

MEMO

TO: Scott Cosman. P ENG.
COMPANY: BC MOTI
FROM: Bob Forsyth
DATE: 21 November 2022
CC: Wayne Byczek, P Eng, Johnathan Tillie, Michael Carreira, P Eng.
PROJECT NO.: VG07794.310
SUBJECT: Silver Skagit Road, South of Hope, BC
Debris Flood Repair at km 28.7
Project Number: 14143, Site ID: SA07 150-31

As requested, we herein provide geotechnical comment regarding proposed repairs (RF Binnie & Associates Ltd. Drawings – numbering to be determined) to the road and related drainage network at km 28.7 of the Silver Skagit Road. During the flood event of November 2021, a new channel was created upslope of the Silver Skagit Road which transported debris onto the road into the form of a fan that covered a 50 m long section of the road to a depth of about two metres. The debris channel stops at the north road edge – the debris fan was retained on its downslope side by a hillock on the south side of the road. The debris flood may be related to the recent blockage of existing drainage channel(s) created by logging of the area upslope of the road during the 1990's and earlier.

The debris fan was removed from the road in October 2022.

An old logging road, now partially overgrown with vegetation and small to mid size trees, diverges from the Silver Skagit Road about 100 m east of the debris channel and trends westward up the slope. The debris channel was observed, during our site visit of November 9, 2022, to cut across the old logging road such that the blockage is upslope of the logging road.

The point where the old logging road meets the Silver Skagit Road is a local topographic low. It is the location of the proposed D17 line in the design drawings. To the south of the road, there is a relatively flat wooded area beyond which, about 30 m south of the road, is a pond.

A preliminary repair design, which could be expanded further from the road following the acquisition of tree removal permits, includes:

- A roadside ditch will run along the north side of the road from the debris channel to the D17 line.
- At the D17 line, a channel will be constructed upstream for a distance of 25 m to the northwest from the road (along the approximate alignment of the old logging road).
- The channel will cross under the Silver Skagit Road through a 1.2 m diameter culvert which will discharge into the wooded area about 10 m south of the road edge.
- The roadside ditch will connect into the D17 channel at a convenient location upstream of the culvert inlet.
- The ground adjacent to the culvert inlet and outlet will be protected with riprap.
- The road pavement structure will consist of High Fines Surfacing Aggregate (HFSA), underlain by Well Graded Base Course (WGB) then Select Granular Subbase (SGSB). The design for the pavement structure is shown below.

Course	In Cut	In Fill
HFSA	100	100
25 mm WGB	225	225
SGSB	300*	150**

Notes: * assumes fine grained subgrade ML/CL/OL/MH/CH/OH. Can be reduced if it is coarse grained.

** assumes coarse grained subgrade GW/GP/GM/GC/SW/SP/SM/SC

- The subbase can be omitted where the underlying subgrade material meets SGSB requirements. We expect that Type D compacted subgrade material, where required by site grades, will consist of locally sourced granular fill. The material removed from the creek bed is expected to be suitable for this purpose.
- The new culvert should be bedded and backfilled with WGB material.
- Fill materials should be compacted in lifts, of maximum 300 mm loose thickness, using vibratory equipment. Water should be added as required so that the fill is close to optimum moisture content during compaction. We understand that compaction of fills will be witnessed by the project civil inspector.
- For permanent construction, fills should consist of non-frozen material and should be placed on non-frozen subgrade material. The material should be compacted while it is still unfrozen.

In our opinion the measures described above are reasonable. However, the blockage that caused the debris flood to occur in its present channel is not remedied by the design. We should visit the site in the spring when it is free of snow. We expect that the drainage patterns can be better observed at that time when the site is free of snow, but still relatively wet, with drainage courses containing flowing water. The design can be adjusted as required once the drainage network upslope of the area is better understood.

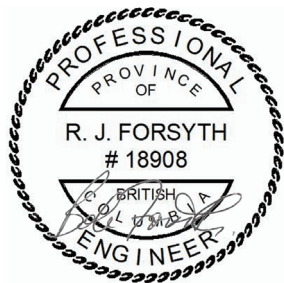
Comments and recommendations presented herein are based on a geotechnical evaluation of the available information as noted. If conditions other than those reported are noted in subsequent phases of the project, WSP E&I Canada Limited should be notified and be given the opportunity to review and revise the current comments and recommendations if necessary. Recommendations presented herein may not be valid if an adequate level of review or inspection is not provided during construction.

This memo has been prepared for the exclusive use of BC MOTI and their appointed agents for specific application to the area covered within this memo. Any use which a third party makes of this memo or any reliance on or decisions made based on it are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this memo. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

Effective September 21, 2022, Wood Environment & Infrastructure Solutions Canada Limited is now operating as WSP E&I Canada Limited. No other aspects of our legal entity, contractual terms or capabilities have changed in relation to this memo submission.

Yours sincerely,

WSP E&I Canada Limited



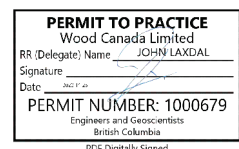
21-Nov-2022 15:37 PST

Bob Forsyth, P.Eng.
Associate Geotechnical Engineer

Reviewed by:

2022-11-23

John Laxdal, P.Eng.
Principal Geotechnical Engineer



PHOTOGRAPHS



Photo 1: Looking east at the debris fan deposited on the road, Sept 14, 2022.



Photo 2: Looking east along the overgrown old logging road. The debris channel crosses the road in the foreground.



Photo 3: Looking west along the Silver Skagit Road at about km 28.8, on Nov 9, 2022. The approximate location of the D 17 line is in the foreground. The old logging road, grown with trees, meets the Silver Skagit Road near this location. Note that the debris fan has been removed from the road at this time.