



Han Construction Ltd.

CLINTON CREEK MINE SITE

RECLAMATION REPORT 2005

PREPARED WITH THE ASSISTANCE OF



ARCTIC ALPINE
RECLAMATION GROUP

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BACK GROUND

SITE LOCATION

The Clinton Creek Asbestos Mine is located 100 km northwest of Dawson City, Yukon.

PHYSICAL DESCRIPTION

The mine site is located primarily in a Northern Yukon sub alpine boreal forest, in a valley of deciduous and coniferous plant communities.

The mine site has seven (7) major areas of disturbance:

1. Hudgeon Lake & Clinton Creek Channel Stabilization area
2. Former Mill Site
3. Tailings Pile & Wolverine Creek
4. 2 Waste Rock Dump Sites
5. Former Crusher Area
6. 3 Pit Areas
 - a. Snowshoe Pit
 - b. Creek Pit
 - c. Porcupine Pit
7. Airport

INTRODUCTION

The 1974 failure of the waste rock deposit created a landslide dam to create a body of water now referred to as Hudgeon Lake. The waste rock channel stabilization work in 2002, 2003 and 2004 by Han Construction Limited (HCL) has occurred along Clinton Creek for a distance of approximately 350 meters downstream from the outlet of Hudgeon Lake. Hudgeon Lake is to remain in place following mine closure / abandonment.

Randy Lewis, Partner, Arctic Alpine Seed Ltd. conducted the initial site evaluation of selected areas of the mine property on October 16, 2003, with Mr. John Mitchell of Han Construction Ltd.

An additional site specific evaluation was conducted in May 2004 and a number of revegetation test / demonstration plots were established at the Channel Stabilization Project area.

The **2004 Clinton Creek Channel Stabilization Project** was approximately 3 hectares of area prepared for revegetation and riparian zone rehabilitation. The objective of the project was to minimize erosion and to assist in the stabilization of the stream banks on Clinton Creek. A Han Construction Reclamation Crew was mobilized to the site on September 16, 2004 and the project was completed October 1, 2004 (see 2004 Site Report)

The **2005 Phase I Seeding Project** was approved to proceed on September 23, 2005. The objective of the project was to reclaim areas of the former mill site and waste rock area that were prepared by other site clean up projects. A Han Construction Ltd. Reclamation Crew was mobilized to the site on September 28, 2005 and the project was completed on October 4, 2005.

This report provides details on the 2005 Phase I Seeding Project and the 2005 site evaluation of the May 2004 test / demonstration plots as well as the project evaluation of the 2004 Clinton Creek Channel Stabilization Project.

LOCAL BENEFITS

The project focused on developing opportunities and methods to maximize local employment and training as well as providing recommendations for the development and completion of the Clinton Creek Mine Closure Plan.

PROJECT MANAGEMENT & RESPONSIBILITIES

As Project Manager, Randy Lewis, Partner, Arctic Alpine Seed Ltd., was primarily responsible for ensuring that the reclamation projects were completely implemented to the Owner's satisfaction including management and training of local labor forces and expediting of materials including:

- layout and design of all areas to be seeded
- harrowing of all areas to be revegetated / seeding / harrowing to incorporate seed
- monitoring and reporting
- reclamation recommendations – best practices and methodologies
- seed mixtures and plant material that conformed to land claims agreements and current Canadian environmental standards for the prevention of the introduction of a foreign seed or plant species.
- recommended seeding rates and methods that are suitable for the variety of areas to be revegetated and stabilized.
- recommended & supervised riparian zone rehabilitation: plant harvesting, planting methods, techniques.
- ensured that grass seed as well as all plant material is indigenous to the site and surrounding areas
- ensuring no fertilizer use on site or hydro seeding on site.

A Han Construction Ltd. Reclamation Crew was hired to work with Arctic Alpine Seed Ltd. until project completion and the local crewmembers received training as Reclamation Technicians.

SCOPE OF WORK

- 1) Site Supervision & Reclamation Technician Crew Training
- 2) Layout and Design of Areas to be Seeded
 - a) Site specific seed mixes for the project – seed varieties / usage / mixing
- 3) Harrowing or Raking (Preparation of Seed Bed for Planting)
 - a) the area to be seeded was scarified to a depth of 15 to 30 cm in order to loosen the site soils
- 4) Seeding of Areas
 - a) The seed was applied by manual broadcast spreading
- 5) Final Harrowing and Raking
 - a) incorporated the seed into the soil surface by harrowing and hand raking
- 6) Monitoring and Reporting

PHASE I SEEDING PROJECT

OVERVIEW

Initial revegetation demonstration / test sites were established in 2004. The sites have shown positive results in the 2005 growing season with seed germination at all locations.

The 2005 Phase I project sites are located at the former mill site and the failed waste rock deposit. There are approximately **6 hectares** of former mill site area that were prepared for revegetation in 2004. There is an additional estimate of **50 hectares** at the waste rock site that require revegetation to minimize erosion and to assist in site stabilization and rehabilitation.

The areas proposed for revegetation are already prepared and graded. It includes the areas adjacent to the service and access roads of the site as well as areas that are not part of the scrap steel area or any area where potential or proposed addition cleanup is required.

SEED SPECIFICATIONS & METHODOLOGY

Based on the most prominent indigenous grass species identified during site evaluation:

- Recommended rate of seeding – 25 kg /hectare
- Seeding rate is based on site / soils examination and the proposed methodology for installation.

The following grass species were identified on site and recommended for use in the site seeding mix:

- *Puccinellia nutalliana* – Alkali grass
- *Agropyron violaceum* – Violet Wheatgrass
- *Deschampsia caespitosa* – Tufted Hair Grass
- *Festuca saximontana* – Northern Fescue
- *Agrostis scabra* – Tickle Grass

2004 Demonstration #1 Former Mill Site Access Road to Top of Tailings Pile - The area immediately adjacent to the road was harrowed to a width of 4 meters. The harrowed area was then seeded with the mix containing the grass and legume species that were identified on site. The area was then re-harrowed to a width of 4 meters.

Seed Mix:

- *Agropyron violaceum* – Violet Wheatgrass
- *Agrostis scabra* – Tickle Grass
- *Deschampsia caespitosa* – Tufted Hair Grass
- *Festuca ovina* – Sheep Fescue
- *Festuca saximontana* – Northern Fescue
- *Poa alpina* – Alpine Bluegrass
- *Puccinellia nutalliana* – Alkali grass

2004 Demonstration #2 Waste Rock Dump Site Access Road to the former Crusher Site and other prepared areas - The area immediately adjacent to the road was harrowed to a width of 4 meters. The harrowed area was then seeded with the site mix containing the grass species that were identified on site. The area was then re-harrowed to a width of 4 meters with the mix described above. Note: Other small areas that were recently graded due to the 2004 site works program were also harrowed and seeded with the mix described above.

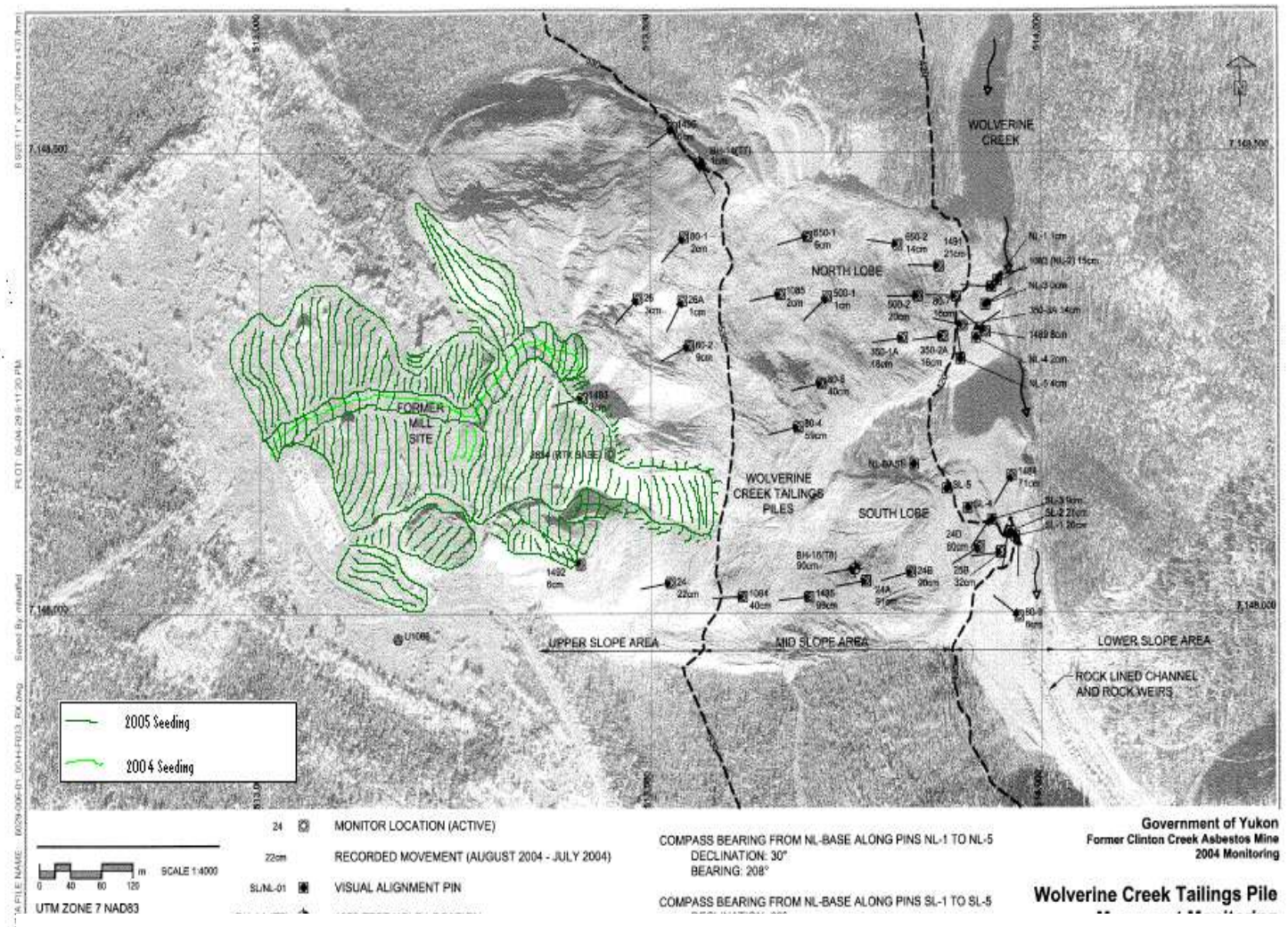
SKETCH 1 - 2005 PHASE I SEEDING PROJECT AREAS

The demonstration areas marked in ___ (light green) were seeded in September of 2004

- A 4 meter area on both sides of the site access road
- A 5 meter x 5 meter area on the sloped area of the site
- A 4 meter area on both sides of the site access road on the top portion of the tailings pile

The 2005 Phase I Seeding areas are marked in _____ (dark green) and were seeded in September of 2005

During an inspection of the 2004 project areas in October of 2005 it was noted that all of the 2004 areas demonstrated positive germination and establishment.



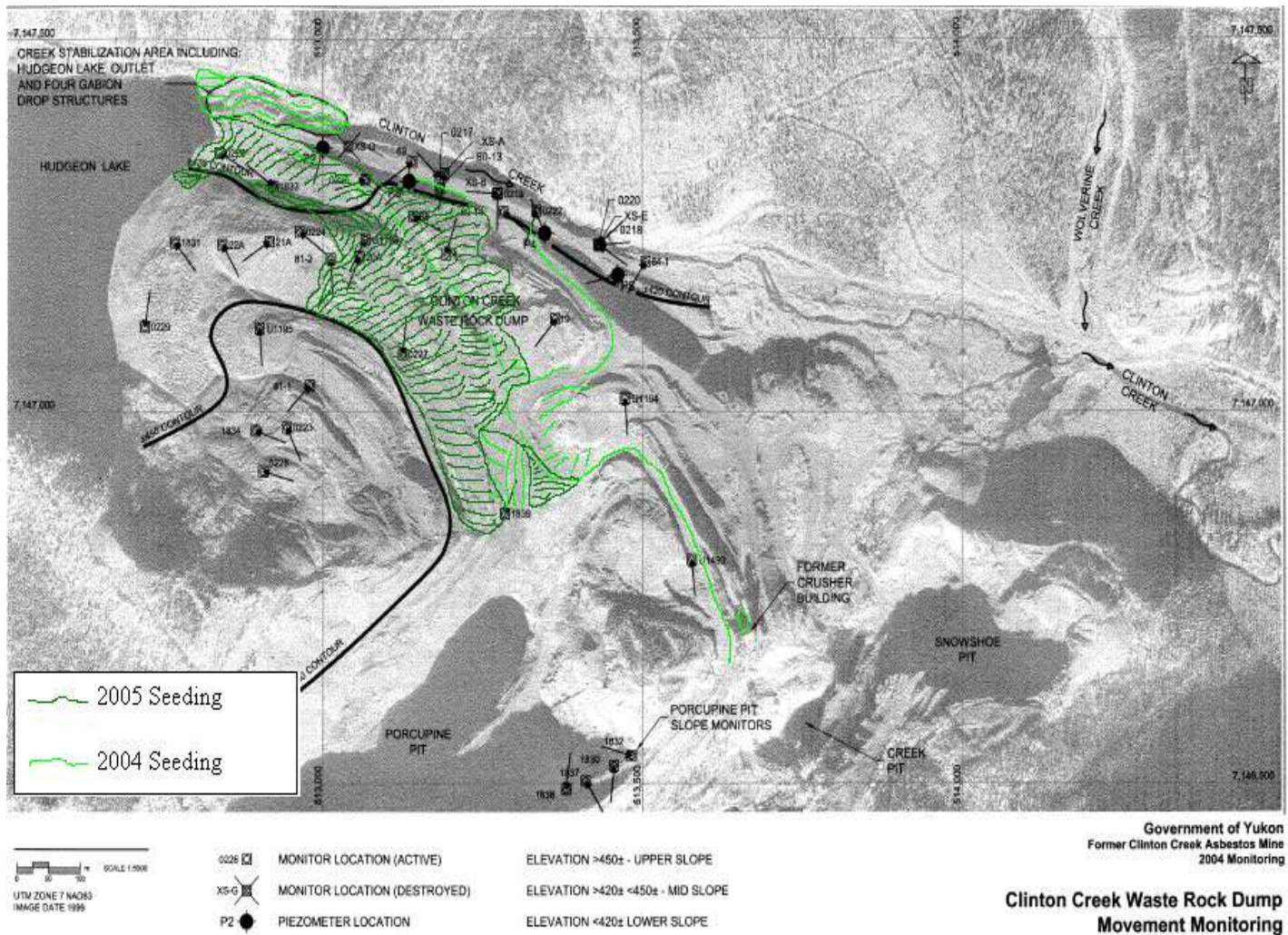
SKETCH 2 – 2005 PHASE I WASTE ROCK SITE SEEDING AREAS

The demonstration areas marked in ___ (light green) were seeded in September of 2004

- A 4 meter area on both sides of the site access roads
- Additional site areas were seeded

The 2005 Phase I Seeding areas are marked in ___ (dark green) and were seeded in September of 2005

During an inspection of the 2004 project areas in October of 2005 it was noted that all of the 2004 areas demonstrated positive germination and establishment.



Introduction

The use of local stem cuttings (plant bundles) possessing dormant buds, as observed with willow bundle has previously shown to be an effective method of transplant and riparian zone rehabilitation. Stream bank stability and erosion control were effectively supported with the use of transplant vegetation.

The following overview of the riparian zone rehabilitation project completed in 2004, the methodology used and a sketch of the areas rehabilitated are provided following:

Objectives

Harvest local plant material and transplant stem cuttings (bundles) of various trees and shrubs, primarily *Salix* sp. (willow) into different areas within the project area.

The 8 (eight) selected sites consisted of locations that were part of the creek stabilization project.

Site Harvesting and Planting Methodology

Trees and shrubs found on the former mill site and the airport were harvested for this project. These areas of existing vegetation had the greatest variety of suitable plant material and contained a cross section of the plant species indigenous to the area. Only branches possessing dormant buds were used.

Bundles included several plant species and were horizontally planted across the slope at the selected sites in order to create a natural plant species distribution and assist channel stabilization.

There were (8) eight areas that required rehabilitation on the site following the construction of the weirs for the channel stabilization project.

Planting depth of plant material structures (bundles & stakes) and below ground plant biomass varied according to several factors, primarily soil composition including porosity, plant species and planting method.

Four methods of planting were tested in various locations and each has previously proven effective and has produced successful plant establishment while remaining cost effective.

Method 1: Plant bundles (3 to 4 stems) of locally harvested plant material approximately 50 cm in length are bundled together and planted horizontally in trenches to a depth of 15 to 30 cm. depending on the soil.

Method 2: Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length are planted vertically to a depth of 50 cm to 1 meter with a tree planting spade.

Method 3: Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length are planted vertically to a depth of 50 cm to 1 meter with a weighted metal probe depending on soil structure and porosity.

Method 4: Below ground plant biomass (roots) were harvested and planted to a depth of 15 to 50 cm.

Site 1 East Side Hodgson Lake – Entrance to Clinton Creek

This area was planted using all four transplanting methods described above as well as a method developed on site due to site soil conditions and local equipment availability.

Method 5: Mechanical Horizontal Trench A loader with a tooth bucket was used to create trenches 2 meters in length approximately 50 cm in depth. Approximately 9 trenches were created. Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically in the trench to a depth of 30 cm, additional plant cuttings were placed horizontally in the trench to provide for more vegetative material to be placed on the site.

Site 2 East Side of Clinton Creek – Above 1st Weir

This area was established as a seed test site in early spring with the species in individual demonstration plots of approximately two (2) meters by six (6) meters:

- *Achillea borealis* - Yarrow
- *Agropyron violaceum* – Violet Wheatgrass
- *Festuca ovina* – Sheep Fescue
- *Hedysarum mackenzii* – Mackenzii Hedysarum
- *Lupinus arcticus* – Arctic Lupine
- *Poa alpina* – Alpine Bluegrass
- *Poa glauca* – Glauous Bluegrass
- *Puccinellia nutalliana* – Alkali grass

Five (5) different woody plant species were planted as an overall test of the various plant materials available on the mine site. Plant bundles (1 to 3 stems) of locally harvested plant material approximately 75 cm in length were planted horizontally in manually dug trenches to a depth of 15 cm. Every individual species in the seed test plot has germinated and has established itself to the second leaf stage

Site 3 East Side of Clinton Creek – Below 2nd Weir

Planting Method 3: Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically to a depth of 50 cm to 1 meter with a weighted metal probe due to the soil structure and porosity.

Site 4 East Side of Clinton Creek – Below 2nd Weir

Planting Method 1: Plant bundles (3 to 4 stems) of locally harvested plant material approximately 50 cm in length were bundled together and planted horizontally in trenches to a depth of 15 to 30 cm. due to the soil structure and porosity.

Site 5 West Side of Clinton Creek – Below 2nd Weir

Method 5: Mechanical Horizontal Trench Planting Method: A loader with a tooth bucket was used to create 2 meter trenches approximately 50 cm in depth. Approximately 9 trenches were created. Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically in the trench to a depth of 30 cm, additional plant cuttings were planted horizontally in the trench to provide for more vegetative material to be placed on the site.

Site 6 West Side of Clinton Creek – Below 1st Weir

Method 5. Mechanical Horizontal Trench Planting Method: A loader with a tooth bucket was used to create 2 meter trenches approximately 50 cm in depth. Approximately 9 trenches were created. Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically in the trench to a depth of 30 cm, additional plant cuttings were planted horizontally in the trench to provide for more vegetative material to be placed on the site.

Site 7 West Side of Clinton Creek – Above 1st Weir

Mechanical Horizontal Trench Planting Method: A loader with a tooth bucket was used to create 2 meter trenches approximately 50 cm in depth. Approximately 9 trenches were created. Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically in the trench to a depth of 30 cm, additional plant cuttings were planted horizontally in the trench to provide for more vegetative material to be placed on the site

Site 8 West Side of Clinton Creek – Above the Channel Stabilization Project

Mechanical Horizontal Trench Planting Method: A loader with a tooth bucket was used to create 2 meter trenches approximately 50 cm in depth. Approximately 9 trenches were created. Plant cuttings (stakes) of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically in the trench to a depth of 30 cm, additional plant cuttings were planted horizontally in the trench to provide for more vegetative material to be placed on the site. Additional areas of the site were planted to help prevent wave erosion on the site.

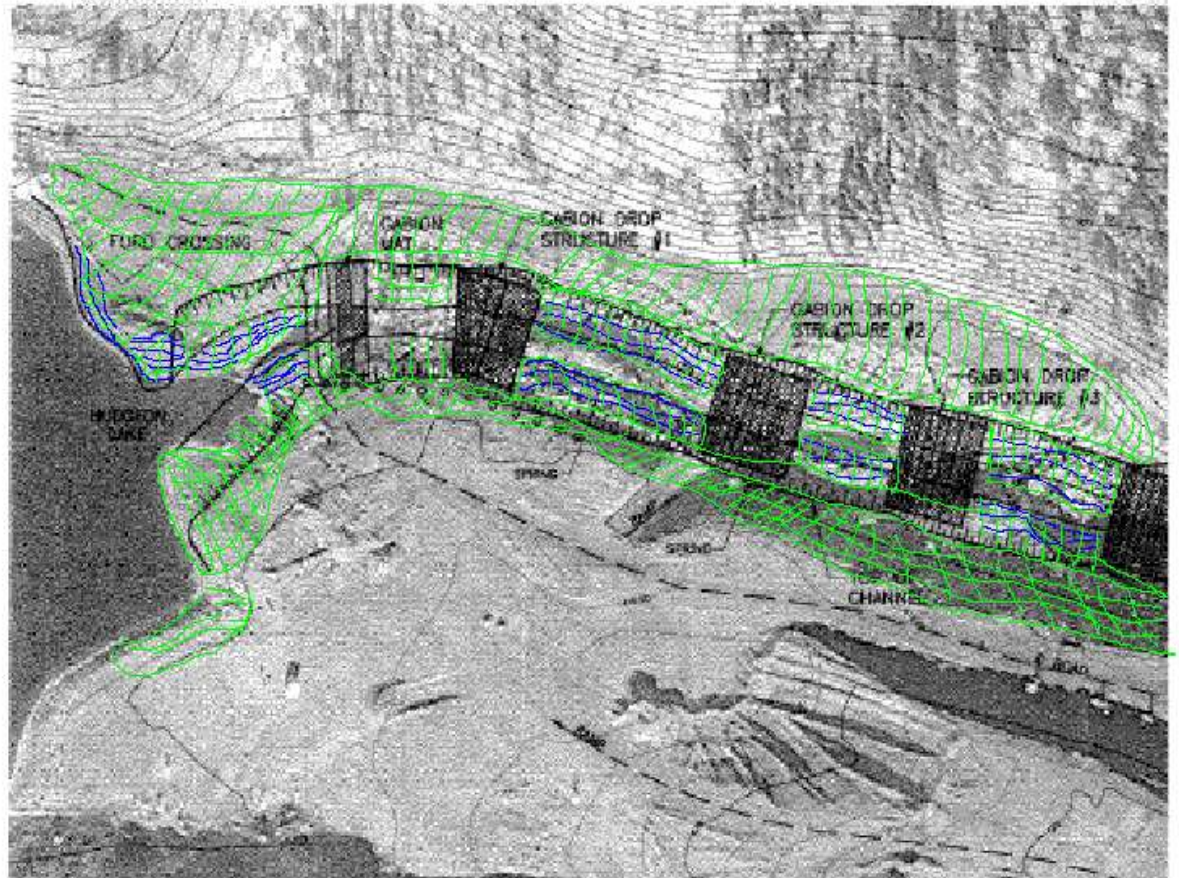
Method 3: Plant cuttings (stakes): of locally harvested plant material approximately 50 cm to 1.5 meters in length were planted vertically to a depth of 50 cm with a weighted metal probe along the steep bank of the lake shoreline. All disturbed areas within the designated boundaries of the project were seeded and harrowed or raked. No fertilizer was used on the mine site.

SKETCH 3 - 2004 CLINTON CREEK CHANNEL STABILIZATION PROJECT SITE AREA

The areas marked in ___(light green) were seeded as the project areas in September of 2004.

The areas marked in ___ (blue) were planted as the riparian area in September of 2004.

During an inspection of the areas in October of 2005 it was noted that all of the 2004 areas demonstrated positive germination and establishment.



CLINTON CREEK
SCALE: 1:50

SUMMARY AND RECOMMENDATIONS

The mine site has seven (7) major areas of disturbance:

1) **Hudgeon Lake & Clinton Creek Channel Stabilization area**

- a) This project area was reclaimed in 2004. The entire 2004 project seeded areas demonstrated positive germination and establishment.
- b) All of the 2004 Project riparian areas demonstrated positive establishment.
- c) Additional local monitoring and reporting are recommended. Annual monitoring and reporting are recommended in order to document results and provide information that will assist in the further development of the reclamation / closure plan for this site.

2) **Former Mill Site**

- a) The revegetation of the Former Mill Site area is complete. The entire Former Mill Site disturbed areas were seeded and harrowed
- b) All of the 2004 seeded areas demonstrated positive germination and establishment.
- c) Annual local monitoring and reporting are recommended in order to document results and provide information that will assist in the further development of the reclamation / closure plan for this site.

3) **Tailings Pile & Wolverine Creek**

- a) The accessible areas of the top elevations of the tailings pile (approximately 5% of the total tailings pile area) were harrowed, seeded and harrowed in the 2005 Phase I Project.
 - i) The top elevations of the tailings pile is approximately 5 % of the total area of the tailings pile, the additional area will require contouring and stabilization in order for these areas to be revegetated in the future. (see recommendations below)
- b) A demonstration project should be considered for this area that would develop positive drainage of the top elevations and direct the drainage towards the former mill site area. This drainage pattern should have a positive effect on the reduction of the slippage of the pile towards Wolverine Creek.
- c) Additionally a portion of the demonstration project could test the effectiveness of harvesting local soils and plant material and placing a vegetative cap on the top elevations with positive drainage to the former mill site and away from the slope.
- d) Approximately 95% of the tailings pile area drains into Wolverine Creek. It is recommended that a Phytoremediation Demonstration Project (using live plant palisade tier planting) be developed for 2006 in order to test the success of containing the lower benches of the tailings pile. Some areas will require contouring and shaping away from the creek to reduce the severity of the toe of the slopes and allow for safe access to the area.
- e) Annual local monitoring and reporting of this area is recommended.

4) **Waste Rock Dump Site Adjacent to Clinton Creek**

- a) Approximately 20% of the total area of this waste rock dump site was prepared, seeded and harrowed in the 2005 Phase I Project. The lower elevations of accessible areas were seeded and harrowed (see diagram)
- b) Some additional contouring for stabilization will be required in order for the remainder of this waste rock dump site to be revegetated in the future (see recommendations below)
- c) It is recommended that the remaining areas of this site receive additional contouring for stabilization in order for the remainder of this waste rock dump site to be revegetated.
- d) All of the 2004 seeded areas demonstrated positive germination and establishment.
- e) Annual local monitoring and reporting are recommended

5) **Additional Areas**

- a) It is recommended that a reclamation site analysis and evaluation for best practices methodologies and budget information be conducted on the following areas
 - i) Waste Rock Dump Site adjacent to the Porcupine Pit
 - ii) Former Crusher Area
 - iii) 3 Pit Areas
 - (1) Snowshoe Pit
 - (2) Creek Pit
 - (3) Porcupine Pit
 - iv) Airport
- 6) This reclamation site analysis and evaluation for best practices methodologies and budget information could be conducted in the fall / winter of 2005 and spring 2006 in order to provide information for the closure planning process and could also address any related public safety concerns of the site.