IESC advice

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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.	See responses below to specific requests.
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.	The Highwall Mining Strategy outlined in section 6.4.1.12 (METServe 2024a, p. 251) provides an overview of surface water management for the highwall mining area and doesn't provide detail around design and potential for subsidence. Section 6.4.4.1- Subsidence (METServe 2024a, p. 251) provides additional information on design and potential ground movement for the highwall trial area. Panel designs have been completed using empirical design software, ARMPS. This software considers site specific conditions including cover depth, coal strength, entry width and vertical stress conditions. The software then compares those parameters to a developed database to provide recommended ranges for panel design layouts based on stability factors that have been proven successful. An uncertainty analysis was not completed for subsidence in the highwall trial area, because a conservative approach to the impact assessment and proposed management has been employed. As an average, the resultant panel design parameters used for the highwall trial are as follows: · Plunge width – 3.5 m; · Web width – 1.2 m; · Barrier pillar width – 5 m; · Number of entries per barrier – 10; and · Plunge height - 1.1 m. The above design parameters are considered conservative and exceed the ARMPS recommended stability factors for the overall panel layout, web width and barrier pillar width. This conservatism is considered warranted as a starting point; however, layout optimisation is expected to occur once the trial has commenced. As the proposed designs are within the recommended stability factors, no subsidence is expected to occur as a result of the highwall mining in this area. The location of the highwall panels are displayed in the project layout figure for the Project.
3	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).	Section 5.3 and 5.3.1 of the Groundwater Impact Assessment describe the project monitoring bore network and the rationale behind the layout of the bores. The site-specific project groundwater monitoring network was designed to target the Permian coal measures and the Tertiary sediments as there is no mapped Quaternary alluvium within or in close proximity to the Project area. A number of the site-specific project groundwater monitoring bores (within and immediately adjacent to the proposed mining area) that target the Permian coal measures and the Tertiary sediments are consistently dry. Dry bores may be seen as a limitation, however this is also valuable information as these bores have been able to consistently demonstrate that a large percentage of the shallow strata targeted by project open pit mining activities are in fact unsaturated and do not contain groundwater. The project monitoring bore network (including the consistently dry bores) confirm the conceptual understanding that much of the strata within the project mining area is dry and that there will be minimal drawdown resulting from the project. The dry monitoring bores indicate that the groundwater levels in the Project area have been historically impacted by the BHP Saraji Mine and Peak Downs Mine, therefore the project is highly unlikely to result in significant impact on the groundwater regime. This is confirmed by the numerical model predictions which demonstrate limited extent and magnitude of drawdown resulting from the project. Groundwater data has been added to the PER document for reference- Appendix U. Please note, this dataset provides the data for existing groundwater bores (MB01, MB06, MB07, MB08, MB09, MB10, MB11 and MB12) as this was the only site-specific data available when the groundwater model was being verified. The only additional monitoring bore which has presently been installed is MB17, with the additional monitoring bores (MB14, MB15, MB16 and MB18) awaiting installation over the coming weeks. The locations of all the monitoring bores are provided in the PER document. The latitudes and longitudes are provided in table 7-11 and a figure displays their spatial distribution within the project area (Figure 7-7).

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			The layout of the groundwater monitoring network is constrained by the following two factors: - Geological extent of the coal seams. The target coal seams of the Moranbah Coal Measures generally strike in a north north-west to south south-east orientation and dip to the east. This local orientation of geology spatially constrains the groundwater monitoring network to the west of proposed Vulcan pits. That is, a monitoring bore that is drilled to the west of the proposed Vulcan pits will intersect Permian strata that is stratigraphically below the target coal seam. The Permian strata below the target coal seam is not predicted to impacted by the project, hence providing little benefit to the groundwater monitoring network. - Extent of tenure. The site is immediately adjacent to the BHP MLs of Saraji Mine and Peak Downs Mine. The establishment of site-specific project groundwater monitoring bores on the BHP MLs to the east is not practical or achievable. This tenure spatially constrains the project groundwater monitoring network to the east of proposed Vulcan pits. Since the submission of the GIA in 2022, a data sharing agreement between Vitrinite and BHP is being established. Until the data agreement is finalised, conditions of this agreement are still unknown, and so is the availability of data under this agreement. The data sharing agreement is currently being established between Vitrinite and BHP. Since submission of the GIA, monitoring of groundwater levels and quality has continued to further establish a baseline dataset to confirm the understanding of pre-project groundwater conditions. Further, additional monitoring bores have been installed for the project (April 2024) to supplement the groundwater monitoring network and confirm the current conceptual understanding. The groundwater model for the project will be reviewed and potentially updated within 12 months of approval. The model is to be updated to incorporate any future available BHP data and the updated dataset from the project groundwater monitoring network, including recently drilled replacement bores.
4	Groundwater	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.	The GIA presents conceptualisations from existing mines and projects in the region. This forms an important part of any GIA and it would be remiss to exclude such discussion. Aspects such as topography, geological and hydrogeology have been considered within the regional context of the project and we are aware of the limitations when extrapolating regional data to local conditions. The conceptualisation within the GIA is also based upon site specific data. This site-specific data includes geology data has been captured by the proponent (including 909 drill holes) to develop a detailed geology model of the site. This site-specific data also includes a dedicated groundwater drilling and investigation program and the installation of a dedicated project groundwater monitoring network. Site specific groundwater level, quality and permeability data has been captured as part of this drilling and investigation program. The concept of faulting, paleochannels or igneous intrusions have been discussed in the regional context and this discussion references other projects in the region. However, the site-specific geology model provided by Vitrinite has not identified any faults, paleochannels or intrusions. Further, the dedicated groundwater drilling and investigation program did not identify faults, paleochannels or intrusions. As these geological features have not been identified in the project area, they are not conceptualised as part of the local hydrogeology. This is reiterated within the GIA. For example Section 4.1 states 'Volcanic intrusions and extrusions (i.e. basalt) are also present within the region, but not in the Project area.' Evidence of paleochannels are described regional in the Quaternary sediments and Tertiary sediments, however Section 4.2.2 is clear that there are no Tertiary sediments present in the project area. Further Sections 2.1.1, 4.2.1, 5.2.1 and 5.3 refer to the absence of Quaternary alluvium near the proposed open pits and more broadly within the Project area. Therefore, if there are no Quaternary sediments or Tertiary sediments present within the project area, there cannot be any paleochannels present within the project area. Further, the proponents geology model does not include the presence of any faults that would be expected to influence local groundwater conditions around the open pit mining operations. In addition to the above, the groundwater level data collected to date from the Project groundwater monitoring network does not show any evidence of major faulting within the Project area. Compartmentalised groundwater blocks, high bore hole yields, broken ground and poor drilling conditions are indicative of faults. None of these conditions are observed with in the Project area.
5	Groundwater	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.	The public geology mapping infers the presence of widespread alluvial sediments over the project area. However, site specific geology data has been captured by the proponent (including 909 drill holes) to develop a detailed geology model for the site. The site geology model includes a horizon which indicates the base of unconsolidated Tertiary material. As discussed in Section 5.2.2 of the GIA, hydrogeologist.com.au has assessed that the lithology intersected above the fresh Permian coal measures in the Project area does not constitute Tertiary aged sediments, rather a weathering profile that has developed during the Tertiary on the Permian strata. The dedicated groundwater drilling and investigation program completed for the project does not support the presence of alluvial sediments within the project area. None of the groundwater monitoring bores intersected alluvial

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			sediments, and several of the monitoring bores that are drilled into specific hydrostratigraphic horizons in the project area have been dry since installation. These dry monitoring bores confirm that much of the shallow strata (regardless of lithology and hydro-stratigraphic units) is dry. Vitrinite have recently undertaken a site-specific creek and alluvium investigation in the drainage features within the Project area. Numerous examples of Permian strata outcrop have been identified within the major tributaries of the Project area, including tributaries of Hughes Creek. Sub-surface investigations into the creek bed sediments has assessed that these sediments are often clayey. Sandy zones occur within the creek bed sediments however they are highly localised, limited spatially to the narrow creek bed and limited in depth. This can expected given the highly incised terrain that occurs upgradient of the Project area. The creek bed sediments do not constitute widespread, extensive and continuous alluvial sediment deposition. On the basis of the above geological data, it can be confirmed that there is no Quaternary alluvium within the Project area. Amendments have been made to other sections of the PER to clarify this recent change. This discussion has been added to Section 6.4.3.15 of the PER. Vitrinite intend on drilling a groundwater monitoring bore immediately adjacent to Hughes Creek. The objectives of this monitoring bore will be to: confirm the absence of alluvial sediments beneath Hughes Creek and to confirm the groundwater level, depth to groundwater table and groundwater quality in this area. The bore is to be drilled to a depth of 10 m to 15 m and is expected to be constructed with the weathered profile of the Permian coal measures.
6	Groundwater	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.	a) Based on literature reviews, depth-to-groundwater data, national GDE mapping, and water quality data, there are likely to be some Terrestrial GDEs contained within the Project area. The locations of these likely GDEs closely match that mapped within the National Atlas of Groundwater Dependent Ecosystems. Additional partly groundwater-dependent ecosystems may be located in the central and southern parts of the project area, based on depth-to-groundwater data. No GDEs will be affected beyond the Project disturbance footprint. No Aquatic GDEs, Subterranean GDEs or Stygofauna are anticipated be impacted by the Project. Terrestrial GDEs mapped within the disturbance footprint associated with the following species which may utilise saline groundwater, *Eucalyptus camaldulensis* and *Melaleuca leucadendra* (associated with RE11.3.25) – high potential and *Eucalyptus Populnea* (11.3.2 and 11.5.3) – moderate potential. Groundwater flow into the Vulcan South and Vulcan North pits will be negligible, and these pits will be essentially dry. Groundwater flow into the Vulcan Main pit will be up to 43 m3/day, which will cause localised drawdown in surrounding aquifers. The drawdown predicted from the groundwater flowing into the pits at Vulcan South is limited in geographic extent (up to 2,400 m to the east of the pits toward existing mining) and magnitude (up to 10 m) and will not affect any GDE's outside of the Projects disturbance footprint. As the pits will be backfilled, no residual drawdown is expected following the cessation of the Project. Therefore, by the time new GDE species (*Eucalyptus camaldulensis*, *Melaleuca leucadendra* and *Eucalyptus Populnea*) have established following rehabilitation, to the size where they will reach the groundwater table, the groundwater will have fully recharged and therefore, there will be no impacts on the effectiveness of rehabilitation for GDE's. See above response to Item 3 in relation to the suitability of the site-specific groundwater monitoring network and availability of data. The topographic elevation data in the project area is based on LIDAR which has an accuracy of 0.15 m. Therefore, the reference to uncertainty of the topography is not relevant in the project area. A depth to groundwater map was provided in the GIA report and prepared for the project area. This map was prepared using the site-specific groundwater monitoring bores and exploration drill hole data (for which the groundwater level data was captured within a month-long program of data collection). This map shows areas of shallow potential groundwater table based on the available data. The areas of shallow depth to groundwater, i.e. less than 10 m depth to groundwater, was predominantly focussed on Hughes Creek. The risk to GDEs and the impact assessment was based on this depth to groundwater map. The groundwater level monitoring completed on the site-specific project groundwater monitoring network to date has confirmed that there is a lack of seasonal variation in the groundwater within the project area. Hydrographs of groundwater levels in the Project area are provided in Appendix P. Monitoring bores MB7, MB9 and MB10 are all located within the footprint of proposed open pit mining and they do not show evidence of seasonality within the observed groundwater levels. Hence it is assessed as appropriate to use and assess a composite timeframe of groundwater level data over the project area to determine the depth to groundwater table. Further, more recent groundwater monitoring data from the groundwater drilling and investigation program has confirmed the depth to groundwater map presented in the GIA.

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			b) An assessment of available groundwater level data at the time of preparing the GIA concluded that there was typically greater than 10 m distance between the floor of the MAT coal seam in the Highwall Mining area and the underlying groundwater table. A more recent assessment of comprehensive groundwater level data in the highwall mining area has confirmed that the groundwater table is generally below the floor of the MAT coal seam. Numerous exploration drill holes have been used to measure the groundwater table within and adjacent to the Highwall Mining area confirming that the MAT coal seam is generally dry and unsaturated. Generally, the distance between the floor of the MAT coal seam and the groundwater table is greater than 2 m in the highwall mining area, however this can be up to 20 m in some areas. There is a single exploration bore hole (VSW301) within the highwall mining area (see table below) that has measured a groundwater level that is 0.7 m above the MAT seam floor. At this drill hole location, the MAT seam is 1.1 m thick and hence the coal seam is only partially saturated. Whilst there are differences between the original and recent assessment of the groundwater table elevation and its distance from the floor of the target coal seam in the highwall mining area. These differences are not considered significant. The highwall mining process is not like conventional open cut mining whereby the entire mined sequence is depressurised, nor is it like conventional underground mining which requires full depressurisation of the target coal seam during mining. Highwall mining involves the use of a highwall miner which extracts coal from plunges in the coal. Any entrained moisture within the coal will be removed as part of the mining process, however as the process does not actively dewater from the coal face, there is unlikely to be full depressurisation or dewatering of the coal seam or the plunges. Therefore, the groundwater effects of highwall mining will be highly localised and constrained to the partially saturated extent of the target coal seam. Once the plunge is mined, groundwater inflow will fill the remnant void and groundwater levels will return to pre-mine conditions. The highwall mining will have no foreseeable effects on the receiving groundwater environment. Site specific groundwater monitoring bores within the Highwall mining area are proposed and are scheduled to be installed within three months. See Table 6-39 of the PER. Vitrinite intend on drilling a groundwater monitoring bore immediately adjacent to Hughes Creek. The objectives of this monitoring bore will be to: confirm the absence of alluvial sediments beneath Hughes Creek and to confirm the groundwater level, depth to groundwater table and groundwater quality in this area. The bore is to be drilled to a depth of 10 m to 15 m and is expected to be constructed with the weathered profile of the Permian coal measures. Site specific groundwater monitoring bores within the Highwall mining area are proposed and are scheduled to be installed within three months. A groundwater monitoring and management plan will be developed for the project to include site specific groundwater monitoring bores within the Highwall mining area.
7	Groundwater	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	The groundwater model has been designed, developed and constructed with reference to the Australian Groundwater Modelling Guidelines and is considered fit for purpose for the assessment of the project and cumulative impacts. Uncertainty analysis was completed in accordance with the guidelines at the time of development. a) The IESC incorrectly assert that the western model boundary was simulated using a general head boundary. The western model boundary was not applied using a general head boundary. Figure 6.2 in the GIA confirms the western model boundary was simulated as a no-flow boundary. Groundwater levels in the western portion of the model domain were simulated using a separate recharge zone (see Figure 6.1 of the GIA). A no flow boundary is considered appropriate on this model boundary as the coal seams targeted by the Project sub-crop a short distance to the west of the Project area and do not extend to the west. The geology present to the west of the Project area is the Back Creek Group, which locally consists of sandstones and fine-grained sedimentary strata that has been deeply eroded and dissected. The Back Creek Group comprises the westernmost extent and basal strata of the Bowen Basin. On this basis it is not conceptualised that there is a significant contribution of groundwater flow from the western model boundary and a no flow boundary is assessed as appropriate. b) Model verification has recently been conducted on the numerical model. The verification has included more recent site-specific groundwater monitoring data and publicly available regional data from the BHP groundwater monitoring network. Additional groundwater monitoring data has included an additional 36 months of groundwater level data from the site-specific monitoring bores. The site-specific groundwater level dataset now considers a duration of three years from 2019 through to the end of 2022. This dataset is significant and exceeds the expectations of a two-year dataset as per the draft IESC guidelines. The verification has also included an additional 65 bores within the public domain. These additional bores are typically limited to only a single groundwater level measurement. The verification has included the addition of 126 observation points. Calibration statistics from the model verification yield an SRMS of 7.6% compared to 4% in the original calibration (see Section 6.1.3 of the GIA).

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		that drawdown extents shown in Figure 32 (hydrogeologist.com.au 2022, Appendix C, p. 60) are not underpredicted.	The verification has shown that the model provides a suitable predictor of groundwater conditions within the Vulcan pits. The verification has had mixed success with the BHP monitoring bores to the east of the Vulcan pits. The BHP monitoring bores are within previously mined areas and adjacent to tailings dams and the numerical model has broad assumptions around topography, geology and mining conditions throughout the Saraji Mine and the Peak Downs Mine. The publicly available data from the BHP monitoring bores is highly likely to be influenced by BHP mining activities. The representation of BHP mining activities are uncertain in the numerical model. Despite the numerical model not matching some of the regional observations, it provides and maintains a good match to the observations at the site-specific project groundwater monitoring network. As discussed above, the current site-specific groundwater monitoring network is being supplemented with additional monitoring data from bores installed for the project in April 2024. These bores will confirm the current conceptual understanding and groundwater conditions. A data sharing agreement is currently being negotiated between Vitrinite and BHP and this will provide additional groundwater data and confirmation of mining activities (historic, current and future approved) for future model updates. The calibration hydrographs of the observed versus modelled levels are provided. c) The GIA and associated modelling includes representation of the project and adjacent mining activities at the BHP Saraji and Peak Downs Mines. The drawdown impacts of the project represent the maximum incremental drawdown of the project on the groundwater regime and therefore represent the project's contribution to cumulative impacts. The cumulative drawdown of the project and approved BHP operations is discussed in section 6.4.3.18 of the PER. A significant contribution of drawdown comes from the approved BHP mining activities. A data sharing agreement is being established between Vitrinite and BHP and this will provide essential data for future model updates. A post closure simulation was not carried out as part of the GIA. The post closure groundwater conditions will be heavily influenced by the approved BHP operations, including the number of, location of, and depth of the final pit voids. Further, the final pit lake elevations are not known. These factors will have significant influence on the groundwater flow conditions including the long-term groundwater levels in the project area and extent of post closure maximum drawdown. A reliable prediction of post closure conditions is not possible until information is provided by BHP. d) The numerical model has been calibrated using site specific and regional groundwater level data and recently verified. The conceptual understanding of site conditions indicates minimal impact on the basis of dry conditions throughout much of the Project area which has been contributed to be approved mining operations at BHP. The base case predictions confirm this conceptualisation of impact and show a minimal extent and magnitude of incremental drawdown associated with the project. A risk assessment determined minimal impact to the groundwater environment from the Project. The calibration uncertainty analysis was not undertaken at the time of the initial model calibration process. Once the model was considered sufficiently calibrated, project impacts were assessed, and the predictive uncertainty analysis was completed in accordance with the guidelines at the time of development. The approach to the predictive uncertainty analysis followed the traditional decision support modelling approach that is summarised by Doherty and Moore (2019). The methodology below was followed: • Define sampling distributions for all model parameters that could possibly impact the model predictions – the limits for the sampling distributions were adjusted based on calibrated value and possible variability of individual parameters. • Generate model input dataset (model 'realisation') honouring the sampling distributions. • Run the model for each 'realization' and extract predictions (heads, flows). Check for calibration statistics (SSQ and SRMS) to assess level of 'miscalibration'. Remove predictions from runs that would be considered not sufficiently calibrated. • Calculate impacts (in our case pit inflows and drawdown) for each of the accepted 'realizations'. • Calculate minimum, maximum and selected percentile values for both pit inflow rates and drawdowns. • Use the percentile values to describe the probability of exceedance of modelled outcome (Table 23) in accordance with ISEC Uncertainty guidelines (Middlemis and Peeters, 2018). As discussed, it is conceptualised (and supported by numerical modelling) that the Project area groundwater conditions are heavily influenced by the approved BHP operations, showing considerable contribution to cumulative impact in the region. The calibration process focused effort on achieving a good calibration in the Project area, whilst still achieving an acceptable calibration in the remainder of the model domain. In our professional opinion, the representation of the approved BHP operations has the ability to significantly influence the current model calibration.

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			The representation of mining (geological layering, drain elevations, progression, temporary filling of pit lakes) is hardwired into the model and cannot practically be included in such quantitative uncertainty analysis of model parameterisation. Hence the parameter ranges in the uncertainty analysis were predefined and purposely constrained (normal distribution) around the calibrated values in order to assess the uncertainty of impacts from the Project only. The parameter ranges used in the uncertainty analysis are considered appropriate and are commensurate with the level of environmental risk of the project, that is minimal impact to groundwater on the basis of dry conditions throughout much of the Project area. It is understood that as uncertainty analysis methodologies develop and improve overtime, further uncertainty analysis is required to fully address with the current uncertainty guidelines (2023). An update to the uncertainty analysis (using contemporary methods) can be carried out once a data sharing agreement between Vitrinite and BHP is established (after acquiring additional observation data and better understanding of geological setting and mining activities in BHP managed areas), thus reducing the qualitative uncertainty around the representation of approved BHP mining activities. The numerical model and groundwater impact assessment was reviewed by a third party to assess it as fit for purpose during the recent 2024 update of the GIA and verification of the groundwater model. The groundwater model for the project will be reviewed and potentially updated within 12 months of approval. The model is to be updated to incorporate available BHP data and the updated dataset from the project groundwater monitoring network. The modelling is to include operational predictions, post-mining predictions and uncertainty analysis.
8	Groundwater	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 quasiequilibrium; 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.	The drawdown contours provided represent the maximum incremental drawdown of the project at any point during mining (not only at the end of mining). As discussed in the response for Item 7, post closure modelling has not been completed for the project. The rationale for not completing post closure modelling is provided below: · Following cessation of mining, the project open pits will be backfilled with overburden emplacement. · The backfilling of the project open pits will cease any evaporative groundwater losses resulting from the project and the local groundwater levels will likely recover to pre-mine conditions. · The BHP Saraji Mine and Peak Downs Mine will include the presence of final pit voids as part of their final landform. · The number of, location of, and depth of the BHP final pit voids are currently unknown. · It is likely that pit lakes will form in these BHP final pit voids, however the elevations of these pit lakes is unknown. · The BHP final pit voids will result in evaporative sinks into perpetuity, thus resulting in regional drawdown effects that extend to the west and to the east. · The post closure drawdown effects of the BHP final pit voids are highly likely to extend into the project area and influence local groundwater conditions. · Regional groundwater flow is from west to east and any potential leachate that may be introduced via the project open pits will be captured in the evaporative sinks of the BHP final voids. The post closure scenario is heavily dependent upon the closure conditions and final landforms at Saraji Mine and Peak Downs Mine (which are unknown). It is not reasonable to expect that numerical modelling is carried out when there is such uncertainty in the current approved mining operations. The groundwater model for the project will be reviewed and potentially updated within two years of approval. The model is to be updated to incorporate available BHP data and the updated dataset from the project groundwater monitoring network. The model is to be updated to include post-mining simulation (pending availability of data).
9	Groundwater	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	A contemporary assessment of groundwater conditions in the highwall mining area have confirmed that the groundwater table is generally below the floor of the MAT coal seam. That is, the MAT coal seam is generally dry and unsaturated. There is expected to be a small discrete localised area of the MAT coal seam that is partially saturated. Where MAW is stored within the mined highwall plunges, there is a likelihood that this MAW may infiltrate into the underlying groundwater table. Thus promoting a local increase in the groundwater table beneath the MAW filled plunges.

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		a) 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.	If subsidence or surficial cracking occurs, there is potential for increased recharge through the unsaturated profile and into the highwall plunges. This increased recharge may promote the local increase of the groundwater table beneath the MAW filled plunges. However, the potential for increased recharge to occur above the highwall plunges is unlikely. The terrain in the highwall mining area is steep and is conducive to high runoff rates, therefore surface water will generally not have the ability to infiltrate through the surface cover and beyond the vegetation rooting depth. If subsidence or surficial cracking were to occur, and there was an increased ability for water ponding at the surface, then it may be reasonable to expect that increased recharge may occur. However, with this conceptualised flow path mechanism, it is likely that that this would result in a reduction in salinity, thus locally improving groundwater conditions within the highwall mining area.
10	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.	The proposed temporary diversion drains were assessed during operational conditions by WRM 2024 and provided within the “Hydraulic Assessment of Temporary Drainage”- Section 5.10.2 of the PER. During the construction phase of the Project, a construction ESC will be developed and the recommend ESC mitigation measures which will be implemented in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guideline (IECA, 2008). Remediation works of the ESC measures will be undertaken if required to ensure potential erosion is captured and sediment laden runoff is managed within the site ESC prior to being released to the downstream environment. The Proponent proposes to install cross drainage structures to convey the 20% AEP design discharge. Hence, it is unlikely that there will be significant impacts to the sediment transport to the downstream environment compared to existing conditions for smaller events. During large and infrequent events, the Project has potential to increase flood levels and velocities, however, the critical duration of these storm events are less than 6 hours as assessed in the Surface Water Assessment (SWA) (WRM, 2023a) and are unlikely given the expected duration of operations (7 years of operation). Further information has been added to Section 5.10.2.4 and 6.4.1.6 and of the PER.
11	Surface water	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).	The Progressive Rehabilitation and Closure Plan (PRCP) (Appendix J of the PER) outlines the rehabilitation of the drainage lines in post-closure conditions. Per Section 9.18 of the PRCP (METServe, 2023), it is proposed to monitor the landforms and reinstated drainage lines for erosion until the appropriate vegetative cover is established and rehabilitation milestones are achieved. There will be negligible post-closure impacts to stream hydrology or flood inundation as the catchments and drainage lines will be reinstated to pre-mining conditions. Restoration of the drainage lines post-closure will have negligible flood impacts compared to pre-mining conditions because the drainage lines being diverted are only temporary, and flows within the in the vicinity of the project are highly ephemeral. Section 6.4.1.2 of the PER discusses potential changes to stream hydrology from the post closure rehabilitation of drainage lines and watercourses. This determined that the Post-closure Conditions configuration will not impact on peak water levels or velocities along Drainage line 5, Drainage line 6, Drainage line 7 and East Creek for events up to and including the 0.1% AEP event. The results also show that there are negligible impacts along Drainage line 8 and Hughes Creek for the 10% and 1% AEP events and small impacts for the 0.1% AEP event. Further, the sub-soil, rock mulch and topsoil materials will generally be sourced within the vicinity of the Project and will be spread and compacted as part of the landform design, including where the drainage lines will be reinstated through backfilled spoil. The enhanced rapid material settlement of the backfilled spoil and the compaction of the sub-soil, rock mulch and topsoil layers over the backfilled spoil is likely to generate similar runoff characteristics to pre-mining conditions and it is unlikely that there will be a significant change to the reinstated drainage line streambed characteristics and infiltration capacity compared to pre-mining conditions. Reinstatement of native ecosystems As described in Section 8.3.1.3 of the PER, all REs within the project area that are classified as ‘native ecosystem’ will be reinstated to their initial classification. All RE’s across the project area to be reinstated and their corresponding rehabilitation areas are summarised in Table 8 4 of the PER. Erosion monitoring Erosion monitoring across the landform will also be undertaken for the early detection of erosion, to allow for early intervention. Erosion monitoring is required as part of the rehabilitation milestone criteria in riparian areas for two milestone criteria -RM4 (surface preparation) and RM9 (achievement of native vegetation land use areas. Therefore, an erosion monitoring methodology will be undertaken at two stages during the rehabilitation of all drainage lines and watercourse diversions. An Appropriately Qualified person will be employed to certify that the final landform is geotechnically stable. Erosion monitoring methodology is further detailed in Section 9.6 of the Vulcan South Soils and Land Suitability Assessment (Appendix L) and Section 8.3.1.3.

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			Summary Landforms will be monitored post-closure and reinstated drainage lines for erosion until the appropriate vegetative cover is established and rehabilitation milestones are achieved. There will be negligible post-closure impacts to stream hydrology or flood inundation as the catchments and drainage lines will be reinstated to pre-mining conditions. Restoration of the drainage lines post-closure will have negligible flood impacts compared to pre-mining conditions because the drainage lines being diverted are only temporary, and flows within the in the vicinity of the project are highly ephemeral.
12	Surface water	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 dewatering 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).	An additional sensitivity analysis was undertaken to respond to this comment. This is summarised below and has been included within Section 6.4.1.10 of the PER. An additional sensitivity analysis was undertaken for both the MAW releases and the site water balance and its effect on sediment dam release. This is described in more detail within the new **Appendix D**.
13	Surface water	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.	This information is located within Appendix W ESCP, in Section 9.2. Water quality is to be monitored at sediment dam release locations as specified in the EA. The surface water quality objectives for sediment dams are specified in Section 5.10.3 of the PER. As now stated in Section 7.2.1.2, water quality monitoring at sediment dam release locations will occur on both rainfall events and a monthly basis, to be within trigger limits detailed in the EA. The following wording has been added to **Section 7.2.1.2**: As stated in **Table 7 2**, sediment dams must be de-silted (removal of sediment accumulating within the sediment storage zone) as part of the sediment dam maintenance to restore the volume of the sediment dams to the original design volume.
14	Surface water	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.	An additional sensitivity analysis has now been undertaken to address this comment from the IESC. This is included within Section 6.4.1.10 of the PER.
15	Surface water	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	A. Additional wording has been added on the cumulative effect to surface water flows within Section 6.4.2.2 B. Additional analysis has been conducted to include the existing Vulcan Coal Mine into the cumulative analysis. This has been updated within Table 6-27- “Existing projects considered in the cumulative impact assessment” and Table 6-26 - “Catchment area of existing projects considered in the cumulative impact assessment” has been updated.
16	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	A. See response to item 5, ground truthing has confirmed there is no shallow alluvium across the Project area. B. The depth to groundwater table map, produced for the GIA, included early groundwater level from the project groundwater monitoring network. The depth to groundwater table map also included a collection of Vitrinite provided groundwater level data from exploration drill holes. This data was combined to produce the depth to groundwater table map. The most recent groundwater level data from the project groundwater monitoring network and other public domain data is consistent with the early time groundwater level, which indicates very stable groundwater levels overtime. Collection of additional data has confirmed the depth to groundwater table mapping provided in the GIA.

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		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).	The numerical model provides a suitable calibration within the project area and is fit for purpose. Therefore the conclusions provided on the impact assessment of GDEs is still suitable and appropriate.
17	Ecology	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.	A. The Terrestrial ecology report and PER conclude that there are impacts on GDEs within the footprint associated with clearing vegetation, as these GDEs are largely associated with riparian vegetation that utilises groundwater. There are no impacts on GDE's outside of the footprint as there are no GDEs within the area of drawdown. The area of drawdown is within the same area where field verification of RE's was conducted, which provides field evidence of the presence of GDE's. There were no species that utilise groundwater, regardless of the depth, within the modelled zone of drawdown. B. As above, terrestrial GDEs were already identified through the flora survey and the RE verification across the survey area (an area larger than just the disturbance footprint).
18	Ecology	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; 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.	a) The results of the surface water assessment concluded that the comparison between Operational Conditions peak flood levels and Existing Conditions peak flood levels show that flood impacts as a result of the proposed mine water infrastructure are generally within the Project MLA area. As described in Section 6.4.1.6, a hydraulic assessment on the potential for erosion of the drainage diversions was undertaken by WRM in response to the guideline requirements and the IESC. The diversions were assessed using the hydraulic design criteria based on the Australian Coal Industry's Research Program (ACARP) study for the Bowen Basin streams, which assess stream power, stream velocity and shear stress as the main hydraulic characteristics of interest. The assessment shows that for the 10% and 1% annual exceedance probability (AEP) design flood events, the operational diversion channels will have similar sediment transport characteristics as the existing channels. Flood levees and water management infrastructure will be installed and inspected regularly across the site so that the drainage diversions do not flood on a regular basis. b) See response to item 10 and 11. c) Rehabilitation of drainage lines is required to be in accordance with the PRCP and PRCP schedule which have specific milestone criteria/conditions that must be met for the area to achieve a stable riparian final land use. See Table 8-1 of the PER. d) See response to item 11. e) It is acknowledged that the Project will cause some fragmentation inside the Project area in vegetation within the catchment and loss of inputs into stream channels. However, this fragmentation is the result of habitat avoidance and will assist in rehabilitation efforts as a source of seeds and other important inputs.
19	Ecology	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).	The ecohydrological model has been updated to include the highwall area.
20	Ecology	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.	While fauna surveys were conducted between October 2018 and October 2019, all habitat quality data gathered from the footprint were collected in June 2023. There is little reason to expect any changes to the faunal habitat values of the site since surveys were undertaken. The footprint has not experienced any clearing, droughts, fires, floods or cyclones since this time. The main alteration to the local landscape is the construction of the Vulcan Coal Mine immediately east of the footprint. Noise, light and dust associated with this disturbance may mean that habitats occupied in 2019 have since been vacated by some fauna. For this reason, data gathered in 2019 represents a more conservative assessment of the habitat values of the site than if the surveys were to be undertaken today. This has been explained in an additional section 4.7.3 (BioCondition Study and Relevance of Survey Data). Habitat presence is seen by DCCEEW as more important than species presence.
21	Mitigation measures	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).	Since submission of the Groundwater Impact Assessment (2022), monitoring of groundwater levels and quality has continued to further establish a baseline dataset to confirm the understanding of pre-project groundwater conditions. Further, additional monitoring bores have been installed for the project (April 2024) to supplement the groundwater

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		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).	monitoring network and confirm the current conceptual understanding. The newly proposed monitoring bores and network are outlined in Section 7.2.2 of the PER. The groundwater monitoring network is considered to be fit for purpose for this assessment. Future changes to the network or the monitoring plan will be needed which are planned for and outlined in a proposed adaptive management strategy. A data sharing agreement is currently being negotiated between Vitrinite and BHP and this will provide additional groundwater data and confirmation of mining activities (historic, current and future approved) for future model updates. Until the data agreement is finalised, conditions of this agreement are still unknown, and so is the availability of data under this agreement. The data sharing agreement is currently being established between Vitrinite and BHP.
22	Mitigation measures	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.	Mitigation measures will be implemented if third party users are identified. A sentence has been added to this accord, in Section 6.4.1.8 of the PER.
23	Mitigation measures	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.	Further information has been added to Section 6.4.1.6 of the PER. See response below: The temporary diversion drains proposed have been designed in accordance with the Queensland Government Department of Natural Resources, Mines and Energy (DNRME's) Guideline: Works that interfere with water in a watercourse for a resource activity — watercourse diversions authorised under the Water Act 2000 (DNRME, 2019). Although the Drainage line 6 and Drainage line 8 diversions are not watercourses, the DNRME (2019) design principles have been adopted for the design. The diversions were assessed using the guideline by WRM (2024), using the hydraulic design criteria based on the Australian Coal Industry's Research Program (ACARP) study for the Bowen Basin streams, which assess stream power, stream velocity and shear stress as the main hydraulic characteristics of interest. The assessment shows that for the 10% and 1% annual exceedance probability (AEP) design flood events, the operational diversion channels will have similar sediment transport characteristics as the existing channels. During detailed design of the temporary diversions, a detailed description of the Erosion and Sediment Control (ESC) mitigation measures will be provided. The temporary diversions are proposed to be rock lined, which is a viable ESC measure in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guideline (IECA, 2008), however, this is one of many alternative ESC measures. The most appropriate ESC measures will be selected and implemented during detailed design. Notwithstanding, the appropriate rock protection will be used in the diversion design, and will outline: · Availability of rock types to be used for the diversion; · Rock hardness; and · Availability and design of rock sizing. It is proposed that monitoring of the diversion drains will be undertaken post-flood event to inspect any sediment transport, erosion or scour issues, and remediation of the ESC measures will be undertaken if required.
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.	All GDEs within the disturbance footprint will be removed via clearing and any mitigation measures that apply to these are outlined in the first section of Table 7-1 'habitat loss'. There are no GDEs located within the drawdown footprint – see response above.
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.	TARPS have been added to all relevant management plans where a TARP is specified as a requirement in the guideline used to inform the plan.
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	Testing of copper and DOC has been included within the REMP (see Appendix X)

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		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.	