UG1 LONGWALLS 101 TO 103
EXTRACTION PLAN

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Approved: S.J. Archinal  Date: 30/03/2019
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Appendix G  UG1 Longwalls 101 to 103 Subsidence Monitoring Program (including Plans 1 to 7)

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Technical Report 1  Subsidence Report
Technical Report 3  Surface Water Technical Report
Technical Report 6  Subsidence Supplementary Report
Technical Report 7  Geotechnical Evaluation of 103 Plunge Panel
1.0 OVERVIEW OF THE EXTRACTION PLAN

1.1 MOOLARBEN COAL COMPLEX OVERVIEW

The Moolarben Coal Complex is an open cut and underground coal mining operation located approximately 40 kilometres (km) north of Mudgee in the Western Coalfield of New South Wales (NSW) (Figure 1).

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited.

Stage 1 at the Moolarben Coal Complex has been operating for several years and at full development will comprise three open cut mines (OC1, OC2 and OC3), a longwall underground mine (UG4), and mining related infrastructure (including coal processing and transport facilities) (Figure 2). Stage 2 at the Moolarben Coal Complex has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2) and mining related infrastructure (Figure 2).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 and would continue to be carried out in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified and Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified, granted under the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act).

1.2 UG1 UNDERGROUND MINE

The UG1 Underground Mine is a component of the approved Moolarben Coal Complex and comprises five longwall panels (Longwalls 101 to 105) (Figure 2). UG1 is approved as per Project Approval (08_0135).

The UG1 Underground Mine commenced first workings in April 2016 and commenced secondary workings (longwall extraction) in October 2017 by longwall mining methods from the Ulan Seam within Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML 1715 (Figure 3).
Figure 1

Source: NSW Land & Property Information (2015); NSW Department of Industry (2016); Office of Environment and Heritage NSW (2016)
Source: MCO (June 2019); NSW Dept of Industry (2019)

ML 1715
ML 1715
ML 1715
ML 1691
ML 1690
ML 1600
ML 1604

OC1
UG4
OC2
OC4
UG2

Longwalls 101 to 103 Study Area

Goulburn River National Park
Munghorn Gap Nature Reserve

GULGONG RAILWAY CREEK
ULAN MINE COMPLEX
Ulan - Wollar Road

LEGEND
Exploration Licence Boundary
Mining Lease Boundary
Haul Road
Existing/Approved Development
Open Cut Mining Area
Out-of-pit Emplacement
Surface Infrastructure Area
Underground Longwall Layout
Longwalls 101 to 103 Study Area

MOOLARBEN COAL COMPLEX
Underground Mine 1
Longwalls 101 to 103 Layout

Figure 3
Underground Mine 1
Longwalls 101 to 103 Layout
and Approximate Mine Progression

Figure 3a
1.3 EXTRACTION PLAN PURPOSE AND SCOPE

This Extraction Plan outline the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences in the UG1 mining area during the secondary extraction of Longwalls 101 to 103 (herein referred to as Longwalls 101-103).

Since the Extraction Plan approval on the 21 September 2017, an igneous intrusion (plug) and associated dykes have been defined near the southwestern end of the approved Longwall 103 footprint. The intrusion prevents economic resource extraction by Longwall mining methods. MCO has revised the mine plan to incorporate a relocated Longwall 103 installation position and a mining First-Workings Plunge Panel where Longwall extraction is not viable. These changes are included in this Extraction Plan amendment.

This Extraction Plan has been prepared in consideration of the NSW Department of Planning and Environment (DP&E) and NSW Division of Resources and Energy (DRE) (2015) *Guidelines for the Preparation of Extraction Plans*.

The objectives of this Extraction Plan are to:

- provide detailed plans of Longwalls 101-103 and the 103 Plunge Panel;
- outline potential subsidence effects, subsidence impacts and environmental consequences due to the extraction of Longwalls 101-103 and the 103 Plunge Panel;
- 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, including detailed performance indicators for subsidence impact performance measures.

Longwalls 101-103 are a subset of Longwalls 101-105, which together form the UG1 Underground Mine at the Moolarben Coal Complex. A separate Extraction Plan will be prepared for Longwalls 104 and 105 prior to secondary extraction of these longwalls commencing.

This Extraction Plan has been prepared by MCO with assistance from Mine Subsidence Engineering Consultants (MSEC), Mine Advice, HydroSimulations, WRM Water & Environment (WRM), Eco Logical Australia Pty Ltd (Eco Logical), Niche Environment and Heritage (Niche) and Resource Strategies. The appointment of the suitably qualified and experienced persons was endorsed by the Secretary of the DP&E.
This Extraction Plan forms part of MCO’s Environmental Management Strategy. The relationship of this Extraction Plan to the MCO Environmental Management Structure is shown in Figure 4.
Environmental Management Strategy
Noise Management Plan
Blast Management Plan
Air Quality Management Plan
Water Management Plan
Site Water Balance
Surface Water Management Plan
Groundwater Management Plan
Biodiversity Management Plan
Rehabilitation Management Plan
Heritage Management Plan
Greenhouse Gas Minimisation Plan
Energy Savings Action Plan
Independent Environmental Audit
Annual Review
Extraction Plan/Subsidence Management Plan
Ulan Road Strategy
EPL 12932
Pollution Incident Response Management Plan
ML 1605, ML 1606, ML 1628 and ML 1691
ML 1715
MLs under Water Management Act 2000
Water Licences under Water Act 1912
EPBC Annual Compliance Reports
Vegetation Clearance Protocol and Landscape Management Plan
Biodiversity Offset Management Plan
1.3.1 Statutory Requirements

Project Approval (08_0135)

This Extraction Plan has been prepared in accordance with Conditions 5 and 6, Schedule 4 of Project Approval (08_0135). The requirements of Conditions 5 and 6, Schedule 4 of Project Approval (08_0135) are summarised in Table 1, along with the relevant section(s) of this Extraction Plan in which the requirements are addressed. Further detail on the requirements of Project Approval (08_0135) is provided in Attachment 1.

Mining Leases

Longwalls 101-103 and 103 Plunge Panel are located within ML 1606, ML 1628, ML 1691 and ML 1715 (Figure 3). Under the conditions of these mining leases, MCO must not commence or undertake underground mining operations that may cause subsidence other than in accordance with an approved Extraction Plan. The approved Extraction Plan must provide for the effective management of risks associated with any subsidence resulting from mining operations.

The requirements of the conditions of the mining leases are summarised in Attachment 1, along with the relevant section of this Extraction Plan where the requirements are addressed.

Licences, Permits and Leases

In addition to the Stage 1 Project Approval (05_0117), Stage 2 Project Approval (08_0135) and the mining leases, all activities at or in association with the Moolarben Coal Complex will be undertaken in accordance with the following licenses, permits and leases:

- The Moolarben Coal Operations Mining Operations Plan (December 2016 – January 2019) (MOP) approved by the DRE.
- The conditions of Environment Protection Licence (EPL) No. 12932 issued by the NSW Environment Protection Authority (EPA) under the NSW Protection of the Environment Operation Act, 1997. Revision of the EPL will be required prior to the commencement of MCO activities that differ from those currently licensed.
- Water Access Licenses issued by the NSW Department of Primary Industries – Water (DPI-Water) under the NSW Water Management Act, 2000.
- Mining and occupational health and safety related approvals granted by DRE and WorkCover NSW.

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### Table 1: Extraction Plan Requirements

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<td>5. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. Each extraction plan must:</td>
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<td>(a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;</td>
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<td>(b) be approved by the Secretary before the Proponent carries out any of the second workings covered by the plan;</td>
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<td>(c) include detailed plans of existing and proposed first and second workings and any associated surface development;</td>
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<td>(d) include detailed performance indicators for each of the performance measures in Tables 18 and 19;</td>
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<td>(e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval;</td>
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<td>(f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 18 and 19, and manage or remediate any impacts and/or environmental consequences;</td>
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<td>(g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected public infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:</td>
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<td>- addresses in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;</td>
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<td>- has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;</td>
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<td>- recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and</td>
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<td>- in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner) and provides for annual auditing of compliance and effectiveness during extraction of longwalls which may impact the infrastructure;</td>
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<td>(h) include a Water Management Plan, which has been prepared in consultation with EPA and DPI Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including:</td>
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<td>- surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;</td>
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<td>- a program to monitor and report stream flows, assess any changes resulting from subsidence impacts and remediate and improve stream stability;</td>
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<td>- a program to monitor and report groundwater inflows to underground workings;</td>
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<td>- a program to predict, manage and monitor impacts on groundwater bores on privately-owned land;</td>
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<td>- a program to:</td>
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<td>- confirm the location and saturated extent of the palaeochannel adjacent to the extents of underground 1 second workings, including drilling of additional investigation bores;</td>
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<td>- monitor and report on the groundwater impacts of underground 1 second workings on the palaeochannel; and a program to monitor and report on the predicted groundwater impacts on the palaeochannel adjacent to underground 1 boundary; and</td>
<td>Appendix A</td>
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<td>(i) include a Biodiversity Management Plan, which has been prepared in consultation with OEH, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities; and water dependent ecosystems;</td>
<td>Appendix C</td>
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<td>(j) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general;</td>
<td>Appendix B</td>
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<td>(k) include a Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders for both Aboriginal and historic heritage, to manage the potential environmental consequences of the proposed second workings on both Aboriginal and non-Aboriginal heritage items, and reflects all requirements under conditions 41-46 of Schedule 3;</td>
<td>Appendix D</td>
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<td>(l) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety in the mining area;</td>
<td>Appendix F</td>
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<td>(m) include a Subsidence Monitoring Program, which has been prepared in consultation with DRE, to:</td>
<td>Appendix G</td>
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<td>- describe the on-going subsidence monitoring program;</td>
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<td>- provide data to assist with the management of the risks associated with subsidence;</td>
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<td>- validate the subsidence predictions;</td>
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<td>- analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and</td>
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<td>- inform the contingency plan and adaptive management process</td>
<td>Section 4.1 and Appendices A to F</td>
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<td>(n) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 18 and 19, or where any such exceedance appears likely;</td>
<td>Section 3.7</td>
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<td>(a) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 56 of Schedule 3; and</td>
<td>Attachment 3 and Appendices A to F</td>
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<td>(p) include a program to collect sufficient baseline data for future Extraction Plans.</td>
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<td>Note: To identify the longwall mining domains referred to in this condition, see Appendix 2.</td>
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Condition 6, Schedule 4
6. The Proponent shall ensure that the management plans required under conditions 5(g)-(l) above include:
(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; and
(b) a detailed description of the measures that would be implemented to remediate predicted impacts.
1.4 STRUCTURE OF THE EXTRACTION PLAN

This Extraction Plan comprises a main text component (this document) and supporting management plans, monitoring programs and studies, which include Appendices A through G and Technical Reports 1 through 5. An overview of the main text sections of the Extraction Plan is presented below:

Section 1 Provides an introduction to the Extraction Plan, including the purpose and scope of the Extraction Plan and a summary of the mine plan and design, subsidence predictions, subsidence impact performance measures and subsidence management approach.

Section 2 Describes the process of development of the Extraction Plan, including: the process of reviewing and updating the predictions of subsidence effects; subsidence impacts and environmental consequences; the risk assessment process for identifying key subsidence management issues; and consultation undertaken by the mine with affected agencies and other key stakeholders.

Section 3 Describes the measures that will be implemented to mitigate, manage, remediate and monitor potential subsidence impacts and environmental consequences on natural and built features.

Section 4 Addresses key elements of how the plan is going to be implemented, including an adaptive management approach, reporting, regular review and key responsibilities.

Section 5 Lists the documents referred to in Sections 1 to 4 of this Extraction Plan.

Attachment 1 Outlines the relevant requirements under the Stage 2 Project Approval (08_0135), Guidelines for the Preparation of Extraction Plans (DP&E and DRE, 2015) and mining leases, and provides the relevant section of this Extraction Plan where the requirements are addressed.

Attachment 2 Provides evidence of MCO’s consultation process for the Extraction Plan.

Attachment 3 Provides details of a program to collect sufficient baseline data for future Extraction Plans.

Attachment 4 Provides a consolidated list of key stakeholder contact information.
Appendices A to G contain key component management and monitoring plans of the Extraction Plan:

Appendix A  UG1 Longwalls 101 to 103 Water Management Plan (LW101-103 WMP)
Appendix B  UG1 Longwalls 101 to 103 Land Management Plan (LW101-103 LMP)
Appendix C  UG1 Longwalls 101 to 103 Biodiversity Management Plan (LW101-103 BMP)
Appendix D  UG1 Longwalls 101 to 103 Heritage Management (LW101-103 HMP)
Appendix E  UG1 Longwalls 101 to 103 Built Features Management Plans (LW101-103 BFMPs)
Appendix F  UG1 Longwalls 101 to 103 Public Safety Management Plan (LW101-103 PSMP)
Appendix G  UG1 Longwalls 101 to 103 Subsidence Monitoring Program (including Plans 1 to 7) (LW101-103 SMP)

This Extraction Plan is also supported by a series of technical reports, prepared by the endorsed suitably qualified specialists, which contain a review of predictions of subsidence effects, subsidence impacts and environmental consequences. The technical reports are contained in Technical Reports 1 to 7:

Technical Report 1  Subsidence Report
Technical Report 3  Surface Water Technical Report
Technical Report 6  Modified Commencing end of LW103 Subsidence Supplementary Report
Technical Report 7  Geotechnical Evaluation of 103 Plunge Panel
1.5 MINE PLANNING AND DESIGN

1.5.1 Geology and Stratigraphy

The Moolarben Coal Complex is located in the northern part of the Western Coalfield, on the north-west margin of the Sydney Basin (Wells Environmental Services, 2008).

Coal occurs in mid to late Permian age (approximately 250 to 275 million years before present) sediments collectively known as the Illawarra Coal Measures (also referred to as Permian coal measures). These units dip between 1 and 2 degrees (°) to the north-east. The Moolarben UG1 Underground Mine will extract coal from the Ulan Seam, targeting the low ash D working section (DWS) ply. The Ulan Seam occurs toward the base of the Illawarra Coal Measures and the Moolarben Seam is approximately 40 metres (m) above the Ulan Seam. The Ulan Seam is considered the equivalent of the Lidsdale Seam, which has been extensively mined further south in the Greater Lithgow District (Wells Environmental Services, 2008).

Narrabeen Group sediments (sandstones and conglomerates) of Triassic age (approximately 200 to 250 million years before present) overlie the coal measures, which in turn overlie older basement rocks of sedimentary (Shoalhaven Group) and igneous origin. Small intrusive plugs and remnant Tertiary-age (approximately 5 to 65 million years before present) basalt flows also outcrop in the area. Unconsolidated and partially consolidated Tertiary-age palaeochannel and Quaternary-age (less than approximately 5 million years before present) sediments occur as valley fill and along dominant drainage lines (Wells Environmental Services, 2008).

Within the Stage 2 Project Area, the Narrabeen Group sediments and basalt flows form low relief ridge and plateau features. In these areas, coal will be extracted using underground mining methods (Wells Environmental Services, 2008).

The Ulan Seam ranges in thickness from around 6 to 13 m and comprises numerous coal plies separated by partings of tuffaceous claystone and carbonaceous shale. Where the Ulan Seam is fully developed, the upper working section (WS1) ranges in thickness from 5.0 to 7.5 m, and the lower working section (WS2) from 4.9 to 6.2 m (Wells Environmental Services, 2008). The DWS and overlying D top ply (DTP) are a subset of WS2 occurring in the lower half of the seam. This section is amenable to underground mining, having a recoverable thickness of up to 3.5 m.
1.5.2 Mining Geometry and Parameters

The Longwalls 101-103 Study Area¹ and proposed mine plan is shown in Figure 3 and key dimensions are summarised in Table 2. Detailed mine layout drawings are provided in Plans 1 to 7 (Appendix G).

Table 2: Key Mining Parameters

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Longwall 101</th>
<th>Longwall 102A</th>
<th>Longwall 102B</th>
<th>Longwall 103</th>
<th>103 Plunge Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM Coal Extracted (Mt)</td>
<td>3.7</td>
<td>4.4</td>
<td>1.5</td>
<td>5.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Gate Road Width (m)</td>
<td>5.4</td>
<td>5.4</td>
<td>5.4</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Gate Road Height (m)</td>
<td>3.4</td>
<td>3.4</td>
<td>3.4</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td>MG Chain Pillar Width (m)</td>
<td>19.6</td>
<td>19.6</td>
<td>19.6</td>
<td>19.6</td>
<td>NA</td>
</tr>
<tr>
<td>TG Chain Pillar Width (m)</td>
<td>-</td>
<td>19.6</td>
<td>19.6</td>
<td>19.6</td>
<td>NA</td>
</tr>
<tr>
<td>Interplunge Pillar Width (m)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>≥10.5</td>
</tr>
<tr>
<td>Longwall Void Width (m)</td>
<td>310.8</td>
<td>310.8</td>
<td>310.8</td>
<td>310.8</td>
<td>NA</td>
</tr>
<tr>
<td>Longwall Void Length (m)</td>
<td>2,561</td>
<td>3,292</td>
<td>1,060</td>
<td>3,831</td>
<td>NA</td>
</tr>
<tr>
<td>Plunge Length (m)</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Extraction Height (m)</td>
<td>3.2 to 3.5</td>
<td></td>
<td></td>
<td></td>
<td>3.4</td>
</tr>
<tr>
<td>Depth of Cover (m)</td>
<td>47 to 165</td>
<td></td>
<td></td>
<td></td>
<td>80-120</td>
</tr>
</tbody>
</table>

ROM = Run-of mine, Mt = million tonnes, MG = maingate, TG = tailgate.

Following approval of the UG1 Optimisation Modification in April 2016, MCO has delineated a geological feature in Longwall 102 that prevents economic mining of this section, and has subsequently revised the longwall layout to incorporate a barrier pillar around this feature. The barrier pillar separating Longwalls 102A and 102B is approximately 140 m in length. In addition, following further detailed design, Longwalls 101-103 have been shortened by approximately 70 m to provide safe operational conveyor distance between the end of the longwalls and main headings.

A second geological intrusion has been located at the commencing end of LW103 preventing viable extraction by longwall mining methods in this area. As a consequence, the LW103 commencing position has been moved outbye of the influence of this structure, and a first workings and plunge

¹ Longwalls 101-103 and the area of land within the furthest extent of the 26.5° angle of draw and 20 millimetres (mm) predicted subsidence contour.
A panel has been established to partially extract the remanent coal that would otherwise become sterilised.

With the exception of these changes, the longwall geometry is the same as that for the approved UG1 Optimisation Modification, and MSEC (2017) concludes that the overall impact assessments for the natural and built features are unchanged or reduced. The revised longwall layout is herein referred to as the Revised Extraction Plan Layout.

1.5.3 Mining Method

Access to the UG1 Longwalls 101-103 is from the OC1 highwall. The extraction of Longwalls 101-103 will occur from west to east. Longwalls 101-103 will be extracted using retreating longwall mining methods for secondary extraction of panels approximately 311 m wide (void width). The longwall panels will be formed by driving two sets of gate roads (the tailgate and maingate roads). Each gate road requires two roadways (headings) to be driven parallel to each other. The two roadways will be used for ventilation purposes, with one of the roadways used as a transport road and the other roadway used to convey the coal that will be mined back to the main conveyors. Construction of development main headings, maingates and tailgates will be undertaken using continuous miners.

The dimensions of the headings will be approximately 5.4 m wide and 3.4 m in height. The headings will be connected approximately every 150 m by driving a cut-through from one heading to another which forms pillars of coal along the length of the gate road. The tailgate and maingate roads will be separated by the approximately 300 m wide longwall panel. The maingate roads and tailgate roads will then be linked together by driving an installation road and bleeder road at the top end of the longwall panels. ROM coal will be conveyed by the maingate conveyor to the main conveyor which will carry coal to the surface of the mine.

The 103 Plunge Panel operates essentially as a first workings panel utilising continuous miners. Partial extraction is afforded by taking plunges of up to 15m length from either side of the “run outs”. The “run outs” are supported using roof bolts in a conventional manner, and once connected provide flood ventilation for the plunging process. The plunges remain unsupported and access into by personnel is prevented. Coal continues to be transported by shuttle cars and conveyors as with maingate 103 development.

The width of the plunges (5.4m) and distance between plunges (9.6m) and “run outs” (>10.5m) has been assessed to provide a long term stable environment. Extraction height is to a maximum of 3.4m for operational and coal quality purposes.
1.5.4 Mine Schedule

The Moolarben Coal Complex is approved to operate seven days a week, 24 hours a day. Longwalls 101-103 are the first longwalls to be extracted at the Moolarben Coal Complex. The provisional extraction schedule for Longwalls 101-103 is provided in Table 3.

Table 3: Provisional Extraction Schedule

<table>
<thead>
<tr>
<th>Panel</th>
<th>Estimated Start Date</th>
<th>Estimated Duration</th>
<th>Estimated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101</td>
<td>October 2017</td>
<td>8 months</td>
<td>June 2018</td>
</tr>
<tr>
<td>LW102 (A+B)</td>
<td>August 2018</td>
<td>12 months</td>
<td>August 2019</td>
</tr>
<tr>
<td>LW103</td>
<td>October 2019</td>
<td>10 months</td>
<td>July 2020</td>
</tr>
<tr>
<td>103 Plunge</td>
<td>March 2019</td>
<td>3 Months</td>
<td>May 2019</td>
</tr>
</tbody>
</table>

Open cut operations (OC1 and OC2) are located in the vicinity of the Longwall 102A tailgate and Longwall 102A and Longwall 103 commencing ends. Open cut operations would not occur simultaneously with longwall mining in the immediate proximity of the adjacent longwall panel (Figure 3a).

1.5.5 Previous and Future Mining

Previous and future workings in the vicinity of Longwalls 101-103 are shown on Figure 3a and in Plans 1, 3 and 7 (Appendix G).

Longwalls 101-103 are the first longwalls to be extracted at the Moolarben Coal Complex. Previous workings in the vicinity of Longwalls 101-103 include OC1, OC2 and OC4. Future longwalls at the UG1 Underground Mine include Longwalls 104 and 105.

Currently there are no plans for mining other coal seams at Moolarben UG1 Underground Mine.

1.6 SUBSIDENCE PREDICTIONS

A review of predictions of subsidence impacts and effects for Longwalls 101-103 was conducted by MSEC (2017) for the Extraction Plan Layout and an updated assessment (2019) provided for the Revised Extraction Plan Layout in consideration of the LW103 commencing position move

Mine Advice (2019) have assessed the subsidence and long term stability of the 103 Plunge Panel within the already approved extraction area of the Extraction Plan layout.
1.6.1 Predicted Conventional Subsidence Movements

The maximum predicted conventional subsidence parameters resulting from the extraction of Longwalls 101 to 103 were determined using the calibrated Incremental Profile Method. The predicted subsidence contours are irregular due to the shallow depths of cover. The maximum predicted tilts and curvatures are very localised and therefore do not necessarily represent the overall (i.e. macro) ground movements. The magnitudes of the localised tilts greater than 100 millimetres per metre (mm/m) and the localised curvatures greater than 3.0 km\(^{-1}\) (1/kilometres) become less meaningful and, therefore, the specific values have not been presented. Revised standards for reporting adopted by MSEC may result in slight differences in reported values compared with previous reports (MSEC, 2017).

The maximum predicted values of incremental conventional subsidence, tilt and curvature, due to the extraction of each of the longwalls, is summarised in Table 4 and remains unchanged for the Revised Extraction Plan Layout.

Table 4: Maximum Predicted Incremental Conventional Subsidence, Tilt and Curvature Resulting from the Extraction of Each of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Longwall</th>
<th>Subsidence(^1) (mm)</th>
<th>Tilt(^2) (mm/m)</th>
<th>Hogging Curvature(^3) (km(^{-1}))</th>
<th>Sagging Curvature(^3) (km(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longwall 101</td>
<td>2250</td>
<td>65</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Longwall 102A</td>
<td>2200</td>
<td>&gt; 100</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Longwall 102B</td>
<td>2150</td>
<td>45</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Longwall 103</td>
<td>2250</td>
<td>70</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
</tbody>
</table>


1 Subsidence refers to vertical displacements of the ground.
2 Tilt is the change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the distance between those two points.
3 Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections.

The maximum predicted values of total conventional subsidence, tilt and curvature, after the extraction of each of the longwalls, is summarised in Table 5. The predicted tilts provided in this table are the maxima after the completion of each of the longwalls. The predicted curvatures are the maxima at any time during or after the extraction of each of the longwalls. Figures 5, 6 and 7 provide incremental subsidence contours for Longwalls 101-103.
Table 5: Maximum Predicted Total Conventional Subsidence, Tilt and Curvature after the Extraction of Each of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Longwall</th>
<th>Subsidence (mm)</th>
<th>Tilt (mm/m)</th>
<th>Hogging Curvature (km⁻¹)</th>
<th>Sagging Curvature (km⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longwall 101</td>
<td>2250</td>
<td>65</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Longwall 102A</td>
<td>2400</td>
<td>&gt; 100</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Longwall 102B</td>
<td>2400</td>
<td>&gt; 100</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
<tr>
<td>Longwall 103</td>
<td>2400</td>
<td>&gt; 100</td>
<td>&gt; 3</td>
<td>&gt; 3</td>
</tr>
</tbody>
</table>


The predictions of conventional subsidence parameters do not include the valley related upsidence and closure movements, or the effects of faults and other geological structures.

The 103 Plunge Panel was designed to provide a long term stable and non-subsiding (<20mm) environment despite the area having existing subsidence approval for full extraction with up to 2400mm of subsidence anticipated (MSEC, 2017). The minimum pillar dimensions between plunges of adjacent “run outs” results in a conservative Factor of Safety of 2.89 as a minimum (Mine Advice 2019a), and are thus considered long term stable. Subsidence associated with elastic pillar compression of the same pillars is anticipated to be up to 16mm, being generally less than survey accuracy and within the range of natural ground movements.

### 1.6.2 Non-Conventional Ground Movements

MSEC (2017) considers it likely that non-conventional ground movements will occur due to near surface geological conditions, steep topography and valley related movements, which are often accompanied by elevated tilts and curvatures. 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 (MSEC, 2017).
MOOLARBEN COAL COMPLEX
Predicted Subsidence after Longwall 101

Figure 5
MOOLARBEN COAL COMPLEX
Predicted Total Subsidence after Longwall 102

Figure 6

Source: MSEC (2017)
1.6.3 Potential for Increased Subsidence between Longwalls 102A and 102B

It is possible that some vertical subsidence could be observed above the barrier pillar. There have been a number of examples in NSW where subsidence monitoring has shown increased vertical subsidence of the surface in areas that are located directly above an isolated coal barrier. Magnitudes of settlement have been observed between 50 and 150 mm above an isolated coal barrier which is greater than predicted using the Standard Incremental Profile Method (MSEC, 2017).

While observed subsidence may exceed predictions for the coal barrier, subsidence monitoring has shown that it is usually accompanied by relatively low conventional tilts, curvature and strains. The potential for impacts above the coal pillar, therefore, do not significantly change (MSEC, 2017).

1.6.4 Predicted Far-Field Movements

In addition to the conventional subsidence movements that have been predicted above and adjacent to Longwalls 101 to 103, it is also likely that far-field horizontal movements will be experienced during the extraction of the longwalls (MSEC, 2017).

Based on an empirical model, the impacts of far-field horizontal movements on the natural features and items of surface infrastructure within the vicinity of Longwalls 101-103 are expected to be insignificant, except where they occur at large structures, such as railway lines, which may be sensitive to small differential movements (MSEC, 2017).

The LW101-103 BFMPs have been developed to manage the potential impacts of far-field movements on relevant infrastructure.

Influence of the Palaeochannel near UG1 on Horizontal Far-field Movements

There are saturated and unsaturated palaeochannel deposits, with a maximum thickness of 40 to 50 m, located to the north and east of Longwalls 101-103, where the depths of cover range from 90 to 130 m, as described in the Moolarben Extraction Plan Longwalls 101 to 103 – Groundwater Assessment Review (HydroSimulations, 2017).

The presence of these palaeochannel deposits should result in reduced far-field movements within and beyond these channels (MSEC, 2017).

Influence of the Open Cut on Horizontal Far-field Movements

Open cut mining areas (OC1, OC2 and OC4) are currently in operation and are located to the north, west and south of Longwalls 101-103 (Figure 3).
The open cut pits extract the overburden material and the target coal seam (i.e. down to the seam floor level of Longwalls 101-103). The effect of the removal of this material is to relieve or redistribute much of the in situ stress in the overburden strata adjacent to the pit. With the removal of the overburden material, the potential for far-field effects to develop in the vicinity of the pit are significantly reduced (MSEC, 2017).

The open cuts have been progressively backfilled with overburden material with mining progression. Potential for far-field movements where the open cut pit has been backfilled between the longwalls and the outer natural overburden is expected to be significantly reduced, similar to the open cut pit, as the backfilled material is unlikely to support any significant stress redistribution (MSEC, 2017).

1.7 SUBSIDENCE IMPACT PERFORMANCE MEASURES

Project Approval (08_0135) requires MCO to ensure the project does not cause any exceedances of the subsidence impact performance measures outlined in Table 18, Condition 1, Schedule 4 and Table 19, Condition 3, Schedule 4. The subsidence impact performance measures are detailed in Table 6.

Not all of the natural, heritage and built features listed in Table 6 are relevant to Longwalls 101-103 or the 103 Plunge Panel. Table 6 provides a description of the features relevant to the subsidence impact performance measures for the Revised Extraction Plan Layout.

<table>
<thead>
<tr>
<th>Subsidence Impact Performance Measure</th>
<th>Relevance to UG1 Longwalls 101 to 103 Extraction Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Resources</strong></td>
<td></td>
</tr>
<tr>
<td>Drainage Lines (DL1 – DL7)</td>
<td>No greater subsidence impacts or environmental consequences than predicted in the EA</td>
</tr>
<tr>
<td></td>
<td>Only Drainage Line DL7 is predicted to be impacted by Longwalls 101-103.</td>
</tr>
<tr>
<td><strong>Land</strong></td>
<td></td>
</tr>
<tr>
<td>Cliffs C7, C9 and C10</td>
<td>Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs or fracturing, that in total do not impact more than 0.5% of the total face of such cliffs within any longwall mining domain)</td>
</tr>
<tr>
<td></td>
<td>Not relevant. Cliffs C7, C9 and C10 are not located within the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td>Other cliffs</td>
<td>No greater subsidence impacts or environmental consequences than predicted in the EA</td>
</tr>
<tr>
<td></td>
<td>Cliffs C5 and C6 are located within the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td>Subsidence Impact Performance Measure</td>
<td>Relevance to UG1 Longwalls 101 to 103 Extraction Plan</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td><strong>Land</strong></td>
<td></td>
</tr>
<tr>
<td>Minor cliffs</td>
<td>Minor environmental consequences</td>
</tr>
<tr>
<td>Rock face features</td>
<td>(that is, occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of features within any longwall mining domain)</td>
</tr>
<tr>
<td>Steep slopes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minor cliffs, rock face features and steep slopes are located in the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td><strong>Biodiversity</strong></td>
<td></td>
</tr>
<tr>
<td>Threatened species, threatened populations, or endangered ecological communities</td>
<td>Negligible subsidence impacts or environmental consequences</td>
</tr>
<tr>
<td></td>
<td>Endangered ecological communities and habitat for threatened species are located within the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td><strong>Heritage Sites</strong></td>
<td></td>
</tr>
<tr>
<td>Aboriginal heritage sites S2MC 236 (AHIMS No.s 36-3-0016 and 36-3-0134)</td>
<td>Negligible subsidence impacts or environmental consequences</td>
</tr>
<tr>
<td></td>
<td>Not relevant. Aboriginal heritage sites S2MC 236 (AHIMS No.s 36-3-0016 and 36-3-0134) are not located within the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td>Historic heritage sites</td>
<td>No greater subsidence impact or environmental consequences than predicted in the EA</td>
</tr>
<tr>
<td></td>
<td>Not relevant. No historic heritage sites are located within the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td><strong>Mine workings</strong></td>
<td></td>
</tr>
<tr>
<td>First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts or negligible environmental consequences</td>
<td>To remain long-term stable and non-subsiding</td>
</tr>
<tr>
<td></td>
<td>First workings have been designed to meet the requirements of Condition 7, Schedule 4 of Project Approval (08_0135).</td>
</tr>
<tr>
<td>Second workings</td>
<td>To be carried out only in accordance with an approved Extraction Plan</td>
</tr>
<tr>
<td></td>
<td>Second workings will be carried out in accordance with an approved Extraction Plan.</td>
</tr>
</tbody>
</table>

**Key public infrastructure:**
Gulgong-Sandy Hollow Railway Line
Ulan-Wollar Road

Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.

The Sandy Hollow Gulgong Railway Line and Ulan-Wollar Road are located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements.

Table 6 (Continued): Subsidence Impact Performance Measures – Natural, Heritage and Built Features

<table>
<thead>
<tr>
<th>Subsidence Impact Performance Measure</th>
<th>Relevance to UG1 Longwalls 101 to 103 Extraction Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other infrastructure:</strong></td>
<td></td>
</tr>
<tr>
<td>Murragamba Road</td>
<td></td>
</tr>
<tr>
<td>Low voltage electricity power line¹</td>
<td></td>
</tr>
<tr>
<td>Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</td>
<td>Murragamba Road is closed to the public. The low voltage electricity power line (66 kilovolt [kV]/22 kV dual circuit powerline) is located 90 m or more from Longwalls 101-103.</td>
</tr>
<tr>
<td>Telecommunication cable</td>
<td></td>
</tr>
<tr>
<td>Fibre-optic cable</td>
<td></td>
</tr>
<tr>
<td>Murragamba Trig Station</td>
<td></td>
</tr>
<tr>
<td>Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</td>
<td>The telecommunication cable and optical fibre cable are located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements. The Murragamba Trig Station is located outside the Longwalls 101-103 Study Area.</td>
</tr>
<tr>
<td>Other built features and improvements, including fences</td>
<td>No other non-mine owned built features and improvements are located within the Longwalls 101-103 Study Area.</td>
</tr>
</tbody>
</table>

Public Safety

| Public safety | Negligible additional risk | Public safety is considered in the LW101-103 PSMP. |

Source: after Table 18, Condition 1 and Table 19, Condition 3, Schedule 4 of Project Approval (08_0135).

¹ Low voltage powerline refers to the 66 kV/22 kV dual circuit powerline.

Natural, heritage and built features relevant to this Extraction Plan are illustrated on Figures 8, 9 and 9a.
Figure 8

Natural Features and Known Aboriginal Heritage Sites in the Vicinity of Longwalls 101 to 103

Source: MCO (2019); NSW Dept of Industry (2016); Eco Logical Australia (2016)
MOOLARBEN COAL COMPLEX
Built Features in the Vicinity of Longwalls 101 to 103

Figure 9
MOOLARBEN COAL COMPLEX
Built Features in the Vicinity of Longwalls 101 to 103

Figure 9a
Drainage Lines (DL1 – DL7)

Four minor ephemeral drainage lines were identified by MSEC (2015) within the UG1 Study Area (i.e. associated with Longwalls 101-105) as part of the Subsidence Assessment for the UG1 Optimisation Modification Environmental Assessment (UG1 Optimisation Modification). All drainage lines identified in the vicinity of the Longwalls 101-103 Study Area are ephemeral as water only flows during, and for short periods after, each rain event (MSEC, 2015).

Of the drainage lines identified within the UG1 Study Area, only a section of drainage line DL7 is predicted to be impacted by Longwalls 102 and 103. DL7 is a tributary of Murragamba Creek, which flows into Wilpinjong Creek.

DL6 is located within the Longwalls 101-103 Study Area however, subsidence impacts are predicted to be negligible. DL4 and DL5 are located within the approved out-of-pit emplacement and no longer exist. These drainage lines have not been considered further in this Extraction Plan.

Further detail on drainage lines is provided in Section 3.1 and Appendix A.

Cliffs C7, C9 and C10

Cliffs C7, C9 and C10 are not located in the vicinity of the Longwalls 101-103 Study Area, and are not considered further in this Extraction Plan.

Other Cliffs

Six cliffs (cliffs C1 to C6) were identified by MSEC (2015) within the UG1 Study Area (i.e. associated with Longwalls 101-105) as part of the Subsidence Assessment for the UG1 Optimisation Modification Environmental Assessment (UG1 Optimisation Modification). The locations of the cliffs were determined from site inspections and 2 m surface contours.

Of the cliffs identified within the UG1 Study Area, only cliffs C5 and C6 lie within the Longwalls 101-103 Study Area.

Cliffs C1, C2, C3 and C4 are located within the approved out-of-pit emplacement or surface infrastructure and no longer exist. These cliffs have not been considered further in this Extraction Plan.

Further detail on cliffs is provided in Section 3.2 and Appendix B.
**Minor Cliffs, Rock Face Features, Steep Slopes and Land in General**

MSEC (2015) also identified a number of overhangs and smaller cliffs (i.e. minor cliffs and rock face features) within the UG1 Study Area, which are referred to as rock ledges.

MSEC (2015) identified a number of steep slopes within the UG1 Study Area. Steep slopes were identified by MSEC as having a gradient of between 1 in 3 (i.e. having an angle to the horizontal of 18°) and 2 in 1 (i.e. having an angle to the horizontal of 63°) and were determined using 2 m contours of the UG1 Study Area.

Land in general refers to the general landscape other than cliffs, minor cliffs, rock face features and steep slopes. Land in general includes other land features such as fire trails and vehicular tracks, however excludes surface features such as drains, diversions, and other MCO assets including the conveyor trace, open cut highwalls and out-of-pit emplacements which are addressed elsewhere in the Extraction Plan. Unsealed vehicular tracks and fire trails are located throughout the UG1 Study Area and above Longwalls 101-103.

Further detail on minor cliffs, rock face features, steep slopes and land in general is provided in Section 3.2 and Appendix B.

**Threatened Species, Threatened Populations, or Endangered Ecological Communities**

Eco Logical (2016) conducted a vegetation validation survey for Longwalls 101-103 and identified the following endangered ecological communities (EEC) and critically endangered ecological communities (CEEC), listed under either the NSW Biodiversity Conservation Act, 1995 (BC Act) and/or under the Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act), in the Longwalls 101-103 Study Area:

- **White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland**, listed as an EEC under the BC Act and CEEC under the EPBC Act.
- **Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions**, listed as an EEC under the BC Act.

In addition to the above, Eco Logical (2016) also identified **Central Hunter Valley Eucalypt Forest and Woodland**, listed as a CEEC under the EPBC Act. This CEEC was listed in May 2015 and does not apply to the approved Stage 1 and Stage 2 mining operations pursuant to section 158A of the EPBC Act.
Five threatened flora species have been recorded at the Moolarben Coal Complex, including (Moolarben Biota, 2006; Ecovision Consulting [Ecovision], 2008; EMGA Mitchell McLennan, 2013):

- *Diuris tricolor* (Pine Donkey Orchid) – vulnerable under the BC Act.
- *Eucalyptus cannonii* (Capertee Stringybark) – vulnerable under the BC Act.
- *Eucalyptus scoparia* (Wallangarra White Gum) – endangered under the BC Act and vulnerable under the EPBC Act.
- *Leucochrysum albicans var tricolor* (Hoary Sunray) – endangered under the EPBC Act.
- *Pomaderris queenslandica* (Scant Pomaderris) – endangered under the BC Act.

Of the above, only Scant Pomaderris was recorded within the Longwalls 101-103 Study Area.

Across the Moolarben Coal Complex, a total of 32 threatened and/or migratory fauna species, consisting of seven mammal species (including six microbat species) and 25 bird species have been recorded by Moolarben Biota (2006), Ecovision (2008) and EMGA Mitchell McLennan (2013) at the Moolarben Coal Complex.

Only a subset of the threatened and migratory species recorded at the Moolarben Coal Complex has been recorded within the Longwalls 101-103 Study Area.

Potential cave-dwelling bat roosting sites have been identified across the UG1 Longwalls 101-103 Study Area, including cliffs C5 and C6 and minor cliffs.

No groundwater dependent ecosystems (GDEs) have been identified in the Longwalls 101-103 Study Area.

Further detail on threatened species, threatened populations, and EECs is provided in Section 3.3 and Appendix C.

*Aboriginal heritage sites S2MC 236 (AHIMS No.s 36-3-0016 and 36-3-0134)*

Aboriginal heritage sites S2MC 236 (AHIMS No.s 36-3-0016 and 36-3-0134) are not located in the vicinity of Longwalls 101-103, and are not considered further in this Extraction Plan.

Further detail on Aboriginal heritage is provided in Section 3.4 and Appendix D.
**Historic Heritage Sites**

Historic heritage sites are not located in the vicinity of Longwalls 101-103, and are not considered further in this Extraction Plan.

**Sandy Hollow Gulgong Railway Line**

The Sandy Hollow Gulgong Railway owned by the Australian Rail Track Corporation (ARTC) runs adjacent to Ulan-Wollar Road. The Sandy Hollow Gulgong Railway is located to the north and east of the Longwalls 101-103 Study Area and the nearest edge of the Longwalls 101-103 vary from approximately 380 m (Longwall 103) to 470 m (Longwall 101) from the rail track.

Further detail on the Sandy Hollow Gulgong Railway Line is provided in Section 3.5 and Appendix E.

**Ulan-Wollar Road and Murragamba Road**

Ulan-Wollar Road runs adjacent to the Sandy Hollow Gulgong Railway. The nearest publicly accessible sections of Ulan-Wollar Road to Longwalls 101-103 are approximately 250 m from Longwall 101 and 335 m from Longwall 103. The nearest closed sections of Ulan-Wollar Road are approximately 100 m from Longwall 103.

Additionally, sections of Murragamba Road and Carrs Gap Road directly overy Longwalls 101 to 103. These roads are closed to the public.

Further detail on Ulan-Wollar Road is provided in Section 3.5 and Appendix E.

**Low Voltage Electricity Power Line**

A 66 kV/22 kV dual circuit powerline owned by Essential Energy runs adjacent to Ulan-Wollar Road and the Sandy Hollow Gulgong Railway Line.

The nearest sections of the 66 kV/22 kV dual circuit powerline are approximately 90 m from the northern (finishing) end of Longwall 103 (Structure 70548) and 230 m from the finishing end of Longwall 101 (Structure 70540), and are beyond the proposed substation location within the Remote Services Facilities. An Essential Energy substation is proposed to the north of Longwall 101.

Further detail on the 66 kV/22 kV dual circuit powerline and substation is provided in Section 3.5 and Appendix E.

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2 Low voltage electricity power line refers to the Essential Energy 66 kilovolt (kV)/22 kV dual circuit powerline.
Telecommunication Cable and Fibre-Optic Cable

The telecommunication cables (i.e. the copper telecommunication cable and an optical fibre cable) are located to the north and east of the Longwalls 101-103 Study Area and are approximately 240 m from Longwall 101 at their nearest point. To the east, the telecommunication cables are approximately 335 m from Longwall 103.

Further detail on the telecommunication cables is provided in Section 3.5 and Appendix E.

Murragamba Trig Station

No survey control marks are located within the Longwalls 101-103 Study Area, however, survey control marks are located beyond the Longwalls 101-103 Study Area (including the Murragamba Trig Station) and may experience far-field horizontal movements as the longwalls are mined.

During mining, MCO will forward relevant notification details in regard to the destruction or disturbance of survey marks caused by extraction of Longwalls 101-103 to The Manager Survey Services, Land and Property Information (LPI) NSW in accordance with Appendix C of the Surveyor General’s Directions No.11 Preservation of Survey Infrastructure.

It is understood that the Senior Surveyor will liaise with MCO and Subsidence Advisory NSW (formerly NSW Mine Subsidence Board [MSB]) regarding the re-establishment and/or replacement of the Murragamba Trig Station and/or other permanent marks, as necessary, on completion of subsidence.

330 kV Electricity Transmission Line

A 330 kV electricity transmission line (ETL) (Wollar-Wellington 330 kV High Voltage Line) owned by TransGrid runs adjacent to Ulan-Wollar Road and the Sandy Hollow Gulgong Railway Line. The 330 kV ETL and towers are located to the north and east of Longwalls 101-103 and the longwalls will not pass beneath these electrical services. The nearest tension tower is 620 m from Longwall 101 and the nearest suspension tower is 340 m from Longwall 101.

It is recognised the 330 kV ETL is ‘key public infrastructure’ and therefore the same subsidence impact performance measures applicable to the Sandy Hollow Gulgong Railway Line and Ulan-Wollar Road will apply.

Further detail on the 330 kV ETL is provided in Section 3.5 and Appendix E.
**Other Built Features and Improvements**

Land within the UG1 Longwalls 101-103 Study Area is primarily owned by MCO, with a small section of Crown Land and council road easements (Figure 10).

No other non-mine owned built features and improvements were identified within the Longwalls 101-103 Study Area.

**1.8 SUBSIDENCE MANAGEMENT APPROACH**

Potential environmental consequences during the mining of Longwalls 101-103 will be managed in accordance with the relevant requirements of Project Approval (08_0135) and other approvals, through:

- **Mine Design** – the layout of Longwalls 101-103 and the 103 Plunge Panel has been developed to meet the subsidence impact performance measures.

- **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 3.8).

- **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) (Sections 3.1 to 3.6).

- **Contingency Plans** – implementation of Contingency Plans in the event an exceedance of a subsidence impact performance measure or if an unexpected impact is detected (Section 4.1), including consideration of identified potential contingency measures (Sections 3.1 to 3.6).

- **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 impact performance measure or if an unexpected impact is detected (Section 4.2).
Land Ownership in the Vicinity of Longwalls 101 to 103

Source: MCO (June 2016); NSW Dept of Industry (2016)
2.0 DEVELOPMENT OF THE EXTRACTION PLAN

2.1 REVIEW OF PREDICTIONS

The predicted subsidence effects, subsidence impacts and environmental consequences of the Moolarben Coal Complex UG1 Underground Mine have been assessed, and subsequently approved, in the Moolarben Coal Project Stage 2 Environmental Assessment Report (Wells Environmental Services, 2008), the Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment (MCO, 2015).

The previously assessed and approved subsidence impacts and environmental consequences have been reviewed for the Extraction Plan Layout by MSEC (2017), HydroSimulations (2017), WRM (2017), Eco Logical (2017) and Niche (2017) (Technical Reports 1 to 5), and subsequently reviewed in MSEC (2019) and Mineadvice (2019) as a part of the Revised Extraction Plan Layout. This section describes the process of reviewing and updating these predictions.

2.1.1 Predicted Subsidence Effects and Subsidence Impacts

A subsidence assessment review for Longwalls 101-103 has been prepared in support of this Extraction Plan by MSEC (2017), MSEC (2019) and Mineadvice (2019), with the outcomes of this assessment incorporated into the management plans in Appendices A to F.

Review of Subsidence Prediction Methodology

The predicted conventional subsidence parameters for Longwalls 101-103 were determined by MSEC (2017) using the Incremental Profile Method. The method is an empirical model based on a large database of observed monitoring data from previous mining within the Southern, Newcastle, Hunter and Western Coalfields of NSW and from mining in the Bowen Basin in Queensland (MSEC, 2017).

The database consists of the observed incremental subsidence profiles, which are the additional subsidence profiles resulting from the extraction of each longwall within a series of longwalls. It can be seen from the normalised incremental subsidence profiles within the database, that the observed shapes and magnitudes are reasonably consistent where the mining geometry and local geology are similar (MSEC, 2017).
Subsidence predictions made using the Incremental Profile Method use the database of observed incremental subsidence profiles, the longwall geometries, local surface and seam information and geology. The method has a tendency to over-predict the conventional subsidence parameters (i.e. is slightly conservative) where the mining geometry and geology are within the range of the empirical database. The predictions can be further tailored to local conditions where observed monitoring data is available close to the mining area. The standard Incremental Profile Method was calibrated using nearby monitoring sites that have similar geology (MSEC, 2017).

Mineadvice have assessed the first workings and pillars of the plunge panel utilising an analytical model for elastic pillar compression as presented by Das (2010) and Ditton (2010).

**Comparison with Previous Predictions of Subsidence Effects**

Predicted subsidence parameters for Longwalls 101-103 were provided in the subsidence assessment prepared by MSEC (2015) in the *Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment* (MCO, 2015). Revised subsidence predictions associated with the shortening of LW103 and inclusion of 103 Plunge Panel are included in MSEC (2019) and Mine Advice (2019).

MSEC has prepared revised subsidence predictions for the Extraction Plan as described in Technical Report 1 and Report 6 and shown on Figures 5, 6 and 7. These predictions are based on the actual layout presented in this Extraction Plan, which incorporates a barrier pillar separating Longwalls 102A and 102B. This barrier pillar has been determined from inseam drilling to be approximately 140 m in length. This amended Extraction Plan also includes the shortened LW103 and 103 Plunge Panel.

The maximum vertical subsidence predicted by MSEC (Technical Report 1) is 2,400 mm, which is the same as the maxima presented in the *Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment* (MCO, 2015). The maximum tilt predicted by MSEC (Technical Report 1) is also the same as the maxima presented in the *Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment* (MCO, 2015), at greater than 100 mm/m. The maximum predicted subsidence effects due to the extraction of LW103 do not change due to the modified commencing end and due to 103 plunge panel. However, the extent of the surface subsidence movements reduce. The predicted subsidence effects for the natural and built features reduce or do not change.

Mineadvice assessed the 103 Plunge Panel subsidence (Report 7) associated with elastic pillar compression of the to be up to 16mm, being generally less than survey accuracy and within the range of natural ground movements.

In summary, MSEC (2017) concludes, “*the overall impact assessments for the natural and built features based on the Extraction Plan Layout are unchanged, or reduce compared to those based on the*
Approved Layout. MSEC (2019) and Mineadvice (2019) further concluded that the impacts on natural and built features from shortening of Longwall 103 and extraction of the 103 plunge panel would remain unchanged, or reduce compared to those based on the Approved Layout.

**Predicted Subsidence Impacts**

Subsidence impacts predicted by MSEC (2017) above Longwalls 101-103 include surface cracking, heaving, buckling, humping and stepping. The extent and severity of these mining induced ground deformations are dependent on a number of factors, including the mine geometry, depth of cover, overburden geology, locations of natural joints in the bedrock, the presence of near surface geological structures and mining conditions (MSEC, 2017).

The revised subsidence impacts predicted by MSEC (Technical Report 1 and 6) are the same or less than the predictions for the Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment (MCO, 2015).

2.1.2 Potential Environmental Consequences

Detailed discussion of potential environmental consequences is provided in the management plans in Appendices A to F and Section 3.

The suitably qualified experts (endorsed by the Secretary of the DP&E) conducted a review of the potential environmental consequences due to the extraction of Longwalls 101-103 for the preparation of each management plan. The reviews concluded that there are no additional potential subsidence impacts or environmental consequences resulting from the extraction of Longwalls 101-103 compared to those assessed and approved for the UG1 Optimisation Modification (MCO, 2015).

2.2 RISK ASSESSMENT

In accordance with the DP&E and DRE (2015) *Guidelines for the Preparation of Extraction Plans*, a number of risk assessments have been undertaken for this Extraction Plan to ensure that appropriate consideration was given to risk assessment and risk management in each component management plan. The risk assessments were reviewed for the Revised Extraction Plan layout and found to be appropriate due to the reduced level of predicted impacts.

2.2.1 Environmental Risk Assessment
An Environmental Risk Assessment (ERA) was conducted for four of the key component plans of this Extraction Plan viz. LW101-103 WMP, LW101-103 LMP, LW101-103 BMP and LW101-103 HMP.

The suitably qualified and experienced experts endorsed by the Secretary of the DP&E for the preparation of the UG1 Longwalls 101 to 103 Extraction Plan participated in the ERA.

The ERA process involved the key steps described below.

Review of Relevant Documentation

In preparation for the ERA workshop, the ERA participants reviewed a number of documents relevant to the risk assessment. This included (but was not limited to):

- The Preliminary Risk Assessment conducted for the Moolarben Coal Project Stage 2 Environmental Assessment Report (Wells Environmental Services, 2008).
- The Subsidence Assessment prepared by MSEC (2015) for the Moolarben Coal Complex Stage 2 UG1 Optimisation Modification (MCO, 2015).
- Project Approval (08_0135) (including subsidence impact performance measures).
- The revised longwall layout (i.e. incorporating a sterilised coal pillar around a geological feature in Longwall 102).

Risk Identification

The participants were asked to identify any additional (specific) issues or risks and/or changes to previously assessed levels of risk in preparation for the ERA workshop.

ERA Workshop

The ERA workshop was held on 8 December 2016. The ERA workshop was facilitated by an independent specialist, Operational Risk Mentoring (ORM).

The ERA took a comprehensive approach to identifying and ranking risks relevant to the Longwalls 101-103 Study Area. The ERA highlighted risks relating to the following potential issues (ORM, 2017a):

- Surface water – issues related to the potential for creating an increased sediment load in surface water flows that could lead to an unwanted release of water above desired suspended/dissolved solid levels.
- Flora and fauna – with potential impacts on habitats and/or compromised rehabilitation.
- Asset related issues – with potential for damage to MCO owned assets.
• Groundwater issues – such as failure of the monitoring program to detect and respond to an impact on the groundwater system or an indeterminate impact on stream flows.
• Land – impacts due to subsidence of steep slopes/minor cliff lines.
• Heritage – with impacts to Aboriginal heritage sites/values.
• Public safety – with potential for step cracking along access tracks (mitigated by the isolation of all affected subsidence areas from third party/public access).

A number of risk control and management measures were identified during the risk assessment. With the application of the identified controls, the consensus was that subsidence related impacts over Longwalls 101-103 could be managed at a tolerable level of risk (ORM, 2017a).

ERA Report Review

All ERA participants were asked to review the draft report that was prepared to summarise the outcomes of the risk assessment workshop. Participants’ comments were incorporated into the final report.

Summary

The ERA concluded potential environmental risks due to the secondary extraction of Longwalls 101-103 were as low as reasonably practicable.

2.2.2 Built Features Management Plan Risk Assessment

Individual risk assessment meetings were held with each infrastructure owner3 (facilitated by an independent specialist, AXYS Consulting) to inform the development of the LW101-103 BFMPs (Appendix E).

In summary, the investigation and analysis methods used during the risk assessments typically included:

• the identification of the infrastructure owner or manager’s assets;
• a review of the revised subsidence predictions and potential impacts on the infrastructure owner’s or manager’s assets;
• a review of the preliminary monitoring plan; and
• the identification of risk control measures and procedures.

3 With the exception of MWRC who advised MCO that a formal risk assessment was not required.
MCO considers all risk control measures and procedures to be feasible to manage all identified risks. The risk control measures and procedures have been incorporated in the LW101-103 BFMPs (Appendix E).

2.2.3 Moolarben Coal Operations Assets Risk Assessment

A separate risk assessment was held for MCO assets in the vicinity of Longwalls 101-103. The risk assessment was held on 8 December 2016 and was facilitated by an independent specialist, ORM.

A number of risk control and management measures were identified during the risk assessment. With the application of the identified controls, the consensus was that subsidence related impacts from the secondary extraction of Longwalls 101-103 were as low as reasonably practicable (ORM, 2017b). The operational risk assessment was reviewed based on the revised Extraction Plan Layout.

2.2.4 Public Safety Management Plan Risk Assessment

A risk assessment was held for the LW101-103 PSMP (Appendix F) to identify and address potential safety hazards to the public, including:

- potential subsidence impacts on built features;
- potential instability of cliff formations or steep slopes caused by subsidence;
- deformations or fracturing of any land caused by subsidence; and
- any other impacts of subsidence.

The risk assessment was held on 21 April 2017 and was facilitated by an independent specialist, AXYS Consulting. The risk assessment was reviewed based on the revised Extraction Plan Layout.

The outcomes of the risk assessment were incorporated into the LW101-103 PSMP.

With the implementation of the identified control strategies, the risks due to the secondary extraction of Longwalls 101-103 were considered to be as low as reasonably practicable.

2.3 CONSULTATION

Consultation is being conducted for this Extraction Plan in accordance with the requirements of Project Approval (08_0135) and in consideration of the Guidelines for the Preparation of Extraction Plans (DP&E and DRE, 2015).
A summary of MCO’s consultation process for the Extraction Plan is provided in Attachment 2.

2.3.1 Government Agencies

A summary of the consultation with government agencies and the key issues raised is provided in Table 7 and Attachment 2 (Table A2-1).

The State of NSW (NSW Crown Land) owns a portion of land (Lot 7010, DP1025345) and the Mid-Western Regional Council (MWRC) owns a number of roads (and associated easements) within the Longwalls 101-103 Study Area (Figure 10). As such, MCO has consulted with NSW Crown Land and MWRC as potentially affected public authorities. All other land within the Longwalls 101-103 Study Area is owned by MCO.

2.3.2 Infrastructure Owners

Consultation with each infrastructure owner/manager was generally conducted in accordance with the following protocol:

- Initial contact to confirm the appropriate infrastructure representative and initial briefing.
- Provision of a specific report prepared by MSEC outlining the subsidence predictions and impact assessment for each infrastructure item.
- Drafts of the LW101-103 BFMPs were distributed for comment to the relevant infrastructure owner, incorporating any comments received from the infrastructure owner on the MSEC report.
- Risk assessment workshops were held with representatives from MCO, the infrastructure owner and relevant specialists where requested by the asset owner.
- Where relevant, MCO funded additional expertise to assist the infrastructure owner to assess appropriate monitoring and management strategies and/or measures.
- Revised drafts of the LW101-103 BFMPs were prepared incorporating the outcomes of the risk assessment.
- Final drafts of the LW101-103 BFMPs were prepared incorporating any comments received from the infrastructure owner.

The reports prepared by MSEC are attached to the relevant LW101-103 BFMPs.
### Table 7: Summary of Consultation with Government Agencies

| Agency                      | Consultation Conducted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Key Issues Raised                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DP&E                        | • 23 November 2015 – MCO requested the endorsement of Extraction Plan team as suitably qualified and experienced persons.  
• 16 November 2016 – MCO requested the endorsement of additional persons for the Extraction Plan team as suitably qualified and experienced persons.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• 10 December 2015 – DP&E endorsed Extraction Plan team.  
• 28 November 2016 – DP&E endorsed additional members for the Extraction Plan team.                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                             |
| DRE                         | • 6 April 2017 – MCO email to DRE notifying them of the Extraction Plan and requesting a meeting on 19 April 2017 to discuss predicted subsidence impacts and proposed monitoring strategies.  
• 19 April 2017 – meeting held with DRE Environmental Department to discuss the Extraction Plan.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• June 2017 – site visit scheduled with DRE.  
• 7 April 2017 – DRE agreed to a meeting and requested a site visit be organised for June 2017.  
• 19 April 2017 – DRE provided comments on proposed monitoring and recommended the LW101-103 BFMP-ARTC be sent to the Office of the National Rail Safety Regulator.                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                             |
| DPI-Water                   | • 7 April 2017 – draft LW101-103 WMP (Version 1) provided for consultation and requested a meeting.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• No issues raised to date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                             |
| EPA                         | • 10 April 2017 – draft LW101-103 WMP (Version 1) provided for consultation.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• 3 May 2017 – EPA indicated that they had no specific comments on the LW101-103 WMP.                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                             |
| Department of Industry –   | • 23 February 2017 – draft LW101-103 LMP (Version 1) provided for consultation.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• 31 March 2017 – Dol-Land advised that they had no specific comment on the LW101-103 LMP.                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                             |
| Land (Dol-Land) / NSW Crown |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                             |
| Land                        |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                             |
| MWRC                        | • 23 February 2017 – draft LW101-103 LMP (Version 1) provided for consultation.  
• Additional consultation in relation to the LW101-103 BFMP-MWRC (Section 2.3.2).  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• 3 April 2017 – MWRC advised that they had no additional comments or suggested changes for the LW101-103 LMP.  
• 10 April 2017 – MWRC indicated they had no further comments on the LW101-103 BFMP-MWRC.                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                             |
| NSW Office of Environment   | • 28 March 2017 – draft LW101-103 BMP (Version 1) provided for consultation.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan.  
• No issues raised to date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                             |
| and Heritage (OEH)          |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                             |
Table 7 (Continued): Summary of Consultation with Government Agencies

<table>
<thead>
<tr>
<th>Agency</th>
<th>Consultation Conducted</th>
<th>Key Issues Raised</th>
</tr>
</thead>
</table>
| OEH (Heritage Division) | • 15 March 2017 – draft LW101-103 HMP (Version 1) provided for consultation.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan. | • No issues raised to date. |
| Subsidence Advisory NSW (formerly MSB) | • 21 February 2017 – MCO letter to Subsidence Advisory NSW for the purposes of notification in relation to the Extraction Plan.  
• May 2017 – submission of the UG1 Longwalls 101 to 103 Extraction Plan. | • No issues raised to date. |
| LPI NSW | • 20 February 2017 – MCO letter to LPI NSW describing potential subsidence effects on survey marks and notification in accordance with the Surveyor General’s Directions No. 11 Preservation of Survey Infrastructure. | • No issues raised to date. |

It should be noted that:

- On 13 April 2017, ARTC indicated satisfaction with Version 3 of the draft Longwalls 101-103 Built Features Management Plan – Australian Rail Track Corporation (LW101-103 BFMP-ARTC).
- On 10 April 2017, MWRC indicated that they would be satisfied with Version 2 of the draft Longwalls 101-103 Built Features Management Plan – MWRC (LW101-103 BFMP-MWRC) if it were updated to address an additional comment. MCO incorporated the requested amendment and provided MWRC with Version 3 of the draft LW101-103 BFMP-MWRC on 12 April 2017. MWRC has provided no further comments.
- On 31 March 2017, TransGrid provided MCO with specific trigger levels for managing potential impacts to the 330 kV ETL towers, which were incorporated into Version 2 of the draft Longwalls 101-103 Built Features Management Plan - TransGrid (LW101-103 BFMP-TransGrid). Version 2 of the draft LW101-103 BFMP-TransGrid was provided to TransGrid on 5 April 2017.

A summary of consultation undertaken with relevant infrastructure owners is provided in Attachment 2 (Table A2-2).
2.3.3 Landholders

Landholders within the Longwalls 101-103 Study Area are MCO, NSW Crown Lands and MWRC. MCO has consulted with NSW Crown Lands and MWRC (Sections 2.3.1 and 2.3.2). The closest landholders outside the Longwalls 101-103 Study Area are Ulan Coal Mines Limited and the NSW National Parks and Wildlife Service, who were provided notification of the Extraction Plan on 21 February 2017.

2.3.4 Public Consultation

MCO meets quarterly with its Community Consultative Committee (CCC) to provide updates on operations at the Moolarben Coal Complex, including (but not limited to) community matters, visitors to site, donations, operations and exploration, approvals, underground operations, employment and Emergency Services collaboration.

MCO will provide an electronic copy of the Extraction Plan to the members of the CCC upon approval by the DP&E, and will also provide a detailed briefing to the CCC in relation to the Extraction Plan at the CCC meeting following approval.

The approved Extraction Plan will be made available on MCO’s website.

2.3.5 Consultation with Aboriginal Stakeholders

A draft of the LW101-103 HMP was provided to Aboriginal stakeholders registered at the Moolarben Coal Complex for their review and comment on 15 March 2017. Comments received were considered before the LW101-103 HMP was finalised and lodged with the Secretary of the DP&E for approval.

2.3.6 Summary of Management Plans Distributed for Comment

A summary of the draft management plans that were distributed for comment is provided in Table 8.
Table 8: Management Plans Distributed for Comment

<table>
<thead>
<tr>
<th>Management Plan</th>
<th>Stakeholder</th>
<th>Date Distributed</th>
<th>Feedback to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 WMP</td>
<td>DPI-Water</td>
<td>Version 1 (7 April 2017)</td>
<td>No comments to date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (May 2017)</td>
<td></td>
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<tr>
<td></td>
<td>EPA</td>
<td>Version 1 (10 April 2017)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Version 2 (May 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MWRC</td>
<td>Version 1 (23 February 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (May 2017)</td>
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</tr>
<tr>
<td>LW101-103 BMP</td>
<td>OEH</td>
<td>Version 1 (28 March 2017)</td>
<td>No comments to date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (May 2017)</td>
<td></td>
</tr>
<tr>
<td>LW101-103 HMP</td>
<td>OEH (Heritage Division)</td>
<td>Version 1 (15 March 2017)</td>
<td>No comments to date.</td>
</tr>
<tr>
<td></td>
<td>Registered Aboriginal parties</td>
<td>Version 1 (15 March 2017)</td>
<td>Comments were received and addressed from one registered Aboriginal party.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (May 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (28 March 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TransGrid</td>
<td>Version 1 (8 March 2017)</td>
<td>No comments to date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (5 April 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telstra</td>
<td>Version 1 (8 March 2017)</td>
<td>No comments to date.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (28 March 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MWRC</td>
<td>Version 1 (9 March 2017)</td>
<td>MWRC indicated they had no further comments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (7 March 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 3 (10 April 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ARTC</td>
<td>Version 1 (7 March 2017)</td>
<td>ARTC indicated satisfaction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 2 (28 March 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Version 3 (5 April 2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DRE</td>
<td>Various¹ (13 April 2017)</td>
<td>DRE provided feedback on proposed monitoring.</td>
</tr>
<tr>
<td>LW101-103 PSMP</td>
<td>DRE</td>
<td>Version 1 (May 2017)</td>
<td></td>
</tr>
<tr>
<td>LW101-103 SMP</td>
<td>DRE</td>
<td>Version 1 (May 2017)</td>
<td></td>
</tr>
</tbody>
</table>

¹ DRE was provided with the following draft LW101-103 BFMPs on 13 April 2017:
- Version 2 of the draft LW101-103 BFMP-EE.
- Version 2 of the draft LW101-103 BFMP-TransGrid.
- Version 2 of the draft LW101-103 BFMP-Telstra.
- Version 3 of the draft LW101-103 BFMP-MWRC.
- Version 3 of the draft LW101-103 BFMP-ARTC.
3.0 SUBSIDENCE MANAGEMENT AND MONITORING

Surface and sub-surface features within the vicinity of Longwalls 101-103 are listed in Table 9. Features within the Longwalls 101-103 Study Area (i.e. within the 26.5° angle of draw and/or 20 mm predicted subsidence contour) may potentially be impacted by the secondary extraction of Longwalls 101-103. There are also features that lie outside the Longwalls 101-103 Study Area that may experience far-field movements. The surface features which are sensitive to such movements have been identified and have been included in the subsidence assessments provided by MSEC (2017) (Technical Report 1).

<table>
<thead>
<tr>
<th>Feature</th>
<th>Section/Management Plan Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Natural Features</strong></td>
<td></td>
</tr>
<tr>
<td>Drainage Lines</td>
<td>Section 3.1 and LW101-103 WMP (Appendix A)</td>
</tr>
<tr>
<td>Cliffs</td>
<td>Section 3.2 and LW101-103 LMP (Appendix B)</td>
</tr>
<tr>
<td>Minor Cliffs, Rock Face Features</td>
<td></td>
</tr>
<tr>
<td>Steep Slopes and Land in General</td>
<td></td>
</tr>
<tr>
<td>Threatened Species, Threatened Populations and EECs</td>
<td>Section 3.3 and LW101-103 BMP (Appendix C)</td>
</tr>
<tr>
<td>Natural Vegetation</td>
<td></td>
</tr>
<tr>
<td><strong>Areas of Archaeological and/or Heritage Significance</strong></td>
<td></td>
</tr>
<tr>
<td>Known Aboriginal Heritage Sites</td>
<td>Section 3.4 and LW101-103 HMP (Appendix D)</td>
</tr>
<tr>
<td><strong>Public Utilities and Other Infrastructure</strong></td>
<td></td>
</tr>
<tr>
<td>ARTC – Sandy Hollow Gulgong Railway Line</td>
<td>Section 3.5 and LW101-103 BFMPs (Appendix E)</td>
</tr>
<tr>
<td>MWRC – Ulan-Wollar Road</td>
<td></td>
</tr>
<tr>
<td>TransGrid – 330 kV electricity transmission line</td>
<td></td>
</tr>
<tr>
<td>Essential Energy – 66 kV/22 kV dual circuit powerline</td>
<td></td>
</tr>
<tr>
<td>Telstra – Telecommunication cables</td>
<td></td>
</tr>
</tbody>
</table>

The location of natural features and known Aboriginal heritage sites in the vicinity of Longwalls 101-103 is shown on Figure 8. The location of surface infrastructure/built features over and adjacent to the Longwalls 101-103 Study Area is shown on Figures 9, 9a, 11, 12, 13, 14 and 15. Descriptions of each of these features are contained within the relevant management plan referenced in Table 9.

Subsidence predictions and potential impacts to surface and sub-surface features are provided and described in MSEC (2017) (Technical Report 1, 6 and 7).
Figure 13
Figure 15
Management measures and monitoring for each feature are included in each of the management plans as indicated in Table 9 and summarised in Sections 3.1 to 3.6.

The component management plans to this Extraction Plan form part of MCO’s Environmental Management System for the Moolarben Coal Complex, as shown on Figure 4. In order to avoid duplication of existing Environmental Management Plans, the component management plans reference sections of the following existing complex-wide plans:

- Water Management Plan, including:
  - Surface Water Management Plan (SWMP); and
  - Groundwater Management Plan (GWMP); and
- Biodiversity Management Plan (BMP); and
- Heritage Management Plan (HMP).

The LW101-103 SMP (Appendix G) has been prepared to monitor subsidence impacts and validate the subsidence predictions and analyse the relationship between the subsidence effects and subsidence impacts of the Extraction Plan and any ensuing environmental consequences. A summary of the proposed monitoring for the Extraction Plan is provided in Section 3.8 and on Figure 16.

3.1 WATER MANAGEMENT

3.1.1 Overview

The LW101-103 WMP is provided in Appendix A. The purpose and scope of the LW101-103 WMP are summarised below:

**Purpose:** The LW101-103 WMP outlines the management of potential environmental consequences on watercourses and aquifers resulting from the extraction of Longwalls 101-103.

**Scope:** The LW101-103 WMP covers watercourses and aquifers within the Longwalls 101-103 Study Area.
Environmental Monitoring Sites Relevant to Longwalls 101 to 103

Source: MCO (June 2019); NSW Dept of Industry (2019); HydroSimulations (2017); Eco Logical Australia (2016)

Figure 16
3.1.2 Key Water Issues, Monitoring and Management Measures

**Drainage Line DL7**

Of the drainage lines identified within the UG1 Study Area, only a section of DL7 is predicted to be impacted by subsidence (i.e. where DL7 directly overlies Longwalls 102 and 103) (MSEC, 2017).

WRM (2017) concluded that subsidence impacts and potential environmental consequences for surface drainage features (i.e. Drainage Line DL7) are consistent with those previously predicted. As a result, it is considered that the subsidence impact performance measure for drainage lines, *No greater subsidence impacts or environmental consequences than predicted in the EA,* will not be exceeded.

**Surface Water Flow and Quality**

There are no subsidence impact performance measures relevant to surface water flow and quality. Notwithstanding, WRM (2017) concluded that impacts on runoff quality are expected to be minimal. As a result, water quality sampling of receiving streams will continue to be undertaken in accordance with the approved complex-wide SWMP.

**Groundwater**

There are no subsidence impact performance measures relevant to groundwater. Notwithstanding, HydroSimulations (2017) concluded that the Extraction Plan Layout would result in the same, or lower, potential impacts in comparison to the layout approved in the UG1 Optimisation Modification. As a result, groundwater monitoring will continue to be undertaken for groundwater extraction, groundwater levels, groundwater quality and leachate/seepage losses from water and water storages as described in section 6.0 of the approved complex-wide GWMP.

**Palaeochannel**

Tertiary palaeochannel deposits have been recognised in the Goulburn River diversion (at Ulan) and in the Murragamba and Wilpinjong creek valleys, with a maximum thickness of 40 m to 50 m.

Transient Electro-Magnetic (TEM) and Direct Current (DC) electrical resistivity surveys have been conducted to better define the thickness and the extent of the palaeochannel to the north-east of UG1 (HydroSimulations, 2015). Following a subsequent program of targeted drilling, HydroSimulations (2017) has determined that the UG1 mine layout for Longwalls 101-103 would not pass beneath any water bearing palaeochannel sediments, as was considered in HydroSimulations (2015).
An additional palaeochannel monitoring bore (standpipe) will be established to the north-east of Longwall 101 to monitor groundwater levels in the palaeochannel, as recommended by HydroSimulations (2017) (Figure 16).

**Summary**

The key issues relating to subsidence impacts on water resources are described in the LW101-103 WMP and the relevant monitoring and management measures are summarised in Table 10, Figure 16 and Section 3.8.

**Table 10: Monitoring and Management for Water Resources during the Extraction of Longwalls 101 to 103**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Objective</th>
<th>Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Line DL7</td>
<td>No significant increase in active erosion in DL7.</td>
<td>Monitoring in accordance with the LW101-103 WMP, including:</td>
<td>• Erosion management.</td>
</tr>
<tr>
<td></td>
<td>No change in stream character for DL7 beyond approved.</td>
<td>• Visual inspection and photographic record of drainage line DL7.</td>
<td>• Remediation of vegetation.</td>
</tr>
<tr>
<td></td>
<td>No measurable change in downstream water quality.</td>
<td>Subsidence monitoring in accordance with the LW101-103 SMP.</td>
<td>• Water ponding management.</td>
</tr>
<tr>
<td></td>
<td>Minimise change in surface flow when cracks appear (as is predicted to occur)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Water Flow and Quality</td>
<td>Subsidence impacts from Longwalls 101-103 do not result in adverse water quality impacts to the downstream environment.</td>
<td>Water quality sampling of receiving streams will continue to be undertaken in accordance with the approved complex-wide SWMP, including monitoring sites SW04 and SW16.</td>
<td>Downstream water quality management.</td>
</tr>
<tr>
<td>Groundwater extraction, groundwater levels, groundwater quality and leachate/seepage losses.</td>
<td>Subsidence impacts from Longwalls 101-103 do not result in exceedances of the salinity, pH and groundwater level triggers in the LW101-103 WMP.</td>
<td>Groundwater monitoring will continue to be undertaken as described in section 6.0 of the approved complex-wide GWMP. Groundwater monitoring bores considered to be relevant to Longwalls 101-103 are described in the LW101-103 WMP.</td>
<td>An investigation will be initiated where the groundwater monitoring identifies results outside the trigger levels (or ranges), consistent with the approved complex-wide GWMP.</td>
</tr>
</tbody>
</table>
3.1.3 Assessment of Performance Indicators and Measures

Performance indicators are presented in the LW101-103 WMP and are summarised in Table 11. Monitoring against these performance indicators during the mining of Longwalls 101-103 is summarised in Table 10, Figure 16 and Section 3.8 and described in detail in Appendix A.

Table 11: Water Resources Performance Measures and Performance Indicators

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Performance Indicators</th>
</tr>
</thead>
</table>
| Drainage Lines (DL1 – DL7)² | - Change in visible erosion.  
| No greater subsidence impacts or environmental consequences than predicted in the EA | - Development of, or change in, headcut erosion along DL7.  
| | - Change in character, such as increased erosion or change in vegetation along drainage line.  
| | - Extensive duration of water ponding.  
| | - Downstream water quality (consistent with approved complex-wide SWMP).  
| | - Appearance of unsealed surface cracking across the bed of DL7. |

¹ Note, only Drainage Line DL7 is relevant to Longwalls 101-103.

It should be noted that Project Approval (08_0135) does not contain any performance measures relevant to surface water flow or quality, or groundwater extraction, groundwater levels, groundwater quality and leachate/seepage losses.

3.1.4 Contingency Plan

In the event that subsidence impacts observed exceed the water subsidence impact performance measure, MCO will implement a Contingency Plan as described in the LW101-103 WMP and summarised in Section 4.1.
3.2 LAND MANAGEMENT

3.2.1 Overview

The LW101-103 LMP is provided in Appendix B. The purpose and scope of the LW101-103 LMP are summarised below:

Purpose: The LW101-103 LMP outlines the management of potential environmental consequences on cliffs, minor cliffs, rock face features, steep slopes and land in general resulting from the extraction of Longwalls 101-103.

Scope: The LW101-103 LMP covers cliffs, minor cliffs, rock face features, steep slopes and land in general within the Longwalls 101-103 Study Area.

3.2.2 Key Land Issues, Monitoring and Management Measures

Cliffs

Cliffs C5 and C6 lie within the Longwalls 101-103 Study Area (Figure 16).

The performance measure ‘No greater subsidence impacts or environmental consequences than predicted in the EA’ for other cliffs is considered to reflect the prediction by MSEC (2015) that cliff instabilities could occur on up to approximately 15% of the lengths of the exposed cliffs in the UG1 Study Area. MSEC (2017) concluded that the potential impacts on the cliff would be the same as those assessed based on the Approved Layout. As a result, it is considered that the subsidence impact performance measure for other cliffs will not be exceeded.

Minor Cliffs, Rock Face Features and Steep Slopes

MSEC (2015) also identified a number of overhangs and smaller cliffs (i.e. minor cliffs and rock face features) within the UG1 Study Area, which are referred to as rock ledges. MSEC (2015) also identified a number of steep slopes within the UG1 Study Area (Figure 16).

The performance measure, ‘Minor environmental consequences (that is, occasional rockfalls, displacement of or dislodgment of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of feature within any longwall mining domain)’ for minor cliffs, rock face features and steep slopes relates to features that are present across the Longwalls 101-103 Study Area. It is expected that occasional rockfalls or fracturing would not impact more than 5% of the total face area of rock ledges and overhangs in the Longwalls 101-103 Study Area (MSEC, 2017), and therefore the subsidence impact performance measure will not be exceeded.
Land in General

There are no subsidence impact performance measures relevant to land in general.

Land in general refers to the general landscape other than cliffs, minor cliffs, rock face features and steep slopes. Land in general includes other land features such as fire trails and vehicular tracks, however excludes surface features such as drains, diversions, and other MCO assets including the conveyor trace, open cut highwalls and out-of-pit emplacements which are addressed elsewhere in the Extraction Plan. Unsealed vehicular tracks and fire trails are located throughout the UG1 Study Area and above Longwalls 101-103.

Summary

The key issues relating to subsidence impacts on cliffs, minor cliffs, rock face features, steep slopes and land in general are described in the LW101-103 LMP and the relevant monitoring and management measures are summarised in Table 12, Figure 16 and Section 3.8.

Table 12: Monitoring and Management for Land during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Objective</th>
<th>Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cliffs C5 and C6</td>
<td>Cliff instabilities could occur on up to approximately 15% of the lengths of the exposed cliffs in the UG1 Study Area.</td>
<td>Monitoring in accordance with the LW101-103 LMP, including visual observations of: • Cliff instabilities or cracking. • Sandstone fracturing. • Rock falls. • Displacement or dislodgement of boulders or slabs. Subsidence monitoring in accordance with the LW101-103 SMP.</td>
<td>Management in accordance with the LW101-103 LMP, including: • Stabilisation techniques. • Erosion and sediment control techniques. • Remediation of surface tension cracks. • Salvage of artefacts (if required). • Measures to address safety hazards.</td>
</tr>
<tr>
<td>Minor cliffs, Rock face features, Steep slopes</td>
<td>Occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of features within any longwall mining domain.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2.3 Assessment of Performance Indicators and Measures

Performance indicators developed for the subsidence impact performance measures relating to land are presented in the LW101-103 LMP and are summarised in Table 13. Monitoring against these performance indicators during the mining of Longwalls 101-103 is summarised in Table 12 and Section 3.8 and described in detail in Appendix B.
Table 13: Land Performance Measures and Performance Indicators

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other cliffs</strong></td>
<td></td>
</tr>
<tr>
<td>No greater subsidence impacts or environmental consequences than predicted in the EA</td>
<td>The total length of cliffs within the Longwalls 101-103 Study Area that experiences cliff instabilities (i.e. the exposure of a fresh face of rock and debris scattered around the base of the cliff) is to be less than 6 m.</td>
</tr>
<tr>
<td><strong>Minor cliffs, rock face features, steep slopes</strong></td>
<td></td>
</tr>
<tr>
<td>Minor environmental consequences (that is, occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of features within any longwall mining domain)</td>
<td>In each instance of an identified impact (that is, occasional rockfalls, displacement of boulders or slabs, or fracturing) to a minor cliff, rock face feature or steep slope, the affected percentage of the total face area of the feature affected will be determined. It is expected that occasional rockfalls or fracturing would not impact more than 5% of the total face area of rock ledges and overhangs in the Longwalls 101-103 Study Area (MSEC, 2017).</td>
</tr>
</tbody>
</table>

3.2.4 Contingency Plan

In the event that subsidence impacts observed exceed the land subsidence impact performance measure, MCO will implement a Contingency Plan as described in the LW101-103 LMP and summarised in Section 4.1.

3.3 BIODIVERSITY MANAGEMENT

3.3.1 Overview

The LW101-103 BMP is provided in Appendix C. The purpose and scope of the LW101-103 BMP are summarised below:

**Purpose:** This LW101-103 BMP outlines the management of potential environmental consequences on aquatic and terrestrial flora and fauna resulting from the extraction of Longwalls 101-103.

**Scope:** This LW101-103 BMP covers aquatic and terrestrial flora and fauna within the Longwalls 101-103 Study Area.
3.3.2 Key Biodiversity Issues, Monitoring and Management Measures

**Threatened Species, Threatened Populations, or Endangered Ecological Communities**

Eco Logical (2016) conducted a vegetation validation survey for Longwalls 101-103 and identified the one EEC and one CEEC listed under either the BC Act and/or the EPBC Act. In addition to the above, Eco Logical (2016) also identified *Central Hunter Valley Eucalypt Forest and Woodland*, listed as a CEEC under the EPBC Act. This CEEC was listed in May 2015 and does not apply to the approved Stage 1 and Stage 2 mining operations pursuant to section 158A of the EPBC Act.

Of the five threatened flora species and 32 threatened and/or migratory fauna species recorded at the Moolarben Coal Complex, only the following subset has been recorded within the Longwalls 101-103 Study Area:

- Scant Pomaderris (*Pomaderris queenslandica*);
- Square-tailed Kite (*Lophoictinia isura*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Gang-Gang Cockatoo (*Callocephalon fimbriatum*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Speckled Warbler (*Chthonicola sagittata*);
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- Diamond Firetail (*Stagonopleura guttata*);
- Varied Sittella (*Daphoenositta chrysoptera*); and
- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*).

MSEC (2017) concluded that the potential impacts from the Extraction Plan Layout on native vegetation, EECs and CEECs would be the same as for the Approved Layout.

The subsidence impact performance measure ‘negligible subsidence impacts or environmental consequences’ for threatened species, threatened populations or EECs was considered by Eco Logical (2017) to be achievable when considering that the effect of subsidence is unlikely to cause any significant impact on vegetation communities or critical habitats, consistent with the predicted impacts for the Approved Layout.

**Summary**

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5 Negligible is defined by Project Approval (08_0135) as “small and unimportant, such as to be not worth considering”.

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Issue</th>
<th>Effective</th>
<th>Review</th>
<th>Author</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCO_UG1_LW101-103_EP</td>
<td>2</td>
<td>Mar 19</td>
<td>Mar 19</td>
<td>Mar 20</td>
<td>MCO</td>
<td>S. Archinal</td>
</tr>
</tbody>
</table>
The key issues relating to subsidence impacts on aquatic and terrestrial flora and fauna are described in the LW101-103 BMP and the relevant monitoring and management measures are summarised in Table 14, Figure 16 and Section 3.8.

**Table 14: Monitoring and Management for Biodiversity during the Extraction of Longwalls 101 to 103**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Objective</th>
<th>Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threatened species, threatened populations, or endangered ecological communities</td>
<td>Negligible subsidence impacts or environmental consequences</td>
<td>Monitoring as described in the LW101-103 BMP, including:</td>
<td>Management in accordance with the LW101-103 BMP, including:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Longwall panel traverses(^1).</td>
<td>• Vegetation management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Floristic monitoring sites(^1).</td>
<td>• Terrestrial fauna and habitat management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Targeted cliff line monitoring.</td>
<td>• Weed management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subsidence monitoring as described in the LW101-103 SMP.</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Including the condition and extent of threatened flora species or EECs (if present).

3.3.3 **Assessment of Performance Indicators and Measures**

Performance indicators developed for the subsidence impact performance measures relating to biodiversity are presented in the LW101-103 BMP and are summarised in Table 15. Monitoring against these performance indicators during the mining of Longwalls 101-103 is summarised in Table 14 and Section 3.8 and described in detail in Appendix C.

**Table 15: Biodiversity Performance Measures and Performance Indicators**

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Threatened Species, Threatened Populations, or Endangered Ecological Communities</strong></td>
<td>Subsidence related impacts to threatened flora, fauna or EECs, including:</td>
</tr>
<tr>
<td><strong>Negligible subsidence impacts or environmental consequences</strong></td>
<td>• areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-103;</td>
</tr>
<tr>
<td></td>
<td>• declining trend in canopy health or vegetation structure inconsistent with seasonal trends at analogue sites;</td>
</tr>
<tr>
<td></td>
<td>• deterioration in tree health outside natural variations (analogue sites to be used as a guide);</td>
</tr>
<tr>
<td></td>
<td>• areas of weed incursion and/or infestation; or</td>
</tr>
<tr>
<td></td>
<td>• mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts.</td>
</tr>
<tr>
<td>Evidence of impacts (attributable to subsidence) to more than 5% of features that provide potential bat roosting sites in the Longwalls 101 to 103 Study Area (i.e. cliffs and minor cliffs).</td>
<td></td>
</tr>
</tbody>
</table>
3.3.4 Contingency Plan

In the event that subsidence impacts observed exceed the biodiversity subsidence impact performance measure, MCO will implement a Contingency Plan as described in the LW101-103 BMP and summarised in Section 4.1.

3.4 HERITAGE MANAGEMENT

3.4.1 Overview

The LW101-103 HMP is provided in Appendix D. The purpose and scope of the LW101-103 HMP are summarised below:

Purpose: The LW101-103 HMP describes the management of potential environmental consequences on Aboriginal and historic heritage resulting from the extraction of Longwalls 101-103.

Scope: The LW101-103 HMP considers Aboriginal and historic heritage within the Longwalls 101-103 Study Area.

3.4.2 Key Heritage Issues, Monitoring and Management Measures

Historic Heritage

Historic heritage sites are not located in the vicinity of Longwalls 101-103, and are not considered further in this Extraction Plan.

Aboriginal Heritage

The key issues relating to subsidence impacts on Aboriginal heritage items are described in the LW101-103 HMP and the relevant monitoring and management measures are summarised below.

A total of 17 Aboriginal heritage sites have been identified within the Longwalls 101-103 Study Area (Niche, 2017) and include isolated finds, artefact scatters, potential archaeological deposits (PADs) and/or rock shelters of low archaeological significance (Figure 8).

Subsequent to the preparation of the complex-wide HMP, an additional inspection was conducted by Niche in December 2016 to confirm the nature of three sites previously recorded as PADs (i.e. PAD 1...
Moolarben Coal, PAD 2 Moolarben Coal and PAD 3 Moolarben Coal) within the Longwalls 101-103 Study Area. Following review of the Moolarben Aboriginal Sites Database and Aboriginal Heritage Information Management System, these sites were considered unlikely to be open PADs and more likely to be associated with rock shelters. All three sites were confirmed to be associated with rock shelters during the inspection (Niche, 2017).

Previous assessments have identified and documented the following general cultural heritage values for the Moolarben Coal Complex area, including the following:

- Archaeological sites having contemporary cultural value because they provide a tangible link to the traditional past (Kuskie, 2013).
- The presence of flora and fauna species with known traditional uses (Kuskie, 2013).
- The area of Moolarben Ridge to the south of Carrs Gap having contemporary cultural value to the Wiradjuri community (Hamm, 2008 and Kuskie, 2013).
- The area along the Goulburn River known as “The Drip” is considered to have high cultural value as the sites in this area represent easily identified material remains and the area is ceremonially important (Hamm, 2006).

Consultation undertaken to date with the Aboriginal community indicates that all Aboriginal heritage sites at the Moolarben Coal Complex, known or otherwise, have high cultural significance.

Aboriginal heritage sites within the Longwalls 101-103 Study Area are considered unlikely to be impacted by subsidence with PAD 3 Moolarben Coal (a rock shelter with one artefact) considered to have the highest risk of impact (MSEC, 2017).

In this regard, MCO will undertake subsidence monitoring of site PAD 3 Moolarben Coal only (Figure 16). In order to identify and document whether any subsidence impacts have arisen from mining activities at PAD 3 Moolarben Coal, the monitoring requirements described in section 5.9.1 of the complex-wide HMP will be implemented for this site. Monitoring will involve the following:

- MCO will engage an appropriately qualified expert to monitor the Aboriginal archaeological sites described as requiring monitoring. This may include the establishment of a percentage estimate of the likelihood of subsidence occurring in sensitive areas.
- Where insufficient pre-existing information is available for any of the specific Aboriginal archaeological sites to permit comparison with the condition post-mining, more detailed recording will occur prior to undermining.
- Monitoring will involve inspecting and recording the condition of these specific Aboriginal archaeological sites within three to six months after undermining has occurred. Each inspection will involve recording of data on environmental conditions, pre-existing human and natural
impacts, heritage evidence present and any identified changes to these environmental and heritage conditions compared with previous inspections. The potential cause (subsidence or other impacts) of changes to the condition of individual sites will be assessed.

- Monitoring will be focussed on the features of the site that make it significant (e.g. grooves, art, artefacts and/or PAD).

- A report documenting the results of monitoring will be prepared that details the methodology of the inspections, conditions of the environment and Aboriginal heritage evidence at the relevant sites, comparisons with previously reported conditions at each site, identification of any natural and/or human impacts during the intervening period, identification of any implications for the ongoing management and protection of Aboriginal heritage evidence at the Moolarben Coal Complex, and documentation of the actual impacts of operations on the Aboriginal archaeological sites.

- Copies of this report will be distributed to the RAPs, OEH and the DP&E and a summary included in the Annual Review.

Monitoring for subsidence related impacts will occur at PAD 3 Moolarben Coal within three to six months of undermining. If, during the monitoring at PAD 3 Moolarben Coal, significant subsidence impacts are identified, then the salvage and excavation procedures outlined in the LW101-103 HMP and complex-wide HMP will be considered.

Monitoring and/or salvage and/or excavation would only occur where safe to do so, as determined in consultation with relevant MCO safety personnel.

For the purpose of determining what constitutes a significant subsidence impact on Aboriginal heritage sites, a site is considered to be “affected by significant subsidence impacts” if it exhibits one or more of the following consequences that cannot be attributed to natural weathering or deterioration:

- overhang collapse;
- cracking of sandstone that coincides with the feature(s) of the site that make it significant; and
- rock fall that damages the feature(s) of the site that make it significant.

3.4.3 Assessment of Performance Indicators and Measures

The Aboriginal heritage sites referenced in the performance measure (i.e. S2MC 236 [AHIMS No.s 36-3-0016 and 36-3-0134]) are not within the boundary of the Longwalls 101-103 Study Area and, as a result, the relevant subsidence impact performance measures will not be exceeded due to the secondary extraction of Longwalls 101-103.
The performance measure for historic heritage sites requiring ‘No greater subsidence impact or environmental consequences than predicted in the EA’ is considered to reflect the predictions by MSEC’s subsidence reports prepared for the Stage 2 EA, Preferred Project Report and UG1 Optimisation Modification EA. All three reports assessed the impacts of subsidence due to Stage 2 operations, with Item 18 (Carr’s Gap Road Stone Wall) the only historic heritage site which was assessed (MSEC, 2008; 2011; 2015). This is also reflected in Appendix 4 of Project Approval (08_0135). Item 18 is located at the south-western end of Longwall 105 and is not within the Longwalls 101-103 Study Area. As a result, the relevant subsidence impact performance measures will not be exceeded due to the secondary extraction of Longwalls 101-103.

3.4.4 Contingency Plan

In the event that subsidence impacts observed exceed the heritage sites subsidence impact performance measures, MCO will implement a Contingency Plan as described in the LW101-103 HMP and summarised in Section 4.1.

3.5 BUILT FEATURES MANAGEMENT

3.5.1 Overview

The LW101-103 BFMPs are provided in Appendix E and includes component plans for the individual infrastructure owners. The purpose and scope of the LW101-103 BFMPs is summarised below:

Purpose: The LW101-103 BFMPs outline the management of potential subsidence impacts on built features resulting from the extraction of Longwalls 101-103.

Scope: The LW101-103 BFMPs consider built features that could experience subsidence effects during the mining of Longwalls 101-103.

3.5.2 Key Built Features Issues, Monitoring and Management Measures

Subcomponent Built Features Management Plans have been prepared for the following assets relevant to Longwalls 101-103 (Figures 9, 9a, 11, 12, 13, 14 and 15):

- Sandy Hollow Gulgong Railway Line (ARTC).
- Public roads (MWRC), including:
  - Ulan Road;
  - Ulan Road bridge (over the Sandy Hollow Gulgong Railway);
- publicly accessible sections of Ulan-Wollar Road (on land owned by MWRC and on land owned by MCO);
- publicly inaccessible (i.e. closed) sections of Ulan-Wollar Road (on land owned by MWRC); and
- other roads closed to the public (on land owned by MWRC) including Murragamba Road and Carrs Gap Road.

- 330 kV ETL and towers (TransGrid).
- Telecommunication cables (Telstra), including:
  - optical fibre cable; and
  - copper cable.
- 66 kV/22 kV dual circuit powerline and timber poles (Essential Energy).
- Substation (Essential Energy).

None of the above are predicted to be subject to potential vertical subsidence. The assets may be subject to potential far-field horizontal movements, however the presence of palaeochannel sediments and the existing open cuts should result in reduced far-field movements.

The key issues relating to management of built features in regard to subsidence impacts are described in the relevant component plans of the LW101-103 BFMPs (Appendix E). The relevant monitoring and management measures for these built features are summarised in Table 16, Attachment 1 of Appendix G (Plan 7) and Section 3.8.

MSEC (2017) (Technical Report 1) also assesses potential subsidence effects, impacts and environmental consequences of other built features not subject to the component plans including survey marks and access roads and tracks.

Access roads/tracks (including fire trails and vehicular tracks) will be managed in accordance with the LW101-103 LMP and the relevant LW101-103 BFMPs.

MCO considered potential risks to MCO-owned assets in the vicinity of Longwalls 101-103 and concluded that with the application of the identified controls, subsidence related impacts from the secondary extraction of Longwalls 101-103 were as low as reasonably practicable (ORM, 2017b).

3.5.3 Assessment of Performance Indicators and Measures

Performance indicators developed for the subsidence impact performance measures relating to built features are presented in the LW101-103 BFMPs and are summarised in Table 16. Monitoring against
these performance indicators during the mining of Longwalls 101-103 is summarised in Table 16 and Section 3.8 and described in detail in Appendix E.

The performance indicators have been developed in consultation with the relevant asset owners (Section 2.3.2 and Attachment 2).

3.5.4 Contingency Plan

In the event that a subsidence impact performance measure relating to built features is considered to have been exceeded, MCO will implement a Contingency Plan as described in detail in the LW101-103 BFMPs and summarised in Section 4.1.
## Table 16: Monitoring and Management for Built Features during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Built Feature</th>
<th>Performance Indicator(s)</th>
<th>Monitoring</th>
<th>Relevant Management Measures</th>
</tr>
</thead>
</table>
| ARTC Sandy Hollow Gulgong Railway Line | • No defects or deformation of the rail track and associated infrastructure due to mining.  
• No visual displacement at joints or cracks in culverts. | Subsidence monitoring based on the FF Line (along the alignment of Ulan-Wollar Road) and as described in the LW101-103 SMP, monitoring parameters include:  
• subsidence;  
• tilt;  
• tensile strain;  
• compressive strain; and  
• absolute horizontal translation.  
If/when ground movement (in excess of survey accuracy) is detected during monitoring of the FF Line, subsidence impact inspections will target the identification of:  
• any defects or deformation of the rail line and associated infrastructure; and  
• changes to the visible surfaces of the culverts including cracking, buckling, shearing, and collapse. | A number of potential management measures in relation to the rail line are considered to be applicable, if required. These may include:  
• speed restriction of trains; and  
• minor repair of track.  
A number of potential management measures in relation to culverts are also considered to be applicable, if required. These include:  
• point repairs;  
• lining;  
• grouting; and  
• culvert replacement.  
Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. |
Table 16 (Continued): Monitoring and Management for Built Features during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Built Feature</th>
<th>Performance Indicator(s)</th>
<th>Monitoring</th>
<th>Relevant Management Measures</th>
</tr>
</thead>
</table>
| Essential Energy 66 kV/22 kV dual circuit powerline and poles within 300 m of the relevant longwall | • The structural integrity of the 66 kV/22 kV dual circuit powerline (power poles and transmission lines) is maintained.  
• The electrical clearance from land, vegetation and roads is maintained.  
• The serviceability of the access roads/tracks is maintained. | Structure survey – 2 x monitoring points at each timber pole. | A number of potential management measures in relation to the 66 kV/22 kV dual circuit powerline and/or Essential Energy substation are considered to be applicable. These include:  
• alteration of conductor tensions;  
• modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors; and  
• strengthening of pole footings.  
The substation foundation will be designed in consultation with Essential Energy including potential management measures.  
In the event management measures are considered to be required, the appropriate action will be determined and implemented in consultation with Essential Energy.  
Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. |
| Essential Energy substation | • The structural integrity of the substation is maintained.  
• The serviceability of the access roads/tracks is maintained. | Subsidence monitoring at survey points installed around the substation. Parameters include:  
• vertical subsidence;  
• tilt;  
• tensile strain; and  
• compressive strain. |
Table 16 (Continued): Monitoring and Management for Built Features during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Built Feature</th>
<th>Performance Indicator(s)</th>
<th>Monitoring</th>
<th>Relevant Management Measures</th>
</tr>
</thead>
</table>
| TransGrid 330 kV ETL and towers (Towers 102 to 111) | • The structural integrity of the 330 kV ETL (towers and transmission lines) is maintained.  
• The electrical clearance from land, vegetation and roads is maintained.  
• The serviceability of the access roads/tracks is maintained. | Subsidence monitoring based on the FF Line (along the alignment of Ulan-Wollar Road) and as described in the LW101-103 SMP, monitoring parameters include:  
• subsidence;  
• tilt;  
• tensile strain;  
• compressive strain; and  
• absolute horizontal translation.  
Tower survey – 4 x leg mounted prisms at each tower (measuring differential separation) as well as target (bolt) locations on both earth peaks of each tower and ground network monitoring at the base of each tower. | A number of potential management measures in relation to the 330 kV ETL are considered to be applicable. These include:  
• alteration of conductor tensions;  
• installation of temporary structures;  
• modification to attachment points such as placement of stringing sheaves to earth wires and/or phase conductors; and  
• strengthening of tower structures through installation of cruciform footings.  
The requirement for these management measures will be determined by TransGrid during the pre-mining inspection / baseline audit and if required, implemented prior to mining within 400 m of the relevant feature.  
Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. |

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<th>Issue</th>
<th>Effective</th>
<th>Review</th>
<th>Author</th>
<th>Approved</th>
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<td>2</td>
<td>Mar 19</td>
<td>Mar 19</td>
<td>Sept 2020</td>
<td>MCO</td>
<td>S.J. Archinal</td>
</tr>
</tbody>
</table>
### Table 16 (Continued): Monitoring and Management for Built Features during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Built Feature</th>
<th>Performance Indicator(s)</th>
<th>Monitoring</th>
<th>Relevant Management Measures</th>
</tr>
</thead>
</table>
| MWRC Ulan-Wollar Road | • No additional visible pavement cracking or other defects of the road pavement (when compared against baseline conditions and sections of road outside the Study Area) resulting in deterioration of road quality.  
• No ponding of water on the road surface as a result of changes in grade from subsidence associated with Longwalls 101-103.  
• No joint displacement or cracking or other defects of the drainage structure (e.g. pipes/culverts) in excess of 5 mm.  
• Serviceability of guard rails, marker posts and signage is maintained. | Subsidence monitoring based on the FF Line (along the alignment of Ulan-Wollar Road) and as described in the LW101-103 SMP, monitoring parameters include:  
• subsidence;  
• tilt;  
• tensile strain;  
• compressive strain; and  
• absolute horizontal translation. | The potential management measures in relation to the Ulan-Wollar Road pavement include:  
• mill and/or replace pavement layers; and  
• crack sealing/repair.  
The potential management measures in relation to drainage structures (pipes/culverts) include:  
• point repairs;  
• replace sections of pipe/culvert; and  
• grouting/sealing of cracks.  
The potential management measures in relation to guard rails, marker posts and signage include repairs and/or replacement of furniture.  
Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. |
| Telstra optical fibre telecommunication cable and copper telecommunication cable | • Negligible transmission loss from mine subsidence impacts.  
• Negligible impacts on structural integrity of the cable lines from mine subsidence. | Subsidence monitoring based on the FF Line (along the alignment of Ulan-Wollar Road) and as described in the LW101-103 SMP, monitoring parameters include:  
• subsidence;  
• tilt;  
• tensile strain; and  
• compressive strain. | A number of potential management measures in relation to telecommunication cables are considered to be applicable (including stabilisation methods if required).  
Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures. |
<table>
<thead>
<tr>
<th>Built Feature</th>
<th>Performance Indicator(s)</th>
<th>Monitoring</th>
<th>Relevant Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Signal integrity testing (resistance testing and Remote Fibre Monitoring System [RFMS]).</td>
<td></td>
</tr>
</tbody>
</table>

- **Document**
  - **Version**: 2
  - **Issue**: Mar 19
  - **Effective**: Mar 19
  - **Review**: Sept 2020
  - **Author**: MCO
  - **Approved**: S.J. Archinal
3.6 PUBLIC SAFETY MANAGEMENT

3.6.1 Overview

The LW101-103 PSMP is provided in Appendix F. The purpose and scope of the LW101-103 PSMP are summarised below:

**Purpose:** The LW101-103 PSMP outlines the management of potential consequences on public safety resulting from the extraction of Longwalls 101-103.

**Scope:** The LW101-103 PSMP covers areas within and proximal to the Longwalls 101-103 Study Area.

3.6.2 Key Public Safety Issues, Monitoring and Management Measures

The primary hazards associated with the extraction of Longwalls 101-103 include:

- potential subsidence impacts on built features;
- potential instability of cliff formations or steep slopes caused by subsidence;
- deformations or fracturing of any land caused by subsidence; and
- any other impacts of subsidence.

With the exception of a portion of land (Lot 7010, DP1025345) owned by NSW Crown Land and a number of closed roads (and associated easements) owned by MWRC, all other land (including farm land and facilities) within the Longwalls 101-103 Study Area is owned by MCO.

Therefore, accessibility to the general public is restricted to the Longwalls 101-103 Study Area.

In addition, the management measures to prevent impacts to built features, which have been developed in consultation with the relevant asset owners (Section 2.3.2), will have the effect of managing potential public safety risks (e.g. management measures for public roads as per the LW101-103 BFMP–MWRC, management measures for the Sandy Hollow Gulgong Railway Line as per the LW101-103 BFMP–ARTC, etc.).

The key issues relating to potential risks to public safety during the extraction of Longwalls 101-103 are described in the LW101-103 PSMP (Appendix F). The relevant monitoring and management measures are summarised in Table 17.
Table 17: Monitoring and Management for Public Safety during the Extraction of Longwalls 101 to 103

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Objective</th>
<th>Monitoring</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public safety</td>
<td>Negligible additional risk to public safety</td>
<td>• Monitoring in accordance with the LW101-103 LMP.</td>
<td>• Restricted access.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitoring in accordance with the LW101-103 BFMP.</td>
<td>• Management of roads/tracks in accordance with the LW101-103 LMP and the LW101-103 BFMP-MWRC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitoring of subsidence in accordance with the LW101-103 SMP.</td>
<td>• Management of built features in accordance with the LW101-103 BFMP.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Other general potential management measures in relation to public safety include:</td>
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<td>- traffic control including diversion of traffic;</td>
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<td>- temporary speed restrictions;</td>
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<td>- warning signs/lights;</td>
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<td>- restriction of public access;</td>
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<td>- erection of barriers;</td>
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<td></td>
<td></td>
<td>- implementation of security services; and</td>
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<td></td>
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<td></td>
<td>- use of emergency services for public control.</td>
</tr>
</tbody>
</table>

3.6.3 Assessment of Performance Indicators and Measures

MCO will assess Longwalls 101-103 against the following public safety performance indicator in the event that any hazard to the general public arising from subsidence impacts becomes evident:

- No more than *negligible additional risk* to public safety.

Specific performance indicators have also been developed with each asset owner and are described in the individual LW101-103 BFMPs.

Monitoring against the performance indicator and performance measure during the mining of Longwalls 101-103 is summarised in Table 17 and described in detail in Appendix F.
3.6.4 Contingency Plan

In the event that the subsidence impact performance measure relating to public safety is considered to have been exceeded, MCO will implement a Contingency Plan as described in detail in the LW101-103 PSMP and summarised in Section 4.1.

3.7 REHABILITATION MANAGEMENT

Condition 5(o), Schedule 4 of Project Approval (08_0135) requires that the Extraction Plan propose relevant revisions to the complex-wide Rehabilitation Management Plan (RMP) required by Condition 56, Schedule 3.

The currently approved complex-wide RMP forms part of the Moolarben Coal Complex Mining Operations Plan (MOP).

The MOP and RMP describes longwall mining in UG1 for the period up to 1 January 2019. In regard to rehabilitation associated with subsidence, the MOP and RMP also describe:

- Potential subsidence impacts associated with longwall mining in UG1 (e.g. surface cracks).
- Subsidence monitoring relevant to identifying remediation and rehabilitation requirements.
- Remediation techniques that would be implemented.
- Rehabilitation goals and objectives for areas requiring remediation, and for disturbance associated with subsidence remediation/monitoring.

Potential Subsidence Impacts and Monitoring

The overriding objective for subsidence management is to minimise the potential for, or extent of, the predicted subsidence impacts.

MSEC (2017) presents potential subsidence impacts for Longwalls 101-103. Potential subsidence impacts include:

- surface cracking;
- changes in stream bed gradients;
- ponding and changes in stream alignment; and
- slope instability and erosion.
Visual monitoring of potential subsidence impacts will be conducted by MCO in accordance with the LW101-103 LMP and LW101-103 WMP.

**Remediation**

A number of potential management measures will be implemented to mitigate/remediate subsidence impacts on land resulting from underground mining operations.

Minor cracks that develop are not expected to require remediation as geomorphologic process will result in natural filling of these cracks over time.

Remediation of typical surface cracks (generally in the order of 150 mm, but up to approximately 500 mm in areas of lower depth of cover) will be undertaken where practicable and accessible using conventional earthmoving equipment (e.g. a backhoe) and will include:

- infilling of surface cracks with soil or other suitable materials; or
- locally re-grading and re-compacting the surface.

Notwithstanding, remediation will be undertaken in the event a crack is identified to present a significant risk to safety of people or livestock and/or presents a long-term degradation or erosion risk.

Areas of surface cracking will be stabilised using erosion protection measures (e.g. vegetation seeding and planting and/or brush matting). Drainage works and rehabilitation of subsidence troughs (i.e. areas of induced ponding) will be conducted as necessary, and may include stabilisation of banks subject to soil slumping.

If surface crack remediation works are required in remnant vegetation areas, compact mobile equipment will be used, where practicable, to minimise damage to surrounding vegetation. If the remediation work (or subsidence monitoring) requires clearing of remnant vegetation to an extent that would exceed the benefit of the remediation, the requirement for remediation will be reviewed. Vegetation that requires clearance will be subject to the Ground Disturbance Permit and Vegetation Clearance Protocol (as per the approved complex-wide BMP).

In summary, remediation of surface cracking will be undertaken where practicable and accessible using conventional earthmoving machinery and include infilling of surface cracks with soil and suitable material or locally re-grading and re-compacting the surface.
Visual monitoring of remediated subsidence areas will be conducted quarterly to identify any requirement for maintenance measures and/or remedial works in accordance with the MOP.

**Rehabilitation**

Rehabilitation associated with subsidence impacts, and any minor disturbance associated with subsidence remediation works or monitoring, will be undertaken in accordance with the approved MOP, RMP and the management and mitigation measures outlined in this Extraction Plan and the relevant component plans (e.g. the LW101-103 LMP).

Rehabilitation objectives and decommissioning phase performance indicators and completion criteria have been developed for the subsidence area (e.g. overlying Longwalls 101-103) and are described in the MOP. The relevant rehabilitation objectives and decommissioning phase performance indicators and completion criteria are:

- **Rehabilitation Objectives:**
  - Land affected by mine induced subsidence will be safe, stable and non-polluting.
  - Land affected by mine subsidence will not present a risk to achieving final land use options.

- **Decommissioning Phase Performance Indicators and Completion Criteria:**
  - No subsidence surface cracks remaining that present a risk to the environment, safety and the final land use objectives.

Rehabilitation performance will be considered to be satisfactory when monitoring data indicates the completion criteria have been met.

**Changes to MOP/RMP**

Following approval of the Extraction Plan, the MOP/RMP would be reviewed, and revised if required, for consistency with this Extraction Plan.
3.8 MONITORING PROGRAM SUMMARY

The various monitoring programs presented in each of the management plans described in Sections 3.1 to 3.5 are summarised in Table 18 and the location of relevant environmental monitoring sites included in the Extraction Plan component monitoring programs (i.e. for the LW101-103 WMP, LW101-103 LMP, LW101-103 BMP and LW101-103 HMP) are presented in Figure 16. The LW101-103 SMP is included in Appendix G.

Details of any subsidence impacts observed will be recorded in the relevant Subsidence Impact Register.
Table 18: Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
</table>
| LW101-103 LMP             | Visual inspection of cliffs | CS and C6. | • Prior to commencement of Longwall 101 extraction.  
• Prior to commencement of Longwall 103 extraction.  
• Within one month of the completion of Longwall 103 extraction. | Evidence of subsidence impacts compared to baseline records by visual inspection of location, physical description (e.g. length and height of cliffs, angle to horizontal) and general condition of cliffs. |
|                           | Minor cliffs, rock face features, steep slopes and land in general | Representative sites within the Study Area. | • Prior to commencement of Longwall 101 extraction.  
• Opportunistic visual observations during mining.  
• Within one month following completion of Longwall 103. | Evidence of subsidence impacts compared to baseline observations (e.g. photography, rockfalls, cliff instabilities, displacement of or dislodgement of boulders or slabs surface cracking) and total face area to be recorded. |
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 BMP</td>
<td>Flora and fauna habitats</td>
<td>Longwall panel traverses.</td>
<td>• During spring, prior to longwall extraction beneath the transect.</td>
<td>Evidence of subsidence impacts compared to baseline condition (e.g. surface cracking, ponding, deterioration in tree health outside natural variations, weed incursion and/or infestation). Nature and extent of any impacts on flora and fauna habitats and observations of terrestrial fauna. The extent and condition of identified threatened flora species or EECs.</td>
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<tr>
<td></td>
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<td></td>
<td>• During spring, for two years following longwall extraction beneath the transect.</td>
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<tr>
<td></td>
<td>Floristic monitoring sites.</td>
<td></td>
<td>• During spring, prior to longwall extraction beneath the monitoring site.</td>
<td>Collection of data at each site for comparison to baseline condition, including:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• During spring, for two years following longwall extraction beneath the monitoring site.</td>
<td>• Canopy health and defoliation.</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>• Vegetation structure.</td>
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<td></td>
<td>• Nature and extent of any impacts on flora and fauna habitats.</td>
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<td></td>
<td>• Evidence of any impacts on terrestrial fauna.</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>• Condition and extent of threatened flora species or EECs (if present).</td>
</tr>
<tr>
<td></td>
<td>Targeted cliff line monitoring</td>
<td></td>
<td>• Prior to commencement of longwall extraction beneath the potential roosting site.</td>
<td>Evidence of subsidence impacts to features that provide potential bat roosting sites compared to baseline condition (e.g. rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Between October and February after completion of longwall extraction.</td>
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</tbody>
</table>

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### Document Information

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<th>Review</th>
<th>Author</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCO_UG1_LW101-103_EP</td>
<td>2</td>
<td>Mar 19</td>
<td>Mar 19</td>
<td>Mar 2020</td>
<td>MCO</td>
<td>S.J. Archinal</td>
</tr>
</tbody>
</table>
## Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 WMP</td>
<td>Drainage line</td>
<td>DL7 above Longwall 103.</td>
<td>- Prior to undermining of drainage line DL7.</td>
<td>Evidence of subsidence impacts compared to baseline records by visual inspection and photographic record (noting any areas of active erosion, sediment deposition, water ponding or streambed cracking).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Within three months of undermining of drainage line DL7.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- An inspection every six months for one year after a longwall undermines drainage line DL7.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface Water Flow and Quality</td>
<td>SW04 and SW16 (Murrayamba &amp; Wilpinjong Creek).</td>
<td>In accordance with the approved complex-wide SWMP.</td>
<td>In accordance with the approved complex-wide SWMP.</td>
</tr>
<tr>
<td></td>
<td>Groundwater extraction, groundwater levels, groundwater quality and leachate/seepage losses from water and water storages</td>
<td>Bores PZ127, PZ130, PZ157, PZ186, PZ187, PZ188, PZ189, PZ179, Bore A, Bore B and Bore C.</td>
<td>In accordance with the approved complex-wide GWMP.</td>
<td>In accordance with the approved complex-wide GWMP.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major Surface Water Dams.</td>
<td>In accordance with the approved complex-wide SWMP.</td>
<td>Water levels.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Issue</th>
<th>Effective</th>
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<tbody>
<tr>
<td>MCO_UG1_LW101-103_EP</td>
<td>2</td>
<td>Mar 19</td>
<td>Mar 19</td>
<td>Mar 20</td>
<td>MCO</td>
<td>S.J. Archinal</td>
</tr>
</tbody>
</table>
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 HMP</td>
<td>Aboriginal Heritage</td>
<td>PAD 3 Moolarben Coal.</td>
<td>• Baseline recording where not sufficiently recorded.</td>
<td>To identify and document whether any subsidence impacts have arisen from mining activities at PAD 3 Moolarben Coal, the monitoring requirements described in section 5.9.1 of the approved complex-wide HMP will be implemented for this site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Within three to six months of undermining.</td>
<td></td>
</tr>
<tr>
<td>LW101-103 BFMP-ARTC</td>
<td>Sandy Hollow</td>
<td>Subsidence impact inspection</td>
<td>• Prior to secondary extraction within 400 m of the Longwall 101 take-off position.</td>
<td>Evidence of subsidence impacts and targeting the identification of:</td>
</tr>
<tr>
<td></td>
<td>Gulgong Railway</td>
<td>“Railway” Line.</td>
<td>• If/when ground movement (in excess of survey accuracy) is detected during monitoring of the FF Line.</td>
<td>• any defects or deformation of the rail line and associated infrastructure; and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• At any time in case of fault or emergency and where requested by ARTC.</td>
<td>• changes to the visible surfaces of the culverts including cracking, buckling, shearing, and collapse.</td>
</tr>
<tr>
<td>LW101-103 BFMP-TransGrid</td>
<td>Condition of 330 kV ETL</td>
<td>Towers 102 to 111.</td>
<td>• Prior to commencement of Longwall 101. [Unless a suitable inspection has been, or will be, completed by TransGrid prior to commencement of Longwall 101 extraction].</td>
<td>Evidence of subsidence impacts compared to baseline record (photographic record) (e.g. land clearance, vegetation clearance, road clearance, integrity and function of support clamps or other items).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Routinely as per TransGrid inspections.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• In the event monitoring detects movements in excess of survey/design tolerances (as advised by TransGrid).</td>
<td></td>
</tr>
<tr>
<td>Extraction Plan Component</td>
<td>Aspect</td>
<td>Sites</td>
<td>Frequency</td>
<td>Purpose/Parameters</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------</td>
<td>-------</td>
<td>-----------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| LW101-103 BFMP-MWRC       | Subsidence impact inspection of Ulan-Wollar Road | Road pavements, culverts and other furniture. | • Prior to commencement of Longwall 101 extraction.  
• If/when ground movement (in excess of survey accuracy) is detected during monitoring of the FF Line.  
• At any time in case of an emergency and requested by MWRC.  
• Routinely as per MWRC inspections. | Evidence of subsidence impacts compared to baseline record (photographic record) and targeting the identification of:  
• impacts to the pavement surface including cracks, buckling and stepping;  
• impacts to the visible surfaces of pipes/culverts including cracking, buckling, shearing, and collapse; and  
• visible impacts to furniture. |
| LW101-103 BFMP-EE         | Condition of 66 kV/22 kV dual circuit powerline | Timber poles within 300 m of the relevant longwall. | • Prior to commencement of longwall extraction.  
• Prior to secondary extraction within 400 m of the longwall take-off positions.  
• In the event monitoring detects movements in excess of survey/design tolerances.  
• At any time in case of fault or emergency and where requested by Essential Energy.  
• Routinely as per Essential Energy inspections.  
• Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position). | Evidence of subsidence impacts compared to baseline record (photographic record) and targeting the identification of:  
• surface cracking (particularly in areas around power pole foundations);  
• surface humps (particularly in areas around power pole foundations);  
• damage to poles, conductors and/or powerlines;  
• reduced ground clearance (vegetation management to be completed by Essential Energy);  
• tilting of power poles [using 2 x reflectors] (resulting in increased/decreased tension in conductors); and  
• bent cross-arms or insulators. |
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
</table>
| LW101-103 BFMP-EE (cont.) | Condition of substation | Essential Energy substation. | • Prior to secondary extraction within 400 m of the Longwall 101 take-off positions.  
• In the event monitoring detects movements in excess of survey/design tolerances.  
• Additional opportunistic observations of subsidence impacts will be conducted during routine works by MCO and its contractors.  
• Within three months of longwall completion (e.g. longwall has been relocated from the final end of block mining position). | Evidence of subsidence impacts compared to design/baseline records by visual inspection of location (e.g. surface cracking; surface humps; and tilting of foundations). |
| LW101-103 BFMP-Telstra | Optical Fibre Cable | Signal integrity testing using a RFMS. | • Prior to secondary extraction within 400 m of the Longwall 101 take-off point.  
• Continuous (monitoring commencement to occur as longwall face approaches within 400 m of the cable to establish more frequent communications with Telstra). | Establish pre-mining condition by taking a baseline RFMS measurement.  
Monitor for loss in signal using 1,625 nanometres Optical Time Domain Reflectometer. |

Subsidence impact inspection.  
If RFMS records a change that exceeds ± 3.0 dB (compared to baseline).  
Evidence of subsidence impacts and targeting the identification of:  
• movement of the cable; and  
• ground compression / tension.
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 BFMP-Telstra</td>
<td>Copper Cable</td>
<td>Signal integrity testing using a resistance test.</td>
<td>Prior to secondary extraction within 400 m of the Longwall 101 take-off point.</td>
<td>Establish pre-mining condition by taking a baseline resistance measurement. In the event monitoring identifies ground movements along FF Line (in excess of survey accuracy), monitor for a significant variation from the baseline reading.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Following identification of ground movements along FF Line (in excess of survey accuracy).</td>
<td></td>
</tr>
</tbody>
</table>
|                           |                 |                                                                      | In the event resistance testing indicates a significant variation from the baseline reading.   | Evidence of subsidence impacts and targeting the identification of:  
  - movement of the cable; and  
  - ground compression / tension.                                                                                                                |
|                           |                 |                                                                      |                                                                                               |                                                                                                                                                    |
| LW101-103 PSMP            | Public Safety   | Built features and land in general in the vicinity of Longwalls 101-103. | In accordance with the LW101-103 BFMPs and LW101-103 LMP.                                    | To identify any potential risks to public safety.                                                                                                     |
|                           |                 |                                                                      |                                                                                               |                                                                                                                                                    |
| LW101-103 SMP             | Subsidence      | “103A” Line                                                          | Prior to commencement of pillar formation and plunging                                      | Main monitoring line traversing 103 Plunge Panel first workings. Vertical subsidence monitoring only.                                            |
|                           |                 |                                                                      | Within 3 months following completion of plunging                                              |                                                                                                                                                     |
|                           |                 |                                                                      |                                                                                               |                                                                                                                                                     |
|                           |                 |                                                                      |                                                                                               | Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of each longwall panel and the total subsidence parameters associated with overall extraction. |
|                           |                 |                                                                      |                                                                                               | To provide information of relevance to each of the management plans.                                                                           |
|                           |                 |                                                                      |                                                                                               |                                                                                                                                                     |

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Issue</th>
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<th>Author</th>
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</thead>
<tbody>
<tr>
<td>MCO_UG1_LW101-103_EP</td>
<td>2</td>
<td>Mar 19</td>
<td>Mar 19</td>
<td>Mar 20</td>
<td>MCO</td>
<td>S.J. Archinal</td>
</tr>
</tbody>
</table>
Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect (cont.)</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
</table>
| LW101-103 SMP (cont.)     | Subsidence     | “B” Line | - Prior to commencement of Longwall 101 extraction.  
- At 100 m intervals determined by the longwall chainage marks while the active mining face is within 400 m of the Longwall 101 commencing end.  
- Within three months following completion of Longwall 101.  
- More frequently if directed by the Principal Subsidence Engineer NSW DRE. | Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of Longwall 101. To provide information of relevance to each of the management plans. |
|                           | “C” Line       |       | - Prior to secondary extraction within 400 m of the Longwall 101 take-off point.  
- At 100 m intervals determined by the longwall chainage marks while the active mining face is within 400 m of the Longwall 101 take-off point.  
- Within three months following completion of Longwall 101.  
- More frequently if directed by the Principal Subsidence Engineer NSW DRE. | Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of Longwall 101, particularly in the vicinity of the overlying tertiary sediments. To provide information of relevance to each of the management plans. |
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
</table>
| LW101-103 SMP (cont.)     | Subsidence (cont.) | “D” Line | • Prior to secondary extraction within 400 m of the Longwall 102 take-off point.  
  • At 100 m intervals determined by the longwall chainage marks while the active mining face is within 400 m of the Longwall 102 take-off point.  
  • Within three months following completion of Longwall 102.  
  • More frequently if directed by the Principal Subsidence Engineer NSW DRE. | Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of Longwall 102, particularly in the vicinity of the overlying tertiary sediments.  
To provide information of relevance to each of the management plans. |
|                           |        | “E” Line | • Prior to secondary extraction within 400 m of the Longwall 103 take-off point.  
  • At 100 m intervals determined by the longwall chainage marks while the active mining face is within 400 m of the Longwall 103 take-off point.  
  • Within three months following completion of Longwall 103.  
  • More frequently if directed by the Principal Subsidence Engineer NSW DRE. | Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of Longwall 103, particularly in the vicinity of the overlying tertiary sediments.  
To provide information of relevance to each of the management plans. |
### Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 SMP (cont.)</td>
<td>Subsidence (cont.)</td>
<td>“BC” Line</td>
<td>• Prior to commencement of Longwall 101 extraction.</td>
<td>Establish to measure the subsidence parameters (e.g. subsidence, tilt, strain) associated with extraction of each longwall panel and the total subsidence parameters associated with overall extraction. To provide information of relevance for the management of MCO assets and highwall stability.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• When the active longwall face is approximately 500 m from the Longwall 101 commencing end.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• When the active longwall face in Longwall 102 retreats past the Longwall 101 commencing end.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• When the active longwall face in Longwall 102 retreats approximately 500 m past the Longwall 101 commencing end.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• More frequently if directed by the Principal Subsidence Engineer NSW DRE.</td>
<td></td>
</tr>
</tbody>
</table>
Table 18 (Continued): Longwalls 101 to 103 Subsidence Impact and Environmental Consequences Monitoring Components

<table>
<thead>
<tr>
<th>Extraction Plan Component</th>
<th>Aspect</th>
<th>Sites</th>
<th>Frequency</th>
<th>Purpose/Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW101-103 SMP (cont.)</td>
<td>Subsidence (cont.)</td>
<td>“FF” Line</td>
<td>• Prior to commencement of Longwall 101 extraction.</td>
<td>Establish “FF” Line to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• When mining reaches the “A” Line for Longwall 101.</td>
<td>• provide monitoring of ground movements about the Ulan-Wollar Road (and adjacent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Prior to secondary extraction within 400 m of the longwall take-off point.</td>
<td>telecommunication cables, Sandy Hollow Gulgong Railway and 330 kV electricity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• At 100 m intervals determined by the longwall chainage marks while the active mining face is within 400 m of the longwall take-off point.</td>
<td>transmission line); and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Within two weeks following completion of longwall recovery from each of Longwalls 101, 102 and 103.</td>
<td>• obtain subsidence information ahead of longwall panels to validate and, if necessary, better calibrate, the MSEC subsidence prediction methods.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Within three months following completion of longwall recovery from each of Longwalls 101, 102 and 103.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• At any time in case of fault or emergency and where requested by relevant asset owners.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• More frequently if directed by the Principal Subsidence Engineer NSW DRE.</td>
<td></td>
</tr>
</tbody>
</table>
4.0 IMPLEMENTATION

4.1 CONTINGENCY RESPONSE

In the event a subsidence impact performance measure described in Table 6 has been exceeded or is likely to be exceeded, MCO will implement the relevant Contingency Plan detailed in the LW101-103 WMP (Appendix A), LW101-103 LMP (Appendix B), LW101-103 BMP (Appendix C), LW101-103 HMP (Appendix D), LW101-103 BFMPs (Appendix E) or the LW101-103 PSMP (Appendix F). In general, the Contingency Plans include the following:

- The observation will be reported to the Underground Technical Manager and/or the Environmental and Community Manager within 24 hours.
- The observation will be recorded in the relevant Subsidence Impact Register (consistent with the monitoring programs described in Section 3).
- Any exceedance of a subsidence impact performance measure will be reported to the DP&E, relevant agencies and relevant stakeholders as soon as practicable after MCO becomes aware of the exceedance.
- MCO will conduct an investigation to evaluate the potential contributing factors.
- MCO will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists, relevant agencies and relevant stakeholders, as necessary.
- MCO will submit the proposed course of action to the DP&E for approval.
- MCO will implement the approved course of action to the satisfaction of the DP&E.

In accordance with Condition 2, Schedule 4 of Project Approval (08_0135), MCO will provide a suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Secretary of the DP&E if either the remediation measures implemented by MCO have failed to remediate the impact or environmental consequence or the Secretary of the DP&E determines that it is not reasonable or feasible to remediate the impact or environmental consequence.

Contingency measures will be developed in consideration of the specific circumstances of the feature (e.g. the location, nature and extent of the impact, and the assessment of environmental consequences). Relevant management and contingency measures are summarised in Section 3 and outlined in the component management plans (Appendices A to F).
Responsibilities during contingency response are outlined in Section 4.6, which is designed to clearly outline actions, levels of responsibility within MCO and reporting requirements where monitoring results indicate that impacts are exceeding (or likely to exceed) predicted or approved limits. This table is designed to support the Trigger Action Response Plans (TARPs) provided in the component management plans (Appendices A to F). These TARPs will be developed further as this Extraction Plan is reviewed and revised.

### 4.2 ADAPTIVE MANAGEMENT

MCO will implement adaptive management in accordance with Condition 2, Schedule 6 of Project Approval (08_0135) to ensure subsidence impact performance measures (Table 6) are achieved at the UG1 Underground Mine. Adaptive management will involve:

- **Planning** – developing management strategies to meet performance measures; identifying performance indicators to assess performance; and establishing monitoring programs to monitor against the performance measures.

- **Implementation** – implementing management strategies and monitoring impacts against performance indicators.


- **Contingency Response** – implementing contingency plans where a potential exceedance of a subsidence impact performance measure or an unexpected impact is detected (Section 4.1).

- **Adjustment** – adjusting management strategies to improve performance, particularly following an exceedance of a subsidence impact performance measure or detection of an unexpected impact.

Where any exceedance of the subsidence impact performance measures is identified as a result of operations undertaken at the UG1 Underground Mine, MCO 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 DP&E 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.
4.3 REPORTING FRAMEWORK

MCO has developed a reporting framework for the Extraction Plan based on the nature of the predicted subsidence impacts and consequences, and streamlining of reporting requirements.

Table 19 provides a summary of the proposed reporting framework, including which stakeholders will receive copies of each report and the distribution method. The subsections below provide further detail on the contents of each reporting mechanism.

**Table 19: Summary of Reporting Framework**

<table>
<thead>
<tr>
<th>Report</th>
<th>Frequency</th>
<th>Distribution</th>
<th>Distribution Method</th>
<th>Responsibility for Data Collation and Preparation</th>
<th>Responsibility for Submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Report</td>
<td>As required – see Section 4.3.1</td>
<td>DP&amp;E DRE EPA (where relevant) Other relevant agencies as specified in management plans</td>
<td>Email</td>
<td>Environmental and Community Manager</td>
<td>General Manager</td>
</tr>
<tr>
<td>Annual Review</td>
<td>Annually</td>
<td>DP&amp;E DRE DPI Water CCC</td>
<td>Email, Post and Website</td>
<td>Environmental and Community Manager</td>
<td>General Manager</td>
</tr>
</tbody>
</table>

4.3.1 Incident Report

An incident is defined as a set of circumstances that causes or threatens to cause or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in Project Approval (08_0135).

The reporting of incidents will be conducted in accordance with Condition 7, Schedule 6 of Project Approval (08_0135).

MCO will notify the Secretary of the DP&E and any other relevant agencies (Table 19) of any incident associated with the UG1 Underground Mine immediately after MCO confirms that an incident has occurred. Within seven days of the date of the incident, MCO will provide the Secretary of the DP&E and any relevant agencies with a detailed report on the incident.
An Incident Report will include the following:

- details on the nature of the incident (including survey results, photographs and date of the incident);
- results of investigation(s) to identify/evaluate the contributing factors to the incident;
- proposed course of action and development of contingency measures; and
- relevant MCO contact details to obtain further information on the incident.

4.3.2 Annual Review

An Annual Review will be prepared and submitted in accordance with Condition 4, Schedule 6 of Project Approval (08_0135). The Annual Review will review the performance of the project to the satisfaction of the Secretary of the DP&E and will:

- describe the works carried out in the previous calendar year, and the development proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the Project over the previous calendar year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the EA;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the Project;
- identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the Project.
4.4 REVIEW OF THE EXTRACTION PLAN

In accordance with Condition 5, Schedule 6 of Project Approval (08_0135), this Extraction Plan will be reviewed within three months of the submission of:

- an Annual Review under Condition 4, Schedule 6;
- an incident report under Condition 7, Schedule 6;
- an audit under Condition 9, Schedule 6; or
- any modification to the conditions of Project Approval (08_0135) or Project Approval (05_0117) (unless the conditions require otherwise); and

if necessary, revised to the satisfaction of the Secretary of the DP&E to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance. Where this review leads to revisions to the Extraction Plan, then within four weeks of the review, the revised Extraction Plan will be submitted to the Secretary of the DP&E for approval.

The revision status of this Extraction Plan is indicated on the title page of each copy.

4.5 REVIEW OF OTHER MANAGEMENT PLANS

Condition 5(o), Schedule 3 of Project Approval (08_0135) requires the Extraction to include proposed revisions to the RMP required under condition 56, Schedule 3 of Project Approval (08_0135).

The MOP was approved by DRE on 13 December 2016. The MOP includes the approved RMP, required under Condition 56, Schedule 3 of Project Approval (08_0135), as an appendix.

MCO will review, and, if necessary, revise the MOP and RMP within three months of the approval of the Extraction Plan.
4.6 KEY RESPONSIBILITIES

Key responsibilities under this Extraction Plan are summarised in Table 20. The component management plans provide additional responsibilities under the plans.

Table 20: Key Extraction Plan Responsibilities

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Task</th>
</tr>
</thead>
</table>
| General Manager            | • Ensure resources are available to MCO personnel to facilitate the completion of responsibilities under this Extraction Plan.  
                              | • Ensure the safety of MCO employees and the public in relation to MCO operations.  
                              | • Approve and instruct implementation of remediation/corrective action/compensation, if necessary. |
| Underground Technical Manager | • Liaise with relevant stakeholders regarding environmental management.  
                                 | • Liaise with relevant stakeholders regarding management of built features.  
                                 | • Ensure monitoring and reporting required in accordance with this Extraction Plan are carried out within specified timeframes, are adequately checked and processed and are prepared to the required standard.  
                                 | • Ensure that any Incident Reports are lodged in a timely manner with all available information.  
                                 | • Ensure that reviews of this Extraction Plan and other plans are conducted as described in Sections 4.4 and 4.5.  
                                 | • Liaise with relevant stakeholders regarding subsidence impact management and related public safety hazards. |
| Environmental and Community Manager | • Liaise with relevant stakeholders regarding environmental management.  
                                      | • Ensure monitoring and reporting required in accordance with this Extraction Plan are carried out within specified timeframes, are adequately checked and processed and are prepared to the required standard.  
                                      | • Ensure that any Incident Reports are lodged in a timely manner with all available information.  
                                      | • Ensure that reviews of this Extraction Plan and other plans are conducted as described in Sections 4.4 and 4.5. |
| Registered Mine Surveyor    | • Undertake all subsidence monitoring to the required standard within the specified timeframes and ensure data are adequately checked, processed and recorded. |
5.0 REFERENCES


Eco Logical Australia Pty Ltd (2016) Moolarben Coal UG1 Vegetation Validation.


Mine Advice (2019), Geotechnical Evaluation of Proposed Taking of Unsupported Plunges in LW103A Block


