BRIEF FILE SUMMARY
(LANDSLIDE RISK ASSESSMENT)

1) **Site (GP21)** SH 719 Henderson Creek Slide (BF73982)

2) **Reference Location along Highway:** SH 719 Approach fill over double culvert (BF73982)

3) **Legal Description:** Sec 29 Twp 79 Rge 12 W6M
4) **UTM Coordinate:** Northing 6195928 Easting 322960
5) **AT File:** GP 21; SH 719 Henderson Creek; BF 73982

6) **Alberta Transportation Plan and Profile**
- Site Plan and 1st Phase Berming Design Drawing (EBA December 18, 2001 letter report)
- 2nd Phase Preliminary Conceptual Design Plan for Temporary Tie-back Retaining Wall (Late 2003 discussions with AT)

7) **General Description of Instability**
- A 13m high fill embankment @ 3H:1V and double bridge culverts (@3495mm diameter) were constructed across the Henderson Creek. At upstream inlet of the double culvert, the creek flow caused erosion at toe of embankment slope and deleterious organics deposits was located beneath toe area. The toe erosion and presence of deleterious organics deposits caused a loss of toe support resulting in a shallow-seated slide failure. The headscarp of slide transgressed to highway shoulder and caused sagging of the guardrail.
- At the upstream inlet, a wood drift catcher was installed as part of the bridge culvert infrastructure. It appeared that wood drift pile-up was substantial and the accumulated volume of drift caused a shrinkage of channel flow width, thus causing a more concentrated narrow flow path, at the inlet channel upstream. This concentrated flow caused erosion of the creek bank and slope toe at culvert inlet area. In conjunction with presence of buried organics, being incompetent foundation material, the creek erosion caused toe scour, loss of toe support and failure of fill which transgressed upslope to affect the highway.
- It is understood from a bridge consultant engineer that the existing double culvert may be hydraulically under-capacity. Thus, it is apparent that an upstream highwater head can avail to incur erosion of upstream banks. A replacement culvert of adequate capacity was considered by AT Bridge Engineer.
- Due to yearly pile up of drift, the narrowing of flow channel and erosion at inlet may recur.
  - The drift accumulation was noted in late summer 2001 slide investigation. The driftwood pile was subsequently cleaned out in early 2002. However, inspection during subsequent years indicated that drift deposition (at inlet) seemed to accumulate yearly to require regular cleanouts.
  - An EBA remediation design (1st Phase Berming Design) (EBA December 18, 2001 letter report) was submitted to AT. AT decided not to implement the remediation design because the bridge culverts were scheduled (by AT Bridge Engineer) for replacement in 2009. The EBA remediation design also recommended the subexcavation of buried organics at the toe area.
- In late 2003, it is understood that AT Bridge Engineer installed temporary riprap protection (using in-stock precast panel) at the toe as an interim toe protection but without the subexcavation of the buried organics beneath the toe area as recommended under EBA 1st Phase Berming Design. It is believed that, with the partial measure in-place, the rate of slide movement may slow down. However, without subexcavation of buried organics and consolidation of the toe area, it is also believed that the slide movement will continue possibly

at a slower rate.

- In 2001-03 inspections, the headscarp of slide transgressed to affect the shoulder line of highway. In consideration of the culvert replacement (2009) strategy and the recent 2003 installation of temporary toe protection, some form of stabilization should still be designed to maintain existing operating road width despite the hopeful anticipation of a slower deterioration of the slide.

8) **Date of Initial Observation**
   - June 2001 reported by local MCI

9) **Date of Last Inspection**
   - June 2003 (2003 Slide Tour)

10) **Instrument Installed**
   - nil

11) **Instrument Operational**
   - n/a

12) **Risk Assessment**
PF (11) * CF (2) = 22

PF = 11
- slide is shallow seated and fill core construction apparently of competent fill
- movement is considered active since
  - yearly drift accumulation caused channel constriction and concentrated flow to recur toe erosion
  - existing buried organic deposits at toe area will continue to destabilize slope
- Interim riprap installation (by AT Bridge Engineer in late 2003) will only be surficial erosion protection to slow down scour of the toe and
  - Probability of catastrophic slipout of the 13m high fill may be low if regular maintenance of toe protection is to be carried out to minimize toe deterioration
  - Further transgression of slide will still recur, possibly at a slower rate, to eventually affect a wider pavement area.
  - In this regard of slower transgression of the slide headscarp to affect the roadway, the use of tieback retaining wall can be considered to retain the road subgrade so that existing road width can be maintained prior to the culvert replacement scheduled for 2009.

CF = 3
- In the event of sliding failure occurrence, closure of one lane will be required to allow repairs
- Traffic volume can be considered low. Traffic may entail farming community users and oil field maintenance access

Note:
This Risk Assessment rating is based on the Scheme proposed by AI in the Request for Proposal. (2000)

Probability Factor (PF) :	1 to 20 scale
Consequence Factor (CF) :	1 to 10 scale

13) **Geotechnical Conditions**
   - The highway fill embankment and double culverts were located across the floodplain of the

Henderson Creek. A slide occurred at the upstream slope and transgressed from toe area to affect the roadway shoulder. The sliding was caused by a loss of toe support which was caused by deposition of deleterious buried organics at/beneath the toe and bank erosion at the culvert inlet toe area. Shallow seated slide movement was assessed and the core of fill construction was considered competent.

- Yearly accumulation of wood drift were observed to be substantial to cause a narrowing of channel width to result in concentrated flow which caused erosion of slope toe at culvert inlet area.
- It was understood that the inadequate hydraulic capacity was assessed of existing double culverts. Thus, the conditions of ponding and an upstream highwater level forced-head at culvert inlet existed to aggravate erosion at upstream bank and toe area of the slope.
- Generally for the floodplain and surrounding area, the surficial soils can include alluvial deposits, lacustrine clay and clay till.

Adjacent Slide Area along Creek valley slope:

- Previous sliding of the valley south slope (approximate 0.3km upgrade south from the double culverts) occurred at the mid-portion of the south access of this creek valley and previous instrumentation installation was noted. Apparently, the slope was reshaped and a toe berm was installed at the river floodplain level.

14) **Chronology**

Historical setting: past site problem (including construction problem)

- Adjacent slide site at creek valley south slope:
- Past sliding activities along the adjacent south approach occurred and instrumentation installation was installed

Past Investigations

Adjacent Site at creek valley south slope:

- Previous instrumentation monitoring of past sliding activities along the south approach. It is possible that previous instrumentation records may reside with MD/ID office that administered this highway from 1996 to 2000.

Mitigative measures implemented (temporary maintenance)

- In 2001 to 2003, the slide only transgressed to affect the guardrail and pavement shoulder area; however, severe settlement and cracking distress across the pavement width was not observed thus far. Patching of pavement was not substantially required yet.

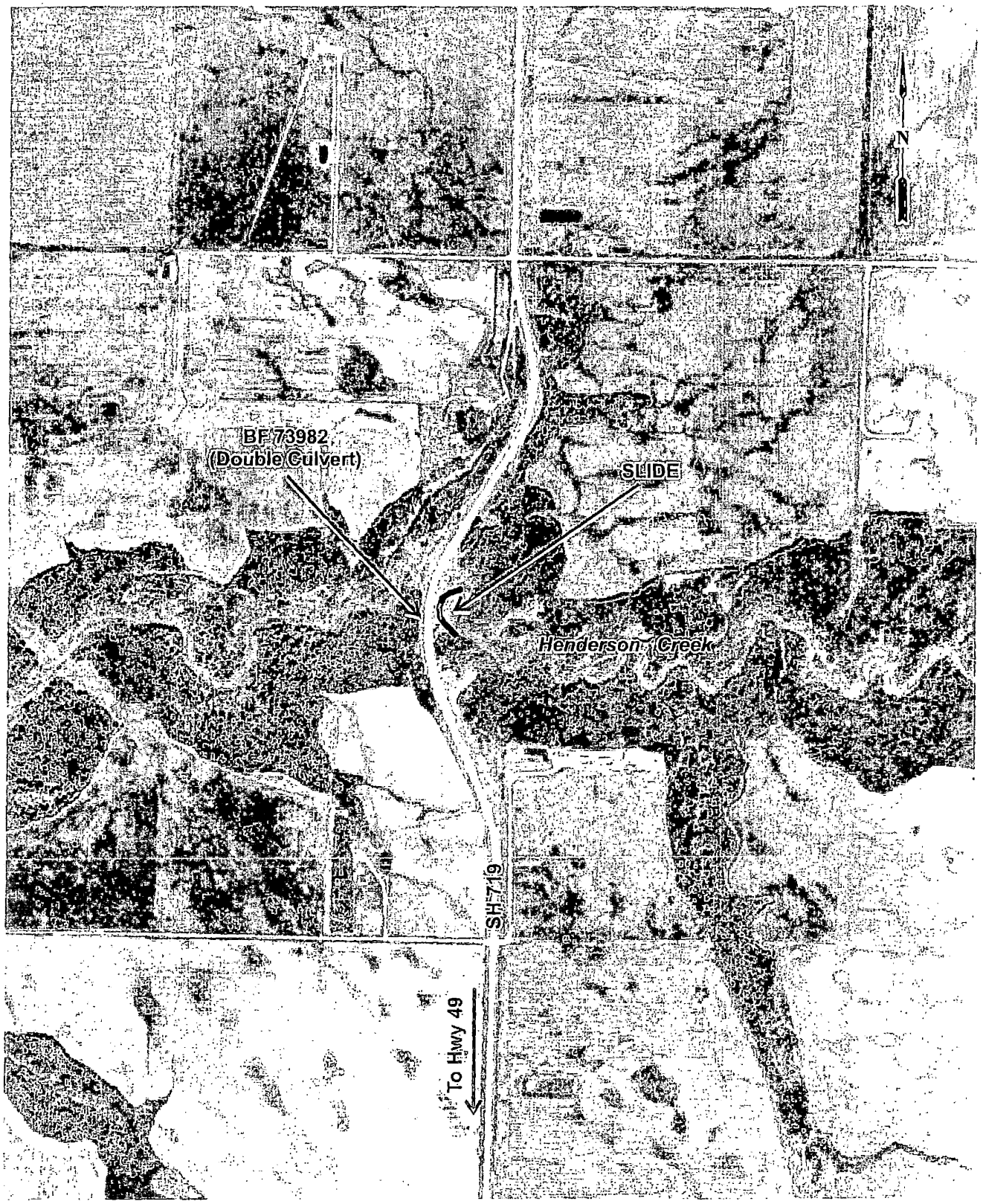
MITIGATIVE MEASURES UNDER CONSIDERATION

- In light of the non-implementation of 1st Phase Berming Design, temporal interim stabilization measure was discussed with AT.
- In 2003, a 2nd Phase Design on temporary Tie-back Retaining Wall was being conceptualized as appropriate for interim stabilization of the roadway elevation.
- As the unstable conditions of the toe area will not be remediated until the culvert replacement in 2009, this interim measure is considered a reasonable temporary measure to retain roadway subgrade and maintain the highway width for the interim duration. The costs can be estimated at slightly above $100,000.

15) **Action**

- Continue the visual monitoring.
- Continue pavement patching (when required) as a pragmatic maintenance measure.
- Design and construct temporary tie-back retaining wall for retention of subgrade as interim stabilization measure to maintain highway serviceability.

END



AIRPHOTO BASE: 83M, LN-1, AS5161B, #284, 01-06-19

Figure 1

2001 Aerial Photograph

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