

**ALBERTA TRANSPORTATION  
GEOHAZARD ASSESSMENT PROGRAM  
PEACE REGION – PEACE RIVER/HIGH LEVEL  
2020 INSPECTION**



<b>Site Number</b>	<b>Location</b>	<b>Name</b>	<b>Hwy</b>	<b>km</b>
PH83	6.1 km W Cleardale	Golf Course Slides	64:02	29.0
<b>Legal Description</b>		<b>UTM Co-ordinates (NAD 83)</b>		
SE1-1-85-11-W6		11V N 6246600	E 340300	

	<b>Date</b>	<b>PF</b>	<b>CF</b>	<b>Total</b>
<b>Previous Call Out:</b>	May 13, 2019	10	3	30
<b>Current Inspection:</b>	June 16, 2020	10	3	30
<b>Road AADT:</b>	320		<b>Year:</b>	2019
<b>Inspected By:</b>	Barry Meays (Thurber) Ed Szmata, Roger Skirrow (AT)			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs		<input checked="" type="checkbox"/> Plans	<input checked="" type="checkbox"/> Maintenance Items

<b>Primary Site Issue:</b>	Two Landslides – one on each of the north (PH83-1) and south (PH83-2) highway sideslope embankments, both associated with separate cross-culverts.	
<b>Dimensions:</b>	Slide 1 (east, downstream ~5H:1V embankment) is 20 m wide by 30 m long; and Slide 2 (west, upstream ~4H:1V embankment) is 15 m wide by 30 m long.	
<b>Date of any remediation:</b>	In 2017 at Slide 1, a 900 mm diameter SWSP was bored alongside the previously existing 1.2 m diameter CSP culvert which had separated.	
<b>Maintenance:</b>	Gravel fill placed over the slide scarps in 2018.	
<b>Observations:</b>	<b>Description</b>	<b>Worse?</b>
<input checked="" type="checkbox"/> Pavement Distress	Slide 2 has affected a 10 m length of pavement in the EB shoulder, with a 13 m long tension crack observed in the EBDL about 1.2 m from the white line. At Slide 2, a dip exists in the pavement overtop the SWSP. Pavement structure at Slide 2 = 0.3m ACP over 0.3m GBC.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	The 2 slides were basically unchanged in size this year - however, the slides continue to move downslope taking the previously placed gravel with them, resulting in increased scarp heights and toe roll distances. Also, some cracks observed in the steep, embankment slope immediately above the 900 mm SWSP inlet of Slide 1.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The inlet of the 760 mm SWSP cross-culvert of Slide 2, was covered in slide debris again this year.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>

**Instrumentation:**

None

**Assessment:**

The slides were relatively unchanged in size this year, however there were some additional movements. The scarp height dropped through the previously placed gravel to 1.7 m (from 1.3 m last year) at Slide 2, and was about the same as last year (1.3 m) at Slide 1. This translated to some additional slide body movements and increased toe roll distances (the inlet of Slide 1 was again covered this year). The previously placed gravel overtop of the slide scarp portions is likely adding a surcharge to the top of the slide and causing additional movements.

Both landslides appear to be based in high plastic clay. It is postulated that the failures are due to a gradual loss of cohesion due to weathering, combined with high groundwater conditions, which has dropped the resistive forces below what is needed to maintain stability.

Information from the MCI indicated there used to be a 1.2 m diameter CSP culvert located under the Slide 1 area, which had apparently separated and created a sink hole. This culvert was attempted to be lined, but debris infill prevented success. Subsequently, a bored 900 mm SWSP was installed (located on the east side of the slide). There were a few cracks observed on the steeper sloping ground around the inlet to this new SWSP (a longer inlet would have allowed flatter sloping ground to be formed around the inlet).

The 760 mm diameter SWSP culvert at Slide 2 appears to drain south highway ditch runoff, as well as a swale draining from the golf course. The inlet was covered with slide material similar to last year.

The landslides will continue to grow in size if not dealt with. In particular, Slide 2 has a 13 m long tension crack located near the center of the EBDL, which suggests that it could retrogress further into the driving lane in the future. The blocked Slide 2 inlet with toe debris has the potential for water to pond at the landslide mass and accelerate movements.

**Recommendations****Maintenance:**

Monitor further movements or enlargement at both slide locations. If either of the slides encroach into the shoulders of the highway, barricades should be erected and enhanced with warning signage until highway repairs are undertaken.

**Short Term:**

Spread out the existing gravel that was placed over the slide headscarps more evenly and level with the outside ground to reduce the load on top of the slide.

If the cracking around the slopes of the new 900 mm SWSP culvert begin to threaten the integrity of the upstream highway embankment, the existing bevelled end of SWSP could be cut off, an additional length of SWSP with a bevelled end welded onto the cut, and new, flatter slopes constructed with compacted clay around the new inlet.

**Medium to Long Term:**

Two options are recommended for mitigating the west **Slide 2:** **a)** Excavate the slide and rebuild the slope with clay and a toe berm, or **b)** Over-excavate the slide and rebuild the slope with granular fill.

**Details for Option a):** Excavate the slide mass (extending over a 15 m length up to the center of the EBDL); Stockpile this excavated material on stable ground near the site; Weld an elbowed extension onto the inlet of the 760 mm dia. SWSP to daylight in the ditch to the west of the repair area and in line with the swale that drains from the golf course; Construct a toe berm over the culvert extension to span between the highway embankment sideslope and the backslope; Reconstruct the upper part of the sideslope with additional clay fill to a flattened inclination; Topsoil and seed the final surface of the embankment sideslope and toe berm; Place riprap around the culvert inlet. This would require closure of 1 lane of the highway during construction

**Ballpark Cost \$300,000.**

**Details for Option b):** Excavate the slide mass and additional clay over a 15 m length extending back to the highway centreline to a level below the highway ditch; Construct a gravel filled shear key below the highway ditch; Reconstruct the embankment with granular fill (Des. 6 Cl. 80); Cap the outer surface of the embankment with clay and seeded topsoil; Place riprap around the culvert inlet. This would also require closure of 1 lane of the highway during construction.

**Ballpark Cost \$350,000.**

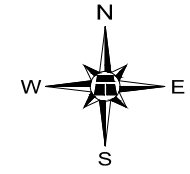
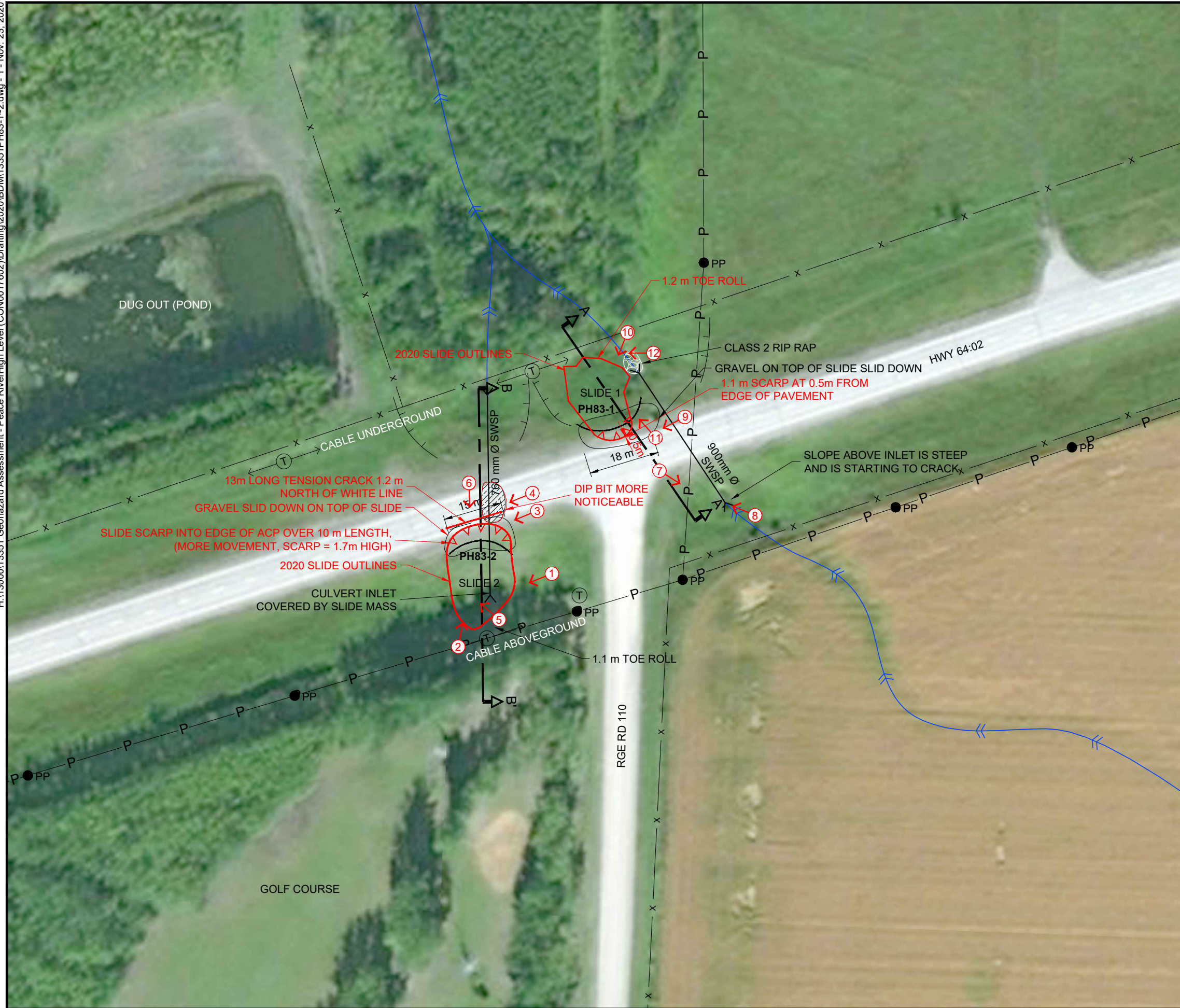
Similar options could be considered for the east **Slide 1**, however extra right of way would be needed for Option a), and the excavation into the pavement should be at least 18 m long may only have to extend up to the shoulder white line. The prices are expected to be of a similar magnitude as for Slide 2.

**Total ballpark cost to fix both landslides at the same time between \$600,000 to \$700,000.**











Other considerations include the presence of Telus cables (adjacent to both slides) that would need to be surveyed and possibly relocated. Overhead power lines are also present near both slide sites and the contractor would need to confirm adequate clearance from these lines for his equipment and obtain permission from the power company.

Consideration could also be given to training all of the south highway ditch runoff across the south approach road, so that all of this water is concentrated into one culvert instead of two (effectively eliminating the east culvert).

H:\13000\13351 Geohazard Assessment - Peace River\High Level (CON0017602)\Drafting\2020\BDM\13351\PH83-1~2.dwg - 1 - Nov. 23, 2020



**LEGEND**

-  SLIDE SCARP
-  EDGE OF DEPRESSION
-  SMOOTH WALL STEEL PIPE (SWSP) CULVERT
-  DIP IN PAVEMENT
-  FENCE
-  OVERHEAD POWER LINE
-  POWER POLE
-  DRAINAGE SWALE
-  TELUS CABLE
-  DIRECTION AND NUMBER OF PHOTO

**NOTES :**

1. SITE FEATURES ARE APPROXIMATE
2. JUNE 16, 2020 OBSERVATIONS SHOWN IN RED

SATELLITE IMAGE FROM ESRI WORLD IMAGERY DOWNLOADED 2017-08-15



**HWY 64:02 GOLF COURSE SLIDES  
6.1 km WEST OF CLEARDALE**

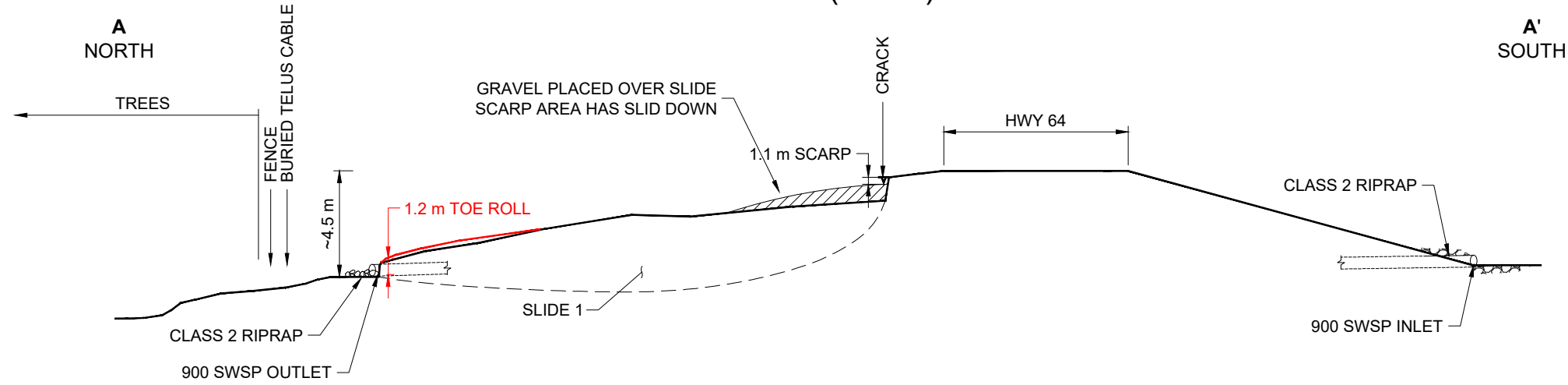
**2020 INSPECTION PLAN**

**FIGURE PH83-1**

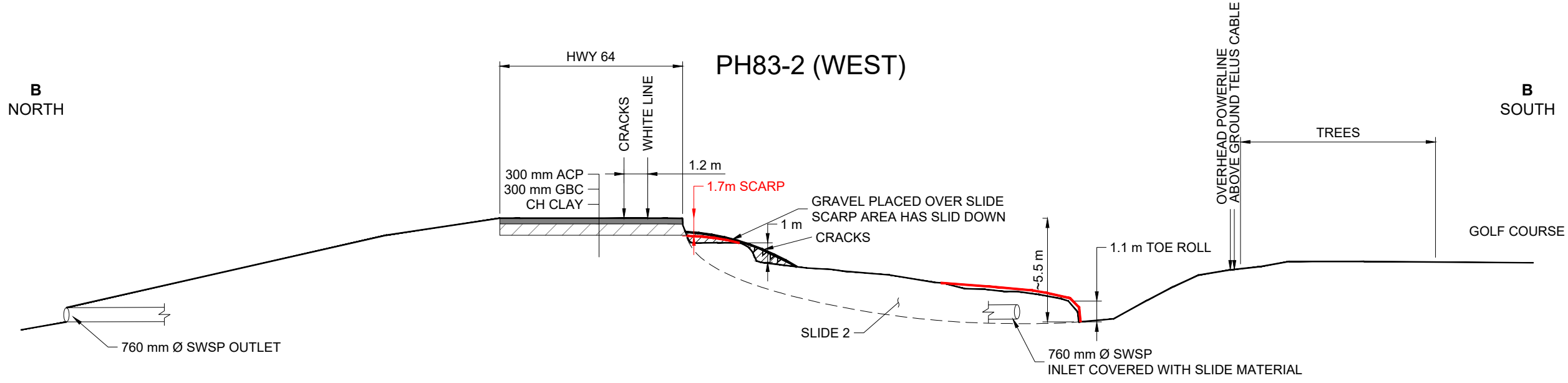
DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:1000
DATE	JUNE 16, 2020
FILE No.	13351




### PH83-1 (EAST)



### PH83-2 (WEST)



- NOTES :
1. SITE FEATURES ARE APPROXIMATE
  2. JUNE 16, 2020 OBSERVATIONS SHOWN IN RED




**HWY 64:02 GOLF COURSE SLIDES  
6.1 km WEST OF CLEARDALE**

**2020 INSPECTION  
CROSS-SECTIONS A-A' & B-B'**

**FIGURE PH83-2**

DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:250
DATE	JUNE 16, 2020
FILE No.	13351



**THURBER ENGINEERING LTD.**



Photo 1 – Looking west across the toe and body of Slide 2. There is an overhead power line running east-west a short distance from the tree line.



Photo 2 – Looking north (upslope) at Slide 2.



Photo 3 – Looking west along the highway embankment and scarp of Slide 2. Note the pitrun gravel that was placed overtop of the slide scarp adjacent to the highway continues to settle and move downslope.



Photo 4 – Looking west at the crack in the highway EB lane OWP adjacent to the Slide 2 scarp.



Photo 5 – Close-up view of the culvert inlet, where Slide 2 debris squeezed around and covered it.



Photo 6 – Looking south from the highway over Slide 2.





Photo 7 – Looking southeast at the drainage gully leading into the culvert inlet area on the opposite (south) side of the highway from Slide 1.



Photo 8 – Looking north at the inlet of the 900 mm dia. SWSP of Slide 1. A few cracks formed around the steeply sloping embankment surface around the inlet.



Photo 9 – Looking west adjacent to the hwy at the Slide 1 slide scarp. Note the dip in the hwy ovetop the culvert crossing at Slide 2 (in the background).



Photo 10 – Looking south across Slide 1 at the north highway embankment and the 900 mm dia. SWSP outlet.



Photo 11 – Looking north from the highway overtop Slide 1.



Photo 12 – Looking northwest at the outlet and downstream erosion gully of Slide 1.