

Advice to decision maker on coal mining project

IESC 2020-0120: Russell Vale Colliery Revised Underground Expansion Project, NSW (EPBC 2020/8702) – Expansion

Requesting agency	The Australian Government Department of Agriculture, Water and the Environment
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The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) provides independent, expert, scientific advice to the Australian and state government regulators on the potential impacts of coal seam gas and large coal mining proposals on water resources. The advice is designed to ensure that decisions by regulators on coal seam gas or large coal mining developments are informed by the best available science.

The IESC was requested by the Australian Government Department of Agriculture, Water and the Environment to provide advice on Wollongong Coal Limited's Russell Vale Colliery Revised Underground Expansion Project in New South Wales. This document provides the IESC's advice in response to the requesting agency's questions. These questions are directed at matters specific to the project to be considered during the requesting agency's assessment process. This advice draws upon the available assessment documentation, data and methodologies, together with the expert deliberations of the IESC, and is assessed against the IESC Information Guidelines (IESC, 2018).

Summary

The proposed Russell Vale Colliery Underground Expansion Project (the "project") is an extension to the existing Russell Vale Colliery, and is located approximately 8 kilometres north of Wollongong, New South Wales. The current proposal is for bord-and-pillar extraction east of Cataract Reservoir, involving only first workings in the Wongawilli Seam and extracting up to 3.7 million tonnes of run-of-mine coal over a five-year period. The project is located within the Cataract Reservoir catchment. Cataract Reservoir is a source of drinking water for Sydney and lies within the Metropolitan Special Area, a restricted-access area designated to protect Sydney's drinking-water catchments. The project is on the Woronora Plateau which supports groundwater-dependent ecosystems (GDEs) such as Coastal Upland Swamps in the

Sydney Basin Bioregion. These swamps are listed as Endangered Ecological Communities (EECs) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *New South Wales Threatened Species Conservation Act 1995* (TSC Act).

The IESC previously provided advice on this proposal on 3 December 2019 (IESC-018) and 5 March 2020 (IESC-112) for the New South Wales Department of Planning, Industry and Environment. As part of the previous IESC-112 advice, it was recommended that the quantitative assessment of the risk of pillar failure be independently peer-reviewed by a recognised expert in multi-seam geomechanical stability. For this assessment, a peer review by Professor Bruce Hebblewhite (Umwelt 2020, Appendix D) has been presented and the project has been reviewed by the Independent Advisory Panel for Underground Mining Advice (IAPUMA). Both reviews propose a number of recommendations which, if adopted, the IESC considers will help support the proponent's predictions that there will be negligible impacts as a result of the project on water-dependent assets, including listed EECs (Coastal Upland Swamps in the Sydney Basin Bioregion) and creeks feeding Sydney's drinking water supply.

Key potential impacts from this project are:

- altered water regimes (including drying) with irreversible effects on EPBC Act-listed swamps;
- long-term effects on Bellambi Gully Creek and nearshore marine environments downstream from the discharge of adit water that exceeds ANZG (2018) default guideline values for freshwater aquatic ecosystems for some metals and metalloids; and
- long-term impacts on groundwater levels and quality post-mining where discharge from adits may occur in perpetuity.

The IESC has identified key areas in which additional work is required to address the key potential impacts, as detailed in this advice. These are summarised below.

- Further work to assess the status of pillar stability in seven of the 14 goaf areas.
- Swamp-specific ecological monitoring should commence at least two years before mining resumes to establish baseline data, then continue during the life of the mine and for a suitable period afterwards until the risk of any further ground movements can be demonstrated to be negligible.
- Swamp-specific water balances for potentially impacted swamps and multiple corresponding reference ones should be calculated based on monitoring data collected over an adequate time period. These multiple reference swamps are needed to differentiate changes caused by mining from those associated with natural climatic variability and will be required to demonstrate negligible impact from the project.
- Further monitoring of the adit water quality to address the potential risks associated with the discharge of either untreated or treated water into Bellambi Gully Creek. This monitoring should occur at more than one site downstream of the release point and should include analysis of sediment-bound contaminants.
- Groundwater and surface water monitoring focusing on the multi-seam extraction areas should quantify the drawdown response during mining and for a long enough period after mining ceases to confirm that no delayed significant impacts occur on aquatic environments, or, if they do, until recovery is complete. These monitoring data should be assimilated into updated models.

Context

Mining has occurred at the project site since the 1880s using various underground mining methods. The original underground proposal in 2009 sought a major expansion in the Wonga West area (a total of seven longwall panels) and the Wonga East area (a total of 11 longwall panels). At the existing mine, multi-seam extraction had led to subsidence and cracking, with the full extent of environmental consequences unclear. As the implications of these uncertainties for catchment water quality and quantity were a major issue, the original proposal was reviewed in 2014 by the NSW Planning Assessment Commission (PAC). They concluded that there was insufficient information available to make a planning decision. The project was then amended, proposing extraction from eight longwalls east of Cataract Reservoir. This proposal was reviewed by the PAC in 2016 which concluded that social and economic benefits of the project were likely outweighed by potential environmental impacts. The project was then significantly revised to the current proposal for bord-and-pillar mining east of Cataract Reservoir, involving only first workings in the Wongawilli Seam.

The project will require the construction of a coal processing plant; however, no coal washing will occur at the site. Existing water management infrastructure will be used, with some minor changes to the water management system. Discharges of treated mine-affected water will continue into Bellambi Gully Creek and will be managed under the existing environment protection licence, EPL 12040.

The IESC previously provided advice to the Australian Government Department of the Environment and the New South Wales Department of Planning and Environment on the project on 11 September 2014. Further advice was provided to the New South Wales PAC on 11 March 2015. Advice was also provided to the Australian Government Department of the Environment on the Russell Vale Longwall 6 Project (23 September 2014), which was approved by the NSW PAC and the Department of the Environment. The IESC provided advice to the New South Wales Department of Planning, Industry and Environment on 3 December 2019 and 5 March 2020 on the current revised project plan.

The project was approved by the NSW Independent Planning Commission under the *NSW Environmental Planning and Assessment Act 1979* on 8 December 2020.

Response to questions

The IESC's advice, in response to the requesting agency's specific questions is provided below.

Question 1: Can the Committee provide comment on whether the information provided in the PER adequately addresses the outstanding information required by the IESC advice of 5 March 2020?

Quantitative assessment of geomechanical stability

1. The advice provided by the IESC 2020-112 on 5 March 2020 (IESC 2020, p. 3) to the NSW Department of Planning, Industry and Environment recommended an independent review of the quantitative assessment by a recognised expert in multi-seam geomechanical stability. The proponent has presented this peer review by a suitable expert (Umwelt 2020, Appendix D) who conducted a review of the quantitative assessment of the risk of pillar failure, and the advice from the Independent Advisory Panel for Underground Mining (IAPUM) which considered the project as part of the assessment for the NSW Independent Planning Commission. The IESC is satisfied that the quantitative assessment of the current status of pillar stability in goafs 8-14 highlights the importance of understanding whether those pillars are stable. The approach adequately addresses the risks of potential impacts to swamps in these cases of potential pillar instability. However, the IESC notes that there is large uncertainty in the probability of catastrophic loss ($P_{\text{receptor affected}}$) that could include long-term drying effects and increased vulnerability to bushfires.

Groundwater and surface water monitoring

2. The IESC 2020-112 advice (IESC 2020, p. 4) recommended that groundwater and surface water monitoring should focus on multi-seam extraction areas, and the IESC reaffirms this guidance. Further discussion on the adequacy of the proposed groundwater and surface water mitigation, management and monitoring measures is provided in Paragraphs 11 and 12. This discussion notes that these monitoring data should be assimilated into updated models and used to improve the reliability of the groundwater and surface water predictions.

Adit discharge water quality

3. The proponent has not discussed the potential long-term influence of mixing between the reject material and the groundwater and water stored within the adit. This is presumably because the results of the geochemical analysis of the reject material indicate a negligible content of sulfur and moderate acid-neutralisation capacity. However, the laboratory results also suggest that metals, including aluminium, antimony, arsenic, molybdenum and selenium, may leach from the reject material (Umwelt 2020, Appendix 1 of Appendix L, pp. 4, 7, 10). Further discussion of the potential long-term impacts on the quality of water resources and subsequent discharge from the adit, including the adequacy of management measures, is provided in Paragraphs 6 and 13.

Site-specific water balance

4. The proponent has generally satisfied the IESC's previous concerns about the underlying assumptions of the surface water balance model (Umwelt 2020, Appendix M, pp. 11, 19). Given the importance of groundwater inflows into underground workings, the IESC recommends that when new surface water and groundwater monitoring data become available, they should be assimilated into updated surface water models and, where necessary, the predictions of site-specific water balance assessments are revised.

Question 2: Can the Committee provide comment on the adequacy of the assessment of adit water discharge to Bellambi Gully Creek, and any potential long term impacts of the proposed action in relation to subsidence and cumulative impacts with other proposed and existing projects?

Adit discharge water

5. The assessment of adit water discharge quality was limited to four physicochemical parameters (pH, electrical conductivity, total suspended solids and turbidity). However, the geochemical results of the reject material suggest that concentrations of multiple soluble metals may exceed the ANZG Guidelines (2018) for aquatic ecosystem protection (Umwelt 2020, Appendix 1 of Appendix L, pp. 4, 7, 10). Furthermore, it is not clear how the discharge will be treated, other than potentially involving coagulation of solids. The emplaced reject material may become a long-term source of contaminants (e.g. metals or metalloids). Should treatment of the water cease after mining operations, these contaminants may impact the ecological values of Bellambi Gully Creek and nearshore marine environments downstream over the long term (decades).
6. Timing and frequency of flows in Bellambi Gully Creek have not been provided, nor has the influence of the timing, frequency, magnitude and duration of releases from LDP2 on this creek's flow regime. These data would help inform the potential risks associated with the discharge of either untreated or treated water from the adit to Bellambi Gully Creek. Changes to the flow regimes may have direct effects on native biota (e.g. inundation of potential breeding and nursery habitats of native fish) and the water and sediment quality of the receiving environments.

Cumulative and long-term impacts

7. It is acknowledged by the proponent that there are cumulative impacts associated with the existing approved operations at Russell Vale Colliery, Cordeaux workings and Bulli Colliery and their residual impacts and recovery post-closure (Umwelt 2020, p. 172). These cumulative impacts were included in the groundwater assessment which was considered in the IESC advice (IESC 2020, p. 4). This advice highlighted that the proponent did not assess the predictions of cumulative water losses and the influences of discharge from adits on long-term groundwater levels, flow and water quality. The subsequent limited assessment of the cumulative and long-term impacts of the project (Umwelt 2020, Section 8.4) should be further strengthened through a comprehensive risk assessment. Where possible, this risk assessment should draw on reliable baseline data against which to judge the effectiveness of proposed mitigation and management plans in addressing cumulative and long-term impacts.

Question 3: Can the Committee provide comment on the adequacy of the proposed mitigation, management and monitoring measures?

8. As outlined within the NSW Consent Conditions, mitigation, management and monitoring measures are to be detailed in management plans. The proponent has not provided management plans for consideration; however, some mitigation measures have been identified in the Public Environment Report (PER). The IESC provides some general recommendations below to support the proposed monitoring and mitigation measures that the proponent has presented within the PER (Umwelt 2020).

Subsidence

9. The PER presents a subsidence monitoring framework (Umwelt 2020, p.139-140). Whilst the IESC commends the use of global navigation satellite systems (GNSS) and interferometric synthetic aperture radar (InSAR), only the broad approach is provided (Umwelt 2020, Figure 9.1, p. 141), and details on the location and number of GNSS units used and the frequency, spatial resolution and methods for InSAR data processing are not given. It is acknowledged that the specifics would be provided in the Subsidence Monitoring Plan at the post-approval stage as outlined in the NSW Development Consent. This Consent provides Performance Measures (NSW DPI 2020, Part C1, p. 21) that outline that there are to be negligible subsidence impacts or environmental consequences to watercourses and swamps. The IESC cannot comment on the adequacy of the proposed mitigation, management and monitoring measures without access to the Subsidence Monitoring Plan, Trigger Action Response Plans (TARPs) and the adaptive management measures documentation. It is recommended that the following measures be included.
- a. The IESC commends the suggested full-time (continuous) high-accuracy ground-based system, backed up by accurate aerial or satellite-based remote sensing on a regular basis (Umwelt 2020, Appendix D, p. 2). It is recommended that the resolution and methods proposed for InSAR monitoring and GNSS position data are reviewed and confirmed as suitable by an organisation with the required expertise (e.g. Geoscience Australia). Spatial resolution and methods used by the proponent should ensure that the vertical and horizontal resolutions are sufficient for quantifying subsidence within and near swamps with sufficient accuracy and precision to detect potential impacts and initiate TARPs. Furthermore, it should include an adequate time-series of pre-mining baseline data, again, of suitable spatial resolution.
 - b. All the existing monitoring systems on Mt Ousley Road and the closure across Cataract Creek should be retained. The IESC notes that the proponent has stated that only some will be retained. It is essential that all monitoring sites on Cataract Creek are maintained to enable impacts and risks to the aquatic systems to be identified and mitigated through TARPs.

- c. The monitoring sites should include the four swamps CCUS1, CCUS6, CCUS20 and CCUS21 because they have already experienced more than 10mm/m tensile strain and are noted as the most vulnerable to being negatively impacted by an increase in strain (Umwelt 2020, Appendix A of Appendix J, p. 29). There is only one monitoring point for CCUS1, while both CCUS20 and CCUS 21 have separate monitoring points within a close proximity. To adequately capture spatial variability, additional monitoring points in potentially impacted swamps and reference swamps (i.e. those unlikely to be affected by the project) are needed, with particular focus on the 15 swamps above the seven unconfirmed collapsed goaf areas (see Paragraph 15).
- d. The proponent should confirm that there are no remaining standing pillars in goafs 8-14. This would require the proponent to confirm the status through observation of the development roadway conditions driven below the edges of the extracted goaf areas (NSW DPI 2020, C 10 g (i). p. 22). The process for confirming the status of the Bulli Seam goaf areas is to include detailed underground geotechnical mapping of the observed changes in vertical and horizontal stress conditions (Umwelt 2020, Appendix D of Appendix J, p. 7).
- e. The IESC supports the conservative guide used in Umwelt 2020 (Appendix D, Table 1, p.3) of 100 mm as a threshold to calculate the risk of vertical subsidence causing catastrophic loss of a single swamp. This threshold could be revised based on new monitoring data collected for the swamps that acknowledges swamp-specific characteristics and cumulative effects of drying.
- f. The proponent has stated that the monitoring systems will provide early warning of increased subsidence prior to mining below the goaf edges and allow time for adaptive management practices that may be required (Umwelt 2020, p. 139). The proponent should describe the adaptive management practices that are intended to be implemented and comment on their likely effectiveness.
- g. The IESC recommends that the regular subsidence observations collected from the monitoring site locations be used to inform TARPs. The TARPs should consider practical options for changes to the mine plan and cease-to-work triggers.
- h. The IESC 2019-108 advice (IESC 2019, p. 6) recommended that an extraction plan be provided for each consecutive section of bord-and-pillar extraction. Each extraction plan should review all subsidence monitoring data from previous sections to confirm that no ground movements have occurred from the project before the next section is commenced. The review should also assess pillar stability nearby, including in overlying historic workings.
- i. As recommended by the IAPUM, the design of the bord-and-pillar workings under longwall panels in the Balgownie Seam should not be reduced from 24.5 m to 19.5 m unless based on appropriate site-specific studies that include reliably estimating pillar load (Umwelt 2020, Appendix A of Appendix D, p. 15).

Groundwater

- 10. Groundwater quality monitoring has been undertaken by the proponent for a suite of physico-chemical parameters and metals/metalloids; however, the IESC notes that monitoring was limited to 11 sites from January 2020 to October 2020 (Umwelt 2020, Appendix J, Table 5, pp. 8-9). Only the combined data from the 11 sites were reported. The proponent should provide the locations of these sites and the site-specific data and continue groundwater baseline monitoring to ensure that seasonal variations in metal and metalloid concentrations are captured.
- 11. The proponent has provided a preliminary groundwater monitoring framework which includes commitments to monitor groundwater levels and gradients near swamps, existing groundwater sites and new sites targeted at the initial mine workings (Umwelt 2020, Table 9.2, pp. 152-155).

Commitments have also been made by the proponent to establish a regional groundwater monitoring network to monitor potential long-term drawdown and recovery of groundwater levels. The IESC recommends the following additions.

- a. Additional groundwater monitoring bores are required below the Scarborough Sandstone to the coal measures. These could include vibrating wire piezometers with multiple points of groundwater level monitoring, and open holes for downhole geophysical logging of strata in addition to groundwater level monitoring. This would also enable testing of hydraulic properties (e.g. hydraulic conductivity and specific storage) at the new bore holes to improve estimates of groundwater losses to the coal seam by improving the groundwater model.
- b. To identify potential changes in connectivity between aquifers and/or surface waters, the pumping rates of mine inflows should be regularly measured and compared to predicted inflow rates and rainfall data and considering changes to water storage within the goafs.
- c. The proponent should develop a program for regular review of groundwater and surface water monitoring data which includes updating of relevant models. To facilitate relevant mitigation and monitoring measures, the proponent should provide the adaptive management practices intended to be implemented. The IESC recommends that the data collected from the monitoring site locations be used to inform TARPs and adaptive management practices where feasible (e.g. adjustment of mine layout).

Surface water

12. The proponent has provided a preliminary surface water monitoring framework which includes commitments to monitor Cataract Creek and its tributaries, Cataract River, swamps and Bellambi Gully Creek in accordance with EPL 12040 (Umwelt 2020, Table 9.2, pp. 149-152). The IESC recommends the following additions to this framework.
 - a. Baseline monitoring of Bellambi Gully Creek for a full suite of analytes was undertaken between January and October 2020 from upstream and downstream locations of the Pit Top (EPL monitoring location 12 and 11 respectively) (Umwelt 2020, Appendix J, Figure 1, p. 2). Baseline monitoring of Bellambi Gully Creek should continue to ensure that seasonal variations in nutrient, sediment and metal/metalloid concentrations are captured. The IESC recommends additional upstream and downstream monitoring sites to better capture spatial variability and also the inclusion of benthic sediment sampling to assess the risk of sediment-bound contaminants (e.g. metals) to downstream and nearshore receiving environments (Bellambi Beach).
 - b. EPL 12040 (NSW DPIE 2020) specifies discharge limits for pH, electrical conductivity (EC), total suspended solids (TSS) and turbidity in Bellambi Gully Creek. Discharges from LDP 1 and LDP 2, which are currently undertaken in accordance with EPL 12040, should include monitoring for a broad suite of metals, and the results should be compared with the ANZG Guidelines (2018) for aquatic ecosystem protection.
 - c. Given that there are already exceedances of several water quality guidelines downstream of LDP2 discharges into Bellambi Gully Creek, and to better interpret the source of these exceedances, the IESC recommends undertaking direct toxicity assessment of the LDP2 discharge prior to release.

Adit discharge water

13. The conditions of development consent (MP09_0013) include a requirement for an Adit Discharge Water Management Plan (ADWMP) which includes predictions of the volumes and discharge water quality from potential groundwater leakage points. Additional requirements which are stipulated in the

development consent and to be included in the ADWMP are timelines for discharges, options for treatment, discharge and beneficial reuse during and after mining operations, and avoidance, mitigation and monitoring measures to reduce potentially adverse impacts. Management of discharges from the adit described in the PER focused on monitoring rather than mitigation measures, the adequacies of which are discussed in Paragraph 6.

Swamps

14. The proponent has not provided an Upland Swamp Monitoring Program (USMP). However, the PER includes the recommendation from the IESC 2019-108 advice to use nested monitoring bores and environmental water tracers to identify whether hydraulic connection exists between the perched aquifers upon which the swamps rely and the Upper Hawkesbury Sandstone aquifers (IESC 2019, p. 7).
15. The IAPUM highlighted that an objective subsidence impact assessment has not been undertaken for all swamps (Umwelt 2020, Appendix A of Appendix J, p. 21). Current monitoring design is focused on swamps CCUS1, CCUS6, CCUS20 and CCUS21 because these swamps are considered most at risk of cumulative impacts (Umwelt 2020, Appendix G, p.32). However, as each swamp will differ in terms of biodiversity, ecological condition and water regime, it is important that monitoring is tailored for each swamp to capture swamp-specific differences in potential vulnerability and responses to any changes associated with subsidence. This tailored monitoring should be extended to include the 15 swamps (CCUS10, CCUS11, CCUS12, CCUS13, CCUS14, CCUS22, CCUS24, CRUS1, CRUS2, CRUS3, CRUS6, CRUS7, BCUS4, BCUS7, BCUS11) located over goafs 8-14 where the status of pillar stability is unconfirmed. The IESC recommends swamp-specific ecological monitoring should commence over at least two years before mining resumes to establish baseline data, then continue during the life of the mine and for a suitable period afterwards until the risk of any further ground movements can be demonstrated to be negligible. Suitable multiple reference (i.e. unaffected by mining) swamps should be monitored at the same time to provide adequate comparative data that will allow potential swamp-specific responses to subsidence and other mine-associated activities to be discriminated from background temporal changes (e.g. droughts, inter-annual variation) and to allow for time lags in the drying of the swamps to be identified.
16. Swamp-specific water balances should be calculated based on monitoring data, including for multiple reference swamps. The proponent should clearly identify the locations and condition of the reference swamps previously used for floristic monitoring (ACUS, BCUS12 and WACUS) and include further swamps with similar topographies near the eastern escarpment, but with no previous undermining.

Question 4: Note the NSW development consent at Appendix E to the PER. Does the IESC consider that any additional conditions would be required to adequately protect Commonwealth matters?

17. The NSW Development Consent includes few quantitative limits. The IESC considers that these should be provided, for example, to assess water and sediment quality exceedances.
18. As an additional condition to better protect the EPBC Act-listed swamps, the IESC considers that 100 mm (see Paragraph 9e) vertical subsidence be used as a conservative threshold.
19. The Consent also requires the development of management plans (i.e. Surface Water Management Plan, Adit Discharge Plan, Subsidence Management Plan). The proponent has stated that the required management plans will be provided at the post-approval stage and so they have not been provided for this assessment. It is for this reason that the IESC cannot provide advice on the conditions and the management plans. However, the response to Question 3 provides some recommendations on the proposed mitigation and monitoring measures that the proponent has presented within the PER (Umwelt 2020). These could be used, if required by the Regulator, to support the conditions to adequately protect Commonwealth matters.

Date of advice	8 February 2021
Source documentation provided to the IESC for the formulation of this advice	Umwelt (2020). <i>Draft Public Environment Report. Russell Vale Colliery Revised Underground Expansion Project (EPBC 2020/8702)</i> . Final, December 2020. Umwelt (Australia) Pty Ltd, Report no. 3687/R17.
References cited within the IESC's advice	<p>ANZG 2018. <i>Australian and New Zealand guidelines for fresh and marine water quality</i>. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT. Available [online]: accessed January 2021.</p> <p>IESC 2019. <i>Advice to decision maker on coal mining project. IESC 2019-108: Russell Vale Colliery Underground Expansion Project (MP 09_0013) – Expansion [Online]</i>. Published 3 December 2019. Available [online]: http://www.iesc.environment.gov.au/projectadvice/russell-vale-expansion-projectadvice-2019-108 accessed January 2021.</p> <p>IESC 2020. <i>Advice to decision maker on coal mining project. IESC 2019-108: Russell Vale Colliery Underground Expansion Project (MP 09_0013) – Expansion [Online]</i>. Published 5 March 2020. Available [online]: https://www.iesc.environment.gov.au/projectadvice/russell-vale-project-advice-2020-112 accessed January 2021.</p> <p>NSW DPIE (2020). <i>Development Consent, Wollongong Coal Limited MP09_0013</i>. The Independent Planning Commission of NSW. Russell Vale Revised Preferred Underground Expansion Project. 8 December 2020</p>