



# **ALBERTA TRANSPORTATION LANDSLIDE RISK ASSESSMENT**

## **SECTION A: GEOTECHNICAL FILE REVIEW**

### **NORTH CENTRAL REGION - ATHABASCA**

**SITE NC42: HWY 754:04 km 20.8, NORTH OF SLAVE LAKE**

Legal Location:	<b>NW-34-77-3-W5M</b>
Nearest Landmark	<b>40 KM EAST OF JCT HWY 88 AND 754 75 KM NORTH OF SLAVE LAKE</b>
Highway Control Section:	<b>HWY 754:04</b>
Date of Initial Observation:	<b>1994</b>
Date of Last Inspection:	<b>June 2008</b>
Last Inspected By:	<b>Thurber Engineering Ltd. (Thurber)</b>
Instruments Installed:	<b>1 SLOPE INCLINOMETER (2006)</b>
Instruments Operational:	<b>1 Slope Inclinator (2008)</b>
Risk Assessment:	<b>PF(9).CF(3) = 27</b>
Last Updated:	<b>2008 – Thurber Engineering Ltd.</b>

## 1. LOCATION

The site is located on Highway 754:04 km 20.8, about 75 km northeast of Slave Lake, Alberta and about 40 km east of the junction of Highways 88 and 754.

## 2. GENERAL DESCRIPTION OF SLOPE INSTABILITY

The slide occurred on the east sideslope of the highway, at about 250 m from the left margin of the Willow River. It is estimated that the overall height of the valley is approximately 35 m to 40 m in this location, based on published topographical mapping.

The site is characterized by an 80 m long slump failure, The scarp is located at about 4.5 m from the pavement edge and has a vertical drop of up to 3 m. Details of the slide main features are shown in a sketch on Figure NC42-1 in Appendix F.

Some longitudinal cracking was observed on the pavement surface but these were crack sealed. It appears that the crack features are not related to the slide because they do not show differential movement or arc shape. As of 2008, no signs of further cracking were noticed, corroborating the relatively slow rate of movement observed in inclinometer readings.

Ditch flow is directed toward the slide area from both directions for a relatively large distance each way (60 m to 100 m). No culverts are noted in the vicinity of the slide.

In 2006, Jacques Whitford installed a slope inclinometer in the centre of the graben area. The test hole showed fill (clay) to about 5 m, overlying clay till down to the end of the test hole, at 15.2 m below ground surface. This information is presented in Section G of the site binder. The slope inclinometer readings indicated a relatively slow creep rate of about 3 mm/yr within the clay till, at around 8 m depth.

## 3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

**Physiographic Region:** Border between the Utikuma Upland and Pelican Mountain Upland (1969, Atlas of Alberta, University and Government of Alberta).

**Bedrock Geology:** The bedrock at the site is of the Labiche formation, dark grey shale and silty shale; ironstone partings and concretions; silty fish-scale bearing

beds in lower part; marine. The depth to bedrock is estimated between 150 and 200 meters (Geological Map of Alberta, AGS, 1999).

**Surficial Geology:** Large-scale surficial deposits map (Surficial Geology of the Willow River Area,) indicates that the site is located in an area of plain moraines (till) deposits, greater than 2 m thick; deposited directly by glacial ice. Locally may contain pre-existing stratified till and lenses of glaciolacustrine or glaciofluvial sediments.

**Hydrogeology:** The Labiche Formation bedrock would be limited to less than 0.1 L/s groundwater flow with similar or slightly higher flows expected from the clay tills (0.1 to 0.4 L/s). However, much higher flows (2 to 8 L/s and up to 38 L/s) would be expected in the glacial or preglacial sand and gravel lenses overlying the bedrock shale. Groundwater flow is expected to be southeast toward the Willow River. An area of local recharge (lakes and slightly higher ground) is located less than 1 km to the northwest of the site.

**Stratigraphy:** Jacques Whitford drilled one hole to 15 m depth to install a slope inclinometer (SI) in the slide area (log attached in Section G). The stratigraphy consisted of 5 m of fill (clay) overlying clay till down to the end of the test hole at 15.2 m below ground surface.

#### 4. CHRONOLOGY

Limited background information is available on this site, but it is understood that this portion of SH754 was first paved in 1995. It is not known when the slide first developed. The first photographs of the slide feature were taken by AT personnel in August 1994 (Appendix F).

##### 2001

In July 2001, an emergency call-out was carried out by Thurber Engineering Ltd (Thurber). In comparison to 1994 photographs, the slope did not appear to be retrogressing toward the road at a fast rate. Construction of a toe berm and subdrain or a pile wall was recommended if conditions worsened. A guardrail was installed extending the length of the slide to increase public safety.

##### 2005 - present

The site was added to the North Central GeoHazard Assessment program and site

inspection was undertaken since then.

In 2006, Jacques Whitford installed a slope inclinometer.

Since 2006, the slope appears to be retrogressing toward the road at a relatively slow creep rate of about 3 mm/yr within the clay till, at around 8 m depth.

In 2005, Thurber recommended relocation of the highway to the west if slide conditions worsened. The same recommendations were made in 2006 and 2007. As an alternative measure, in 2008, soil nailing reinforcement along the scarp line was recommended, in addition to ditch water collection and discharge toward the river in a location away from the slide area to reduce the rate of retrogression of the slide scarp toward the highway.

## REFERENCES

1. University and Government of Alberta, 1969. "Atlas of Alberta."
2. Alberta Research Council, 1977. "Earth Sciences Report 77-1, Hydrogeology" Included "Hydrogeological Map, Lesser Slave Lake, Alberta, NTS 83-O."
3. Alberta Geological Survey, Alberta Energy and Utilities Board, 1999. "Surficial Geology of the Willow River Area, Alberta, NTS 83 O/NE" Map No. 313.
4. Surveys and Mapping Branch, Department of Energy, Mines and Resources, 1981. NTS 1:50,000 Topographic Map, 83 O/9: "Improvement District 17, Alberta."
5. Alberta Geological Survey, Alberta Energy and Utilities Board, 1999. "Geological Map of Alberta." Map No. 236.