

APPENDIX F

EROSION CONTROL

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www.shuswapnorthokanaganrailtrail.ca/development-plan



Memo



Draft for Review

To: Phil McIntyre-Paul and Thomas Simkins Project No.: 1576
From: Tara Hirsekorn, P.Eng. and Kalie Smith, EIT Date: July 27, 2020
Re: **Sicamous to Armstrong Rail Trail – Information to Assist Cost Estimate**

1.0 INTRODUCTION

Waters Edge Engineering Ltd. (Waters Edge) prepared this memo for the Shuswap Trail Alliance (STA) to provide information regarding trail lengths corresponding to generic treatment types to assist with costing for a grant application for funding to complete the Sicamous to Armstrong rail trail. Waters Edge undertook an additional site visit on July 22, 2020 to examine the Mara Lake shoreline trail surface from approximately km 15.5 to km 0 to apply generic treatment types and approximate lengths to assist STA with a rough cost estimate. A site visit to the erosion locations noted at approximately km 32.75 along the Shuswap River behind North Enderby Timber was undertaken on April 27, 2020 as part of the initial project scope.

This memo provides approximate lengths of generic treatment types along the Mara Lake shoreline. The memo also provides options considered and approximate costing for the eroded spots along the Shuswap River at km 32.75. These estimates contain a large margin of error as they are provided ahead of finishing the site assessment scope.

2.0 SITE VISITS AND METHODOLOGY

2.1 MARA LAKE

A site visit to examine the Mara Lake shoreline by boat was undertaken on May 15, 2020. The water level was approximately 347.234m at the time of the site visit. The collector app provided by the CSRD was used to log line segments along the shoreline and details about their existing rock, vegetation, trail edge condition, and general erosion state. Data points were also logged with unique features such as culverts, gabions, and other structures.

A second site visit to Mara Lake on July 22, 2020 was undertaken specifically to assist with costing for STA despite the high-water conditions that made it impossible to fully assess the shoreline condition and treatment types. However, this site visit provided further accuracy by assessing the visible shoreline from the trail surface and to determine generic treatment types likely to be associated with the lengths of shoreline that were determined during the May 15, 2020 site visit by boat. The recorded water level was 348.176m at the time of the site visit. An elevation of 349.29m, which is the estimated water level with a 10-year return period, was used to determine if the trail needed to be raised.

The line segments logged during the boat site visit were re-examined and some new erosion locations were identified following the 2020 flooding. One of four (4) treatment types was assigned to the lines for costing purposes: full riprap, partial riprap, alternative structural/geotechnical, and raise trail.

2.2 SHUSWAP RIVER

A site visit to the eroded locations along the Shuswap River at km 32.75 was undertaken on April 27, 2020 to examine possible solutions to the three (3) erosion spots noted behind North Enderby Timber. Possible solutions and approximate costs were tabulated and discussed with the project biologist on May 4, 2020. During this conversation, it was suggested by the biologist that a riprap solution would be recommended over an alternative structural/geotechnical solution to simplify the permitting process.

3.0 LENGTHS AND GENERIC TREATMENT TYPES FOR COSTING

3.1 MARA LAKE

Table 1 below provides the recorded line segments from approximately km 0 to km 15 and generic treatment types for cost estimate purposes. It does not include locations where the trail can be moved over.

Table 1: Lengths and generic treatment types along Mara Lake shoreline

Proposed Treatment Type (Generic)	Length of shoreline (m)
Full Riprap with a key trench at toe	1,519 (including km 1-1.5)
Partial Riprap	3,094
Alternative structural/geotechnical	300
Raise Trail*	3,130

*Lengths corresponding to "Raise Trail" are those having a trail surface elevation below 349.29m, approximately a 1 in 10-year lake level. Note these lengths are approximate based on point measurements along the trail without LiDAR. These can overlap with other treatment types.

"Full Riprap" refers to riprap with a 2H:1V slope (steepest) and minimum two layers of rock thickness. This riprap would extend from 343.89m (1 m below the agreed upon low water level (LWL) for Mara Lake with a keyed-in toe) to 349.89m, which is the estimated water level with a 10-year return period for inundation, plus 0.6m freeboard for waves, or an agreed upon top vertical extent for riprap once LiDAR data is obtained. The riprap should extend above the trail in a trapezoidal berm in places where the elevation of the trail surface is at or below this minimum benchmark elevation. Excavation will be required to embed the riprap toe and containment is anticipated to be required during construction. Locations near private docks (km 1-1.5) have fine gravels, very little vegetation or larger rock and evidence of erosion damage from 2020 flooding. These have been counted in "full riprap". Vegetated flex-MSE or similar alternative products would also work in place of riprap, but private owners may remove the vegetation.

"Partial Riprap" refers to shoreline segments not requiring full riprap. These include segments with existing rock to be augmented, or well-vegetated sections requiring riprap either in a scour pocket beneath vegetation, or to work around the existing vegetation, or both.

"Alternative structural/geotechnical" refers to sections where a riprap treatment could not be constructed due to steep drop-offs into the lake. These sections typically have existing structural protection (i.e. gabions) in a failing state requiring replacement or rehabilitation.

"Raise Trail" refers to locations where the trail surface is below 349.29m, which was determined to be the lake level with a return period of approximately 10 years, meaning trail surface inundation is anticipated roughly every 10 years on average. In locations where the trail is raised, depending on the shoreline profile, it is recommended to construct a berm at the trail edge to protect the trail surface from wave scour. The protection could be any of the listed treatments depending on site conditions. Alternatives in low-risk zones include placing sacrificial riprap or to supplement the existing vegetation with vegetation having woody roots as opposed to grasses. Vegetated flex-MSE walls may be appropriate in some locations.

3.2 SHUSWAP RIVER

Table 2 provides erosion protection options considered, approximate costs and final risk levels for the three (3) erosion locations near km 32.75 along the Shuswap River behind North Enderby Timber:

Table 2: Options considered and approximate costs for erosion on Shuswap River (km 32.75)

Option	Advantages	Disadvantages	Final Risk	Approximate Cost Estimate (+/- 30%)
Sheet pile wall with riprap in front	Full trail width, can restore trail edge & maintain straight trail	Vertical wall reflects flow/energy downstream (could cause further erosion)	Moderate	\$320,000
Full riprap – key-in toe trench	Can maintain straight trail	Working in water, long-reach excavator required	High	\$320,000
Move trail over and 2H:1V riprap (need to move over approx. 3 m)	Could create viewpoint(s)	Trail not straight, may have to purchase land from North Enderby Timber	Moderate	\$384,000 plus additional land from North Enderby Timber
Lock block/gabion wall	Can maintain straight trail	Must be keyed-in below water, clay-base can have freeze/thaw issues	High	\$320,000
Over-steepened riprap (1H:1V) (no key trench)	Short-term protection/buys time	Unstable, short-term, continual monitoring required	Very-High	\$240,000
Leave as-is	Low cost, preferred from environmental standpoint	Unstable, public safety risk, erosion will continue	Very-High	Approx. \$3,200 (Signage, fencing, vegetation)

Based on conversations with the project biologist, it is likely that a full riprap section will be implemented at these locations along Shuswap River. One of the erosion spots requires either restoring the trail edge for a width of 1.7m for 7.5m length or moving the trail over closer to North Enderby Timber. The other sites are 10 m long and 22 m long, for a total length of 40 m requiring erosion protection.

4.0 LIMITATIONS & CLOSURE

This document has been prepared for Shuswap Trail Alliance (STA) and it is intended for their exclusive use on this project and may not be relied upon by any other party. Waters Edge provides opinions in this document based on the minimal information available and provided by others and provides no warranty on this information. Climate change may impact the estimated return period events of storms and water levels as well as sediment trends. All project guidance, estimations and correspondence are bound by the terms in the Services Agreement.

Waters Edge Engineering trusts this report meets your present requirements. If you require additional information, please do not hesitate to contact us.

Sincerely,
 Waters Edge Engineering Ltd.

Reviewed by:

ISSUED FOR REVIEW

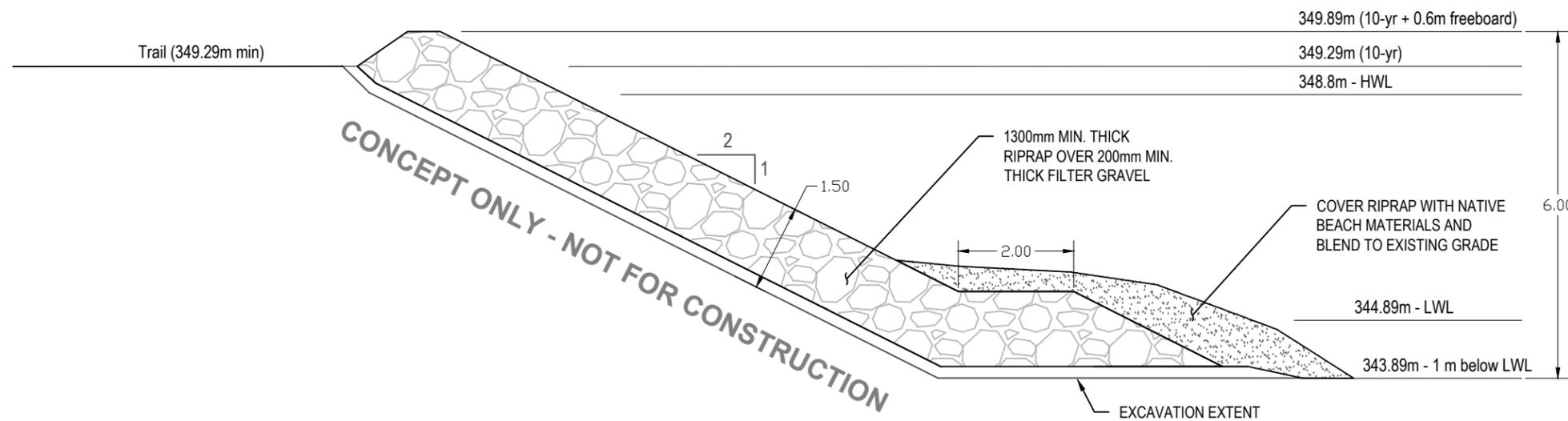
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NOT FOR CONSTRUCTION



Legend:

SECTION IS PRESENTED FOR DISCUSSION PURPOSES ONLY. MATERIALS HAVE NOT YET BEEN SIZED FOR THE SITE.

Notes:



Project No:

1576

Date:

AUGUST 04, 2020

Figure No:

FULL RIPRAP

Client:

SHUSWAP TRAIL ALLIANCE

Issued by:

WATERS EDGE ENGINEERING LTD.
"Quality * Value * Innovation"

Project:

SICAMOUS TO ARMSTRONG RAIL TRAIL

Location: MARA LAKE

Title:

FULL RIPRAP SECTION CONCEPT