THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION GEOHAZARD ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW

PEACE RIVER/HIGH LEVEL REGION

SITE: PH43 DAISHOWA – PILE WALL SITE (SITE A) (STATION 13+500)

LEGAL LOCATION:	NE12-085-21 W5M and NW07-085-21 W5M
AT CONTROL SECTION:	HWY 968:01
NEAREST LANDMARK:	Peace River Bridge near Daishowa Pulp Mill (Station 11+00)
DATE OF INITIAL OBSERVATION:	1989
DATE OF LAST INSPECTION:	May 28, 2008
LAST INSPECTED BY:	Thurber Engineering Ltd.
INSTRUMENTS INSTALLED:	Multiple
INSTRUMENTS OPERATIONAL:	SI-4, SI-5, SI-6, SI03-6, SI-04-1, SI04-3
RISK ASSESSMENT:	PF(13) * CF(4) = 52
LAST UPDATED:	Thurber Engineering Ltd. October 2008

1. INTRODUCTION

This section is a review of files made available by Alberta Transportation specifically pertaining to conditions at the referenced geohazard site. This review is based on a compilation of a previous Part 'A' Review undertaken by AMEC for PH7 dated November 2000, annual Part 'B' Site Inspections undertaken since 2001, as well as relevant information from Part 'F' Plans and Part 'G' Site Documentation. Published geological and geotechnical information was also used to supplement the report.

Secondary Road 968 descends to the Peace River bridge just south of the Daishowa Pulp Mill from the east upland area by following a steeply incised unnamed creek valley/ravine. The Peace River Valley at this location is approximately 220 m deep. Widespread landsliding occurs naturally in this area but was exacerbated during construction of the highway in 1989/90, requiring some alignment changes and construction of berms and large upslope unloading. Erosion associated with the unnamed creek which flows along the north side of the roadway has also been an ongoing problem and continues to affect toe berms and road fills and has led to some major remediation projects to date.

Originally, all of the geohazards associated with the Daishowa East Hill approach were designated as being within PH7. In 2006, the site was subdivided into four separate areas as follows:

- PH7 (Site 7 & 8) - Extends from about Station 12+050 to Station 13+100 and includes the major riprap lined channel and gabion drop structures on the north side of the roadway and the recently installed (2007) erosion control measure test section in the upstream ditch.
- PH41 (Site 5) - Extends from about Station 11+600 to Station 12+050 and encompasses a previously unstable embankment slope and the lower of the major gabion erosion control structures on the east hill.
- PH42 (Pumping Well Site) - Extends from about Station 13+150 to Station 13+350 and includes an active landslide involving the roadway and it's embankment slope. Several pumping wells were installed previously in an attempt to dewater a layer of gravel encountered at depth.
- PH43 (Site A and B) - Extends from about Station 13+350 to Station 14+100 and includes two large road fills with culverted toe berms

constructed across the unnamed creek. The western Site A is most active and a tangent pile wall was installed in 2004 to protect the roadway.

The location of PH 43 is shown in Figure 1.

2. DESCRIPTION OF GEOHAZARD

The geohazard at PH43 Site A consists of instability of the approximately 30 m high road embankment. This site has a history of slope instability dating back to shortly after construction. In 1990 the slide was first mitigated by the installation of a large toe berm across the valley bottom and channeling the creek below the berm.

In 2003, a large reactivation of sliding occurred at the west end of the site which was mitigated in 2004 by the installation of a tangent pile wall downslope of the roadway. The terrain below the pile wall continues to be unstable and shallow and deep-seated failure mechanisms have been identified. Severe erosion and slumping at the culvert outlet under the toe berm has been occurring since about 2001.

3. GEOLOGICAL AND GEOTECHNICAL CONDITIONS

3.1 Physiographic Setting

The study area is located within the Peace River Lowland physiographic region.

3.2 Bedrock Geology

According to Hamilton et al. (1999), the Peace River Valley at this location cuts through several bedrock sequences and the following bedrock groups underlie portions of the general study area from the upland level to river level:

- Dunvegan Formation (Kd): grey, fine-grained, feldspathic sandstone with hard calcareous beds; laminated siltstone and grey silty shale; deltaic to marine.
- Shaftesbury Formation (Ksh): dark grey fish-scale bearing shale, silty in upper part; numerous nodules and thin beds of concretionary ironstone; bentonite partings; lower part with thin silty and sandy intervals; marine.
- Peace River Formation (Kp): dark grey silty shale; fine-grained glauconitic sandstone, silty interbeds in lower part (Harmon Member); fine-grained quartzose sandstone (Cadotte Member); shoreline complex.

Bedrock is locally exposed on the lower portion of the valley slope along the Peace River upstream and downstream of the bridge.

3.3 Surficial Geology

The east valley wall of the Peace River valley is comprised of colluvium (i.e. landslide terrain) that is derived from the upland glaciolacustrine materials and the underlying soils and bedrock. The lacustrine deposits are complex and consist of layers of clay, silt and sand, and overlie clay till and, locally, sand and gravel above the bedrock.

These lacustrine deposits are believed to be pre-glacial in origin and have been only partially eroded by the present day Peace River leaving much of this material exposed in the valley walls.

A groundwater table near surface is common in the area and is exacerbated by the presence of sand and gravel layers, some of which became blocked during road construction by the placement of fill and subsequent landsliding.

3.4 Stratigraphy

Soil conditions at the site basically consist of medium to high plastic clay fill overlying clay and/or clay till over bedrock. Locally sand and gravel layers exist in the valley slopes.

4. CHRONOLOGY

1989-1990 Construction of road.

1990 Aug Note to file from Karl Li. Reactivation of slide at 13+540 (Site A) occurred after heavy rainfall in June 1990 encroaching to centerline of roadway. Slide was 40 m wide and 25 m high. Previously installed horizontal drains assumed destroyed. Proposal submitted to install large toe berm and to channel creek under berm as was done at Site B. Backslope and transverse subdrains also recommended. Four slope inclinometers were recommended.

2001	Significant erosion and slumping occurred at the culvert discharge from under toe berm resulting in the loss of several sections of culvert.
2002	Slide affecting shoulder of westbound lane occurred in May 2002. Significant retrogression between May and September. The slide was about 30 m wide at that time.
2003	Additional sliding occurred at the west end of the fill slope. Several slope inclinometers installed after 2003 slide but sheared off shortly after installation.
2004 Jun	A below grade tangent pile wall was installed downslope of the roadway on the west end of the fill in response to the sliding that occurred in 2002 and 2003. Shallow sliding reported on the east side of fill slope.
2004 Sep	Shallow slide occurred below recently constructed pile wall in an area used to temporarily store construction spoil.
2005-2008	Sliding below pile wall continues. Evidence of deeper large scale movements further downslope increasing. Erosion and slumping at culvert outlet worsening.

REFERENCES

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