

SITE NUMBER AND NAME: C025 Western Monarch Slide		HIGHWAY & KM: 569:02, 18.469	PREVIOUS INSPECTION DATE: May 31, 2022	INSPECTION DATE: June 18, 2024
LEGAL DESCRIPTION: 02-20-27-18-W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5686096 395423		RISK ASSESSMENT: PF: 9 CF: 4 TOTAL: 36	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 140 (east) and 80 (west) (Reference No. 111210 & 113210)			CONTRACT MAINTENANCE AREA (CMA): 521	

SUMMARY OF SITE INSTRUMENTATION: Operational: One vibrating wire piezometer (VWPs) and one standpipe piezometer (SP) installed in 2004 (dry since installation). Inoperable: One slope inclinometer (SI) installed in 2004, one SI installed in March 2017 (instrument was found sheared 0.6 m below ground surface during spring 2019 readings), and one piezometer installed in 2017. LAST READING DATE: May 16, 2019 (no longer reading instruments)	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rocky Wang (TEC)
PRIMARY SITE ISSUE: A natural slope failure in bedrock that is retrogressing towards the south side (eastbound lane) of Hwy 569 where it traverses the slope of a small valley that leads to the Red Deer River valley. A potential sinkhole associated with old coal-mine workings in the area was observed in the ditch close to the intersection of Hwy 569 and Hwy 10/Hwy 564.	
APPROXIMATE DIMENSIONS: The slide is approximately 25 m wide, and the backscarp is within 2 m of the guardrail. The highway embankment is approximately 20 m high with an overall slope between approximately 1.5H:1V to 2H:1V.	
DATE OF ANY REMEDIAL ACTION: Fall 2008 – slope excavated below failure surface and reconstructed with geosynthetic reinforced granular fill.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X	Gravel surfaced road, recently graded, difficult to assess if there is any recent distress.		X
Slope Movement	X		The slide appears to have movement downslope since the 2022 inspection (ground cracks observed near head scarp and within slide mass). The failed material is blocking the creek along the slope toe.	X	
Erosion	X		Erosion caused by surface water runoff along the south (eastbound) edge of highway.	X	
Seepage		X	N/A – none observed during 2024 inspection		X
Culvert Distress		X	N/A – no culverts at the site		X

COMMENTS

In 2019, TEC and KCB inspected the top of the backslope to further assess highway re-alignment. Benches in the backslope above the highway could be part of a larger historic landslide or they could be remains of earthworks from historic coal-mining activity. A drilling investigation with instrument installations (slope inclinometers and piezometers) should be completed to assess the stability of the backslope and to assess subsurface conditions before road realignment and associated excavations are undertaken.

Coal slack waste piles from historic mining activities at this site are present to the northeast of the site. The C025 site is underlain by old mine workings (from AER database on coal-mine workings). A potential coal-mine void sinkhole was first observed during the 2021 inspection, in the westbound ditch, near the intersection of Hwy 569 and Hwy 10/Hwy 564. Between the 2022 and 2024 inspections, no significant changes in the size of the sinkhole were observed.

The thickness of the overburden material appears to be less near the intersection, at a lower elevation (the coal-seam would have been generally horizontal) which means that sinkholes from coal-mine roof collapse would be more likely to be present at surface.

Between the 2022 and 2024 inspections, the rate of movement of the slide has increased. There has been expansion to the south (left) of the slide by approximately 10 m with ground cracks observed along the head scarp. The slide expansion appears to be lateral movement only, and the head scarp is not noticeably closer to the guardrail. The slide expansion appears to be attributed to a slide further downslope of the main slide (Photos 1 and 2).

Drainage at the site is poor, with surface water flows over the slide area. Rills have formed along the south (eastbound) shoulder of the highway (Photo 3).

The slide mass appears to have moved downslope since the 2022 inspection (as evident by ground cracks within the slide mass and the slide mass constricting the unnamed creek along the toe of the slope (Photos 1, 2, and 4)). The ground cracks observed appear to be older (i.e., may not be from spring 2024) since the edges of the cracks appeared more rounded than sharp.

The slope and slide area, except for the near-vertical back and side scarps, are well vegetated with grass (Photo 5 and 6). The north edge of the slide is at the tree line.

Another slide was identified on the south (eastbound) side of Hwy 569, approximately 350 m to the east (downhill) of the C025 site. The slide appears to be upslope from what might be a coal slack pile. The slide is currently not impacting the highway.

Maintenance/Repair/Monitoring Recommendations:

- Regular inspections should be completed by TEC's MCI, particularly after precipitation events (spring freshet or significant rainfall event (i.e., heavy or prolonged rainfall)).
- The site should continue to be inspected every two years as part of the Central Region GRMP Inspections.
- Recommended repair options include the following:
 - Drainage improvements (e.g., construct ditches) to direct flows away from the slide area.
 - Re-alignment of the road upslope (i.e., north) towards the backslope, which would require land acquisition. The realignment would need to avoid areas undermined by coal mining (e.g., near the intersection of Hwy 569 and Hwy 10/Hwy 564).
 - An alternate approach to mitigating risk to the highway is to soil nail the slope like what is being completed for C017-1 and C017-3 (TEC Contract No. CON0022533) and also completed at the S039 Southern Region site (TEC Contract No. CON0019630) in early-2023. Soil nailing would reinforce the backslope and reduce the potential for future regression towards the highway.

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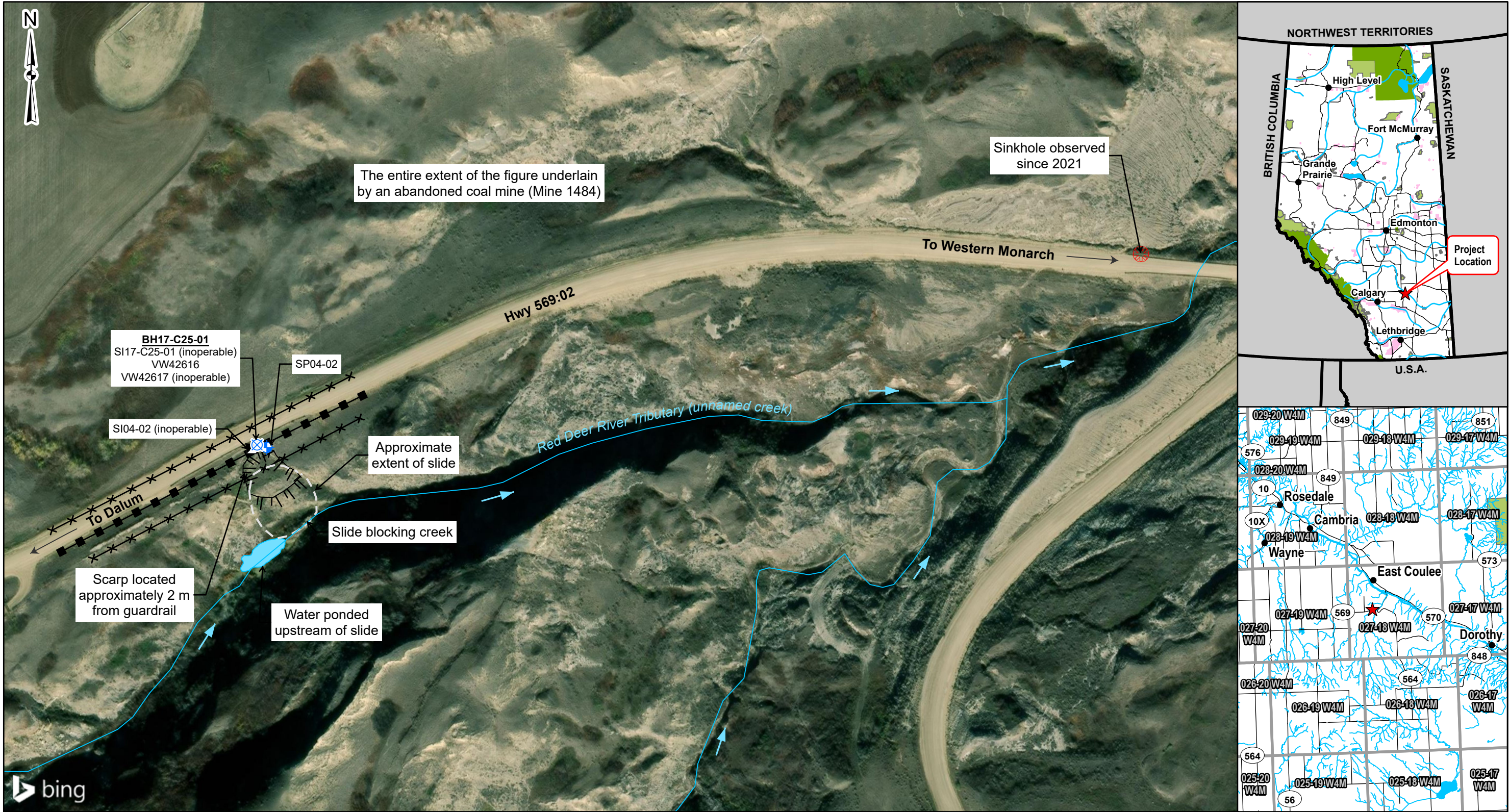
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James Lyons, P.Eng.
Civil Engineer

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Legend

- | | | |
|-----------------------------|-------------|------------------|
| ▣ Slope Inclinometer | — Bench | → Flow Direction |
| ⊗ Vibrating Wire Piezometer | └┐ Scarp | — Watercourse |
| ⊕ Standpipe Piezometer | ■ Guardrail | Ponded Water |
| ⊗ Sinkhole | ×× Fence | |

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: 2024 MICROSOFT CORPORATION, MAXAR, CNES DISTRIBUTION AIRBUS DS.
4. LOCATION OF INSTRUMENTS IS APPROXIMATE (NOT SURVEYED)

CLIENT

Alberta

Klohn Crippen Berger

PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan C025 - Western Monarch Slide Hwy 569:02, km 18.469		
SCALE 1:2,750	PROJECT No. A05116A02	FIG No. 1

Photo 1 **Oblique aerial photo of the C025 slide. Photo taken June 18, 2024, facing northwest.**



Photo 2 **Oblique aerial photo of the C025 slide. Photo taken June 18, 2024, facing north-northeast.**



Photo 3 **Minor erosion along the south edge of the highway upslope of the slide. Photo taken June 18, 2024, facing southeast.**



Photo 4 **Head scarp of the slide where ground cracks were observed. Extent (number and width) of ground cracks have increased since the 2022 inspection. Photo taken June 18, 2024, facing east.**



Photo 5 **Head scarp of the slide. The slide mass is well vegetated, but the vertical face of the head scarp shows evidence of recent erosion. Photo taken June 18, 2024, facing north.**



Photo 6 **Damaged fence that runs through the slide area. Photo taken June 28, 2024, facing west.**

