

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT
PEACE REGION (PEACE RIVER DISTRICT)
2022 INSPECTION**



Site Number	Location	Name	Hwy	km
PH045-1	North of Manning, AB	Meikle River (Pile Wall)	35:08	26.2
Legal Description		UTM Co-ordinates		
SW7-94-22-W5M		11U E 467,581	N	6,333,081

	Date	PF	CF	Total
Previous Inspection:	21-June-2017	7	4	28
Current Inspection:	3-June-2022	11	4	44
Road AADT:	1330		Year:	2022
Inspected By:	Rishi Adhikari, TRANS Ed Szmata, TRANS Max Shannon, TRANS Erwin Kurz, TRANS		Ken Froese, Thurber Mark Gallego, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs	<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items	

Primary Site Issue:	Slope movement and erosion affecting highway and sideslope		
Dimensions:	115 m pile wall		
Date of Remediation:	2016: Install H-pile and lagging formwork to backfill behind and below existing cap beam with fillcrete; highway overlaid; new HTSC guardrail installed 2018: HTSC replaced by W-Beam guardrail		
Maintenance:	2011: Pitrun placed to repair erosion at drain and repair elephant trunk Frequent patching of voids behind cap beam		
Observations:	Description	Worsened?	
<input checked="" type="checkbox"/> Pavement Distress	Pile wall starting to pull away again – crack opening up against water	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Slope Movement	North slide graben starting to move (2022) and taking lagging wall with it.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Erosion	Erosion beneath wall and around drain pipes repaired;	<input type="checkbox"/>	
<input checked="" type="checkbox"/> Seepage	Pile wall voids repaired; subdrain pipe in lower portion of slope exposed and extended	<input type="checkbox"/>	
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>	
<input checked="" type="checkbox"/> Other	H-piles and timber lagging damaged by slope movement and pulling away from the water	<input checked="" type="checkbox"/>	
Instrumentation (as of Spring 2022):			
Inclinometers	Three slope inclinometers (SI-49, -50 and -51) within the cap beam remain operational. Cumulative pile head movements are currently 73 mm to 160 mm with rates of movement of 2.8 mm/year to 5.7 mm/year, which are similar to the previous few readings. Rate plots show steady movement at SI-49, accelerating trend at SI-50, and variable trend at SI-51 (but with overall steady trend) with no obvious long-term improvement from the 2016 repairs.		
Assessment:			
The site is subjected to ongoing creep movements of the slope had led to the formation of voids behind the pile wall and cap beam and subsequent loss of material from below the highway and cap			

beam. This was repaired in 2016 using steel H-piles and timber lagging to act as forms for placement of grout in the voids. During construction, it was observed that the tie-back anchors shown on the drawing consisted of 100 mm diameter screw piles installed at various depths and angles and are free-floating (not connected to the piles or cap beam). These anchors perhaps provide some minimal reinforcement of the slope but do not contribute to holding the wall in place. The excavation behind the cap beam to clean out the voids was between 1.5 m to 2 m in width and 527 m³ of grout was required to backfill the excavation. During excavation, there was a hard ledge of asphalt encountered about 1 m below the top of the cap beam from about 30 m to 57 m south of the north end of the cap beam that required an excavator-mounted jackhammer to break up. The pattern of highway surface repairs exposed during excavation indicates that that area was likely the lowest point of previous failures. At some point, a base sandwich was required to repair the highway surface. It should be noted that the cap beam had variable thickness being 2 m on the face (downslope) and 1 m on the back (upslope), with the vertical transition occurring near the face downslope of the capped concrete piles.

The repairs undertaken to the wall were to protect against future void formation rather than to provide additional support against movement. It was anticipated that the wall would continue to deflect due to the creep movement of the slope. At the time of 2022 assessment, this creep movement has resumed resulting in the displacement of two sections of the timber lagging wall, formation of a void below the cap beam, and fresh displacement on the scarp and graben at the north end of the wall. The orthophoto developed from drone photography allowed the identification of several additional scarps forming below the wall. Unfortunately, the crack between the asphalt and the cap beam has started forming again. It appears that the landslide has begun active movement, i.e., more than creep, and there is the potential for significant displacement particularly at the north end of the site.

Recommendations:

Short-Term:

- Routine crack sealing between the asphalt and the cap beam to limit infiltration of runoff.

Long-Term:

- As this landslide has become active again, it is recommended that a geotechnical investigation and analysis of pile-soil interaction be undertaken in the near-future so that a tie-back system can be designed. It is anticipated that additional stabilization measures will be required at this site.

Ongoing Investigation:

- Due to the recent movement, it is suggested that the frequency of Geohazard inspection be increased to at least every second year. Bi-annual instrumentation readings should continue as scheduled.

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

Ken Froese, P.Eng.
Associate | Senior Geotechnical Engineer



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.

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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.

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- 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.

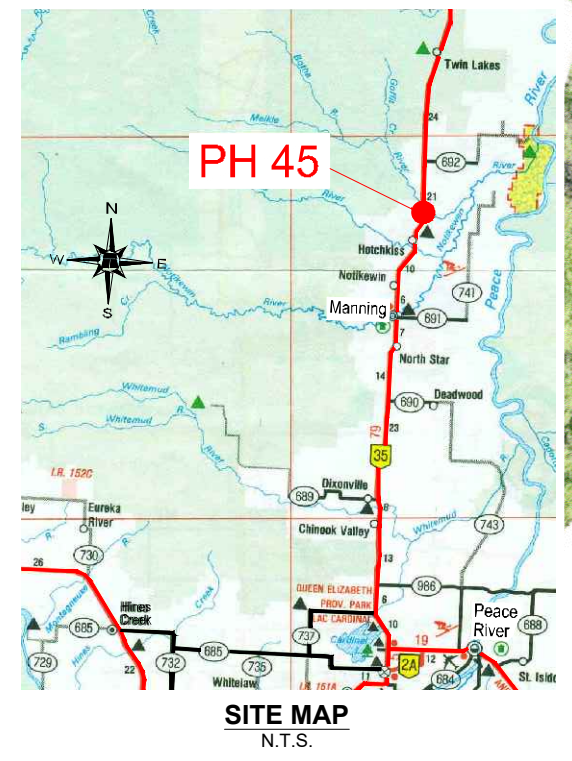
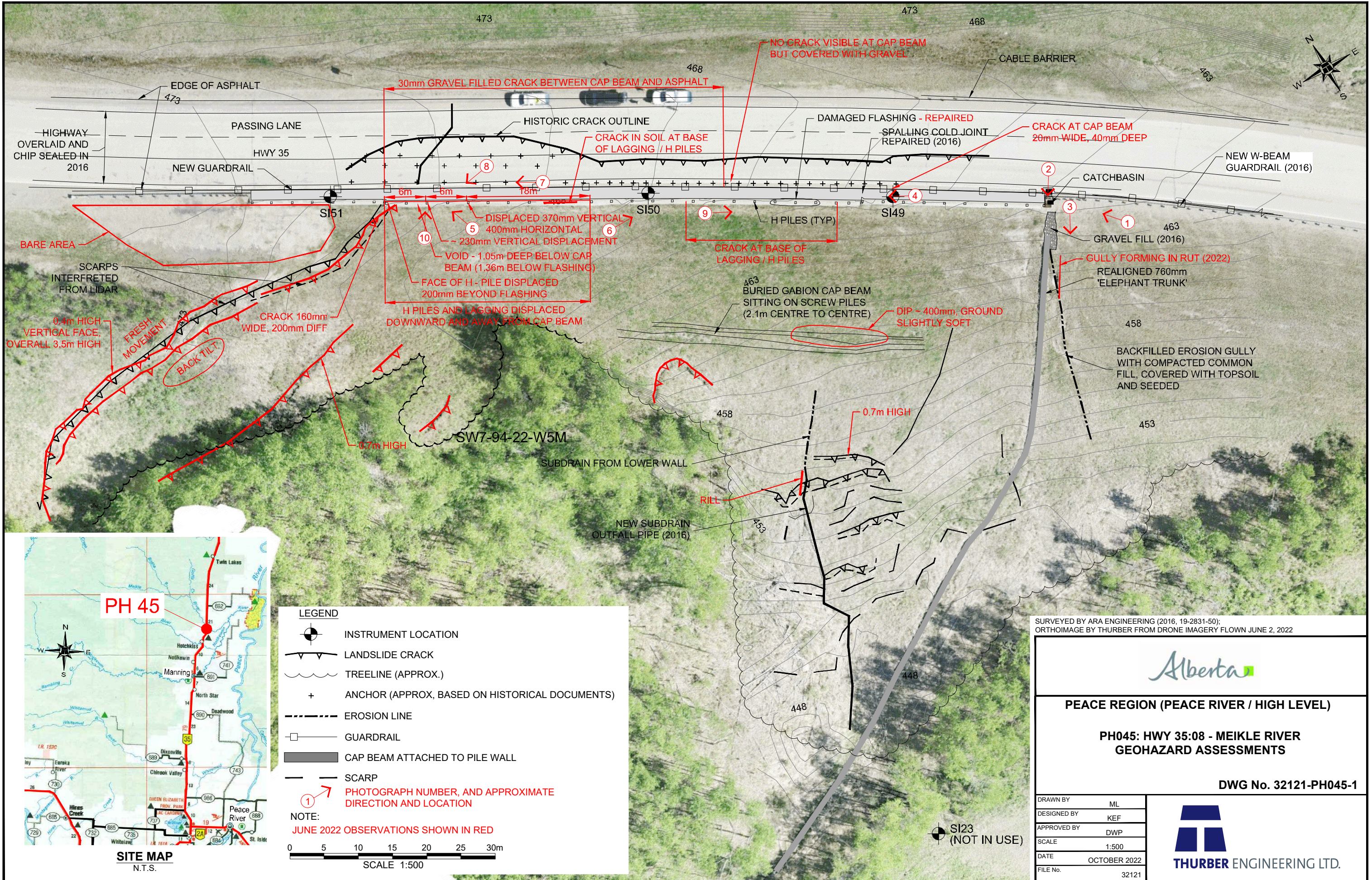
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

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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LEGEND

- INSTRUMENT LOCATION
- LANDSLIDE CRACK
- TREELINE (APPROX.)
- ANCHOR (APPROX, BASED ON HISTORICAL DOCUMENTS)
- EROSION LINE
- GUARDRAIL
- CAP BEAM ATTACHED TO PILE WALL
- SCARP
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

NOTE:
 JUNE 2022 OBSERVATIONS SHOWN IN RED

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

SURVEYED BY ARA ENGINEERING (2016, 19-2831-50);
 ORTHOIMAGE BY THURBER FROM DRONE IMAGERY FLOWN JUNE 2, 2022

Alberta

PEACE REGION (PEACE RIVER / HIGH LEVEL)

**PH045: HWY 35:08 - MEIKLE RIVER
 GEOHAZARD ASSESSMENTS**

DWG No. 32121-PH045-1

DRAWN BY	ML
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	1:500
DATE	OCTOBER 2022
FILE No.	32121

THURBER ENGINEERING LTD.



Photo 1 – Looking northwest at the catch basin and pile wall.



Photo 2 – Catch basin inlet at the south end of the wall leading to the elephant trunk downpipe.



Photo 3 – Looking downslope at “elephant trunk” drain pipe. There is some erosion forming in mower ruts on the left (south) side of the drain pipe.



Photo 4 – Looking northwest at repaired and overlaid asphalt surface. A new bridge rail was installed during construction and damaged flashing at about the center of the wall noted previously has been repaired.



Photo 5 – Looking north at the displaced H-pile and timber lagging wall near the scarp at the north end of the wall.



Photo 6 – Looking east at the end of the displaced section of lagging and beyond to (as yet) undisturbed lagging.



Photo 7 – Looking at the crack that is opening up again between the cap beam and asphalt.

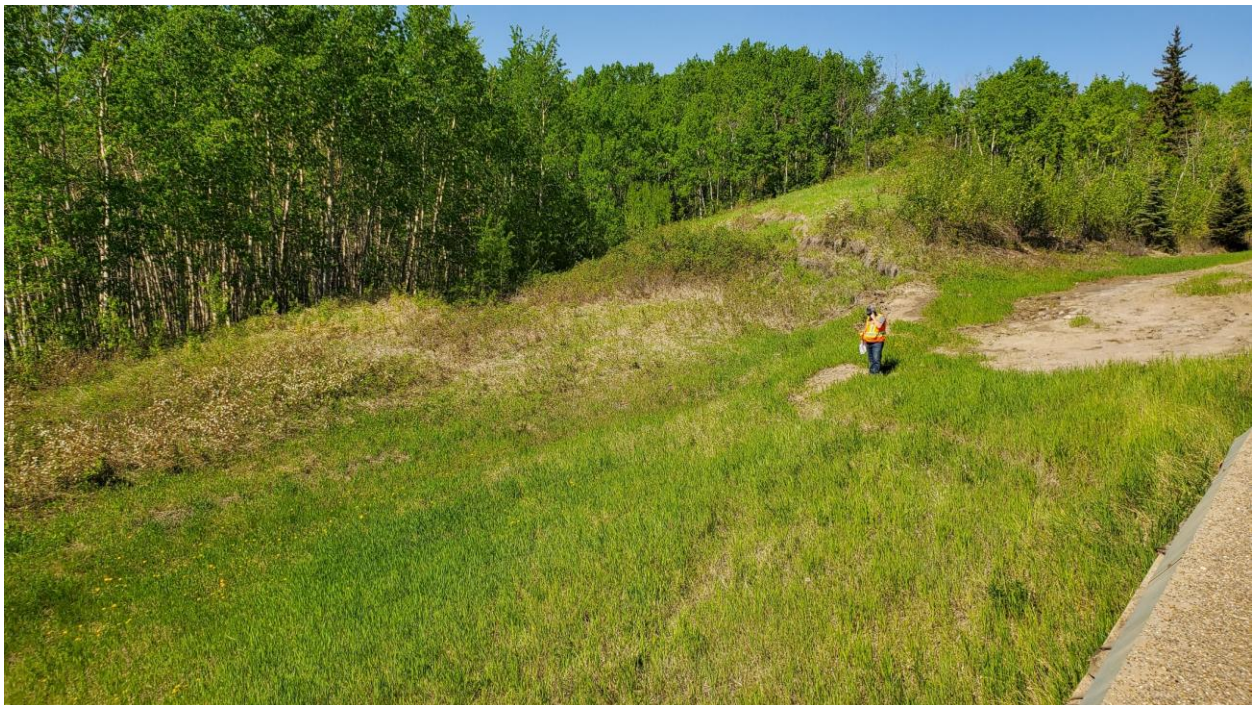


Photo 8 – Looking west at graben block northwest of the wall, which appears to have become re-activated.



Photo 9 – The crack forming below the lagging wall at the south end where the soil is starting to pull away.



Photo 10 – The void forming in front of and behind the cap beam as the lagging wall and grout backfill is displaced by slope movement.