In the matter of the Fingerboards Mineral Sand Project EES

Inquiry and Advisory Committee

Proponent: Kalbar Operations Pty Ltd

Expert Witness Statement of John Sweeney

Expert of Kalbar Operations Pty Ltd

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Annexure

1. Name and address

Mr John Sweeney

Senior Associate Hydrogeologist

Level 1, 436 Johnston Street, Abbotsford, VIC 3067 Australia

2. Qualifications and experience

I am a hydrogeologist and environmental scientist with over 15 years' experience in the field of environmental management and impact assessment with specialisations in:

- Soil and groundwater contamination assessment
- Mining hydrogeology
- Water resource assessment
- Groundwater remediation
- Groundwater and surface water impact assessments

My curriculum vitae is attached as Annexure A which provides further details of my qualifications and expertise.

Qualifications

I hold a Bachelor of Science (Hons) degree from the University of Melbourne.

Affiliations

I hold the following positions and professional affiliations:

- Registered Professional Geoscientist (No. 10212): Hydrogeology, Environmental Geoscience
- Victorian Branch Committee Member, Australian Institute of Geoscientists
- Member, International Association of Hydrogeologists

3. Scope

Role in preparation of the EES

I am a co-author of the *Groundwater and Surface Water Impact Assessment* (Coffey, 2020), herein referred to as the GSWIA report. The GSWIA report was submitted as Appendix A006 of the Fingerboards mineral sands project (Project) environmental effects statement (EES).

The GSWIA report was co-authored by former Coffey employee, Mr Michael Blackam. Mr Blackam is a Senior Principal Hydrogeologist and Hydrologist with over 20 years' experience. He now holds a similar position with consulting firm CMW Geosciences Pty Ltd.

The GSWIA report includes original work which Mr Blackam and I completed to inform the understanding of baseline environmental conditions and the potential project impacts, as well as the synthesis of technical investigations that were prepared by other specialists, in particular Water

Technology Pty Ltd and EMM Consulting Pty Ltd. Work conducted by other specialists has been referenced in the GSWIA report and in my statement where relevant.

I was not an author of other documents such as the EES chapters, the Draft Works Approval Application, or the Draft Work Plan. However, I provide my opinion in response to issues raised by submissions where they relate to aspects of the groundwater or surface water environment, and where they fall within my area of expertise.

Other persons who assisted

I have not been assisted by others in the preparation of this statement.

Instructions

In relation to the Fingerboards Mineral Sands Project (the project) EES, I have been instructed by White and Case Pty Ltd (White and Case), acting as legal advisors to Kalbar Operations Pty Ltd (Kalbar), to prepare this expert witness statement to assist the Inquiry and Advisory Committee (IAC) being held by Planning Panels Victoria.

In summary, White and Case requested that I:

1. Prepare an expert witness statement in which I:
    - Set out my background and relevant experience;
    - Briefly describe and summarise the Groundwater and Surface Water Impact Assessment (GSWIA report) prepared in support of the EES, and my role in preparing it. In particular, detail whether there is anything in the GSWIA report that I disagree with or wish to elaborate on and set out any additional information considered necessary to include, including any additional assumptions; and
    - Consider the submissions that are relevant to my area of expertise and respond to any issues raised; and
2. If required, prepare and present expert evidence at the IAC inquiry hearing.

A copy of White and Case's engagement letter is provided in Annexure B.

I have read Planning Panels Victoria's Guide for Expert Witnesses and I am aware that I have an overriding duty to the Panel on matters relevant to my expertise.

4. Methodology

4.1. Impact assessment methodology

Together with my co-author, Mr Blackam, I developed and implemented the following impact assessment methodology during the development of the GSWIA report.

Desktop review and baseline monitoring

- I undertook a desktop review of relevant information to inform my characterisation of the expected baseline surface and groundwater conditions (Section 3 of the GSWIA report).
- I completed a site inspection during May 2017 to gain an appreciation of the site, the regional setting and to identify suitable drilling locations and surface water sampling locations.
- I developed a baseline water monitoring plan which outlined my recommended groundwater monitoring locations for the Coongulmerang Formation aquifer in the mine area, and surface water monitoring locations across the mine area and Mitchell River. It also provided details of the recommended sampling methods, frequency, and laboratory analytical requirements (outlined in Section 4 of the GSWIA report).

- Kalbar engaged a drilling contractor to drill and install the groundwater monitoring wells screening the Coongulmerang Formation within the mine area. This work was supervised by Matthew Golovanoff, an experienced Kalbar geologist. I was provided with, and had regard to, the drilling results in preparing the GSWIA report (summarised in Section 4.2.1 of the GSWIA report).
- I oversaw a combined groundwater and surface water monitoring event conducted by Coffey, during June 2017.
- Kalbar subsequently engaged Ventia Pty Ltd to provide ongoing groundwater and surface water monitoring services. Results of the Ventia's monitoring were provided to me for use in the GSWIA (Appendix H of the GSWIA report).

Investigation, analysis, and modelling

- I summarised the relevant legislative setting for the project (Section 1.5 of the GSWIA) and identified the beneficial uses and protected environmental values of groundwater and surface water that required consideration by the GSWIA (Sections 3.5.6, 3.6.4, and 5 of the GSWIA report).
- Kalbar engaged a number of specialists to assess different aspects of the project's impact on the water environment, as well as to determine the project's water requirements and the site's water balance. Kalbar engaged and provided direction to these specialists.
- I reviewed and summarised the following specialist reports and their key findings in the GSWIA:
    - EMM, 2020. Fingerboards Mineral Sands Project, Conceptual Surface Water Management Strategy and Water Balance. Report prepared for Kalbar Operations Pty Ltd, April 2020 (Appendix A of the GSWIA).
    - EMM, 2020. Fingerboards Groundwater Modelling Report In support of the Environmental Effects Statement. Report prepared for Kalbar Operations Pty Limited, April 2020 (Appendix B of the GSWIA).
    - Water Technology, 2020. Fingerboards Mineral Sands Landscape Stability and Sediment Transport Regime Assessment. Version 10. April 2020 (Appendix C of the GSWIA).
    - EGI, 2020. Geochem Testing of Fingerboard Tailings and Overburden. Memorandum to Kalbar Operations Ltd. 14 April 2020 (Appendix D of the GSWIA).
    - Water Technology, 2020. Fingerboards Mineral Sands. Surface Water Assessment – Site Study. 30 April 2020 (Appendix E of the GSWIA).
    - Water Technology, 2020. Fingerboards Mineral Sands. Surface Water Assessment – Regional Study. 4 April 2020 (Appendix F of the GSWIA).
    - Ecology & Heritage Partners, 2020. Detailed Ecological Investigations for the Proposed Fingerboards Mineral Sands Project, Glenaladale, Victoria. Report prepared for Kalbar Operations Pty Limited, August 2020 (Appendix A005 of the EES).
    - Austral Research and Consulting, 2020. Kalbar Fingerboards – GDE Impact Assessment (Final). April 2020 (Appendix 8 of Appendix A005 of the EES).
    - Landloch, 2020. Landform, Geology, and Soil Investigation– Fingerboards Mineral Sands Project. Report prepared for Kalbar Operations, April 2020 (Appendix A001 of the EES).

Impact assessment

- I applied a consistent risk-based impact assessment methodology that was aligned with the impact assessment approach established for the project (outlined in Section 7.3.2 of the EES). This approach was also consistent with the EES scoping requirements for the project. The assessment method involved the following steps:
    a. **Establish the context.** Set the context for the assessment through the identification and definition of environmental values.
    b. **Identify potential impacts and issues.** Review potential impacts and identify possible causes of changes to environmental values as a result of the project.

c. **Consequence analysis.** Assess the consequence of the identified impacts. Table 1 reproduces the consequence ranking from the GSWIA, which provides guidance criteria for assigning the level of consequence for each impact.

d. **Frequency analysis.** Estimate the frequency or likelihood of a change to environmental values occurring, assuming the effective implementation of risk reduction through elimination, mitigation and management. Table 1 reproduces the consequence ranking from the GSWIA, which provides guidance criteria to determine the 'likelihood' of the impact occurring with the predicted level of consequence.

e. **Analyse residual risk.** Analyse the risk of harm to environmental values using qualitative or quantitative techniques that define risk as:

Risk = Consequence x Likelihood

The Consequence Level and Likelihood Level are compared to the Risk Matrix reproduced from the GSWIA in Table 2 to determine the residual risk rating.

f. **Risk reduction.** Depending on the residual risk rating, identify additional risk reduction controls and measures (avoidance, mitigation and management measures) that may be required.

Table 1: Qualitative criteria for likelihood and consequence

Descriptor	Description
Likelihood	
Almost certain	A hazard, event and pathway exists, and harm has occurred in similar environments and circumstances elsewhere, and is expected to occur more than once over the duration of the project activity, project phase or project life.
Likely	A hazard, event and pathway exists, and harm has occurred in similar environments and circumstances elsewhere, and is likely to occur at least once over the duration of the project activity, project phase or project life.
Possible	A hazard, event and pathway exists, and harm has occurred in similar environments and circumstances elsewhere, and may occur over the duration of the project activity, project phase or project life.
Unlikely	A hazard, event and pathway exists, and harm has occurred in similar environments and circumstances elsewhere, but is unlikely to occur over the duration of the project activity, project phase or project life.
Rare	A hazard, event and pathway is theoretically possible on this project, has occurred once elsewhere but not anticipated over the duration of the project activity, project phase or project life.
Consequence	
Negligible	A temporary or short-term localised impact that will resolve itself in the short-term without intervention.
Minor	A temporary or short-term localised impact that can be effectively managed with standard management measures.
Moderate	A short to medium term impact that extends beyond the area of disturbance to the surrounding area. Specific management measures may be required to effectively manage the impact.
Major	A medium to long term impact that is widespread. Specific management measures are required to effectively manage the impact.
Extreme	A long term, widespread and potentially irreversible impact. Design modification is required to eliminate the impact or specific management measures are required to reduce the likelihood of occurrence of the impact.

Table 2: Risk evaluation matrix

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Negligible	Very low	Very low	Very low	Low	Moderate
	Minor	Very low	Low	Low	Moderate	Moderate
	Moderate	Low	Low	Moderate	High	High
	Major	Low	Moderate	High	Major	Major
	Extreme	Moderate	High	Major	Major	Major

Development of mitigation, management, and monitoring measures

- In consultation with key specialists and Kalbar, I developed mitigation, management and monitoring measures that were designed to reduce the frequency or magnitude of potential impacts with moderate or high unmitigated risk.
- Assuming the successful implementation of the listed measures, I then reassessed the residual impact to the water environment.

Review and improvement

The GSWIA report has undergone multiple phases of project review (by Coffey and Kalbar) and external review prior to public display.

The first draft of the GSWIA was issued in June 2018 for review and comment by the Technical Reference Group (TRG), which comprised various state regulators and government agencies including:

- Environment Protection Authority Victoria (EPA)
- Southern Rural Water (SRW)
- East Gippsland Water (EGW).
- East Gippsland Catchment Management Authority (East Gippsland CMA)
- West Gippsland Catchment Management Authority (West Gippsland CMA)
- Department of Environment, Land, Water and Planning (DELWP) Impact Assessment Unit
- Department of Environment, Land, Water and Planning (DELWP) Wetland Program, Waterway Health
- Earth Resources Victoria
- Agriculture Victoria

The TRG was supported by AECOM, who provided an Independent Review of Water Related Studies (2019) on behalf of DELWP Impact Assessment Unit.

Through this process, the GSWIA was updated multiple times between June 2018 and October 2020, to address the review comments and feedback from the TRG, and in response to the peer review comments.

This process of review and improvement has resulted in numerous changes to the original project description and significantly expanded the level of detail in the GSWIA report. This included listing substantially more potential impacts that were previously considered low risk and development of additional mitigation measures.

4.2. Methodology for responding to submissions to the IAC

My response to public submissions was undertaken based on an initial review and classification of all 908 submissions, which was conducted by Kalbar. Their classification process tagged each submission in relation to the issues raised. Only those submissions identified by Kalbar as relating to a water issue have been reviewed by me in preparation of this statement. Two submissions (Submission 909 and 910) were received after Kalbar's review and classification was completed. I have reviewed these submissions for relevance and addressed comments where necessary.

The issues that were raised across multiple submissions typically aligned with key themes. These themes have formed the basis of Section 6 of my submission.

Where an issue raised by a submission relates directly to the work of another water specialist (e.g., groundwater modelling) and not to my interpretation or application of their work, I do not provide a response in my statement as the issue will be addressed by the relevant specialist.

Submission 716 includes a 154 page report. Due to the size of the submission and the broad range of topics covered, I reviewed only the following sections were reviewed for items of relevance to my work:

- 1 Introduction
- 2.1 Key areas of concern
- 2.2 Environmental risk assessment
- 2.3 Consistency of the EES and technical reports
- 2.4 Adequacy of identified future Environmental Performance Requirements
- 2.5 Recommendations
- 3.4 Surface water
- 3.5 Groundwater
- 3.8 Ecology (terrestrial and aquatic biodiversity)
- 3.15 Draft work plan
- 3.16 Draft EPA works approval

Submission 813 totals 656 pages, spanning most elements of the EES. I reviewed the following sections of their submission for issues that relate to my work and which either seek clarification or, in my opinion, require a response. General opinions, statements or objections are noted but not directly addressed by my statement. The following sections of submission 813 were reviewed:

- Introduction
- Background
- Chapter 1: Water
- Chapter 3: Rehabilitation
- Chapter 4: Tailings storage facility
- Chapter 18: Draft work plan
- Chapter 19: EPA works approval
- Chapter 20: Risk

5. Findings

5.1. Additional work undertaken since preparation of the report

5.1.1. Changes to the project description

Since submission of the GSWIA and the EES, White and Case, acting on behalf of the proponent, issued a letter to the IAC on 18 January 2021 that documented corrections and proposed changes to the project description.

I note the following amendments which have implications to the assumptions made in the GSWIA:

- The rate of water recovery from the fine tailings using amphirols was likely to be overestimated, and therefore the project's water supply requirement of 3 GL/year was likely to be underestimated.
- The additional water not recovered from fine tailings would be lost to entrainment and evaporation.
- When applying the corrected water recovery rate, the corresponding water supply requirement for the project when using amphirols alone would be in the range of 4 to 5 GL/year.

This scenario forms the basis of my written statement submitted to the IAC. I note that the requirement to address the increased water supply in my statement was communicated to me on 29th January 2021, which has provided limited time to consider the full range of potential impacts that might exist. Furthermore, I have not received any updated advice on the implications of the increased water supply volume from the other water specialists whose work I relied upon when writing the GSWIA.

I have reviewed the work presented in the GSWIA and I believe that it is sufficiently conservative to form an opinion on the potential impacts of the increased water supply. The GSWIA and the EES considered and assessed two water supply options, as well as a combination of the two options. They were:

- 3 GL/year winter-fill from the Mitchell River.
- 3 GL/year groundwater from the Latrobe Group aquifer.

In this statement, I have made a base case assumption that the proponent would seek the increased annual water supply of up to 5 GL/year from a combination of both resources, but I have assumed that no more than 3 GL/year from either source.

The GSWIA assumed that an additional 6 GL/year of winter-fill entitlement may be available for the Mitchell River, and at the time of writing the GSWIA, SRW had deferred allocation of the additional water. I am now aware that SRW has allocated or offered to the market 4 GL of the available 6 GL.

As the Latrobe Group aquifer is fully allocated, the proponent would rely on successfully purchasing and transferring the required allocation from existing licence holder(s) within the Water Supply Protection Area. Both water supply options would also require assessment and approval by SRW, and no assurances have been made by them to my knowledge.

5.1.2. Additional information and assessment completed

Reports and data

The following report was provided and has been reviewed for relevance since preparation of the Assessment:

- Frood., et, al. 2018. Inventory and condition assessment of the chain of pond systems of the Perry River and Providence Ponds catchment. Report to the West Gippsland Catchment Management Authority, December 2018.

My comments on this report and the assessment of chain of ponds systems extending up the Honeysuckle Creek tributary and onto the project area are provided in Section 6.3.3.

Site investigation work

Kalbar has completed additional exploration drilling after publication the GSWIA, which has implications on Section 8.3.2 (page 212) of the GSWIA. The relevant paragraphs of the original report text are reproduced below:

> *Kalbar completed a review of 380 exploration boreholes that nominally covered the full aerial extent of the mineral deposit on a gridded arrangement of approximately 200 m by 200 m with the broadest spacing approximately 400 m by 400 m. Drill hole logging was carried out over the full depth of each hole with, amongst other things, records of moisture content. Perched groundwater was not identified in any boreholes. …*
>
> *The Coongulmerang Formation vadose zone has been extensively drilled above the watertable and no instances of perched groundwater have been identified. This suggests that perched groundwater at MW07 is an anomaly or issues may exist with the bore construction, possibly allowing water ingress. …*
>
> *The likelihood of clay horizons causing significant changes to the groundwater mound development, to the extent that impacts to beneficial uses of groundwater may be affected (such as impacts to buildings and structures, or increased impact to GDEs), is considered Unlikely. The consequence would be Moderate, noting that these effects would be localised and not significantly different to impacts already assessed by the wider mound development. This corresponds with a Low residual risk.*
>
> *Regular groundwater level monitoring, comparison to model predictions, and periodic refinement of the groundwater model will allow for a proactive management approach to mitigate adverse effects of mounding, should they occur. With these management measured in place the mitigated consequence is reduced to Minor, and the residual risk is Low.*

Additional drilling identified approximately 6 locations where the water strike depth suggested perched water above the watertable at other locations. This data has been provided to Mr. Joel Georgiou of EMM, who I assume will address this in his expert witness statement.

I have reviewed the interpreted data, as presented by Mr Georgiou, and believe that the available data continues to support my conceptualisation that perched water may exist in the Coongulmerang Formation but that it is not laterally continuous. The data also supports my conceptualisation that Perry River (where it passes the project area) and the chain of ponds within the catchment, are unlikely to be dependent on the regional groundwater table (discussed further in Section 6.2).

It is my opinion that the additional work completed by Kalbar and the assessment of this data by Mr Georgiou, which I agree with, supports the conclusions presented in the GSWIA.

5.2. Summary of opinions

I adopt the GSWIA report as the basis of my evidence before the IAC subject to the following amendments and clarifications.

Table 3 lists minor corrections to the GSWIA and the EES that are required as brought to my attention by submission 716.

Table 3: Noted corrections

Submission	Comment	Response
716	Boisdale Formation sands and gravels are reportedly under the deposit (p.40) but these are not shown on the cross section through the site (figure 3-3) nor discussed (P.46)	Generally, where the Boisdale Formation has been mentioned in the GSWIA, this was in the context of its relevance as a high value aquifer in a regional hydrogeological setting (further south of the project area). The Nuntin Clay Member (part of the Boisdale Formation) may be present beneath the site, but the Warruk Sand Member (the aquifer component of the Boisdale Formation) is thought not to be present (Table 3-4, p.43). The last sentence on page 40 of the GSWIA is incorrect and should be removed. This relates to an earlier interpretation presented in a draft of the GSWIA report. This does not affect the remainder of the assessment which correctly describes the presence of the Balook Formation.
716	EES Table 8.2 does not mention Balook Fm / Latrobe Valley Group. This is inconsistent with EES 8.3.3.1 (Figure 8.3) and the groundwater modelling which assumes Balook Fm / Latrobe Valley Group occur beneath the site (bore MW09d) and receive seepage (if seepage occurs) from tailings in mine voids (Figure 8.17). If not present, the seepage from mine voids would only be to the Coongulmerang Fm.	While not the author of the EES document, I agree that Table 8.2 incorrectly omits the Balook Formation / Latrobe Valley Group. Whilst omitted from Table 8.2, the EES does discuss the presence of deeper aquifers in later sections and correctly summarises the potential impacts to receptors of the Balook / Latrobe Valley Group aquifers (such as Woodglen ASR).
716	Appendix A006 section 10.2 refers to fresh water (surface water and groundwater). Groundwater cannot be considered "fresh water" similar to Mitchell River water or rainwater (as Latrobe Group groundwater is >500 mg/L TDS).	Noted and agreed. Section 10.2 - Project Activities, describes the main features of the mine and the full sentence reads, "Fresh water (surface water and groundwater) storage in engineered impoundments" and relates to the structure itself as a potential hazard, and frames the later chapters which talk about water types and quality.
	Appendix A006 Table 7-7…Total phosphorous 1.07 mg/L is not highlighted in the table to show it exceeds ecosystem criteria.	Noted. Phosphorous was incorrectly left unhighlighted. The reported concentration of phosphorus is more likely attributed to background concentrations in the Mitchell River water source (which ranged up to 5.44 mg/L during baseline monitoring) rather than from interaction with the mineralised ore. Phosphorous was below the laboratory's limit of reporting for the tailings ASLP samples that were collected using deionised water. Phosphorus is unlikely to pose an increased risk to the aquatic ecosystem of the receiving environment of the Mitchell River.
NA		The GSWIA states that SRW has not yet issued the 6 GL of water that might be available for use by new winter-fill licence holders. It is my understanding that since issuing the report, SRW has; • Allocated 2 GL to Gunaikurnai Land and Waters Corporation (GLaWAC); • Offered 2GL to the market in November 2020; and • Deferred allocation of the remaining 2GL It is likely that Kalbar would only seek a winter-fill licence application of 2GL/year with the remaining supply volume sought from a groundwater allocation.

Submission	Comment	Response
		The GSWIA conservatively assumes a 3 GL/year winter-fill allocation from the Mitchell River.
NA		The proponent has outlined a correction to the assumed fine tailings water recovery rate. This correction, in turn, increases the water supply requirement from 3 GL/year to 5 GL/year. To meet these water supply requirements, I have made the following base case assumptions: • 2 GL/year surface water from the Mitchell River under a winter-fill licence. • 3 GL/year groundwater from the Latrobe Group.

The following sections summarise my assessment of impacts posed by the project to the groundwater and surface water environment. My assessment is consistent with the methodology outlined in Section 4.1.

I direct the IAC and other readers to refer to the GSWIA report which provides substantially more context and justification for these conclusions.

5.2.1. Winter-fill extraction from Mitchell River

Impacts to other users

Kalbar originally proposed to source 3 GL/year from the Mitchell River under a winter-fill licensed allocation which was to be sought from SRW. This assumption is now likely to be highly conservative with only 2 GL/year remaining unallocated not yet offered to the market.

Winter-fill licence allows extraction from July to October when passing flows at Glenaladale flow gauging station exceed a 1,400 ML/day threshold.

The winter-fill threshold is well above the 185 ML/day flow limit at which point restrictions are enforced on irrigators. The likelihood of Kalbar's proposed surface water extraction impacting on the year-round irrigators is characterised by the GSWIA as Rare, as Kalbar's access to water will be restricted at a higher flow rate than is imposed on irrigators. The consequence of an impact to irrigators, however unlikely, would feasibly be Major. When comparing likelihood and consequence using the risk matrix in Table 2, the residual impact on irrigators is Low.

It is possible that Kalbar's proposed winter-fill extraction might affect the access of other winter-fill licence holders during periods of low flow, as they share the same 1,400 ML/day minimum flow threshold. I reviewed the past 10 years of flow records for the Mitchell River and assessed that Kalbar's proposed winter-fill allocation would have caused flow to drop below the 1,400 ML/day on 16 of the 3,045 total days (0.53%), leading to restrictions for other licence holders. I assessed the likelihood of existing winter-fill licence holders being impacted during the mine life to be Possible, based on my conclusion that over the past 10 years', 16 of the total 3,045 days the proposed extraction rate would have affected 0.53% of the available days within the winter fill period being restricted. A Minor consequence has been determined for this impact, based on the ability for other winter-fill licence holders to increase pumping during higher flow periods and make up for reduced days of access.

The Woodglen Aquifer Storage and Recovery (ASR) project's winter-fill licence conditions include a much lower passing flow requirement of 600 ML/day. Therefore, Kalbar's proposed extraction for a mine water supply would not compete with, or restrict, the supply of water to the Woodglen ASR project. With such a low likelihood of impact, the residual impact to the Woodglen ASR is considered Low.

Impacts to the aquatic ecosystem

I completed a review of the published environmental flow requirement of the Mitchell River and Gippsland Lakes which informed my assessment of potential impacts of Kalbar's proposed water extraction on the health of the aquatic ecosystems of the Michell River and Gippsland Lakes. The following summary establishes the basis for my assessment of the likely environmental effects:

- The recommended minimum environmental flows in the Mitchell River between December and May were reported as the lesser of either 200 ML/day or the natural flow for 75% of days. The December to May period referenced by the minimum environmental flows will not coincide with Kalbar's proposed winter-fill extraction. However, they have been conservatively adopted to apply for the full year for the purpose of the assessment. I concluded that the 1,400 ML/day winter-fill trigger was substantially higher than the minimum environmental flow requirement of the Mitchell River.

- Flows of over 5,000 ML/day are required over at least two days during spring and early summer to flush fish eggs and young larvae out of the confined estuary zone to more favourable seagrass habitat around the shores of the Gippsland Lakes. Kalbar's predicted average pumping rate over the winter-fill period (24 ML/day, based on the original 3 GL/year allocation) equates to 0.48% of the minimum 5,000 ML/day flushing flow requirement. A flow reduction of 0.48% is considered to have a negligible consequence on Mitchell River's ability to deliver annual flushing flow cycles.

- Upstream migration cues for juvenile diadromous fish (including Australian Grayling) require flows of at least 1,000 ML/day for nine days between November to February. Kalbar's winter-fill licence conditions would not coincide with this period, and a feasible impact on migration cues is not present.

- Flow of around 1,250 ML/day in late winter to early spring is required to maintain favourable salt wedge conditions in Jones Bay (Gippsland Lakes) to support food production and fish habitat in the river downs-stream of Bairnsdale. Assuming a daily average pumping rate of 24 ML/day by Kalbar over the winter-fill period (corresponding to the original 3 GL/year winter-fill allocation), the 1,400 ML/day winter-fill trigger was considered to be sufficiently higher than the 1,250 ML/day minimum flow requirement to maintain the salt wedge in Jones Bay.

Based on these factors, I considered that the likelihood of Kalbar's proposed extraction of surface water from the Mitchell River having an adverse environmental effect on the Mitchell River and/or the Gippsland Lakes is Rare, and the consequence would be Moderate. Therefore, I assessed that Kalbar's proposed extraction from the Mitchell River would have a Low residual impact.

In many cases the aesthetic enjoyment, traditional owner, and cultural and spiritual values are intrinsically linked to the environmental health of the river. In my judgement, and in the absence of specific flow criteria for the use, the risk of impact to these values is therefore aligned with the assessment made for ecosystem health, presented above.

The alluvial aquifer is recharged primarily by the Mitchell River during periods of high flow and flood events. The rating curve for the Mitchell River flow gauge at Glenaladale was used to inform an indicative assessment of the stream water level change that might result from Kalbar's proposed 24 ML/day average extraction (based on the original 3 GL/year winter-fill allocation sought by Kalbar).

The stream level change resulting from a 24 ML/day reduction in flow was beyond the resolution of the published rating curve. For comparison, a much larger, hypothetical 1000 ML/day reduction during a high flow event (3,000 ML/day) is estimated to result in less than a 0.5 m reduction in stream height. Therefore, the proposed 45 ML/day would have a substantially smaller effect on stream height, and would be Unlikely to effect the rate of groundwater recharge to the Mitchell River alluvium. The risk of impact to the Mitchell River alluvium is considered to be Low.

5.2.2. Fine tailings disposal to the TSF

Fine tailings will be temporarily stored in an engineered TSF that will be located close to the WCP. The engineered TSF will consist of up to four cells, will be up to 90 ha in size, and will contain approximately 3,000,000 m^3 of fine tailings which will be deposited as a slurry. When sufficient capacity is created in the mine void, the fines tailings will be returned from the TSF to the mine void.

Potential impacts to groundwater

The permeability value estimated for the slime tailings is low, estimated to be approximately 2.8 x 10^{-7} m/s. For a situation where 100 mm of water is ponded over 5 m of fine tailings, this would give a very low free draining rate, estimated at 0.48 mm/d (Loch, 2019).

EMMs water balance model assumed minimal seepage from the TSF. This was also reflected by EMMs groundwater model (Appendix B of the GSWIA), which assumed that the TSF and would not contribute to the development of the mound.

The likelihood of seepage occurring beneath the fine tailings TSF and negatively effecting the beneficial uses of groundwater after application of the proposed mitigation and management measures is considered Unlikely. The consequence is considered to be Minor. The residual risk to groundwater levels, posed by disposal of fine tailings to the TSF during operations, has been assessed as Low

Despite the predicted low rate of seepage, the GSWIA has conservatively assumed that some seepage may occur, representing a potential to affect the quality of the underlying Coongulmerang Formation groundwater.

Work was conducted by Kalbar and EGI (Appendix D of the GSWIA) to estimate the quality of water entrained with the fine tailings material or rainfall seeping through the deposited tailings. Results indicated concentrations of aluminium (0.07 mg/L) and copper (0.002 mg/L) marginally exceed the freshwater aquatic ecosystem protection criteria (0.055 mg/L and 0.0014 mg/L, respectively).

Fine tailings leachate water quality does not exceed drinking water health criteria, however leachable concentrations of aluminium (0.07 mg/L) and iron (0.09 mg/L) may create aesthetic issues if present in drinking water.

The predicted concentrations of aluminium, copper and iron in tailings seepage water were below the mean concentration that naturally occur in Coongulmerang Formation groundwater and were not considered to represent a hazard to the Water Dependent Ecosystem beneficial use of groundwater at the point of discharge (such as the Mitchell River and the Mitchell River alluvial aquifer) or potable water supply.

Therefore, I considered that the likelihood of infiltrating water causing an adverse effect on a protected beneficial use of groundwater would be Unlikely. The groundwater monitoring measures proposed by Kalbar will provide early warning and an opportunity to remediate or otherwise reduce the risk. The consequence of an impact would be Moderate. The residual risk of a quality impact posed by the disposal of fine tailings to the TSF during operations has been assessed as Low.

TSF failure

The TSF will be designed, constructed and operated in accordance with relevant requirements of:

- Australian National Committee on Large Dams (ANCOLD) *Guidelines on the consequence categories for dams (October 2012)* (which replace ANCCOLD *Guidelines on the assessment of the consequences of dam failure*),
- ANCOLD *Guidelines on tailings dams – planning, design, construction, operation and closure – Revision 1* (July 2019)
- ERR's *Technical Guideline Design and Management of Tailings Storage Facilities* (DEDJTR, April 2017).

Based on severity of potential damage and loss, in conjunction with the population at risk, an assessment of hazard rating was conducted as part of the Draft Work Plan (Attachment B of the EES). Based on population at risk of 1 to 10 and highest damage and loss severity level 'Medium', a hazard rating of 'Significant' was adopted for the TSF designs as per guidelines. I note that I did not author the Draft Work Plan or conduct the assessment, however I have relied on the conclusions that it presents for the purpose of the GSWIA.

When considering the short, five-year operational life of the TSF, and the commitment to construction methods described in the work plan, I considered that the likelihood of TSF failure is extremely Rare. I have assumed the highest ‘Extreme’ consequence to the downstream surface water catchments. The residual risk from TSF failure to the Perry River catchment and the Gippsland Lakes of Moderate.

5.2.3. Tailings disposal to the mine void

Raised groundwater levels associated with tailings disposal to the mine void

The potential for raised groundwater levels to impact on groundwater dependent ecosystems (GDEs) was assessed by EHP (2020) (Appendix A005 of the EES) who also drew on results of the groundwater modelling by EMM (Appendix B of the GSWIA). The lower reach of Moulin Creek, a tributary of Mitchell River to north of the project area, was identified by EHP as having an area terrestrial vegetation that may experience raised groundwater levels associated with groundwater mounding.

Following a site inspection of the area along the lower reaches of Moilun Creek EHP concluded that many areas identified as potential GDEs did not support remnant native vegetation or were highly modified and subject to ongoing disturbances such as agricultural activities. They concluded that impacts to the vegetation associated with groundwater mounding are likely to be localised and negligible.

I have relied upon the work of EHP in my assessment and considered that the likelihood of an adverse impact to terrestrial groundwater dependent ecosystems (GDEs) from groundwater mounding would be Unlikely. I concluded that, based on the EHP’s assessment the consequence of a loss of high value vegetation communities within the mapped GDE areas would be Minor due to their limited extent beyond the mine area, and that existing vegetation offsets would be in place. The residual risk posed by mounding to GDEs is Low when comparing likelihood and consequence to the risk evaluation matrix (Table 2).

Groundwater modelling (Appendix B of the GSWIA) estimated that raised groundwater levels could result in 725 kL/day (0.725 ML) increase in baseflow to the Mitchell River. It is my understanding that the increased water supply under Scenario 1 (excluding centrifuges) would not contribute to increased seepage to groundwater or increase mounding. The additional water is understood to be lost to evaporation and entrainment in the fine tailings.

I assessed that the predicted increase in baseflow could represent a potential 1% to 2% increase of total river flow rates under the typical low flow conditions over the past 10 years (approximately 50 ML/day). The likelihood of groundwater mounding having an adverse effect on the aquatic ecosystem of the Mitchell River is Unlikely due to the negligible increase in flow rate. Should an adverse impact to Mitchell River aquatic ecosystem occur, the effect would be localised and temporary, and the consequence is considered to be Minor. The residual impact is Low.

Groundwater mounding in the Coongulmerang Formation aquifer was not predicted to extend to the Gippsland Lakes, Providence Ponds, the Perry River, or the Woodglen ASR site (Appendix B of the GSWIA). The likelihood of a measurable effect at these receptors is therefore considered Rare. The consequence of raised water levels or increased discharge, if it occurred, would be Minor because a level change alone was considered unlikely to result in a discernible change to the ecosystem health. The residual risk posed by mounding to these receptors is considered Very Low.

The likelihood of clay horizons in the subsurface significantly altering the development of the groundwater mound development, to the extent that impacts to beneficial uses of groundwater would eventuate (such as impacts to buildings and structures, or increased impact to GDEs), is considered Unlikely. The consequence would be Moderate, noting that these effects would be localised and not significantly different to impacts already assessed by the wider mound development. This corresponds with a Low residual risk.

The likelihood of raised groundwater levels affecting the stability of engineered structures is considered Rare. The is due to the relative elevation of the groundwater mound that will be below the base of the mine void, and well below the surrounding natural ground surface where mine infrastructure will be constructed. The residual risk of impact is Low.

Groundwater quality impacts associated with tailings disposal to the mine void

The predicted concentration of aluminium in tailings seepage water marginally exceeds the freshwater aquatic ecosystem protection criteria, but is less than the mean concentration of aluminium that naturally occurs in the Coongulmerang Formation aquifer. The placement of tailings in the unlined void is therefore not considered to represent a hazard to the Water Dependent Ecosystem beneficial use of groundwater.

The predicted quality of tailings seepage water did not exceed any drinking water health-based criteria. Concentrations of dissolved aluminium (0.08 mg/L) and dissolved iron (0.07 mg/L) exceeded aesthetic drinking water criteria. However, the reported concentrations of aluminium and iron below the dissolved concentrations in groundwater and would not result in increased concentrations in groundwater.

Based on the above considerations, I assessed the residual risks of a quality impact to groundwater from the disposal of tailings to be Low.

5.2.4. Process water

For the purpose of predicting the likely quality of process water, Kalbar collected a composite sample of Coongulmerang Formation ore and produced a 1:5 ratio mix with surface water from Mitchell River (the proposed source of process water). The sample was agitated for a period of hours then allowed to stand for 24 hours before a sample of the decant water was extracted and submitted for laboratory analysis. A second sample of the decant water was filtered to assess only the dissolved concentrations.

Dissolved concentrations were adopted as representative of process water that might infiltrate through the subsurface to groundwater. Concentrations were very low, typically below the laboratory limit of reporting (LOR). For this reason, the quality of water held in the process water dam and lost through seepage from the mine void is unlikely to represent a hazard to groundwater, corresponding to a Negligible consequence. Therefore, I consider the risks associated with infiltration of process water to be Very Low.

5.2.5. Groundwater extraction from the Latrobe Group aquifer

The potential for groundwater extraction to impact on aquifer resources, other groundwater users and the surface water environment (including GDEs) was assessed using EMM's numerical groundwater model (Appendix B of the GSWIA).

EMM concluded that the overlying Seaspray Group provides an effective barrier for vertical pressure effects. Groundwater drawdown was unlikely to extend to the Mitchell River alluvium (which is hydraulically connected to the Mitchell River). Drawdown of approximately 0.25 m in the Mitchell River alluvials as a result of pumping from the Latrobe Group would be offset by mounding of 0.31 m that may extend from beneath the mine void. The net effect is slightly increased groundwater levels in the Mitchell River alluvium, which may lead to slightly increased baseflow discharge to the Mitchell River (discussed further in Section 5.2.2 and 6.3.4).

The model predicted a water budget change of approximately 1% or less at the Perry River (where it is potentially groundwater dependent further southwest of the project area), Gippsland Lakes, and the Mitchell River as a result of project activities. Based on the work conducted by EMM, I considered the likelihood of groundwater extraction from the Latrobe Group aquifer having a measurable impact on GDEs to be Unlikely.

Based on the groundwater modelling results, should a measurable impact occur, I considered that it would be a short to medium term beyond the mine area, corresponding to a Moderate consequence. I assessed the residual impact as Low in line with the Risk Evaluation Matrix (Table 2).

Negligible change (±0.2 m) to groundwater level at the Woodglen ASR site was predicted by the groundwater model. Groundwater extraction for mine water supply is considered to represent a Low risk to the Woodglen ASR project. This takes into account the significant pressure changes that would occur in response to the injection of surface water and subsequent extraction as part of the ASR program, compared to a predicted ±0.2 m influence from the project.

Two registered bores located in Fernbank (85891 and NI_2) were assessed as Likely to experience some groundwater level drawdown reaching a maximum of approximately 5 m. The consequence of 5 m drawdown is considered to be Low given the significant water column available at these bores, which means that the bores would still produce groundwater without significant impact to yield. The modelled drawdown was considered to have a Low impact to registered groundwater users in the Latrobe Group aquifer.

Predicted drawdown to the overlying Boisdale aquifer was predicted to be a maximum of 0.2 m by the groundwater model, which would not adversely affect bore yields. This would result in a Minor consequence. A Very Low residual risk is considered to apply.

The likelihood of ground settlement occurring in the area surrounding the proposed borefield is Unlikely because the area of greatest drawdown will be spatially limited and at significant depth. Furthermore, the Seaspray Group lithology can be considered low-risk of compaction because it comprises calcareous sand, sandy and silty limestone, with patchy carbonate sediment. Formations having a high subsidence risk typically comprise silt and clay lithologies, which are susceptible to compaction. In the case that settlement did occur it would be limited to a localised area around the borefield. Based on the historical response to 40 m of past drawdown, the consequence would be Minor, with a residual risk of Very Low.

Groundwater model simulation for the three year groundwater extraction scenario indicated that drawdown in the Latrobe Group aquifer was unlikely to extend to the coastal zone, and did not transmit upward to the overlying aquifers connected to the coastal system at that location. Therefore, the residual impact of saline water intrusion occurring in coastal aquifers as a result of groundwater extraction is considered to be Low.

The groundwater model was used to simulate the effect of groundwater extraction on level changes in the vicinity of the Gippsland Lakes. EMM concluded that the overlying Seaspray Group provides an effective barrier for vertical pressure effects, with maximum drawdown of 0.5 m simulated in the Seaspray group in the vicinity of the extraction borefield. Negligible effects were predicted for the Gippsland Lakes which exist several kilometres to the south of the borefield. Therefore, the likelihood of groundwater extraction from the Latrobe Group aquifer having a measurable impact on the Gippsland Lakes was considered Rare with a potentially Major consequence. The residual risk is assessed as being Low.

5.2.6. Retention of mine contact water in water management dams

The quality of mine contact water has potential to be impacted by the mine activities and may include elevated sediment load and some elevated metals. Therefore, mine contact water will be retained in water dams and pumped to the process water dam.

I considered that prior to developing additional mitigation measures, the impact of retaining mine contact water to other extractive users of the Mitchell and Perry rivers was Moderate, due the potential for them to experience reduced water supply. To minimise the potential impact, Kalbar has committed to using water of a suitable quality from the fresh water dam to offset retained mine contact water by releasing the same volume of water to either the Mitchell River or Perry River, as required. The GSWIA has assuming that the offset water quality from the fresh water dam will have the same or better quality than that of pre-mining runoff from the project area. This mitigation of offsetting retained flows with water from the fresh water dam reduces the likelihood of an adverse impact occurring, resulting in a Low residual risk.

Reduced flow in the downstream sections of the ephemeral gullies has the potential to impact on the health of the aquatic and terrestrial ecosystems associated with the pools of water and vegetation that remain within the gullies, and the aesthetic enjoyment, agriculture and irrigation water supply (from farm dams), and traditional owner, cultural and spiritual values of these features. Prior to application of mitigation measures, I assessed the risk of impact to the downstream gullies as High.

To reduce the potential impact, Kalbar will undertake periodic monitoring of surface water levels, quality and ecosystem health features downstream of the project area to assess water level and quality to ensure that ecosystem health is not adversely affected. Adaptive management will be implemented and, based on monitoring results, the offset of water that would typically be returned via the water pipeline to the Mitchell River, may alternatively be directed down drainage gullies in a controlled manner. After applying these management measures the residual likelihood of impact is considered to be Unlikely leading to a Low residual impact.

5.2.7. Release of mine contact water

Under normal operation, water retained in the water management dams will be progressively drawn down to the process water circuit. During extreme precipitation events, water levels in the water management dams can rise above the maximum design operating level and potentially lead to the discharge of mine contact water via spillways to the downstream catchment.

Kalbar, in consultation with EPA, included the capacity to treat mine contact water at a rate of 24 ML/day to reduce the likelihood of discharge from mine contact water dams. The estimated frequency achieved for a mine contact water release to the Mitchell River catchment was approximately once every 50 years, and approximately once every 100 years to the Perry River catchment (after applying additional measures, such as preferential emptying of water management dams and adopting bulk water treatment).

The predicted concentrations of aluminium, chromium, and copper in mine contact water exceeds ecosystem protection criteria, but are either less than or equal to the measured baseline concentrations in surface water within the downstream gullies during a flow event. The consequence of a discharge event on the aquatic ecosystem of the ephemeral drainage gullies has been demonstrated to be Negligible. The residual risk of a release of mine contact water to the ephemeral drainage gullies is Very Low.

Water Technology (2020c) modelled the rare event where mine contact water discharges to the receiving waters of the Mitchell and Perry rivers. The release of mine contact water was demonstrated as unlikely to increase concentrations in the Mitchell River or Perry River above background levels for sediment, nutrients and heavy metals. Therefore, the consequence of a discharge event occurring on the aquatic ecosystem of the Mitchell River and Perry River, and agricultural water supply has been demonstrated to be Negligible. The residual risk of a release of mine contact water to the Perry River and Mitchell River is Very Low.

The release of mine contact water to the Mitchell and Perry rivers and the change in sediment load is assessed as having a Very Low residual risk of impact to Lake King and Lake Wellington based on modelling conducted by Water Technology. The residual risk of nutrients and metals impacting on the water quality of the Gippsland Lakes was also assessed to be Very Low based on Water Technology’s modelling.

5.2.8. Landform changes

Water Technology (Appendix E of the GSWIA) completed flood modelling for the project area and surrounding catchment and concluded that a maximum flood level increase of up to 300 mm was predicted within the project area in response to topographic changes. Most increased flood conditions were associated with the installation of the impoundments designed to prevent runoff from leaving the site. I concluded that a Low residual impact is likely after considering mitigation measures, such as controls to prevent erosion and consideration of flood levels during detailed design of site infrastructure. Flood modelling of the downstream (offsite) catchment indicated a minor increased flood depth and might occur. A Very Low residual impact is assumed for offsite receptors.

Changes to topography could alter the distribution of groundwater recharge rates leading to altered groundwater conditions. The likelihood of impact is considered Possible as mining will alter the catchment topography. The consequence of this impact is considered to be Negligible as Kalbar aims to restore the land to its pre-mining land capability and maintain catchment geometry which would not result in substantial changes to recharge rates. The residual risk is considered to be Very Low

6. Response to submissions

This section provides my response to key themes that were raised across multiple submissions from regulators, representatives of community groups, and individuals.

6.1. Water supply

6.1.1. Water supply licensing requirements

Submission 291 makes a range of comments that question the suitability of the work presented in the GSWIA and the EES to meet the requirements of the proposed take and use licence for the Mitchell River and the proposed groundwater licence.

These comments are all noted and will be considered in preparing licence applications, but they do not relate to the adequacy of the GSWIA report in meeting the scoping requirements for the EES.

It is my opinion that the level of investigation and assessment presented in the GSWIA adequately addresses the potential impacts associated with both of the groundwater and surface water supply options presented, and is sufficient for the purpose of the EES.

I note that revisions will be required to the work presented in the GSWIA to reflect the reduced water supply requirement from the Mitchell River. Further work is proposed by Kalbar and water specialists to support the various licence applications if the EES is favourably assessed.

6.1.2. Impacts associated with extraction from Mitchell River

The GSWIA assumed that the proponent would source the full 3 GL/year from the Mitchell River under a winter-fill licensed allocation which will be sought from SRW. This was based on the knowledge that the Gippsland Region Sustainable Water Strategy (DSE, 2011) lifted the precautionary water allocation cap on the Mitchell River, indicating that an additional 6 GL of winter-fill entitlement may have been available for allocation at the time of writing the GSWIA.

It is my understanding that since submission of the GSWIA, SRW has;

- Allocated 2 GL to GLaWAC;
- Offered 2 GL to the market in November 2020; and
- Deferred allocation of the remaining 2 GL.

Concerns were raised by members of the community that Kalbar's proposed extraction of surface water from the Mitchell River may reduce the available water supply to other users or impact on the ecology of the Mitchell River and the Gippsland Lakes.

Extraction of water from the Mitchell River would only be conducted in line with licence conditions, should such a licence be granted by SRW. A condition of the winter-fill licence is expected to require that water only be extracted by Kalbar between July 1 to October 31 when the passing flow at the Glenaladale flow gauge is above a minimum threshold of 1,400 ML per day.

The 1,400 ML/day threshold is well above the 185 ML/day flow limit where restrictions have historically been enforced on irrigators. It is my opinion that Kalbar's proposed extraction from the Mitchell River will therefore not compete with irrigators or other year-round surface water users.

It is feasible that Kalbar's proposed extraction could result in the 1,400 ML/day threshold being reached marginally quicker by other winter-fill licence holders during a period of declining stream flow rates. The previous 10 years flow monitoring data was reviewed to identify what impact Kalbar's extraction might have had during that period. The assessment found that extraction of the volume sought by Kalbar would have resulted in an additional 16 days (or 0.53% of the total available winter-fill days) of restricted access for other winter-fill licence holders over the 10 year period assessed.

The Woodglen ASR project's winter-fill licence has a much lower passing flow requirement of 600 ML/day and would not experience additional restriction as a result of Kalbar's proposed extraction.

A review of the environmental flow requirement of the Mitchell River and Gippsland Lakes was conducted and is reported in full in Section 8.5.1 of the GSWIA and is summarised in Section 5.2.1 of my statement.

Based on the assessment provided in Section 5.2.1, it is my opinion that the winter-fill trigger is sufficiently conservative to protect the minimum environmental summer flows, minimum flows required to maintain salt wedge conditions in Jones Bay, and minimum flow cues for upstream fish migration. I do not expect that reduced flow will have an adverse effect on the aquatic environment or other users.

6.1.3. Groundwater extraction from the Latrobe Group aquifer

Potential for greater drawdown than expected

Submission 716 raises a suggestion that groundwater level drawdown may be significantly greater than modelled and that extraction from a shallow aquifer may be required to augment supply.

This scenario, specifically extraction from shallower aquifers, is not considered as a contingency by the project and has therefore not been included in the GSWIA.

The magnitude of groundwater level drawdown has been considered as part of the sensitivity analysis included in EMM's groundwater modelling report (Appendix B of the GSWIA). These results were considered when developing the risk rankings in the GSWIA. EMM's analysis demonstrated that varying model parameters within plausible ranges did not result in any significant groundwater related impacts to key sensitive receptors. I formed the opinion that the potential increased drawdown within the range predicted by EMM's sensitivity analysis would have a negligible additional impact on groundwater receptors and did not warrant separate assessment.

6.1.4. Impacts associated with loss of supply

Kalbar has stated that should the available water supply in a given year be insufficient to maintain production to the next winter-fill period, water will be sought from the Latrobe Group aquifer. If a suitable groundwater allocation cannot be secured or a licence is not approved, production will taper or cease. There are no plans to seek an alternative water supply from shallow aquifers such as the Coongulmerang Formation or the alluvial aquifers along the Mitchell River that are heavily relied upon by irrigators.

Scaling down of operations would need to be planned, with priority given to continue dust control to the following winter-fill period by retaining water or by application of other dust control measures. These measures were outlined in the GSWIA.

Based on these commitments, the GSWIA considered potential groundwater and surface water impacts associated with reduced water supply to be negligible, and did not warrant in depth discussion in the GSWIA report. Kalbar will however need to formalise these procedures in greater detail prior to construction, and reinforce their commitment to ensuring that key environmental management measures in management plans can be maintained during periods of temporary shutdown. I consider that this level of commitment and understanding should be achievable, and is sufficient for the purpose of assessing impacts to the water environment.

Some submissions noted that in the event of an extended drought period where very little water is available to Kalbar, there may be a risk that the mine may no longer be commercially viable, and the mine may be left unrehabilitated. This scenario was not addressed by the GSWIA as it was not considered likely to eventuate based on the historical Mitchell River flow data. However, I do recognise the uncertainty presented by climate change.

While this scenario is unlikely to eventuate, it is not impossible. I would expect that the potential impact of the proponent's insolvency as a result of extended drought, and its inability to finance the rehabilitation of the site, would need to be addressed by the rehabilitation bond that will be held for the project.

6.2. Conceptualisation and groundwater flow

Numerous submissions raise concerns with a potential groundwater impact that, in my opinion, could be resolved by improving the audience's understanding of the hydrogeological conceptual model.

Figure 1 illustrates my conceptual understanding of the existing groundwater and surface water environment in the vicinity of the Fingerboards. This is important to consider when communicating my assessment of the potential impacts to the environment.

Aquifers and perched groundwater

My conceptualisation of the groundwater environment considers two distinct zones of water in the subsurface, which have varying degrees of interaction with surface water and GDEs. These are summarised below and illustrated in Figure 1.

1) **Regional groundwater:** The unconfined watertable has been encountered across the mine area within the Coongulmerang Formation aquifer elevations ranging from 45 m AHD in the west of the mine area to 27 m AHD in the east of the mine area, next to the Mitchell River. Regional groundwater is laterally continuous and flows beneath the site from high elevation to low elevation (i.e. towards the Mitchell River). The regional groundwater is expected to support:

    - Baseflow to the Mitchell River (and the aquatic ecosystem).
    - Riparian vegetation along Mitchell River (terrestrial GDE).
    - Groundwater dependent vegetation identified by EHP along Moilun Creek, north of the mine area.

    Project impacts to the regional water table (such as changes to levels or quality) have potential to extend beyond the project boundary.

2) **Perched water:** Perched water occurs when rainfall or runoff infiltrating from the surface accumulates on low permeability clay horizons in the subsurface, forming isolated lenses of water that exist above the regional groundwater. Two types of perched water are likely to be present:

    a) **Near-surface drainage:** The presence of low permeability horizons (such as clay layers, weathering features, and the interface between soil horizons) are likely to promote the drainage of water in the shallow subsurface towards nearby surface water features. Where it exists, near-surface drainage is laterally continuous at the local sub-catchment scale and is isolated from deeper groundwater and surrounding catchments. Near-surface drainage is likely to support the following GDEs:

        - Providence Ponds.
        - Chain of ponds features and other waterholes.
        - Farm dams considered by some EES submitters to be 'spring fed' dams.

    b) **Perched groundwater lenses:** Isolated areas of perched water have been identified beneath the site. Perched groundwater can exist at depths from a few metres below surface to around 40 m below surface. Exploration drilling indicates that perched water lenses are not laterally continuous (i.e. not found in the surrounding boreholes). Perched groundwater is unlikely to migrate laterally more than a few metres. Perched groundwater at depth would not support any terrestrial or aquatic GDEs.

This is consistent with the assumptions and conceptual understanding presented in the EES and the GSWIA.

Groundwater flow direction

Submission 716 (p.29) states that "an alternative interpretation of the data presented, is groundwater beneath the east half of site flows toward Mitchell River, and beneath the west half of site toward Perry River. This possibility does not appear to have been considered in the model conceptualisation and risk assessment."

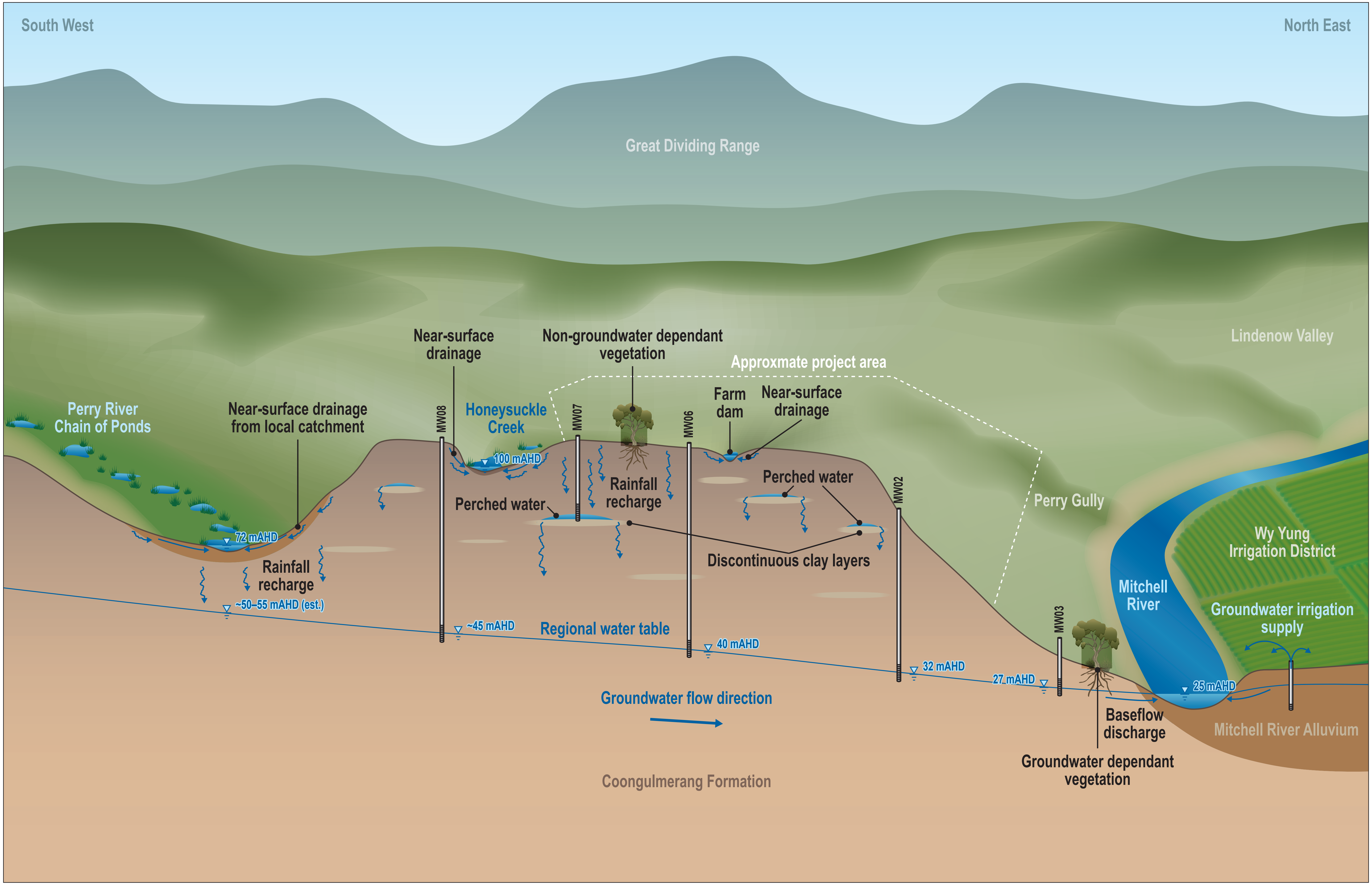
The inferred groundwater flow direction adopted by the GSWIA is shown on Figures 4-10 to Figure 4-15 of the GSWIA report. The inferred flow direction adopted by the GSWIA is based on the available measured groundwater levels and indicates that groundwater flows in a north and north-easterly direction across the mine area towards the Mitchell River. This is consistent with the Mitchell River acting as a regional groundwater discharge point.

The alternative interpretation presented in Submission 716 was considered during development of the conceptual hydrogeological model, however in my opinion it was not supported by the available data. For a groundwater divide to exist west of the current groundwater monitoring network it would require Perry River to be a groundwater discharge feature. I do not believe this to be the case based on the following lines of evidence:

1. The Perry River is at a much higher elevation (~75 m AHD) compared to the Mitchell River (~23 m AHD) (refer to Figure 1).
2. The presence of a permanent chain of pond landscape along the Perry River valley suggests it is not a significant groundwater discharge feature. A regional groundwater discharge feature would have similar flow characteristics to the Mitchell River.
3. Groundwater level contours projected towards the west remain below the base of the Perry River.
4. Exploration drilling west of the mine area support the projected groundwater levels in the vicinity of the Perry River.

I believe that the available information supports the interpretation adopted by the GSWIA. However, I acknowledge that the alternative interpretation cannot be completely discounted without groundwater level monitoring data further to the west.

It should be noted that the Perry River was conservatively included as potential groundwater receptor in the GSWIA, and adopting the alternative interpretation would not result in new potential impacts arising that have not already been assessed by the GSWIA.



coffey A TETRA TECH COMPANY	Date: 28.01.2021 Project: 754-ENAUABTF11607AK File Name: 11607AK_R01_F001_GRA	Kalbar Operations Pty Ltd Fingerboards Mineral Sands Project	KALBAR OPERATIONS PTY LTD	Hydrogeological conceptual model	Figure No: 1

6.3. Groundwater dependent ecosystems

6.3.1. Identification of GDEs

Questions were raised in relation to the method used to identify GDEs within and beyond the project boundary.

The following method of identifying GDEs was implemented as outlined in Section 3.5.4 of the GSWIA. This included:

1. Desktop assessment using published maps and reports;
2. Baseline groundwater level monitoring to establish local groundwater levels and the presence of perched water in the subsurface.
3. Regional groundwater modelling (Appendix B of the GSWIA) to support Ecology & Heritage Partners (Appendix A005 of the EES) to identify zones of shallow groundwater that might potentially support GDEs; and
4. Field surveys conducted by Austral and Ecology & Heritage Partners (Appendix A005 of the EES).

6.3.2. Providence ponds and Perry River chain of pond systems

A number of submissions state their confusion around the GDE status of the Providence Ponds and other chain of ponds features through the upper reaches of the Perry River catchment. The conceptual hydrogeological model has been simplified and reiterated in Section 6.2 of my statement, and will assist the following discussion.

It is my opinion that the chain of ponds within the Perry River catchment rely on near-surface drainage which directs water via the subsurface from the local surface water catchment.

The ponds exists at elevations that are several 10s of metres above the regional groundwater table (Figure 1). Groundwater beneath the mine site is therefore likely to be disconnected from the shallow drainage features that support the Providence Ponds and other chain of ponds west and south of the mine area.

In my opinion, the available evidence support the conclusion that the Providence Ponds are reliant on shallow, subsurface drainage sourced only from the local catchment. They do not rely on, or interact with, deeper groundwater that might be influenced by the proposed mining activities.

It is prudent to consider what the implications would be if the conceptualisation I have put forward is incorrect:

1) Raised groundwater levels (mounding) beneath the mine is not predicted to extend to the Providence Ponds.
2) EMM’s groundwater modelling included particle tracking analysis which predicts the movement of tailings seepage in groundwater from the site. Seepage was shown not to migrate towards Perry River catchment (refer to Figure 7.26 of Attachment B of the GSWIA report).
3) If modelling was found to be inaccurate and seepage water did migrate towards the Perry River and/or ponds, the tailings water quality has been demonstrated to be comparable to that of the native groundwater quality in the Coongulmerang Formation, and is unlikely to pose an increased quality risk.
4) The predicted groundwater level drawdown of 0.2 m (which in my opinion will be isolated at depth below the ponds) is well within the range of seasonal groundwater level fluctuations of the Coongulmerang Formation aquifer and would be unlikely to result in an adverse impact to the aquatic ecology (and other values) of the ponds.

The available information suggests that there is neither a hazard nor a viable groundwater pathway connecting the mine site to the ponds. Additional groundwater monitoring wells installed to west of the project area would provide an increased level of confidence in the conceptual hydrogeological model and may be beneficial for the ongoing monitoring of groundwater impacts. However, I believe the necessary level of confidence has been achieved to support the EES and I do not agree with the suggestion that further investigation of the chain of pond system is warranted for the purpose of assessing potential impacts in the GSWIA.

6.3.3. Honeysuckle Creek chain of ponds (onsite)

Submission 358 infers that chain of ponds have been mapped to extend up the Honeysuckle Creek sub-catchment and across parts of the southwestern zone of the project area. This is understood to be based primarily on the work presented in the report *Inventory and condition assessment of the chain of pond systems of the Perry River and Providence Ponds catchment* (Frood et. al., 2018).

Based on my observations during a site inspection in 2017, I considered that the features corresponded mostly to either erosion features or farm dams constructed within drainage channels, and not a natural chain of pond system.

I understand that the ecological status of these ponds will be addressed in the statements of other specialists who have more recently completed an assessment of the mapped ponds in relation to this issue.

I do not believe these onsite ponds are dependent on groundwater. The baseline monitoring program included groundwater level monitoring at monitoring well MW07 which is near the Honeysuckle Creek tributary. The levels monitored at this well were in the order of 40 m below the ground surface. It should be noted that in my opinion, the measured groundwater level at MW07 actually represents perched water, and the regional groundwater table exists a further 10 to 20 metres below.

Regardless, the groundwater level in close proximity to the onsite 'ponds' can be directly demonstrated to be well below the base of any surface water features in the Honeysuckle Creek catchment on site and they are not dependent on, nor affected by the changes to the regional watertable aquifer.

6.3.4. Impact of raised groundwater levels at GDEs

Submissions raised concerns that the impact assessment did not address the potential for change in water quality from displacement and increased discharge of higher salinity groundwater to GDEs.

I can confirm that the potential quality impact was considered but not individually reported in the GSWIA as it was considered to be of negligible likelihood following the assessment of potential baseflow volume change to the Mitchell River (presented in Section 8.4.6 of the GSWIA).

EMM’s assessment of baseflow contribution to the Mitchell River and their groundwater modelling results (Appendix B of the GSWIA) formed the basis of my assessment of changes to baseflow contribution to the Mitchell River.

EMM’s modelling concluded that the small predicted rise in groundwater levels beneath the Mitchell River could result in an estimated increase in baseflow of 0.725 ML/day. I calculate that this volume equates to an increase in river flow rate of between 1% to 2% increase when flows fall below 100 ML/day. During low flow conditions, baseflow would typically represent almost all of the observed flow in the river and a minor increase in baseflow contribution would be unlikely to alter the quality of Mitchell River water.

I have estimated the potential effect that an additional 0.725 ML/day of groundwater discharge might have on surface water quality in the Mitchell river under low flow conditions. My assessment assumed the following parameters:

- Mitchell River TDS: 52 mg/L (based on field measured values at MR02)
- Mitchell River flow rate: 60 ML/day

- Coongulmerang groundwater TDS: 1,200 mg/L (mean concentration at MW03 & MW04, along Mitchell River)
- Increased baseflow contribution: 0.725 ML/day

I estimate that under the very low flow conditions in the Mitchell River, the TDS concentration of Mitchell River water could increase from 52 mg/L to 66 mg/L as a result of an additional 0.725 ML/day baseflow discharge.

There were 37 days during the past 10 years when flows were recorded below 100 ML/day at the Glenaladale flow gauge (224203). The corresponding TDS values measured on those days (converted based on a ratio of 0.65 of the measured EC) ranged from 41 mg/L to 78 mg/L. The estimated TDS increase from 52 mg/L to 66 mg/L as a result of groundwater mounding remains within the historical range of TDS in the Mitchell River during low flow conditions.

Based on the above assessment, I considered that the likelihood of a 14 mg/L increase in TDS adversely impacting on the aquatic ecosystem of the Mitchell River would be Rare. Should an adverse impact to Mitchell River aquatic ecosystem occur, the effect would be minor, localised and temporary (during the period of extremely low flow) and the consequence was considered to be Minor. I considered the residual impact on the aquatic ecosystem of the Mitchell River to be Very Low.

6.4. Tailings storage facility

The TSF was a consistent feature of concern across many public submission. The issues raised can be broadly categorised into the following key themes:

- The presence of a permanent legacy feature.
- The risk of groundwater contamination from TSF seepage.
- The potential for catastrophic failure of the TSF and impacts to the downstream catchment.
- The absence of detailed design information for the TSF.

The EES was based on a project description that assumed fine tailings will be temporarily stored within an engineered TSF until they can be relocated to the mine void (from approximately year 5). The TSF is located on the mine path and will be decommissioned so that mining can progress in that area. The TSF is a temporary feature which reduces the likelihood of a range of potential impacts occurring.

Seepage predictions completed by Kalbar and other specialists indicated that the fine tails will not freely drain water. Water is entrained in the tailings and a portion of the water is released over time and either recovered to the process water circuit or lost to evaporation. This is demonstrated by EMM's water balance calculations in Appendix A of the GSWIA. I considered that the likelihood of a quality impact to groundwater from the TSF will be unlikely.

The quality of the seepage water from the fine tailings fraction is summarised in section 5.2.3 of my statement. If the current assumptions were found to be inaccurate and some seepage did occur, the predicted quality of seepage water from the TSF would not contain dissolved concentrations of metals above the background concentrations in groundwater. I conservatively adopted a Moderate consequence ranking should the concentrations of dissolve metals be higher than predicted.

The GSWIA recognises the potential impact of a catastrophic failure of the TSF in Section 8.4.7, stating "Potential environmental impacts associated with a TSF failure would primarily be related to the physical damage caused to the downstream catchment, such as destruction of aquatic habitats, scour and/or sedimentation in creeks and rivers. Although a release from the TSF has not been modelled, given its location, impacts would most likely extend from the site, down the ephemeral Honeysuckle Creek tributary to the Perry River. A lesser component of discharge may feasibly report to the Mitchell River. The Gippsland Lakes are approximately 50 km downstream of the mine site and may be, in turn, be impacted in the case of a failure."

The environmental consequence of a TSF dam failure has been based on the ANCOLD consequence rating of Significant, corresponding to an 'Extreme' consequence in the risk assessment matrix adopted by the EES. This is the highest possible consequence rating, and reflects the high ecological and cultural values of the receiving environment. I do not believe that any of the submissions dispute this aspect of my assessment.

The design, construction, monitoring and decommissioning of this TSF will comply with the Department of Economic Development, Jobs, Transport and Resources – Technical Guideline Design and Management of Tailings Storage Facilities (DEDJTR, 2017). My assessment of the GSWIA assumes that commitments made around the adequate design in the Draft Work Plan (Attachment B of the EES) will be conducted to the satisfaction of the regulators prior to receiving approval to construct the TSF. I note that the final Work Plan will include substantially more geotechnical testing and design work that demonstrate suitability to the ground conditions and the rainfall conditions that are common to the region.

However, I recognise that all TSFs and large dams have an inherent hazard. The likelihood of a catastrophic failure is typically informed by the:

- Adequacy of the design to the local geotechnical and environmental conditions; and
- Appropriate ongoing maintenance of the TSF (such as the water level management, and performance of internal drains)

It is not uncommon for TSFs on mining projects to be expanded beyond their original design capacity if the mine life is extended. This is unlikely to be the case for the Fingerboards project as the TSF is temporary and on the mine path. Similarly, TSFs are almost always permanent features that require a degree of ongoing maintenance to ensure their safety. This is also not the case for the Fingerboards project.

When considering the short, five-year operational life of the TSF, and the commitment to well established construction methods described in the draft work plan, I consider that the likelihood of TSF failure is Rare. Based on the risk assessment matrix adopted by the EES, the residual risk of TSF failure to the Perry River and Gippsland Lakes is Moderate.

I believe that this assessment adequately reflects the risk posed by the TSF, noting that the moderate residual risk reflects the highest possible consequence rating should a catastrophic failure occur.

Public submissions also raise concerns that seepage from the TSF might affect spring fed dams. I discuss this further in section 6.7.

6.5. Seepage from the tailings disposal

6.5.1. Seepage water quality impacts to groundwater

The potential impact of seepage from coarse tailings returned to the mine void on groundwater quality of the Coongulmerang Formation aquifer has been raised by several submissions.

Submission 358 noted that, "the documentation acknowledges that tailings seepage water is likely to have aluminium and copper concentrations which exceed the water quality objectives for ecosystem protection", and "the tailings seepage will be contaminated by aluminium, arsenic, chromium, and copper. The impacts of neither the quantity nor quality of tailings seepage have not been considered in the EES."

In response to these comments, I refer to Section 8.3.2 of the GSWIA which includes two sections that address these risks. I note that submission 358 includes reference to concentrations of chromium and arsenic that exceed ecosystem protection criteria. I believe this reference relates to leachate results from the mineral concentrate (chromium of 0.034 mg/L) and the unfiltered process water (arsenic of 0.039 mg/L). Both arsenic and chromium concentrations were below the adopted ecosystem and human health criteria for both fine and coarse tailings.

Results indicated concentrations of aluminium (0.07 mg/L) and copper (0.002 mg/L) marginally exceed the freshwater aquatic ecosystem protection criteria for tailings seepage. The predicted concentrations are less than the mean concentrations of aluminium and copper that naturally occur in Coongulmerang Formation aquifer, and the quality of seepage water was considered to have a low potential for impact on groundwater receptors.

In my opinion, the leachable concentrations of metals from tailings are unlikely to adversely affect water quality in the Coongulmerang Formation aquifer beneath the site.

6.5.2. Process water quality

Submission 514 makes a valid comment that, “The Project has assessed the potential quality of the process water, with results suggesting that the quality will be within natural background levels for the upper aquifer. However, EPA is concerned that the capture and re-use of process water may cause increases in the concentration of leachable analytes over time. As such, there is potential for the quality of water seeping from the tailings to increase above background levels over time, thereby posing a changing risk profile to protected beneficial uses as the Project progresses.”.

Submission 514 also states that, “The quality of the proposed discharge appears to present a low risk to beneficial uses, however, due to the Project’s predictions that a noticeable impact from the tailings water plume would extend significantly off-site, and the potential that water quality would decrease over time, EPA has some concerns regarding potential impacts to protected beneficial uses of groundwater and therefore seeks further information.” This issue was also raised by Submission 813.

I acknowledge that the potential effect of recycling approximately half of the process water on the process water quality over time was not specifically addressed by the GSWIA. I offer the following assessment in response.

The estimated process water quality from a single leach of the target ore using water from the Mitchell River is presented in Table 7-7 of the GSWIA. Two samples were collected from the leachate for laboratory analysis: unfiltered (representing concentrations of total metals) and filtered (representing concentrations of dissolved metals).

The dissolved concentrations of all reported metals (including aluminium and copper) were below the laboratory limit of reporting (LOR). Elevated concentrations of metals were shown to be consistently associated with the fine particulate matter in the unfiltered process water.

At the time of writing my statement I have not been provided with the updated water balance for Scenario 1. I understand from preliminary estimates of the water balance associated with Scenario 1 (no centrifuges), that the reduced recovery of water from the fine tailings and increase freshwater input would reduce the potential for increased concentrations of metals over time. Further work may be required to assess the potential change in process water quality over time under Scenario 1 (no centrifuges).

Submission 716 correctly notes that the target ore was not subject to 1:5 leaching using Latrobe Group groundwater. For the purposes of the GSWIA, a water quality sample was collected using a sample of the preferred and more likely long term source of mine water supply at the time of writing; the Mitchell River.

Further assessment and leachate testing with Latrobe Group aquifer groundwater should be carried out to give added confidence in relation to solute concentrations sourced from the ore and tailings, and provide direct assessment of potential quality impacts on the Coongulmerang Formation.

6.5.3. Impacts from lateral movement of seepage

Submission 716 and the DELWP Peer Reviewer questioned the effects that the naturally occurring interbedded clays and sands of the Coongulmerang Formation might have on the vertical infiltration of seepage below the base of the mine void.

I have recognised in the GSWIA that low permeability horizons exist in the subsurface to the extent that they currently result in some areas of perched water. The potential impact on the groundwater mound development has been discussed in Section 8.3.2 of the GSWIA report. Kalbar’s available exploration data suggest that, where clay horizons exist, they are laterally discontinuous and are unlikely to significantly influence the geometry of the groundwater mound.

Regular groundwater level monitoring, comparison to model predictions, and periodic refinement of the groundwater model will allow for a proactive management approach to mitigate adverse effects of mounding, should they occur. A range of commonly available options exist to control groundwater levels depending on the depth and position in the landscape.

6.6. Dewatering the mine pit

Submission 358 state that “shallow aquifer impacts from dewatering of the mine pit have also not been included in the risk assessment”.

Submission 813 states that “Throughout the entire EES document the existence of a crucial shallow aquifer system in the proposed project has been ignored. In the rehabilitation report the depth to groundwater is consistently referred to as being below the bottom of the mining pit. The Visualizing Victoria’s Groundwater (VVG) website clearly shows the existence of this aquifer. It is situated well above the floor of the mining pit in most areas, and in some areas is extremely close to the surface. The VVG map data is validated by the existence of farm dams and springs in the area that never dry up.”

The GSWIA has been based on the measured groundwater levels in multiple groundwater monitoring wells installed at the mine site. Measured groundwater levels are vastly more reliable than interpolation between water levels measured in the state observation bore network, which underpin the groundwater levels in VVG.

I am confident that the mine void will remain above the water table of the Coongulmerang Formation aquifer and dewatering will not be required. Groundwater levels in the Coongulmerang Formation aquifer will not be drawn down by the mining activities (excluding effects of a groundwater supply borefield).

I have presented my conceptual hydrogeological model in Section 6.2. I believe that the ‘shallow aquifer system’ referenced by Submission 813 corresponds to what I have described as near-surface drainage from the surrounding catchment.

6.7. Spring fed dams

The presence and need for assessment of spring fed dams has been raised by representatives of the TRG and by DELWP’s peer reviewer. Several public submissions also reference the presence of spring fed dams and raise concerns regarding potential impacts of reduced flows or degraded quality due to the mine.

A request was made to SRW during the baseline assessment to provide the available information on spring fed dams, however this was not made available. During the TRG review process, SRW commented that “Section 2.6.1 of the Drat Work Plan states 'Scattered farm dams and soaks occur across the mining licence.' The report needs to confirm what actions have been taken to search for springs and soaks and evidence this, and what risk is posed by the mine.”

Kalbar’s response noted that “Of 33 aquatic survey sites plus several other dams studied in the Biodiversity Assessment, only one was listed as ‘possible spring/groundwater fed’. This feature is outside of the mine footprint in Simpson Gully.”

SRW’s response was that, “This level of assessment is adequate for an EES but more clarity and detailed assessment will be necessary for any licence application.”

It is my interpretation that most farm dams within and immediately surrounding the project area would be positioned several 10’s of metres above the inferred watertable in the Coongulmerang Formation aquifer (refer to Figure 1). In preparation of this statement I sought further information from Kalbar on the possible location of farm dams that might be considered ‘spring fed’ by local landowners so that a more direct assessment could be offered. Kalbar identified two dams shown on Figure 2 that might be considered by landowners to be spring fed, based on anecdotal evidence.

When compared to the inferred groundwater levels in the area (also shown on Figure 2), the base of these farm dams are expected to exist at elevations between 43 m and 75 m above the watertable.

Therefore, I believe that if these dams are supported by seepage, that seepage it would be attributed to the same near-surface drainage processes described for the natural chain of ponds further west of the project area (refer to Sections 6.2 and 6.3).

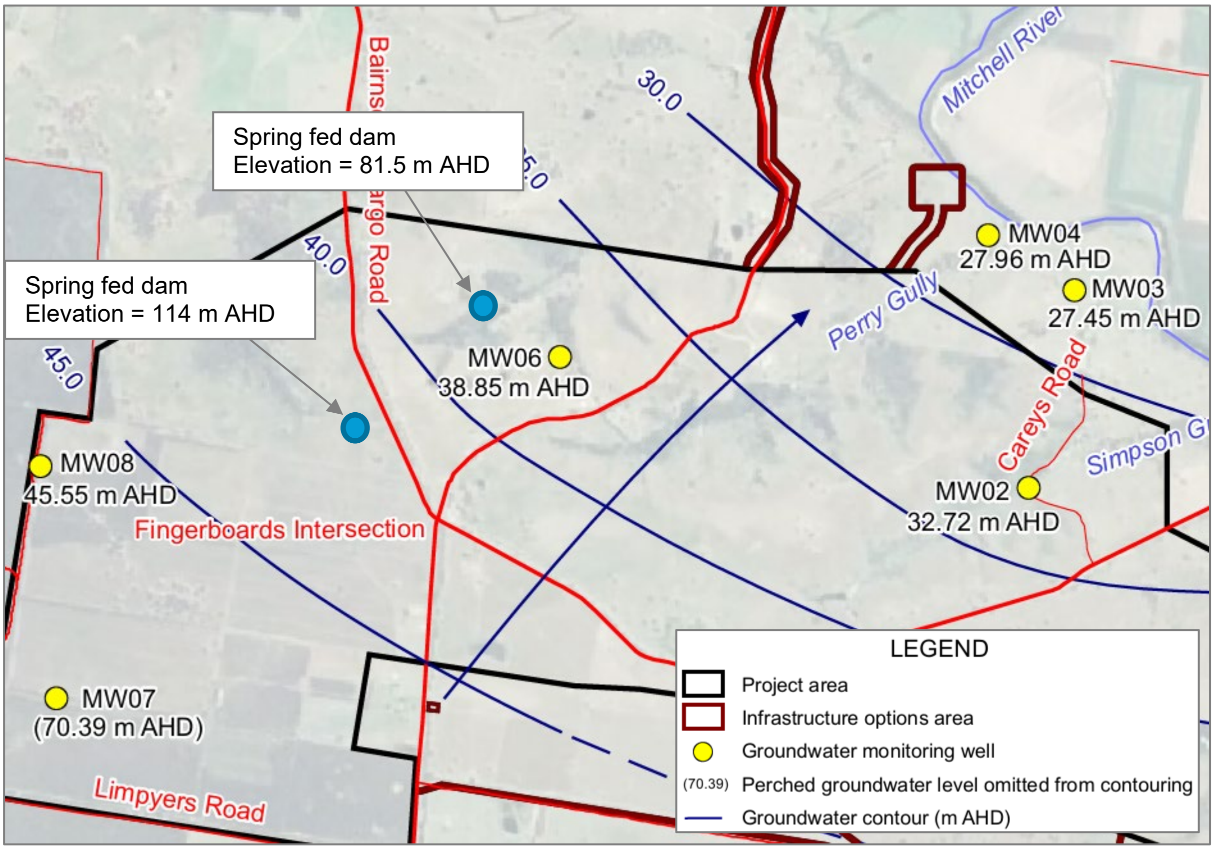


Figure 2: Possible locations of spring fed dams

Where other spring fed dams exist outside of the mine lease area at similar elevations, I expect that these would also be supported by near-surface drainage from the local surface water catchment and would be isolated from impacts (such as mounding or drawdown) that might affect the regional watertable.

Possible exceptions might exist to the northeast of the project area where the watertable may come close to the ground surface at the break of slope along the escarpment. To my knowledge, spring fed dams have not been reported in this area.

Submissions question the risk posed by the temporary TSF on spring fed dams. I accept that this is a reasonable concern in the case where the temporary TSF is located within, or very near to the local surface water catchment that supplies a spring fed dam. In this case further assessment should be undertaken to assess the potential for minor seepage from the unlined TSF to be diverted via the same near-surface drainage layers towards spring fed dams.

Dams at greater distance from the TSF are unlikely to be affected by seepage. Further assessment of spring fed dams in the vicinity of the mine area should be considered by Kalbar as they are identified.

6.8. Groundwater users

Submission 716 questions the data source used for the assessment of registered groundwater users presented in the GSWIA.

The Victorian Water Measurement Information System (VWMIS) was used for the original bore search first conducted during 2017. The VWMIS data extract function was not working at the time of a later bore search that was run during 2018 to expand the search area to include the proposed borefield. The Bureau of Meteorology (BoM) Groundwater Explorer was used as an alternative. The BoM Groundwater explorer is updated annually from new entries to the VWMIS and is considered sufficient for the purposes of the EES.

I recommend that an updated bore search be undertaken as part of the groundwater licence application.

Submission 716 recommends consideration of unregistered users that may exist within the modelled zone of influence around the groundwater bore field. I believe that this is a reasonable suggestion, and agree with a recommendation that Kalbar make enquiries with landowners within the nominated drawdown zone to identify active, potentially unregistered bores, as part of the groundwater licence application.

6.9. Woodglen ASR

Submissions 692 and 716 raised concerns that groundwater mounding may interfere with the normal operation of the Woodglen ASR facility which accesses the Latrobe Valley Group at Woodglen. Submission 692 also raised the concern that groundwater extraction for project water supply might adversely affect the Woodglen ASR borefield.

My assessment of these potential impacts in Section 8.3.2 of the GSWIA was based primarily on the groundwater modelling work completed by EMM (Appendix B of the GSWIA report).

Groundwater modelling directly assessed the net effect of both mounding and drawdown and concluded that no change (±0.2 m) to groundwater levels at the Woodglen ASR site were simulated.

Potential for seepage water to migrate to Woodglen ASR and have an adverse quality impact was also assessed in Section 8.3.2 of the GSWIA. A quality impact requires both a source of impact (contamination) and a complete pathway between the mine site ASR site. I concluded in Section 6.5.1 of this statement that there was low potential for a groundwater quality impact to the Coongulmerang Formation aquifer.

EMM developed a numerical groundwater model to predict the movement of groundwater originating from multiple points beneath the mine site as the groundwater mound develops. Their modelling takes into account the significant pressure changes that would occur in response to the injection of surface water and subsequent extraction as part of the Woodglen ASR program. Modelled particle tracking results are discussed in Section 7.7.3 of GSWIA. The model suggest that groundwater from the mine area is unlikely to migrate towards the Woodglen ASR wells.

In the absence of a likely source of groundwater contamination and an incomplete linkage with the ASR site, I concluded that there was a low risk of a quality impact to the Woodglen ASR. Recognising the high risk and public concern, I recommended expansion of the existing groundwater monitoring network prior to construction to include additional monitoring locations in the Balook Formation/Latrobe Valley Group Aquifer between the project boundary and the Woodglen ASR to provide advanced warning of potential impacts that will allow for appropriate remedial actions to be implemented if required.

6.10. Geothermal resources

Submission 716 questions the assessment of impact to the geothermal resource potential of groundwater. This beneficial use typically applies to groundwaters with temperatures between 30 and 70 °C (State Environment Protection Policy (Waters), 2018).

I offer the following additional assessment in response to the issues raised by submission 716. Groundwater temperature was measured during groundwater sampling of the Coongulmerang Formation and Balook Formation aquifers, and was also measured during the air lift yield test and pumping test in the deeper Latrobe Group aquifer.

Reported temperatures generally followed a geothermal gradient of increasing temperature with depth. The groundwater temperature in the deeper Latrobe Group aquifer was measured at 26.2 °C during the air lift test and is considered representative of this formation at the borefield location. A higher temperature (31.4 °C) was measured during a pumping test conducted at the same borehole, however this was thought to be influenced by the heat of the electric submersible pump used during the test.

I concluded that groundwater in the Coongulmerang Formation, Balook Formation, and the Latrobe Group (in the vicinity of the borefield) would not be considered to have a geothermal resource that requires protection due to the measured temperatures being below 30°C. However, this beneficial use might reasonably exist at greater depths further south of the study area.

Groundwater modelling conducted by EMM (Appendix B of the GSWIA) estimated that seepage beneath the mine voids is not expected to impact on deeper aquifers further south of the project area, and I concluded that their geothermal resource potential would not be affected. This potential impact was discounted from the assessment.

6.11. Water management dams

Kalbar has committed to metering the volumes of water pumped from water management dams following a runoff event, and offsetting the volume of retained water by returning fresh water from the raw water dam to Mitchell River. The offset addresses potential impacts to the Mitchell River.

Submission 291 raises concerns about the detailed function of the water management dams, and how they would be monitored, managed and reported on.

It is my opinion that the impact assessment must make certain assumptions when considering the feasibility of a proposed management or mitigation measure so far as it can be relied upon to achieve the stated goal. While the proposed measures might be considered complex from a licensing perspective, I do not believe that the technical feasibility of the water transfer system proposed by Kalbar is novel for the mining sector. It relies on rudimentary pump and pipe systems, fitted with flow meters for the purpose of meeting the anticipated license requirements.

I am of the opinion that the proposed water management system can be readily implemented and is of low technical complexity, particularly when considering the infrequent nature of its operation.

Submission 716 sought clearly documented design criteria for the proposed clean water diversions and conveyance channels.

EMM's Conceptual Surface Water Management Strategy and Water Balance report (Appendix A to the GSWIA) includes further details of water management infrastructure including nominal catchment outlets in Figure 9.3 and indicative discharge pipelines in Figure 6.2. Additional details including the detailed design criteria for the dams will be developed during detailed design, after submission of the EES. In my opinion, the level of detail required to assess the risks posed by dam structures to the surface water (or groundwater) environment has been provided. Further detail will be consistent with the design guidelines and criteria committed to by Kalbar, and would not alter the conclusions of the GSWIA.

6.12. Surface water quality impacts

Existing (pre-mining) surface water quality

The assessment of potential impacts associated with the release of mine contact water requires an understanding of the existing (pre-mining) water quality draining from the project area.

I recognise that the infrequent nature, and short duration of flow events in the ephemeral gullies across the project area has provided a limited dataset. However, multiple lines of evidence have been presented in Section 7.5.1 of the GSWIA to characterise existing water quality. They include:

- Water quality results from routine monitoring of ponds and dams located in the ephemeral drainage lines (12 rounds between June 2017 and March 2020).
- Water quality results from event based monitoring (four events between June 2019 and February 2020).
- Published mean concentrations values for event-based nutrients and total suspended solids (TSS).
- Estimates using a 1:5 water extract of Haunted Hill formation soil and deionised water.

Baseline monitoring (including event based monitoring) will be continued by Kalbar through until the start of construction. The baseline monitoring dataset should be reviewed periodically to determine if the assumptions made in relation to the baseline quality remain valid or if revised modelling may be required.

Water Technology (Appendix F of GSWIA) concluded that the concentrations of total phosphorus and aluminium in existing (pre-mining) runoff exceed the freshwater ecosystem protection criteria. Water quality results from flow events that occurred after Water Technology completed their modelling indicate that concentrations of total nitrogen can also exceed the freshwater ecosystem protection criteria.

In response to comments relating to the effect of bushfires and floods on the characterisation of background water quality for the Mitchell and Perry rivers, I note the following comment from Water Technology (Appendix F of GSWIA) which I have relied upon when considering this issue, “It should also be noted that all pre-mining TSS concentrations for both river systems were generated from the impact assessment spreadsheet model that was built excluding data from 2007, as it was an extreme outlier due to the combination of recent bushfires and a flooding event. In reality, the background TSS in the receiving waters was much higher during this time.” Based on the approach adopted by Water Technology, I believe that their modelling and my subsequent impact assessment adequately takes account of the effects of the 2007 bushfire.

Release of mine contact water

Some submission commented on the potential for mine contact water to impact on the downstream water quality of the ephemeral gullies and both Mitchell and Perry rivers.

These risks have been addressed in Sections 8.4.4, 8.4.5 and 8.5.2 of the GSWIA, and rely on the modelling completed by Water Technology (Appendix F of the GSWIA), which assessed the effects of mine contact water discharges on the water quality of the Mitchell and Perry rivers.

The quality of mine contact water was estimated to have elevated concentrations of total phosphorus, chromium and copper that exceed the freshwater ecosystem protection criteria. The concentration of total phosphorus in mine contact runoff (0.086 mg/L) was predicted to be less than the concentration of total phosphorus in natural runoff from the site (0.12 mg/L), and was not considered to represent an increased risk to the receiving environment.

Water Technology’s modelling concluded that there would be no increase above background levels in the Mitchell River for sediment, nutrients or metals due to mining operations, including both the unplanned release of mine contact water and return of offset water from the fresh water dam.

The rare occasion that a release of mine contact water from water management dams discharged to the Perry River, the modelling also indicated that there was not an increase in concentrations above background levels for sediment, nutrients or heavy metals.

Sediment and nutrient load reporting to the Gippsland Lakes is understood to also be an important consideration for the ecosystem health. An assessment of changes to sediment and nutrient load reporting to the Gippsland Lakes was undertaken by Water Technology. I summarise the potential impacts of increased sediment and nutrient loads in Section 8.5.2 of the GSWIA report.

No increased nutrient load was predicted. I determined that the predicted 0.06% increased sediment load via the Mitchell River (under some mine layouts) and average increased sediment rate of 2.5×10^{-10} mm/year was not expected to have a measurable impact on the hydraulic function or aquatic ecosystem health of the Gippsland Lakes. I concluded that the release of mine contact water to the Mitchell and Perry rivers and the change in sediment load had a Very Low residual risk of impact to Lake King and Lake Wellington.

Spills and leaks

Further justification was sought by Submission 716 to support the conclusion that there was a low potential for quality impact from minor spills or leaks of some hazardous materials.

The GSWIA assumed the use of low toxicity flocculants that would pose a negligible impact from minor spills. I understand that the nominated flocculants have recently been reviewed by Kalbar and that they have committed to using only low toxicity flocculants at the site. This will be addressed further in the statements of other experts.

Water treatment (dissolved air flotation)

To reduce the frequency of a release of mine contact water to the downstream environment, the water management dams will be progressively emptied by pumping to a water treatment plant at a rate of up to 24 ML/day so that it can be directed to the fresh water dam as required.

If the freshwater dam is full when the treatment plant is operating, excess blended water would be discharged from the freshwater dam to the Mitchell River via the winter-fill pipeline. Discharge of blended water would also be required periodically to offset of volume of water withheld from entering the Mitchell and/or Perry river catchments.

Some submissions sought further information to demonstrate the capacity of the nominated treatment technology to achieve the necessary water quality for discharge to the surface water environment.

The GSWIA did not assess the potential impact of treated and blended water being returned from the fresh water dam to the Mitchell River as the blended water was assumed to achieve the discharge objectives that are yet to be agreed with the regulator.

I note that the surface water quality modelling completed by Water Technology (Appendix F of the GSWIA) assessed the potential impact of releasing offset water from the fresh water dam that was conservatively assumed to have the same quality as pre-mining runoff. This included concentrations of total phosphorus (0.12 mg/L) and aluminium (0.79 mg/L) that exceed freshwater ecosystem protection criteria, and total nitrogen concentration of 0.7 mg/L. Modelling results indicated that at the adopted concentrations, there would not be a measurable increase in contaminant concentrations downstream in the Mitchell River or Perry River.

6.13. Impacts to ephemeral stream biodiversity and downstream users

Submission 291 comments that "there will also need to be consideration of waterways downstream of the dam, before they join the Mitchell River, and the need to maintain flows for these environments".

The GSWIA has considered potential impacts to the downstream users in the ephemeral drainage gullies in Section 8.4.3.

I concluded that the likelihood of temporary water management dams reducing surface water flows to the ephemeral creeks and gullies during the period of operation was considered Likely and the consequence of a negative effect to the beneficial uses listed above could be Moderate, resulting in a High risk of impact. To address this, Kalbar will undertake periodic monitoring of surface water levels, quality and ecosystem health features downstream of the project area to assess water level and quality to ensure that ecosystem health is not adversely affected. Based on monitoring results, the offset of water that would typically be returned via the water pipeline to the Mitchell River, may alternatively be directed down drainage gullies in a controlled manner.

It is my opinion that the proposed management measures will ensure that the volume of retained water in the gullies is known, and the proposed offset with fresh water has been well stated in the EES and the GSWIA report. This includes options to direct the offset water to the drainage gullies in a controlled manner. I would recommend that the Kalbar in consultation with SRW consider including mechanisms to allow offset water to be delivered directly to impacted farm dams, offering improved water quality compared to baseline conditions.

6.14. Traditional Owner cultural values of water

The quality of groundwater and surface water in Victoria is protected under the State Environment Protection Policy (SEPP) (Waters) 2018, which is issued under the Environment Protection Act 1970. The SEPP (Waters) 2018 sets out the beneficial uses of groundwater and surface water that require protection, and includes ‘Traditional owner cultural values’.

This beneficial use is described as “protecting the values of water for cultural needs, to ensure that Traditional Owner cultural practices can continue. Values may include traditional aquaculture, fishing, harvesting, cultivation of freshwater and marine foods, fish, grasses, medicines and filtration of water holes”.

A beneficial use is considered to be precluded when the required water quality criteria for that particular beneficial use is exceeded. The SEPP (Waters) 2018 states that:

> *No specific environmental quality indicators or objectives are provided for the two beneficial uses of Traditional Owner cultural values; and Cultural and spiritual values. Environmental quality objectives for other beneficial uses such as water dependent ecosystems and their species go some way to protecting the cultural and spiritual values, including spiritual relationships, sacred sites and customary use. Where environmental quality indicators and objectives specified for other beneficial uses do not adequately protect cultural and spiritual values or Traditional Owner cultural values then subclause (4) applies. Traditional Owners should be engaged in the development of environmental quality indicators or objectives through local management and planning processes for waterways and catchments.*

As a result, an assessment of Traditional Owner cultural values of groundwater and surface water in the study area was completed adopting environmental quality objectives for the beneficial use of ‘Water Dependent Ecosystems and their Species’.

A workshop with Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) was planned during the baseline assessment period and prior to writing the Assessment report to discuss other specific cultural values of water that the traditional owners may have to the study area, and which might require specific consideration. It is understood that this was postponed by GLaWAC.

Consequently, the assessment of traditional owner cultural values of water has been partially assessed in the GSWIA, considering potential water quality impacts to Traditional Owner cultural values.

The Cultural Heritage Assessment should be consulted for a more holistic assessment of Traditional Owner cultural heritage impacts, and it would also be desirable if discussions with GLaWAC could continue, if possible, to discuss water quality objectives to protect Traditional Owner cultural and spiritual values.

Submission 662, subsequently provided by the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) on behalf of the Gunaikurnai people, provides further context regarding some of the cultural values of surface water and groundwater features. The following extract is taken from Submission 662.

> "GLaWAC is concerned about the impact of the proposed mine on the surface water and groundwater in the area; we concede we lack the technical knowledge to determine the level of risk, but through this submission wish to highlight the importance of Wangangarra [Gunaikurnai name for the Mitchell River upstream from Bairnsdale], the seasonal streams in the area and the values they support, including freshwater cray, and the Perry and the Chain of Ponds that are part of the Perry system. For the Gunaikurnai, the Perry River and the Chain of Ponds would have been a reliable source of freshwater, even in times of drought."

The GSWIA has assessed the potential impact of the project on the Traditional Owner cultural values protected beneficial use of surface water. This is based on assessment of predicted changes to surface water quantity and quality downstream of the project within ephemeral drainage gullies and receiving waters of the Mitchell River (Wangangarra), Perry River and Gippsland Lakes.

After applying control measures to minimise the discharge of mine contact water, I concluded that a residual risk of water quality impact to the aquatic ecosystems of the receiving waters was Very Low. In line with the SEPP (Waters) 2018, this assessment extends to the Traditional Owner cultural values protected beneficial use.

6.15. Monitoring requirements

Groundwater and surface water

A number of specific recommendations have been made in several submission in relation to ongoing groundwater or surface water monitoring. In most cases the comments relate to the draft Water Quality and Hydrology Risk Treatment Plan (which I did not author), but which generally reflects the recommendations made in the GSWIA.

Recommendations were general in nature and address key data gaps or critical monitoring points that would be required to adequately monitor potential impacts that were identified in the GSWIA.

As a whole, all comments relating to recommended improvements to the proposed monitoring activities are noted and will be considered during later development of more detailed monitoring plans.

I offer the following responses to some specific comments or recommendations raised in submissions:

- Baseline monitoring has been ongoing since 2017 and is recommended to continue through until the start of construction. Section 9.3.1 of the GSWIA states, "Baseline monitoring will continue from the existing monitoring network through until the start of mine construction.".
- In my opinion, higher frequency surface water quality monitoring set at a routine monthly frequency would be not significantly improve the certainty of conclusions in the GSWIA. The approach of combined quarterly scheduled sampling and flow event sampling is considered more beneficial than more frequent sampling of stagnant ponds.

Tailings return water

Submission 514 recommends that a monitoring program should be implemented to monitor the water draining from the tailings to ensure the quality of this water remains within risk based trigger levels designed to ensure that the water seeping from the tailings would not lead to an unacceptable risk to protected beneficial uses of groundwater.

I support this recommendation.

GDE monitoring

Recommendations were made in some submissions to include a GDE Management plan to be implemented by Kalbar to further improve the confidence in protecting GDEs. This recommendation is consistent with the statements made in *Section 9.5 - GDE management strategy* of the GSWIA.

Table 9-1 of Risk Treatment Plan: Biodiversity commits to the following monitoring of watercourse health, which will include the identified terrestrial GDEs:

- 2-yearly AUSRIVAS (or equivalent) assessment of biophysical condition of ephemeral drainage lines (Perry Gully; Simpsons Gully; Lucas Creek; Long Marsh Gully; Moilun Creek and unnamed tributary of Honeysuckle Creek).

Detailed monitoring requirements will be incorporated into the final risk treatment plans and will reflect approval and regulator requirements.

Performance standards

In response to Section 9.3.4.2 of the EES, submission 552 lists a number of recommendations for Kalbar to establish more quantifiable measures and performance standards.

Detailed performance standards will be incorporated into the final risk treatment plans and will reflect approval and regulator requirements.

7. Declaration

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Inquiry and Advisory Committee.

Signed ……………………………………………

Dated ……2 February 2021………………

Annexure A - Curriculum vitae

Our people

John Sweeney BSc (hons) MIAG RPGeo

Senior Associate Hydrogeologist

Professional profile

I am a hydrogeologist and environmental consultant with over 15 years of experience supporting clients across the mining, oil and gas, defence, civil infrastructure, property development, and water sectors.

Throughout my career I have gained broad experience working on Australian and international projects where I have applied my technical expertise in groundwater conceptualisation, hydraulic testing, water resource assessment, geochemistry, and environmental impact assessment. I also have extensive experience in contaminated land assessment including the assessment of former industrial properties, contaminant hydrogeology, and the assessment of natural attenuation processes.

Qualifications

- University of Melbourne, 2004, Bachelor of Science (honours)

Other training

- Applied Groundwater Modelling Using Visual MODFLOW (Schlumberger).
- Soil and Groundwater Pollution (National Groundwater Association).
- Introduction to Hydrogeochemistry (Minerals Council of Australia)
- Introduction to Hydrogeology (Minerals Council of Australia)

Professional associations & positions

- International Association of Hydrogeologists (Member)
- Australian Institute of Geoscientists:
  - Registered Professional Geoscientist
  - Victorian Branch Committee Member
  - Registration Review Panel Member

Career summary

- 2016-present, Senior Associate Hydrogeologist, Coffey Services Australia Pty Ltd
- 2013 – 2016, Senior Hydrogeologist, Hydrus Consulting Pty Ltd
- 2008 – 2013, Senior Hydrogeologist, WorleyParsons Pty Ltd
- 2005 – 2007, Environmental Scientist, Golder Associates Pty Ltd

Areas of expertise

- Physical hydrogeology
- Groundwater resource management
- Environmental impact assessment
- Groundwater resource exploration
- Mining hydrogeology
- Aquifer testing
- Groundwater modelling
- Dewatering assessments
- Contaminant hydrogeology

Environmental impact assessment

Bawdwin Mine, Myanmar Metals Ltd, Myanmar.

Designed and established the baseline groundwater and surface water monitoring program to assess existing conditions at the 600-year old Bawdwin mine in northern Shan State, Myanmar. Scope included in country assessment to develop a conceptual model of the water environment, characterise groundwater and surface water occurrence and quality, and assess potential impacts of the proposed mine redevelopment and ancillary infrastructure on sensitive water receptors. The in-country assessment included training local environmental specialists to continue periodic baseline groundwater and surface water monitoring.

Gold Ridge Mine, Gold Ridge Mining Ltd, Solomon Islands

Lead the scoping and implementation of a baseline groundwater assessment to support the environmental approvals to redevelop the Gold Ridge mine. Scope included in-country assessment to develop a conceptual hydrogeological model, identification of historical contamination issues, and establishing a network of groundwater monitoring wells. Authored the groundwater sub-plan for the site Environmental Management Plan.

Wafi-Golpu Project, Wafi-Golpu Joint Venture, Papua New Guinea.

Authored the groundwater impact assessment chapter for the proposed block cave copper-gold mine located approximately 300 kilometres (km) north-northwest of Port Moresby. Located in a high rainfall zone and combined with potentially acid-forming characteristics of the rock, the project required consideration of groundwater impacts, and a robust water management strategy through operation and closure. Presented impact assessment conclusions to key stakeholders, including PNG government, and independent review panel.

Sepik Development Project, Frieda River Limited, Papua New Guinea.

Authored the groundwater impact assessment chapter for the Sepik Development Project environmental impact statement (EIS). The project included two commercial projects: the Frieda River Copper-Gold Project and the Frieda River Hydroelectric Project. The assessment considered potential groundwater impacts associated with a new integrated tailings storage facility and hydroelectric dam reservoir located within the Frieda River valley, and a conventional open-pit mine operation.

Waisoi Project, Namosi Joint Venture, Fiji.

Completed the baseline characterisation and groundwater and surface water impact assessment for the Waisoi Copper Gold project located on Viti Levu, approximately 30 km northwest of the Fijian capital Suva. Adopted a significance assessment approach to assess the level of impact of the project on identified environmental values.

Tonkolili ESHIA, African Minerals Ltd, Sierra Leone.

Conducted a groundwater and surface water baseline assessment across the greenfield mine site, infrastructure corridor and new port development. Developed a conceptual understanding of the hydrological cycle and completed a groundwater and surface water impact assessment for the project. Provided input into the ESHIA report for submission to regulators and international investors.

Poltava Mine DFS, Ferrexpo Poltava Mining, Ukraine.

Liaised with local senior mine management to develop an Integrated Water Management Plan for expansion of this existing iron ore mine. Assessed mine water security and potential environmental impact from the mine expansion. Developed input for the definitive feasibility study (DFS) report on issues of hydrogeological resource assessment, dewatering production rates, likely environmental impacts, and water management issues.

Water Resource Assessment, Eurasia Gold, Kyrgyzstan.

Preliminary water resource assessment for proposed mining development in Kyrgyzstan. Identified and worked within international best practice standards and legislation for transboundary aquifer management. Produced a preliminary water resource assessment report to guide the development of further scoping studies.

Mining

Iron Duke TSF dewatering, OneSteel, South Australia. Developed a numerical groundwater model (MODFLOW) to assess different methods of combating rising water levels around two tailings storage facilities. The model was used to identify the optimal arrangement of dewatering wells, drains and caissons to achieving the required drawdown. Supervised a program of aquifer testing at wells adjacent to a tailings storage facility. Interpreted results to refine the aquifer parameters and provide recommendations for sustainable pumping rates and pump sizing. Developed an ongoing groundwater level and quality monitoring program.

Groundwater Exploration, OneSteel, South Australia. Desktop assessment followed by a groundwater exploration program aiming to identify a sustainable process water supply for the Southern Middleback Range mine sites. Supervised a programme of groundwater exploration drilling and aquifer tests at Iron Baron to identify a sustainable mine water supply.

Groundwater assessment, Incitec Pivot, Phosphate Hill, Australia. Developed a transient site water balance and reviewed projected dewatering requirements to incorporate into a long term groundwater resource assessment. Provided an estimate of groundwater storage and the ability of the major aquifers to meet future demand. Assessed alternative resources in neighbouring groundwater basins and developed an exploration schedule to ensure future water supply security. Provided a preliminary groundwater impact assessment for submission to regulators.

Tengrela Groundwater Assessment, Perseus Mining Ltd, Cote d'Ivorie. Reviewed existing exploration and environmental baseline data to direct a groundwater exploration program at a greenfield mine development. Used GIS tools to interpret numerous data sets and identify exploration target zones. Provided remote assistance during drilling activities ahead of onsite aquifer test work.

Tonkolili DFS, African Minerals Ltd, Sierra Leone. Carried out a groundwater resource assessment for a greenfield mine development. Identified groundwater resource options for construction and operational phases of the mine site, 200 km railway and a deep water port. Provided groundwater resource estimates including quantity, quality and likely extraction potential for inclusion in the client's DFS report.

Tonkolili Tailings Assessment, Perseus Mining Ltd, Cote d'Ivorie. Developed a 3D numerical model (MODFLOW) to predict TSF infiltration rates in an environmntally sensitive area. Used the numerical model to test the effectiveness of different TSF water management options on infiltration rates. Preparations made to advance the model to assess contaminant transport and the potential for impact to environmental receptors.

Poltava Mine DFS, Ferrexpo Poltava Mining, Ukraine. Liaised with local senior mine management to develop an Integrated Water Management Plan. Assessed risks to the reliable supply of mine water and potential issues of environmental impacts. Developed input for the definitive feasibility study (DFS) report on issues of hydrogeological resource assessment, dewatering production rates, likely environmental impacts, and water management issues. Provided advice and drafted input for inclusion in DFS report.

Water Resource Assessment, Eurasia Gold, Kyrgyzstan. Preliminary water resource assessment for a proposed mining development in Kyrgyzstan. Identified and worked within international best practice standards and legislation for transboundary aquifer management. Produced a preliminary water resource assessment report to guide the development of further scoping studies.

Infrastructure & Construction

North East Link Project (Tender Submission), Victoria, Australia. Formed part of the specialist hydrogeological team supporting ViaNova's (consortium of John Holland Group, Acciona Construction, Lendlease Services, Plenary Group, Acciona Concesiones) tender submission for the design, construction and operation of this $16 billion tunnelling and road infrastructure project located in Melbourne's inner east. Responsibilities included providing technical advice to the design and construction teams, identification of high value groundwater dependent ecosystems, assessing the potential project impacts of the proposed design to sensitive groundwater and surface water receptors, and developing suitable mitigation measures to minimise potential impacts.

M6S1 tunnel (Tender Submission), New South Wales, Australia. Formed part of the specialist hydrogeological team supporting CPB-Ghella Joint Venture's tender submission for design and construction of this $2.5 billion road tunnel project in Sydney's inner south. Responsibilities included providing technical hydrogeological advice, assessing existing groundwater contamination risk, assessing the potential project impacts to the surrounding environment and groundwater users, and developing appropriate mitigation measures.

Level Crossing Removal Project – North West Program Alliance, Melbourne. Groundwater and land contamination assessment and management advice during delivery of a programme of grade separation projects for the North West Program Alliance.

420 Spencer St, Maxcon Pty Ltd, Melbourne Australia. Carried out groundwater sampling, aquifer testing and groundwater modelling for a proposed residential development at 420 Spencer St Melbourne to establish the likely range of groundwater drain flows associated with permanent dewatering of an excavated and constructed basement.

Casey Cultural Precinct, City of Casey, Australia*.* Engaged to conduct a field hydrogeological assessment and groundwater modelling for dewatering of the proposed Casey Cultural Precinct redevelopment. Responsibilities included project management of the installation of six groundwater monitoring wells, aquifer hydraulic testing & interpretation, and development of a numerical groundwater model to simulate dewatering of the basement excavation.

Water supply

Bylong Coal Mine water supply, KEPCO Bylong, Australia. Conducted several variable rate and 24 hour constant rate pumping tests to assess the water resources within the project area of the Bylong Coal Project, approximately 55 km north-east of Mudgee in New South Wales. The collected data was analysed to provide a preliminary feasibility assessment of a groundwater-sourced mine water supply.

Irrigation Water Supply, Hooke Property, Australia. Provided field supervision of a 7 day groundwater pumping test to investigate the suitability of using a deep lead aquifer in Serpentine, Victoria to supply irrigation water. The purpose of the was to determine if the design demand yield of 10-20 ML/day could be sustained over a long-period of time without affecting the raw water quality, overlying aquifers and Serpentine Creek.

Contaminated land

OneSteel Martin Bright, Somerton, Victoria. Project manager for $1.4M groundwater investigation and remediation project to manage hexavalent chromium and PFAS contamination associated with historical chrome plating facility. Project included installation of over 200 groundwater wells, groundwater remediation and risk assessment for two contaminant plumes migrating offsite towards groundwater dependent ecosystems. Work included developing and implementing complex scopes of work to assess groundwater, surface water, soil, stormwater and air impacts with short deadlines. Ultimately delivered close-out of contamination issues and transition to a phase of ongoing monitoring.

Environmental Manager Secondment, AkzoNobel Pty Ltd, Melbourne, Victoria. Managed the response of a global paint and coatings manufacturer to an EPA enforcement notice relating to perceived contamination of soil and groundwater. Provided guidance on the technical approach needed to respond to the notice as well as coordinate a tender for subsequent site assessment work. Represented the client at meetings with the auditor and interfaced with the client's legal team. Conducted a comprehensive Phase I Site Assessment including a review of the complex fractured aquifer setting, regional contamination issues and industrial development history of the local area.

Paisley Park Childcare Centre, Mollard Property Investments, Flemington, Victoria*.* Completed a preliminary environmental assessment of a former commercial property in Flemington, Victoria. The property was subject to a 53X EPA Environmental Audit required to rezone the site for redevelopment as an early learning centre. Developed a work plan to potential contamination risks identified during by preliminary assessment which was accepted by the appointed Auditor and is due for implementation during 2016.

Caltex Dandenong North, Caltex, Dandenong North, Victoria. Provided an assessment of groundwater contamination beneath a former Caltex Service Station being rezoned for residential development. Drafted a CUTEP (clean up to the extent practicable) submission for auditor approval based on multiple lines of evidence including; plume stability, mass flux assessment, assimilative capacity review and risk assessment to down gradient receptors.

Landfill Compliance Reporting, Wollert Landfill, Victoria. Reviewed groundwater and surface water monitoring data and drafted a groundwater monitoring plan to standardise future monitoring activities at a municipal landfill. Victoria, Australia.

Landfill Risk Assessment, Darebin City Council, Victoria, Australia. Designed the phase I and phase II site investigations of a former quarry filled with waste. Supervised a program of test pitting to delineate the extent and nature of the landfill material. Installed landfill gas bores to determine the presence and level of risk posed by landfill gas. Conducted indoor air quality monitoring in surrounding buildings. Melbourne, Australia.

Lyndhurst Landfill Compliance Monitoring, SITA, Lyndhurst, Victoria. Conducted annual groundwater and surface water monitoring data reviews for a hazardous waste landfill site. Provided guidance on the expansion of the existing groundwater monitoring network and supervised subsequent drilling activities.

Landfill Risk Assessment, London Borough of Barking and Dagenham, United Kingdom. Carried out a site investigation and risk assessment for a historical landfill to identify potential risks posed by residual contamination to human health and environmental receptors. This involved development of conceptual site model and contaminant fate and transport modelling using the Environment Agency's Remedial Targets Spreadsheet.

Tullamarine Landfill, Cleanaway, Melbourne, Victoria. Supervised geotechnical drilling (including rock core logging), groundwater monitoring well design and installation (including DNAPL wells) associated with hazardous waste landfill.

Webb Dock Redevelopment, Melbourne International Container Terminals Ltd, Melbourne, Victoria. Provided environmental support and technical advice on contaminated land issues during the tender process for the planned redevelopment of the Webb Dock East and West container terminals. Activities included strategic review of site contamination assessment information to support the Concept Design services for development of the tender response by McConnell Dowell and SMEC. This work ensured that the tender identified and accounted for all contractual and practical redevelopment issues associated with soil and groundwater contamination at the site.

Olympic Redevelopment Project, London Development Agency, United Kingdom. Undertook site investigation, soil sampling, groundwater well installation and groundwater sampling. Identified areas of soil contamination requiring offsite disposal. Undertook soil waste classification and provided estimates for tender development. Developed a soil remediation approach document.

Gasworks Groundwater Remediation, National Grid, Dunstable, UK. Undertook groundwater sampling and data analysis for development of a site conceptual model at a former gasworks. Developed, in conjunction with local stakeholders, a detailed approach to modelling the transport of dissolved phase contaminants.

Groundwater Risk Assessment, National Grid, United Kingdom. Undertook groundwater investigations at numerous former gasworks sites across the UK to develop controlled waters risk assessments. This involved the development of site conceptual models followed by contaminant fate and transport modelling and numerical groundwater modelling to assess the level of risk to controlled waters receptors. Worked closely with local stakeholders and regulators.

Groundwater Risk Assessment, Wycombe District Council, United Kingdom. Designed a groundwater monitoring programme to identify the likely source of a plume of PCE contamination detected beneath the High Wycombe town centre. Proposed a further phase of site investigation to delineate the extent of contamination and develop a numerical groundwater model to assess the risk to local controlled waters receptors.

Oil and gas

Spatial Analysis of Coal Seam Gas Water Chemistry, Queensland Department of Environment Resource Management (DERM), Australia. Spatial analysis of hydrogeochemistry and potentiometry of the Surat and Bowen Basins. Constrained local and regional flow paths. Hydrograph analysis and residual head mapping to identify zones of potential inter-aquifer flow.

Provision of Research Services on the Impacts of Coal Seam Gas and Coal Mining on Water in a Panel Arrangement, Office of Water Science, Australia. National proposal manager for successful appointment to a panel of experts to provide research services to the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Developments. Ongoing project coordination role after appointment through attendance at industry briefings in Canberra.

Bioregional Assessment, Southern Gulf Catchments, Queensland, Australia. Completed a preliminary vulnerability assessment of over 600 groundwater bores in close proximity to proposed CSG development in the Galilee Basin, Queensland. This work involved assigning a likely aquifer formation to each bore based on drilling logs, geological reference documents and petroleum & CSG exploration data in the area.

Surat Gas Project – Drilling Supervision, Arrow Energy, Queensland, Australia. Provided drilling supervision and bore construction design in the Surat Basin, Queensland. Drilling of shallow groundwater observation and pumping bores in the Condamine River Alluvium and Gubberamunda Sandstone Aquifer.

Produced Water Injection Study, Arrow Energy, Queensland, Australia. Provided hydrogeological support to various studies into the viability of injecting treated waste water from coal seam gas extraction. Developed summaries of expected groundwater chemistry across multiple aquifers leading to a study of produced water treatment requirements. Carried out an options narrowing study to identify viable injection options, technologies and methodologies.

Baseline Groundwater Assessment, Australia Pacific LNG, Darling Downs, Queensland. Involved auditing and sampling land holder groundwater bores within coal seam gas development regions of the Surat Basin. Educate landholders on CSG activities and regional hydrogeological setting. Data management and coordinate reporting for landholders.

Produced Water Injection Study, Rasheed Petroleum (Rashpetco), Egypt. Developed a numerical groundwater model using GW Vistas to assess the technical and commercial feasibility for deep injection of produced water below an onshore gas treatment facility. Modelled various scenarios to assess pressure predictions (Modflow), fluid migration (Modpath) and contaminant transport (MT3D).

Annexure B - Instructions

WHITE & CASE

15 September 2020

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Australia

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John Sweeney
Coffey Services Australia Pty Ltd
Level 1, 436 Johnston Street
Abbotsford, Victoria 3067

By email: john.sweeney@coffey.com

Confidential and subject to legal professional privilege

Dear Mr Sweeney

Fingerboards mineral sands project

We act as legal advisors to Kalbar Operations Pty Ltd (**Kalbar**), the proponent of the Fingerboards mineral sands project (**Project**).

This letter confirms and sets out the scope of your retainer to prepare an expert witness statement and potentially also present evidence at the inquiry hearing to be held in relation to the environment effects statement (**EES**) prepared for the Project pursuant to the *Environment Effects Act 1978* (Vic).

1. The Project

Kalbar proposes to develop the Project on an area of approximately 1,675 hectares within the eastern part of the Glenaladale mineral sands deposit in East Gippsland, Victoria. The Project site is located near the Mitchell River, approximately 2 km south of Glenaladale, 4 km south-west of Mitchell River National Park and 20 km north-west of Bairnsdale.

The Project includes the development of an open cut mineral sands mine and associated infrastructure. It is expected to have a mine life of 15–20 years and involve extraction of approximately 170 Mt of ore to produce approximately 6 Mt of mineral concentrate for export overseas.

2. Panel and EES inquiry

The EES and the studies and assessments that underpin it (together with a draft planning scheme amendment and application for an EPA works approval) are presently on public exhibition until the end of October 2020.

The inquiry is scheduled to convene its directions hearing on 13 November 2020, and the inquiry hearing is scheduled to commence on 7 December 2020. We will keep you informed of any relevant directions, including the timetable for filing evidence and, if required, any expert conferences.

3. Scope

This letter is confirmation of your engagement as an independent expert to:

(a) prepare an expert witness statement in which you:

  (i) set out your background and relevant expertise;

(ii) briefly describe and summarise the Groundwater and Surface Water Impact Assessment (**Assessment**) prepared in support of the EES and your role in preparing it. In particular, we ask that you detail whether there is anything in the Assessment that you disagree with or wish to elaborate on and set out any additional information that you consider necessary to include, including any additional assumptions; and

(iii) consider the submissions that are relevant to your area of expertise and respond to any issues raised; and

(b) if required, prepare and present expert evidence at the inquiry hearing.

We will provide further instructions on the scope of your engagement and any new instructions as necessary.

4. Form of your expert witness statement

The form and content of your expert witness statement should be prepared in accordance with Planning Panel Victoria's *Guide to Expert Evidence* (**Guide**). We enclose a copy of the Guide for your reference. Please review the Guide and ensure your witness statement addresses the matters set out in it, in particular those matters listed under the heading 'The expert witness statement'. Please contact us if there is anything in the Guide that you do not understand, or if you have questions in relation to it.

Until your expert witness statement is in final form it should not be signed. You should, however, be aware that unsigned documents may need to be disclosed to other parties.

5. Your duties and responsibilities as an expert witness

Even though you are engaged by Kalbar, you are retained as an expert to assist the inquiry, and you have an overriding duty to it. The inquiry will expect you to be objective, professional and form an independent view as to the matters in respect to which your opinion is sought.

6. Timing

The timing for completion of your expert witness statement is to be advised. We will let you know as soon as we can.

7. Conflict of interest

It is important that you are free from any possible conflict of interest in providing your advice. You should ensure that you have no connection with any potential party to this matter that could preclude you from providing your opinion in an objective and independent manner.

15 September 2020

8. Costs and invoicing

Coffey will continue to be contractually engaged by Kalbar and Kalbar will continue to be responsible for the payment of your fees. Your accounts should be sent directly to the appropriate person nominated by Kalbar.

9. Confidentiality

Your engagement and any documents you prepare under it should be marked "Confidential and subject to legal professional privilege".

If anyone other than ourselves, Kalbar or its technical advisers contact you about this engagement or the work you are undertaking under this engagement, please contact us immediately.

If you have any questions about this letter or require any additional information, please contact us.

Yours sincerely,

Tim Power

Tim Power
Partner

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Kirsty Campbell

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Enc: Planning Panel Victoria's *Guide to Expert Evidence* - April 2019

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