prior to the site being undermined. Subsequently, a Baseline Heritage Assessment has been developed by RPS for the EP Area with the purpose of reviewing the relevant heritage information to identify heritage items within the region.²⁹

PRS has previously conducted heritage field surveys in a number of locations within the Project Area. The RPS Baseline Heritage Assessment included a full desktop review of the previous field data collected and reports and plans relevant to the Project Area. Documents reviewed are as follows:

- Baseline Historic Heritage Assessment (RPS 2013)
- Aboriginal Cultural Heritage Assessment (RPS 2013)
- Airly Mine Extension Project Impact Assessment (RPS 2013)
- Airly REF Aboriginal Due Diligence Assessment (RPS 2016)
- Aboriginal Cultural Heritage Management Plan (Western Region) (RPS 2017, RPS 2020)
- Aboriginal Cultural Heritage Management Plan (ML1331) (RPS 2018)
- Historic Heritage Management Plan (Western Region) (RPS 2020)
- Aboriginal Heritage Due Diligence Assessment, Airy Subsidence Lines (RPS 2018)

²⁹ See Attachment I – Technical Report: Heritage (RPS, 2021)

Furthermore, the following registers were used to search, on 3 June 2021, for heritage items within the Airly Mine project boundary:

- Lithgow City Council LEP (Schedule 5);
- Mid Western Regional Council LEP;
- Commonwealth Heritage Register;
- NSW State Heritage Register (SHR); or
- s170 registers (state owned items).

The Baseline Heritage Assessment confirmed that Aboriginal and European heritage sites are located within the Airly Mine project boundary (i.e., including areas beyond the current EP Area), as follows:

- 24 sites registered on the Aboriginal Heritage Information Management System (AHIMS);
- 1 general heritage item, and 33 archaeological heritage items that are listed under the Lithgow City Council LEP (Schedule 5)

Previously registered AHIMS sites and historic archaeological sites were groundtruthed in 2020. RPS identified that no archaeological sites are located within the Project Area, even though the boundary of historic archaeological items permeates the western boundary of the Project Area.

None of the European heritage sites within the Airly Mine project boundary, as searched on 3 June 2021, are located within the EP Area. One Aboriginal heritage sites is located within the Extended Monitoring and Management Area of the overall EP Area (AHIMS 45-1-0167).

AHIMS 45-1-0167 will not be undermined and is located beyond the 26.5 degrees Angle of Draw area (i.e. there is no influence of subsidence predicted at this location), therefore it is considered extremely unlikely that the site would be impacted by mining.

As informed by the RPS Baseline Assessment, 1 Aboriginal Heritage item consisting of a Rock Shelter (AHIMS 41-1-0167) has been identified within the EP Area and is considered Extremely High cultural significance rank by the Registered Aboriginal Parties (RAPs) in the Western Region Aboriginal Cultural Heritage Management Plan (RPS 2017, 2020). This site was also attributed a high scientific (archaeological) significance rank both locally and regionally.

AHIMS 45-1-0167 will be monitored according to the Western Region ACHMP mitigation measures and management protocols as detailed in **Table 4.5**.

Table 4.5: Heritage Performance Measures, Indicators, Monitoring and Management

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
AHIMS 45-1-0167	Negligible consequences to feature	Nil surface cracking/exfoliation of the feature	Undertake monitoring as per ACHMP (2020)	Refer to ACHMP (2020)

4.5 Built Features Management Plan

The Built Features Management Plan for MW13-16 (MW13-16 BFMP) has been developed as a key component of the Extraction Plan in accordance with Condition 7.(i)(ii) in Schedule 3 of SSD_5581, and is contained in Volume 3 of this Extraction Plan.

The purpose of the Built Features Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on built features affected by the secondary extraction of MW13-16.

As required, the BFMP has been prepared in consultation with relevant stakeholders and infrastructure owners to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings.

The built features managed by the MW13-16 BFMP for the EP Area are detailed in **Table 4.6** along with their relevant management plan and monitoring programs.

Table 4.6: Built Features Performance Measures, Indicators, Monitoring and Management

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Airly Turret Communication Tower	- Always safe and serviceable - Damage must be fully repairable, and must be fully repaired	Presence/absence of mine-induced damage or change to features (no signal strength decrease or loss of service)	Vertical subsidence (mm) Horizontal displacement (mm) Tilt (mm/m) at base of tower Targeted GNSS Monitoring Stations	Integrated Subsidence Monitoring Program In accordance with MW13-16 Master Trigger Action Response Plans (see Appendix 8)
Nissen Hut	- Always safe and serviceable, unless otherwise agreed with the owner - Damage must be fully repairable, and must be fully repaired	Presence/absence of damage or change to Nissen Hut and outhouse	Structural Integrity Report Structural movement of Nissen Hut Ground movements Dam Water level (mAHD)	Integrated Subsidence Monitoring Program In accordance with MW13-16 Master Trigger Action Response Plans (see Appendix 8)
Walking and 4WD tracks	- Use should be maintained wherever practicable in consultation with BCD - Damage must be fully repairable and must be fully repaired	Presence/absence of mine-induced damage or change to features (significant rock falls and surface cracking) Various Parameters relevant to each method	3D oblique photogrammetry Stereo vertical photogrammetry Targeted GNSS Monitoring Stations Targeted visual surface inspections	Integrated Subsidence Monitoring Program Safety Warning Signage (in consultation with NPWS) MW13-16 Master Trigger Action Response Plans (see Appendix 8)

4.6 Public Safety Management Plan / Principal Hazard Management Plan

The Public Safety Management Plan for MW13-16 (MW13-16 PSMP) has been developed as a key component of the Extraction Plan in accordance with Condition 7.(i)(vii) in Schedule 3 of SSD_5581, and is contained in Volume 3 of this Extraction Plan.

The purpose of the Public Safety Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts that may affect public safety, specifically from the secondary extraction of MW13-16.

Panel and pillar mining within the EP Area is not considered a principal hazard.³⁰ Notwithstanding, the Public Safety Management Plan has also been prepared with consideration of the requirements of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* (Clause 23 and 24) to manage subsidence as principal mining hazard. Regulatory requirements applicable to the development of the Public Safety Management Plan to manage subsidence related risks to public safety, including to private property and public infrastructure are outlined in the Public Safety Management Plan.

The performance measure for public safety requires negligible additional risk, in consultation with the Resources Regulator and BCD. It is not expected that there would be any adverse impacts on natural and built surface features within the EP Area which have relevance to public safety. In addition to the Public Safety Management Plan, the features identified within the EP Area relevant to public safety are also managed under other supporting plans as noted in **Table 4.7**.

Table 4.7: Public Safety Features within the EP Area and Relevant Management Plans

Feature	Identification and Assessment	Management and Monitoring ^a
Cliffs, minor cliffs and pagodas	Attachment C – Subsidence and Environmental Risk Assessment (EP Area) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)	Land Management Plan for MW13-16 Subsidence Monitoring Program for MW13-16 Trigger Action Response Plan for MW13-16
Mugii Murum-ban SCA, including Steep Slopes and Rock Outcrops	Attachment C – Subsidence and Environmental Risk Assessment (EP Area) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)	Land Management Plan for MW13-16 Subsidence Monitoring Program for MW13-16 Trigger Action Response Plan for MW13-16
Walking and 4WD tracks	Attachment C – Subsidence and Environmental Risk Assessment (EP Area) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)	Built Features Management Plan for MW13-16 Subsidence Monitoring Program for MW13-16 Trigger Action Response Plan for MW13-16
Airly Turret Communication Tower	Attachment C – Subsidence and Environmental Risk Assessment (EP Area) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)	Built Features Management Plan for MW13-16 Subsidence Monitoring Program for MW13-16 Trigger Action Response Plan for MW13-16
Nissen Hut	Attachment C – Subsidence and Environmental Risk Assessment (EP Area) Attachment F – Technical Report: Subsidence Assessment (MSEC, 2021)	Built Features Management Plan for MW13-16 Subsidence Monitoring Program for MW13-16 Trigger Action Response Plan for MW13-16

a) in addition to the Public Safety Management Plan for MW13-16 (MW13-16 PSMP)

³⁰ See Section 2.1.2, sub-heading Subsidence as a Principal Hazard

4.7 Subsidence Monitoring Program

An integrated Subsidence Monitoring Program for MW13-16 (MW13-16 SMP) has been developed as a component of the Extraction Plan in accordance with Condition 7.(i)(i) in Schedule 3 of SSD_5581.

The purpose of the Subsidence Monitoring Program is to set out the program for monitoring the subsidence movements and effects associated with second workings within the EP Area and to provide consolidated summaries of monitoring for natural and built features.

Table 4.8 provides a summary of the subsidence monitoring program that will be undertaken to monitor and manage the effects of subsidence within the EP Area. **Table 4.9** provides a summary of the monitoring program for natural and built features within the EP Area.³¹

All forms of subsidence monitoring will be undertaken by appropriately qualified and experienced personnel. The results from the subsidence monitoring program will be evaluated by appropriately qualified and experienced personnel against the performance measures and subsidence predictions.

Table 4.8: Subsidence Monitoring Program Summary

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
Underground Mine Control (MW13-16 SMP)	Confirm that formation of underground workings for development and extraction is implemented as per approved designs	Underground survey of chain pillar / workings as completed in the active panel Visual inspections Overlay of 'as built' pillars (as surveyed) against designs	<u>During mining:</u> Up to weekly in active working areas during mining <u>Post Mining:</u> Final inspection of pillars at completion of active panel, additional post mining inspections for accessible pillars in the Extended Monitoring and Management Area (Cliff Line Zone of First Workings)
Airly Mine GNSS Monitoring Stations (MW13-16 SMP)	Continuous occupation monitoring, including for baseline, at key locations / surface features (e.g. large cliffs, valley closure measurements, built features, public access areas, pseudo 'transverse' and 'longitudinal' lines)	Continuous near real time point data (raw data set at 10 second intervals) using the Global Navigation Satellite System (GNSS)	<u>Baseline:</u> Installed September 2021, continuous data from installation through to commencement of secondary extraction of nearest panel (i.e. some stations far from MW13 will continue to provide baseline until mining comes nearer) <u>During mining:</u> Continuous throughout extraction MW13-MW16 <u>Post Mining:</u> GNSS stations will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) following completion of panels MW13-MW16

³¹ See Volume 3: Component Management Plans for further details

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
Prism Monitoring (MW13-16 SMP)	Provide accurate survey of vertical and horizontal movements from secondary and potential structural movement to ensure within modelled predictions	Radiations using Total Stations to prisms on Nissen Hut, tied to GNSS point control at GNSS1 (remote station beyond mining area on NE of Mt Airly)	<u>Baseline:</u> Resurveyed twice following installation, then prior to secondary extraction commencing in MW13. <u>During mining:</u> Following extraction of MW13, MW14 and MW15B. <u>Post Mining:</u> Final Survey 12 months after completion of final panel MW15B
Conventional 3D Subsidence Survey Points (MW13-16 SMP)	Provide accurate survey of vertical and horizontal movements from secondary and potential structural movement to ensure within modelled predictions	Surveys by Traversing (Standard 1)	<u>Baseline:</u> Resurveyed twice following installation, then prior to secondary extraction commencing in MW13. <u>During mining:</u> Following extraction of MW13, MW14 and MW15B. <u>Post Mining:</u> Final Survey 12 months after completion of final panel MW15B
Tilt sensor (MW13-16 SMP)	Continuous accurate information on tilt-related movements in near real time at the Airly Turret Emergency Communications Tower	Continuous near real time point data (raw data set at daily intervals)	<u>Baseline:</u> Installed September 2021, continuous data from installation through to commencement of secondary extraction of nearest panel MW13. <u>During Mining:</u> Continuous throughout extraction MW13-MW16 <u>Post Mining:</u> Tilt Meter sensor will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) and for at least 12 months after completion of final panel MW15B
Stereo Vertical Photogrammetry (MW13-16 SMP)	Differential subsidence measure between each monitoring event ('epochs') across large areas. Vertical subsidence movements monitoring of 'broad-area' (typically >50mm at high confidence levels) relative to previous monitoring events ('epochs')	High Resolution (35mm x 35mm pixel size) Stereo Vertical Photogrammetry georeferenced to GNSS monitoring stations	<u>Baseline:</u> At least three surveys undertaken prior to miniwall extraction. <u>During Mining:</u> At least one survey throughout extraction MW13-MW16 <u>Post Mining:</u> At least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
3D Oblique Photogrammetry (MW13-16 SMP)	Presence/absence of mine-induced damage or change to features (significant rock falls and surface cracking).	High Resolution (50mm x 50mm pixel size) 3D Oblique Photogrammetry	<u>Baseline:</u> At least three surveys undertaken prior to miniwall extraction. <u>During Mining:</u> At least one survey throughout extraction MW13-MW16 <u>Post Mining:</u> At least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).
Targeted visual surface inspection (MW13-16 SMP)	Complementary supportive monitoring	Visual inspection of relevant area/location where safely accessible	Only if triggered as per MW13-16 Master TARP triggers

Table 4.9: Natural and Built Feature Monitoring Program Summary

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
Surface water flow and quality (Airly Mine WMP)	Evidence of subsidence impacts compared to baseline records	Undertake surface water quality monitoring in accordance with section 4.2.2 of the WMP	Undertake surface water quality monitoring in accordance with section 4.2.2 of the WMP
Groundwater extraction, levels, quality (Airly Mine WMP)	Confirm impacts of mining are consistent with hydrogeological model predictions	Undertake groundwater quality monitoring in accordance with section 4.4.1 of the WMP	Undertake groundwater quality monitoring in accordance with section 4.4.1 of the WMP
Stream Health (Airly Mine WMP)	Evidence of subsidence impacts compared to baseline records	Undertake stream health monitoring in accordance with section 5.4.1 of WMP	Undertake stream health monitoring in accordance with section 5.4.1 of WMP
Cliffs, Minor Cliffs & Pagodas (MW13-16 LMP and MW13-16 PSMP)	Presence/absence of mine-induced damage or change to features (significant rock falls and surface cracking) Various Parameters relevant to each method	3D oblique photogrammetry, and Stereo vertical photogrammetry	Remote aerial monitoring is undertaken at approximately six-month intervals. At least three surveys will have been undertaken prior to miniwall extraction. At least one survey throughout extraction MW13-MW16 and at least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
		Targeted GNSS Monitoring Stations	Installed September 2021, continuous data from installation, throughout extraction of MW13-MW16 and will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) following completion of panels MW13-MW16
		Targeted visual surface inspections	Only if triggered as per MW13-16 Master TARP triggers
General Land Surface (excl. cliffs and pagodas) (MW13-16 LMP and MW13-16 PSMP)	Evidence of subsidence impacts compared to baseline records	3D oblique photogrammetry, and Stereo vertical photogrammetry	Remote aerial monitoring is undertaken at approximately six-month intervals. At least three surveys will have been undertaken prior to miniwall extraction. At least one survey throughout extraction MW13-MW16 and at least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).
		Targeted GNSS Monitoring Stations	Installed September 2021, continuous data from installation, throughout extraction of MW13-MW16 and will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) following completion of panels MW13-MW16
		Targeted visual surface inspections	Only if triggered as per MW13-16 Master TARP triggers
The Grotto (MW13-16 LMP)	Evidence of subsidence impacts compared to baseline records	3D oblique photogrammetry, and Stereo vertical photogrammetry	Remote aerial monitoring is undertaken at approximately six-month intervals. At least three surveys will have been undertaken prior to miniwall extraction. At least one survey throughout extraction MW13-MW16 and at least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
		Targeted GNSS Monitoring Stations	Installed September 2021, continuous data from installation, throughout extraction of MW13-MW16 and will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) following completion of panels MW13-MW16
		Surface water flow and quality monitoring is undertaken in accordance with section 4.2.2 of the WMP	Surface water flow and quality monitoring is undertaken in accordance with section 4.2.2 of the WMP
Terrestrial Ecology (MW13-16 BMP)	Evidence of subsidence impacts compared to baseline records	Terrestrial Ecology monitoring is undertaken in accordance with the Airly Mine BMP (site wide management plan)	Terrestrial Ecology monitoring is undertaken in accordance with the Airly Mine BMP (site wide management plan)
Aquatic Ecology (MW13-16 BMP and Airly Mine WMP)	Evidence of subsidence impacts compared to baseline records	Aquatic Ecology monitoring is undertaken in accordance with Section 4.5.2 of the WMP	Aquatic Ecology monitoring is undertaken in accordance with Section 4.5.2 of the WMP
AHIMS 45-1-0167 (Western Region ACHMP)	Evidence of subsidence impacts compared to baseline records	Monitoring procedures in accordance with the Western Region ACHMP	Only if triggered as per MW13-16 Master TARP triggers
Airly Turret Communication Tower (MW13-16 BFMP and MW13-16 PSMP)	Monitoring to ensure always safe and serviceable	Targeted GNSS Monitoring Stations	Installed September 2021, continuous data from installation, throughout extraction MW13-MW16 and will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) and for at least 12 months after completion of final panel MW15B
		Tilt sensor	Installed September 2021, continuous data from installation, throughout extraction MW13-MW16 and will remain in-situ until consistent results are obtained demonstrating completion of major subsidence movement (i.e. within survey error) and for at least 12 months after completion of final panel MW15B

Monitoring Component / Feature (Management Plan)	Purpose/Parameter	Monitoring Method	Frequency & Duration
Nissen Hut (MW13-16 BFMP and MW13-16 PSMP)	Evidence of subsidence impacts compared to baseline records	Conventional 3D Subsidence Survey Points	To be resurveyed at least twice following installation and prior to secondary extraction commencing in MW13. Survey following extraction of MW13, MW14 and MW15B, with a final Survey 12 months after completion of final panel MW15B
		Tilt sensor	To be resurveyed at least twice following installation and prior to secondary extraction commencing in MW13. Survey following extraction of MW13, MW14 and MW15B, with a final Survey 12 months after completion of final panel MW15B
Walking and 4WD tracks (MW13-16 BFMP and MW13-16 PSMP)	Evidence of subsidence impacts compared to baseline records	3D oblique photogrammetry, and Stereo vertical photogrammetry	Remote aerial monitoring is undertaken at approximately six-month intervals. At least three surveys will have been undertaken prior to miniwall extraction. At least one survey throughout extraction MW13-MW16 and at least one survey will be undertaken following completion of panels MW13-MW16. No further detailed analysis after post mining survey has indicated negligible impacts (in the undermined area).
		Targeted visual surface inspections	Only if triggered as per MW13-16 Master TARP triggers

5 IMPLEMENTATION

5.1 Trigger Action Response Plans

A detailed Master Trigger Action Response Plan for MW13-16 (MW13-16 Master TARP) has been developed for the Extraction Plan to reflect the commitments of this Extraction Plan and supporting management plans³². Whilst impacts are not predicted nor expected, the MW13-16 Master TARP provides a process of tiered and escalating trigger levels for contingency measures should measures should subsidence and impacts be greater than predicted/approved. The MW13-16 Master TARP applies only to the EP Area (separate TARPs apply to other established EP Areas in various approved mining zones).

Given the mine design specifically to avoid impacts, the MW13-16 Master TARP includes detailed measures for **Underground Mining Controls** to ensure that the mining geometry is formed as per the approved design specifications that determine the predicted subsidence movements and impacts.

Detailed performance indicators to meet Performance Measures set by development consent SSD_5581 are outlined in the Subsidence Monitoring Program for MW13-16 (MW13-16 SMP) and incorporated into relevant aspects of the MW13-16 Master TARP. The contingency plan where a performance indicator has been exceeded is outlined in the MW13-16 Master TARP. A trigger will result in additional investigations to determine if the exceedance is related to non-mining-factors or is a consequence of mining activity. The response to these exceedances will follow the MW13-16 Master TARP. Management/ corrective actions can be implemented where required to remedy these non-conformities and report accordingly.

5.2 Adaptive Management

5.2.1 Centennial Coal Adaptive Management Framework

An Adaptive Management Framework provides for flexible decision making, adjusted to consider uncertainties as management outcomes are understood.

Through feedback to the management process, the management procedures are changed in steps until monitoring shows that the desired outcome is obtained. The monitoring program has been developed so that there is statistical confidence in the outcome.

In adaptive management the goal to be achieved is set, so there is no uncertainty as to the outcome, and conditions requiring adaptive management do not lack certainty, but rather they establish a regime which would permit changes, within defined parameters, to the way the outcome is achieved.

The Centennial Coal Adaptive Management Framework is a process of ongoing testing, learning, monitoring and managing and relies on:

- Description of the environmental value and its role in the landscape, including aspects of an operation that may result in a significant impact to the environmental value (not all aspects of a project will generate impacts);
- A model of the environmental response to certain management actions/decisions, supported by the description of the environment;
- Mechanisms to test the model;
- Engagement with relevant stakeholders in the description of the environment and development of models, model outcomes and management actions/decisions;
- Identification of clear management objectives for each environmental value;

³² See Appendix 8

- Monitoring the system using best available technologies and multiple lines of evidence to:
 - Evaluate progress against objectives;
 - Determine the status of the system;
 - Increase our understanding of the system; and
 - Refine the modelling where applicable.

5.2.2 Adaptive Management Strategy for Airly Mine

Airly Mine has sought to eliminate risks and avoid potential impacts to surface features, as the most effective form of management on the risk hierarchy, through an extensive mine design process.³³ Progressive implementation and monitoring of mining within the approved mining zones during the mine schedule affords further opportunity and flexibility for adaptive management if required.

The adaptive management approach at Airly Mine involves monitoring and evaluation against performance measures and associated indicators in the *Master Trigger Action Response Plans for MW13-16 (MW13-16 Master TARP)* established for the extraction plan and supporting management plans.

Where performance indicators indicate increasing levels of risk (i.e., where relevant thresholds of conditions green, amber or red are being exceeded), escalating adaptive management measures are engaged in accordance with the MW13-16 TARP. The process has been successfully implemented in existing Extraction Plan areas at Airly Mine and has been updated to reflect EIS commitments and consent requirements for the Airly Mine Extension Project, including specific performance measures.

In accordance with Condition 7 (Adaptive Management) in Schedule 6 of SSD_5581, where any exceedance of applicable maximum criteria and/or performance measures has occurred (Condition Red), Centennial will at the earliest opportunity:

- a) Take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur
- b) Consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
- c) Implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

Adaptive management measures would follow failure/root cause analysis where appropriate (including review of any observed impacts in EP Areas for potential mining induced causes, acknowledging the dynamic natural environment such as cliffs), and would be undertaken in consultation with relevant stakeholders, and involve review of this management plan.

Centennial Airly's approach to adaptive management allows for modifications to be made to the mine design in the event that performance measures are not met. The mine design is conservative enough in terms of subsidence that changes can be made to the underground operations should impacts be outside the predicted levels before any significantly adverse impact actually occurs. If required, the following actions could be used in isolation or in various combinations to adapt the mine workings to avoid adverse impacts:

- Avoid mining under sensitive surface features by increasing horizontal offsets from major features or relocating the underground mining equipment.
- Changing the dimension of pillars or void widths / adjust roadway widths to ensure total extracted span and pillar sizes are within appropriate limits.

³³ See Section 3.1

- Review and upgrade operational control and communication systems (including Development and Extraction Control Procedures).
- Review and undertake appropriate monitoring.

Each of these actions has the potential to have a significant impact on the feasibility of the operation, and would only be undertaken as a considered response to impacts outside predicted values. It is noted that the mine design has been modified from that proposed in the EIS and already includes an increase in the size of protection zones by commencing or stopping extraction further away from sensitive features than planned and significantly larger pillar sizes.

5.3 Remediation / Rehabilitation of Potential Impacts

Due to the minimal subsidence expected the need to implement remediation/rehabilitation measures for potential impacts are considered unlikely. However, in the event that remediation is required, Airly Mine will undertake remediation in accordance with:

- Conditions 7a)-7c) in Schedule 6 of SSD_5581, noting in particular the requirement to submit a report to DPIE describing remediation options and any preferred remediation measures or other course of action;
- Any relevant actions prescribed in the *MW13-16 Master TARP* developed for this Extraction Plan (or other relevant plans of management);
- The current Mining Operations Plan and Rehabilitation Management Plan; and
- In consultation with key stakeholders including any affected land holders and relevant government agencies.

A Response Strategy will be adopted if a significant impact is detected as a result of mining activities within the Extraction Plan area.

5.4 Reporting and Notifications

Reporting is undertaken in accordance with the requirements of specific requirements of relevant approvals and licences including SSD_5581, EPL12374 and EPBC 2013/.7076, and generally in accordance with the Guidelines for the Preparation of Extraction Plans ('EP Guidelines', DP&E, 2015). Additionally, high potential incident notifications for unexpected subsidence events in relation to the safety of other persons under WHS legislation has also been included.³⁴

Airly will submit the following reports as summarised in **Table 5.1** during the secondary extraction as relevant to management of land, and detailed further within the Extraction Plan main document. The frequency of reporting is proposed to be proportionate and reflective of the nature of the current EP Area and no predicted surface impacts with negligible ground movements.³⁵

Table 5.1: Reporting and Notification Requirements

Report	Triggers	Relevant Statutory Conditions	Requirements
Notification of Controlled Action Commencement	Commencement of Controlled Action EPBC 2013/7076	Condition 2 of EPBC 2013/7076	- DoEE to be notified in writing of date of commencement of controlled action (including first workings), required within fourteen (14) days after commencement. Note: This condition has been satisfied by Centennial Airly as per details below in footnote 2).
Website Publication	Approval of the management plan by the Minister (DPIE); Advice /reports received from the IEP (relevant to this management plan); Completion of the Annual Review Receipt of complaint relating to aspects covered by this Extraction Plan	Condition 7 of EPBC 2013 / 7076 (1 month) Schedule 6, Condition 14(a) of SSD_5581 Schedule 6, Condition 10 of SSD_5581 Schedule 6, Condition 2(g) of SSD_5581	- Copy of this management plan to be published on Centennial Airly website within one (1) month of approval by the Minister (DoEE) and kept up to date (DPIE). - Any advice/reports (relevant to this management plan) issued by the IEP are to be published on the Centennial Airly website. - Comprehensive summary of monitoring results of the development. - The last five (5) Annual Reviews to be published on Centennial Airly website. - Protocol for managing complaints (register updated monthly). - Complaints register published on website.
Incident ¹ - Reporting	Any set of circumstances that causes or threatens material harm to the environment; and/or breaches or exceeds the limits or performance measures/criteria in development consent SSD_5581 ¹ .	Consent condition 9 (Schedule 6) of SSD_5581.	- Detailed report to be provided to DPIE on the incident within seven (7) days of the incident - Secretary of DPIE and any other relevant agencies to be notified immediately (including DPIE, EPA and DoEE) if material harm to the environment is threatened or caused. - Includes non-compliance with any statutory requirements or exceedance of performance measures.
	Any incident ¹ relating to land in accordance with consent condition 9 (Schedule 6), EPL12374 condition R2, EPBC 2013/7076 Condition 1, or as triggered by the TARP (reporting incidents under Management Plans as	EPBC 2013/7076 Condition 1, or as triggered by the TARP (reporting incidents under Management Plans as per Schedule 6, Condition 2 of SSD_5581).	- Any additional notifications and reporting as per relevant approved TARP, including actions being undertaken to prevent recurrence. - The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the POEO Act. As per R2.1 of the EPL, notifications to EPA must be made by phoning the Environment Line service on 131 555.

³⁴ Notification requirements relating to injuries (if relevant) are managed separately under the Airly Mine Safety Management System (SMS).

³⁵ The approach is consistent with Section 6 of the EP Guidelines and undertaken for previously approved extraction plans at Airly Mine.

Report	Triggers	Relevant Statutory Conditions	Requirements
	per Schedule 6, Condition 2 of SSD_5581).	EPL12374 condition R2	The licensee must provide written details of the above notification to the EPA within 7 days of the date on which the incident occurred, as per R2.2 of EPL.
Duty to notify Resource Regulator of certain incidents - High Potential Incident' Reporting (WHS legislation)	High Potential Incidents ³ that relate to this Extraction Plan	WHS Regulation (Mines and Petroleum Sites, 2014) Clause 128 - <i>Duty to notify regulator of certain incidents</i> Section 6 of the Guidelines for Managing Risks of Subsidence (WHS (Mines and Petroleum Sites), February 2017	Respond in accordance with Clause 128 (1): - all reasonable steps must be undertaken to ensure that the regulator is notified after becoming aware of an incident (other than a notifiable incident defined by the Regulations -refer the Safety Management System for details): - Notifications in accordance with the WHS Guide "Notification of Incident and Injury" (April 2018) as per 'Other Incident' category, including: - Notification must be as soon as possible and: - in the case of a high potential incident that resulted in an injury or illness, no later than 48 hours after becoming aware the incident resulted in an injury or illness, or - no later than 7 days after becoming aware of the incident (whichever is earlier). - Notification must be in writing using the Notification of incident and injury form. - Notify key stakeholders including DPIE, NPWS as soon as practicable of the above. Note: Whilst unexpected, should an incident actually occur which causes injury (as defined by Clause 13 Sch9) separate priority notifications apply in accordance with WHS requirements and the mine SMS.
Subsidence Impacts and Environmental Monitoring Report	Reporting of all impacts and environmental monitoring results annually in a combined report with previous EP reporting for which the same survey is performed (i.e. reporting following completion of aerial surveys).	Condition 10, Schedule 6 of SSD_5581 Section 6 of DP&E EP Guidelines	This report will include: - a comprehensive summary of all impacts, including: - A summary of integrated subsidence monitoring program results (conventional, remote⁴ and underground monitoring); - Results of related environmental monitoring where applicable; - An assessment of impact compliance (if impacts remained within predictions, any which exceed predictions but remained with performance measures and/or performance indicators, and if any impacts exceeded performance measures of consent). - Details of any observed impacts (including full description, location identification using aerial photos and mining layout, photos, targeted inspection results (including photos) and characterisation of the impact in accordance with the relevant TARP). - Details if impacts were likely mining-induced. - Actions to be undertaken to prevent recurrence of any mining induced impacts; - a comprehensive summary of relevant quantitative and qualitative environmental monitoring results. - Any revisions to the TARP undertaken in consultation with stakeholders. - Any other adaptive management measures as relevant

Report	Triggers	Relevant Statutory Conditions	Requirements
Annual Review	Annual Review report required under development consent condition 11 (Schedule 6), SSD_5581.	Condition 11 (Schedule 6), SSD_5581	Report to include: - All aspects detailed in Condition 11(a)-(f), Schedule 6 of consent (detailed in the Extraction Plan and Subsidence Monitoring Program) as relevant to this document. - Information presented in the above periodic Subsidence Impacts and Environmental Monitoring Reports (as per the EP Guidelines); - The review is required to be submitted by 31st March each year unless otherwise agreed by the Secretary (DPIE). Copies of the last five (5) reviews to be published on Centennial Airly website as per Condition 14, Schedule 6 of consent.
Annual Controlled Action Compliance Report (EPBC 2013/ 7076)	Annual report required under EPBC 2013 / 7076	Condition 4 of EPBC 2013 / 7076.	- Compliance report published on Centennial Airly website within 3 months of every annual (12 month) anniversary of commencement of controlled action (first workings). - Details of report in accordance with Condition 4 of EPBC 2013/7076. - Documentary evidence providing proof of date of publication to website and non-compliance with any conditions to be provided to the Department (DoEE) at same time the compliance report is published.
Formal Notification of SCA Access to Mudgee NPWS Office	Contractor requiring monitoring access to the SCA	Routine (or other) monitoring	Notification of proposed access dates/times to be provided to NPWS Area Office in Mudgee prior to accessing the Mugii Murum-ban SCA.

Notes:

- The above table is not intended to and does not represent reporting and notification requirements defined by WHS legislation other than that noted above (including all other 'notifiable incidents') – refer the mine Safety Management System (SMS) for all such requirements. High Potential Incidents under the WHS in relation to subsidence are identified and defined above. Incidents under Development Consent SSD_5581 are defined as "A set of circumstances that causes or threatens material harm to the environment; and/or breaches of exceeds the limits or performance measures/criteria in this consent".
- EPBC Approval 2013/7076 was received from DoEE on 18th May 2017. Centennial Airly provided written notice to DoEE on 29th May 2017 advising the date for commencement of controlled action as Saturday 20th May 2017. For clarity, the notification applies to the entire development consent approval area and was satisfied for activities undertaken in relation to a previous Extraction Plan.
- High Potential Incidents that relate to this Extraction Plan are defined by Clause 128 (5) (a) as:

'an event referred to in clause 179 (a) (i)-(xviii) that would have been a dangerous incident if a person were reasonably in the vicinity at the time when the incident or event occurred and in usual circumstances a person could have been in that vicinity at that time, relevant Dangerous Incidents listed in Clause 179(a)(i)-(xviii) include:

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'.

And Clause 128 (5) (m) as:

'Any indication from monitoring data of the development of subsidence which may result in damage to any plant or structure or a failure of ground
- The intention of reporting for aerial/remote monitoring results will be to provide relevant and focused reporting and analysis for both mined and unmined areas within the EP Area in each reporting period, whilst assembling significant raw data sets for the entire EP Area which can be further interrogated if required/triggered. Significant raw data collected from high definition LiDAR and high-resolution 3D photogrammetry throughout the EP Area will initially be processed to detect potential changes relevant to baseline and performance measures/indicators (the process and results of which will be summarised in reports). Detailed analysis and reporting will subsequently be focused on areas mined within each reporting period (including specific features undermined) and if/where change has been detected (including within unmined areas where natural rock falls may occur and within previously mined areas). Detailed analysis and reporting on each and every feature located within the entire EP Area is not intended to be undertaken, although noting aerial monitoring survey data is held for such wherever required.

5.5 Review and Auditing

5.5.1 Review Triggered by Planning and Environmental Approval Requirements

In accordance with Schedule 6 in Condition 3 of SSD_5581, as a minimum Airly will review this Plan within three months of the following:

- Submission of an incident report;
- Submission of an Annual Review (required 31 March annually);
- Submission of an Independent Environmental Audit; or
- Any modification to the conditions of SSD_5581.

Where this leads to revisions of the document, within four (4) weeks of the review the revised document must be submitted to DPIE for the approval of the Secretary. Continual improvement shall be achieved through monitoring, internal and external communication with stakeholders, implementation of corrective and preventative actions and through monitoring progress against the objectives included in the environmental management plans. The reporting framework³⁶ will document the effectiveness of this Extraction Plan (and the supporting Management Plans) through comparison of the predicted negligible impacts of subsidence against actual outcomes.

Each variation to this Plan will be identified in the Document Control Table at the beginning of this document.

Additionally, to maintain consistency with existing management plans and previous Extraction Plans at the mine, relevant component plans will also be reviewed in the event that the following occur:

- Stakeholders raise issues that necessitate a review;
- There are other changes to management requirements (e.g. changes to other related approvals besides consent, such as Mining Lease and/or EPL conditions);
- Where unpredicted impacts or consequences have required implementation of contingency actions under this plan; or
- Monitoring or audit processes demonstrate that a review is warranted.
- Where otherwise triggered by the MW13-16 Master TARP.
- Where triggered by (or for) review of other related management plans (if applicable).
- Every three (3) years as a minimum (where not already triggered above);

Any amendments to relevant component plans will be undertaken in accordance with Consent/relevant approvals and in consultation with key relevant stakeholders where required. Following any significant changes a copy of the amended component plans will be forwarded to DPIE and the IEP.

5.5.2 Review Triggered by WHS Legislation Requirements

In addition to planning development consent requirements, Airly Mine must review and as necessary revise the risk control measures implemented for subsidence in accordance with Clause 10 of the *WHSMP Regulation (2014)*. This is primarily related to public safety which is management under the Public Safety Management Plan for MW13-16 (MW13-16 PSMP) and is also relevant to the Land Management Plan for MW13-16 (MW13-16 LMP) due to the landscape features which were identified as directly related to potential risk to public safety (including cliffs and pagodas).

³⁶ See Section 5.4

Monitoring and review processes³⁷ will provide essential feedback for:

- Detecting changes,
- Verifying the risk assessments previously conducted,
- Ensuring the effectiveness and reliability of risk control measures, and
- Supporting continual improvement and change management.

In accordance with the *Managing Risks of Subsidence Guideline* (NSWRR, 2017) in triggering and undertaking reviews the following will be considered:

- Risk control for subsidence should be reviewed and revised as necessary when:
 - (1) a significant change from the assumptions used or the results of risk assessments is detected;³⁸
 - (2) a significant change in the site-specific conditions is identified;³⁹
 - (3) there are early warnings of abnormal subsidence where significant surface or subsurface features exist;⁴⁰
 - (4) the control measure does not control the risk it was implemented to control so far as is reasonably practicable,
 - (5) a new relevant hazard or risk is identified,
 - (6) the results of consultation indicate that a review is necessary,
 - (7) an incident or notifiable incident has occurred, or
 - (8) the results of an audit indicate that a review is necessary
- key stakeholders must, so far as is reasonably practicable, be consulted and the following questions should be addressed:
 - (1) Have all subsidence hazards been identified?
 - (2) Is the mine operator's understanding of subsidence hazards still current and correct?
 - (3) Have the implemented risk control measures been working effectively?
 - (4) Are the risks of subsidence being adequately managed?
 - (5) Have there been any early warnings of changes from the results of risk assessments, which warrant corrective or proactive management actions or the commencement of emergency procedures?
 - (6) Have any incidents of subsidence occurred and what is the learning from the investigations of these incidents?
 - (7) Should the implemented risk control measures be revised according to the results of subsidence monitoring and review?

³⁷ Airly mine must ensure that any interpretation of subsidence information (e.g. reviewing the risk control measures for subsidence) is carried out only by a competent person.

³⁸ A change (from the assumptions used or the results of risk assessments) is significant if the implemented risk controls may become less effective or ineffective as a result of this change.

³⁹ A change in the site-specific conditions is significant if the implemented risk controls may become less effective or ineffective as a result of this change (e.g., identification of geological structures that may cause abnormal subsidence).

⁴⁰ In the context of subsidence risk management, the significance of surface or subsurface features is determined by the severity of the potential health and safety consequences if these features are adversely affected by subsidence

5.5.3 Periodic Auditing

Comprehensive Independent Environmental Audits of the entire approved development under development consent SSD_5581 are undertaken within 1 year of commencement and every 3 years thereafter (unless directed otherwise) in accordance with Conditions 12 and 13.

Auditing of any rehabilitation undertaken for the mine (including for subsidence if triggered) is undertaken in accordance with the Mining Operations Plan / Rehabilitation Management Plan under Condition 29 of development consent SSD_5581.

Additionally, in accordance with clause 15(c) of the WHSMP Regulation (2014), auditing will be undertaken in accordance with the Airly Mine Safety Management System (**SMS**), against the performance standards for measuring the effectiveness of all aspects of the SMS, including the methods, frequency and results of the audit process. The audit should also consider the following matters:

- (1) competency of the auditor,
- (2) the person responsible for ensuring the audit is conducted, and
- (3) the person responsible for implementing the results of the audit.

5.6 Roles and Responsibilities

The responsibility for implementation, monitoring and review of the Extraction Plan lies with the Technical Services Manager. The ultimate responsibility for the implementation of the Extraction Plan lies with the Mine Manager, who shall make appropriate resources available. The roles and responsibilities for the current Extraction Plan are outlined in **Table 5.2**.

Table 5.2: Key Personnel and Accountabilities

Position	Responsibility
Mine Manager	- Ensuring that sufficient resources are available to implement and execute the requirements of this Plan; and - Reporting triggers/non-conformances to external stakeholders.
Technical Services Manager	- Coordinate the implementation, monitoring and review of the Extraction Plan - Coordinate underground inspections and subsidence monitoring program associated with this EP and relevant component plans; - Coordinate implementation of the mine design and Master TARP. - Reporting triggers/non-conformances internally to the mine manager as appropriate. - Reporting to DPIE and NSW Resources Regulator of subsidence and pillar system performance upon completion of specified monitoring intervals.
Production Manager	- Implement mine design - Establish and maintain underground monitoring and inspections program; - Auditing as required
Mine Surveyor	- Survey as built initial development pillars - Establish and maintain subsidence monitoring program; - Internal reporting as required. - Mark up centre lines for driveage in pillars - Produce final mining plan for extraction workings to be carried out in consultation with the Technical Services Manager.
Environment and Community Coordinator	Implementation, monitoring and review of this plan, including: - The carrying out of targeted inspections; - The installation and maintenance of signage where required; - Reporting triggers/non-conformances internally to the Mine Manager as appropriate; - Consulting with land owners, landholders and managers regarding any land management issues arising from subsidence within the EP Area. This includes (but may not be limited to) NPWS, Office of Crown Lands and private landowners within the EP Area (if and as applicable); - Consultation during the review process with relevant stakeholders and distributing this EP and relevant component plans; - Coordinating any remediation work as required; - Inspecting targeted accessible areas susceptible to tensile and compressive strains and potential cracking as required (e.g. accessible tracks and trails); - Co-ordinating the generation and submission of formal reporting requirements outlined in this Plan; and - Reviewing this EP and relevant component plans.

6 REFERENCES

- Golder Associates (2014a). *Airly Mine Extension Project Environmental Impact Statement*, Golder Associates, April 2014
- Golder Associates (2014b). *Subsidence Predictions and Impact Assessment (SIA) for Airly Mine (127621105-003-R-Rev2)*, Golder Associates, January 2014
- Golder Associates (2014c). *Subsidence Impact Assessment on the Cliff Lines and Associated Landforms for Airly Mine. Report Number (127621105-001-R-RevA)*
- Golder Associates (2018). *Geotechnical Reference Report: Airly Mine. Report Number (127621105-341-R-Rev0)*
- MSEC (2015). *MSEC749 Peer Review of Airly Mine Subsidence Predictions and Assessments - letter 150318*.
- MSEC (2021). *MSEC1195 Airly Mine MW13 to MW16 – Subsidence Predictions and Impact Assessments for the Natural and Built Features over and near the Proposed MWs 13 to 16 in Support of the Extraction Plan Application*
- Independent Review Panel (2016). *Report of the Independent Review Panel Established to Report on Accuracy and Reliability Of Mine Subsidence Impacts On Sensitive Features Across The Airly Mine Extension Application Area*
- SCT (2021a). *Airly Mine: Subsidence and Pillar Geometry Modelling Assessment (Report No. AIRLY5240)*
- SCT (2021b). *Airly Mine Subsidence and Pillar Width Modelling Assessment – Point Hatteras Mining Area, Mt Genowlan (Report No. AIRLY5265)*
- Strata² (2020). *Panel and Pillar Mining Zone: Geotechnical Issues Related to the Update of the Extraction Plan for Miniwalls 7 to 9 (Report No: AIR-017-Rev0)*
- Strata² (2019a). *Panel and Pillar Mining Zone: Revised Subsidence Estimates and Impacts (Report No. AIR-006-Rev1)*
- Strata² (2019b). *Estimation of Surface Impacts (including Cliffs) due to the Extraction of Miniwalls 2 to 15' (Report No. AIR-004-Rev0)*

ABBREVIATIONS

BMP	Biodiversity Management Plan
CLZ	Cliff Line Zone of First Workings (approved mining zone under consent SSD_5581)
DP&E	NSW Department of Planning and Environment
DOC	Depth of Cover
ESU	Environmental Sustainability Unit, formerly within the Division of Resources and Geoscience (DRG), now within the NSW Resources Regulator within NSW DP&E.
EP	Extraction Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environment Protection License
ESU	Environmental Sustainability Unit (NSW Resources Regulator)
HHMP	Historic Heritage Management Plan
IEP	Independent Expert Panel (post-consent)
IRP	Independent Review Panel (pre-consent)
LCC	Lithgow City Council
LMP	Land Management Plan
MEP	Airly Mine Extension Project
ML	Mining Lease
MOD	Modification to Airly Mine's former Development Consent (DA162/91)
NPWS	NSW National Parks and Wildlife Service
NSW-RR	NSW Resources Regulator
OEH	NSW Office of Environment & Heritage
PPMZ	Partial Pillar Mining Zone (approved mining zone under consent SSD_5581)
PSMP	Public Safety Management Plan
SCA	State Conservation Area
SSD	State Significant Development
SMP	Subsidence Monitoring Program
SMZ	Shallow Mining Zone (approved mining zone under consent SSD_5581)
TARP	Trigger Action Response Plan
WMP	Water Management Plan