THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

December 8, 2006 File: 15-85-38

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

Attention: Mr. Ed Szmata

PEACE REGION (SWAN HILLS AREA) GEOHAZARD ASSESSMENT
HWY 744:02 LITTLE SMOKY RIVER SOUTH OF BRIDGE (SH 10, SITE #1C)
2006 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2006 annual site inspection of a slide adjacent to the highway embankment on Hwy 744:02 located about 1.5 km south of the bridge over the Little Smoky River about 25 km south of Girouxville, Alberta. Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE047/2004) with Alberta Infrastructure and Transportation (AIT).

Mr. Barry Meays, P.Eng and Mr. Gurpreet Bala, M.Sc. of Thurber undertook the inspection on May 24, 2006 in the presence of Mr. Roger Skirrow, P. Eng., Mr. Ed Szmata and Mr. Bruce Henderson, all of AIT.

1. BACKGROUND

This site was added to the geohazard inspection program last year in 2005. It is located about 400 m south Site #2, in and downslope of the west highway embankment. The slide occurred in fall of 2004.

Observations made during the 2005 annual inspections indicated that the highway embankment is a 4 to 5 m high sideslope fill having a 19^0 slope above the slide scarp. The slope southwest of the highway embankment in the slide area was in the order of about 10^0 to 15^0. The slide was on a well-grassed surface, located within and downslope of the highway embankment. The slide appeared to be

confined to the north by a grassed hill or knoll which was formerly used as a borrow pit, and to the northwest by slightly higher ground. It extended to the southwest into a gully or drainage run. Relatively heavy bush covered the drainage run and extended further west, with the southwest to north edges of the slide coincident with the edge of the bush and drainage run. An access road to a gravel pit existed further southwest, and the old highway was located a distance west of the slide.

The overall slide dimensions were indicated to be about 40 wide and about 35 m long, and had an overall vertical elevation drop of about 13 m from the highway to the drainage run downslope of the toe. The backscarp was up to 3 m high, was as close as 4.5 m from the edge of the pavement, was sitting at an approximate 45^0 inclination, and exposed a weathered high plastic clay surface. Intermediate scarp cracks were observed through the slide mass. The slide movement has pushed forest litter and trees at the downslope terminus. A toe roll up to 2.5 m high was observed adjacent to the drainage run.

2. SITE OBSERVATIONS

The condition of this site is shown on the attached site sketch plan and cross-section. Selected photographs taken during the visit are also attached.

During this year's visit, the backscarp had retrogressed back towards the highway further south and was about 4.5 m away from the edge of the pavement. The surface of the backscarp had a shiny appearance as in Photo 3 and was indicative of the presence of high plastic clays in the slump mass. Slight signs of surface runoff or seepage were observed on the highway embankment southeast of the slide.

3. ASSESSMENT

The highway embankment failure appears to be mainly due to saturation of the slope as a result of a prolonged period of rainy weather, where the roadway embankment fill was placed over and at a somewhat steeper slope (19^0) than the relatively flatter native ground surface below the toe of the fill (at 12^0). The subsurface conditions in the slope appear to consist of high plastic clay. Over time, the clay may have become desiccated and weakened by freeze thaw and wet dry cycles which resulted in fissures and/or softened soil into which surface infiltration could permeate.

Since the existing natural slope below the toe of the embankment fill is sitting so flat, this area may have been a previously failed area, and was only re-activated by the above trigger.

The slide will likely continue to worsen with time as a result of water infiltration and headscarp retrogression.

4. RISK LEVEL

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

PF(13) * CF(3) = **39** (26 Last year)

This risk level was based on a Probability Factor (PF) of 13 (active with a high rate of movement, steady or increasing) and a Consequence Factor (CF) of 3 (site having a moderate fill where partial closure of the highway could result if the slide continues to retrogress towards the highway).

5. RECOMMENDATIONS

5.1 Short Term

The east ditch directly across from the slide should be inspected to see if a depression exists which could pond water and potentially surcharge the slide. If so, this area should be filled with compacted clay or the ditch should be properly graded to reduce water ponding potential.

5.2 Long Term

The recommended long-term solution is to construct a toe berm to stabilize the slide area. This will require that a culvert pipe be placed in the base of the drainage run under the berm. The berm will extend a short distance up the opposite slope. The failed portion of the slope located above the berm level will be subexcavated and reconstructed with well-compacted drier clay or gravel, benched into the intact portion of the highway embankment. The bush area in the vicinity of the berm will need to be cleared. Some erosion protection will be required just downstream of the end of the new culvert, and possibly a flow energy dissipation bowl may need to be constructed at the downstream end of the new culvert outlet lined with riprap, and placed over a non-woven geotextile. High flow soil covering may also be placed along the slope over the repaired area at the location of concentrated surface flows. Silt fence should be placed at the downstream limit of the repairs and monitored for a year.

Another requirement will be to strip the topsoil from the slide area and replace and seed it upon completion of the repairs. Compliance with Alberta Environment should be made prior to initiating any of the long-term measures in the event that there are any environmental restrictions due to the drainage runs.

A right-of-way request will need to be prepared as part of the design, and land negotiation will be required.

The ballpark cost of the work, excluding land and engineering costs, is estimated to be in the order of $300,000 to $400,000.

5.3 Investigation

A topographic survey, detailed design and tender package are considered necessary prior to carrying out the proposed long term remedial measures.

To assess an appropriate long term alternative, consideration should be given to drilling test holes and installing standpipe piezometers (P's) at this site to assess the soil conditions down slope of the highway embankment where the relatively flat natural slope exists and to determine the governing piezometric surface at the site. Two test holes completed with standpipes are recommended at the proposed locations and depths shown on Figure SH10-1C-1. Surveying of this site is recommended prior to implementing permanent remedial measures, to properly assess drainage and to better define quantities.

The cost of the investigation is estimated to be in the order of $15,000.

5.4 Maintenance

The slide area should be inspected by the Maintenance Contract Inspector, on at least monthly basis to see if the slide enlarges and approaches the edge of the highway. If the slide scarp retrogresses, warning signs, and either barricades or a guardrail should be set up and maintained around the slide area to warn motorists of the hazard.

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 condition worsens.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, P.Eng.
Review Principal

Barry Meays, P.Eng.
Project Engineer

Gurpreet Bala, M.Sc.
Project Coordinator
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Attachments

cc: Mr. Roger Skirrow, P.Eng.
Director of Geotechnical Services, AIT

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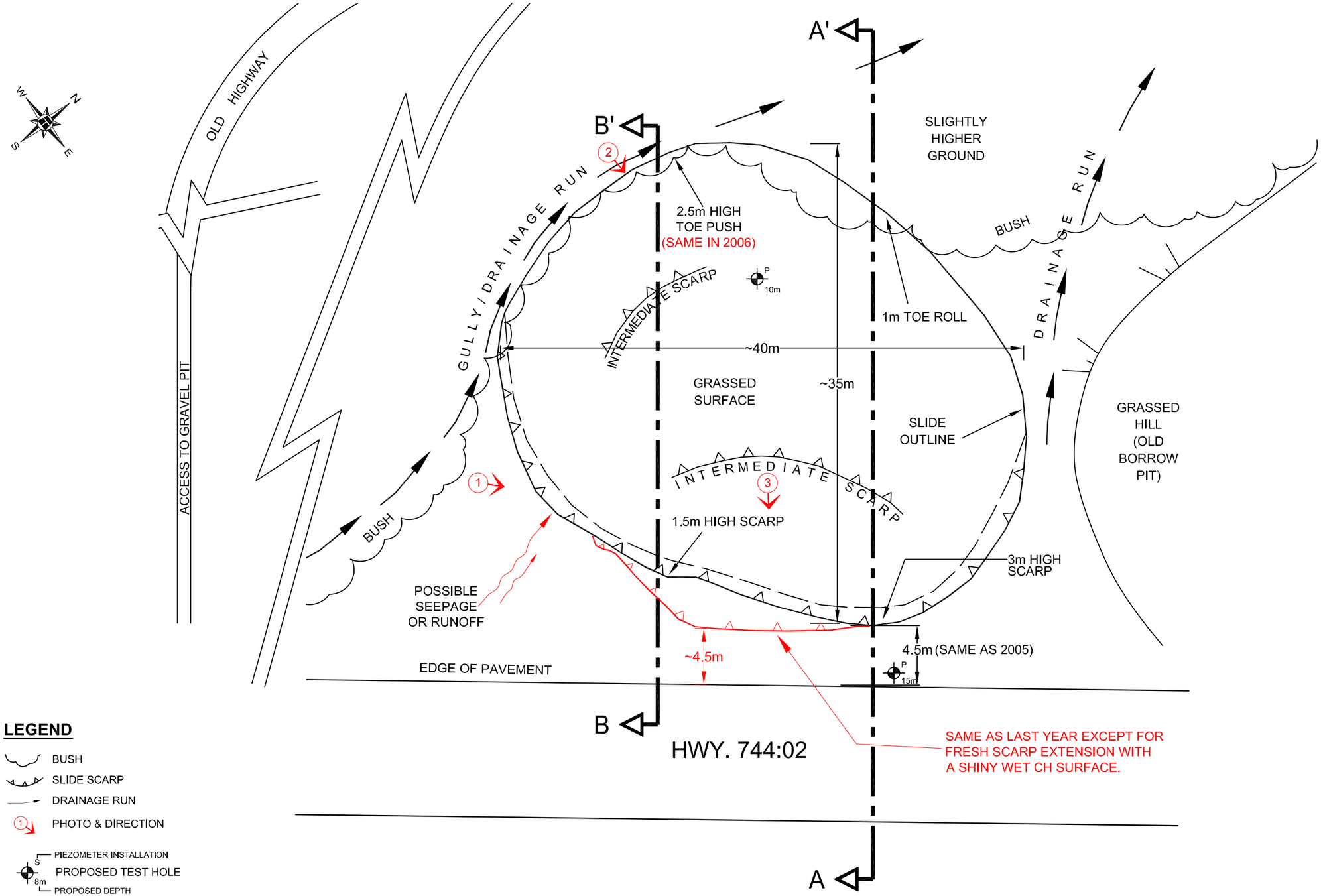

LEGEND

- BUSH
- SLIDE SCARP
- DRAINAGE RUN
- ① PHOTO & DIRECTION
- PIEZOMETER INSTALLATION
- S — PROPOSED TEST HOLE
- 8m — PROPOSED DEPTH

NOTES :

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK
2. MAY 24, 2006 OBSERVATIONS SHOWN IN RED

PLAN VIEW

APPROX. 1:300

0 2 4 6 8 10 15 20m

SCALE 1:300

FIGURE SH10-1C-1 - SITE PLAN
SLIDE ON HWY 744:02, SH10-SITE 1C
PEACE RIVER (SWAN HILLS) REGION

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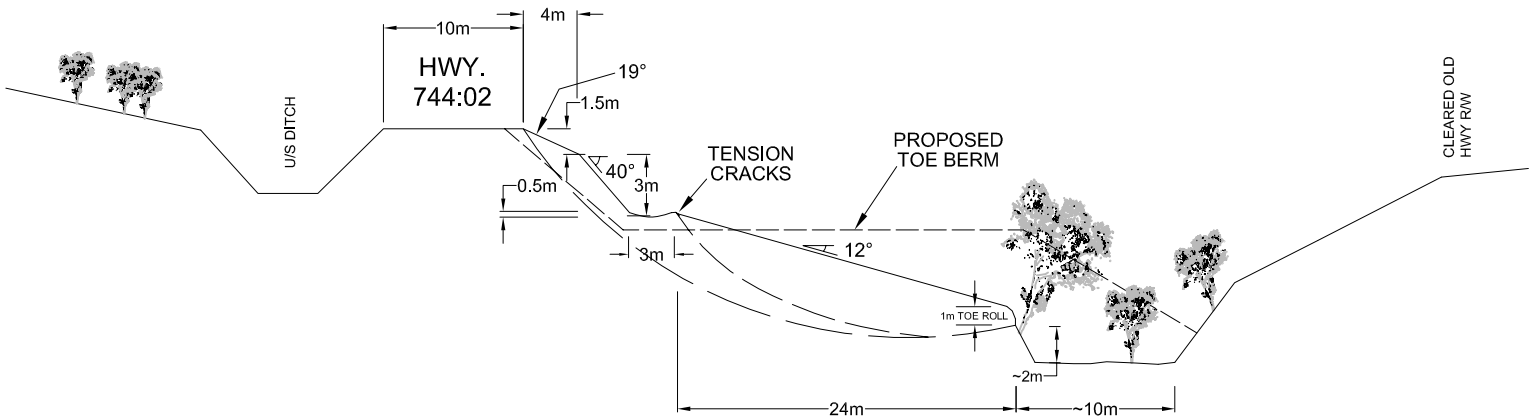
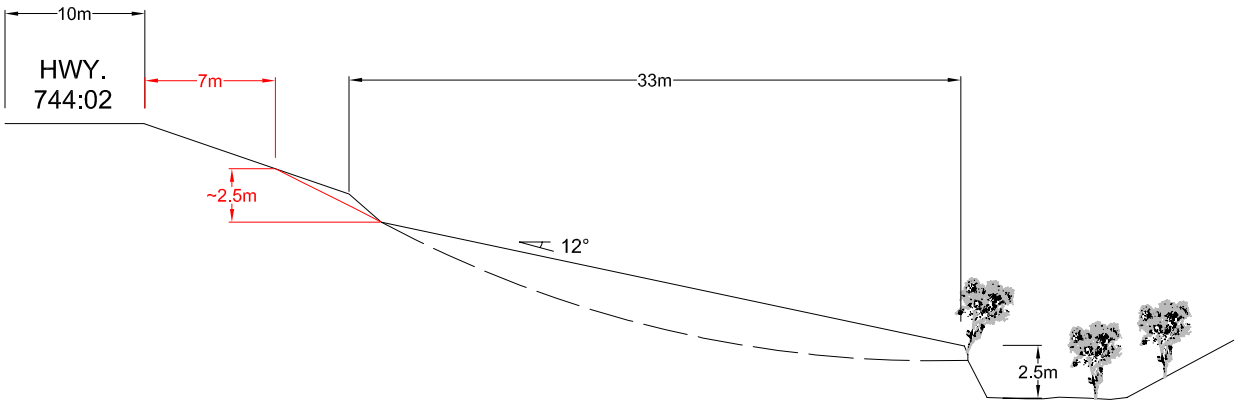


SECTION A-A'

N.T.S.



SECTION B-B'

N.T.S.

NOTES :

1. BASE PLAN AND CONTOURS PROVIDED BY EXH ENGINEERING SERVICES LTD.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. MAY 24, 2006 OBSERVATIONS SHOWN IN RED

FIGURE SH10-1C-2 - SECTIONS
SLIDE ON HWY 744:02, SH10-SITE 1C
PEACE RIVER (SWAN HILLS) REGION

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Photo 1 - Looking north from south edge of slide, May 24, 2006.

Photo 2 - Looking east from the grassed hill west of slide, May 24, 2006.

Photo 3 - Looking east (upslope) along slide from middle of slump, slickensides can be noticed, May 24, 2006.