



Moolarben Coal Complex

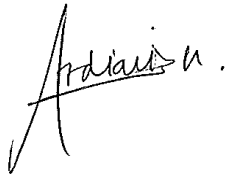
UG2 Modification Surface Water Assessment

Moolarben Coal Operations Pty Ltd
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1 Introduction

1.1 OVERVIEW OF THE MOOLARBEN COAL COMPLEX

The Moolarben Coal Complex (MCC) is located in the Western Coalfields of New South Wales (NSW), approximately 40 kilometres (km) north-east of Mudgee. The MCC comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities). Refer to Figure 1.1 and Figure 1.2 for locality and general arrangement plans for the MCC respectively.

The MCC is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the MCC are currently approved until 31 December 2038 in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) and Project Approval (08_0135) (Moolarben Coal Project Stage 2). UG2 is included in the Moolarben Coal Project Stage 2 which was approved on 30 January 2015.

WRM Water & Environment Pty Ltd (WRM) was engaged by Moolarben Coal Operations Pty Ltd (MCO) to undertake a Surface Water Assessment for the proposed UG2 Modification (the Modification).

This Surface Water Assessment forms part of a Modification Report which has been prepared by MCO to support an application to modify Project Approval (08_0135). A review of potential surface water impacts is required to support the proposed Modification.

1.2 OVERVIEW OF PROPOSED MODIFICATION

The Modification includes the following changes to the approved UG2:

- Optimisation of the approved UG2 layout (including the extension of two approved longwall panels).
- Increased UG2 extraction height from 3.0 metres (m) to 3.5 m.
- Revised UG2 mining sequence.
- Increased UG2 run-of-mine (ROM) coal production from 9.4 million tonnes (Mt) to 13.9 Mt.
- Construction and operation of a remote services infrastructure area (including two UG2 service boreholes) within the approved OC4 disturbance footprint to support UG2 operations.
- Development of an additional non-subsiding gate road along the southern boundary of the UG1 mining area to assist with ventilation in UG2.
- Small reduction in the approved OC4 extent to accommodate the optimised UG2 layout.

The Modification would not change the approved operational mine life, disturbance footprint, open cut and underground annual coal extraction limits, water management design and objectives, or management of coal reject material disposal at the MCC.

The proposed Modification general arrangement is shown on Figure 1.2.

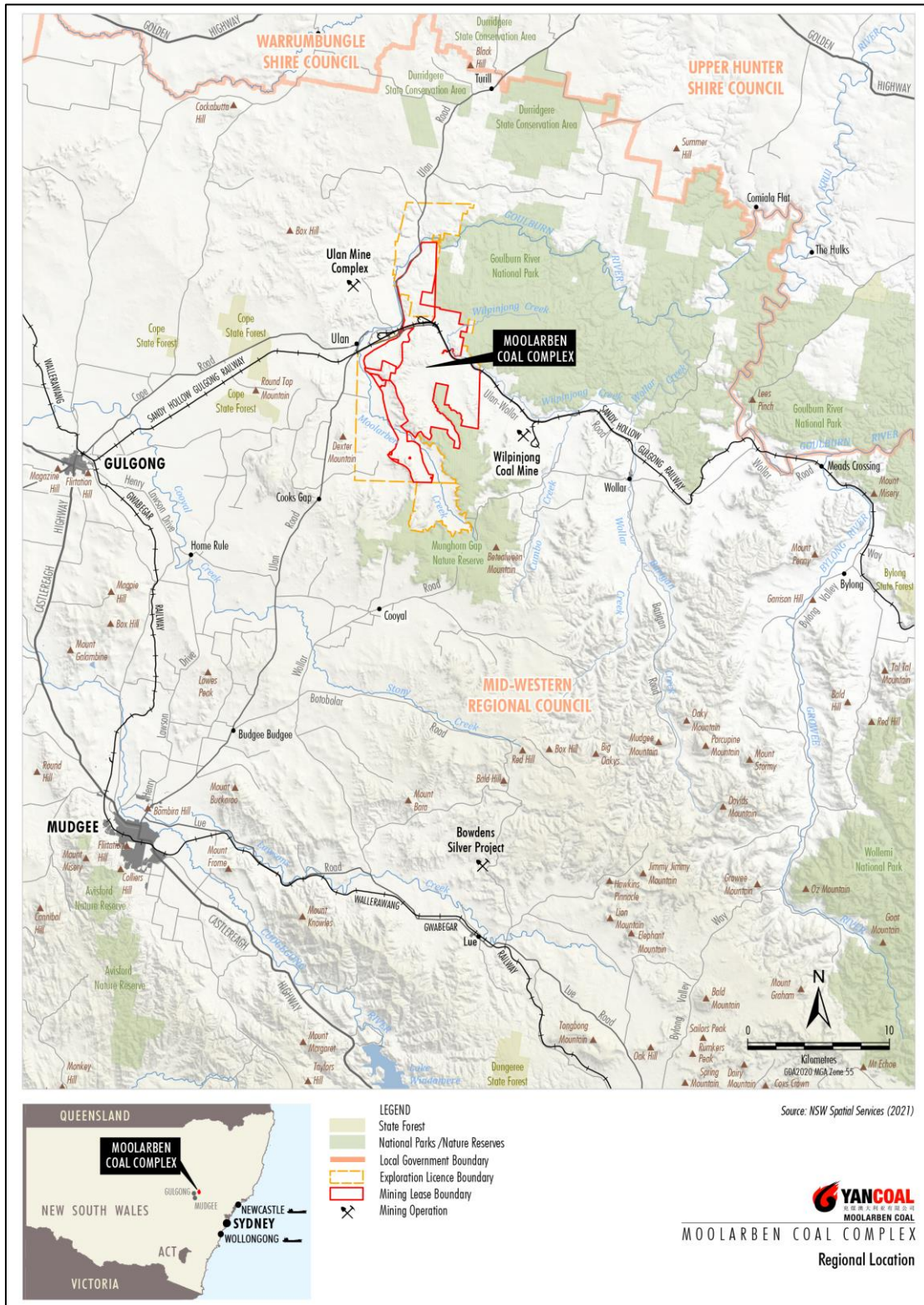


Figure 1.1 - Regional Location

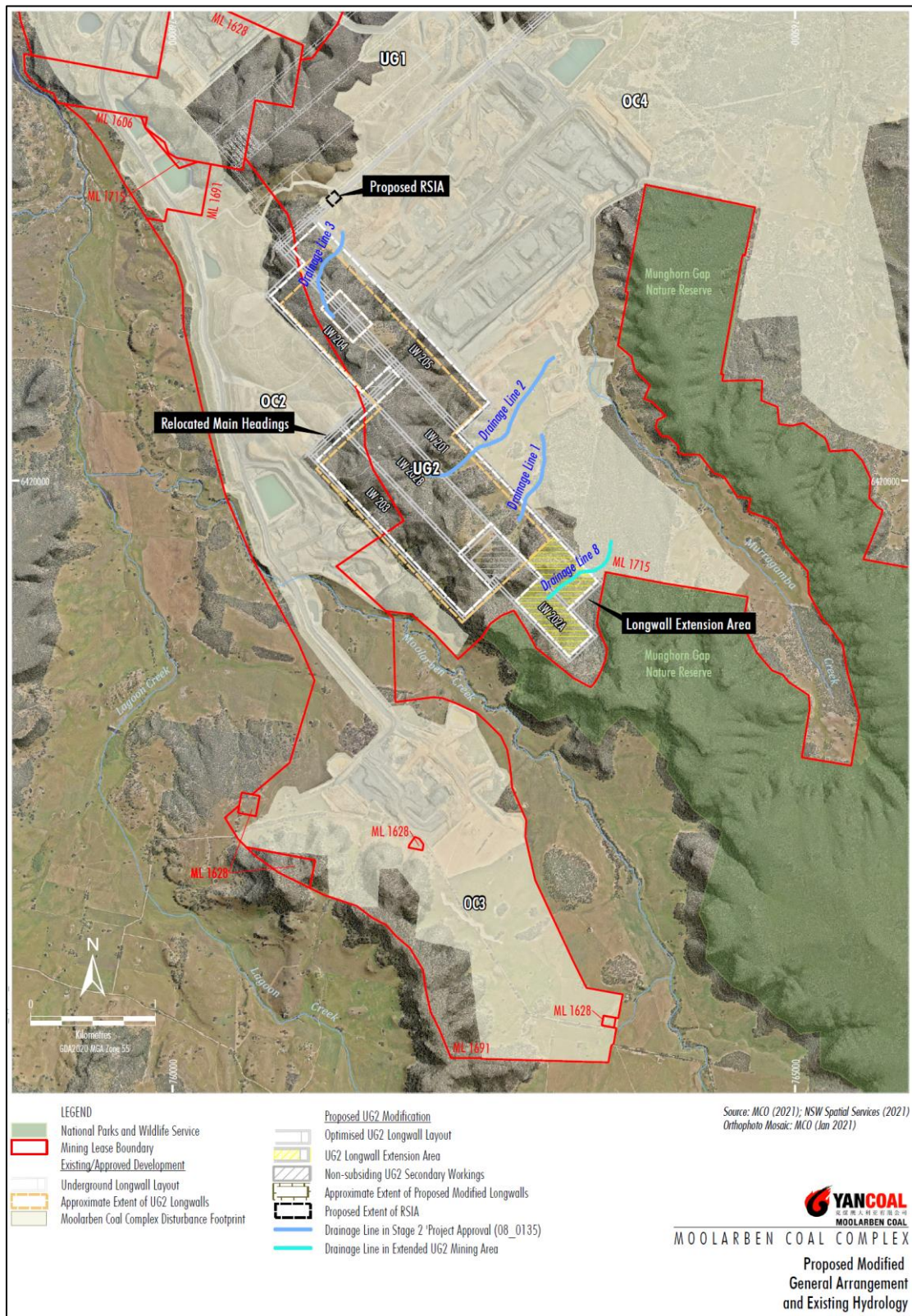


Figure 1.2 - Proposed modified general arrangement and existing hydrology

1.3 ASSESSMENT SCOPE

The scope of work for this Surface Water Assessment includes the following components:

- Assess the consequences of the predicted subsidence impacts on the surface water environment as a result of the Modification compared to the impact of the approved MCC; and
- Review the potential impact of the Modification on the MCC water balance.

The above have been considered in the context of the Approved UG2 Mining Area and the Extended UG2 Mining Area.

2 Existing surface water environment

2.1 PREVIOUS STUDIES

A description of the existing surface water environment at the MCC is provided in the Surface Water Management Plan (SWMP) (MCO, 2020a) and the Site Water Balance (SWB) (MCO, 2020b), including:

- Regional drainage network;
- Local drainage network;
- Climatic conditions;
- Streamflow;
- Surface water quality; and
- Environment Protection Licence (EPL) 12932 release conditions.

2.2 SURFACE DRAINAGE IN THE VICINITY OF UG2

The modified UG2 would only underlie minor drainage lines in relatively steep topography between two watercourses (Moolarben and Murragamba Creeks). Figure 1.2 shows the drainage lines overlying UG2, including Drainage Lines 1, 2 and 3 defined in the Stage 2 Project Approval (08_0135). Drainage Lines 1, 2 and 3 are located in the Approved UG2 Mining Area. An additional drainage line (Drainage Line 8) is located in the Extended UG2 Mining Area.

Surface drainage overlying LW201-205 is characterised by steep first order drainage lines that are typically forested in the higher elevations. Stream gradients are typically in the range of 4% to 11%.

The drainage lines located above LW201, LW202 and LW205 (which includes the Extended UG2 Mining Area) drain north-easterly to the OC4 disturbance areas. The drainage lines located above LW203 and LW204 drain south-westerly to the OC2 disturbance and rehabilitation areas.

The drainage lines overlying LW201-205 are ephemeral, so water typically flows during and for short periods after a rainfall event. Ponding naturally develops along some sections of the drainage lines for short periods of time after major rain events.

All of the drainage lines above UG2 report to disturbed open cut mining areas or previously mined areas undergoing rehabilitation.

2.3 MCC WATER MANAGEMENT REQUIREMENTS

The MCC is operated in accordance with various statutory requirements under its State and Commonwealth approvals and other licencing requirements. In summary, these include (but are not limited to) the following requirements:

- Preparation and implementation of a Water Management Plan (including the SWMP and SWB) for the MCC operations;
- Compliance with specific water management performance measures for general water management, sediment dams and clean water diversions, water storages and other matters;
- Compliance with specific subsidence impact performance measures for particular drainage lines at the MCC;
- Operation in accordance with water pollution avoidance measures in EPL 12932 issued under the Protection of the Environment Operations Act 1997; and
- Obtain necessary Water Access Licences under the Water Management Act 2000 as they are required.

3 Impact assessment

The potential impacts of the Modification on surface water resources compared to the approved UG2 operations include:

- Changes to predicted subsidence impacts on the surface water environment within the Approved UG2 Mining Area and the Extended UG2 Mining Area; and
- Impact on the MCC site water balance from changes in the MCC surface layout, changes to water demands and underground mine inflows.

These potential incremental impacts are discussed in the following sections.

3.1 SUBSIDENCE IMPACTS

3.1.1 Predicted Subsidence Impacts

The incremental subsidence impacts of the Modification have been assessed by Mine Subsidence Engineering Consultants (MSEC) (2021), including consideration of the incremental change in impacts on surface water features compared to the approved UG2. Key findings relevant to this assessment include:

- For the Approved UG2 Mining Area, an increase in vertical subsidence is predicted where there is an increase in extraction height, however there would be no associated increase in maximum tilts and curvatures and therefore no changes to subsidence impact assessments or environmental consequences.
- For the Extended UG2 Mining Area (i.e. where there is no previously approved development), the predicted vertical subsidence, maximum predicted tilt and curvatures would be similar to those predicted for the Approved UG2 Mining Area and therefore the potential impacts to features in the Extended Mining Area would be similar to the Approved Mining Area.

3.1.2 Impact Assessment

The consequences of the predicted subsidence impacts on the surface water environment include:

- Changes to ponding along the drainage lines;
- Potential increased erosion along the drainage lines and associated water quality impacts; and
- Potential changes to stream flow in the drainage lines.

3.1.2.1 Ponding

As shown on Figure 1.2, the modified UG2 would underlie minor drainage lines in relatively steep topography. Additional ponding may occur along the drainage lines resulting from the extraction of the longwalls (MSEC, 2021).

A review of the post-mining surface model for the approved UG2 (i.e. not including the Modification) indicates a number of small areas along ephemeral drainage lines where ponding may be caused or increased by subsidence. These potential ponding areas for the approved MCC (i.e. including UG2 and other underground longwall areas) range from 0.1 m to 0.9 m in depth, with maximum areas of up to 0.1 hectares (ha).

The post-mining surface model for the modified UG2 shows that within the Approved UG2 Mining Area, these topographical depressions would form further downstream compared to the approved UG2, due to the minor shift in the longwall panel layout to the north-east. It is predicted that:

- The changes in maximum ponding depths range from a reduction of up to 0.35 m to an increase of up to 0.4 m; and
- The changes in maximum ponded areas range from a reduction of up to 0.04 ha to an increase of up to 0.09 ha.

In the Extended UG2 Mining Area, approximately five additional areas of potential ponding could form, albeit at very shallow depths and small surface areas. The post-mining surface model for the modified UG2 shows that these additional potential ponding areas would range from 0.2 m to 0.7 m in depth, with maximum ponded areas of 0.01 ha to 0.2 ha. As the drainage lines are ephemeral, ponding would only occur in these predicted ponding areas for short durations after rainfall events.

The majority of this additional potential ponding area is within the OC4 extent (i.e. within the approved disturbance footprint).

The abovementioned potential ponding impacts would be managed in accordance with existing management measures described in MCC's approved SWMP (refer to Section 4).

3.1.2.2 Potential erosion and water quality impacts

Sections of beds downstream of the additional ponding areas may erode during subsequent rain events, especially during times of high flow (MSEC, 2021). The potential erosion and associated water quality impacts in the approved UG2 Mining Area as a result of the modified UG2 would be similar to the approved UG2. It is expected that, over time, the gradients along the drainage lines would approach grades similar to those that existed before mining. The extent of additional ponding along the drainage lines would therefore be expected to decrease with time. The impact on runoff water quality is expected to be negligible.

The potential erosion impacts and associated water quality impacts in the Extended UG2 Mining Area would be similar to the Approved UG2 Mining Area (i.e. negligible). The abovementioned potential erosion impacts would be managed in accordance with existing management measures described in MCC's approved SWMP (refer to Section 4).

3.1.2.3 Stream flows

Fracturing and dilation of the bedrock would occur as a result of the extraction of the longwalls (MSEC, 2011). Where this fracturing and dilation occurs along the drainage lines, loss of flow into surface cracks may occur.

The potential for cracking and associated stream flow losses in the Approved UG2 Mining Area as a result of the modified UG2 would be similar to the approved UG2. In times of heavy rainfall, the majority of the surface water runoff would be expected to flow over the surface cracking in the beds and only a small proportion of the flow would be diverted into the fractured and dilated strata below. In times of low flow, however, a larger proportion of the surface water flow could be diverted into the strata below the beds and this could affect the quantity of water flowing through the drainage lines. Nevertheless, during high flow or low flow times, this small quantity is expected to have little impact on the overall quantity of water flowing out of the drainage lines. In addition, the drainage lines above UG2 report to disturbed mining and rehabilitation areas at the MCC (i.e. would otherwise be captured in the MCC site water management system).

The potential for cracking and associated stream flow losses in the Extended UG2 Mining Area would be similar to the Approved UG2 Mining Area.

3.1.2.4 Consideration of subsidence impact performance measures

Project Approval (08_0135) provides the following subsidence impact performance measures relevant to Drainage Lines 1, 2 and 3:

“No greater subsidence impacts or environmental consequences than predicted in the EA.”

There are no specific subsidence impact performance measures for Drainage Line 8.

MSEC (2021) concluded that no changes to Subsidence Impact Performance Measures for Drainage Lines 1,2 and 3 outlined in the Stage 2 Project Approval (08_0135) would be required as a result of the Modification.

The impact assessments outlined in Sections 3.1.2.1 to 3.1.2.3 support this conclusion.

3.2 IMPACTS ON SITE WATER BALANCE

3.2.1 Overview of the MCC water management system

A description of the existing and approved MCC water management system is provided in the SWMP (MCO, 2020a) and the SWB (MCO, 2020b), including the following:

- Key objectives of the surface water management strategy;
- Sources of water supply;
- Site water demands;
- Details of the existing surface water management infrastructure; and
- Details of the proposed surface water management infrastructure for Stage 1 and Stage 2 operations.

The most recent assessment of the MCC water management system performance is given in the *MCC Open Cut Optimisation Modification Surface Water Impact Assessment* (WRM, 2017).

3.2.2 Impacts on mine site water balance

The potential impacts of the Modification on the approved SWB have been assessed for:

- Changes in the MCC surface layout;
- Changes to underground water demand; and
- Changes to groundwater inflows to UG2.

3.2.2.1 MCC surface layout

The Modification would result in the following changes to the MCC surface layout (Figure 1.2):

- A small reduction in the approved OC4 extent to accommodate the optimised UG2 layout; and
- The new remote services infrastructure area within the approved OC4 disturbance footprint.

These proposed changes would not result in any increase in the approved MCC disturbance footprint and would not change the surface water catchment areas draining to the MCC water management system. Therefore, there would be negligible impact on the site water balance and performance of the approved MCC water management system as a result of the Modification.

3.2.2.2 Underground mining water demand in UG2

The previous water balance investigation (WRM, 2017) assumed an underground water demand of 525 megalitres per annum (ML/a) for the MCC. There is no change in the underground mining rate in UG2 for the Modification compared to the approved UG2 operation. Therefore, there is no expected change in the annual underground water demand and negligible impact on the SWB resulting from the Modification.

The site has access to significant volumes of water including surplus mine water sourced under agreement from the adjacent Ulan Mine Complex.

3.2.2.3 Groundwater inflows to UG2

AGE (2021) has assessed the potential incremental groundwater impacts of the Modification and concluded that the groundwater inflows would not significantly change.

Therefore, the Modification would not significantly change water demands and underground mine water inflows associated with underground mining operations at UG2.

4 Management, monitoring and licensing

Surface water impacts associated with the MCC operations are managed under MCO's approved SWMP (MCO, 2020a), developed in consultation with the NSW Department of Planning, Industry and Environment - Water and NSW Environment Protection Authority. The primary objectives of the SWMP are to:

- Ensure that the water quality leaving the mine site meets the appropriate quality standards under EPL 12932;
- Define the structures, strategies and procedures to be implemented to ensure that all environmental impacts associated with site water management are minimised;
- Define a program to monitor and assess impacts on surface water;
- Define how the mine will mitigate and respond to potential impacts from mining activities on surface water;
- Divert upslope clean surface water runoff around disturbed areas where feasible;
- Maximise the reuse of groundwater inflows to mining areas;
- Maximise the reuse of water captured from disturbed areas onsite;
- Maximise water sharing with other mines; and
- Ensure that water discharged from site meets appropriate criteria as specified in EPL 12932.

The SWMP describes the monitoring and management of surface water, including details of management response actions across the MCC and addresses the water management performance measures outlined in Project Approval (08_0135) (and Project Approval [05_0117]). The SWMP would be reviewed and updated as required to accommodate the proposed Modification.

An Extraction Plan will be developed for the modified UG2 in accordance with Project Approval (08_0135). The Extraction Plan would include a program to monitor and manage the potential impacts of subsidence on the surface water environment. Consistent with existing management measures adopted at the MCC, potential management measures may include:

- The implementation of minor engineering works to drain the small ponded areas; and
- The implementation of erosion management/remediation works.

As the change in potential subsidence impacts of the UG2 Modification is small (when compared to the approved UG2 operations), this strategy remains unchanged under the Modification.

In accordance with Project Approval (08_0135), MCO would obtain necessary Water Access Licence under the Water Management Act 2000 for the modified MCC.

5 Summary of findings

This Surface Water Assessment has considered the potential impacts of the Modification on surface water resources. Overall, the incremental impacts of the Modification on surface water resources are small or negligible compared to the approved UG2. A summary of the assessed impacts on the surface water management system is as follows:

- For the Approved UG2 Mining Area, an increase in vertical subsidence is predicted where there is an increase in extraction height, however there would be no associated increase in maximum tilts and curvatures and therefore no changes to subsidence impact assessments or environmental consequences.
- For the Extended UG2 Mining Area (i.e. where there is no previously approved development), the predicted vertical subsidence, maximum predicted tilt and curvatures would be similar to those predicted for the Approved UG2 Mining Area and therefore the potential impacts to features in the Extended Mining Area would be similar to the Approved Mining Area.
- Changes to potential ponding as a result of the Modification subsidence would be minor.
- The potential water quality impacts associated with increased erosion in the drainage lines is expected to be negligible.
- There is expected to be little impact on the overall quantity of water flowing out of the drainage lines.
- No changes to Subsidence Impact Performance Measures for Drainage Lines 1, 2 and 3 outlined in the Stage 2 Project Approval (08_0135) would be required as a result of the Modification.
- The proposed changes included as part of the Modification are minor and would not change the surface water catchment areas draining to the MCC water management system. Additionally, the Modification would not significantly change water demands and underground mine water inflows compared to the approved UG2 operations. Therefore, the Modification would not have any material impact on the SWB and the operation of the water management system.

The potential impacts to surface water resources which result from the proposed Modification would be managed under the existing MCC surface water management system and in accordance with the SWMP (MCO, 2020a). The SWMP would be reviewed and updated as required to incorporate the proposed Modification.

In addition, an Extraction Plan would be developed for the modified UG2 in accordance with Project Approval (08_0135). The Extraction Plan would include a program to monitor and manage the potential impacts of subsidence on the surface water environment.

6 References

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