

SITE NUMBER AND NAME: S037 Springhill Creek		HIGHWAY & KM: 533:02, 22.174	PREVIOUS INSPECTION DATE: May 10, 2019	INSPECTION DATE: May 20, 2022
LEGAL DESCRIPTION: 09-32-015-29 W4M 10-32-015-29 W4M 16-32-015-29 W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5576818 290160		RISK ASSESMENT: PF: 8 CF: 3 TOTAL: 24	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 1380 (east) & 1250 (west), (Reference No. 83120)			CONTRACTOR MAINTENANCE AREA (CMA): 27	

SUMMARY OF SITE INSTRUMENTATION: Two slope inclinometers (SI10-1 and SI10-2) and two vibrating wire piezometers (VWP10-1150 and VWP10-1151) LAST READING DATE: May 3, 2022	INSPECTED BY: Chris Morgan (KCB) Laura Assaad (KCB) Roger Skirrow (AT) Alex Frotten (AT)
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PRIMARY SITE ISSUE: Three relatively shallow earth slides (Slide 1, 2, and 3) on the south side of highway embankment. The slides are believed to be caused by an over steepened slope and potential infiltration/erosion.

APPROXIMATE DIMENSIONS: Three landslide zones located over approximately 500 m of highway. The natural slope to south of highway is sloped at approximately 2H:1V, approximately 30 m high. The sliding beneath the highway has been previously reported/estimated to be a maximum of 5 m deep. Instability of the natural slopes appears to be relatively shallow.

DATE OF ANY REMEDIAL ACTION: 2014 – pavement patching and crack sealing was completed upslope of Slide 2.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement cracking has been observed along the site.		X
Slope Movement	X		Three shallow slides on the east highway embankment slope.	X	
Erosion	X		The CSP slope drain at Slide 1 is being undermined.	X	
Seepage		X	N/A – none observed		X
Culvert Distress	X		The CSP slope drain at Slide 1 is being undermined.	X	

COMMENTS

General:

- Generally, no discernible change was observed in the pavement surface since the 2019 inspection. Small amount of new cracking at Slide 3 (east end) was observed during the 2022 inspection.
- Slides 2 and 3 show signs of slow ongoing movements, which may be seasonal (i.e., during freshet or rainfall events). It is possible that Slide 2 and 3 may be part of the same landslide complex that has its head scarp on the north (upslope) side of the roadway. The triggering mechanism may be due to buried springs beneath the embankment fill and/or saturation of the fill by rainfall events generating runoff from the pavement surface.

Slide 1:

- The slide is located at a transition from cut to embankment fill and may be associated with an erosional gully feature. There is no discernible pavement distress upslope of the slide.
- Ditch and seepage drainage from south side of cut section and surface water runoff from the highway may have contributed to sliding and gullying.
- The fence along the slide zone is leaning downslope and appears to be leaning more since the 2019 inspection (Photo 1). The head scarp has retrogressed towards the edge of the highway and is approximately 1.7 m upslope of the fence along a 15 m length. Where the head scarp is impacting the fence, the ground appears to have settled approximately 0.8 m since the 2019 inspection. The power pole at this slide is near vertical and has no changed since the 2019 inspection.
- The CSP slope drain appears to have pulled away from cable anchors and is being undermined by surface water runoff from the south (eastbound) ditch (Photo 2).
- There is significant vegetation and small tree growth in gully below head scarp, indicating either a zone of seepage or surface water runoff is concentrated in this area.

Slide 2:

- The slide is believed to be a shallow slide that may be attributed to poor drainage (surface water runoff from highway surface and poor ditch grading) and/or seepage in the embankment/foundation.
- There are two arc shaped pavement cracks upslope of the slide (Photo 3). The pavement cracks could indicate the location of the right (west) flank if a rotational slide. During the 2022 inspection, some secondary cracking was observed in the south (eastbound) lane. However, the extent (i.e., length) of the zone of pavement cracking has not changed since the 2019 inspection.
- Between the 2019 and 2022 inspections, a portion of the fence appears to have been displaced downslope due to slide movement. However, the head scarp has not reached the fence.

Slide 3:

- The slide is located on south slope of embankment and is impacting the fence line but does not appear to be impacting the road surface. The head scarp is less than 5 m from the south (eastbound) edge of the highway (Photo 4).
- The fence is intact but has been displaced approximately 2.5 m downslope and settled approximately 1.5 m since the 2019 inspection. A power pole in the slide area is leaning at an angle of approximately 5° to 6° in the downslope direction and the upslope anchor cable was slack.
- Trees at the toe of the slope are leaning back towards the highway/slope. Slide blocks are actively deforming downslope. Exposed soils in the head scarp were wet and animal burrows were observed during the 2022 inspection. Drainage from road surface and seepage likely trigger for incremental movements.
- Between 2019 and 2022, there appears to be slight expansion in the flanks of the slide (i.e., the slide may be slowly expanding laterally).

Maintenance/Repair/Monitoring Recommendations:

- Repair options include slope stabilization and drainage measures.
- Slide stabilization could include excavating slide material and replacing it with geogrid reinforced granular fill; soil nailing; or a combination of geogrid reinforced fill and soil nailing (soil nailing near the lower portion of the slide and geogrid reinforced fill higher up on the slope).
- Drainage improvements include repairing the inlets of CSP slope drains so surface water is conveyed to the toe of the slope instead of over the slide area and installing either an asphalt berm at the edge of pavement with HTC/B protection from damage, or a berm/ditch block in the ditch to keep surface water from flowing over the crest of the slope and allow CSP slope drains to convey water to the toe of the slope. Alternatively, directionally drilled subsurface drains could also be located below the failure plane from the flanks of the slide, to drain water seeping into the slope.

- The site should continue to be inspected every two-years as part of the Southern Region GRMP Section B inspections and instruments read annually (spring only) as part of the Section C instrumentation monitoring.

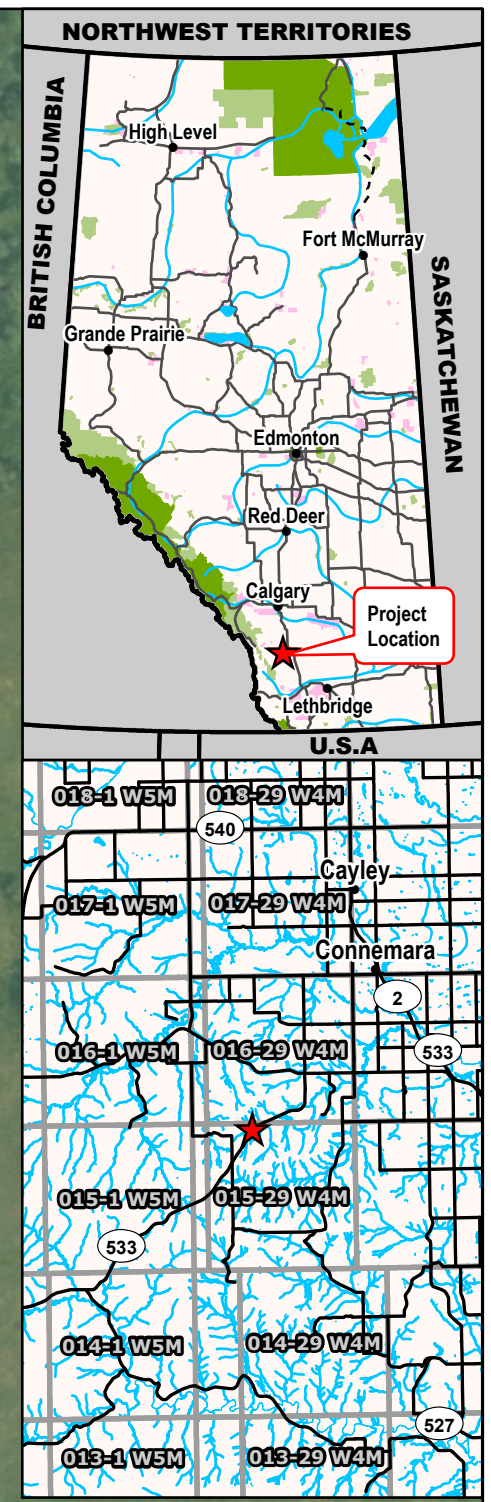
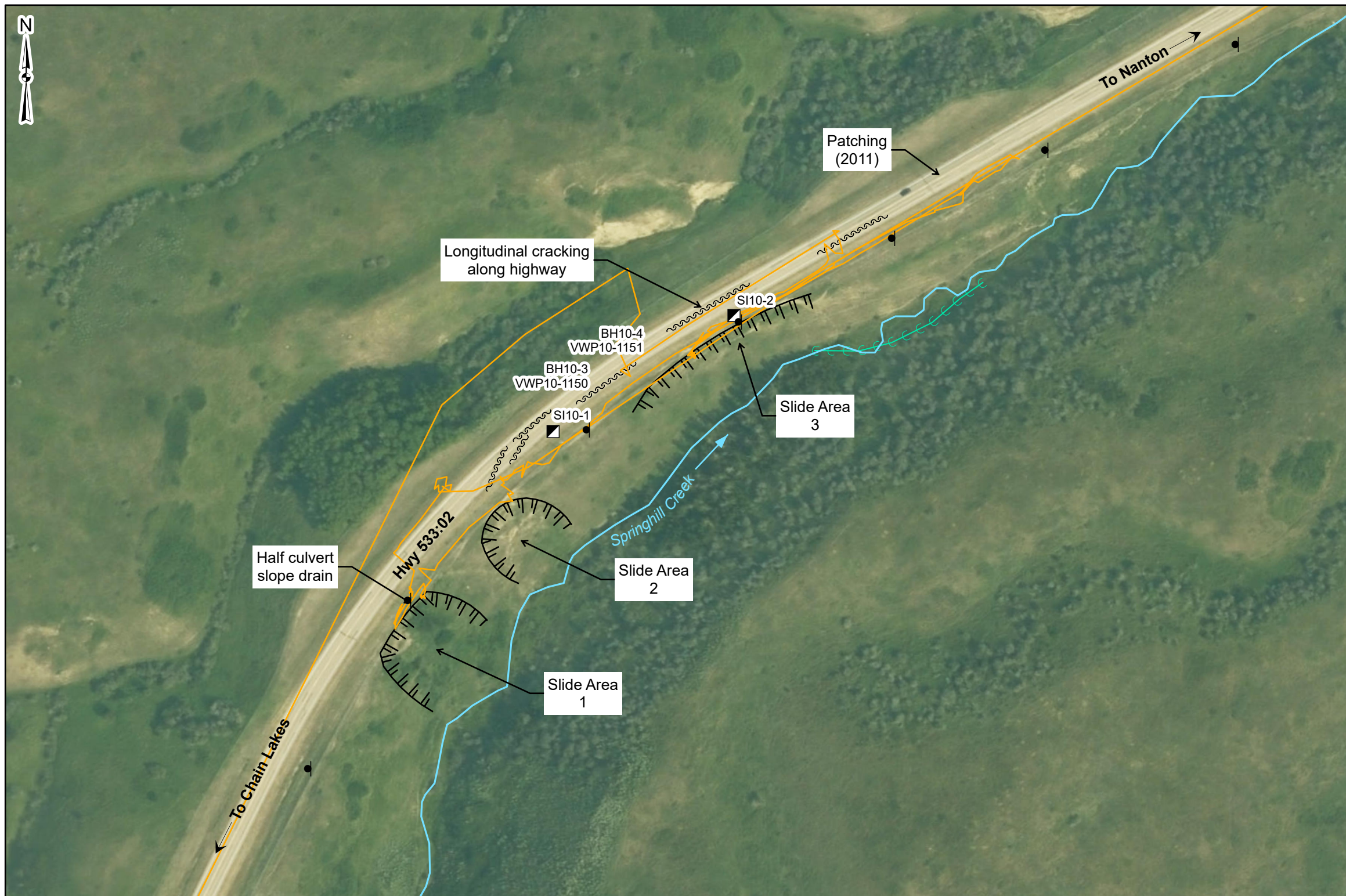
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Chris Gräpel, M.Eng., P.Eng.
Senior Civil Engineer, Associate



- Legend**
- Vibrating Wire Piezometer
 - Slope Inclinometer
 - Power Pole
 - GPS Track (May 20, 2022)
 - Possible Toe Bulge
 - Scarp
 - Pavement Crack
 - Creek
 - Flow Direction



NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM ZONE 12N
 3. IMAGE SOURCE: WORLD IMAGERY, ESRI ARCGIS ONLINE. SOUTHERN ALBERTA 2015 IMAGERY

CLIENT

PROJECT SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan S037 - Springhill Creek Hwy 533:02, km 22.336		
SCALE 1:2,000	PROJECT No. A05115A03	FIG No. 1

Time:
Date:
File:

Inspection Photographs

- Photo 1** The slide at Slide Area 1 is not impacting road surface. The fence posts and power pole are tilting downslope towards the toe of the slope. Photo taken May 20, 2022, facing west-southwest.



- Photo 2** The CSP slope drain at Slide Area 1 is in poor condition and is being undermined by surface runoff from highway ditch. Photo taken May 20, 2022, facing northeast.



Photo 3 Pavement cracking has been sealed near the Slide Area 2 site. Photo taken May 20, 2022, facing north.



Photo 4 Slide Area 3 (east end) – The back scarp at Slide Area 3 is approximately 5 m from the south edge of the highway. The fence posts and power pole are leaning downslope towards the toe of the slope. The power pole is leaning at approximately 5° to 6° from vertical. Photo taken May 20, 2022, facing west-southwest.

