Proceedings of the 15th Annual British Columbia Mine Reclamation Symposium in Kamloops, BC, 1991.
The Technical and Research Committee on Reclamation

INTEGRATING MINING WITH OTHER RESOURCE USERS AT THE AFTON MINE

AFTON OPERATING CORPORATION
KAMLOOPS, B.C.
C.J. Price

ABSTRACT

Afton 's operation of a copper-gold mine and concentrator near Kamloops since 1977 has demonstrated that mining can be integrated with other resource users in close proximity to a population centre. In particular, integration of the recently developed Ajax orebody with ranching, recreational fishing and licensed water users has presented some special challenges.

Proceedings of the 15th Annual British Columbia Mine Reclamation Symposium in Kamloops, BC, 1991.
The Technical and Research Committee on Reclamation

INTEGRATING MINING WITH OTHER RESOURCE USERS AT THE AFTON MINE

INTRODUCTION

Afton Operating Corporation, which is a partnership between Teck Corporation with 73% and Metall Mining Corporation, operates a copper-gold open pit mine near Kamloops in the southern interior of British Columbia. The mine site and plant site are closer to residential development, highways and other resource users than most Canadian mines. The current pit and waste dumps are adjacent to a lake used for recreational fishing and irrigation storage. Part of one of the previous pits was located within the city limits of Kamloops.

Production from the original Afton pit commenced in late 1977 at about 6800 tonnes of ore per day. Afton produces a concentrate containing copper and gold which is shipped to Japanese smelters. Approximately 24 million pounds of copper and 25,000 ounces of gold were produced in 1990. Currently about 200 persons are employed at Afton.

Infrastructure at Afton's plantsite includes the primary crusher, an 8,500 tpd concentrator, maintenance shops and warehouse facilities, the assay laboratory and the administration building. A 100 tpd copper smelting facility was shut down permanently in 1983.

The following is the sequence of open pits that have been completed at Afton:

OPEN PIT	OPERATION TIME	ORE 10^6 tonnes	WASTE ROCK 10^6 tonnes
Afton	1977-1987	22.2	119
Pothook	July 87 to Sept 88	2.4	5.6
Crescent	Oct 88 to May 89	1.5	2.7
Ajax West (stage 1)	June 89 to March 90	3.8	7.1

The Ajax East Pit is currently being mined. There are plans for an Ajax West Pit which should extend the life of the operation until 1995.

TAILINGS IMPOUNDMENT

A 117 hectare tailings impoundment is located west of the Afton pit. Up to 85% of the tailings pond water is recycled to the milling process. There is no discharge of tailings water to the downstream Cherry Creek watershed. Monitoring of water quality downstream of the tailings dam since 1976 has demonstrated that there is no impact on the downstream domestic and irrigation water resources from the Afton tailings disposal system. The graph of copper values on the following page illustrates the low values in the tailings and in Cherry Creek upstream and downstream of the tailings pond.

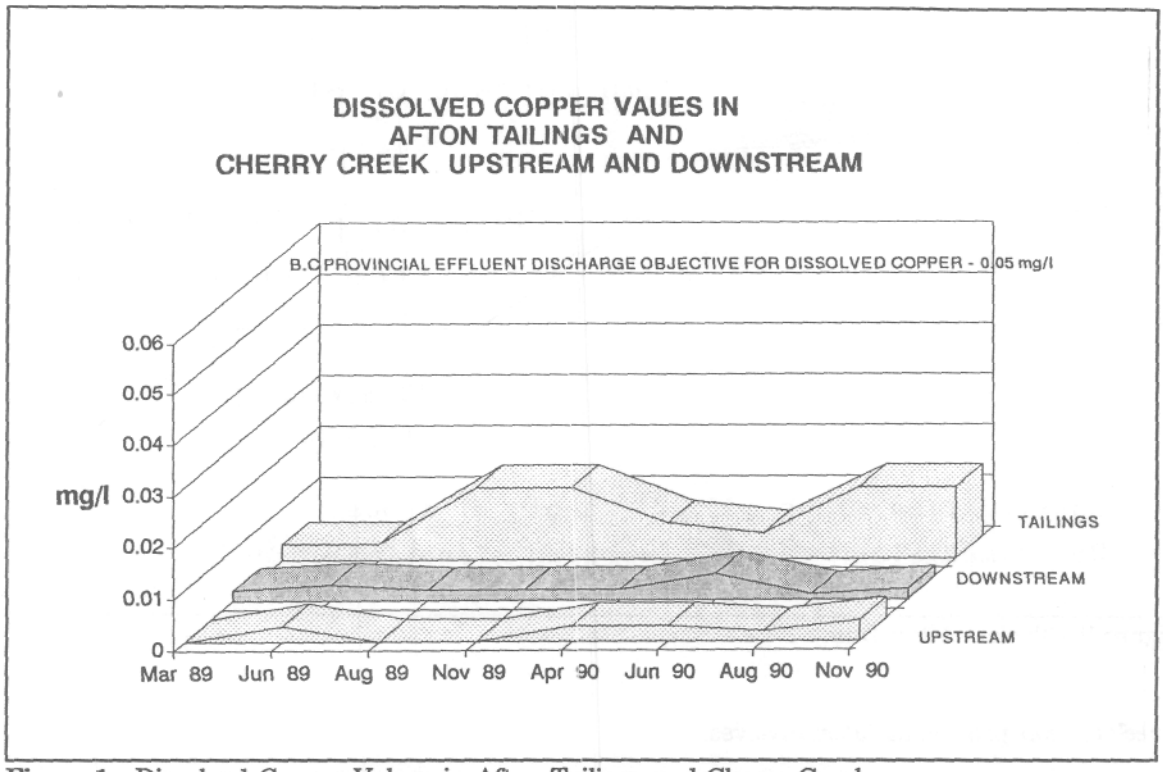

Figure 1 - Dissolved Copper Values in Afton Tailings and Cherry Creek

MINING AND RANCHING

Ranching has historically been the primary land use in the Kamloops area. Mining and ranching have coexisted at Afton since start-up in 1977. Sugarloaf Ranches, Afton's sister company has operated a 250 head cow/calf ranching operation on the land surrounding the mine site. In late 1988 the Morrison ranch was purchased to allow access to the Ajax ore bodies. This increased the ranching area to over 5000 hectares with approximately 600 head of cattle.

The productivity of 110 acres of rangeland was enhanced by seeding and irrigation to help offset the removal of land for mining. Two crops of alfalfa are cut annually on this irrigated land and used for winter feed for cattle herd.

Most of the land used for mining purposes at Afton has been temporarily removed from the agricultural land reserve on the condition that it be reclaimed and restored to its former level of productivity, after mining activities are completed.

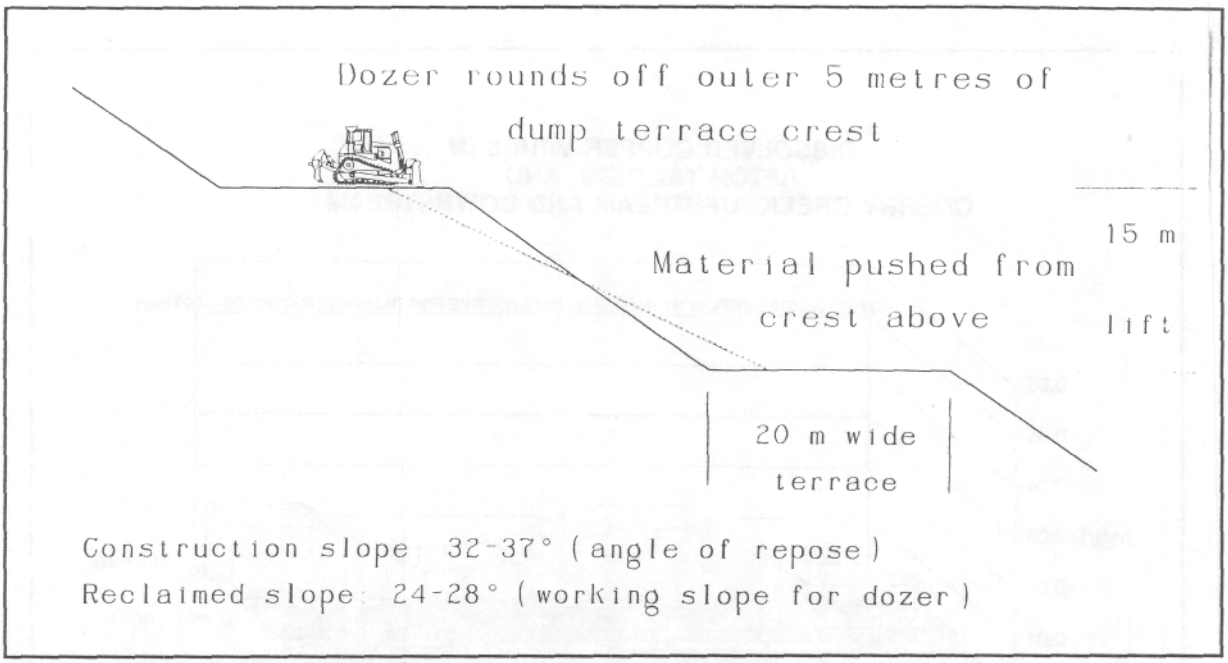

Figure 2 - Typical Afton Dump Face

The reclamation process at Afton involves:

1. Contouring rock waste dumps, haulage roads and other disturbed land with a dozer. Since the natural terrain is relatively flat, the waste dumps are designed with a terraced profile so that contouring with a dozer can ultimately be achieved most economically.

2. The contoured rock dumps are covered with glacial till that had been stockpiled for this purpose as each open pit was initially developed.

3. The final step in restoring the land is seeding to establish vegetation. Seeding is done by hand mechanical spreader or by helicopter depending on the slope and the total area to be covered.

Crested wheat grass, has been the only species which has been real successful in the semi-arid climate with an average of 250 mm of annual precipitation. This is not surprising as the crested wheat grass is the grass species which most closely resembles the native bunch grass. Other species, including annual rye do not even seem to germinate. Alfalfa is added to the seed mis in an attempt to have legume growth and some areas the alfalfa has had moderate success.

The major portions of all Afton waste rock dumps have been reclaimed as they have become inactive. Ultimately all the reclaimed area will be available as rangeland after mining ceases and the grass becomes hardy enough to withstand the cattle grazing, usually after 4-6 years of growth.

The open pits and steep slopes of the tailings dam are areas that will not be reclaimed, however this area represents a small proportion of the land disturbed by mining.

MINING AND RECREATIONAL FISHING

The Ajax ore deposit is located near Jacko Lake which is used as a recreational fishing resource and as licensed storage for downstream irrigation. The concerns of these two resource users have had to be dealt with by Afton.

Rainbow trout were introduced to Jacko Lake in the 1940's. It is stocked each year by the Ministry of Environment - Fish and Wildlife Branch. Although the lake is located on private land, the Kamloops Fish and Game Association had an understanding with the former land owner for public access to the lake during non-winter months for fishing purposes.

Prior to receiving approval in principle for the Ajax Project in 1989 numerous meetings were held over a nine month period with both the Ministry of Environment representatives and the fisherman to exchange information regarding their concerns and Afton's mine plan. Through these discussions and meetings the following concerns were identified as being the most important to the fisherman:

1. Loss of Access to Jacko Lake

   With Afton acquiring ownership of the ranch on which Jacko Lake is situated, concerns were raised about the loss of access by the fisherman. To ensure guaranteed access, Afton and the Kamloops Fish and Game Association signed an agreement that provides

   a. A legal road easement to the lake
   b. A lease for the land used for parking and the boat launch

   for a period of time extending five years beyond the mine life.

2. Visual Impact of Mining Operations on the Fistdng Experience

   Afton's initial plans for location of the haulage road and the mine buildings were based on the most economical options. The haul road north of the lake was planned to be routed adjacent to the lake shore. Lake users on the other hand proposed the road be routed at least a few kilometers further north where it would be completely out of sight. The additional cost for their proposal was estimated to be $6.0 million. This was simply too expensive;.

   A compromise was reached and the final road location was further back from the lake shore. This placed the road in a rock-cut for a considerable distance, partially blocking the mine traffic from view. Where possible portions of the haul road berm visible from the lake were contoured and seeded. The mine dry building was constructed in a location not visible from the lake.

3. Dust and Noise from Trucks on Haul Road

   This concern was addressed in part by relocating the planned road further back from the lake. Afton agreed to provide dust control by water spraying the road surface or by treating the road surface with magnesium chloride, an effective dust suppressant. After applying $MgCl_2$ to several trial sections the entire 11 km haulage road was treated with MgCL, on two occasions in 1990. The cost of the $MgCl_2$ in 1990 was approximately $100,000 which was a saving when compared to controlling the dust with water trucks.

4. Lake Draining in the Pit

   Fears were expressed that lake water could drain into the pit, when mining progresses below the elevation of Jacko Lake. The lake surface is at the 891 meter elevation while the ultimate pit bottom is designed at 760 meter elevation or 130 meters lower than the lake.

   A hydrogeological study concluded it was very unlikely for significant quantities of water to flow to the pit from Jacko Lake. This study included ground resistivity surveys between the lake and the pit to detect potential water carrying channels and test drill holes to measure the rock permeability. In spite of these conclusions a $0.5 million bond was secured to cover the cost of mitigative work should it become necessary.

Government approval for the Ajax project was granted after the technical, environmental and social aspects were dealt with to the satisfaction of the Ministries represented on the Mine Development Steering Committee.

There have been no complaints received from the fishermen during the past two years of mining near Jacko Lake.

MINING AND LICENSED WATER USERS

Water licences entitling users a legal right to the water in Jacko Lake and Peterson Creek date back to 1877. The water is used for irrigation of hay fields by ranchers. In the wetter years most of the licensed requirements can be met, however in dry years the quantity of water can be much less than required. For example in 1989 and 1990 there was been no water available for irrigation from Jacko Lake because of low snow pack in the watershed.

The licensed water users were concerned that both the quantity and quality of water might be adversely affected by the planned mining activity adjacent to Peterson Creek.

Afton recognized that no water could be taken out of Jacko Lake or Peterson Creek and all water required for mining purposes would have to be hauled from the plantsite.

The adjacent Figure illustrates the general mine plan in relation to Peterson Creek. Land on either side of Peterson Creek will be disturbed by mining. Based on a hydrological engineering study, a number of mitigative measures were proposed to compensate for land alienated from the watershed by virtue of mining. The measures were endorsed by the Ministry of Environment - Water Management Branch and subsequently presented at meetings held with the licensed water users. Four of the measures were finally mutually agreed to.

1. Lining Creek Channel

   Historically it has been estimated that 50% of water released from Jacko Lake was not available for irrigation due to seepage and evapotranspiration that was occurring in the creek channel between the storage dam and the first irrigation gate located several kilometers downstream.

   The portion of Peterson Creek channel running through the minesite as illustrated with packed, impervious till for 1000 meters, will reduce these water losses. The new channel was completed in the fall of 1990.

2. Dredging Lake Discharge Channel

   The Lake discharge channel has silted in over the years reducing the quantity of stored water available for discharge to the downstream users by one third. Dredging the channel restored the availability of the full live storage of the lake.

3. Raising of Water Storage Dam

   The study estimated that about 25% of the inflow to Jacko Lake was being spilled during wet years. By raising the dam by one meter in the fall of 1990 the live storage doubled thereby retaining water for subsequent drier years.

4. Improving water flow measurement

   A system for continuous water flow measurement was installed at two locations downstream of Jacko Lake. This detailed information allows for better management of the stored water resource by the water bailiff.

With respect to water quality, a background water study covering Jacko Lake, Peterson Creek including domestic wells, was initiated three years prior to any mining activity. Lake and creek water quality will continue to be monitored by a sampling program throughout the mine life.

The potential of mine waste rock and tailings to produce acid drainage long after mining is completed is one of the most serious environmental problems that every new mine must address. As part of the environmental study Afton conducted 275 separate acid-base accounting tests on both diamond drill core and tailings samples. These tests indicated the potential for acid rock drainage was not a problem due to the presence of neutralizing calcite. The tests show the Ajax waste rock is a net acid consumer.

Containment ponds and ditching were built to isolate ainy potentially contaminated run off water from the waste rock dumps and the open pit area thereby avoiding direct discharge into Peterson Creek. The location of the ditching and various containment pondis is shown on the slide. Construction of the main settling pond is shown in this slide. These structures were designed for a 200 year peak flow.

The environmental study, isolation of mine area runoff water and ongoing water monitoring addressed the concerns relating to water quality of Peterson Creek.

CONCLUSIONS

Solutions to Afton's problem of integrating mining with other resource users may be site specific but probably demonstrate some underlying fundamentals:

1. Resolution of problems requires direct ongoing communication between the mining company, the appropriate government agency, the mine development steering committee and the affected parties. Problems are often due to perception and not fact. For example there was some fear from the Fish and Wildlife Branch and the fisherman that the lake would have to be cleared for every blast due to the danger of fly rock; in actual fact fly rock from Afton blasting is not an issue and there was no need to clear the lake.

2. Mining can coexist with other resource users even in environmentally sensitive areas, to the benefit of all parties involved. However all parties must have some flexibility in their position to accommodate the needs of the other parties.