



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 33:12 EMBANKMENT SLUMP (SH 9)
2006 ANNUAL INSPECTION REPORT**

Dear Sir:

This letter documents the 2006 annual site inspection of an area of slope instability located along Hwy 33:12 about 23 km north of Swan Hills, 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 23, 2006 in the presence of Mr. Roger Skirrow, P. Eng., Mr. Ed Szmata and Mr. Rodney Johnston, all of AIT.

1. BACKGROUND

The slump was first noticed about 7 years ago and has been getting progressively worse. The instability consisted of a 30 m long slump in the west 3H:1V sideslope of a 12 m high highway embankment fill at a culvert crossing location.

Our first assessment of this slump was carried out as part of the 2000 annual landslide assessment work and is included in Section B of the binder. Thurber carried out a geotechnical drilling investigation on June 19, 2001 and remedial options for repair of the landslide were provided in our preliminary engineering report dated March 13, 2002 (included in Section G of the Binder).

The option selected by AIT for which a detailed design and tender package was prepared consisted of a 15 m wide by 4 m high toe berm, subexcavation and re-construction of the upper portion of the slide above the berm with locally available compacted sand fill, and extension of the culvert by about 35 m with riprap placed at the outlet. Construction of this option was completed in December, 2004.

Slumping also existed around the inlet of the culvert on the east side of the highway embankment, about 6 m wide, 2.2 m in vertical height, and about 6 m into the slope from the culvert end, where the end section of the culvert had broken off, and water was flowing under and into the separated joint. Repairs performed at the same time in 2004 consisted of excavation of the inlet area (about 6 m x 6 m x 2 m), removal and replacement of the 6 m long CSP end piece of the culvert, reconstruction of the slope by placement of uniformly compacted clay to prevent flow-by, re-alignment/straightening of the creek channel about 9 m upstream of the culvert end, and armouring the inlet with riprap.

2. SITE OBSERVATIONS

The changes in condition since last year are shown on the attached site sketch plan and cross-section, which shows the updated remediation measures. Selected photographs taken during the visit are also attached.

Grass growth was thinner along the steep section of the rehabilitated west side slope than that along the gentle slope section close to the highway. Two silt fences installed across the slope in a north-south fashion above the culvert outlet were in generally good condition, with only a couple of loose spots. It is recommended to keep the silt fences at the toe of the slope for another year, as silting was observed at the base of the silt fences. An additional silt fence located lower down the slope along the south edge of the creek was loose. No silting was observed on the silt fences along the creek and thus these silt fences may be removed. A 7 m long crack up to 20 mm wide observed in 2005, right at the grade change of the flatter upper slope and lower steeper slope nearer the south side of the old slump (see Figure), was still visible.

The creek channel immediately upstream of the rehabilitated culvert inlet on the east side of the highway was approaching the culvert at a severe skew to the culvert alignment. The freshly placed riprap was also slightly higher than the culvert invert elevation. The silt fence installed at the inlet was loose at couple of spots.

The south subdrain outlet was buried and the wash gravel around the outlet disturbed due to vehicular movement on it. Both of the subdrains were dry.

Several deer and moose footprints were visible at the site.

3. ASSESSMENT

Prior to the 2004 repair, the previous instability was considered to have been triggered by ongoing erosion from the creek along the base of the slope. The fresh crack observed south of the culvert at the break in the west sideslope could simply be attributed to settlement of the freshly placed fill, but it could possibly be a reflection of the previous instability crack.

The slumping on the upstream side (east) was also likely caused by erosion, and possibly hampered by debris in the pipe. The recent repairs have remedied this situation; however future erosion is possible due to the sharp bend in the channel immediately in front of the culvert inlet.

4. RISK LEVEL

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

$$PF(3) * CF(3) = 9 \text{ (Was } 9 \times 3 = 27 \text{ last year prior to repairs)}$$

A Probability Factor of 3 is considered appropriate since the slide is inactive with a low probability of remobilization. A Consequence Factor of 3 is still considered appropriate since the embankment fill is fairly high and at a culvert crossing but the repaired failure is currently not affecting the pavement.

5. RECOMMENDATIONS

It was suggested to take this site off of the annual assessment inspections as the rehabilitation work of the slide was performing to satisfaction.

5.1 Short Term

The 2004 remedial measures have improved the overall condition of the existing slump on both sides of the highway. However, the crack observed south of the culvert at the boundary of the slope segments should be periodically monitored, to see if it is a reflection of a portion of the previous slump or simply recent settlement of the fill, and to warn of a potential worsening of the condition.

Yearly visual monitoring by the Maintenance Contractor Inspector is also still recommended for the remainder of the site to assess the performance of the recent repairs, and to see if erosion will re-emerge in the future at either the inlet or outlet of the culvert. The condition and functionality of the subdrains installed as part of the repairs on the west slope should be monitored. The progress of revegetation on the backslope should also be checked.

5.2 Long Term

No long term measures are required at this time due to the recent repairs.

5.3 Maintenance

It is recommended to tighten and re-base the lower silt fence at the toe of slope, west of the highway into the soil. The silt fence along the creek can be removed. Similarly, the silt fence east of the highway above the culvert inlet should be re-instated. The grass cover on the steep section of the slope was thin, and it might need reseeding if it does not get dense.

A check should be kept on the flow through the subdrains. The south subdrain outlet that was observed buried might have to be exposed for proper functioning.

Some additional riprap should be added to the outside bend of the channel upstream of the culver inlet, to lower the risk of future erosion.

These above maintenance measures are expected to cost in the order of \$3,000.

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



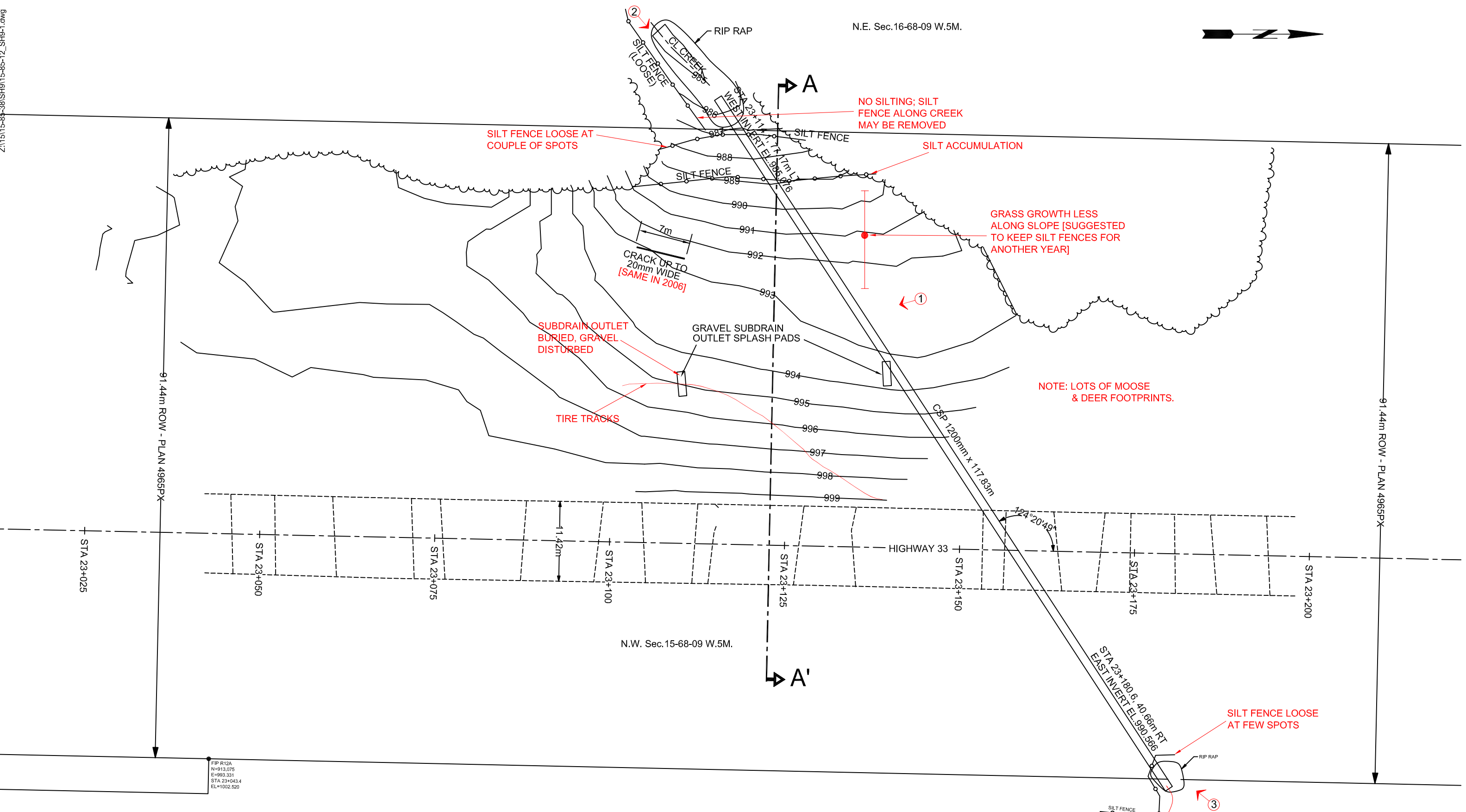
Project Engineer

Gurpreet Bala, M.Sc.
Asstt. Project Engineer
/dw

Attachments

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

N.E. Sec.16-68-09 W.5M.



- NOTES :**
1. BASE PLAN & CONTOURS PROVIDED BY EXH ENGINEERING SERVICES LTD.
 2. FEATURE LOCATIONS ARE APPROXIMATE.
 3. PREVIOUS OBSERVATIONS SHOWN IN BLACK
 4. MAY 23, 2006 OBSERVATIONS SHOWN IN RED

LEGEND :

③ → PHOTO AND DIRECTION

FIGURE SH9-1
HWY 33:12 EMBANKMENT SLUMP
23 km NORTH OF SWAN HILLS (SH9)
UPDATED SITE SKETCH PLAN

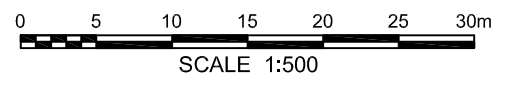




Photo 1 - Looking south to southwest along slope and culvert outlet, May 23, 2006.



Photo 2 - Looking northeast at culvert outlet. Note loose silt fence south of creek, May 23, 2006.



Photo 3 - Looking west at culvert inlet. Note sharp channel bend in front of culvert and riprap higher than inlet, May 23, 2006.