

## MINING AND WATER POLLUTION

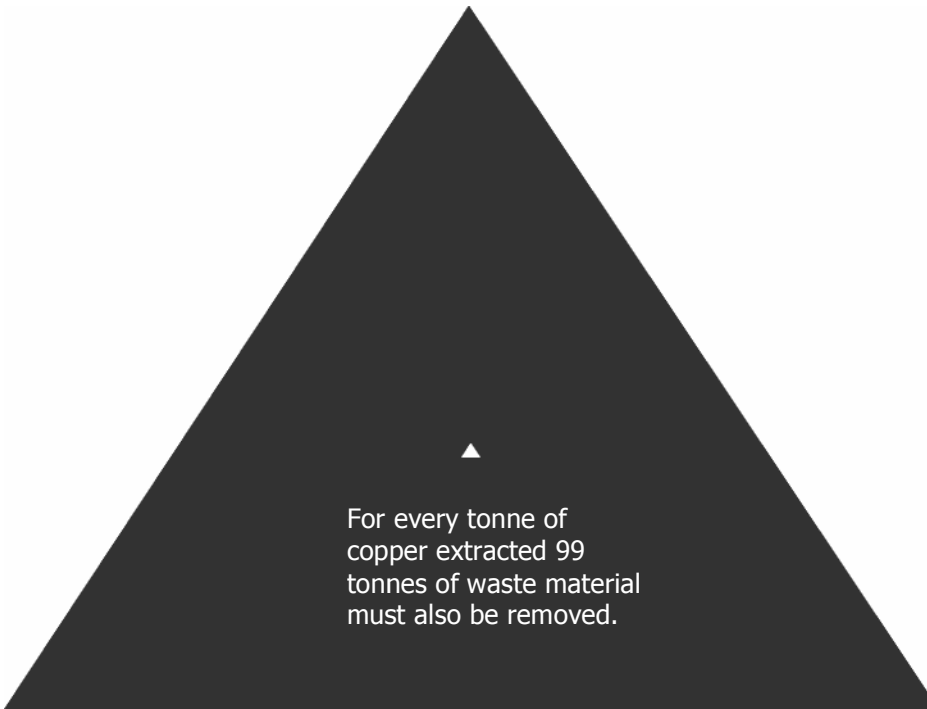
Water is essential to life on our planet. A prerequisite of sustainable development must be to ensure uncontaminated streams, rivers, lakes and oceans. There is growing public concern about the condition of fresh water in Canada. Mining affects fresh water through heavy use of water in processing ore, and through water pollution from discharged mine effluent and seepage from tailings and waste rock impoundments. Increasingly, human activities such as mining threaten the water sources on which we all depend. Water has been called “mining’s most common casualty” (James Lyon, interview, Mineral Policy Center, Washington DC). There is growing awareness of the environmental legacy of mining activities that have been undertaken with little concern for the environment. The price we have paid for our everyday use of minerals has sometimes been very high. Mining by its nature consumes, diverts and can seriously pollute water resources.

### Negative Impacts

While there have been improvements to mining practices in recent years, significant environmental risks remain. Negative impacts can vary from the sedimentation caused by poorly built roads during exploration through to the sediment, and disturbance of water during mine construction. Water pollution from mine waste rock and tailings may need to be managed for decades, if not centuries, after closure. These impacts depend on a variety of factors, such as the sensitivity of local terrain, the composition of minerals being mined, the type of technology employed, the skill, knowledge and environmental commitment of the company, and finally, our ability to monitor and enforce compliance with environmental regulations. One of the problems is that mining has become more mechanized and therefore able to handle more rock and ore material than ever before. Therefore, mine waste has multiplied enormously. As mine technologies are developed to make it more profitable to mine low grade ore, even more waste will be generated in the future.

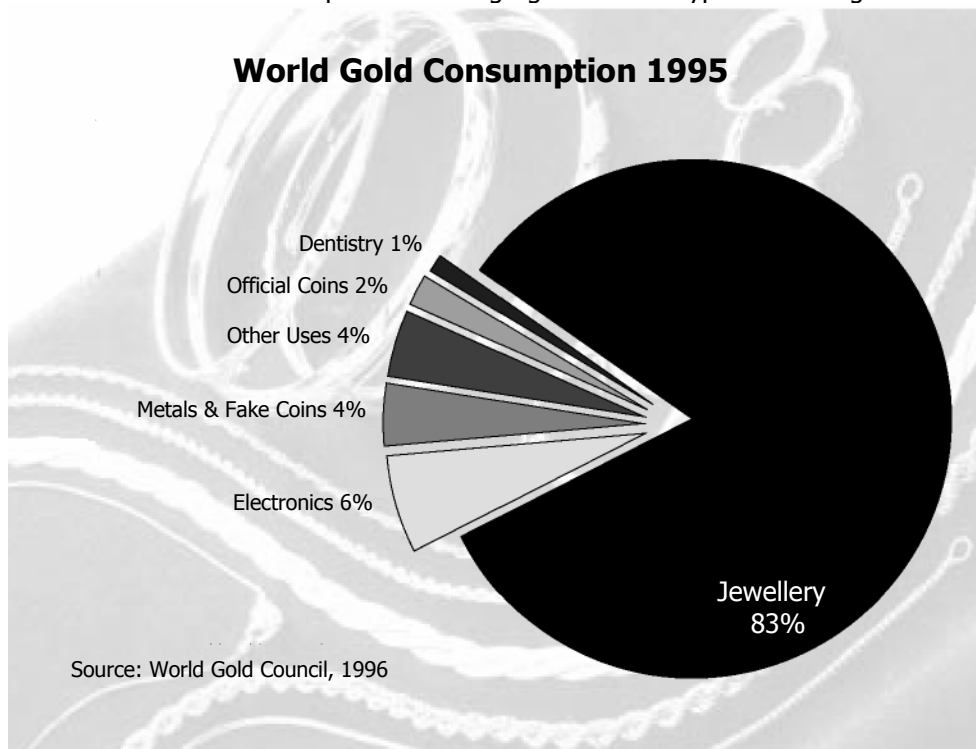
### Waste from the Mining Process

Ore is mineralized rock containing a valued metal such as gold or copper, or other mineral substance such as coal. Open-pit mining involves the excavation of large quantities of waste rock (material not containing the target mineral) in order to extract the desired mineral ore. The ore is then crushed into finely ground tailings for processing with various chemicals and separating processes to extract the final product. In Canada on average for every tonne of copper extracted 99 tonnes of waste material (made up of soil, waste rock and the finely ground “tailings”) must also be removed.



**Amount of Copper Removed Compared to Amount of Waste Material that Must also be Removed**

The amount of gold extracted per tonne of material disturbed is even less. Almost three tonnes of ore is needed to produce enough gold for one typical wedding band.



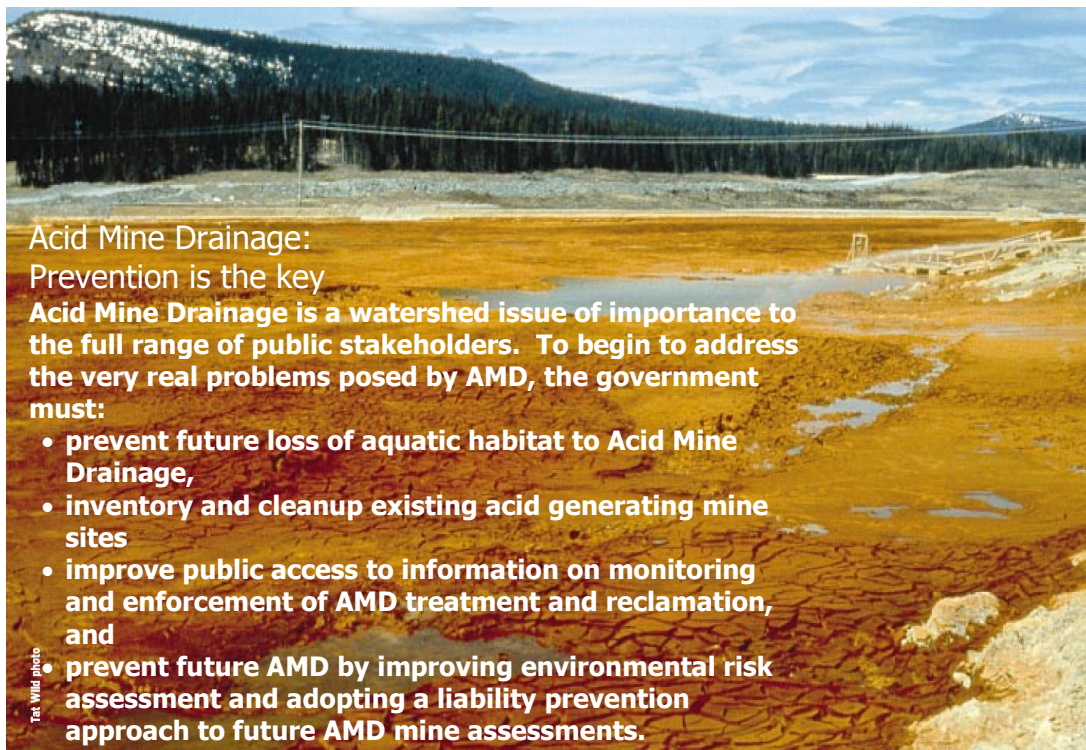
The Canadian mineral industry generates one million tonnes of waste rock and 950,000 tonnes of tailings per day, totaling 650 million tonnes of waste per year. After being removed, waste rock, which often contains acid-generating sulphides, heavy metals, and other contaminants, is usually stored above ground in large free-draining piles. This waste rock and the exposed bedrock walls from which it is excavated are the source of most of the metals pollution caused by mining in British Columbia. In other regions of North America tailings also represent a major source of heavy metals contamination of waterways.

## Types of Water Pollution from Mining

There are four main types of mining impacts on water quality.

### 1. Acid Mine Drainage

Acid Rock Drainage (ARD) is a natural process whereby sulphuric acid is produced when sulphides in rocks are exposed to air and water. Acid Mine Drainage (AMD) is essentially the same process, greatly magnified. When large quantities of rock containing sulphide minerals are excavated from an open pit or opened up in an underground mine, it reacts with water and oxygen to create sulphuric acid. When the water reaches a certain level of acidity, a naturally occurring type of bacteria called *Thiobacillus ferrooxidans* may kick in, accelerating the oxidation and acidification processes, leaching even more trace metals from the wastes. The acid will leach from the rock as long as its source rock is exposed to air and water and until the sulphides are leached out – a process that can last hundreds, even thousands of years. Acid is carried off the minesite by rainwater or surface drainage and deposited into nearby streams, rivers, lakes and groundwater. AMD severely degrades water quality, and can kill aquatic life and make water virtually unusable.



**Acid Mine Drainage: Prevention Is the Key**

## 2. Heavy Metal Contamination & Leaching

Heavy metal pollution is caused when such metals as arsenic, cobalt, copper, cadmium, lead, silver and zinc contained in excavated rock or exposed in an underground mine come in contact with water. Metals are leached out and carried downstream as water washes over the rock surface. Although metals can become mobile in neutral pH conditions, leaching is particularly accelerated in the low pH conditions such as are created by Acid Mine Drainage.

## 3. Processing Chemicals Pollution

This kind of pollution occurs when chemical agents (such as cyanide or sulphuric acid used by mining companies to separate the target mineral from the ore) spill, leak, or leach from the mine site into nearby water bodies. These chemicals can be highly toxic to humans and wildlife.

## 4. Erosion and Sedimentation

Mineral development disturbs soil and rock in the course of constructing and maintaining roads, open pits, and waste impoundments. In the absence of adequate prevention and control strategies, erosion of the exposed earth may carry substantial amounts of sediment into streams, rivers and lakes. Excessive sediment can clog riverbeds and smother watershed vegetation, wildlife habitat and aquatic organisms.

## Water Quantity

Mining can deplete surface and groundwater supplies. Groundwater withdrawals may damage or destroy streamside habitat many miles from the actual mine site. In Nevada, the driest state in the United States of America, the Humboldt River is being drained to benefit gold mining operations along the Carlin Trend. Mines in the northeastern Nevada desert pumped out more than 580 billion gallons of water between 1986 and 2001 – enough to feed New York City's taps for more than a year. Groundwater withdrawn from the Santa Cruz River Basin in Southern Arizona for use at a nearby copper mine is lowering the water table and drying up the river.

## Lessons from the Past

The Tsolum River Experience: Short-term mine, long-term costs.

The Tsolum River on Vancouver used to run clean and clear from its source near Mount Washington to the Courtenay estuary. For thousands of years, the river provided rich runs of coho, pink, chum and cutthroat salmon, as well as steelhead trout that weighed up to 23 pounds. The river was rich with life, sustaining human communities and the entire ecosystem through which it flowed. Impacts on the river started in the post war era when logging and irrigated agriculture moved into the watershed, gravel was mined from the riverbed in the lower reaches and then, in 1964, the Mt Washington Copper Mining Co. moved into the upper Tsolum watershed. The company began a small open-pit copper mine adjacent to the Tsolum River. During three years of operation, the company excavated 360,000 tonnes of ore and 940,000 tonnes of waste rock before abandoning the mine in 1966. It was a small mine, high up in the mountain, disturbing an area of only 13 hectares. But it left behind a toxic legacy that has spread far beyond the mine's perimeter. After 1966, the coho escapement declined steadily from 15,000 to a low of 14 in 1987. The coho are particularly vulnerable to toxicity caused by acid mine drainage as they reside in the system for up to 14 months after hatching. Trout are thought to be as vulnerable to the changes in water quality because of their long residence in fresh water. Despite expensive, publicly funded restocking efforts, government

reports show “virtually no salmon” living in or returning to the Tsolum River. Also, the wonderful steel-head runs are also gone from the river—a tremendous loss. By 1985, with the demise of the Tsolum River came the loss of the Tsolum river fishery of pinks, coho, chum and steelhead, which had generated as much as \$2 million per year for the community. The government’s watershed assessment concluded that “the fisheries resource is believed to have declined [by 90 per cent] predominantly because of Acid Mine Drainage from Mount Washington.” It has been estimated that the loss of the fishery, combined with millions of taxpayer dollars spent for mine clean-up, have cost at least \$60 million so far.

### What Can be Done?

“Once a mine is in operation water protection must remain the highest goal of the company, even if it means reduced mineral productivity. Adopting this common-sense ethic is the only way we can ensure that the golden dreams of mining do not turn into the nightmare of poisoned streams.” (Carlos De Rosa & James Lyon, *Golden Dreams, Poisoned Streams*. Mineral Policy Center, Washington DC, 1997).

Changes in laws, technologies and attitudes have begun to address some of the most immediate threats posed by mineral development, but there are still many areas of mining practices and regulations that need to be addressed. Unfortunately, significant reductions in federal and provincial government budgets have affected the capacity to administer, monitor and enforce existing laws and policies. As a result, there have been ongoing water quality and waste management problems at many mines. There have been a number of preventable accidents including massive sediment loading into fish-bearing streams, the building of roads with acid generating waste rock, non-compliance with waste handling plans, and repeated violations of water quality standards. Alan Young, of the Environmental Mining Council of BC, notes that “over the last year, we have seen an inability in regional government offices to monitor and enforce environmental standards at several mine sites. The agencies do not have the resources to do the job, and unfortunately, some companies don’t seem to respond unless penalized. Without enforceable standards we are faced with decreased corporate accountability, and increased ecological liability.” According to Young, “we can pay now or pay later, and history has shown us that, especially with mining, clean up is always more expensive than prevention. Good companies understand this concept, but the laws are not there for the good guys.” Deregulation favoured by the industry would further reduce accountability, consistency and transparency with respect to protecting clean water. Without an effective regulatory base, voluntary measures have not, and will not deliver reliable, consistent safeguards and environmental performance improvements.

For the sake of current and future generations we need to safeguard the purity and quantity of our water against irresponsible mineral development. We need to ensure the best pollution prevention strategies are employed in cases where the risks can be managed. We also need to recognize that in some places mining should not be allowed to proceed because the identified risks to other resources, such as water, are too great.

In the right place – and with conscientious companies, new technologies and good planning – many of the potential impacts are avoidable. In fact, most mine pollution arises from negligence not necessity.

The Safe Drinking Water Foundation has educational programs that can supplement the information found in this fact sheet. Operation Water Drop looks at the chemical contaminants that are found in water; it is designed for a science class. Operation Water Flow looks at how water is used, where it comes from and how much it costs; it has lessons that are designed for Social Studies, Math, Biology, Chemistry and Science classes. Operation Water Spirit presents a First Nations perspective of water and the surrounding issues; it is designed for Native Studies or Social Studies classes. Operation Water Health looks at common health issues surrounding drinking water in Canada and around the world and is designed for a Health, Science and Social Studies collaboration. Operation Water Pollution focuses on how water pollution occurs and how it is cleaned up and has been designed for a Science and Social Studies collaboration. To access more information on these and other educational activities, as well as additional fact sheets, visit the Safe Drinking Water Foundation website at [www.safewater.org](http://www.safewater.org).

### Resources:

Alaskans for Responsible Mining. December, 2004. Environmental Impacts Fact Sheet.

[http://www.miningwatch.ca/sites/www.miningwatch.ca/files/ARM\\_Envr\\_Impacts\\_Fact\\_Sheet\\_0.pdf](http://www.miningwatch.ca/sites/www.miningwatch.ca/files/ARM_Envr_Impacts_Fact_Sheet_0.pdf)

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McClure, Robert & Schneider, Andrew. June 12, 2001. The Seattle Post Intelligencer: More than a century of mining has left the West deeply scarred.

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