STONY PLAIN REGION
GEOHAZARD RISK ASSESSMENT
SITE INSPECTION FORM

SITE NUMBER AND NAME:	HIGHWAY AND KM:	PREVIOUS INSPECTION DATE:	INSPECTION DATE:
NC 23 – Landslide near Greenwood Lake Road	Hwy 39:06, km 13.08	June 5, 2013	June 10, 2014
LEGAL DESCRIPTION:	**NAD 83 COORDINATES:**	**RISK ASSESSMENT:**	
NE 4-49-5-W5M	-44710 E, 5896868 N	PF: 7 CF: 4 **TOTAL: 28**	

SUMMARY OF SITE INSTRUMENTATION:	INSPECTED BY:
Slope Inclinometers: 5 Pneumatic Piezometers: 10 (+1 Non-functioning) Standpipe Piezometers: 3	Matthew Weatherby, P.Eng. (Tetra Tech EBA) Tony Ruban, M.Eng., P.Eng. (Tetra Tech EBA) Rob Huston, E.I.T. (AT) Rishi Adhikari, P.Eng. (AT)

LAST READING DATE: March 23, 2014

PRIMARY SITE ISSUE: Highway situated on a large historic landslide which is failing primarily north toward Modeste Creek; the lower west flank portion continues to move which has previously caused pavement distress.

APPROXIMATE DIMENSIONS: 350 m long extending to the crest of the valley slope.

DATE OF REMEDIAL ACTION:
Horizontal drainage galleries and gabion wall were installed in 2005 along Modeste Creek.
A westbound passing lane was constructed in 2007 which resulted in pavement cracking. Cracks have been sealed periodically.
French drains were installed during 2007 construction to prevent blocking seepage.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement dip and cracking located on west flank of landslide area.		X
Slope Movement	X		Lower portion of landslide experiencing movement.		X
Erosion		X	Rill erosion along north facing slope - reduced due to increased vegetation.		X
	X		Erosion gully at culvert outlet (km 13.1)		X
Seepage		X	Moisture was not observed along toe of north slope from blocked French drains. Possibly obscured by vegetation.		X
Culvert Distress		X	Culvert inlet (km 13.1) above ditch causing ponding.		X

COMMENTS:
Vegetation well established on north facing slope.
East culvert inlet elevated above ditch causing ponding.
Location and site plan shown on Figure NC-23.
Site conditions shown in Photos 1 to 5.
Risk level unchanged from 2013.

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SITE OBSERVATIONS:

- The north facing slope was filled and re-graded during the construction of the new passing lane in 2007. Vegetation, consisting primarily of horsetails, has naturally established on the fill slope. The fill slope was not topsoiled or seeded after completion of construction.
- The highway is slightly super-elevated and drains towards the north facing slope. In the past, rainwater falling either directly onto the slope face or from runoff has caused rill erosion. There was no evidence of rill erosion observed during the recent inspection due to the established vegetation.
- A culvert located at approximate km 13.1 discharges onto a small armoured splash pad located at the midpoint of the north facing slope. The splash pad consists of sparsely placed rounded to sub-rounded riprap extending approximately 1 to 2 m past the culvert outfall. During sustained or intense precipitation events water drains over the splash pad onto the lightly vegetated fill which has formed a channel extending from the splash pad to the toe of the embankment. Effects of erosion have decreased since 2010 partly due to the increase in vegetation along the slope.
- The km 13.1 culvert inlet is elevated above the ditch base by approximately 0.15 m. This allows surface water to pond around the culvert inlet and potentially infiltrate into the highway embankment.
- The sideslope in the vicinity of the culvert outlet at km 12.9 was observed to be locally steeper than the surrounding sideslopes, a condition noted in previous inspections. There appears to be some disturbance near the bottom of the sideslope above the culvert outlet. It is unclear at this time what has caused the disturbance. The disturbance appears less pronounced than previous inspections.
- Seepage areas identified in previous inspections were not visible during the recent site inspection. The seepage areas were first identified during a call-out in 2008 and were attributed to horizontal drains which had been buried during the construction of the passing lane. The seepage areas are likely obscured by the sideslope vegetation.
- The horizontal drainage galleries located at the toe of the embankment near Modeste Creek were inspected. The east gallery was opened and two of the nine drainage pipes were observed to be flowing. The west gallery was opened and one of the nine drainage pipes was observed to be flowing.
- The gabion basket structure that supports and armors the drainage gallery discharge was in good condition. As noted in previous inspections, some minor erosion from surface water flow was noted on the west flank of the structure. The culvert installed through the gabion basket was conveying water from the drainage galleries to Modeste Creek.

RECOMMENDATIONS:

- The existing landslide should continue to be monitored through instrumentation and annual inspections.
- The south inlet of the culvert at km 13.1 is too high. Re-grading, consisting of minor fill placement into the ditch at the inlet, should be implemented to permit drainage into the culvert and prevent ponding. Riprap armoring at the inlet should be salvaged and replaced upon completion of grading.
- When the culvert inlet drainage at km 13.1 is improved, flow volumes are expected to increase therefore the riprap splash pad on the outfall side of the culvert should be extended (or an acceptable erosion control alternative) to the base of the embankment to reduce the possibility of increased erosion occurring on the slope.
- The sideslope in the vicinity of the culvert outlet at km 12.9 should be flattened and the culvert extended to maintain the original sideslope and minimize the potential for reactivation of the historic movements on this flank of the slide. Until that time the disturbance previously observed along the sideslope above the culvert should be monitored carefully.
- All drains beneath the passing lane fill should be exposed to ensure they are operating adequately. They should be extended and backfilled with free drainage gravel. A proposal has been submitted to AT for this work (Tetra Tech EBA File No. PE12101119, dated May 13, 2009). This proposal also includes steam cleaning of the horizontal drains to improve drainage of ponding water and groundwater from upslope to the drainage galleries located at the toe of the embankment near Modeste Creek.
- The silt fence at the toe of the north facing slope can be removed as vegetation has been established.
- Erosion occurring at the west flank of the gabion structure adjacent to the drainage galleries should be repaired. Additional fill and grading should be implemented to direct surface water drainage away from the gabion structures to reduce the potential for reoccurrence.