



Advice to decision maker on coal mining project

IESC 2024-149: Vulcan South Coal Mine Project (EPBC 2023/09708) – Expansion

Requesting agency	The Australian Government Department of Climate Change, Energy, the Environment and Water
Date of request	10 May 2024
Date request accepted	13 May 2024
Advice stage	Assessment

The Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (the IESC) provides independent, expert, scientific advice to the Australian and state government regulators on the potential impacts of unconventional gas and large coal mining proposals on water resources. The advice is designed to ensure that decisions by regulators on unconventional 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 Vitrinite Pty Ltd's Vulcan South Coal Mine 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 2024).

Summary

The Vulcan South Coal Mine Project (the 'project') is a proposed new area of open-cut coal mining, targeting coking and some thermal coal, located in the Bowen Basin region of Queensland, approximately 35 km south of the township of Moranbah (MetServe 2024a, p. 12). The project will disturb up to 1,476.4 ha of land within Mine Lease Application 700073 (the MLA) (MetServe 2024a, p. 39) and will extract 13.5 Mt over the nine-year life of the mine with an extraction rate of 1.95 million tonnes per annum (Mtpa) (MetServe 2024a, p. 12).

The project includes the excavation of three open-cut pits targeting the Alex and Dysart Lower-Lower (DLL) seams of the Moranbah Coal Measures (hydrogeologist.com.au 2022, p. 30), development of a

highwall mining trial area, and construction of a rail loop loading facility, coal handling and processing plant (CHPP) and ancillary infrastructure (MetServe 2024a, p. 12). The pits will be progressively mined over nine years, starting in the north of the project area with the Vulcan North and Vulcan Main pits and moving south to finish with the Vulcan South pit (MetServe 2024a, p. 35). The proposed highwall mining is to access the coal seam from surface outcrop by narrow panels (or 'plunges'). The implications for water resources due to ground movement and subsidence are highly uncertain given the very limited data available from similar operations.

The project area is in the headwaters of Boomerang, Hughes, Barrett, East and Harrow creeks (MetServe 2024a, p. 66). Two drainage lines will be diverted around the Vulcan North and Vulcan South pits (MetServe 2024a, Figure 5-11, p. 152). The proposed rehabilitation of the project area includes progressive backfilling of all pits (MetServe 2024a, p. 35), stabilisation of waste rock emplacements through reseeded with grazing grasses (MetServe 2024b, p. 98) and realigning the diverted streams back to their original courses over the backfilled pits (WRM 2023, p. 85).

The proponent's ecological desktop surveys identified potential terrestrial groundwater-dependent ecosystems (GDEs) along Hughes and Boomerang creeks as well as along several unnamed watercourses within the project area (MetServe 2023, p. 29). Riparian vegetation along Hughes and Boomerang creeks provide habitat for at least five species listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. There are also 119 ha of the Brigalow (*Acacia harpophylla* dominant and co-dominant) Threatened Ecological Community (TEC) in the project area, of which 71.2 ha will be cleared.

Potential impacts from this project are:

- removal of up to 1,309.6 ha of remnant vegetation of varying condition, including known habitat for several EPBC Act-listed species and areas of a TEC and riparian and groundwater-dependent vegetation;
- increased erosion and sedimentation downstream of the project area from stream diversions and increased flood depths and velocities;
- decreased water quality downstream of Hughes and East creeks due to overflows of sediment dams into receiving creeks;
- groundwater drawdown of underlying aquifers within and surrounding the project area that may impact GDEs and riparian vegetation along Hughes Creek and its tributaries;
- changes in groundwater quality as backfilling of pits with waste rock could allow flow-through of groundwater that may be contaminated from exposure to waste rock eastwards towards Plumtree Creek (a tributary of Hughes Creek); and
- cumulative impacts with mining activities nearby (Saraji Mine Complex, Peak Downs and Caval Ridge) and on site (e.g. Matilda and Jupiter pits).

The provided impact assessment reports summarise work undertaken at several nearby mines; however, insufficient site-specific data and information have been provided, especially to inform groundwater and surface water modelling.

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

- Collection of additional, up-to-date, site-specific field data that will enable clear identification of potential impact pathways and receptors in and near the project area that may be impacted by the project. This should include:

- measuring groundwater levels and water quality to improve characterisation of the shallow groundwater system, particularly in riparian zones and low-lying parts of the landscape; and
 - ground surveys and mapping of riparian vegetation and occurrence of terrestrial GDEs, as well as their condition and dependence on groundwater.
- Revised groundwater modelling informed by the additional data above and supplemented by further regional groundwater data. This should include modelling of the post-mining period.
 - Further analysis of potential impacts to GDEs, riparian vegetation and other water-dependent assets as a result of changes to groundwater dynamics, surface water flows, groundwater and surface water quality, followed by identification and justification of any necessary mitigation measures.
 - Once further site-specific data have been collected, the impact pathway diagram should be updated to refine the understanding of how and where the project may impact water resources. This will assist in validating further proposed monitoring programs and support development of management plans.
 - Further details about the water management system for preventing impacts to receiving environments from overflows of sediment dams and ensuring that water management infrastructure is in place prior to activities that could contribute to decreased water quality in receiving creeks.
 - Detailed discussion about proposed mitigation measures for erosion and sedimentation arising from stream diversion and altered flooding depths and velocities.
 - For the highwall mining, information concerning the specific locations, design and potential ground movement (including subsidence) is required to determine potential environmental impacts.
 - Provision of evidence and modelling to better characterise the cumulative impacts of this project and adjacent mining on groundwater, surface water (including water quality) and ecological receptors in the project area and downstream.

Context

The project proposes to develop a new area of open-cut mining predominantly for coking coal, and associated infrastructure in the Bowen Basin, 35 km south of Moranbah, Queensland. The project consists of three open-cut pits and a trial of highwall mining over an operational life of nine years with rehabilitation works to increase the life of the project to 22 years (MetServe 2024a, p. 12). The proponent has an already-approved pit (Jupiter (2020/8676)) to the north of the proposed open-cut pit areas, and another project currently being assessed under the EPBC Act (Matilda Pit and Ancillary Infrastructure Project (EPBC 2022/09361)) which is also north of the open-cut pits and east of the highwall trial. Other mines near the project area include Saraji Mine Complex, Peak Downs and Caval Ridge (WRM 2023, Figure 1-1, p. 17).

The project will include the development of additional infrastructure in the project area, including the CHPP, haul road and rail-loop loading facility. The construction of the CHPP will facilitate coal being processed on site from the three open-cut pits and highwall mining trial. Waste rock will initially be stored in dumps surrounding the open-cut pits with material from the later stages of mining used to backfill the open-cut pits.

The project is in the headwaters of Boomerang, Hughes, Barrett, East and Harrow creeks which are tributaries of the Isaac River, part of the Fitzroy catchment. These watercourses are ephemeral, with Quaternary alluvium associated with the larger channels within the region (MetServe 2024a, p. 56). Tertiary alluvium is mapped (hydrogeologist.com.au 2022, Figure 4.4, p. 27) as widely occurring within and surrounding the project area. The project will divert two drainage lines around the Vulcan North and Vulcan South pits (MetServe 2024a, Figure 5-11, p. 152). These diversions are to be realigned to their original channels once the project is completed (WRM 2023, p. 85). Additionally, a water management system will be established to collect any rainfall runoff and mine-affected water (MAW). The proponent has recently been issued an Environmental Protection Order (EPO) Notice by the Queensland Government for infringements relating to the development of the water management system and water quality impacts from the existing Jupiter pit into the receiving environment (DESI 2024).

The project area covers approximately 3,819 ha with a proposed disturbance area of 1,476.4 ha (MetServe 2024a, p. 39). Of this, 769.7 ha are remnant vegetation of varying condition (low to high quality) (MetServe 2023, p. vii), 59.1 ha are regrowth vegetation (MetServe 2023, Table 3-1, p. 19), and 647.7 ha are considered cleared pasture although it too includes regrowth (MetServe 2023, Table 3-1, p. 19). Six Matters of National Environmental Significance (MNES) were recorded within the project area: Koala (*Phascolarctos cinereus* – endangered), Squatter Pigeon (*Geophaps scripta scripta* – vulnerable), Greater Glider (*Petauroides volans* – endangered), Rufous Fantail (*Rhipidura rufifrons* - migratory), White-throated Needletail (*Hirundapus caudacutus* - migratory) and the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (endangered). Suitable habitat for Ornamental Snake (*Denisonia maculata* – vulnerable) also occurs on the site and it is recorded on adjacent mine-sites (Saraji and Peak Downs) (MetServe 2023, p. 48). These MNES were largely recorded in association with watercourses, GDEs and surrounding vegetation, some of which are to be cleared for the project. Some of the remaining vegetation may be impacted due to changes in the water regime from the diversions and the water management system. Arboreal mammals (including Koalas and Greater Gliders) are likely to be affected by the loss or degradation of habitat trees arising from local water regime changes and riparian zone fragmentation (e.g. for diversions).

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, particularly the baseline and modelled data, and the conclusions drawn by the proponent, are sufficient to assess the proposed action's impacts to surface and groundwater resources, GDEs and other third-party users, and cumulative impacts with other proposed and existing projects?

Question 2: Can the Committee identify and discuss what additional information is required to enable the assessment of impacts on surface and groundwater resources?

1. The IESC considers that the baseline and modelled data, and the conclusions drawn by the proponent, are not yet sufficient to reliably assess the proposed action's individual and cumulative impacts to surface and groundwater resources, GDEs and other third-party users. The following paragraphs outline what additional information would be required to better assess potential impacts on surface and groundwater water resources.
2. As part of the proposed project, the proponent plans to trial highwall mining in a section of the MLA. The highwall mining will involve accessing additional coal resource from surface outcrop, extracting coal from narrow mined panels up to approximately 300 m long (MetServe 2024a, p. 251). The proponent has provided limited information on the specific locations, design and potential for ground movement (including subsidence). Assessment of potential impacts was qualitative and did not

consider the planned variation in parameters. Further project details and consideration of potential environmental impacts are therefore required.

Groundwater

3. Limited groundwater monitoring data are available across the 13 project-specific monitoring bores, partly due to several bores being dry. Additionally, up- and down-gradient monitoring locations are not represented, with the layout of bores perpendicular to inferred groundwater flow. Further data are needed to characterise baseline conditions of the groundwater system in the project area, prior to operations commencing. Without this information, it will be difficult during operations to identify impacts and determine whether they approach or exceed natural variability. Where the monitoring network is spatially constrained by the mining tenure, the proponent could develop a data-sharing agreement with neighbouring mines to obtain downgradient monitoring data (hydrogeologist.com.au 2022, Appendix C, p. 55).
4. The conceptualisation of geological features, hydrogeology, and surface water-groundwater interactions relies heavily on desktop analyses and impact assessments from other projects in the region. However, conceptual models derived from these sources at the project scale need to be validated by site-specific data and field investigations. For example, faulting, paleochannels or igneous intrusions potentially affecting groundwater flow have been identified in the broader region (hydrogeologist.com.au 2022, pp. 22, 28, 30-31), and therefore should be evaluated further in the project area to justify their omission from conceptual and numerical models. Additionally, due to differences in topography, elevation, and geological/hydrostratigraphic units present, conceptualisations from surrounding mines are not always applicable to the project area.
5. Impacts to alluvial groundwater, and any ecological assets that depend on alluvial systems (MetServe 2024a, p. 56), have not been assessed as it is asserted with minimal evidence that the alluvium in the project area is discontinuous and frequently dry (hydrogeologist.com.au 2022, Appendix C, p. 8). Site-specific studies should be conducted to determine the presence and hydrogeological regime of alluvial sediments in the project area. Following this, updates to the groundwater model may be necessary.
6. Minimal reliable data were provided on the depth to the water table, which is crucial to determining potential surface-groundwater interactions and the likely presence of GDEs. There is a poor representation of up- and down-gradient monitoring points, and the final elevation contour map (hydrogeologist.com.au 2022, Figure 5.5, p. 50) represents a composite of available observations over time rather than at one point in time.
 - a. From this information, including topographic elevation data which were identified as carrying additional uncertainty (hydrogeologist.com.au 2022, Appendix C, p. 54), interactions between surface water and shallow groundwater were assessed to be absent in the project area. Additional groundwater monitoring near creek lines should be conducted to confirm this. Monitoring data should be extensive enough to detect any temporal variability or spatial trends in groundwater levels.
 - b. Similarly, groundwater elevations were used to infer that highwall mining would not have impacts to groundwater, as the water table is approximately 10 m below the highwall plunges in the Matilda seam (hydrogeologist.com.au 2022, p. 49). As described in the previous paragraph 6a, water-level monitoring at the proposed highwall sites would increase confidence in this assessment. This monitoring needs to be ongoing.
7. The groundwater model was not designed, constructed or calibrated in a way that allows confidence in the drawdown predictions over the mine life. The following issues should be addressed to improve

the accuracy of model predictions and ensure that the full range of potential impacts to groundwater and groundwater-dependent users can be considered.

- a. The general head boundary conditions applied to the model require justification, particularly the western boundary that lies less than 5 km from the open pits and borders the proposed highwall mining area. Confidence in drawdown predictions would be increased once the boundary conditions are supported by additional data (refer to Paragraph 3).
 - b. As outlined in Paragraph 3, the data available for model calibration were spatially limited and of inconsistent quality. Additional time-series data will be needed to improve the confidence in the model calibration. Such data may be available from neighbouring mines under data-sharing arrangements.
 - i. Additional data should aim to increase the number of calibration points for each model layer, particularly those present at the project site (weathered zone and DLL seam), to improve modelling of current conditions and project impacts.
 - ii. Hydrographs of observed versus modelled groundwater levels should also be provided where transient water level data are available (hydrogeologist.com.au 2022, Appendix C, p. 34).
 - c. Alongside model outcomes of the project's contribution to cumulative impacts (MetServe 2024a, Figures 6-37 to 6-38, pp. 297-298), the proponent should discuss the potential for the project to cause thresholds in natural systems to be exceeded (e.g., whether the project's contribution to groundwater drawdown in a specific area means that the water table becomes too deep for terrestrial GDEs to access). As above, this should consider timeframes beyond the end of mining.
 - d. The reported final parameter distributions for the uncertainty analysis were often narrow. With highly limited calibration data available, a broader range of parameters may require exploration to provide confidence that drawdown extents shown in Figure 32 (hydrogeologist.com.au 2022, Appendix C, p. 60) are not underpredicted.
8. Modelling of post-mining conditions is required. It should evaluate the following:
- a. the timing and extent of the maximum predicted drawdown. The maps provided for the weathered zone and DLL coal seam (hydrogeologist.com.au 2022, Figures 6.7 to 6.8, pp. 84-85) presume this occurs at the end of mining; however, drawdown may take decades or longer to propagate away from the mine. The model should simulate recovery of groundwater levels until they reach quasi-equilibrium;
 - b. the risk of backfilled pit-voids acting as areas of enhanced groundwater recharge due to altered hydraulic parameters, despite plans for compaction of surface material during rehabilitation. This could permanently raise the water table, altering groundwater interaction with creeks and vegetation; and
 - c. the validity of the assumption (hydrogeologist.com.au 2022, p. 92) that pit voids at Saraji and/or Peak Downs mines will prevent the extent of eastward migration of potential contaminants released from in-pit waste rock dumps. These contaminants may pose a risk to downstream receptors such as Plumtree Creek.
9. Impact assessments for the highwall mining have not been conducted on the assumption that the highwall mining area will not interact with groundwater (hydrogeologist.com.au 2022, p. 49). However, potential impact pathways that have not been identified include:
- a. interactions between mine-affected water (MAW) and the underlying water table, where MAW is stored within completed plunges (MetServe 2024a, Figure 6-20, pp. 251-253); and

- b. altered recharge or infiltration regimes through the cover material if subsidence or cracking occurs. The potential for 1.1 m of subsidence was identified (MetServe 2023, p. 77); though did not evaluate a range of possible surface impacts of ground movement, including subsidence.

Surface water

10. The proponent plans to divert two streams around the Vulcan North and Vulcan South pits (MetServe 2024a, Figure 5-11, p. 152). Due to the sodicity of the soil within the project area (RGS 2022, p. 22), there is an increased potential for impacts to the downstream environment from erosion and sedimentation during construction of the diversions and also during operation when the extent, depth and velocity of flood inundation will be considerably altered (see Figures C.1, C.3-C.6, D.1- D.4 and D.6, WRM 2023, pp. 184-196). The proponent should provide detailed information on the potential for erosion and sedimentation within the diverted channels and from the altered floodplain dynamics.
11. Once operations cease and the pits are backfilled, the proponent plans to reinstate the drainage lines back to their original pre-mining state. However, the works will still have impacts on flood inundation behaviour post closure and there are areas that will require ongoing erosion control measures. It is unclear what measures will be put in place to monitor and control the legacy impacts post-closure. Although the proponent has considered bank stabilisation (MetServe 2024b p. 118) and rock lining to reduce erosion and sedimentation in stream (MetServe 2024a, p.325), the proponent has not assessed the potential impacts to stream hydrology, and aquatic and riparian habitats due to the initial diversions and then the reinstatement of the original channels across a different substrate (waste rock) that is likely to have very different streambed characteristics (e.g. greater infiltration capacity).
12. The proponent has optimised the water management system to reduce the risk of uncontrolled releases during operations and it is stated (e.g. WRM 2023, p. 111) that no spills of MAW to the external environment will occur under any modelled climate sequence. While some sensitivity analyses were undertaken with respect to changing climate and haul-road dust suppression demands, little consideration appears to have been given to the uncertainties inherent in the de-watering rates associated with rainfall intensities and variable storm durations. Some assessment should be made of system performance under more extended and extreme storms, noting that this should now include allowance for the 1.3 °C of global warming that has occurred over the historical period used to derive design rainfall information (DCCEEW, 2023).
13. As part of the water management system, the proponent will construct sediment dams where sediment will be allowed to settle (WRM 2023, p. 75) before water can overflow to Hughes and East creeks. There is limited discussion on the frequency of sediment removal from the sediment dams and whether this sediment might be contaminated (and therefore require suitable treatment or containment). The proponent should provide more information about sediment dam maintenance and the disposal of any sediment removed from the dams. There should also be a detailed monitoring program of sediment quality in the dams to ensure that any material released or removed does not pose a contamination risk.
14. It is also noted that no sensitivity analysis was undertaken on the inflow estimates computed for mine water balance dynamics using the Australian Water Balance Model (AWBM) rainfall-runoff model. The parameters adopted for this model are solely based on regional information without site-specific calibration, and as such the likelihood of overflows from the 20 sediment dams is subject to high uncertainty. This uncertainty has not been considered in the performance assessment of forecast inventory and should be accounted for in further sensitivity analyses.
15. The proponent discusses cumulative impacts on water quality from the project and surrounding mines (e.g. Saraji Mine Complex, Peak Downs, Caval Ridge) but does not provide details on potential

cumulative impacts to surface water flows or cumulative impacts from the proposed project and other pits in the mining area (e.g. Matilda and Jupiter pits).

- a. The proponent has provided limited discussion about potential changes to surface water flows as a cumulative effect from different projects. Many of the surrounding streams have been diverted by other mines and these mines also collect rainfall runoff within water management systems. The proponent should assess the potential changes to surface water flows arising from the combined effects of stream diversions, changes in flooding and decreased stream flows due to rainfall runoff captured by the water management systems.
- b. The proponent should assess potential cumulative impacts to surface water for the entirety of the approved and planned operations at the Vulcan Complex to ensure an understanding of overall potential impacts to surface water.

Ecology

16. Assessment of potential impacts to GDEs included insufficient field validation of their occurrence and condition. Although aquatic GDEs are unlikely given the ephemeral nature of the surface water systems in the project area, there are likely to be subsurface and terrestrial GDEs that may be affected.
 - a. A stygofauna pilot study was conducted; however, only bores located in the coal seam and Permian layers at a minimum depth of 12 m were sampled (FRC 2022, Table 4.1, p.12), yielding a single stygobitic taxon. Stygofauna should also be sampled from shallower depths, particularly from alluvial aquifers in the project area because the proponent acknowledges that the groundwater in shallow alluvium throughout the project area has environmental values as defined in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (FRC 2022, p. 18).
 - b. Potential terrestrial GDEs were assessed through a desktop analysis comparing estimated depths to water table, water quality and likely GDE distributions from the Bureau of Meteorology (BOM) National GDE Atlas with field-verified regional ecosystem mapping (MetServe 2023, p. 28). The data used to generate the map of estimated water table depths were spatially and temporally limited (see Paragraph 6). Further field data are needed to verify the depths to groundwater across the project area, particularly in areas where mapping suggests depth to water is less than 10 m (hydrogeologist.com.au 2022, Figure 5.10, p. 60).
17. To improve the characterisation of terrestrial GDEs and the understanding of potential impacts of the project, the following are needed:
 - a. improved characterisation and conceptualisation of the shallow groundwater (see Paragraph 5). Further data and clarification are needed on the spatial extent and temporal variability of shallow groundwater to support the proponent's conclusions that there will be no impacts of the project on terrestrial GDEs; and
 - b. field data on the potential groundwater use by vegetation (following methods outlined in Doody et al. (2019)), especially in areas where depths to groundwater are less than 10 m and drawdown is predicted.
18. Potential impacts to water-dependent assets from the proposed creek diversions have not been fully assessed, although increases in flood depths and velocity around the diversions are predicted (see Paragraph 10) (WRM 2023, p. 146). Additional information is needed, including:
 - a. the potential for vegetation to become excessively inundated (waterlogged), particularly along riparian corridors adjacent to the proposed diversions (METServe 2024, Figure 5.11, p.154 & Figure 5.18, p.166);

- b. increases in turbidity and sedimentation (see Paragraphs 10-11) that may have implications for sediment transport, riparian vegetation, and downstream aquatic ecosystems;
 - c. loss or impairment of instream habitat and ecological function in the original drainage lines, especially in sections where inflows have been diverted or that receive diverted flows, and then again when removing the diversions to reinstate the original drainage lines;
 - d. changes to flow regimes, water quality and aquatic biota in post-mining drainage lines reinstated through back-filled spoil (e.g. Drainage lines 6 and 8, MetServe 2024a, pp. 238-239) and which is likely to have different streambed characteristics (e.g. potentially higher infiltration rates leading to shorter flow durations and loss of refugial pools) from the original channels; and
 - e. disruption of riparian zone connectivity for the lengths of the diverted channels during operations (up to nine years) and then again when the channels are reinstated but before riparian vegetation is re-established (which may take many years), depriving the stream ecosystem of organic inputs from streamside vegetation and potentially fragmenting populations of arboreal fauna such as Koalas and Greater Gliders.
19. Following collection of the data and information outlined in Paragraphs 3-8, 15 and 16-20, an updated evidence-based ecohydrological conceptual model and associated impact pathway diagrams should be developed for all water resources and their ecological components in the project area, to ensure that all potential impact pathways are identified and assessed (Commonwealth of Australia 2024). This will also help guide the development of appropriate monitoring, mitigation and management actions (see response to Question 3).
20. The proponent plans to clear up to 1,309.6 ha of vegetation which provides habitat for various MNES and includes areas of terrestrial GDEs and riparian vegetation. However, as flora and fauna surveys are four years old (last survey having been conducted in 2020) (MetServe 2023, pp. 6-8), recent climatic events (e.g. low rainfall in 2019) may have changed vegetation conditions. The proponent should conduct further field surveys to provide updated data on the distribution and condition of potential MNES, TECs, GDEs and riparian vegetation within the project area. This will provide a more robust baseline dataset against which to assess project-related impacts and determine the effectiveness of any mitigation measures.

Question 3: Can the Committee provide comment on the adequacy of the proposed mitigation, management and monitoring measures? Does the Committee consider that any additional measures are needed to remain within the projected levels of impact or sufficiently reduce the risks to surface and groundwater resources, GDEs and other third-party users, and cumulative impacts with other proposed and existing projects?

21. An adaptive management strategy is proposed to assist with management and mitigation of drawdown and potential groundwater quality impacts (hydrogeologist.com.au 2022, p. 93). Improvements to this strategy are outlined below.
- a. Many of the monitoring bores forming the groundwater monitoring network will be destroyed during mining operations. Although replacement monitoring bores will be established (hydrogeologist.com.au 2022, p. 93), their locations and monitoring scopes have not been identified. Replacement bores should be established with sufficient time prior to mining commencing to ensure consistency with data from the original monitoring network, and sited to ensure that impacts to groundwater levels and quality can be detected prior to reaching receptors such as GDEs.

- b. An agreement to share groundwater data across neighbouring mines would assist in understanding hydrogeological stressors caused by mining, given that predicted drawdown extends into neighbouring tenures (hydrogeologist.com.au 2022, p. 94).
22. The proponent does not predict impacts to third party groundwater users and surface water systems, and therefore no mitigation measures are currently proposed (hydrogeologist.com.au 2022, p. 95). Mitigation measures may be required if new impacts arise or if investigations and/or updated modelling outlined in the responses to Questions 1 and 2 indicate a greater likelihood of currently identified impacts.
23. Rock-lining of diversions was mentioned as a mitigation measure to reduce the risk of erosion and sedimentation (see Paragraph 10); however, limited information was provided. A detailed description of this mitigation measure should be provided, along with a description of the program for monitoring the environments downstream from the diversions to assess the effectiveness of the mitigation.
24. No mitigation, monitoring or management measures are proposed for terrestrial GDEs as the proponent concludes there will be no impact (MetServe 2023, p. 85). Mitigation measures are provided for subterranean GDEs because of low risk of impact is reported (FRC 2022, p. 27); however, these are heavily dependent on mitigation measures proposed for other areas of the project such as groundwater drawdown and monitoring quality of sediment and MAW dams. Mitigation, monitoring and management measures should be considered for terrestrial GDEs, especially for potential impacts from groundwater drawdown.
25. The proponent states that all management plans will contain a Trigger Action Response Plan (TARP) (MetServe 2024a, p. 356). However, no management plans were provided, preventing the IESC from commenting on their adequacy.
26. The Environmental Authority (EA) (DESI 2023) sets out the required monitoring of parameters for water quality. However, the EA does not mention monitoring of zinc or nickel (DESI 2023, Table E2, pp. 24-25) for groundwater quality, and copper (DESI 2023, Table F3, p. 34) in uncontrolled releases from sediment dams. Monitoring of these parameters would identify whether concentrations in groundwater or surface waters exceed water quality guidelines. Dissolved organic carbon (DOC) should also be monitored at the same time as the metals so that bioavailability of the metals released can be determined.

Question 4: Can the Committee discuss if the proposed mitigation, management and monitoring measures are adequate to address the issues in the Qld Environment Protection Order (EPO), for the adjacent Vulcan Coal Mine on ML 700060, to prevent similar incidents in the future for Vulcan South Coal Mine?

27. The IESC cannot comment on the proposed mitigation, management and monitoring measures because the proponent's sediment and erosion control plan was not provided for assessment. There is limited discussion in the Surface Water Assessment (WRM 2023) document about when the sediment and MAW dams will be constructed. The proponent should ensure that these measures will happen in a timely manner to prevent incidents similar to those that occurred at Vulcan South Coal Mine.

Date of advice	20 June 2024
Source documentation provided to the IESC for the	MetServe 2024a. <i>Public Environment Report Vulcan South (2023/09708)</i> . Prepared for Vitrinite Pty Ltd, May 2024.

**formulation of
this advice**

**References
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