Grants Reclamation Project Large Tailings Pile Evapotranspiration Cover Project July 2023

Homestake Mining Company of California

SUMMARY OF SOME KEY COMMENTS/CONCERNS

1. There is considerable uncertainty regarding the performance of the proposed top slope ET cover with respect to long-term erosional stability. Additional engineering justification should be provided to support/demonstrate that the erosion protection layer, if designed and constructed as currently proposed, would provide the required erosion protection to satisfy the 200- to 1,000 -year performance period requirement with a minimum of required maintenance. Given the long slope lengths (≤ 991 ft) and relatively steep slope inclinations (~2.0 %) of the proposed top slope ET cover, the low percentage of rock proposed for the rock/soil matrix and the small diameter of the rock material, the potential for rills/gullies to form in the completed top slope cover over the course of its design life is a significant potential concern that requires thorough analysis. Existing available information appears to suggest that a different approach for constructing the erosion protection layer could be expected to provide superior long-term erosion protection performance compared to the method currently proposed.
2. Test data from test pits excavated in the West and North Borrow Area soils indicate that variabilities exist in soil types within these areas. Soils from two specific locales in the North Borrow Area are proposed to be sourced for constructing the erosion protection layer. Given the likely variability in soil types and soil conditions across this borrow area, material sourced from these two locales for building this cover layer should be tested, in advance, at a high frequency for dispersion potential (Emerson Crumb, pinhole, and double hydrometer) prior to transporting the soil to the LTP for use in erosion protection layer construction. Use of dispersive soils for constructing the erosion protection layer should be avoided as such soils are likely highly susceptible to erosion and could facilitate future formation of rills and gullies in the cover. If such soil dispersion potential test data are ambiguous, additional testing to further assess the soil's erodibility characteristics (e.g., Erosion Function Apparatus; Hole Erosion Test, etc…) may be beneficial to further support the appropriateness of the proposed erosion protection layer design. (Comment Matrix #2)
3. Additional details should be provided regarding requirements for constructing and completing prior performance monitoring of the ET cover test pad (test fill) to verify that the cover layer can be efficiently constructed and that it will meet all applicable performance standards specified for the test fill. Additional information is needed to demonstrate whether all relevant/applicable performance standards for this test fill have been identified/established. Owing to the importance of limiting future seepage from the LTP to groundwater, for example, the addition of an infiltration (percolation) standard for the test fill should be considered. (comment matrix #3)
4. Additional requirements should be added to address additional earthwork that will need to be performed to ensure that runoff flows from the ET top slope cover, once constructed, will cleanly connect with (transition smoothly into) the upper portion of the (existing) side slope cover. (Comment Matrix# 10)
5. Additional information should be provided to support the selection of the compaction criteria proposed for construction of the growth medium layer. (Comment Matrix #13)

6. The upper bound Ksat values in cover layers developed for variably saturated flow model sensitivity analysis are likely not sufficiently conservative to account for natural soil forming processes. Ksat for all cover layers was increased by a factor of 5-10. This seems low considering Ksat in cover materials has been measured to increase by a factor of 100-1000 from as-built specifications at certain LM study sites (e.g. Grand Junction Disposal Site Lysimeter Test Facility, etc.) due to natural soil forming processes. Further, the increase in Ksat for model sensitivity seems to cover only potential variability in available cover material at time of placement, not changes in Ksat due to natural soil forming processes over time. (Comment Matrix #34)
7. It may be helpful to decision-makers reviewing and assessing the validity of these sensitivity analyses if a table or series of tables were provided showing the changes made to relevant model input parameters for each sensitivity study. (Comment Matrix 37)
8. Detail on the variably saturated flow model configuration is generally lacking. (Comment matrix # 38 – 40)
9. Detail on statistical uncertainty of the model outputs for each scenario is generally lacking. (Comment Matrix # 39)
10. Is it generally appropriate to include tailings layers in a model evaluating hydrologic performance of an ET cover design? The argument as to the validity of the model configuration, with the free drainage bottom boundary within the sandy tailings layer, is outside the scope of this independent review. (Comment Matrix # 41 – 42)
11. It is not clear throughout the Model Results section as to how the model handles, or computes, runoff. (Comment Matrix # 40)
12. It is not clear how the model handles winter precipitation, of which there was a rigorous statistical dataset generated for the 1000-yr simulation period. (Comment Matrix #43)
13. It is impossible to assess the sensitivity of the model to changes in material properties when only a summary table of the 1000-yr average is provided and no data on model outputs are given. (Comment Matrix #47)
14. Each of the base case and sensitivity analysis scenario sections are overall written vaguely without reference to specific model data trends or parameters. (Comment Matrix #46, 48-50, 52)
15. Additional detail is required as to how the coarseness of the material properties is the cause in a decrease in average soil water storage relative to the base case and how this translated to the changes made to model input parameters for this sensitivity scenario. (Comment Matrix #49)
16. More detail and reasoning about the difference between the model predictions between the Saltbush-grassland vegetation sensitivity case and the base case should be provided. (Comment matrix #51, 42)
17. It would be more convincing to support the conclusion that vegetation community does not influence predicted net infiltration with modeled water balance flux data for the cover layers over the 1000-year simulation period. What was the T flux over time compared to the sagebrush-grassland community? The second statement here is very conclusive and needs to be supported by multiple lines of reasoning and not just one 1000-year average. (Comment Matrix #53)
18. The 'Net infiltration' dashed line in Figure 28 seems to be routinely above a net infiltration of 0.01 in/year, even though it is reported that the average net infiltration of 0.01 in/year occurs

over the 1000-year period. Please provide quantitative support for the assertion that net infiltration is an average of 0.01 in/year. (Comment Matrix #54)

19. What portion of this increase in storage in the Successional Regression scenario results is within the tailings layers? The purpose of this modeling task is to evaluate the performance of the proposed ET cover design. If storage is considerably increasing within the tailings then would arguably pertain to cover performance with regard to net infiltration. (Comment Matrix #55)
20. Please use the considerations in the comments above to provide sufficient detail/proof that the cover design will effectively function as an E cover to minimize net infiltration flux into the tailings over the next 1000 years. In Table 23, the reported 1000-year average storage is 34.47 in/year compared to the base case which is 22.01 in/year. If this increase in average storage is not removed by evaporation and amounts to storage increase within the tailings then this apparent increase in storage may actually be unaccounted net infiltration flux hidden within the storage term. (Comment Matrix #54 -60)
21. The summary of 1000-year averages reported in Table 23 are not at all different between the base case and the Climate-Change Precipitation sensitivity analysis, which leads the reader to believe that either the modeled cover system performance is not at all dependent on rainfall intensity and duration, or the sensitivity scenario is not adequately devised to evaluate wet periods. It is generally well understood from ET cover field datasets that especially wet periods account for a significant proportion of net infiltration flux through store-and-release cover systems, and that a cover design must take these possible events or wet periods into account by having the adequate amount of storage. The conclusion proposed in this cover design report suggests the opposite is true without field data or modeled water balance trend data to support. (Comment Matrix #62)
22. Figure 31 shows a decrease in moisture content in each of the material layers from year 0-100 except for the compacted tailings layer, which increased in moisture content from initial condition. Please explain the trends in each of these moisture contents as it relates to the processes removing/adding moisture to the model layers. Is the sand tailings layer effectively acting as a capillary barrier in this domain? (Comment Matrix #63)
23. Please provide the water balance trend data from the model outputs that shows net infiltration in relation to the “wettest periods” or the “wettest winters” (Comment Matrix #64)