| SITE NUMBER AND NAME: **C058 Erosion and Sinkholes** | HIGHWAY & KM: 570:01, 8.3, 9.2, 9.8 | PREVIOUS INSPECTION DATE: June 26, 2023 | INSPECTION DATE: **June 10, 2025** |
|---|---|---|---|
| LEGAL DESCRIPTION: 10-08-27-17 W4M | NAD 83 COORDINATES:<br>UTM Northing Easting<br>C058-1 12 5683470 405475<br>C058-2 12 5683845 404934<br>C058-3 12 5684148 404224 | RISK ASSESSMENT:<br>C058-1: PF: 8 CF: 5 TOTAL: 40<br>C058-2: PF: 8 CF: 5 TOTAL: 40<br>C058-3: PF: 8 CF: 5 TOTAL: 40 | |
| HIGHWAY CLASSIFICATION NUMBER: 3 | | CONTRACT MAINTENANCE AREA (CMA): 521 | |
| AVERAGE ANNUAL DAILY TRAFFIC (AADT): 500 (west) & 400 (east) (Ref No. 116220 & 997198) | | | |

| SUMMARY OF SITE INSTRUMENTATION:<br><br>There is no instrumentation at the C058 site.<br><br>LAST READING DATE: N/A | INSPECTED BY:<br>Chris Gräpel (KCB)<br>James Lyons (KCB)<br>Tony Penney (TEC)<br>Chris Newman (TEC)<br>Imram Mehmood (TEC) |
|---|---|
| | |
| PRIMARY SITE ISSUE: Settlement of Hwy 570:01 due to the presence of dispersive-soil voids beneath the highway surface. | |
| APPROXIMATE DIMENSIONS: Numerous subsurface voids along an approximate 1.5 km stretch of Hwy 570:01. | |
| 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 $m^3$ 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 | | Pavement settlement and regular pavement patching completed at all three subsites. C058-1: A sinkhole has been observed at the north edge of highway surface and is backfilled with asphalt. A new sinkhole (estimated to be approximately 1 m deep, 1.5 m wide, and 2 m long) was observed below the middle of the north (westbound) lane during the 2025 inspection. | X | |
| Slope Movement | | X | N/A – none observed during the 2025 inspection. | | X |
| Erosion | X | | C058-1: Dispersive soil voids beneath the highway surface. Erosion gully downstream of culvert outlet.<br>C058-1 and -2: Soil voids of various sizes forming north and south of highway along drainage pathways.<br>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 (west of the culvert outlet). | X | |

| | | | | | |
|---|---|---|---|---|---|
| Seepage | | X | C058-1: Seepage observed through a sinkhole outlet in the north Red Deer River slope. | X | |
| Culvert Distress | | X | N/A – none observed during the 2025 inspection. | | X |

**COMMENTS**

General:

- The portion of Hwy 570:01 along the Red Deer River valley is susceptible to dispersive-soil-void geohazards.
- In 2019, KCB submitted a draft of geohazard-risk-level factors (probability and consequence factors) for subsurface-void geohazards to TEC for review and comment.

C058-1:

- The highway was patched between the 2023 and 2025 inspections (Photo 1). The dip in the highway surface (across both lanes) did not appear to have significantly changed between the 2023 and 2025 inspections.
- An existing sinkhole (previously estimated to be between approximately 0.3 m to 0.5 m in diameter) was on the north edge of the pavement and has been backfilled with pavement during pavement patching (Photo 2). A red diamond hazard marker, used to identify the sinkhole location, was lying on the ground beside the sinkhole during the 2025 inspection.
- During the 2025 inspection, a subsurface void was discovered below the north (westbound) lane (Photo 3 and 4). At surface, there is a relatively small hole through the highway surface, approximately 150 mm (6'') in diameter. However, below surface, KCB and TEC estimated (using a flashlight and tape measure) the void was approximately 1 m deep, 1.5 m wide, and 2 m long.
  - TEC immediately implemented temporary traffic control measures (single lane closure) to divert traffic to the south (westbound) lane.
  - KCB drove to an area of cell reception and notified the Maintenance Contract Inspector (MCI) of the void discovered below the highway surface. The MCI told KCB they would immediately contact the Highway Maintenance Contractor (HMC) who would mobilize to site to set up traffic accommodations and backfill the void. The HMC was on-site within 1 hour of notifying the MCI.
  - A drone flight was completed while KCB and TEC were waiting for the HMC to arrive on site. During the drone flight, KCB observed two sinkholes/voids south of the pavement patch on the riverbank approximately 1 m to 2 m above the Red Deer River (Photo 7). Water was flowing out of the sinkholes during the inspection.
  - TEC informed KCB after the site inspection that the HMC backfilled the void with "dirty" gravel.
- A sinkhole near the culvert inlet (north of the highway) was filled in October 2018. The grout is intact and has not subsided since 2018. There is vegetation (small shrubs) in the north ditch near the culvert inlet (Photo 5).
- A void was observed in the bottom portion of the riverbank, approximately 1 m to 2 m above the water level (Photo 7), and a linear erosion feature (up to 1 m deep, Photo 6) located on the south side of the highway. The linear erosion feature was located downstream of the culvert outlet (Photo 6 and 7). The two erosion features were located across the highway diagonally from the dip in the pavement surface and subsurface void observed during the 2025 inspection. This may indicate the presence of a series of voids below the highway surface along a preferential drainage path.

C058-2:

- A pavement patch was completed between the 2023 and 2025 inspections (Photo 8). The settlement appeared similar to during the 2023 inspection (Photo 9).

- A large sinkhole was first observed north of the highway (north of the pavement patch) at the fence line during the 2018 inspection. The sinkhole has expanded between the 2023 and 2025 inspections and was approximately 3 m in diameter (Photo 10 and 11).
- Local material was placed in the north (westbound) highway ditch, east of the culvert inlet (Photo 10). This fill was most likely placed to backfill erosion features on the north highway embankment slope and ditch.
- In 2018, a sinkhole was discovered along the valley draw above the highway. The sinkhole lines up with the sinkhole observed in the north ditch (below the fence) and downslope of the road. The sinkhole was not inspected during the 2025 inspection.
- Since 2018, additional sinkholes have been observed at the site, below the fence line on the south side of highway at the culvert outlet, and near the toe of the slope (Photo 11).

C058-3:

- During the 2018 inspection, the MCI identified two sinkholes marked with 2"x 4" 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.
- In 2021, the north (westbound) lane of highway was patched where a sinkhole has been observed since the 2018 inspection. The site appears to have been patched again between the 2023 and 2025 inspections.
- 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 were buried with soil deposits and gravel fill.
- A large sinkhole was located at the toe of the south highway embankment slope (first observed during the 2018 inspection) (Photo 12). The sinkhole did not appear to have enlarged significantly since the 2023 inspection.
- A continuous void (or series of voids) could have been 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.
- A subsurface investigation, consisting of drilling and geophysical surveys, should be performed to assess the potential for subsurface voids along the site. Boreholes should be drilled at each subsite to support interpretation of the geophysical surveys (a combination of MASW, ERT, and GPR). The results of the subsurface investigation will be used to develop mitigation options (short-term and long-term) for the site (e.g., excavate and replace the highway subgrade with granular fill). KCB prepared a proposal following the 2025 Section B inspection and submitted it to TEC for review and comment on July 11, 2025.
- 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 performed immediately if further subsidence is noted.

KCB has prepared this report in a manner consistent with the level of care, skill, and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

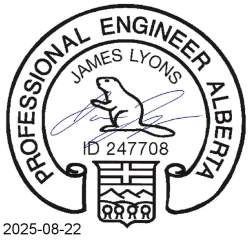
(i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.

(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.

(iii) The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.

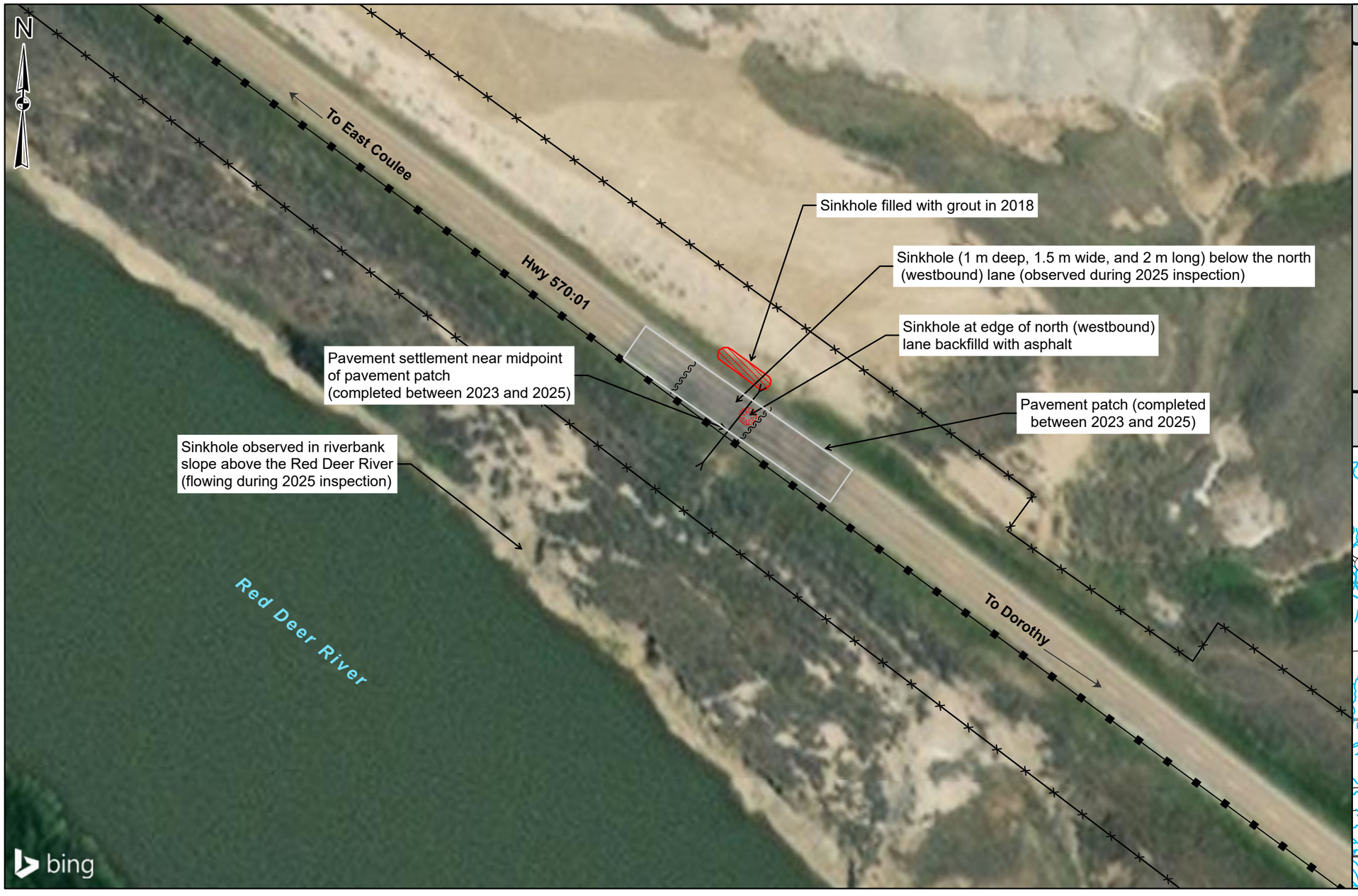
(iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

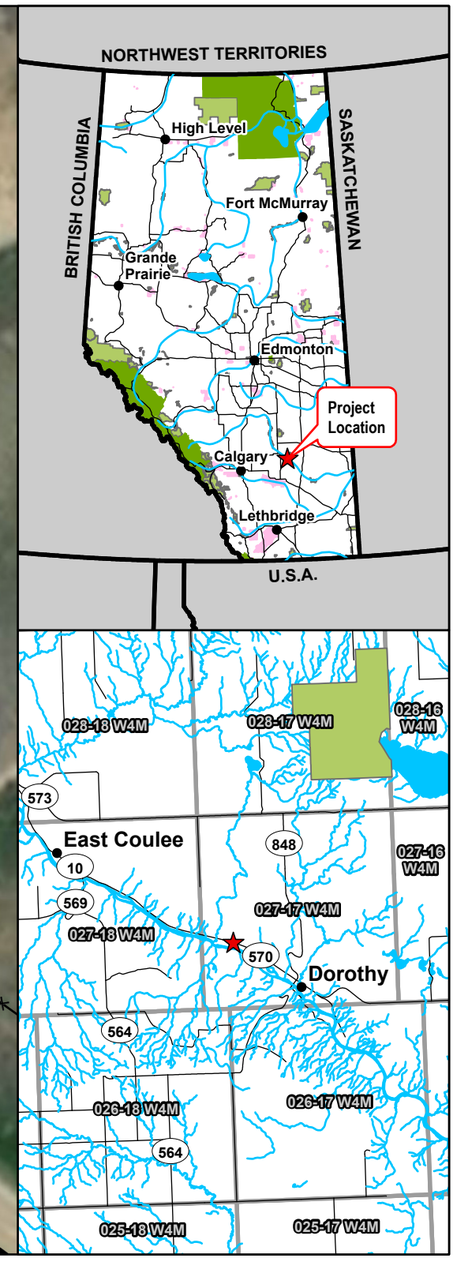
(v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.




James Lyons, P.Eng.
Civil Engineer

PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.
RM SIGNATURE: _____
RM APEGA ID #: 58463
DATE: August 25 2025
PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)




**Legend**

- Crack
- Guardrail
- Culvert
- Sinkhole
- Grouted Sinkhole
- Fence

0 25 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C058-1 - Erosion and Sinkholes
Hwy 570:01, km 8.3

SCALE: 1:750 | PROJECT No.: A05116A02 | FIG No.: 1

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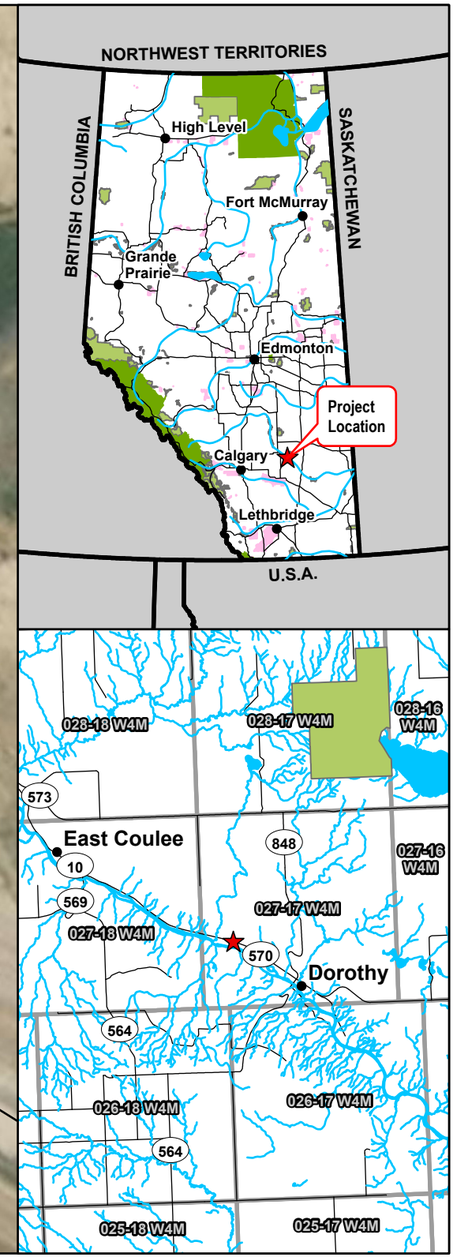


**Legend**

- Crack
- Guardrail
- Culvert
- Sinkhole
- Fence

0 25 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C058-2 - Erosion and Sinkholes
Hwy 570:01, km 9.2

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:750 | A05116A02 | 2 |

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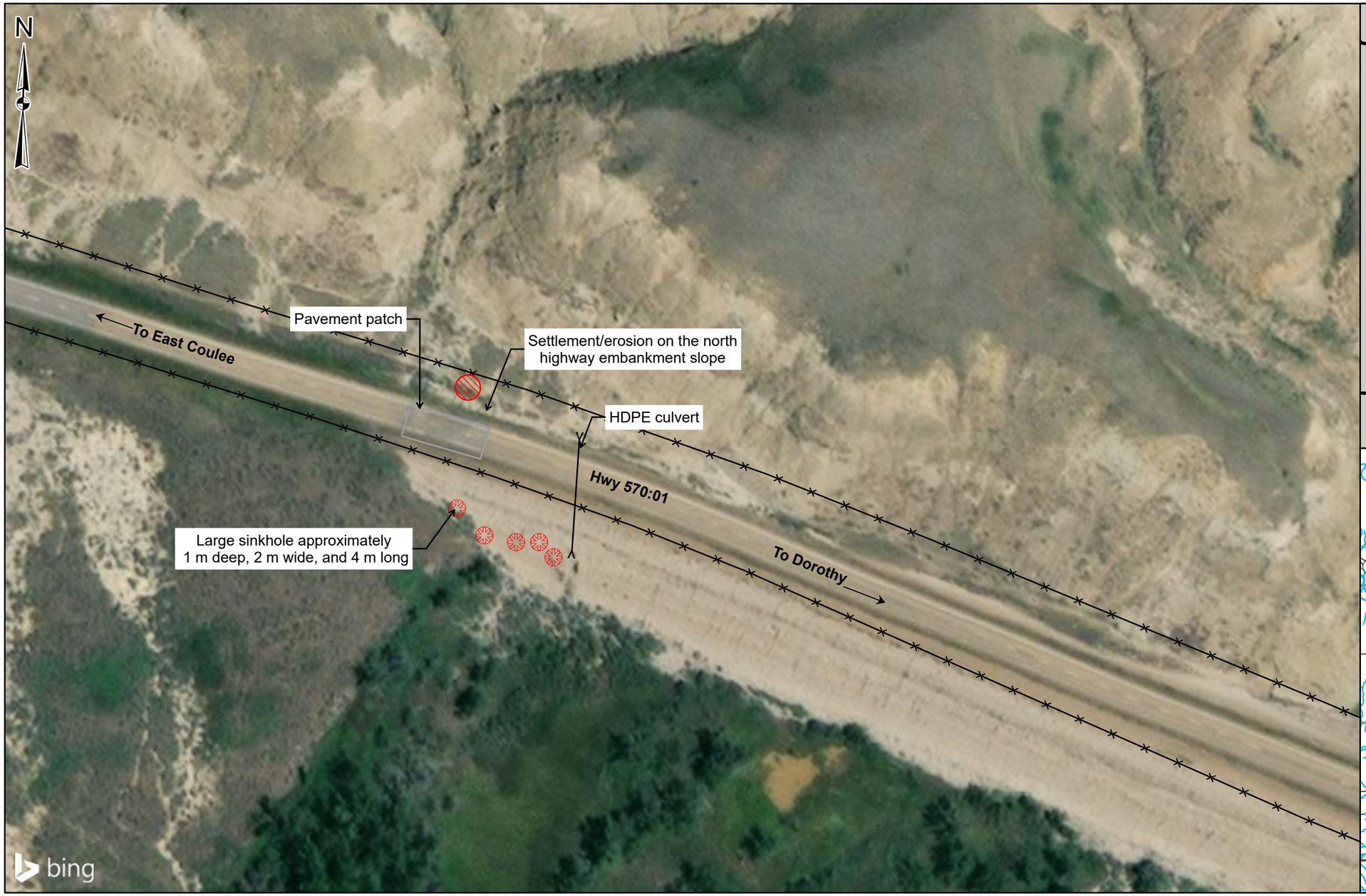


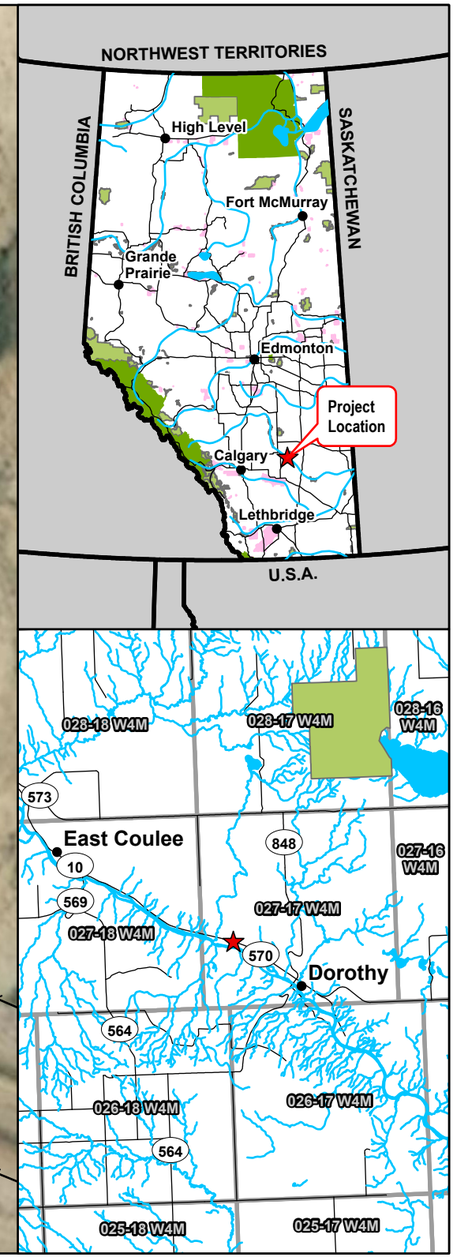


**Legend**

- Fence
- Grouted Sinkhole
- Sinkhole
- Culvert
- Guardrail

0 25 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: 2025 MICROSOFT CORPORATION, 2025 MAXAR CNES, DISTRIBUTION AIRBUS DS

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C058-3 - Erosion and Sinkholes
Hwy 570:01, km 8.4

| SCALE | PROJECT No. | FIG No. |
|---|---|---|
| 1:750 | A05116A02 | 3 |

File: Z:\AE\DM\A05116A02 ABT Central Region GRMP\400 Drawings\GIS\02_ProFiles\2023\Section B\ABT_Central_SectionB_230724\ABT_Central_SectionB_230724.aprx Date: Time: Creator: : NMirhadi

# Inspection Photographs

**Photo 1** **Pavement patch completed at the C058-1 site between the 2023 and 2025 inspections. Photo taken June 10, 2025 facing west.**

**Photo 2** **Pavement settlement and sinkhole backfilled with asphalt at the north edge of the highway surface. Red diamond hazard sign lying at the edge of the road. Photo taken June 10, 2025 facing southwest.**

**Photo 3** **Sinkhole (approximately 1 m deep, 1.5 m wide, and 2 m long) below the middle of the north (westbound) lane discovered during the 2025 inspection. Photo taken June 10, 2025 facing southwest.**

**Photo 4** **Highway Maintenance Contractor applying spray paint around sinkhole opening. Photo taken June 10, 2025 facing east.**

**Photo 5** **Culvert inlet in the north (westbound) ditch. Photo taken June 10, 2025 facing south.**


**Photo 6** **Erosion gully on downstream (south) highway embankment slope. Photo taken June 10, 2025 facing south.**

**Photo 7** **Void (indicated by red arrow) observed on the north riverbank slope during the 2025 inspection, downslope of the sinkhole observed beneath the highway surface (indicated by red arrow). Culvert outlet and linear erosion feature (up to 1 m deep) indicated by red arrow. Water was flowing out the void during the inspection. Photo taken June 10, 2025 facing north.**

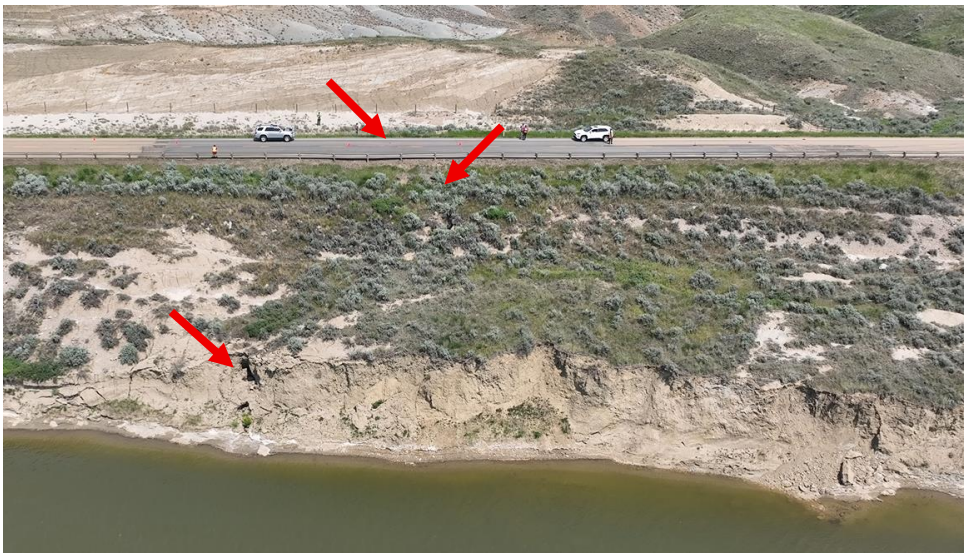

**Photo 8** **Pavement patch (completed between 2023 and 2025) at the C058-2 site. Photo taken June 10, 2025 facing west.**

**Photo 9** **Dip in highway surface at the C058-2 site. Photo taken June 10, 2025 facing southeast.**

**Photo 10** **Large sinkhole (approximately 3 m in diameter) in the north (westbound) ditch that is impacting the fence. Photo taken June 10, 2025 facing north.**

**Photo 11** **Aerial photo of the C58-2 site showing the pavement patch, culvert outlet (indicated by red arrow), and large sinkhole (indicated by red circle). Photo taken June 10, 2025 facing northwest.**

**Photo 12** **Aerial photo of the C058-3 site showing the pavement patch and culvert outlet (indicated by red circle). Photo taken June 10, 2025 facing north.**