

December 19, 2011
CG25352.300

Mr. Ross Dickson
Alberta Transportation
2nd Floor, 803 Manning Road NE
Calgary, AB T2E 7M8

Dear Ross:

**Re: Southern Region Geohazard Assessment
Fall 2011 Instrumentation Monitoring Results
Site S22: Highway 762:02, "S" Curve**

This letter documents the Fall 2011 instrument readings at the above-noted site and can be inserted into Section C of the site binder. The updated site plan, instrument data, and plots are also attached and can be inserted into Section D of the site binder.

1.0 OBSERVATIONS

1.1 Field Program and Instrumentation Status

A reading was attempted for SI 2007-9 at the S22 – "S" Curve site on Hwy 762:02, on October 3, 2011 by Mr. Tyler Clay, EIT, of AMEC Environment & Infrastructure (AMEC), a division of AMEC Americas Limited. The instruments are no longer functioning at the site. The slope inclinometers have become obstructed due to excessive deformation, and the piezometers could not be located and are likely paved over.

The instruments at the site were installed to monitor a landslide that is causing ongoing damage to the road surface. Ongoing damage was evident at the time of the attempted Fall 2011 readings, with pronounced cracks in the road surface resulting in down-drop of the southbound lane, forming the same pattern as was observed during previous site visits. Please refer to Figure S22-1 in Section D for a site plan showing the instrument locations and to Figure S22-2 for a cross-section.

AMEC Environment & Infrastructure
A division of AMEC Americas Limited
140 Quarry Park Blvd. SE
Calgary, AB, CANADA T2C 3G3
Tel +1 (403) 248-4331
Fax +1 (403) 248-2188

www.amec.com

2.0 INTERPRETATION AND RECOMMENDATIONS

2.1 General

2.2 Zones of Movement

Zones of previous movement and historical results are summarized in Table S22-1.

2.3 Interpretation of Monitoring Results and Recommendations

2.3.1 Interpretation

SI 2007-9

- A reading of the SI was attempted but the SI was found to be excessively deformed and can no longer be read.
- There had been approximately 69 mm of movement in a zone around 982.5 m elevation (roughly 10 to 11 m depth below the road) from April 2007 to May 2011. Movement had been towards the east (bearing 112°), which is towards the creek to the east/southeast of the site but skewed away from the upslope/downslope direction of the road fill embankment at this location.
- There was a distinct seasonal pattern to the movement in 2007 and 2008. Peak movement rates were measured between May and September in 2007 and 2008 and relatively dormant periods over the winters.

SI 2007-7

- This SI has been inoperable since the September 2007 readings due to the accumulated landslide movement having deformed the SI casing to the point where the SI probe can no longer pass below the movement zone around 7.4 m depth. There had been 94 mm of movement in a zone around 984 m elevation (roughly 8 m depth below the road) between April and September 2007.

Piezometer data:

- The piezometers could not be located at the time of the attempted Fall 2011 readings and were likely paved over at some point after the Spring 2011 readings.
- Piezometer tip number 60222 that was installed in Borehole 2007-8 had measured pressures ranging from 0 to 12 kPa. These pressures are equivalent to 1.2 m or less of groundwater above the piezometer tip elevation of 987.3 m.
- Piezometer tip number 60221 that was installed in Borehole 2007-10 had measured pressures ranging from 75 to 80 kPa. These pressures are equivalent to groundwater

elevations around 989.3 to 989.8 m (roughly 3 m above the base of the road fill and 4 m below ground surface) relative to the piezometer tip elevation of 981.6 m.

Previous SI data showed that there was ground movement beneath the settled and cracked area along the highway. The movement was occurring around 982.5 to 984 m elevation (approximately 8 to 11 m below the road surface) and was towards the east. The movement elevation was around, or slightly below, the elevation of the creek channel at the base of the valley. The ground movement was judged to be the cause of the ongoing damage to the road surface at this site.

The ground movement was occurring around the contact between the clay/varved silt and clay soils and the underlying clay till. The ground movement may have been triggered by the load of the road fill embankment and the numerous overlays that had been placed to repair the damage from the cracking and settlement. The relatively high piezometric pressure measured around the elevation of the movement surface in SI 2007-9 also suggested that high groundwater levels were a contributing factor to the movement. Based on the ongoing damage to the road surface as of the Fall of 2011, it is judged that the subsurface conditions leading to the landslide movement have not fundamentally changed since the last readings.

2.3.2 Recommendations

AMEC recommends the following for this site:

- The semi-annual instrument readings and annual site inspections should be discontinued. Recovery of the piezometers is not recommended, as sufficient information has been obtained to proceed with a repair.
- Construction of drainage trenches into the underlying native soils to lower the groundwater levels at the site and attempt to reduce the rate and magnitude of future landslide movement at this site. AMEC has submitted a repair design and can proceed with the preparation of a draft tender package for the repair at AT's request.

3.0 INSTRUMENTATION REPAIRS AND MAINTENANCE REQUIRED

No instrument repairs or recovery work is recommended at this time, because it does not appear that the site conditions have changed and that there is any need for further monitoring in order to confirm or revise the completed repair design.

AMEC has previously provided recommendations for the installation of additional instruments to provide monitoring during and after construction of the repair measures.



TABLE S22-1
FALL 2011 – “S” Curve
Slope Inclinator Instrumentation
Reading Summary

Date Monitored: attempted on October 3, 2011

INSTRUMENT NAME AND COORDINATES (LATITUDE AND LONGITUDE)	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AT DEPTH SINCE INITIAL READING	MAXIMUM RATE OF MOVEMENT	CURRENT STATUS	DATE OF PREVIOUS READING	SINCE PREVIOUS READING		
						INCREMENTAL MOVEMENT	RATE OF MOVEMENT	CHANGE IN RATE OF MOVEMENT
2007-7 (50°48'.994N, 114°28'.6612W)	5/15/2007	94mm at 7.9m depth at 155° from May 2007 to September 2007	235mm/yr (Summer 2007)	Not operational. SI probe cannot pass below 7.4 m depth due to accumulated landslide movement.	9/14/2007	N/A	N/A	N/A
2007-9 (50°48'.971N, 114°28'.653W)	5/15/2007	68.7 mm at 10.7m at 97° from May 2007 to May 2011	82mm/yr (May to Sept 2008)	Not operational. SI probe cannot pass below 10 m depth due to accumulated landslide movement.	3/05/2011	N/A	N/A	N/A



TABLE S22-2
Fall 2011 – “S” Curve
Piezometer Instrumentation
Reading Summary

Date Monitored: attempted on October 3, 2011

INSTRUMENT TIP SERIAL NUMBER AND COORDINATES (LATITUDE AND LONGITUDE)	DATE INITIALIZED	TIP ELEVATION¹ (m)	GROUND ELEVATION¹ (m)	CURRENT STATUS	MAXIMUM PIEZOMETRIC ELEVATION (m)	CURRENT PIEZOMETRIC ELEVATION (m)	PREVIOUS PIEZOMETRIC ELEVATION (m)	CHANGE IN CALCULATED EQUIVALENT GROUNDWATER ELEVATION SINCE PREVIOUS READING (m)	PORE WATER PRESSURE RATIO (r_u)
2007-8 (60222) (50°48'.994N, 114°28'.6612W)	4/5/2007	987.34	991.91	No access (paved over or buried during Summer 2009)	988.53 (May 2009)	N/A	988.53	N/A	N/A
2007-10 (60221) (50°48'.971N, 114°28'.653W)	4/5/2007	981.60	993.49	No access (paved over or buried during Summer/ Fall 2011)	989.77 (May 2007)	989.53	989.16	+0.37	0.37

¹Relative to assumed site benchmark of 1000 m.

4.0 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 Environment & Infrastructure, a division of AMEC 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 Environment & Infrastructure,
a division of AMEC Americas Limited**

[ORIGINAL SIGNED AND STAMPED ON DECEMBER 19, 2011]

Tyler Clay, B.A.Sc., EIT
Geological Engineer

Bryan Bale, M.Sc., P.Eng.
Geotechnical Engineer







Reviewed by:

APEGGA Permit to Practice No. P-04546

Andrew Bidwell, M.Eng., P.Eng.
Associate Geological Engineer

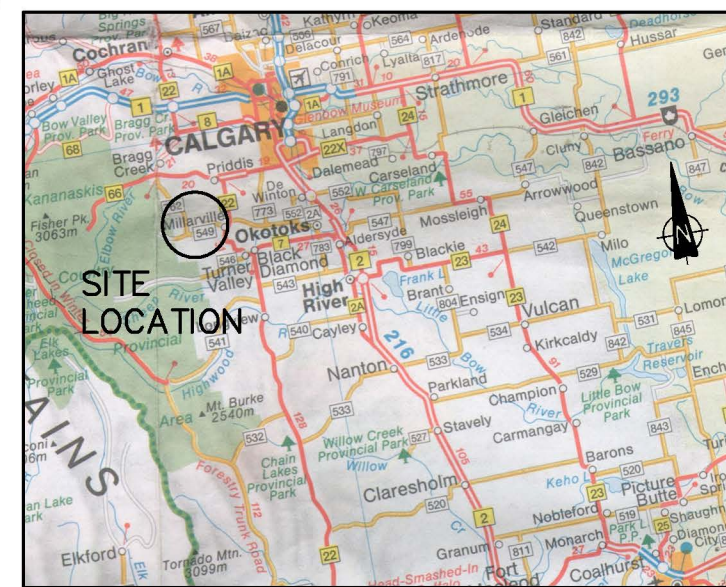
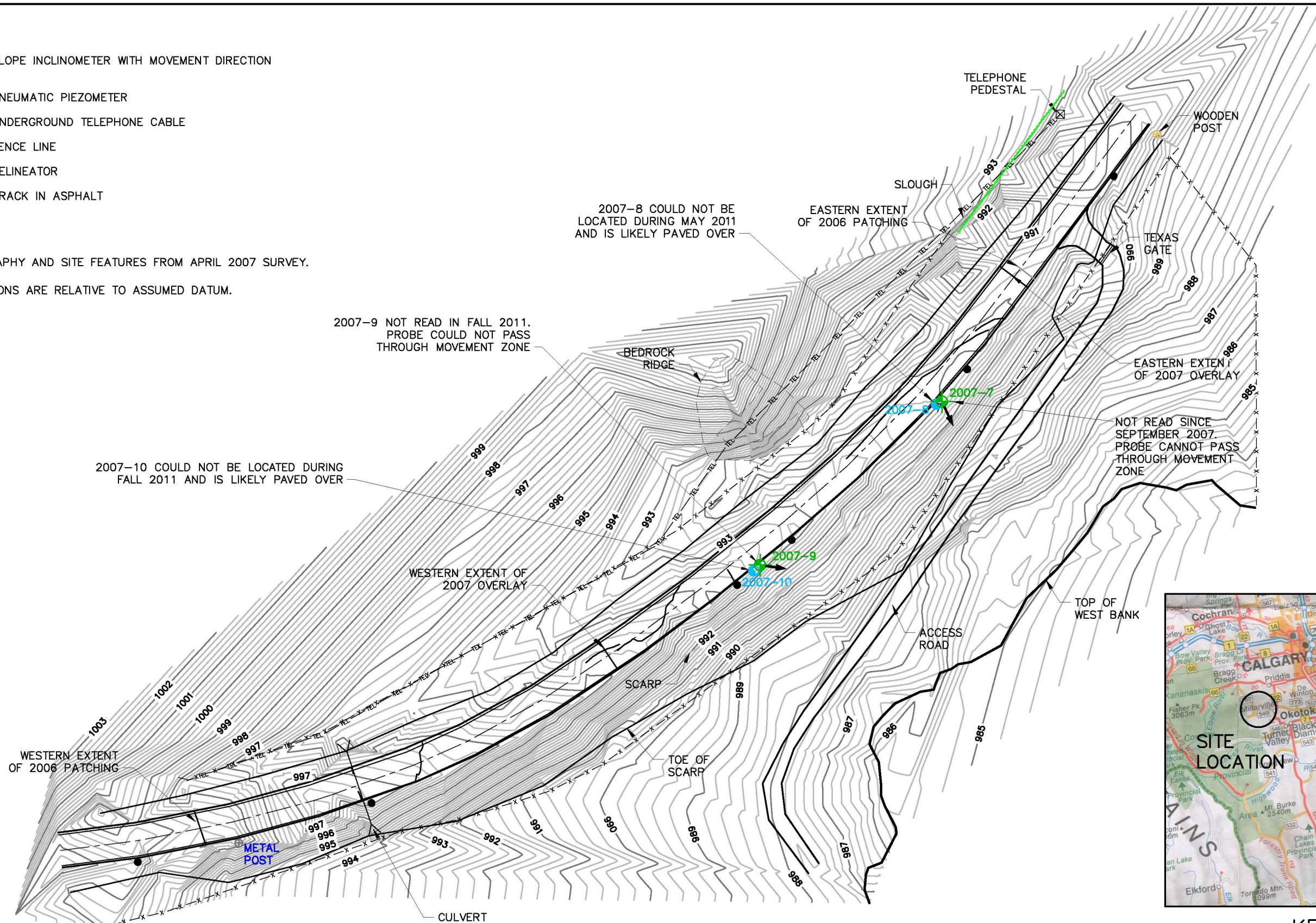
SECTION D
Southern Region Geohazard Assignment
Site S22 – “S” Curve
Fall 2011 Site Plan & Slope Cross-Section

LEGEND:

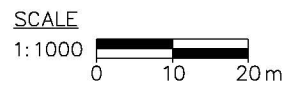
-  SLOPE INCLINOMETER WITH MOVEMENT DIRECTION
-  PNEUMATIC PIEZOMETER
-  UNDERGROUND TELEPHONE CABLE
-  FENCE LINE
-  DELINEATOR
-  CRACK IN ASPHALT



NOTES:

1. TOPOGRAPHY AND SITE FEATURES FROM APRIL 2007 SURVEY.
2. ELEVATIONS ARE RELATIVE TO ASSUMED DATUM.



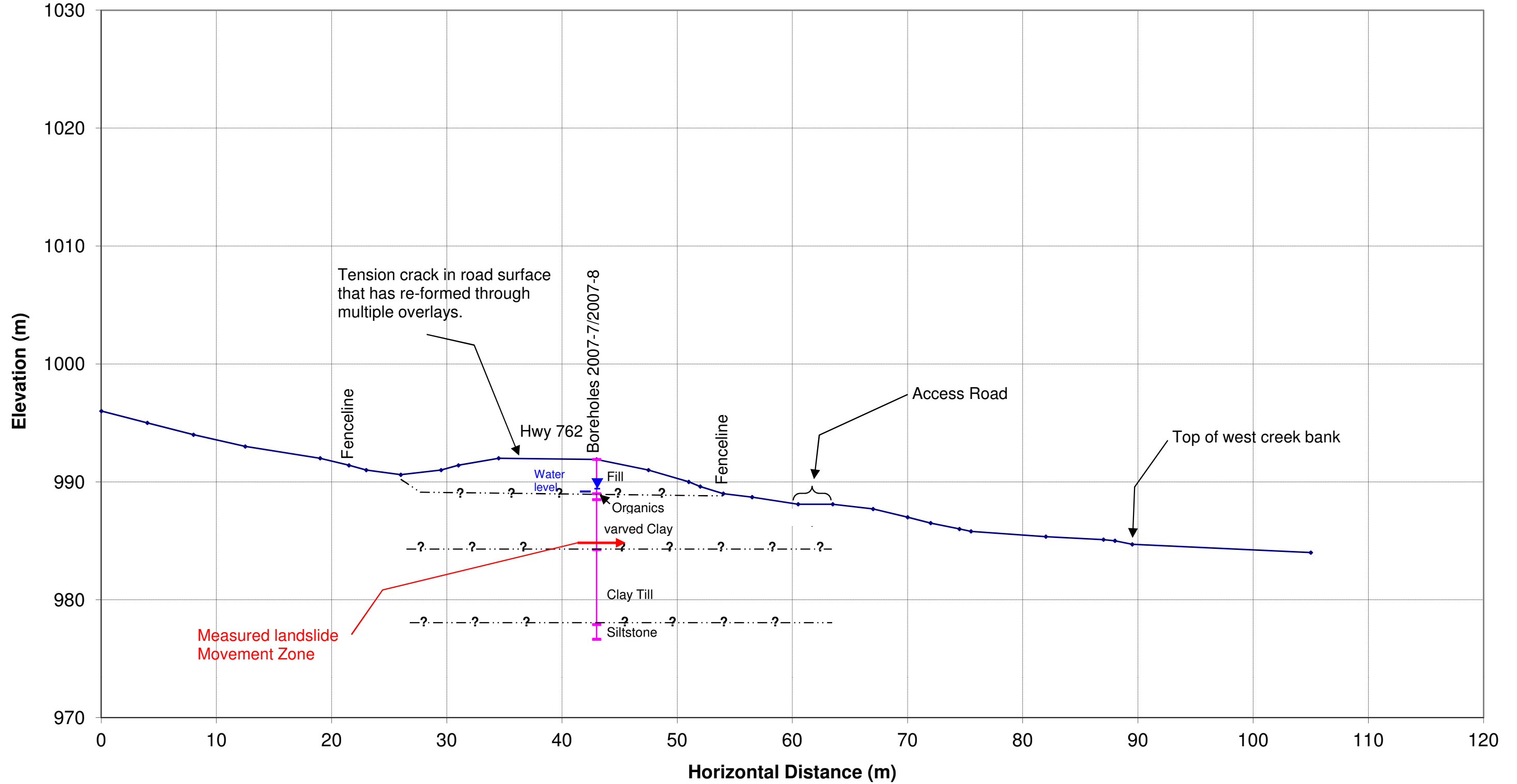
KEY PLAN
N.T.S.



 	PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT AND INSTRUMENTATION MONITORING				
	TITLE: SITE S22 - SH 762 - S CURVE				
CLIENT:	DATE: DECEMBER 2011	JOB No.: CG25352.300	CAD FILE: 25352N05.dwg	FIGURE No.: FIGURE S22-1	REV. A

Northwest

Southeast



Approximate Scale 1:333

Client	Alberta Transportation		Figure S22-2	
Project	S22 - "S" Curve Slide		Date:	Revision
Slope Cross-Section at Boreholes 2007-7/2007-8			Dec-11	
			Job No. CG25352.300	
			File No.:	

