

SITE NUMBER AND NAME: <b>S037 Springhill Creek</b>		HIGHWAY & KM: 533:02, 21.962 & 22.336	PREVIOUS INSPECTION DATE: May 2, 2018	INSPECTION DATE: <b>May 10, 2019</b>
LEGAL DESCRIPTION: 09/10/16-32-015-29 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), (Ref 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 2019	INSPECTED BY: Chris Gräpel (KCB) Chris Morgan (KCB) Alex Frotten (AT) Roger Skirrow (AT) Nicolas Ropchan (AT)
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**PRIMARY SITE ISSUE:** 3 earth (embankment) slides on the south side of highway (west to east = 1, 2 & 3), Slide 1 - On south slope but not affecting road surface. Inlet of half culvert (flume) displaced by erosion causing drainage to flow onto slide surface and exacerbate slide movement.

Slide 2 – Patched arc shaped cracks in pavement across both lanes, slump block downslope of fence on south slope.

Slide 3 – Largest slide, affecting fence but approximately 4 m from pavement, inward leaning trees are an indication of toe bulge at toe of embankment slope.

**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:** None recent. Pavement patches placed in 2014 at Slide 2.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Previous cracking was filled. Small amount of fresh cracking observed at Slide 2.	X	
Slope Movement	X		Head of Slide 3 appears to have settled slightly since 2018 inspection, minimal change visible at Slides 1 & 2.		X
Erosion	X		Inlet of half culvert (flume) at Slide 1 eroding		X
Seepage		X	None observed		X
Culvert Distress	X		Half culvert (flume) at Slide 1 not working fully due to erosion undermining the inlet		X

COMMENTS
<p>Pavement appears generally unchanged, small amount of new cracking at Slide 3. Visit site every 2 years as part of GRMP tour and reduce instrument readings to once a year moving forward.</p>
<p>Slide 1 on south side at transition from cut to embankment fill that may be associated with an erosional gully feature.</p> <ul style="list-style-type: none"> <li>- Ditch and seepage drainage from south side of cut section and road runoff at this location may have contributed to earth slide and gully erosion.</li> <li>- Half culvert flume appears to have pulled away from cable anchors, invert is undermined and flume full of debris.</li> <li>- Significant vegetation and small tree growth in gully below head scarp indicating either seepage, or more likely runoff enters slope here.</li> <li>- No distress in pavement.</li> <li>- Power pole standing near vertical at an angle of 1° in the downslope direction (no change since 2018). Fence is leaning and moved downslope.</li> <li>- SI between slides 1 and 2 not showing any movement and power pole is vertical.</li> </ul>
<p>Slide 2:</p> <ul style="list-style-type: none"> <li>- Two arc shaped patched pavement cracks indicative of right flank of rotational landslide.</li> <li>- Slump block on south slope, head scarp downslope of fence.</li> <li>- Earth slides are shallow and may involve seepage erosion and sloughing.</li> <li>- Drainage from road surface and seepage likely trigger for incremental movements.</li> <li>- Power pole standing at an angle of 5.6° in the downslope direction. Fence is displaced downslope.</li> </ul>
<p>Slide 3:</p> <ul style="list-style-type: none"> <li>- Slide is located on south slope of embankment, affecting the fence line but not the road. Power pole in slide area leaning approximately 5° in the downslope direction (no change since 2018), but the anchor cable was slack.</li> <li>- Trees leaning back at toe of slope, appears to be toe of slide.</li> <li>- Relatively fresh scarps were noted on the slide mass near the head scarp in 2016. Additional movement noted in subsequent inspections and further settlement of crest area noted during 2019 inspection.</li> <li>- Head of slide appears to have widened. Estimated as 80 m wide in 2019 inspection.</li> <li>- No cracks on the road surface.</li> <li>- Offset from the head scarp to the road edge, measured slightly west of the power pole, remains 4.2 m (no change since 2018).</li> <li>- Drainage from road surface and seepage likely trigger for incremental movements.</li> </ul>
<p>Possible that slides 2 and 3 may be part of the same landslide complex that has its head scarp on the north 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.</p>
<p>Slides 2 and 3 show signs of ongoing incremental movements, which are likely seasonal in nature due to rainfall events.</p>
<p>Candidate repairs at this site include both slide stabilization and drainage measures. The slides could be excavated out and a geogrid reinforced slope constructed. Alternatively, the slides could be stabilized with soil nails and regraded to promote drainage from the slide area, or some combination of soil-nailing the lower part of the slide with GRS reconstruction near the head of the slide.</p>
<p>Drainage improvements include repairing the inlets of CSP flumes on the slope so drainage is conveyed to the toe of the slope, and also to install either an asphalt berm at the edge of pavement with HTCB protection from damage, or a compost berm in the ditch to keep surface water from flowing over the crest of the slope and allow CSP flumes to convey water to the toe of the slope. Directionally drilled drains could also be located below the failure plane from the flanks of the slide, to drain water seeping into the slope.</p>

**Photo 1** Slide 1 - Slide not affecting road surface. Some fence displacement in downslope direction at the head scarp (red circle). Power pole leaning downslope. Photo taken facing southwest on May 10, 2019.



**Photo 2** Sealed cracking on highway surface located approximately above the slide 2 location. Photo was taken facing north on May 10, 2019.

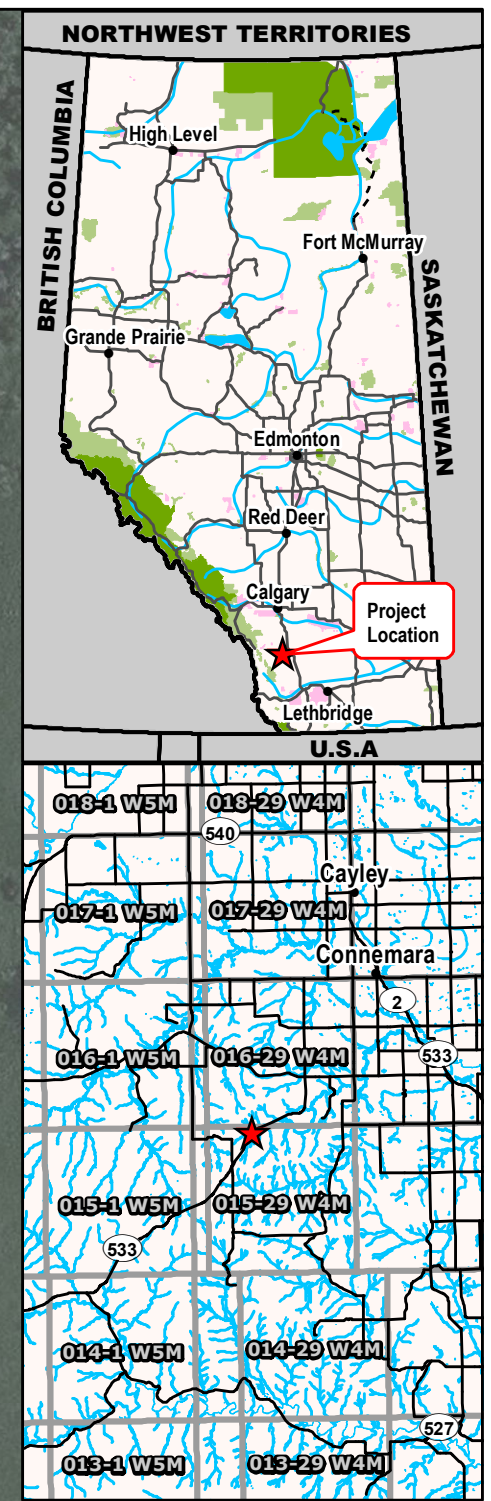
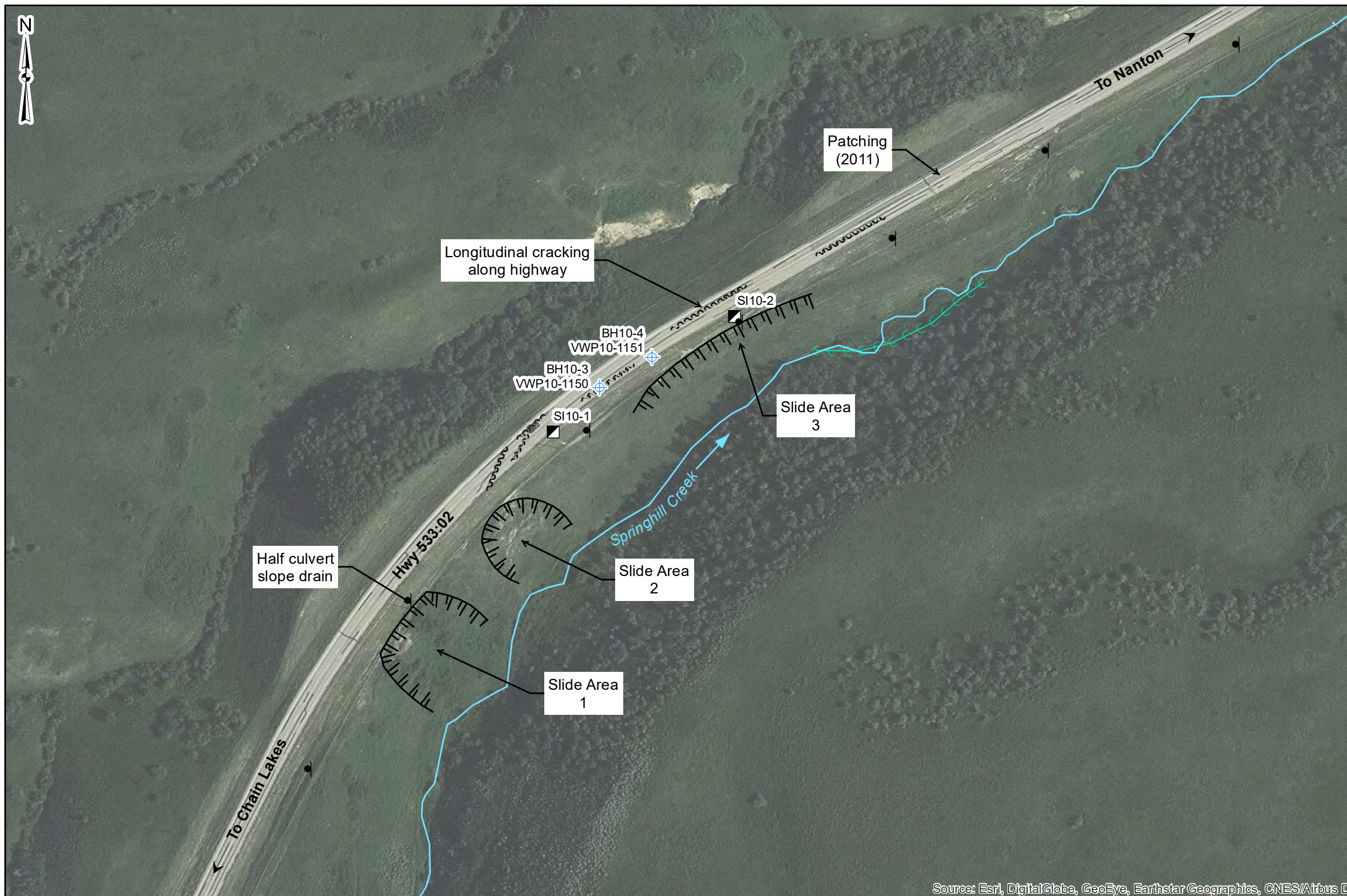


**Photo 3** Slide 2 – Fence displacement at the head scarp (red circle). Pole in slide area leaning approximately 5.6° downslope. Photo was taken facing north on May 10, 2019.








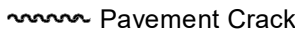
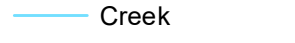
**Photo 4** Slide 3 – Back scarp measured to be 4.2 m from asphalt (no change from 2018). Fence displacement down slope. Pole in slide area leaning approximately 5° downslope. Photo taken facing west on May 10, 2019.





Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Legend**

-  Borehole
-  Slope Inclinometer
-  Power Pole
-  Possible Toe Bulge
-  Scarp
-  Pavement Crack
-  Creek



NOTES:  
 1. HORIZONTAL DATUM: NAD83  
 2. GRID ZONE: UTM Zone 12N  
 3. IMAGE SOURCE: World Imagery, 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: 11:55:32 AM  
 Date: June 14, 2019  
 File: Z:\A\EDM\A05115A03\ABT Southern Region GRMP\400 Drawings\2019\2 Section BIM\XDS\037\_190614.mxd