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

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
SH008-1	2 km E of Watino Bridge	Watino East Hill	49:08	18.80-19.05
Legal Description		**UTM Co-ordinates**		
NE26-77-24-W5M		11U E 462,307	N 6,173,153	

	Date	PF	CF	Total
Previous Inspection:	12-Jun-2019	12	2	24
Current Inspection:	3-Jun-2020	12	2	24
Road AADT:	870		**Year:**	2020
Inspected By:	Rocky Wang, TRANS Ed Szmata, TRANS		Ken Froese, Thurber	
Report Attachments:	☑ Photographs ☑ Plans		☐ Maintenance Items	

Primary Site Issue:	Rotational, retrogressive failures in 10 m high backslope.	
Dimensions:	250 m length of backslope slumping on south side of highway.	
Date of Remediation:	1993: Highway re-routed to this current alignment. 1994: Assessment of subdrains in north slope found them to be working well. 1999: Design undertaken for French drains in south backslope slump area but not constructed. 2001: Gravel placed to buttress upper portion of Slump A and lower portion of Slump C and placed 3 m wide riprap lining in ditch. 2003: Rip-rap-lined channel constructed on lower half of Slump B.	
Maintenance:	2004: Additional stone added to south ditch east of Slump C. 2006: Rip-rap placed in north ditch. 2015: Slumped material in the south ditch removed. 2019: Site regraded to open up south ditch; north sideslope also regraded	
Observations:	**Description**	**Worsened?**
☐ Pavement Distress		☐
☑ Slope Movement	Four separate slump blocks in the south backslope.	☑
☑ Erosion	Slumped material removed from the ditch, leaving bare soil exposed.	☑
☑ Seepage	Seepage noted in the backslope and accumulating in grabens.	☑
☑ Bridge/Culvert Distress	Outlet of drainage pipe partially obstructed.	☐
☑ Other	Two pipelines are located immediately south of the backslope.	☐
Instrumentation:		
None.		

Assessment:

This site is located at the crest of the Smoky River valley; however, the backslope slumping appears to be the result of seepage from exposed sandy/silty layers in the backslope rather than deep-seated instability due to valley movements. At the present time, there is no impact to the highway surface as the depth of failure is contained within the height of the backslope. Records in Alberta Transportation files indicate that this area was deemed to have a factor of safety of 1.25 at a 3H:1V inclination. South slopes to the west and east of this localized area are apparently stable although not quite as high; the north slope is of a similar height and also appears stable. This may indicate a concentration of weaker soils on the south side of this cut, that the drainage measures implemented in the north backslope at the time of construction have been effective, or that the direction of horizontal groundwater flow is a contributing factor.

In the spring of 2019, the maintenance contractor excavated the toe rolls to improve ditch drainage. The material was wasted higher up on the slopes. The contractor also added two swales on the slope to assist with drainage from the sag ponds further up the slope. The grading work obscured some of the slide features and may also contribute to local instability at the toe due to the overall steepening of the lower portion of the backslope. However, it solved the ditch drainage issue. In 2020, there was deterioration of the toe of this regrading with some sloughing and erosion observed. The upper portions of the fill are starting to revegetate.

The uppermost scarp of Slump A did not appear to have regressed since 2016; however, signs of fresh vertical movement were observed in 2017 and 2018. Further movement was observed in 2019 including a new tension crack about 2 m further upslope on the east flank of the slump and minor regression at line B. The tension crack had widened as of 2020 and some material had fallen in the slide. In 2017, one of the pins in line B was removed from the slide mass and placed 5 m further back of pin B1. The encroachment into the ditch had increased in 2017 and 2018; regrading in 2019 has pushed the toe further back into the slope. Slump B appears relatively unchanged since 2018 although a mid-slope toe appeared more defined. The slumps further west (D and E) appeared to be relatively unchanged since 2016 although additional cracks were mapped in 2018 (they may have been present before but not recorded) and toe rolls heights were measured in 2019. Seepage is accumulating at the tops of some of the slump blocks which will further reduce the strength of the slumped material and lead to further movement. With the continued seepage and the continued removal of material from the ditch (whether eroded by water or excavated to maintain ditch flow), the slumps will likely retrogress as toe support is lost. The rate of regression of the top of the slumps is difficult to estimate and it is recommended that a remediation option be developed along with a minimum horizontal offset to the pipelines that would trigger its construction.

An underground utility locate was undertaken in 2018 to identify the locations of the pipelines at the top of the slope. The TransCanada pipeline (TCPL) was closest at an offset 3.9 m south of Pin A1 and 0.1 m south of Pin B3. The East Peace Gas Co-op natural gas line is located further south of the TCPL line.

Recommendations:

Short-Term:

- Remove material from the ditch when required to maintain flow but do not place the excavated material back onto the slide mass as it will load the slide. Augment the ditch bottom rip-rap to minimize downcutting and erosion of the recently-graded faces of the slide toe rolls. Excavated material from the regrading in the spring of 2019 should be removed to reduce the potential for local instability.
- Establish a line of communication with the pipeline owners to determine risk tolerance and minimum setback distance.

Long-Term:

- Develop remediation options such as: flattening of the backslope with a buried culvert along the ditch (so that the toe of the slope can be moved to the north), reconstruct slope with gravel material or select clay with French drains and subdrains, install a groundwater cut-off trench at the top of the slope.

Ongoing Investigation:

- It is recommended that the annual GeoHazard inspection should continue as scheduled.
- A geotechnical drilling program may be required depending on the remediation option(s) considered.

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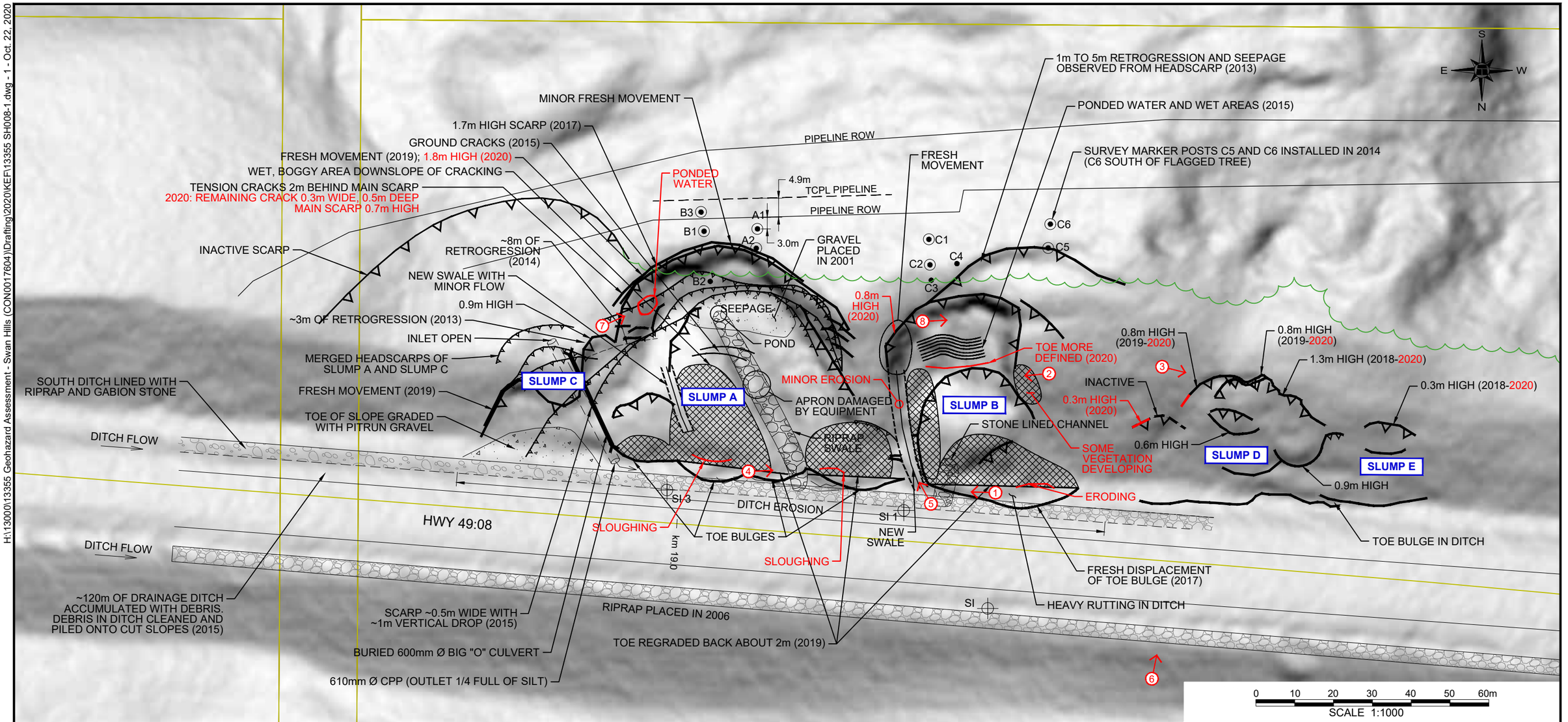

0 10 20 30 40 50 60m

SCALE 1:1000

LEGEND:

- SURVEY PIN (CURRENT)
- SURVEY PIN (DISPLACED IN SLIDE MASS)
- SLOPE INCLINOMETER (NONE FUNCTIONAL)
- SLIDE SCARP CRACK
- 2019 GRADING
- DIRECTION AND NUMBER OF PHOTO

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK.(2013-2015 FROM AMEC FIGURE 1, PROJECT EG10030 PROVIDED BY ALBERTA TRANSPORTATION.)
3. LIDAR PROVIDED BY ALBERTA TRANSPORTATION DATED 2007-2008 AND SHADED FROM WHITE AT 0° TO BLACK AT 30°
4. JUNE 2020 OBSERVATION SHOWN IN RED.
5. DRAWING RESET IN 2017, MANY PREVIOUS OBSERVATIONS REMOVED. SEE 2016 DRAWING FOR THOSE HISTORIC DETAILS.
6. SCARP CRACKS VERIFIED FROM UAV IMAGERY IN 2018.

	MARKER DISTANCES (m)								SCARP HEIGHT (m)			
MARKER	2020	2019	2018	2017	2016	2015	2014	2013	2020	2019	2018	2017
B1 - B2			4.9	-	-	-	-	5.7				
B2 - SCARP			-	-	-	-	-	5.2				
B1 - SCARP	3.2	3.2	3.3	3.3	3.3	3.4	3.4	-	1.6****	1.7	1.9	1.9
B1 - B3*, **				5.0	-	-	-	-				
A1 - A2***			5.0	5.4	5.4	6.6	6.6	5.4				
A2 - SCARP	0.8	0.8	0.8	0.9	0.9	1.2	1.2	2.1	1.3	1.3	1.3	1.3
C1 - C2			7.8	7.8	7.8	7.8	7.8	7.9				
C2 - C3			-	-	-	-	-	5.1				
C2 - SCARP	2.1	2.1	2.1	2.2	2.2	2.3	2.3	2.3	0.6****	1.1	1.0	0.7
C5 - C6			2.0	2.0	2.0	2.0	2.0	-				
C5 - SCARP	5.7	5.7	5.9	5.9	5.9	5.9	6.0	-	1.0	0.7	0.4	0.3

*B2 REBAR PIN SALVAGED AND INSTALLED 5m BEHIND B1 AND RENAMED B3
**B3 LOCATED 0.1m NORTH OF TCPL PIPELINE
***A1 LOCATED 3.9m NORTH OF TCPL PIPELINE
**** SCARP HAS RAVELLED SO LESS VERTICAL

Alberta

PEACE REGION (SWAN HILLS)

SH008-1: HWY 49:08 WATINO EAST HILL SMOKY RIVER 2020 SITE INSPECTION PLAN

DWG No. 13355-SH008-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	1:1000
DATE	OCTOBER 2020
FILE No.	13355

THURBER ENGINEERING LTD.

Photo 1 – Looking east at toes of Slumps B and A which were excavated in 2019 to improve ditch flow with the material placed back onto the slide masses.

Photo 2 – Looking southeast at the top of Slump B. Disturbances from 2019 regrading becoming vegetated.

Photo 3 – Looking west at crest of Slump D

Photo 4 – Looking west at the toe of Slump B.

Photo 5: Recent grading (2019) of lower portion of the slope at toe of Slump B becoming vegetated.

Photo 6: Looking southwest at Slump D (by R. Wang, TRANS).

Photo 7: Looking south at recent movement on the east flank of Slump A.

Photo 8: Looking west at top of Slump B.