

Advice to decision maker on coal mining project

IESC 2022-135: Isaac River Coal Mine (EPBC 2021/8980) New Development

Requesting agency	The Australian Government Department of Climate Change, Energy, the Environment and Water
Date of request	21 July 2022
Date request accepted	22 July 2022
Advice stage	Referral

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 Climate Change, Energy, the Environment and Water to provide advice on the Bowen Coking Coal Limited's Isaac River Coal Mine project in Queensland. 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 Isaac River Coal Mine (the 'project') is a new open-cut coal mine, located 28 km east of Moranbah, Queensland and immediately east of the operating Daunia Coal Mine. It will involve mining approximately 500,000 tonnes per annum (tpa) of hard coking coal, semi-hard coking coal and Pulverised Coal Injection product over five years. This proposed scale and life of mine are relatively small in the context of neighbouring mining projects.

The project area is in the North Creek catchment, a tributary of the Isaac River (part of the greater Fitzroy River Basin). The Isaac River, North Creek and New Chum Creek in the vicinity of the project are ephemeral, flowing only after sustained or intense rainfall. Their catchments and riparian zones support patches of Threatened Ecological Communities (TEC) including Brigalow (*Acacia harpophylla* dominant

and co-dominant) listed under the *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) as endangered, and several terrestrial groundwater-dependent ecosystems (GDEs). The riparian vegetation provides critical habitat for EPBC Act-listed species such as the Greater Glider (*Petauroides volans*) and Koala (*Phascolarctos cinereus*).

The IESC has identified substantial shortcomings in the proponent's analysis, especially the groundwater modelling, that currently prevent reliable assessment of the project's environmental impacts. However, given the spatial scale, location and proposed duration of the project, the IESC considers that the following key potential impacts are likely:

- impaired surface water quality and possibly sediment quality downstream of the release point(s) of untreated mine-affected water (MAW) and water from the sediment dam, with impacts potentially extending down North Creek to the Isaac River;
- reduction or loss of groundwater-dependent riparian zone vegetation along North Creek and an unnamed tributary, potentially arising from project-specific or cumulative drawdown, that may reduce habitat values for EPBC Act-listed species such as Greater Gliders and Koalas;
- contribution to cumulative and long-term impacts on surface waters (e.g., North Creek and Isaac River) and GDEs within and near the project area; and
- long-term risks (e.g., deteriorating water quality) associated with the final void.

The IESC has identified key areas in which additional work is required. These are summarised below.

- The hydrogeological conceptual model needs to be developed and documented in more detail supported by relevant evidence.
- The numerical groundwater model should be revised to address shortcomings in model domain, boundary conditions and steady state calibration, the representation of mine closure and uncertainty analysis methodology.
- After revision of the hydrogeological conceptual model and numerical groundwater model, reassess the cumulative impacts of the likely effects on water resources of this project with all nearby current and future mining activities.
- The water quality monitoring program in the Receiving Environment Monitoring Program (REMP) should be revised, including expanding the monitoring program and suite of analytes.
- Develop an ecohydrological conceptual model that represents the key interactions between groundwater, surface water and water-dependent ecosystems in and near the project area (including the downstream Isaac River). This model should be used to identify potential impact pathways and their consequences and indicate where monitoring and mitigation measures are needed.

Context

The Isaac River Coal Mine (the 'project') is a new open-cut coal mine in the Bowen Basin, Queensland. It is located immediately east of the existing Daunia Coal Mine and close to the Red Mountain Coal Handling and Processing Plant (RM CHPP). The project site is also near other mines in the region including Olive Downs Mine, Moorvale Mine, and the Mavis and Millennium Mine pits. The project is expected to produce 500,000 tonnes of metallurgical (coking) coal per annum for five years, using open-cut and highwall mining methods to target the Vermont and Leichhardt seams of the Rangal Coal Measures. The project will utilise the infrastructure located at the RM CHPP. After mining finishes, the project will operate for a further two years for rehabilitation and mine closure.

Watercourses and drainage lines in the project area are ephemeral and typically flow only after sustained or intense rainfall. The proposed pit is approximately 2.5 km from North Creek to the east, about 5 km from the New Chum Creek to the west and over 7 km from the Isaac River at its closest point to the southwest. The Environmental Authority (EA) for the operation of the mine includes licenced discharge to a tributary of North Creek that then flows into the Isaac River.

The predominant land uses within the North Creek catchment are stock grazing and mining (Moorvale Mine, which also has environmental approval for water releases to North Creek). The project has a proposed disturbance area of 175 ha and will clear 25 ha of essential habitat for Ornamental Snake (*Denisonia maculata*). The project area contains patches of the TEC Brigalow (*Acacia harpophylla* dominant and co-dominant) and riparian vegetation along North Creek which is also likely to provide habitat for EPBC-listed species such as Koalas and Greater Gliders.

Response to questions

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

Question 1: Noting the relevant water quality objectives, water management information and requirements associated with the Environmental Authority, can the Committee provide comment on likely scale and extent of potential downstream impacts to North Creek and Isaac River water resources resulting from the proposed water releases?

1. The IESC agrees with the proponent that the scale and extent of the proposed water releases are unlikely to substantially alter flow regimes downstream in North Creek and the Isaac River. However, there may be changes to surface water quality (Paragraphs 2-6) and sediment quality (Paragraphs 7-8) that could have downstream impacts on North Creek and Isaac River water resources, and also contribute to cumulative impacts of mining in the area (Paragraphs 9, 15-16).

Potential impacts on downstream surface water quality

2. As part of the Olive Downs EIS, local water quality data were collected from North Creek and Isaac River upstream and downstream of its confluence with North Creek and the proposed licensed discharge point of mine-affected water (MAW). Turbidity, suspended solids, total sulfate, electrical conductivity, ammonia, total aluminium, dissolved aluminium, dissolved copper and dissolved zinc have periodically exceeded water quality objectives (WQOs) in North Creek and Isaac River. The EA (Item C6) provides for this by requiring no action if the downstream result during MAW release is less than the background (ambient monitoring) upstream site, even if concentrations of analytes exceed the trigger values.
3. Although not required in the EA, in the REMP the proponent has undertaken to also monitor metals in the downstream sites during MAW release. Background monitoring of all metals will also be required at the upstream site so that where exceedances of metal trigger values occur, downstream metal concentrations can be compared to upstream concentrations (as per EA C6). The REMP should be revised to include this additional monitoring. Direct toxicity assessment of the MAW and upstream and downstream waters of North Creek during release may also be useful to evaluate possible interactive effects in the MAW and receiving waters.
4. The EA requires that both the sediment dam and the mine water dam be monitored quarterly for all analytes, and that the receiving environment up to 10 km downstream of the mine access road also be monitored while sediment-affected water is being discharged from the site. This required monitoring needs to be incorporated into the revised REMP.
5. The IESC also recommends that an additional monitoring site, within 200 m downstream of the MAW release point, be included in the revised REMP.

6. Site-based erosion and sediment controls are required by the EA and a conceptual plan is provided by the proponent (CDM Smith 2021a; Engeny 2021). Overtopping of the sediment dam is predicted to occur at least once in 50% of years (CDM Smith 2021a, Figure 6-80, p. 402) and should be continuously monitored during wet weather events to assess the effectiveness of sediment control measures applied to runoff to the unnamed tributary of North Creek.

Potential impacts on downstream sediment quality

7. The proponent presents evidence of elevated concentrations of background contaminants in sediments from North Creek and Isaac River, including a range of metals and some hydrocarbons (e.g., chrysene, phenanthrene) (CDM Smith 2021a, p. 352). Pulsed flows are likely to transport sediments downstream in these predominantly sand-bed streams where they may be deposited in the riparian zone and near-channel floodplain. Therefore, there is a possibility that contaminants may enter food webs along the aquatic-terrestrial interfaces of North Creek. These potential exposure pathways should be explored in an ecohydrological conceptual model (Paragraph 13). The IESC acknowledges that this project is comparatively short-term (five years) but the proponent should consider potential long-term impacts arising from legacy effects of contaminated sediments and how these might be mitigated.
8. In the REMP, the proponent proposes to monitor sediment quality annually for the first two years of operation to “establish baseline sediment quality values”. The REMP does not specify how many samples or where these samples will be collected. This information is required to determine background sediment quality. The IESC recommends that sediment quality parameters should be measured at least six-monthly for two years prior to operations commencing and for two years after operations commence. The REMP should also specify where these samples will be collected.

Cumulative impacts downstream of the release point

9. Although the project is small-scale and short-term compared with other mining developments in the Bowen Basin, untreated releases of MAW could still contribute to past, existing (and future) declines in water quality and sediment quality in North Creek and the Isaac River resulting from nearby mines and other land-uses in their catchments. Assessing the project’s individual contributions to these cumulative impacts is important, especially for persistent toxicants such as polyaromatic hydrocarbons (CDM Smith 2021a, p. 352). The proponent has assessed potential cumulative impacts of groundwater drawdown (see response to Question 2) but has not evaluated how the licenced MAW releases to North Creek may contribute to cumulative impacts of poor water quality and sediment quality on the biota and ecological processes downstream. This assessment is needed, especially where downstream concentrations of physicochemical, metal, nutrient and hydrocarbon parameters may approach ecologically significant tipping points.

Question 2: Can the committee provide comment on the likely scale and extent of impacts to GDEs and groundwater systems as a result of drawdown?
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10. There is limited evidence in the proponent’s documentation to support the conceptual model of the groundwater system and drawdown that may impact GDEs. The proponent’s documentation includes significant hydrogeological information, but this is not synthesised into a coherent description of the hydrogeological conceptual understanding. The conceptual model assumes an offset of groundwater levels across a significant thrust fault and does not indicate any influence of the granitoid intrusion on groundwater levels, particularly across the contact zone with sedimentary strata. If fault mapping and seismic surveys identify faults that could intercept the mine workings (CDM Smith 2021c, p. 11), the possible extent of fault influence on groundwater flow either across or along the fault zone should be investigated with a risk-based evaluation. A more substantive conceptual model is required to provide justification and explanation of important model design elements, such as the size of the model domain, the location and type of boundary conditions

applied and interactions between groundwater, surface water and vegetation. The model report (CDM Smith 2021c) does not address how other mining activities in the area have likely affected the groundwater system, particularly the development of the Daunia Mine directly adjacent to the project area.

11. The IESC has little confidence in the predictions of drawdown from the current groundwater model. This is due to the shortcomings of the hydrogeological conceptualisation, inadequate description and justification of key model design decisions, poor steady state calibration, the proximity of model boundaries, the representation of mine closure, and the uncertainty analysis (CDM Smith 2021c). The groundwater modelling work and reporting have not followed industry practice documented in the Australian Groundwater Modelling Guidelines and has not been subject to independent peer review. The approach adopted by the groundwater model uncertainty analysis is unlikely to reflect the true range of uncertainty in predictions and other methods may be more appropriate. The proponent should address these weaknesses and develop a local-scale model that is informed by boundary conditions obtained from an existing regional model. The following paragraphs provide examples of the shortcomings that need to be addressed.
12. The numerical groundwater model is not sufficient to assess potential impacts of the project. The model should be revised based on the following recommendations.
 - a. Predicted groundwater level contours within the alluvium and Rangal Coal Measures extend beyond the model domain (CDM Smith 2021c, Figures 12-13, pp. 30-31). The proponent should extend the model domain and reconsider the appropriateness of the boundary conditions.
 - b. The ratio of vertical hydraulic conductivity to horizontal hydraulic conductivity within each hydrogeological unit has been assumed to be only 0.01 (CDM Smith 2021c, p. 22). This assumption has not been justified. The proponent's numerical groundwater model may therefore systematically underestimate groundwater drawdown in all units, including the alluvium.
13. The inadequacies of the hydrogeological conceptual model (Paragraph 10) and numerical groundwater model (Paragraph 12) and the method used for cumulative impact assessment (Paragraph 15) currently prevent reliable assessment of the likely scale and extent of impacts to GDEs and groundwater systems as a result of drawdown. When these inadequacies have been addressed, the proponent should reassess potential impacts of the project on GDEs and riparian vegetation along New Chum Creek and North Creek and within the zone of projected drawdown. This reassessment should be guided by an ecohydrological conceptual model that includes all key surface and groundwater hydrological pathways and components (i.e., all water resources, including GDEs) in the project area, predicted drawdown zone and downstream. In particular, the proponent should assess the potential cumulative impacts of drawdown on riparian vegetation, some of which may be groundwater-dependent (SLR 2022a, pp. 11-12) and provide habitat for EPBC Act-listed species such as the Greater Glider and Koala.
14. Model predictions suggest that groundwater mounding caused by the hydraulic loading of the WRD is predicted to drain into the pit void during mining operations (CDM Smith 2021a, p. 479). Given the limited geochemical analysis of the solid waste rock material that indicated elemental enrichment of arsenic, copper, mercury and zinc and total sulfur, this mound may become a long-term source of groundwater contamination. The proponent should undertake a more complete geochemical analysis including leachate testing of coal, waste rock and rejects.

Cumulative drawdown impacts

15. The current numerical groundwater model only considers the cumulative drawdown impacts of the adjacent Daunia Mine Pits (CDM Smith 2021c, p. 2) but does not include the Moorvale, Poitrel and Isaac Plains mines. A separate regional-scale groundwater model (completed for the Caval Ridge Mine Horse Pit Extension Project) included a simulation of nearby operations but excluded the current project. The proponent overlaid the project's groundwater impact predictions over this regional-scale model to assess cumulative impacts (SLR 2022b, p.3). This method is not fit for the purpose of quantifying potential drawdown impacts on GDEs. The proponent should include these surrounding operations in the revised numerical groundwater model and discriminate predicted drawdown due to the project alone from that of the project and surrounding coal mines.

Additional considerations

16. The EA requires that groundwater quality monitoring in reference and compliance bores should include quarterly measurements of EC and pH, and six-monthly monitoring of other analytes (major ions, C6-C9 and C10-C36 Total Recoverable Hydrocarbons, and a limited suite of metals/metalloids (aluminium, arsenic, molybdenum, selenium)). Only if the groundwater quality limits are exceeded on three consecutive occasions in the same bore (potentially over an 18-month period), is action by the proponent required. Previous monitoring has already shown that groundwaters regularly exceed Fitzroy local WQOs for nickel, with some exceedances also for chromium, copper, manganese and zinc. The groundwater monitoring plan should therefore include these additional five analytes to determine if concentrations of these metals in groundwater are increasing due to project activities.

17. The IESC recommends that the final void be backfilled. If a final void remains, or partial backfilling is not designed to limit surface water and groundwater interactions, then appropriate ongoing risk-based evaluation and monitoring of water salinity and potential mobilisation of contaminants is recommended.

Date of advice	03 September 2022
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Source documentation provided to the IESC for the formulation of this advice	CDM Smith 2021a. <i>EPBC Referral - Preliminary Document Report for the Isaac River Coking Coal Project (MLa 700062 and MLa 700063)</i> . Bowen Coking Coal. 18 June 2021. BCC_PRD_V1_16062021b
	CDM Smith 2021b. <i>Environmental Assessment Report in support of Application for Site Specific Environmental Authority for the Isaac River Coking Coal Project (MLa 700062 and MLa 700063)</i> . Bowen Coking Coal. 25 May 2021. Updated EAR_Rev1_260521
	DES 2022a. <i>Environmental authority EA100114091 – Isaac River Coal Mine</i> . EA100114091. 29 March 2022.

References cited within the IESC's advice	IESC 2018. <i>Information Guidelines for proponents preparing coal seam gas and large coal mining development proposals</i> [Online]. Available: http://www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-may-2018.pdf .
	CDM Smith 2021a. <i>EPBC Referral – Preliminary Documentation Report for the Isaac River Coking Coal Project (MLa 700062 and MLa 700063)</i> . Prepared for Bowen Coking Coal Ltd. Ref: BCC_PRD_V1_16062021b 18 June 2021.

CDM Smith 2021b. *Environmental Assessment Report in support of Application for Site Specific Environmental Authority for the Isaac River Coking Coal Project (MLa 700062 and MLa 700063)*. Updated EAR_Rev1_260521. 25 May 2021

CDM Smith 2021c. *Isaac River Groundwater Modelling Technical Appendix*. Prepared for Bowen Coking Coal Limited. 29 April 2021.

Engeny 2021. Bowen Coking Coal (BCC) Conceptual Erosion and Sediment Control Plan Isaac River Coal Project. Engeny Water Management 11 May 2021 M7270_003-REP-001-01

SLR 2022a. *Isaac River Coal Project Groundwater Management and Monitoring Program*. Prepared for Coking Coal One Pty, Ltd. SLR Ref: 620.30757.00400-R01, Version No: -v1.0. July 2022.

SLR 2022b. *Isaac River Groundwater Assessment Cumulative Impacts*. Prepared for Bowen Coking Coal Ltd / Coking Coal One Pty Ltd. SLR Ref: 620.30757.00600-M01-v2.0-20220718.docx
