

SITE NUMBER AND NAME: S039-1 Brocket Slides	HIGHWAY & KM: 3:06, 12.952	PREVIOUS INSPECTION DATE: May 29, 2024	INSPECTION DATE: May 28, 2025
LEGAL DESCRIPTION: 09/10-07-007-28 W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5491976 298990	RISK ASSESSMENT: PF: 13 CF: 3 TOTAL: 39	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 5240 (west) & 5260 (east) (Reference No. 84050)		CONTRACTOR MAINTENANCE AREA (CMA): 522	

SUMMARY OF SITE INSTRUMENTATION: 2017 and 2023 – Four slope inclinometers (SIs) and two vibrating wire piezometers (VWPs) are operable at the site. LAST READING DATE: May 23, 2025	INSPECTED BY: Chris Gräpel (KCB) Jorge Rodriguez (KCB) Alex Frotten (TEC) Rishi Adhikari (TEC)
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PRIMARY SITE ISSUE: Landslide in the north highway embankment/valley slope likely attributed to weak fine-grained soils and elevated groundwater table.
APPROXIMATE DIMENSIONS: The landslide is approximately 45 m wide at edge of westbound lane (undermining edge of pavement). The approximate height of the river valley slope is 50 m with an average slope of 2.0H:1.0V. The overall width of the unstable zone is approximately 135 m. The repaired section has an approximate height of 13 m with a slope of 1.5H:1V to the midslope bench.
DATE OF ANY REMEDIAL ACTION: 2023 – the slope above the bench was graded, and 215 soil nails 16 m long were installed. Over the soil nail section of the repair, a steel grid wire mesh was installed, and the slope surface was seeded.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Longitudinal pavement cracks in the north (westbound) lane along the crest of the slope.		X
Slope Movement	X		Ground cracks were observed at the crest of the slide, in the slide mass, and along the west flank.		X
Erosion	X		Water runoff from the highway has created rill erosion on the poorly vegetated slope. Increased rill erosion was observed during the 2025 inspection.	X	
Seepage	X		No seepage was observed during the 2025 inspection; however, it has been previously observed in the east slide mass near the crest of the slope.		X
Culvert Distress		X	N/A – none observed during the 2025 inspection,		X

COMMENTS

General:

- In 2016, a site investigation program that included the installation of geotechnical instruments was completed. Three SIs and four VWP's were installed to monitor movement and groundwater conditions, respectively, and support design work. The findings of the investigation were included in KCB's Options Assessment Report issued to TEC on July 21, 2017.
- On September 22, 2021, KCB released a design report to evaluate mitigation options, summarize our background review, and present the results of our site investigation, instrumentation data, laboratory testing, and design-build memorandum. The report also outlined our site characterization and options assessment, which included three mitigation options. KCB then prepared a tender package, awarded to Greenfield's Construction Ltd. on March 25, 2022.
- Construction took place between October 20, 2022, and June 15, 2023. The repair scope typically involved grading the slope, installing 215 16-m-long soil nails, applying a steel grid wire mesh facing, and hydroseeding. In June 2023, a tension crack was noted near the slope's crest at the east end of the repaired area, and relatively large rills and small gullies were forming on the surface due to surface water runoff from the highway. Greenfield was asked to mobilize and backfill the tension crack with fine-grained material, as well as construct a small berm at the crest of the slope. Greenfield completed the work from October 5 to 18, 2023.

Post-Construction Notes:

- During the 2024 site inspections, we observed additional slope movement in most of the repair area. The soil nails were seen to be taking the load from slope movement, but in several locations, the material on the slope was moving around the anchor plates. The material on the slope isn't behaving as expected in the repair design, which assumed the material was cohesive with a high plastic index based on the site investigation. More concerning is that the soil was deforming around and above the anchor plates at the slope surface, indicating it's acting like a plastic rather than in a semi-solid to solid state.
- Furthermore, the installed surface mesh did not meet the tender's requirements but was accepted after contract award via a request for information (RFI). The mesh lacked an erosion control element, allowing material to move through and not be held in place. The lack of erosion protection in the mesh has allowed erosion and sloughing to occur from seepage water flow and flow over the crest of the repaired slope, resulting in limited vegetation growth. Rilling on the slope surface has resulted in a limited number of anchor plates having soil removed from beneath them, which will impact the ability of the soil nails to resist destabilizing forces within the slope.

S039-1:

- The longitudinal pavement cracking along the crest of the slope does not appear to have changed between the 2024 and 2025 inspections (Photo 1). The cracking is along approximately a 20-m length of the highway above the slope.
- The guardrail along the crest of the slope appears to be in good condition, and no obvious deflection was observed during the 2025 inspection (Photos 1 and 2).
- The granular fill berm installed at the crest of the slope in October 2023, to direct surface water flow from the highway further downslope (east), is eroding and is almost gone (Photo 2). It appears the gravel berm was constructed on top of straw wattles, which have now settled and shifted downslope. During the 2025 inspection, there was no evidence of recent erosion. KCB suspects the berm may be completely washed out after a large rainfall event.
- In the upper third of the slope, the vegetative cover on the slope has improved between the 2024 and 2025 inspections (Photos 3 and 5). However, the vegetation appears to be mostly from weeds and the seed spread during construction appears to have not rooted. In the lower half of the repaired slope, there is little to no vegetative cover (Photos 4 and 5). The bench downslope of the repair has good vegetative

cover.

- There was evidence of salt coating the slope, especially near the toe, indicating the presence of saline soils, although there is no conclusive evidence for the presence of dispersive soils at the site; salts could affect vegetation growth. Other factors impacting vegetation growth could be related to the steepness of the slopes and changes to groundwater conditions. Nevertheless, we note that the areas outside of the slope before repair were reasonably well vegetated.
- During the 2025 inspection, the slope appeared drier than previous inspections, despite recent rainfall at the site.
- Ground cracks and rill erosion observed during previous inspections appear to have been backfilled by material being eroded from the upper portion of the slope (Photo 5 and 6).
- The bulging around the anchor plates does not appear to have worsened between the 2024 and 2025 inspections (Photo 5 and 6). Some of the anchor plates are almost completely buried by sediment being transported from further up the slope.
- Overall, the slope is performing better than expected, especially given wet weather preceding the inspection.

Maintenance/Repair/Monitoring Recommendations:

- The site should be regularly inspected by TEC's Maintenance Contract Inspector (MCI).
- The site should be inspected annually as part of the Southern Region GRMP Section B inspections.
- The site should be read twice per year (spring and fall) as part of the Southern Region GRMP Section C readings.
- In July 2024, KCB was authorized by TEC to assess slope stability repairs due to construction issues. KCB evaluated options, presenting results to TEC on April 14, 2025, with the report submitted on April 25, 2025. TEC chose to construct a gabion basket retaining wall 2 m from the slope toe, flattening the slope with geogrid-reinforced granular fill (Des. 6 Cl. 25), and armouring with Class 1M riprap. KCB issued a Request for Quotation (RFQ) and Environmental Risk Assessment (ERA) to TEC on July 22 and August 12, 2025.
- The repair outline in the 2025 RFQ included cutting off excess lengths of the soil nails, topsoil stripping, construct a 2.5-m-high 84-m-long gabion basket retaining wall along the toe of the repaired slope, backfilling rills and voids on the slope surface and flattening the slope from 1.5H:1V to 2H:1V with geogrid-reinforced granular fill (Des. 2 Cl. 25) and armouring the slope with Class 1M riprap. The repair should tie into the existing slopes east and west of the site. Non-woven geotextile should be installed behind and below the retaining wall and between the Class 1M riprap and geogrid-reinforced slope.

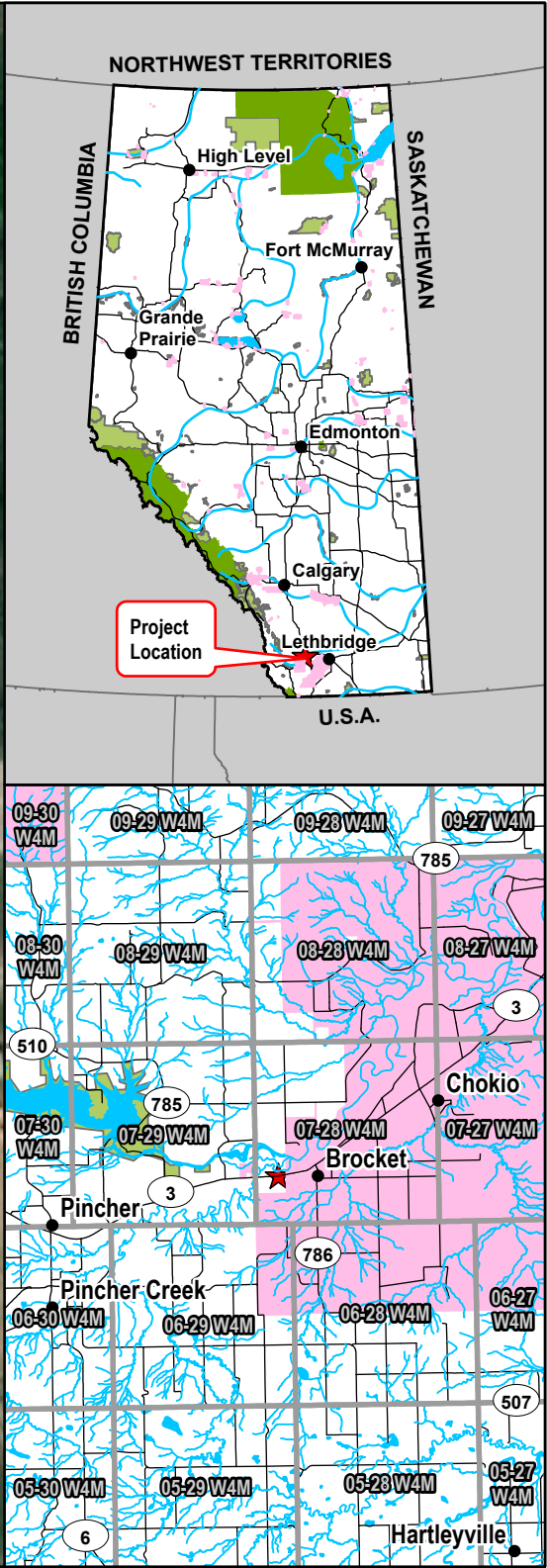
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Jorge Rodriguez, Ph.D., M.Sc., P.Eng.
Geotechnical Engineer



Legend

- Slope Inclinator (SI)
- ⊗ Vibrating Wire Piezometer (VW)
- Flow Direction
- ⊥ Scarp
- ⊗ Soil Nail Repair Area

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: MAXAR 2025
4. STRIKETHROUGH INDICATES INSTRUMENT IS INACTIVE

CLIENT

Alberta

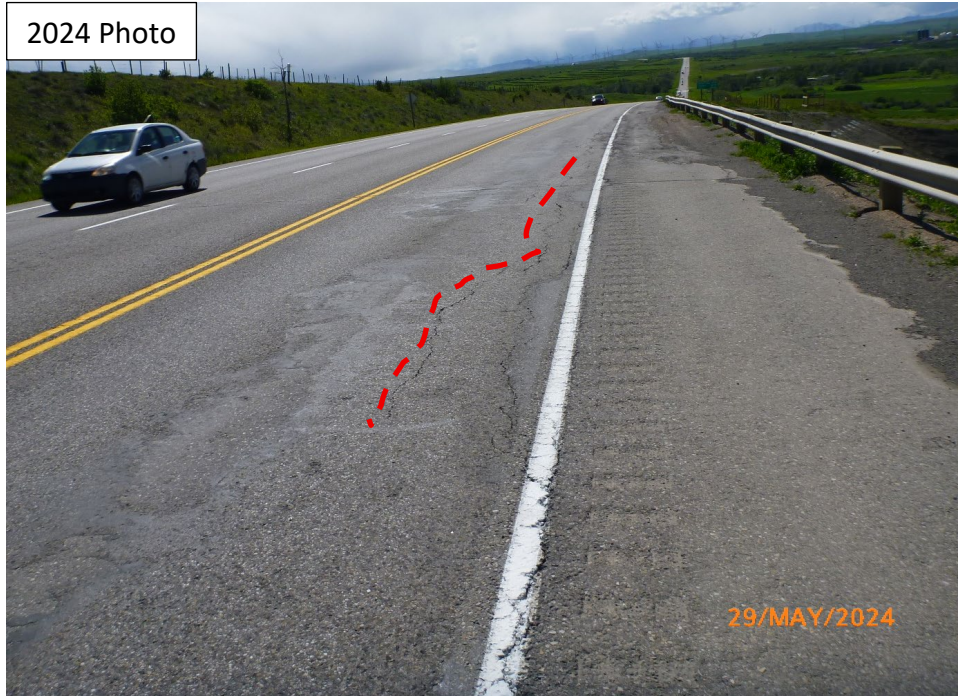
Klohn Crippen Berger

PROJECT SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan S039 - Brockton Slides Hwy 3.06, km 12.952		
SCALE 1:1,250	PROJECT No. A05116A03	FIG No. 1

Inspection Photographs

Photo 1 Comparison of pavement distress (cracking and settlement) along the crest of the slope between the 2024 and 2025 inspections (red dashed line). Distress appears similar between the consecutive inspections. Photos taken May 29, 2024, facing west, and May 28, 2025, facing east.

2024 Photo



2025 Photo

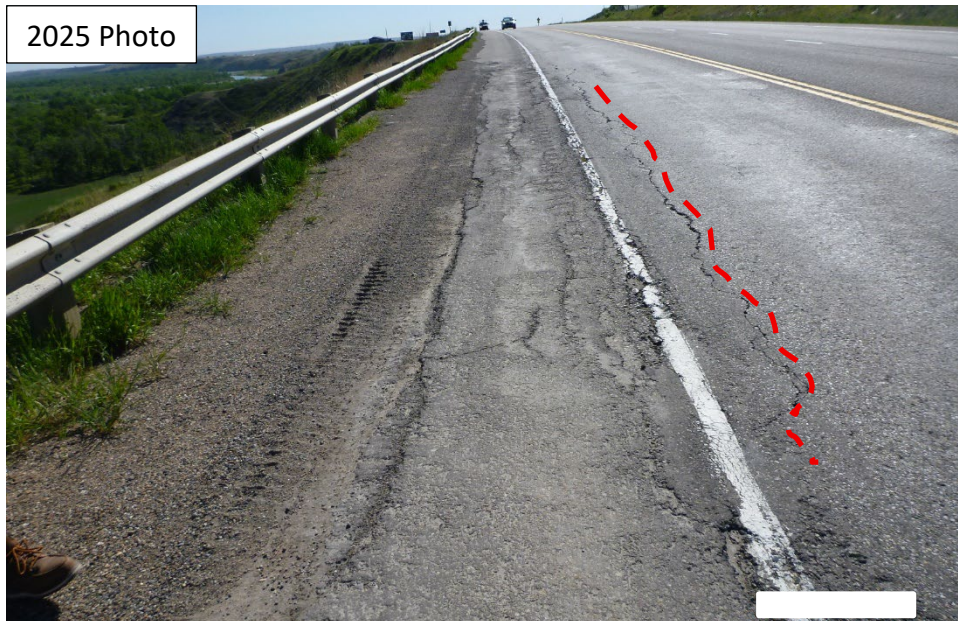


Photo 2 Sand and gravel berm at the crest of the slope is being eroded from surface water runoff from the highway surface. Straw wattle is almost buried. Photo taken May 28, 2025, facing east.



Photo 3 The slope is poorly vegetated, especially in the lower third of the slope. Photo taken May 28, 2025, facing west.



Photo 4 Erosion was observed on the slope surface below the wire mesh facing. Photo taken May 28, 2025, facing west.

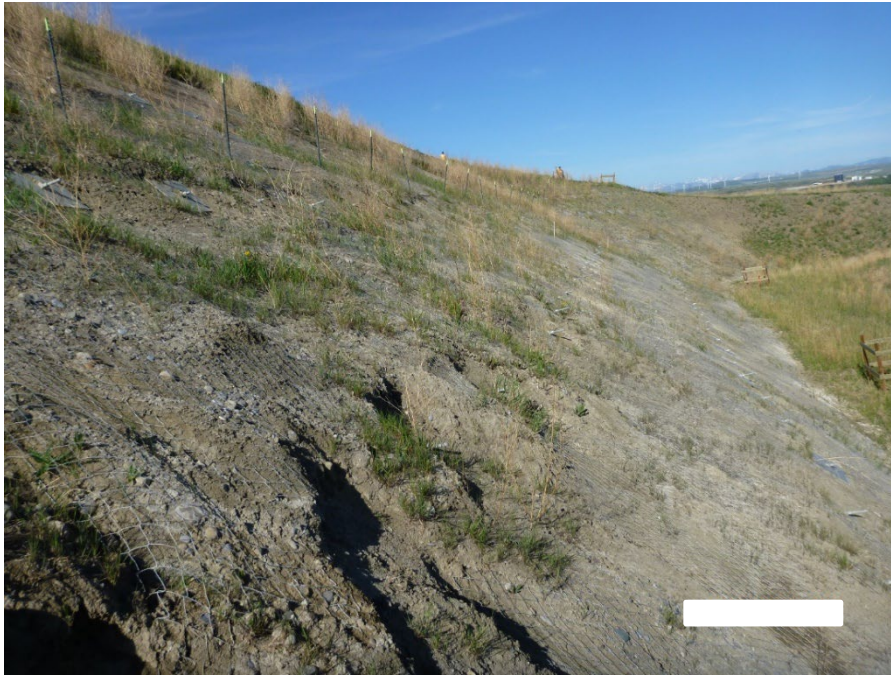


Photo 5 Rill erosion and sloughing on the slope surface near the east extent of the site. Some of the anchor plates have been covered by sediment. Photo taken May 28, 2025, facing south.

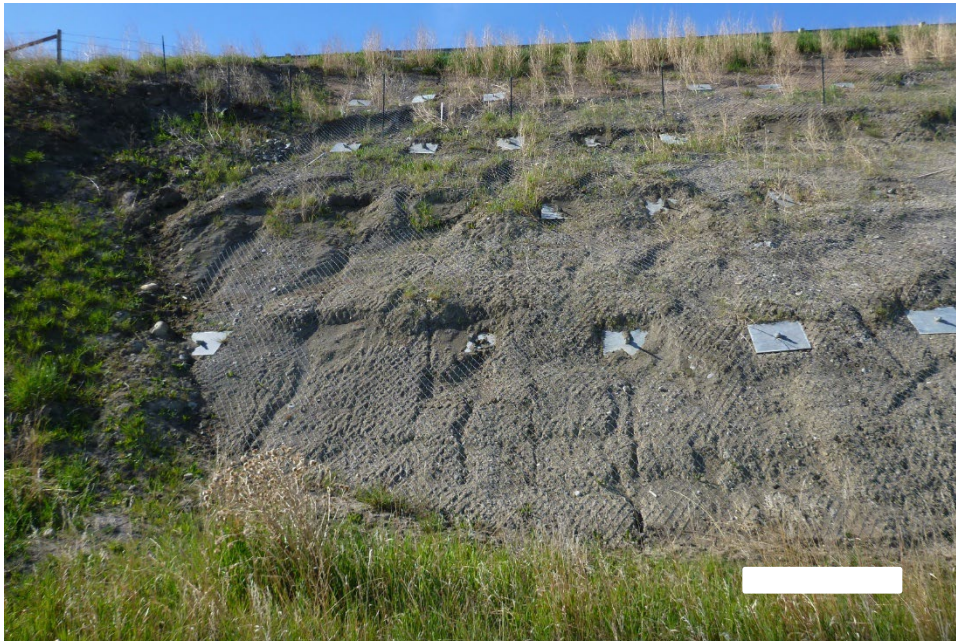


Photo 6 Erosion on the slope surface (red dashed line) near the east extent of the site. Some of the anchor plates have been covered by sediment. Photo taken May 28, 2025, facing southeast.

