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30 May 2024

Mr Andrew Woidt
Land Access and Approvals Lead (SA/NT)
BHP Olympic Dam Corporation Pty Ltd
Level 6, 10 Franklin Street
ADELAIDE SA 5000
Via email: [redacted]

Dear Mr Woidt

Request for Response Document – Oak Dam Retention Lease Proposal and Miscellaneous Purposes Licence Management Plan

I refer to your applications dated 5 December 2023 as detailed below:

Applicant Name	BHP Olympic Dam Corporation Pty Ltd
Application Type	Retention Lease and two Miscellaneous Purposes Licences
Application Date	5 December 2023
Miscellaneous Licence/ Retention Lease Reference	RLA M2023/0161 MPLA 2023/0338 MPLA 2023/0339

The Retention Lease (RL) and two Miscellaneous Purposes Licences (MPLs) application documents submitted were publicly advertised and circulated to the landholder with an invitation for comment from 28 March to 2 May 2024.

The RL and MPL applications were circulated to relevant government departments. A consolidated list of matters raised and requested information is provided in **Attachment 1**.

The Department for Energy and Mining (DEM) received one public submission which has been included as **Attachment 2**.

REGULATION AND COMPLIANCE DIVISION
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Government of South Australia
Department for Energy and Mining

Next Steps		Details
1	Review matters raised by Government	Matters raised by Government are included in Attachment 1.
2	Review Public Submission	Copy of the public submission received is provided in accordance with section 56H(4)(a) of the *Mining Act 1971* (Mining Act) in Attachment 2.
3	Submit Response Document	In accordance with sections 44(2) and 49(2) of the Mining Act DEM requires you to provide a formal written response document, addressing the matters raised by government and in public submissions within 90 days. Please submit the Response Document via email to: • DEM.MiningRegRehab@sa.gov.au

If you have any further queries, please contact DEM staff as below:

Nathan Zeman
Team Leader Mining Assessments
DEM.MiningRegRehab@sa.gov.au
nathan.zeman@sa.gov.au
[redacted]

Yours sincerely

Nathan Zeman
TEAM LEADER MINING ASSESSMENTS
Signed in accordance with delegated powers and functions

Attachment 1: Matters raised by Government

#	Proposal Ref.	Description of Matters Raised	Further Information Required in a Response Document
Matters Raised by Department for Energy and Mining			
1.	Section 2.2.4 Third-party mining tenements	Further information is required describing how proposed operations are intended to interact with existing and proposed activities on overlapping third-party mineral tenements, particularly where an agreement pursuant to section 80(2) of the Mining Act is yet to be reached with those overlapping tenements. The further information should demonstrate that those interactions will not compromise the ability to undertake authorized operations on the proposed lease/license or achieve any proposed environmental outcomes. Further information is required on the results of consultation undertaken with overlapping third-party mineral tenement holders. It is noted that local mining and exploration companies have been identified as key stakeholders (Section 6.2 of the Proposal), however the results of consultation with these stakeholders has not been provided.	Provide the further information requested in the matters raised.
2.	Section 4.4.2 Exploration	The description of exploration activities is to be reviewed to ensure that the exploration activities that are proposed to continue on the proposed RL are aligned with the activities described in the approved ongoing Exploration PEPR 2022-031, including rehabilitation of those activities. As an example Table 5.3 (Rehabilitation (design, construction and operation) considerations) mentions rehabilitation of drill pads, but does	Provide further information describing all relevant activities in Exploration PEPR 2022-031, inclusive of rehabilitation activities and timing which have not been adequately addressed in the RL Proposal.

		not mention rehabilitation of exploration drillholes, groundwater exploration drillholes or geotechnical investigation deep drilling holes. Similarly, the schedule of rehabilitation of exploration activities described in the Exploration PEPR 2022-031 is not reflected or considered in the rehabilitation timing described in Section 5.1.6 of the RL Proposal and should be clarified. Further information must be provided on any activities described in the approved Exploration PEPR which have not been reflected in the RL Proposal.	
3.	Exploration impact assessment	It appears impacts and environmental outcomes associated with the exploration activities, as described in the Exploration PEPR 2022-031 have not been clearly assessed or included in the RL Proposal impact assessment.	Review the impact assessment and provide further information on the potential impacts, control measures and associated outcomes and measurement criteria to ensure all potential impacts associated with exploration activities are appropriately assessed.
4.	Section 4.3.7 – Borrow Pit(s)	Section 4.3.7 states that extractive minerals will be "recovered from a borrow pit(s) established on, and authorised by, the Proposal to support the OKDUGA Project activities" (Section 4.3.7). No further detail is provided of what extractive minerals/material this will be (e.g., lime and sandstone from crushed rock from the overburden) and for what it will be used for (e.g., road base). Section 5.2.2.4 mentions that rehabilitation of the borrow pits would include backfilling of any remaining stockpiled extractive materials to the pit. Further information about the type and use of extractive minerals/materials is requested.	Provide further information about the type and use of extractive minerals/ materials.

5.	Section 4.7.2.4 Construction (Waste Rock) 5.2.2.3 Domain 2 (surface infrastructure) – Waste rock landform	Section 4.7.2.4 states *"is likely the waste rock would be dumped using either paddock dumping or end tipping."* Best practice for the placement of waste rock is considered to be through paddock dumping to reduce pore spaces. Refer to the Rock Placement Strategies to Enhance Operational and Closure Performance of Mine Rock Stockpiles (INAP report) for further information regarding methods for waste rock formation.	Provide further discussion to demonstrate paddock dumping is being considered the preferred method of placing waste rock.
6.	4.10.3.2 Electricity supply	The proponent is advised to contact DEM Office of the Technical Regulator (OTR) to discuss a generator development approval certificate Generator development technical requirements and approvals (energymining.sa.gov.au) and electricity infrastructure Safety, Reliability, Maintenance and Management Plan (SRMTMP), and ESCOSA to obtain an electricity transmission and distribution licence, if the decision is made to connect to the existing transmission network. In this case the SRMTMP requirement could be met by adding the new assets to the existing BHP SRMTMP Electricity transmission and distribution licence - BHP Olympic Dam (escosa.sa.gov.au).	
7.	Section 5 Waste rock landform and borrow pit closure plan	Further information is required in relation to the closure and rehabilitation plans for the waste rock landform and borrow pit. The proposed post closure land use of the OKDUGA is to return the land to pastoral use. It is projected that by the end of the project there will be a total of 1.2 million tonnes of waste produced. The waste rock is proposed to be stockpiled on a waste rock formation within the confines of the allocated fenced surface infrastructure footprint (Figure 1.2 & Figure 4.1). DEM consider that instead of the stockpiling of waste rock formation (WRF) material there may be opportunity to use this material to fill the proposed borrow pit. This could assist with: 1. Reduction of surface footprint from mining activities.	Provide information to demonstrate that all opportunities for progressive rehabilitation have been considered, in particular for the storage of waste rock. Provide a discussion on the option and potential for using waste rock material in backfilling the borrow pit.

		2. Making the requirement and effort of rock armouring to WRF negligible (Figure 4.14) and facilitate progressive rehabilitation. 3. Reducing the risk of slope erosion and failure post closure of borrow pit by filling with waste rock material. Assuming the estimates of the waste rock formation are correct in Figure 5.4, this strategy can fill approximately half of the borrow pit void. This could lead to a more favourable closure outcome for the OKDUGA project.	
8.	Section 5.2 Closure	The document states in all domains 5.2.2.1 that: *“Monitoring and Management Plans to be developed for closure during the operational stage for revegetation, weed and feral pest management and sediment and erosion control.”* This is suggesting that Monitoring and Management plans for closure are going to be developed during operations. Specific monitoring and management strategies and plans for closure must be included in a PEPR (should a lease/license be granted) prior to operations commencement.	For noting.
9.	Section 5.2 Closure	Following Comment 8, monitoring and management plans are to be developed during operations, suggesting that the comparison of post closure ecological surveys and ecological baseline surveys have not been considered, see table 7.5, and associated proposed environmental outcomes and outcome measurement criteria tables (Table 8.2, 8.3, 8.4, 8.5).	Clarify if and when post closure ecological surveys will be completed for demonstrating achievement of mine completion outcomes.

10.	Section 5.2.2.3 Closure and rehabilitation phase (Domain 2)	Page 197 of the Proposal states *"NORM (including PAF, if required) would be contained within a cell 2.5m from the surface of the WRL to meet South Australia regulations for radiation containment; however, the remaining WRL surface would not require the capping layer."* Section 4.7.2.3 further states "*some drilling muds may contain NORM*". It is noted that Figure 4.14 is general in nature and not specific as to where and how NORM material (if encountered) will be contained. Further detail is required about the NORMs which are expected to be encountered, including: • What is the estimated volume and area of each NORM material predicted throughout the project; and • Are the NORM materials expected to be encountered in only drilling muds or will there be rocks which also contain NORMs A discussion should be provided on how NORM material will affect the achievement of closure outcomes, should NORM material be encountered.	Provide further information and discussion on NORMs as per the matters raised.
11.	Section 5.2.2.4 Closure "Borrow pit(s)"	The statement "Borrow pit(s)" (pg 200) infers there may be multiple borrow pits in scope for the project. The term "Borrow pit(s)" is used throughout entire document, for example Section 4.7.4 (pg 142) "on-lease borrow pit(s)", however, the plans – Fig 4.15, Fig 5.3, Fig 5.4 only show one large borrow pit. Consistent terminology should be used throughout the report.	Clarify how many borrow pit(s) are proposed for the project. If additional borrow pits are proposed, additional detail must be provided including locations and design details.
12.	Section 5.2.2.3 Closure	Shaping of the waste rock landform should be to final slopes of no greater than 1:4 (as per Section 5.2.2.1 which states *'Shaping of*	Confirm that the final shape of the waste rock landform will have a slope of no greater than 1:4.

	Domain 2 (surface infrastructure)	*landscape to ensure no slopes greater than 1 vertical in 4 horizontal would remain upon closure.'*	
13.	Section 5.2.2.4 Closure	Borrow pits - Grading and battering of pit slopes is proposed to a gradient of 1:3 or less. DEM recommends that a gradient 1:4 should be considered as per 5.2.2.1.	Review and provide clarification on the gradient of the borrow pit upon closure
14.	Section 5.2.2.4 Closure	Fig 5.4 Post-closure (cross section) – the Borrow Pit Cross section shows a slope of 45 deg. This should be 1:3 to be consistent with what is proposed in section 5.2.2.4 (or with updated pit slope gradient as per previous comment 13)	Provide an updated borrow pit cross section that is consistent with the pit slopes described in section 5.2.2.4.
15.	Tables 8.2, 8.3, 8.4 and 8.5	Tables 8.2, 8.3, 8.4 and 8.5 identifies the SPR ID related to the Environmental outcome. However, some SPR ID listed are not linked to a confirmed impact event. For example: RL Project Area. Air (noise) - A01 Air (air quality) – A52, A53 Air (radiation) – A43, A44, A45, A46, A47 Air (greenhouse gas) – A60, A61 Groundwater (quantity) – GW20 to GW35 Land (habitat and vegetation quality) – L37 to L40 Surface Water (quality) – SW01 to SW8, SW13 Similarly for the other tables.	Please review the confirmed impact events and the requirement for outcome, measurement criteria and strategies.
16.	Tables 8.3 and 8.4	Please clarify if Table 8.4 is a duplicate of Table 8.3 as they appear identical and are both titled: '*SIC MPL Project Area – Proposed Environmental Outcome, OMCs and Lis'*	Provide clarification on whether the tables are unintentionally duplicated.

Matters Raised by Department for Energy and Mining (Hydrogeology)			
17.	Entire document	*mRL* is not defined. Table 10.2.2 explains mRL as *metres relative level* but does not provide what the level is relative to. A definition is required for 0 mRL and an explanation provided of the relationship between mRL and mAHD.	Provide a definition for what the RL is. Provide information on the relationship between mRL and mAHD.
18.	Section 3.2.1 Hydrogeology	This section sets the foundation of the conceptual hydrogeology and should therefore be clear. Because of inconsistencies between text, table and conceptual hydrogeological cross-sections, this section is ambiguous. Please also refer to comments 19, 20 and 21. The Arcoona Quartzite is considered an aquitard (upper section) and an aquifer (lower section) in Table 3.4. However, the Arcoona Quartzite is presented as a single unit in Figure 3.9, entitled Conceptual Hydrogeological Cross-Sections. If, as the table indicates, the upper part is an aquitard, then it would be reasonable to expect that this unit would be separated from the fractured Lower Arcoona Quartzite, that is considered an aquifer, in Figure 3.9. Further, the legend in Figure 3.9 indicates that the entire Arcoona Quartzite is part of the Tent Hill Aquifer (THA). This statement may be incorrect, as Table 3.4 indicates, it is the Lower Arcoona Quartzite that is part of the THA. Please refer to Comment 31 for further justification/evidence needed on the separation. The geological legend refers to the Lower Sedimentary Package while the groundwater legend refers to the PFA (Pandurra Formation Aquifer). The concepts would be easier to follow if consistent hydrogeological units were used. The conceptual cross-section in Figure 3.9 indicates the "*water table*" in both the THA and PFA. The water table refers to the surface where the	Clarify the role of the Lower and Upper Arcoona Quartzite and ensure consistently used terms in the response document. Explain/provide further justification why the Upper and Lower Arcoona Quartzite are considered an aquitard, and aquifer, respectively. Summarise the findings of OZ Minerals (2017d) on this subject. Provide an updated version of Figure 3.9 that shows the Upper and Lower Arcoona Quartzite separated. Ensure the updated version of Figure 3.9 has a correct term for the PFA.

		water pressure is equal to the atmospheric pressure and therefore should not be used for deeper confined aquifers such as the PFA (or where the THA is confined). Please refer to Comment 21 for further notes on this subject.	
19.	Section 3.2.1 Appendix C4 2.1.2	Please also refer to Comment 40. The status of the perched aquifer and the conceptualisation of it is important because of some of the local landholder's reliance on shallow wells with low salinity (3.2.2.1). For perched aquifers to occur, water should accumulate over a very low hydraulic conductivity perching layer in the unsaturated zone. Under the perching layer unsaturated conditions should prevail down to where the water table aquifer occurs. *These fresher groundwater lenses are generally hydraulically disconnected from the regional saline groundwater system (OZ Minerals 2017d).* It would be beneficial to summarise the justification/evidence provided by OZ Minerals (2017d) for the disconnection of the perched and regional systems. An explanation is required on how representative OZ Minerals (2017d) conclusions are to the OKDUGA project. The conceptual hydrogeology in 3.2.1 is not clear on the following: what is the perching layer, what evidence is there for unsaturated conditions below the perching layer and where is the water table with respect to the perched water. Figure 3.9 does not show a perched layer, it would be beneficial to indicate it. It is important to point out that the perched water *hydraulically disconnected* is not completely independent from the underlying groundwater system as (slow) downward flow, under unsaturated	Provide evidence/justification for the perched water concept. Clarify the position of the perched system and water table aquifer underneath. Provide maps, cross-sections and explain the relationship between perched water and the water table to ensure consistent interpretation throughout the documents.

		conditions, could occur from the Quaternary perched water to the underlying water table.	
20.	Section 3.2.1 Hydrogeology App A of App. C4 2.4	It is appreciated that Figure 3.9 is a conceptual representation only. However, it is important to indicate the thickness of the units correctly, at least approximately and relatively. Table 3.4 indicates the thickness of the THA as 40 m (within the OKDUGA project) and the Woomera Shale as 20 m. Figure 3.9, however, indicates the thickness of the latter Woomera Shale as larger than that of the THA. There is a significant difference between the conceptualisation of a thin aquitard between two aquifers or a thin aquifer underlain by a thick aquitard and a thick confined aquifer, in particular, in understanding the hydraulic connection between the aquifers (here THA and PFA). *Under the THA, the Woomera Shale forms a competent aquitard mostly more than 100 m thick across most of the study area, except where the Pandurra Formation outcrops to the northeast of Lake Windabout, where it is absent, and directly east of the Project, where it is about 50 m thick.* The text above contradicts Table 2.4 that suggest a thickness of 20 m for the Woomera Shale. It is noted that the proposal does not seem to include actual hydrogeological cross-sections. Such cross-sections are required, inclusive of drillholes, groundwater heads/elevations, salinity and the topography to better illustrate the linkages between hydrogeological concepts and reality.	Provide updated and corrected conceptual hydrogeological cross-sections: provide a corrected thicknesses of the Hydrostratigraphic Unit (HSU) and updated discussion to ensure consistent information. Provide actual hydrogeological cross-sections as described in the matter raised.
21.	Sections 3.2.1 and 3.2.3.1.	The conceptual cross-section in Figure 3.9 indicates the "*water table*" in both the THA and PFA. The water table refers to the surface where the	Provide updated and corrected conceptual hydrogeological cross-

	App. C4 2.3 Figure xx	water pressure is equal to the atmospheric pressure and therefore should not be used for deeper confined aquifers such as the PFA (or where the THA is confined). It is also important to indicate the trends in groundwater elevations/heads correctly, at least approximately and relatively. In Figure 3.9 the groundwater elevations/head in the THA is consistently above that of the PFA. Figures 3.13 and 3.14, however, indicate that the two converge towards Lake Torrens. The groundwater elevations/head beneath the OKDUGA project rectangle, for example is 110-120 m AHD in the THA and 70-75 m AHD in the PFA. Just to the west of Lake Torrens, both are approximately 30-40 m AHD indicating converge towards Lake Torrens. Groundwater head/elevation is an important feature of conceptualisation and therefore it would be important to reconcile Figures 3.9, 3.13 and 3.14.	sections. Provide corrected thicknesses of the HSUs, terms, groundwater elevation / head curves and updated discussion to ensure consistent information.
22.	Section 3.2.3.1 and App. C4 Figure 2.10	It is unclear how Figure 2.10 in C4 (Figure 3.13 in the proposal) was constructed. There is a single datapoint marked in the north-east corner inside the RL rectangle and surrounded by a 120 m AHD groundwater elevation contour line. Figure 2.10 also indicates a groundwater high over the RL rectangle, with an approximate SW-NE orientation. It is suspected the high is the same as the groundwater divide in Figure 3-7, Appendix K1, Baseline hydrogeological assessment for the Olympic Dam expansion project. The divide in Fig. 3-7, however, is to the west of the RL rectangle. Map A of Kellett et.al., 1999 (Hydrogeological Assessment of a Region in Central Northern South Australia, J Kellett, S Veitch, I McNaught, A van der Voort. Bureau of Rural Sciences Australia. Canberra, 1999) also placed the divide west of the RL rectangle.	Provide an updated and corrected Figure 3.13 (and 2.10 in C4).

		A check of point groundwater elevation data in SARIG (refer https://minerals.sarig.sa.gov.au/Details.aspx?DRILLHOLE_NO=20755) suggest that Fig 3-7 of K1 is correct and the positioning of the high in Appendix C4, Figure 2-10 may be incorrect. The culprit appears, on a cursory check on SARIG, the single datapoint in the RL in Figure 2.10, that is probably water well 633600027. 633600027 had an erroneous groundwater elevation of 128.7 mAHD. The error is due to an incorrect transcript of the depth to groundwater, instead of 352' (107.4 m), 7.4 m was entered into SA Geodata. Further, even the 7.4 m depth to groundwater appears to be erroneous, probably representing an artificially low (perhaps the measurement was done when the water level was still recovering) groundwater. Please refer to the historical document attached below. Although it is recognised that the error was in SA Geodata, the onus is on the proponent to check the quality of data used for the proposal. In this case groundwater elevation data from 633600027 should not have been used for the purpose of creating Figure 2-10. A basic check between the depth to groundwater in the database and that marked in historic documents revealed the error for DEM. As a result, depth to groundwater was changed and marked "anomalous" by DEW colleagues on 13/2/2024). The position of the blue lines in Figure 3.13 (Figure 2.10 in C4), depicting inferred groundwater flow, appear to be inconsistent with the groundwater elevation contours, especially if the groundwater divide is where it is indicated by Fig 3-7 of Appendix K1. Unless based on information other than the contours, groundwater flow lines are assumed to be normal (perpendicular) to the contours. The blue lines, however, do not satisfy this criterion.	

Government of South Australia
Department for Energy and Mining

D.M. C10

S.A. DEPARTMENT OF MINES

BORE DETAILS RECORD

OFFICE USE ONLY
Sample No.
Reference F1101-
Borehole State No. 095 000 084

Occupier's Name S Kidman + Co

Postal Address Arcoona Stn

Grid I/5 Check

LOCATION OF BORE— County 3

Hundred .... Section ....

Pastoral Lease (if out of hundreds) ....

Space for sketch showing location of bore in the section (indicate distance from boundaries if possible)

NORTH ↑

BORE DETAILS—

Total depth (feet)	Water cut (feet)	Water level below surface	Supply (gallons per hour)
117m.	111m.	107.4m.	9100L/dy.

Casing size .... (inches) From .... to .... feet

Height of bore above sea level .... feet

Situation of bore (✓ where appropriate)—

In gully .... On level ground .... On ridge .... On hill ....

Pump type and size ....

Pump setting below surface .... feet

Notes on strata encountered during drilling

(Abandoned.

"North Backwater" (No 51)

QUALITY OF WATER—

Water is required for ....

Present analysis (Office use only) .... in parts per million.

Any known previous analysis 12146ppm. grains per gallon or parts per million.

Has water been used for (✓ where appropriate)—

Sheep .... Horses .... Cattle .... Poultry .... Others ....

Has water been used on—

Lucerne .... Pastures .... Vegetables .... Fruit trees .... Others ....

Has water been used for—

Washing .... Drinking .... Domestic .... Hot water service .... Boilers ....

Sample collected by (name) ....

Please forward to:—
Director of Mines,
Box 38, Rundle Street, P.O.,
Adelaide, S.A. 5000

Signed ....

Date ....

OFFICE USE ONLY

60bks50—11.70 82560 0

Signed 6336/27

23.	Section 3.5 Fig.3.30 and App. C4 Fig.2.6	The potential GDEs are difficult to see at the scale provided. An updated figure focusing on the OKDUGA project would help interpretation, as would increasing the transparency of the basemap. The source of the data should be stated (i.e. BOM GDE Atlas).	Provide an updated Potential GDE figure. Provide the source for the data used for this figure.
24.	Sections 3.5.5 and 6.12	*Lake Torrens supports aquatic GDEs in accordance with the BoM GDE Atlas, however Lake Torrens is very often dry (i.e. it has only filled twice in the last 100 years) and is hypersaline. Therefore this classification is likely inaccurate.* This is a simplistic statement. Whilst the lake is often dry, that does not disqualify it from being a GDE. It is understood, for example, that endemic species may populate salt crusts. *Lake Torrens is an important feature of the South Australian Geographical Landscape and has recognised National Parks status. The importance of Lake Torrens to the people of South Australia has been considered in the OKDUGA Project design work and studies undertaken to ensure its environmental value is held for future generations.* The statements in italics from 3.5.5 and 6.12 in the same document appear to be inconsistent. The statement in 6.12 is best demonstrated by a comprehensive assessment of Lake Torrens as a GDE.	Either provide more robust justification and evidence for the claim that the classification is inaccurate, or consider Lake Torrens as a GDE.
25.	Section 4.10.2.2 Attachment B of App. C4	Options for water supply are listed in this section 4.10.2.2 without a clear statement which option constitutes the proposal. It is unclear what the status of the *Local saline wellfield* (11 wells at 2L/s, total of **22L/s**) is and if and how the predicted impacts from this wellfield were combined with mine dewatering and the Northern Wellfield.	Provide an updated and corrected set of water scenarios with an explanation of which scenario the predicted impacts refer to.

		Attachment B of Appendix C4 reports on analytical modelling of four wells in the upper LSP (high k) layer, each at 3.75 L/s (total of **15 L/s**). Is this an alternative to 4.10.2.2 or an update? Figure B2 of Attachment B of Appendix C4 indicates significant drawdowns predicted in the LSP (high k), even intersecting (0.2m contour) the numerical model boundaries (to the SE and NW), at the end of exploration period. Figure 3.11 of Appendix C4, however, indicates predicted drawdowns (0.2m drawdown contour) in the LSP (high k) inside the model boundary of the model domain. It is understood from the text in 3.2.2 that the analytical model predictions in Figure 3.11 of Appendix C4 do include (under Cumulative Case Two) the predicted impacts from the OKDUGA wellfield: *Cumulative case two, analytical modelling of the drawdown from **OKDUGA Project** and the **Northern Wellfield** at the end of exploration, and the **OKDUGA water supply wellfield** was assessed.* It is unclear how this is possible, i.e. if the drawdown predicted from the OKDUGA water supply wells alone intersects the model boundary, how can the same predicted drawdown contour of 0.2 m in Figure 3.11 be inside the boundary from Cumulative Case Two. Note the time stamp on both figures is the same, end of exploration. Being “inside” the boundary here means less drawdown predicted from the **combined** *OKDUGA Project, the Northern Wellfield and the OKDUGA water supply wellfield* than the drawdown predicted from the latter water supply field **alone**.	Provide updated and corrected drawdown figures and text explanations to ensure consistency.

26.	Sections 7.3.6.2, 7.4, 7.5.3, 7.5.7, 7.5.8, 7.6	The summary and groundwater impact assessment provided is based on groundwater modelling using Constant Head Boundary (CHB) model boundaries where, by definition, the drawdown is assumed to be zero. As per comments 25, 42 and 50, this is considered an incorrect approach because the CHBs are impacted by drawdowns. Further, there is a large uncertainty in the adopted boundary values (comments 34, 39, 43 and 44). Therefore these sections (including what is a confirmed impact and what is not; and the uncertainties in Table 7.5), and the predicted impacts need to be reviewed and revised accordingly.	Provide a firm commitment with a plan and associated dates to review the model and update and correct model boundaries. Provide updated and corrected information relating to the assessment of potential groundwater impacts based on updated hydrogeological conceptualisation and understanding.
27.	Section 8	Please refer to Comment 26. The Outcome Measurement Criteria and Leading Indicators in Table 8.2, referring to the groundwater model, are not appropriate because of the significant model uncertainties and require review.	Provide an updated and corrected groundwater model and updated Outcome Measurement Criteria and Leading Indicators <u>or</u> provide revised model independent outcomes and draft criteria.
28.	Section 8.3	The Forward Work Plan should include a review of the groundwater model and associated date, to address the issues raised in this request for a response document.	Provide an additional plan of forward work that includes the review of the groundwater model (refer to comments 26 and 27).
29.	Section 8	The details provided on the proposed groundwater monitoring (outcome measurement criteria) are inadequate. Applicable Terms of Reference (TOR) for the Oak Dam applications requires the proponent to *as far as practical comply with the five elements set out in regulation 46(5) of the Mining Regulations 2020*. The five elements in the Mining Regulations 2020 refer to: a) what is to be measured and the form of the measurements that are to be used; and	Provide updated and corrected outcome measurement criteria details in accordance with applicable Terms of Reference and the Mining Regulations 2020.

		b) the locations where the relevant measurements are to be taken, or how such locations are to be determined; and c) what is proposed to be taken to constitute the achievement of the relevant outcomes (with consideration being given to any inherent errors of measurement); and d) the frequency of any measurement or monitoring; and e) any background or control data that is to be used, or how any such data is to be acquired. Of the five elements above, the proposal only provides three (a, c and d) in Section 8. The other two aspects, in particular the number and location of monitoring wells are required. A draft groundwater monitoring plan for this proposal is important because the groundwater impact assessment relies on a numerical groundwater model that is uncertain and inconsistent with the conceptual hydrogeology. In these circumstances, relying on actual and comprehensive monitoring data will be crucial for measuring the achievement of groundwater outcomes. Note that whilst this comment has been applied to the groundwater measurement criteria, DEM recommends that all draft outcome measurement criteria provided in Section 8.2 of the Proposal be reviewed to ensure the requirements set out in regulation 46(5) have been appropriately addressed. Updated details should be provided wherever applicable.	
30.	App. C4 2.1.2	*The wellfields total 16 production bores (CDM Smith 2018), and their locations as of 2018 are shown in Figure 2.1.* The position of the wellfields is important because of the proximity to OKDUGA. They are <u>not</u> shown in Figure 2.1.	Provide an updated and corrected figure. Include the wellfield locations to ensure consistency between text, table and figure.

		The text refers to 16 wells, Table 2.1 shows 12, Figure 2.1 shows none.	
31.	App. C4 2.1.2 A of C4 2.3.3	*Fracturing occurs mostly within the Pandurra Formation, only four exploration holes recorded observations of fracturing across the Tent Hill Formation.* Please refer to Comment 18. The statement above appears to contradict (or at least does not support) the fractured nature of the Lower Arcoona Quartzite in the proposal and Table 2.4 in C4.	Provide updated and corrected text to ensure consistency.
32.	App. C4 2.1.2 and 2.3 Table 2.4 A of C4 Table 2.3	Please refer to comments 18 and 31. The Arcoona Quartzite is considered as an aquitard (upper section) and an aquifer (lower section) in Table 2.4. However, the Arcoona Quartzite is presented as a single unit in Figure xx entitled Conceptual Hydrogeological Cross-Sections. If, as the table indicates, the upper part is a leaky aquitard, then it would be reasonable to expect that this unit would be separated from the fractured Lower Arcoona Quartzite, considered an aquifer, in Figure xx (please also correct the figure number). Further, the legend in Figure xx indicates that the entire Arcoona Quartzite is part of the Tent Hill Aquifer (THA). DEMs understanding is that is incorrect and as Table 2.4 indicates it is the Lower Arcoona Quartzite that is part of the THA.	Provide an updated Figure that shows the Upper and Lower Arcoona Quartzite separated. Provide further explanation why the Upper and Lower Arcoona Quartzite are considered an aquitard, and aquifer, respectively. Provide justification /evidence and summarise the findings of Jacobs (2016a) on this subject.
33.	Section 3.2.3.1 App. C4 2.2.1 Figures 2.5 and 2.6 in Attachment A of Appendix C4	It appears that the proponent has not acquired adequate local data for the OKDUGA project. Table 2.6 of Appendix C4 lists, under the title *"Project groundwater bore details*" 36 drillholes. On closer examination, however, it appears that there is only one active water bore (and two abandoned water wells); the rest, 33 are exploration/mineral drillholes. Thus, there appears to be only one water bore listed in Table 2.6.	Explain why more local data were not acquired for the OKDUGA project. Provide an updated Table 2.6 with a corrected title. Reconcile text and figures so that they all show/explain correct and consistent datapoints.

		Closer to the OKDUGA project, the groundwater contour maps provided in the proposal have no datapoints in Figures 3.13 (THA) and 3.14 (PFA); a single datapoint in the THA (Figure 2.10 in C4) and no observation sites are marked for the PFA (Figure 2.11). In Attachment A the corresponding Figure 2.5 shows a single datapoint in the THA and Figure 2.6 none for the PFA inside the RL area (reference in full is Figures 2.5 and 2.6 in Attachment A of Appendix C4). *All drill holes with an 'AD' prefix are exploration bores only with no monitoring infrastructure installed. ADHY01 was drilled in July 2022 and has been converted into a monitoring bore targeting the PFA to support baseline studies.* No explanation is provided for what happened to the other 30+ drillholes. Judging from their depths (up to 1250 m deep), converting more of them to groundwater/ monitoring wells would be a cost-effective way to generate more hydrogeological data and more certainty.	Explain/clarify how many groundwater monitoring wells are there within the OKDUGA project.
34.	App. C4 2.2.2 A of C4 2.4.4	*These level measurements nor have they been density corrected for salinity.* The values adopted at CHBs are groundwater elevations, not groundwater heads, without a density correction. No quantitative justification was provided for this approach and the proponent did not quantify the magnitude of the density correction. Density correction is necessary if: 1. the groundwater elevation was calculated as the difference between the reference elevation and the depth to groundwater measured, for example by a dipper, and 2. groundwater is of a density that is significantly different from that of cold freshwater with a density of 1000 kg/m^3 (such	Provide worked numerical examples on density corrections. Knowing the magnitude of density corrections will enable an assessment on how important (or not) the density corrections are.

		groundwaters are typically saline, density > 1000 kg/m^3 or hot with density < 1000 kg/m^3). The deeper the well, the more groundwater it contains and the larger the density correction (assuming constant salinity/density in the well column). It follows that density correction may be significant for deep wells producing saline water, or for deep wells with hot groundwater. In the OKDUGA setting, the wells are deep (Table 2.6 of Attachment A of Appendix C4) and the groundwater in the PFA is saline (Section 2.4.5). Hence it is suggested that density corrected heads (sometimes referred to as equivalent freshwater heads) could significantly differ from groundwater elevations. The lack of density correction impacts not only determining boundary cell values but also groundwater head/elevation contour maps, hydraulic gradients, calibration/history matching and the interpretation of model predictions (just about every aspect of a groundwater model).	
35.	App. C4 2.2.4	*Specific yield is the amount of water removed from an aquifer by the force of gravity to a bore.* Re-phrase this definition to the more wide-spread definition of yield due to a unit 1m drop in groundwater, and explain that specific yield is used for unconfined aquifers. *Storativity is the **equivalent** of specific storage and aquifer thickness, representing the volume of water an aquifer releases or takes into storage.* This statement requires clarification, in particular whether this should be “*product of*” rather than *equivalent*. Also, an explanation is required that storativity refers to confined aquifers.	Provide information and statements on hydrogeological properties addressing the matters raised.

		Hydraulic conductivity and permeability are used in the same sections interchangeably. Section 2.2.4 would be easier to comprehend if only minimal hydrogeological terms were used corresponding to the columns in Table 2.7.	
36.	App. C4 2.1 Table 2.5 App. C4 2.2.4 Table 2.7 A of C4 Table 2.4 and 2.5	There are significant inconsistencies between the conceptual status of HSUs that are considered aquifers and the hydraulic conductivity values provided in Tables 2.5 and 2.7 (in Attachment A of C4, Tables 2.4 and 2.5). Either the hydraulic conductivity values are unrealistic (imported from regions not representative to local conditions) or the HSU descriptions are incorrect: • Hydraulic conductivity spans over six orders of magnitude in the **Quaternary Aquifer** according to available data from Olympic Dam, covering a wide range of **aquitards** and only the high end of the range covers an aquifer. • The hydraulic conductivity range for the **Quaternary Aquifer** from the Carrapateena Mine calibrated groundwater model is more representative of an **aquitard** than an aquifer. • For the **THA, considered an aquifer**, the hydraulic conductivity range starts at 3 x 10^{-2} m/d (regional literature review) and 6 x 10^{-4} m/d (Olympic Dam, literature review and calibrated groundwater model) both indicating **aquitards**. Only the high end of the horizontal hydraulic conductivity range indicates an aquifer. • The PFA, considered an **aquifer**, has a calibrated model hydraulic conductivity from the Carrapateena Mine of 5×10^{-3} m/d and from pump tests 2.7 to 3.4 x 10^{-5} m/d. Such values	Provide a reconciliation between the conceptual hydrogeology HSUs and their hydraulic conductivity. Provide justification and evidence for the choice of HSUs and the relevance of Olympic Dam hydrogeology to the OKDUGA project.

		represent **aquitards**, most probably even the lower end of aquitards. • The LSP is considered an **aquifer**, yet the various components of the LSP all have 10^{-4} to 10^{-2} m/d assumed hydraulic conductivity in Table 2.5. This range is typical to an **aquitard, not an aquifer**. • The Woomera Shale, described as a competent aquitard, is characterised by hydraulic conductivities in the range 10^{-6} to 10^{-2} m/d in Table 2.5 with a focus on 10^{-4} m/d. These values indeed represent typical aquitards; however, they are not much different from the ranges provided for the PFA/LSP that are considered aquifers.	
37.	App. C4 2.3	As described in Comment 36, there are significant inconsistencies between the conceptual status of HSUs that are considered aquifers and the hydraulic conductivity values provided in Tables 2.5 and 2.7. These inconsistencies present themselves in the hydrogeological conceptual model in Section 2.3. Comments on the first paragraph of C4 2.3: *The main study area aquifers are the sedimentary THA and PFA, located within the Stuart Shelf.* The hydraulic properties provided in Table 2.7 suggest these are aquitards, rather than aquifers. *The PFA is confined, and the THA varies from confined to unconfined depending on location.* It is unclear why and where the THA is confined if the Quaternary forms a perched aquifer. Please refer to Comment 19.	Provide an updated and corrected text, tables and conceptual hydrogeology to ensure consistency. Clarify the status of HSUs and reconcile these with the hydraulic conductivities. Consider and address these matters raised in the updated conceptual hydrogeology. Reconcile Figures 3.9 with 3.13 and 3.14 in the main document; Figures 3.9 with 2.10 and 2.11 in Appendix C4.

		Groundwater elevations are comparable (i.e. within 50 m) between the two aquifers, and there is a minor downwards vertical hydraulic gradient. Vertical hydraulic connectivity between the units is limited by the Woomera Shale, considered to be an aquitard, however, transfer of groundwater can occur via fracturing. Please refer to Comment 21. 50 m is considered a very large difference in groundwater elevation/head. In Figure 3.9 (of the main proposal as well as in C4) the groundwater elevations/head in the THA is consistently above that of the PFA. Figures 3.13 and 3.14 (of the main proposal, corresponding to Figs 2.10 and 2.11 of C4), however, indicate that the heads converge towards Lake Torrens. The groundwater elevations/head beneath the OKDUGA project rectangle, for example, is 110-120 m AHD in the THA and 70-75 m AHD in the PFA. Just to the west of Lake Torrens, both are approximately 30-40 m AHD. Therefore, an approximate 40 m difference in groundwater elevation is reduced to about zero along the flow path towards Lake Torrens. In DEM's experience, near groundwater discharge areas, such as Lake Torrens, the convergence described above is typical and therefore more likely than the parallel 'water tables" indicated in Figure 3.9. Further, near discharge areas, the deeper heads (PFA) tend to be higher than the shallow (THA). This may potentially occur when density correction (Comment 34) is applied.	
38.	A of App. C4 2.4.2 and 2.4.3	*regional groundwater flow from west to east, towards Lake Torrens* *…* *Regionally, groundwater flows into the study area from the west.*	Provide a corrected version of Figure 2.5 and text to ensure consistency. Explain if findings from previous studies were incorporated in the proposal.

		Figure 2.5 indicates, for the THA, groundwater elevations that form a high beneath the RL area and flow emanating in all directions from the high. It is unclear whether the proponent considered previous work, for example Appendix K1, Baseline hydrogeological assessment for the Olympic Dam expansion project in this assessment. Please also refer to Comment 22.	
39.	A of App. C4 2.7	*There is a minor downward gradient from the THA to the PFA local to the project.* It is unclear what the statement above based on. Please also refer to Comment 34 about the need for knowing the magnitude of density correction and the impact correction may have on hydraulic gradients. Without density correction, a statement like above may be misleading. This is particularly important for vertical hydraulic gradients because the density (salinity) correction may be larger for the LSP/PFA than for the THA, potentially influencing (or even reversing) the inferred vertical hydraulic gradient.	Refer to Comment 34 about the need for density correction and knowing the magnitude of density correction. Provide worked numerical examples on density corrections and an explanation how they can influence vertical hydraulic gradients. Review and revise the statement as necessary based on density corrected heads.
40.	A of App. C4 2.4 A of App. C4 3.3	The status of Quaternary sediments is unclear. The *Alluvium, Quaternary sediments* is described as: *Unconfined, shallow aquifer …recharged locally by rainfall. Spatially discontinuous and often unsaturated. Shallow groundwater lenses may occur, post rainfall events.* The problem is that Section 2.4 does not provide an unambiguous description of the Quaternary sediments; rather hints that the Quaternary may form an unconfined aquifer, a perched aquifer or is	Provide updated groundwater heads in the Quaternary (where exists) and the THA and a comparison between those at the same or nearby locations. Describe the relationship between heads in the Quaternary (where exists) and the THA.

		unsaturated. Figure 2.8, conceptual hydrogeological cross-sections, do not even show Quaternary sediments, except beneath Lake Torrens. From the information provided, it is unclear, for instance whether the Quaternary sediments (where they exist) form a perched groundwater with the THA below being the “proper” water table aquifer. Text in 2.4.4 suggests this: *The watertable within the uppermost aquifer, the THA, …* Or, whether the water table is located in the Quaternary sediments (where they occur) and in the THA elsewhere. The most important aspect would be to provide groundwater heads in the Quaternary (where exists) and the THA in the same or nearby locations; the relationship between those could determine if the proposed dewatering may impact on the saturated parts of the Quaternary sediments (or not). Further, it is unclear if the Quaternary is represented in the model or not, if it is saturated or not, and if yes, where. Neither the description in the text, nor in Table 3.1 (*Arcoona Quartzite/Andamooka Limestone/ surficial sediments)* provides this information. Figure 3.2 does not show Quaternary and Layer 1 starts with the Arcoona Quartzite, as part of the THA. Attachment A of C4, Section 1.6 states that: *The groundwater flow model was not designed to explicitly simulate the unsaturated zone, surface water or perched groundwater nor water quality/solute transport.* Clarification is required on whether perched is the same thing as the Quaternary.	Explain and justify if dewatering may impact on the saturated parts of the Quaternary sediments (or not).

		There is also a comment in 4.2.2, *Modelled steady state watertable elevation, which represents the THA* - does this suggest the water table is entirely within the THA?	
41.	A of App. C4 3.5 and 5.2	The Northern Wellfield wells are situated close to OKDUGA and it would be beneficial to show a comparison between the OKDUGA and Carrapateena Mine models using available information (adopted model boundaries and values, HSUs and parameters). The documentation does not appear to provide such a comparison.	Provide discussions (and illustrations) using all available information of the boundary conditions used for both the Carrapateena Mine and the OKDUGA models to show consistency.
42.	A of App. C4 3.5.1	*As described in section 2.4.4, groundwater generally flows from west to east towards Lake Torrens. In the groundwater model, this is simulated with constant head boundary conditions in the HSUs representing the THA and LSP.* The text above disregards the local high in the THA (Comment 38). Numerical groundwater flow models aim to solve the groundwater flow equations and to do so need to make certain assumptions along the model boundaries. In the OKDUGA model, the entire model domain is surrounded by constant heads (CHB) cells. The head in CHBs are fixed regardless of the system conditions and they can provide, or remove, infinite amounts of water to maintain the heads at the constant value. CHBs need to be therefore selected carefully, otherwise CHBs can have a significant influence on the results of a simulation and may lead to unrealistic predictions if predicted drawdowns are close to the CHBs. Such (close) conditions occur for several scenarios in the OKDUGA model. This issue has previously been raised and DEM requires further action and commitment from BHP on this issue.	Provide updated and corrected CHBs or a firm commitment with a timeline to fix the incorrect boundaries in a forward work plan.
43.	A of App. C4 3.5.1	*… and everywhere else at the model edge they are assigned based on the inferred groundwater levels as shown in Figure 2.5. In the absence*	Provide a robust justification why the extrapolated and density uncorrected

		of groundwater level data for the LSP near the model boundary (see Figure 2.6), the groundwater levels for the LSP were set equal to those assigned to the THA. The adopted boundary head values are based on very few datapoints (21 for the THA and 9 for the PFA), collected at different times. Figures 2.5 (THA, 21 datapoints) and 2.6 (LSP, 9 datapoints) of Appendix C4 show the datapoints and interpreted contours. The distribution of datapoints in these figures suggest that all values for CHBs were extrapolated (as opposed to interpolation, extrapolation carries more uncertainty). With the exception of the northern boundary for the THA, the distance of datapoints from the model boundaries and the data distribution suggests that all other CHB values adopted are very uncertain. Boundary values for the THA and PFA The boundary values are also understood to be the same for the shallower THA and the deeper PFA aquifers; this appears to contradict the statement the intervening Woomera Shale is a competent aquitard. In DEM's experience, the groundwater heads near recharge areas tend to be higher in the shallow (here THA) aquifer. Conversely, near discharge areas such as Lake Torrens, the deeper PFA groundwater heads would likely be higher than those in the THA. At a minimum, groundwater heads are very unlikely to be the same for shallow and deep aquifers, separated by a competent aquitard, everywhere surrounding the model domain. Please also refer to Comment 34, about the need for density correction.	values used for CHBs are valid, or explore alternatives to boost data and information (such as by remeasuring heads in existing wells, converting mineral drillholes to monitoring wells, including wells outside the model domain, literature review etc). Provide evidence/justification for the use of common boundary heads for the THA and PFA HSUs or provide an updated/corrected model with boundary conditions.
44.	A of App. C4 4.2.2	The caption of Figure 4.2 *is Scatter plot of steady state modelled versus measured hydraulic head,* the x axis title is *measured groundwater elevation* and the y axis title is *modelled groundwater elevation.*	Provide worked numerical examples on density corrections. Knowing the magnitude of density corrections will

		The figure, in DEM's view, shows steady state modelled **head** on the y-axis versus measured groundwater **elevation** in the x-axis. More importantly the figure compares two different measures of groundwater and disregards the need for density correction. Models provide predictions of groundwater head while dipper/tape measurements, uncorrected to density, provide groundwater elevations. These potentially different measures are used for calibration (history matching) and this approach may or may not be appropriate to use, depending on the magnitude of the density correction. An explanation is required about the potential errors this approach includes, and the impact such error may have on the statistics provided in the proposal. This issue is also associated with groundwater head/elevation contour maps, hydraulic gradients, model boundary conditions, calibration/history matching and the interpretation of model predictions (Refer also to comment 34).	enable an assessment on how important (or not) the density corrections are. Provide an updated/corrected Figure 4.2 to ensure consistent measures of groundwater are compared.
45.	A of App. C4 4.2.2	It is unclear why there are more observation points in Figure 4.4 than in Figure 2.5. Presumably, residuals can only be calculated in Figure 4.4 if measured values exist at a location. If so, an explanation is required on where the points extra to Figure 2.5 come from. Examples include just north of the RL area there are three red points (-8.3, -9.1 and -7.9 m labelled) that do not seem to exist in Figure 2.5.	Provide an explanation on why there more are observation points in Figure 4.4 than in Figure 2.5.
46.	A of App. C4 4.2.2	DEM does not have access to the model, only to the model documentation; hence having transparent documentation is important. The model documentation lacks details that are essential to understand, and to assess, if the model is suitable for the purpose of this application. There is no documentation of calibrated/observed groundwater head	Provide measured and predicted groundwater contours for the PFA and a description of these.

		maps for the PFA, where most of the drawdown is predicted. Histograms of parameter distributions for pilot points only are provided, without parameter distribution maps. There is no map in the proposal showing the depth to water table, where evaporation from groundwater occurs in the model, and the relationship to potential/actual GDEs. There are no actual cross sections or maps indicating the relative position of perched water in the Quaternary Sediments with respect to groundwater in the THA. There are no groundwater head contour predictions provided, similar to Figure 4.4, but for different HSUs. In particular, it would be beneficial to see the contours of Figure 2.6 overlaid with a figure providing model predicted heads for the PFA. Please also refer to Comment 34 about the need for density corrected heads.	
47.	A of App. C4 4.2.2	*Modelled groundwater flow is broadly from the west towards Lake Torrens in the east, with local variability towards the nearby ephemeral creek lines.* Figures 2.5 and 4.4 indicate otherwise. Groundwater elevations form a high beneath the RL area and flow emanating in all directions from the high. Please refer to Comment 38.	Correct the text or Figures 2.5 and 4.4 according to the matter raised.
48.	A of App. C4 4.4	It is vital to understand the calibrated model hydraulics in order to comprehend the predicted impacts. Figure 4.5 and those in Appendix A of Attachment A of Appendix C4 do not appear to be informative on their own. These are histograms conveying the number of occurrences within a particular value range, for example for hydraulic conductivity, on the left scale for pre- and post-calibration and on the right scale for the base case scenario.	Provide parameter distribution maps and consider changing the histograms to clustered columns of relative frequency.

		The issue is that these histograms do not show the spatial distribution of parameters. It would be beneficial to see **maps** of recharge and hydraulic parameter distributions. Further, DEM consider the histograms would be easier to understand if a single vertical scale was used with relative frequency and the use clustered columns.	
49.	A of App. C4 5.3.1	It is unclear why the ET component does not change in time in Figure 5.1. Conceptually, the base case will introduce some drawdown and therefore it was expected that the ET, for the new, deeper water table (in the THA ?) would decrease in time.	Explain why the ET component does not change.
50.	A of App. C4 5.3.3 and 5.3.5	Please refer to Comment 43. Predicted incremental drawdown, due to the OKDUGA project excavations only (excluding the drawdown associated with groundwater abstraction from the Northern Wellfield) is close to the model boundaries in Figures 5.4 and 5.8 (Upper LSP high K). Further, predicted cumulative drawdown, due to both the OKDUGA and Carrapateena Northern Wellfield projects is close to the model boundaries in Figures 5.10, 5.13 and 5.14 (Upper LSP high K). It is important to note that the model *predicted* drawdown would not intersect the model boundary because the model boundary is <u>assumed</u> to be constant head (CHB), where drawdown, by definition, is <u>assumed to be 0m</u>. The model simply returns the assumption as a prediction, a type of circular logic. CHBs that are not *far* from the source of the impact are incorrect and such boundary conditions should be modified. *CHBs are used to fix the head value in selected grid cells regardless of the system conditions in the surrounding grid cells, thus acting as a*	Provide a firm commitment, with a timeline, to correct the model boundaries.

		*potentially infinite source of water entering the system, or as an infinite sink for water leaving the system. Therefore, specified head boundary conditions can have a significant influence on the results of a simulation, and may lead to unrealistic predictions, particularly when used in locations close to the area of interest (*Waterloo Hydrogeologic, Conceptual Modeling Workflow > Defining Boundary Conditions > Theory (waterloohydrogeologic.com), DEM requires information on the further action and commitments proposed to address this issue.	
Matters Raised by Department for Energy and Mining (Geochemistry)			
51.	General comment on geochemistry	The current geochemical assessment appears very preliminary that requires further robust geochemical assessment to address the numerous uncertainties highlighted in the following. In view of this, DEM require a plan for a more robust geochemical assessment, including further geochemical testing to be undertaken using appropriate sample representativeness. Further guidance on requirements for geochemical assessment is provided in DEM regulatory guideline MG46 Assessment and management of AMD.	
52.	Appendix B1 Section 4.1.3 Sample classification	*"A preliminary sample classification can be completed using total sulfur as an indicator of MPA (conservative) and total CO_2 as an indicator of ANC (with caution – see Section 4.1.2)."* *"While total CO_2 is considered a reliable indicator of the carbonate content in the samples (Section 3.3) it may not be a reliable indicator of acid neutralising capacity (ANC) if iron-bearing carbonates are present."* The possible overestimation of ANC using total CO_2 is of concern and requires further assessment.	The uncertainties in the ANC estimation need to be addressed by undertaking further testing using a relatively more reliable method. Provide a plan for a more robust method for ANC estimation.

53.	Appendix B1 Section 4.1.3 Sample classification	The Arcoona Quartzite (ZWA, ZWAR and ZWAW) and ZRS units class as potentially acid forming (PAF), but there is an uncertainty about this classification outcome.	To minimise overestimation of the MPA and ANC parameters of the Arcoona Quartzite (ZWA, ZWAR and ZWAW) and ZRS units, further geochemical testing is required to address the current uncertainties.
54.	B1 Section 4.1.3 Sample classification	The one ZRS sample classed as PAF – but given the origin of the sample (weathered zone) and the observations from the Olympic Dam dataset, the sulfur is in all likelihood present as sulfate, and it is considered unlikely that this material will generate acidity. DEM note that there are limited number of samples for the ZRS unit – only one.	Provide an assessment of the potential saline drainage from this unit. The number of samples used for this assessment should be tailored based on the estimated tonnage of this unit.
55.	B1 Section 4.1.3 Sample classification	The NAF classification for the majority of materials within the cover sequence suggests a low risk of acid drainage developing from waste rock deposited in a surface waste rock storage facility.	Non-acid forming (NAF) materials must be further identified and assessed, as appropriate: • Non-acid forming but metal leaching (NAF-ML, associated with NMD) • Non-acid forming but saline (NAF-SD, associated with SD) • Non-acid forming and acid consuming (NAF-AC) Non-acid forming and “inert” (NAF)
56.	B1 Section 4.2 Potential for contaminant leaching	*“Many elements are more soluble and leachable under acidic conditions.”* However, the pH and EC of the various samples were not measured.	Provide measured values of pH and EC of the various samples.

57.	B1 Section 4.2 Potential for contaminant leaching	*"The lower 20–30 m at the base of the ZPF unit was associated with higher averages for some parameters (Table 3.2). This is illustrated in Figure 4.4 for arsenic, where it can be seen that the arsenic content is low in most of the depth profile, but there is a trend upwards near the base of the ZPF."* *"Notwithstanding the occasional presence of material with more significant bulk elemental content, it is considered that the risk of contaminant leaching is low given that conditions are likely to remain pH neutral."* *"No leach testing has been conducted to-date, and there are no data available to directly assess the potential for contaminant leaching."* Some metal(loid)s such as zinc, manganese, arsenic, and cadmium are relatively soluble at near-neutral pH and so concentrations of these metals may be elevated under these conditions (neutral and metalliferous drainage, NMD). The potential for contaminant leaching especially from the ZPF unit requires testing.	Provide an assessment of the potential for contaminant leaching from the ZPF unit.
Matters Raised by Department for Environment and Water (DEW)			
General Comments Whilst there is emphasis on explaining the risk related to drawdown impacts on the THA and LSP on the surficial environment and the usage of the groundwater in question, there is less emphasis of the potential risk the mishandling of such water might have on near surface environments and groundwater resources if it were to escape containment. By extension, discussing risks to near surface groundwater resources in the Quaternary and Tertiary aquifers also receive less emphasis; whilst there is acknowledgement that these resources are small, localised, and not heavily utilised, they appear important with respect to GDE support and may form important emergency water supplies in times of drought. Whilst risk related to drawdown in QT aquifers are unlikely, this is not the only risk vector.			

With respect to GDE's and Lake Torrens, there is inconsistency and a lack of clarity with respect to describing the groundwater related-conceptualisation of these environments and therefore the groundwater-related risk vectors that may transfer adverse impacts. Whilst this inconsistency and lack of clarity may not alter the overall risk profile, it may lead to incorrect assumptions informing the groundwater assessment.

Draft details concerning the groundwater monitoring and management plan require further development. There are no draft monitoring well locations, proposed construction details or specific compliance targets presented. These are required to support the application.

Modelling-Specific General Comments
There are significant issues with the data used in this project, including:

- The hydraulic head data (the data) used to develop the conceptual model are very limited in distribution and have been collected over the last 80 years. Also, it is unclear which of the data is from what period in time.
- The data are from groundwater with quite different salinity. Density corrections need to be added to the data or quantitative justification provided as to why this correction will not change the data.
- The contours developed from this data have been extrapolated well beyond locations where data is available. Data is needed beyond the current model boundary to provide justification for the contours that are then used to determine constant head boundary conditions for the uppermost layer (THA).
- Data for the lower layer (LSP) are very limited and do not support any valid contouring.
- Available extraction rates from the Carrapateena Production bores are needed to develop an accurate model of groundwater flow within the model area.

This has resulted in a poorly developed conceptual model and subsequent numerical model. It will be necessary to address the data issues before further development of the model can be undertaken.

Model design also needs to be reconsidered with respect to the key questions being addressed. Drawdown extent should not be limited by model design, whether that is the domain size or the boundary conditions. The current model has issues with both, which will need to be addressed.

Model calibration will also need to be addressed after the data issues have been resolved. It is critical that the numerical model demonstrates its ability to replicate historic conditions as well as consistency with the conceptualisation. This needs to be thoroughly documented.

58.	Vol 1 Figure 1.1	The location of the Carrapateena Mine wellfields should be included on this, or a similar map. The wellfields are discussed extensively as a key receptor and therefore their location needs to be provided.	Provide an updated Figure 1.1 (or similar) which includes the location of the Carrapateena Mine wellfields.
59.	Vol 1, Table 3.4 Vol 3, App C4, Table 2.4	The information included in this Groundwater Systems Table is used extensively. It is unclear what it is based on.	Provide references or data to support entries made in this table.
60.	Vol 1, Fig 3.10	Groundwater bores provided in this figure require label identifiers.	Provide an updated version of Figure 3.10 which includes labels for all bores.
61.	Vol 1, Sect 3.2.2.1	Perched groundwater systems are mentioned. The basis for this needs to be explained.	Provide data or references to support the statements of perched groundwater systems.
62.	Vol 1, Figure 3.13 and 3.14 Vol 3, App C4 Figure 2.10 & 2.11 Vol 3, App. C4 Att. A Figure 2.5	These figures need to be updated to have hydraulic head values included and the flow lines corrected or removed. The detail found within the potentiometric surface presented in Figure 3.13 does not appear justified by the data points presented. Particularly within the RL and in the southern portion of the map where there are several localised mound and sink features that do not appear attached to measurement data. Further the confidence of the contouring where extrapolated beyond data points is not indicated via dashing or question marks. Finally, there is no comment regarding whether available data used in these maps have been checked. Given the limitations in available data, evidence of QAQC is important. The detail found in related figures in the main report and App. C4 are different, with the latter showing more data points.	Provide updated versions of these figures and remove the flow lines. Provide the necessary detail to either the figure or the text or re-present the potentiometric surface so it is respectful of available data. Provide comment on what QAQC was conducted on groundwater level data in the development of these figures. Ensure all updated figures representative of the potentiometric surfaces interpreted for the study area are consistent and are reflective of available information. There is a major issue with using non-density corrected heads in model

		These heads have not been corrected for density differences. They need to be either corrected or an acceptable justification as to why correction is not necessary provided.	development without sufficient justification. Heads must be corrected for density differences or tables developed to show that the density corrections have no effect.
63.	Vol 1, 3.2	*For non-prescribed water resource areas, high level principles in statutory regional landscape plans and specific principles to guide water affecting activities work together to protect water resources and dependent ecosystems.* Note that Section 8 of the Landscapes SA Act (2019) also stipulates the statutory obligations concerning the protection of the environment and associated natural resources. It is from here that the aforementioned regional landscape plans specific principles obtain their basis.	For noting
64.	Vol 1, 3.2.2.2 Vol 1, 3.5.5 Vol 3, App C4 2.3	*Euro Spring and Gorge Spring (Figure 3.11), which occur in Salt Creek and are supported by both groundwater and surface water flows, **are predicted to lose their groundwater contribution** (OZ Minerals 2019).* *Ecological field surveys undertaken for the nearby Carrapateena mine confirmed terrestrial vegetation relies on rainfall runoff, creek flows **and shallow groundwater, and this vegetation is mostly associated with creek lines and springs** (OZ Minerals 2017e).* ***Groundwater supported springs are located on lower reaches of Salt Creek.** Waterholes along Bosworth Creek are not likely to be supported by groundwater flow from underlying aquifers, rather they are pools that are observed around deeply incised parts of the creek that have the ability to hold water for a period of time, post a rainfall event.*	

		However, this impact is considered minor, ***as groundwater is not considered to sustain*** *the lake water level, lake ecosystems and/or* ***GDEs.***	
	Vol 3, App C4 4.3.4 Vol 3, App. C4 2.1.2 (a)	By definition, a spring requires a groundwater contribution, consequently the discussions should concern the source of that groundwater. DEW understand that the springs in question are likely to lose any contribution from *the THA and LSP aquifers* but not all groundwater contribution. Groundwater from the localised Quaternary and Tertiary aquifer, bank storage and other localised sources are expected to still contribute flow. This is an important characterisation as it defines vectors of risk transfer to springs. Please provide the requested detail or clarify if incorrect. *In the Quaternary sediments and the THA, the groundwater level is expected to draw down by approximately 5 m around the Northern Wellfield with the zone of influence extending up to 20 km from the Northern Wellfield.* *Euro Springs and George Spring, which occur in Salt Creek and are supported by both groundwater and surface water flows, are predicted to lose their groundwater contribution (OZ Minerals Limited (OZL) 2019).*	Provide clarification or provide corrected statements concerning springs and their relationship to the various aquifers that may supply spring water to them.
		Please check these statements and correct if necessary. As written, they imply that there will be a 5m drawdown in the Quaternary aquifer, that the Quaternary and THA aquifers are connected and that springs will lose all groundwater contribution. DEW believe the drawdown was referring to the THA aquifer, as the Quaternary Aquifer was not explicitly modelled. Further, in *Section vi. Hydrogeology*, it is stated that the Quaternary and deeper saline aquifers are disconnected and the Quaternary Aquifer obtains recharge from rainfall and overbank flows	Please review these statements and provide corrected statements where necessary.

		and in Ap C4 S2.2.2 that water level monitoring in Quaternary aquifers shows fluctuations of up to 1.4m related to rainfall recharge. DEW note that the Carrapateena Mine has clear monitoring and reporting obligations related to the springs that centre around maintaining the health of the spring-supported ecological community (MP5662258.pdf (pir.sa.gov.au)). Therefore such distinctions concerning the source of spring water and the potential impact of mining require clarity.	
65.	Vol 1, Figure 3.11 Vol 1, Section 3.5.5 Vol 3, App C4, ES1 Vol 3, App C4 ES2 Vol 3, App C4, 4.6 Vol 3, App C4 Figure 2.6	*Groundwater supported springs are located on the lower reaches of Salt Creek.* *Further investigation of watercourse springs along Salt Creek and associated potential GDEs to confirm whether vegetation is an important plant community type and level of reliance on groundwater from the LSP.* Whilst the citation "Bush Blitz (2016)" is used to discuss the lack of stygofauna in the region, Bush Blitz (2016) also noted a spring located at Wilaroo Lagoon located to the north of the RL. To Quote "*The mound spring found near Wilaroo Lagoon, close to the former 'flowing bore' is a unique feature, with unique aquatic species in the outflow of the spring that are restricted to this very small area. The fauna would be highly vulnerable to disturbances such as desiccation or pollution. When visiting the spring, a number of dead cows were found in the surroundings and also in the actual spring vent, making the water putrid. None of the taxa found in the outflow were found in the vent, where they normally would occur, and where source populations of fauna exist under fluctuating water levels. It is possible that under the current situation, with no fauna in the spring vent, fauna may go extinct if the outflow area dries out when water flow decreases. To conserve these unique fauna the following recommendations are made—fence off the*	Provide an updated version of Figure 3.11 (Regional springs and waterholes) which shows the Bush Blitz 2016 location. Provide an assessment of the potential impacts of proposed activities on the spring discussed by Bush Blitz 2016.

		mound spring and its outflow area and clear out the vent, but ensure that the outflow area does not dry out or become contaminated during the process. DEW notes that there is a Public Fauna Super Table entry in the Biodiversity Database SA (BDBSA) located near this position that has the following details: Species: Hylaeus riekianus, Common Name: n/a, Class Name: INVERTEBRATES, Fauna Code: OPI1047690-1, Generated Location: 7.4 km ENE of Bowilia Hill (summit), State Rating:, Sighting Date: 1/9/2016 With respect to forward work programs investigating springs, the work by Bush Blitz (2016) suggests that not all springs within the general vicinity of the RL application have been sufficiently mapped or characterised. Therefore forward work programs should include works to verify third party reports of springs and their descriptions and/ or identify any new spring localities that may fall under the influence of the project.	Provide a forward works program commitment to undertake an audit of spring localities and to map any previously unknown locations.
66.	Vol 1, 3.5.5 Vol 3, App. C4 2.1.3 iv Vol 3, App C4, 3.3 Vol 3, App D1, 2.2.6	*Lake Torrens supports aquatic GDEs in accordance with the BoM GDE Atlas, however Lake Torrens is very often dry (i.e. it has only filled twice in the last 100 years) and is hypersaline. Therefore this classification is likely inaccurate.* The statement, which is repeated several times throughout the document, appears to obscure the importance of Lake Torrens as a habitat that requires protection by concentrating on definition. To quote EBS (2008) *Endemic salt lake invertebrates, such as spiders, scorpions, beetles, crickets and ants, are known to be present within the project area. Their habitat is restricted to the surface of the salt lakes and some species are yet to be described. Conservation significant species have been identified within the project area and any disturbance of these limited habitats should be avoided."*	Provide updated statements of Lake Torrens which recognise and make consideration for the following points: a) Lake Torrens is a significant ecological and cultural feature b) Lake Torrens is recognised as a major groundwater sink c) Due to the difficulty in studying this environment there is still large uncertainty and so risk assessment is necessarily conservative.

		Consequently, the integrity of the salt crust environment is of great importance. Whilst how such an environment might therefore be classified is a subject of discussion, it is still an important habitat that is protected with National Park status and where groundwater is recognised as an important contributing feature to the landscape. Further, there are several prior reports related to the Carrapateena Mine and Olympic Dam Expansion that map springs on the lake surface. Whilst there may be little information concerning the ecosystems and cultural values such springs support, let alone their number and locality, a conservative risk approach would be to treat these springs as aquatic GDE's. Given so little is known about spring environments on Lake Torrens, treating the whole lake as an aquatic GDE might be seen as a conservative approach. Consequently, whilst DEW do not dispute that Lake Torrens is predominantly a dry and hypersaline environment for most of the time, DEW require statements concerning the environmental importance and groundwater dependency of Lake Torrens to reflect citations as well as the inherent uncertainty as it pertains to risk. EBS (2008) Section 5.2.3.2 <SAMREF.SARIG1>WCIR Record 1 of 3 (pir.sa.gov.au) Lake Torrens, Australia - keybiodiversityareas.org Banded Stilt - The Australian Museum appendix-f1_conceptual-groundwater-model.pdf (bhp.com)	
67.	Vol 1, 4.4.1	*Key activities undertaken under the EPEPR include: groundwater exploration drilling – water exploration, groundwater testing and characterisation, installation of production wells and installation of groundwater monitoring wells.*	Provide the requested information.

		Further information is required on whether these activities were completed in time to inform Appendix C4, or whether the data limitations described in this appendix have been addressed by the described completed works.	
68.	Vol 1, Figure 4.26	The following matters regarding this figure and subsequently the water balance of operations require further elaboration. 1. There is no volume allocated for dust suppression in years 1-2 2. There is a line between human consumption and sewage disposal connecting to portal and decline that appears to have no volume attached in either figure – discuss whether this line is meaningful 3. The sum of inputs for the settled water dam in years 1-2 is 223ML/y, whereas outputs appear to be 153ML/y. Clarify whether this is correct. If so, explain where does the 70ML/y difference end up. 4. Whilst the above imbalance is the largest noted, there are other minor imbalances noted of up to 16ML/d. Please check the figure for inaccuracies and correct if required.	Provide the requested information and if necessary, provide an updated Figure showing the site-wide water balance model.
69.	Vol 1, 5.1.3	*Groundwater* *BHP must ensure there is no significant adverse impact to the quantity or quality of groundwater within the aquifers outside of the RL and MPL tenements caused by authorised exploration operations.* Whilst the document has placed emphasis on groundwater resources directly impacted via dewatering and water supply activities, there are still aquifers that are identified as supporting environments, landforms and ecosystems that may be impacted by other risk vectors, such as spillages, uncontrolled water releases and similar. Further, the applicant has indicated that there is still uncertainty regarding the connection	An additional closure objective should be included that there are to be no adverse impacts to any landforms, environments or ecosystems dependent on groundwater either inside or outside the RL and MLP caused by authorised exploration operations.

		between groundwater in directly impacted aquifers and surficial environments, as indicated by descriptions of forward work plans. Hence the commitments regarding groundwater should extend beyond impacts to groundwater itself.	
70.	Vol 1, Table 7.4 Vol 1, 7.5.1.8 Vol 3, App. C4 ES1 Vol 3, App C4 2.1.3 v(a) Vol 1, 7.5.3 Vol 3, App C4, Table 3.1 Vol 3, App C4 3.3	*During construction, operation and closure, groundwater affecting activities, including groundwater abstraction, mine dewatering and activities that reduce aquifer recharge from surface water, result in a reduction of groundwater quantity at Lake Torrens, impacting the cultural amenity, cultural heritage and state and national values of the Lake Torrens National Park* *During construction, operation and closure, groundwater affecting activities, including groundwater abstraction, mine dewatering and activities that reduce aquifer recharge from surface water, result in a reduction of groundwater quantity, impacting cultural amenity, ecosystems of cultural significance and local social value and impacting the ability of third party users and future users to meet their water supply needs.* *The potential inundation of vegetation from an unplanned release of hypersaline water (e.g. from excessive runoff from dust suppression activities or failure of a primary storage vessel) can result in far reaching and long-lasting impacts.* *The exceptions are: minor utilisation of perched Quaternary sediments for stock watering …* *Furthermore, the location of pastoral stations near Quaternary sediments and watercourses is likely intentional (OZL 2017).* *7.5.3 Groundwater dependent ecosystems*	Provide additional or modified groundwater related statements so that risks to groundwater and groundwater dependent cultural and environmental assets also address potential impacts that may affect the quantity or quality of groundwater found within shallow (In particular the Quaternary) aquifers. Ensure the ecological significance of ecosystems is explicitly recognised.

		Third party landholder bores: groundwater utilisation by landholders is sparse. The groundwater related statements in Table 7.4 and section 7.5.3 do not adequately capture risks to near-surface (particularly Quaternary) groundwater resources that may support ecosystems or supply third parties to adverse impacts described in section 7.5.1.8. Further, ecosystems and users not reliant on groundwater may be impacted by such uncontrolled releases, not only through (as mentioned) surface water inundation, but by potentially raising or polluting the water table with hypersaline groundwater. Finally, there is no mention of construction activities potentially altering recharge, either by quantity or quality, to shallow (particularly Quaternary) aquifers. With respect to minor utilisations for stock water, whilst this is likely true, the shallow groundwater resources in question may be of high value during times of drought and therefore users may be sensitive to impacts, as inferred by the statement in App. C2 S2.1.3. Finally, there is no reference to the ecological significance of the environments surrounding proposed operations. Ecological and cultural significance may be different and therefore should be described explicitly from one another.	
71.	Vol 1, 7.5.8.1 Vol. 3, App. C4 3.3 Vol 3, App C4 4.3.2 Vol 3, App C4 Table 4.2	*Up to 2 m of groundwater drawdown is predicted to extend to Lake Torrens, potentially resulting in reductions in groundwater contribution to the Lake.* ***However, the impact is considered minor as the groundwater contribution to Lake Torrens comprises only 3% of the water balance and groundwater is not considered to sustain the Lake water level and/or Lake ecosystems.*** *Furthermore, modelling suggests that the potential reductions in groundwater flow contribution to Lake Torrens would be only 2%. On*	Where applicable, provide corrected text and references for accuracy. Undertake an assessment of potential impacts on Lake Torrens that considers: a) Lake Torrens is a major groundwater sink; and b) That whilst groundwater from western shoreline aquifers only

	Vol 3, App C4, 4.6 Vol 3, App C5, 2.2.2	*this basis, i.e. a potential reduction from 3% to 2.94% of groundwater contribution to Lake Torrens, the impact significance has been rated Level 2 (not significant).* *Groundwater discharge does not sustain Lake water levels and/or ecosystems.* *However, the impact is considered minor as the groundwater contribution to Lake Torrens comprises only 3% of the water balance and groundwater is not considered to sustain the lake water level and/or lake ecosystems.* *Minor potential reduction in groundwater contribution to Lake Torrens, where groundwater does not sustain Lake water levels and/or ecosystems.* *On average, approximately 80% of water entering Lake Torrens is from direct rainfall,* ***10% from groundwater inflow,*** *and 10% from catchment runoff (Figure 2.5).* Whilst the risk of impact to Lake Torrens via groundwater drawdown might be low, the reasoning expressed throughout the document lacks nuance or contain misquotations. Further it is unclear what is meant by “lake levels”; for instance is this referring to surface water level, which are ephemeral and largely absent temporally, or does this refer to the water table level. Jacobs (2017) notes that 3% refers to the “*3.3 GL/year from the west (approximately 3% of total groundwater inflows to Lake Torrens), and at an estimated 111 GL/year from the east (approximately 97% of groundwater inflows to Lake Torrens”* Combined, the 114.3 GL/yr. constitutes approximately 10% of total water inflows to Lake Torrens, whilst 80% of inflow comes from direct rainfall on the lake surface. This	contribute on balance, 3% to total water input to the lake, drawdowns associated with the project are not likely to be evenly distributed across the lake but localised near the project itself.

		figure matches figures found in App. C5. Further, qualitative description in Jacobs (2017) indicates that much of this rainfall inflow will evaporate, with a portion infiltrating. Once infiltrated such water may be called groundwater. DEW notes that Jacobs (2017) has not attempted to quantify how much of the total rainfall volume infiltrates lake sediments compared to being evaporated, so the proportional contribution to lake sediment groundwater content between groundwater inflow from the east and west of Lake Torrens and infiltrating rainwater remains unknown. Further, Jacobs (2017) discusses inputs to the lake in totality, rather than discussing localised impacts to the lake. One might anticipate that any drawdown the project will cause under the lake will not be evenly distributed over the totality of the lake but will be concentrated at the nearest point of the lake to the project. This impact may be complicated by the presence of a brine wedge under the lake, as mentioned in Attachment A S2.4.4. Further, there is no description concerning the timing of these extractions and how this may relate to risk.	
72.	Vol 1, Table 8.1	Control and management strategies that protect shallow groundwater and related users are missing.	Provide control and management strategies for potential impacts on shallow groundwater.
73.	Vol 1, Table 8.2	*Groundwater level monitoring at nominated monitoring bores demonstrates a trend over four consecutive monitoring periods of decreasing groundwater levels in excess of that predicted within the groundwater model.* There is no map or map reference showing the locations of proposed monitoring wells. There is no information on the number of wells. Finally, there is no information on what aquifer the proposed wells are installed to monitor.	Provide the missing details on groundwater measurement criteria concerning the position, target depths and predicted groundwater levels obtained from modelling for each monitoring well, as described in the current statement. For the purposes of a mineral tenement application, this information may be provided in draft form.

74.	Vol 3, App. C4 1.2	Given the proximity to Lake Torrens National Park, *the National Parks and Wildlife Protection Act (1972)* is relevant, if any activity of proposed operations damages the Park. *For non-prescribed water resource areas, high level principles in statutory regional landscape plans and specific principles to guide water affecting activities work together to protect water resources and dependent ecosystems.* Development of these regulations stems from requirements under Section 8 of the Landscapes SA Act (2019), which discusses general statutory obligations.	For noting
75.	Vol 3, App C4, Fig 2.1	The Carrapateena production bores are not shown on the figure.	Provide an updated figure which includes the Carrapateena production bores.
76.	Vol 3, App C4 2.1.2 & References	*Groundwater investigations and assessments pertaining to the Olympic Dam and Carrapateena Mines.* Further information that may be useful are the original hydrogeological baseline assessments commissioned by Teck Resources when they were still majority operator of the Carrapateena Mine. These reports contain the original hydrogeological conceptualisation and detail the original GDE mapping. The reference can be found here: Reference	For noting
77.	Vol. 3, App. C4 2.1.3 Vol. 3, App. C4 Table 3.1	*Cultural and Native Title* The section does not discuss the cultural significance of groundwater explicitly, but instead ddiscusses cultural values in general. A discussion should be provided on any available information concerning cultural values of groundwater. Whilst it is understood some culturally sensitive information may not be disclosed, an understanding at a high	Please provide the requested information.

		level of a link between groundwater and cultural importance would still be valuable to understand. Alternatively, if cultural values of groundwater are not understood, this should contribute to the scope of any forward works program. Table 3.1 indicates some impacts on cultural amenity receptors are "Unconfirmed" without providing any justification. Justification for all unconfirmed events should be provided.	
78.	Vol. 3, App C4, 2.1.3 v(a)	*BHP also intends to undertake a bore field census to confirm the status of bores, particularly at Arcoona and Bosworth stations, where there are approximately 25 landholder bores as per the WaterConnect database, and likely less active bores.* DEW also request the applicant ascertain the importance of these bores and clarify when, if at all, they are used (i.e., during times of drought).	Provide updated details of the bore field census to include obtaining information concerning the importance and use of bores with respect to drought conditions.
79.	Vol 3, App C4, Table 2.2	A figure needs to be provided to show how rainfall and evaporation (or ET) vary through the year. The model suggests a recharge rate of 0.1-0.4mm/yr., and this needs to be supported.	Provide a figure as requested.
80.	Vol 3, App C4, Table 2.5	The basis for these conductivity values needs to be provided.	Provide an explanation for the basis for the conductivity values.
81.	Vol 3, App C4, Sect 2.2.2	This section brings into question many aspects of the groundwater flow model, as the model uses heads from heavily extrapolated contours as fixed boundary heads and the actual heads within PESTPP-IES. Also, the measured head data have been collected over a period of 80 years and it is unclear what data have been measured at any specific time. This is another issue in using the data to develop a model and associated boundary conditions.	The conceptual model and its boundaries needs to be reviewed based on more data, spatially distributed and over a reasonably consistent time frame.

82.	Vol 3, App C4, Sect 2.2.2	Hydrographs from the Carrapateena bores should be provided where they are available.	Provide available hydrographs from Carrapateena bores.
83.	Vol 3, App C4, Fig 2.12 and 2.13	These figures strongly suggest that density corrected heads need to be developed and used in conceptual model development.	Provide density corrected heads.
84.	Vol 3, App. C4 Figure 2.14 Vol 3, App. C4 Att. A, Figure 2.8	*Conceptual hydrogeological cross section* Whilst DEW acknowledge that the cross section is meant to be a conceptual representation only, based on current geological knowledge and presented potentiometric surfaces, there appears to be sufficient information to more accurately depict water levels than what is indicated. This would be helpful in determining where the THA is either confined or unconfined (and therefore representative of the water table) and to confirm conceptual relationships between groundwater pressures in the THA and LSP aquifers.	Provide or describe the source of information used to generate the geological cross section conceptual model. Where necessary provide updated cross sections with redrawn groundwater level information that is reflective of potentiometric surface interpretation and data source.
85.	Vol 3, App C4, Sect 2.3 Vol 3, App C4 Att A Sect 2.7	It is not clear how the presented data and information to this point in the report supports many of the assertions made in this section. Particularly where there is a stated data deficiency, this deficiency requires reference in this section as well with accompanying discussion as to how it has limited conceptualisation and therefore why the conceptualisation adopted was chosen.	Review these assertions and provide updated information where necessary to support the assertions. Provide reference to the supportive data where available, and provide revised assertions where data isn't available to reflect this limitation.
86.	Vol 3, App C4, Sect 3.2.2iib	*"It is acknowledged that some LSP drawdown reaches the model boundaries; however, the uncertainty associated with fluxes across boundaries is likely far smaller than that induced by limitations of site investigations and monitoring (to date). The model extent will be revised in future model iterations."*	Provide an assessment of the effect of the CHB conditions and the location of the boundary on drawdown in the LSP aquifer.

		The fact that the modelling suggests that drawdown reaches the boundary in the LSP aquifer is significant and needs to be assessed quantitatively.	
87.	Vol 3, App C4, Fig 3.8	The drawdown and recovery shown in these wells will depend on the boundary conditions applied within the model. As these boundary conditions and the location of the boundaries are reassessed, the results shown here will change, and so will the associated conclusions.	Please redevelop analysis once boundary locations and conditions are re-assessed and provide an updated drawdown figure and discussion.
88.	Vol 3, App C4, Sect 3.2.2vi	*"The primary attribute of an aquifer that controls the propagation of drawdown or governs the change in hydraulic head is the hydraulic diffusivity, which is the ratio of the aquifer's transmissivity and the storativity. At present time, adopted aquifer property ranges are based on steady state calibration only and the project teams best guess estimate of plausible aquifer properties based on public available datasets and reports, that are not necessarily local to the OKDUGA Project. Although a thorough predictive uncertainty analysis has been undertaken as part of numerical modelling, there is no guarantee that the adopted base case properties or the adopted aquifer ranges associated with the ensemble of realisations has completely covered the true range of aquifer properties. Also, a large assumption related to the conceptual model is that the higher permeability zones of the LSP directly correlate with fracture density, which needs further investigation and confirmation. It is recommended that a forward work plan is undertaken to include various site based and laboratory testing methods to reduce the uncertainty related to aquifer properties and thus drawdown propagation, which may include but not limited to pumping tests, packer tests and laboratory-based testing for permeability and storativity."* This could certainly be considered, but obtaining more recent and spatially distributed hydraulic head data would be far more beneficial.	Obtain and provide additional available hydraulic head data to support the groundwater assessment.

89.	Vol 3, App C4, Sect 3.2.2 Vol 3, App C4, Sect 3.3 and Ch 4	These sections need to be reassessed once the issues with the modelling report (Attachment A) are resolved. Please refer to the comments made in relation to Attachment A.	Provide a further work commitment to re-assess and provide updated corresponding information following the appropriate rectification of the modelling report.
90.	Vol 3, App C4, Table 2.1 Vol 3, App C4, Table 2.6 Vol 3, App. C4, Att. A, 3.5.5 4.1.1 Table 2 2.6	The Carrapateena bore (Northern Wellfield) details are not here. The screened interval and extraction rates are required in the modelling report so that they can be appropriately included in the model. Screened interval(s) need to be specified. *The wellfield is permitted to abstract up to 7 ML/d and is comprised of 12 wells (although exact construction details are not publicly available).* *"…history-matching targets: 21 of the wells are screened in the THA and 9 are screened in the LSP."* It is unclear what is meant by "not publicly available" as construction details inclusive of depths of casing, screens etc, diameters, and materials are required to be made public as part of well permitting. Such information also appears in summary in the report.	Provide the requested details on screened intervals and extraction rates. Provide clarification concerning what information is not publicly available that would aid numerical modelling.
91.	Vol. 3, App. C4 Table 2.7 Vol. 3, App. C4 Att. A Table 2.4 Vol. 3, App. C4 Att. A 2.4.1	DEW notes that there is a wide range of K value for certain HSU's within the study area, which leads to concerns that HSU hydraulic properties may be mis-interpreted or mis-calibrated during modelling. Whilst DEW acknowledge this as an uncertainty that requires additional work to reduce and note discussion on parameters provided in Section 2.4.1 of Attachment A, further discussion is required regarding the spatial distribution of such results with respect to this being grounds to reject certain measurements. For instance the comment is made about difference of measurement made at "*at Olympic Dam Mine versus at*	Provide further discussion regarding the spatial distribution of data in the C4 Table 2.7 and C4 Att A Table 2.4 with respect to this being grounds to reject certain measurements. Provide further discussion on the apparent highlighted contradiction with respect to model conceptualisation and

	Vol. 3, App. C4 Att. A, Table 2.5	*Carrapateena Mine versus regionally"*. Discussion is required on whether this is sufficient reason to reject measurements collected distal to the study area. Further, whilst noting commentary in section 2.4.1 Attachment A, in some cases (such as the PFA) all available K information presented appears to contradict HSU conceptualisation. E.g. Very low K values for an interpreted aquifer. In other words, all the available data does not support the conceptualisation as the variance does not appear great enough to accommodate. Further discussion is required on this apparent contradiction with respect to model conceptualisation and scenario analysis. Justification is required on why this apparent contradiction is unlikely to impact results and interpretation of modelling outputs.	scenario analysis. Provide justification why this apparent contradiction is unlikely to impact results and interpretation of modelling outputs.
92.	Vol 3, App. C4, att A 2.2.3 Vol 3, App. C4, Att. A, 2.6 Vol 3, App. C4, Att. A, 2.7	*Jacobs (2016a) investigated the Bosworth Creek waterhole source close to Lake Torrens and found it was evenly split between the Tent Hill Aquifer and rainfall. However, when flowing, the predominant water source to Bosworth Creek is rainfall.* *There are two waterholes along Bosworth Creek. These are not likely to be supported by groundwater flow from underlying aquifers, rather they are pools that are observed around deeply incised parts of the creek that can hold water for a period of time.* *Waterholes along Bosworth Creek are not likely to be supported by groundwater flow from underlying aquifers, rather they are pools that are observed around deeply incised parts of the creek that can hold water for a period of time, post a rainfall event.* The above statements appear to contradict. The first statement appears to say that Jacobs (2016a) presents evidence that the THA can contribute up to approximately 50% of water inputs to the Bosworth	Provide clarification of this apparent contradiction.

		Creek waterhole, whilst the other two statements say groundwater contribution to this waterhole is unlikely.	
93.	Vol. 3, App. C4 2.2.5	*An overview of the groundwater quality results from the Carrapateena Mine is provided in Table 2.8. For all groundwater units the pH is neutral and is dominated by sodium and chloride ions.* It is recommended this be graphically presented though the use of a diagram, such as a Piper diagram or similar.	Display hydrochemistry data on a figure to illustrate the argument being made.
94.	Vol. 3, App. C4 Table 3.1	*Unconfirmed, due to no extraction of mineralised material, the depth of groundwater and engineering design there will be no seepage to the underlying groundwater system.* Confirmation needs to be provided on whether material need to be mineralised for it to be a potential source of acid and metalliferous drainage.	Provide the requested information.
95.	Vol. 3, App. C4 3.3	*In addition, two springs fed by the fractured rock aquifer (LSP) that may support GDEs are located along Salt Creek. Incremental drawdown does not extend to these two springs, however cumulative LSP drawdown of up to 0.5 m does, based on the conservative assessment from the Upper LSP high K layer. These GDEs occur near creek lines, and the GDEs and potential reliance on groundwater has not been ground truthed.* Whilst DEW acknowledge this statement and welcome any work focussed on understanding the source of groundwater at spring environments, this hypothesis appears different to other descriptions concerning the source of spring water within the study area, which variously does or does not include contributions from deeper saline aquifers, shallow groundwater from the Quaternary aquifers, overbank flows and surface water flows.	Clarify the inconsistent descriptions concerning the source of water to springs and the uncertainties inherent in this.

96.	Vol 3, App C4, App A, Sect 1.6	Given the paucity of usable data, a Class 1 analysis is possibly achievable, provided the DEW recommendations mentioned above are incorporated. However, the model will always be based on the available (limited) data, so a Class 3 outcome using Uncertainty Analyses is considered an unreasonable expectation.	For noting.
97.	Vol 3, App C4, Att A, Table 2.1 Vol 3, App C4, App A, Sects 2.3 and 2.4 Vol 3, App C4, App A, Sect 3.5.2 and 3.5.3	*Evaporation is kept constant across the whole model domain at a maximum potential of 2,750 mm/yr. and an extinction depth of 3 m.* Further discussion is required on how Rainfall and Evapotranspiration (ET) vary during the year and how this variation is used to support the recharge value used in the model. Further, the extinction depth does not appear to be based on anything. Justification is required on the choice of a 3m extinction depth. Finally, the choice to use the maximum evaporation rate as a constant appears a conservative choice, however this is not explained. Similarly, the choice to use a very low Re requires justification.	Include a figure showing monthly averages and a discussion that supports the value(s) used. Provide an explanation for the chosen extinction depth and why simply using the maximum evaporation rate and very low Re is considered acceptable.
98.	Vol. 3, App. C4 Att A, 2.3.1	*From north to south the LSP becomes thinner while the Arcoona Quartzite and Woomera Shale thicken. The Andamooka Limestone is predominantly absent in the centre and south of the study area. The depth to basement is also shallower in the north, at approximately 450 mAHD compared to 700 mAHD in the centre and south.* It is requested that this data be displayed on a figure.	Provide a figure or figures which displays the extents and thicknesses of significant HSU's.
99.	Vol 3, App C4, App A, Figs 2.5 and 2.6	These are the figures that should be used in place of those in Vol 1 and App C4. The flow direction arrows have been removed. These figures are used as the bases for much of the modelling effort, and they need to be corrected: all head data need to be density-corrected or sufficient justification provided if not. The contours need to be far better justified, particularly in areas where no data appears.	These changes need to be made and the conceptual model updated accordingly.

100.	Vol. 3, App. C4 App. C4, Att. A, 2.4.4 Vol. 3, App. C4 App. C4, Att. A, 2.7 Vol. 3, App. C4 App. C4, Att. A 4.2.2	*The watertable within the uppermost aquifer, the THA, ranges from 5 to 70 metres below ground level (mbgl) across the Stuart Shelf and is influenced by ground elevation (Jacobs 2016).* *The PFA is confined and the THA varies from confined to unconfined depending on location.* *Modelled steady state watertable elevation, which represents the THA, for the base realisation, as well as the spatial distribution of the base realisation residuals is shown in Figure 4.4.* Groundwater conditions in the THA aquifer are not clear. Figure 4.4, whilst representative of modelled steady state water table and residuals, this would also be the pre-scenario water level in the THA Aquifer. This requires confirmation The contours along the southern boundary seem to show a lot of unsupported variation. By extension, DEW infers therefore that groundwater found in Quaternary aquifers are unconfined perched groundwater conditions and do not represent the water table. This also requires confirmation.	Provide further clarification on: a) whether groundwater in the THA represents the water table; and b) if it does not and is instead a confined aquifer, indicate where this is and discuss how this impacts scenario analysis. Please confirm interpreted details. Provide an explanation of the variation evident in contouring along the southern boundary.
101.	Vol 3, App C4, App A, Sects 2.4.2 and 2.4.3, Sect 2.4.4,	There appear to be very little data to support these interpretations. As they are important aspects of the conceptual model, further data and justification are required. Cross referencing to appropriate supporting citation and/ or data are required. In particular, the following aspects need further elaboration: i. evidence for natural boundary condition interpretations ii. recharge and discharge mechanisms	Provide reference to appropriate supporting citation and/ or data where available, and provide revised assertions where data isn't available to reflect this limitation.

		iii. discussion about hydraulic head gradients and how these gradients from different aquifers related to one another.	
102.	Vol 3, App C4, App A, Sect 2.4.3b	The lack of correct extraction data for the Carrapateena production bores (Northern Wellfield) is a significant limitation in the model.	Include this data where available in updated hydrogeological assessments.
103.	Vol. 3, App. C4 App. C4, Att. A, 3.1	*It is environmentally conservative to assume that the intermediate fractured rock groundwater system is interconnected at the site-wide scale and is also permeable. This assumption allows for drawdown/ mounding to propagate radially outwards from the project components and, therefore, assessment of impacts to receptors is skewed towards over-emphasising potential impacts.* Whilst DEW acknowledge that the approach may be considered conservative, other aspects such as heterogeneity, linkages between GDE's and fault related conduits and the relatively low storage inherent in fractured rock aquifers mean that in other aspects, the approach may not be conservative.	Provide further discussion about any monitoring and/ or modelling contingency being made in forward planned works to address uncertainty if this assumption does not prove to be conservative.
104.	Vol. 3, App. C4 App. C4, Att. A, Figure 3.1	An updated version of this map (or similar) is requested indicating the location of springs and waterholes.	Provide an updated version of Figure 3.1 (or similar) which indicates the location of springs and waterholes.
105.	Vol 3, App C4, App A, Fig 3.2 Vol 3, App C4, App A, Table 3.2	MODFLOW-USG and Vistas may well have (stability) issues with the number of layers and complexity of the vertical grid shown in this figure. In support of this interpretation, the 2465 yrs. to control stability is a good indication that the complexity of the vertical layering is an issue with the computational aspects of MODFLOW-USG.	Recommend the vertical layering be simplified in model updates.

106.	Vol 3, App C4, App A, Sect 3.5.1 and Fig 3.4	These boundary conditions are considered unacceptable. Boundary conditions control the whole solution and therefore must be fully supportable.	More data must be collected and/ or incorporated (if currently available) that can support acceptable boundary conditions.
107.	Vol 3, App C4, App A, Sect 3.5.1	Where data is available, heads in the LSP aquifer are significantly different from those in the THA. In addition, density-corrected heads may show an even greater difference. Using the same boundary heads in the LSP aquifer as in the THA aquifer cannot be supported.	Boundary values in the LSP aquifer are required to be changed to ensure they can be supported from a hydrogeologic point of view.
108.	Vol 3, App C4, App A, Ch 4	Given the lack of acceptable hydraulic head data, the application of PESTPP-IES cannot be supported. There is a concern that without adequate constraint with appropriately collected and adequately spaced head data, any output obtained using PESTPP-IES will be unrealistic or too uncertain to be useful.	Reconsider conceptual model and modelling approach once acceptable head data are available.
109.	Vol 3, App C4, App A, Sect 4.4 and the associated appendix.	None of these figures provide any clear indication as to what were the calibrated values that were determined for the calibrated model.	Provide values and a discussion to clarify what values were estimated from PEST and then used in the model.
110.	Vol 3, App C4, App A, Sect 4.4	The results from this modelling effort do not appear to have included the Carrapateena (Northern Wellfield) production wells. In addition, clarification is required on whether the surface for the LSP aquifer has not been included as a figure.	Provide a figure that shows results that include Carrapateena production well (Northern Wellfield) extraction.
111.	Vol 3, App C4, App A, Fig 5.1	The results shown in this figure are questionable. Given that the flows in and flows out are controlled by the constant head boundaries, which are kept fixed, then the variation in storage-in with no storage-out over time does not seem hydrogeologically valid.	Correct the constant head boundaries and provide an updated version of this figure.

112.	Vol 3, App C4, App A, Table 5.2 and Fig 5.2	The results shown in Fig 5.2 provide a very large range of outcomes because of the probabilistic form mentioned in Table 5.2 and its associated text. No justification nor basis has been provided for this probabilistic form.	Provide a basis for this analysis and these results.
113.	Vol 3, App C4, App A, Sect 5.3.3i and Fig 5.4, Vol 3, App C4, App A, Sect 5.3.4i and Fig 5.10 Vol 3, App C4, App A, Sect 5.3.4ii and Figs 5.11 to 5.14	Sect 5.3.3i and Fig 5.4: This figure shows very clearly that drawdown is expected to reach the boundary of the model for the LSP aquifer. CHB conditions are not appropriate under these circumstances. Sect 5.3.4i and Fig 5.10: The drawdown as a result of the combined extraction in the LSP aquifer very clearly reaches the model boundaries. See comments directly above. Sect 5.3.4ii and Figs 5.11 to 5.14: Figure 5.12 suggests that the CHB for the THA aquifer may also not be appropriate; Figures 5.13 and 5.14 definitely show that the LSP aquifer has a problem.	Boundary conditions for the LSP aquifer need to change or the boundary location needs to extend beyond the existing location.
114.	Vol 3, App C4, App A, Sect 5.3.3ii and Figs 5.5 to 5.8	The basis for these figures needs to be provided. In addition, Figure 5.8 seems to strongly support the comment that CHB conditions are not appropriate.	Provide the basis for these results and reconsider boundaries.
115.	Vol. 3, App. C4, Att. A, 5.3.3 Figure 5.3 Figure 5.6	Simulated drawdown in the THA aquifer, particularly during the recovery phase, appears to be coincidently limited to the south by Boswell Creek, however this relationship does not appear to be discussed. Discussion is required on whether this is coincident or is how Boswell Creek represented in the model impacting drawdown propagation in the THA aquifer to the south. If so, a discussion is required on if this influence is realistic.	Provide discussion on the apparent role Boswell Creek is having on the extent of drawdown contours in modelled outputs.

116.	Vol 3, App C4, App A, Sect 5.3.5	An analysis of the effect of CHBs on model results using mass balance relationships appears to be incorrect. Running a few of the problem scenarios for the LSP aquifer with boundaries moved or conditions changed is needed to support this assertion.	Examine and provide discussion on the model results under different boundaries and boundary conditions.
117.	Vol 3, App C4, App A, Ch 7	DEW agrees with the stated limitations. The bullets provided here identify issues that reinforce the previously stated concerns regarding current model development and supporting analyses. Further, density correction must be added as a limitation.	Provide a discussion on density correction as a limitation.
118.	Vol 3, App C4, Att B, Table B.1	This table, or something equivalent to it, should have appeared in the numerical modelling chapter. In addition, a discussion is required on how the values of conductivity have been estimated in layers or sections of layers where no head data are available for calibration.	Provide the discussion requested in the matter raised.
119.	Vol 3, App C4, Att B	It is not clear what boundary conditions are used for this analytical model and how it is appropriate for this modelling investigation.	Provide clarification.
120.	Vol 3, App C4, Att B, Fig B2	This shows that drawdown in the LSP aquifer reaches the 30km boundary using only the mining production wells. A discussion is required explaining what happens when the Carrapateena Production (Northern Wellfield) wells are included in the assessment.	Provide clarification.
121.	Vol 3, App C4, Att B, Fig B2	It is not clear whether production wells were included in the numerical model.	Provide clarification.
122.	Volume 3 of 4 Appendix B to Appendix D	DEW are seeking more information on the SEB offset scores. This is not clear in the **Impact Assessment (Appendix D)** As per requirement in TOR 006 – Mineral mine lease/licence applications 2.8 Vegetation Clearance 2.8.1 Description of Vegetation Clearance	State the estimated quantum of significant environmental benefit (SEB) to be gained in exchange for the proposed clearance and describe how the SEB will be provided.

		If clearing of native vegetation is proposed, a map (as per 5.1.2.2) and description of the vegetation present in the application area must be provided, showing: • The extent of any proposed vegetation clearance; and • the likelihood of the presence of threatened flora.	
123.	Vol 1, 3.2.3.2	**Editorial note:** *Groundwater inflows were obtained from the RL Project Area exploration bore. Yields were estimated to be 0.5 to 0.6 litres per second (L/s) from the THA and 1.7 to 2.7 L/s from the lower sections of the PFA, with no reported fracture zones intersected (OZ Minerals 2017b).* Clarify whether the RL referred to here is the same RL as the subject of this application. In which case, clarify why Oz Minerals (2017b) is cited (ie was the exploration bore one drilled by Oz Minerals).	Provide an explanation and correction if required
124.	Vol. 3, App. C4 App. C4, Att. A, 3.1	**Note:** *From a Project water balance perspective, assuming interconnected and permeable fractured rock conditions is also conservative in that it may tend to over-predict groundwater inflow rates during construction, which will reduce the risk of under-estimating groundwater licensing requirements.* Whilst DEW appreciate the approach, a licence to extract groundwater is only required if the extraction occurs within a prescribed wells area. This is not the case in this instance.	
Matters Raised by South Australian Arid Lands Landscape Board (SAAL Landscape Board)			
125.	L71 + L72 Appendix D – Section 4.3.3.7 – Impact of	**Bird strikes on electrical poles – reflectors / monitoring** In Appendix E2 (pages 243 – 245), impact factors L71 & L72 list key controls measures that BHP will undertake that includes perch guards,	Provide clarification and further information as per the matters raised.

	transmission lines of avian fauna Appendix E2	conductor insulators and provision of adjacent perches to transmission lines. In Appendix F1 – EPBC Act significant impact assessment - Recommendations made by Lathwida include attaching reflectors to powerlines at regular intervals and at important points along the line adjacent to potential foraging habitat (pages 503 & 509) to mitigate risks to avian fauna. Confirmation is required that this step will also be undertaken to further mitigate risks. Clarification is required whether there is any monitoring proposed along transmission lines to document impacts to avian fauna. While it has been identified that the risk to EPBC listed raptors and migratory species is potentially low, wedge-tailed eagles are also present in the area. While we note they are not EPBC listed or state listed, they do carry both cultural significance for Indigenous Australians and ecological significance and they have a larger potential impact from the transmission lines.	
126.	Appendix E2 L12 Pgs 216 & 217	**Vegetation clearance – pre-clearance protocols** Clarify whether BHP is proposing to establish protocols or methods regarding vegetation clearance and the preparation of a site leading up to clearance. Specifically in regards to the impacts to native fauna, such as; - Final survey or monitoring in the days leading up to clearance - Proposed captures and translocations of native fauna - Intensive feral predator control leading up to vegetation clearance to reduce predation of displaced fauna	Provide further information as per the matters raised.

		Provide details of what steps are proposed to minimise (or stop) any native animal fatalities during the clearing process.	
127.	Appendix C5, Section 3.	**Stormwater Catchment Dam and Waste Rock Landform dam discharge.** Appendix C5, Section 3 indicates that stormwater collection dam and waste rock landform dam could discharge into the northern and southern watercourses respectively (of the surface infrastructure site) during large rainfall events. The Water Affecting Activity (WAA) Control Policy also covers discharge of water into a watercourse and these activities require a WAA permit. Confirmation is required that water collected in the stormwater collection dam is proposed be used onsite as service water, or will discharge into offsite watercourses.	Provide clarification as per the matter raised.
128.	Table 8.1	**Flow diversion techniques** Confirm and provide information on whether there are likely to be any surface water diversions in and around the surface water infrastructure or the camp. Particularly for clean surface water that originates from outside the infrastructure and could be diverted to drainage lines, rather than surface water that may come into contact with proposed operations.	Provide information as per the matters raised.
129.		In addition to protecting watercourses, drainage lines and surface water flows, describe what control measures are proposed for managing potential impacts on the cane grass swamps (as a water dependent ecosystem, rather than a vegetation community).	Provide information as per the matters raised.

		This is noting a cane grass swamp exists in close proximity to the access road between the exploration hub and the surface infrastructure site.	
130.	Section 4.8 Pg 161 and Section 4.9.2.4 – Page 164 And Appendix C5	**Note: Watercourse crossings for the road to explosives magazine and in SIC and WIC MPLs** Should a lease and licenses be granted, all watercourse crossings in the RL, SIC MPL and WIC MPL are likely to require a Water Affecting Activity (WAA) permit. Permit applications need to be submitted to the SAAL Landscape Board at least 3-4 months prior to works commencing. The SAAL Landscape Board should be consulted once design details have been finalised prior to making any permit application to ensure the works align with the Board's Water Affecting Activity Control Policy.	
131.	Section 4.9.2	**Note: Surface water management infrastructure** Once the full plans and specifications of the surface management infrastructure have been finalised, SAAL Landscape Board should be consulted to clarify the need for further permitting.	
Matters Raised by South Australian Environment Protection Authority			
132.	Surface Water - sizing of ponds	It has been proposed to size the stormwater dam and the runoff dams to capture and contain a 20% AEP (1 in 5 rain event). The EPA recommend sites in arid and semi-arid areas should aim to capture a 1% AEP event. This is due to the reduced rainfall and high evaporation rates in these localities. As a minimum, sizing should aim for a 5% AEP (1 in 20 year event) with monitoring proposed to demonstrate that any overflow is of suitable quality to be discharged to the environment. If a 1% AEP is catered for then no monitoring of overflow events are required as an event larger than a 1% AEP is considered to be an extreme event.	Given the arid location of the site, all wastewater and stormwater ponds should ideally be sized to capture and contain all runoff up to and including a 1% AEP event. If it is only possible to size the ponds for a 5% AEP event, a monitoring program should be proposed to monitor any discharge/overflow from these ponds that might enter a waterbody or watercourse, demonstrating the water is either of

			suitable quality to be discharged to the environment, or demonstrating the impacts this discharge has had on the waterbody.
133.	Surface Water – placement of ponds	Any wastewater/stormwater ponds should ideally not be located in a 1% AEP flood zone. If that is not possible, then the batters should be constructed in manner to prevent any inflow of flood water, or collapse of embankments during these extreme conditions.	Given that the Stormwater dam and Runoff dam 2 are currently proposed for locations that will be impacted by any flood waters greater than a 10% AEP, further details are required explaining how overflows from these dams will be prevented and how the embankments of the dams will be constructed to prevent collapse or breakthrough.
134.	Appendix C4 Page 34/37 Main Doc Page 41 - Baseline groundwater quality	Not enough information provided to constitute a groundwater quality baseline assessment or dataset. As a minimum, groundwater quality should be monitored at least on a quarterly basis for at least two years to assess for variability and establish a baseline water quality data set. This should provide at least 8 data points for each monitoring well, which can potentially be combined into a larger single data set if no significant heterogeneity is identified between the groundwater quality from each well. A single monitoring round is not enough to properly characterise the temporal and spatial variation in groundwater quality. The EPA expectations about what constitutes sufficient baseline groundwater quality was first raised with BHP in July 2023. Insufficient evidence has been provided in the proposal to address those expectations.	Provide the results of all further groundwater baseline data collection undertaken to date. Provide details of a program of further groundwater data collection to be undertaken prior to operations commencing (that may impact groundwater quality) to establish a baseline groundwater quality dataset which satisfies EPA expectations and guidelines.

		There is still opportunity before the commencement of mining operations (that have potential to impact groundwater quality) to establish a satisfactory baseline groundwater quality dataset. The following link refers to the recently published EPA guideline on *"Establishing Baseline Groundwater Quality"*. https://www.epa.sa.gov.au/environmental_info/water_quality/groundwater	
135.	General	**Authorisation Requirements** BHP is reminded that all required authorisations under both EP and RPC Act are to be in place prior to commencement of operations (should mineral tenements be granted under the Mining Act). **Environment Protection Act, 1993** The proponent currently does not hold an EPA licence for Oak Dam. The proponent is advised to contact the EPA as soon as practicable for further information about the requirements. Possible prescribed activities include: • Mining/Extractives, • Concrete Batching • Waste (waste processing, wastewater treatment plant, composting).	
136.	General	**Radiation Protection and Control Act 2021** The proponent currently has a Radiation Management Licence (51416) and the Radiation Management Plan has been reviewed and approved by the EPA. BHP is required to contact the EPA to determine whether additional licence requirements are necessary under RPC Act.	

Attachment 2: Public submission

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ROXBY COUNCIL

Application for Retention Lease & two Miscellaneous Purpose Licences by BHP related to the Oak Dam Copper Deposit

2 May 2024

Department of Energy & Mining

Your Reference:

M2023/0161

2023/000338

2023/000339

Submission by the Municipal Council of Roxby Downs

The subject land comprises the prospective Oak Dam Copper deposit and is located 65 km southeast of Olympic Dam and 55 km southeast of Roxby Downs.

BHP has made application to Department of Energy and Mining for suitable forms of tenure over land surrounding and ancillary to the Oak Dam deposit to enable it to undertake advanced exploration. This exploration work will determine if the resource can be economically mined.

BHP has developed a strategy to explore the deposit called the Oak Dam Underground Access Project. (OKDUGA) This will enable underground drilling to be undertaken as opposed to surface drilling thus enabling more precise examination, understanding and measurement of the resource.

This project involves the construction of two decline tunnels of 6km in length to provide access to the orebody.

The tunnels will require a construction period of 6 years, which will be followed by a 2.5 year exploration period. A two year rehabilitation period is also proposed giving a total estimated project life of 10 years.

Supporting surface infrastructure will be established at the site to support logistics and performance of the work.

This includes an accommodation village to house 310 predominantly FIFO workers who will be brought to the site from the Olympic Dam airport by road transport.

BHP has prepared extensive documentation in support of its lease and licence applications comprising in depth investigations of environmental, social and governance impacts.

Of particular significance for Roxby Downs is the Social Impact Analysis (SIA) which examines regional social and economic impacts of the project. Key findings of the SIA highlight impacts including:

- reduced availability of flights due to increased demand driven by OKDUGA workforce,
- increased traffic and potential delays on Olympic Dam Highway due to increased traffic volumes associated with movement of material and workforce from the site; and
- potential reduced access to short term accommodation in Roxby Downs.

ROXBY COUNCIL

Positive impacts include:

- increased labour force participation
- increased economic productivity and work opportunities for locally based business due to demand for goods and services.

Roxby Council supports the applications by BHP for tenure to secure the vital exploration work to prove the potential of the Oak Dam prospect. The exploration and development of the Oak Dam resource with reinforce the strength and economic potential of the Copper SA province. The existing development at Olympic Dam and its capacity to scale up to achieve the production capabilities necessary to realise the full potential of Copper SA provide significant opportunities for Roxby Downs to contribute to this success. By providing a stable residential base for workers and contractors forward planning for Roxby Downs needs to be a critical part of the planning for resource development and optimisation.

For business as usual operations there is already a critical supply situation with no available land in Roxby Downs for development of new light industry. With increasing levels of fabrication sophistication and technical support, together with the need for capacity to service emerging demand, additional serviced industrial land needs to be prioritized.

Roxby Council is keen to participate with the Department and BHP in forward planning to ensure that Roxby Downs has the community capacity to support this exciting decade long exploration project.

Authorised:

Roy D Blight
Chief Executive
Municipal Council of Roxby Downs

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