14-15. LINK BETWEEN WRE/TSF MANAGEMENT AND GROUNDWATER ASSESSMENT

Concern:

The groundwater assessment (Jacobs 2020) considers groundwater availability around the site. No peer review has been conducted on groundwater contamination risks. The hazardous nature of substances in the WRE and TSF merit a local and detailed model of hydrogeological processes to adequately manage the proposed activity. There is significant risk of TSF leachate bypassing the seepage collection ponds and entering the groundwater system.

This query responds to the following SEARs for SSD 5765:

- A description of the existing environment likely to be affected by the development, using sufficient baseline data;
- A description of mitigations and
    - Whether these are best practice and represent a full range of measures
    - Whether they will be effective / key performance indicators
    - Contingency plans for residual risks / monitoring and reporting on environmental performance
- An assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;
- A summary of commitments
- Part 3: Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the *Aquifer Interference Policy 2012* for each relevant water source listed in column 1 of that Table.
- Part 3: impacts to significant water resources or threatened species are minimised to the greatest extent practicable
- Assessment of likely impacts to aquifers; detailed site water balance, management of excess water and reliability
- DRG, Attachment 2A requires rehabilitation methods including
  e) monitoring for rehabilitation
  i) details of triggering intervention
  k) details of post rehabilitation management
  l)i) assessment of rehabilitation techniques against objectives
  l) ii) assessment of potential acid mine drainage
  l) iii) processes to identify and management geochemical risks throughout mine life
  m) iii) groundwater assessment for final water level in any tailing storage facility void
  o) consideration of controls
- DRE/DPE requires a Water Management Strategy that considers
    - the existing surface and groundwater qualities
    - a robust baseline
    - a description of how groundwater and aquatic ecosystems will be monitored, Trigger Action Response Plan and trend identification

DISCUSSION

There is a 77 ha waste rock emplacement (WRE), a 14 ha low grade ore stockpile, an 8 ha oxide ore stockpile and a 117 ha tailings storage facility (TSF) proposed to store mined material on the surface. 57% of the waste rock is reported to be potentially acid forming (Advisian, 2020, p. 5). Leachate is proposed to be stored in a leachate management dam near Price and Hawkins creeks. It is questionable whether the large scale hydrogeological model presented in Jacobs (2020) is suitable for assessing the potential risk of groundwater contamination from the TSF and dam. The existing regional model is not peer reviewed for groundwater contamination.

One example of the need for higher resolution (fine grid) models is the disconnect between the Jacobs (2020) work and the Cardno (2020) and ATC Williams (2020) work when faults are considered. Faults have the potential to readily transmit large quantities of groundwater. The only reference to the faults mapped beneath the planned TSF is on page 2 of ATC Williams (2020). ATC Williams (2020 p.2) suggest leakage through faults (Figure 1) is considered in 'Section 7'. Transmissive faults can form a highly transmissive underground flow conduit in a preferred direction, potentially to a significant receptor. No reference to faults can been seen in Section 7 and the TSF design and monitoring plan in ATC Williams (2020) does not appear to consider the leakage risk posed by faulting (ATC Williams, 2020).

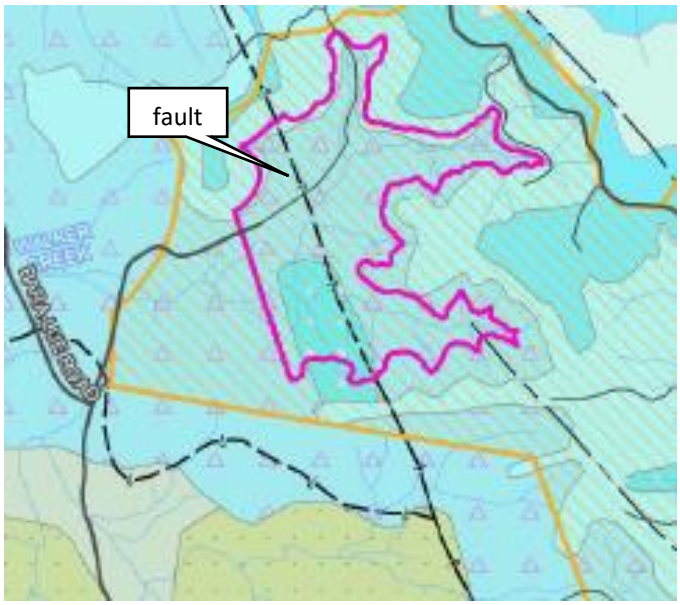

Figure 1: Structural geology – adapted from Figure 11 of (Jacobs (Australia), 2020, pp. 5-57)

Similarly, the leachate management dam and sumps designed to capture leachate from the ~22 million tonnes of potentially acid forming (PAF) waste rock do not consider the presence of faults. Figure 2 indicates that the throw on this fault may be hundreds of metres.

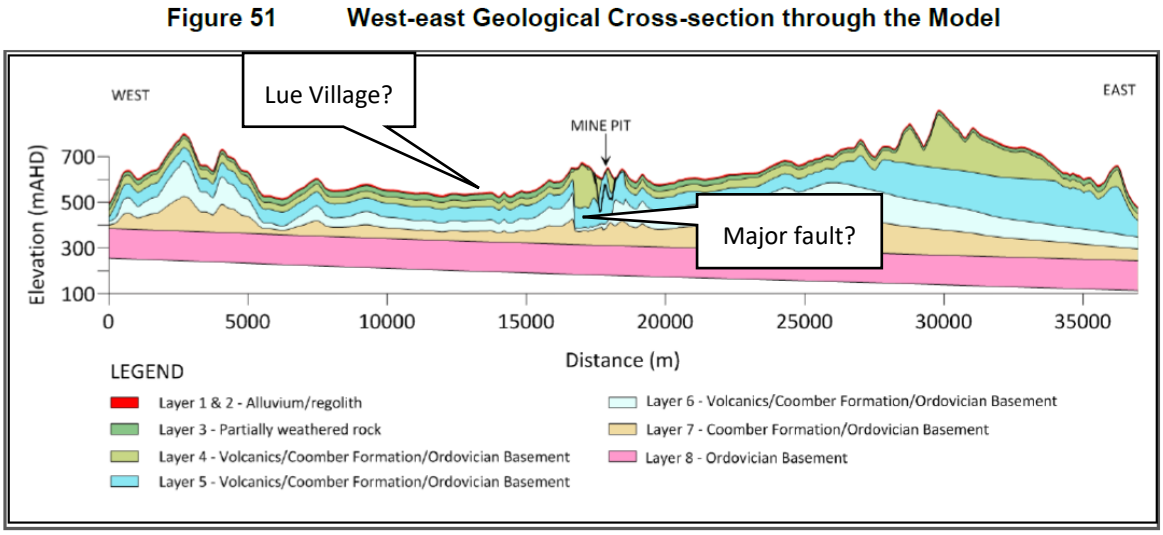

Figure 2: West-east modelled cross section. Source: Adapted from Figure 51 from (Jacobs (Australia), 2020, pp. 5-143)

Many beneficial uses of groundwater occur near the township of Lue, however, there is no hydrostratigraphic section, nor cross section, between the proposed mine and Lue to indicate the pathway linking the proposed activity to the Beneficial Uses. Figure 3 shows that the elevation of the TSF (600-615 mAHD) is higher than the Lue Public School (~560 mAHD). No groundwater contour map or particle tracking map >100 years post mining is presented in the EIS to infer groundwater flow direction.

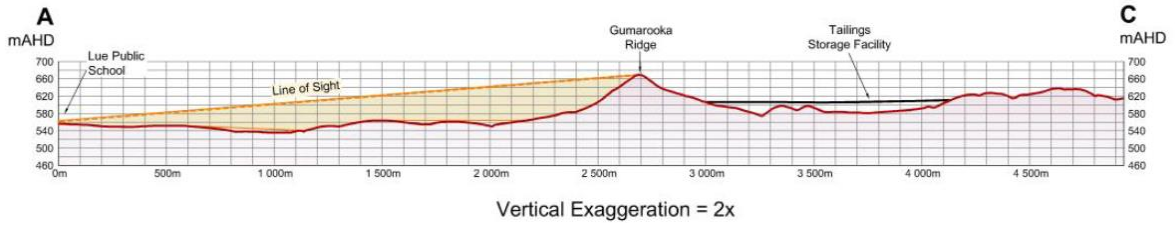

Figure 3: relative elevation of TSF and Lue Public School. Source: Figure 4.9.2 of (R. W. Corkery & Co. Pty. Limited, 2020, pp. 4-210)

The Jacobs model also does not indicate groundwater flows when the pit lake level stabilises (50-300 years after the proposed activity commences). Figure 74 of Jacobs (2020) shows the drawdown after 50 years, however, no drawdown map of 130 years is presented in the EIS. This is when the pit lake level is predicted to equalise at 573-578 m (depending on the decade - refer to Figure 75), around 30 m higher than the 543-548 mAHD groundwater levels around the Lue village shown in Figure 25b (Jacobs (Australia), 2020, pp. 5-91). Evaporation is predicted to lower the water level by 5 m from pre-mining levels. An updated groundwater contour map is likely to demonstrate the inferred flow direction of leachate away from as well as towards the equalised pit lake level.

Figure 75 Pit Lake Equilibrium Level

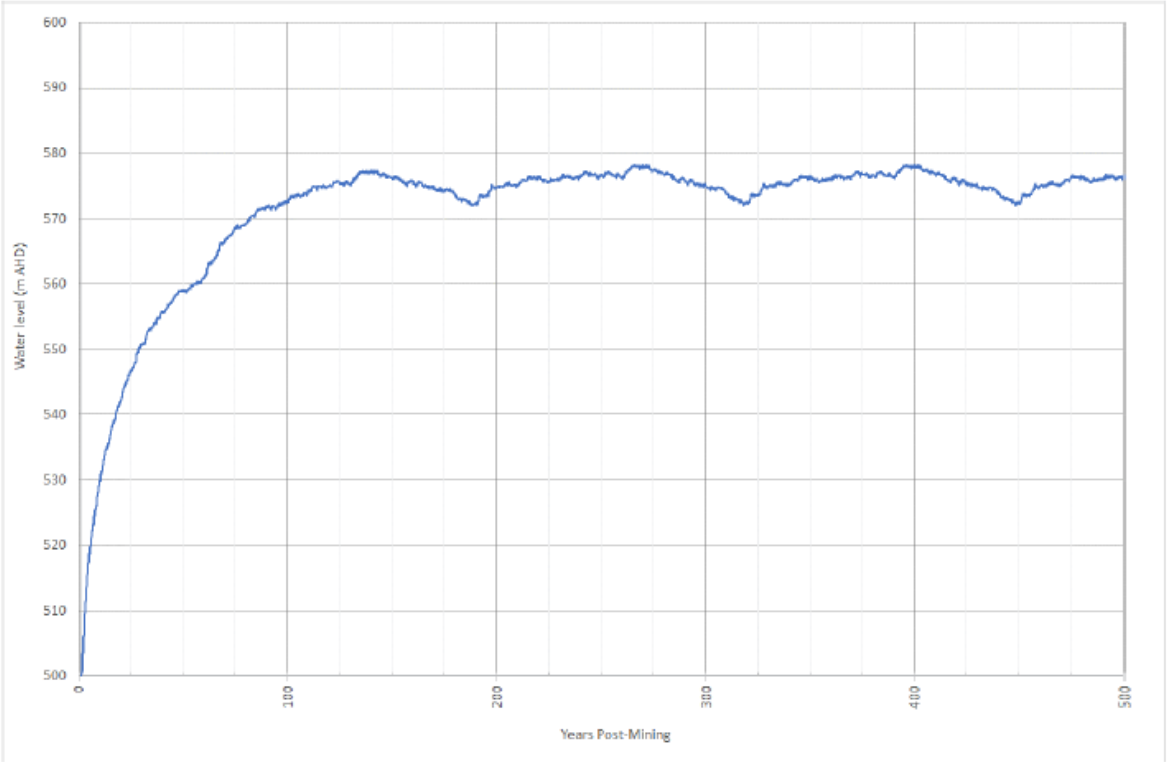

Figure 4: Pit lake equilibrium - between 573-578 mAHD. Source: Figure 75 (Jacobs (Australia), 2020, pp. 5-174)

An appropriate resolution groundwater contour map post mining, 50 years post mining and 130 years post mining would help confirm the groundwater flow gradients around the pit lake and beneath other key site infrastructure such as the TSF and leachate management dam. Particle tracking using the groundwater flow model or a solute transport model would also confirm that potential seepage from the TSF and WRE reports to the pit lake.

REFERENCES

Advisian, 2020. *Preliminary design of PAF waste rock emplacement, oxide ore stockpile and the southern barrier,* Perth: Bowdens Silver Pty Limited.

ATC Williams, 2020. *Tailings storage facility preliminary design,* Melbourne: Bowdens Silver Pty Limited.

Jacobs (Australia), 2020. *Part 5 - Groundwater Assessment,* Sydney: Silver Mines Pty. Limited.

R. W. Corkery & Co. Pty. Limited, 2020. *EIS Bowdens Silver Project,* Sydney: Bowdens Silver Pty Limited.