RFI 091
Pebble Project EIS

Request for Information

Title/Subject:	**Bulk TSF Cover Options**
Requestor:	**AECOM**
Date Transmitted:	**10/5/2018**
Recipient:	**Pebble Limited Partnership (PLP)**
Response Requested by:	**10/12/2018**
Rationale:	The proposed cover for closure of the Bulk TSF is described in the Closure Water Management Pond: *The Bulk TSF will be reclaimed by re-sloping and covering the bulk tailings beach surface with a low permeability cover material (for example with compacted overburden or a synthetic liner) and capping it with rockfill sourced from the deconstruction of the Pyritic TSF embankments. A capillary break and growth medium will be placed to minimize contact of precipitation runoff with the bulk tailings*. Scoping comments request an analysis of the closure cover alternatives: *Different covers for the reclaimed tailings area – including "store and release" and impermeable covers – need to be addressed as alternatives in the EIS.*
Describe the Information Requested and Level of Detail:	Please describe the cover options that were considered when developing the proposed Bulk TSF cover at closure. Please include an analysis of "store and release" and impermeable covers and an evaluation of key operational and environmental tradeoffs including impacts to Waters of the US.

Recipient Response Form

Date Received from USACE:	Click here to enter text.
Response from Recipient (Describe Information Requested to the Level of Detail Requested; Provide Attachments as Needed):	Click here to enter text.
List Number and Type of Response Attachments:	**RFI 091 Bulk TSF Cover Options.pdf**
Date Returned to USACE:	Click here to enter text.

AECOM Intake Form

Date Response was Received:	**10/11/2018**
Received by:	**AECOM**
Describe any Follow-up Related to this RFI:	**None at this time.**

From: James Fueg, Pebble Limited Partnership

To: Shane McCoy, US Army Corps of Engineers

Date: October 10th, 2018

RFI091 included the following request: ***Please describe the cover options that were considered when developing the proposed Bulk TSF cover at closure. Please include an analysis of "store and release" and impermeable covers and an evaluation of key operational and environmental tradeoffs including impacts to Waters of the US.***

Response

In evaluating cover options for the long-term post closure management of project tails two primary options were considered, wet and dry closure. Wet closure can be considered appropriate when there is potential for sulfide contained in the tails to oxidize over time, resulting in acidic seepage or runoff water. The value of wet closure is offset by the disadvantages associated with maintaining an active water retention structure in perpetuity.

PLP elected to address this risk by storing the tailings as two separate streams (bulk and pyritic) allowing for different long-term management strategies in closure. The pyritic tails will be returned to the pit for permanent sub-aqueous storage in a gravity well removing the potential for acidification and all the risks associated with maintaining an active water retention structure in perpetuity.

Transferring the pyritic tailings to the pit at closure allows for the implementation of a dry surface closure approach for the bulk tailings, as the bulk tailings have no acid generation potential associated with them.

The use of a flow-through design for the north embankment of the Bulk TSF provides an avenue for seepage water to pass through the bulk tails, promoting consolidation of the tailings mass, and preventing a "bath tub" effect that prohibits the drainage of seepage water.

As outlined in the closure water management plan, the bulk tailings will be allowed to consolidate for ten years, before being graded as needed to direct runoff towards the spillway. A capillary break layer will be placed, with an overlying low permeability layer, followed by growth medium and revegetation. The capillary break will be composed of rock fill removed from the pyritic TSF embankments after that facility is decommissioned.

Several options have been considered for the low permeability layer and the preferred solution is the use of low permeability natural glacial till material from the site. Several other alternatives exist as outlined below. A final design, that may incorporate one or more of the options listed below, will be

developed during detailed design and the State dam safety, reclamation, and closure review and permitting processes.

Options that have been considered for the low permeability layer include the following:

Low permeability natural glacial till material. This preferred cover design involves the placement of a layer of locally stockpiled material (from the stripping of the pit and other project facilities) placed in controlled and compacted layers. The hydraulic parameters and required cover thickness would be established during detailed design.

Advantages of the compacted glacial till liner system:

- Glacial till is a natural material that is available at site.
- Glacial till is not subject to potential loss or degradation over the long term.
- Glacial till does not require a specialized crew or specialty equipment for effective placement.
- Glacial till is a relatively cost-efficient material that can be sourced from the mine area.

Disadvantages of the compacted glacial till liner system:

- Glacial material has a higher hydraulic conductivity than a synthetic or geosynthetic liner.

Synthetic liners.

These include bituminous geomembrane (BGM) liner, high density polyethylene (HDPE), and linear low-density polyethylene (LLDPE).

Advantages of the synthetic liner systems:

- Material permeability is negligible.

Disadvantages of synthetic liner systems:

- Joints/welds where the synthetic material is fused together have the potential to be weaker than the rest of the liner, and if exposed to tension from long term settlement and movement, may separate.
- Service life is variable and not always well defined for long term post-closure use.
- Installation of synthetic liners can be difficult in low temperatures, if it is windy, raining, sleeting, or snowing.
- Synthetic material can be expensive and heavy (especially BGM), presenting logistical challenges for transport to site.

Geosynthetic clay liner (GCL).

Advantages of the GCL system:

- Material permeability is negligible if correctly installed.
- GCLs are “self-healing” from punctures.

Disadvantages of the GCL system:

- No installation is possible during rain or onto a wet surface.
- GCL can prematurely swell if it is saturated before soil backfill is placed, which could diminish the permeability properties.
- Some materials are unsuitable because of cation exchange occurring between the waste material and the GCL, reducing the performance of the GCL.
- GCL has a lower shear strength than the other geosynthetic liners.
- Supplying sufficient GCL material would be costly and present logistical challenges.

Store and release covers (SRC) are designed to retain all precipitated water within inert material overlying the tailings, from where the water is removed by evapotranspiration. SRC systems are typically most effective in warm, semi-arid climates where there is no, or limited, net precipitation (annual evaporation exceeds precipitation), even if there may be elevated levels of precipitation in some seasons (e.g. monsoon areas). Typical SRC systems consist of a layer of soil (usually well graded with significant fines) with dense vegetation coverage on top. Examples of SRC systems do exist in northern latitudes, with several more proposed, however these are in areas that are more arid than the Pebble area.

The proposed Pebble cover system will function as a partial SRC, in that the growth medium (soil) and overlying vegetation will serve to trap a portion of the precipitation, which will then undergo evapotranspiration. However, net precipitation levels and the nature of the precipitation (freezing winters, followed by heavy freshet runoff, followed by wet summer and fall conditions) dictate that there will always be significant surface runoff. Annual average precipitation in the NFK basin is 56 inches, with evapotranspiration from natural (reclaimed) areas at 8 inches and sublimation at 4 inches, for net precipitation of 44 inches, a significant portion of which is rapidly released during the freshet.

Pebble is looking to minimize water infiltration and the resultant seepage, with the long-term objective of minimizing, or even eliminating, the volume of seepage that must be collected and treated from the embankment toe. This drives the requirement for a capillary break and low permeability layer underlying the growth medium layer of the cover. Conversely, this also protects surface runoff water quality, allowing the water to be placed directly back into the NFK drainage (once it has been demonstrated to meet water quality criteria) where it enhances existing flow, downstream riparian wetlands, and available fish habitat.

Regardless of the exact nature and thickness of the soil cover layer and underlying materials, the grade, elevation of the site, and the probable nature of colonizing vegetation make it unlikely that high value wetlands could be established over the closed bulk TSF site.

In summary, PLP believes that our proposed closure cover concept provides for maximum direct and indirect environmental benefits in post closure.

1) It provides for dry closure of the TSF.
2) It minimizes seepage and the requirements for long term seepage collection and treatment.
3) It protects run-off water quality and maximizes downstream flows, with commensurate benefits to wetlands and fish habitat.
4) It allows for the creation of a natural, vegetated, surface for the closed TSF.