ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – SWAN HILLS DISTRICT
2020 CALL OUT INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
Call Out – GP052	North of Debolt	Puskwaskau River Slide	736:02	27.1
Legal Description		**UTM Co-ordinates (NAD 83)**		
NW26-74-1-W6		11U N 6,144,288	E 434,543	

	Date	PF	CF	Total
Previous Inspection:				
Current Inspection:	May 30, 2020	13	5	65
Road AADT:	130		**Year:**	2019
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rishi Adhikari (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Landslide with a 5 m high backscarp in embankment fill on northwest side of highway which is now cutting into road edge.	
Dimensions:	The slide is about ~20 m long by 40 m wide and there is an overly steepened bank along the Puskwaskau River which has been eroded.	
Date of any remediation:		
Maintenance:		
Observations:	**Description**	**Worse?**
☑ Pavement Distress	The main scarp has retrogressed into the highway and a portion of the southbound lane has slid away.	☐
☑ Slope Movement	The landslide occurred within the west sideslope of a 13 m high embankment fill, adjacent to an oxbow. The toe roll is present at the base of the slope encroaching into the oxbow, while the backscarp has retrogressed into the highway. On the south side of the highway an overly steep riverbank has been eroded and has sloughed into the river causing it to retrogress towards the highway.	☐
☑ Erosion	There is some erosion on the south side of the highway along the Puskwaskau Riverbank.	☐
☑ Seepage	The landslide mass and backscarp was wet and there was ponded water within several tension cracks. The backscarp was wet	☐
☐ Bridge/Culvert Distress		☐
☑ Other	The overly steepened riverbank on the south side of the highway will likely continue to retrogress towards the highway due to erosion and continued sloughing. There is a leaning power pole that may be compromised soon. There is a broken Telus communications cable (due to the slide movements) and a temporary Telus line installed that runs through the west landslide area.	☐
Instrumentation: None		

Assessment:

The slide is approximately 20 m long by 40 m wide and located in a 13 m high embankment fill side slope. The soils exposed in the slide scarp appeared to consist of brown high plastic clay. The slide mass has slid down and is toeing out at the edge of an oxbow lake.

There was damage to the highway as the backscarp had retrogressed into the highway and there was relatively fresh sloughing and moist/wet soil within the slide mass, which was marked with many small tension cracks and tears further downslope within the slide mass, along with free ponding of water in a couple low lying tears.

It is anticipated that the slide was triggered by water seepage and weathering leading to loss of cohesion in the embankment fill. Weak high plastic clay embankment materials along with excessive precipitation leading to a rise in groundwater level may also have contributed to causing the slide. The main scarp of the active landslide has retrogressed into the highway which may soon require partial closure of the highway.

The riverbank next to the Puskwaskau river on the other (south) side of the highway is very steep. The river appears to eroding/undercutting the bank which causes the overhang to slough into the river and this process continues to retrogress towards the highway. At the time of the inspection the erosion was approximately 6 m away from the highway; however, there was a leaning power pole that will likely be compromised soon.

Recommendations:

Investigation:
A subsurface drilling investigation was completed on July 15 and 16, 2020. A total of three test holes were drilled using solid stem and hand augering methods. This provided information on the subsurface soil and groundwater conditions for inputs to a slope stability assessment to assess potential slope stabilization design measures.

Short Term:
In the short term, the slide should be regularly monitored for regression of the slide scarp. The southbound lane may need to be closed if retrogression continues and more signage/barricades placed.

Medium to Long Term:

Potential repair options for the west landslide area are as follows:

Option 1:
Sub-excavate the failed slide mass down to intact foundation soil and rebuild the slope with imported pit run gravel with layers of geogrid. The excavation for the gravel wedge would likely need to extend to about the east shoulder of the highway, requiring a depressed detour on the east slope, however this should be confirmed by the slope stability assessment. The new fill material should be placed and compacted in thin horizontal lifts, benched into the intact slope surface, utilizing a gravel shear key (if required) to stabilize the slide area. Some of the more suitable excavated clay material could be used to provide a clay cap overtop the gravel as the finished slope surface to shed runoff, with any excess removed from site. A subdrain should be installed along the base of the slide excavation to drain any subsurface water that may enter the new fill zone.

Option 2:
An alternate option would be to construct a toe berm within the oxbow/marsh area and rebuild the slope above the berm with granular fill to an inclination of 3H:1V or flatter. A subdrain should be installed along the base of the slide excavation to drain any subsurface water that may enter the new fill zone. To complete work in the wetland area, a Water Act application and a WAIR will be required.

Option 3:
A third option consists of installing two h-pile walls parallel to one another and the highway downslope of the backscarp and armouring the toe area with rip rap.

Potential repair options for the south eroded riverbank area are as follows:

Option 1:
Armour the base of the bank with a heavy riprap toe berm and rebuild the portion of slope above the berm with geogrid reinforced gravel

Option 2:
Construct rock vanes or spurs to deflect the flow of the river away from the eroded bank and cut the bank back to a more consistent inclination and reinforce it with soil nails (or anchors) and a mesh facing (such as armourmax or equivalent.

Both of the options for the riverbank erosion will require permits from DFO to work within the river. Also, for each of the options, the power pole should be straightened and reinforced or moved to a more stable location.

Ball park costs for all of the above-noted options will be provided in Thurber's preliminary engineering report for this site.

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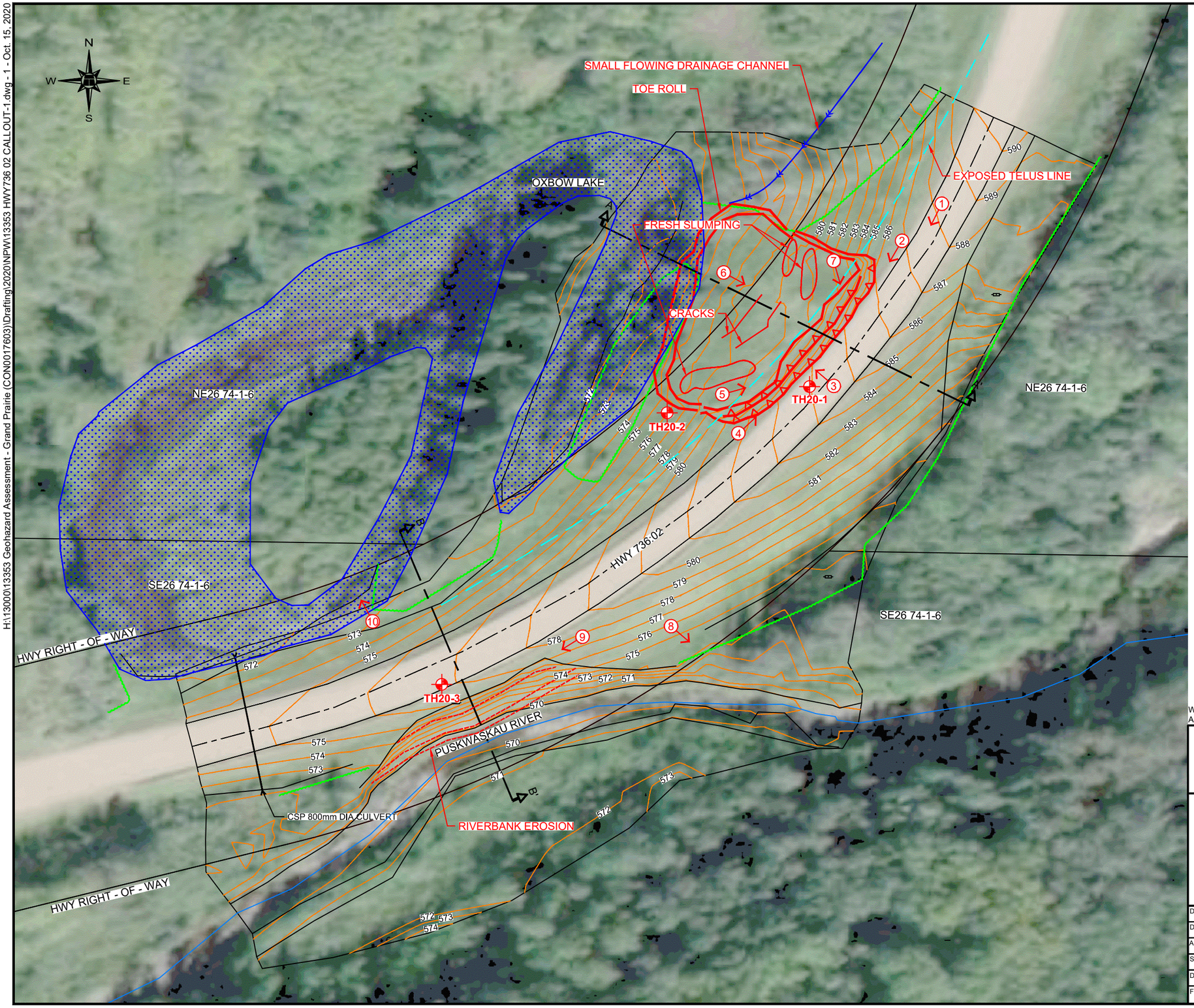

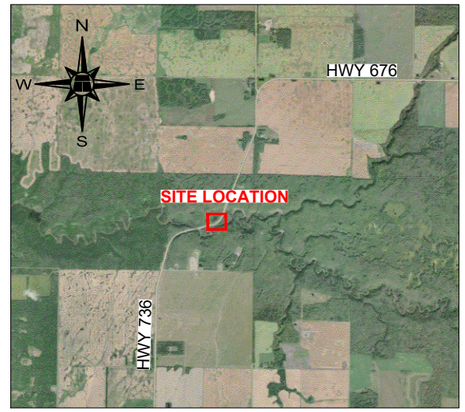

KEY PLAN
SCALE:1:100 000

LEGEND

- TEST HOLE LOCATION
- SCARP CRACK
- CRACK
- APPROXIMATE LOCATION OF TREE LINE
- POWER POLE LOCATION
- GUY WIRE SUPPORT
- CULVERT
- GROUND SURFACE CONTOUR IN METERS (CONTOUR INTERVAL = 1m)
- WET LAND
- DRAINAGE CHANNEL
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

0 10 20 30 40 50m
SCALE 1:800

WSP SURVEYED ON OCTOBER 6, 2020;
AIR PHOTO FROM ESRI WORLD IMAGERY EXPORTED ON OCTOBER 9, 2020

Alberta

HWY 736:02 - PUSKWASKAU RIVER SLIDES NORTH OF DEBOLT (GP052) - LANDSLIDE REPAIRS

2020 CALLOUT PLAN

DWG No. 13353 HWY 736:02-CALLOUT-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:800
DATE	OCTOBER 2020
FILE No.	29422

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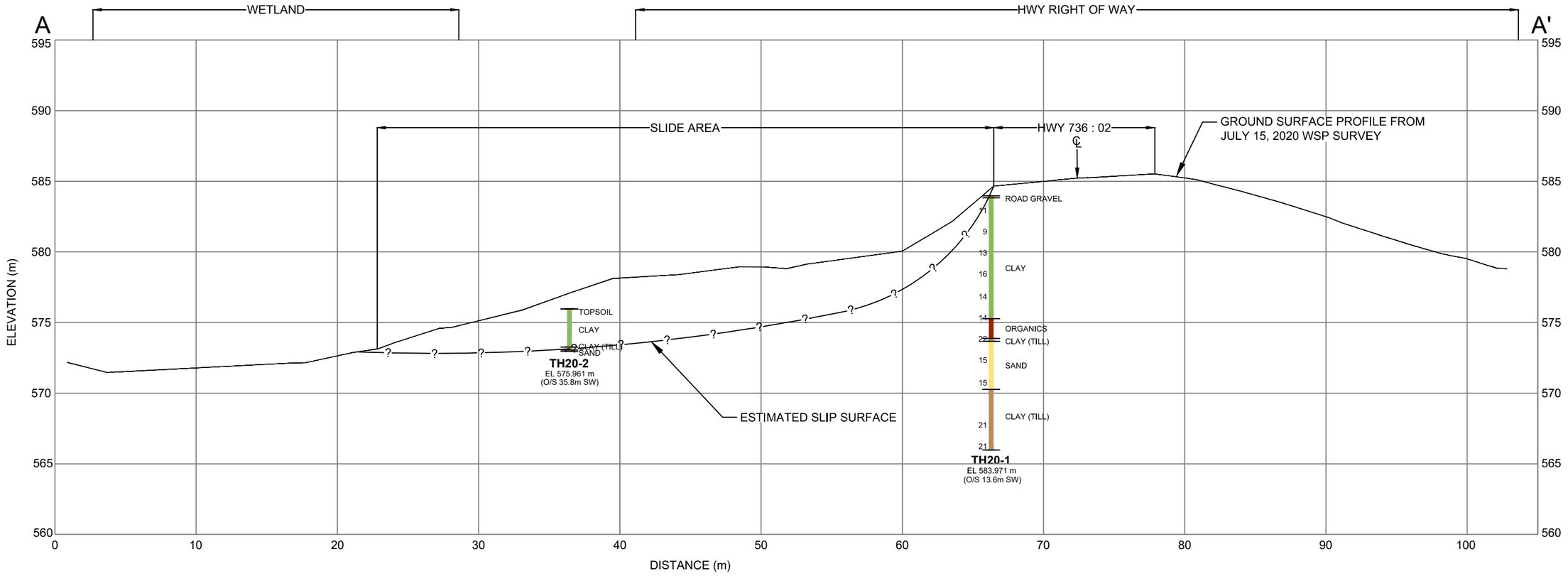

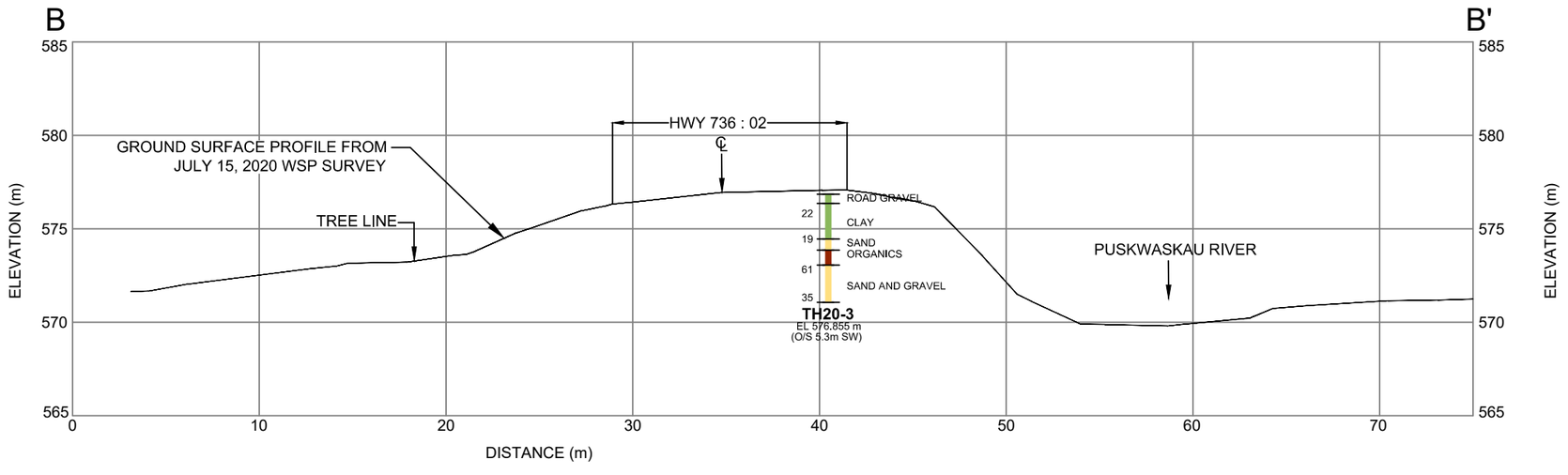

LEGEND

15 I SPT N VALUE

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

Alberta

HWY 736:02 - PUSKWASKAU RIVER SLIDES
NORTH OF DEBOLT (GP052) - LANDSLIDE REPAIRS

STRATIGRAPHIC CROSS - SECTIONS A - A' AND B - B'

DWG No. 29422-2

DRAWN BY	ML
DESIGNED BY	LM
APPROVED BY	DWP
SCALE	1:300
DATE	AUGUST 2020
FILE No.	29422

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	**Photo 1.** Looking southwest at main scarp from the road.
	**Photo 2.** Looking southwest at the back scarp which has retrogressed into the highway.

	**Photo 3.** Looking west down at failed slide mass.
	**Photo 4.** Looking northeast at back scarp.

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	**Photo 5.** Looking east at back scarp and destroyed Telus line.
	**Photo 6.** Looking southeast up slide mass.

	**Photo 7.** Looking south at the back scarp and wet slide mass.
	**Photo 8.** Looking east at the Puskwaskau River.

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	**Photo 9.** Looking southwest at the riverbank erosion.
	**Photo 10.** Looking north at the oxbow lake.