

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION–GRANDE PRAIRIE
2022 INSPECTION REPORT**



THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP004a	Burnt River Bridge (BF73877)	Burnt River Bridge (West Approach Slide)	49:06	10.586
GP004d (Not Visited)		Burnt River Bridge (East Approach Slide)		11.000
Legal Description		UTM Co-ordinates		
NW¼10-078-04-W6M		11U E 403300	N 6178800	

	Date	PF	CF	Total
Previous Inspection:	12-July-2021	12	7	84
Current Inspection:	18-May-2022	12	7	84
Road AADT:	1020		Year:	2021
Inspected by:	Ed Szmata, AT Max Shannon, AT Kristen Tappenden, AT		Don Proudfoot, Thurber Nicole Wilder, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs	<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items	

Primary Site Issue:	<p>See previous annual inspection and call out reports from the Geohazard binder for a complete historical perspective of this site.</p> <p><u>West Approach Slides:</u> The west approach to the Burnt (Saddle) River Bridge (BF73877) was constructed as a side hill embankment through a deep-seated landslide that is activated by meandering of the Burnt River, which is situated about 200 m downslope of the roadway. In 1991, the highway alignment through the Burnt (Saddle) River crossing at this site was shifted further upslope with the intention of locating the highway outside of the landslide area.</p> <p>Between 2010 and 2012, two smaller landslides developed near the backscarp of the deep-seated landslide and likely accounted for distress and cracking of roadway embankment and pavement.</p> <p><u>East Approach Slide:</u> This was not assessed in 2022.</p>
Dimensions:	<p><u>West Approach Slides:</u> The larger deep-seated main landslide is about 390 m in width along the backscarp and extends about 250 m downslope into the Burnt (Saddle) River.</p> <p>Little Slide No. 1 and Little Slide No. 2 were identified as separate slides during previous inspections. These two slides appear to have merged into one which is about 390 m wide and extends about 50 m downslopes of the roadway.</p> <p><u>East Approach Slide:</u> Not assessed in 2022.</p>
Maintenance:	A more recent ACP patch was placed on the pavement affected by the West Approach Sides in 2021.

Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracks were observed on the pavement affected by the West Approach Slides along profiles observed in previous years, which have reflected through the recent ACP patch placed in 2021. Steep (~1 m) drop off on south side of highway from numerous patches over the years.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	The roadway was affected by landslides at the west approach to the Burnt River Bridge (BF73877) crossing (the east side was not looked at this year). The west approach slide appeared to have worsened as the scarp crack has shown through the very recent ACP patch with a measured vertical drop of up 30 mm and it is open to 50 mm and may be a retrogression of the deep-seated slide movement.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	River erosion is ongoing at the toe of the larger deep-seated landslide on the west as the Burnt River continuously erodes the toe of the north valley slope. The scour holes in the erosion gully along the south ditch appeared a bit larger and were filled with water.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	The previously ponded water area on the north side of the Highway was wet during the 2022 inspection, the reeds were present in the backslope ditch above the backscarp of the larger landslide at the West Approach Slide area. The two scour holes within the erosion gully formed to the northwest of the site were filled with water in 2022.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation:		
SI-16	Installed about 70 m downslope of the Hwy 49:06 EBL at approximately the middle height of the Burnt River north valley slope. This SI showed no discernible movement since the fall 2021 readings. This SI was installed to a depth of 30 m; hence, it is possible that this SI was not installed deep enough to intercept the slide shear zone.	
PN-13	Installed about 10 m downslope of the Hwy 49:06 EBL had showed a water level of 0.32 m below ground surface during the fall 2021; however, the instrument would not stabilize in spring 2022 and is likely damaged.	
PN-15	Installed about 10 m upslope of the Hwy 49:06 WBL and showed an increase in water level of 0.08 m since the fall 2021 readings, the piezometer shows a water level of 4.13 m below ground surface.	

Assessment:

West Approach Slides:

The distress of the roadway embankment and pavement is due to a combination of movements of a large deep-seated landslide and two smaller landslides which appeared to have merged into one and may be a retrogression of the deep-seated landslide. The slide may have been exacerbated by seepage emanating from the backslope above the highway and a high groundwater level. This section of the highway has already been realigned once to alleviate the impacts of the landslides.

The origin of the large deep-seated landslide that effects the roadway was very likely triggered by river erosion at the toe of the north valley slope in a meander loop of the Burnt River. The long-term mitigation measures would be to either realign the highway further upslope, which may require relocating the highway on the upper plateau completely out of the river valley and implement riverbank reinforcement at the toe of the valley slope. The river re-alignment would likely require bypassing a bend and require drop structures. The actual extent and configuration of riverbank reinforcement would need to be assessed by a river hydraulics specialist.

The effects to the roadway caused by two smaller slides which have merged may be maintained in the short term with regular patching and sealing of the cracks. However, this does not eliminate the threat to the roadway from the landslide of much larger scale as these slides may be a retrogression of it and they will likely continue to show through ACP patches each year as observed.

AT suggested that a subdrain may be constructed in the north ditch and that the eastbound lane shoulder be built out so that the shoulder can be re-established and eliminate the sharp drop off.

Because the natural soil conditions through the site are poor and the size of the slide, the conventional slope stabilization measures techniques such as pile walls and toe berms might not be suitable for this site.

East Approach Slide:

No inspection was performed at this site this year.

Recommendations:

Same recommendations as provided in 2021 are still valid and repeated below.

Ballpark Cost

MAINTENANCE:

Due to continued patching of the roadway the south shoulder of the road is currently quite steep and sharp. Consideration should be given to add some compacted gravel on the south side slope to minimize the differential drop. This work may be done at the next time AT is patching the roadway.

\$15,000

SHORT TERM:

The aperture/extent of the cracks in the pavement affected by the West Approach Slides should be regularly monitored for signs of development and deterioration. Open cracks should be sealed or patched as soon as practical. A subdrain could be constructed in the north ditch, however we first recommend drilling a few test holes and installing piezometers to assess whether lowering of the water table is feasible with a subdrain below the ditch alignment.

Monitoring
\$50,000

LONG TERM:

Realign the highway out of the river valley or realign the river to allow a toe berm buttress and river channel armouring works to be installed. The extent and associated cost for each of these options would need to be further assessed.

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.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer

Nicole Wilder, M.Eng., P.Eng.
Geotechnical Engineer



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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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- 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.

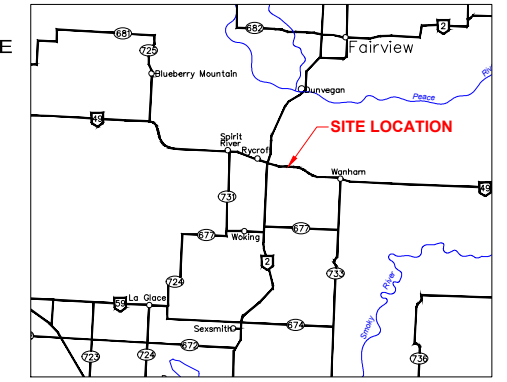
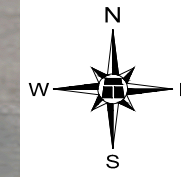
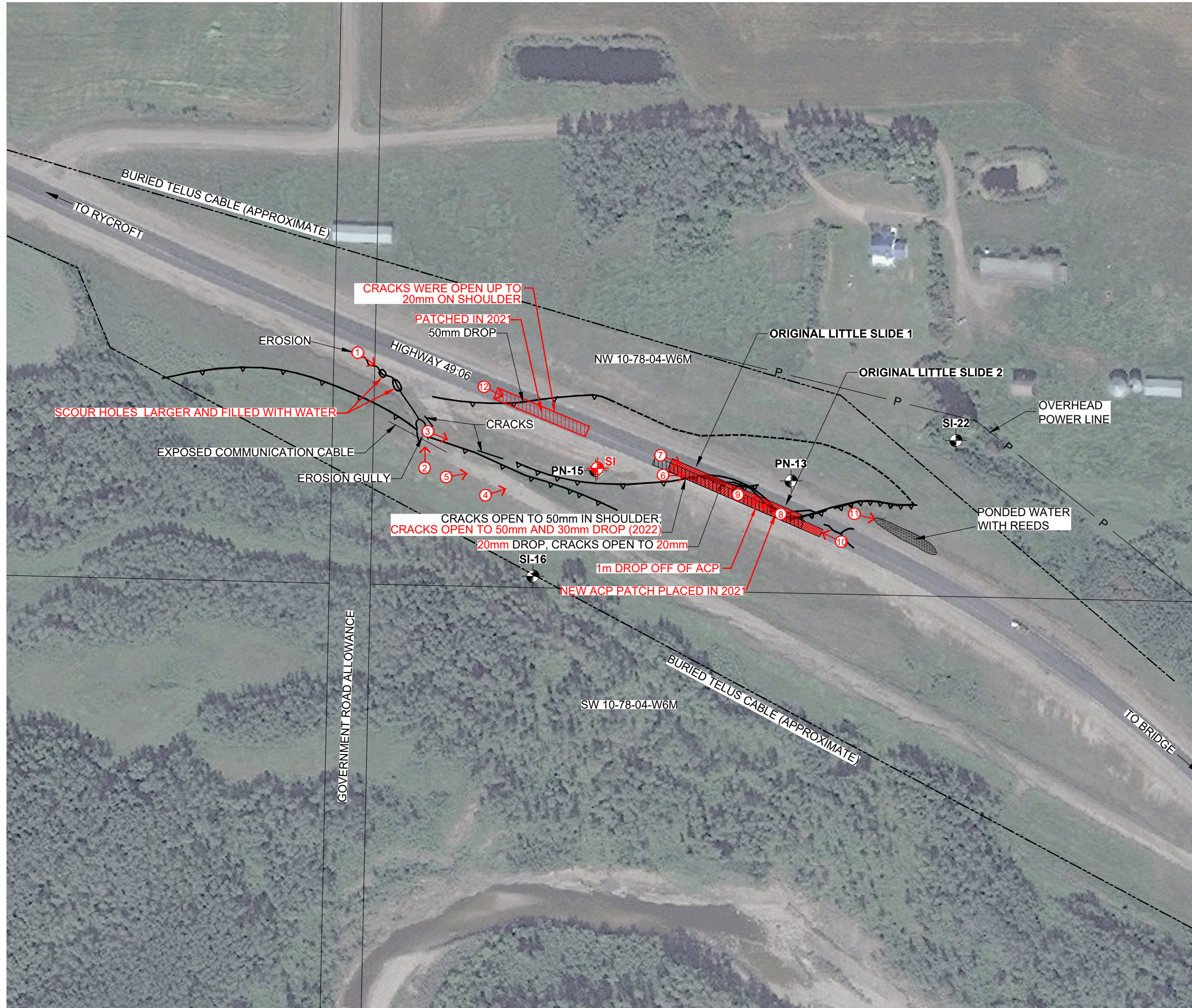
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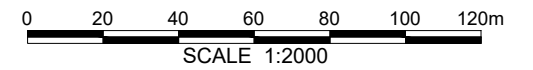
KEY PLAN
SCALE: 1:2 000 000

LEGEND

- APPROXIMATE INSTRUMENT LOCATION
- SLOPE INCLINOMETER
- PNEUMATIC PIEZOMETER
- SCARP CRACK
- POSSIBLE SCARP RETROGRESSION
- DIRECTION AND NUMBER OF PHOTO

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. MAY 18, 2022 FEATURES SHOWN IN RED



**PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
GP004A-1: HWY 49:06 BURNT RIVER BRIDGE**

2022 INSPECTION FIGURE

DWG No. 32123-GP004A-1-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:2000
DATE	OCTOBER 2022
FILE No.	32123





Photo 1.
Looking southeast at erosion gully that has formed in the south ditch which had pooling water in it in 2022.



Photo 2.
Looking north from edge of erosion gully. Note the ditch along south side of highway tails off and has been the contributor to this erosion.



Photo 3.
Looking southeast
at where scarp
crosses the old
highway alignment.



Photo 4.
Looking northeast
at southern slide
scarp which
crosses the old
highway alignment.



Photo 5.
Looking southeast
from old highway
alignment at south
slide scarp.



Photo 6.
Looking east from
the shoulder of the
EBL of Hwy 49:06
at the westmost dip
in the 2021 ACP
patch.



Photo 7.
Looking east from the shoulder of the EBL of Hwy 49:06 at the dip in the 2021 ACP patch.



Photo 8.
Looking northwest from the middle of Hwy 49:06 from the south end of the 2021 ACP patch.



Photo 9.
Looking east from near the middle of the 2021 ACP patch where crack continues into WBL.



Photo 10.
Looking northwest from the EBL of Hwy 49:06 at the south end of the site.



Photo 11.
Looking southeast
at ponded water
and reeds on north
side of highway.



Photo 12.
Looking southeast
at the northwest
end of the site at
scarp crack open
on the SBL
shoulder.