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HANDBOOK OF RECLAMATION TECHNIQUES AND MINING LAND USE

A Guide to Compliance With The
Yukon Quartz Mining Land Use Regulations
and Other Applicable Environmental Regulations In Mining Exploration and Development

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Government

Energy Mines and Resources
Minerals Management Branch

This handbook is being distributed as a draft. We are interested in hear from you and will be accepting comments on improvements including additional reclamation techniques until November 30, 2006 at: mining@gov.yk.ca

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HANDBOOK OF RECLAMATION TECHNIQUES AND MINING LAND USE

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1.0 Introduction

This handbook has been prepared by the Yukon Government for use by operators conducting mineral exploration programs under the mining land use regime of the *Quartz Mining Act.* The overall purpose of the handbook is to contribute to environmental protection by providing information that can help avert mining land use impacts or assist in reclamation. The handbook outlines requirements, fundamentals, strategies, and where they exist, preferred methods on the part of the Yukon Government in relation to operating practices or reclamation methods.

Information outlining **requirements** is intended to orient mineral exploration companies and prospectors to Yukon Government requirements when conducting exploration programs. On occasion, related federal requirements may be discussed.

In describing **fundamentals,** the principles of animal behaviour, runoff, erosion, sediment control re-vegetation, or important background information for other topics as it may pertain to exploration activities is provided.

The handbook describes **strategies** in order to familiarize operators with a range of options for consideration during exploration operations and reclamation**.**

Occasionally, the handbook outlines **Preferred Methods.** Where there are preferred methods on the part of Government, the practice is highlighted as Preferred Methods. If an operator considers that an alternative is preferred where a "Preferred Method" is identified, he is invited to contact the Department of Energy Mines & Resources, Chief of Mining Land Use to share the merits of the proposed alternative. This will enable discussion between operators and government on methods, and inform government on local situations and practical developments in the field of prevention and reclamation.

The Yukon Government anticipates that this information will help support public environmental, cultural and fiscal management objectives, at the same time that mineral exploration contributes to economic development.

The user of this handbook is reminded that this document does not have the force of law. Many of the matters discussed here relate to possible strategies and methods of achieving requirements and desired outcomes. Simply implementing a strategy or practice outlined in this handbook does not ensure that legal requirements have been met. Rather, the strategies and methods discussed are considered to have a strong potential, based on current knowledge, to help achieve environmental and cultural protection objectives. Site specific conditions, information available to the operator in the field and other considerations may contribute to the effectiveness of one strategy or technique over another. The operator's judgment and knowledge will clearly play a pivotal role, and the government relies in this regard, upon operators' and their field practices in realizing public objectives.

For exploration beyond the Class 1 entry-level grassroots activities, results and knowledge gained through a *Yukon Environmental and Socio Economic Assessment Act* (YESAA) assessment and the regulatory process will focus strategies as well as specify legal operational and reclamation requirements. Operating conditions under the

applicable mining legislation, as well as provisions of other Yukon legislation set out the legal requirements operators are expected to adhere to. This handbook should not be considered a substitute for the applicable statutes and regulations.

The reader is also advised that this handbook does not address requirements of First Nations or Canada. There may be applicable requirements on the part of other governments. This handbook does refer to certain federal requirements, particularly under the *Fisheries Act*. Such references should not be considered comprehensive. Where there is a mineral right on Category A Settlement Land, there is a right of access, for purposes of exercising that right, to cross and make necessary stops without the consent of the affected First Nation if the access is of a casual and insignificant nature or if the route used is generally recognized and was being used for access on a regular basis, as long as there is no significant alteration to the route. Access in relation to Category B Settlement Lands is subject to the particular First Nations requirements as well as the land claim agreement in place for that area. Operators are encouraged to contact the relevant First Nation prior to using Settlement Land.

This handbook is organized to address general requirements, but also includes sections addressing specific types of exploration activities and features. There are general requirements and considerations regarding:

- historic sites and burial grounds
- wildlife
- erosion control
- re-vegetation
- permafrost

Each subsection describes requirements, general considerations, strategies and preferred methods applicable to many or all types of exploration activity. The activity-specific sections elaborate on considerations particular to those circumstances. For example, strategies for addressing vulnerabilities associated with permafrost in installation of culverts are addressed in the road and trail building section. The Mining Land Use Regulations, glossary of terms, contact information and cited laws, standards and guideline references are appended.

2.0 General Considerations

The topics covered in this section, including Historic Objects & Burial Sites and Wildlife & Wildlife Key Areas, represent general considerations that are essential in planning exploration projects. Areas with known or potential historic interest, burial sites or wildlife key areas are to be avoided and, therefore, must be thoroughly considered at the **planning stage** of any project regardless of the scale or location of the proposed activities.

2.1 Historic Objects and Burial Sites

Requirements

The *Historic Resources Act* applies to mining exploration land use activities. It is an offence, under the *Act*, to alter or destroy historic objects, which are defined to include archaeological and palaeontological objects, and human remains. It requires people to report to the Minister responsible for Heritage the finding of an object that is likely a historic object or remains that are potentially human**.** For operational and administrative ease specific conditions in Class 2 to 4 licenses may establish periodic reporting relating to finds. Furthermore, any sites containing archeological or paleontological remains or a burial site must be promptly marked and protected by the operator from any further disturbance. The Chief of Mining Land Use must also be promptly notified of a find, and no further activities undertaken until the Chief advises the operator otherwise. If the object is found on settlement land, the finder is required to report this finding to the First Nation which governs the settlement land. In some cases, an operator may be required to obtain an historic resources permit from the Yukon government in order to resume activities at the site.

The Mining Land Use Regulations further prohibit exploration within 30 meters of a known archaeological or paleontological site without written authorization by the Chief of Mining Land Use.

The *Cemeteries and Burial Sites Act* prohibits the deposit of waste within 100 meters of a cemetery or burial site; it prohibits the placement of markers on cemeteries and burial sites; and prohibits the removal or disturbance of a marker, monument or fence associated with a cemetery or burial site. The *Quartz Mining Act* prohibits staking of claims on land where churches and cemeteries are located.

> Archaeological Object means an object that is the product of human art, workmanship, or use, and it includes plant and animal remains that have been modified or deposited in consequence of human activities, and is of value for its historic or archaeological significance.

Strategies

Known Sites

Operators are required to avoid known historic sites and burial grounds. These are the steps the operator can take:

1) Contact the First Nation in whose Traditional Territory the claims are located as well as the Heritage Branch, Department of Tourism. Enquire about known sites. Also ask about specific evidence to watch for.
2) Check your claim map. Most burial sites have been selected as part of the land claims process, and will be noted on the maps available at the Mining Recorder's office[1].

Unknown Sites

If a person finds evidence of a previously unknown historic site, human remains, grave or burial site, they must stop work. If you have a class 2 notification or a class 3 or 4 approval, please refer to the section on historic objects and burial sites for details on the manner of reporting. There are three steps the operator can take to identify any known sites in the claim area before work begins:

1) Make sure people involved with on site exploration activities have a chance to become familiar with evidence of burial sites and historic resources. The Heritage Branch has produced a highly visual handbook ("Handbook for the Identification of Heritage Sites and Features") to aid people in recognizing such evidence. The main things to watch for are stone or wooden markers, fenced graves, grave and spirit houses, family crests or clan symbols. You may even come across human remains that may have become exposed due to erosion, development activity or other soil disturbances. Other historic objects might be harder to identify but if you suspect you have encountered a Historic Object, err on the side of caution.
2) When you encounter evidence of a feature or site or remains potentially human, the following steps must be followed.

   General:
   - Stop work and flag an adequate area around the site to protect it (30 meters at minimum).
   - Ensure employees do not disturb the site.
   - Photograph if possible and report to the Chief of Mining Land Use

   Grave sites

   Human habitations, workings:
   - Avoid disturbing artefacts, cabins, and in the Klondike area, roadhouse and dredge locations.

   Animal tissue remains:
   - If discovered in thawed ground, photograph.
   - If it is not possible to avoid the area, excavate material/animal and re-freeze.

   Animal bones & tusks:
   - Collect as much of the animal as can be located and preserved.
   - Try to verify whether it is a single animal, a 'graveyard' or a grave site.

[1] Maps are also available at Yukon and federal land claims offices.

Figure 1. The photo shows an example of an archaeological object that might not be easy to recognize in the field.

2.2 Protecting Wildlife and Wildlife Key Areas

Requirements

Wildlife and wildlife habitat in the Yukon are protected under the *Wildlife Act*[2]. It is a legal offence to harass wildlife and to encourage wildlife to become a public nuisance. The latter offence is usually brought about by feeding an animal or leaving food or garbage in a place where wildlife may have access to it or by not taking reasonable precautions to prevent wildlife from having access or being attracted to the area. It is also an offence to damage or interfere with a beaver dam, or den, lair or nest of any wildlife. Regulations may be in place regarding a wildlife (or migratory bird) sanctuary or habitat protection area that limit the conduct, timing or methods for specific activities and which prescribe the management of the area.

[2] Sections 35 and 36 of the *Act* prevent "Damage to or Destruction of Habitat". In addition, under Section 138.3, Habitat Protection Areas may be designated by the Commissioner in Executive Council. The habitat of migratory birds is protected by the federal *Migratory Birds Convention Act*. Regulations under the *Act* establish sanctuaries. Special provisions regarding activities within migratory bird sanctuaries may apply. At the date of writing of this handbook, no migratory bird sanctuaries have been established in the Yukon. The *Wildlife Act* and the *Migratory Birds Convention Act* (Canada) are enforced by the Yukon Government conservation officers and the RCMP. The *Canadian Wildlife Act* provides for the establishments of wildlife areas. The Nisutlin River Delta National Wildlife Area is the only site designated to date in the Yukon

Fundamentals

Habitat fragmentation is understood to result when wildlife continually avoids useable habitat due to sensory disturbance from direct and indirect activities associated with mineral exploration. Indirect activities include traffic, hunting and recreation resulting from improved road access associated with exploration.

Wildlife key areas are areas where animals tend to congregate for certain activities or are areas instrumental to the life cycle or movement of the animals. Wildlife key areas include locations such as staging and nesting sites for waterfowl, nesting sites for raptors, beaver and muskrat lodges, winter range for thin horn sheep and goats, late winter range for caribou, moose, mule deer, elk and wood bison, calving and rearing areas, denning areas, mineral licks and travel corridors. Many wildlife key areas are only utilized for certain seasons of the year and their importance may not be obvious at other times. Wildlife key areas may be disrupted despite the best efforts to minimize impacts to the land, vegetation and wildlife. In some areas, mining land use activities may be subject to restrictions (for example – timing of activities) in order to accommodate concerns about wildlife. To find out more about wildlife key areas and time periods critical to wildlife, contact the Department of Environment (Wildlife Key Area Inventory Program or NatureServe Yukon).

Mineral exploration often occurs in remote mountainous regions that can only be accessed by aircraft. These areas, or the access to them, are often in alpine sheep range, and particular consideration should be taken into account in such circumstances. Research and observation indicate that sheep are highly susceptible to over-flight disturbance. Disturbance is any activity that interrupts the regular behaviour and routine of animals. When disturbed, an alpine animal will:

Become vigilant: The animal interrupts its activity, such as foraging, stands with its head above its shoulders, and scans the surroundings.

Stop eating: The animal will stop eating and usually become vigilant.

Un-bed: The animal will get up from a lying position. It is usually ruminating (chewing its cud) when it is bedded.

Flee: The animal will walk and/or run a distance from its pre-disturbance position. The distance can range from a few steps to over a kilometer, depending on the degree of disturbance. Each of these reactions costs the animal energy.

Detailed information on the behaviour of sheep and sheep-human interaction is available in the handbook on sheep listed in Appendix D.

Many of these impacts are also experienced by other wildlife and should be kept in mind whenever using aircraft.

Strategies

Wildlife Key Areas

Wildlife key areas should be avoided wherever possible. The Department of Environment maps wildlife key areas; inventory of wildlife habitat is an ongoing process and maps are continually being updated. The department's internet site makes maps and interpretive information available to the public. If you are unsure of the habitat you will be travelling through or working in, local Wildlife Officers or staff of the Wildlife Key Area Inventory Program of NatureServe Yukon, Department of the Environment can provide you with information (see Appendix A.3 for contacts). Wildlife Habitat Protection Guidelines are maintained by the Department of Environment (DoE) and are available from their regional offices (see Appendix C). During the YESAA assessment and/or the mining land use application process, or when planning for a Class 1 activities, it can be useful to touch base with these people while considering the answers to some of the questions the application asks with respect to wildlife key areas in the vicinity of your project.

Comment: (Verify, DoE, Jan. 3, 06)

Wildlife

- Encourage awareness about wildlife and avoid disturbance by establishing wildlife protection policies.
- Educate employees and contractors about potential wildlife issues and mitigation.
- Manage activities and transportation on access roads and trails to avoid wildlife mortality.
- Eliminate movement barriers from wildlife access routes.

All reasonable precautions must be taken to avoid disturbance or harassment of wildlife in the area of the exploration program, including no feeding of animals and in choosing the location of camp sites. In general:

- select a campsite away from important habitat, high use areas, corridors and nesting sites
- keep food waste in well sealed containers until disposed of to avoid attracting wildlife
- incinerate or remove food from the site as soon as possible
- never feed wildlife,

These general principles are discussed in greater detail in the section 4.0 on Camp Maintenance.

Species-specific management guidelines have been developed by DoE, and may prove informative to operators. These are available for caribou, grizzly bear, moose and sheep at the department or through the Yukon Fish and Wildlife Management Board website (www.yfwmb.yk.ca).

To Minimize The Disturbance To Sheep:

- *Whenever possible, fly more than 3.5 km from known sheep ranges.*

If sheep cannot see or hear the aircraft they obviously will not be disturbed. The closer the aircraft gets to the sheep, the greater the disturbance and the faster and farther the sheep will flee.

- *Plan your route to avoid sensitive areas.*

If you must fly near a sheep range, avoid known lambing cliffs and mineral licks from May 1 to June 15.

- *Plan a route that places a ridge between you and the sheep.*

If you must fly near a sheep range, ridges can act as visual and sound barriers. But be careful: if the aircraft suddenly appears over a ridge without warning sheep will be strongly disturbed.

- *Fly below the sheep.*

If you must fly near sheep range, fly below the level of the sheep. Sheep naturally seek safety by fleeing upslope. If they are forced to flee downslope, they are more likely to fall and hurt themselves.

- *Concentrate your total flying time.*

Sheep tend to be less affected if flights are concentrated into a single session, rather than spaced out over several days. In some cases it may be best to have two aircraft, rather than one, operating over a shorter time.

- *Fly when sheep are active.*

Morning flights may disturb sheep less than flights in the afternoon, when sheep are usually bedded and ruminating. If scheduling allows, avoid flying between 11 a.m. and 3 p.m.

- *Fly at an angle when approaching sheep areas*

Try to avoid flying directly toward sheep. Sheep perceive the aircraft as an avian predator and so flee to escape. Approaches on an angle, especially from below, will seem less threatening.

- *Proceed on course*

It is tempting to take a closer look, but good wildlife viewing is observing animals without interrupting their normal activities. The preferred method of government biologists is to proceed with no detours and disrupt the animals as little as possible.

Remember to consider wildlife habitat when planning your camp locations and constructing access roads and trails. These considerations are brought up again in the following sections as appropriate.

Other Considerations

In order to control hunting and wildlife disturbance on site, companies can implement policies such as:

- **No hunting applicable to persons while they are in camp or working in any areas of the exploration project.**
- **On site firearms for protection only**
- **No wildlife harassment on site**
- **Prohibition of personal use of ATVs on site**

Pictures of fleeing animals are permanent evidence of being too close to them. Use binoculars or a telephoto lens to get a better view. Better yet, take the time to land where animals won't be disturbed and view them from there.

3.0 Erosion Control and Re-vegetation

Fundamentals

Erosion control and re-vegetation go hand in hand: if the soil surface is constantly unstable due to erosive forces, then re-vegetation can't take hold. Likewise, where plant cover is not re established, the surface will be more subject to erosion. In general, re-sloping or re-contouring of physically disturbed sites will be done as a means of preparing the site for successful re-vegetation, which in turn prevents erosion and sediment discharge. The measures taken to stabilize the disturbed land and/or prepare it for re-vegetation will vary depending on the scale and type of activity, the soil type, and the amount of permafrost present; operators may want to refer to the "Guidelines for Reclamation/Re-vegetation in the Yukon" (1993) Edited by C.E Kennedy. (Yukon Government publication).

3.1 The Basic Principles

Understanding how runoff and soil erosion happens is the first step in preventing and controlling it. Unfavourable environmental outcomes that can result from mining land use, have to do with the erosive force of water and to a much lesser extent, wind. General runoff over the exploration and development area can cause non-point source sediment. Excessive sedimentation (build-up of soil particles in the water and along the stream bed) will result if runoff and erosion if they are not controlled.

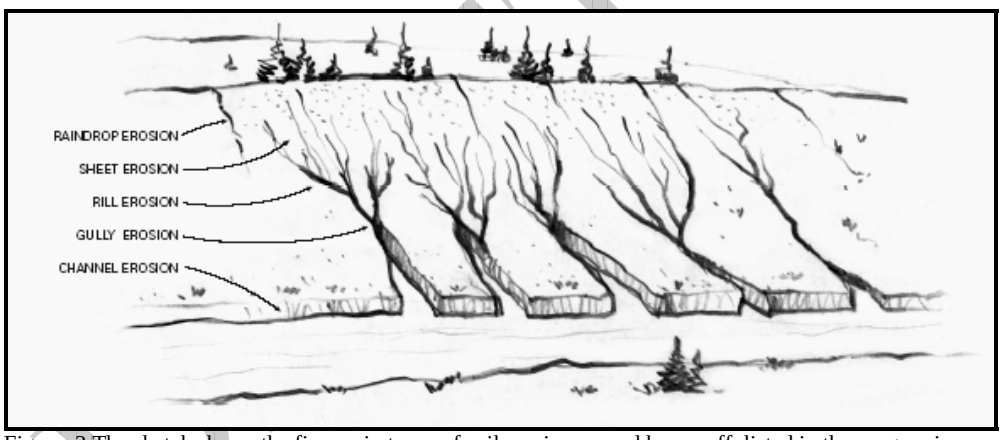


Figure. 2 The sketch shows the five main types of soil erosion caused by runoff, listed in the progressive order in which they develop in nature.

The five types of soil erosion shown in the above diagram are defined as follows. Splash (raindrop) erosion is the detachment of soil particles from the impact of raindrops. Sheet erosion is the constant removal of thin layers of soil from sheets of water flowing across a slope. Rill erosion is soil being removed by water flowing through small sporadic shallow channels. Gully erosion is an advanced stage of rill erosion that happens when rills become enlarged and form gullies, which are longer-lived, deeper channels. Stream channel erosion includes the removal of soil along channel banks and riparian areas, as well as the scouring of sediment from the channel bed. These last two forms generate the most sediment.

It is much easier and less expensive to control splash, sheet and rill erosion than it is to stop gulling and stream channel erosion

Runoff control is all about controlling the erosive and sediment transport forces of water over the site. Prevent or control runoff and there will be less erosion and less costly sediment control measures. Site drainage and contouring is the key element. Erosion control measures are meant to stop soil particles from getting loose and travelling off site. Keeping the slope as flat as possible and developing as much plant cover as possible and encouraging rapid re-growth of plants is the best defence against erosion. Controlling Sediment is the last and hardest step because it involves storing and settling before discharge to aquatic habitats. Slowing runoff velocities or holding sediment-laden water in ponds or depressions gives gravity time to do its job. Improper drainage can result in "piping" and collapse of banks. Small ephemeral (part time) streams result from rainfall, snowmelt, or seasonal springs (groundwater discharges).

Plant cover is the most important factor in soil erosion. The faster vegetation cover can be re-established; the sooner erosion can be controlled. Vegetation not only protects the soil from the erosive force of rain, it also holds it together and makes it more resistant to erosion.

Basic Strategies

These are among the preferred methods to consider:

- Keep the footprint as small as possible.
- Sensitive areas (silty or fine sandy soils or permafrost) should be identified and avoided if at all possible.
- Avoid activities like stripping, clearing and building embankments during heavy rain.
- Whenever possible, schedule stripping so as to minimize the time soils will be exposed.
- Direct flows to catchment basins located at bottom of slopes or to wetland areas.
- Conducting periodic reclamation activities throughout the life of the project instead of leaving everything to the end of the operation can minimize soil exposure time.
- Encourage re-vegetation at every stage using locally available plant and organic materials set aside during stripping.
- Limit the exposure of the soil to the water. Divert runoff away from erosion-prone areas to less vulnerable areas or provide erosion resistant covers for highly erosion-prone areas.
- All soil piles and exposed side slopes should be contoured to reduce slope length and steepness.
- Breach dykes and access roads where failure of those structures would result in deposition of sediment into streams.

- Armour (protect with rock or largest available materials) ditches and small channels where erosion could be expected, such as steep grades or flows through or over fine-grained materials.
- Increase the roughness at the soil surface to slow down water and provide water pooling sites to encourage re-vegetation.

Table 1 shows recommended slope grades for the different soil types. Fine textured soil erodes easily and needs more attention than coarse soil. As water accelerates, it becomes more erosive. Slow it down! By reducing the slope length or steepness, water can be slowed down, reducing the potential for erosion.

Table 1. Slope Grades by Soil Type

Slope	Soil Characteristic	Recommended Procedures
Side Slope	Ice rich soil	Leave vertical. Undercut so vegetative layer will fall and cover exposed slope.
	Less than 5% frost	Grade slope to less that 2:1 Round off top of slope.
	Coarse, well-drained soils	Grade slope to less that 2:1 Bench slope if over 15m high.
	Fine, poorly-drained soils	Grade slope to less that 3:1
Pile	Coarse, well-drained soils	Grade slope to less that 2:1 Round off top of pile.
	Fine, poorly-drained soils	Grade slope to less that 3:1 Round off top of pile.

3.2 Guidelines for Runoff, Erosion and Sediment Control

Requirements

The environmental objective for erosion control is to leave slopes, excavations and other disturbed lands in a range of conditions that will limit the incidence of soil erosion, slumping and other instabilities. The purpose of controlling erosion is to prevent excessive sediment load from entering nearby streams. Operating condition #39 requires that all reasonable care be taken to prevent sedimentation from entering a water body. Depositing sediment into fish bearing or fish habitat streams is prohibited under Section 36(3) of the *Fisheries Act*, and Section 9.(1) of the *Yukon Waters Act* prohibits the deposit of any waste (defined as any substance that is detrimental to people, animals, fish or plants), including sediment into any water body. Under some conditions any of these prohibitions may be otherwise permitted in a water licence.

Fundamentals

Controlling runoff on the mineral exploration site with a good layout of ditches, drains, and diversions is essential. Prevention is easier and cheaper than corrective measures. In some cases, however, erosion and sedimentation will occur and sediment runoff control

will be necessary. Runoff and sediment control should be relied upon as instruments of last resort in preventing impacts from sediment release from the site. Following are some practices to control runoff, erosion and sediment in mineral exploration and development.

Strategies for Slope Contouring:

Any significant amount of earth movement during exploration will require some grade restoration or side-slope contouring. The guidelines for contouring offered below are intended for piles and side slopes resulting from any exploration activity.

- Side slopes with ice rich soils, as in "black muck", may be left vertical or near vertical to thaw and stabilize naturally. Ideally these may be undercut so that the top vegetated mat falls over and covers the exposed ice rich slope.

- Side slopes and/or push piles may be contoured so as to blend with the natural topography and the top of piles and slopes may be rounded off.

- Side slopes with no permafrost made up of coarse, well drained soils should be graded to a slope less than 2 horizontal: 1 vertical, and if over 15m high should be benched to prevent excessive erosion.

- Side slopes with no permafrost made up of poorly drained, fine grained soil should be graded to a slope less than 3 horizontal: 1 vertical.

- Piles of coarse soils should be graded to a slope less than 2 horizontal: 1 vertical, and the top of the pile rounded off.

- Piles of fine grained soils, topsoil or organics should be graded to a slope less than 3 horizontal: 1 vertical and the top of the pile rounded off.

- Side slopes with less than 5 percent frost by volume should be graded to a slope less than 2 horizontal: 1 vertical and the top of the slope rounded off.

Strategies for Surface roughening

If done properly, surface roughening or “scarification” can cut sediment load from slopes by more than fifty percent. Scarification just means breaking up compacted surface material and is best accomplished using some kind of implement to scratch the surface parallel to the contour of the slope, like harrowing a farm field. Exposed slopes should not be left smoothly graded and compacted because this practice leads to increased runoff velocities. Roughening slows the water down, reduces soil compaction, increases infiltration rates and provides micro sites that promote natural re-vegetation. Surface roughening can be accomplished by tracking slopes with machinery or simply placing logs and woody debris on the slope; but it has to be done in a specific direction. The grooves left by the grouser bars on the tracks must be perpendicular to the slope direction, because grooves parallel to the hill will accelerate the runoff and increase the erosion.

Where surface soils appear unlikely to sustain growth, these areas could be prepared as follows:

- Topsoil and organic matter set aside may be bladed out onto the surface.
- The soil matrix may be improved by blading fine-grained soils onto coarse-grained surfaces.
- A native selection seed mix and fertilizer appropriate for the site characteristics and region may be applied.

Strategies for using rock to control erosion

There are two strategies to control erosion; using the coarsest available materials to control the force of water and using plant growth in combination with machine work to control erosion. For the first strategy, the minimum rock size required to armour an area must be determined prior to use to ensure that the rock used will not wash away.

Uses of rock for erosion control include:

- Covering for slopes that are difficult to re-vegetate
- Lining of erosion-prone ditches
- Weighting of the toe of slopes by adding rock to form a permeable berm, preventing rotational slope failure
- Protection of stream crossing structures
- Scour protection at outlet areas such as culverts and drainage ditches
- Stream bank protection

Strategies for controlling sedimentation

To control down-slope and downstream sedimentation, an operating plan should include measures to keep sediment-laden water caused by land use operations from reaching streams. Following are some suggestions on how to achieve this:

- Construct a sump either by pushing up berms or by excavating depressions, or else by using existing topographic low areas to trap silt-laden run-off from unstable slopes or cut banks.
- Maintain a vegetated buffer strip or setback between the natural boundaries of streams and the operation. These setbacks can perform well as sediment traps and also serve to maintain stream bank stability and limit the destabilisation of the watercourse itself.
- Arrange windrows of slash perpendicular to the slope to trap sediment from stripped areas.
- Construct drainage ditches along the bottom of highly erosive piles or slopes to carry silt-laden run-off to either sedimentation ponds or alternative sediment traps.
- Construct benches on slopes to control erosion.

3.3 Guidelines for Re-vegetation

Requirements

The Operating Conditions outline practices related to re-vegetation, and specifically include:

- how the vegetative mat shall be removed;
- taking care to preserve native seed stock (#1);
- re-establishing vegetation, including requirements to mimic similar, naturally occurring environments in the area (#2(1));
- provision of an adequate growth medium (#2(2)); and
- avoidance of any introduction of non-invasive species (#3).

Fundamentals

Once a disturbed site has been re-contoured, the goal is to give natural re-vegetation the best possible chance of success by leaving the soil surface in a condition that will promote plant growth which closely approximates the naturally occurring environment. The question is whether or not a given surface will be likely to re-vegetate. Compacted surfaces, smoothly graded surfaces on slopes, and dry coarse-grained surfaces are the least likely to sustain growth. Make the best use of organic materials by spreading conserved piles onto surfaces not likely to re-vegetate on their own. The following are some suggested methods for the re-establishment of the vegetative mat[3].

Strategies for Re-vegetation

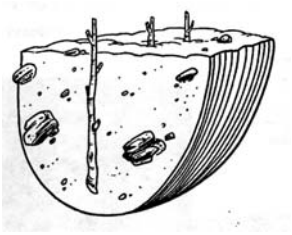
[3] For additional options and in-depth strategies specific to the Yukon operators may wish to consult the "Guidelines for Reclamation/Re-vegetation in the Yukon" (1993), Edited by C.E. Kenedy, Yukon Government Publication.

Machine spreading of stockpiled organics

At the beginning of the exploration activity, strip and stockpile only the top horizon of soil – as deep as root penetration – and make windrows of this material perpendicular to the slope or in a convenient place to be spread out later. (This material is often referred to as the "vegetative mat").

Set aside stripped pods of immature vegetative mat and stockpile for planting later. (The pod will die off if it dries out or if the roots are exposed). The material should be stored in a manner that prevents die-off and should be replaced as soon as possible after completion of mining. When the area has been explored, prepare the slope/area. Backfill trenches, re-grade piles to acceptable slopes and bench exposed slopes if a trench runs parallel to the slope. Then spread the stockpiled material back over the area. If a tracked excavator with a thumb is available, this can be used to develop pods of organics in small depressions, and to throw lager pieces across the surface. A dozer or loader can also be used to spread the organics over wide areas – keep in mind that tracks should be parallel to steeper slopes. Machine spreading is of course, much more straight-forward on level terrain.

Planting Woody Vegetation



Woody vegetation will help re-establish natural vegetation on disturbed sites and provide resistance to erosion at the same time. Planting woody vegetation in the Yukon really comes down to willow and alder with some use of poplar. Live cuttings of willows and other shrubs should be taken when the plant is dormant – either after the leaves fall off in the fall or before the buds fill out in the early spring. The cuttings have to be kept in a cool, moist, dark place until needed. No method will work unless the plants are collected at the right time and installed properly. (See bioengineering, p. 18)

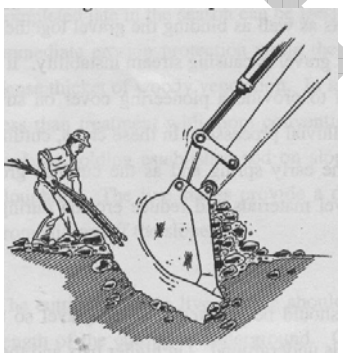
Stripped pods of immature vegetative mat can be dug up, preferably by hand, and stockpiled for planting later (figure 4). This is most effective in programs where the reclamation is done shortly after testing is completed because the pod will die off if it dries out or if the roots are exposed. The length of time it takes to replant the vegetation will determine what care is required to ensure survival of stockpiled vegetation.

Figure. 4. In this alpine setting, where re-vegetation slow, the vegetative mat is carefully stripped and set aside for replacement once sampling of the trench is completed. This technique is most effective when reclamation occurs soon after disturbance.

Seeding

Natural species are far preferable when considering planting any vegetation in areas disturbed by mining in the Yukon. Guidelines are published which list the recommended mix of native varieties ("Guidelines for Reclamation/Re-vegetation in the Yukon"). These typically include a few grasses mixed with legumes. Native varieties are available from suppliers who may recommend specific mixes for the area depending on climatic zone and elevation. In order to closely approximate the original environment and avoid the introduction of noxious or invasive species, the use of native seed mixes is preferred. Seeding will be much more effective if the site is first prepared by scarification or other means of creating seed traps and micro sites for moisture and seeds.

Bioengineering



Gravel Bar Staking

Bioengineering normally means the use of live plant material to stabilize stream banks or side slopes to prevent erosion. Bioengineering in mining exploration applications is very new to the Yukon. It is being actively tested by the Mining and Petroleum Environment Research Group (MPERG) and shows some promise for effective solutions to erosion problems (MPERG reports are available on website www.yukonmining.com). The method is labour intensive and has a short window of opportunity in the Yukon. The time-frame to use this technique is short because most of the methods should be done when plants are dormant, such as in the early spring or fall.

There are many different types of bioengineered structures; brush layers, wattle bundles and fences, pole drains, live staking, gravel bar staking (shown above), live brush

mattresses and geotextile wraps to name a few. By using plant material to make a silt fence, the plant growth will anchor the soil, form a micro terrace and naturally stabilize and strengthen over time. Little or no maintenance is required. Live silt fences may be useful on overburden piles or on problem exposed slopes such as at the top of a permafrost gully.

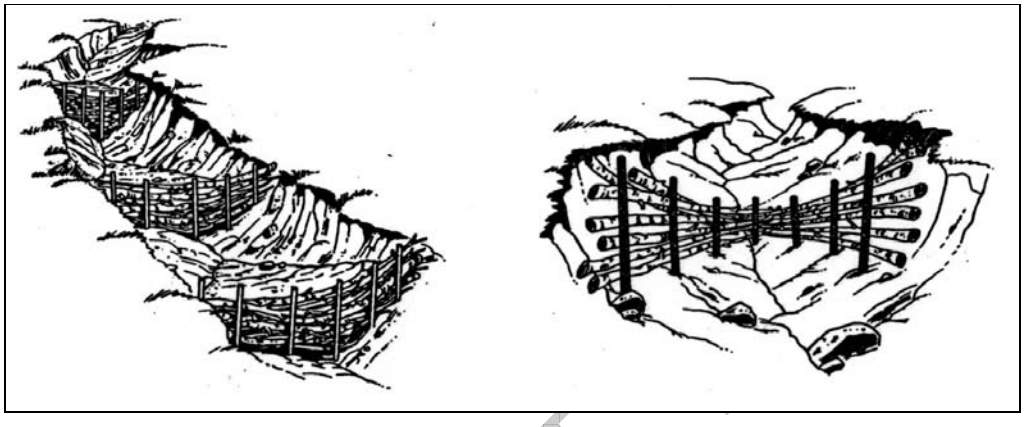


Figure 5. Live silt fences or wattle fences use live woven cuttings and stakes to prevent ongoing erosion.

Bioengineering techniques for mineral exploration applications are site specific. Field trials and individual experiments will eventually develop a group of effective methods. Research and experimentation on bioengineering are ongoing in the Yukon. Up to date information, analyses and results are available on the MPERG website - www.yukonmining.com

3.4 Permafrost Considerations

Requirements

All exploration activities must be conducted in a manner that avoids or minimizes the disturbances of local permafrost conditions (operating condition #5). Reference to permafrost requirements are also found for roads and trails (#34 & 36).

Fundamentals

Some areas underlain by permafrost are more sensitive to the potential erosion effects of physical disturbances than areas which are not frozen all year round. For example, as frozen ground is exposed to surface temperatures it will begin to melt and can result in large volumes of surface water. The rates of erosion, as well as re-vegetation success, are quite different among the mining districts depending on permafrost thicknesses, lateral extent and water/ice content. If fine grained soils with high moisture contents are encountered, melting can result in failures even on very flat slopes. The approach to erosion control and re-vegetation is different as well. Look for suggestions of strategies for working in permafrost throughout this guide, within the specific areas of activities that you are planning (i.e. camp construction, clearing, trenching, drilling, and road construction).

The following map shows how the different permafrost types in the Yukon are distributed. Because of its widespread distribution throughout the territory, permafrost considerations are of importance to most, if not all planned exploration operations.

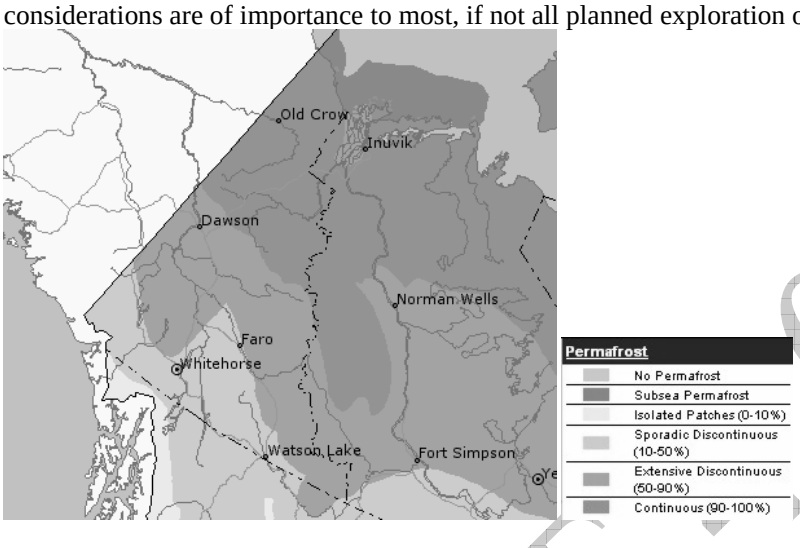


Figure 6. Distribution of permafrost in North-western Canada (taken from the Natural Resources Canada atlas website).

Preferred Methods

Due to the sensitive nature of permafrost the following hierarchy of actions should be applied when working in these areas:

1. Prior to undertaking activities identify areas of permafrost through reconnaissance and air photo interpretation of the area.
2. Avoid areas of permafrost wherever possible.
3. Where areas of permafrost cannot be avoided, take reasonable measures to ensure disturbance does not occur (One possible measure is operating during winter months).
4. Where disturbance of permafrost is unavoidable, take measures to stabilize the area and prevent ongoing thaw erosion.

Features to watch for when identifying areas of permafrost include:

- Widely dispersed, stunted and typically-leaning black spruce
- Vegetative mat dominated by moss and shrubs
- North facing slopes in discontinuous permafrost areas.

4.0 Mineral Exploration Camp Operation and Management

Requirements

The objectives associated with exploration camps are outlined in the Operating Conditions (#10 & 11) and can be summarized as follows:

- Avoiding land or water pollution and risk to wildlife through proper waste disposal and handling.
- Attention to litter and waste management and reduction.
- Clean up and restoration of work areas or campsites seasonally and at the end of the exploration program.

Operators must maintain a camp in a sanitary condition and provide adequate facilities for persons in camp, according to the Regulations Respecting the Sanitation of Camps under the *Public Health and Safety Act*. The conditions of workplaces and buildings are also specifically regulated by the Public Health Regulations. Unsanitary conditions that may endanger public health, or anything that accumulates on site that is likely to become a public nuisance, is to be avoided.

The *Environment Act* includes provisions respecting the storage and disposal of solid waste. A permit is required under the Solid Waste Regulations to construct, operate and maintain records in relation to a dump used for the disposal of solid waste. The local environmental protection officer will provide operating standards for the construction and operation of a dump. Solid waste shall be handled and disposed of in a manner that does not attract or is likely to attract wildlife, according to *Wildlife Act* requirements.

Depending on the system used for management of human waste, either the "Standards for the Construction, Installation and Maintenance of a Pit Privy" or the Sewage Disposal Systems Regulations (PHSA) will apply as well as the Public Health Regulations. Contraction of a communicable disease by a person in camp requires certain precautionary measures on the part of operators, as set out in the Regulations Respecting the Sanitation of Camps.

At the end of the program, the operator is required to remove materials and equipment which would otherwise be considered rubbish, in accordance with the Regulations Respecting the Removal of Rubbish.

Various other provisions under the *Environment Act* may apply in certain camp situations. Some equipment used for heating, electrical generation and incineration may be regulated and require a permit under the Air Emissions Regulations. A permit may be required if special waste will be generated, handled or disposed of in relation to the camp and exploration program as set out in the Special Waste Regulations. The handling, offering for transport or transporting of special waste or waste dangerous goods will have to be done in accordance with requirements under the Special Waste Regulations, the *Motor Transport Act*, and the federal *Dangerous Goods and Transportation Act* as well as the *Motor Vehicle Transport Act*.

Fundamentals

Choosing a location for your camp, shop, and other infrastructure requirements is extremely important; planning ahead will result in minimizing the reclamation activities required at the end of the operation. Your initial examination of the property should take into careful consideration where the least impact will result from the continued use of a site.

When camps are established on or near sheep habitat, two types of impact may occur. First, the camp itself and associated facilities may destroy sheep habitat. Second, and more important, the activities of people living in such camps can disturb the use of habitat by sheep. The noise generated at a camp by heavy equipment, generators or compressors has been shown to displace sheep. The magnitude of these impacts will vary according to the size and duration of the camp, the types of activities carried out, the mode of access (land or air), proximity of activity to key sheep habitats and whether or not the local sheep population is hunted. Sheep displaced by camps may affect traditional range use and can lead to permanent range abandonment.

The presence of camps in the wilderness is the main factor in attracting wildlife into project areas. Strong odours and an abundance of garbage in camp can attract bears, particularly young bears, into situations that are dangerous, not only to bears but to humans and human property as well. Adult bears in situations such as this "produce" generations of young bears already food conditioned and less responsive to human presence. These bears often take these habits to other parts of their home range and enter into conflict situations well removed from the source that instigated the behaviour.

Strategies for Camp Location and Layout

- When establishing a new camp, locate the campsite in existing clearings or abandoned camp sites where practical. Wherever possible, locate camps where they can be accessed by existing transportation networks.
- Locate residential and office buildings no less than 30 meters from the high water mark of streams.
- Locate mechanical shops or buildings camp facilities and structures used for storage of toxic/deleterious materials no less than 30 meters from the high water mark of streams.
- Lay out buildings and other facilities on well drained soils with enough room for present and future needs.
- Locate subsurface grey water pits and/or pit privies at least 30 meters from the high water mark of streams and at least 1.2 meters above bedrock or water table. If very permeable soils are encountered, the pit privy or grey water pit should be lined with 0.6 meters of sand or silt. These measures may help to prevent downstream pollution by pathogenic (disease causing) organisms.
- A properly designed and installed sewage disposal system may be required for large camps and certainly for permanent dwellings. Complete information on private sewage disposal systems is available from Health & Social Services, Environmental Health Services or the nearest Natural Recourses Officer office.

If a large-scale camp is planned with permanent structures or more than 250 person-days per season, or the camp is situated in an environmentally sensitive area, more sophisticated measures and more consultation with the Chief of Mining Land Use will be required when developing the Operating Plan.

Strategies for Wildlife Key Areas Protection

The following will assist in minimizing the potential for negative impacts on local wildlife resulting from mining land use camps:

- Avoid establishing camps on sheep ranges. If camps must be established within sheep range, avoid locating them on or within 1 kilometre of key areas such as winter ranges, lambing areas, rutting grounds and mineral licks. If no alternatives exist, seasonal restrictions may minimize negative impacts. (See Sheep Management Guidelines from DoE.)
- If possible, reduce the noise level generated at a camp by muffling equipment such as engines, compressors and generators.
- Wherever possible, do not establish new land access to a camp, but use temporary winter access to haul in equipment and material.
- Burn combustible and odorous kitchen waste on a regular basis in an acceptable incinerator or remove daily to a designated waste disposal site. Forced air or fuel fired incineration should be used to ensure food remains are completely burned. The incineration of garbage will help to eliminate odours attractive to bears (garbage odour is the attraction in 70% of bear problems). Incineration can save money and also saves bears. More information on avoiding bear problems is available from the Department of Environment.
- A home built incinerator should have a good venting system and mesh to suspend the garbage as well as slow burning accelerant like diesel fuel to promote a complete burn. Commercial forced air, fuel fired incinerators should be considered for large camps. The main thing is to incinerate the garbage, not roast it in a pit or common drum because this will only attract bears. Also, open pit burning is often forbidden due to fire hazards.
- Do not randomly dump/store garbage, including at the periphery of the site.
- Dispose of incinerator residue by burying in a designated pit or remove residue from the site
- Store garbage in wildlife resistant sealed containers until disposed of.
- Back haul solid waste to the nearest maintained dump
- Burial of non-combustible waste including metal, wire, glass and plastic, is only allowed when a mining inspector has been consulted prior to the burial of any material and has approved the location, method and means of burial.
- When non-combustible debris is buried, it should be crushed and/or compacted and then buried beneath at least 1 meter of compacted overburden to ensure erosion control and to prevent eventual exposure.
- Remove all garbage in continuous permafrost areas. Buried material in permafrost is likely to be forced to the surface by frost action.

- Avoid scattering wood debris, empty drums, junked equipment and metal waste over the claims. Remove these items from work areas regularly and keep in a secure area for final disposal.

For Seasonal Shut-Down:

- Back haul all non-combustible garbage. When backhaul is not possible, inert materials may be buried on site with 1 meter of overburden. Compact overburden after burial to prevent soil erosion and facilitate re-vegetation.
- Look around. Has solid waste been cleaned up? Have wildlife attractions been removed?

For Final Camp Abandonment:

- Remove everything from the site, including all buildings, machinery, materials, fuel drums, used hydro carbons, unburied solid waste, and metal waste including junked vehicles.
- Certain structures and materials may be left on site for future re use in accordance with an approved operating plan.

5.0 Getting There - Access Roads, Trails and Off-Road Trail Use

Requirements

The objectives for use of existing and planned roads and trails or off road trail use are to minimize the footprint, mainly through careful planning and by taking appropriate actions where foreseeable problems arise (operating conditions #33 to 38). It is also important to keep in mind that the Operating Conditions and their objectives for archaeological sites, erosion control, re-vegetation, permafrost, and fuel storage apply.

Road construction on and off claims will require the applicable approvals under the MLUR and Land Use Regulations. On quartz claims, the road will be included in the Notification or Operating Plan. Off-claims, a Land Use Permit will be required.

Use of existing roads and trails are subject to weight restrictions:

- Use of trails and roads must be within the design limits or tolerances of the road or trail. Where the design limits or tolerances are *not* known:
    - for roads, vehicles with less than 40t GVW may be used;
    - for trails, vehicles less than 20t GVW may be used.
- Vehicles must be operated so as to avoid rutting or gouging of roads or trails.
- Vehicles greater than 20 t GVW may not be used when severe rutting and gouging of the route results

Temporary trails, which are defined as trails for which access must be blocked to prevent further vehicular access when an operation ceases, are used primarily in the early stages of exploration and are allowed for Class I activities subject to strict environmental standards:

- Routes must be reconnoitred and flagged
- Width does not exceed 7m or 1m more than the width of the equipment to be moved along the temporary trail, which ever is less,
- The temporary trail is only used for the purpose of moving sampling equipment between test sites

Fundamentals

The following guidelines and references are offered to assist in completing a mitigation/reclamation plan for an access roads or trails. Each area within a corridor will have its own unique terrain and site specific engineering problems. Prior to ground truthing, topographic map and air photo reconnaissance should be done. Through air photo interpretation it is possible to predict permafrost areas (through vegetation interpretation), severity of slopes, timber size, surface material type and availability, wet areas, etc. Active and abandoned stream channels will be obvious. All photo interpretation should be verified on the ground - even the best photogrammetrist can make interpretation errors.

Strategies for road planning

- *Plan Routes Carefully*
- Review maps and air photos.
- Where possible use an aircraft fly-over.
- Scout the trail to gauge potential pitfalls such as seepage areas and bogs.
- Plan routes carefully to avoid areas where permafrost degradation or other conditions will cause erosion
- Implement appropriate wildlife protection measures, which may include maintenance guidelines for winter, speed reduction zones, signs at crossings, radio equipped trucks and reporting of wildlife on roads.

What to Avoid when Selecting a Route

- Avoid seepage zones by routing to drier, elevated ground where practicable.
- Avoid areas of erratic slope changes to evade extensive cut and fill requirements.
- Avoid steep slopes. Select routes to keep slopes as low as possible. Maximum grades of 8 to 10 percent are desirable, although short pitches (less than 5m) of up to 15 percent are acceptable if necessary.
- Avoid north facing slopes.
- Avoid unnecessary stream crossings. Select crossings that approach the stream at right angles and cross where the channel is straight, unobstructed, well defined, and has minimum bank height.
- Avoid known archaeological and burial sites. Consult with the First Nation nearest the proposed route and the Heritage Branch of the Government of the Yukon to find out about known sites along the route. In some cases, an archaeological survey may be called for.
- Avoid duplication of roads and trails. Consideration should be given to all existing trails and roads in the immediate area. If at all practical, these roads and trails should be utilized rather than constructing additional ones, but make sure the old route is in an acceptable location first. Many old roads and tote trails were pushed in with little regard for the environment. Use of these routes may not be acceptable today.
- Do not use stream beds or channels as part of access routes.
- Avoid construction of roads wider than necessary for the equipment that must be moved. Build the road consistent with safety and traffic needs, while planning for the least reclamation.
- Avoid environmentally sensitive areas, critical wildlife habitat, and critical time periods for wildlife.

Access Roads Trails in Permafrost

Here are basics to minimize disturbance and sedimentation when getting to and from a mineral exploration site:

- Avoid areas of permafrost where practicable.
- Where it is not possible to avoid permafrost, select routes that are upslope or on ridges where bedrock is closer to the surface.
- In areas of discontinuous permafrost, select frost-free, south-facing slopes where possible.
- Plan for minimizing impact and how to fix or reclaim the trail. For example in areas of semi-frozen taiga sensitive to any impacts including low ground pressure vehicles, the tracks made by the vehicle may have to be covered with mosses or local vegetation to ensure that the ground re-freezes and does not become a channel for water to accumulate in.
- If possible, use a low-impact vehicle or ATV rather than moving heavy equipment back and forth to access work sites.
- In the event that rutting and gouging occurs, the surface must be restored by re-grading and repairing the road surface. This avoids the gouges becoming stream channels during heavy rain events and road surface erosion.
- Avoid serious terrain damage by moving heavy equipment when the surface is frozen and has good snow cover.

Figure 8 Degradation of the vegetative layer, which acts to insulate the underlying ice, has resulted in pooling of melt water at the surface.

5.1 Building New Bush Roads

Information needed when proposing a new road includes:

- The route marked on a topographical map
- The location of existing roads and trails
- The location of proposed stream crossing and bank conditions
- The location of any proposed culverts
- The road condition (i.e. 2-wheel drive, 4x4, winter only)
- The start up date for construction
- The method used to maintain the road

Winter access routes are subject to the following:

- There must be adequate frost penetration and snow cover to support vehicle weight
- Snow fills must be removed from stream crossings before spring break-up
- Dozer blades must be raised to avoid cutting the organic layer
- Rubber pads must be fixed to tracks, reducing impact on the organic layer

5.2 Drainage Structures

Fundamentals

Mining roads and trail systems should be designed, maintained and operated to maintain the surface drainage pattern by letting the water cross the road through cross ditches and cross drains (usually a culvert or log flume to convey water from one side to the other). The following are some established ways to achieve drainage on bush roads and trails.

Strategies

Cross drainage techniques:

In-sloping or out-sloping the road surface can control water without ditches or cross drains. In-sloping keeps the water in the road cut and out-sloping directs the water across the road to the shoulder. This technique is for roads at less than 6% grade and with very little planned traffic.

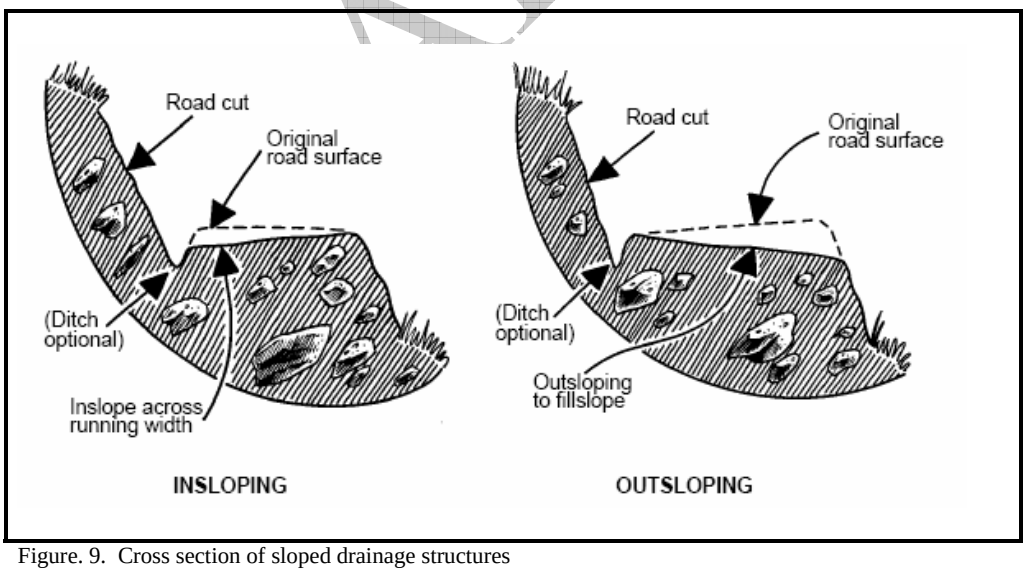


Figure. 9. Cross section of sloped drainage structures

Ditching:

Ditches are designed to catch intercepted underground flows and runoff and deliver it through cross-drainage to the low side of the road, keeping the roadbed well drained. If

possible, ditch drains should not discharge directly into streams. On grades steeper than 5%, ditch vegetation should be encouraged as a means to prevent ditch erosion, especially in fine-textured soils. In extreme cases, ditch erosion can destabilize stable cut slopes. Frequent cross drainage should be built to reduce the amount of water and its energy.

In fine-textured soils where fill slopes are highly erosion-prone, cross drain culverts are not desirable because of the inherent risk of erosion. An alternative is to armour the ditch with rock and carry water down-grade in the ditch until it can be safely taken across with a cross drain culvert. Placing "rock steps" in the armoured ditch at right angle to the flow will also collect fines and slow down the ditch water. Narrow, V-shaped ditches will speed up flows, whereas wide, flat-bottom ditches will slow it down. This is important to know because doubling the water velocity (speed) will allow the water to move particles 32 times bigger and 64 times heavier. A number of manufactured products such as silt fences, silt grids, as well as bioengineering (see above) etc., are available to reduce ditch erosion and to collect fines. However, they should be considered temporary solutions that require regular inspections, maintenance, and eventual replacement. The best ditch will fail if sloughing of the cut slope occurs. Ditch construction and maintenance should therefore always establish stable cut slope angles.

Where the road cut is constantly sloughing and filling the ditch, a longitudinal french drain can be used. In-sloping or out-sloping the road surface may also be appropriate to control water flows. Do not direct water onto erosion-prone or unstable slopes.

The following are a series of diagrams which illustrate construction details for various types of drainage structures typically used in roads (Figures. 10-12).

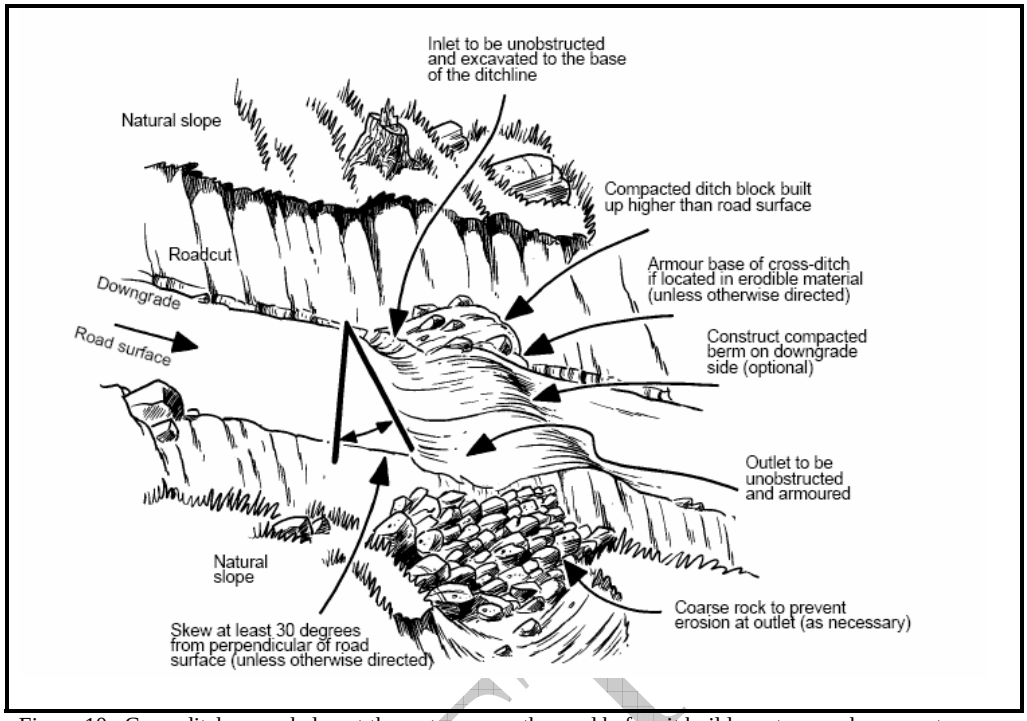


Figure 10. Cross ditches can help get the water across the road before it builds up too much momentum. .

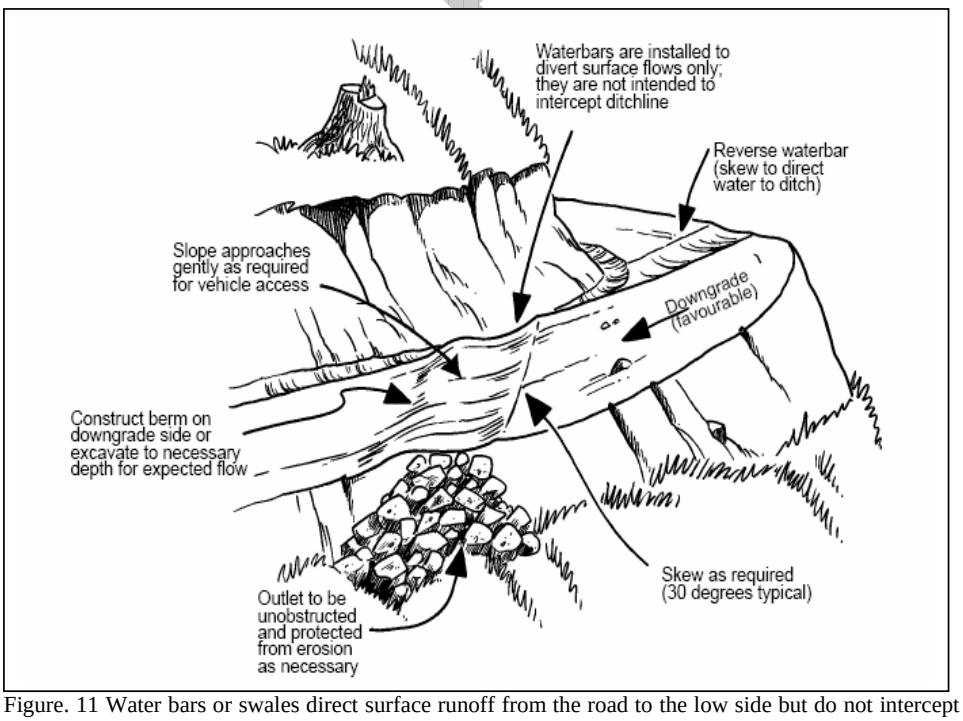


Figure. 11 Water bars or swales direct surface runoff from the road to the low side but do not intercept the ditch line

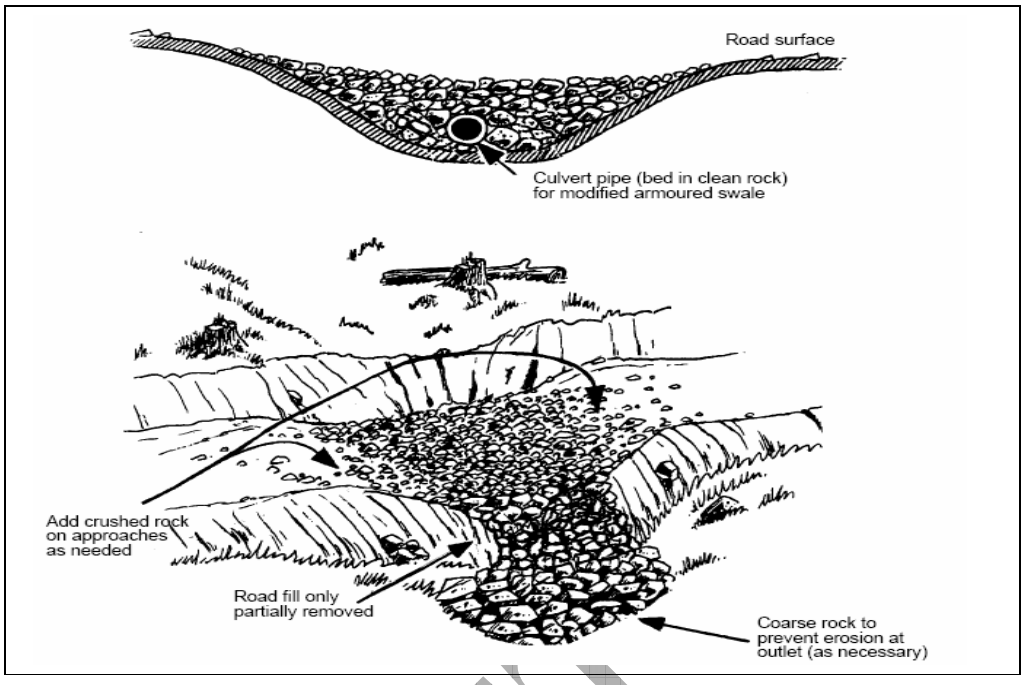


Figure. 12 Armoured swales direct surface runoff from the road to the low side

Cross Drains:

Install cross drain in-fills using corrugated metal pipe (CMP) or log culverts high enough in the road to let the water drain away (Figure 13). If the ground is soft or it looks like the culvert will settle, support with rock or support the log culvert with mud sills (logs under the bottom crib logs).

- Slope the cross drain at least 2% and not more than 20%
    - Space the drains frequently enough so that 16 to 24 inch pipes can handle the high flows (as opposed to large pipes spaced far apart)
- Construct parallel ditches on steep slopes and uphill patches
- Install corduroy logs
- Ditch blocks are berms of coarse material that force the flow into to a culvert. The top of a ditch block must be kept about one foot (.3 m) below the road grade so that if the culvert plugs, the water rises over the ditch block and carries on to the next one instead of washing out the road.

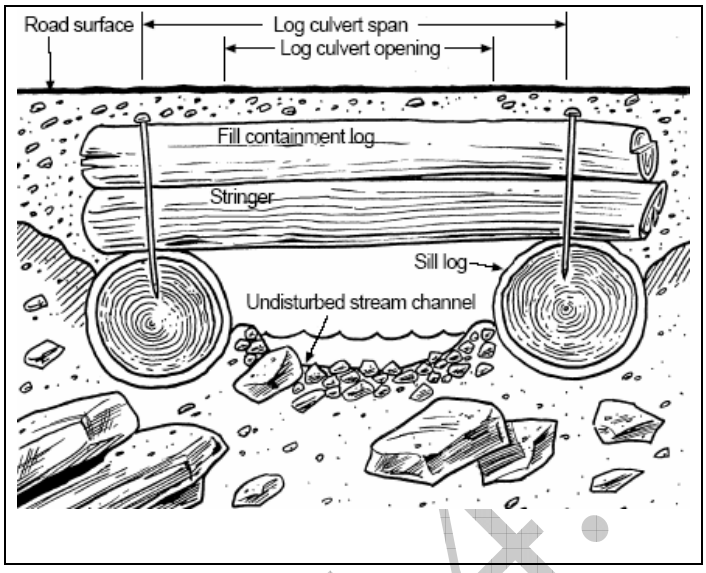


Figure. 13. Cross section of a log cross drain

5.3 Sediment control along roads

Sediment traps

For runoff drains and ditches the most common sediments are sands and gravels that are eroded from the bed and banks. Simple traps can be installed at points where channel slopes decrease or before cross drains to allow these materials to settle. These clean-outs or traps can then be mucked out during low flow. Settling rates are dependant on the size of the particle, but if channel velocities are reduced to 1 foot per second (0.3 m/s) most sands and gravels will settle out in a very short distance. A typical sediment trap in a ditch would be twice as deep as the ditch when full and about three times as long (twice the bank-full depth for a distance of 3 bank-full widths). As a rule-of-thumb, the clean-out or trap should have 0.5-1.0 m of sediment storage in the bottom before the materials would impeded normal flows.

5.4 Stream Crossings

Requirements

The Department of Fisheries and Oceans, Canada (DFO) are responsible for enforcement of the *Fisheries Act*, which protects fish and fish habitat. If your planned access routes will cross any streams or other small waterways you need to consider whether you will require authorization or a letter of advice from DFO.

You will require a water license under the *Waters Act* if you plan to:

- Alter banks or stream beds in order to make your crossing
- Plan to install a culvert
- Utilize a crossing that is greater than 5 meters in length from high water to high water points on each side of the crossing
- Deposit a waste

Fundamentals

If the route has been planned carefully then stream crossings will have been kept to a bare minimum. However, in many areas of the Yukon the strict avoidance of streams while exploring your claims might not be possible.

Examples where this might be the case include areas where:

- the terrain is steep and small incised gullies are abundant,
- the area has already been mined and the existing access roads to and on your claims already have established small fords.

For any stream crossing, whether you require permission or not, the following are preferred methods:

- Select crossings that approach the stream at right angles
- Cross where the channel is straight, unobstructed, well defined and has minimum bank height.

Fording streams in less sensitive fish habitat should be done so as to reduce sedimentation and erosion. (If fording is necessary across bigger creeks or rivers, DFO should be consulted for specific advice.) Significant stream crossings wherever there is fish habitat must be designed according to existing licensing and DFO protocol.

Strategies

A ford is just a dip in the road built to allow wet crossings of a stream during low to normal flows. Fords should be safe, erosion free, storm-proof and require no maintenance. The stream should be checked to make sure it is not a fish stream. A good ford should let high flows through without erosion, not have gross sediment input from the approaches and keep the stream from jumping its banks at high water. A ford should either pass debris or trap it.

The largest cobbles or boulders in the channel are the sizes to look for when making a ford because these have resisted erosion so far.

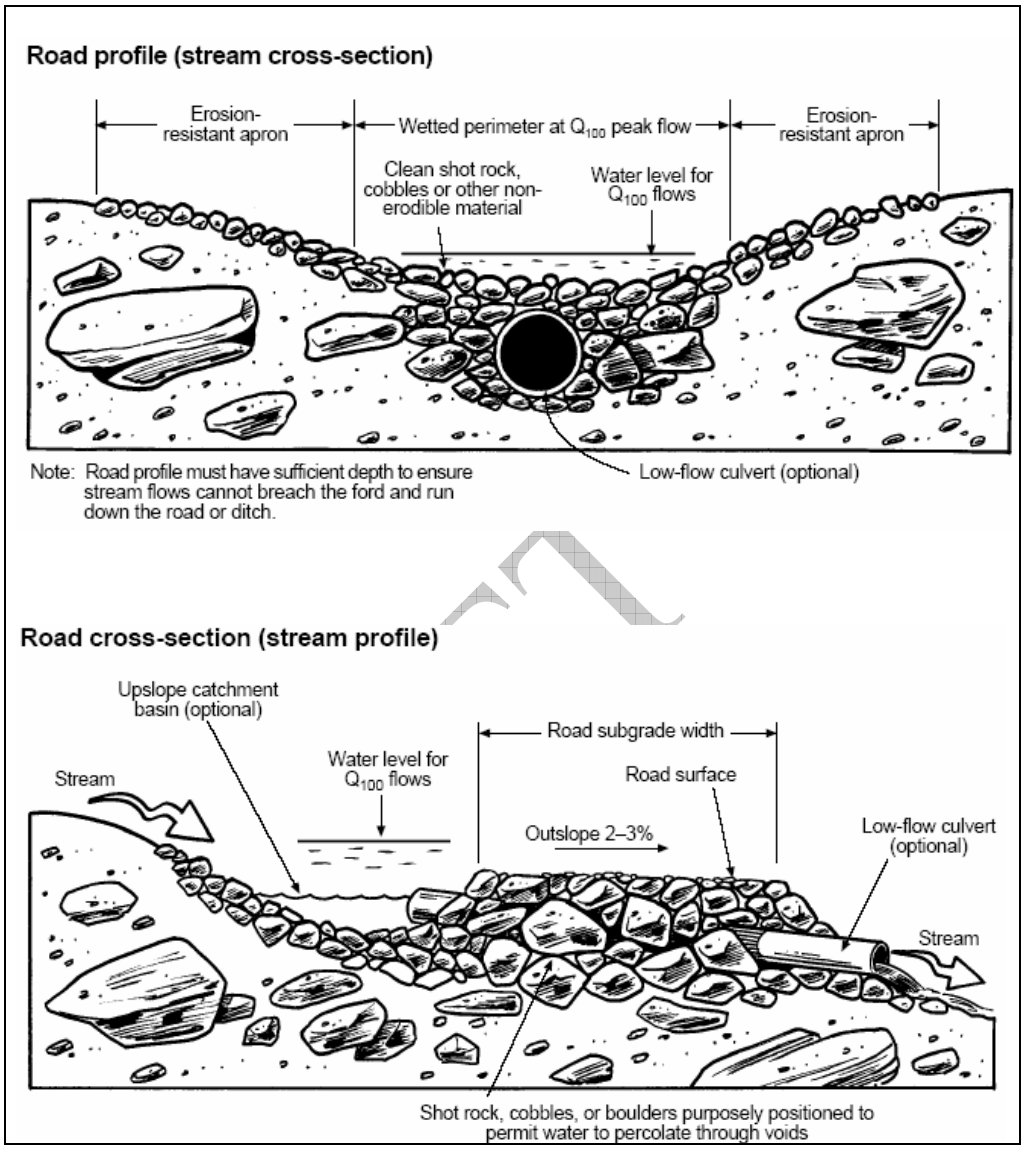


Figure.15 Longitudinal and perpendicular cross sections of a stream fording.

Abandonment or Reclamation of Roads and Trails:

If the access road leads to other operations or forms part of a publicly used road system, it does not have to be reclaimed. Otherwise, public access should be blocked by constructing barriers of logs, slash, berms or other acceptable means.

- All culverts should be removed and replaced by non-erosive cross ditches.
- On steep access, earth breakers may be built upon to divert surface runoff.
- Compacted surfaces should be scarified to promote re-vegetation.
- Entrance ways into open pits at mine sites should be blocked by barriers such as earthen berms, slash, logs or other acceptable means

Abandoned Drains

If seepage from a cut slope is persistent and threatens to form gullies, the following forms of drains should be used:

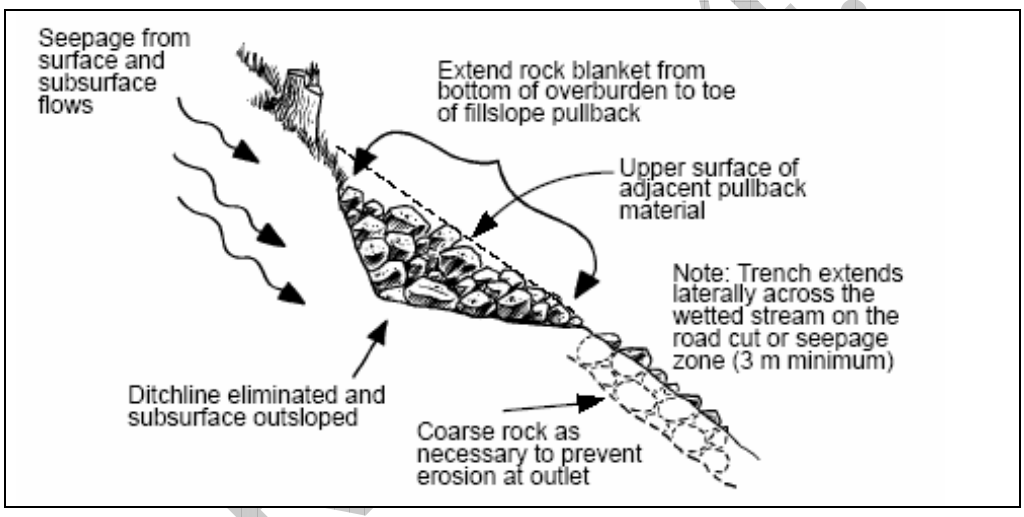


Figure.16 A Trench Drain is a coarse cross ditch to pass both surface water and seepage across the abandoned road

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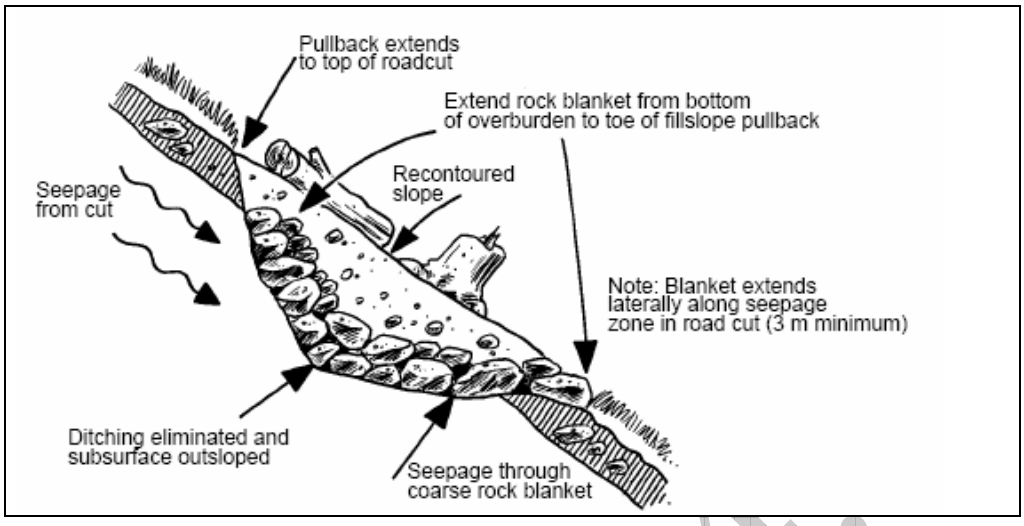

Figure.17 Blanket Drains disperse subsurface flow under the abandoned road and are not intended for surface drainage

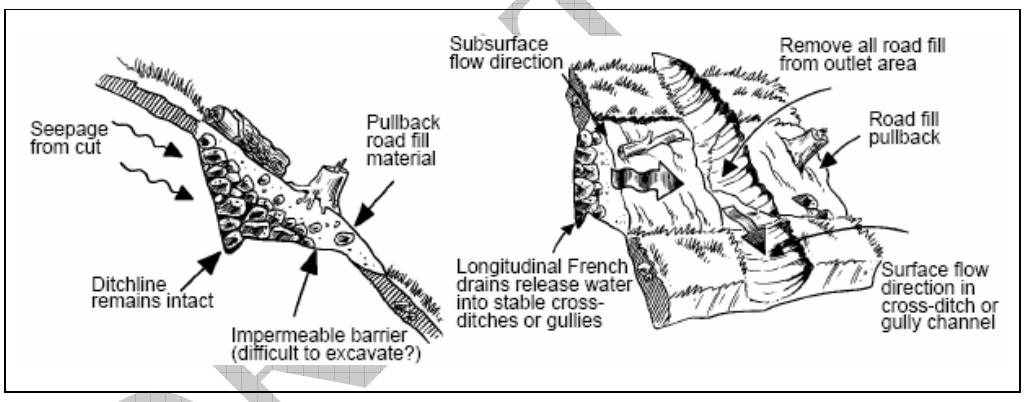

Figure.18 French Drains divert flow along the base of a cut slope and discharge it to a stable location

Abandoned Fords

The following diagram shows how to construct a ford for a road that will no longer be maintained. Armour is used to stabilize the banks and prevent ongoing erosion.

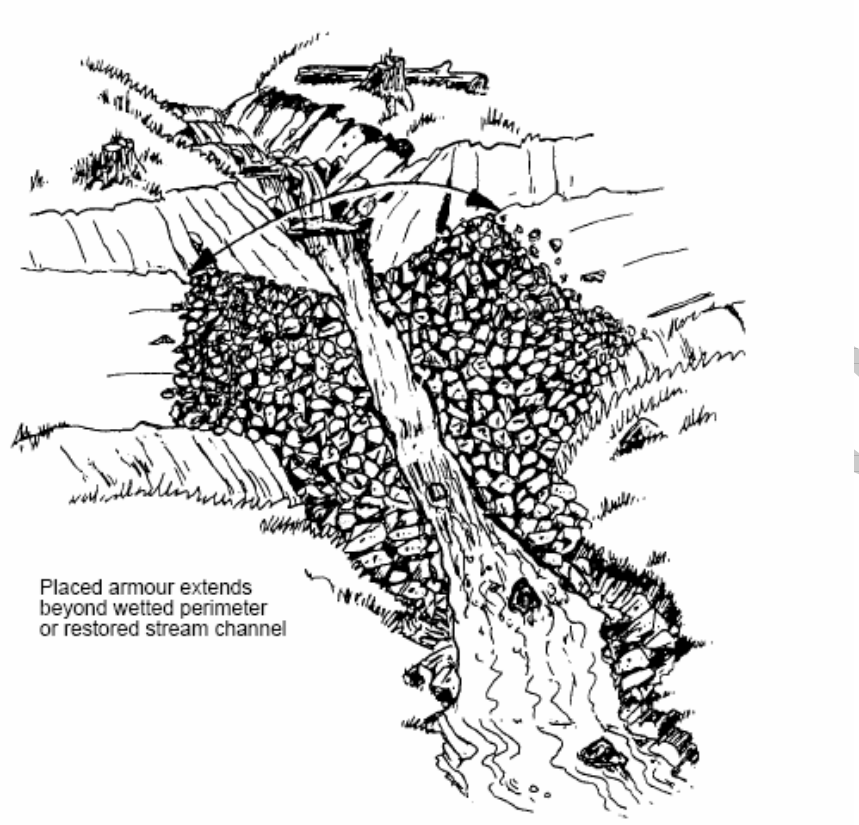

Figure19. Armoured ford on an abandoned road

5.5 Guidelines for Use of Off-Road Vehicles:

Fundamentals

If the exploration program requires the mobilization of equipment (such as a dozer, excavator or drill) to a location on the property not connected by road, care must be taken to minimize impact. As in road and trail building, planning off road mobilization is the first and most important step. Reconnaissance should include a review of maps and air photos, and/or aircraft fly over. Cause as little land disturbance as possible and avoid environmentally sensitive areas such as permafrost, critical wildlife habitat and critical wildlife time periods. In order to assess whether your claims or the access to your claims occurs in an environmentally sensitive area, contact the Department of Environment, Government of the Yukon (see Appendix D). In some cases it may be prudent to consult with a mining inspector.

Figure.20. A backhoe was carefully walked into a property located in the high alpine while a person walked behind to replace any moss which might have become dislodged.

Strategies

The route may be selected by reviewing large scale topographic maps and air photographs to select the most competent surface. The entire route should be ground truthed and flagged at regular intervals.

- If rutting and gouging that may lead to gullying, ponding, or permafrost degradation occurs, then the mobilization of the vehicle(s) should be suspended or relocated to ground capable of bearing the vehicle.
- Tracked vehicles should be provided with mushroom pads to minimize terrain damage.
- Dozers should travel with the blade raised so as not to rip up the vegetative mat.
- Where critical wildlife habitat has been identified, the route should be changed so as to avoid the habitat. (please refer to information on Protecting Wildlife)
- Vehicle travel may have to be temporarily suspended so as to avoid disturbance to wildlife during critical periods.
- When traversing ice rich permafrost areas, the vehicle(s) may only be mobilized either when the active layer is frozen, or whenever the surface is strong enough to support the vehicle without permafrost degradation.
- When stream crossing is necessary during off road use of vehicles, be sure to reconnoitre the route first and note the location and bank conditions in the Notification or Operating Plan. Preferred methods for crossings are right angle crossings to the stream or across a suitable coarse-grained diagonal.

Crossing of fish bearing streams may be allowed under certain circumstances on the advice of the Department of Fisheries and Oceans and in accordance with the

requirements of the *Waters Act*, but don't use stream beds as access routes, especially on low gradient streams. Using stream beds as access routes in open water may result in charges pursuant to the *Fisheries Act*. Consultation with the Habitat Enhancement Branch of the Department of Fisheries and Oceans is advisable prior to crossing any stream.

Winter access

Planned overland movement of equipment may not take place until there is adequate frost penetration and snow cover. Overland movement of equipment should cease when the surface can no longer support the weight of vehicles without cutting into the organic layer.

- Snow fills should be removed from stream crossings before spring break up.
- Dozer blades should be raised so as not to cut the organic layer.
- Dozer blade shoes may be used so as not to cut the organic layer.

Figure.21 Use of winter roads/trails to mobilize equipment and supplies helps to reduce the impact of exploration programs, particularly in permafrost terrains.

6.0 Clearing Trees and Brush

Requirements

Most disturbances caused by typical mineral exploration activities begin with clearing of trees and brush. The following are basic environmental standards outlined by the Operating Conditions in the Regulations:

- Cut brush must not be piled so that it blocks movement of wildlife or people.
- Lines must be cut by hand or with hand-held tools (for Class 1 & 2)
- Lines must not exceed 1.5 m in width (for Class 1)
- All risk of fire hazard must be avoided
- Removed brush shall not be piled so that it blocks movement of wildlife or people
- Leaning trees created by the cutting of lines, corridors, temporary trails, and clearings must be felled
- When it is economically viable to do so, timber suitable for sale must be salvaged and stockpiled

Fundamentals

Larger scale removal of trees and brush from corridors or clearings requires attention to these environmental objectives:

- avoiding fire hazards
- encouraging decomposition
- allowing for salvage of economically viable timber resources, or "merchantable timber"

Reduction of cover, and creating linear openings in the forest, may increase vulnerability of wildlife to predation and hunting. Assessing this factor in making decisions regarding the extent, pattern and location of clearings in regard to known and likely wildlife use can help reduce wildlife mortality.

Strategies

The following are examples of ways to deal with brush piles which result from line cutting and clearings.

- Locate brush piles away from the edge of standing trees. Locate piles to avoid blocking existing trails used by wildlife, trappers, or other land users.
- Tightly compact brush piles and/or windrows to the ground surface by walking tracked equipment up onto the pile or windrow after dropping each blade load.
- Burn brush piles and windrows in accordance with a valid Burning Permit.
- Bury brush piles or windrows so that nothing protrudes from the ground, and cover with 1 m of mineral soil and a layer of topsoil, in that order.
- Set aside merchantable timber for salvage.

Sale of Timber

Requirements

It is not the responsibility of the operator to determine whether or not the timber which they plan to clear is "merchantable". It is up to the Natural Resources Officer to identify economically viable timber stands at the time that they review a Notification or an Operating Plan. Class 1 operators may contact the NRO to determine whether plans to remove timber involve any merchantable timber. For exploration land use in general, an "economically viable timber resource" is defined as timber of a size, quality, and quantity that can be harvested economically. Since all mining land use activities requiring mechanical clearing of significant areas of timber require either Notification or an Operating Plan, the Chief of Mining Land Use will have ample time to respond to the exploration program plan and advise the operator as to the presence of viable timber. If Yukon government officials deem the timber economically viable they may put out a tender for bids to harvest the salvageable timber. The right to use timber in support of exploration and mining activities is established in the mining legislation; however, this right is limited in scope and does not given the claimholder the right to all timber on a claim for other purposes or uses.

Sections 76 & 80 of the *Quartz Mining Act* still apply to the salvage of timber on mining claims. If there is timber surplus to needs for mining purposes, you may apply for a commercial timber permit to allow you or a third party to harvest and sell this wood. You may also deck the timber for later disposal by the Crown. Keep in mind that the removal of trees and subsequent possible salvage of timber only applies to land that must be cleared for exploration purposes. You must demonstrate to the Chief of Mining Land Use that the clearing is essential to the operation.

Strategies for Clearing in Permafrost soils

When stripping vegetation is unavoidable in permafrost areas (black spruce, moss and shrubs indicate permafrost soil), clear the trees and brush first, preferably with a chain saw. If heavy equipment is required because of the scale of the operation, windrow the active layer. Store this material in a place where it will be easy to spread back out onto the stripped area. If possible, protect these stockpiles from drying out or being eroded by runoff. (Please refer to section 3.4 on Permafrost Considerations.)

Granular, un-vegetated overburden should be left in stable piles, sloped and contoured, at least 5 m from the edge of standing trees. The following are preferred methods to keep in mind when working in permafrost terrains:

- Capture, dewater, re-vegetate. Catch the thawed muck, and dry it out. Natural re-vegetation will do the rest.
- Keep the footprint as small as required for the job.

7.0 Trenching Programs

Requirements

The environmental objectives for trenching are to minimize terrain hazards and promote re-vegetation of the site through restorative backfilling of all trenches dug by machine. Basically, the operating conditions (#6 & 7) require that when trenching is done with mechanized equipment, the operator segregate material into two piles: the vegetative mat, and the overburden, and bedrock piles. These materials are to be conserved and used for backfilling trenches.

Strategies:

- Use backhoe equipment where possible; cat trenches can cause larger than necessary ground disturbance for the same results
- Reduce instability problems by orienting trenches horizontally across steep slopes whenever possible
- Berm trenches at low elevation end to prevent failing gullies and water erosion

Backfilling trenches

- Reduce terrain hazards and promote re-vegetation through restorative backfilling of all trenches
- Where there is no organic cover, the excavated surface material should be conserved for backfill
- Prepare surface for successful natural re-vegetation by replacing the stockpiled overburden and vegetative mat when available
- Contour backfilled trenches contoured so as to blend in with the surrounding topography
- Trees and brush that were cleared for trenching may be spread over the re-contoured trench site
- For Class 1 & 2 activities, the trench must be backfilled after sampling and before the end of the season.

Natural Re-vegetation

- Avoid use of agronomic seed mixes if not required

Comment: Ask about word choice

Trenching in Permafrost

Fundamentals

Most of the instability problems in trenching arise from excavating in frozen ground or from orienting trenches parallel to sleep slopes. Thawing permafrost slopes will slough and fail until they reach equilibrium, which is usually three to four seasons.

When trenching in permafrost, cut the trees and brush first, and stockpile this material for spreading later. Use the excavator to cut into the active layer (unfrozen) and cast this material onto one side of the trench. Then cast the deeper permafrost soil and mineral soil to the opposite side. Backfill trenches in the reverse order, finishing up by placing the active layer and scattering the trees and brush onto the surface. Note that for Class 1 & 2 activities, the trench must be backfilled after sampling and before the end of the season.

Strategies

The following are some precautions to take when trenching in permafrost:

- Refill the trench as soon as possible after excavation to limit the disturbance to the surrounding overburden
- In the case of small pits or trenches that must remain open for several weeks, the placement of an insulating cover or lid, such as foam or wood, may reduce the progress of permafrost degradation
- If exploration trenches or pits in permafrost cut across slope contours, ditch plugs or other means will minimize surface water flow down the trench
- Trenches in permafrost that have been refilled and re-seeded with native vegetation tend to re-vegetate and stabilize quickly.

Figure 22. Photo on right shows a typical permafrost terrain prior to trenching and the left photo shows a reclaimed trench in the same area, two years after the end of the program.

8.0 Drilling Programs

Requirements

The environmental objective in drilling programs is to reclaim the drill site to as close to natural conditions as possible (operating conditions #25 to 32). Mobilization and support of drilling programs is subject to all other applicable operating conditions, particularly those for erosion control, re-vegetation, permafrost, cleanliness, and fuel handling.

Fundamentals

Environmental impacts associated with drilling are minimal and localized and can easily be avoided with good practice. Clearing and surface disturbance is minimal and drill sites are easily reclaimed.

Strategies

Types of Equipment

- Plan to use helicopter supported drill equipment whenever possible, particularly at the earliest stages of program development, to avoid construction of roads or trails.
- For ground accessed programs, use tracked equipment over skids. Also, for all programs the preferred standard is use of low-ground pressure vehicles.

Figure.24 Track mounted drill equipment requires a minimum of ground disturbance for temporary trails.

The following are preferred methods for drilling programs:

- Minimize the area affected by drill cuttings, and contain mud in a sump.
- Minimize the area cleared and levelled for drill platforms.

- Minimize disturbance to the vegetative mat.
- Store drill core on competent ground under a shed or other acceptable cover.
- Plug holes properly using grout, rock, logs or commercial plugs as the situation warrants, whenever holes could pose a hazard or artesian conditions are encountered.
- Be sure to handle petroleum products, waste oil and drill additives as per their operating conditions, and clean up all garbage and litter at the site.
- Avoid the use of drilling additives, and where they are necessary use non-toxic drilling additives.
- Re-circulate drill fluids wherever possible.
- Re-contour the site and re-vegetate as the situation warrants. Apply seed mix and fertilizer if natural vegetation techniques are unlikely to be successful.

Figure 25 An example of stable core storage

Drilling in Permafrost

Requirements

Experience in the north has demonstrated that the main problems encountered when drilling in permafrost terrain revolve around access. If the vegetative mat is disturbed by skids or tracks, permafrost at the surface melts rapidly and rapid erosion may ensue. An example of low impact is track mounted drills which require minimum disturbance during temporary trail construction. Use of skids should be avoided in most situations, and in particular in permafrost areas. Remember, the use of skids is only permitted outside of winter where no other means of transporting equipment is feasible (#36).

Strategies

Some things to consider when planning your drilling program in permafrost areas:

- Plan helicopter supported drill programs.
- Drill during times of freeze and snow cover to reduce disturbance of the surface layer.
- Limit disturbance to the vegetative mat on drill pads.
- Limit size of clearings to minimum requirements.

Figure.26 In response to environmental considerations, small drill equipment easily transported by helicopter is becoming more widely available.

9.0 Handling Chemicals and Fuel

Requirements

The objectives of fuel and hazardous substance handling and storage (operating conditions #12 to 19) are:

- Spill prevention through proper handling, storage and contingency planning.
- Secondary containment for large volumes of stationary storage.
- Prevention of land and water pollution through proper vehicle operation and maintenance, and safe handling and disposal of waste petroleum products.

Waste Petroleum Products and other special waste must be disposed of in accordance with the Special Waste Regulation, pursuant to the *Environment Act*. A special waste permit is required for:

- Operations that generate, dispose of, release, mix or dilute certain quantities of special waste; or,
- Operations that handle or dispose of special wastes produced by other generators (i.e. operate a Special Waste Management Facility).

In mineral exploration applications, special waste permits might be required for storage of large amounts of waste oil, antifreeze, batteries, any other dangerous goods deemed to be waste.

Hazardous substances must be stored, handled and disposed of according to Workplace Hazardous Materials Information System, pursuant to the *Occupational Health and Safety Act.*

Fuel and Chemical Storage

Where fuels and chemicals must be stored on site above ground storage facilities, with the capacity to contain spills should be provided. These containment facilities are required to protect adjacent lands and water in the event of a spill. Fuel storage areas should be stable and set back greater than the minimum set back from watercourses in order to avoid spillage into the watershed.

Spill Prevention

Requirements

Labelling of containers for all controlled substances under the *Hazardous Products Act* (Canada) is required under the Workplace Hazardous Materials Information System Regulations (WHMIS) under the *Occupational Health and Safety Act* (Yukon). Marking of containers will identify potential liabilities and also act as an incentive to remove empty containers from sites.

Strategies

The following are suggested ways to ensure that petroleum products and chemicals are stored and handled in as safe a manner as possible:

- Ensure that all fuel and chemical containers, regardless of size, are situated on stable ground located well above the ordinary high water mark of any watercourse.
- Leave a safe distance between fuel caches and water bodies and drainages; ensure that containers and facilities with a capacity greater than 4,000 litres are located at least 30 metres from any watercourse.
- Store fuel drums in an upright position to prevent the possibility of spills and leaks.
- Ensure all containers are sealed when not in use.
- Ensure that every precaution is taken to avoid spillage during fuel and chemical transfers.
- Make sure to conduct regular checks of fuel and chemical storage containers.
- Ensure that all stationary containers and facilities with a total capacity of greater than 4,000 litres are provided with secondary containment. Where possible, smaller containers and facilities should also be provided with secondary containment.
- Ensure that all fuel containers of 200 litres or greater are clearly marked in bold print with the operator's name and the type of petroleum product contained, as required under WHMIS, and the date cached if applicable.
- Ensure that a fuel and chemical spill contingency plan is posted adjacent to all fuel storage areas. Ensure that all staff are trained in implementation of the plan.
- Ensure that all waste petroleum products are safely stored on site or properly disposed of.

Options for Fuel Storage

Requirements

Stationary fuel storage in excess of 4,000 litres will be provided with secondary containment made of one of the following:

- Double storage tank wall
- synthetic membrane filter
- concrete
- bonded masonry
- prepared impermeable soil layer
- any other acceptable material provided that it forms an impermeable barrier.

Note: An impermeable barrier is any material through which a petroleum product will not easily pass. For more information on methods of secondary containment see the Code of Practice for Aboveground Storage Tanks.`

Absorbent materials will be kept on hand adjacent to stationary storage facilities in excess of 4,000 litres. The absorbent material will be either:

- commercially available petroleum product absorbent material; or
- any acceptable alternative material that is capable of absorbing spilled petroleum products.

Waste petroleum products will be safely stored on site.

Waste petroleum products should be burned completely or stored at specific sites for later disposal at an authorized facility.

Fuel and Chemical Spill Emergency Plans

Fundamentals

A fuel and chemical spill emergency plan should be simple and practical. Ideally, it includes plans for the prevention, reporting, control and cleanup of accidental spills.

Requirements

A fuel and chemical spill emergency plan is required for all classes of quartz exploration programs or placer exploration and mining operations under Section H of the Operating Conditions (see Schedule I of the Quartz or Placer Mining Land Use Regulations). Sub-section 17 of the Operating Conditions states that: A fuel spill emergency plan must be in place and a copy of it posted on-site. If you are conducting a class 1 exploration program, that involves the use of fuel, you are obliged to have a fuel and chemical spill emergency plan.

- While not required to provide a fuel spill plan at the time you submit your Notification or Operating Plan to the Mining Land Use Office for approval, you must have completed a spill plan before beginning exploration or mining activities

- Provide the Mining Land Use Office with a copy of the spill plan prior to beginning your program, and once fuel is stored on claims or leases, a spill plan must be posted on-site with all persons working at the site aware of its location and content and trained to implement the plan.

Strategies

Training about a fuel spill emergency plan and posting the plan on site will help make everyone on site mindful of the steps to be taken to ensure safety and minimize environmental impacts. The key to responding to fuel spills is to ensure they are isolated and not allowed to spread to adjacent land or into water bodies.

- Contain the spill into empty barrels.
- Use absorbents (manufactured or sawdust) to absorb small fuel spills.
- If conditions are appropriate, burning of spilled petroleum product may be permitted.
- Spill clean-up in open water bodies may be achieved with absorbent material
- On land, earthen dikes can be used to hold fuel until removal is possible.
- Dikes should be lined with plastic to prevent seepage into the ground.

Fuel spills must be immediately reported to the Spill Report Centre (867) 667-7244

Have this number posted at the site.

For all petroleum products, any spill with a quantity greater than 100 L must be reported, or, any spill which exceeds the quantities conditions of a Water Licence.

When A Spill Occurs:

You must take these steps immediately after a spill has been identified:

- Report the spill to the Yukon Spill Report Centre.
- Notify the owner or person in charge of the spilled substance and any person who may be adversely affected by the spill.
- Take all reasonable measures to confine the spill. Restore the site to the condition that it was in before the spill.

Guidelines for Fuel Spill Contingency Plans

If you have any questions regarding details of the Spill Contingency Plan, please contact the Mining Land Use Office and we will direct you to an available Mining Inspector. The following is a summary of what is required for a typical plan:

Introduction
Introduce the operation and operators and a little on previous mining land use operations (i.e. history).

Access
Describe the route(s) being taking, ice bridge locations, stream crossings etc.

Haulage Contractor
If using a contractor to haul fuel, provide information on the company

i.e. experience, describe equipment to be used

Spill Prevention Procedures
Describe what you will do and how. The following procedures may be included:

- vehicle inspections to ensure the unit is roadworthy
- tanker inspection to ensure all hatch covers are locked down and hatch gaskets are sound and seating properly
- checking all valves (and the frequency)
- verifying road and conditions and restricting travel to low-traffic, good-road-condition circumstances
- monitor progress by call-in at designated points;
- onboard provision of materials and equipment to be used in an emergency
- listing all equipment;
- maintaining an empty tanker compartment in the event fuel needs to be transferred from a damaged compartment;
- transfer hoses and other equipment, form part of transfer tanks equipment

Spill Response Equipment
List where the equipment is and how it will be utilized.

Response Procedures
Details on how you or your representative will handle a possible spill. This should include describing the sequence of actions that will be taken in the event of a spill and who will be responsible for taking those actions. The actions taken should include stopping discharges, containment of the spill, notification of authorities, clean up, etc.

Containment Procedures
Describe how you will contain a spill - both small and large, and seasonal, can be described.

Spill Site Clean-up
Describe methods you are prepared to employ in the clean-up. (Examples: Pump to another tank, absorbent material, remove contaminated snow from site to approved disposal site, etc.

Reporting
Provide details on who will report the spill and how.

Spill Reporting Flow Chart

Chart Showing spill notification procedures to report the spill to the24-Hour Yukon Spill Reporting Line (867) 667-7244 and to the Mining Inspections Division (867) 667-3211.

Appendix A Fuel Fact Sheets
Self Explanatory

Appendix B Fuel Spill Notes
Items to include are: spill prevention, snow, permafrost, ice, recording of events, public relations (in the event of a large spill.)

Appendix C Telephone Contacts
A list of your contacts

If a Spill Results in a Contaminated Site

If a site has contamination in soil or water at levels above those in the applicable standards it is considered a contaminated site. The Contaminated Sites Regulation establishes cleanup standards, processes for identifying and investigating contaminated sites, and permits for managing contaminated material. A fuel or chemical spill may result in a contaminated site. If this is the case, the site must be investigated and a restoration plan developed and carried out. The CSR specifies what must be included in Site Investigation and Site Assessment reports.

Test results from suspected contaminated sites are compared to the applicable standards to determine whether or not a site is contaminated, or if a contaminated site has been adequately cleaned up.

Under the CSR, permits are required to relocate contaminated material from one site to another, to construct or operate a Land Treatment Facility, or to use Risk-Based Restoration Standards.

A special waste permit is required under the *Special Waste Regulations* for:

1. people who generate, dispose of, release, mix or dilute certain quantities of their own special waste; or,
2. people who handle or dispose of special wastes produced by other generators (i.e. operate a Special Waste Management Facility).

In mineral exploration applications, special waste permits might be required for storage of large amounts of waste oil, antifreeze, batteries, any other dangerous goods deemed to be waste.

10.0 Underground Exploration

Requirements

If a mineral exploration program includes underground exploration, a detailed plan must be made for how to dispose of waste rock (#41) and how to deal with acid generating rock #(42) or intercepted groundwater.

Strategies

Provide a map showing the location of adits and storage of the waste rock at the surface, and cross sections of underground workings. Plan sections and cross sections should include geology and location of the ore body.

The following information should be provided in an operating plan:

- Dimensions of the underground workings
- Describe the amount of material that will be moved to surface (meters^3)

- Describe the amount of material that will be stored at surface (meters^3)
- Describe the composition of each rock type that will be stored at surface as waste rock material, and the composition of the ore material
- If sulphide minerals are present in the waste rock or ore material, identify whether and what characterization-testing been done to determine ARD/metal leaching potential
- Identify distance of stored waste material from any drainage or standing bodies of water
- Identify water discharges from the underground workings
    - Identify whether composition of discharge has been determined. If so, describe
    - Describe how the water will be contained and treated, if required
    - Describe how the waste rock storage areas will be reclaimed
- Describe both seasonal and permanent closure plans

11.0 Guidelines For A Pre-Season Or A Post-Season Summary Report

The purpose of this guideline is to help operators with an approved Operating Plan containing a term and condition requiring the submission of an annual Pre-Season and/or a Post-Season Summary Report to know what they need to report.

Background Information:

If a multi-year Operating Plan is approved without the details of the activities beyond the first year, a Pre-Season Report is required in each subsequent year of the approval period to provide the Mining Land Use office with approximate locations of where activities will occur. A Post-Season Report is also required at the end of each season to provide the Mining Land Use office with exact locations of disturbances (clearings, trenches, roads, etc.), as well as any reclamation activities that were accomplished during the current field season. Operators may wish to provide a copy of their post season report to the First Nation associated with the traditional territory where the work has been conducted.

Information to include:

- Total length and width of corridors
- Total volume of trenching per claim
- Number of clearings per claim and purpose for clearings (i.e. campsite, drill site, etc.)
- Surface area of the clearings
- Total length of new access roads
- Total length of road upgrades on claims
- Total length and width of new trails
- Total length of off road use
- Total amount of explosives
- For underground structures, total volume of material moved to surface
- Description of any reclamation activities
- Status of camp
- Status of fuel storage
- Location map showing the exact location of any disturbances created or reclamation accomplished during the current field season

Appendix A.1
"Table 1
EXPLORATION PROGRAM CLASS CRITERIA

	Column 1	Column 2	Column 3	Column 4
Item	Activity	Class 1 Criteria	Class 2 Criteria	Class 3 Criteria
1.	Construction of structures other than underground structures	Structures without foundations intended for use for a period of not more than 12 consecutive months	Structures without foundations	Structures with foundations
2.	Number of person-days in camp	Not exceeding 250	Not exceeding 250	More than 250
3.	Number of person in camp at any one time	Not exceeding 10	More than 10	More than 10
4.	Storage of fuel, total amount stored	Not exceeding 5000 L	Not exceeding 40,000 L	More than 40,000 L
5.	Storage of fuel, amount per container	Not exceeding 2000 L	Not exceeding 10,000 L	More than 10,000 L
6.	Construction of lines	Not exceeding 1.5m in width and cut by hand or with hand held tools	More then 1.5m in width and cut with tools that are not hand held	More then 1.5m in width and cut with tools that are not hand held
7.	Construction of corridors, width	Not exceeding 5m in width	Not exceeding 5m in width	Not exceeding 10m in width
8.	Construction of corridors, length	Total length not exceeding 0.5km	Total length not exceeding 0.5km	Total length of more than 0.5km
9.	Trenching	Not exceeding, (a) 1200m^3 on a group of three adjoining claims in the program, provided that no claim in the program forms part of more than one group of three, or (b) 400 m^3 per claim that is not part of a group of three adjoining claims referred to in paragraph (a)	Total volume not exceeding 1200m^3 per claim per year	Total volume not exceeding 5,000m^3 per claim per year to a maximum of 10,000 m^3 over the life of the exploration program
10.	Number of Clearings per claim, including existing clearings	Not exceeding 8	Not exceeding 8	More than 8
11.	Number of clearings, helicopter pads and camps	No more than 2 of the 8 clearings referred to in item 10	No more than 2 of the 8 clearings referred to in item 10	More than 8
12.	Surface area of clearings	Not exceeding 200m^2 , except for clearings for helicopter pads and camps which cannot exceed 500m^2	(a) Not exceeding 400m^2 per clearing, if only trees and brush are removed;	(a) more than 400m^2 per clearing, if only trees and brush are removed;

			(b) Not exceeding 500m^2 per clearing, for helicopter pads and camps; or (c) Not exceeding 1,000m^2 , if vegetative mat is removed	(b) More than 500m^2 per clearing, for helicopter pads and camps; or (c) more than 1,000m^2 , if the vegetative mat is removed
13.	Establishing new access roads, per exploration program	Not authorized	Not exceeding 5km	Not exceeding 15km
14.	Upgrading of access roads, per exploration program	Not authorized	Not exceeding 10km	Not exceeding 30km
15.	Establishment of trails, other than temporary trails, per exploration program	Not authorized	Not exceeding 10m in width and 15km in total length	Not exceeding 15m in width and 40km in total length
16.	Establishing or using temporary trails, per exploration program	Not authorized on Category A Settlement Land or on Category B Settlement Land On Land other than Category A Settlement Land or Category B Settlement Land , establishing a temporary trail or using temporary trail that was established for another program if (a)the temporary trail width does not exceed 7m or 1m more than the width of the equipment to be moved along the temporary trail, which ever is less; (b) the total temporary trail length does not exceed 3kn; and (c) the temporary trail is only used for the purpose of moving sampling equipment between test sites		
17.	Use of vehicles on existing roads or trails	Within the design limits or tolerances of the road or, if design limits or tolerances of roads or trails are not known, vehicles with a gross weight of less than 40t for roads, and less than 20t for trails	Within the design limits or tolerances of the road or, if design limits or tolerances of roads or trails are not known, vehicles with a gross weight of less than	Within the design limits or tolerances of the road or, if design limits or tolerances of roads or trails are not known, vehicles with a gross weight of more

			40t for roads, and less than 20t for trails	than 40t for roads, and less than 20t for trails
18.	Off-road use of vehicles in summer	Low ground pressure vehicles only	Vehicles with a gross vehicle weight not exceeding 20t, that are used over a distance of not more than 15km	Vehicles with a gross vehicle weight of more than 20t, that are used over a distance of not more than 40km per year
19.	Off-road use of vehicles in winter	Low ground pressure vehicles or vehicles with a gross vehicle weight not exceeding 40t used over a distance of not more than 15km	Vehicles other than low ground pressure vehicles, used over a distance of not more than 25km	Vehicles other than low ground pressure vehicles, used over an unlimited distance
20.	Use of explosives	Not exceeding 1,000kg in any 30 day period	More than 1,000kg in any 30 day period	More than 1,000kg in any 30 day period
21.	Construction of underground structures	Construction in which not more than 500t of rock is moved to the surface	Not more than 40,000t of rock is moved to the surface per year and not more than a total of 20,000t is moved to the surface for the exploration program	Not more than 100,000t of rock is moved to the surface per year and not more than a total of 200,000t is moved to the surface for the exploration program”

Schedule 1
Operating Conditions

A Removal of the vegetative mat

1 If the vegetative mat must be removed to carry out exploration activities, it must be removed so as to protect the seed and root stock contained within the mat and be stored separately from other overburden or bedrock removed for use in re-establishing the vegetative mat when the exploration program ceases.

B Re-establishment of the vegetative mat

2(1) All vegetated areas disturbed by exploration act ivies, including fuel and waste storage areas, clearings, corridors, temporary trails, camps and supporting infrastructure, and trenches and rill sites, must be left in a condition conducive to re-vegetation by native plant species or other species adaptable to the local environment to encourage re-vegetation comparable to similar, naturally occurring, environments in the area.

(2) Conditions conducive to re-vegetation include provision of adequate soil layer with moisture retaining ability, no soil contamination by hydrocarbons, or other hazardous substances, provision of adequate seed or root stock and contoured or otherwise stable slopes.

2 If adequate seed or root stock is not naturally available, re-seeding or transplanting of vegetation is required. Only non-invasive species may be used for re-seeding or transplanting.

C Erosion control and permafrost

4 All areas disturbed during an exploration program must be re-sloped, contoured or otherwise stabilized to prevent long-term soil erosion, slumping and subsidence.

5 All exploration activities must be carried out to avoid or minimize damage to and loss of permafrost.

D Trenching

6 Trenching carried out by hand or using hand-held tools must be methodical. All trenches must be stabilized and marked to minimize risk to the public.

7 Trenches constructed with mechanized equipment must be back filled by first depositing any removed overburden and bedrock and then replacing the vegetative mat that was removed to construct the trench

E Historic objects and burial grounds

8 Exploration activities must not be carried out within 30m of a known archeological site unless the Chief indicates, in writing, that such activities may be carried out.

9 Any sites containing archeological objects, palaeontological objects or human remains or burial sites discovered in the course of carrying out an exploration

program must be immediately marked and protected from further disturbance and, as soon as practicable, the discovery reported to the Chief. No further activities may be carried out within 30m of the site until the Chief indicates, in writing, that activities may be resumed.

F Solid waste

10 All solid waste, including debris, equipment, barrels, drums, and scrap metal, must be safely stored on the site of the exploration program while the program is carried out and must be disposed of in accordance with the Solid Waste Regulation when the program ceases.

11 camp must be kept lean and tidy.

G Petroleum storage

12 If petroleum fuel storage capacity exceeds 4000L, a secondary containment structure must be constructed. The containment structure must be made of a material impervious to petroleum products and

(a) if there is a single storage tank, be of sufficient size to accommodate at least 110% of the capacity of the storage tank; or

(b) if there is more than one storage tank, be of sufficient size to accomidate110% of the capacity of the largest storage tank or 10% of the total capacity of all the tanks, whichever is larger.

13 All petroleum products, including waste petroleum products, and any other hazardous substances must be stored in a secure fashion no less than 30m from the ordinary high water mark of any water body

14 All petroleum products, including waste petroleum products, and any other hazardous substance, must be transferred and handled without spillage.

15 All petroleum products and any other hazardous substance must be removed from the site of the exploration program when the program ceases.

16 All waste petroleum products and any other special waste, as defined in the Special Waste Regulation, generated in the course of carrying out the explorations program must be disposed of in accordance with the Special Waste Regulations when the program ceases.

H Spills and spill contingency plans

17 A spill contingency plan for petroleum products and other hazardous waste must be prepared and posted in the camp and at all fuel handling locations used in carrying out the exploration program.

18 All pill clean-up equipment and material must be maintained in a state of readiness sufficient at all times to contain and clean-up any hazardous material spills.

19 If a spill occurs, the spill contingency plan must be immediately implemented and notice given to the 24-hour Yukon Spill Report Line. As soon as practicable, an inspector must be contacted. Whatever remedial action is required to clean-up the spill and reclaim the affected land and water must be taken.

20 Vehicles must be maintained and operated to prevent spills of fuel, lubricants, coolants and oil.

J Timber and brush

21 Cut brush must not be piled do that it blocks movement of wildlife or people.

22 Leaning trees created by cutting of lines, corridors, temporary trails, and clearings must be felled.

23 When it is economically viable to do so, timber suitable for sale must be salvaged and stock piled.

24 All risk of fire hazard must be avoided.

K Drilling

25 l reasonable efforts must be made when drilling to minimize the impact on wildlife and the public

26 Vegetation, other than that with in a drill sump, must not be covered with drill cuttings.

27 Core must be stored in a stable fashion.

28 Drill mud must be re-circulated when possible.

29 All drill fluids must be contained in a sump.

30 Drill holes that pose a hazard or that lead to ground water must be plugged to prevent flow of water to the surface.

31 The location of drill holes must be marked by flagging or other suitable means at the location of the drill hole.

32 Drilling waste, including fluid, cuttings, and mud must not be left within 30m of a water body.

L Road, trails, and off-road trail use.

33 All vehicles must be operated to avoid rutting and gouging of roads and trails.

34 Off road and trail routes must be reconnoitered and must be used in a way that minimized ground disturbance, including damage to permafrost and sensitive wildlife habitat.

35 If rutting, gouging, pounding or permafrost degradation occurs off road or trail, vehicle use must be suspended or relocated to ground that is capable of bearing the weight of the vehicle without cause such damage.

36 Use of skids on permafrost or wet ground is only permitted outside of winter where it is not reasonable to use any other means of transporting equipment.

37 Routes for temporary trails must be reconnoitered and flagged.

38 In addition to any remedial action required in relation to item 2 of this schedule, temporary rails must be blocked to prevent further vehicular access.

M Release of sediment

39 All reasonable care must be taken in carrying out exploration activities near or adjacent to a water body to prevent sediment from entering a water body, unless otherwise permitted by law.

N Use of explosives

40 Explosives must be set off in a manner to minimize the impact on wildlife and the public and to ensure that forest fires, unplanned landslides, or artificial damming of water bodies does not occur.

O Waste rock

41 Waste rock piles must be located at least 30m from the any water body and be physically stable.

42 Waste rock containing sulfides must be returned to underground.

43 Access to underground openings must be blocked to prevent access by wildlife and people."

Appendix A.2: Explanation of Classes

The Quartz Mining Land Use Regulation establishes a classification system based on varying levels of specific activities. These threshold levels of activities categorize mineral exploration activities in four classes of programs. Class 1 through Class 4 represent exploration activities with an increasing potential to cause adverse environmental impacts.

All Class 2, 3 and 4 programs are subject to the *Yukon Environmental and Socio – Economic Assessment Act (YESAA).* YESAA sets out a process to assess the environmental and socio-economic effects of projects and other activities in the Yukon. Environmental and socio-economic assessments are conducted by the Yukon Environmental and Socio – Economic Assessment Board or one of its six Designated Offices.

The Yukon Government continues to be the decision maker and to be responsible for regulating and enforcing requirements for exploration projects which fall under its legislated authority.

Class 1 Program

This class is characterized by grass roots exploration activity on claims or leases such as line cutting, drilling, mobilization of equipment, and moving minimal amounts of overburden. Carried out in compliance with the Operating Conditions, the activities in Class 1 should have very little potential for lasting or significant effects on the environment. ***No prior government approval is required for Class 1,*** but the activity will still be subject to inspection for compliance with the Operating Conditions of the MLUR and all other applicable environmental legislation.

Class 2 Program

This classification covers programs that are approved for one year only or less and includes a range of exploration land use activities typical of a modest exploration program such as road or trail work, camps with temporary structures, trenching programs, mobilization of heavy equipment, underground work, etc. Reclamation must be performed prior to the expiration of that year. Before commencing a Class 2 activity, the Chief of Mining Land Use must be informed through ***Notification,*** which explains the proposed activities and what measures will be taken by the operator to minimize environmental effects. This notification may be submitted anytime after the issuance of a decision document by government. The operator may proceed with the

program when advised the Chief of Mining Land Use or 25 days after submitting the notification, whichever occurs first.

Class 3 Program

This classification includes all of the exploration land use activity associated with an advanced exploration program such as road building or upgrades, large camps, bulk trenching, etc. Since the activities are more extensive under this class of program, there is a significant potential for environmental effects. All Class 3 operations require submission of a detailed exploration land use ***Operating Plan,*** which must be reviewed and approved by government before proceeding. The reclamation and mitigation alternatives and guidelines in this booklet may be useful when preparing the plan. The plan will first be screened under the YESAA, which may return the plan with recommended mitigation attached, prior to submission for an approval.

Class 4 Program

This classification is distinguished from Class 3 by extensive road and trail work, long traverses of heavy equipment and significant underground work. ***In addition to operating plans, Class 4 activities require public notification.*** Public consultation may also be required if there are warranted concerns about the program.

What is an Operating Plan?

This is the detailed plan that must be submitted to the Chief for Class 3 or Class 4 activities. The plan has to be reviewed within specified time limits and approved before the operator may commence the activity. The Regulations specify in point form the particular information that an operating plan must include. Operating Plan details are further outlined in the *Guide to Mining Land Use Regulations: Policies and Procedures* booklet, available from the Mining Recorders' Offices. For the purposes of *this* handbook, the Operating Plan must contain all of the planned activities of the exploration program along with a description of **how the land use disturbance will be reclaimed and how any adverse affects to the environment will be mitigated.**

APPENDIX B

GLOSSARY OF TERMS

Access Road: means a road which provides access to a public highway or any private road

Archaeological Object: an object that is the product of human art, workmanship, or use, and it includes plant and animal remains that have been modified by or deposited in consequence of human activities, and is of value for its historic or archaeological significance.

Archaeological Site: means a place where Archaeological objects are found

Bench Gravel: gravel beds on the side of a valley above the present stream bottom, which represent part of the stream bed when it was at a higher level.

Buffer Strip: means a strip of vegetated land left undisturbed adjacent to a watercourse.

Clearing: an area that is cleared of trees, brush or vegetative mat for the purpose of establishing a campsite or carrying out mining exploration, but does not include an area cleared for the purpose of establishing a corridor or trail.

Corridor: a path from which trees and brush have been cut to accommodate a water line, fuel line or power line

Critical Habitat: habitat areas which are critical to a significant number of individuals of a species during at least part of the year.

Cross Ditch: a shallow trench excavated by hand or by dozer blade across the surface of the road in the downslope direction. Its purpose is to allow water to travel to the lower side of the road without eroding or ponding, and it also provides a barrier to vehicles.

Cross Drain: culverts or pipes placed in the road grade, set below the level of side ditches and inclined about 2% more than the road grade above.

Ethnographic Object: an item of material culture relating to the history and traditional culture of Yukon First Nations.

Environmental Effect: means in respect of a project:
(a) any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and
(b) any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada.

Environmentally Sensitive Areas: areas which are rated as high value for archaeological or historic sites, timber, recreation, watershed, wildlife and unique land forms.

Foundation: means the part of a structure that penetrates the ground and supports the structure

Grouser: raised potion of a vehicle belt or track, extending across the width of the belt or track at a right angle to direction of track movement.

Line: means a linear clearing for the purpose of carrying out a geophysical, geological or engineering survey

Merchantable Timber: Timber located on mining claims that has been determined to be of a size, quality and overall quantity that it can likely be harvested economically, all cost factors considered.

Narrow Valley: a constricted section of a mountain pass, valley, a gap or narrow passage between mountains

Natural Boundary: means the visible high water mark of any body of water where the presence and action of the water is so common and usual and so long continued so as to mark upon the soil of the bed of the body of water a character that is distinct from the banks in respect to vegetation or to the nature of the soil. The best estimates of the edge of dormant or old side channels and marsh areas are considered to be natural boundaries

Ordinary High Water Mark: The visible high water mark of any lake, river, stream or other body of water where the presence and action of water is active such that the water level is indicated on the sill of the bed or bank of the lake, river stream or other body of water.

Overburden: barren rock or soil material, either loose or consolidated, overlying a mineral deposit, which must be removed prior to mining (the loose soil, silt, sand, gravel or other unconsolidated material overlying bedrock, either transported or formed in place)

Permafrost: Permafrost is ground that remains frozen through at least two consecutive winters and the intervening summer.

Permanent Structure: means a surface structure suitable for indefinite use, including any buildings with a foundation

Reclamation: The return of a site disturbed by mining and or exploration activities to a condition where it will make a suitable environment for the reestablishment of the site.

Rehabilitation: The return of a site disturbed by mining and/or exploration activities to a condition of stability which promotes the re-establishment of habitat, etc. or to a specific use previously designated in a land use plan.

Re-vegetation: The re-establishment of self-sustaining vegetation on land, which previously had vegetative cover.

Riparian Habitat (or Riparian Zone): the riparian zone includes both terrestrial and aquatic ecosystems which are in or adjacent to permanently flowing intermittent or standing watercourses and their flood plains or active terrace systems.

Road: means a pathway for vehicular traffic, the construction of which requires the movement of rock or earth.

Scarification: Mechanically scratching, ripping, breaking up or loosening previously compacted or hard soil to a depth of 15 to 40 cm for the purpose of encouraging self-sustaining growth of native plant species.

Seasonal Structure: means a surface structure that is dismantled and moved at the end of each mining season

Settlement Land: means Category A Settlement Land , Category B Settlement Land as identified on claim maps.

Stripping: remove the vegetation and overburden from a geographic area.

Sump: means a manmade or natural pit, trench, hollow or cavity in the earth's surface used for the purpose of depositing waste material.

Temporary Structure: means a surface structure used for more than one season which is not of permanent construction and does not include seasonal structures

Terrace: any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope
- a horizontal or gently sloping ridge or embankment of earth built along the contours of a hillside for the purpose of conserving moisture, reducing erosion, or controlling runoff

Terrain Hazards: Natural landscape features which pose a risk or hazard to humans or wildlife (i.e. landslide prone areas, unstable slopes, slumps, etc.)

Topsoil: - a presumably fertile soil used to cover areas of special planting
- corresponds to A Horizon
- the dark-coloured upper portion of a soil, varying in depth according to soil type

Traditional Territory: means the geographic area of a particular First Nation

Trail: means access to a site(s) within a claim(s) that is constructed with little or no movement of rock or earth

Trenching: means any excavation carried out on a mineral claim for the purpose of obtaining geological information

Upgrading: in relation to roads, means re-establishing a road that has not been useable for more than five years by vehicles of a type the road was originally designed to serve, modifying a road to provide usability for vehicles that are of a different type than those the road was originally designed to serve and any other upgrading or modifying of a road, other than for maintenance or erosion control.

Vegetative Mat: means the organic horizon of soil which is characterized by the accumulation of organic matter or partly decomposed organic matter, derived mainly from leaves, twigs and woody materials including the root mass of living vegetation.

Waste (camp definition): Garbage, refuse and other discarded materials resulting from human activities; does not include hazardous or special waste

Water bar (or Swale): Purposeful depressions used to direct surface water. They also can temporarily hold small quantities of water and allow it to infiltrate into the soil.

Watercourse: means a natural watercourse, body of water or water supply, whether usually containing water or not, and includes groundwater, springs, swamps and gulches.

Windrow: a low bank, heap, or other accumulation of material, formed naturally by the wind or the tide, or artificially

APPENDIX C

CONTACT INFORMATION

1. Mining Lands Office

LOCATION: 4th Floor, Shoppers Plaza, 211 Main Street, Whitehorse, Yukon

MAILING ADDRESS: Mining Lands Office
Box 2703 (K-9)
Whitehorse, Yukon Y1A 2C6

TELEPHONE NUMBERS:

Chief of Mining Land Use	(867) 456-3822
Regional Mining Lands Officer	(867)456-3961
Mining Lands Officer - Whitehorse	(867)667-3107
Mining Lands Officer - Dawson	(867)993-5343
Mining Lands Officer - Mayo	(867)996-2256
Mining Lands Officer – Watson Lake	(867)536-7366
First Nation Liaison Officer	(867)667-8708
Fax	(867)456-3899

2. HERITAGE RESOURCES, YUKON GOVERNMENT (867)667-5683

3. ENVIRONMENT, YUKON GOVERNMENT (867)667-5652

Appendix D: Referenced Handbooks, Guidelines, Laws and Standards

Current Yukon legislation can be accessed at the Yukon Government, Energy, Mines and Resources web site under the heading of 'Legislation'. Included are both the Acts and the associated Regulations.
Available on-line at www.emr.gov.yk.ca/info/legilation.html

Acts Referenced

1. *Environment Act*
2. *Environmental and Socio – Economic Assessment Act (YESAA)*
3. *Fisheries Act,*
4. *Hazardous Products Act (Canada)*
5. *Migratory Birds Convention Act.*
6. *Motor Vehicle Transport Act*
7. *Occupational Health and Safety Act.*
8. *Public Health and Safety Act*
9. *Quartz Mining Act*
10. *Wildlife Act*
11. *Waters Act*

Referenced Regulations

1. Air Emissions Regulations
2. Contaminated Sites Regulation
3. Mining Land Use Regulations
4. Public Health Regulations
5. Public Health Regulations.
6. Quartz Mining Land Use Regulation
7. Regulations Respecting the Removal of Rubbish.
8. Regulations Respecting the Sanitation of Camps
9. Sewage Disposal Systems Regulations
10. Solid Waste Regulations
11. Special Waste Regulations
12. Workplace Hazardous Materials Information System Regulations

Guidebooks and Handbooks

1. *"Guide to Mining Land Use Regulations: Policies and Procedures"* booklet, available from the Mining Recorders' Offices.
2. "Guidelines for Reclamation / Re-vegetation in the Yukon" (1993) Edited by C.E Kennedy. (Yukon Government publication).
3. "*Handbook for the Identification of Heritage Sites and Features*" YG Dept. Culture and Tourism