ENSHAM LIFE OF MINE EXTENSION PROJECT

Groundwater Impact Assessment

Prepared for:

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006

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PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Level 2, 15 Astor Terrace
Spring Hill QLD 4000 Australia
(PO Box 26 Spring Hill QLD 4004)
T: +61 7 3858 4800
E: brisbane@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with AECOM Australia Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
665.ENS02.10000-R01-01 FINAL	20 April 2020	Ines Epari	Claire Stephenson	Claire Stephenson
665.ENS02.10000-R00-01 FINAL	23 March 2020	Ines Epari	Derwin Lyons Claire Stephenson	Claire Stephenson

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) was engaged by AECOM Australia Pty Ltd (AECOM), on behalf of Ensham Resources Pty Ltd (Ensham Resources) to assess the potential impacts of the proposed Ensham Life of Mine Extension Project (the Project) on groundwater values, in support of the impact assessment for the Project.

The scope of this groundwater impact assessment is limited to the underground mining operations proposed within the Project Area.

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres (km) east of Emerald in Queensland (Figure 1). The Project proposes to increase the life of the existing underground operations by extending the underground bord and pillar mine into an area identified as the Project Area (zones 1, 2, and 3) commencing from within Mining Lease (ML) 7459, ML70326, ML70365, and ML70366 to an area west of ML70365 within part of MDL 217 (Figure 2). The Project will produce at up to approximately 4.5 million tonnes per annum and would extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The extension of the underground operation using existing infrastructure means that no surface construction or surface disturbance will be required to facilitate the Project.

The hydrogeological setting of the Project Area comprises of two groundwater bearing units, the Quaternary aged alluvium and the Permian aged Rangal Coal Measures. These two key units are separated by a low permeability unit, the Rewan Group.

The Quaternary aged alluvium comprises shallow sequences of clay, silty sand and sand, underlain by basal sands and gravel. The groundwater in the alluvium shows high salinity, which makes it unsuitable for groundwater uses such as stock watering and irrigation. The alluvium is not well connected with Nogoa River, which can be concluded by the difference in salinity between the more saline alluvial groundwater and the fresher river water. Furthermore, some bores installed in the alluvium are sporadically dry, also indicating that there is no continuous recharge from Nogoa River.

The Rangal Coal Measures comprise economic coal seams interbedded with low permeability siltstone, sandstone and shale. The coal seams contain groundwater that is generally saline and not suitable for stock water supply or irrigation.

A review of potential sensitive receptors showed that there are 19 landholder bores within a 15 km radius from the Project Area. Nine are currently used for stock watering, one for irrigation and one for stock and domestic use. The remaining eight are currently not in use. Mapped groundwater dependent ecosystems (GDEs) were visualised in the vicinity of the Project Area; there are low confidence GDEs identified along the Nogoa River and a wetland south of the open-cut area of Ensham Mine. No springs were identified within a 50 km radius of the Project Area. The closest intake area for the Great Artesian Basin (GAB) is located 50 km south-east of the Project Area, which means the mine will have no impact on the recharge to the GAB.

A recent peer reviewed groundwater model for the Ensham Mine was used as the base for the groundwater model used for the groundwater impact assessment. This previous groundwater model represented both the currently approved underground mining and the above-ground open pit operations. The groundwater model domain extends 43 km from north to south and 35 km from east to west. The stratigraphy is discretised into 12 model layers. The groundwater model was updated with the most recent groundwater observations and the proposed mine plan for the Project was added. The model was validated against the new observation data and deemed fit for purpose to assess the Project.

Predictive groundwater modelling showed that the Project will result in additional groundwater inflow compared to currently approved underground mining (Approved Case) due to the proposed extended life of mine. However, the order of magnitude of inflow after the year 2028 remains similar (3 to 12 ML/day, compared to 5 to 20 ML/day for the Approved Case before 2028). Modelling also showed that the additional alluvial take (alluvial water seeping into lower formations) is limited at approximately 0.01 ML/day, which is considered immeasurable. The same is valid for the predicted impact of mining on the Nogoa River baseflow, which is not predicted to change between the Approved Case and the Project.

The predicted additional groundwater drawdown in the target coal seams at end of mining extends 5 km to the north-west and 7 km to the west and the south-west. The drawdown is limited to the extent of the coal seams in the east where the coal seams outcrop or subcrop.

The post-mining equilibrium was calculated over a timeframe of 220 years (compared to the 17-year mine life). Some permanent reduction in water levels is predicted for the water levels in the target coal seams.

A sensitivity analysis approach was adopted to assess the model uncertainty. Nine selected model parameters were assessed, and the changes in the predictions, both from a water balance and drawdown perspective, were assessed. Parameters sensitive for the underground mine inflow predictions included coal seam hydraulic conductivity, the alluvium hydraulic conductivity, and the streambed conductance. Parameters sensitive for the Nogoa River baseflow changes are the alluvium hydraulic conductivity (horizontal and vertical) and the streambed conductance. The predicted drawdown contours are most sensitive to the coal seam horizontal hydraulic conductivity. Field measurements of this parameter would be useful for further model iterations. Recharge and storage parameters were found not to be sensitive for the model predictions.

The groundwater model was then used to assess potential impacts on groundwater users. There was no predicted additional groundwater level drawdown within the alluvium in the Project Area. However, some additional drawdown is observed in the wider Study area, specifically east of the open-cut voids. There are no predicted water levels reductions of greater than 2 m in any of the landholder bores. Jamar and Winton Creek bores show the largest additional drawdown of 10 cm. The identified GDEs and the identified wetland are not predicted to be impacted by the additional groundwater extraction and drawdown. There are no additional impacts predicted on groundwater quality. There are no predicted impacts from predicted subsidence on groundwater. There were no predicted changes to Nogoa River stream losses and no leakage from the coal seams into the alluvium has been predicted.

A comprehensive groundwater monitoring program is currently in place for the open-cut and approved underground mining operations at Ensham Mine. This study recommends including five additional monitoring bores into the monitoring program after Project approval, two of which have already been installed in October / November 2019.

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1.1 Overview

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The scope of this study is to:

- describe the existing hydrogeological environment of the Project Area and surrounds
- assess the potential impacts of mining on the groundwater related environment
- propose measures to manage or mitigate impacts on groundwater environmental values.

The study area for the purpose of this assessment is the extent of the groundwater model domain, which includes the Project Area and surrounds. The scope of this groundwater impact assessment is limited to the underground mining operations proposed within the Project Area.

1.2 Project background

Ensham Mine is an existing open-cut and underground bord and pillar coal mine located approximately 35 kilometres (km) east of Emerald in Queensland (Figure 1). The Project proposes to increase the life of the existing underground operations by extending the underground bord and pillar mine into an area identified as the Project Area (zones 1, 2, and 3) commencing from within Mining Lease (ML) 7459, ML70326, ML70365, and ML70366 to an area west of ML70365 within part of MDL 217 (Figure 2). The Project will produce at up to approximately 4.5 million tonnes per annum and would extend the Ensham Life of Mine (LOM) by up to nine years to approximately 2037. The extension of the underground operation using existing infrastructure means that no surface construction or surface disturbance will be required to facilitate the Project.

1.3 Existing infrastructure and mining operations

The Ensham Mine currently produces up to 5.3 Million tonnes per annum (Mtpa) of coal for both the open-cut and underground operations. The open-cut operation is scheduled to continue to approximately 2024, followed by further rehabilitation of the open-cut mine. Current approved underground operations are due to cease in 2028.

The existing mine has been operating since 1993 and covers a strike length of over 20 km, from Pit A in the south to Pit Y (Yongala) in the north. Pit A South, A North and B are located south of the Nogoa River, with pits C, D, E, F and Y all located north of the Nogoa River (Figure 3).

Open-cut operations are decreasing due to increasing strip ratios, as the coal seams have been followed down-dip to increasing depths. Underground operations commenced in 2011, as a small trial bord and pillar mine. The main working seam followed through a portal from Pit C, progressing in a westerly direction underneath the Nogoa River floodplain. The current bord and pillar underground operation is located on ML 7459 and ML 70365 and targets the combined Aries / Castor seam plies. This will be referred to as the Approved Case in this report.