
ALBERTA TRANSPORTATION LANDSLIDE RISK ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW NORTH CENTRAL REGION

SITE NC86: HWY39:06, KM 4.9, HWY 39 and TWSHP ROAD 491A INTERSECTION

LEGAL LOCATION:	SW 11-49-06-W5M
NEAREST LANDMARK:	15 km EAST OF DRAYTON VALLEY HWY 39 AND TWSHP ROAD 491A INTERSECTION
Highway Control Section:	HWY 39:06, km 4.9
Date of Initial Observation:	2016
Date of Last Inspection:	2017
Last Inspected By:	Stantec Consulting Inc.
Instruments Installed:	2 Slope Inclinometers (2017), 3 Vibrating Wire Piezometers (2017), 1 Standpipe Piezometer (2017)
Instruments Operational:	1 Vibrating Wire Piezometers (2017)
Risk Assessment:	PF(9) · CF(3) = RL (27)
Last Updated:	August 2017 – Stantec Consulting Ltd.



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1. LOCATION

The site is located at the southeast corner of the intersection of Township Road 491A and Highway 39, approximately 15 km east of Drayton Valley, Alberta. Legal land description SW-11-49-06-W5M.

2. GENERAL DESCRIPTION OF SLOPE INSTABILITY

Site NC86 is located along Highway 39 and east of Range Road 491. The Range Road crosses a tributary to Buck Lake Creek and curves around the top of the bank to intersect Highway 39. The overall area around Highway 759 was originally part of Stony Plain Site NC19: Buck Lake Creek that had a history of instability dating back to 1977.

As stated in the NC19 site summary, historically, multiple landslides have taken place on the south embankment slope and east of the junction with Highway 759 in 1989, 2000, and 2007. Two past remedial repairs (1990 and 2003) were undertaken on the south slope of Highway 39 approximately 500 m east of the junction to reduce and eliminate landslide activity. As part of the remediation, a toe berm, drainage measures, and a 70 m long concrete pile wall was built in the area. Another major slope instability was observed during the regular inspection activity in the area in 2007. An embankment slope failure occurred at km 5.6 and was repaired in Fall 2007 by installing a toe berm and gravel drainage layer. Since then, the sites were continuously being maintained and repaired by Alberta Transportation. NC19 was removed from the monitoring program (GRMP) in 2011 due to several years of favorable performance.

In early October 2016, Alberta Transportation noticed the landslide at NC86 and an emergency call-out inspection was conducted by Stantec personnel in November 2016. During the call-out inspection, observations were made of the road surfaces, the embankment, the valley slope, and culvert drainage surrounding the intersection area. Detailed findings of the call-out inspection conducted at this site can be found in Stantec (2016).

Distress at the site consisted of a landslide with a vertical scarp parallel to the edge of the road on the northbound lane of Township Road 491A. The roadway surface remained largely unaffected at that time with no significant dips or distress. One crack approximately 20 m long was observed along the edge of the roadway parallel to the scarp and offset into the roadway about 1 m.

The landslide mass extended a horizontal distance about 30 m downslope to the top of the tributary valley slope. The toe bulge was about 1.0 m to 1.3 m high and exposed soil comprised high plastic glaciolacustrine clay with soft to stiff consistency and high water content. The soil enveloped the trees at the toe bulge as it moved downslope. Wet soil and seepage was identified throughout the slide mass. The culvert was observed to be blocked and no free water was observed draining from the culvert. The landslide movement displaced the existing fence line by about 4 m away from its previous alignment.

In general, given the wet/saturated ground conditions within the slide mass and the seep near the toe bulge, it is believed that the high groundwater table was a major contributing factor to the instability. Another contributing factor may be due to poor surface water drainage conditions and high plastic soil within the embankment fill and native subgrade. These conditions are believed to



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have caused a small failure that was subsequently repaired by the Maintenance Contractor, who placed 200 tonnes of clay fill near the crest of the embankment. This then triggered the larger landslide that was observed by Stantec during the call out.

3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

PHYSIOGRAPHIC REGION

Alberta Eastern Plains (EBA, January 2009)

BEDROCK GEOLOGY

Bedrock geology found on this site belongs to either the Paskapoo Formation or the Scollard Member, consisting of clay shale, siltstone, sandstone, and bentonitic mudstones. Based on the water well records, bedrock is anticipated to be shallower than 15 m.

SURFICIAL GEOLOGY

The site is located in an area of glaciolacustrine sediments overlain by highway embankment fill. The valley slopes of the Buck Lake Creek tributary generally comprise of colluvial deposits overlying bedrock belonging to one of either the Paskapoo formation or the Scollard Member.

SITE STRATIGRAPHY

Three (3) boreholes were advanced during a geotechnical investigation undertaken in February 2017. The boreholes were drilled within the landslide mass to depths of about 16.5 m below ground surface (bgs). The stratigraphy encountered within the borehole investigation generally consisted of embankment fill overlying a layer of high plastic clay, followed by a layer of sandy clay, underlain by highly weathered clay shale. Bedrock was encountered in all boreholes at elevations varying from 781 m to 788 m.

HYDROGEOLOGY

Groundwater tends to drain from the uplands north of the highway to the creek south of the highway embankment. According to the NC19 site summary, the high groundwater level within the backslope contributed to the slope instabilities in the area.

4. CHRONOLOGY

GENERAL

As documented in a Thurber site-inspection report (January 2001), landslides in the area have been repaired in 1977, 1981, and 1985, however no detailed construction information was available. In addition, as per the site summary for NC19 (January 2009), repairs were conducted at the site in 1990 and 2003.



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1990

According to an NC19 site summary dated January 2009: Buck Lake Creek underwent a reconstruction of the side slope. In 1990, an earth embankment was constructed about 100 m east of the current NC86 site across the stream to buttress the landslide. Culverts were installed within the buttress to allow the creek to continue to flow.

2003

As noted in the NC19 site summary issued on January 2009, a pile wall was constructed in 2003 on the south side of Highway 39 and 500 m to the east of the intersection of Highway 39 and Township Road 491A to stabilize the upper portion of the slide that was previously affecting the road surface. It consisted of a 70-m long cast in place concrete pile wall. Pile diameters were 1.22 m and were installed to a depth of 10 m.

2011

NC19: Buck Lake Creek was removed from the monitoring program due to several years of favorable performance.

2016

The most recent distress in October 2016 was believed to have occurred due to high groundwater level, and poor drainage, exacerbated by placement of fill material near the crest of the embankment.

During the callout, wet soil was observed throughout the slide mass on the southern and northern limits and surrounding the culvert. Seepage was also identified below the southeast toe bulge on the tributary slope. The culvert to drain the water ponding on the east of Township Road 491A was observed to be blocked and no free water was observed draining from the culvert. In addition to that, the distress was believed to be triggered when the maintenance contractor placed approximately 200 tonnes of clay fill at the top of the embankment to fill in the vertical scarp created by the displaced soil mass on November 2, 2016. Subsequently, further movement happened and created a vertical scarp up to 1.5 m that stretches over 20 m along the edge of the road.

Upon completion of site inspection, Stantec completed geotechnical investigation in February 2017 and advanced three boreholes and installed several piezometers and slope inclinometers. The site was included in the annual instrumentation monitoring cycle as part of the Geohazard Risk Management Program as of 2017. A remediation strategy is currently in progress.



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5. GEOTECHNICAL INSTRUMENTATION

Two slope inclinometers, three vibrating wire piezometers, and one standpipe piezometer were installed at the site to monitor ground movements and groundwater levels in 2017. The location of these instruments is shown on **Figure 1**.

6. REFERENCES

Alberta Transportation, Geotechnical Files.

EBA Engineering Consultants Ltd., January 2009, "Section A: Geotechnical File Review – Site NC19: Landslide Area Buck Lake Creek Hwy 39:06," File: E12101085.001.

Thurber Engineering Ltd., January 25, 2001, "North Central Region Landslide Assessment HWY39:06 Buck Lake Creek Potential Slope Instability SW-11-49-6-W5M," File 15-76-24.

Stantec Consulting Ltd., November 18, 2016, "Site NC86 – Highway 39 and Township Road 491A, East of Drayton Valley, Task D – Call-out Report," File: 123312435.

Stantec Consulting Ltd., March 20, 2017, "NC86 – Highway 39 and Township Road 491A, East of Drayton Valley, Task F – Geohazard Mitigation."

DEPARTMENT BAR CODE

BY STANTEC

DATE 2016-mo-dd

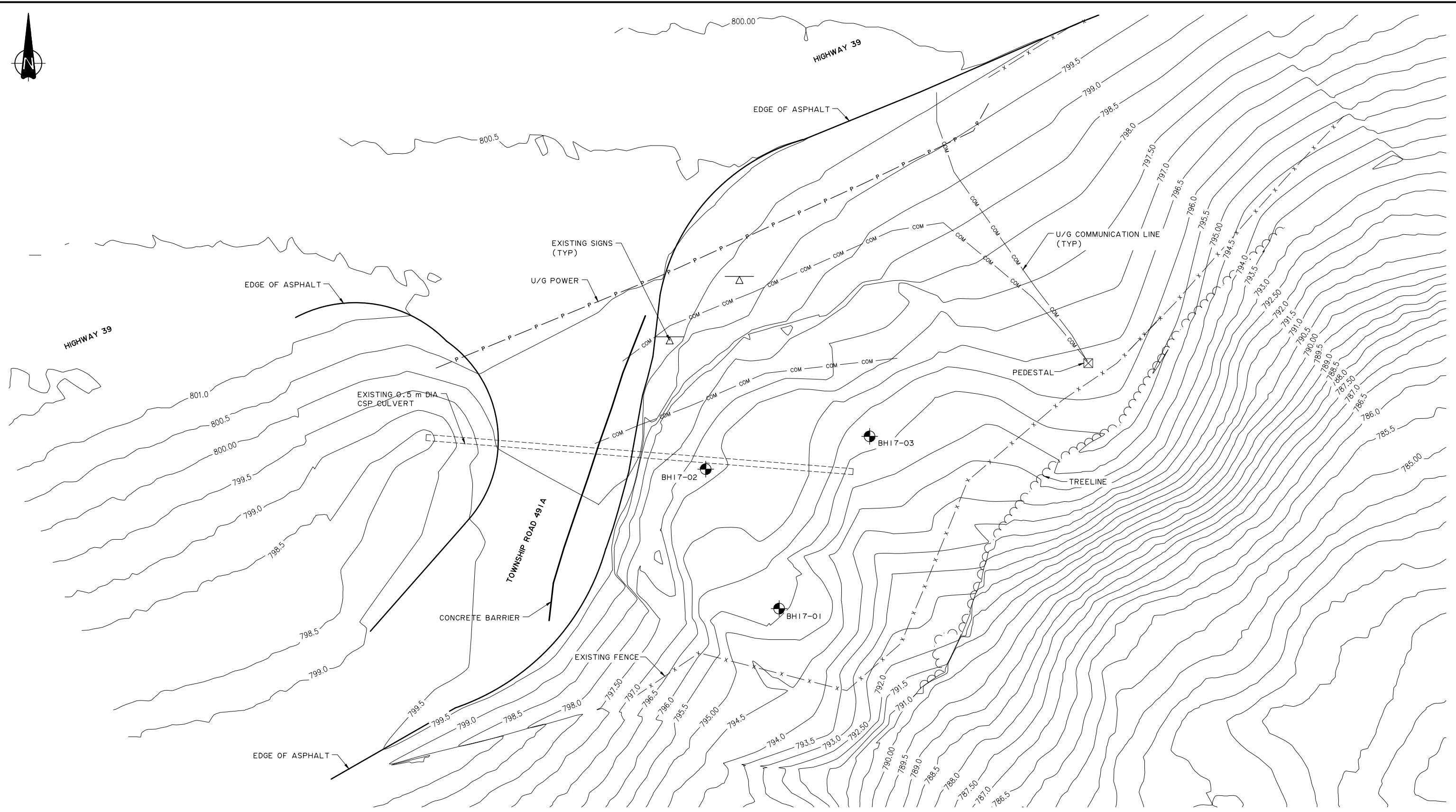
PHOTO

DESCRIPTION GENERAL LAYOUT

CONTRACT 658/02

HIGHWAY

DRAWING FIG-2



PLAN
Scale 0 3 9 15m
1:300

NOTE:
FEATURE LOCATIONS ARE APPROXIMATE

CONSULTANT

JOB No. 123312435

DESIGNER

DATE

REV	DATE	REVISION	BY
1	2017-02-28	LOCATION SE 10-49-6-W5M	SITE -

Alberta Transportation

NC86 - HWY 39 AND TWP RD 491A
GEOHAZARD MONITORING PROGRAM
NEAR DRAYTON VALLEY
BOREHOLE LOCATION PLAN

CONTRACT	HIGHWAY	SHEET	DRAWING
-	39:02	1 of 1	FIG-1

2017-02-28