

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – SWAN HILLS
2022 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	21.55-21.61 21.61-21.80
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:	3-Jun-2020	Site 14: 12 Site 15: 8	3 3	36 24
Current Inspection:	1-Jun-2022	Site 14: 12 Site 15: 8	3 3	36 24
Road AADT:	230		Year:	2022
Inspected By:	Rishi Adhikari, TRANS Max Shannon, 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:	<p><u>Site 14:</u> Highway is adjacent to slumps resulting from aggressive erosion along channel of tributary to Peavine Creek. This Site is 8 m above and 60 m away from the tributary gully of the Peavine Creek.</p> <p><u>Site 15:</u> Highway traverses deep-seated, retrogressive landslide with ongoing creep movement due partly to erosion at toe by the Little Smoky River and 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.</p>		
Date of Remediation:	None		
Maintenance:	Routine crack sealing, milling, and patching, when required. 2017: Overlay through Sites 13, 15, and 14 2019: milling at Site 15 2020: Line painting, spot patching over crack at Site 15 2021: Highway Overlay (50 mm)		
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 creek valley and are retrogressing as creek continues to erode.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Erosion	Significant erosion along channel of tributary to Peavine Creek.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Seepage	Ponded water observed in the east ditch.	<input type="checkbox"/>	

<input checked="" type="checkbox"/> Bridge/Culvert Distress	Twin culverts at km 21.77 were placed with new twin SWSP culverts and riprap aprons.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Observations (Site 15):	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Site was recently overlaid. Some of the previous longitudinal and traverse cracks have reflected through.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Site is located on an active deep-seated landslide moving toward the Peavine Creek. There is also a slump at the top of the backslope.	<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.	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation: None.		
Assessment:		
<p>The overall valley slope is moving as several separate slide blocks in response to the toe erosion and downcutting of two different rivers resulting in numerous 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.</p> <p>Site 14: The highway is adjacent to a tributary to the Peavine Creek and the channel is aggressively downcutting resulting in slumping less than 20 m from the highway – the nick point of one of the gullies is about 14 m from the culvert outlet. The erosion is driven by overland flow through the east ditch as well as the west ditch as the flow is diverted below the highway to the east ditch at this location. Heavy spring runoff and rain falls in 2019 and 2020 significantly increased the width and length of the erosion. The remaining field marker for measuring the regression 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. 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).</p> <p>Site 15: The overall valley movements have led to a diagonal crack across the highway at this location which likely represents the uppermost scarp of the deep-seated, retrogressive movements in the valley. The noticeable 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. In addition, 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 were no changes observed during the 2022 inspection. 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. Tension cracks were observed in 2017 in the field above this slump indicating that it is retrogressing although it did not appear significantly different since 2017.</p>		

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 headscarp of the erosion ravine to slow retrogression of the erosion up-gradient.

Medium-Term:

- If the highway is not re-aligned, consideration should be given to remediating the erosion in the tributary channel at Site 14 by installing a series of rock check dams or armouring most of the channel bottom.
- Consideration could also be given to the installation of steel sheet piles along the highway at Site 14 as an interim measure if the gully regresses close enough to the highway that there is concern for the safety of the traveling public. A guardrail would also be required in this scenario. Preliminary engineering should be undertaken so that this remediation can be implemented quickly when required.

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. However, given the high cost of this option and as it is a low volume highway, it is unlikely that realignment will be undertaken in the near future.

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.

Don Proudfoot, P.Eng.
Principal | 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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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

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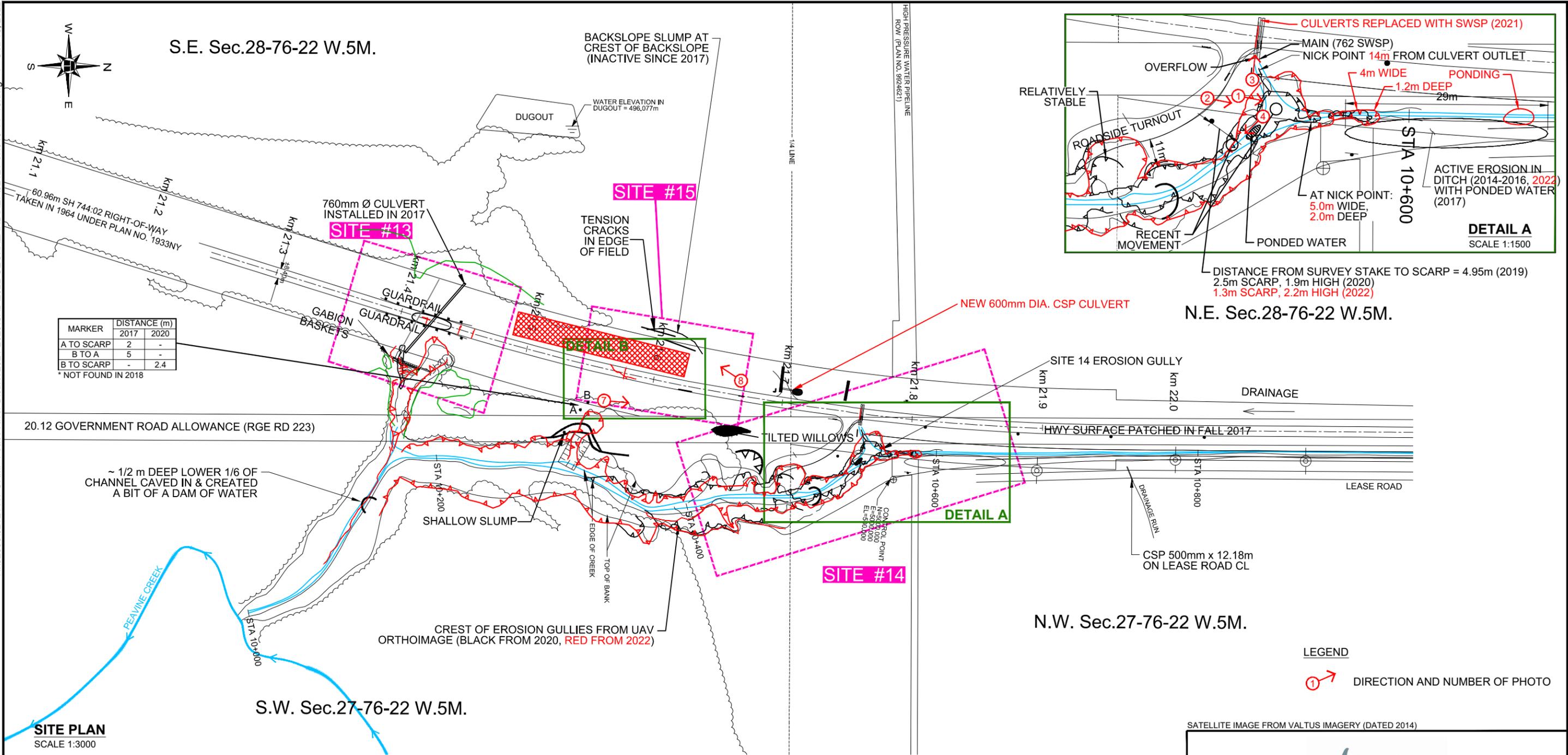




Photo 1, Site 14 – Looking north along the east ditch at increasing depth of erosion along the tributary.



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



Photo 3, Site 14 – Looking at outlets of new SWSP twin culverts outlets which replaced older CSP culverts.



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



Photo 5, Site 15 – Looking north at diagonal crack intersecting the highway. There is a slight dip in the east lane on the south side (downslope) of the crack.



Photo 6, Site 15 – Looking south at the main crack (note grading and erosion protection in the west ditch).



Photo 7, Site 15 – Looking north at head of shallow slump downslope of the highway.



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



2022 UAV orthomosaic of the erosion gully at SH013.