THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

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Alberta Infrastructure and Transportation
Room 301, Provincial Building
9621 - 96 Avenue
Peace River, AB T8S 1T4

Attention: Mr. Ed Szmata

PEACE RIVER (HIGH LEVEL) REGION GEOHAZARD ASSESSMENT
HWY 682:02 WEST OF FAIRVIEW - SITE 4 (PH29)
GRIMM'S CREEK SITE
2005 ANNUAL INSPECTION REPORT

Dear Sir;

This letter documents the 2005 annual site inspection of erosion and slope instability along Hwy 682:02 at Site #4 – Grimm's Creek, west of Fairview, Alberta. The inspection was undertaken by Thurber Engineering Ltd. (Thurber) in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE049/2004) with Alberta Infrastructure and Transportation (AIT). Mr. Don Proudfoot P. Eng. of Thurber undertook the inspection on June 14, 2005.

1. BACKGROUND

The available background information for the site is described in the Geotechnical File Review in Section A of the site binder. More site specific and recent information are summarized in the 2004 inspection report included in Section B.

No construction or maintenance work has been carried out at this site since our last visit in 2004.

2. SITE OBSERVATIONS

A site plan showing existing slide and erosion features is provided on Figure 1. The base plan for this figure was prepared by Mr. David Morrison of AIT using information from AIT's bridge files supplemented by picking up additional site features using a GPS unit. Thurber has added additional comments and notes, pertinent to our visit, in red. Selected photographs of the site, taken on June 14, 2005 are also attached.

Photo #1 shows an overall view of the highway embankment south sideslope. Photo #2 shows the shallow North Slump, which hadn't noticeably changed since our 2004 visit. Photo #3 shows a new sink hole which had developed above the culvert extension alignment subsequent to our June 2004 visit. The sink hole was about 7 m by 4 m in size and about 2 m in depth. The West Slump appeared similar in appearance to the 2004 visit.

The stability and erosion condition in the vicinity of the outlet of the culvert extension had deteriorated significantly since the 2004 visit (refer to Photo #5 and #6). There was a well developed active slide block in the lower part of the highway fill which had a 3m high bare backscarp located about 35 m upslope of the culvert extension outlet. Another tension crack was forming an additional 35 m upslope from the main scarp, in the vicinity of a grout vent tube that was presumably used for grouting the 2000 culvert extension. As shown on Photo #4 an erosion channel (scar) had also developed along the flank of this secondary slide block from surface water draining into the main slide block. As shown in Photo #7, extensive sliding had occurred along the sides of the original creek valley near and downstream of the culvert extension outlet.

Ice was present blocking the outlet of the culvert extension. Slide debris from the valley slopes was partially covering the gabion matt lining downstream of the culvert extension outlet.

A slight dip was noted in the highway surface approximately over the culvert alignment. There were also some longitudinal cracks in the pavement, however these did not appear to be related to slope movements.

3. ASSESSMENT

The outlet area of the culvert extension is currently in a very unstable condition. The instability is considered to be triggered by aggressive down-cutting of the creek bed at and downstream of the culvert outfall. Most of the erosion likely occurs in the spring when melt water runoff flows are high. The erosion protection provided at the culvert extension outlet has not been sufficient to dissipate the flow energy from the creek water to prevent downward erosion at the outlet. Further downstream from the outlet, the creek gradient is too steep to prevent down-cutting of the native unarmored clay material.

The sliding may have damaged the culvert. It was not possible to assess whether the culvert was broken due to the ice blockage. However, the presence of the sink hole over the culvert extension alignment suggests that the culvert may have pulled apart and that water may be eroding outside the culvert.

The North and West slumps appear shallow in nature and are likely the result of progressive softening and loss of cohesion to the clay fill in the embankment slope.

4. RISK LEVEL

The risk level for this site has been assessed as follows:

PF(13) * CF(4) = 52

A Probability Factor of 13 is considered appropriate since the slide near the culvert outlet is active with a high rate of movement. A Consequence Factor of 4 is considered appropriate since the slide is in a high fill and is affecting the function of a centerline culvert. If no remedial measures are carried out this site could deteriorate very rapidly.

5. RECOMMENDATIONS

5.1 Short Term

In the short term the culvert should be inspected to confirm whether the slide movement has damaged it. If damage is noted, the culvert should be repaired prior to spring 2006 to prevent further erosion and extension of the slide areas. If water leaks from the culvert into the slide mass it could cause a faster/larger movement.

The creek bed at the outfall of the culvert should also be cleaned up be removing disturbed soil and protected with some Class 2 riprap placed over non-woven geotextile. This is only meant as a temporary measure until such time as more permanent long term measures can be implemented.

5.2 Investigation

The following investigation program is recommended to determine suitable long term measures to mitigate the instability and erosion problems at this site:

- Detailed survey of the sideslope and culvert outfall area.
- Streambed profile from 100 m upstream of culvert inlet downstream to the confluence with Hines Creek
- Review of drainage watershed, assessment of design flows and suitability of the existing culvert to pass the design flows (especially spring meltwater runoff events)
- Drill three test holes along the culvert alignment and 1 test hole above the North and West slumps. Install slope inclinometers (SI's) in 2 of the

test holes and pneumatic piezometers in all of the test holes. The proposed locations of the test holes and Sis are shown on Figure 1.
- Drill two hand auger holes in the creek bed downstream of the culvert outlet
- Carry out stability analyses and prepare remedial options.

Based on previous projects the above investigation and preliminary design work is expected to cost in the order of $45,000 to complete.

5.3 Potential Long Term Measures

Possible long term solutions might consist of one of the following options assuming that the culvert has already been repaired:

a) Remove the slumped material back to the grout vent tube, extend the smooth wall pipe further downstream to a location where the creek gradient flattens (to be determined by survey) and reconstruct the lower part of the slope with common clay fill. The clay could be obtained from the excavated material provided it is moisture conditioned (disced and dried) before use, or from the steep valley walls adjacent to the creek. This option will only be feasible if a longer pipe can safely pass the design flows. Suitable erosion protection and a flow dissipation bowl will be required at the outlet of the new pipe extension.

b) Construct a rigid concrete pile wall, concrete drop structure and concrete flow dissipation bowl across the creek valley near the existing culvert extension outlet. Remove the slide material upslope of the structure and replace it with suitable new common clay fill as discussed in Option a) above.

For each of the above options, consideration could be given to installing further natural drop structures at additional locations downstream of the outfall possibly consisting of staked natural logs (wattles) and/or biologs to slow and pool the water. Also, the areas of the sideslope that have been affected by shallow slumping at the North and West slumps could be subexcavated and rebuilt with reconditioned, lime or cement stabilized clay.

There is currently insufficient information available to provide an accurate estimate of the construction costs for the long term measures. However, based on previous projects they will likely be in the order of $500,000 to $800,000.

5.4 Maintenance

Culvert repairs and temporary riprap at the culvert outlet are the primary maintenance items for this site. These are discussed in more detail in our November 2005 Call out report.

6. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if the slide conditions worsen.

Yours very truly,
Thurber Engineering Ltd.
Dimitri Papanicolas, P.Eng.
Review Principal

Don Proudfoot, P.Eng.
Review Principal
/slp

Attachment