

**ALBERTA TRANSPORTATION AND
ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION - SWAN HILLS
2024 INSPECTION**



Site Number	Location	Name	Hwy	km
SH010-1	Little Smoky River	Little Smoky River Valley, South Hill – Site #1	744:02	14.4-14.7
Legal Description		UTM Co-ordinates		
NE-13-76-23-W5		11U E 473,759	N	6,160,016

	Date	PF	CF	Total
Previous Inspection:	6-Jun-2023	11	3	33
Current Inspection:	4-Jun-2024	11	3	33
Road AADT:	270		Year:	2023
Inspected By:	Rishi Adhikari, TEC Robert Senior, TEC		Ken Froese, Thurber Roger Skirrow, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items

Primary Site Issue:	Highway traverses deep-seated, retrogressive landslide with ongoing creep movement due partly to erosion at toe by the Little Smoky River resulting in cracking and sagging of the pavement surface at several locations. Site #1 is 110 m above and 1.1 km from the Little Smoky River.	
Dimensions:	170 m scarp located 5 m downslope of the highway (north of culvert) and slumping located 30 m from highway (south of culvert). Two erosion gullies on backslope from overland drainage.	
Date of Remediation:	1974: Upslope realignment of highway due to slide movement. 2004: 600 m of realignment of Hwy 744 (through SH10 and SH28) approx. 10 m into backslope with toe berm.	
Maintenance:	2020/2021: Patch	
Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Crack across highway at km 14.5 with dip and increasing length of cracks forming to the north. Existing cracks continue to widen.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Two older slump blocks north of the culvert and downslope of the highway have become active. Movement on a third block damaged the lower portion of the gabion mattress swale. Scarp cracks between the north slump and the highway are moving. Tension cracks formed upslope of the scarp and are retrogressing towards highway.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Two gullies on backslope: north remained 2 m wide and 1.5 m deep and the south still remained >4 m wide but was 2.2 m deep at the crest. Short gully in ditch at km 14.4 remained the same.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert	800 mm centreline CSP culvert at km 14.45 downstream apron damaged by slope movement. CSP was 1/3 full and corroding. 800 mm centreline CSP culvert at km 14.69 is in good condition.	<input checked="" type="checkbox"/>

<input checked="" type="checkbox"/> Other	Sediment from gullies accumulating over ditch gabion check baskets	<input type="checkbox"/>
Instrumentation:		
None.		

Assessment:

The overall valley slope is moving as several separate slide blocks in response to the toe erosion and downcutting by the Little Smoky River resulting in numerous scarps, sag ponds, and differential movement zones. South of the bridge, the highway intersects the scarps of these blocks at several locations over 2.7 km with the potential for an uneven highway surface and cracking, although the south side of the river valley appears more stable than the north.

The highway at this site has been realigned twice: once in 1974 and then again in 2004 after major landslide movements resumed in 1996. Prior to the second realignment, five inclinometers and four piezometers were installed in August 2002; however, these were destroyed or removed during construction in 2004. The LiDAR surface inset on the Drawing shows the presence of two toe rolls west of the highway (dashed line) below km 14.45. The plateau below the highway beyond the toe rolls appears to be an abandoned river terrace yet the valley slope has become active again in the last five years despite the absence of direct river erosion. Section A-A' highlights the relative topography through the area and indicates the proximity to the highway of the scarps between km 14.48 and km 14.55.

In 2021, the movement zone of the slide located north of the culvert expanded an additional 20 m south towards the gabion basket swale, with observed vertical displacements of up to 0.8 m. The tension cracks observed in 2020 between the highway and the main slide have developed into longer and continuous scarps. Fresh movement on most of the scarps was observed in 2022. There was less movement during the 2023 inspection. During the 2024 inspection, tension cracks formed upslope of the main scarp, indicating retrogression into the highway. No changes were observed to the cracks on the highway. Measurements of the survey stakes at the scarp crest west of the highway at km 14.45 indicated that the scarp has deepened and is actively moving.

The two gullies in the backslope did not appear to have widened. The south gully was observed to be deeper during the 2024 inspection. Continued movement has caused ravelling and slumping of the slopes. These gullies will continue to worsen until repaired. Sediment from these gullies is accumulating in the ditch and culvert inlet and overtopping the gabion check baskets reducing their effectiveness.

Recommendations:

Short-Term:

The local MCI should continue to monitor the highway surface for movements and seal open cracks to limit surface water infiltration into the landslide mass.

The backslope erosion gullies should be repaired, and properly sized swales should be constructed to carry water down the slope to the highway east ditch.

Medium-Term:

The large slide mass between km 14.48 and km 14.62 is active. Determining the feasibility of various mitigation options for this site requires additional investigation and study. It is recommended that a geotechnical investigation be undertaken to better understand the extent of the slide and the stratigraphy. It is recommended that two deep inclinometers be installed within this slide mass (to determine the depth and rate of movement) and a third placed upslope of the km 14.45 slump (to monitor regression toward the highway).

Long-Term:

Overall, the portion of the highway south of the river is relatively stable and low maintenance compared to portion of the highway north of the river. However, the slide is progressing toward the highway, and it is recommended that preliminary engineering be initiated soon as remedial measures may need to be implemented within 5 years. A potential longer-term solution might be to construct a large toe berm on the terrace to buttress the moving slope although this would require significant vegetation clearing and

potential stabilization of soft soils located at the toe of the slope. Alternatively, another re-alignment away from the landslide zone could be considered – this study is now underway.

Ongoing Investigations:

Due to the ongoing movements observed at this site, it is recommended that the Geohazard inspection continued to be undertaken annually.

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.

Roger Skirrow, P.Eng.
Senior Geotechnical Engineer

Mark Gallego, P.Eng.
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.

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

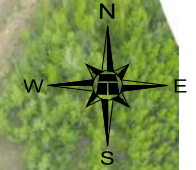
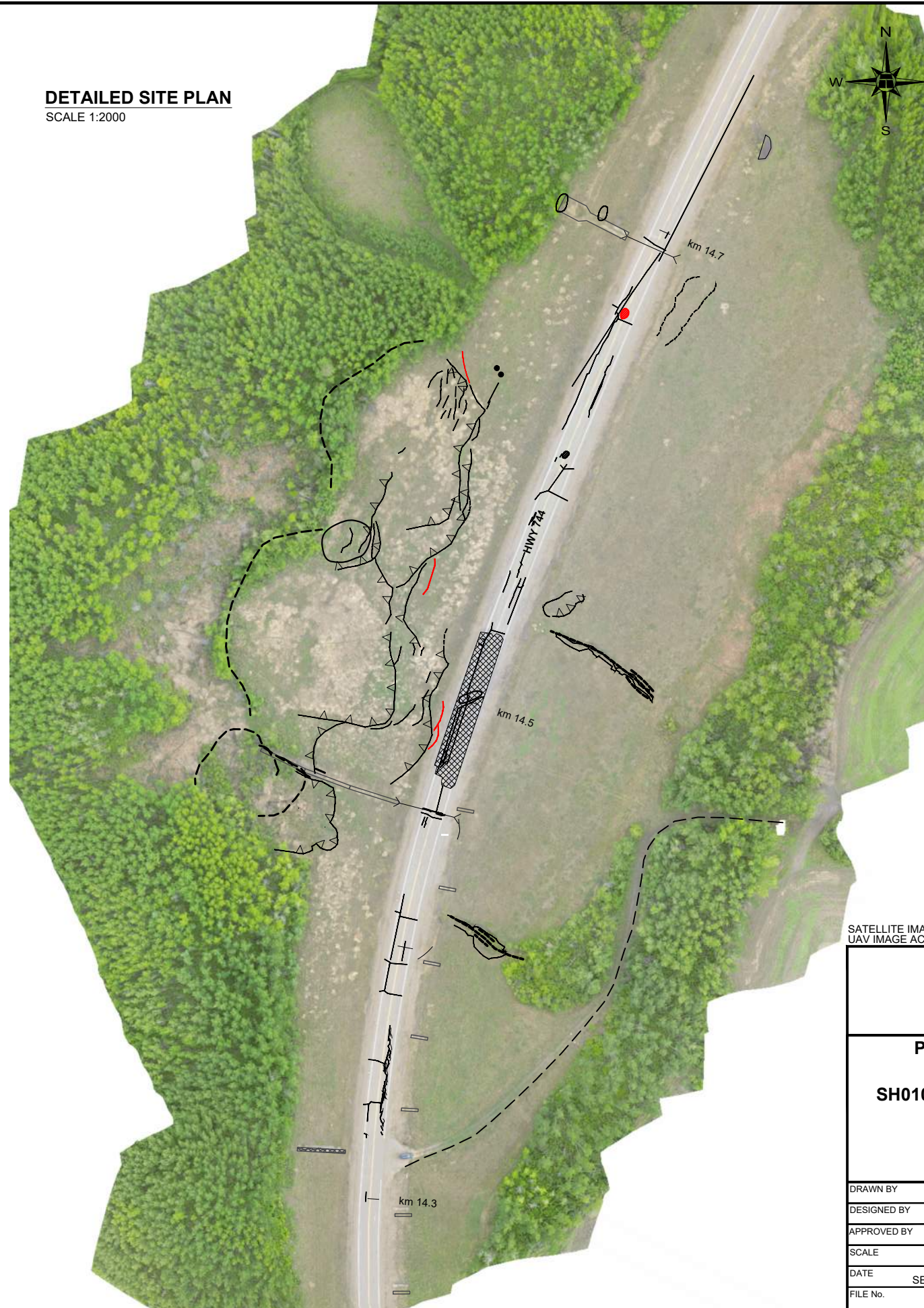
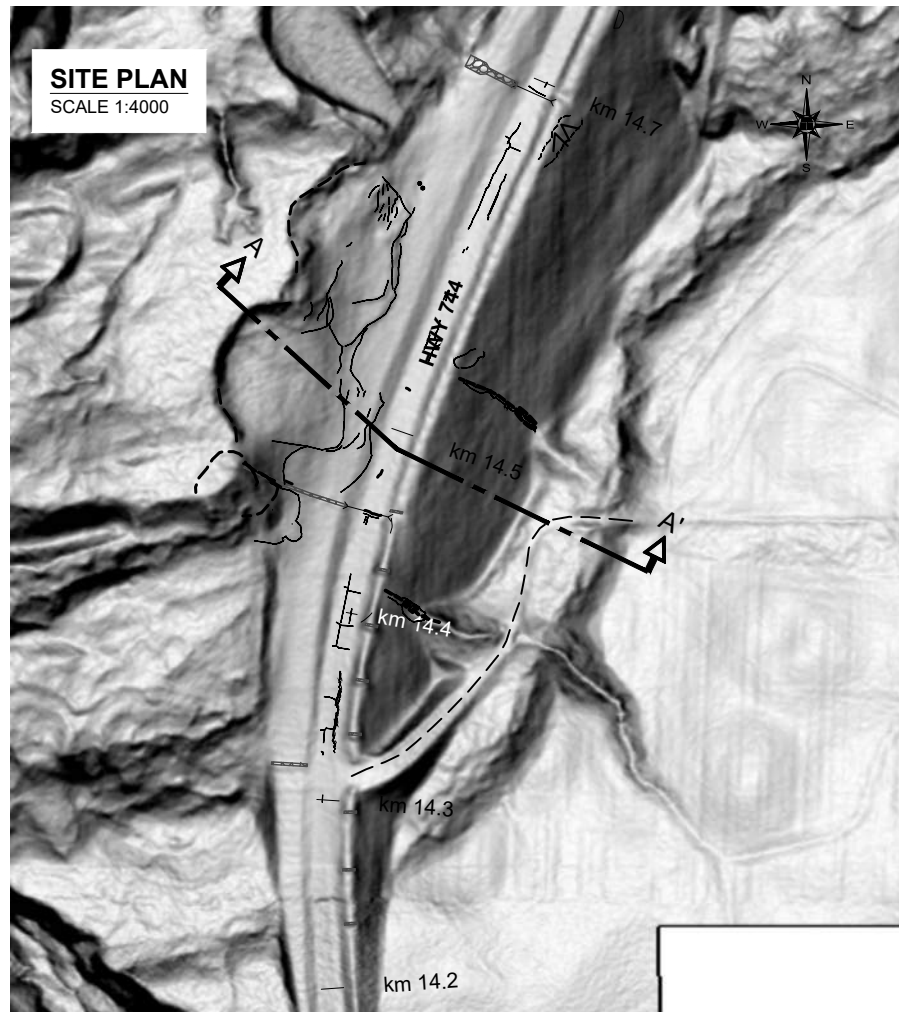
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification 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

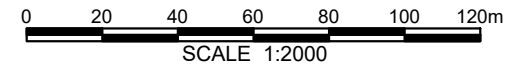
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- LEGEND**
- SCARP
 - TENSION CRACK / TOE ROLL



- NOTES**
1. FEATURE LOCATIONS ARE APPROXIMATE. COMMENTS PRIOR TO 2020 REMOVED FOR CLARITY. CONSULT 2023 DRAWINGS FOR HISTORICAL INFORMATION.
 2. TO CONVERT FROM PREVIOUS STATIONING TO CURRENT KILOMETERS, SUBTRACT 7m.
 3. 2013-2015 FROM AMEC FIGURE 1, PROJECT EG10030, PROVIDED BY ALBERTA TRANSPORTATION.
 4. JUNE 2024 OBSERVATIONS SHOWN IN RED.

SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)
UAV IMAGE ACQUIRED BY THURBER (JUNE 2020)

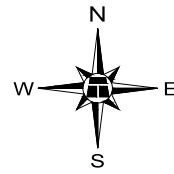


PEACE REGION (PEACE RIVER DISTRICT)
SH010: HWY 744:02 LITTLE SMOKY RIVER VALLEY (SITE #1)
2024 SITE INSPECTION PLAN
DWG No. 32121-SH010-1-1

DRAWN BY	DLA
DESIGNED BY	MG
APPROVED BY	RKS
SCALE	AS SHOWN
DATE	SEPTEMBER 2024
FILE No.	32121



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POSSIBLE SCARP AS TREES BENT/DOWN;
LARGE OPEN AREA TO NORTH MAY BE
PORTION OF OLD HIGHWAY ALIGNMENT
OR WASTE MATERIAL FROM GRADING

LEGEND

- SCARP
- TENSION CRACK / TOE ROLL
- DIRECTION AND NUMBER OF PHOTO

100mm WIDE, 80mm DEEP (2022)
100mm WIDE, 200mm DEEP (2023)
100mm WIDE, 300mm DEEP, 10mm DIFF (2024)

0.7m HIGH (2021)
1.5m HIGH (2022)
1.2m HIGH (2023, 2024)

0.8m HIGH (2021)
1.5m HIGH (2022)
1.0m HIGH (2023)

1.4m HIGH (2022, 2023)

0.7m HIGH
1.6m HIGH (2020)

TENSION CRACK: 10.3m TO ACP CREST

1.4m HIGH, 9m TO ACP CREST

TWO OLD INSTRUMENTS

BENT

1.2m HIGH (2021, 2022)

BACKWARDS TILT

TOE ROLL

0.4m HIGH

0.9m VERTICAL

RAVELLED

GABION BASKET SWALE

CRACK PATCH (2023, 2024)

30-40mm WIDE

DIP

TENSION CRACK (2023)

1.6m HIGH (2021), 1.5m HIGH (2023)

20mm WIDE

0.5m HIGH (TOE ROLL)

SHALLOW SLUMP

0.7m HIGH (2022)
0.9m HIGH (2024)

1.2m HIGH (2020)

10mm WIDE

2.9m WIDE, 1.3m DEEP (2020)
2.0m WIDE, 1.4m DEEP (2022, 2023)

10-20mm WIDE

CRACK THROUGH PATCH

10-20mm WIDE (2023)
20-40mm WIDE (2024)

ACP PATCH

NORTH GULLY

3.1m WIDE, 1.9m DEEP (2020)
2.0m WIDE, 1.5m DEEP (2022, 2023)

1.8m WIDE, 1.2m DEEP (2020)
2.0m WIDE, 2.0m DEEP (2022, 2023)

km 14.7

20-30mm WIDE

SEEPAGE

50-70mm WIDE, 10mm DEEP (2023, 2024)

800 mm Ø CSP

DIP, CRACKS

ALLIGATOR CRACKING FROM APPARENT SOFT SUBGRADE

DIP

CRACKS 10-20mm WIDE (2022)
CRACKS 10-30mm WIDE, 0mm DIFF (2024)

DIP

TENSION CRACK (2023)

1.6m HIGH (2021), 1.5m HIGH (2023)

20mm WIDE

0.5m HIGH (TOE ROLL)

SHALLOW SLUMP

0.7m HIGH (2022)
0.9m HIGH (2024)

1.2m HIGH (2020)

10mm WIDE

2.9m WIDE, 1.3m DEEP (2020)
2.0m WIDE, 1.4m DEEP (2022, 2023)

10-20mm WIDE

CRACK THROUGH PATCH

10-20mm WIDE (2023)
20-40mm WIDE (2024)

ACP PATCH

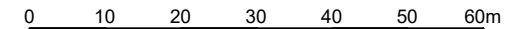
NORTH GULLY

3.1m WIDE, 1.9m DEEP (2020)
2.0m WIDE, 1.5m DEEP (2022, 2023)

1.8m WIDE, 1.2m DEEP (2020)
2.0m WIDE, 2.0m DEEP (2022, 2023)

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE. COMMENTS PRIOR TO 2020 REMOVED FOR CLARITY. CONSULT 2023 DRAWINGS FOR HISTORICAL INFORMATION.
2. TO CONVERT FROM PREVIOUS STATIONING TO CURRENT KILOMETERS, SUBTRACT 7m.
3. 2013-2015 FROM AMEC FIGURE 1, PROJECT EG10030, PROVIDED BY ALBERTA TRANSPORTATION.
4. JUNE 2024 OBSERVATIONS SHOWN IN RED.



SCALE 1:1000

LIDAR FROM ALBERTA TRANSPORTATION (DATED 2006-2008)
SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)
UAV IMAGE ACQUIRED BY THURBER (JUNE 2020)



PEACE REGION (PEACE RIVER DISTRICT)

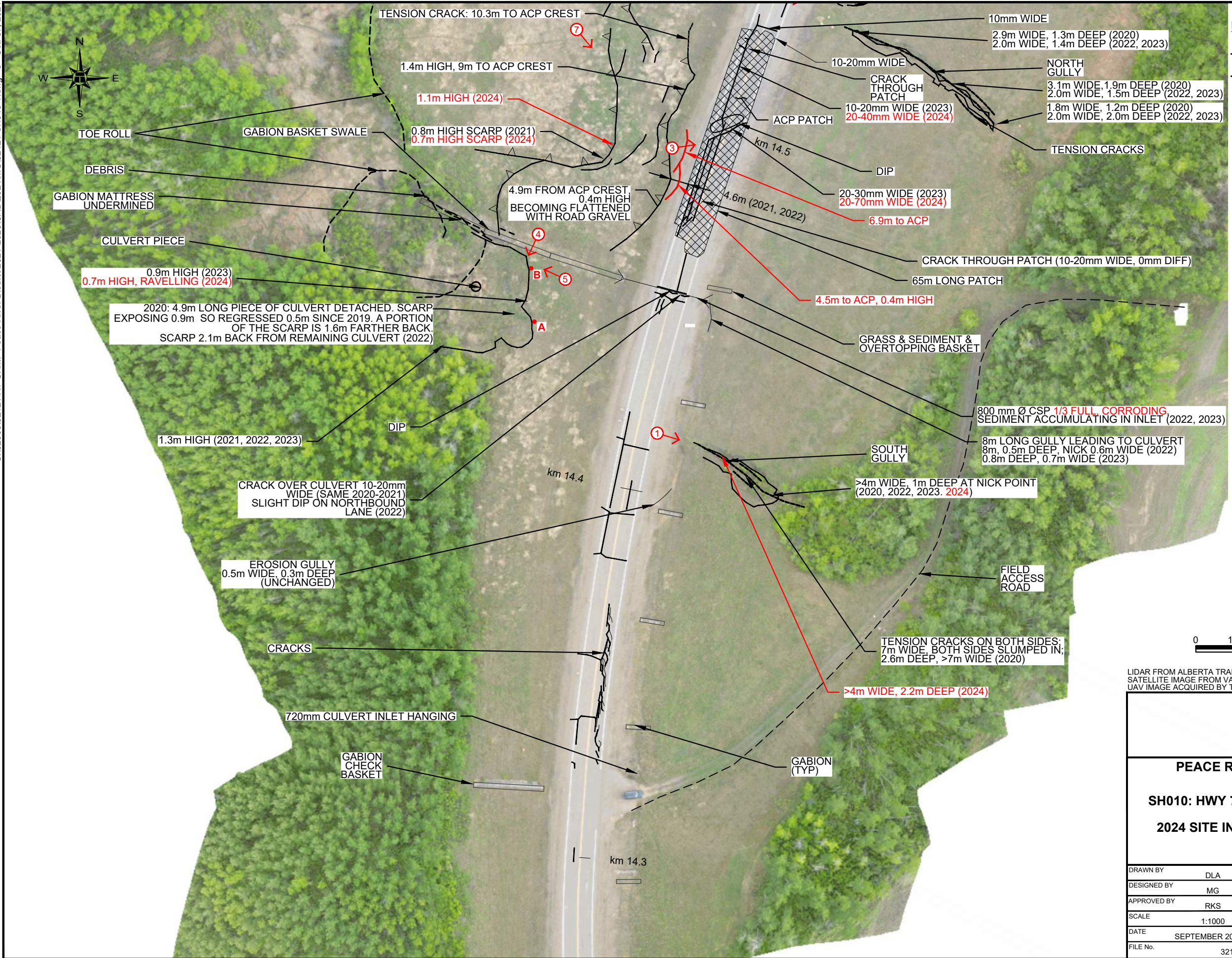
SH010: HWY 744:02 LITTLE SMOKY RIVER VALLEY (SITE #1)
2024 SITE INSPECTION PLAN - NORTH PORTION

DWG No. 32121-SH010-1-2

DRAWN BY	DLA
DESIGNED BY	MG
APPROVED BY	RKS
SCALE	1:1000
DATE	SEPTEMBER 2024
FILE No.	32121



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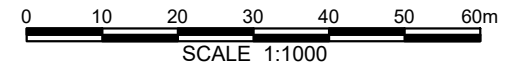
LEGEND

- ▽ SCARP
- - - TENSION CRACK / TOE ROLL
- ① → DIRECTION AND NUMBER OF PHOTO

MARKER	DISTANCE FROM SCARP		VERTICAL HEIGHT OF SCARP	
	2023	2024	2023	2024
A	2.0m	1.9m	0.8m	0.9m
B	1.8m	-	0.3m	-

NOTES

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3. 2013-2015 FROM AMEC FIGURE 1, PROJECT EG10030, PROVIDED BY ALBERTA TRANSPORTATION.
4. JUNE 2024 OBSERVATIONS SHOWN IN RED.



LIDAR FROM ALBERTA TRANSPORTATION (DATED 2006-2008)
 SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)
 UAV IMAGE ACQUIRED BY THURBER (JUNE 2024)



PEACE REGION (PEACE RIVER DISTRICT)

SH010: HWY 744:02 LITTLE SMOKY RIVER VALLEY (SITE #1)

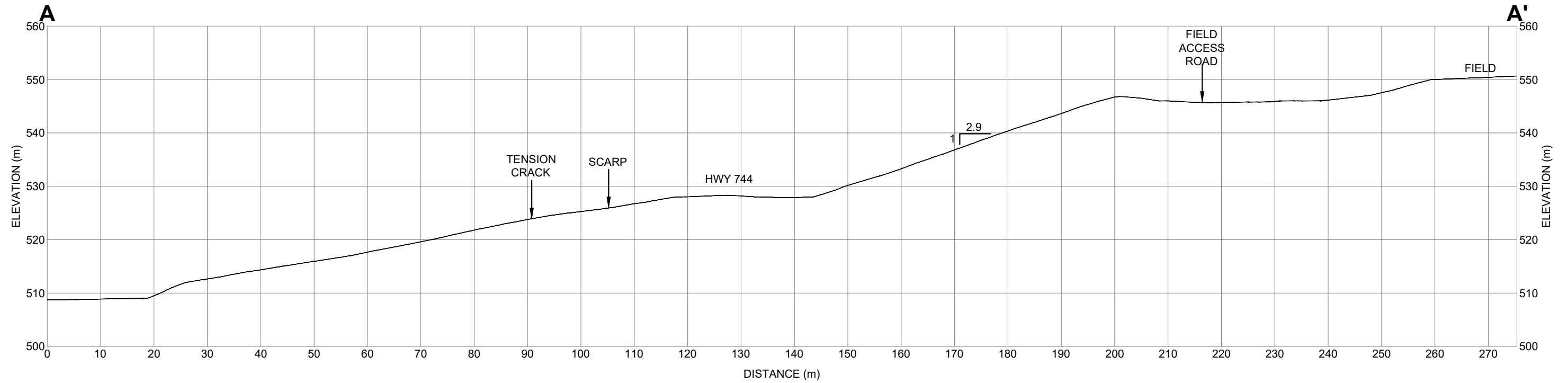
2024 SITE INSPECTION PLAN - SOUTH PORTION

DWG No. 32121-SH010-1-3

DRAWN BY	DLA
DESIGNED BY	MG
APPROVED BY	RKS
SCALE	1:1000
DATE	SEPTEMBER 2024
FILE No.	32121



THURBER ENGINEERING LTD.



NOTE
 1. GROUND PROFILE FROM 2006-2008 LIDAR DATA PROVIDED BY ALBERTA TRANSPORTATION



PEACE REGION (PEACE RIVER DISTRICT)

**SH010: HWY 744:02 LITTLE SMOKY RIVER VALLEY
 (SITE #1)
 CROSS-SECTION A-A'**

DWG No. 32121-SH010-1-4

DRAWN BY	DLA
DESIGNED BY	MG
APPROVED BY	RKS
SCALE	1:750
DATE	SEPTEMBER 2024
FILE No.	32121





Photo 1 – Looking east at south gully.



Photo 2 – Looking east at north gully; note slump to left of gully on lower part of slope.



Photo 3 – Looking northeast at crack pattern reflecting through patch on highway above scarps shown in Photo 7.



Photo 4 – Looking south at slide at km 14.45 located adjacent to south gabion basket swale. The culvert may be from the previous highway alignment.



Photo 5 – Looking west where slide at km 14.45 cuts into the gabion basket swale. There has been a lot of vegetative growth in this area.



Photo 6 – Looking south at scarps downslope of highway at about km 14.6.



Photo 7 – Looking southeast at scarps downslope of the highway at about km 14.5.