MERG Report 2005-2

Upgrades to the Bioengineering Installations at Noname Creek 2003/2004

By

Laberge Environmental Services

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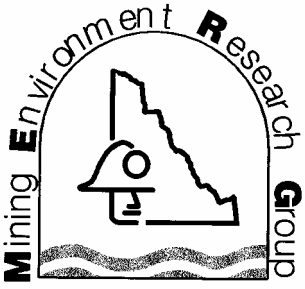

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For the
MINING ENVIRONMENT RESEARCH GROUP (MERG)

Submitted By
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1.0 BACKGROUND

Various bioengineering techniques were employed in September 2001, in attempts to stabilize a permafrost-rich slope that had been disturbed by placer mining activity in the Noname Creek area in central Yukon. The site is an eroded gully that had formed as a result of heavy-tracked mining equipment traversing the slope. The gully is one to two meters deep and up to eight meters wide.

A series of gully breaks were constructed across the upper reaches of the gully, spanning a linear distance of approximately 100 meters. A live pole drain, approximately 25 meters long was installed upstream of the first gully break. A second pole drain, approximately eight meters long was placed between gully breaks 6 and 7.

Live willow cuttings were staked between the gully breaks and above the first gully break to aid in stabilizing any flow.

Dormant live plant material consisting of two species of willow, *Salix arbusculoides* and *Salix alaxensis*, were collected from the Big Creek riparian zones for use in all of the bioengineering installations.

Complete descriptions of these installations are detailed in MERG Report 2002-2 (Laberge Environmental Services, 2002).

In July 2002, the bioengineering structures at Noname Creek were surveyed. The evaluation included a structural assessment of the live gully breaks and live pole drains, and a preliminary assessment of their ability to survive spring runoff, trap sediment and reduce further gully erosion.

Almost all of the willow cuttings were surviving, with most showing new growth. Although there was no water running in the gully at the time of the survey, there

appeared to be adequate soil moisture to support the growth of these willow species. All of the gully breaks had remained structurally sound, and most had trapped sediment during the spring runoff. In some cases, however, channels had eroded under the wattle fences, resulting in a failure to trap sediment. These breaches in the gully breaks occurred in the narrower, steeper sections of the gully.

Graminoids, particularly blue-joint reed grass (*Calamagrostis canadensis*) and sedges (*Carex* spp.), had colonized areas where sediment had been trapped behind the gully breaks.

The two live pole drains had remained intact, although some erosion had occurred at the drain inlets and along the sides of the drains. The willow cuttings used for constructing these drains had sprouted and were rooting. New shoots and leaves had sprouted from the uppermost cuttings (those not covered with the backfilled soil).

All but a few of the live willow stakes survived. Those not surviving were the ones planted on the higher, drier sides of the gully. There was evidence of considerable browsing by rodents on the new willow leaves and shoots. This had occurred on both the gully breaks and the willow stakes. Fresh moose tracks were also observed in and around the gully at the site of the bioengineering installations.

Based on the July observations, recommendations were made for additional experimentation to be carried out the following season.

This report details the upgrades undertaken in September 2003 and May 2004. Photographs are presented in Appendix A.

2.0 September 2003 Upgrades

Initial attempts to carry out the upgrades to the Noname Creek project were carried out from September 22nd to 25th, 2003. Dormant willow cuttings (primarily *Salix arbusculoides*) were collected from a donor site near Big Creek, just downstream from its confluence with Mechanic Creek, and transported to Noname Creek by truck and ATV.

An extension was constructed to the upper pole drain, creating approximately 70 meters of continuous live pole drain. The pole drain was branched at the upper end to help capture potentially separate seepages. A short span of the lower pole drain was covered with a single layer of biodegradable geotextile prior to backfilling, to determine if this would aid in controlling erosion along the sides. The geotextile material is of a loose enough weave that sprouting plants should have no problem penetrating it. Backfilling of the erosion cuts around the drain was also completed.

Live willow cuttings were randomly staked along both sides of the drain. Live cuttings were also staked in the areas between the gully breaks.

Attempts were made to rehabilitate the first gully break. A small trench was hand dug upstream of the break and biodegradable geotextile (coconut fiber mat) was laid over the upstream side of the gully break including the breached channel. The geotextile was held in place with live willow cuttings and backfilled. This upgrading work had to be discontinued as the ground was too frozen to be workable with hand tools. The week before and the week of the fieldwork were unseasonably cold resulting in snow cover and frost penetration of approximately one foot. This slowed down the progress of the physical work considerably (which was all manual labour) that was necessary in order to construct the remediation structures. Ideally, several more gully breaks were to be fortified with the biodegradable geotextile. Backfilling was also hampered as the excavated material consisted of frozen clumps of earth that resisted compaction around the pole drains and the gully break. Remediation work was suspended until May 2004.

3.0 May 2004 Upgrades

Final upgrades to the bioengineering installations were completed from May 26th to 28th, 2004. Dormant willow cuttings, *Salix glauca,* collected from a donor site near Lake Laberge in early May, were transported to Noname Creek by truck and ATV. Willows from the Big Creek area that had been used in the past bioengineering structures, could not be used on this survey as they would have been past dormancy by late May. For successful transplants, the willows must be harvested while in a dormant state. The harvested willows from the Laberge area were kept cool, but not frozen, until transported to the Noname site.

The erosion cuts around the upper pole drain were backfilled and compacted at points where the ground had been too frozen to work in September 2003. The lower pole drain (between gully breaks 6 and 7) was also re-backfilled. The area of pole drain that was covered by a geotextile layer displayed no signs of erosion. No above ground willow growth was observed yet from the recently installed (September 2003) sections of pole drain.

The previously installed willow stakes and structures were supporting spring growth, with some even producing catkins.

The upgrades made to the first gully break in September 2003 appear to be successful as no erosion has occurred. Sediment has been trapped upstream of the gully break.

Biodegradable geotextile was laid over the erosion cuts at cross-gully breaks 2, 3, 5, 6, 8 and 9. At each gully break, the geotextile was secured with live willow stakes on the upstream side and then backfilled. Structural repairs also included replacing or resetting several of the stakes (black spruce) that support the gully breaks.

4.0 DISCUSSION AND RECOMMENDATIONS

A major advantage of bioengineering work is that the use of heavy equipment is usually not required. It is, however, quite labour-intensive. The collection, storage, transport and placement of live plant materials can be very time-consuming.

The use of local species of willows in the construction of bioengineering structures has been very successful. The plants, which for the most part were installed in 2001, continue to grow and propagate, forming stable structures.

The gully breaks appear to be forming effective sediment traps thus controlling erosion. The use of biodegradable geotextile, based on a nine month assessment (September 2003 to May 2004, gully break #1), appears to increase the efficiency of the breaks by preventing erosion channels. The placing of a layer of geotextile over the pole drain installations may also improve erosion control.

During June and July 2004, several large forest fires were active in the Yukon. One of these was in the Big Creek area (Plate 17). On August 4, 2004, Karen Pellitier, with the Mineral Development Branch, visited the Noname Creek study area. The entire slope had severely burned, including the ground layer. The willow structures in the gully however, appeared relatively untouched and supported green growth (Plates -----).

This fire has likely removed much of the insulation layer, and it is suspected that the underlying permafrost will commence melting in the summer of 2005. Eventually there could be mass movement of this slope. It is recommended that the Noname Creek site be assessed in 2005, as it is probable that flows will now increase in the gully.

5.0 ACKNOWLEDGEMENTS

The authors extend their thanks to John, Diane and Buddy Gow, placer miners on Mechanic Creek, for the use of their camp on Revenue Creek during the September 2003 rehabilitation work. Thanks are also offered to employees, Karen Pellitier (September 2003) and Steve Colp (May 2004) of Energy Mines and Resources, YTG, for their labour in assisting in the upgrading to the wattle fences and the pole drains. The use of support equipment provided by YTG is also appreciated.

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APPENDIX A

PHOTOGRAPHS OF BIOENGINEERING REPAIRS AND UPGRADES APPLIED AT NONAME CREEK

September 2003 Upgrades

PLATE # 1: Transporting dormant willows and geotextile to access point to Noname repair site, September 23, 2003.

PLATE # 2: First gully break prior to upgrades. September 24, 2004.

PLATE #3: First gully break under construction, Sept. 24/03.

PLATE #4: First gully break repairs completed, Sept. 24/03

PLATE #5: Installing new pole drain into frozen trench.

PLATE #6: Backfilling pole drain with frozen material.

PLATE #7: “Y” pole drain at top of new pole drain, September 24, 2003.

PLATE #8: Live staking up slope of “Y” pole drain, September 24, 2003.

MAY 2004 UPGRADES

PLATE #9: Gully break #1 repaired in Sept ’03 has not breached and has trapped sediment. Note mud layer on geotextile indicating where water level had been earlier in May 2004.

PLATE # 10: Downstream side of gully break #1, May 27, 2004.

PLATE #11: Gully break #3 prior to repairs, May 27, 2004.

PLATE #12: Gully break #3 after placement of geotextile, May 27, 2004.

PLATE #13: Repaired gully break #8. Note spring shoots of willow growing from wattle fence.

PLATE #14: Gully break #6 prior to upgrades, May 27, 2004.

PLATE #15: Gully break #6 after upgrades. May 27/04.

PLATE #16: Pole drain between gully breaks 6 and 7. Note sprouting and continued growth from pole drain, and trapped sediment. May 27/04.

AUGUST 4th, 2004, POST FOREST FIRE

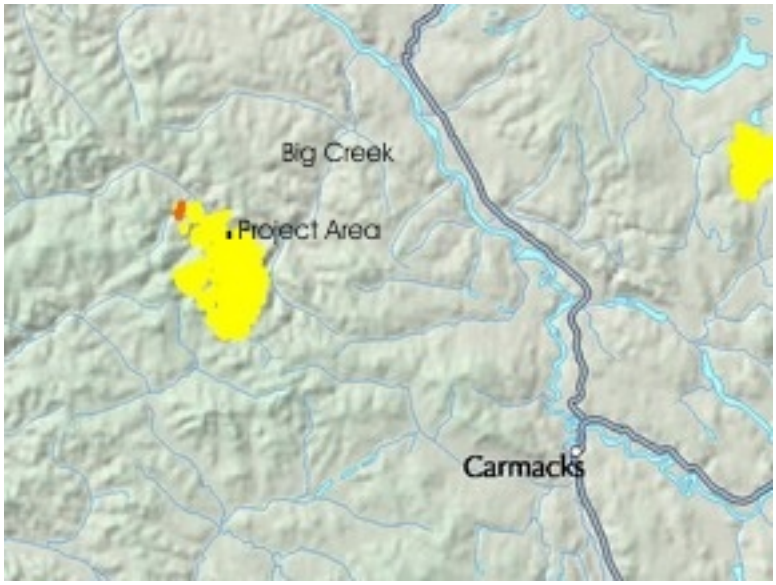

PLATE #17: Fire map from a satellite image taken on July 15, 2004. The yellow area indicates burnt land and the orange indicates currently burning.

PLATE #18: Live staking from Sept /03 (see PLATE #8) sprouting good growth although surrounding area is burnt. Grasses in gully appear unaffected as well. Aug 4/04.

PLATE #19: Looking up to gully break #10 from intact gully break #11 (not in picture) Break # 10 is effectively holding back sediment terrace. Live staking of willows appear scorched but not dead. Most grasses are viable.

PLATE #20: Close up of gully break showing correct decanting of surface flow. Note new willow shoots on wattle fence.

PLATE #21: Pole drain showing robust willow growth despite burnt and scorched surroundings.