



17 December 2015

Mr Brett Corven
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PO Box 99
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Our ref: 31/290400/0
248607
Your ref:

Dear Brett

Proposed Dargues Reef Mine – Modification 3 Comments on Response by Proponent

1 Introduction

Eurobodalla Shire Council (ESC) and Palerang Council (PC) briefed Dr Peter Beck of GHD Pty Ltd (GHD) to provide comment on the responses prepared by the proponent to GHD's report on the proposed Modification 3 to Mining Operations at the Dargues Reef Mine Project (the Project Site), currently in the process of being developed. GHD had prepared a report with comments on the proposed modification as follows:

- GHD, 2015, "Eurobodalla and Palerang Shire Council - Proposed Dargues Reef Mine, Review of Proposed Modification 3 Change to Mining Operations", Ref G:\31\2904000\WP\245897.docx, dated 26 August 2015

We understand that the proponent prepared a response to GHD's report, which was included in:

- RW Corkery, 2015, "*Response to Submissions Dargues Gold Mine - Modification 3*", November 2015, Ref No. 752/42

2 Objective

The key objectives of the comments sought by ESC and PC from Dr Beck are as follows:

1. Provide an opinion on the risk to the water quality in the ESC drinking water catchment as a result of the proponent abandoning the proposed Carbon In Leach plant that would have used cyanide; and
2. Provide general commentary on the proponents response to GHD's report dated 28 August 2015.

3 Scope of Work

To meet these key objectives the following scope of works was completed:

- Review the information provided in the RW Corkery, 2015 responses and discuss potential risks to the water quality in the ESC drinking water catchment.
- Provide comments on the RW Corkery, 2015 responses regarding the information contained therein, the integrity of the data used in the analysis undertaken and the validity of the conclusions reached.
- Document the review in this letter report.



4 Discussion

This section presents our comments on the responses prepared by the proponent on our earlier report.

4.1 Response to: 3.7.4.1 Cyanide and Gold Recovery

The proponent acknowledges that the proposed installation of a Carbon In Leach (CIL) plant that utilises cyanide has been abandoned. This has removed the most significant potential risk to human health and the environment posed by the modification. The proponent will now only place coarse gravity separated tailings into the Tailings Storage Facility (TSF) and the sulphidic concentrate that contains heavy metals will be transported for processing at an off-site facility.

Now that the use of the CIL plant has been abandoned the TSF will retain the more benign tailings, which contain lower concentrations of heavy metals that would tend to be less mobile. Therefore in the event of a catastrophic failure of the TSF dam the most significant impact would be by sediment that would migrate through the catchment but which would pose a lower toxicity risk to water quality and any impacts would be of a shorter duration as the sediment settles out along the flow path.

4.2 Response to: 3.7.4.2 Risks Associated with Cyanide

As the proposed use of the CIL plant has been abandoned the risk posed by cyanide has been removed.

4.3 Response to: 3.7.4.3 Adequacy of Proposed Processing Operations and Environmental Controls

The proponent contends "*Reference is made throughout RWC (2010a) and RWC (2015) to the fact that all storage containers and other tanks would be constructed and banded in accordance with AS4452 Storage and Handling of Toxic Substances. That commitment remains unchanged as a result of the removal of the use of cyanide from the Proposed Modification.*"

GHD's previous comment on the limitations of bund storage still stands; however, the risk profile has changed as a multiple failure event would not involve the same level of toxic substance release and hence any accidental release would likely have a lower impact on the environment if released beyond the containment infrastructure.

Also the proponent contends "*Preparation of detailed management plans is typically a matter that is left until after granting or modification of a Project Approval. However, in the present case, a range of detailed management plans have already been approved and are available online website. As required by Condition 5(4) of MP10_0054, these plans would be reviewed and if required revised in consultation with relevant government agencies, including Palerang and Eurobodalla Councils, following granting of any modification. As a result, the Proponent contends that ample information is available to assess the adequacy of risks associated with the Proposed Modification.*"

Again, our point stands; however now that the proposed CIL plant using cyanide has been abandoned the risk profile has decreased significantly and hence the proposed management plans would appear reasonable as any release would pose a lower level of risk to human health and the environment.



Further, *“The Proponent notes that a range of management measures would be implemented to manage critical aspects of the Project, including for example the following.*

- *Engineering measures, including bunding and compliance with design and construction codes, including those of the Dams Safety Committee of NSW, as well as relevant Australian and industry standards.*
- *Certification and supervision of the design and construction of the processing plant and Tailings Storage Facility.*
- *Automated monitoring and shutoff of pumps and valves.*
- *Scheduled operational (daily), on-site engineering (weekly and monthly) and independent consultant engineering (annually) inspections and testing and maintenance.*
- *Detailed procedural manuals describing operational procedures.*

As a result, the Proponent rejects the suggestion that insufficient redundancies have been included or that over-reliance is placed on operators. Finally, the Proponent notes that required staff competencies would not typically be a matter relevant to an application under the EP&A Act.”

The point raised related to risk and the relevant management, response and mitigation measures, not compliance of the application with EP&A Act. Again, the significance of the point has reduced as any potential failure would result in lower risk as the process no longer involves use and generation of large quantities of toxic substances. However, while the proponent’s response focuses on the CIL plant and tailings transfer infrastructure it does not address the issue of reliance on operator inspection with respect to the TSF dam stability. The proponent’s response does not appear to specifically address this issue.

In addition the proponent contends “As modification of the Tailings Storage Facility no longer forms a component of the Proposed Modification, the Proponent contends that this statement is no longer relevant. However, the Proponent notes that the facility is not a landfill and the Solid Waste Guidelines do not therefore apply.”

Again our point related to risk and context. However, as noted now that use of cyanide has been abandoned the risk profile has shifted significantly as the TSF will no longer receive large quantities of toxic substances. GHD drew an analogy in the report to a landfill, which in our opinion would be appropriate given that Modification 3, when it included deposition of toxic metal containing waste onto land, was akin to a landfill. The point was to highlight the significant difference in the proposed leachate containment and management system for the modified TSF and a licensed landfill that could receive similar wastes.

As a final response in this section the proponent contends “As the design of the Tailings Storage Facility and the composition of the tailings to be placed within it would be consistent with the approved Project, the Proponent contends that this issue is no longer relevant. Notwithstanding this, the Proponent notes that during rehabilitation of the Tailings Storage Facility, a suitable impermeable barrier/layer and/or store and release cover would be installed on the Tailings Storage Facility to minimise the potential for infiltration of water into the tailings. As a result, long-term generation of leachate from the facility is unlikely to be a significant risk. As a result, a formal assessment of the risk of that aspect of the Project was not undertaken.



Finally, the Proponent notes that GHD (2015) states that the approved processing methodology would result “only a relatively limited risk to human health and the environment during and post operation of the mine” and post mining management of the facility would be managed using relatively simple measures. As the Proposed Modification as amended would include processing and tailings storage operations as approved, the Proponent presumes that the above comments are no longer relevant.”

Since the proponent has abandoned the proposed CIL plant that uses cyanide and will transport the ore concentrate to another location for processing the risk of generating leachate that contains toxic metals and migration risk in the environment has decreased significantly.

4.4 Response to: 3.7.4.4 Consequences of Failure of Proposed Controls

The proponent contends “*The Proponent notes that the Tailings Storage Facility has been designed and would be constructed in accordance with the requirements of the following guidelines.*

- *Dams Safety Committee of New South Wales DSC3A Consequence Categories for Dams.*
- *Dams Safety Committee of New South Wales DSC3F Tailings Dams.*
- *Australian National Committee on Large Dams (ANCOLD) Guidelines on the Consequence Categories for Dams.*

As a result, the Proponent contends that the risk of catastrophic failure of the Tailings Storage Facility would be unchanged from the approved Project and would be in line with the above guidelines.”

GHD concurs that any risk from catastrophic failure is diminished by the proponent abandoning the proposed installation of a CIL plant that uses cyanide. Therefore any catastrophic failure would result in mainly sediment discharge with the limited presence of potentially toxic compounds present.

However, GHD notes that the design of the TSF dam as approved was not designed in accordance with the *Dams Safety Committee of New South Wales DSC3F Tailings Dams* criteria. The Knight Piésold report dated 22 October 2010, which provided the original dam design makes no reference to this guideline. The *Dams Safety Committee of New South Wales DSC3F Tailings Dams* guidance document was not published until June 2012. Since the original dam design is significantly different to the design proposed in Modification 3 the response needs to acknowledge that by reverting back to the approved project the TSF dam is in fact not designed in compliance with *Dams Safety Committee of New South Wales DSC3F Tailings Dams* as stated in the response, unless the proponent conducted further investigations to demonstrate the TSF dam is in fact compliant with this guidance.

4.5 Response to: 3.7.4.5 Extension of Mine Life

The proponent contends “*The Proponent notes that GHD (2015) determined that the proposed increase in mine life would pose an insignificant increase in the risk associated with the Proposed Modification compared to the use of cyanide within the Project Site. As that component has been withdrawn, the Proponent contends that the extended mine life is no longer an issue of significant concern for GHD.”*



We tend to concur that since the proposed CIL plant using cyanide has been abandoned increased mine life is not considered to present a significant increase in risk profile of the site to human health and the environment. However, a separate assessment of the approved TSF's ability to handle the additional tailings volume will be required to demonstrate that the proposed increase in tailings stored does not adversely affect the long term stability of the TSF dam.

4.6 Response to: 3.7.4.6 Increase in Total Production

The proponent contends "*As the use of a CIL plant and placement of leached concentrate tailings within the Tailings Storage Facility no longer forms a component of the Proposed Modification, the Proponent contends that the increase in total production is no longer an issue of significant concern for GHD.*"

We tend to concur that since the proposed CIL plant using cyanide has been abandoned increased mine life is not considered to present a significant increase in risk profile of the site to human health and the environment. However, a separate assessment of the approved TSF's ability to handle the additional tailings volume will be required to demonstrate that the proposed increase in tailings stored does not adversely affect the long term stability of the TSF dam.

4.7 Response to: 3.7.4.7 Construction of an Enlarged Tailings Dam

The proponent contends "*The Proponent notes that GHD (2015) determined that storage of flotation tailings only would not pose a significant risk to the environment. As storage of leached concentrate within the facility has been withdrawn from the Proposed Modification, the Proponent contends that the extended mine life is not an issue of significant concern for GHD.*"

We tend to concur that since the proposed CIL plant using cyanide has been abandoned increased mine life is not considered to present a significant increase in risk profile of the site to human health and the environment. However, a separate assessment of the approved TSF's ability to handle the additional tailings volume will be required to demonstrate that the proposed increase in tailings stored does not adversely affect the long term stability of the TSF dam.

The proponent also contends "*The Proponent has engaged Knight Piésold to design the Tailings Storage Facility. Knight Piésold are experts in the design of such facilities within Australia and worldwide. In addition, the design and construction of the facility will be required to be reviewed and approved by the Dams Safety Committee of New South Wales prior to construction commencing, following completion of each stage and audited annually. In addition, the Proponent notes that the Dams Safety Committee reviewed the Tailings Storage Facility Final Design Report (Knight Piésold, 2011) at its February 2012 meeting and confirmed in writing on 3 February 2012 that the "overall design conforms to Committee requirements".*"

We tend to concur, the proposed key milestone independent review by the Dam Safety Committee of NSW would be appropriate. However, a separate assessment of the approved TSF's ability to handle the additional tailings volume will be required to demonstrate that the proposed increase in tailings stored does not adversely affect the long term stability of the TSF dam.



Also, the proponent contends *“The risk of catastrophic failure of the Tailings Storage Facility is required to be taken into consideration when determining the Hazard Rating for the facility at the outset of the design stage in accordance with the following guidelines:*

- *Dams Safety Committee of New South Wales DSC3A Consequence Categories for Dams.*
- *Dams Safety Committee of New South Wales DSC3F Tailings Dams.*
- *Australian National Committee on Large Dams (ANCOLD) Guidelines on the Consequence Categories for Dams.*

As a result, the Proponent rejects the assertion that these matters and the associated risks associated with them have been understated for either the approved Tailings Storage Facility design or that presented in RWC (2015).

GHD disagrees with this response. The proponent does not present any substantive study of the impacts a catastrophic TSF failure would have on human health and the environment. The response focuses on design of the TSF dam and not the consequences of a failure. GHD's point is considered to remain valid. Also as noted above, the approved TSF dam was not designed with appropriate reference to Dams Safety Committee of New South Wales DSC3F Tailings Dams guidance as this postdates the original dam design.

Further, the proponent contends “As the design of the Tailings Storage Facility and the composition of the tailings to be placed within it would be consistent with the approved Project, the Proponent contends that this issue is no longer relevant. In addition, the Proponent notes that GHD (2015) states that the approved processing methodology would result in “only relatively limited risk to human health and the environment during an post operation of the mine” and post mining management of the facility would be “able to be managed using relatively simple measures”

We tend to concur that since the proposed CIL plant using cyanide has been abandoned the risk profile to human health and the environment of the proposal has decreased significantly.

In addition the proponent contends “This issue has been addressed above. In summary, the Proponent notes that it will be required to manage the approved Tailings Storage Facility until all relevant government agencies are satisfied that the closure criteria have been achieved and the Mining Lease and associated security bond have been returned.”

The proponent appears to have missed the point of the comments. The comment referred to the lifecycle cost of the project not being adequately assessed. However, now that the proposed development of a CIL plan using cyanide use has been abandoned the risk profile has decreased and therefore the consequences of any failure of the TSF in the future have decreased.

Finally for this section the proponent contends “This would be a matter for future applications to modify MP10_0054 and is not a matter that is relevant to this application.”

The point made in our comment remains. Given the ore body has not been closed out, there remains the possibility of the TSF being expanded should more ore be available at economically recoverable rates.

GHD considered that there will be a tipping point where any catastrophic TSF failure will discharge a materially significant amount of tailings that have a long term impact on the down-gradient catchment.



4.8 Response to: 3.7.4.8 Consequence of Leachate Discharge

The proponent contends “As the design of the Tailings Storage Facility and the composition of the tailings to be placed within it would be consistent with the approved Project, the Proponent contends that this issue is no longer relevant. In addition, the Proponent notes that GHD (2015) states that risks associated with the approved tailings management operations would be relatively benign and able to be managed “using relatively simple measures”.”

We tend to concur; as proposed installation of a CIL plant using cyanide has been abandoned the risk profile has significantly decreased. The only aspect that needs further consideration is the maximum capacity of the tailings that can be stored in the TSF. Modification 3 already proposes an increase to the amount of tailings stored. As the proponent now intends to use the approved TSF design but store a greater volume of tailings there is a need to reassess the TSF dam stability to establish that the design remains suitable for long term storage of the tailings.

The proponent further contends “Notwithstanding the above, the Proponent is unsure how GHD (2015) arrived at the conclusion reached. The following presents a back calculated example for the statement that the Proposed Modification would result in an exceedance of the drinking water guideline criterion for chromium at the Deua River at the Wamban gauge.

- Worst case seepage rate 0.187L/s or 269L/day
- Mean Daily Minimum Flow at the Wamban gauge 43 000 000L/day
- Resulting dilution factor 159 851
- Australian Drinking Water standard chromium 0.05 mg/L
- Required chromium concentration in seepage water 7 992 mg/L

A concentration of 7 992 mg/L chromium is clearly many orders of magnitude in excess of what would reasonably be expected to be contained in leachate from the Tailings Storage Facility.”

The proponents calculation seems flawed. There are 86400 seconds in a day. Therefore the leaching rate would be 16,160 L/day not 269 L/day. It appears that the proponent used a leaching rate of 0.187 L/min not 0.187 L/sec. This would result in a significant overestimation of the dilution factors.

Using the correct conversion factor for L/sec to L/day the dilution factor would be 2660 not 159 851.

Therefore after taking dilution into consideration the Chromium Concentration would be 0.25 mg/L under minimum flow conditions, which exceeds the drinking water criteria of 0.05 mg/L.

Therefore our original point would remain valid and highlights that the proponents risk assessment had not adequately characterised the potential impact from the proposed TSF and associated leachate discharge.

As a final point in response to this issue the proponent contends “As the design of the Tailings Storage Facility and the composition of the tailings to be placed within it would be consistent with the approved Project, the Proponent contends that these comments are no longer relevant. However, it is unclear how or why GHD (2015) assumed a seepage rate two orders of magnitude higher than the worst case scenario calculated by Knight Piésold. As a result, the Proponent rejects this assertion.”



GHD disagrees with the Knight Piésold seepage calculation as they assumed ideal conditions and performance long term. As the liner proposed is not commensurate with even the minimum liner for a landfill the application of liner installation and degradation rates applied to landfill liners was considered reasonable and would provide a more realistic estimate of the long term leaching rate.

GHD therefore considers the calculations to present reasonable assumptions and scenarios.

4.9 Response to: 3.7.4.9 Tailings Composition

The proponent contends *“As the design of the Tailings Storage Facility and the composition of the tailings to be placed within it would be consistent with the approved Project, the Proponent contends that these comments are no longer relevant. Supporting this assertion is the statement by GHD (2015) that risks associated with the approved tailings management operations would be relatively benign and able to be managed using “relatively simple measures”.*

Notwithstanding the above, the Proponent contends that the analysis presented by GHD (2015) is simplistic and based on flawed assumptions. For example, GHD (2015) assume highly alkaline conditions in the Tailings Storage Facility of between pH 9 and pH 13 and draw a range of conclusions re the solubility of metals as a result. In reality, such alkaline conditions are highly unlikely to occur. As a result, the conclusions re the solubility of the various metals, are fundamentally flawed.”

This response appears to have misinterpreted the pH reference in GHD’s report. For the record, the pH 9 to 13 was in reference to the CIL plant where metal mobilisation would occur. Operation of the CIL plant requires alkaline conditions to limit the risk of hydrogen cyanide generation, which would pose a high risk to the health and safety of workers in the CIL plant. Our contention remains that the geochemical conditions in the CIL plant would be conducive to the mobilisation of a range of toxic metals that then discharge into the TSF. This point is highlighted in Table 10 of the Modification 3 application, which clearly shows that heavy metals would be concentrated in the tailings and discharged into the TSF. The risk assessment then needs to consider the geochemical fate and transport of these in the TSF leachate and environment.

The key point is that the risk was not adequately assessed and that the conservative analysis undertaken by GHD was an initial starting point and highlights that the issue needs further consideration. At no point did the Modification 3 application consider the risk to human health and the environment that may be associated with the discharge of toxic heavy metals into the TSF. As highlighted in GHD’s comment on the seepage rate, when analysis was undertaken it contained basic errors that then led to an underestimate of the potential risk posed. GHD’s contention remains that the application for Modification 3 understated the potential risk and lacked adequate assessment of potential risks.

Further the proponent contends *“Finally, Table 9 of RWC (2015) presents the chemical composition of the flotation tailings that would be placed into the Tailings Storage Facility. The table presents the geochemical abundance index (GAI), a measure of how enriched a particular element is compared to the average crustal abundance, for a range of elements. For most elements, the GAI is zero indicating that these elements are not enriched compared to the average crustal abundance. Elements with a GAI of greater than 1 include the following.*

- Silver GAI = 2



- Boron GAI = 2
- Molybdenum GAI = 3
- Antimony GAI = 4

Each of these elements is identified in Table 3 of GHD (2015) as having a low mobility. As a result, the Proponent contends that the proposed and approved tailings stream would not result in unacceptable solubility of metals in leachate."

We tend to concur; now that the proponent has abandoned the proposed installation of a CIL plant that uses cyanide, the risk of toxic metal mobilisation into solution and discharge has decreased. However, as noted in the response by the proponent the tailings will be enriched in Silver and Antimony, both of which are toxic. Antimony in particular is an emerging issue in gold mining, and discharge in dust in particular is an emerging concern. The proponent's inference that the low mobility in solution equated to low risk is inappropriate. Given both silver and antimony are toxic, the risk posed to human health and the environment should be appropriately characterised.

4.10 Response to: 3.7.4.10 Risk Assessment Limitations

4.10.1 Toxic and Harmful Substances

The proponent contends "*The Proponent notes that the proposed use of cyanide has been removed from the Proposed Modification. Issues associated with the solubility of metals within the Tailings Storage Facility have been addressed previously.*"

Now that the proponent has abandoned the proposed CIL plant using cyanide, and given GHD's comments set out above, no further response is required in relating to this response other than to reiterate that the risk assessment provided by the proponent did not adequately consider all potential contaminants of concern associated with the proposed Modification 3.

4.10.2 Monitoring, Management and Response Measures

The proponent contends "*The Proponent notes that a range of Management Plans have been prepared for the Project and approved by the relevant government agencies. These plans are publicly available and would be required to be reviewed and amended, if required, in consultation with those same agencies. As a result, the Proponent contends that adequate information is available within the approved plans and RWC (2015) to enable the application to be determined.*"

The proponent's response is unclear. It is presumed that the response refers to the approved project and not the modified project. As noted above, there are aspects of the proposed Modification 3 that are to be retained. There are a number of aspect that are therefore not adequately addressed in the approved project plans and these require further consideration.



4.10.3 Catastrophic TSF Dam Failure

The proponent contends “*This issue has been addressed previously in Section 3.7.4.4.*”

As noted in GHD’s comment on 3.7.4.4 (section 4.4), the design of the TSF dam as approved was not designed in accordance with the *Dams Safety Committee of New South Wales DSC3F Tailings Dams* criteria. The Knight Piésold report dated 22 October 2010, which provided the original dam design makes no reference to this guideline. The *Dams Safety Committee of New South Wales DSC3F Tailings Dams* guidance document was not published until June 2012. Since the original dam design is significantly different to the design proposed in Modification 3 the response needs to acknowledge that by reverting back to the approved project the TSF dam is in fact not designed in compliance with *Dams Safety Committee of New South Wales DSC3F Tailings Dams* as stated in the response, unless the proponent conducted further investigations to demonstrate the TSF dam is in fact compliant with this guidance.

Also, Modification 3 if approved will place a larger amount of tailings into the TSF as originally approved. The response from the proponent makes no mention of how this change in risk profile was evaluated. This aspect needs to be addressed before any aspect of Modification 3 is approved.

The proponent further contends “*Section 2.7.2.1 of RWC (2010a) describes the geotechnical assessments that have been undertaken within the footprint of the approved Tailings Storage Facility. In summary, these include:*

- *Three cored boreholes, each to approximately 30 m depth. Two were located in the vicinity of drainage lines approximately where the TSF embankment would be constructed and one in the area of the final decant /pond.*
- *Nine packer tests, three in each borehole at nominal depths of 5 m, 10 m and 25 m.*
- *A series of 28 test pits along the proposed embankment alignment, within the footprint of the Tailings Storage Facility basin and downstream of the proposed embankment alignment.*
- *Laboratory testing of samples collected.*

The site investigation concluded the following.

- *Shallow horizons of alluvium and/or colluvium were encountered in proximity to the creek alignment overlying weathered granite.*
- *Weathered “granite” was intersected to depth between 7 m and 20 m overlying competent bedrock.*
- *Groundwater was encountered at depths of between 1.6 m and 2.9 m below the base of the creek.*
- *In situ permeability testing using packer tests indicated an in situ permeability of 1.5×10^{-7} m/s to 2.3×10^{-6} m/s.*
- *The sub-surface conditions are considered suitable for construction of the proposed TSF embankment and associated infrastructure.”*

While some investigations were undertaken as part of the original approval there was no detailed soil property assessment and the investigation was for the purpose of a different and smaller TSF than that proposed in Modification 3. Further the Knight Piésold report 2015, clearly states that the TSF soil liner design was based on assumed rather than measured soil properties.



Also, the proponent contends “Section 2.1 of Knight Piésold (2015a) states that the Tailings Storage Facility has been designed in accordance with the following guidelines.

- Dams Safety Committee of New South Wales DSC3A Consequence Categories for Dams.
- Dams Safety Committee of New South Wales DSC3F Tailings Dams.
- Australian National Committee on Large Dams (ANCOLD) Guidelines on the Consequence Categories for Dams.
- Australian National Committee on Large Dams (ANCOLD) Guidelines on Tailings Dams.”

The point raised still stands, the relevant Commonwealth guidelines do not appear to have been referenced. Overall the proponent appears have adopted a minimal rather than best practice approach by selecting the minimum guidance necessary for approval but not consulting a broader set of guidance that would inform best practice approaches.

Finally, in response to this aspect the proponent contends “The Proponent notes that the Victorian Department of Primary Industry 2004 guideline Management of Tailings Storage Facilities is referenced in Condition 3(24) of MP10_0054 in relation to the permeability of the basin of the facility. Other aspects of the design of the Tailings Storage Facility have been completed in accordance with the requirements of the Dams Safety Committee of NSW.”

As noted above this response is further reflection of the proponent’s minimal rather than best practice approach to the design and planning of the proposed mine operations.

4.10.4 Long Term Leaching from Tailings Storage Facility

The proponent contends “Section 3 of Knight Piésold (2011) identifies the geotechnical site investigations that were undertaken over a three week period during the initial design phase of the Tailings Storage Facility. That work included:

- drilling of three boreholes using diamond coring techniques;
- test pitting at twenty eight locations;
- in situ permeability testing; and
- laboratory testing of selected samples.

In situ permeability testing determined typical permeability of between 1.5×10^{-7} m/s and 2.3×10^{-6} m/s, with laboratory permeability testing indicating that remoulded samples were capable of achieving a permeability of between 8×10^{-7} m/s and 6×10^{-10} m/s. In addition, the geosynthetic liner will provide an effective permeability of 1×10^{-11} m/s.”

This reference and information was not included in Appendix 7 of the Modification 3 application and the report simply states that the 10^{-8} m/sec permeability was assumed. No reference to the geotechnical report was included. The design and performance assessment by GHD was therefore based on the most recent data and design presented in the proponent’s documentation, particularly given the significant changes in the TSF design proposed as part of Modification 3.



The proponent also contends “*The Proponent is not aware of where the impression that only a single pass would be used to construct the clay liner for the Tailings Storage Facility. However, the Proponent notes that the design criteria are related to a performance specification to achieve a specified permeability and the methodology used to achieve that is generally not specified as long as the criteria has been achieved and is verified through testing.*”

The Knight Piésold 2015 report includes a statement that only a single pass is proposed, refer to Appendix 7, Section 5.3.2, which states “*The liner will be constructed by scarifying the surface soil, moisture conditioning and re-compacting to a target permeability of 3×10^{-8} m/sec.*”. This description would suggest that the liner was proposed to be constructed of a single pass layer without due regard for thickness and depth performance. The proponent’s response suggests a minimal approach that is not consistent with the liner design requirements and performance specifications normally expected at waste storage facilities and is not in line with best practice liner design, construction and performance specifications.

As a final point in this response the proponent contends “*As the Tailings Storage Facility would be constructed in a manner consistent with the approved facility, this issue is not longer relevant.*”

We tend to concur; by abandoning the proposed installation of a CIL plan that uses cyanide the risk of leachate containing high concentrations of toxic metals has decreased. Therefore the overall risk to human health and the environment by any leachate discharge from the TSF has decreased.

4.10.5 Sustainability Principles

The proponent contends “*The Proponent notes that Section 2.14.2 of RWC (2010a) states that the long-term rehabilitation objective for the Project is as follows.*

“Provide a low maintenance, geotechnically stable, non-polluting and safe landform which blends with surrounding landforms and provides land suitable for the final land use of nature conservation and/or agriculture.”

This objective is embodied in the current Mining Operations Plan that has been prepared for the Project and would be a key component of future Mining Operations Plans. In addition, the Proponent notes that it will be required to provide a security for rehabilitation of the site and that security will not be released until the relevant government agencies agree that all mine closure and relinquishment requirements, including those to ensure the long-term stability of the site, have been achieved. As a result, the Proponent disagrees that it has not considered the long-term post closure phase of the mine.”

While the proponent’s response clarifies the proposed approach to rehabilitation of the site, the point raised remains valid as the economic analysis did not appear to include consideration of costs of rehabilitation and long term management costs. Therefore the proponent’s assessment did not adequately consider sustainability principles as they related to the post closure impacts on the environment, cost burden of the community and the social consequences of the full mine lifecycle. The proponent’s response was considered inadequate with respect to compliance with sustainability principals.

The project should consider the full project lifecycle cost to inform decision making.



5 Summation

The review of the responses to GHD's 2015 report has highlighted some aspects that require further consideration as follows:

- As the proponent has now abandoned the installation of the CIL plant that uses cyanide, disposal of sulphidic tailings that concentrate potentially toxic heavy metals in the TSF has been minimised. The bulk of the tailings will be in line with those in the approved project and form a more benign waste that is stored in the TSF.
- Consequently with abandonment of the proposed CIL plant installation the most significant consequence of a TSF dam failure would be the discharge of a large amount of tailings into the Deua River catchment. This sediment, while not high in toxic heavy metals, would impact the water quality in the catchment by addition of fines that affect turbidity of the water and additional sediment load that could affect the stream bed and aquatic ecosystems through burial. As the tailings would be relatively benign the impacts would be relatively temporary as the sediment load is flushed from the catchment.
- Modification 3 includes a proposal to extend the mine life and the amount of ore mined. As the proponent has now abandoned the installation of the CIL plant that uses cyanide and appears to be reverting back to the approved TSF, rather than new TSF as proposed in Modification 3 the suitability of the approved TSF to store the additional tailings generated by the increased amount of ore extracted needs to be considered.
- Alternatively the proponent could retain the TSF design as proposed in Modification 3 as this design was developed with recognition that the increased tailings stored required a more stable TSF dam design, which in part prompted the change from the approved upstream construction method to the downstream construction method proposed in Modification 3.
- The proponent's responses refer to cyanide use no longer being proposed. However, the proponent's response makes no mention of abandoning the CIL plant installation as included in the Modification 3 application. It is presumed by abandoning on site processing using cyanide the installation of the CIL plant has also been abandoned. This aspect needs to be clarified and a commitment obtained from the proponent that the CIL plant has also been removed from the Modification 3 application.
- Finally the proponent's response in regard to the seepage rate calculations appears to contain an error that could significantly underestimate the leachate discharge rate. This should be corrected even though the use of cyanide and the enlarged tailings facility components of the Modification 3 application have been abandoned.



GHD would like to thank ESC for the opportunity to continue to work on review of the Dargues Reef Mining Project. We trust that the information provided in this letter report will be sufficient to assist ESC in decision making with regard to potential risks to the drinking water catchment in which the Project Site is located.

Should you have any questions or require any further information please do not hesitate to contact us.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Peter Beck', is written over a light blue rectangular background.

Peter Beck

Principal Environmental Scientist
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