OUT21/7458

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Dear Mr Nevill

Narrabri Underground Mine Stage 3 Extension Project (SSD-10269)
Response to Submissions (RTS) and Additional Information

I refer to your email of 2 June 2021 to the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) about the above matter.

DPIE Water and NRAR have reviewed the RTS and additional information and still have remaining concerns regarding water take, groundwater model, groundwater monitoring and impact on Groundwater Dependent Ecosystems.

Any further referrals to DPIE Water and NRAR can be sent by email to landuse.enquiries@dpie.nsw.gov.au. or to the following coordinating officer within DPIE Water:

Alistair Drew, Project Officer
E: Alistair.drew@dpie.nsw.gov.au

Yours sincerely

Mitchell Isaacs
Chief Knowledge Officer
Department of Planning, Industry and Environment: Water
11 August 2021

Attachment A

Detailed advice to DPIE Planning & Assessment regarding the Narrabri Underground Mine Stage 3 Extension Project (SSD-10269) RTS and Additional Information

The RTS and additional information provided by the proponent relates to the following DPIE Water/NRAR advice:

- DPIE Water Response- Narrabri Coal Mine Stage 3 (SSD 10269)- EIS - OUT20/13350,
- DPIE Water Response Narrabri underground extension groundwater model review - OUT21/4438.

1.0 Water Take and Entitlement

1.1 Explanation

The proponent has not quantified the surface water take due to subsidence related fracturing as requested, but rather indicated it is not expected or quantifiable and that they will rely on monitoring the water in the underground to identify an increase due to surface runoff. NRAR considers this approach inadequate as water that enters subsidence cracks may not reach the underground workings in all or part, and any water take without holding sufficient entitlement would be a compliance issue.

As stated in previous responses on this project, if surface water enters subsidence cracks, this volume needs to be quantified and accounted for by acquisition of sufficient entitlement in the relevant surface water source. If subsidence cracks form, there is the potential for surface water take. Therefore, in addition to monitoring underground dewatered volumes, we recommend monitoring of subsidence cracks be included as an indicator of surface water take, and this needs to be supported by an accepted method to quantify this water take. We require sufficient entitlement to be held before any water take occurs. Due to the timeframes involved in obtaining entitlement it is recommended a viable pathway be identified prior to any water take occurring. If remediation of subsidence cracks is viable to prevent water take from occurring this may reduce the requirement in part or full to account for water take during the project life and post mining.

The option to obtain water entitlement in the Gunnedah-Oxley Basin groundwater source via a Controlled Allocation Order is viable based on previous Orders. If this option is pursued the proponent would need to ensure it is acted upon with sufficient time to account for the water take. This would need to be with the understanding that the Orders are available periodically, rather than upon request.

The option to obtain water entitlement in the Gunnedah-Oxley Basin groundwater source via trading with existing licences held by the proponent is viable based on the usage information provided for 2019. There is uncertainty however as to what the water demands at the other mine sites would be in 2040 when the peak water take is predicted. Further information is required, as identified in DPIE Water and NRAR's response to the EIS, to confirm this as a viable option

1.2 Recommendations

<u>Prior to Determination</u>

- Quantify the annual volume of surface water take due to subsidence related surface fracturing for both the existing and proposed project for a range of climatic scenarios (wet, average, dry) and demonstrate sufficient entitlement can be acquired in the relevant water source to account for the maximum take.
- Clarify the availability of water entitlement currently used at other mine sites by the proponent, during the period when additional entitlement is required for this project.

Post Determination

- The Water Management Plan should be updated to reflect additional monitoring, metering and management measures to report on groundwater inflows and potential impacts to water sources due to the underground development. Where existing monitoring bores are to be impacted, suitable alternatives need to be installed with baseline data collection commenced prior to mining activities.
- The proponent should develop a water balance to measure actual water take from surface and groundwater sources, this should include accurate metering where possible. The water balance should be used in ongoing reviews of actual versus modelled water take and impact predictions. This will be a key component to confirm impact predictions, the adequacy of mitigating measures and compliance for water take.
- The proponent must report on water take at the site each year (direct and indirect) in the Annual Review. This is to include water take where a water licence is required and where an exemption applies. Where a water licence is required the water take needs to be reviewed against existing water licences.
- The proponent must ensure sufficient water entitlement is held in a Water Access Licence/s (WAL) to account for the maximum predicted take for each water source prior to take occurring.
- The proponent must ensure that relevant nomination of work dealing applications for WALs proposed to account for water take by the project have been completed prior to the water take occurring.
- The proponent should be aware of the rules of the relevant water sharing plans and how they may impact the project and ability to trade or take water.
- Subsidence impacts to watercourses need to be remediated to ensure stability and natural ecological functioning. Works are to be in accordance with the Guidelines for Controlled Activities on Waterfront Land (NRAR 2018).

2.0 Groundwater Model

2.1 Explanation

The proponent has provided geological cross sections, these have improved our understanding of their model conceptualisation.

The proponent appears to have addressed the majority of issues raised in DPIE Water submission OUT21/4438, with only the following items to further address:

- The proponent has made no commitment in terms of timing to provide the revised Model Calibration Report to address Schedule 4, Condition 9 in Stage 2 Modification 5 (MOD5) Mine Approval (PA 08_144) as per Recommendation 1.
- The terminology and expression applied in the presentation of the modelled water balance results, especially regarding groundwater storage, are ambiguous and require clarification. The proponent describes storage inputs which the readers might assume to refer to increased storage water in the aquifer, but alternatively might mean water release from storage. Accordingly, the water balance as presented cannot be verified against rainfall conditions.

We note the groundwater level data used for conceptualisation and groundwater model purposes in the Groundwater Assessment (AGE, 2020) was subject to a review by the proponent. Vibrating wire piezometers were effectively verified against manual water level reads from other nearby standpipe piezometers in the same unit. Any erroneous data identified during this review were flagged and excluded from use for conceptualisation and model calibration purposes.

2.2 Recommendations – Prior to Determination

- Clarify the modelled water balance by defining the storage and recharge components, their relationship with each other, and the notation used to present their relative changes, so that their predicted inflows and outflows are not ambiguous.
- Commit to a date for providing the revised Model Calibration Report to DPIE Water for review as per Recommendation 1 in OUT21/4438.

3.0 Drawdown

3.1 Explanation

The proponent has provided additional contour maps for the years of predicted maximum drawdown in each aquifer due to the project and has clearly explained why bores in alluvium up-dip to the east of the project are not at risk. Previously inconsistent estimates of brine volumes and salinity for injection have been clarified.

The proponent submits that the forecast maximum drawdown impact of 2 metres, equivalent to the Aquifer Interference Policy 2012 level 1 minimal impact consideration, at the Namoi alluvium boundary is a consistent outcome of 100 model realisations. These were supported by a predictive uncertainty analysis and a further 100 model realisations that were analysed for the statistical likelihood of an excessive drawdown extending into the alluvium.

Furthermore, the proponent reasons that the sharp drawdown-impact boundary, under all model realisations, is the result of the high recharge, hydraulic conductivity and storage properties of the alluvium and relatively low rate of discharge into the underlying depressurised Permian strata.

The proponent does not, however, explain the coincidence that the overarching model assumptions, limitations and constraints, which bound the range of all possible realisations, have resulted in a predicted maximum drawdown impact at the alluvial boundary which precisely matches the Aquifer Interference Policy 2012 level 1 minimal impact consideration (of 2 m).

Given the inherent uncertainties with modelling, this predicted maximum drawdown provides no margin for error. The establishment of demonstrably reliable early-warning monitoring systems and mitigation measures is therefore crucial for this project.

Please see recommendations in 4.2.

4.0 Groundwater Management Plan

4.1 Explanation

The proponent has committed to updating the Water Management Plan to reflect additional monitoring, metering, and management measures to report on groundwater inflows and potential impacts. The Plan would include data quality assurance and control protocols and would consider the DPIE Water recommendations.

Monitoring network

The proponent has described the additional subsidence monitoring that will be undertaken as recommended in the EIS Appendix A Subsidence Assessment.

The Submissions Report, and current Subsidence Monitoring Program and Extraction Plan do not present or commit to providing a clear analytical methodology for differentiating pore-pressure changes related to subsidence versus other groundwater stressors (climate, third-party land use) and, consequently, for the early detection of subsidence-related impacts.

Six additional groundwater monitoring sites have been proposed for installation along the boundary or to the south of the lease following project approval. Each of these sites is to include a standpipe in alluvium, a standpipe in the immediately underlying bedrock, and nested vibrating wire piezometers in the consolidated units. Upon the field verification of groundwater

dependence, monitoring standpipes would also be installed at the three spring sites. All proposed standpipes will be added to the water-quality monitoring program.

The proposed two new southern monitoring sites and one eastern site satisfy the recommendation to enable the early detection of impacts on third party bores and the southern high-priority Groundwater Dependent Ecosystem (GDE) areas and would assist in reducing the groundwater model's predictive uncertainty for those areas.

We recommend that additional site-representative groundwater monitoring infrastructure should be installed for several areas remotely mapped as having high-priority groundwater-dependent vegetation and where drawdown is predicted to exceed the Aquifer Interference Policy 2012 level 1 minimal-impact threshold, including:

- A tributary of Tulla Mullen Creek to the south of the mine, and 2 km south of the proposed new monitoring site number 6 (Submissions Report Fig. 8), where predicted to have a broad area of maximum drawdown exceeding 5 m.
- Areas of red gum and river red gum along Tulla Mullen Creek to the southeast of the mine; the drawdown is predicted to not exceed 5 m, however, that depth (taken from the IESC submission) is not a legislated threshold.
- Areas to the northeast of the mine mapped as shallow wetland sedgeland, box grassy woodland, ironbark, or river red gum. The shallow nature of the sedgeland renders it vulnerable. These areas are near or adjacent to other broad areas of high-priority GDE for which the Aquifer Interference Policy 2012 drawdown threshold is predicted to not be exceeded but also require impact monitoring to account for uncertainty in the drawdown predictions.

The proponent has not demonstrated any field verification of the remotely mapped potential high-priority GDE areas which are outside the current and proposed mining leases and predicted to be impacted by the proposal. Their existence, condition and vulnerability are therefore presently uncertain. The proponent had completed a flora field survey only for parts of the mining leases. Based on the available study references, all flora information from outside the lease areas has been remotely inferred.

Water quality monitoring

On water-quality matters, the proponent refers the reader to a series of annual environmental reports and annual reviews as well as the current site Water Management Plan (NCOPL 2017), the latter of which refers to the Water Management Plan issue 4 (URS 2013) for much of the key information.

The proponent includes only salinity in groundwater quality assessments and reviews, in the incorrect belief that the NSW Aquifer Interference Policy 2012 does not include minimal impact considerations for other indices.

The Aquifer Interference Policy 2012 specifies that any change in groundwater quality should not lower the beneficial use category of a groundwater source. The term "beneficial use category" is described in the NSW Groundwater Quality Protection Policy 1998 as being equivalent to the term "environmental value" in the national water quality guidelines, since superseded by "community value" in the current ANZ Guidelines for Fresh and Marine Water Quality (2018).

Accordingly, the proponent is required under the Aquifer Interference Policy 2012 to apply the current national water quality guidelines to identify, validate, monitor, and report on water-quality indicators that are relevant to stakeholder-agreed community values. All community values are susceptible to a variety of physical and chemical stressors and toxicants which cannot be indicated by salinity alone. The status of additional key water-quality indicators must therefore be reported on.

The Submissions Report has not addressed the insufficient and inconsistent specifications in the available water management plans, extraction plans and annual reviews in relation to converting values of electrical conductivity to total dissolved solids.

4.2 Recommendations

Prior to Determination

- Detail and clarify the methodology applied at groundwater monitoring sites for the early detection of potential subsidence-related impacts including the analytical methodology used for differentiating pore-pressure changes related to subsidence versus other groundwater stressors (climate, third-party land use).
- Provide a field survey to verify the existence, ecological condition, and ecosystem value of any potential high-priority terrestrial GDE located outside the mining leases that are predicted to be potentially impacted by at least 2 m of groundwater drawdown. Some information has been presented on this however it appears to only cover GDEs within the mine lease area.
- For all field verified GDE sites, install site-representative groundwater monitoring infrastructure for inclusion in the monitoring program and establish appropriate make good provisions.

Post Determination

- Revise the current operation's Water Management Plan to incorporate the extension, with the following inclusions to be developed in consultation with DPIE Water and with consideration of previous DPIE Water recommendations, including but not to limited to the following:
    - An appropriate data quality-assurance plan based on relevant standards and guidelines.
    - Identification and validation of relevant water quality objectives and water quality indices relevant to stakeholder-agreed community values for each relevant groundwater source and potential receptor based on the current national water quality guidelines (ANZG 2018; available < https://www.waterquality.gov.au >).
    - Procedures based on ANZG (2018) for the establishment, updating and annual reporting of site-specific baseline status, variability, and the early detection of state trends and change against trigger values for each water-quality objective using control charts and with uncertainty estimated from quality control measures.
    - Improved procedures for establishing appropriate factors for converting electrical conductivity to total dissolved solids for each sampling site with consideration of the influence of major ionic composition.
    - Updated trigger action response plans (TARPs).
    - Specific inclusion of monitoring bores sites between the project and the alluvium relative to the predicted 2m drawdown contour near the boundary with the alluvium. This is required due to potential risk to the alluvium from the project and also to validate conceptualisation of the boundary between the Gunnedah Basin and the alluvium in this area.

5.0 Surface Water Impacts

5.1 Explanation

A number of watercourses overlie the proposed extraction area. These watercourses cross multiple subsidence block alignments and are expected to have significant channel gradient change as subsidence occurs and stream flow velocities increase from upstream chain pillars towards the centre of the individual longwall subsidence trough. All the affected watercourses are sand bedded systems, with moderate to very high sensitivity to altered channel bed gradients.

The affected watercourses are generally low order (1-2 Strahler) and are within 'hardened' banks, limiting lateral migration with the exception of Kurrajong Creek and Tulla Mullen Creek Tributary 1. Relying on the NSW River Styles database, DPIE Water considers the two watercourses that

may be impacted and trigger bed incision and flushing release of sand slugs are Kurrajong Ck and Tulla Mullen Creek Tributary No. 1. The loose sand beds of these watercourses are vulnerable to bed incision and channel degradation, as can be seen in Kurrajong Ck immediately downstream of the outer (downstream) boundary of the longwall block extension.

Subsidence monitoring reported in the RTS report indicate previous subsidence induced cracking has been left to natural processes or infilled by machinery. No details have been provided as to whether any of these actions were successful. Natural infill is claimed to be an effective measure to address mining-induced subsidence, altered landscape tilt and increased or deformed channel bed gradients overlying mining goaves. No evidence has been provided to demonstrate the effectiveness of unconsolidated sediment infill to mining fracture zones to arrest channel disturbance, incision and subsequent erosion.

Relying on fracture infill from surrounding land is not regarded as an appropriate response measure to the risk of subsidence-induced tensile fracturing. An appropriate response is to identify the trigger response mechanisms to be adopted for the entire mine site, based on geomorphic and hydrologic significance of the impacted watercourses.

The Environmental Impact Statement refers to a Subsidence Management Plan Trigger Action Response Plan (SMP TARP) requirement for the existing mining operation in relation to stream channel impacts. No details are provided on trigger values or any response measures for potential or actual subsidence impacts or bed incision risk to these watercourses.

Alteration of surface gradient may exceed bedform competence thresholds by up to an order of magnitude. Two watercourses are classified as laterally unconfined, continuous channel, low sinuosity, sand bed River Style with high vulnerability to degradation. Increased bed gradients along sand bed river channels lacking exposed bedrock controls or large woody debris are likely to incise and lead to extensive channel degradation. Kurrajong Creek has incised and degraded for several hundred metres immediately downstream of the easternmost longwall panel alignment.

A description of channel form and any channel incision or bed and bank scour in watercourses overlying previous and existing mining operations should be provided to allow an assessment of channel alteration risk and documentation of channel alteration or remediation. This can then be used to determine trigger levels for an appropriate set of responses to mining-induced surface fracturing and reporting on stream condition to DPIE Water.

5.2 Recommendations – Post Determination

- The applicant should specify triggers for investigation and remedial actions beyond the one sentence include in Table 5.3 of Appendix C of the Environmental Impact Statement.
- Triggers for response and remedial action should be specified in the SMP TARP and provided to DPIE Water for review. Where existing channel deterioration is detected, the application should also nominate options for response and remediation of subsidence channel gradient alteration and bed and bank cracking.
- Performance reporting on channel form and any remedial actions undertaken should be provided to DPIE Water for assessment and review of River Style condition and future geomorphic recovery.

End Attachment A