Accompanies:
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"Environmental assessment of maintenance practices along Yukon highways"

ENVIRONMENTAL CONCERNS ASSOCIATED WITH HIGHWAY MAINTENANCE

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The following comments accompany a package of slides prepared for the Yukon Department of Highways and Transportation. The slides and comments relate to some of the environmental concerns reflected in the respective pictures that have been identified in the Environmental Protection Service report 'Environmental Assessment of Maintenance Practices Along Yukon Highway Rights-of-way'. Many of the environmental concerns identified are related or due to engineering problems or concerns, or can be mitigated by specific engineering or maintenance practices. The engineering and maintenance comments will be added by the Department of Highways and Transportation.

Slide Number & Description

1. Exposed roadway embankments comprised of fine materials are prone to erosion from road surface runoff. When adjacent to a watercourse, direct sedimentation will occur during periods of runoff (km 462.4, Hwy. 4).

2. Successful revegetation programs will prevent surface erosion as well as providing an aesthetically pleasing roadside environment which complements the natural scenery (km 1391.7, Hwy. 1).

3. This slide shows several problems:
   i) Road surface runoff accumulates down long grade sections where the fall line exceeds the crown slope.
   ii) Roadside berms or windrows do not allow road surface runoff to disperse.
   iii) Embankments consisting of fine material are susceptible to erosion.

The combined situation results in sediment being transferred from the road embankment into a watercourse causing an impact on water quality (km 551.4, Hwy. 4).

4. This embankment consists of coarse aggregate material and even though it is in a situation prone to the accumulation of surface runoff, i.e. on a steep slope, there is no evidence of erosion. Embankments consisting of fine textured material and situated on a grade such as in the preceeding slide could be faced with coarse aggregate material to prevent erosion and the resulting sedimentation to watercourses (km 102, Hwy. 9).

5. Backslopes consisting of fine textured material are extremely susceptible to surface erosion. Larger volumes of sediment are eroded from these backslopes and transported into nearby watercourses causing degradation of water quality (km 1179.6, Hwy. 1).

6. Revegetation programs protect exposed backslopes from surface erosion which in turn minimizes sedimentation to watercourses. Successfully revegetated backslopes are also aesthetically pleasing and reduce ditch maintenance (km 1346.5, Hwy. 1).

7. Backslopes combining a fine texture soil having a high moisture content are very unstable and present a long term environmental concern and maintenance problem (km 1388, Hwy. 1).

8. This backslope was similar to the preceeding slide. The backslope was stabilized by applying a blanket of granular material followed by reseeding. The slumping has been controlled thus preventing the environmental problem and minimizing maintenance costs (km 1386.7, Hwy. 1).

9. Right-of-way grooming projects should anticipate runoff and provide drainage ditches. In this situation, surface runoff will erode a

channel through the fine textured soil material and transport sediment into the adjacent watercourse (km 97.7, Hwy. 4).

10. This area was not properly prepared to receive runoff and is transporting large volumes of sediment directing into a water course causing stream sedimentation (km 112, Hwy. 4).

11. Ditches through erodable soil types can be lined with coarse aggregate material to prevent erosion of the parent material and the resulting sedimentation to watercourses (Mountain View Road).

12. Grooming ditches that are a chronic maintenance problem does little to prevent the problem from reoccurring. Maintenance should incorporate the use of lining with coarse material, ditch checks, and cross drains to minimize the erosion potential (km 1334.9, Hwy. 1).

13. Runoff can also be transported across erodable slopes by using flumes. It is important to prepare a non-erodable apron at the end of the flume to dissipate the energy of the flowing water (km 1376.4, Hwy. 1).

14. Maintenance programs frequently involve cleaning ditches and trimming backslopes. The waste material should be transported to a stable waste disposal site. This slide shows waste material being deposited in a location where it will enter a watercourse and affect the aquatic environment (km 81.4, Hwy. 2).

15. The road embankment at this stream crossing consists of an erodable material. Erosion caused by road surface runoff and the streamflow is noticeable. Eroded mineral sediments are transported directly into the stream during periods of runoff causing stream sedimentation. Maintenance programs should face the embankment with a coarse aggregate material to prevent further loss of embankment material and impact to the watercourse (km 77, Hwy. 4).

16. Scouring of road embankments adjacent to streams is both an environmental concern and a maintenance problem. Loss of embankment material and stream sedimentation will continue to be a problem until a more durable substrate is used to protect the embankment from stream erosion (km 74.8, Hwy. 10).

17. This embankment was armoured with rock and sheet piling during construction and will be effective in preventing an environmental concern and a maintenance problem (km 243.1, Hwy. 3).

18. Where wing berms are necessary at a stream crossing, the rip rap should be used throughout the length to ensure control of the stream and prevent the erosion/sedimentation problem (km 1696, Hwy. 1).

19. Wing berms not adequately protected are susceptible to erosion. More serious problems can occur if the stream breaches the existing channel such as shown at the left side of the slide (km 48.7, Hwy. 5).

20. Maintenance crews are repairing eroded berms with pit run material. The fine material will continue to erode necessitating further maintenance and causing additional stream sedimentation. A more durable material such as rock rip rap should be used in repairing berms (km 62.4, Hwy. 10).

21. Debris must be routinely cleaned from culverts to ensure the unimpeded flow of water and the unrestricted passage for fish (km 29.6, Hwy. 5).

22. Culverts can become a barrier to fish passage by velocity and outfall barriers. This can prevent fish from reaching their spawning grounds and restrict access to extensive reaches of rearing habitat (km 1895.3, Hwy. 1).

23. Maintenance crews can minimize the barriers to fish passage by constructing stable arrangements of rock to decrease flow velocity and raise the backwater pool elevation (km 190.6, Hwy. 3).

24. Stream crossings that are abandoned should be excavated wide enough to accomodate the natural stream meander width and sloped to provide a stable substrate so that natural revegetation can occur. The side slopes shown in this slide will continue to erode and deposit sediment directly into the watercourse (km 1171.7, Hwy. 1).

25. Water withdrawal sites should be sloped away from the watercourse so that accidental water and fuel spills do not directly re-enter the stream (km 637.8, Hwy. 2).

26. Intakes on water pumps should be modified to comply with DFO intake screening guidelines which prevent the entry of fish into the pumping system (km 128.3, Hwy. 2).

27. Allowing vegetation to grow on streambanks is important to the stream ecosystem. Vegetation will stabilize the streambank and thus prevent erosion/sedimentation and provides shade and cover to fish as well as being an important source of nutrients into the aquatic ecosystem (km 637.8, Hwy. 2).

28. If vegetation control is absolutely necessary at stream crossings, it should be accomplished by methods which do not affect the stability of the stream bank, such as hand clearing. Slash should be removed above the high water mark to permit it from interferring with flow patterns (km 37, Hwy. 8).

29. Vegetation control on the right-of-way has utilized conventional road graders. This exposes large areas of the right-of-way to surface erosion which will increase the amount of sediment transported into watercourses (km 193, Hwy. 3).

30. Maintaining proper right-of-way drainage is an important maintenance consideration, however the amount of area disturbed should be restricted to the ditch. This slide shows that a road grader exposed a large area beyond the ditch which was previously vegetated in a self-perpetuating grass community. This practice will accelerate surface erosion which will increase the amount of sediment being transported into the ditch, requiring further maintenance, as well as causing sedimentation to the downstream watercourse. Exposing the mineral soil also encourages the growth of undesirable shrubs, which create another maintenance problem (km 1547, Hwy. 1).

PLATE 69 - Stable rock arrangements in the downstream channel are useful techniques to decrease water velocity and improve fish passage (km 190.6, Hwy. 3).

PLATE 70 - Debris plugging this culvert blocked fish passage and flooded off-right-of-way vegetation (km 1411, Hwy. 1).

PLATE 71 - A beaver dam near the culvert inlet is flooding off-right-of-way vegetation (km 473, Hwy. 4).

PLATE 72 - Debris will affect the capacity of the culvert to pass water, which is particularly important during periods of high flow. Improperly maintained culverts are a threat to the stability of the road embankment (Km 29.6, Hwy. 5).

PLATE 73 - Streams with a high bedload movement are dredged for extensive lengths above and below the highway right-of-way to maintain the integrity of the road crossing (km 1724.8, Hwy. 1).

PLATE 74 - The downstream portions of these streams may receive periodic use by fish which reside in the lake. River training programs should be properly planned to avoid possible conflicts with fish utilization (km 1715.8, Hwy. 1).

River training causes environmental impact through the displacement of stream dwelling invertebrates and in some situations, river training could conflict with fish spawning habitat (Plate 74). Minimizing the environmental impact can be accomplished through selection of timing, frequency, and location of river training programs. Consultation with other government agencies, and in particular, the Department of Fisheries and Oceans, is recommended prior to commencement of a river training program.

7 OTHER MAINTENANCE ACTIVITIES

Other highway maintenance activities which presented an environmental concern were the calcium chloride and vegetation control programs.

The stockpiles of calcium chloride were always located on well drained sites and protected from water runoff. At only one site did the stockpile site appear to present a concern. This occured when calcium chloride was pushed into standing timber which resulted in localized killing of the surrounding vegetation (Plates 75 & 76).

The trucks which haul calcium chloride are routinely washed to prevent corrosion. In a recently publicized example, the truck washing was purported to have contaminated domestic water supplies at the Beaver Creek maintenance camp. Although this survey never investigated this type of problem, it is not unreasonable to assume that this could be occurring unknowningly at many other washing sites. It is suggested that the Highway Maintenance Branch evaluate this activity and consider methods to prevent contamination of surface and groundwater.

Associated with the calcium chloride program are the numerous water withdrawal sites. These sites can be damaging to local watercourses if the area is not properly prepared. The pump, where possible, should be located on a well drained site and sloped away from the water source, preferrably into a vegetated buffer. In this manner, accidental oil and water spills can be filtered before re-entering the watercourse (Plate 77). If a sump is required, the spoil should be placed above the highwater mark (Plate 78).

All water pump intakes were screened, whether or not located in a fish bearing stream. However, none of the screens met the current design specifications recommended by the Department of Fisheries and Oceans (Plate 79). Intake screens can be easily modified to comply with the mesh opening size of 0.1 inch (25mm). These and other regulatory matters should be clarified with Department of Fisheries and Oceans prior to establishing a water withdrawal site.

PLATE 75 - Calcium chloride has been inadvertently mixed with overburden material and caused localized killing of the vegetation (km 38.9, Hwy. 11).

PLATE 76 - Surface runoff from a calcium chloride stockpile site is affecting the nearby vegetation (km 38.9, Hwy. 11).

PLATE 77 - Water withdrawal sites should be prepared so that accidental water and oil spills are contained or drain into a vegetated buffer. Oil contaminated soil should be removed to a site where it will not affect water quality (km 637.8, Hwy. 2).

PLATE 78 - The spoil from this sump was deposited into the stream on the right hand side of photograph. If sumps are necessary, the spoil material should be deposited in a stable location above the high water mark (km 128.3, Hwy. 2).

PLATE 79 - A typical water intake screen which exceeds the recommended mesh opening size of 0.1 inch (25 mm). Intakes, such as this, may entrap small fish (km 128.3, Hwy. 2).

PLATE 80 - Vegetation control is a common maintenance program along Yukon highways (km 202, Hwy. 5).

The control of vegetation is a necessary part of highway maintenance (Plate 80). Various methods are in use ranging from hand clearing to mechanized methods using the hydro-axe or road graders.

Hand clearing causes the least environmental disturbance and should always be used, if necessary, on streambanks (Plate 81). The hydro-axe has certain environmental advantages in that it can operate from the roadway and avoid terrain damage. Road graders, on the other hand, cause considerable environmental damage by destroying all vegetation, instead of selectively removing the problem shrubs as the hydro-axe does. The blading method exposes the erodable soil surface and redirects surface runoff patterns, contributing to accelerated surface erosion and sedimentation to watercourses. In addition, blading the right-of-way directly conflicts with aesthetic values (Plate 82), and in certain areas with the benefits of revegetation programs.

Although blading on well drained granular soil types generally caused minimal environmental impact, the objectives of the maintenance program are questioned when stable, self perpetuating grass communites are destroyed (Plate 83) and when the bladed width appears to be excessive (Plate 84). It was also observed that repeated blading may actually encourage the growth of non-desirable shrub species (Plate 85).

Before a road grader is used for vegetation control, some important considerations should be reviewed, such as; is there a better method, is vegetation control actually necessary, and how much should be done? These are important questions that should be considered to ensure that the program benefits offset the concerns regarding aesthetic and environmental values.

PLATE 81 - If vegetation control is necessary at stream crossings, the least environmental impact is caused by hand clearing methods (km 37, Hwy. 8).

PLATE 82 - Blading the entire right-of-way exposed large areas to surface erosion and conflicts with aesthetic values (km 193, Hwy. 3).

PLATE 83 - Blading in areas which are predominantly grass communities conflicts with good right-of-way management (km 1549.3, Hwy. 1).

PLATE 84 - Blading, if necessary to restore drainage systems, should not expose large areas (km 1547, Hwy. 1).

PLATE 85 - In certain areas, repeated blading may actually encourage the growth of undesirable species of shrubs (km 1573.8, Hwy. 1).

8 SUMMARY

The preceeding sections presented environmental concerns observed along Yukon highway rights-of-way. In this section, a summary of environmental considerations for maintenance programs are listed. Most of these points are already in practice along the highways. However, in view of the fact that there are still site specific examples, it suggests some improvements can be made.

Road Embankment

- disperse road surface runoff through adequate crowning
- prevent runoff from accummulating on the road surface
- use half section culverts to transport concentrated road surface runoff across erodable material
- take corrective action to unstable embankments
- encourage the establishment of grasses along the road embankment
- along encroachments of waterbodies, direct road surface runoff to the ditch side.

Backslopes

- take corrective action to unstable backslopes
- intercept subsurface and surface water above the backslope and control in an effective manner
- install a carefully designed bench cut on large backslopes
- encourage revegetation of backslopes.

Drainage Controls

- line ditches through fine textured soils with coarse material
- divert ditches away from erodable soil sources
- use ditch blocks and cross drains on long grade sections
- use energy dissipators at culvert outlets
- provide settling basins to trap sediment before entering a watercourse
- keep ditches and culverts in good working condition
- waste material should be deposited at a stable waste site where it will not enter a watercourse.

Stream Crossings

- maintain culverts in an efficient working manner
- periodically inspect crossing structures for fish migration problems
- take corrective action to ensure fish passage
- armour road embankments and berms with a non-erodable material
- encourage vegetation growth along streambanks
- use only hand clearing methods on streambanks
- ensure river training programs are approved by other government agencies
- abandoned stream crossings should be left in a stable manner that will facilitate natural revegetation.

In concluding, the results of this survey have identified several areas of environmental concern with respect to highway maintenance practices. Although, in consideration of the 4,000 kilometers of highway in the Yukon, the frequency of environmental problems was relatively low. This is partly due to the regional geology and climate, but also is a function of the quality of existing highway maintenance programs. It is felt that the majority of environmental concerns identified can be resolved to the mutual benefit of environmental and engineering objectives through consultation with highway maintenance personnel.

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