

## Site 24 – Elpoca Mountain Debris Flows

This site is located approximately 400 m southbound from the south junction between Highway 40 and the Valleyview Trail. Figure E6 shows a 1999 airphoto of the site. There are debris flow deposits on the treed slope above the highway right-of-way. The deposits are roughly centered around a creek channel that flows down from the south ridge of Elpoca Mountain. The debris does not extend into the cleared highway right-of-way. The segment of the creek channel within the cleared highway right-of-way is well-defined and typically incised 1 m or less. There was only a trickle flow within this segment of the channel at the time of the inspection in August 2005.

The creek channel was traversed for a distance of approximately 300 m upslope of the highway. The debris flow deposits were noted in the treed area above the right-of-way and are not visible from the highway. The approximate extent of the debris flow deposits is shown on Figure E6. The segment of the creek channel between the treeline above the highway and roughly 200 m further upslope was poorly defined within the blanket of debris on the slope. It appeared that the creek channel in this area had been infilled with debris earlier in 2005 and the creek flow went overland across the debris on the slope. The debris blanketing the slope tapers out around the treeline along the east edge of the right-of-way, as shown on Figure E6.

Further upslope (greater than approximately 200 m above the highway) the creek channel was incised approximately 1 to 2 m into the slope. This segment of the channel was dry at the time of the inspection. The channel in this area is surrounded by a broad area (greater than 30 m wide) of cobble to small boulder sized debris blanketing the slope. The slope inclination and creek channel gradient in this area was around 8 to 10°. It appeared that the debris had been deposited during several events in previous years, including a significant amount of “fresh” looking debris judged to be from earlier in 2005.

As shown in Photo 1 and on the airphoto in Figure E6, the debris fan on the treed slope above the highway right-of-way is below the steep upper slopes of Mount Elpoca where large volumes of rockfall debris accumulate above the treeline. This rockfall debris gradually moves further downslope over time due to gravity and surface runoff (rain and snowmelt) and contributes to the development of the debris fans above the highway.

The airphoto on Figure E6 also shows two other debris fans on the slope above the highway and a short distance northwest from the debris fan that was traversed. These debris fans appear to be similar in form to the one shown on Photos 2 to 4 and they do not extend into the cleared highway right-of-way.

Gardner (1982) reported that Highway 40 was obstructed on two occasions by debris flows caused by intense rainfall – once in 1975 and once in 1979 – at locations where the highway crossed seasonal creek channels at Mount Elpoca. The creek channels are described as having an upper catchment composed of steep bedrock surface above

treeline, a mid-section eroding down into Mesozoic shales (which are relatively erodible and generate significant volumes of debris) and a lower portion across a debris fan. No further details about the exact location(s) of these debris flows are given. The description of the channel profile(s) and bedrock types is consistent this site.

The 1975 event was reported to have occurred after a rainstorm with an intensity of 80 mm/24 hours which was reported to have a return period of 1 in 25 years in this area. Given this relatively low return period, it is expected that similar precipitation events would likely have occurred around this site since 1975. The climate station data plotted in Appendix D consists of monthly precipitation totals and is therefore not directly comparable to the 24 hour intensity value quoted above. Figure D2 in Appendix D shows that the June 2005 monthly precipitation total recorded at the Kananaskis-Pocaterra climate station (approximately 10 km from this site) was the highest recorded since the beginning of the available data in 1976. It is possible that debris flows occurred at this site during June 2005 due to high-intensity periods of rain and/or the cumulative amount of rain during the month.

AMEC recommends the following Risk Level factors for this site using the debris flow frequency-severity matrix:

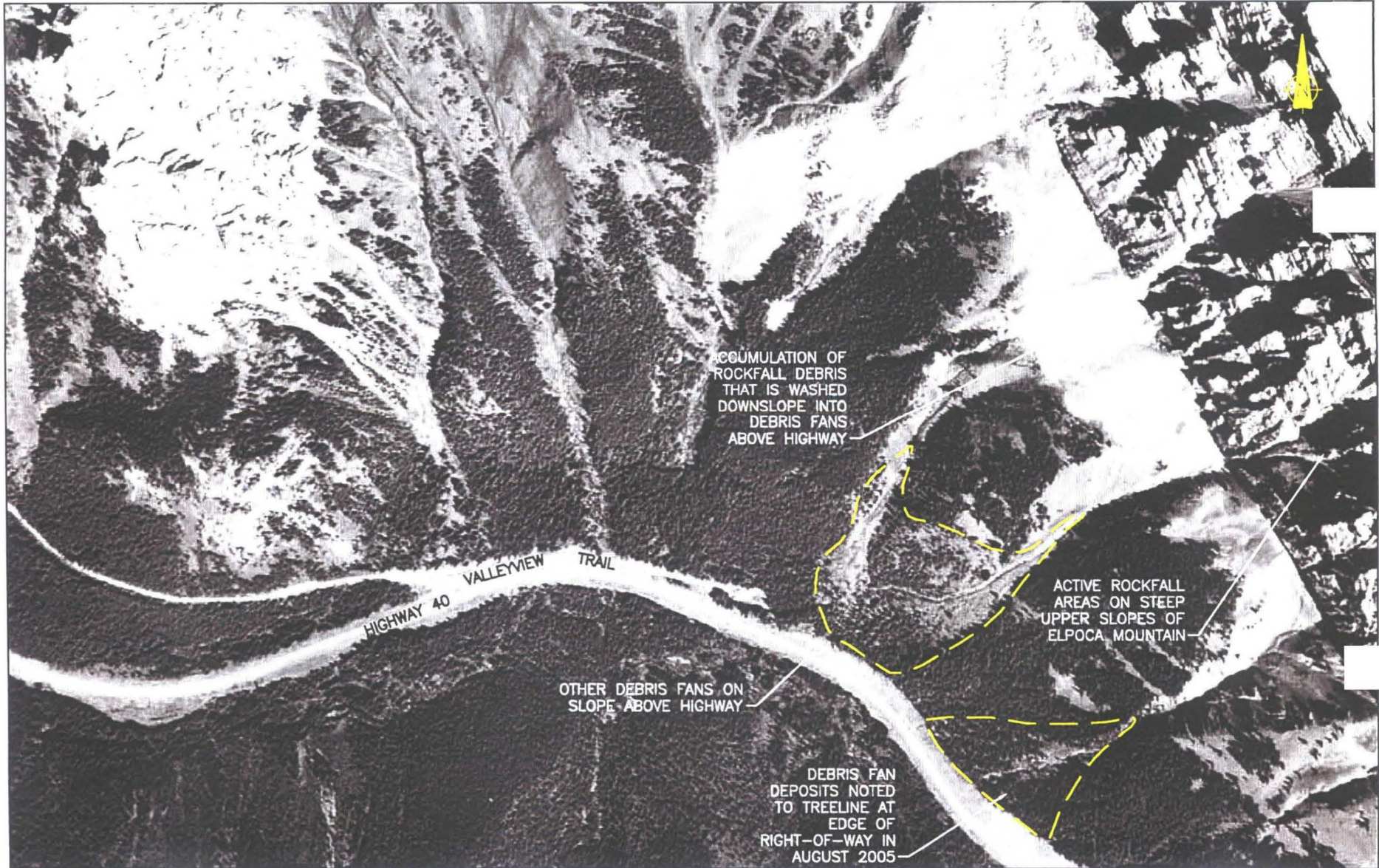
- Probability Factor of 10 based on the appearance of the debris that suggests that debris flows may occur each year.
- Consequence Factor of 2 based on the fact that the debris deposition does not extend down into the highway right-of-way, at least since the 1975 and 1979 blockages reported in Gardner (1982). Otherwise, the Consequence Factor would be 4 to 6. It is possible that the debris fan within the right-of-way was cleared during construction of the highway during the 1970's and has not been covered with new debris since that time.

Therefore, the recommended Risk Level for this site is 20.

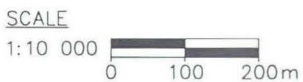
It is judged that if another debris flow event similar to the 1975 and 1979 events that blocked the highway occurred, the debris flowing along the creek channel would spread across the cleared area along the northeast side of the highway right-of-way and accumulate there before possibly encroaching onto the highway.

The recommended Risk Level at this site should be compared to the Highway Base Road site where a similar hazard poses a higher risk to the highway.

No further work is recommended for this site at this time. If future debris flows encroach into the highway right-of-way, the debris should be removed.



AIRPHOTO REFERENCE: PROVINCE OF ALBERTA, 99-091, AP 82J, LN-19, AS5084 No.137, 1:20, 000, 99-07-12



**amec** Earth & Environmental

CLIENT:



PROJECT: HWY 40/HWY 541 GEOHAZARDS REVIEW

TITLE: ELPOCA MOUNTAIN DEBRIS FLOWS

DATE: DECEMBER 2005	JOB No.: CG25211	CAD FILE: 25211N01.dwg	FIGURE No.: FIGURE E6	REV. A
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**Photo 1** (top) – Facing southeast towards the lower west slopes of Elpoca Mountain from the summit of Gap Mountain. This view shows how the rockfall areas on the upper slopes of Elpoca Mountain generate debris that is subsequently transported downslope via surface runoff and tributary creeks and contribute to debris fans in the treed areas further downslope.



**Photo 2** (bottom) – Typical view of braided creek channel and debris flow deposits blanketing the slope approximately 50 m upslope of the cleared highway right-of-way. There is no distinct creek channel in this area (compare with Photo 3 from further upstream) and it appeared that the channel had been filled with debris earlier in 2005 and the creek flow went overland and percolated down into the debris.



**Photo 3** (top) – Another view of the debris flow deposits upslope of the highway right-of-way.



**Photo 4** (bottom) – Incised creek channel, approximately 1 to 2 m deep, located approximately 200 m upslope of the highway right-of-way and within an area of channel overflow debris deposition. This incised channel was not present further downstream (towards the highway) – compare with Photo 2 from further downstream and closer to the highway.