THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION GEOHAZARD ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW

PEACE RIVER/HIGH LEVEL REGION

SITE: PH41 DAISHOWA – SITE 5 (STATION 12+000)

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:	SI-1, SI-2 & SI-3 (installed 1995?)
INSTRUMENTS OPERATIONAL:	SI-1 & SI-2
RISK ASSESSMENT:	PF(9) * CF(2) = 18
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 the 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 its 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 41 is shown in Figure 1.

2. DESCRIPTION OF GEOHAZARD

PH 41 basically consists of two geohazards; the fill embankment itself which experienced instability shortly after construction and continues to creep, and the large localized erosional failure of the culvert installed through the toe berm to stabilize the road fill which occurred in 2001.

It is understood the fill embankment instability was mitigated in 1990 with the construction of a 10 m high toe berm across the valley bottom with a culvert in its base to pass flow from the creek that runs the entire north length of the east access road. The berm appears to have been successful in stabilizing the fill embankment which is now relatively inactive and is only showing creep like movements.

It is understood that in 2001, about 10 years after installation, the culvert under the toe berm washed out, leaving an eroded gully through the toe berm. While this erosion did not immediately reactivate the embankment instability, it had the potential to do so if left unmitigated. After a failed attempt to install erosional control measures in 2003, the current gabion energy dissipation structure and riprap lined channel appear to performing satisfactorily.

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 and associated tributaries are 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. Cracks formed along 200 m of sideslope of fill embankment.

1990 Aug Note to file by Karl Li. Cracks continued to appear despite toe berm. Recommendation to channel the creek into a culvert and construct a 10 m high toe berm. Finger drains were to be installed where seepage was observed. Recommendation made to install slope inclinometers.

2001 Erosion of culvert through toe berm first identified by AMEC during annual inspection. Erosion did not appear to have reactivated the fill slope instability at that time.

2002 Design of erosion control measures.

2003 Construction of erosional control measures started in February 2003, but were incomplete prior to spring runoff, resulting in the destruction of the gabion structure.

2004 Completion of present day gabion energy dissipation structure.

2006/7 Breach of dyke at inlet to lined channel causing deep gully erosion as runoff bypassed the channel. Repairs made in spring 2007.

2008 Erosion control measures functioning as designed. Embankment slope movements small and creep-like.

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