ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA
2020 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC90-1	17 Km NW of Athabasca	**Baptiste Creek Bridge NW Approach Fill Landslide**	02:42	17.94
Legal Description		**UTM Co-ordinates (NAD 83)**		
SW-6-67-23-W4M		12 6071799 E 338303		

	Date	PF	CF	Total
Previous Inspection:	May 7, 2018	13	6	78
Current Inspection	June 5, 2020	6	3	18
Road AADT:	1,500		**Year:**	2019
Inspected By:	Arthur Kavulok, and Roger Skirrow (AT) Tarek Abdelaziz and José Pineda (TEL)			
Report Attachments:	☑ Photographs	☐ Plans	☑ Maintenance Items	

Primary Site Issue	Landslide within the NW approach fill of Bridge File (BF) 7055, impacting highway, NW wing wall, abutment supports, and the capacity of the creek channel
Dimensions:	The slide is approximately 30 m long and 40 m wide
Site History / Available Information:	The existing bridge structure was constructed in 2008 under AT Contract No. 7681/08 to replace a six span bridge structure that was constructed in the 1970s. The new structure consists of a 47 m single span steel girder bridge with integral abutments. The construction of the new bridge required the construction of a temporary detour on the west side of the old bridge as well as a temporary bridge structure. The old bridge was supported on seven rows of piles. The tips of the old bridge piles were founded at an approximate elevation of 577 m. The piles of the old bridge were cut off and left in place as per the as-built drawings. In addition, the creek was realigned/shaped as part of the 2008 contract. The approach fill head slope is inclined at 2H:1V and 3H:1V on the north and south side of the Baptiste Creek, respectively. The side slopes of the approach fill are approximately 3H:1V on both sides of the creek. Approximately 6 m of fill was placed on the west side of the bridge to the north of the creek alignment to accommodate the construction of the new bridge. Records indicate that an instability occurred within the south head slope during the construction of the old bridge in the 70s. The repair at that time, consisted of flattening the head slope from 2H:1V to 3H:1V, resulting in an increase of the bridge span by about 10 m. In 1979, an instability occurred to the east of the north abutment outside the bridge location. The repair of the north abutment consisted of slope flattening along with the construction of a toe buttress and finger drains. In September 2017, AT noticed a lateral movement of the NW side slopes. A void formed adjacent to the taper of the existing trough drain and below the NW corner of the abutment seat. Between October 16 and 20, 2017, eleven cubic meters of Class C concrete was used to fill voids formed behind the trough drain taper and below abutment seat. A concrete block was also constructed by the face of the abutment seat to fill the gap formed below the abutment

	seat. However, major slope movement occurred abruptly on October 23, 2017. The sudden movement resulted in the formation of a gap below the wing wall and the abutment seat, and the failure of the trough drain. The repairs at the NW side slopes were completed from March 3, 2019 to October 15, 2019. The repairs generally included (a) installation of cantilever and tied-back sheet pile walls, (b) slope flattening of the northwest slope, (c) instream work to restore the creek channel, and (d) structural work to repair the landslide-induced damages to the north bridge abutment. Geotechnical instrumentation consisting of load cells, strain gauges, vibrating wire piezometers, and a slope inclinometer were also installed to monitor wall deflections, anchor loads, and slope movements to monitor the effectiveness of the recent repair measures. The vibrating wire piezometers, load cells, and strain gauges were all wired to a Campbell Scientific CR6 datalogger which was programed to take daily readings.	
Observations:	**Description**	**Worse?**
☑ Pavement Distress		☐
☑ Slope Movement		☐
☑ Erosion	Minor erosion rills noted within the dug channel north of the landslide area at the mouth of the highway east ditch (See Photos 3 and 4)	☐
☑ Seepage		☐
☑ Bridge/Culvert Distress		☐
☑ Other	Local areas showing bare vegetation between the new barbed wire fence and the west ditch	☐

Active Instrumentation (1SI, 2VWs, 7 VCs, 3SG):

Slope inclinometer SI19-1, located at the toe of the slope above Pile Wall A location, has shown no discernible movement since initialization.

Vibrating wire piezometers VW19-1A (tip depth at 5 m) and VW19-1B (tip depth at 10 m) showed decreases in ground water level by up to 0.6 m since September 2019. Groundwater levels were measured at 2.7 m and 1.8 m below ground surface at VW19-1A and VW19-1B, respectively.

Load cells were installed in seven selected anchors along the tied-back sheet pile wall. The design load/lock-off load for Cells VC2135, VC2131, VC2136, and VC2133 is 140 kN and 210 kN for Cells VC2132, VC2134, and VC2130. All load cell readings recorded in the spring of 2020 were below their design load/lock-off load but did not show significant changes in readings since they were last read in September 2019. Load Cells VC2135, VC2131, VC2136, and VC2133 showed increases in load of 6.73 kN, 3.89 kN, 4.16 kN, and 3.94 kN, respectively. VC2132, VC2134 and VC2130 showed decreases in load of 11.44 kN, 9.4 kN, and 2.53 kN, respectively.

The upper, middle and lower strain gauges showed decreases in total micro-strain of 25.48, 9.00 and 8.14, respectively, since the previous readings in September 2019.

Assessment (Refer to attached Figures and Photos)**:**

The 2019 repairs have been effective in stabilizing the landslide movement.

The minor erosion rills shown in Photos 3 and 4 is within a shallow temporary channel dug during construction to the south of the east ditch to convey surface flow from the ditch to the bush. Rill erosion should not be an issue in the future as long as vegetation grows in the channel. If rill erosion continues to be an issue, an additional measure will need to be implemented.

Recommendations:

This site should be inspected again next year to confirm the effectiveness of the repair measures. Continued monitoring of the installed geotechnical instrumentation is also recommended.

If water continues to pond in the east ditch, consideration should be given to re-grading the ditch to promote drainage. The flow from the ditch can be accommodated through the dug channel but it should be protected (armored with Class 1M Riprap) to avoid future erosion issues. Otherwise, a culvert could be installed below the existing approach to the south of the site to convey surface water towards north.

H:\13000\13357 Geohazard Assessment - Athabasca (CON0017605)\Drafting\2020\JGP\13357-NC90 FIGURE 1.dwg - F1 - Oct. 08, 2020

PONDING WATER IN DITCH
RUTTING
EROSION RILLS
Fd. I. PIN
ROAD ALLOWANCE
ROAD ALLOWANCE
TO SLAVE LAKE
NEW GUARDRAIL
10H:1V
18+025
HWY 2:42
REMOVE AND DISPOSE EXISTING GUARDRAIL AND INSTALL NEW GUARDRAIL SECTIONS FROM STA. 17+987.4 TO STA. 18+042
BLEND IN FILL TO COVER BACKSIDE OF DRAIN TROUGH AND SHEET PILE
1.0m WIDE x 0.3m DEEP FILTER GRAVEL (DES 8, CL 25)
INSTALL TIED BACK SHEET PILE WALL B
BURRITO FILTER FRAVEL WRAPPED IN NON-WOVEN GEOTEXTILE TYPE B INSTALLED AT THE BASE OF THE WALL TO DRAIN SEEPAGE FROM ANCHOR HOLES INTO THE ARMORED CREEK BANK
CONSTRUCT DRAIN TROUGH BEHIND PILE WALL B. DRAIN TROUGH TO DAYLIGHT INTO RIPRAP ZONE
18+000
ACP PATCH 19m LONG
FLATTEN SLOPE TO 6H:1V AND BLEND EDGES OF REGRADED AREA
CONSTRUCT SWALE LINED WITH TRM TYPE C (CURLEX ENFORCER) AS PER ALBERTA TRANSPORTATION'S BMP #13
5.9H:1V
5.1H:1V
VARIES
CONCRETE DRAIN TROUGH
NOT ENCOUNTERED
0.610 m ø STEEL CASING AND HP 310x132 PILE (TYP)
WING WALL
UPPER 6m REMOVED
17+975
324 mm STEEL PIPE PILES FILLED WITH CONCRETE
REMOVE LOOSE MATERIAL, BACKFILL WITH GRANULAR FILL (DES 2, CL 25) OVERLAIN BY 300 mm OF COMPACTED CLAY CAP
SALVAGE AND REPLACE CLASS 1M RIPRAP UNDER BRIDGE DRAIN
508 mm STEEL PIPE PILES FILLED WITH CONCRETE
CREEK BED
HWY RIGHT-OF-WAY
17+950
FILLED IN VOID OF EXISTING RIPRAP WITH CLASS 1 RIPRAP
INSTALL BARBED WIRE FENCE (TYPE B)
TH19-1
VERTICAL DRAIN(TYP)
RESTORE CHANNEL ALIGNMENT
INSTALL CANTILEVER SHEET PILE WALL A
FILL VOIDS WITH FILTER GRAVEL (DES 8, CL 25) TO ELEV 577.65 m
REGRADE CREEK BED, RECONSTRUCT NORTH BANK, AND ARMOUR NORTH AND SOUTH BANKS WITH CLASS 1 RIPRAP (REFER TO SHEETS 6, 8, 10, 11 FOR DETAILS)
LIMIT OF WSP 2018-07-18 SURVEY
SW06 067-23 W4M
SW06 067-23 W4M
LIMIT OF WSP 2018-07-18 SURVEY
HV1
HV2
HV3
HV4
588
585.0
582.5
580.0
577.5

N
W
E
S

LEGEND

- NEW INSTRUMENT LOCATION
- CP — CONTROL POINT
- VERTICAL DRAIN
- HV — FORMER PILES TO BE EXPOSED (HYDROVAC)
- STABILIZED LANDSLIDE AREA
- EXISTING CLASS 1M RIPRAP
- DESIGN GRADING LIMITS
- CLASS 1 RIPRAP
- TRM TYPE C
- T — TELUS LINE (APPROXIMATE)
- TA — ABANDONED TELUS LINE
- X — BARBED WIRE FENCE
- NEW TYPE B FENCE
- P — OVERHEAD POWER LINE (APPROXIMATE)
- TREELINE
- GUARD RAIL
- 582 — GROUND SURFACE CONTOUR
- Fd. I. PIN — FOUND IRON PIN
- ① — PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

NOTE:
JUNE 5, 2020 SITE INSPECTION OBSERVATIONS SHOWN IN RED.

0 4 8 12 16 20 24m
SCALE 1:400

Alberta

NORTH CENTRAL REGION (ATHABASCA AREA)
2020 GEOHAZARD ASSESSMENT

NC90 - BAPTISTE CREEK BRIDGE
NW APPROACH FILL LANDSLIDE (BF7055)
HWY 2:42, 17km NW OF ATHABASCA

FIGURE 1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:400
DATE	SEPTEMBER 2020
FILE No.	13357

THURBER ENGINEERING LTD.

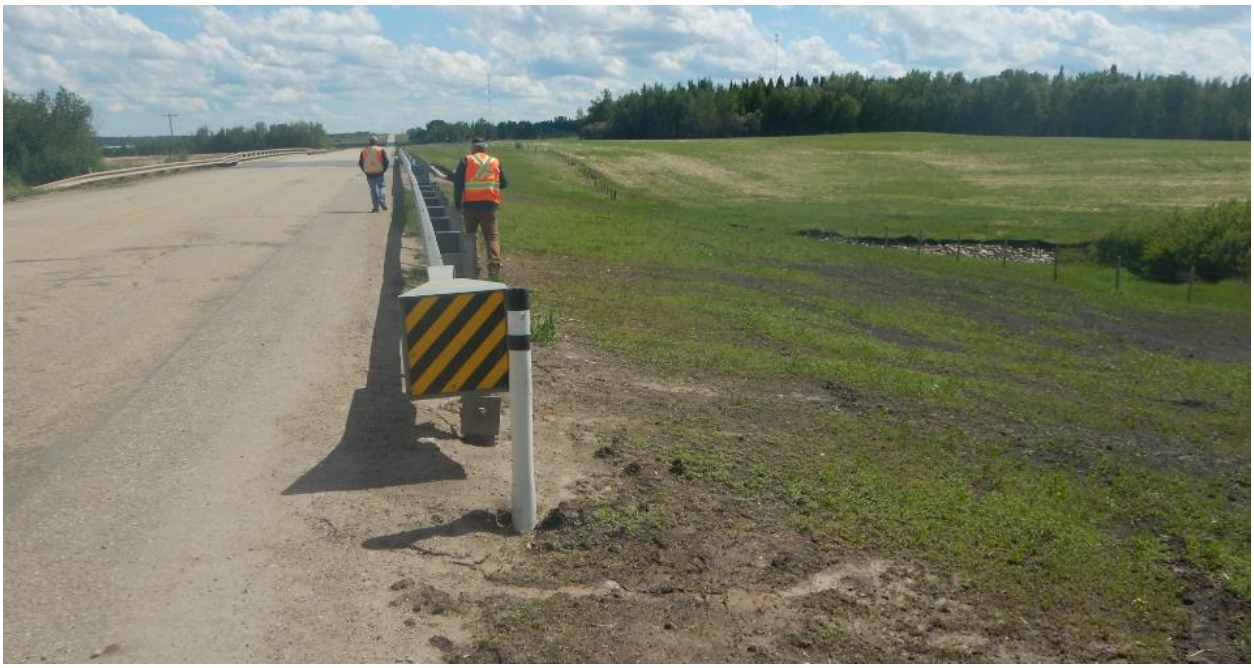

Photo No. 1 – Looking south at new guard rail and embankment west side slope; note growth of grass vegetation within the slope

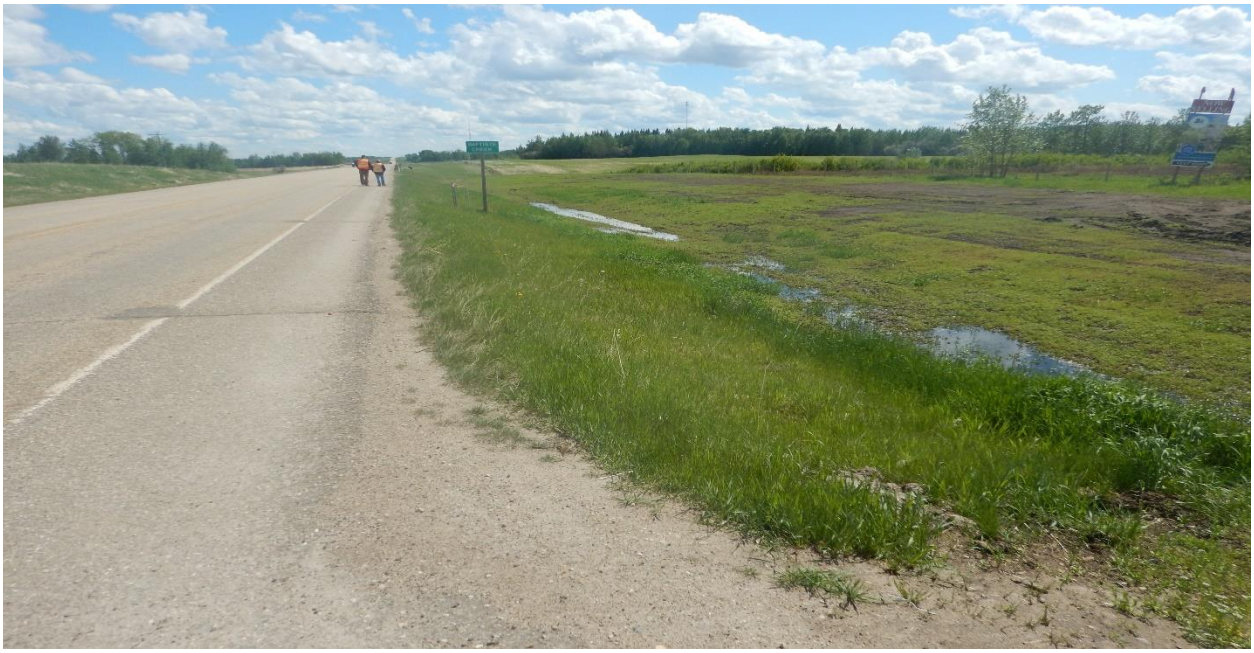

Photo No. 1a – Looking south at the highway east ditch to the south of the repair area; note ponding of surface water in the ditch

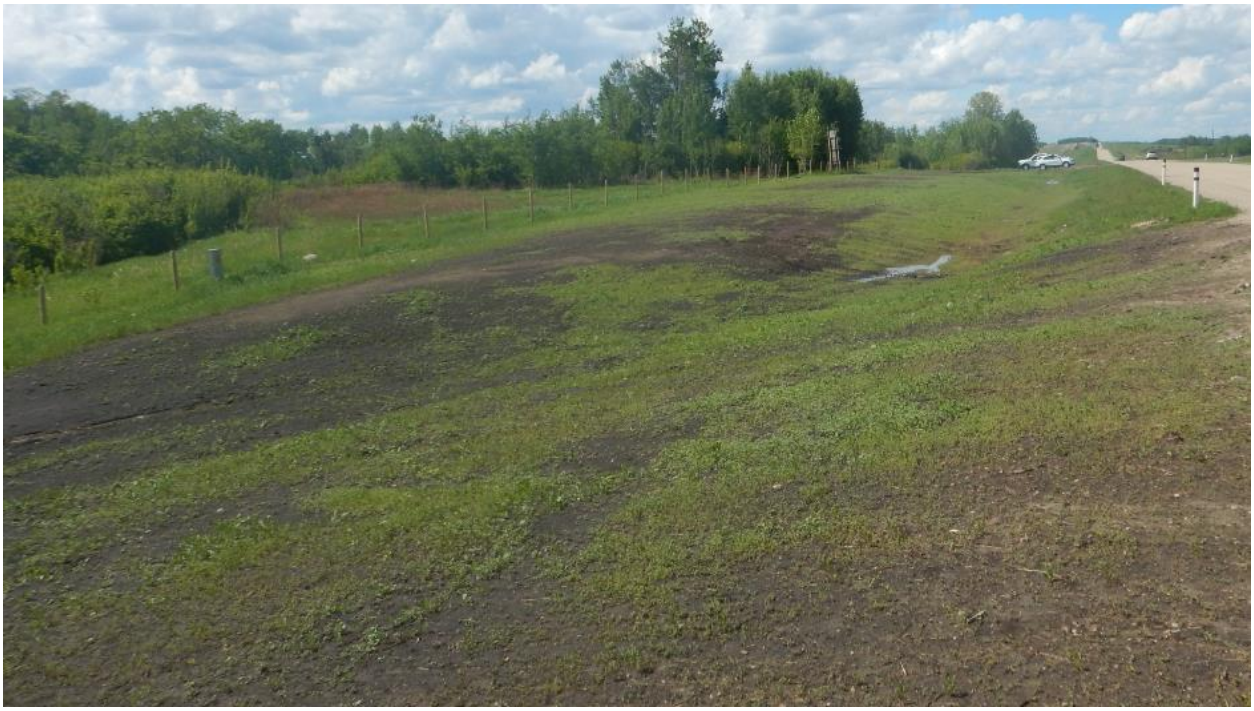

Photo No. 2 – Looking north at some rill erosion developing south of the highway ditch

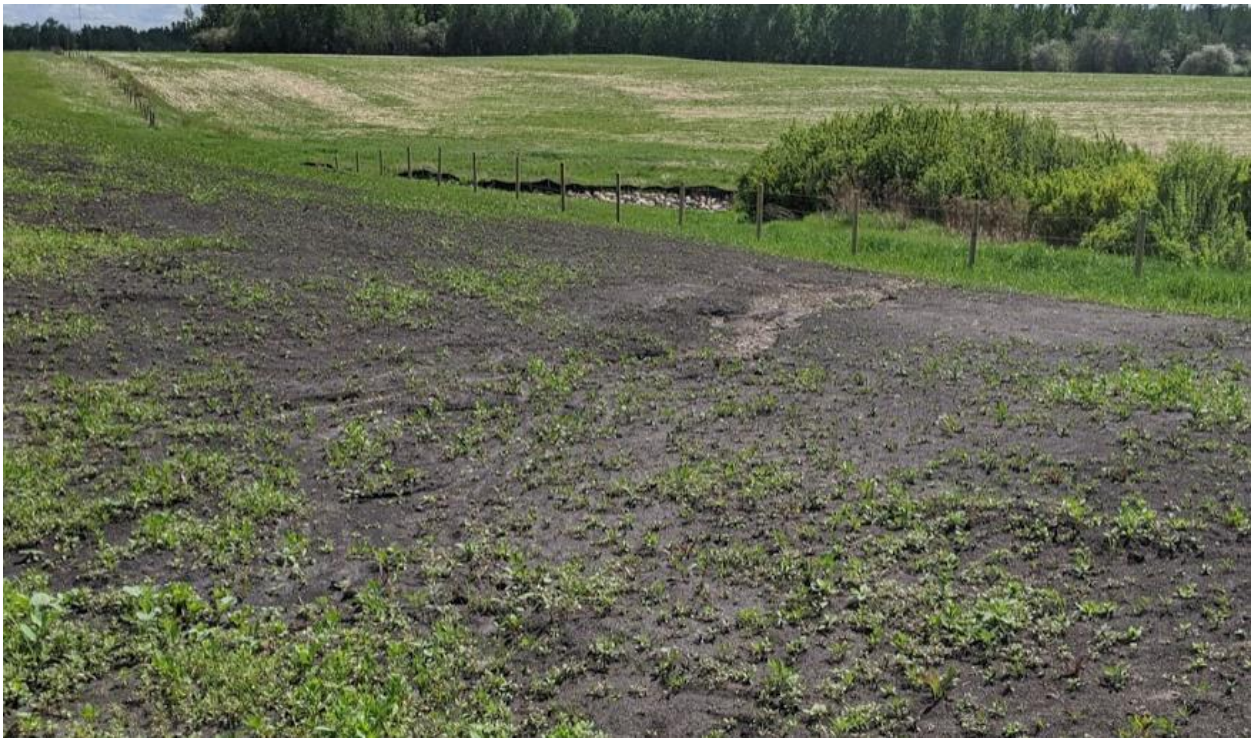

Photo No. 3 – Closer look at rill erosion mentioned in Photo No. 2

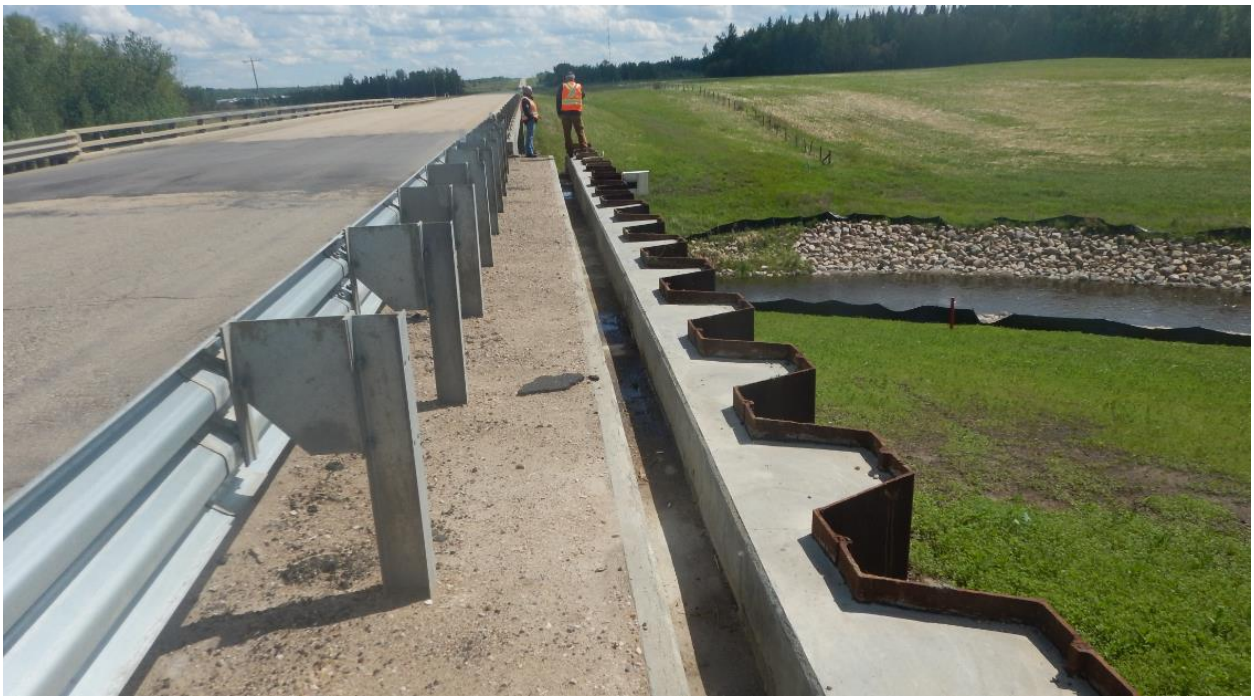

Photo No. 4 – Looking south at guardrail and concrete drain trough behind Sheet Pile Wall B

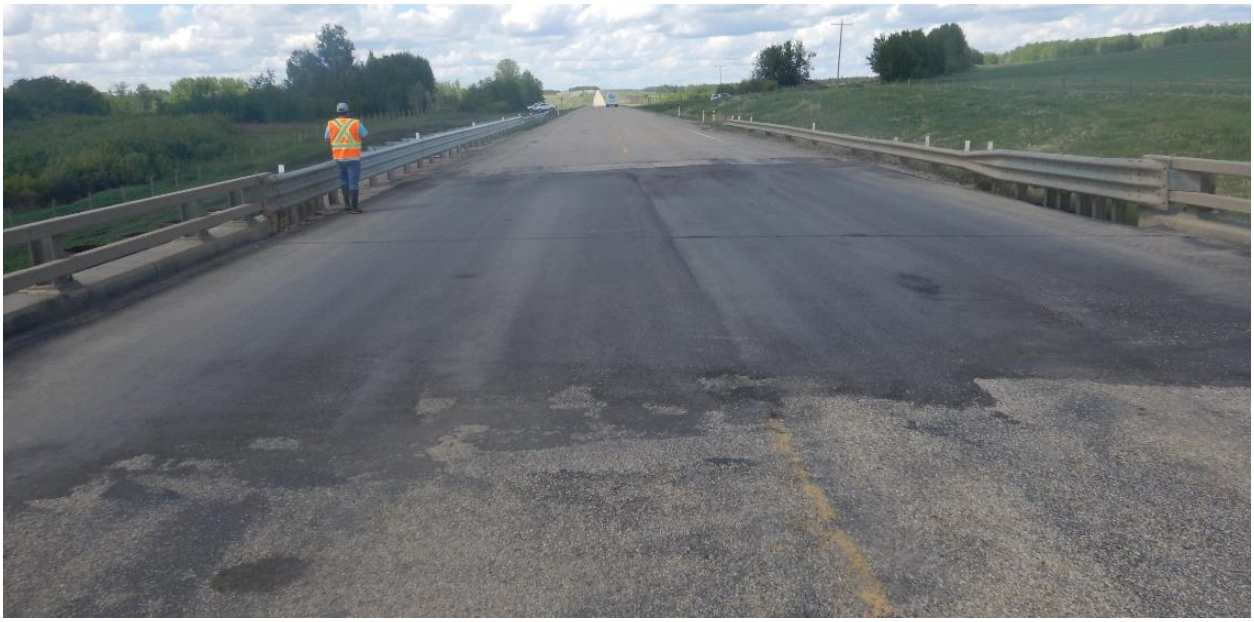

Photo No. 5 – Looking north at a 19 m long ACP patch placed along the highway behind the north abutment

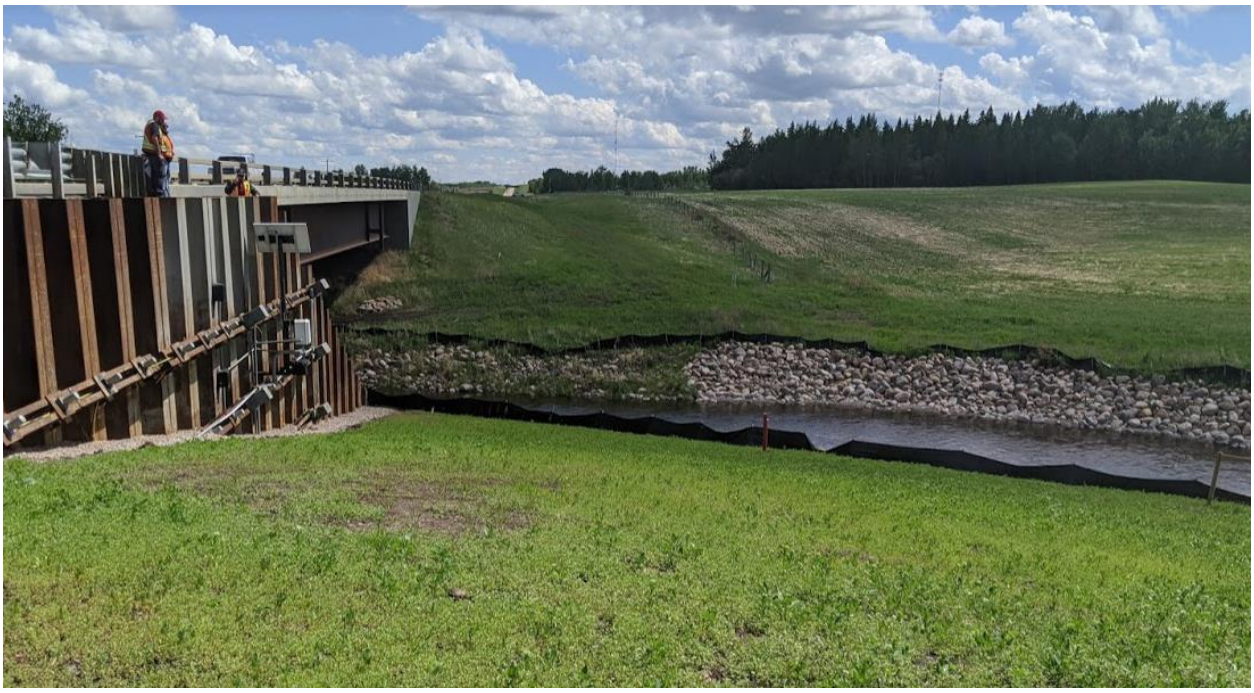

Photo No. 6 – Sheet Pile Wall B with three rows of anchors supporting the highway embankment; Sheet Pile Wall A is buried below ground and is parallel to the toe of the slope.

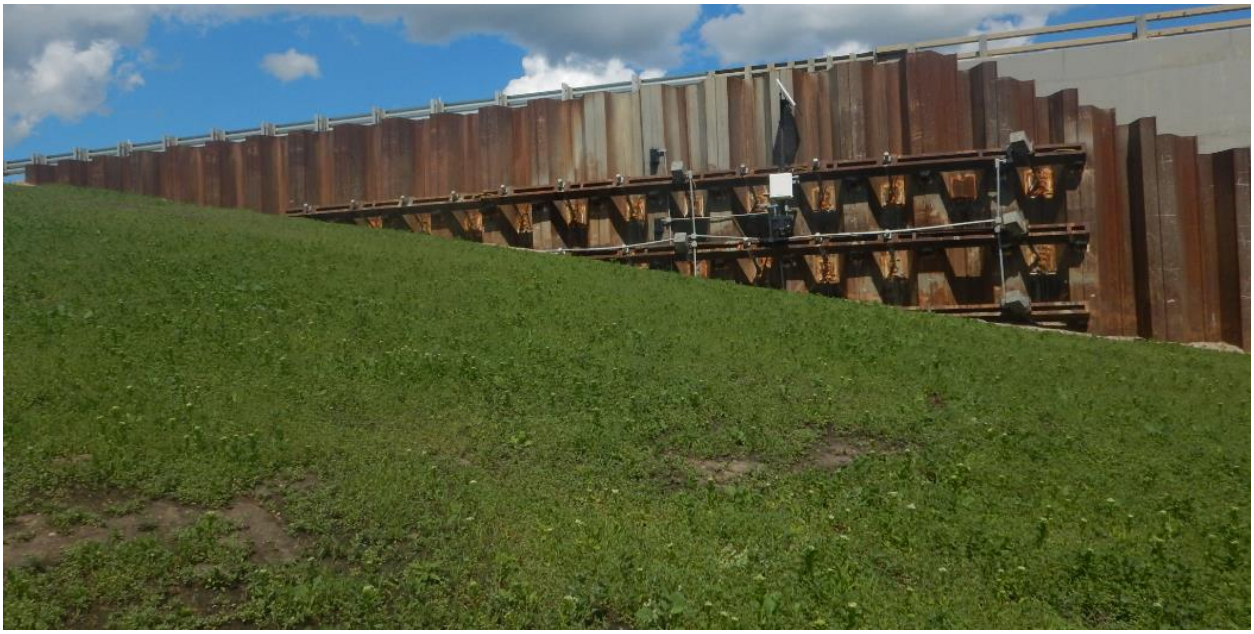

Photo No. 7 – Vegetation growing nicely along the newly graded 5H:1V north facing slope

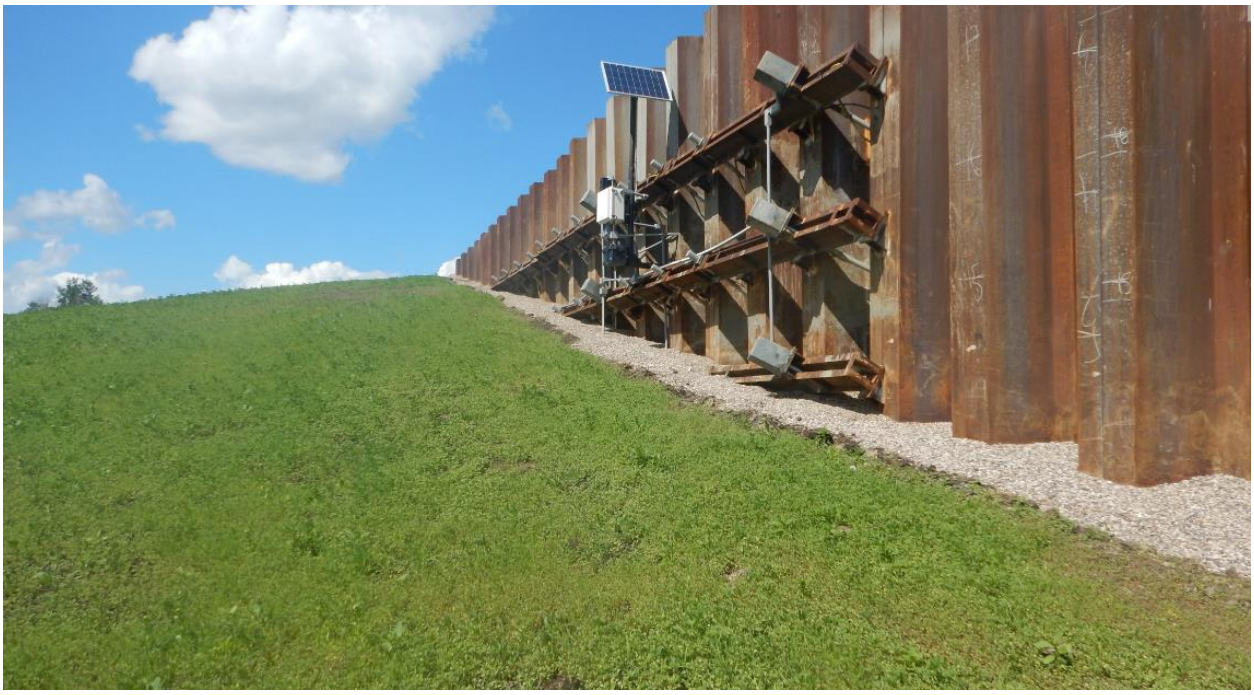

Photo No. 8 – Datalogger and solar panel installed on Sheet Pile Wall B

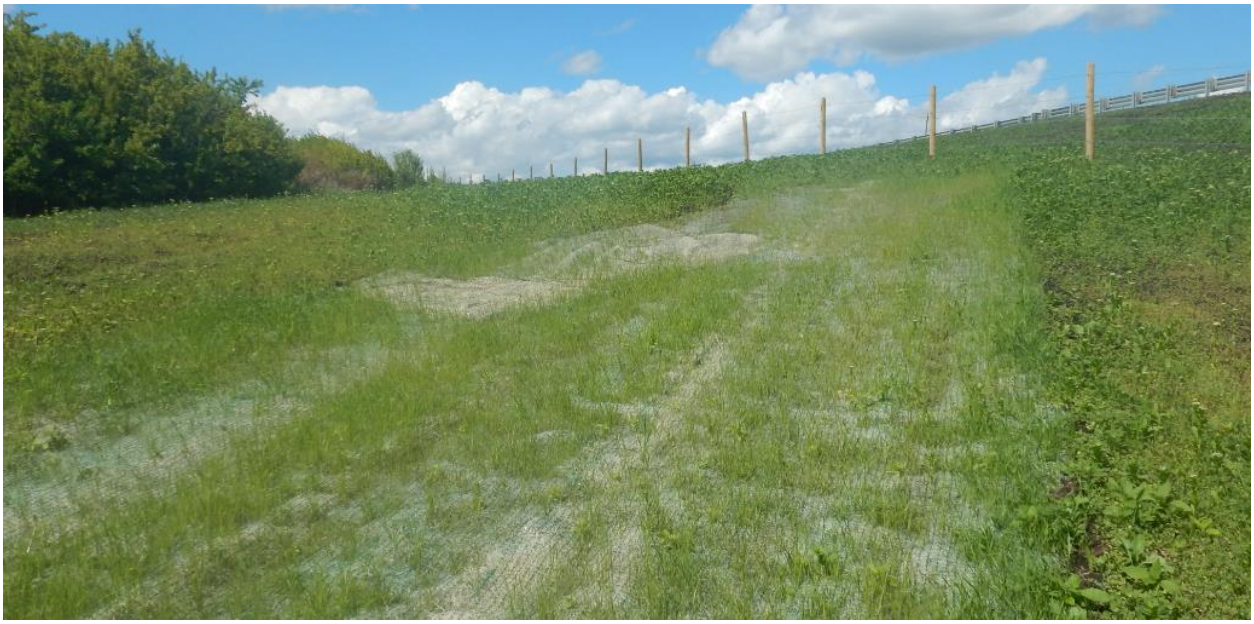

Photo No. 9 – New Type C TRM and Barbed Wire Fencing

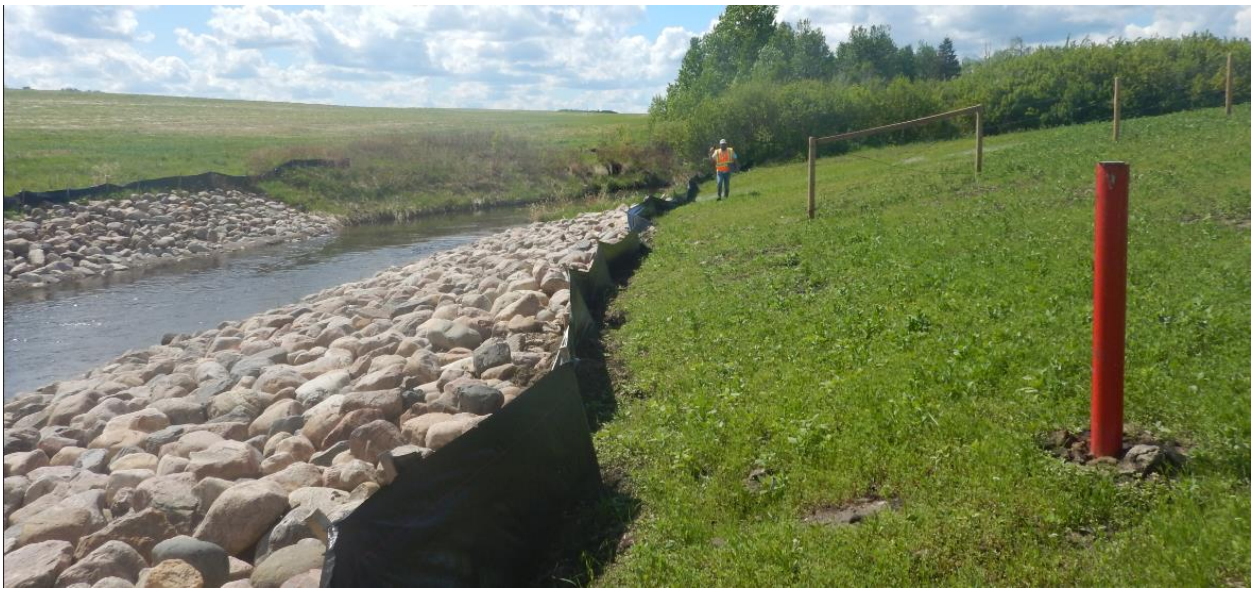

Photo No. 10 – Looking west at the armored creek bank from the bottom of the slope (i.e.at Sheet Pile Wall A location); banks were armored using Class 1 Riprap

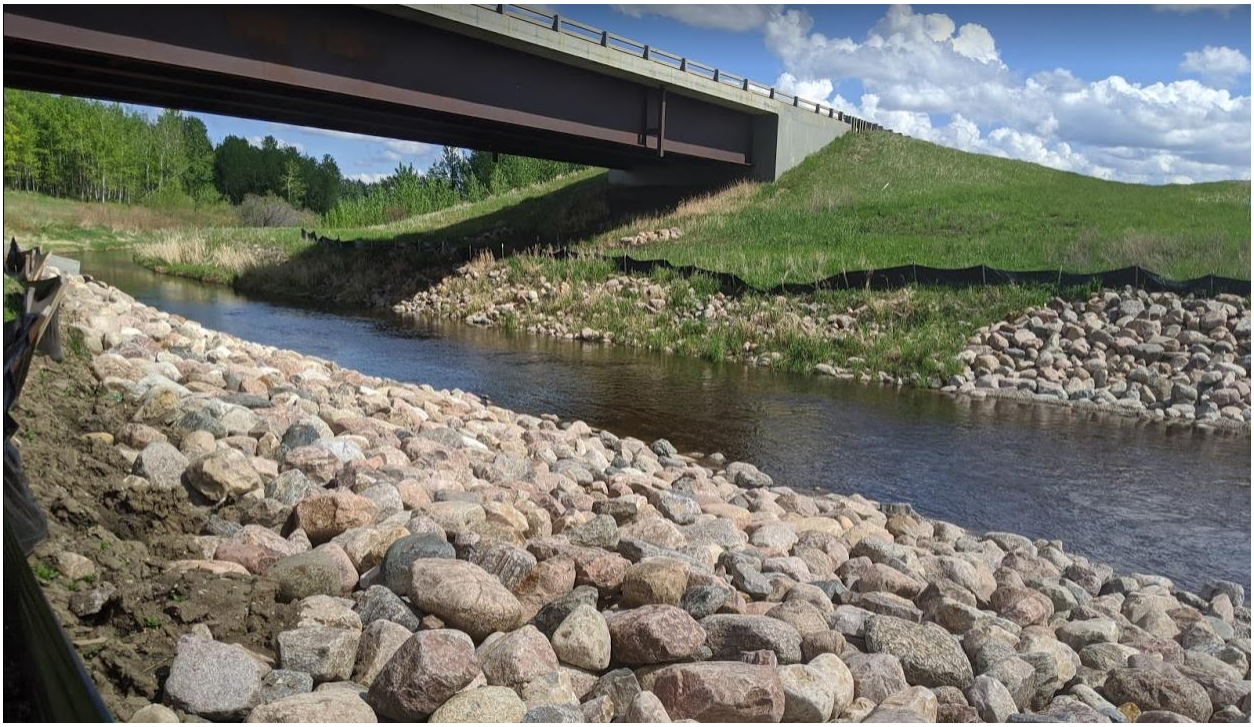

Photo No. 11 – Looking east at the armored creek banks from the bottom of the slope