



September 8, 2009

File: 15-16-229

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

Attention: Mr. Ed Szmata

**PEACE REGION (PEACE RIVER/HIGH LEVEL) GEOHAZARD ASSESSMENT
HWY 2:60 EMBANKMENT SLIDE AREA (PH 13), NAMPA
2009 ANNUAL INSPECTION REPORT**

Dear Sir;

This letter documents the 2009 annual site inspection of an area of slope instability located along Hwy 2:60, about 1.7 km north of the Town of Nampa, Alberta (Figure PH13-1). Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE105/2008) with Alberta Transportation (AT).

Mr. R. Saunders, P.Eng. of Thurber undertook the inspection on May 27, 2009 in the company of Mr. Roger Skirrow, P. Eng., Mr. Neil Kjelland, P.Eng. and Mr. Ed Szmata of AT and the local MCI.

1. BACKGROUND

Thurber's last annual inspection of the site was in May 2008. Site conditions at that time are described in our Part B assessment letter in the site binder. Additional information regarding the site is provided in the Geotechnical File Review in Section A of the binder.

2. SITE OBSERVATIONS

Conditions at the site appeared to be relatively unchanged since the 2008 inspection and are noted on the attached site sketch plan. Select photographs taken during the visit are also included.

The following summarizes the observations made at each slide segment within the study area.

South Slide

The condition of the concrete retaining wall and piles appeared similar to that reported in previous assessments as can be seen in Photos 13-01 and 13-02 from 2009 and 2008, respectively. The graben area forming as the slide mass creeps downslope below the wall appeared to be similar to that observed in 2008 (Photo 13-03).

The row of pipe piles along the edge of the road contained water at a depth of 0.1 m to 0.2 m, similar to the previous assessments.

Central Slide

The slide area below the lagging wall appeared to be in a similar condition as noted in previous inspections (Photo 13-04). The retaining wall itself also appeared to be in a similar condition to that reported in previous assessments as shown in Photos 13-05 and 13-06 and 8 from 2009 and 2008, respectively. As in previous years, measurements were taken on the inclination of the piles using a hand held clinometer. The results are shown in Figure 13-2 and show no discernible increase in pile inclination since measurements began in 2004.

As noted in previous assessments, some of the lagging has become dislodged in the southern portion of the wall (Photo 13-05).

The roadway adjacent to this area was patched in 2006 to address the local settlement around the piles/cracking that previously existed and has not changed since 2008 (Photo 13-10).

North Slide

The north slide area is the most active of the three areas within PH13 and is the only one of the three that has not been remediated to date. Photos 13-07 and 13-08 show the headscarp area of the slide encroaching into the edge of the roadway and guardrails. The slide is considered to be shallow, with an estimated maximum depth of 2 m.

As noted in previous inspections, an apparent spring is located in the west highway ditch about 50 m north of the slide site. Signs adjacent to the "spring" indicate that a water line crosses under the highway at this location. It is considered possible that a leak in the water line is responsible for this feature. It is also possible that water from this source is contributing to the slide activity.

Cracking in the roadway upslope of this slide appears to have increased since 2008 and are now slightly open (Photo 13-10).

3. ASSESSMENT

The Central Slide at this site is considered to be inactive. Recent patching of the asphalt appears to have addressed the settlement of the shoulder adjacent to the wall, noted as of concern in previous assessments. Notwithstanding the above, there is still some potential for loss of ground behind both of the retaining walls at this site. This could cause a sinkhole and potentially affect the highway surface.

Some ongoing downslope movement is likely occurring below the concrete retaining wall at the South Slide, evidenced by the formation of a graben between the piles and the slide mass. This movement is not believed to have affected the functionality of the retaining wall at this time, although the slope should be regularly monitored.

No remedial measures have been conducted for the North Slide, and the headscarp is presently located at the guardrail. As discussed earlier, the slide appears to be shallow and is likely being exacerbated by a possible leak in the water line located north of the site.

At this time, the slide is not affecting the road surface, but if mitigation measures are not undertaken soon, it is likely that the slide will begin to affect the paved surface.

4. RISK LEVEL

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

$$PF(13) * CF(3) = 39$$

A Probability Factor of 13 is considered appropriate since the north slide is active with a perceived high rate of movement (4 m of retrogression since 2004). A Consequence Factor of 3 is considered appropriate since the embankment fill is moderately high and a partial closure of the road would be a direct result of an aggressive slide movement.

This is unchanged from the assessments undertaken in 2005 to 2008.

5. RECOMMENDATIONS

5.1 Short Term

In the short term, the site should be regularly inspected by the MCI to assess if the highway becomes affected, and implement any traffic safety requirements.

The owner of the water line should be contacted and advised that a leak is suspected, and that repairs should be implemented as soon as possible.

5.2 Long Term

It is understood that a new bridge is being proposed over the Heart River just south of the PH13 that would involve a realignment of the highway away from the current areas of instability. Providing this work is undertaken in the next few years, there is likely no requirement for additional long-term remediation measures at this site. However, if plans for a new bridge were to go on hold, then consideration for long-term mitigation may be required as outlined below.

Potential long term stabilization measures at this site include construction of a third pile wall at the north site, replacement of the slide mass with a free-draining granular material (gravel) and slope flattening. These options could be combined depending on costs and final configurations. A variation on the slope flattening option would include a toe berm. Based on similar previous projects it is expected that the costs of remedial measures to fix the north slide will be in the order of \$280,000.

5.3 Investigation

Should long-term mitigation measures be required due to delays in the new bridge and highway realignment, the next phase of work for this site would be to carry out a detailed topographic survey, geotechnical investigation and stability analyses to assess the most effective remedial solution. The geotechnical investigation could consist of a test hole at the shoulder of the road, complete with a standpipe piezometer, and 3 test pits at the base of slope to assess a potential toe berm option. The investigation work as described above, including a preliminary engineering report, is expected to cost about \$30,000.

5.4 Maintenance

The following recommendations are made for this site:

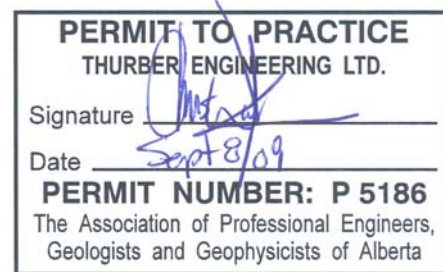
- Cracks in the pavement should be sealed.
- A wedge of clean (<5% fines) granular material should be placed at the base of the southern 5 panels of the timber lagging wall (Central Slide). The intent of this is to reduce loss of ground due to the dislodged lagging. The granular material can be dumped from the top of the wall and should extend 0.3 m above the dislodged lagging. The estimated size of the wedge is 10 m long by 1.2 m high, with a 2H:1V slope out from the retaining wall.

The above-noted maintenance measures have an estimated cost of \$4,000.

6. CLOSURE

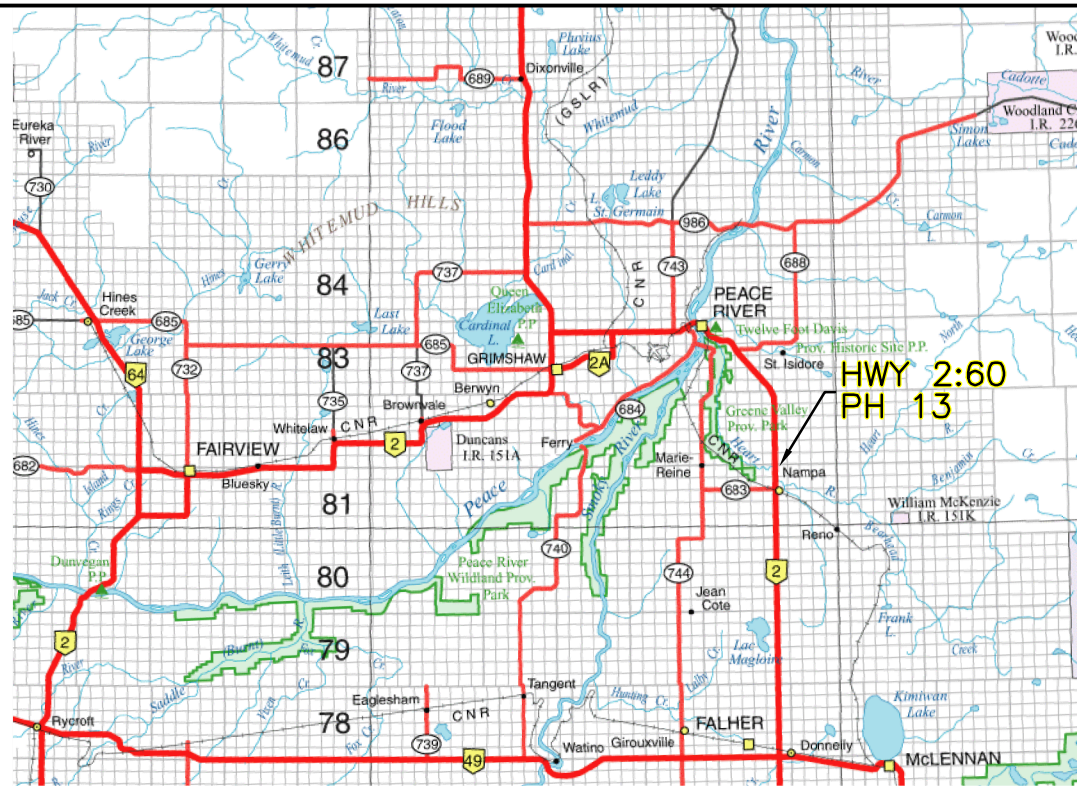
We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if the slide condition worsens.

Yours very truly,
Thurber Engineering Ltd.
Chris Workman, M.Eng., P.Eng.
Review Principal



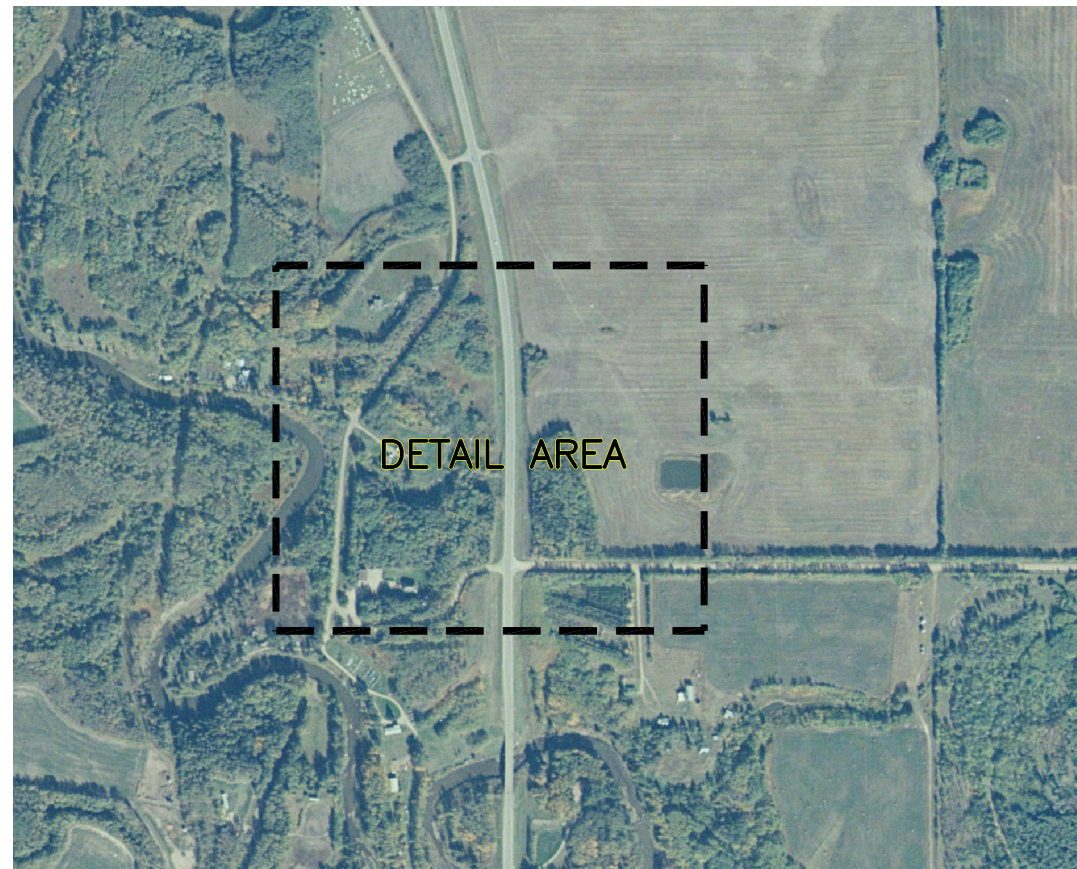
Robert Saunders, M.Eng., P.Eng.
Senior Geotechnical Engineer

Attachments



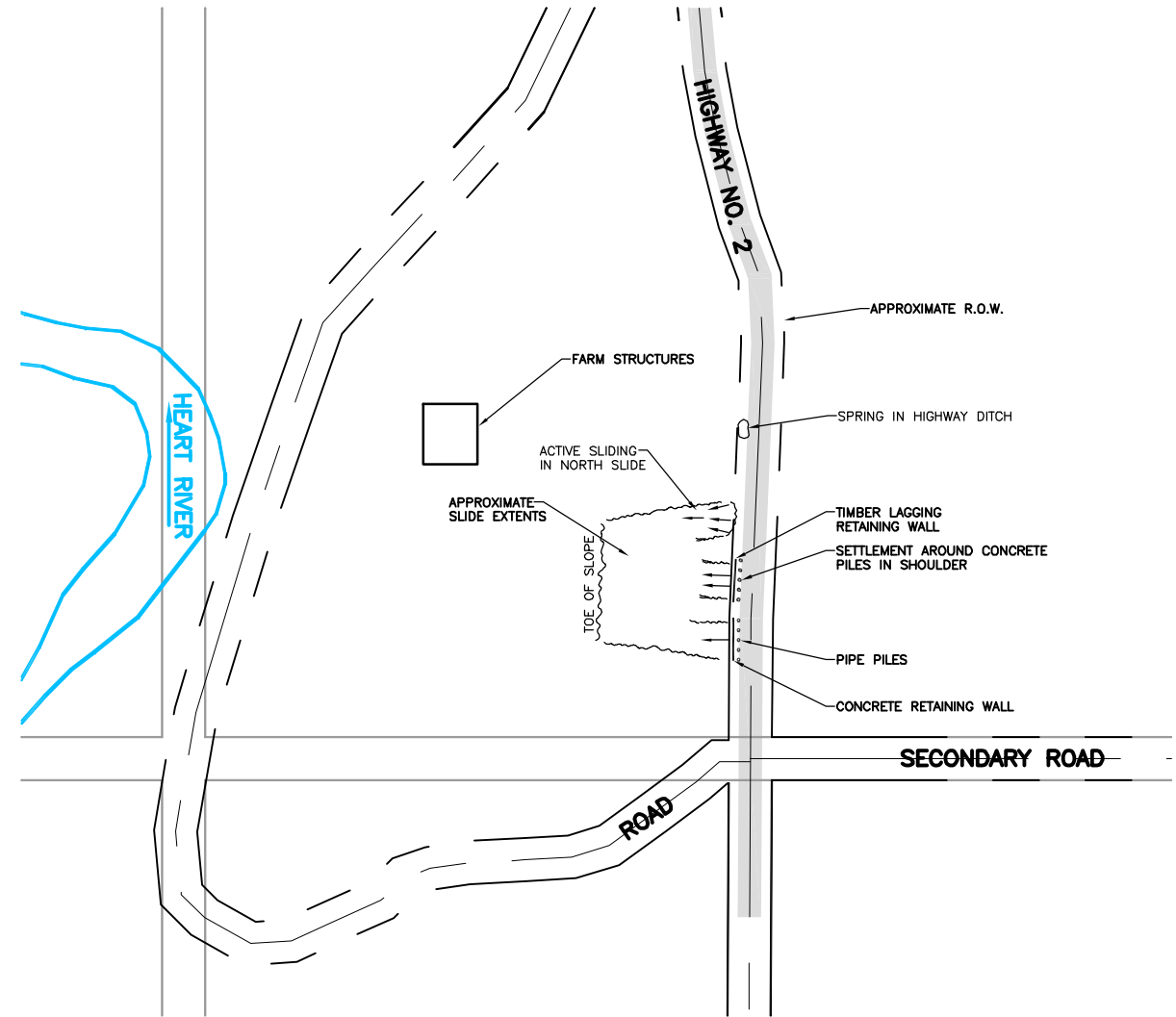
KEY MAP

SCALE 1:1 000 000



LOCATION PLAN

SCALE 1:10 000



DETAIL PLAN

NOT TO SCALE

NOTES:

- 1 AIRPHOTO BASE FROM TARIN RESOURCE SERVICES LIMITED (1 m/PIXEL) 1999.
- 2 SLIDE FEATURES ARE SHOWN APPROXIMATELY ONLY.
- 3 DRAWINGS MUST BE USED IN CONJUNCTION WITH ATTACHED REPORT AND ARE SUBJECT TO THE STATEMENT OF GENERAL CONDITIONS.

DRAWN BY	ICB/ACM	DESIGNED BY	RJS	APPROVED BY	WCW
SCALE	AS SHOWN	DATE	AUGUST 27, 2009	FILE No.	15-16-229-B3C

Government of Alberta
Transportation

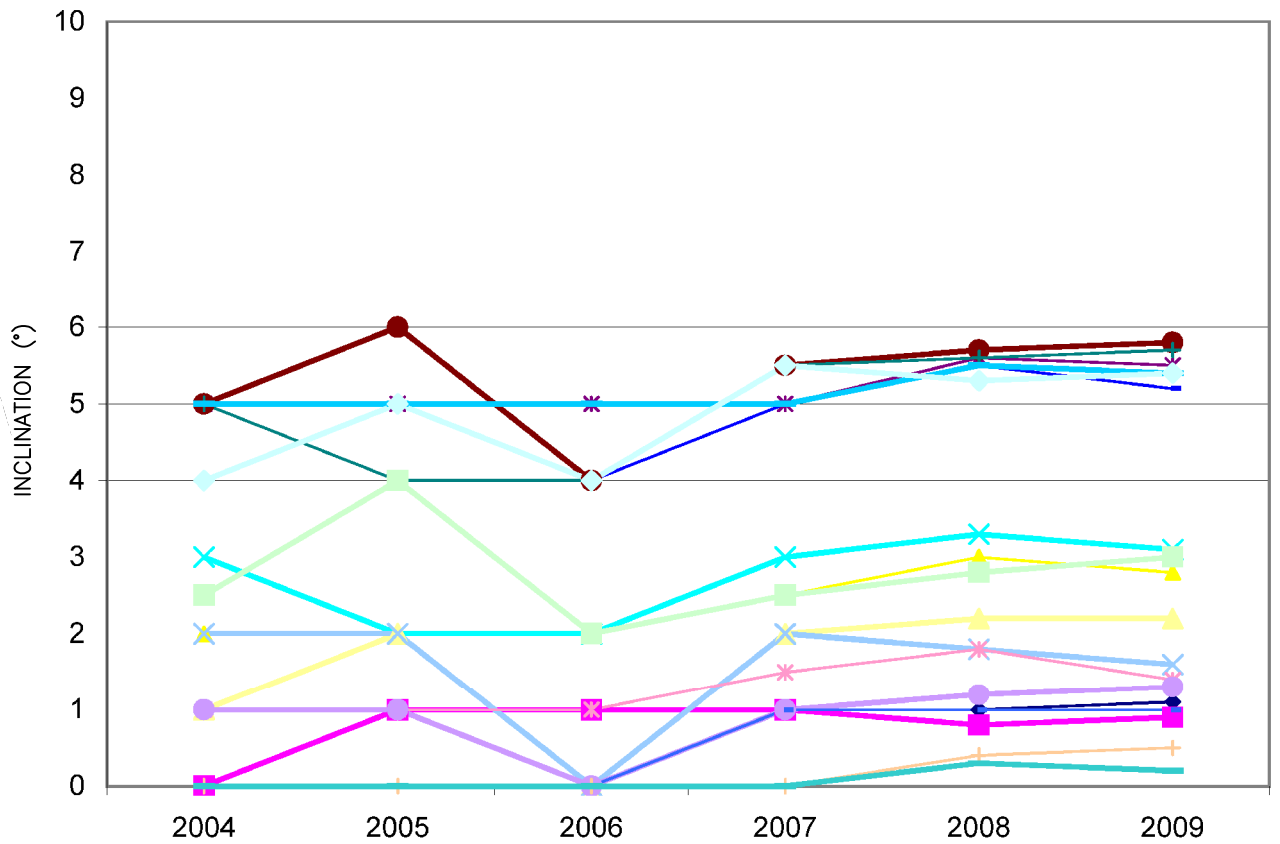
PEACE REGION (PEACE RIVER/HIGH LEVEL)

**NAMPA
HWY 2:60 (PH13)
LOCATION PLAN**

FIGURE PH13-1



THURBER ENGINEERING LTD.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS



	Jun-04	Jun-05	Jun-06	May-07	May-08	May-09
Pile 1	1.0	1.0	1.0	1.0	1.0	1.1
Pile 2	0.0	1.0	1.0	1.0	0.8	0.9
Pile 3	2.0	2.0	2.0	2.5	3.0	2.8
Pile 4	3.0	2.0	2.0	3.0	3.3	3.1
Pile 5	5.0	5.0	5.0	5.0	5.6	5.5
Pile 6	5.0	6.0	4.0	5.5	5.7	5.8
Pile 7	5.0	4.0	4.0	5.5	5.6	5.7
Pile 8	4.0	5.0	4.0	5.0	5.5	5.2
Pile 9	5.0	5.0	5.0	5.0	5.5	5.4
Pile 10	4.0	5.0	4.0	5.5	5.3	5.4
Pile 11	2.5	4.0	2.0	2.5	2.8	3.0
Pile 12	1.0	2.0	0.0	2.0	2.2	2.2
Pile 13	2.0	2.0	0.0	2.0	1.8	1.6
Pile 14	1.0	1.0	1.0	1.5	1.8	1.4
Pile 15	1.0	1.0	0.0	1.0	1.2	1.3
Pile 16	0.0	0.0	0.0	0.0	0.4	0.5
Pile 17	0.0	0.0	0.0	1.0	1.0	1.0
Pile 18	0.0	0.0	0.0	0.0	0.3	0.2

INCLINATION (°)

DRAWN BY ICB | DESIGNED BY RJS | APPROVED BY WCW | SCALE AS SHOWN | DATE SEPTEMBER 9, 2009 | FILE No. 15-16-229-B5B

**PEACE REGION (PEACE RIVER/HIGH LEVEL)
NAMPA HWY 2:60 (PH13)
LAGGING WALL INCLINATION READINGS**

PH13-2



Photo 13-01

May 2009

Looking north at concrete retaining wall in South Slide area.



Photo 13-02

May 2008

Similar view as Photo 13-01 above taken in 2008.



Photo 13-03

May 2009

Close-up looking south at concrete retaining wall in South Slide area. Note development of a graben (sunken area) immediately downslope of piles.



Photo 13-04

May 2009

Looking downslope at Central Slide area below lagging retaining wall.



Photo 13-05

May 2009

Looking north along lagging retaining wall in Central Slide area.



Photo 13-06

May 2008

Similar view to Photo 13-05 from 2008. No discernible changes to conditions of retaining wall or immediate downslope.



Photo 13-07

May 2009

View of headscarp of North Slide at edge of guardrail.



Photo 13-08

May 2008

Similar view as Photo 13-07 taken in 2008. No discernible change since 2008.



Photo 13-09

May 2009

View looking downslope At North Slide area below roadway.



Photo 13-10

May 2008

View looking south at cracking parallel to the roadway in the vicinity of the North Slide. Cracks are open and slightly wider than in 2008. Patched asphalt adjacent to lagging wall in Central Slide area shown in the distance.