

SITE NUMBER AND NAME: S003 Cochrane		HIGHWAY & KM: 22:16, 9.875	PREVIOUS INSPECTION DATE: April 30, 2018	INSPECTION DATE: May 7, 2019
LEGAL DESCRIPTION: 06-34-025-04 W5M	NAD 83 COORDINATES: UTM Northing Easting 11 5672104 676003		RISK ASSESMENT: PF: 13 CF: 4 TOTAL: 52	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 19530 (north), 14900 (south) (Ref No. 70000075)			CONTRACTOR MAINTENANCE AREA (CMA): 28	

SUMMARY OF SITE INSTRUMENTATION: 4 functional piezometers and 1 functional slope inclinometer LAST READING DATE: April 2019		INSPECTED BY: Chris Gräpel (KCB) Chris Morgan (KCB) Renato Macciotta (KCB) Roger Skirrow (AT) Alex Frotten (AT) Nicolas Ropchan (AT)
PRIMARY SITE ISSUE: Slope instability affecting northbound lane, approximately 3 m into northbound lane. Landslide appears to be related to seepage and deeper instability located downslope.		
APPROXIMATE DIMENSIONS: Embankment slope (within highway boundary) is approximately 10 m high and sloped at 3H:1V. Natural slope below embankment is quite high (over 30 m) and there is a zone of landsliding at the outside bend of the Bow River. Embankment slide area is approximately 50 m by 50 m in area of highway with 4 m to 9 m slide depth. Sliding below the highway embankment appears to be shallow but has the potential to undermine and exacerbate the sliding at the highway embankment. The valley slope below the main slide area has a slope angle of 70%.		
DATE OF ANY REMEDIAL ACTION: Patched as needed over the last two years. Drilling program undertaken in March 2018 that included the installation of 1 SI and 3 VWPs.		

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Increased settlement and cracking on northbound lane and shoulder.	X	
Slope Movement	X		Cracking and settlement on shoulder of highway. Slides observed downslope in wooded area.	X	
Erosion	X		Downslope of highway boundary	X	
Seepage	X		Downslope of toe roll	X	
Culvert Distress		X	None present.		X

COMMENTS

Site has deteriorated since 2018 inspection. Pavement appears to have settled since 2018 with more cracks and more dislocated trees visible. Some sections of the slide are moving faster than others. Repairs options are being reviewed.

The highway ditch across slide area is lined with geomembrane and riprap, and has completely settled. Ditch now discharges directly into the slide zone and the geotextile is exposed. Pavement patching and crack sealing should continue, however surface runoff will continue to saturate the slide mass and exacerbate instability. Only one functional slope inclinometer remains at the site.

Toe roll is more defined than last year. Wet areas visible on right flank of the slide, below the toe roll.

Fence across slide zone is deflected, undermined, and tipped over by slope movement.

Shallow failures downstream correspond with runoff areas. Slope movement on the steeper section of the slope (outside of highway boundary) are visible, including tension cracking, erosion scars, and dislocated trees.

Long-term plans at this site include twinning on the uphill side. A design has been submitted by KCB which includes a pile wall to stabilize the existing highway lanes, drainage and an improved ditch. The ditch should be lined and be upslope of the pile wall to maintain ditch integrity. The pile wall is planned to be installed off the northbound lane shoulder, and design allowed for an additional lane width of fill on the east side of the highway to account for loading when the highway is twinned.

Photo 1 **Landslide affecting northbound lane approximately 3 m into the lane (red arrow).
Photo was taken facing southeast on May 7, 2019.**



Photo 2 **Cracking and settlement on the highway shoulder. Photo taken facing northwest on
May 7, 2019.**



Photo 3 Complete settlement of the drainage ditch with exposed liner, surface water runoff now discharging directly onto the slide zone. Photo taken facing northwest on May 7, 2019.

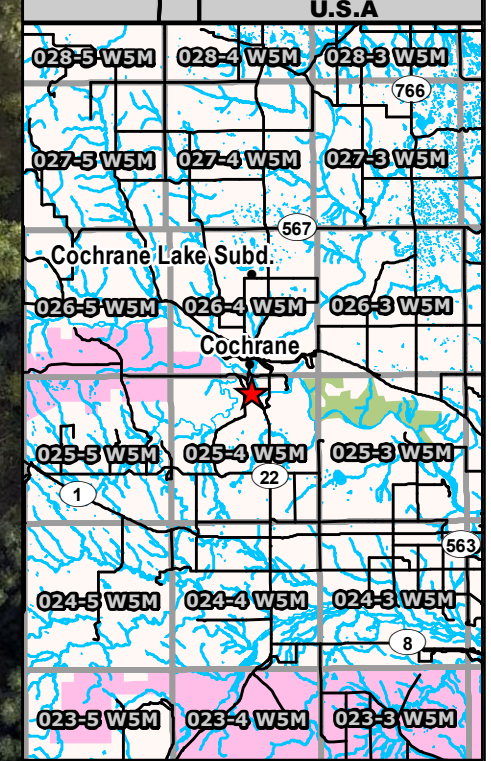
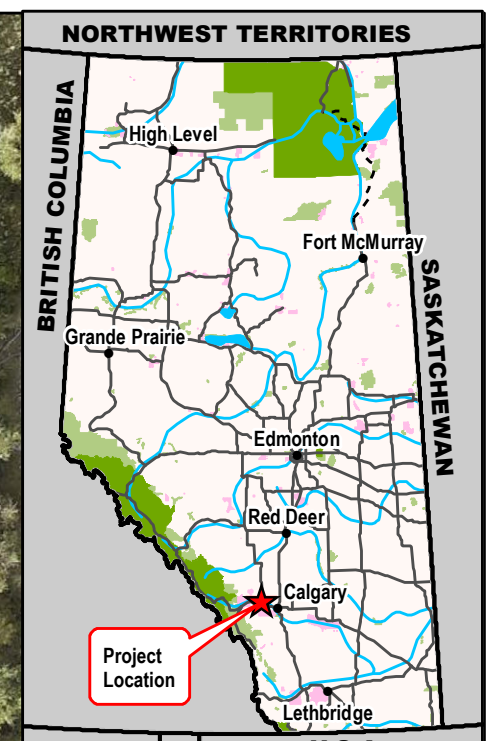


Photo 4 Fence deflection due to slope movement. Photo taken facing north on May 7, 2019.



Photo 5 Slope movement in forested area to the east of the highway. Photo taken facing south on May 7, 2019.





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



Legend

- ▲ GPS Waypoints (May 7, 2019)
- ◆ Pneumatic Piezometer
- Slope Inclinometer
- ⊗ Vibrating Wire Piezometer
- GPS Track (May 7, 2019)
- ▬ Main Scarp
- ~ Crack
- ➡ Flow Direction

NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM Zone 11N
 3. IMAGE SOURCE: World Imagery from ArcGIS Online.
 Source date January 1, 2017

CLIENT




PROJECT SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan S003 - Cochrane Hwy 22:16, km 9.875		
SCALE 1:1,000	PROJECT No. A05115A03	FIG No. 1

Time: 16:43:34 PM
Date: May 29, 2019
File: Z:\A\EDM\A05115A03\ABT Southern Region GRMP\400 Drawings\2019\2 Section BIM\XDS\03_190517.mxd