CENTRAL REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **C073-I and -II: Slide and Erosion Sites**	HIGHWAY & KM: 580:02, 23.604 2A:12, 15.725	PREVIOUS INSPECTION DATE: August 14, 2020	INSPECTION DATE: **June 23, 2021**
LEGAL DESCRIPTION: **C073-I:** SE 06-30-01-W5M **C073-II:** NE 29-30-01-W5M	NAD 83 COORDINATES: UTM Northing Easting 11 5713022 699532 11 5720905 701123	RISK ASSESSMENT: PF: 1 CF: 2 TOTAL: 2 PF: 1 CF: 7 TOTAL: 7	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): **C073-I:** 1240 (east) & 1620 (west) (Reference No. 68250 & 76260) **C073-II:** 4660 (north) & 2760 (south) (Reference No. 70000526 & 70000216)		CONTRACT MAINTENANCE AREA (CMA): 514	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the C073 sites. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Roger Skirrow (AT) Tony Penney (AT)

PRIMARY SITE ISSUE: The C073 slide (C073-I) was believed to be caused by surface water flows off the highway saturating the embankment fill. The C073 erosion (C073-II) is caused by surface water flows from the west (southbound) ditch, over steepened slope for a vegetated slope, and erosion is most likely exacerbated during periods of increased precipitation.

APPROXIMATE DIMENSIONS: C073 Slide Site was approximately 20 m wide, 7 m to 11 m high, and 1 m to 2 m deep. The C073 Erosion Site is approximately 5 to 8 m wide (crest to crest), 3 m deep, and 30 m long.

DATE OF ANY REMEDIAL ACTION: 2020 – The C073 slide site was repaired in August 2020 and consisted of geogrid reinforced fill, a common fill toe berm, a 900 mm diameter CSP culvert, and an overflow channel.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		C073-I: asphalt placed during the 2020 repairs is in poor condition		X
Slope Movement	X		C073-I: a thin longitudinal crack was observed between the new asphalt shoulder and the existing asphalt		X
Erosion	X		C073-II: an erosion gully in in the west (southbound) ditch		X
Seepage		X	N/A		X
Culvert Distress		X	C073-I: the 900 diameter CSP culvert installed in 2020 is in good condition		X

COMMENTS

C073-I:

- The shallow surficial slide on the north highway embankment was impacting the north (westbound) lane of Hwy 580. The slide was first inspected by AT and KCB in July 2019 during the Central Region GRMP annual inspection tour. The slide was approximately 20 m wide, 1 m to 2 m deep, and 7 m to 11 m high. Failed material was deposited at the toe of the highway embankment in the ditch bottom, and also to the west of the slide, impacting a private fence and depositing material at the edge of Carstairs Creek. The backscarp of the slide was a vertical face approximately 2 m high, where the guardrail and 5 guardrail posts were left unsupported. KCB issued a call-out report to AT on September 26, 2019.

- A follow-up site visit was completed in May 2020, where KCB and AT discussed repair options. KCB issued a repair design to the Highway Maintenance Contractor (HMC) in July 2020 and the repair was completed in August 2020. The repair included rebuilding the embankment slope with geogrid reinforced fill, a toe berm that abutted against the slope north of the highway embankment, a 900 mm diameter CSP culvert oriented along the existing ditch bottom, a riprap apron at the culvert inlet and outlet, and a riprap lined overflow channel at the toe berm and natural slope contact. The site was hydro-mulched after construction was completed.
- During construction, the HMC observed an area approximately 15 m west of the original slide that was being impacted from surface water flows over the north edge of the highway. The area was also repaired during construction (topsoil stripping, fill placement, topsoil spreading, and hydro-mulching). The area repaired was approximately 10 m in length.
- During the June 2021 inspection, the repaired slope, toe berm, and culvert appeared to be in good condition. However, the vegetation growth/coverage on the repaired slope and upstream ditch is poor and requires additional seeding (Photos 1, 3, and 4).
- A local resident spoke with KCB and AT regarding a beaver dam on the upstream side of the culvert below the highway embankment (oriented north-south, along Carstairs Creek). There has been beaver damming of the culvert inlet since KCB and AT first inspected the site in July 2019, and a local resident spoke also spoke with KCB regarding the beaver dam when they were on site during construction in August 2020.

C073-II:

- An erosion gully has formed in the west (southbound) ditch, approximately 20 m west of Hwy 2A. The erosion gully is approximately 5 to 8 m wide (crest to crest), 3 m deep, and 30 m long. The erosion gully has 45° side slopes and is east (downslope) of a private landowner's fence.
- KCB and AT believe the erosion gully formed due to the steepness of the ditch at the erosion site (estimated to be between 12.5% to 14%), large catchment area, and inadequate erosion protection (i.e., only vegetation). Erosion is likely exacerbated by periods of increased precipitation.
- The depth of the erosion gully decreases further downstream (north) where a well-vegetated area acts as a sediment trap. No sediments were observed at the outlet of the erosion gully.
- KCB and AT inspected 6 years ago and agree the erosion gully has not significantly changed since that inspection (i.e., retrogressed towards the highway or private fence).

Discussed Remedial Actions:

C073-I:

- The HMC should re-seed the C073-I site in 2021. The HMC could hydro-seed the repaired slope and upstream ditch from westbound lane of Hwy 580.

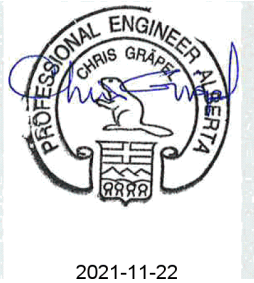
C073-II:

- AT should have the HMC (Volker) complete the repairs at the C073-II site. The repair options could include backfilling the erosion gully with fine-grained material (e.g., clay till), grading the ditch to allow for positive drainage, and hydro-seeding. However, due to the steepness of the ditch, the repair may need to incorporate more permanent erosion control measures (e.g., geocell armouring, TRM with bonded-fibre matrix, geosynthetics, riprap etc.).
- KCB will complete a hydrotechnical assessment to determine the flow the ditch will have to accommodate (e.g., maximum flow for the 1:10 year rain event) and provide sketches to the HMC for the repair work.

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



2021-11-22

Chris Gräpel, M.Eng., P.Eng.
Civil Engineer, Associate

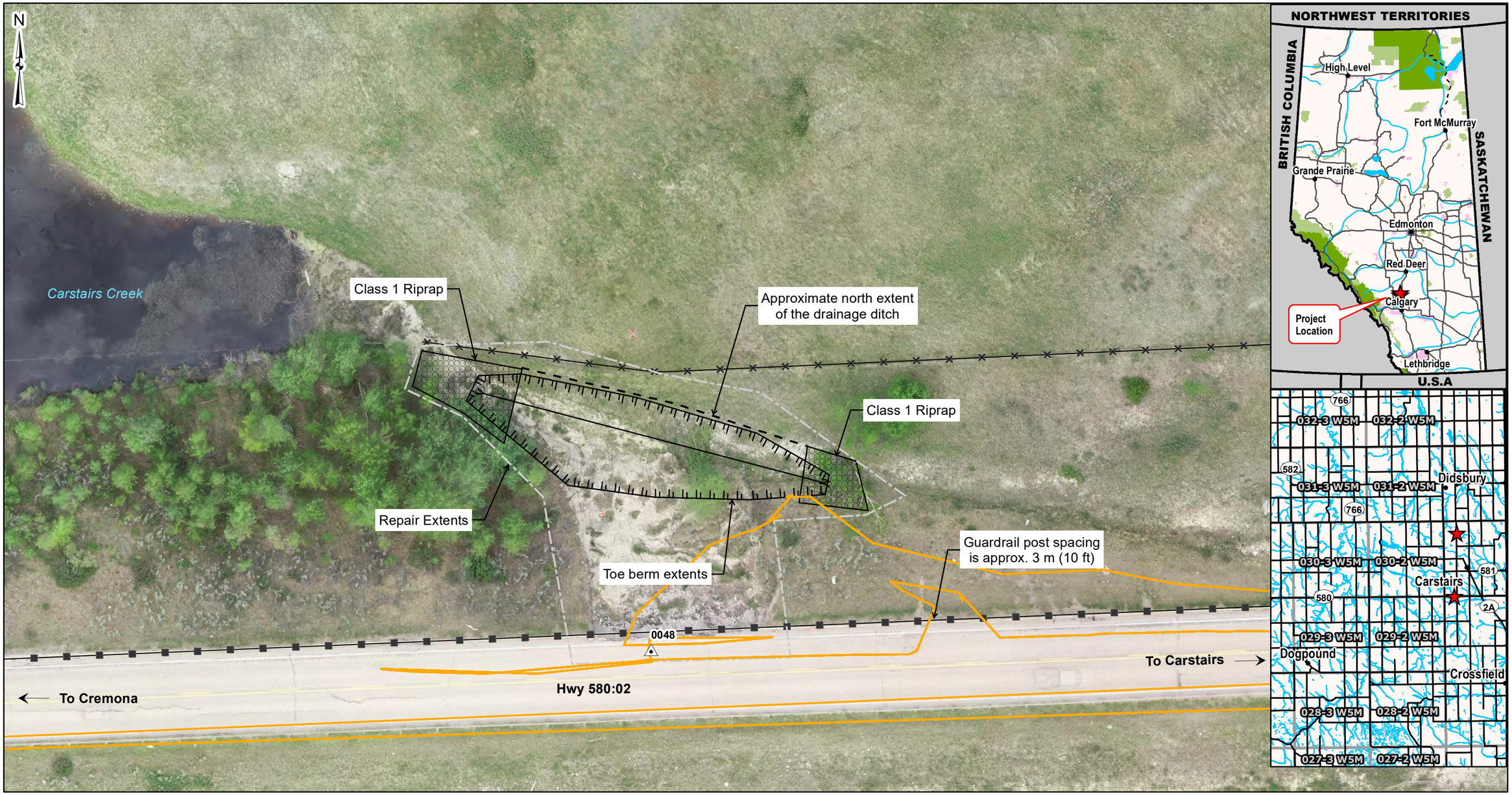
PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.

RM SIGNATURE: _____

RM APEGA ID #: 187607

DATE: 22 Nov. 2021

PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)



Legend

- GPS Waypoint (June 23, 2021)
- GPS Track (June 23, 2021)
- Repair Extents
- Guardrail
- Fence
- Culvert

Meters
0 10

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM Zone 11N
3. IMAGE SOURCE: Abacus Datagraphics Ltd. Image dated July 30, 2013 to October 14, 2013
4. Location of instruments is approximate (not surveyed)

CLIENT: Alberta Government

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C073-I - Southwest of Carstairs
Hwy 580

SCALE	PROJECT No.	FIG No.
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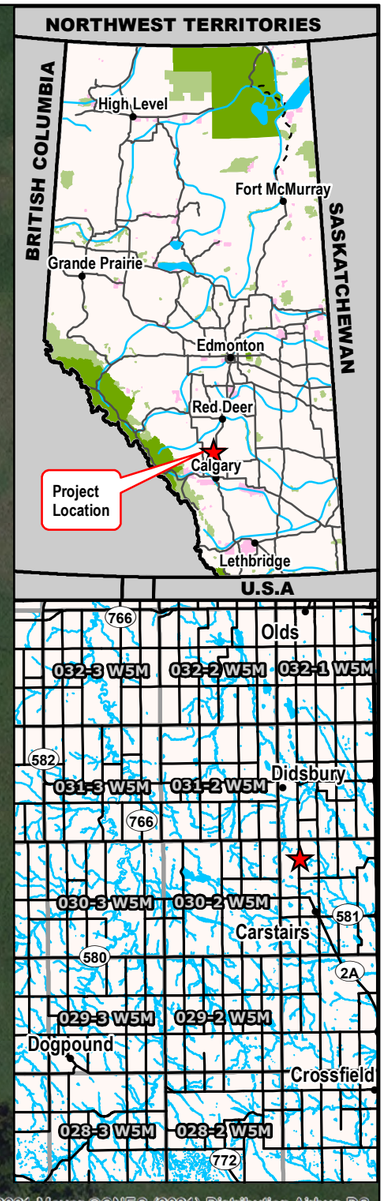

Legend

- GPS Waypoint (June 23, 2021)
- GPS Track (June 23, 2021)
- Guardrail
- Erosion

Meters
0 50

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM Zone 11N
3. IMAGE SOURCE: Abacus Datagraphics Ltd. Image dated July 30, 2013 to October 14, 2013
4. Location of instruments is approximate (not surveyed)

CLIENT: Alberta Government

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C073-II - North of Carstairs
Hwy 2A

SCALE	PROJECT No.	FIG No.
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Inspection Photographs

Photo 1 **An overview of the C073 slide area from the north (westbound) shoulder of Hwy 580, before and after repairs. Photos taken July 10, 2019 and June 23, 2021 facing west and northwest, respectively.**

Photo 2 **Area near Carstairs Creek where failed material from the C073 slide sloughed into when the embankment failed in 2019, before and after the 2020 repairs. Photo taken July 10, 2019 and June 23, 2021 facing northwest.**

Photo 3 **The east side of the slide repair, 900 mm diameter CSP culvert inlet, riprap apron, and overflow channel. Photo taken June 23, 2021 facing northwest.**

Photo 5 **Erosion site approximately 4.7 km north of Carstairs, in the west (southbound) ditch of Hwy 2A. Photo taken June 23, 2021 facing southwest.**

Photo 7 **The sides of the erosion gully are near-vertical, and the depth of the erosion gully decreases as it progresses north. Photo taken June 23, 2021 facing northwest.**