ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2023 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
SH036-1	Northeast of High Prairie	Prairie Echo Community Hall Slide	679:06	8.18 – 8.24
Legal Description		**UTM Co-ordinates**		
SW26-76-16-W5M		11U E 539,209	N 6,162,497	

	Date	PF	CF	Total
Previous Inspection:	30-May-2022	8	4	32 (Call-out)
Current Inspection:	5-Jun-2023	11	4	44
Road AADT:	300		**Year:**	2023
Inspected By:	Kristen Tappenden, TEC Rodney Johnston, TEC Max Shannon, TEC		Ken Froese, Thurber Mark Gallego, Thurber	
Report Attachments:	☑ Photographs ☑ Plans		☐ Maintenance Items	

Primary Site Issue:	Arc-shaped cracking cutting across the EBL and partway into the WBL. Subsidence of WBL lane and shoulder.	
Dimensions:	Main slide: 60 m long affecting 8 m of highway Secondary backslope seepage: 6 m long affecting north shoulder	
Date of Remediation:		
Maintenance/Site History:	2019: Site overlay 2023: Patched in July	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	Cracks and slight dip in outer wheel path of EBL. Dip forming in north shoulder at secondary backslope seepage zone	☑
☑ Slope Movement	Arc-shaped cracking cutting across the EBL and partway into the WBL. Cracks were also observed at two locations at the fogline along the WBL.; possible toe rolls and bulged fence line observed downslope of the highway at the base of the slope	☑
☐ Erosion		☐
☑ Seepage	Two culvert-style wells on the southside of the highway had water levels at the ground surface.	☑
☐ Bridge/Culvert Distress		☐
☐ Other		☐
Instrumentation:		
Slope Inclinometer TH23-1	The readings indicated a movement zone at a depth between 6.1 m and 8.6 m below ground surface with an average rate of 43 mm/year between January 10 and March 8, 2023.	
Vibrating Wire Piezometer TH23-1 TH23-2 TH23-3	Short term groundwater monitoring indicated that artesian groundwater conditions exist at this site, with the groundwater table at 3.7 m, 2.3 m and 2.3 m above the existing ground surface at TH23-1, TH23-2, and TH23-3, respectively.	

Assessment:

This site has not had historical landslide issues and the cracks in the pavement were first noticed in Spring 2022. The highway in this area was overlaid in 2019. The MCI requested a call-out during the annual Geohazard Risk Management Program (GRMP) tour in late May 2022. The highway embankment measures about 3.2 m in height on the south side with a sideslope inclination of 2.7H:1V.

During the 2022 call-out inspection, there was an arc-shaped, 31 m-long crack cutting across the east-bound lane (EBL) and partway into the west-bound lane (WBL) at the west side of the site. There was also a hairline crack extending 5 m further west. Possible toe rolls were observed downslope of the highway to the north and the south of the fence. There was a dugout or pond located downhill about 130 m southwest of the site where the water level was less than 1 m below ground surface. There were two old culvert-style wells observed on the south side of the highway as shown on the Drawing. The first was near the east end of the crack and had a water level 0.47 m below ground surface which appeared to be controlled by a drain pipe whose outlet was located about 7 m southwest of the well. The second was about 70 m east, slightly higher in elevation, and the water level was at ground surface and was visible around the outside of the well. There was also a spring located in the backslope cut on the north side of the highway in this same area. These two older wells could indicate that past remediation has been attempted at this site by use of dewatering.

The instability has occurred where the highway is transitioning from a shallow cut in the east to low fills in the west, so the embankment is relatively high in this transition area. Based on a line of groundwater seeps noted on satellite imagery and the presence of groundwater at or near surface adjacent to the highway, this transition area is also located along the line of these seeps (approximately northwest-southeast alignment). Thus, the instability is likely driven by a high groundwater table. This may have been further exacerbated by the recent overlay and recent increases in annual precipitation that have been observed anecdotally in this area which has triggered instability at several locations in the High Prairie and Swan Hills region. This instability may have commenced a few years ago as creep movement but has now had sufficient deformation to be visible on the highway surface especially with the recent overlay.

In early 2023, the site was drilled for a preliminary engineering assessment (see Thurber Project 35964). The test holes drilled through the highway south embankment slope (locations shown on the drawings) encountered about 0.5 m to 3.0 m of clay fill overlying firm to stiff, high plastic native clay that extended to depths 3.1 m to 9.1 m below ground surface. The clay was underlain by clay till that extended to depths 8.1 m to 10.3 m below ground surface. Bedrock was encountered beneath the clay till and extended to the bottom of the test holes.

During the 2023 geohazard inspection, the arc-shaped crack cutting across the east-bound lane (EBL) and partway into the west-bound lane (WBL) extended further west where hairline cracks were previously observed. The possible toe rolls observed downslope of the main crack north of the fence and south of the fence during the call-out inspection did not appear to have worsened. However, the dip on the highway appears to have worsened since the call-out inspection. The two old culvert-style wells on the south side of the highway had water present at the ground surface. A scarp has formed at the spring located in the backslope cut on the north side of the highway at the east end of the site. Cracks were also observed at two locations at the fogline along the WBL: one adjacent to the spring and backslope slumping at the east end of the site, and one north of the main arc-shaped crack at the west end of the site.

The presence of high plastic clay and high groundwater table are the main triggers to the observed landslide movement at this site. It is anticipated that now the landslide has been activated, that movement will continue until it is remediated. The current dip on the highway surface could create a rough driving condition and reduce the ride quality to motorists as the deformation of the embankment continues. Frequent maintenance may be required.

Recommendations:

Short-Term:

- Road maintenance should continue as necessary to maintain a safe roadway surface and may consist of milling, patching, and crack sealing of the ACP.

Medium/Long-Term:

The preliminary engineering report proposed three remedial measures:

- Install wick drains and 24 m wide (on skew) clay berm at the toe, and excavate 2 m deep into highway embankment and replace with 1 m washed rock
- Install wick drains and 65 m wide (on skew) clay berm
- Install wick drains, excavate 3 m deep into highway surface and replace with gravel and geogrid, and 40 m wide (on skew) clay berm

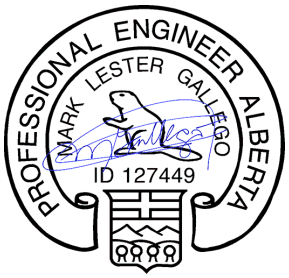
Inspection:

This site has been scheduled for Geohazard inspection every two years on the current contract. Due to the increasing rate of movement, we recommended increasing the frequency of inspections to annual.

Closure

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

Tarek Abdelaziz, Ph.D., P.Eng.
Partner | Senior Geotechnical Engineer



October 12, 2023

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE:
RM APEGA ID #: 91085
DATE: October 12, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Mark Gallego, M.Eng., P.Eng.
Geotechnical Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or 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 Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together 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. THURBER IS NOT 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 Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

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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 the Report is delivered subject to 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. If 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 Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not 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 Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order 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. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not 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.

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2023\MG\32121 SH036-1.dwg - 1n - Oct. 11, 2023

SW 26-076-16-W5M

NW 23-076-16-W5M

JANUARY 11, 2023 SURVEY BOUNDARY, CONTOURS OUTSIDE SURVEY BOUNDARY FROM 2008 LIDAR

HWY RIGHT OF WAY

OUTLET EL. 610.383m

CSP 600mm Ø

INLET EL. 610.744m

HWY 679

CRACK AT FOGLINE

MAIN CRACK ~31 m LONG

40mm WIDE

20mm WIDE, 20mm DEEP

50mm WIDE

HAIRLINE CRACK ~5m LONG

25mm WIDE

(SI,VW) TH23-1

TH23-2 (VW)

TH23-3 (VW)

DIP IN ROAD

SPRING IN BACKSLOPE

CATTAILS

0.8m HIGH SCARP

WATER IN RUTS

CRACK 20-30mm WIDE IN FOGLINE, DIP TOWARD DITCH

SLIGHT DEPRESSION FORMING

WELL

WATER ABOVE GROUND

OUTLET

WELL

TOE ROLL LOCATION FROM MAY 30, 2022 CALLOUT

POSSIBLE BULGED FENCELINE

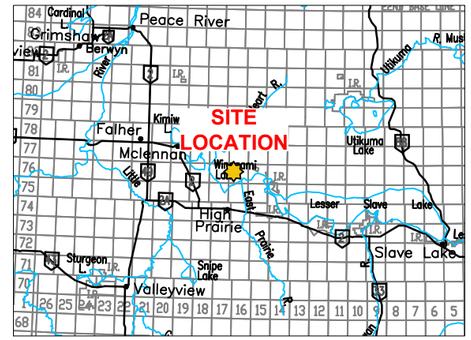
POSSIBLE TOE ROLLS

HWY RIGHT OF WAY

N

W E

S



KEY MAP

SCALE 1:3 000 000

0 10 20 30 40 50 60m

SCALE 1:1000

GROUND SURFACE CONTOURS ARE FROM MCINTOSH PERRY SURVEYED JANUARY 11, 2023
CONTOURS OUTSIDE SURVEY BOUNDARY FROM 2008 LIDAR

LEGEND

- CRACK (APPROXIMATE)
- APPROXIMATE TEST HOLE LOCATION
- (SI) SLOPE INCLINOMETER
- (VW) VIBRATING WIRE PIEZOMETER
- T TELUS LINE
- x FENCE LINE
- P OVERHEAD POWER LINE
- GL GAS LINE
- GROUND SURFACE CONTOUR (CONTOUR INTERVAL = 1m)
- TREE LINE
- POWER POLE
- 1 DIRECTION AND NUMBER OF PHOTO

NOTES:
1. THIS PLAN ONLY SHOWS THE SURVEYED LIMITS OF THE SECTIONS OF UNDERGROUND UTILITIES THAT WERE FLAGGED IN THE FIELD AS PART OF A ONECALL BOOKING. THE UTILITIES EXTEND BEYOND THE SURVEYED LIMITS.
2. JUNE 2023 OBSERVATIONS SHOWN IN RED.

Alberta

PEACE REGION (PEACE RIVER DISTRICT)

PRAIRIE ECHO: HWY 679:06 km 8.18 TO km 8.24
2023 INSPECTION PLAN

DWG NO. 32121-SH036-1

DRAWN BY	ML
DESIGNED BY	MG
APPROVED BY	TSA
SCALE	1:1000
DATE	OCTOBER 2023
FILE No.	32121

THURBER ENGINEERING LTD.

Photo 1 – Looking east along the EBL of the highway where there is a slight dip in the road.

Photo 2 – Looking east at the west end of the arc-shaped crack. A crack is also forming on the shoulder of the WBL.

Photo 3: Looking west at cracks propagating west of the main scarp crack where previous hairline cracks were observed.

Photo 4: Looking west at the main scarp crack where it crosses the EBL.

Photo 5: Looking west across the site at the general topography sloping down toward the southwest.

Photo 6: Looking northeast at a spring slumping observed in backslope to the east of the site. Cattails and ponded water are present in the ditch and cracking is developing on the shoulder.