

SITE NUMBER AND NAME: <b>C058-1, -2, &amp; -3 Sinkholes</b>		HIGHWAY & KM: 570:02, 8.3, 9.2, 9.8	PREVIOUS INSPECTION DATE: June 24, 2021	INSPECTION DATE: <b>June 26, 2023</b>
LEGAL DESCRIPTION: 10-08-27-17 W4M	NAD 83 COORDINATES: UTM Northing Easting <b>C058-1</b> 12 5683470 405475 <b>C058-2</b> 12 5683845 404934 <b>C058-3</b> 12 5684148 404224		RISK ASSESSMENT: <b>C058-1:</b> PF: 8 CF: 5 TOTAL: 40 <b>C058-2:</b> PF: 8 CF: 5 TOTAL: 40 <b>C058-3:</b> PF: 8 CF: 5 TOTAL: 40	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 500 (west) & 400 (east) (Ref No. 116220 & 997198)			CONTRACT MAINTENANCE AREA (CMA): 521	

SUMMARY OF SITE INSTRUMENTATION:  There is no instrumentation at the C058 site.  LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rishi Adhikari (TEC) Pramaya Kannel (TEC)
PRIMARY SITE ISSUE: Settlement of Hwy 570 due to the presence of dispersive-soil voids beneath the highway surface.	
APPROXIMATE DIMENSIONS: Numerous soil voids along a 1.5 km stretch of Hwy 570.	
DATE OF ANY REMEDIAL ACTION: May 3, 2010 – remediated using foam injection; May 29, 2015 – excavated (deep) and reconstructed with gravel fill and a culvert; unknown – sinkholes in ditch backfilled; speed reduction signs to 50 km/h and hazard markers installed. Sinkhole at C058-1 on near south edge of pavement recently patched. October 2018 – at C058-1 sinkhole at culvert inlet was filled with 4 m <sup>3</sup> of grout. 2019 – All sites appeared to have been recently patched (MCI later confirmed that all sites were patched in June 2019). 2021 – All sites appeared to have been recently patched.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		C058-1: Pavement settlement across both lane and a small sinkhole forming on north edge of pavement. C058-2: New pavement patch in the north (westbound) lane. C058-3: Pavement settlement has been observed across both lanes.	X	
Slope Movement		X	N/A – none observed during the 2023 inspection.		X
Erosion	X		C058-1: Dispersive soil voids potentially forming beneath highway. Erosion channel downstream of culvert at south end of site. C058-1 and -2: Soil voids of various sizes forming above and below highway along drainage pathways. C058-3: Small sinkholes on the north and south highway embankment slopes, and a large sinkhole at the toe of the south highway embankment slope.	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**

General:

- The portion of Hwy 570:02 along the Red Deer River valley appears to be susceptible to dispersive-soil-void geohazards.
- A draft of geohazard-risk-level factors (e.g., probability and consequence factors) for subsurface-void geohazards was submitted to TEC for review and discussion in early 2019 for review and comment.

C058-1:

- The highway was last patched in 2021 (Photo 1). The dip in the highway surface (across both lanes) appears more significant than during the 2021 inspection.
- A small sinkhole (0.3 to 0.5 m in diameter) has formed on the north edge of the pavement (Photo 1 and 2). The sinkhole is located across the highway diagonally from a dip in the pavement surface on the south side of the highway indicating the presence of a void.
- A sinkhole at the culvert inlet (north of the highway) was filled in October 2018. The grout is intact and has not subsided since 2018.

C058-2:

- Pavement has been recently patched in both lanes. The patch has settled since the 2021 pavement patch (Photo 4).
- A large sinkhole was discovered north of the highway at the fence line during the 2018 inspection. The sinkhole has expanded since the 2021 inspection (north of the pavement patch).
- A sinkhole was discovered along the valley draw above the highway in 2018 that lines up with the sinkhole downslope of the road.
- Additional sinkholes have been observed since 2018, below the fence line on the south side of highway at the culvert outlet and near the toe of the slope.
- Local material was placed in the north (westbound) highway ditch, east of the culvert inlet (Photo 3). This fill was most likely placed to backfill erosion features on the north highway embankment slope and ditch.

C058-3:

- During the 2018 inspection, the MCI identified two sinkholes marked with 2"x4" wooden posts that were full of water following filling of the sinkhole with grout, indicating that the void had been plugged. When dispersive voids re-opened beneath the road, the MCI could see the water in the holes dropped, indicating that void filling/plugging efforts had failed. The ground around the posts has since been covered in sediment, obscuring observations of groundwater.
- North (westbound lane) of highway was patched in 2021, where a sinkhole has been observed since the 2018 inspection.
- A sinkhole in the north ditch was filled with grout in 2018. The grout appeared to be heaving from groundwater pressure during the 2018 inspection. The grout cap and sinkhole are now buried with soil deposits and gravel fill.
- A large sinkhole is located at the toe of the south highway embankment slope (first observed during the 108 inspection) (Photo 6). The sinkhole appears to have enlarged since the 2021 inspection.
- A continuous void (or series of voids) could be present under the entire highway at this location.

Maintenance/Repair/Monitoring Recommendations:

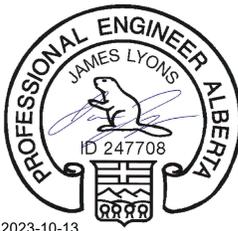
- The sites should continue to be regularly inspected by TEC’s Maintenance Contract Inspector (MCI).
- The sites should continue to be inspected every two-years as part of the Central Region GRMP Section B Inspections.
- No repairs are required at the C058 sites. However, if voids are present at depth below the highway, anywhere the highway embankment is founded on dispersive soils or constructed with dispersive soils, enlargement of a void could result in subsidence of the pavement, followed by brittle collapse of the pavement. TEC’s strategy to date is to backfill sinkholes and voids and patch the pavement when subsidence of the pavement occurs. The hazard markers at the C058 sites should be maintained. A speed reduction should be implemented, and repairs conducted immediately if further subsidence is noted.

This report is an instrument of service of Klohn Crippen Berger Ltd. (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Central Region Geohazard Risk Management Program (Contract No. CON0022160) and it may not be relied upon by any other party without KCB's written consent.

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- (i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
- (ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
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- (iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.
- (v) 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.



James Lyons, P.Eng.  
Civil Engineer

## Inspection Photographs

**Photo 1** There appears to be a more significant dip in the pavement surface at C058-1 since the 2021 inspection. A small sinkhole (first observed in 2018) is on the north edge of the pavement (indicated by red arrow). Photo taken June 26, 2023, facing west-southwest.



**Photo 2** The sinkhole first observed in 2018 along the north edge of pavement at C058-1 was backfilled with asphalt during the 2021 pavement patch. Photo taken June 26, 2023, facing southwest.



**Photo 3** Local material was spread in the north (westbound) ditch at the C058-2 site between the 2021 and 2023 inspections (most likely to backfill sinkholes previously observed at the site). Photo taken June 26, 2023, facing east.



**Photo 4** A pavement patch was completed in the north (westbound) lane at the C058-2 site between the 2021 and 2023 inspections in an area of previously observed settlement. Photo taken June 26, 2023, facing west.



**Photo 5** C058-3 has not been patched between the 2021 and 2023 inspections. Photo taken June 26, 2023, facing northeast.



**Photo 6** Large sinkhole (indicated by a red circle) at the toe of the south highway embankment at C058-3 appears to have expanded since the 2021 inspection. Photo taken June 26, 2023, facing southwest.



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- Legend**
- ✕ — Fence
  - ~~~~ Crack
  - > < Culvert
  - — Guardrail
  - ⊗ Sinkhole



NOTES:  
 1. HORIZONTAL DATUM: NAD83  
 2. GRID ZONE: UTM ZONE 11N  
 3. IMAGE SOURCE: 2023 MICROSOFT CORPORATION, 2023 MAXAR CNES, DISTRIBUTION AIRBUS DS

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*Alberta*

**Klohn Crippen Berger**

PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM		
TITLE Site Plan C058-I - Sinkholes Hwy 570:01, km 8.3		
SCALE 1:750	PROJECT No. A05116A02	FIG No. 1



**Legend**

- ✕ — Fence
- ~~~~ Crack
- > < Culvert
- — Guardrail
- ⊗ Sinkhole



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 3. IMAGE SOURCE: 2023 MICROSOFT CORPORATION, 2023 MAXAR CNES, DISTRIBUTION AIRBUS DS

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CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE

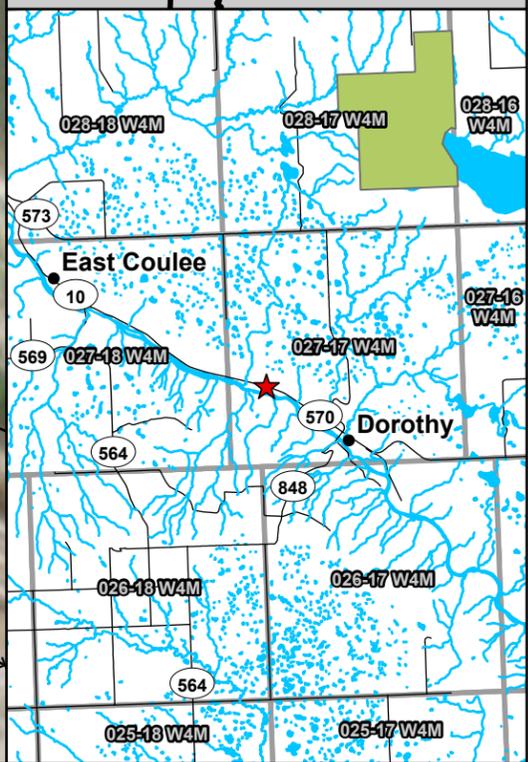
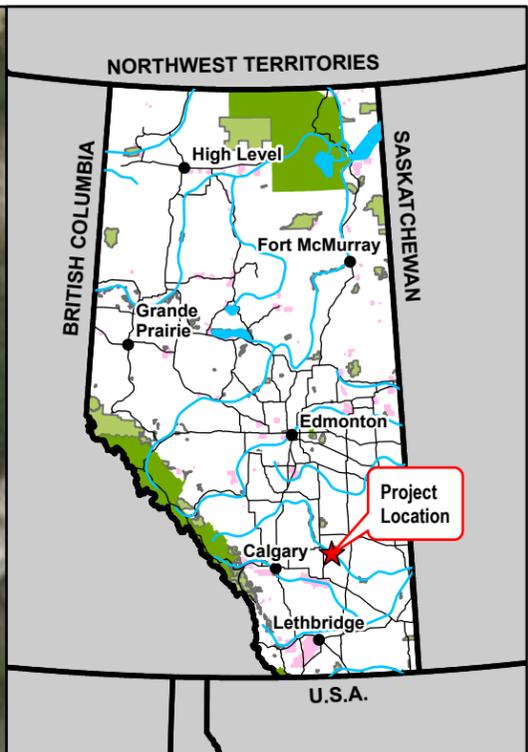
Site Plan  
 C058-II - Sinkholes  
 Hwy 570:01, km 9.2

SCALE 1:750

PROJECT No. A05116A02

FIG No. 1

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**Legend**

- ✕ — Fence
- > Culvert
- — Guardrail
- ◌ Grouted Sinkhole
- ⊗ Sinkhole



NOTES:  
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 2. GRID ZONE: UTM ZONE 11N  
 3. IMAGE SOURCE: 2023 MICROSOFT CORPORATION, 2023 MAXAR CNES, DISTRIBUTION AIRBUS DS

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PROJECT

CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE

Site Plan  
 C058-III - Sinkholes  
 Hwy 570:01, km 8.4

SCALE 1:750

PROJECT No. A05116A02

FIG No. 1