ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT - NORTH
2025 INSPECTION

Site Number	Location	Name	Hwy	km
PH077-1 and 77-2	West of Fairview	Sites E of Hines Creek Bridge	682:02	12.5-12.8
Legal Description		**UTM Co-ordinates (NAD 83)**		
NE35-81-5-W6		11V N 6215000 E 396650		

	Date	PF	CF	Total
Previous Inspection:	May 7, 2024	12 9	4 4	48 (PH077-1) 36 (PH077-2)
Current Inspection:	May 6, 2025	12 9	4 4	48 (PH077-1) 36 (PH077-2)
Road AADT:	340		**Year:**	2024
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Robert Senior, Chris Newman, Ken Szmata, (TEC)			
Report Prepared By:	Nicole Wilder, Don Proudfoot (Review)			
Report Attachments:	☒ Photographs ☒ Plans ☒ Maintenance Items			

Primary Site Issue:	PH077-1: Creek bank slumping caused by creek erosion continues to retrogress and has caused cracks to appear in the highway about 150 m east of the bridge. A shallow slide in the south embankment slope also exists at the east end. A newer 35 m wide slump has formed in the south embankment slope and below it a large area has slumped into the creek. PH077-2: Settlement and cracking in the highway and an active landslide through the south embankment are causing distress to the BF75380 culvert and pavement. Channel and ditch erosion on the north embankment have created a slide around the culvert inlet which has remained in similar condition since 2021. Additional creek bank slumping was observed.
Dimensions:	PH077-1: Slide dimensions ~110 m wide along the riverbank parallel to the highway x ~30m long. Newer slump is ~ 35 m wide and ~20 m long. PH077-2: South embankment slide ~40 m wide x 75 m long extending to river which appeared somewhat grown over. North embankment slope slide ~40 m wide x ~40 m also appeared somewhat grown over. A newer 10 m long erosion gully formed upslope of the northeast v-shaped ditch but seems to have filled in somewhat in 2025.
Date of any remediation:	PH077-2 was repaired in the fall of 2014 with a new 1.8m dia. SWSP (WSP = Consultant, In-Line = Contractor). Landslide movements occurring since construction have required strutting and patching/sealing of the culvert. In 2021, rip rap was added on one of the north v-shaped ditches, and to the upper portion of the south v-shaped ditch, where erosion was noted previously at PH077-2. It appeared that the trash rack had been cleaned out of debris in 2022.
Maintenance:	Crack sealing, ongoing repairs to the culvert pipe at PH077-2. A thin highway overlay was placed through both sites in 2023.

Observations:	Description	Worsened?	
		Yes	No
☒ Pavement Distress	At PH077-1, a 40 m long crack and a 15m long crack (near the east end) had existed in the highway and are starting to show through the 2023 overlay. A noticeable dip exists across a 45 m length of the highway. At PH077-2, hairline cracks are starting to show through the 2023 overlay and a noticeable dip exists across a 40 m length of the highway overtop the SWSP culvert, with another dip existing further east.	☒	☐
☒ Slope Movement	At PH077-1: Towards the east a shallow 35 m wide south embankment slide developed and the backscarp is 6.2 m away from the guardrail with a 0.7 m high backscarp. Just east of this slide, there is an overgrown 15 m wide shallow side slope slide with a 0.4 m high scarp, 0.6 m high toe push that is 2.75 m away from the guardrail. The Creek has eroded the toe of the south embankment, and continued creek bank slumping is evident, with a 20 m wide area that slumped into the creek south of the 35 m wide slide, this appeared fairly similar in 2025. At PH077-2: A landslide has developed through the south embankment and has deformed the culvert. There is a 0.4 m high scarp located 4.9 m from the white shoulder line which appeared overgrown in 2025. North of the highway, a 1.5 m wide graben crack with a 0.25 m drop has developed above the erosion near the culvert inlet, and which has developed into a slide that previously retrogressed back towards the highway; this was unchanged in 2025. The riverbank is also locally slumping upstream and downstream of the culvert outlet	☒	☐
☒ Erosion	At PH077-1, active erosion caused by the creek is occurring at the toe of the slope along the creek's edge. At PH077-2, some of the riprap at the base of the south east riprap lined ditch was washed away by the creek.	☒	☐
☒ Seepage	At PH077-1 the soil within the tension crack within the 35 m wide slide was moist to wet.	☒	☐
☐ Bridge/Culvert Distress	The upstream end of the 1.8 m diameter SWSP (BF75380) at PH077-2 was about 0.5 m buried with silt and debris at the drift catcher and the outlet did not appear to be visibly damaged at the time of our inspection but was somewhat buried in silt although the baffles were visible and had some ice inside. The 2025 bridge inspection noted that the vertical elbow was detaching from the pipe at 93 m from inlet and that below this there was no access due to silt. Baffles were tearing and there were distortions and cracks/separations within the culvert, which had a low rating advisory due to roof sag and sidewall deflections. The report also noted that drift and silt should be removed from pipe and drift catcher.	☒	☐
☐ Other		☐	☐

Instrumentation:

Last Read on June 14, 2025
Slope Inclinometers:
TH24-02: showed rates of movement of 1.0 mm/yr over 0.4 to 2.2 m depth, and 5.9 mm/yr over 8.3 m to 10.8 m depth, respectively. Both rates of movement are the highest recorded in the instrument since initialization.
TH24-04: showed a rate of movement of 2.2 mm/yr over 0 m to 1.1 m depth, corresponding to a decrease in the rate of movement of 33.2 mm/yr since the February 24, 2025 reading
TH24-06: showed no discernible movement over 0.1 m to 1.9 m depth since the February 24, 2025 reading.
TH24-09: showed a potential zone of creep movement over 0 m to 7.1 m depth. Over 21.1 m to 23 m depth, TH24-09 showed a potential movement zone with a rate of 1.6 mm/yr,; however, this deflection looks like it might be due to compression of the SI casing due to settlement of the surrounding fill rather than an actual horizontal movement. Further monitoring will be required to confirm these potential movement zones..
TH24-10: shows no well defined movement zones since it was initialized in July, 2024.
TH24-11: Was previously thought to be sheared off using a dummy probe; however, it now showed a rate of movement of 1.6 mm/yr over 1.2 m to 6.7 m depth.

Piezometers:
Since the previous readings on February 24, 2025, the groundwater level in vibrating wire piezometer TH24-01 decreased by 0.08 m. Vibrating wire piezometers TH24-02 to TH24-12 showed increases in groundwater levels compared to February 24, 2025 ranging from 0.03 m in TH24-02 to 8.76 m in TH24-12. Vibrating wire piezometers TH24- 03 to TH24-06, TH24-08, TH24-11, and TH24-12 registered the highest groundwater levels recorded since initialization.
It should be confirmed whether the large increase in TH24-12 is an actual trend, or a reading error during the spring of 2025 readings. This piezometer is in a test hole that was drilled east of PH077-2 for a possible highway realignment option.

Background/Assessment (Refer to Drawings 32123-PH077, -1-1, -2-1)**:**

At PH077-1, the slide roughly paralleling the creek and highway is a direct result of erosion by Hines Creek and resulting soil loss along the toe of the embankment. The slope will tend to flatten with time due to loss of cohesion in the clay fill embankment material. Therefore, the slide could also gradually enlarge into the driving lanes of the highway surface, and there are already indications of this presumably starting to occur based on the cracks and dips in the highway. The smaller 15 m wide and larger 35 m wide slide near the east end of this site may have also been triggered by east ditch runoff erosion, and/or having a slope that is too steep for the composition material of the embankment. Ditch or surface erosion of the slope could also contribute to more rapid slope movements.

At PH077-2, the existing bridge file management system records indicate that BF75380 at PH077-2 consists of a 1.8 m diameter SWSP having an in-service date of 2014.

PH077-2 was repaired in 2012 with a new culvert pipe installed in 2014, and there was some mention of a slide at the site at that time. The soil conditions identified from 2 test holes drilled through the highway as part of the 2012 design indicated a predominant clay fill embankment, overlying a stratified predominant clay deposit, overlying glacial clay till near creek level. The submitted As-Built drawings indicated that the new pipe was a 157 m long x 1.8 m dia. SWSP spanning beneath the highway, containing horizontal and vertical elbows, and which also contained a 1.2 m diameter vertical access manhole located 34 m downslope of the highway centerline. A drawing note described the installation methodology as “Installed SWSP by augering and jacking through the existing road fill, backfill of culvert ends and other typical details in accordance with Std Drawing S-1418-03”. Another drawing note indicated “Organic, and soft/yielding materials removed from existing slope failures prior to backfilling.”

The 2025 Bridge Inspection Report indicated that; the vertical elbow is detaching from the pipe, several gaps and sagging exist, there is exposed fill at the circumferential seam ~93 m from the upstream end, holes in the side walls due to baffles tearing off ~18 m and 16 m from the downstream end and a 23 mm crack 67 m from upstream end that was partially repaired. Steel struts have been installed within the culvert to deal with barrel distortions. This culvert has been given a low rating advisory by MPA Engineering Ltd. on June 2, 2025. Indicating the low rating was due to the roof sag (26%), sidewall

deflection (23%) and gap/crack at the circumferential seam at the vertical elbow (93 m from upstream end) with exposed fill and 0.3 m deep void.

The cracks and subsidence in the south embankment slope are evidence that a landslide has formed in the slope at this location. This is supported by 2015 reports from TEC that the culvert barrel had become distorted and separated, which indicate that the landslide is deep seated. The slide backscarps appeared somewhat grown over in 2025 and only small movements have been indicated in the Sis installed in 20204, hence movements appear to have slowed.

Similarly, cracks in the north embankment slope which previously retrogressed to near the highway also suggest a landslide has developed. This is also supported by a documented crack in the culvert. This landslide was likely triggered by loss of toe support due to erosion caused by the tributary creek. Highway ditch runoff erosion (at the TRM/gabion intersections) may have also been contributing factors.

Settlement observed overtop of the culvert at Site 2, in the form of dips and cracks in the highway could be the result of embankment fill settlement but might also be an indication that the slide movement will eventually retrogress towards the highway or has already.

Recommendations:

In the short term, regular monitoring of these sites should be undertaken for enlargement. If any of the slides encroach into the shoulders of the highway, barricades should be erected and enhanced with warning signage until highway repairs are undertaken. A temporary detour upslope (to the north of the highway) may also be required depending on the extent of the highway affected.

In the short term at PH077-2 breaks in the joints of the culvert should be sealed by installing a thin sleeve at each joint that is welded on the upstream side and shingled in the downstream direction over the gaps, or by sealing the gaps with ethafoam on an annual basis until more permanent repairs can be completed.

PH077-1 and PH077-2:

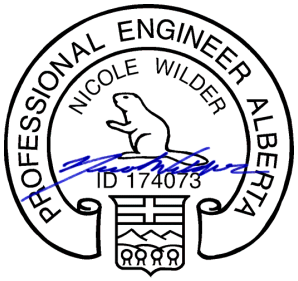
Long Term: Thurber submitted the preliminary engineering report on September 29, 2025 after discussions with the geotechnical and bridge groups which considered several repair options for both sites and combined certain options. From these discussions it is understood that construction would be scheduled for 2026 or 2027 depending on when the bridge group has funding for the repair of their culvert at Site 2. It is further understood that Option 1 using a toe berm and bank armouring at Site 1 combined with Option 3, which involves excavating and replacing the fill around the BF culvert between the creek and TH24-09 with better quality fill reinforced with geogrid, after installing subdrains and sand drains to reduce groundwater levels, and extending the culvert and flatting the slope at Site 1, would be the preferred option. Environmental approvals (DFO, AEP) will be needed for working within the Hines Creek and the tributary creek.

Ballpark Cost $5 Million

CLOSURE

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

Don Proudfoot, M.Eng., P.Eng.
Partner | Senior Geotechnical Engineer



2025-10-06

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 6, 2025
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Nicole Wilder, M.Eng., P.Eng.
Associate | Geotechnical Engineer

THURBER

STATEMENT FOR USE AND INTERPRETATION OF REPORT

1. STANDARD OF CARE

This Report has been prepared in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality and in compliance with all applicable laws.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment, including this Statement For Use and Interpretation of Report, 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, AS DESCRIBED ABOVE. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TOTHE WHOLE OF THE 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 for the development, design objectives, and/or purposes described to Thurber by the Client. **NO OTHER PARTY MAY USE OR RELY ON THE REPORT OR ANY PORTION THEREOF FOR OTHER THAN THE CLIENT'S BENEFIT IN CONNECTION WITH THE PURPOSES DESCRIBED IN THE REPORT**. Any use which a third party makes of the Report is the sole responsibility of such third party and is always subject to this Statement for Use and Interpretation of Report. Thurber accepts no liability or responsibility for damages suffered by any third party resulting from use of the Report for purposes outside the reasonable contemplation of Thurber at the time it was prepared or in any manner unintended by Thurber.

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 is inherently judgement-based. 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 parties making use of such documents or records with or without our express written consent need to 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 parties. Some conditions are subject to change over time and those making use of the Report need to be aware of this possibility and understand that the Report only presents the interpreted conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client must 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 based on conditions in evidence at the time of site inspections and based on 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 resulting from misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other parties 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 is recommended to 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 need to 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 to confirm and document that the site conditions do not materially differ from those 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. 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 other parties 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, unless such decisions expressly form part of the stated purpose of the Report as described in Paragraph 3.

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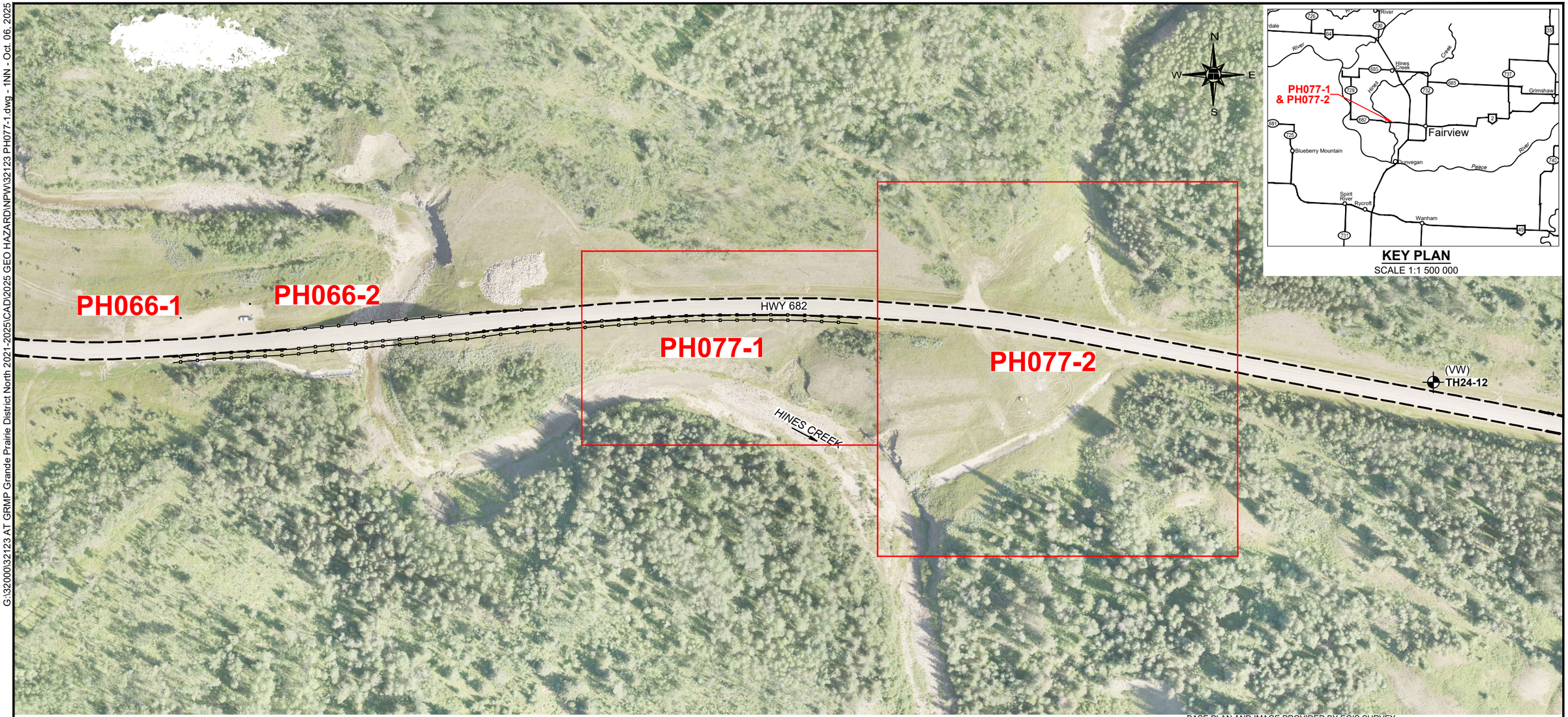


KEY PLAN
SCALE 1:1 500 000

LEGEND

2024 TEST HOLE LOCATION

(VW) VIBRATING WIRE PIEZOMETER

0 20 40 60 80 100 120m
SCALE 1:2000

BASE PLAN AND IMAGE PROVIDED BY EGIS SURVEY

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH077-1 & PH077-2 EAST SIDE OF HINES CREEK BRIDGE
HWY 682:02, km 12.6~12.7

SITE LOCATION PLAN

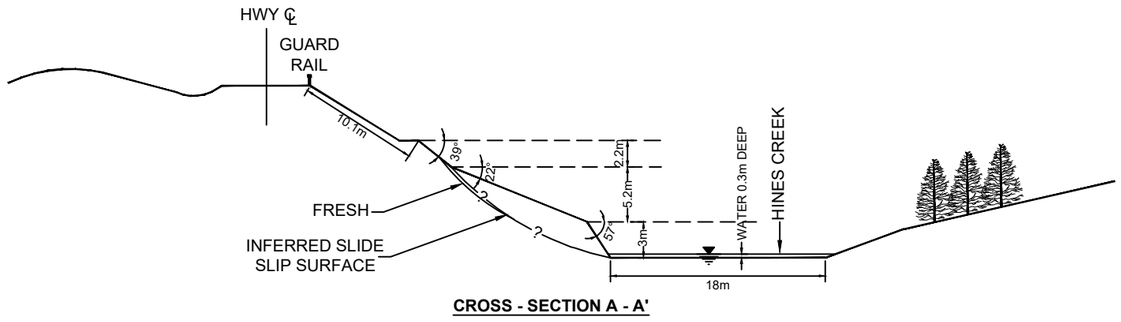
DWG No. 32123-PH077

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:2000
DATE	OCTOBER 2025
FILE No.	32123

THURBER

G:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2025 GEO HAZARD\NPW\32123 PH077-1.dwg - 2NN - Oct. 06, 2025

(VW) TH24-01
CULVERT
(VW) TH24-03
DIP IN HIGHWAY
(VW) TH24-05
HAIRLINE CRACK STARTING TO SHOW THROUGH OVERLAY AND DIP IS VISIBLE
CRACKS
CRACK STARTING TO SHOW THROUGH OVERLAY SAME IN 2025
CRACK
HWY 682
(SI,VW) TH24-02
TH24-04 (SI,VW)
(SI,VW) TH24-06
BACKSCARP IS 6.2m AWAY FROM GUARDRAIL
SLIDE OUTLINE (GRASSED OVER)
0.4m HIGH SLIDE SCARP 2.75m FROM GUARD RAIL
0.7m HIGH BACKSCARP
GRASS COVERED
TENSION CRACKS
SAME
0.6m HIGH TOE PUSH
KNOB
FRESH, ACTIVE TOE EROSION & RELATED TOE SLUMPING INTO CREEK
HINES CREEK
SLIDE BLOCK IN FLANK OF BIGGER SLIDE
475
480
485
490
495
75m



CROSS - SECTION A - A'

N
W E
S

LEGEND

- TREE LINE
- 2024 TEST HOLE LOCATION
- (SI) SLOPE INCLINOMETER
- (VW) VIBRATING WIRE PIEZOMETER
- 2011 TEST HOLE LOCATION
- SCARP CRACK (APPROXIMATE)
- EDGE OF HIGHWAY PAVEMENT
- POWER POLE
- OVERHEAD POWER LINE
- PED TELUS PEDESTAL
- UNDERGROUND TELUS LINE
- GUARDRAIL
- CULVERT
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. MAY 6, 2025 FEATURES SHOWN IN RED
4. RED SCARP OUTLINE IS FROM AUGUST 1, 2024 SURVEY COMPLETED BY EGIS

0 5 10 15 20 25 30m
SCALE 1:500

BASE PLAN AND IMAGE PROVIDED BY EGIS SURVEY

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH077-1 & PH077-2 EAST SIDE OF HINES CREEK BRIDGE
HWY 682:02, km 12.6~12.7

2025 INSPECTION PLAN - SITE 1

DWG No. 32123-PH077-1-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:500
DATE	OCTOBER 2025
FILE No.	32123

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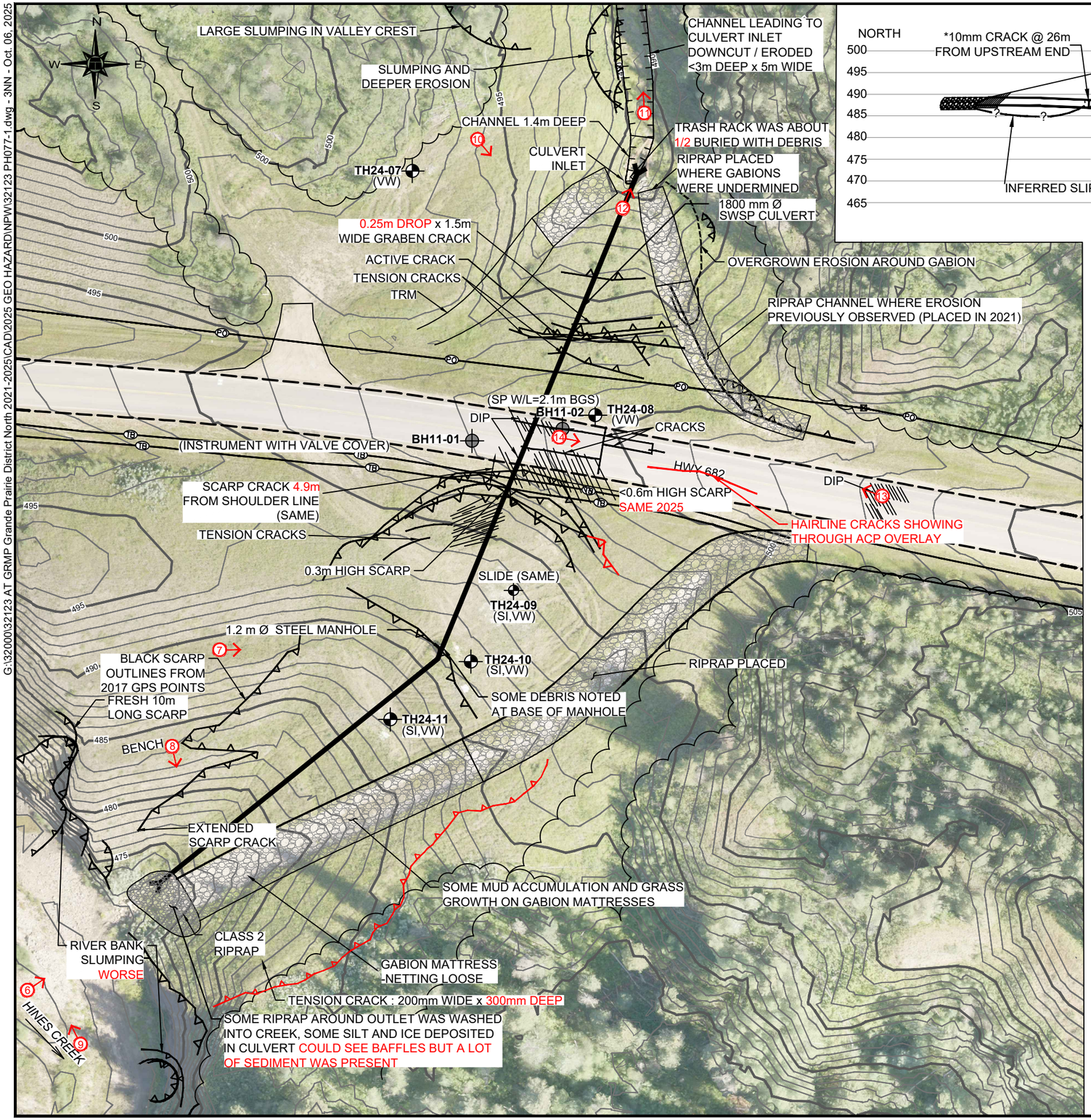

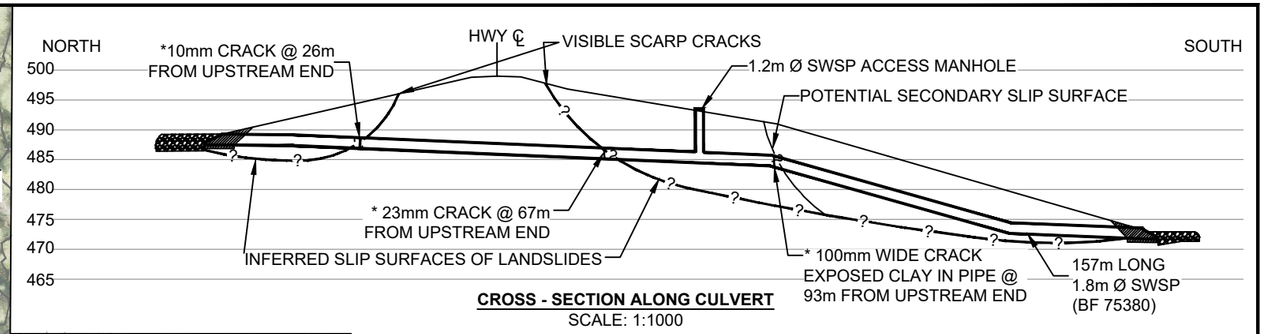

CROSS - SECTION ALONG CULVERT
SCALE: 1:1000

LEGEND

- TREE LINE
- 2024 TEST HOLE LOCATION
- (SI) SLOPE INCLINOMETER
- (VW) VIBRATING WIRE PIEZOMETER
- 2011 TEST HOLE LOCATION
- SCARP CRACK (APPROXIMATE)
- EDGE OF HIGHWAY PAVEMENT
- POWER POLE
- OVERHEAD POWER LINE
- PED TELUS PEDESTAL
- UNDERGROUND TELUS LINE
- GUARDRAIL
- CULVERT
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

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4. RED SCARP OUTLINE IS FROM AUGUST 1, 2024 SURVEY COMPLETED BY EGIS

0 10 20 30 40 50m
SCALE 1:750

BASE PLAN AND IMAGE PROVIDED BY EGIS SURVEY

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
PH077-1 & PH077-2 EAST SIDE OF HINES CREEK BRIDGE
HWY 682:02, km 12.6~12.7

2025 INSPECTION PLAN - SITE 2

DWG No. 32123-PH077-2-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:750
DATE	OCTOBER 2025
FILE No.	32123

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Photo 1. Looking east at Slide PH077-1 at the erosion along the north side of the Creek.

Photo 2. Looking east at the shallow slide in the south embankment slope at Site 1.

Photo 3. Looking west at the fresh toe slumping above the creek at PH077-1 in the south highway embankment.

Photo 4. Looking west along the highway at where the cracks in the highway were (before overlay) above the Slide at PH077-1 The dip is still evident.

Photo 5. Looking west at newer slump that developed west of the knob hill.

Photo 6. Looking north at culvert outlet and river bank erosion and sloughing on either side.

Photo 7. Looking east at riprap swale into the gabion mattress channel of PH077-2.

Photo 8. Looking southeast at the southeast ditch drainage channel of PH077-2, Hines Creek.

Photo 9. Looking west at river erosion adjacent to the culvert outlet area of PH077-2.

Photo 10. Looking southeast at the v-shaped ditches on the north side of the highway.

Photo 11. Looking north at eroded tributary creek channel leading into the culvert inlet north of the highway at PH077-2.

Photo 12. Looking north at the culvert inlet area at PH077-2, the trash rack appeared half full of debris.

Photo 13. Looking west at the dip in the highway.

Photo 14. Looking east at the dip in the highway.