

**ALBERTA TRANSPORTATION
AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION–GRANDE PRAIRIE
2024 INSPECTION REPORT**



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:	29-May-2023	12	7	84
Current Inspection:	6-May-2024	12	7	84
Road AADT:	1060	Year:		2023
Inspected by:	Robert Senior, TEC Rocky Wang, TEC		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 downward erosion of the meandering of the Burnt River, which is situated about 200 m downslope of the roadway. The slides along the river bank caused distress to the previous road alignment and bridge which lead to the abandonment of the old alignment and bridge.</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. These two smaller scarps have now coalesced into one larger slide.</p>
Dimensions:	<p><u>West Approach Slides:</u> The landslide is about 480 m in width along the backscarp and extends about 250 m downslope into the Burnt (Saddle) River. The backscarp was traced into the backslope of the highway and further southeast of the previously observed cracks. The elevation difference between the slide cracks in the road surface and the Burnt (Saddle) River generally varies between 38 m at the northwest and 28 m towards the southeast.</p>
Maintenance:	<p>An ACP patch was placed on the pavement affected by the West Approach Sides in 2021, and the pavement was milled in 2022 and again in 2023.</p>

<p>Remediation:</p>	<p>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>During construction of the new alignment cracking of the new west highway approach fill was observed. This movement was stabilized with the use of lightweight fill (wood chips) and a tangent pile wall.</p> <p>In 2012 it is understood that there was approximately 36 m wide section of roadway that was excavated out and a section replaced with mechanically stabilized granular fill and the remaining compacted granular fill, a shear key and a subdrain beneath it. Some as-built cross-sections describing this work are attached to this report.</p>	
<p>Observations:</p>	<p>Description</p>	<p>Worsened?</p>
<p><input checked="" type="checkbox"/> Pavement Distress</p>	<p>Cracks were observed on the pavement affected by the West Approach Slides along profiles observed in previous years, which are showing through the milled pavement. There is a steep (~1.3 m) drop off on the south side of the highway from numerous patches over the years.</p>	<p><input checked="" type="checkbox"/></p>
<p><input checked="" type="checkbox"/> Slope Movement</p>	<p>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 distorted the recently milled pavement with a measured vertical drop of up to 70 mm and it is open to 100 mm. The scarp crack was also tracked about 180 m further east south of the highway during the 2023 inspection.</p>	<p><input checked="" type="checkbox"/></p>
<p><input checked="" type="checkbox"/> Erosion</p>	<p>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 in similar condition as in 2023 and were mostly dry.</p>	<p><input type="checkbox"/></p>
<p><input checked="" type="checkbox"/> Seepage</p>	<p>The previously ponded water area on the north side of the Highway was wet during the 2024 inspection and a larger area was wet from what appeared to be a spring. The two scour holes within the erosion gully formed to the northwest of the site were mostly dry. There was also some seepage observed above an existing 200 mm diameter CSP subdrain downslope of the scarp crack during the last inspection.</p>	<p><input checked="" type="checkbox"/></p>
<p><input checked="" type="checkbox"/> Bridge/Culvert Distress</p>		<p><input type="checkbox"/></p>
<p><input checked="" type="checkbox"/> Other</p>	<p>A 1.5 m diameter sinkhole was observed over an existing 800 mm diameter CSP culvert.</p>	<p><input type="checkbox"/></p>
<p>Instrumentation:</p>		
<p>SI-16</p>	<p>Installed about 70 m downslope of the Hwy 49:06 EBL to a depth of 30 m below ground surface at approximately the middle height of the Burnt River north valley slope. This SI showed no discernible movement since the last reading; however, between 2014 and 2016 there was an increase</p>	

	in movement near depths at 24 and 27 m depth which has since shown a decrease in movement in these zones. The depth of movement in SI16, has been marked by us on the attached stratigraphic cross-sections prepared by EBA.
PN-13	Installed about 10 m upslope of the Hwy 49:06 EBL had previously showed a water level of 0.32 m below ground surface during the fall 2021; however, the instrument would not stabilize since spring 2022 and is likely damaged.
PN-15	Installed about 10 m downslope of the Hwy 49:06 WBL and showed a decrease in water level of 0.05 m since the fall 2023 readings, the piezometer shows a water level of 4.27 m below ground surface.

Assessment:

The distress of the roadway embankment and pavement is due to the retrogression of the original deep-seated landslide. 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. This road alignment was realigned in 1991 and then had a small 36 m wide section excavated and replaced in 2012; however, the deep-seated slide has now retrogressed and is affecting the newer (1991) re-alignment and 2012 remediation. The slide is likely being exacerbated by the continual river erosion, 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 original landslides; however, this alignment was not re-aligned far enough away from the river.

Several options for remediating the landslide had previously been provided by EBA and Terrace Engineering such as diverting the river further south and building an armoured toe berm, constructing a pile wall at the toe, diverting the river and connecting the shank (neck) of the Ox-bow and further realignment of the highway upslope. The latter two options were not considered feasible due to the steep bed grade of the larger river realignment that would require steep drop structures and weirs along with difficulties getting DFO approvals and another realignment wasn't considered reliable. In 2005 the pile wall option was considered as a superior option to diverting the river and constructing a toe berm; however, to our knowledge this pile wall was not constructed and no additional remediation has taken place since 2012.

Recommendations:

Ballpark Cost

MAINTENANCE:

Due to continued patching/milling 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 TEC is patching the roadway. A guardrail should also be installed along the eastbound lane shoulder

\$50,000

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 to lower the groundwater level and potentially slow down slide movements.

\$200,000

LONG TERM:

Realign the highway further north/uphill outside the current landslide limits or realign the river (the smaller realignment mention by EBA) to allow a toe berm buttress and river channel armoured works to be installed. The extent and associated cost for each of these options would need to be further assessed. Due to the size of the landslide a pile wall option would likely not be cost effective for this site.

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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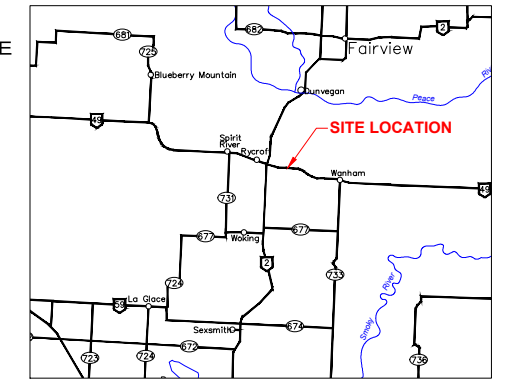
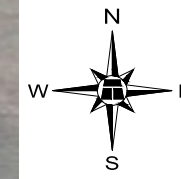
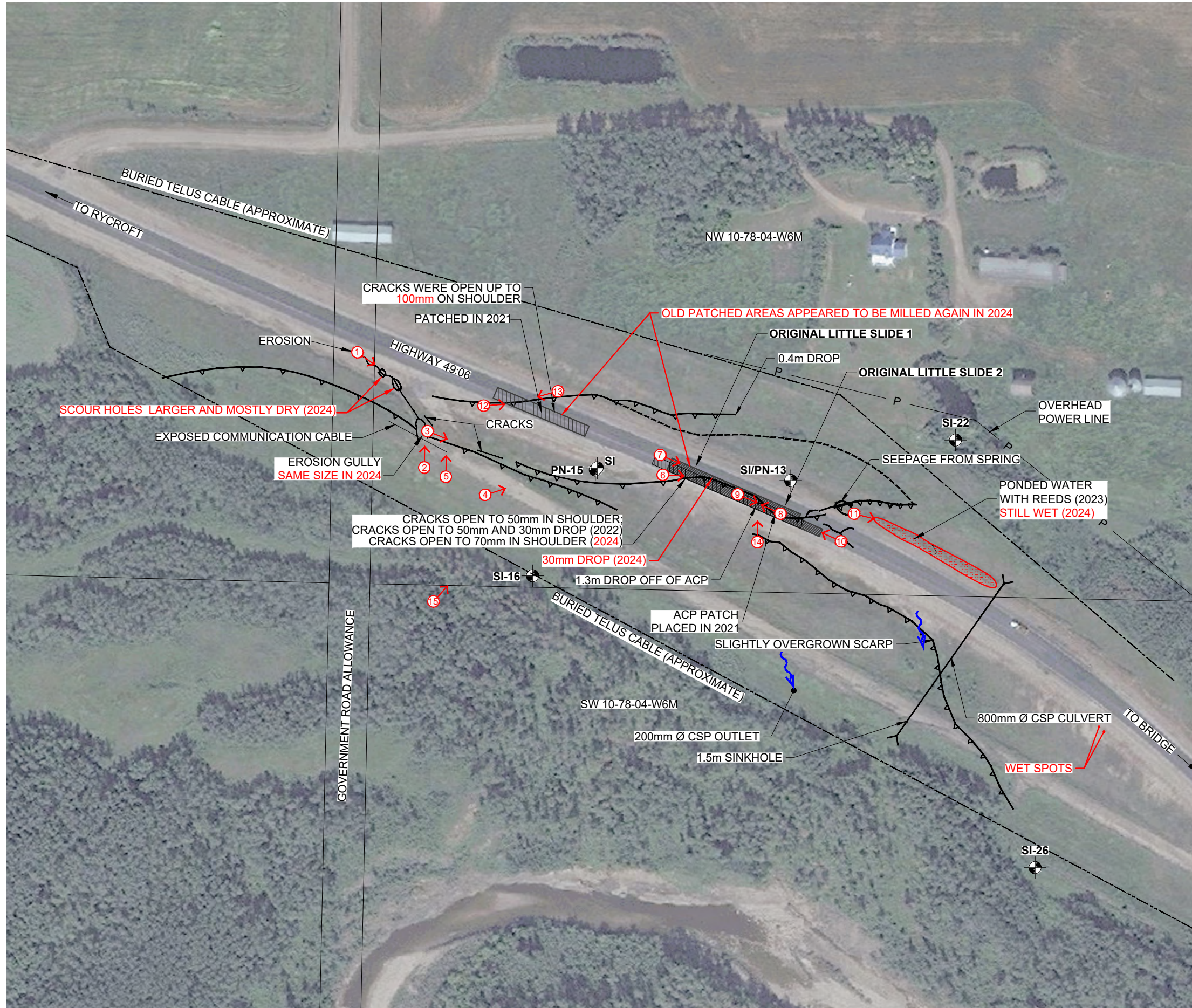
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- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has 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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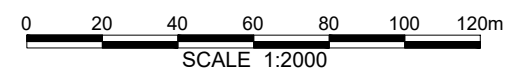
KEY PLAN
SCALE: 1:2 000 000


LEGEND

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

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. MAY 6, 2024 FEATURES SHOWN IN RED






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

2024 INSPECTION FIGURE

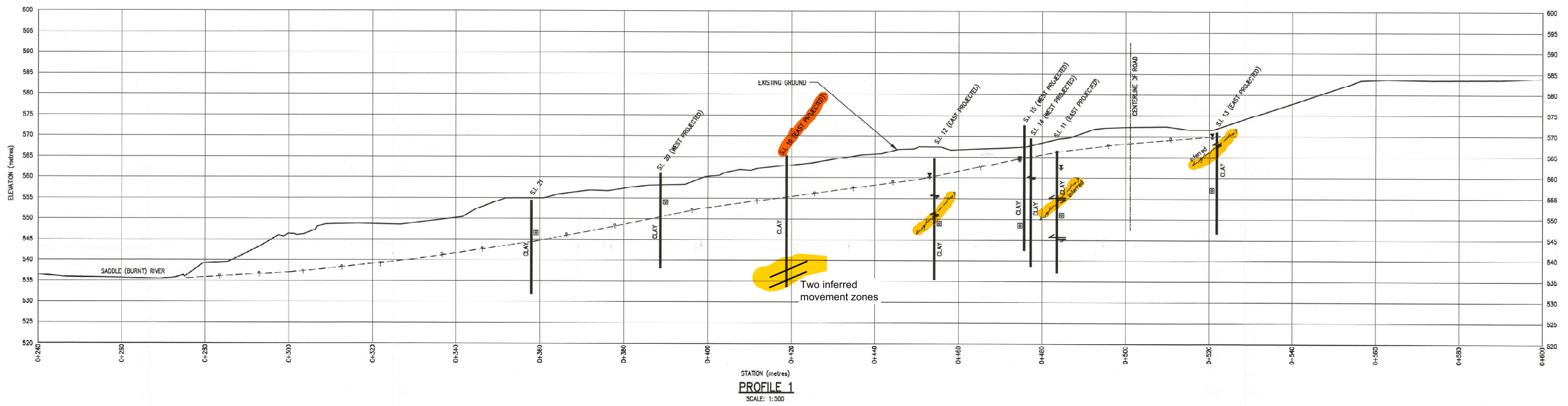
DWG No. 32123-GP004A-1-1

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DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:2000
DATE	AUGUST 2024
FILE No.	32123



SOUTH

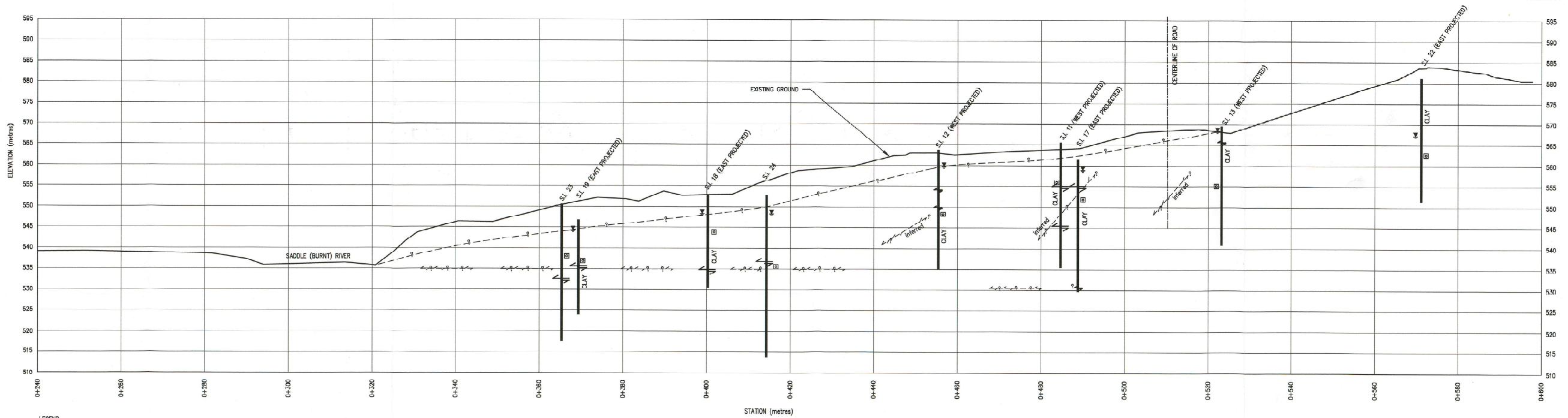
NORTH



PROFILE 1
SCALE: 1:500

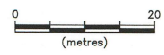
SOUTH

NORTH



PROFILE 2
SCALE: 1:500

LEGEND
 ▽ - WATER LEVEL
 ⊞ - PIEZOMETER INSTALLED



DWG. NO.	DESCRIPTION	DATE	NO.	DESCRIPTION	DATE	APPR.
	REFERENCE DRAWINGS			REVISIONS		

EBA Engineering Consultants Ltd.

DATE: 28/08/01
 DESIGNED BY: KL
 DRAWN BY: DRG
 SCALE: 1:2000
 JOB No: 0104-00-22537.003
 ACAD FILENAME: 22537d08a.dwg

RYCROFT - HIGHWAY 49 PROJECT
 SADDLE (BURNT) RIVER
 SURVEYED PROFILE LINES
 AND GENERATED CONTOUR PLAN
 PROFILE LINES 1&2
 DRAWING NO. 2

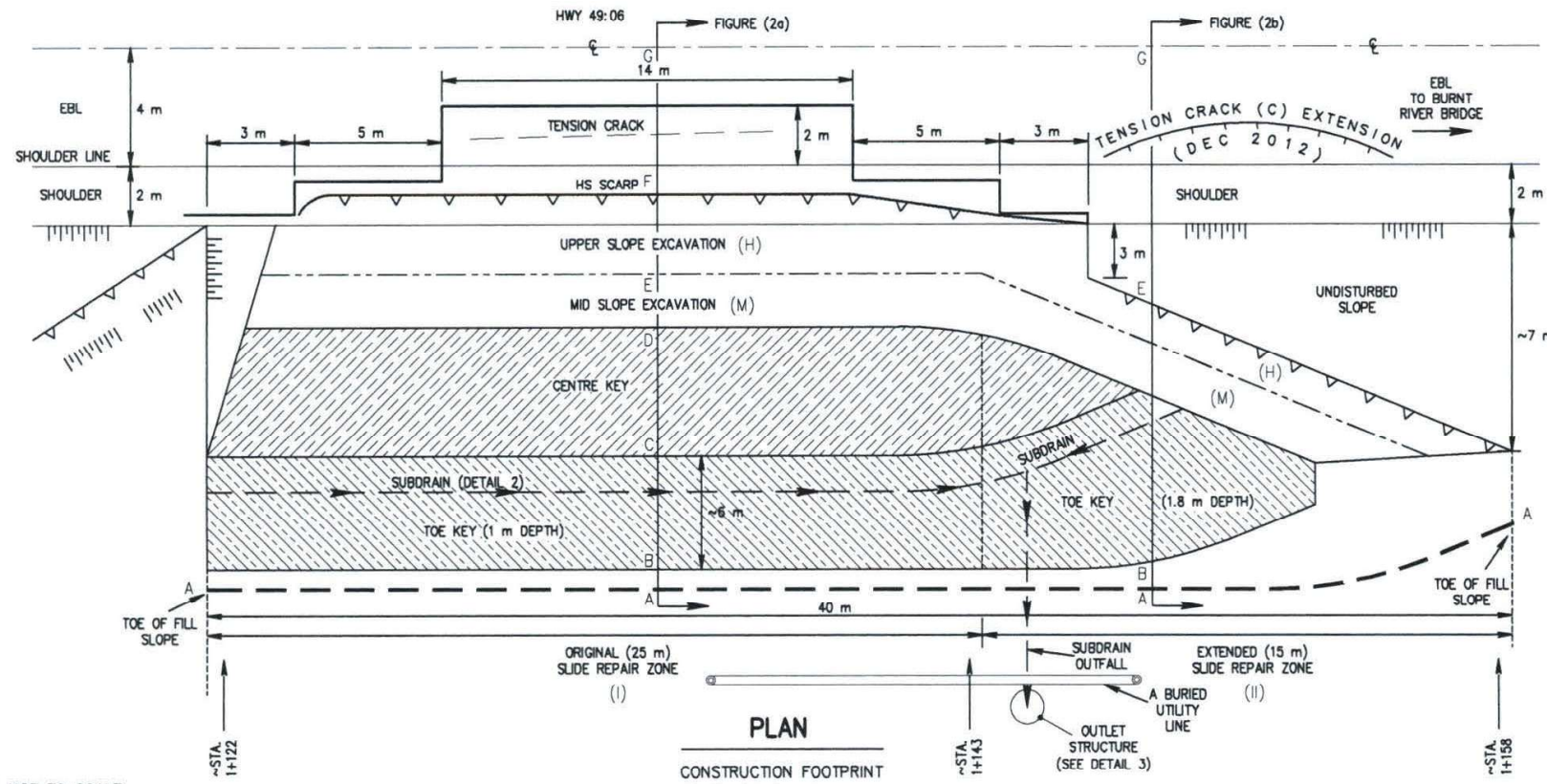
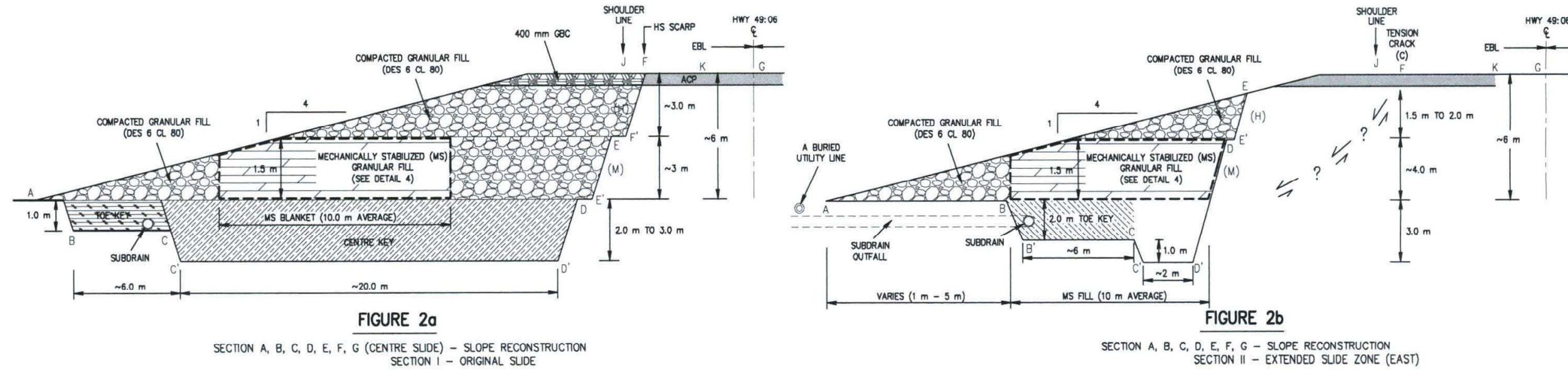


Figure 2
As-Built Plan and Cross-Section (Abridged)
for Slope Reconstruction at Little Slide at
West Approach (GP-4a) to Burnt River Bridge



Photo 1. Looking southeast at erosion gully that had formed in the south ditch which had pooling water in it in 2022 but the scour holes were mainly dry with slight moisture in 2024. Photo credit: Don Proudfoot.



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 credit: Nicole Wilder.



Photo 3. Looking southeast at where scarp crosses the old highway alignment. Photo credit: Don Proudfoot.



Photo 4. Looking northeast at southern slide scarp which crosses the old highway alignment. Photo credit: Nicole Wilder.



Photo 5. Looking southeast from old highway alignment at south slide scarp. Photo Credit: Nicole Wilder.



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



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



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



**Photo 9. Looking east from near the middle of the 2021 ACP patch where crack continues into WBL.
Photo Credit: Nicole Wilder.**



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



Photo 11. Looking southeast at ponded water and reeds on north side of highway. Photo Credit: Don Proudfoot.



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



Photo 13. Looking southwest at the northwest end of the site at the scarp crack. Photo Credit: Don Proudfoot.



Photo 14. Looking north at the thick accumulation of asphalt patches in the landslide area . Photo Credit: Nicole Wilder.