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wheeler

December 2015

Project Number: CG25399

Alberta Transportation
2nd Floor, 803 Manning Road NE
Calgary, Alberta T2E 7M8

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment
2015 Annual Inspection Report
Site S38: Highway 22:08, Callum Creek Landslide**

Dear Ross:

This letter documents the 2015 annual site inspection of Site S38 – Callum Creek Landslide Site on Highway 22:08. The site is 11 km north of the Oldman River Bridge and approximately 10 km south of the Highway 22 and Highway 520 junction.

Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler), a division of Amec Foster Wheeler Americas Limited, performed this inspection in partial fulfillment of the scope of work for the supply of geotechnical services for Alberta Transportation's (AT's) Southern Region (AT contract CON0013506).

The site inspection was performed on May 27, 2015 by Bryan Bale, P.Eng., and Tyler Clay, P.Eng., of Amec Foster Wheeler; with Roger Skirrow, P.Eng., and Ross Dickson of AT during the 2015 Annual Tour.

1.0 SUMMARY

The site was repaired in early 2014. The repair involved the installation of two pile walls on the east side of the highway and a drainage trench in the west upslope ditch. The overall site appeared to be in good condition. The Risk Level remained at 18, which is reduced from the 2013 level of 91 prior to the repair work. The performance of the completed repair should be monitored in the future through site inspections and new instrument installations are recommended. The site should be inspected next during the 2016 annual tour.

2.0 BACKGROUND

Minor tension cracking and settlement of the road surface at this site were first noted in 2005. The first inspection of this site under AT's Geohazard Risk Management Program was performed on March 3, 2011, after a member of the public notified AT of worsening conditions at this site. At the time of that site inspection, the road surface was exhibiting arc-shaped cracking and settlement across an approximately 80 to 100 m long segment of the road, which was interpreted to represent a landslide headscarp. The northern end of the affected road segment had a series of tension cracks in the pavement, roughly parallel to the road direction, and possibly indicating future expansion of the arc-shaped cracking. The landsliding did not appear to be linked to the slide area a short distance northbound from the site that was previously repaired with a pile wall. The road at the site has two lanes and appears to be a cut/fill embankment along the natural valley slope. The slope below the road is at an angle of 17 to 18°.

Borehole drilling and instrument installations were recommended following the 2011 inspection to investigate the subsurface conditions and to provide a basis for the selection and design of a repair. Two slope inclinometers and two vibrating wire piezometers were installed April 2011¹. The slope inclinometers have since been sheared. A repair design, consisting of two pile walls and an upslope trench drain, was prepared in 2012 with construction completed in 2014. The completed repair is expected to significantly reduce the landslide hazard at the site. Refer to Figures S38-1 and S38-2 for an overall plan of the site features in relation to the constructed repair.

3.0 SITE OBSERVATIONS

A summary of observations and discussions on site with the AT personnel from the May 2015 inspection is presented below. Please also refer to the S38 Spring 2015 instrumentation monitoring report for a more detailed presentation and discussion of the instrument data.

- The road surface had minor settlement at the south end but no cracking was observed through the new pavement overlay placed in 2014.
- The ditch drain outlet had seepage (<0.5 L / min) and signs of past flow. The ditch was starting to vegetate with no signs of erosion.
- The embankment slope in the area of the pile walls was well vegetated, with no cracks or erosion, and no exposed piles. The slope had been graded to restore the preconstruction topography.

¹ AMEC Earth & Environmental. 2011. *S38 - Hwy 22:08 – Callum Creek Landslide Site 2011 Geotechnical Investigation, Instrument Installations and Initial Readings*, submitted to Alberta Transportation, June 2011, AMEC File No. CG25359

4.0 ASSESSMENT

The site assessment from 2015 has remained unchanged since the previous inspection in 2014.

In general the repaired area appeared to be in good condition. There were areas where minor settlement of the fill had occurred but erosion was not evident. The observed settlement areas will be inspected in the future to ensure settlement does not worsen but this is not considered to affect the repair performance. No exposure of piles was noted.

Vegetation had begun to grow on both slopes and the lower slope was well vegetated showing no signs of erosion.

The repair work appears to be performing well. However, as there is currently no instrumentation at this site, Amec Foster Wheeler cannot monitor the effectiveness of the pile walls.

5.0 RISK LEVEL

The current recommended Risk Level for this site, based on AT's general geohazard risk matrix, is as follows:

- Probability Factor of 9 based on the active landslide conditions that are expected to continue at a decreasing rate as resistance from the pile wall increases. This probability factor may be reduced in the future if low movement rates are observed at the site or slide activity is determined to become inactive.
- Consequence Factor of 2 given that landslide failure within the affected portion of the highway is no longer expected with the repair in place. Ongoing movement is expected at a relatively lower rate than previously observed which may result in pavement settlement along previously observed extents resulting in a loss of service of a portion of the roadway or affect the safety of motorists, but not requiring a closure.

Therefore, the current recommended Risk Level for this site is 18 (9 x 2), which was significantly reduced in 2014 from the 2013 Risk Level of 91. The risk level may be reduced if the repair functions as expected and the site shows continued stability for several consecutive years.

6.0 RECOMMENDATIONS

Amec Foster Wheeler provides the following recommendations for this site based of the 2015 site assessment:

- The instruments at the site should continue to be monitored semi-annually as part of the Southern Region Geohazard Program and the site should be inspected during the 2016 Annual Tour to evaluate the repair performance and check for changing conditions.
- Two SIs should be installed; one above the upper pile wall and one in between the two pile walls. The installation of these instruments is recommended in order to monitor the



performance of the pile walls rather than waiting for signs of deformation on the road surface to indicate a problem. Amec Foster Wheeler can submit the proposal for this work for AT's consideration.

- The top of the piles should be monitored for exposure. Erosion may cause the piles to become exposed.
- If significant erosion is noted at the ditch drain outlet, possible erosion control measures could be recommended.



7.0 CLOSURE

This report has been prepared for the exclusive use of Alberta Transportation for the specific project described herein. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. AMEC Foster Wheeler Environment & Infrastructure, a division of AMEC Foster Wheeler Americas Limited, cannot accept responsibility for such damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report has been prepared in accordance with accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

We trust that this meets your needs at this time. Please contact the undersigned if you have any questions or require any further information.

Respectfully Submitted,

**AMEC Foster Wheeler Environment & Infrastructure,
a division of AMEC Foster Wheeler Americas Limited**

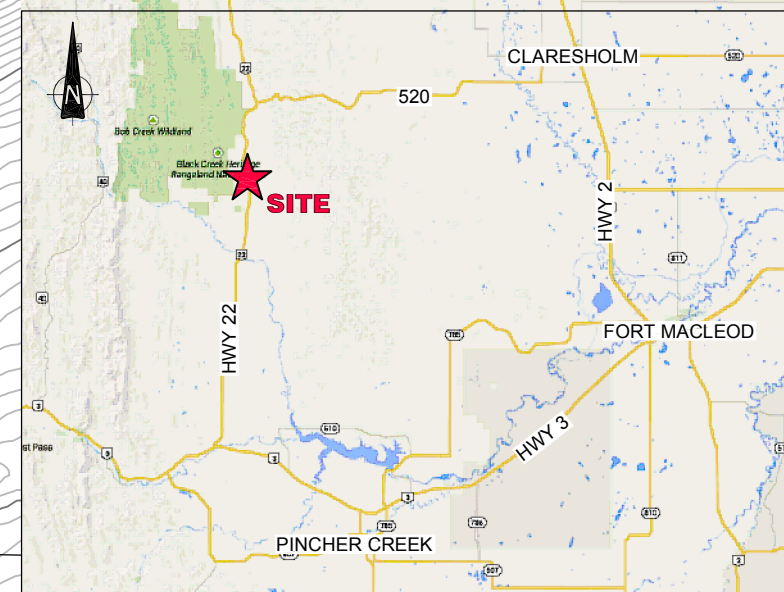
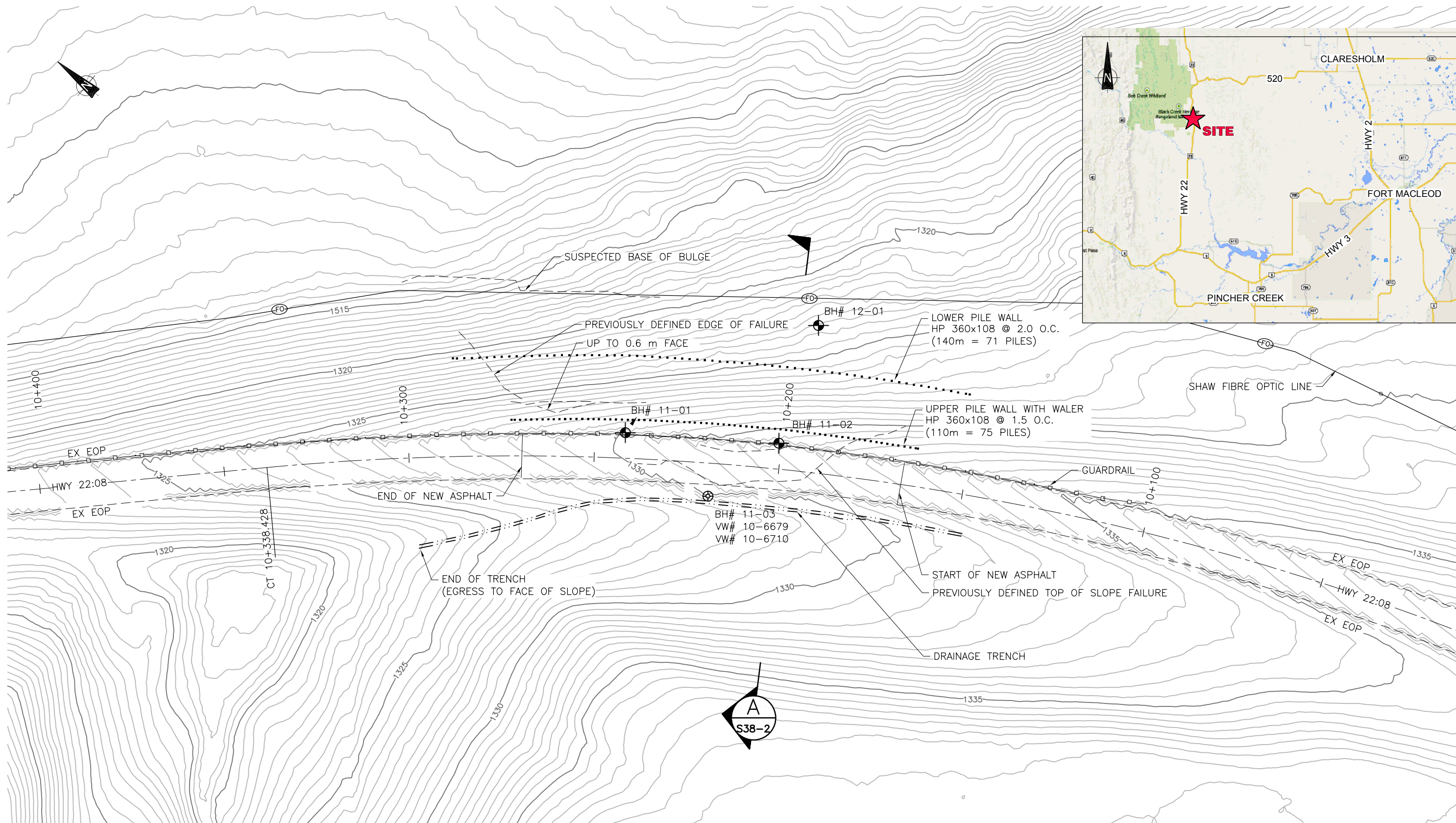
Original Stamped & Issued December 23, 2015

Nisar Khan, B.Sc., G.I.T.
Geologist-In-Training

Ryan Mateff, B.A.Sc., P.Eng.
Geotechnical Engineer

APEGA Permit No. 04546

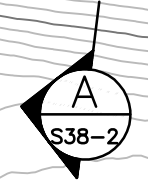
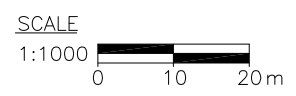
Reviewed by:
Mickey Davachi, PhD., P.Eng.,
Principle Geotechnical Engineer



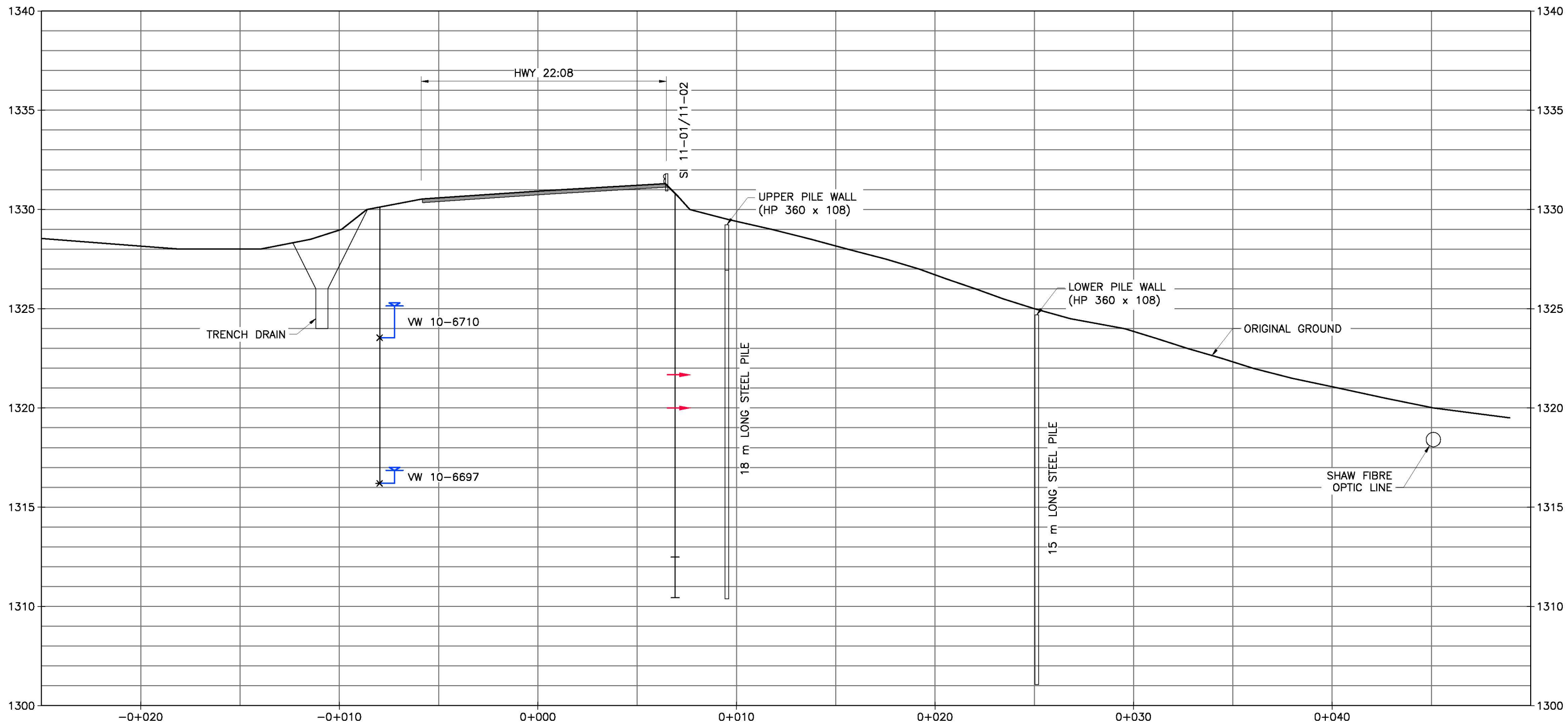
- LEGEND:**
- BH#11-01 SLOPE INCLINOMETER
 - BH#11-03 VIBRATING WIRE PIEZOMETER

NOTES:

1. BOTH SI'S OUT OF OPERATION.



		PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT AND INSTRUMENTATION MONITORING			
		TITLE: S38 - HWY 22:08 - CALLUM CREEK LANDSLIDE SITE PLAN			
CLIENT:		DATE: JUNE 2015	JOB No.: CG25399.300	CAD FILE: 25399B08.dwg	FIGURE No.: FIG S38-1
					REV. A

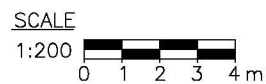


NOTES:

1. INSTRUMENT LOCATIONS FROM 2014 SURVEY.
2. WATER LEVEL READINGS FROM MAY 2015.

LEGEND:

- X PIEZOMETER TIP
- Water Level Symbol WATER LEVEL
- Red Arrow MOVEMENT ZONE



	PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT AND INSTRUMENTATION MONITORING			
	TITLE: S38 - HWY 22:08 - CALLUM CREEK LANDSLIDE CROSS SECTION A			
CLIENT:	DATE: JUNE 2015	JOB No.: CG25399.300	CAD FILE: 25399B08.dwg	FIGURE No.: FIG S38-2
				REV.: A



Photo S38-1 (May 2015) – Facing south from the west side of the highway looking at erosion / sediment blanket and socks. Vegetation has started to grow on slope.



Photo S38-2 (May 2015) – Facing south along the drain ditch alignment at drain ditch outlet. Drain ditch outlet has seepage.



Photo S38-3 (May 2015) –
Facing south from the west
side of the highway. New
pavement overlay placed in
2014 was in good condition.



Photo S38-4 (May 2015) –
Current Instrumentation



Photo S38-5 (May 2015) –
Facing south from the east
side of the highway. 2014
overlay is in good condition.



Photo S38-6 (May 2015) –
Facing north standing on the
lower slope. Slope is well
vegetated and piles are not
exposed.