



**ALBERTA TRANSPORTATION
LANDSLIDE RISK ASSESSMENT**

SECTION A: GEOTECHNICAL FILE REVIEW

NORTH CENTRAL REGION (ATHABASCA AREA)

SITE NC17B (SUPERTEST HILL)

HIGHWAY CONTROL SECTION	Hwy 63:12, km 15.45 to 16.8
NEAREST LANDMARK:	22 km North of Fort McMurray
LEGAL LOCATION:	24 & 25-91-10-W4
Date of Initial Observation:	1978
Date of Last Inspection:	July, 2007
Last Inspected By:	Thurber Engineering Ltd. (TEL)
Instruments Installed:	6 Slope Inclinometers (in 2000).
Instruments Operational:	6 Slope Inclinometers.
Risk Assessment:	PF(2) * CF(10) = 20
Last Updated:	Thurber Engineering Ltd., March, 2009
Previous Update:	None

1. LOCATION

The site is located along Hwy 63:12 about 22 km north of Fort McMurray.

Highway 63:12 crosses Poplar Creek in a north direction and ascends the west valley slope of the Athabasca River which is approximately 50 m high. The centerline of the Poplar Creek crossing is at about km 15.75.

2. GENERAL DESCRIPTION OF SLOPE INSTABILITIES AND EROSION

The original 44 m high west highway backslope which had experienced some instabilities in the past had been repaired by a combination of drainage measures and a toe berm at the base of the east highway embankment fill. Twinning of the new highway to the west of the existing highway took place in 2000 and involved a high backslope cut at 3H:1V, with 10 m wide benches at 10 m height increments. Slope inclinometers SI1 to SI6 were installed during slope excavation, with subsequent monitoring indicating slow creep movements in SI3, SI5 and SI6 along a high plastic clay layer of up to 5 mm/year.

Major erosion developed at this site between 2000 and 2002. This erosion was repaired as part of Contract 6608/02 in 2002/2003 (see Section 4 - Chronology), and appears to be performing quite well to date. Minor items recommended for maintenance included: a few patches barren of vegetation and beginning to develop erosion rills, silt build-up in the riprap lined bowl at the culvert outlet, a small area in the median ditch which was beginning to show erosion along the edge of the gabion mattress and quads running under the bridge had created a preferential runoff path that could lead to erosion near the headslope area.

A major pipeline from Suncor is located about 30 m back from the crest of the backslope that was widened in 2000.

3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

Based on information obtained from two cross-sections in the binder from 2000 test holes by EBA for highway twinning, located on the west sideslope, the soil stratigraphy at this site consists of clay till overlying clay overlying sand and silt, with the clay layer daylighting in the slope near the level of the upslope highway ditch.

The following map references were searched:



- Physiographic Region- McMurray Lowland.
- Bedrock Geology- Consists of Lower Cretaceous age deposits, (McMurray Formation - thick bedded quartzose sandstone and siltstone, oil impregnated grey silty shale interbeds in upper part, non marine to deltaic); or Upper Devonian (Waterways Formation – grey and greenish grey shale and argillaceous limestone interbedded with grey to grey-brown fine-grained to coarse clastic limestone, marine). Located just north of the Stony Valley channel thalweg. Bedrock elevation ~ 280 m. The drift thickness is less than 15 m.
- Surficial Geology - Located on: Alluvial Fan area; but near Outwash Sand.
- Hydrogeology - Unconsolidated deposits (sand/silt) overlying McMurray Formation overlying Devonian Formation, with yields in the range of 2 to 6 litres/sec. A flowing well exists a couple of kilometers southeast of the site.

4. CHRONOLOGY/REFERENCES

The following new developments are noted:

- Aug., 1978 Hand-written note and sketch dated Aug. 29 (attached for insertion into Section G of Binder). Describes conditions and proposed locations for two new subdrain locations, and provides recommendations for maintenance of existing drains.
- Oct., 1978 Note to File by G. Spicer, Construction Branch dated Oct. 5 (attached for insertion into Section G of Binder). Six vertical holes were drilled on top of Supertest Hill to an average depth of 48 feet, indicating a relatively high water table. A sub-drain was installed in another hole drilled. The slumps appear to be caused by surface water infiltration, with the backslopes demonstrating extreme erosion caused by a high water table, non-cohesive soils, and heavy runoff from frequent rains. An additional slump developing north of the berm. The 10 subdrains installed in 1976 appear non-existent with only traces of flow. Only 3 of the 6 horizontal drain pipes located at ditch level are functioning. The downdrain ditch on the east side of the fill is severely eroded. Maintenance is recommended.
- Oct., 1989 Memo dated Oct. 17 and attached sketch from Assist. Dir. Geotech. Services to John Schroder. West backslope slumping and erosion in east and west ditches was observed/assessed.



- June, 2000 EBA Engineering Consultants Ltd. conducted a geotechnical investigation for highway twinning through the site area.
- 2000 Earth Tech (Canada) Ltd. prepared a design with geotechnical input provided by EBA for the highway twinning. Based on information contained in the annual geohazard inspection reports, the twinning was carried out on the west side of the existing highway and involved widening the 44m high cut at Supertest Hill. The existing cut slope had experienced instability during and shortly after construction in the late 1970's, after which time a combination of drainage measures and a toe berm were used to stabilize the failed area. The slope was constructed at 3H:1V with 10 m wide benches located at 10 m height increments. The stratigraphic conditions in the slope generally consisted of clay till overlying clay overlying sand and silt. The clay layer daylighted in the slope near the level of the upslope highway ditch. During construction a seepage zone was observed above the third bench and a system of finger drains and a lined swale were installed to manage the seepage (see Figures 2 and 3 – Cross-sections, and As-Built Figures 4 and 5 – Finger Drain Installation, already in the binder). Slope inclinometers were installed and monitored during slope excavation and indicated a favourable stability condition, although Thurber's 2001 instrument reading review suggests there were some small movements along the clay layer. Drawings showing these features and the inclinometer records are included in Sections F and C/D, respectively, of the site binder.
- April, 2002 E-mail message and cost estimate from Don Proudfoot of Thurber to Mike Baik of TRANS (attached for insertion into Section G of the Binder). Indicates a severe erosion condition has developed in the median and south ditches and is degrading with time. Silt has also been transported downslope, blocking the drop pipe outlet at the bottom of the median, and accumulating at the base of the south ditch. In the median, rock check berms have washed out and erosion is evident above the gabion lined section. In the south ditch rock check berms and straw matting have also eroded. A cost of about \$600,000 was estimated for remedial repairs.
- 2002-2003 Thurber Engineering Ltd. prepared a detailed design and tender package in the fall of 2002 for remedial measures to repair and guard against further erosion of the highway ditches and sideslopes. Wilco Landscape Contractors Ltd. performed the work in the fall of 2002 and spring of 2003, which basically consisted of: silt removal, construction of a stilling basin at the base of the west ditch, improvements to the grate of the median drop pipe, a combination of



gabion mattress/basket lining and high flow soil covering in the west and median ditches, backfilling/topsoiling/seeding/low flow soil covering the sideslope erosion rills/gullies, regrading the east sideslope berm to drain to an interceptor swale, and installing a culvert at the south end of the swale to drain the collected water into an existing channel. Further details of the remedial measures were provided in Thurber's construction summary report dated June 30, 2003.

- 2001-2007 Annual Geohazard Inspection reports by Thurber Eng. Ltd. – 7 reports for consecutive years, already included in the binder.
- June, 2003 Information contained in 2003 annual geohazard inspection. A new section of ditch lining in the east highway ditch between about Stations 16+485 and 16+850 was constructed. It consisted of 115 m of gabion mattress and 250 m of turf reinforcement matting (TRM) with synthetic ditch barriers spaced at about 5 m along the lined ditch.
- 2006 Information contained in 2006 annual geohazard inspection. Concrete drainage troughs were installed to carry bridge drainage in a controlled manner down the highway embankment fill slopes. The guardrail that used to be present along the east side of the highway had been replaced with concrete jersey barriers.