ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION–GRANDE PRAIRIE DISTRICT - NORTH
2021 INSPECTION REPORT

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP014	Hwy 733:04	Bad Heart River South	733:04	8.938
Legal Description		**UTM Co-ordinates (NAD 83)**		
LSD-9-28-75-3 W6M		11U E 412076	N 6154417	

	Date	PF	CF	Total
Previous Inspection:	13-Jun-2017	9	4	36
Current Inspection:	12-Jul-2021	7	6	42
Road AADT:	610		Year:	2020
Inspected by:	Ed Szmata, AT Roger Skirrow, AT Rocky Wang, AT Max Shannon, AT		Don Proudfoot, Thurber Nicole Wilder, Thurber	
Report Attachments:	☑ Photographs ☑ Plans		☐ Maintenance Items	

Primary Site Issue:	The roadway is located within an active landslide area on the Bad Heart River Valley south slope. The ongoing slope movements caused distress and cracking of pavement structure, requiring regular maintenance at a frequency of one to two years. The movement rate of the landslide appears to be slow based on site inspections during past years.	
Dimensions:	The slide impact area is about 320 m long along the roadway alignment where cracks were observed on the pavement at the time of site inspection. Previous slope inclinometer (SI98-6 and SI-11) readings indicated that the slip surface was located at depths varying from 12 m to 17 m below the ground surface (approximate elevations from 618 m to 628 m). The extent and actual depths of the sliding zone perpendicular to the roadway alignment could not be defined from the existing information and require additional geotechnical instrumentation and monitoring to confirm.	
Maintenance:	Crack sealing, pavement patching, and milling was carried out in 2016.	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	Crack opening up to 80 mm was observed during the 2021 site inspection as well as increased rutting and settlement in certain areas. One of the cracks on the west has become braided. A new crack was observed near the east portion of the site that had a 20 mm drop.	☑
☐ Slope Movement	No obvious slope movement was observed	☐
☐ Erosion	A large erosion gully had previously formed along the north side of the highway in the ditch south of this site. This area had been repaired in august 2020 and remains in good condition in 2021.	☐
☑ Seepage	No seepage or ponded water was observed in 2021.	☐

☑ Bridge/Culvert Distress	The previous centerline culvert that was partially blocked was not observed in 2021; however, a new 1200 mm diameter SWSP culvert was installed at the east end of the site in June 2020.	☑
☐ Other		☐

Instrumentation:

One slope inclinometer (SI98-7) and three pneumatic piezometers (PN-11A, PN-11B, and PN-11C) have been monitored to date.

SI98-7	This SI was accessible and located at toe of the embankment slope. The recent readings of this SI did not show any discernible movements.
PN-11A PN-11B PN-11C	The readings from PN-11B and PN-11C pneumatic piezometers indicated a decrease in the groundwater level of 0.03 m to 0.23 m respectively since the spring of 2020 instrument readings. PN-11A showed no increase in water level since the last readings in spring 2020.

Assessment:

No discernable slope movements were observed at this site during this inspection. Ongoing embankment creep was observed and appeared to account for the observed distress and cracking of the roadway pavement structure. Further details of the background information about this site can be obtained from the previous reports in the site Geohazard Binder and are not repeated herein.

In order to keep the roadway surface in a suitable driving condition, AT has been sealing cracks and patching the pavement at a frequency of one to two years.

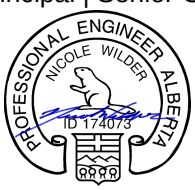
Recommendations:

	Ballpark Cost
In the short term, it is recommended that the cracks in the pavement be sealed or overlain with an asphalt patch as required. All observed drops along the landslide backscarp should also be milled and the area should be regularly monitored for signs of active slope movements.	Maintenance ($60,000 every 2 years)
A geotechnical investigation is required to assess the mechanisms of the persistent embankment failure observed at this site and to design long term mitigation measures. The locations of the proposed new instruments are presented herein on the 2021 Geohazard Inspection Figure Drawing 32123-GP014-1.	$30,000

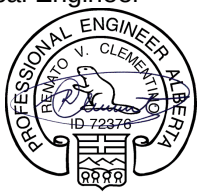
CLOSURE

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.

Renato Clementino, Ph.D., P.Eng.
Principal | Senior Geotechnical Engineer



October 13, 2021



October 14, 2021

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE:
RM APEGA ID #: 72376
DATE: October 14, 2021
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Nicole Wilder, 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

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 THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's 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 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.

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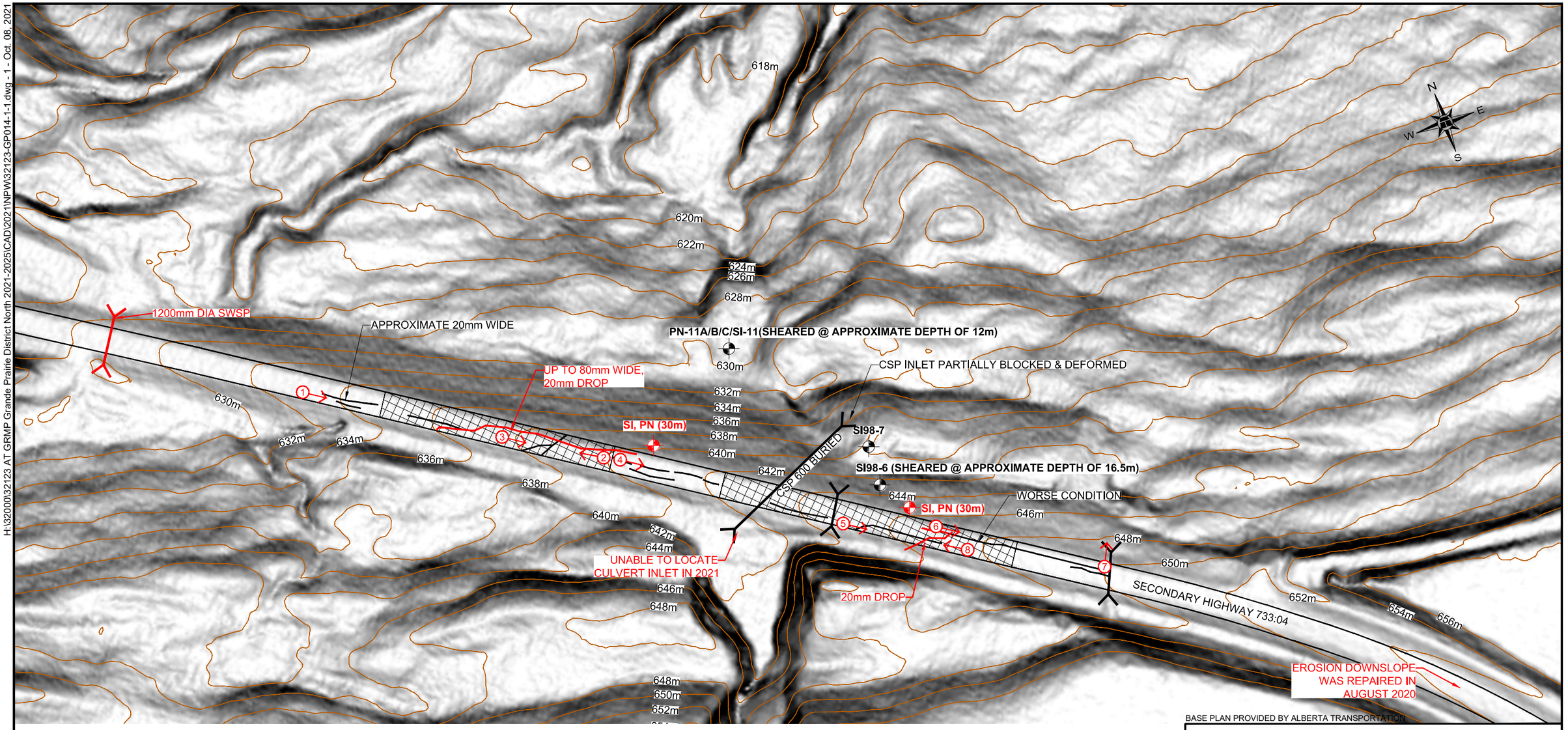

BASE PLAN PROVIDED BY ALBERTA TRANSPORTATION

LEGEND

- PROPOSED INSTRUMENT LOCATION
- APPROXIMATE LOCATION OF EXISTING INSTRUMENT
- SI SLOPE INCLINOMETER
- PN PNEUMATIC PIEZOMETER
- GROUND SURFACE CONTOUR (2m INTERVAL)
- CRACK (APPROXIMATE)
- PATCHED AREA
- (1) DIRECTION AND NUMBER OF PHOTO

NOTES:

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK.
2. GROUND SURFACE CONTOUR GENERATED FROM LIDAR DATA.
3. NEW 1200mm SWSP CULVERT INSTALLED IN JUNE 2021
4. JULY 12, 2021 OBSERVATIONS SHOWN IN RED

0 20 40 60 80 m
SCALE 1:1500

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
GP014-1: HWY 733:04 BAD HEART RIVER SOUTH

2021 INSPECTION FIGURES

DWG No. 32123-GP014-1-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:1500
DATE	OCTOBER 2021
FILE No.	32123

THURBER ENGINEERING LTD.

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	**Photo 1.** Looking southeast along Hwy 733.
	**Photo 2.** Cracks reflecting through patch in pavement.

	**Photo 3.** Crack near middle of northmost asphalt patch.
	**Photo 4.** Cracks on asphalt in between the two patches.

	**Photo 5.** Crack near middle which may be a scarp crack from arch shape.
	**Photo 6.** Cracks on southern asphalt patch in northbound lane.

	**Photo 7.** New 1200 mm SWSP culvert outlet installed in June 2021.
	**Photo 8.** Looking northwest at cracks in pavement on south portion of the site.