OUT19/216

Andrew Rode
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NSW Department of Planning and Environment

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Dear Mr Rode

Tahmoor South Coal Project (SSD 8445).
EIS Exhibition

I refer to your email of 16 January 2019 to the Department of Industry (DoI) in respect to the above matter. Comment has been sought from relevant branches of Lands & Water and Department of Primary Industries. Any further referrals to Department of Industry can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

The department provides the following comments and recommendations for consideration in assessment of the proposal.

Department of Primary Industries (DPI) Agriculture

DPI Agriculture is satisfied that the strategies and measures, outlined in the EIS prepared by AECOM Australia Pty Ltd (December 2018), adequately address the potential impacts of subsidence on rural infrastructure, local waterways and groundwater relevant to agricultural operations and/ or infrastructure.

DPI Fisheries

DPI Fisheries requires the monitoring program for water quality to include baseflow monitoring in the creeks and monitoring of iron floc entering the Bargo River.

This is due to the potential impacts of poor water quality entering the downstream end of the Bargo River and the Nepean River. Poor water quality may occur from cracking the rock bases of the tributary creeks of the Bargo River allowing water to percolate through the bedrock and potentially generating iron floc. Iron floc has a smothering effect on the eggs of Macquarie Perch laid in the interstices in gravel riffles. This is of particular importance in the area of the Bargo River downstream of Mermaid Pools.

DoI – Lands

All Crown Land and Crown Roads within a Mining Lease must be subject to a Compensation Agreement issued under Section 265 of the Mining Act 1992, to be agreed and executed prior to any mining activity taking place and within 12 months of Project/ Modification Approval. The Compensation Agreement may include conditions requiring the Mining Lease Holder to purchase Crown land impacted on by mining activity.

All Crown Land and Crown Roads located within an Exploration Licence, where subject to exploration activity, must be subject to an Access Arrangement issued under Section 141 of the Mining Act 1992, to be agreed and executed prior to any exploration activity taking place.

DoI -– Water and Natural Resources Access Regulator (NRAR)

DoI Water provides the following recommendations. Please note detailed advice is in Attachment A.

- The Rejects Emplacement Area covers waterfront land and should be rehabilitated in accordance with the Guidelines for Working on Waterfront Land https://www.industry.nsw.gov.au/water/licensing-trade/approvals/controlled-activities. The Rehabilitation Management Plan is to be developed in consultation with the Natural Resources Access Regulator
- The proponent should clearly demonstrate the ability to obtain the necessary authorised entitlement to account for the maximum take of water from both surface water and groundwater sources in accordance with the Aquifer Interference Policy. This is because:
    - the Surface Water Impact Assessment identifies daily losses that amount to a maximum surface water flow reduction of 172 ML/y for the Bargo River, Tea Tree Hollow and Dog Trap Creek combined. The project will require additional surface water licences to account for this predicted incidental take.
    - The groundwater modelling indicates that a maximum take of 2,850 ML/y will occur, which is substantially greater than the volume currently authorised by licences held by Tahmoor Mine. However the accuracy of this estimate is reliant on the modelled predictions of groundwater level drawdown which are subject to a 21m absolute residual mean error. A robust analysis of the maximum potential groundwater take based on a revised modelling effort is therefore necessary to confirm the accuracy of the predicted volume
- Clarification and validation of the surface water modelling undertaken for the EIS is required, with respect to the modelling approach used particularly when predicting changes to low base flows.
- The groundwater model should be revised and predictive scenarios re-run to confirm the magnitudes of potential impacts currently estimated in the EIS. As the model has a large error range in simulated historical groundwater levels, the Department believes the model is incapable of making reliable impact predictions.
- Expansion of the existing surface water monitoring network should be undertaken to improve monitoring of stream flow and pool water levels.
- Expansion of the groundwater monitoring network in consultation with the department is required to address the uncertainty identified in section 4.10 of the groundwater modelling report.
- The proponent should establish an inventory (census) of all bores in the project model domain (which is to be maintained throughout the project), showing their status (water level and quality), any make good measures implemented as well as their timing, or any other mitigation approaches used.
- A number of water supply works are predicted to have greater than 2m drawdown, which is considered a Level 2 impact under the Aquifer Interference Policy and a ‘make good’ plan for all affected groundwater users should be prepared and commented upon by the department to provide DPE the confidence that adverse impacts can be successfully addressed.
- Further, due to the level of uncertainty in the groundwater model, the department does not consider that the proponent can demonstrate that impacts to other water users or groundwater dependent ecosystems are Level 1 impacts, and accordingly should be considered Level 2 impacts, unless the model is improved. This requires ‘make good’ plans for all potentially affected groundwater users, along with appropriate studies to demonstrate that the variation will not prevent the long-term viability of the dependent ecosystem. It is recommended that these studies be undertaken in consultation with the Office of Environment and Heritage.
- A trigger action response plan to address all criteria exceedances be prepared in consultation with the department to provide confidence that adverse impacts can be successfully identified should they occur.

The Department recommends a meeting with the proponent's consultants to discuss the above surface water and groundwater issues associated with this development.

Yours sincerely

Mitchell Isaacs
Director Strategic Relations
Lands and Water
5 March 2019

DoI Water/ and NRAR Recommendations – more detailed advice.

DoI Water has reviewed the EA and provides the following comments/recommendations.

1The Rejects Emplacement Area should be rehabilitated in accordance with the Guidelines for Working on Waterfront Land https://www.industry.nsw.gov.au/water/licensing-trade/approvals/controlled-activities. The Rehabilitation Management Plan is to be developed in consultation with the Natural Resources Access Regulator

2 The EIS should clearly demonstrate the ability to obtain the necessary authorised entitlement to account for the maximum take of water from both surface water and groundwater sources in accordance with the Aquifer Interference Policy.

a. The Surface Water Impact Assessment identifies daily losses that amount to a maximum surface water flow reduction of 172 ML/y for the Bargo River, Tea Tree Hollow and Dog Trap Creek combined. The project will require additional surface water licences to account for this predicted incidental take. The details (magnitude, timing and frequency) of the incidental surface water take caused by underground mining and dewatering should be clarified and the volumes confirmed.

b. The groundwater modelling indicates that a maximum take of 2,850 ML/y will occur, which is substantially greater than the volume currently authorised by licences held by Tahmoor Mine. However the accuracy of this estimate is reliant on the modelled predictions of groundwater level drawdown which are subject to a 21m absolute residual mean error. A robust analysis of the maximum potential groundwater take based on a revised modelling effort is therefore necessary to confirm the accuracy of the predicted volume.

3 Clarification and validation of the surface water modelling undertaken for the EIS is required, including the following:

a. The Australian Water Balance Model (AWBM) models used in the Surface Water Baseline Study should be reviewed and validated.

b. Metrics should be provided from the model validation to identify the uncertainty in the AWBM models with specific reference to the *Guidelines for rainfall-runoff modelling: Towards best practice model application*.

c. Calculations for the catchment area of Lake Gandangarra should be reviewed and confirmed.

d. Lake-aquifer interaction assessment should be undertaken to assess not only changes in lake water levels, but also bed conductance and other relevant parameters.

4 The department considers that the groundwater model should be revised and predictive scenarios re-run to confirm the magnitudes of potential impacts currently estimated in the EIS.

a. A detailed list of the limitations and assumptions in the techniques used to inform the modelling should be provided.

b. Once the model is redeveloped, the sensitivity and uncertainty of the model should be characterised in line with the *Explanatory Note, Uncertainty Analysis in Groundwater Modelling, Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining*, 2018.

c. Impact predictions should be given using the P90 of the outcome of the sensitivity and uncertainty analysis.

d. Justification should be provided as to why bore abstraction was not included in the model, including detailed sensitivity and uncertainty analysis of the inclusion or exclusion of the effects of pumping.

e. Steady-state results and calibration data should be provided to identify the transient model sensitivity to initial conditions and compare how the model behaves without storage terms.

f. Explanation of why the surface water stage (elevation) was not used in calibration.

g. Clarification of the effects of weights that were assigned to observations on transient model performance.

h. Justification of the overestimated evapotranspiration (ET) from the water table (e.g. 40%, Table 5-2) despite this effect being included in the recharge (RCH) component (which represents a form of double counting). Sensitivity and uncertainty analyses for this parameter should be provided.

i. Justification of the potentially underestimated recharge. Sensitivity and uncertainty analyses for this parameter should be provided.

j. Clarification of the calibration targets for steady-state modelling.

k. Provision of the steady-state simulation water balance is required.

l. Provision of the relative parameter sensitivity assessments is needed for both the steady-state and transient models.

m. Documentation of the hydraulic conductivity anisotropy (KH/KV) data based on project domain field data and discussion of the significance of this characteristic is required.

n. Verification of the geological layering uncertainty noted in Section 4.11 is required based on borehole logs and other project intrusive investigation data.

o. Discussion of the consequences of changes in aquifer storage presented in the water balance accounts for surface water and groundwater systems around the project domain is required.

p. Quantification of the error in the estimation of project area rainfall and subsequently recharge component of the groundwater model, as well as justification of the approach of combining the rainfall records from two separate weather stations. The data combination method is not described and the resultant synthetic rainfall estimates may not be realistic, particularly in representing the Millennium Drought.

q. Inclusion of improved sensitivity and uncertainty analysis to clarify the representation of faults as either flow barriers or conduits within the model.

r. Enhance the model to reduce SRMS (Scaled Root Mean Squared) error for all layers within the model to rectify the high values presented for the current version (Table 4-3 shows that SRMS>5% for all units except layer 1).

s. Reconstruct the model to address the model calibration error (21m absolute residual mean) and reduce the uncertainty in predicted outcomes.

t. Improve model zonation or undertake pilot point calibration to correct the single zone per layer representation of hydraulic properties and improve model calibration.

u. Undertake and report on a detailed sensitivity and uncertainty analysis of the exclusion of the eastern area of the model domain resulting from the placement of a no flow boundary.

v. Explanation of the counter intuitive results obtained from running different lake level scenarios, how this affects model confidence level and possible reasons (e.g. numerical instability) which can impact on model performance and predictions.

w. Reconstruction of the model to utilise the unstructured grid capability of the Modflow USG platform to address the excessive run time and disk space requirements of the current version.

x. Clarification of how the groundwater model has simulated changes in the lakes wetted area as a result of changes in water levels.

y. Explanation of the discrepancy between the surface water bodies mainly being conceptualised as losing whereas they are implemented as gaining features in the numerical model as suggested in the presented water budgets.

z. Undertake of particle tracking or another suitable method to define zones affected by mining activities (capture zone extent) for licencing purposes.

aa. Clarification of the drain cell inactivation to represent change from open space to goaf.

bb. Discussion of the possibility that mine inflows (2.1% of water budget) may be an underestimation as a result of the overestimation of ET and discharge to surface water.

cc. Justification of the adopted bed conductance (C) values (e.g. 100 m²/d for drain cells representing longwalls).

dd. As the effects on baseflow may be underestimated, especially in low flow conditions, transient analysis should be undertaken to identify the magnitude of depletion and possible length of dry periods.

ee. Justification for the use if the Modflow River Package rather than the MODFLOW lake package to represent the Thirlmere Lakes and use the most appropriate package based on the analysis.

ff. Provide more detailed information on the natural variability or a base case of ponded water levels in Thirlmere Lakes to justify the statements made within the EIS. A stochastic sensitivity analysis would allow the department to identify the uncertainty in the model used for Thirlmere Lakes.

5 Expansion of the existing surface water monitoring network should be undertaken to achieve the following.

a. Support the reinstatement of surface stream flow monitoring gauges as well as enhancing the reliability of recorded low flows.

b. Address the number of pool water level monitoring sites as there are too few. Three in Dog Trap Creek and Two in Tea Tree Hollow are insufficient to detect changes across the project area.

c. Review the proposed number of pool water level monitoring sites and increase them to at least six pools per creek and have water level loggers installed.

d. River flow monitoring should be implemented as soon as possible and persist throughout the life of the mine and include 5 years of post-project monitoring to assess the long-term impacts.

6 Expansion of the groundwater monitoring network in consultation with the department is required to address the uncertainty identified in section 4.10 of the groundwater modelling report. This should involve:

a. Shallow groundwater monitoring within Hawkesbury Sandstone (in association with surface water monitoring), comprising at least 25 purpose built cased and screened monitoring bores to approximately 20 m depth alongside the rivers and streams most likely to be impacted.

b. Deep groundwater monitoring at each of at least five separate sites between the mining domain and Thirlmere Lakes of the Hawkesbury Sandstone, upper and

lower Bulgo Sandstone and Scarborough Sandstone in isolation using purpose-built cased and screened monitoring bores.

c. Deep monitoring bores at each of the five sites are to be fully cored and comprehensively packer tested throughout.

d. Groundwater level monitoring should be implemented as soon as possible using water level loggers recording at a minimum daily frequency and continuing for an agreed period after the cessation of mining.

7 The proponent should establish an inventory (census) of all bores in the project model domain (which is to be maintained throughout the project), showing their status (water level and quality), any make good measures implemented as well as their timing, or any other mitigation approaches used.

8 A ‘make good’ plan for all potentially affected groundwater users (including ecosystems) should be prepared and commented upon by the department to provide DPE the confidence that adverse impacts can be successfully addressed.

9 A trigger action response plan to address all criteria exceedances be prepared in consultation with the department to provide confidence that adverse impacts can be successfully identified should they occur.