

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



Site Number	Location	Name	Hwy	km
SH013-14 SH013-15	Little Smoky River	Little Smoky River Valley, North Hill – Sites #14 & #15	744:02	21.61-21.80 21.55-21.61
Legal Description		UTM Co-ordinates		
Site 14: SE28/SW27-76-22-W5M		11U E 478,675	N	6,163,221
Site 15: SE28/SW27-76-22-W5M		11U E 478,647	N	6,163,070

	Date	PF	CF	Total
Previous Inspection:	6-Jun-2023	Site 14: 11	4	44
		Site 15: 11	3	33
Current Inspection:	4-Jun-2024	Site 14: 11	4	44
		Site 15: 11	3	33
Road AADT:	270		Year:	2023
Inspected By:	Rishi Adhikari, TEC		Ken Froese, Thurber	
	Robert Senior, TEC		Roger Skirrow, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input checked="" type="checkbox"/> Maintenance Items

Primary Site Issue:	<p><u>Site 14:</u> Highway is adjacent to slumps resulting from aggressive erosion along a ravine leading south and easterly to Peavine Creek. The erosion has progressed northerly over the years and now affects the east ditch of the highway and a culvert.</p> <p><u>Site 15:</u> Highway traverses deep-seated, retrogressive landslide with ongoing creep movement due partly to erosion at toe by the Peavine Creek resulting in cracking and sagging of the pavement surface at numerous locations. Approx. 4 km of the highway crosses this unstable north valley slope. This Site is 25 m above and 90 m away from the tributary gully of the Peavine Creek.</p>	
Dimensions:	<p><u>Site 14:</u> 55 m length of highway parallels active erosion area.</p> <p><u>Site 15:</u> 40 m length of highway with distortion and cracking. The cracking at this site likely represents the northern flank of a much larger instability. The main scarp can be observed extending +75m into the treeline along the west side of the highway.</p>	
Date of Remediation:	None	
Maintenance:	<p>Routine crack sealing, milling, and patching, when required.</p> <p>2017: Overlay through Sites 13, 15, and 14</p> <p>2019: Milling at Site 15</p> <p>2020: Spot patching over crack at Site 15</p> <p>2021: Hwy upgrades on north valley slope including 50 mm overlay, new guardrails, line painting, and ditch improvements</p> <p>2023: Milling at Site 15</p>	
Observations (Site 14):	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Transverse crack over twin culverts	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Slumps have developed along the tributary gully and are retrogressing as it continues to downcut.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Significant erosion along the east highway ditch and ravine leading to Peavine Creek.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Ponded water observed in the east ditch.	<input checked="" type="checkbox"/>

<input checked="" type="checkbox"/> Bridge/Culvert	Riprap apron at north pipe outlet collapsed with the riprap accumulating in the channel.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Observations (Site 15)	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Previous longitudinal and traverse cracks have reflected through and extended. Main crack area had multiple coalescing cracks.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Site is located on the north flank of an active deep-seated landslide moving toward the Peavine Creek. There is also a slump at the top of the backslope. It is not definitively known where the slide crack intersects the highway on the south side of the slide mass.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Erosion control consisting of matting and GeoRidges installed in west ditch where gully was previously observed. Minor rills forming on portions of the sideslope and ditch. New gullies are developing upstream outside of the erosion control area.	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>

Instrumentation: None.

Assessment:

The overall north valley slope is moving as several separate slide blocks in response to the toe erosion and downcutting of two different rivers. There are numerous head and intermediate scarps, sag ponds, and differential movement zones going in slightly different directions. The highway intersects the scarps of these blocks at several locations resulting in an uneven highway surface and cracking.

Site 14:

The highway is adjacent to a ravine that acts as an ephemeral tributary to the Peavine Creek. The channel flows to the south until it joins with the outflow from the culvert at Site 13 where it abruptly turns to the east and enters Peavine Creek. The ravine bed has aggressively downcut over the years with a mobile nick point (the start point of downcutting) that has exited the ravine and is now moving northward along the highway east ditch. Embankment slumping, related to the downcutting is extensive along the slopes of the ravine and is less than 20 m from the highway. There are two nick points, one moving along the east ditch and one moving westerly toward a centerline culvert. The westerly moving nick point is about 14 m from a culvert outlet. The erosion is fueled by overland flow carried by the highway east ditch, augmented by flow diverted from the west ditch through a centerline culvert. Heavy spring runoff and rain falls in 2019 and 2020 significantly increased the width and length of the erosion. Survey lathes were installed upstream of the nick points to monitor progression of the bank erosion and bed scour. The remaining lathe for was reset in 2019 and the offset from the crest of the slumping decreased from 4.95 m in 2019 to 1.3 m in 2022. Additional stakes were placed in 2023 to monitor the regression of the slide scarps including one near the south end of the roadside turnout. During the 2024 inspection, it appears that the slide scarp near the south end of the roadside turning is continuing to retrogress. The scarp north of the twin culverts is 7.5 m from the edge of the pavement. The erosion occurring in the highway ditch could be controlled with erosion control products; however, the downcutting along the tributary channel would require extensive works to reduce the erosion as this natural process will continue to extend as the grade of the tributary moves toward equilibrium conditions (geological time-scale process).

Site 15:

The overall valley movements have led to a diagonal crack across the highway at this location which likely represents the northern flank of the uppermost scarp of the deep-seated, retrogressive movements in the valley. The dip in the highway surface on the downslope side of the crack was removed with the

highway overlay in 2021. The main crack pattern has become re-established after the overlay including some differential across the cracks. Increased crack width was observed in 2023; however, the vertical difference was reduced as the main crack area had been recently milled. During the 2024 inspections, the main crack area had multiple coalescing cracks, and the cracks continued to widen. The cracks were infilled with sand and gravel. There is some erosion located downslope (east) of the highway and shallower scarp which may both be contributing to the movement at the highway. There is also a backslope slump that has formed about 1 m from the valley crest which may be the result of cut slope angle rather than the overall valley movement.

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.
- Riprap could be placed at the nick points to slow the rate of downcutting and scour retrogression.

Medium-Term:

- There are no practical medium-term options considered for Site 15.
- For Site 14 consideration could be given to the installation of a proper channel drop structure. The location of the drop structure could be downstream of the two nick points, and the channel bed between the nick points and the drop structure would be restored and armored. Preliminary engineering should be undertaken so that this remediation can be implemented quickly when required. A hydrotechnical assessment would be required to determine flow conditions for sizing of the drop structure(s).

Long-Term:

- It is understood that, at this time, the only long-term remediation option under consideration is realignment of the entire north hill section of Highway 744 and this study is currently being undertaken by CIMA+. Realignment is likely the only practical option to deal with Site 15 issues.
- Additional ravine channel bed stabilization could be undertaken to protect the highway from erosion induced ravine slope instabilities, and from lateral migration of the channel bed. This might consist of armouring the channel bed with heavy rip rap and inclusion of a series of drop structures and stilling ponds.

Ongoing Investigation:

- It is recommended that the annual Geohazard inspection should continue as scheduled.
- Minimum offset distances or triggers should be established so that remedial measures can be determined and implemented prior to distress of the highway.

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

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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.

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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.

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Photo 1, Site 14 – Looking southwest at slide scarp north of twin culverts that is retrogressing towards the highway.



Photo 2, Site 14 – Looking north along the east ditch.



Photo 3, Site 14 – Looking at outlets of SWSP twin culverts outlets. The riprap apron at the north SWSP had collapsed.



Photo 4, Site 14 – Looking south at slumping along the tributary channel.



Photo 5, Site 15 – Looking north at diagonal crack intersecting the highway that was recently milled.



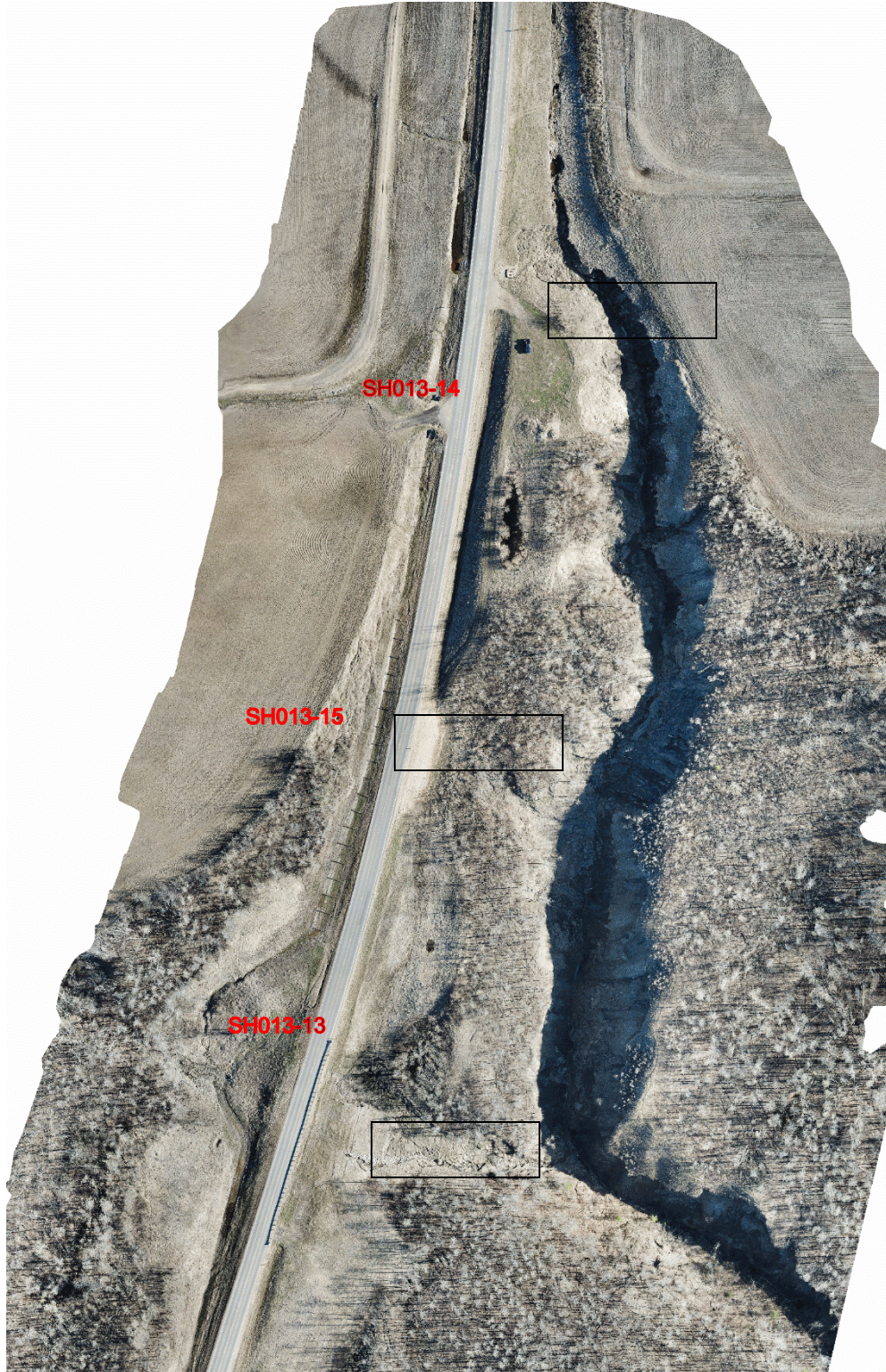
Photo 6, Site 15 – Looking south at the main crack and milled section of road.



Photo 7, Site 15 – Looking northeast where scarp from road extends southwest into the treeline



Photo 8, Site 15 – Looking southwest at backslope slump at valley crest.



2022 UAV orthomosaic of the erosion gully at SH013-13, SH013-14, and SH013-15 locations.