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Teck

February 19th, 2019

Brent Martellaro
Division Mining, Land and Water
Department of Natural Resources
3700 Airport Way
Fairbanks, AK 99709-4699

RE: Red Dog Mine Reclamation Closure Amendment Request for the Tailings Storage Facility Final Beaching Height

Teck Alaska Inc. Red Dog Mine is requesting an amendment to the Reclamation and Closure Plan (RCP), Approval F20169958 to allow for beaching of tailings to the 993' level and reducing the cover material from 40-in to 24-in. Amendment F20169958.01 (approved June 25, 2018) addressed the expansion of the Tailings Storage Facility (TSF) to an anticipated 1006-ft elevation. Golder Associate Inc. prepared an assessment of the proposed changes and the Engineer of Record agrees with the proposed concept. A copy of the Golder Associate Inc. assessment letter is included with this request for your review.

The current RCP assumes a struck tailings height of 975-ft. Teck is requesting to raise the struck tailings to a proposed nominal height of 993-ft for effective tailings deposition to ensure an adequate beach length and slope angle for the Tailings Main Dam (TMD) beach. Maintaining a target 600-ft beach width at the TMD has shown a significant reduction in seepage volume and is a dam safety best practice for the TMD. Changes to the beach closure configuration allow for the geometry required to create and maintain a 600-ft beach with both operational and closure TSF water levels.

Teck also requests to amend the closure cover material (unmineralized shale) requirement for the TMD beach area. Currently, the RCP requires a total cover material thickness of 40-in utilizing two separate 20-in layers – a compacted lower layer and uncompacted "vegetation" layer. Teck requests to remove the requirement for a 20-in compacted layer (RCP fig. 22) for the TMD beach area and proposes an uncompacted cover material thickness of 24-in placed above the synthetic liner over the TMD beach area (fig. 27, Golder report). The synthetic liner placed beneath the cover material provides a barrier to reduce oxygen from reaching the underlying tailings making the 20-in compacted layer in the original design unnecessary. The reduction of cover material thickness from 40-in to 24-in is requested only for the TMD beach areas.

To allow for the required 2-ft of cover material for vegetative growth and protection of the geomembrane from equipment traffic, a 1-ft cap of material will be placed on the crest of the TMD. Tailings would remain a minimum of 1-ft below the TMD's nominal seal zone.

Reducing the cover material thickness (1.3 feet) for the TMD beach area eliminates the need for approximately 95,000 cubic yards of cover material currently required for closure of the main dam beach area (3,200' x 600'). No significant bond changes are necessary with this amendment request. Teck will re-evaluate the overall financial assurance calculation during the 2021 renewal process.

If you have any questions regarding this amendment request, please feel free to contact Frank Bendrick at (907) 754-5138, frank.bendrick@teck.com or Tyler Oester at (907) 754-5820, tyler@oesterteck.com.

Les Yesnik
General Manager – Red Dog Mine

cc: Tim Pilon, ADEC, Fairbanks;
Lance Miller , NANA
Charlie Cobb, ANDR, Fairbanks

January 03, 2019 Reference No. 18103660-018-L-Rev1-9000

Nancy Tracy and Tyler Oester
Teck Alaska Incorporated
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RED DOG TAILINGS STORAGE FACILITY – TAILINGS MAIN DAM BEACH CONFIGURATION AT CLOSURE

On behalf of Teck Alaska Incorporated (Teck), Golder Associates Inc. (Golder) has prepared this letter to provide our assessment of the proposed conceptual beach closure configuration at the Tailings Main Dam (TMD) at Red Dog Mine, Alaska. Golder understands this configuration would apply for those areas where a tailings beach is present, which could occur along the TMD embankment and wing wall.

The proposed closure section provided by Teck for Golder's review is shown in Attachment 1, and allows for a maximum struck tailings elevation at closure of 993 feet, and a minimum normal pond elevation of 995 feet to maintain 2 feet of water cover over the tailings. Table 1 presents the elevations resulting from a hydrologic/hydraulic assessment carried out by Golder[1]. The assessment provides the derivation for the maximum struck tailings elevation, which match those shown in Attachment 1.

Table 1: Derivation of Maximum Struck Tailings Elevation

Component	Depth (feet)	Elevation (feet AMSL)
Maximum Struck Tailings Elevation	**N/A**	**993.0**
Water Cover	2	995.0
Max Normal Pond (Spring freshet)	1.7	996.7
Surcharge Storage (PMF – Rain-on-Snow)	3.2	999.9
Wind Setup	1.3	1,001.2
Wave Runup	0.6	1,001.8

[1] Golder Associates Inc. (Golder). 2018. Red Dog Mine Stage XII TSF Closure Spillway Design, Technical Memorandum 18109819-006-TM-RevA-2000 submitted to Teck Alaska Incorporated, dated December 27. (Project Number 18109819). Redmond, WA: Golder.

Component	Depth (feet)	Elevation (feet AMSL)
Spillway Invert	**N/A**	**1,001.8**
Routing of PMF through Spillway (Rain-on-Snow Event)	2.6	1,004.4
Wind Setup	0.7	1,005.1
Wave Runup	0.6	1,005.7
Additional Freeboard Historically Allowed	0.3	1,006
Dam Crest	**N/A**	**1,006**

Seepage modeling and operational experience have shown that a tailings beach established against the embankment significantly reduces seepage reporting to the underdrain system at the TMD. Teck has established in their closure plan a criterion that a 600-foot-wide beach be established against the TMD as shown in Attachment 1. Golder, as Engineer of Record (EOR) of the TMD, has reviewed this configuration, has assessed that it will not reduce embankment stability, and agrees with the concept, including maintaining the 600-foot-wide beach against the embankment.

As shown in Attachment 1, the closure configuration allows for 2 feet of cover material placed over the 600-foot-wide beach, with a geomembrane liner separating the cover material from the tailings. One foot of beach freeboard is provided at the embankment, resulting in one foot of cover material overlying the upstream embankment crest. Although the slope of the erosion protection is not shown, Golder anticipates that if it is steeper than the tailings beach slope it would reduce the height of the wave runup.

We hope this adequately defines our assessment of the closure configuration for the TMD at Red Dog Mine, Alaska. Please contact us if there are any questions or you require further details.

Golder Associates Inc.

Steven L. Anderson, PE
Associate, Senior Geotechnical Engineering Consultant

Thomas G. Krzewinski, PE, D.GE, F.ASCE
Principal, Senior Geotechnical Engineering Consultant

SLA/TGK/af

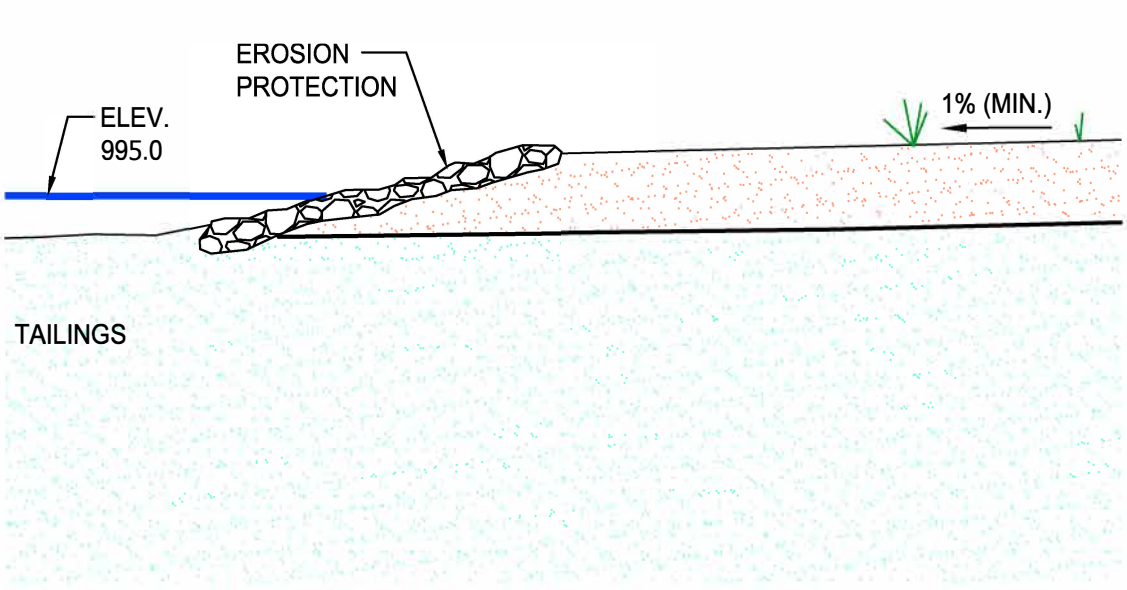
Attachments: Attachment 1 – Main Dam Beach, Typical Section

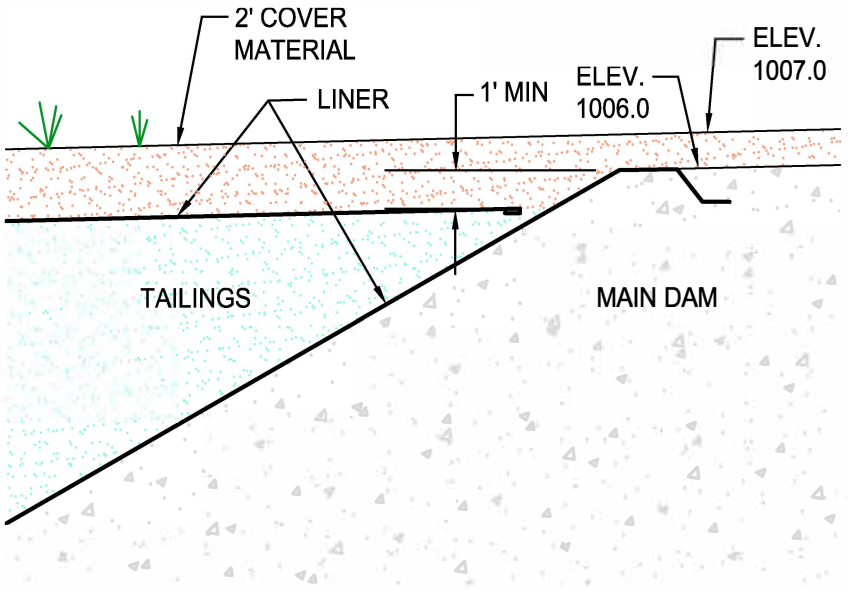
https://golderassociates.sharepoint.com/sites/28589g/deliverables/3.0 issued/18103660-018-l-closure_configuration/rev1/18103660-018-l-rev1-9000-closure_configuration_03jan19.docx

ATTACHMENT 1

Main Dam Beach, Typical Section

Component of Storage	Depth (feet)	Resulting Elevation (feet AMSL)
Struck Tailings Surface	N/A	993.0
Minimum Water Cover	2.0	995.0
Spring Freshet (Max. Normal Pond)	1.7	996.7
Probable Maximum Flood (Rain-on-Snow Event)	3.2	999.9
Freeboard for Wind/Wave	1.9	1001.8
Routing Inflow Design Flood (Rain-on-Snow Event)	2.6	1004.4
Freeboard for Wind/Wave	1.3	1005.7
Additional Freeeboard Historically Allowed	0.3	1006.0
Dam Crest	N/A	1006.0





NOTES

1. Table has been modified from 2016 R&C Plan (November 2016) and is based on the spillway design prepared by Golder in December 2018.

Teck

RED DOG MINE

Project:
RED DOG MINE
RECLAMATION AND CLOSURE PLAN

Drawing Title:
MAIN DAM BEACH
TYPICAL SECTION

Figure No:
27

Designed:	Date:	Checked:	Date:	Scale:	MWO or Job #:	Revision:
TO	12/27/18			SCALE = NONE		B