

**PEACE REGION – GRANDE PRAIRIE
GEOHAZARD RISK ASSESSMENT
SITE INSPECTION FORM**

SITE NUMBER GP-24	SITE NAME Hamelin Creek Slide BF-76987	HIGHWAY & KM Hwy 725:02	PREVIOUS INSPECTION DATE July 11, 2012	INSPECTION DATE May 22, 2013
LEGAL DESCRIPTION LSD 11-5-81-8-W6M	NAD 83 COORDINATES N 6,207,569 E 361,702	Previous Risk Assessment PF: 2 CF: 4 TOTAL: 8		
		CURRENT 2012 RISK ASSESSMENT PF: 2 CF: 4 TOTAL: 8		

<p>SUMMARY OF SITE INSTRUMENTATION:</p> <p><i>Totals Operational instruments Operational</i> Slope Indicators (8 pcs) Piezometers (8 pcs)</p> <p>LAST READING DATE: LAST READING DATE: May, 2013 For details, refer to 2013 Cycle 1 Instrumentation Report</p>	<p>INSPECTED BY:</p> <p><u>Inspection Group:</u></p> <p>(i)KarlEng: Karl Li, Justin Kei (ii) AT: Ed Szmata, Ted Prue, Ken Misik, Roger Skirrow</p>
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<p>INSTRUMENTATION Monitoring Results/Updates: (reiterated from previous report)</p> <p>A) At upstream face of fill embankment, lateral spreading and creep movement of fill monitored at a 5m zone between depths of 9m to 14m. This movement has drastically slowed down at several months after installation (2003) of stone columns and reconstruction of top portion of fills. Current movement rate is apparently slow.</p> <p>B) Shear movement of NW valley slope was monitored (about 14m to 17m depth range from surface of upstream slope) and was likely buttressed at completion of reconstruction (2003) of fills. Movement rate (5-7mm/yr from 2007 to 2012) is currently considered slow.</p> <p>C) For current maintenance stage (starting Fall 2011), a review of the instrumentation monitoring results indicate that no drastic movements or change of groundwater regime is apparent. It is apparent that substantial stabilization of site has been effective.</p> <p>Note: a) Refer to 2013 Cycle 1 Instrumentation Report for details b) Refer to 2008 Slide Tour Report for other detailed comments</p>

<p>PRIMARY SITE ISSUE: <i>(Reiterated from previous reports)</i></p> <p>The following salient points are provided. (Refer to details in the 2008 and earlier Slide Tour Reports)</p> <p>A) New Arch Concrete Culvert Construction Stage (2002).</p> <ul style="list-style-type: none"> - Sliding Failure of a 30m high fills (constructed of frozen soils) occurred and caused structural deformation to new arch culvert beneath. Sliding movement of adjacent valley slopes was likely triggered as their toe area were off-loaded by excavation for deepening of upstream river
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channel.

- The design of new arch culvert has included a channel realignment design which entailed a deepening (about 5m) of channel gradeline and a convergent confluence of 2 watercourses (Hamelin Creek and a tributary creek) to inflow the new culvert via a 90 degree flow entry
- The sliding failure of frozen fill was investigated and a remedy repair was designed by Thurber Consultants. The remedy design entails (i) installation of stone columns to stabilize the frozen fills left-in-place at/below culvert level and (ii) removal of frozen fill and reconstruction new fills above culvert level so that the installed precast culvert (already inplace) can be preserved without reconstruction.
- As result of channel deepening and its realignment, bank slumping(s) and movement of valley slope resulted along new excavated channel along inlet stretch

B) After 2002/2003 Stabilization of Slide and Reconstruction of Fills, it was recognized that the following remaining site distresses still prevailed:

- Continual settlement of fill as a portion of frozen fill (at and below culvert level) was left in place. Lateral spreading of fill apparently was continuing.
- Slumping failure (**Slump 4**) of banks along the upstream stretch of newly excavated Hamelin Creek channel
- Sliding movement of fills at inlet and outlet ends of arch culvert. At south toe (**Slump 3**) of inlet wing-wall and at south toe (**Slump 2**) at outlet of culvert of Hamelin Creek
- A fillet of fill slumping (**Slump 1**) at NW corner of road (junction of an north access) at verge of north end of approach fill.
- Structural deformation of arch culvert was surveyed.
- Two backslope failures at cut slopes (west and east) at south approach
- In 2010, remediation work for the above Slump 1-4 zones was carried out by a contractor and considered substantially completed. The remediation work was designed by Thurbers.
- Since a remediation design for above site distress areas (Slumps 1,2,3 &4) was constructed and the site thus ended its remediation stage (Fall 2011). Thus in Fall 2011, AT bridge engineer transferred the site custodianship to AT Regional and Geotechnical Offices for site maintenance. Thereafter, the site is categorized in its maintenance stage (Fall 2011) with responsibility of its instrumentation monitoring under the regional geotechnical consultant (KarlEng)

Note:

Refer to previous 2008 Slide Tour and earlier reports for details.

APPROXIMATE DIMENSIONS:

(Reiterated from previous report)

Items of Distress:

- (i) Approx. 0.3km length of high fills (30m in height) (previous frozen fill failure) undergoing continual settlement distress. Future rate of settlement can be expected to decrease.
- (ii) Backslope failures at both sides (east side and west side) of south approach Each backslope slide can measured about 40m x 40m each. Backslope heights can be estimated at 30m. The west backslope slide is longer (along roadway direction) in length. The east backslope slide is more active and may toe roll to block the ditch.

Prior to 2010 repair, the following site distress were noted. They were subsequently repaired in 2010.

- (iii) The central portion of the of concrete arch (200m in length) can be under structural distress
- (iv) Approx. 100m stretch of bank slumping at upstream Hamelin Creek

(v)	Approx. 30mx30m area of sliding of fill at culvert inlet toe at top of south wing-wall as well as a toe slide at culvert outlet.
DATE OF ANY REMEDIAL ACTION:	
Items of remediation	
(i)	2002/2003 has completed remediation and reconstruction of (previously failed frozen fill)
(ii)	2009 (Approx). Two pairs of strap beams were installed at mid section of crown of arch culvert. (1 pair at 2+3 o'clock and 1 pair at 9+10 o'clock positions) for stiffening of any structural deformation of culvert.
(iii)	2010 Spring – Repairs to Slumps 1,2,3,4 were carried out by contract. <ul style="list-style-type: none"> • Slump 1 (NW corner+access) – A repair by granular fill and subdrainage • Slump 2 (toe of fill at culvert outlet) - A repair by granular fill and subdrainage • Slump 3 (toe of fill at culvert inlet wingwall) - A repair by soil nails. • Slump 4 (Bank slumping at upstream channel) - A repair by soil nails and riprap armor of bank.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
PAVEMENT DISTRESS	x		Settlement of fill at top of arch culvert has slowed down. Pavement contortion not as serious due to improved patching and milling workmanship		x
SLOPE MOVEMENT		x (recent **2010 repairs)	a) Lateral spreading of fill has substantial slowed down with lengthy dissipation of pore pressure with gradually thawing of frozen fills (stone columns) with time <u>Other slide movement has been arrested with</u> b) **Soil nails installed at upstream toe inlet wingwall area (Slump 3) and at upstream bank area (Slump 4) c/w riprap bank protection c) **Granular fill replacement and subdrains installed at NW road corner (Slump 1) and culvert outlet toe (Slump 2)	x	x
EROSION	b)	a) (recent **2010 repairs	a) Hamelin Creek - Bank erosion (Slump 4) **repaired along about 100m upstream stretch b) Tributary Channel - Shifting of channel bed out of intended riprap lined channel upstream of culvert inlet		x

SEEPAGE	n/a		n/a		
CULVERT DISTRESS	?	x (recent **2010 repairs	Two pairs of strapped beam installed at mid section to stiffen culvert crown at 2+3 and 9+10 o'clock positions.		x
Settlement of Fill	x		<p>a) Only top portion of fill (frozen) embankment was replaced and reconstructed. Slow settlement of fill will still continue due to bottom frozen fills un-replaced.</p> <p>b) Bottom portion of frozen fill was left in place and fills was stabilized with stone columns which allow thawing of frozen fill and dissipation of pore pressure with long term settlement expected to decrease with time.</p> <p>c) Settlement will be long term due to gradual consolidation of slowly thawing fills in response to rate of dissipation of excess pore pressure with time.</p>	x	x

COMMENTS:

In current 2013 site visit, it was reviewed that

- 1) No obvious deterioration of site has occurred over previous year (2012/2013).

Other previous comments on the site remain effective. The followings are reiterated:

- 2) Pavement sagging and fill settlement has not deteriorated. This can be due to improved workmanship in patching and smoothing off of roadway contortion. Better roadway serviceability resulted.
 - However, pavement patching and repairs should be carried out as required for roadway serviceability.
- 3) The 2010 repair work (Slumps 1-4) was inspected in satisfactory condition.
 - Slump 1 (NW corner+access) – A repair by granular fill and subdrainage
 - Slump 2 (toe of fill at culvert outlet) - A repair by granular fill and subdrainage
 - Slump 3 (toe of fill at culvert inlet wingwall) - A repair by soil nails.
 - Slump 4 (Bank slumping at upstream channel) - A repair by soil nails and riprap armoring of bank.

The site was successfully revegetated.
- 4) Prior to completion of last remediation stage(2010), additional instrumentations were installed to monitor effects of the repairs.
 - It is required to continue the instrumentation monitoring and yearly inspection of the site.
- 5) Prior to completion of last remediation stage(2010), additional instrumentations were installed to monitor effects of the repairs.
 - It is required to continue the instrumentation monitoring and yearly inspection of the site.
- 6) Annual inspection of this site should be continued.

Important Note:

This form assessment is an update for current year only. Please refer to the detailed assessment provided as in the earlier Slide Tour Reports for background understanding of this site.

END



Photo 1

Looking west (toward upstream) and north (away from Hwy 49) from roadway edge guardrail (panorama view)

- Previous (2010) repair work on upstream side of road embankment still in good condition



Photo 1a

Road pavement conditions on top of fill embankment – Looking north

- It seems apparent that previous fill settlement and pavement cracking has quiet down
- But some uneven sagging of fill needs to be leveling and smoothing for roadway serviceability

Note: Photos taken on June, 2013

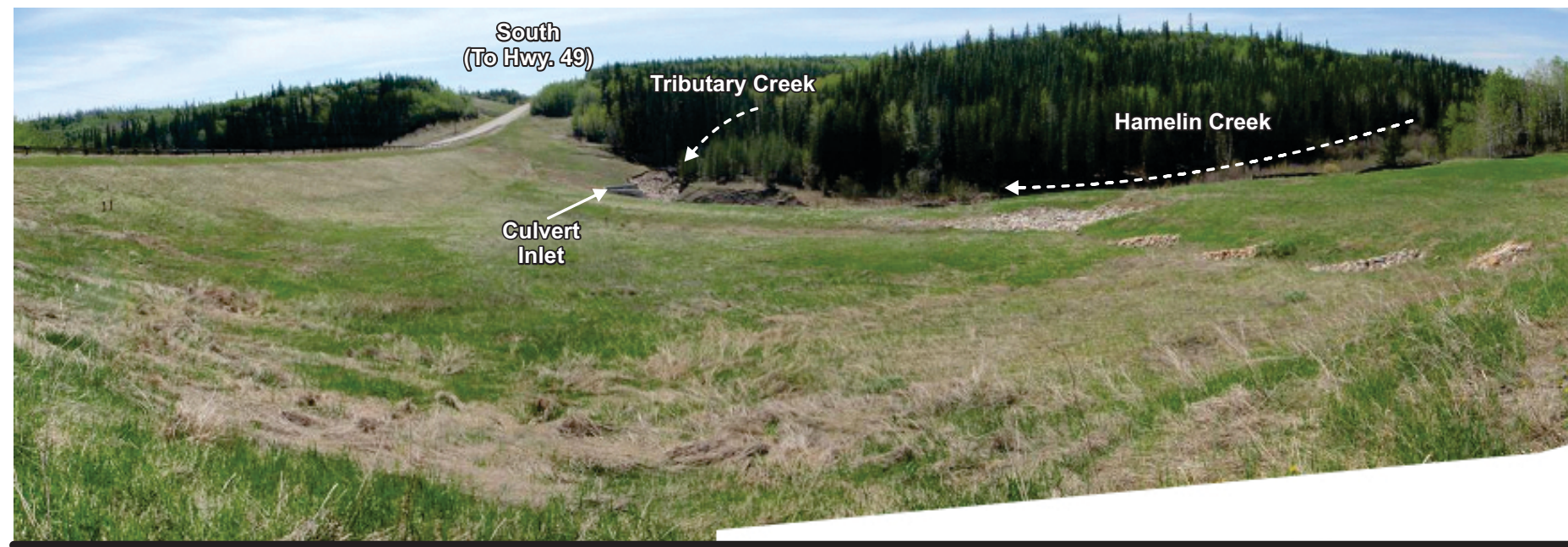


Photo 2

Looking west (toward upstream) and south (towards Hwy 49) showing Culvert Inlet

- Another Panorama view
- Previous (2010) repair work on upstream side of site still in good condition



Photo 2a

Looking South

- Some relic tension crack along road edge at top of fill still visible
- Majority of lateral spreading and settlement of fill has quiet down in recent years
- A sag of pavement (settlement of fill) still evident on east side (north bound lane) and needs to be filled in and levelled to smooth over

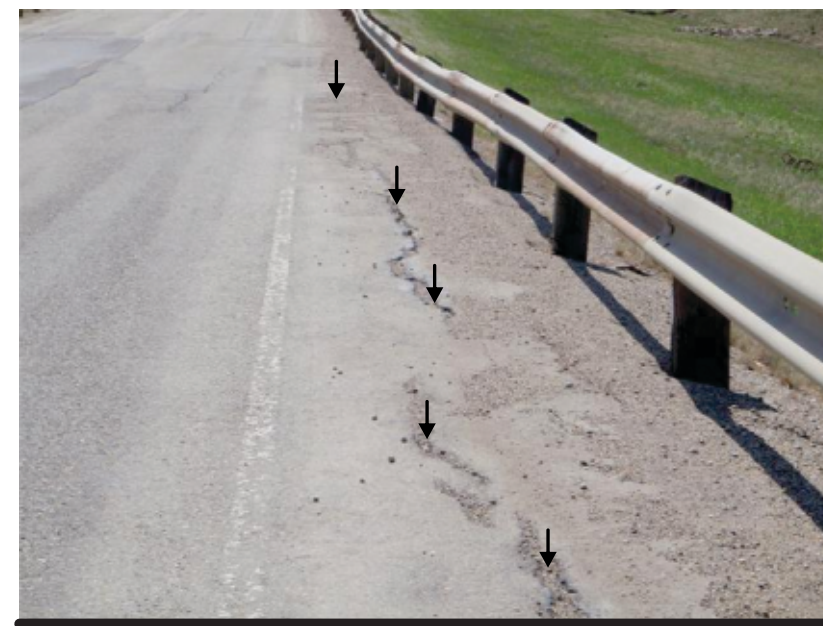


Photo 2b

Looking South

- Some relic tension crack along road edge at top of fill still visible
- Majority of lateral spreading and settlement of fill has quiet down in recent years
- A sag of pavement (settlement of fill) still evident on east side (north bound lane) and needs to be filled in and levelled to smooth over



Photo 2c

Looking South

- Some relic tension crack along road edge at top of fill still visible
- Majority of lateral spreading and settlement of fill has quiet down in recent years
- A sag of pavement (settlement of fill) still evident on east side (north bound lane) and needs to be filled in and levelled to smooth over

Note: Photos taken on June, 2013



Photo 3
Looking upstream at Hamelin Creek and at Tributary Creek

- Opposite bank and valley slope of Hamelin Creek was eroded steeply
- Bank on highway side well protected by recent (2010) bank armouring
- Previous (2010) repair work on upstream side of site still in good condition
- Culvert Inlet and channel thorough-way looked unblocked

Photo 3a
Looking upstream at Hamelin Creek and at Tributary Creek

- Opposite bank and valley slope of Hamelin Creek was eroded steeply
- Bank on highway side well protected by recent (2010) bank armouring
- Previous (2010) repair work on upstream side of site still in good condition
- Culvert Inlet and channel thorough-way looked unblocked



Photo 3b
Looking upstream at Hamelin Creek and at Tributary Creek

- Opposite bank and valley slope of Hamelin Creek was eroded steeply
- Bank on highway side well protected by recent (2010) bank armouring
- Previous (2010) repair work on upstream side of site still in good condition (right of photo)
- Culvert Inlet and channel thorough-way looked unblocked

Note: Photos taken on June, 2013



Photo 4

Another view with Culvert Inlet and upstream of Hamelin Creek - Looking downstream

- Recent (2010) bank armour riprap performing well



Photo 4a

Upstream of Hamelin Creek - Looking upstream

- No drastic of channel downcut towards upstream apparent

Note: Photos taken on June, 2013



Photo 5

- A view of downstream straight channel (from top of concrete box culvert outlet at toe of fill)**
- Severe bank slumping sliding along north (left) side of channel bank
 - Steepening of bank eroded along both left and right (both north and south) sides of channel bank



Photo 5a

- A view of north bank of downstream channel from opposite side of channel**
- Riprap bank immediately to culvert outlet in good condition
 - But, adjacent bank slump sliding of channel bank occurring at a previous ditch channel outfall location (B) along north side
 - Previous channel outfall riprap pad (B) and its concrete housing was eroded

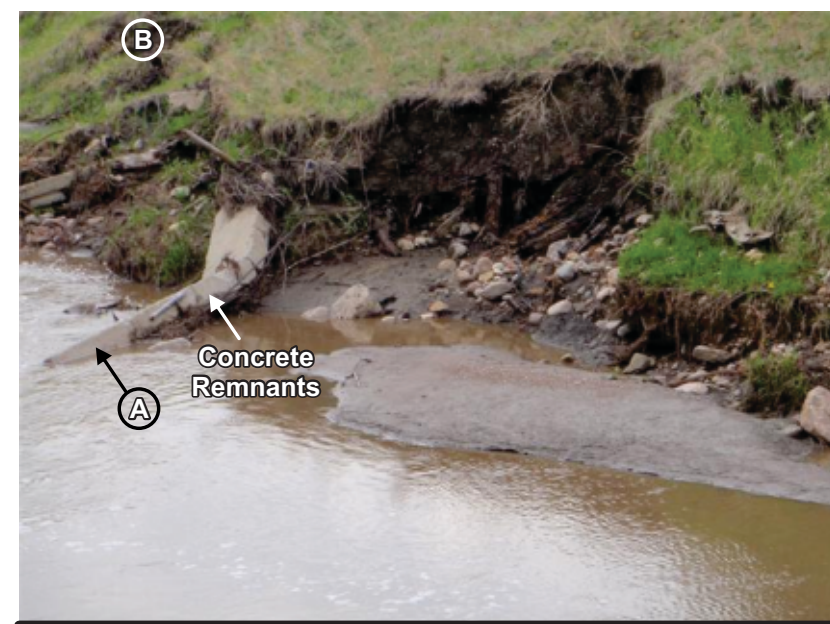


Photo 5b

- North bank slumping failure**
- Close up of bank area of eroded riprap pad and concrete housing



Photo 5c

- Looking upstream at culvert outlet (box culvert)**
- A steepening of both banks along this straight reconstructed downstream channel

Note: Photos taken on June, 2013