

**GEOHAZARD ASSESSMENT PROGRAM**

**PEACE RIVER/HIGH LEVEL AREA**

**CALLOUT (JANUARY 28, 2015)**



**Government of Alberta**  
Transportation

**THURBER ENGINEERING LTD.**

Site Number	Location	Name	Hwy	km
PH2	East Hill	33+900 to 34+100	2:60	34.0
Legal Description		UTM Co-ordinates (NAD 83)		
SW27-083-21-W5		11V E 485195	N 6230670	

	Date	PF	CF	Total
<b>Previous Inspection:</b>	August 12, 2014	9	6	54
<b>Current Inspection:</b>	January 28, 2015	11	6	66
<b>Road AADT:</b>	5520		<b>Year:</b>	2013
<b>Inspected By:</b>	Shawn Russell (Thurber); Ed Szmata (TRANS)			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

<b>Primary Site Issue:</b>	A landslide is affecting all three lanes of the highway, resulting in tension cracks and dips in the asphalt.		
<b>Dimensions:</b>	The original landslide was affecting about 40 m of highway, however new cracks and dips suggest that the total length of highway affected is now about 90 m (refer to Dwg. 15-16-305-PH2-1).		
<b>Maintenance:</b>	None since 2011	<b>Worsened?</b>	
<b>Observations:</b>	<b>Description</b>	<b>Yes</b>	<b>No</b>
<input checked="" type="checkbox"/> Pavement Distress	There are tension cracks and dips in the pavement.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Slope inclinometer 13-2 shows a distinct shear plane about 18 m below the d/s shoulder of the highway. The movement rate has increased.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Some erosion has occurred in the valley slope beyond the outlet of the centreline culvert located west of the distressed pavement area	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>	<input type="checkbox"/>

**Instrumentation:**

SI13-2, located partway down the sideslope at the original landslide zone, shows a slip surface at 17.5 m depth and has a rate of movement of 12 mm/year as measured on January 28, 2015. The depth of movement in SI13-3, located further downslope, is not as well defined. It is possible that the slip surface extends below the bottom of the SI casing.

New Instruments were installed in December 2014 (3 SI's, 6 Pneumatic Piezometers and one Standpipe Piezometer). Readings taken since their installation (attached) indicate possible zones of movement at similar depths to the SI's installed in 2013 (about 18 m deep at the guardrail). These instruments will continue to be read until a distinct movement zone can be observed.

**Assessment:**

A deep-seated landslide is affecting the roadway and appears to be growing in lateral extent and rate of movement. The interpolated slip surface extends to about 18 m below the highway at the guard rail, as shown on the attached Dwg. 15-16-305-PH2-2A. The highway is located on a side hill alignment

within a tributary valley to the Heart River. There is a high cut slope on the north (uphill) side of the highway and a small fill over a natural bench over a steep valley slope on the south (downhill) side.

Based on LiDAR imagery (Refer to Dwg 15-16-357-PH2-3), the highway was constructed over a large ancient landslide and the current movement appears to be a local retrogression of a slide block within the old landslide into the highway fill, possibly due to progressive failure due to a gradual loss of cohesion or a change in groundwater conditions. The tributary to the Heart River is present 122 m below the highway surface. This landslide has the potential to close all three lanes of the highway, which is the main access route to the Town of Peace River and a part of the national transportation network.

Recent observations made by the MCI and the Maintenance Contractor have indicated that both dips have worsened during the months of December 2014 and January 2015, which is typically a more dormant period for landslide activity. There is a significant risk that the rate of movement will increase in the Spring months, when the ground thaws and water tables are typically higher at which point a sudden failure, resulting in the closure of the highway, is more likely to occur.

### **Recommendations:**

**Cost**

#### **Maintenance:**

The highway should be patched as necessary to provide a safe riding surface. Landslide warning signs should be erected to warn the public in case of a sudden movement of the landslide.

A speed reduction through the area (The current gazetted speed is 100 km/hr) should also be considered. Based on the accentuation of the dipping in the asphalt pavement observed in December 2014 and January 2015 that the landslide is currently active and a failure of the highway embankment could be imminent.

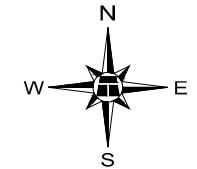
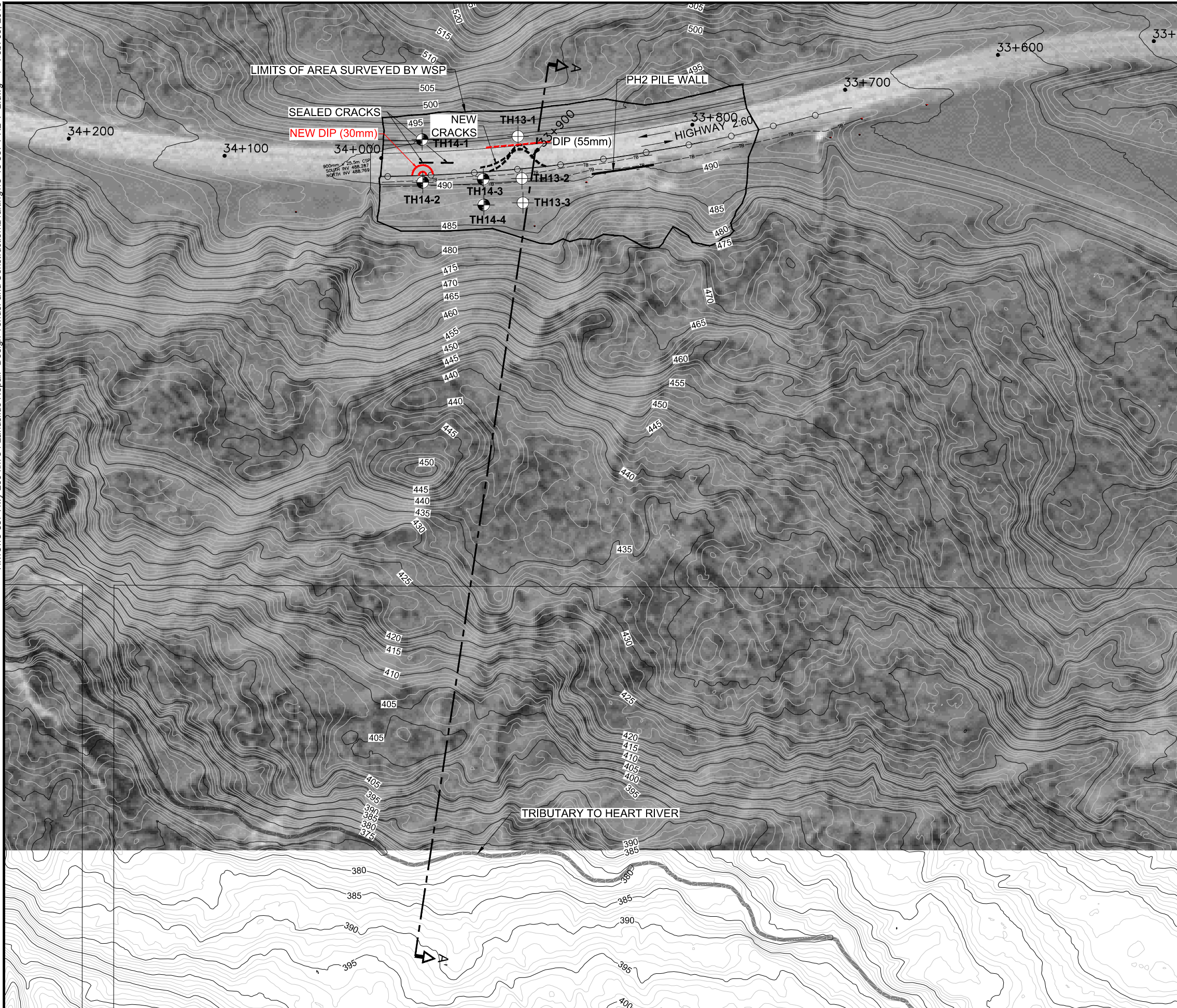
#### **Possible Remedial Measures and Ballpark Costs:**

1. Realignment of the roadway. The highway could be re-aligned to the north away from the active landslide area. However, the re-alignment would need to be about 600 m in length and would require a substantial cut into the 40 m high backslope. The re-alignment would impact the future twinning of the highway and since the highway would still cross the ancient landslide there is a risk of future failure. **\$6,000,000**
2. Construction of a tied back pile wall. Based on the latest observations the pile wall would need to be about 120 m in length. However, the slip surface is deep and several rows of tie-backs would be required to maintain the current alignment **\$6,500,000**
3. A hybrid solution combining elements of the previous two options, with a slight re-alignment (say 1 lane) further to the north would allow for a pile to be located further north where the depth of the shear plane is shallower, but at the cost of grading and pinning. The total cost would likely be similar to option 1 and 2.



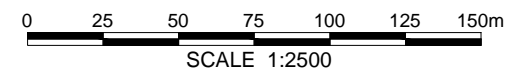


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- LEGEND**
- PREVIOUS TEST HOLE LOCATION
  - PROPOSED TEST HOLE LOCATION
  - GUARD RAIL
  - TELUS LINE
  - 490 GROUND CONTOUR
  - APPROXIMATE OUTLINE OF DIP IN PAVEMENT

**NOTE**  
 CONTOURS BASED ON SITE SURVEY INSIDE LIMITS SURVEYED BY WSP AND LIDAR OUTSIDE THOSE LIMITS.



BASE PLAN PROVIDED BY WSP



**HWY 2:60 NEW LANDSLIDE WEST OF EAST HILL PILE WALL (PH2) - PEACE RIVER, ALBERTA**

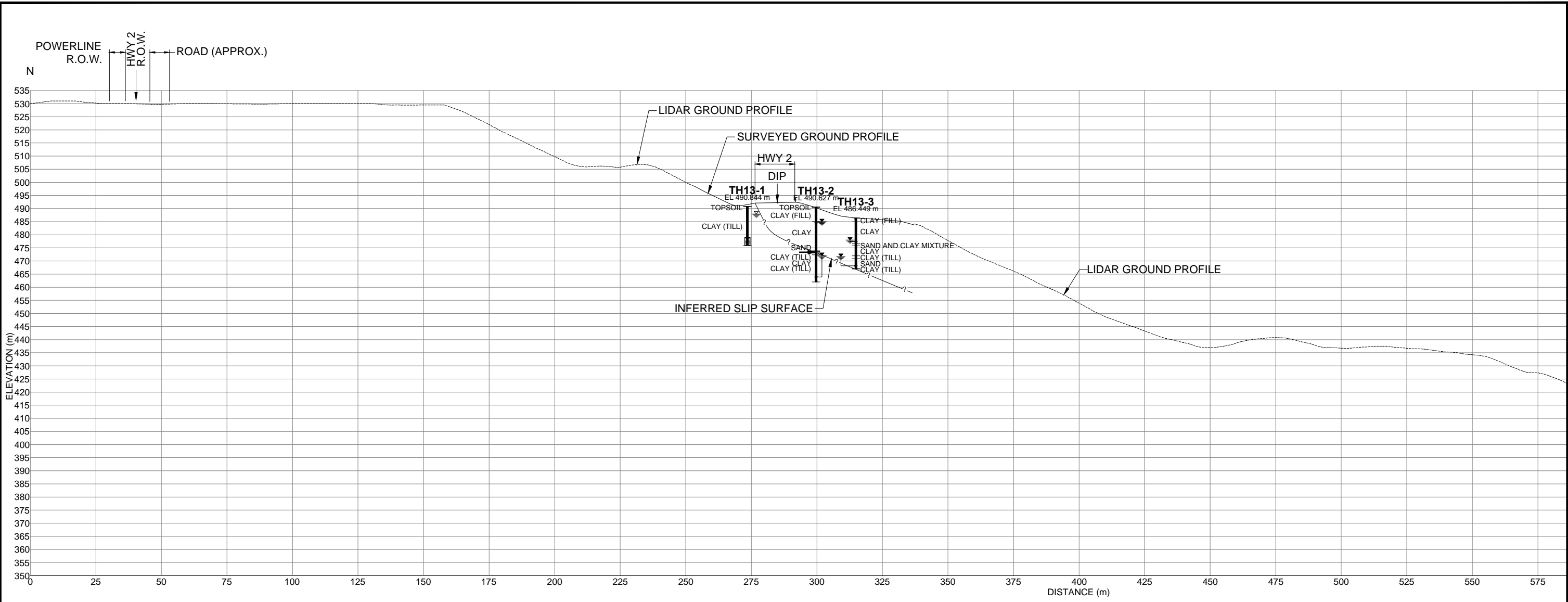
**JANUARY 28, 2015 (CALL-OUT)  
 SITE PLAN SHOWING CONTOURS  
 AND TEST HOLE LOCATIONS**

DWG No. 15-16-357-PH2-1






DRAWN BY	KLW
DESIGNED BY	PIO
APPROVED BY	TSA
SCALE	1:2500
DATE	JANUARY 2015
FILE No.	15-16-357







**LEGEND**

-  STANDPIPE PIEZOMETER SCREENED INTERVAL
-  WATER LEVEL IN PIEZOMETER (JANUARY 28, 2015)
-  PNEUMATIC PIEZOMETER TIP LOCATION
-  DEPTH OF MOVEMENT IN SLOPE INCLINOMETER
-  WATER LEVEL IN HOLE AT END OF DRILLING

**NOTE**

1. 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.



Transportation

**HWY 2:60 NEW LANDSLIDE WEST OF EAST HILL PILE WALL (PH2) - PEACE RIVER, ALBERTA**

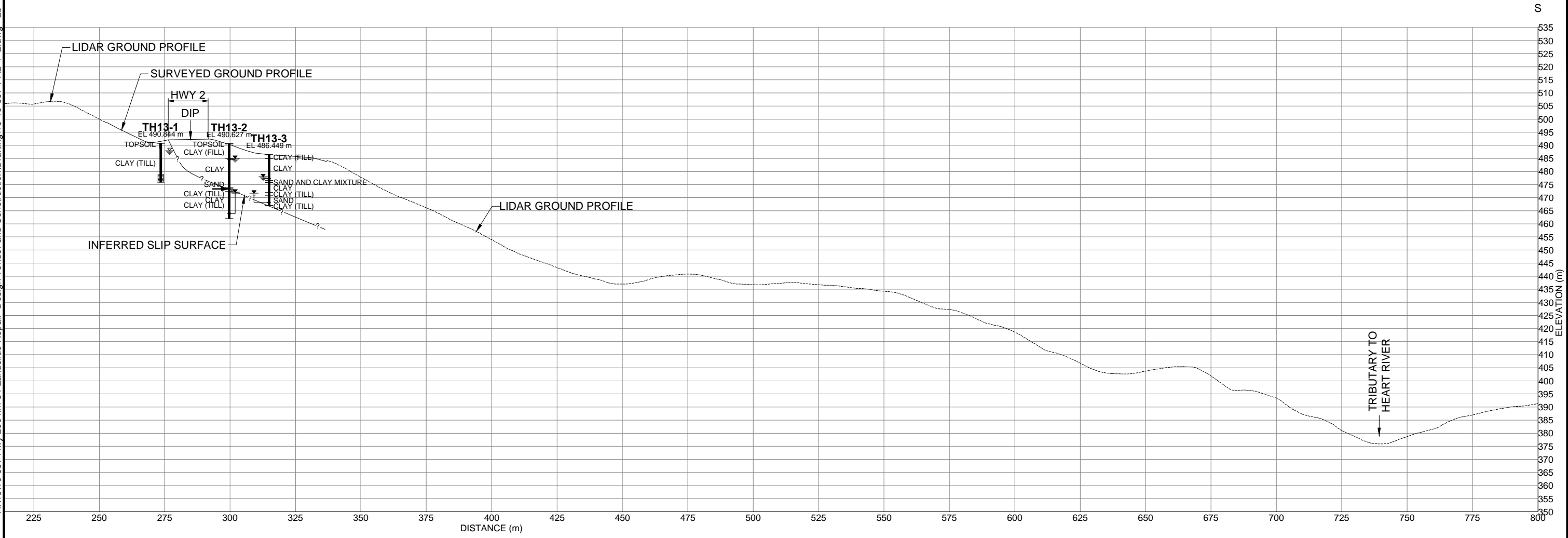
**STRATIGRAPHIC CROSS-SECTION A-A'**

**DWG No. 15-16-357-PH2-2A**

DRAWN BY	KLW
DESIGNED BY	SGR
APPROVED BY	DWP
SCALE	1:1500
DATE	JANUARY 2015
FILE No.	15-16-357



**THURBER ENGINEERING LTD.**



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**HWY 2:60 NEW LANDSLIDE WEST OF EAST HILL PILE WALL (PH2) - PEACE RIVER, ALBERTA**

**STRATIGRAPHIC CROSS-SECTION A-A'**

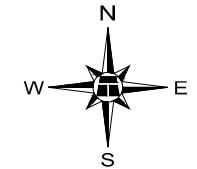
**DWG No. 15-16-357-PH2-2B**

DRAWN BY	KLW
DESIGNED BY	SGR
APPROVED BY	DWP
SCALE	1:1500
DATE	JANUARY 2015
FILE No.	15-16-357



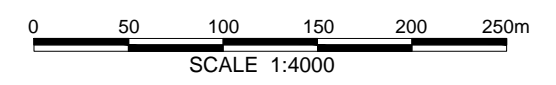


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- LEGEND**
- PREVIOUS TEST HOLE LOCATION
  - PROPOSED TEST HOLE LOCATION
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BASE PLAN PROVIDED BY WSP



**HWY 2:60 NEW LANDSLIDE WEST OF EAST HILL PILE WALL (PH2) - PEACE RIVER, ALBERTA**

**JANUARY 28, 2015 (CALL-OUT)  
 LIDAR SLOPE SHADER SITE PLAN  
 SHOWING TEST HOLE LOCATIONS**

**DWG No. 15-16-357-PH2-3**

DRAWN BY	KLW
DESIGNED BY	PIO
APPROVED BY	TSA
SCALE	1:4000
DATE	JANUARY 2015
FILE No.	15-16-357







Photo 1 – Looking southwest at section of highway that is affected by landslide (Jan. 28, 2015)



Photo 2 – Looking west at sideslope area between highway and valley slope and the main dip the roadway (January 28, 2015)





Photo 3 – Looking east at dip and tension cracks near headscarp of landslide (Jan. 22, 2015)



Photo 4 – Looking east at cracks propagating in EB lanes, from original landslide area. Water is ponding in dipped areas. (January 22, 2015)