ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – SWAN HILLS
2022 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
SH022-5 SH022-6	Little Smoky River	Little Smoky River Valley, North Hill – Sites #5 and #6	744:02	19.00-19.14 19.20-19.53
Legal Description		**UTM Co-ordinates**		
Site 5: SW21-76-22-W5M Site 6: SW21-76-22-W5M		11U E 477,204 11U E 477,479	N 6,161,204 N 6,161,291	

	Date	PF	CF	Total
Previous Inspection:	2-June-2020	11 9	3 3	Site 5: 33 Site 6: 27
Current Inspection:	31-May-2022	10 9	4 3	Site 5: 40 Site 6: 27
Road AADT:	230		**Year:**	2022
Inspected By:	Rishi Adhikari, TRANS Ed Szmata, TRANS Max Shannon, TRANS		Ken Froese, Thurber Mark Gallego, Thurber	
Report Attachments:	☑ Photographs ☑ Plans		☑ Maintenance Items	

Primary Site Issue:	Highway traverses deep-seated, retrogressive landslides with ongoing creep movements 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. Site #5 is 60 m above and 505 m away from the Little Smoky River and Site #6 is 65 m above and 460 m away.	
Dimensions:	Site 5: 145 m length of highway affected by cracking and distortion Site 6: 330 m length of highway affected by cracking and distortion	
Date of Remediation:	May have been significant overlay at both Sites #5 and #6 incorporating GBC "sandwich."	
Maintenance:	Routine ACP crack sealing, milling, and patching (2014 and 2015), when required. 2017: Patched (portion of Site #6) 2019: Patched EBL over most of Site #5 and both lanes over most of Site #6; spot-patching of larger cracks at both sites; milling at both sites 2020: Line painting, gravel fill placed on slumping sideslope at Site 5 2021: Highway overlay (50mm), culvert replacement	
Observations (Site 5):	**Description**	**Worsened?**
☑ Pavement Distress	Site was recently overlaid. Some of the previous longitudinal and traverse cracks have reflected through.	☑
☑ Slope Movement	Site is located on an active deep-seated landslide moving toward the Little Smoky River. There is a significant scarp located about 20 m downslope from the pavement edge at km 19.06.	☑

	A new slide formed at the edge of pavement in 2020 at km 19.07 and continues to move.	
☐ Erosion		☐
☐ Seepage		☐
☑ Bridge/Culvert Distress	Culvert at km 19.07: inlet is partially blocked and too high and outlet is partly obstructed by slide debris.	☑
☐ Other		☐
Observations (Site 6):	**Description**	**Worsened?**
☑ Pavement Distress	Site was recently overlaid. Some of the previous longitudinal and traverse cracks have reflected through.	☑
☑ Slope Movement	Site is located on an active deep-seated landslide moving toward the Little Smoky River. This site crosses over a sag pond/graben.	☑
☑ Erosion	An erosion gully is present at km 19.40. The ditch was lined with erosion control products during the 2021 overlay.	☐
☐ Seepage		☐
☑ Bridge/Culvert Distress	New SWSP culvert installed at km 19.23 is not draining. Ponded water observed at inlet and outlet.	☑
☐ Other		☐

Instrumentation: None.

Assessment:

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.

Site 5:
Cracks have started to re-appear on the road surface after the highway was overlaid last year (2021). Given the overall valley condition, continued creep movement is expected which may manifest as increased crack lengths, widths, and height differential as well as vertical pavement distortion. The retrogressive scarp about 5 m in width located at km 19.06, just beyond the culvert outlet at km 19.07, was likely triggered by erosion, had widened somewhat in 2020 but did not appear to have advanced closer to the highway as was also observed in the 2022 inspection. However, the 2020 slide in the highway embankment has become re-established after the grading work completed in 2021 and is now 0.75 m from the fog line. The toe roll was partially obstructed the culvert outlet.

Site 6:
Cracks have started to re-appear on the road surface after the highway was overlaid last year (2021). Given the overall valley condition, continued creep movement is expected which may manifest as increased crack lengths, widths, and height differential as well as vertical pavement distortion. The erosion feature at km 19.40 was repaired with a portion of the north ditch regraded and erosion controls measures installed including matting and GeoRidges. The portion of the north ditch that doesn't have the erosion control measures in place has cattails present, indicating poor drainage over a portion of the ditch. The new smooth wall steel pipe culvert that replaced the old culvert is not draining as pooled water was observed at the inlet and outlet.

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.

Medium-Term:

- Preliminary engineering should be undertaken for short-term repair of the 2020 slide at km 19.07. Consideration should be given to replacing and extending the culvert at this location at the same time to ensure that the discharge is controlled (elephant trunk down to sag pond). It is anticipated that a local excavation and replacement with geo-grid reinforced gravel will be the simplest solution; the potential for the lower slide at km 19.06 to retrogress into the highway at this location should also be considered in the design.
- Although the culvert at km 19.07 (Site 5) was just installed, it should be replaced as the inlet is too high to adequately drain the upslope sag pond and limit infiltration.
- The grading at the culvert outlet at km 19.23 (Site 6) should be re-evaluated to determine if the water can be drained away from the outlet to limit ponding and infiltration.

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. Consideration is also being given to a shorter realignment which will occur farther up the slope and will likely not include Site #5 but will likely connect with the existing alignment at Site #6.

Ongoing Investigation:

- It is recommended that the annual Geohazard inspection 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.

Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer

PROFESSIONAL ENGINEER ALBERTA
MARK LESTER GALLEGO
ID 127449

October 17, 2022

PROFESSIONAL ENGINEER ALBERTA
DONALD PROUDFOOT
ID 51674

October 17, 2022

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 17, 2022
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Mark Gallego, P.Eng.
Geotechnical Engineer

THURBER

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.

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.

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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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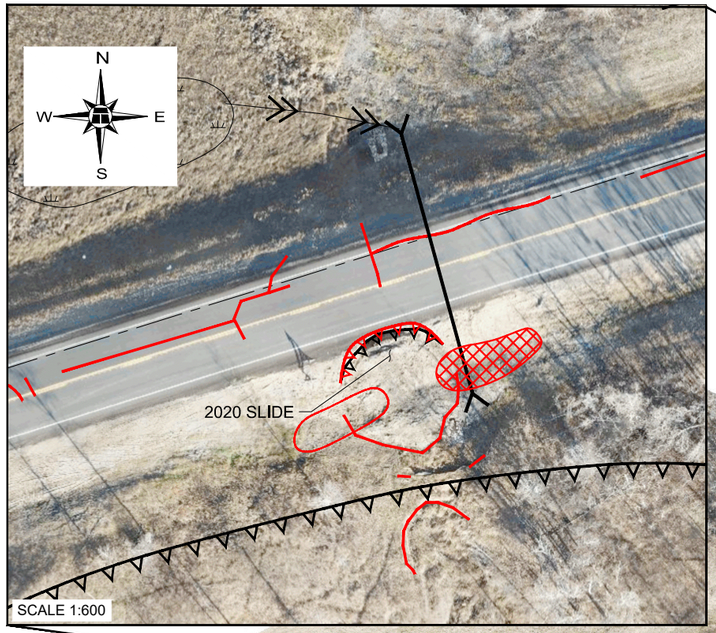
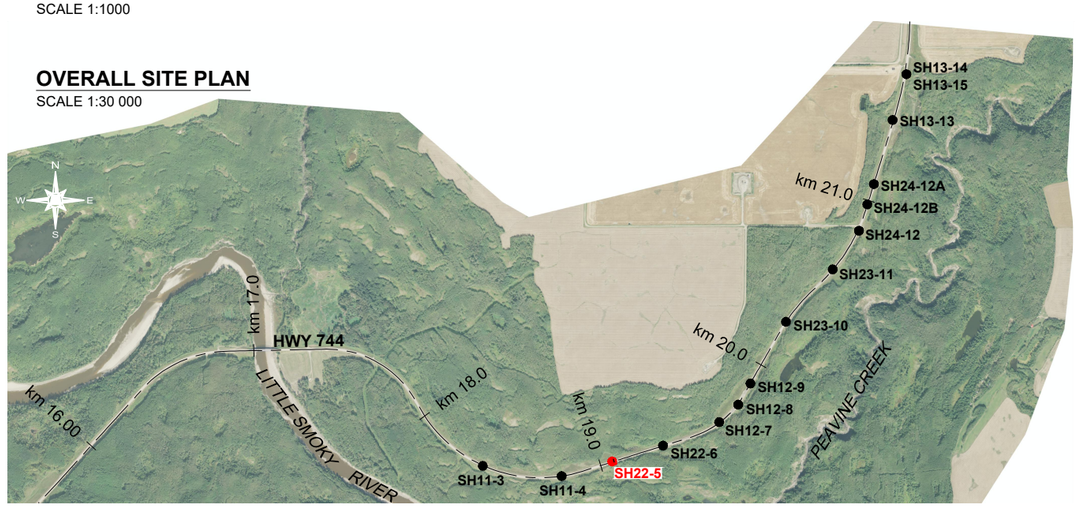


DETAILED SITE PLAN
SCALE 1:1000

OVERALL SITE PLAN
SCALE 1:30 000



LEGEND

- CULVERT
- GUARDRAIL
- CURVE SIGN
- ① DIRECTION AND NUMBER OF PHOTO

NOTES
1. FEATURE LOCATIONS ARE APPROXIMATE.
2. MAY 2022 OBSERVATIONS SHOWN IN RED.
3. CRACK AND PATCH PATTERNS RESET AS HWY 744 WAS OVERLAID IN SUMMER 2021.
4. GUARDRAIL AND CULVERT LOCATIONS TAKEN FROM MCINTOSH PERRY AS-BUILT DRONE SURVEY (JULY 2021).

0 10 20 30 40 50 60m
SCALE 1:1000

ORTHOIMAGE DERIVED FROM UAV PHOTOGRAPHS (THURBER 2021)
DIGITAL ELEVATION SURFACE GENERATED FROM UAV IMAGERY (THURBER 2021)

Alberta

PEACE REGION (SWAN HILLS)

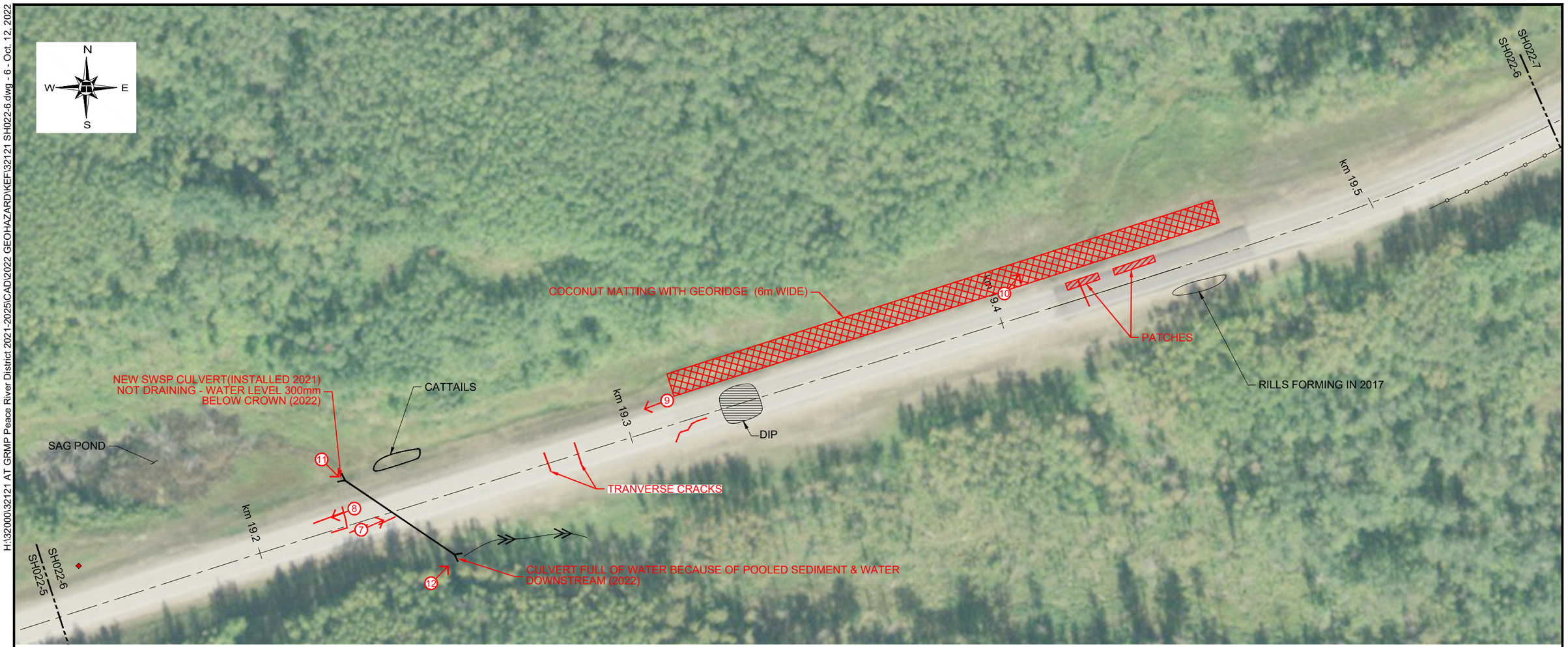
SH022-5: HWY 744:02 LITTLE SMOKY RIVER VALLEY 2022 SITE INSPECTION PLAN

DWG No. 32121-SH022-5

DRAWN BY	ML
DESIGNED BY	MG
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	OCTOBER 2022
FILE No.	32121

THURBER ENGINEERING LTD.

H:\32000\32121 AT GRMP Peace River District 2021-2025\CAD\2022 GEOHAZARD\KEF\32121 SH022-6.dwg - 6 - Oct. 12, 2022

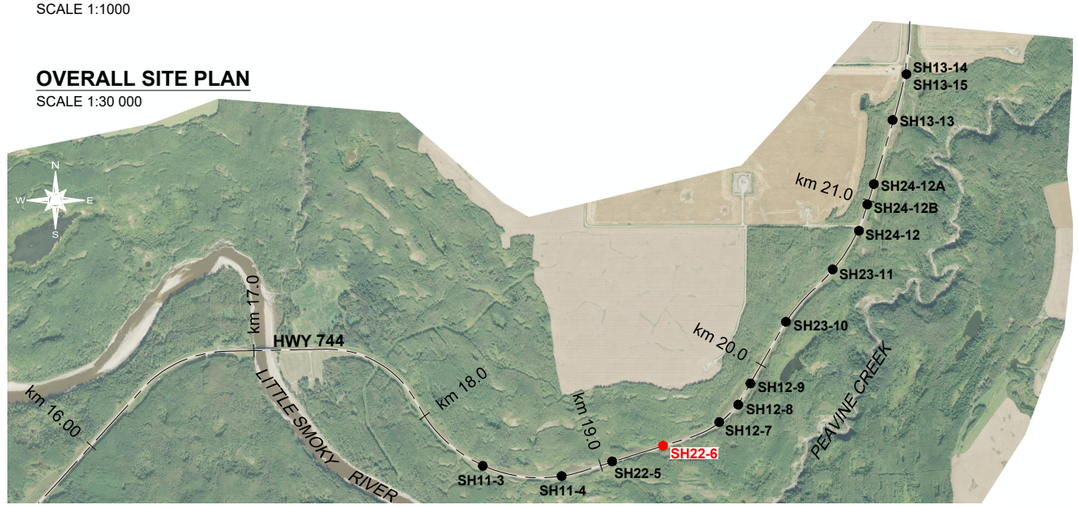


DETAILED SITE PLAN

SCALE 1:1000

OVERALL SITE PLAN

SCALE 1:30 000



LEGEND

- CULVERT
- GUARDRAIL
- RED TEMPORARY HAZARD SIGN
- ASPHALT PATCH
- DIRECTION AND NUMBER OF PHOTO

NOTES

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0 10 20 30 40 50 60m

SCALE 1:1000

SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)

Alberta

PEACE REGION (SWAN HILLS)

SH022-6: HWY 744:02 LITTLE SMOKY RIVER VALLEY 2022 SITE INSPECTION PLAN

DWG No. 32121-SH022-6

DRAWN BY	ML
DESIGNED BY	MG
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	OCTOBER 2022
FILE No.	32121

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Photo 1, Site 5 – Looking north at slump that has formed at the north edge of the deep landslide depression adjacent to the highway at about km 19.06. Culvert outlet partially blocked with debris.

Photo 2, Site 5 – Looking east at crack pattern and slide at edge of right shoulder.

Photo 3: Looking east at the fill placed over the 2020 slump during the highway overlay in 2021.

Photo 4, Site 5: Looking west at slide over the culvert outlet at km 19.07.

Photo 5, Site 5 – Looking northeast at intermittent cracking between km 19.10 to km 19.13.

Photo 6, Site 5 – Looking southwest at intermittent cracking between km 19.10 to km 19.13.

Photo 7, Site 6 – Looking northeast at cracks on the road south of the culvert.

Photo 8, Site 6 – Looking west at west end of Site #6 toward Site #5.

Photo 9, Site 6 – Looking west at cattails in gully at km 19.3.

Photo 10, Site 6 – Looking northeast at matting and GeoRidges installed in the upslope ditch.

Photo 11, Site 6 – Looking southeast at inlet of new culvert that has pooled water because it is not draining.

Photo 12, Site 6 – Looking northeast at new culvert outlet that has pooled water because it is not draining.