SOUTHERN REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **S031-II Mystery Culvert**	HIGHWAY & KM: 762:02, 17.660	PREVIOUS INSPECTION DATE: July 5, 2021	INSPECTION DATE: **May 16, 2022**
LEGAL DESCRIPTION: 07-19-22-04-W5M	NAD 83 COORDINATES: UTM 11 Northing 5639613 Easting 672917	RISK ASSESMENT: **S031-I**: PF: 1 CF: 1 TOTAL: 1 **S031-II:** PF: 11 CF: 4 TOTAL: 44	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 720 (north) & 1420 (south) (Reference No. 65170 & 60180)		CONTRACTOR MAINTENANCE AREA (CMA): 27	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the S031-II site. LAST READING DATE: N/A	INSPECTED BY: Chris Morgan (KCB) Laura Assaad (KCB) Roger Skirrow (AT) Alex Frotten (AT) Maury Siddons (AT)
PRIMARY SITE ISSUE: Monitoring of two repaired embankment failures. Prior to repair, the embankment failures were impacting the southbound lane at both site I and II.	
APPROXIMATE DIMENSIONS: S031-I: Slide approximately 45 m wide, up to 3 m into the highway. Cracking previously observed to the middle of the highway. S031-II: Slide approximately 40 m wide, up to 2 m into the highway. Most of the cracking was observed on the west shoulder. The height of the highway embankment is approximately 4 m to 5 m. Before toe berm construction, the embankment was approximately 6 m high.	
DATE OF ANY REMEDIAL ACTION: Fall 2017 – S031-I was repaired including excavating and replacing the embankment material, building a toe berm, and improving drainage. S031-II – previous pavement patches have been completed at the site	

ITEM	**CONDITION EXISTS**		**DESCRIPTION AND LOCATION**	**NOTICABLE CHANGE FROM LAST INSPECTION**	
	YES	NO		YES	NO
Pavement Distress	X		S031-II: Pavement cracking and settlement in west (southbound) lane.	X	
Slope Movement	X		S031-II: Slight bulge in slope and cracking at the head of the slide.		X
Erosion		X	N/A – none observed		X
Seepage		X	N/A – none observed. A wetland is located along the west side of the highway embankment.		X
Culvert Distress	X		S031-II: The CSP culverts appear rusted and deformed		X

COMMENTS

S031-I (not visited in 2022):

- During the 2021 drive-by inspection the site appeared to be in good condition following 2017 repairs.
- Vegetation is establishing on the slope and no distress was observed in pavement surface.
- The riprap armoured drainage ditch was previously graded improperly (i.e., center of channel was higher than outside edges). However, the MCI reported that the ditch had been repaired since the previous inspection.

S031-II:

- There appears to be ongoing settlement and/or slope movement at the site. However, and the pavement cracked within the 1-year warranty period. In 2019, a tension crack was observed in the pavement and has continued to enlarge (Photo 4).
- During the 2022 inspection it was noted that the patched area had settled approximately 20 mm (the settlement was approximately 10 mm to 15 mm in 2021) (Photo 1 and 2).
- The MCI reported that the pavement had settled approximately 200 mm vertically and required patching in June 2020. During the 2020 inspection, mid-slope tension cracking was noted along the west embankment between the north and south culverts. The side slopes appear well vegetated. There is a slight bulge in the slope but no discernible change between the 2021 and 2022 inspections.
- The tension crack appears to have increased in length by 10 m (extending north and south). The total length of the tension crack is approximately 40 m. Longitudinal cracks up to 10 mm wide were observed through the patch and at the north end of the site (Photos 1 through 4).
- Pavement cracking in the west (southbound) lane is offset 1.9 m from the white line on the shoulder (offset 1.7 m in 2021), and the east (northbound) lane has started to be impacted.
- Two CSP culverts are present at S031-II site that are underlying the highway (oriented east-west) (Photo 5 and 6). The south culvert was replaced as part of the 2017 repair work, and the north culvert is outside the site limits. Both culverts appeared deformed and bowed beneath the highway embankment. An asphalt apron is at the outlet of the north culvert (Photo 6).
- The east (northbound) ditch appears poorly drained.

Maintenance/Repair/Monitoring Recommendations:

- S031-I can be removed from the active list of sites for the Southern Region. The S031-III site should be inspected annually as part of the Southern Region GRMP Section B inspections.
- Candidate repair options for the S031-II site include: (i) a driven steel H-pile wall (ii) excavate and replace the embankment fill with geogrid reinforced granular fill, including a shear key near the toe of the highway embankment. (iii) Reduce embankment loading using lightweight fill (e.g., cematrix or polystyrene) in the top third of the slope.
- One borehole could be drilled at the S031-II site to assess the ground conditions. A slope inclinometer should be installed in the borehole to assess the depth of movement at the site and to help determine the depth of a potential pile wall repair.
- The repair work at the S031-II site could be completed by Alberta Transportation's Highway Maintenance Contractor (HMC). A design memo (including repair sketches and quantity estimates) could be prepared by KCB to assist the HMC.

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Alberta Transportation (Client) for the specific application to the Southern Region Geohazard Risk Management Program (Contract No. CON0022161) and it may not be relied upon by any other party without KCB's written consent.

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.

September 27 2022
I.D. # 58463

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

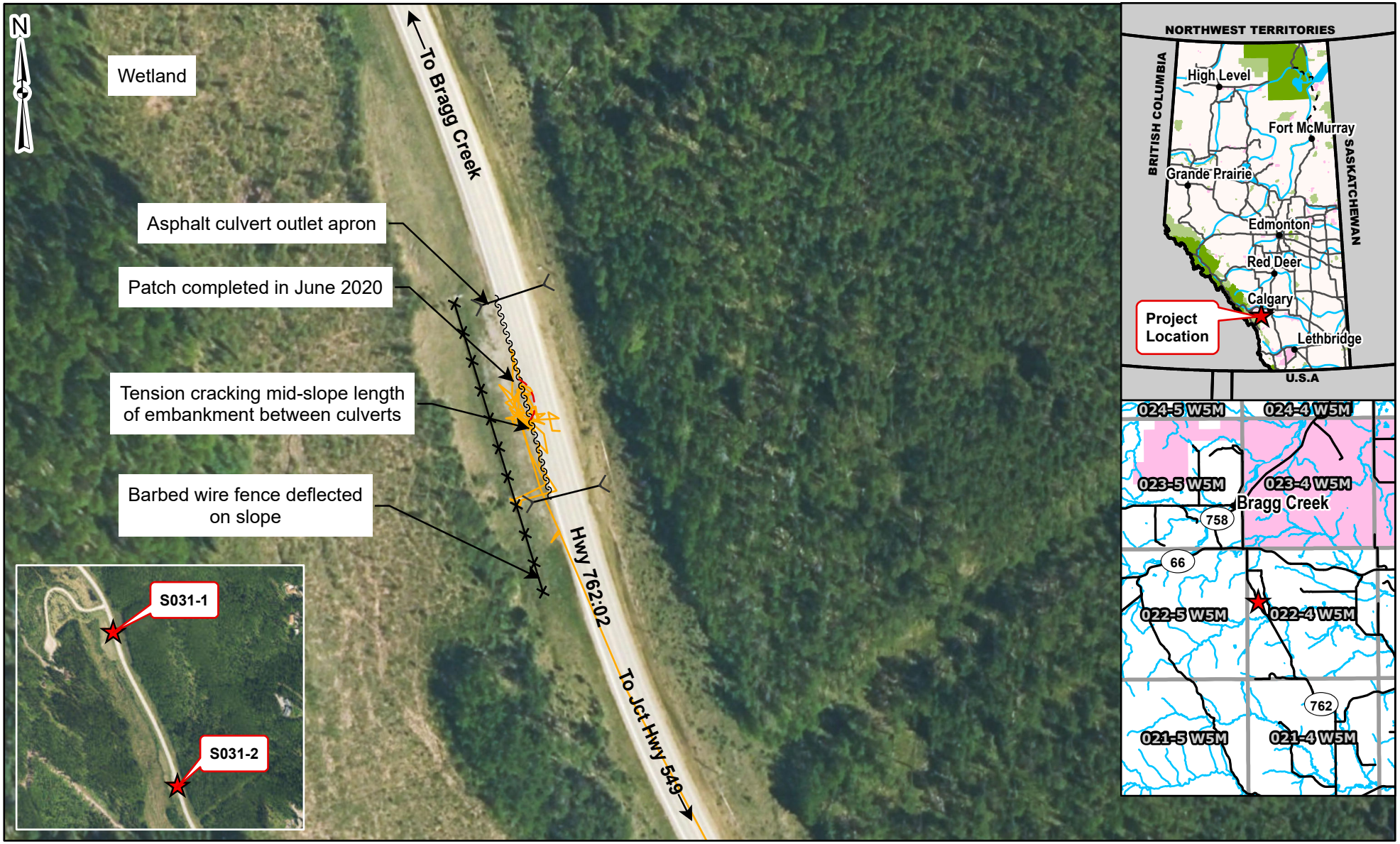
PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.

RM SIGNATURE: _____

RM APEGA ID #: 187607

DATE: 28 Sep. 2022

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



0 50 Metres

Legend

- Fence
- Culvert
- Tension Crack
- Transverse Crack
- GPS Track (May 16, 2022)

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 11N
3. IMAGE SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS AND THE GIS USER COMMUNITY.

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
S031-2 - Mystery Culvert
Hwy 762:02, km 97.660

SCALE	PROJECT No.	FIG No.
1:1,500	A05116A03	1

File: Z:\AC\GY\Alberta\A05116A03 ABT Southern Region GRMP\400 Drawings\2022\Section B\ArcGIS Pro Figures\S031-2\S031-2.aprx Date: Time: Creator: : aharrison

Inspection Photographs

Photo 1 **Pavement cracking and settlement in the west (southbound) lane. The location was patched in June 2020. Photo was taken May 16, 2022, facing southeast.**

Photo 2 **Pavement patch north of the slide repair area where there has been pavement cracking and settlement. Photo was taken May 16, 2022, facing southeast.**

Photo 3 **Transverse and longitudinal pavement cracking at the location of the pavement patch. The longitudinal crack is along the contact between new and old pavement. Photo was taken May 16, 2022, facing northeast.**

Photo 4 **Longitudinal pavement crack in the west (southbound) lane. Photo taken May 16, 2022, facing east.**

Photo 5 **The west (southbound) ditch, CSP culvert inlet, and the approximate location of the 2017 toe berm repair (indicated by red arrow). Photo was taken May 16, 2022, facing north.**

Photo 6 **Asphalt apron at the outlet of the north CSP culvert. Photo taken May 16, 2022, facing north.**