



**THURBER ENGINEERING LTD.**

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

July 25, 2008

File: 15-16-213A

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

Attention: Mr. Ed Szmata

**PEACE REGION (PEACE – HIGH LEVEL AREA) GEOHAZARD ASSESSMENT  
HWY 688:02 PAT'S CREEK (PH50)**

Dear Sir:

This letter documents the 2008 annual site inspection of an area of slope instability located along Highway 688:02 about 2.5 km east of the junction of Highway 688 and Highway 2. 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 Infrastructure and Transportation (AT).

Mr. Robert Saunders, P.Eng. of Thurber undertook the inspection on May 28, 2008 in the presence of Mr. Roger Skirrow, P. Eng. and Mr. Ed Szmata of AIT.

**1. BACKGROUND**

This site has a history of stability problems associated with the north embankment slope. In 2001, two slides occurred in the north embankment which resulted in the lower slide mass being excavated and reconstructed with pitrun gravel placed over geotextile. A concrete end treatment around the culvert and a riprap lined swale constructed along the northeast edge of the fill to mitigate an erosion problem were also installed at that time.

In August 2006, Thurber undertook a callout inspection of a moderately large, shallow slope instability affecting the upper portion of the north embankment slope. Following that inspection, a preliminary engineering assessment was undertaken by Thurber, which included the drilling of a test hole in the westbound roadway and excavation of a test pit on the slope through the toe of the slump. The results of that assessment, with several conceptual remediation options, were presented in a letter report dated February 20, 2007.

In 2007/8, UMA Engineering Ltd. (UMA) undertook a geotechnical investigation in support of the detailed design of long-term remediation measures for this site which included the installation of piezometers and slope inclinometers.

The site condition at the time of the 2007 inspection is described in our Part B assessment letter in the PH50 site binder. Additional information of the site is provided in the Geotechnical File Review in Section A of the binder.

## **2. SITE OBSERVATIONS**

At the time of the May 2008 inspection, the slope instability on the upper portion of the embankment was approximately 60 m long and up to 25 m wide, centered within the north side of the embankment over Pat's Creek (Figure 50-1). Conditions within the slide area were relatively unchanged from 2007, with the exception of site grading undertaken to access the slope as part of the geotechnical investigation undertaken by UMA (Photos 50-01 to 50-04).

The slide was observed to be confined to the upper third of the slope. The upper portion of the embankment slope had a gradient of about 18° and the lower (stable portion) had a gradient of about 15°. Since 2007, the eastern end of the slide complex appears to be more defined (Photos 50-03 and 50-04).

The headscarp of the slide extended to the shoulder of the westbound lane. The guardrail that had been undermined at the west and east ends of the slide in 2007 has since be relocated upslope closer to the westbound driving lane (Photos 50-05 to 50-07).

In 2007, the estimated depth of the slide rupture surface was in order of only 1 m, although this might have deepened slightly with time. The soil (fill) exposed within the headscarp was noted to be a high plastic clay.

In the vicinity of the mid-slope instrumentation installed by UMA at the western end of the slide complex, seepage and ponding water were noted during the 2008 inspection that did not appear to be related to surface runoff (Photo 50-08).

## **3. ASSESSMENT**

Based on the preliminary geotechnical assessment completed for the site, the cause of the slumping was determined to be a result of weathering and a loss of strength within the clay fill (i.e. loss of cohesion) over time. The trigger mechanism for the slide was likely a heavy precipitation event.

Further instability and retrogression is possible as runoff into the slide mass at the scarp areas is unimpeded.

#### **4. RISK LEVEL**

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

$$PF(11) * CF(4) = 44$$

A Probability Factor of 11 is considered appropriate since the slide is active with a steady rate of movement, though movement might accelerate if heavy or prolonged rainfall occurs. A Consequence Factor of 4 is considered appropriate since the fill slope is associated with a high fill and a culvert structure. Further movement would likely result in closure of the westbound travel lane.

#### **5. RECOMMENDATIONS**

##### **5.1 Short Term**

In the short term, the site should be regularly inspected by the MCI to ensure the westbound travel lane does not become undermined again and fail further into the roadway.

##### **5.2 Long Term**

It is understood long-term remediation measures are currently being designed by UMA.

##### **5.3 Investigation**

As this site was recently investigated by UMA in support of detailed design of remediation measures, no further investigation is considered necessary at this time.

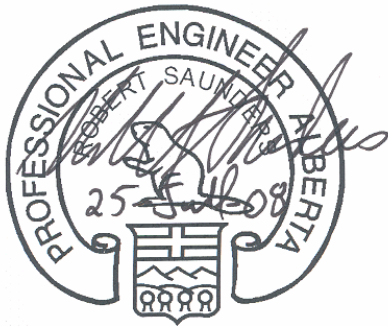
##### **5.4 Maintenance**

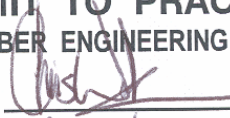
Until remediation measures can be completed, surface runoff should be directed away from the two scarp features at either end of the slide area. If possible, runoff should be intercepted at the ends of the embankment and directed down the slope outside of the slide area.

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



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| <p><b>PERMIT TO PRACTICE</b><br/><b>THURBER ENGINEERING LTD.</b></p> <p>Signature <u></u></p> <p>Date <u>July 25/08</u></p> <p><b>PERMIT NUMBER: P 5186</b><br/>The Association of Professional Engineers,<br/>Geologists and Geophysicists of Alberta</p> |
|---|

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

Attachments

## STATEMENT OF GENERAL CONDITIONS

### 1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

## INTERPRETATION OF THE REPORT *(continued . . . .)*

- c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.
- d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

## **6. RISK LIMITATION**

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

## **7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS**

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

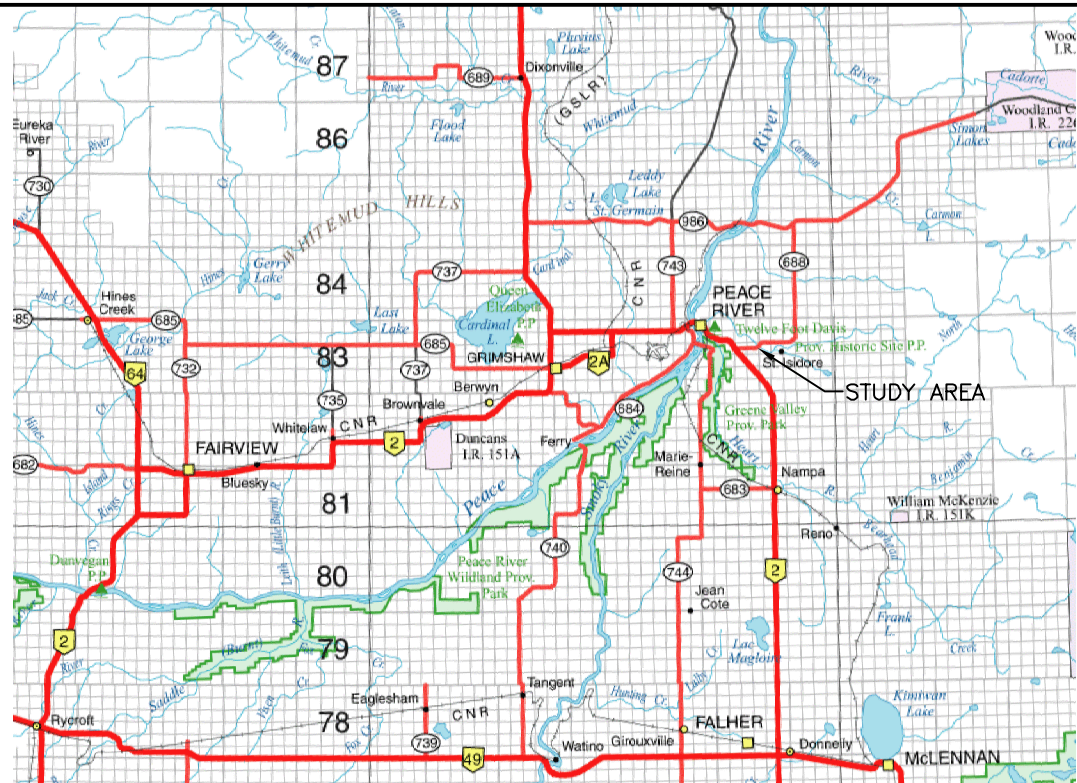
## **8. CONTROL OF WORK AND JOBSITE SAFETY**

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

## **9. INDEPENDENT JUDGEMENTS OF CLIENT**

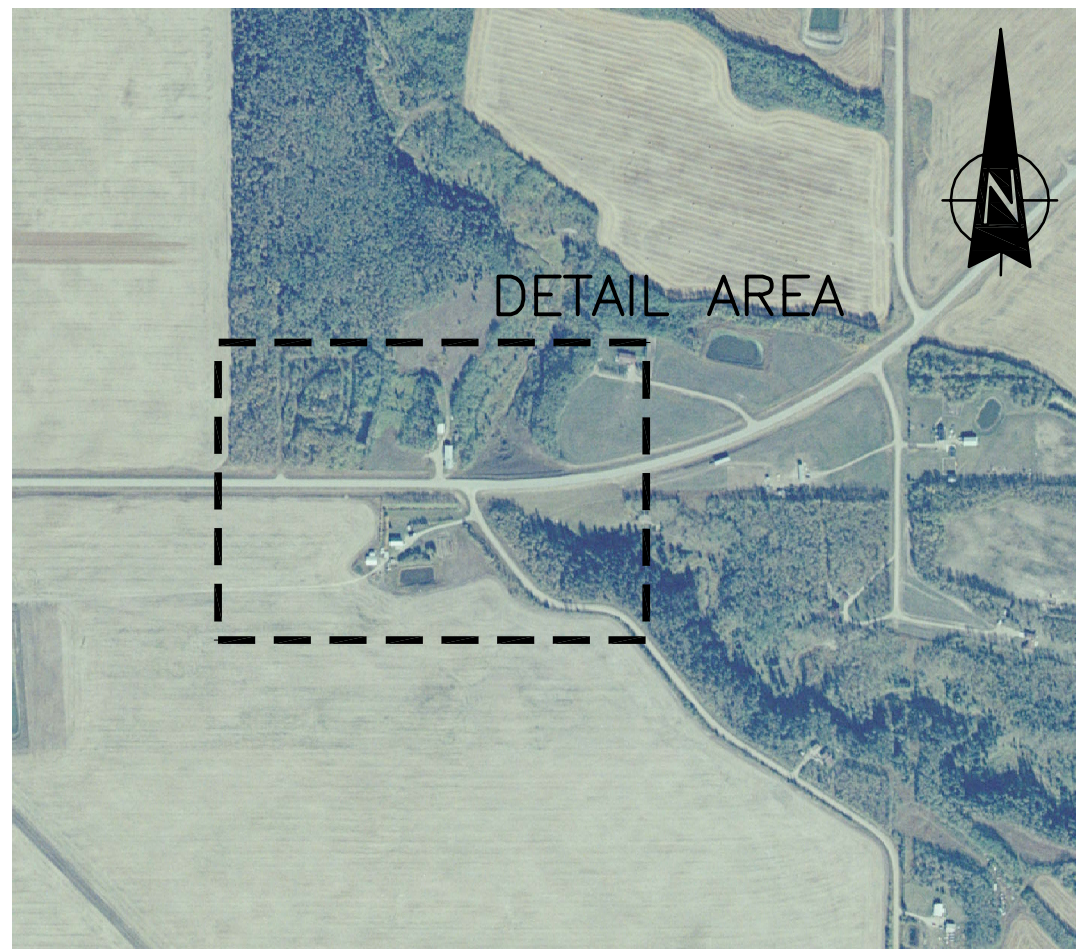
The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.





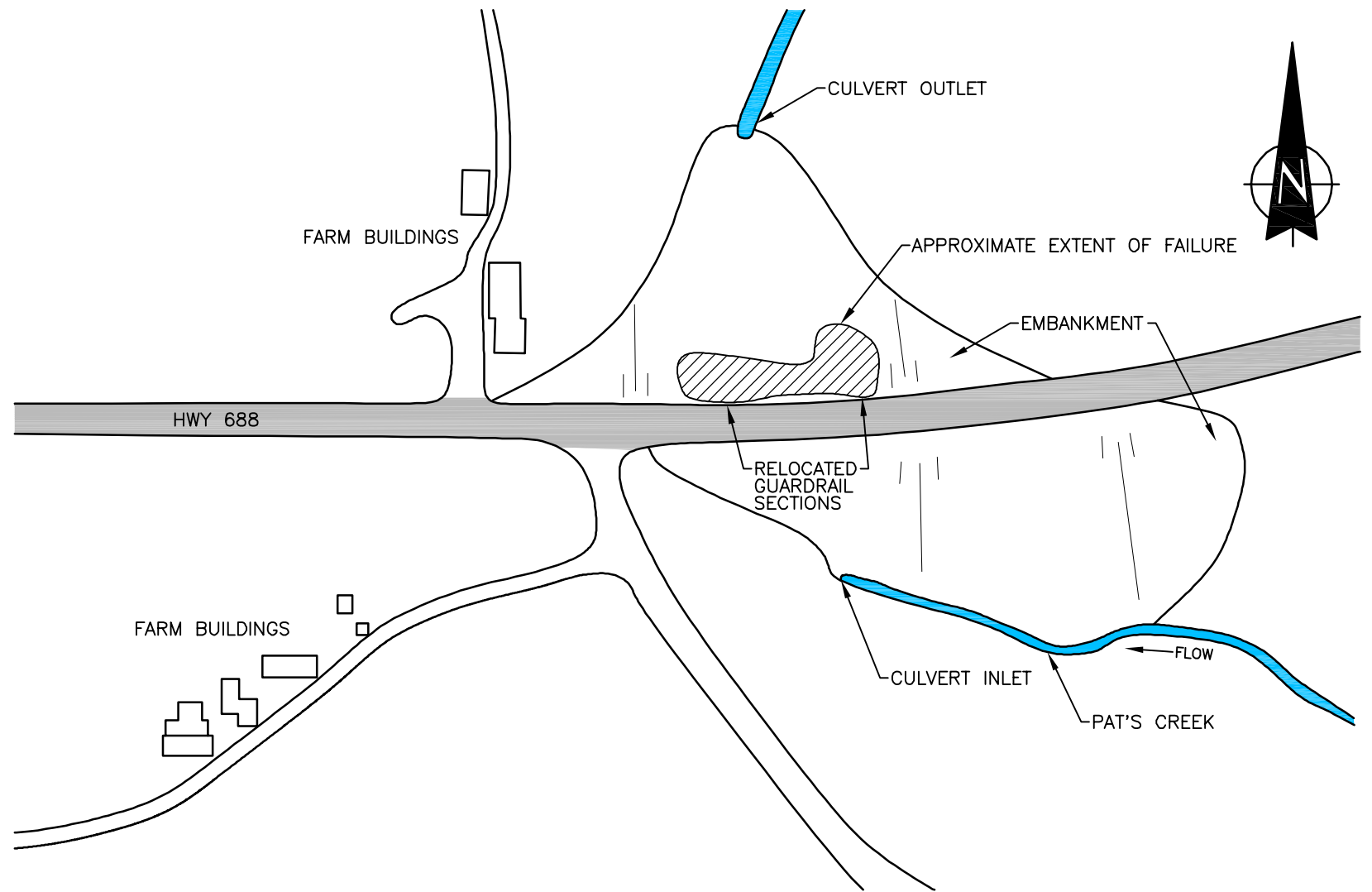
**KEY MAP**

SCALE 1:1 000 000



**LOCATION MAP**

SCALE 1:10 000



**DETAIL MAP**

SCALE 1:2 000 (APPROX.)

**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      | DESIGNED BY | RJS           | APPROVED BY | WCW            |
| SCALE    | AS SHOWN | DATE        | JULY 10, 2008 | FILE No.    | 15-16-213A-B1A |

**Alberta** Transportation  
 PEACE REGION (PEACE RIVER/HIGH LEVEL)

**PAT'S CREEK  
 HWY 688:02 (PH50)  
 SITE LOCATION PLAN**

**FIGURE PH50-1**







**Photo 50-01**

**May 2008**

View looking southwest at unstable fill slope below roadway.



**Photo 50-02**

**May 2007**

Similar view as Photo 50-01 above taken in 2007. Slide is relatively unchanged with the exception of access grading undertaken for recently installed instrumentation.





**Photo 50-03**

**May 2008**

View looking at east end of slide complex.



**Photo 50-04**

**May 2008**

View looking downslope eastern flank of slide complex shown in Photo 50-03





**Photo 50-05**

**May 2008**

Looking east  
along headscarp  
of western end of  
slide complex



**Photo 50-06**

**May 2007**

Similar view to  
Photo 50-05 taken  
in 2007.  
Headscarp  
relatively  
unchanged but  
guardrail moved  
upslope in 2008.





**Photo 50-07**

**May 2008**

View looking west along headscarp of eastern end of slide complex.



**Photo 50-08**

**May 2008**

Close-up of instrumentation cluster installed mid-slope in western portion of slide complex. Note the seepage and ponding water believed to reflect groundwater discharge.