THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

August 1, 2006 File: 15-85-49

Alberta Infrastructure and Transportation
Room 223, Provincial Building
4709 – 44 Avenue
Stony Plain, Alberta
T7Z 1N4

Attention: Mr. Randy Shaul

NORTH CENTRAL REGION – STONY PLAIN AREA
GEOHAZARD ASSESSMENT CALL-OUT, (CE 142-06)
NC 56: WEST DITCH EROSION ALONG HWY 60:02

Dear Sir:

This report presents the results of a call-out for the above noted site located along Hwy 60:02, approximately 0.5 km south of the intersection with Hwy 16. The site is located in Sec. 12, Twp. 53, Rge. 1, W5M. Mr. Don Proudfoot, P. Eng. and Mr. Gustavo Padros, M.Sc. of Thurber Engineering Ltd. conducted the inspection on July 18, 2006. Mr. Randy Shaul of Alberta Infrastructure and Transportation (AIT) made the request for the call-out, and was present during the site reconnaissance along with Mr. David Tough, AIT's area Maintenance Contract Inspector (MCI).

1. BACKGROUND

An existing ditch located west of Hwy 60:02 has experienced soil erosion problems since 2002. A Telus telephone cable is currently exposed as its soil cover has been eroded. The erosion rate apparently has been increasing lately, prompting a callout request.

Earthworks for adding turning lanes along Highway 60 are currently taking place.

2. OBSERVATIONS

The ditch located west of Hwy 60:02 was inspected during the site reconnaissance. The water in the ditch flows in a south to north direction. The incoming ditch from the south was shallow, about 1 m below the highway elevation and was formerly covered with grass (earthworks for upgrading it are currently

taking place). The longitudinal alignment of the ditch is about 6 m west of the highway shoulder. However, the ditch turns northwest for a length of about 12 m, descending to about 5 m below the highway elevation and continues there towards the north. In that transition turn, a thin layer of riprap was previously placed to protect the bottom of the ditch against erosion. It was at that location where an erosion gully 9 m long x 2.7 m wide x 1.2 m deep was noticed, exposing a Telus telephone cable as its soil cover has been eroded. No geotextile was noted under the riprap. The erosion direction in the gully is retrogressive, advancing through the transition turn of the ditch towards the southeast.

The soil at the erosion gully location is mainly composed of silty sand. Some riprap boulders mentioned above were observed at the bottom of the gully as the soil around them has been eroded.

At the end of the transition turn there is a 900 mm diameter CSP culvert, which discharges into the deeper ditch section onto a rip-rap apron made of rounded alluvial boulders 100 mm to 250 mm in diameter. The culvert outlet was clogged with mud and sticks.

The west sideslope of Hwy 60 is well covered with grass and no erosion features were noted on the sideslope. However, a slump was noted on the east slope of the ditch, about 10 m north of the culvert. The slump was about 2 m high and 20 m wide. The toe of the ditch slope seems to have been eroded by the water running in the ditch. A surficial crack extends 30 m from the slump towards the north, parallel to the ditch suggesting that the slump is on the verge of growing in size.

A small slump was also observed on the west slope of the ditch, located opposite to the above-mentioned slump. The height of that slope is 2.8 m and the west ditch slope has a 22 degree inclination.

3. ASSESSMENT

The erosion gully located on the west ditch of Highway 60:02 is the result of insufficient erosion protection in the transition turn of a ditch formerly constructed to join two segments of the west ditch that had a misalignment of about 6 m and a height difference of about 2 m. The thin boulder layer placed at the bottom of the ditch to prevent soil erosion proved insufficient and the incoming water flow from the south quickly eroded the soil along the transition turn that joins the two segments of the ditch. This erosion is retrogressive, advancing to the southeast, towards the direction of the incoming flow.

Given the soil at that location is composed of silty sand and that it is eroded easily, the rate of erosion increases quickly as the exposed surface increases. Since the

upgraded ditch to the south is near the highway shoulder, the erosion gully will extend towards there, if not corrected promptly.

Erosion along the toe of the ditch slopes due to runoff in the ditch and from flow exiting from the CSP culvert may have triggered the ditch slope failures. The slump in the east slope of the lower level ditch could eventually retrogress toward the highway and endanger the stability of the highway embankment.

4. RISK LEVEL

Based on the AIT's Risk level rating system, the risk level for this site has been assessed as follows:

$$\text{Risk (22)} = \text{PF (11)} \times \text{CF (2)} \qquad \text{[Eq. 1]}$$

This risk level was based on a Probability Factor (PF) of 11 (active erosion with moderate but increasing rate) and a Consequence Factor (CF) of 2 (erosion affecting use of the highway ditch but not requiring closure of the roadway).

5. RECOMMENDATIONS

In the short term, the ground surface at the erosion gully location should be stripped and all loose or disturbed material removed. The disturbed riprap should also be removed and salvaged if possible. The gully should be backfilled with packed clay. A new ditch with a smoother alignment should be excavated through the new fill to smoothly transfer the flow from the upper level highway ditch to the lower level highway ditch. The ditch should be cut with a flat bottom and sloped sides and lined with Class 1 riprap placed over non-woven geotextile. A suggested ditch cross-section is shown on Figure NC56-1. Care will need to be taken to avoid damaging the Telus cable that crosses the eroded ditch section.

The culvert outlet should be also be cleaned out. Additional riprap (over non-woven geotextile) should be placed in the lower level ditch to extend the current rip-rap north beyond the CSP culvert outlet and partway up the west ditch slope opposite the culvert outlet.

The ball park cost of the proposed short term repairs is about $ 15,000.

In the long term, the slump on the east ditch slope should be repaired. Extending the rip-rap as mentioned earlier may help preventing further erosion at the toe of the slope. The slide material should be excavated and removed, and the rip-rap ditch (over non-woven geotextile) should be extended 50 m north beyond the existing CSP culvert. The slope should be reconstructed using compacted pit run gravel (AIT 6-80) as backfill material. The gravel backfill will also provide some

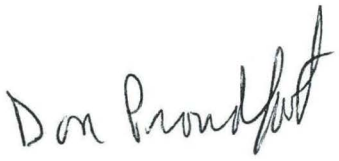
slope drainage in case seepage has been a contributing factor to the slope failure. Finally, the repaired slope should be covered with topsoil and double seeded to prevent surface erosion.

The ball park cost of the proposed long term repairs is about $ 150,000.

6. CLOSURE

We trust that the above information is sufficient for your present requirements. However, if you have any questions or require any additional input please do not hesitate to call us.

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



Gustavo Padros, M.Sc.,
Assistant Project Engineer
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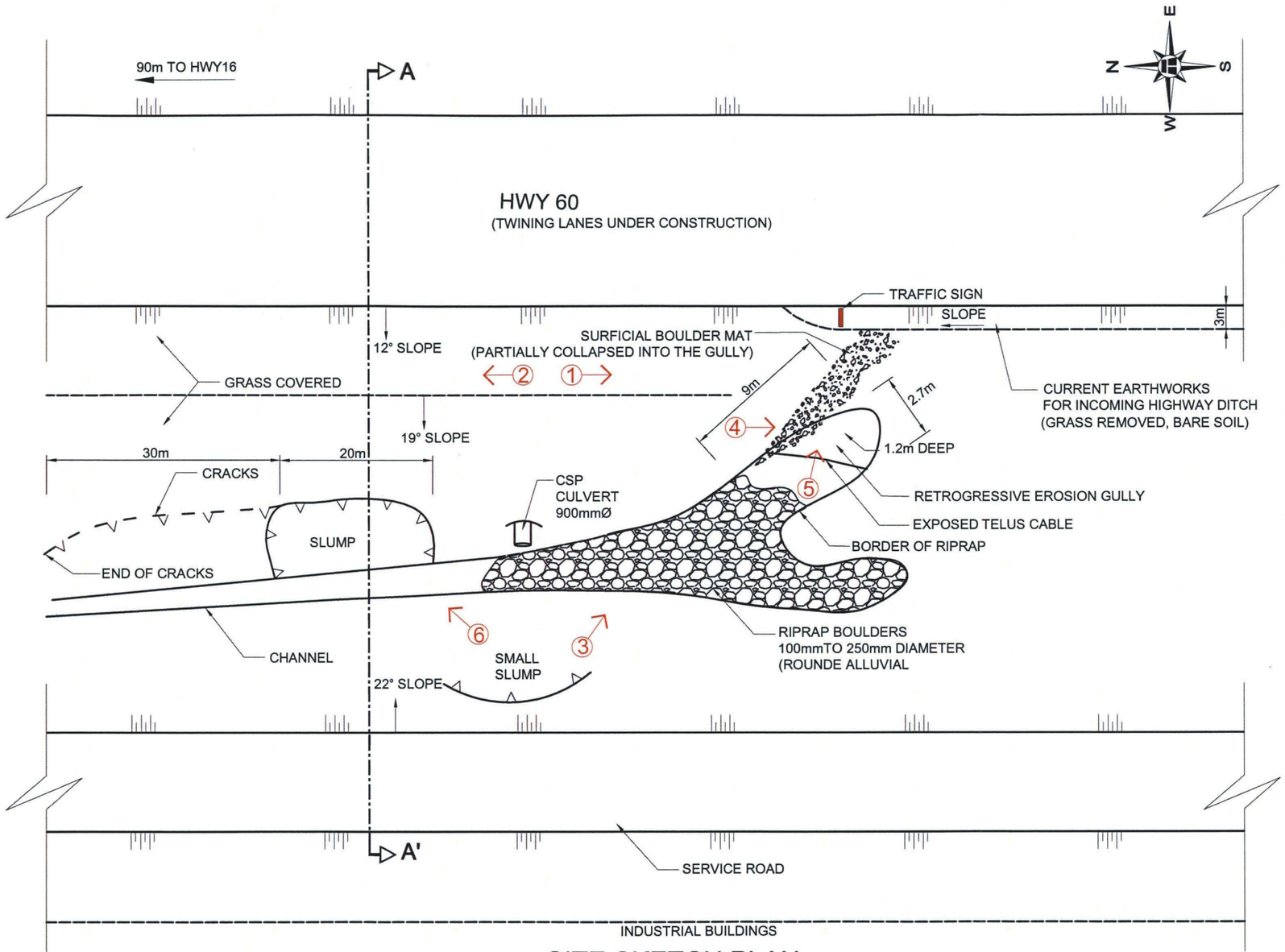
Attachment



SITE SKETCH PLAN

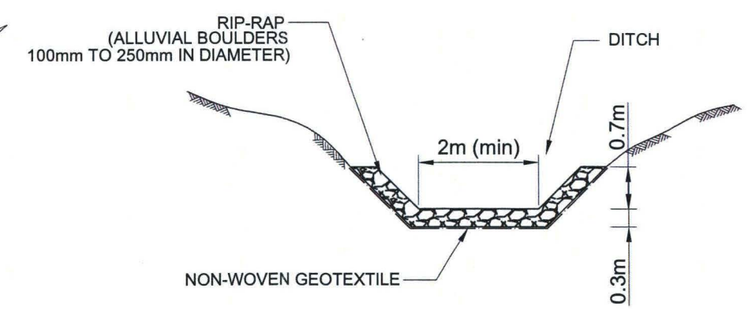
N.T.S.

LEGEND:

- CRACKS
- SLIDE BACKSCARP
- RIP-RAP
- COLLAPSED BOULDER MAT
- ① PHOTO AND DIRECTION

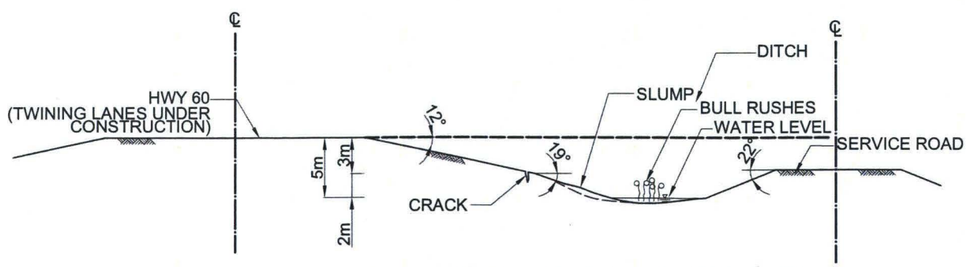
SITE MAP

N.T.S.



EXTENDED DITCH SECTION

N.T.S.



CROSS SECTION A-A'

N.T.S.

FIGURE NC56-1 SITE PLAN

NC56: HWY 60:02 WEST DITCH EROSION

NORTH CENTRAL REGION - STONY PLAIN AREA GEOHAZARD ASSESSMENT

DATE : JULY 2006

THURBER PROJECT #15-85-49

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PHOTO 1: Looking south at the location of ditch erosion. Grading associated with the construction of a turning lane is visible further to the south.

PHOTO 2: View of the lower level highway ditch, looking north.

PHOTO 3: Looking southeast at the erosion gully and the transition turn of the ditch. The 900 mm diameter CSP outlet is also visible.

PHOTO 4: Erosion gully.