

SITE NUMBER AND NAME: C062 Back Slope Failure North of Vermillion Dam		HIGHWAY & KM: 41:20, 2.889	PREVIOUS INSPECTION DATE: June 29, 2021	INSPECTION DATE: June 28, 2023
LEGAL DESCRIPTION: 16-31-050-06 W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5912662 509163		RISK ASSESSMENT: PF: 9 CF: 3 TOTAL: 27	
Average Annual Daily Traffic (AADT): 3200 (north) & 4,070 (south) (Ref No. 997074 & 990207)			CONTRACTOR MAINTENANCE AREA (CMA): 512	

SUMMARY OF SITE INSTRUMENTATION: Operable: One slope inclinometer (SI), six vibrating wire piezometers (VWPs), and one standpipe piezometer installed in April 2018. Inoperable: Two slope inclinometers installed in April 2018. LAST READING DATE: September 19, 2023	INSPECTED BY: James Lyons (KCB) Guerin White (KCB) Tony Penney (TEC) Wade Nichol (TEC) Rishi Adhikari (TEC) Pramaya Kannel (TEC)
PRIMARY SITE ISSUE: Large deep-seated-translational earth slide on back/cut slope of highway. Toe roll starting to block ditch. The landslide is expanding laterally around the “nose” of the cut slope to the north Vermillion River valley slope. The landslide on the Vermillion River valley slope is impacting powerline transmission towers (ATCO) and is above the outlet channel from the Vermillion Dam spillway.	
APPROXIMATE DIMENSIONS: Approximately 200 m wide at highway and 50 m along the river valley slope. The fence at crest of back slope undermined over a 70 m length. Back slope is approximately 25 m high, sloped at approximately 3H:1V.	
DATE OF ANY REMEDIAL ACTION: N/A	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X	N/A – none observed during the 2023 inspection.		X
Slope Movement	X		There is a defined backscarp and toe roll at the east (northbound) highway backslope	X	
Erosion	X		A 300-mm-diameter sinkhole approximately 1 m deep was observed in the west (southbound) ditch.	X	
Seepage		X	N/A – none observed during the 2023 inspection.		X
Culvert Distress		X	N/A – none observed during the 2023 inspection.		X

COMMENTS

Slide area extends along the crest of the east (northbound) backslope to the river valley slope south of the ATCO power poles. Bench on river valley slope is located at the previous Hwy 41 alignment, before it was realigned across Vermilion Dam in 1981.

Between the 2020 and 2021 inspections, the toe roll of the slide appeared to have deformed further into the ditch. Between the 2021 and 2023 inspections, the toe roll appears more defined, but does not appear to extend further into the east (northbound) ditch (Photo 1 and 2). However, the amount of movement is difficult to assess due to tall vegetation.

Cracking was observed in 2020 on the river valley slope near the ATCO power poles and directly north of the outlet channel from the Vermillion Dam spillway. The grass on the backslope and river valley slope is tall and may be obscuring other slide features. The degree of cracking (i.e., length and width) appears similar to during the 2021 inspection.

Settlement at the top of the east (northbound) backslope has been previously observed near the power poles and on the slope below the power poles. The settlement/cracking observed was approximately 0.3 m wide by 0.5 m deep and does not appear to have changed significantly since the 2021 inspection. A sinkhole approximately 1.0 m long and 0.3 m wide was observed near the southwest extent of the backslope during the June 2021 inspection and does not appear to have changed since the 2021 inspection.

The slide appears to have progressed further north along the east (northbound) backslope since the 2021 inspection. The amount the slide has progressed is difficult to estimate. However, KCB estimates the slide has extended approximately 20 m to 30 m to the north between the 2021 and 2023 inspections. No significant change was observed at the crest of the slope between the 2021 and 2023 inspections (Photo 3).

A tension crack was first observed in 2020 on the downslope bench created during the geotechnical investigation completed in April 2018 (bench constructed in March 2018). The tension crack is approximately 25 mm wide and doesn't appear to have changed between the 2020 and 2023 inspections (not found during the 2021 inspection).

A sinkhole approximately 300 mm in diameter and 1 m deep was observed in the west (southbound) lane ditch, approximately 10 m from the edge of pavement (Photo 5)

Pavement distress (i.e., alligator cracking) was observed in the highway surface along the length of the site (Photo 6). The cracking appeared worse in the east (northbound) lane than the west (southbound) lane.

Maintenance/Repair/Monitoring Recommendations:

- The site should be regularly inspected by TEC's Maintenance Contract Inspector (MCI).
- The site should continue to be inspected every two-years as part of the Central Region GRMP Section B Inspections.
- Previous repair recommendations include installing either horizontal drains or flatten the slope (i.e., excavating the head of the slide). If TEC decides they want to flatten the slope to increase slope stability, they should consult with the Town of Vermilion on a material stockpile location, or if there is any local uses for the removed material.
- With TEC's permission, KCB contacted ATCO and Alberta Environment and Parks (AEP) on July 18, 2019 and advised them of the possible impact of slide movement to the powerline tower and outlet channel from Vermilion Dam spillway, respectively. AEP had the slide area reviewed in a recent dam safety review and the slide was judged to not be an issue to the dam spillway. KCB received no response from ATCO.

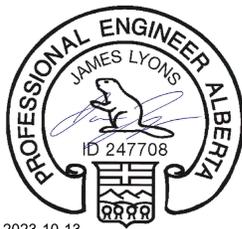
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This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



2023-10-13

James Lyons, P.Eng.
Civil Engineer

Inspection Photographs

- Photo 1** Backscarp and toe roll of slide. The toe roll appears more defined since the 2021 inspection. Benches cut into slope were completed during KCB's 2018 drilling and instrumentation installation program. Photo taken June 28, 2023, facing southeast.



- Photo 2** East (northbound) ditch and toe roll. The ditch is well vegetated and the toe roll appears more defined since the 2021 inspection. Photos taken June 28, 2023, facing northeast.



Photo 3 No significant change in the slope, head scarp, and fence line at the crest of the slope since the 2021 inspection. Photo taken June 28, 2023, facing north.



Photo 4 Tension crack previously observed near the fence line at the crest of the slope. Photo taken June 28, 2023, facing south.

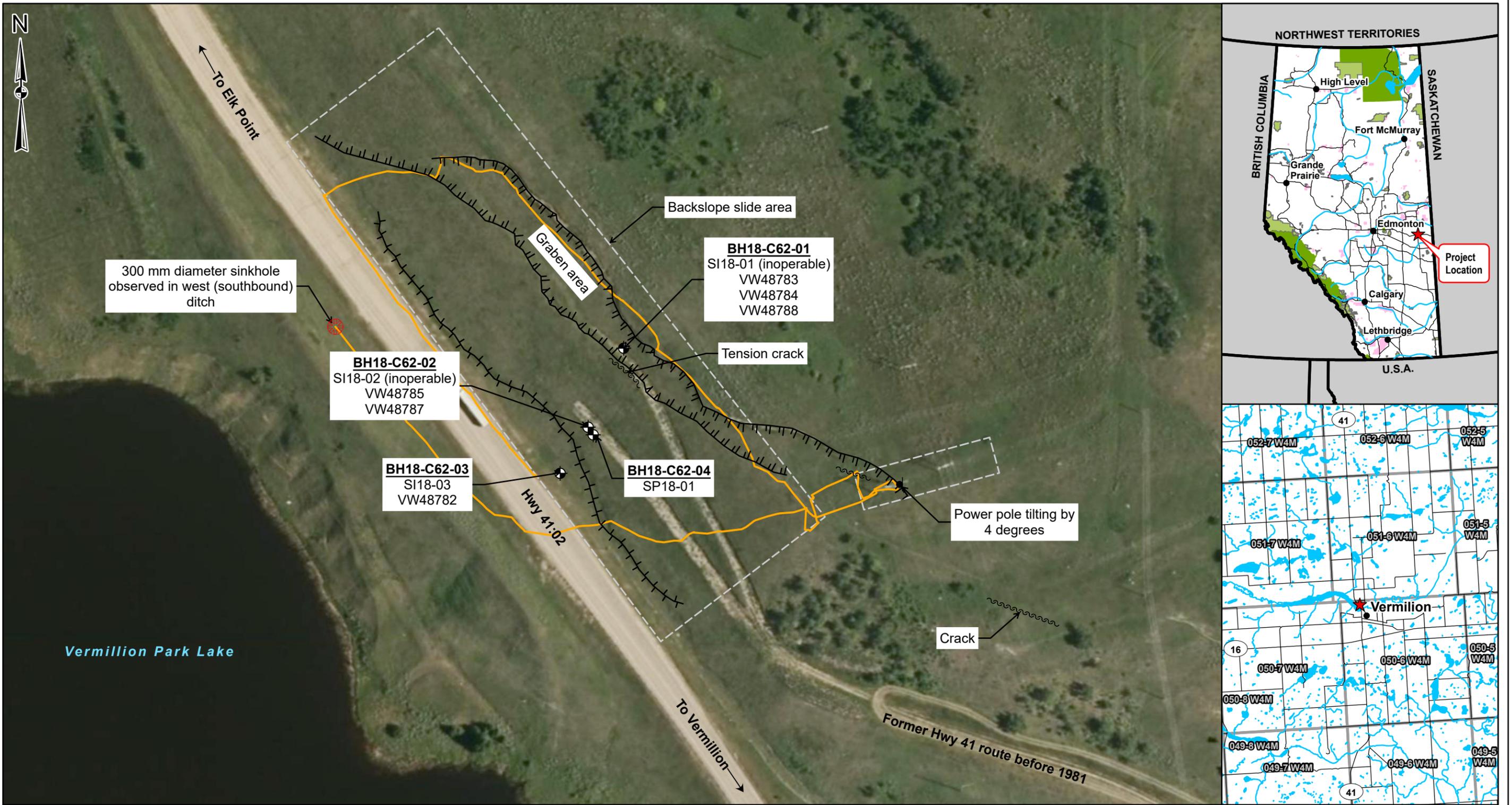


Photo 5 Sinkhole approximately 0.5 m in diameter and 1.0 m deep observed in the west (southbound) ditch (indicated by red arrow). Photo taken June 28, 2023, facing south.



Photo 3 Pavement distress (i.e., alligator cracking) was observed was in highway surface downslope of the C062 site. Photo taken June 28, 2023, facing south southwest.





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Legend

- Borehole
- Power Pole
- GPS Track (June 28, 2023)
- Main Scarp
- Minor Scarp
- Crack
- Toe Roll
- Sinkhole



NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM ZONE 12N
 3. IMAGE SOURCE: VERMILLION RIVER COUNTY

CLIENT

Alberta

Klohn Crippen Berger

PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan C062 - Vermillion Backslope Hwy 41:02, km 2.889		
SCALE 1:1,500	PROJECT No. A05116A02	FIG No. 1