SOUTHERN REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **S041 East Coulee Slide**	HIGHWAY & KM: 564:10, 32.353	PREVIOUS INSPECTION DATE: May 31, 2022	INSPECTION DATE: **June 18, 2024**
LEGAL DESCRIPTION: 04-21-27-18 W4M	NAD 83COORDINATES: UTM 12 Northing 5686022 Easting 396402	RISK ASSESSMENT: Slide: PF: 8 CF: 3 TOTAL: 24 Erosion: PF: 11 CF: 4 TOTAL: 44	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 60 (south) (Reference No. 113210)		CONTRACT MAINTENANCE AREA (CMA): 521	

SUMMARY OF SITE INSTRUMENTATION:	INSPECTED BY:
There are no instruments at the S041 site. LAST READING DATE: N/A	Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rocky Wang (TEC)

PRIMARY SITE ISSUE: A natural slope failure on the west side (southbound lane) of Hwy 564 that was triggered by highway widening (i.e., cut and fill placement) in 1979. Sinkholes have developed near/above the culvert underlying the highway west of the slide and slope drain.

APPROXIMATE DIMENSIONS: The slide is approximately 120 m wide at the crest and 250 m wide near the mid-slope. Below where the slope was previously repaired, the slope is approximately 50 m high sloped at 3H:1V. The sinkhole near the culvert in the highway embankment is approximately 3 m to 4 m in diameter and 3 m to 4 m deep. The sinkhole west of the slope drain is approximately 3 m to 4 m wide, 2 m to 3 m deep, and 10 m to 15 m long.

DATE OF ANY REMEDIAL ACTION: 2008 – 800 soils nails were launched, and a geosynthetic reinforced toe berm was constructed to support the highway; 2021 – the highway was realigned to the south into the upslope ditch.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X	Gravel appears to be added to road surface and periodically graded.		X
Slope Movement	X		Guardrail was settling before being repaired in 2021. Slide head scarp is outflanking the existing soil nail wall to the northeast.		X
Erosion	X		Erosion caused by surface water runoff and leakage through culvert joints. Sinkholes were observed near/above the culvert underlying the highway west of the slide.	X	
Seepage		X	N/A – none observed		X
Culvert Distress	X		Culvert underlying the highway was exposed and separated due to ongoing erosion.	X	

COMMENTS

Slide:

- The slide appears to be a translational slide with some rotation that is sliding on a weak layer (depth of weak layer is unknown due to lack of instrumentation data, but a depth of between 6 m and 17 m below ground surface has been estimated based on visual observations). The downslope crest of the slide tips back towards the highway. Tension cracks observed during 2017 inspection appear to have been filled. Since the 2017 inspection, the slide is starting to outflank the existing soil nail wall to the northeast.

- In 2021, the guardrail was raised and shifted upslope approximately 3 m as part of realigning the highway/road narrowing. The highway surface was shifted/realigned south into the south (westbound) ditch and a "Road Narrows – 35 km/hr" sign was installed beside the north (eastbound) lane at the east end of the site (near the top of the hill).
- The area downslope of the guardrail, above the previous slope repairs and along where the highway was shifted in 2021, is poorly vegetated (Photo 3).
- During the inspection, ground cracks up to approximately 50 mm wide was observed upslope of the geosynthetic reinforced soil wall (Photo 4). The geosynthetic wall appears to have deflected between the 2022 and 2024 inspections (Photo 5).
- Drainage at the site is poor. A shallow ditch exists on the south side of the highway but is periodically filled with gravel during grading. The old geocell in the ditch has also been damaged and buried during grading operations. There was minor erosion observed in the south (westbound) ditch during the inspection (Photo 6).

Erosion:

- A sinkhole above the CSP culvert underlying the highway developed between the 2022 and 2024 inspections (Photo 7). The sinkhole is approximately 4 m in diameter and up to 2 m to 3 m deep. At the base of the sinkhole, the CSP culvert has separated (Photo 8).
- Flow from surface runoff and from the CSP culvert has resulted in piping through the highway embankment, and a second sinkhole has formed approximately 10 m to 15 m northwest of the sinkhole above the CSP culvert (Photo 7). This sinkhole is approximately 3 m to 4 m wide, 2 m to 3 m deep, and 15 m to 20 m long.
- Along the half pipe CSP slope drain (downslope of the CSP culvert) there is evidence of ongoing erosion, likely from surface water flow from the highway embankment and leakage from the slope drain (Photo 2).
- At the slope drain outlet, there is a large erosion gully (Photo 2). The erosion gully was observed from a distance during the 2024 inspection and no field measurements were taken. The erosion gully is not yet impacting the highway embankment and is outside of TEC's right-of-way.

Maintenance/Repair/Monitoring Recommendations:

- The separated culvert underlying the highway should be repaired. The hanging culvert should be removed, and a seamless HDPE pipe should sleeve the existing CSP culvert (the anulus between the new and existing culvert should be backfilled with grout). The new culvert should be backfilled with compacted non-dispersive material (e.g., well graded granular fill).
    - During the repair work, the sinkhole west of the slope drain should be backfilled with compacted non-dispersive material (e.g., well graded granular fill).
    - The slope drain should be replaced with a seamless HDPE slope drain and an energy dissipation structure built at the slope drain outlet.
    - KCB can prepare and issue a proposal for the hydrotechnical assessment and design of the replacement culvert, slope drain, and energy dissipation structure (including design figures, quantities, and c-estimate). KCB believes this repair should be completed by TEC's HMC and can prepare a Request for Quotation (RFQ) to provide to the HMC.
- The slide site was repaired in 2021. The site should continue to be monitored and inspected once per contract cycle as part of the Southern Region GRMP Section B Inspections.
    - The highway should be regularly graded by TEC's HMC to direct flows towards the south (westbound) ditch and off the slide.
- The site should be regularly inspected by TEC's MCI. The vegetation cover is poor downslope of the guardrail, where the highway was shifted in 2021. The area should be seeded with a seed mix suitable for the Alberta Badlands.

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(ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.

(iii) The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.

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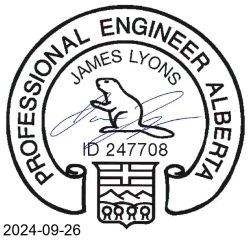
(v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



2024-09-26

James Lyons, P.Eng.
Civil Engineer

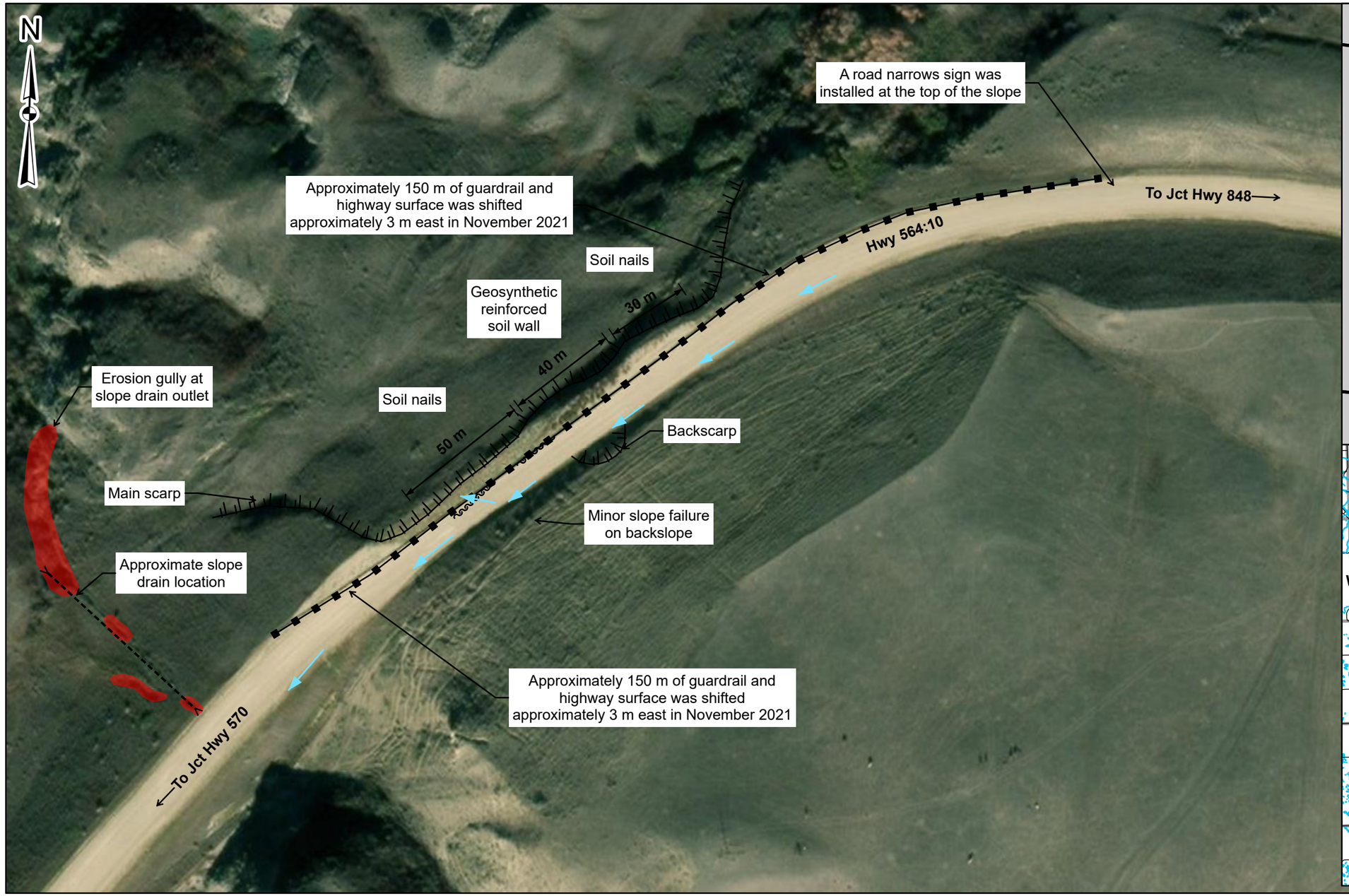
PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.

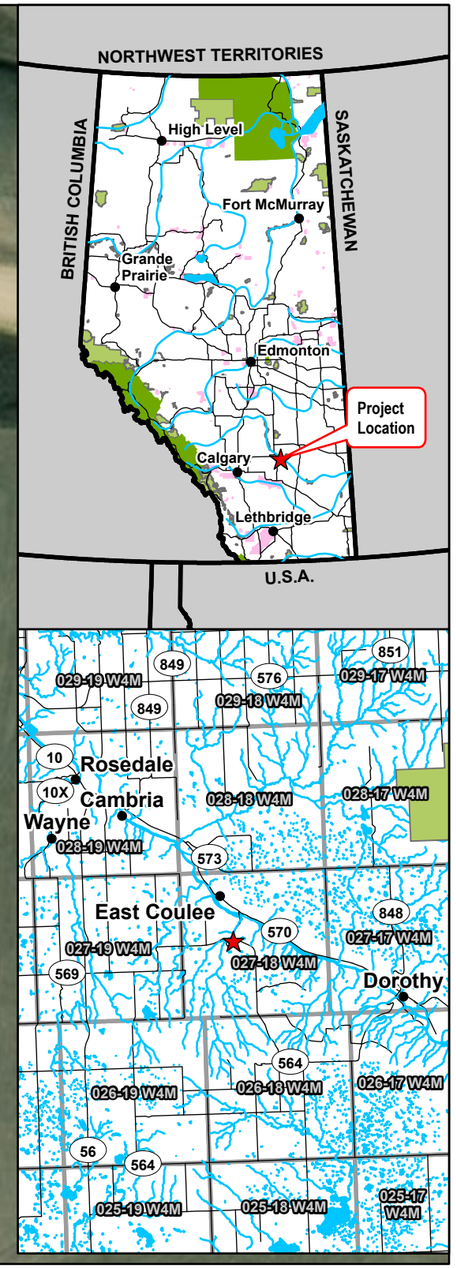
RM SIGNATURE: Pamela Jones

RM APEGA ID #: 187607

DATE: 26 Sep. 2024

PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)





Legend

- Flow Direction
- Drain
- Crack
- Scarp
- Guardrail
- Dimension
- Erosion

0 100 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
S041 - East Coulee Slide
Hwy 564:10, km 32.353

SCALE	PROJECT No.	FIG No.
1:1,500	A05116A03	1

File: Z:\AE\DM\A05116A02 ABT Central Region GRMP400 Drawings\GIS\02_ProFiles\2024\Section B\AT_CentralRegion_SectionB_240627\AT_CentralRegion_SectionB_240627.aprx Date: Time: Creator: : AHarrison

Inspection Photographs

Photo 1 **Aerial photo of the S041 East Coulee Slide site indicating the length of highway where there has been previous repairs (soil nails and geosynthetic reinforced soil wall). The westbound lane was shifted upslope in 2021. Photo taken June 18, 2024, facing southeast.**

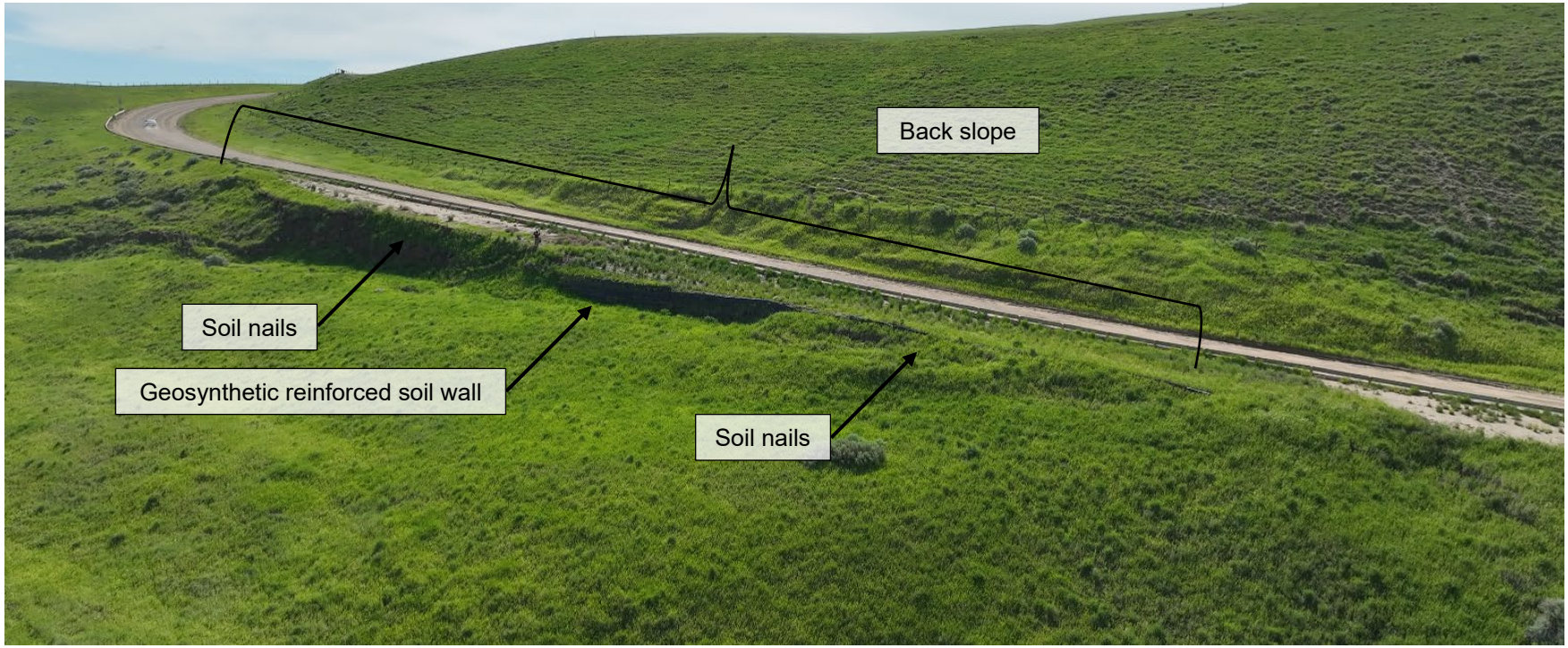


Photo 2 **Aerial image of the west extent of the S041 East Coulee Slide site, indicating the west soil nail repair, slope drain west of the slide site, as well as new erosion features near/along the slope drain. Photo taken June 18, 2024, facing south.**

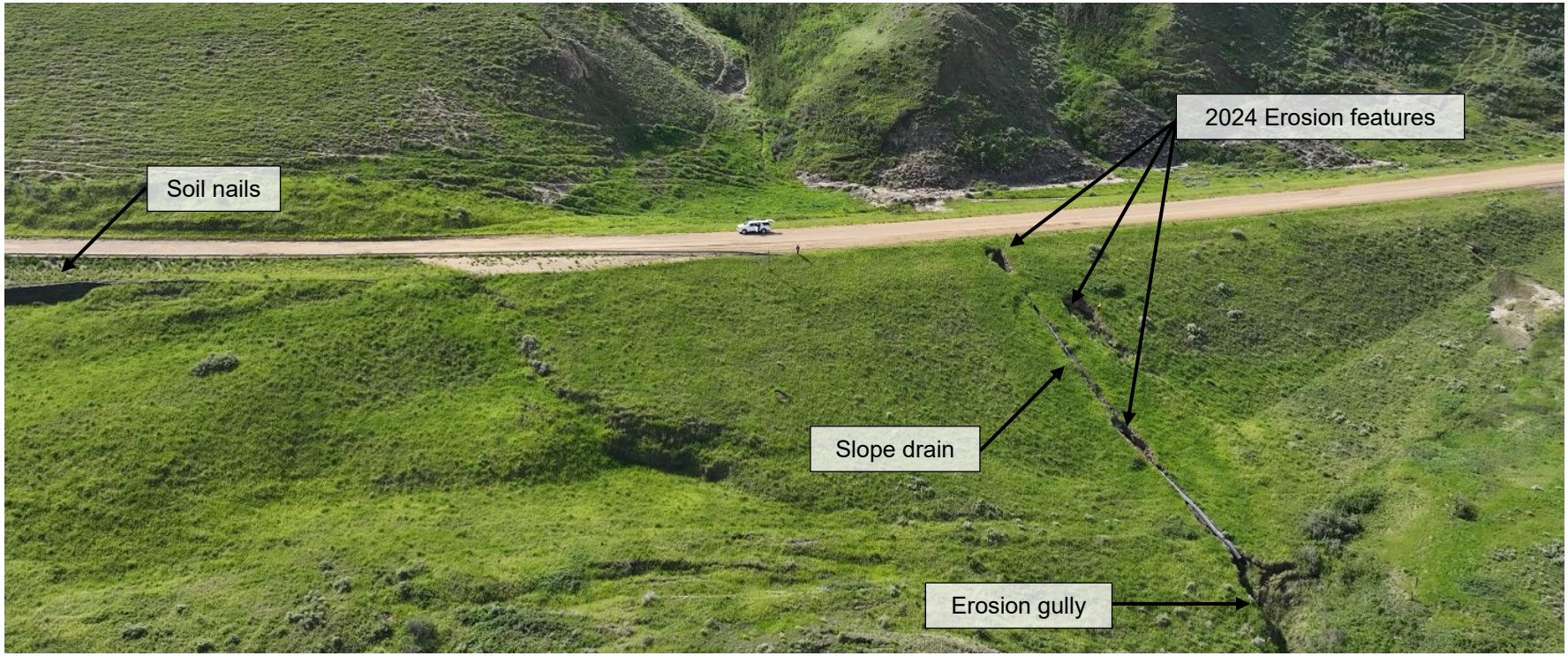


Photo 3 **Crest along the eastern portion of the slide at the location of the previous soil nail repair. Slope is poorly vegetated downslope of the guardrail (upslope of the soil nails) after the highway was shifted in 2021. Photo taken June 18, 2024, facing east.**

Photo 4 **Ground crack up to approximately 50 mm wide located upslope of the geosynthetically reinforced soil wall. Photo taken June 18, 2024.**

Photo 5 **The slope along the geosynthetically reinforced soil wall appears to have deflected between the 2022 and 2024 inspections. Photo taken June 18, 2024, facing east.**

Photo 6 **The highway surface is in good condition. There is minor erosion along the south (eastbound) ditch. Photo taken June 18, 2024, facing west.**

Photo 7 **Sinkholes located above and west of the culvert underlying H564:10 and slope drain. The sinkhole to the west is significantly larger and more developed than during the 2022 inspection while the sinkhole above the culvert was first observed in 2024. Photo taken June 18, 2024, facing south.**

Photo 8 **Sinkhole above the culvert and upslope of the slope drain. Sinkhole is approximately 4 m in diameter and up to 2 m to 3 m deep. Lower sinkhole location indicated by black arrow. Photo taken June 18, 2024, facing north.**