ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA & FORT MCMURRAY DISTRICTS
2022 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC 069-1	14 km south of Wandering River	S. of Wandering River- BF 76427	63:02	32
Legal Description		**UTM Co-ordinates (NAD 83)**		
SW-27-70-17-W4M		12 N 6105290 E 403588		

	Date	PF	CF	Total
Previous Inspection:	June 24, 2020	8	4	32
Current Inspection:	June 07, 2022	8	4	32
Road AADT:	3910		**Year:**	2022
Inspected By:	Tarek Abdelaziz, José Pineda (Thurber) Arthur Kavulok, Amy Driessen, Rishi Adhikari (TRANS)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Creep movements of east and west side slopes of Hwy 63 SBL causing pavement distress
Dimensions:	Highway 63 Southbound Lanes Landslides: East Landslide affecting about 90 m of the highway and West Landslide affecting about 50 m of the highway
Date of any remediation:	West side slope embankment failed in 2009 causing damage to the existing 1910 mm dia. SPCSP culvert and development of slide cracks along the highway. Emergency repairs were completed in May 2010 and consisted of building a toe berm along the bottom of the slope and extending the culvert outlet by about 28 m (using a 2000 mm CSP). The existing culvert failed during construction (approximately 28 m from the original culvert outlet location), and was strutted over a distance of about 12 m. An 1800 diameter SWSP was auger bored below the highway to temporarily replace the existing pipe. In 2013, the following was carried out during the construction of highway twinning project at this location: Grouting of old culverts, pipe jacking a 3630 mm diameter SWSP culvert below highway, diversion of stream channels at the inlet and outlet of the new pipe, increasing the size of the berm downslope of the highway SBL, and grading of future highway northbound lanes. The highway was patched in the vicinity of the southern flank of the east landslide near the pipe jacking pit.
History/Maintenance:	The original highway was a two-lane undivided highway. The east and west landslides developed on the east and west side slopes of the original highway. The highway was upgraded between 2014 and 2016 to a four-lane divided highway. The two lanes of the former

	highway are currently the southbound lanes of the new highway. **West Landslide:** ACP overlay on the SBL of the former highway in June 2010; ACP overlay on the former highway SBL in 2014 and 2015 **East Landslide:** ACP overlay on the southern limits of the NBL of former highway in 2014 Erosion issues identified in 2014 were addressed by others: The erosion within the diversion channel at the inlet of the new pipe and along the south facing drainage channel to the north of the pipe were repaired; South facing drainage Channel: erosion control included extension of existing soil covering mat further north, armouring the southern segment of the channel using Class 1M riprap, inclusion of spring berms along the channel within the segment covered with the erosion mat; North facing Draining channel: erosion control included placement of a Class 1M riprap over existing soil covering mat, and installation of geo-ridge berms within the northern portion covered with the erosion blanket; fibre rolls installed along the crest of the east slope of the NBL above the inlet of the pipe. One of the erosion issues identified in 2015 was addressed by others under the contract for the highway twinning project. The erosion gully developed within the north facing drainage channel above the culvert inlet location was repaired through the extension of the riprap channel to the bottom of the slope towards the diversion channel.	
Observations:	**Description**	**Worse?**
☑ Pavement Distress	**West Landslide (western lane of highway SBLs):** 25 mm dip for about 50 m **East Landslide (eastern lane of highway SBLs):** 10 to 20 mm dip for about 90 m **Western Lane of highway SBLs:** The existing patch on the western lane is 40 to 50 mm higher than surrounding pavement surfaces. Asphalt wheel marks noted at the north end of the ACP patch due to a hump at the patch transition	☐
☑ Slope Movement	**West Landslide (western lane of highway SBLs):** 20 to 70 mm wide reflective landslide cracks with up to 25 mm drop across crack surfaces; existing shoulder crack to the north of the northern limits of the landslide is 50 to 60 mm wide and has 20 mm drop **East Landslide (eastern lane of highway SBLs):** 20 to 60 mm wide landslide cracks with up to 25 mm drop across crack surfaces	☑
☑ Erosion	Diversion channel at the inlet of the pipe: erosion/slump on the north facing slope exposed fabric and shifted riprap South facing drainage Channel to the east of the highway NBLs: Spring berms and synthetic ditch barrier failed; severe erosion gullies (up to 900 mm wide and 400 mm deep) to the north of the outlet of the NBL centerline	☐

	culvert; localized erosion within the ditch to the south of the culvert outlet (4 m long, 2 m wide, and 600 mm deep); severe erosion gully near the mouth of the channel within the western edge riprap (18 m long x 1.2 m wide x 1.3 m deep) was partially filled by adjacent riprap and water was flowing under this area Slump in the east back slope of the highway NBLs healed and was covered with vegetation Three sinkholes filled with water within the highway median ditch: 3m wide x 18 m long x 0.6 m deep 3m wide x 6 m long x 0.4 m deep 2 m wide x 3 m long x 0.4 m deep	
☑ Seepage		☐
☑ Bridge/Culvert Distress	The 600 mm diameter culvert below the highway NBLs has sagged and water is ponding inside the pipe	☐
☑ Other	Vegetation continued to grow within the highway median, side slopes of the highway NBLs, and within south facing drainage channel to the east of the NBLs	☐

Instrumentation: (3SIs, 3 PNs, 2 VWs)

West Landslide: SI13-14 showed a rate of movement of 0.1 mm/yr. SI09-4 showed a rated of movement of 0.4 mm/yr. PN09-3: Ground water levels decrease by about 0.2 m.

East Landslide: SI09-1 was sheared off/blocked at a depth of 3 m below ground surface; this instrument was creeping during the previous visit in the spring of 2021 at 0.8 mm/yr; and SI10-1 showed no discernable movement; PN09-1: Ground water levels decreased by about 0.05 m, PN10-1: showed a groundwater level decrease of approximately 0.3 m, VW 13-11 and 13-12: Groundwater levels decreased by 0.15 m since the spring of 2021.

Assessment (Refer to attached Figure)**:**

In general, the remedial measures have been effective in stabilizing the east and west landslides of the highway SBLs.

The highway surface condition appears to have deteriorated due to the ongoing creep movements of the landslides, as evidenced by further opening of cracks and the more distinct dips on the southbound lanes. The exiting dips on the SBLs continue to create a rough ride to travellers.

The existing shoulder crack to the north of the northern limit of the west lane of the old highway may reflect a new movement to the west of the highway; however, there is no visible evidence downslope of the highway to confirm this hypothesis, and this should be confirmed through future inspections.

The top surface elevation of the patch placed in 2015 along the most western lane of the old highway is about 40 to 50 mm higher than the top surface elevation of the pavement surface outside the boundaries of the patched area. This has resulted in an uncomfortable ride on the highway surface and constitutes a major safety hazard to the motorists. The existing dip on the highway lanes has also aggravated the situation.

The sink holes developed near the bottom of the new lanes west side slope are near the inlets of the old culverts and channels. It is likely that the sinkholes reflect poor subgrade preparation and backfill construction practice at these locations.

The ongoing erosion along south facing ditch to the east of the highway NBLs does not appear to be as active as observed in 2020 as vegetation continues to grow in this area.

The highway east back slope slump is completely covered with vegetation and does not seem to be as active as observed in 2017.

Recommendations:

It is recommended that the site be inspected every second year.

Consideration should be given to milling the 2015 ACP patch and placing a new patch on the highway SBLs. The new patch should provide a smooth ride to motorists and eliminate the safety hazard, associated with uneven pavement surfaces within the site.

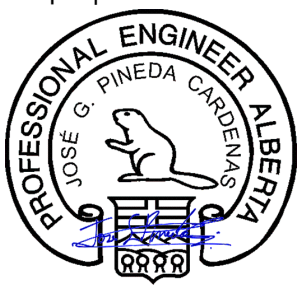
The sinkholes should be backfilled with compacted gravel or clay. Prior to backfilling the sinkholes, it is recommended that the bottom and the sides of the sink holes be cleaned of loose materials and debris.

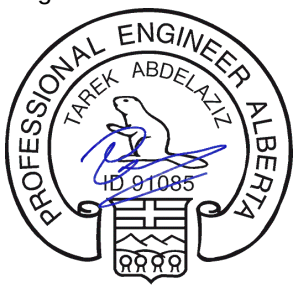
A CCTV inspection should be undertaken for the existing 600 mm diameter culvert below the highway NBL. Based on the inspection results, it may be required to either replace or line the pipe to enhance surface drainage in the highway median.

Closure

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph. D., P.Eng.
Principal | Senior Geotechnical Engineer





PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: October 14, 2022
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

José Pineda, M.Eng., P.Eng.
Associate | Geotechnical Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\2022\UGP\32122-NC069-1.dwg - NC69-1 - Oct. 13, 2022

ACP PATCH
20-30mm WIDE CRACK
SOFT AND WET SPOT (SLUMP DEBRIS) CATTAILS, SLUMP
DEBRIS FILLED DITCH, PONDING WATER SAME IN 2019, 2020 DRY IN 2022
SLUMP - 7m WIDE, 1m DEEP & 1m WIDE SCARP CRACKS BECAME BIGGER IN 2017; NOT VISIBLE - VEGETATION COVERED IN 2019 SAME IN 2020, 2022
LONGITUDINAL CRACKS ON SHOULDER; CRACK EXTENDED FURTHER SOUTH, 30mm WIDE, NO DROP (2017) EXTENDED FURTHER SOUTH, 40mm WIDE, 15-20mm DROP- NO SIGNS OF INSTABILITY DOWNSLOPE OF CRACK LOCATION 50-60mm WIDE, 20mm DROP (2022)
15-20mm IN 2015, 2016, 2017, 2019 30mm WIDE, NO DROP (2020) 35mm WIDE, NO DROP (2022)
NEW CROSSING GULLY 600mm WIDE x 200mm DEEP (2019) 900mm WIDE x 400mm DEEP (2020) VEGETATION IS HELPING WITH EROSION, GULLY 700mm WIDE, 400mm DEEP IN 2022
EROSION GULLIES EXTENDING 10m BACK FROM TOP OF BACKSLOPE NOT VISIBLE; COVERED WITH VEGETATION IN 2022
EROSION SOUTH OF EXISTING SYNTHETIC DITCH BARRIER (2016) - FILLED WITH WATER DRY IN 2022
5 - 10 mm WIDE CRACK (2020); 10-20mm WIDE, NO DROP (2022)
HUMP NOTED IN 2021, SAME 2022
10mm WIDE, 10mm DROP IN 2015, 2016, 2017
10-20mm WIDE, NO DROP (2019)
10-30mm WIDE, NO DROP (2020), SAME(2022)
TYPE C RECP ON SLOPES (TYP)
10-40mm WIDE, 10-20mm DROP IN 2012, 2014, 2015, 2016, 2017
20-40mm WIDE, 10-20mm DROP (2019)
20-50mm WIDE, 10-20mm DROP (2020)
20-60mm WIDE, 15-20mm DROP (2022)
SYNTHETIC DITCH BARRIER FAILED IN 2016, SAME IN 2017, SAME IN 2019 SAME IN 2020, 2022
R/W
20:1
5:1
4:1
6:1
7:1
ACP PATCH (2010)
20mm DIP BOUNDED BY CRACKS (2015) 5-10mm (2016, 2017),10mm (2019) 15-20mm DROP (2020) 15-20mm WIDE, 25mm DROP (2022)
RECP (STRAW MAT)
WATER PONDING BEHIND BERM
SPRING BERMS, THE MOST NORTHERN BERM WAS NOT ANCHORED PROPERLY, PUSHED OVER AND FAILED - MIDDLE BERM FAILED IN 2016 ALL SPRING BERMS FAILED IN 2019
32+397.05
MONITORING STATION (VW13-13)
32+381.70
SI10-1/PN10-1 GS=548.63
EAST LANE IS 40-50mm LOWER THAN WEST LANE (2017), SAME IN 2019, 2020, 2022
WATER FLOWING 2017, 2020 DRY (2022)
132+350
EXISTING PATCH CREATED A 40mm LIP BETWEEN THE TWO LANES AND AT THE NORTH END OF THE PATCH (2017),(SAME IN 2019, 2020, 2022)
10-40mm WIDE, 10-20mm DROP (2015)
10-30mm WIDE, 5-10mm DROP (2016) SAME IN 2017
20-70mm WIDE, NO DROP (2019)
20-70mm WIDE, 15mm DROP (2020)
20-70mm WIDE, 20-25mm DROP (2022)
600mm DIA. CSP CULVERT; CULVERT SAGGED IN 2017 SAME IN 2019
EROSION GULLY BETWEEN SPRING BERMS - 500mm WIDE X 400mm DEEP SAME IN 2017, WATER FLOWS INTO GULLY
DRAINAGE
R/W
VW13-13
SI09-4 GS=546.85
WATER PONDING INSIDE AND AT CULVERT OUTLET SAME IN 2019, 2020
SI13-14
ACP PATCH IN 2015
15-20mm DROP (2017, 2019, 2022)
NEW SINK HOLE (2 m WIDE, 3 m LONG, 400 mm DEEP)
GULLY - 800mm WIDE, 400mm DEEP (2019)
GULLY - 900mm WIDE, 400mm DEEP (2020, 2022)
132+400
PN09-3
CRACK 35mm WIDE, NO DROP (2019) 50mm WIDE, NO DROP (2020) SAME (2022)
CRACK 10mm WIDE, 5mm DROP; 20-50mm WIDE, 5mm DROP (2017, 2019)
SINKHOLE 3m WIDE x 6m LONG x 0.4m DEEP, FILLED WITH WATER IN 2017, DRY IN 2019, WET IN 2022
CLASS 1M RIPRAP - CHANNEL IS NOT SHAPED PROPERLY SAME IN 2016, 2017
600mm WIDE, 400mm DEEP GULLY (2019) SEVERE EROSION 6m LONG, 4m WIDE, 0.5m DEEP (SAME IN 2020) 4m LONG, 2m WIDE, 0.6m DEEP (2022)
VW13-12
1910 mm SPCSP. OVERFLOW PIPE (GROUTED IN 2013)
1800mm SWSP. (GROUTED IN 2013)
SINKHOLE 3m WIDE x18m LONG x 0.6m DEEP, FILLED WITH WATER IN 2017, DRY IN 2019, NORTHERN HALF FILLED WITH WATER(2022)
SIDE SLOPE BARE OF VEGETATION (2015) VEGETATED (2016) WELL VEGETATED (2017)
MONITORING STATION (VW13-11 & VW13-12)
SI09-1/PN09-1 GS=548.80
132+350
3630mm Ø SWSP CULVERT (BF76427)
10-15mm DIP (2016, 2017, 2019, 2020, 2022)
VW13-11
132+342.05
TOP OF BERM EL. 542.0 (TYP)
ACP PATCH (2014)
ACP PATCH (2013)
15-25mm WIDE, NO DROP (2017) EXTENDED 30mm WIDE, NO DROP (2019) 25-60mm WIDE, LESS THAN 5mm DROP (2020) 25-60mm WIDE, 10mm DROP (2022)
EROSION / SHALLOW SLUMPS SHIFTED RIPRAP - REPAIRED USING RIPRAP AND NON - WOVEN GEOTEXTILE
SHARP DROP OFF 200mm (2022)
10m LONG DEEP EROSION GULLY DISPLACED NON-WOVEN GEOTEXTILE AND SHIFTED RIPRAP (2016); 15m LONG, 1-2m WIDE, 0.3-0.8m DEEP (2017); 18m LONG, 1-2m WIDE, 1.3m DEEP (2019) ADJACENT RIPRAP NATURALLY FILLED THE GULLY. WATER FLOWING UNDER RIPRAP IN THIS AREA (2020) SAME 2022
SILT FENCE AND DEBRIS IN CHANNEL SAME IN 2016
HAIRLINE CRACK (2011) 20mm WIDE, NO DROP (2012) 30mm WIDE (2014) 5-10mm WIDE, NO DROP (2015) SAME IN 2016 25mm WIDE, NO DROP (2017) 40mm WIDE, NO DROP (2019) 30-60mm WIDE, NO DROP (2020) SAME (2022)
CLASS 1 ROCK RIPRAP PLACED 0.45m THICK (TYP BOTH ENDS)
EROSION / SHALLOW SLUMP EXPOSED FABRIC AND SHIFTED RIPRAP - BECAME BIGGER IN SIZE IN 2016 SAME IN 2017
32+300
FIBRE ROLLS
VEGETATION GREW IN MEDIAN
TOP OF BANK (TYP)
BOTTOM OF BANK (TYP)
132+292.13
132+250
GEORIDGE - FAILED, NOT ANCHORED PROPERLY
NEW CLASS 1M RIP RAP LINED CHANNEL SAME IN 2017
SLOPE LIMITS (APPROX)
FORMER HWY 63 (HWY 63 SBLs)
HWY 63 NBLs - HIGHWAY WAS PAVED IN 2015
CLASS 1M RIPRAP LINED CHANNEL - EROSION GULLY SHIFTED RIPRAP AND RIPRAP PLACED ON EXISTING SOIL COVERING MAT SAME IN 2017
SYNTHETIC DITCH BARRIER FAILED (SAME IN 2017)
WEST LANDSLIDE
EAST LANDSLIDE
VEGETATION GREW BETWEEN GEORIDGES SAME 2022

N
W
E
S

LEGEND

- INSTRUMENT LOCATION
- MONITORING STATION
- 2013 & 2014 ACP PATCH
- SI — SLOPE INCLINOMETER
- PN — PNEUMATIC PIEZOMETER
- VW — VIBRATING WIRE PIEZOMETER
- P — OVERHEAD POWERLINE
- FENCE LINE
- PP — POWER POLE
- RECP ON SLOPES
- ① PHOTOGRAPH NUMBER, AND APPROXIMATE LOCATION AND DIRECTION

NOTE:
1. OLD 1800 & 1910mm CULVERTS WERE GROUTED IN 2013.
2. HIGHWAY NORTHBOUND LANES AND THE NEW 3630mm DIA. CULVERT(BF76427) WERE CONSTRUCTED IN 2013.
3. JUNE 7, 2022 OBSERVATIONS SHOWN IN RED

0 10 20 30 40 50m
SCALE 1:750

BASE PLAN PROVIDED BY WSP.

Alberta

NORTH CENTRAL REGION
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2022 GEOHAZARD ASSESSMENT

NC069-1: HWY 63:02 (km 32) - BF76427
SITE PLAN SHOWING SITE FEATURES

DWG No. NC069-1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:750
DATE	SEPTEMBER 2022
FILE No.	32122

THURBER ENGINEERING LTD.

Photo No. 1 – General view of the highway SBLs condition (looking south); note presence of highway cracks (on former highway SBL) to the northern limit of the west landslide

Photo No. 2 – Looking south at open diagonal and longitudinal cracks on the former highway NBL surface from the north limit of the east landslide

Photo No. 3 – Looking south at an open longitudinal reflective crack within the middle section of the east landslide; not the presence of a 40 to 50 mm elevation difference between the highway lanes (2015 patch created a lip between the lanes)

Photo No. 4 – Looking south from the southern limit of the east landslide at reflective diagonal crack on the existing patch

Photo No. 5 – East landslide (looking north form the northern limit of the landslide)

Photo No. 6 – Looking north at the east landslide reflective cracks on the highway surface

Photo No. 7 – Looking north at one of the sinkholes developed in the highway median

Photo No. 8 – Looking inside the outlet of the 600 mm diameter CSP culvert installed below the NBLs; water is ponding inside the pipe

Photo No. 9 – Looking northeast at the backslope slump area observed in 2017; vegetation has grown within the slump area

Photo No. 10 – South facing channel; looking at synthetic ditch barrier; note vegetation has grown and erosion in this area is no longer visible

Photo No. 11 – Looking south at a gully approximately 900 mm wide x 400 mm deep; note vegetation is starting to cover the gully in this zone

Photo No. 12 – South facing channel: erosion along the ditch (4 m long x 2 m wide x 0.6 m deep) has not significantly grown since 2020

Photo No. 13 – Erosion gully developed on the west edge of the channel has been filled with riprap

Photo No. 14 – looking northeast along the riprap lined north facing drainage channel