

Water-Related Impacts at the Pebble Mine

Metal mines throughout the world have degraded water quality and require enormous volumes of water. Mining affects water quantity and quality and ways in which the Bristol Bay watershed may be vulnerable should the Pebble Mine be developed.

WATER QUANTITY

Modern metal mining requires massive volumes of water, which are typically diverted from fisheries, domestic, recreational, and agricultural uses, thus increasing competition for water. For example, diversion of lake water in the Andes by Southern Peru Copper Corp. has dried up lakes and surrounding meadows used for fishing and grazing.

Developing and operating the Pebble Mine would require billions of gallons of water each year of mine operation. Northern Dynasty Mines, Inc. (NDM) applied to the State of Alaska in July of 2006 for water rights in the following amounts (in gallons per year):

Location	Surface Water	Groundwater
South Fork Koktuli	12.03 billion	2.8 billion
North Fork Koktuli	8.02 billion	0.2 billion
Upper Talarik Creek	6.84 billion	1.7 billion

This is nearly 35 billion gallons of water a year: more than annual water consumption rates in Anchorage¹.

WATER QUALITY

Site operation chemicals: Mine operations use tremendous amounts of chemicals—explosives, fuels, oils, greases, antifreeze, water treatment chemicals, herbicides, pesticides, and road de-icing compounds – that may be released into local surface and groundwater and can be toxic to fish and wildlife.

Tailings: Ore is pulverized and mixed with water and chemicals that separate copper, gold and other metals from the rock. More than 99 percent of processed ore becomes a solid-water-chemical waste called tailings that will be permanently stored within large impoundments.

Tailings contain process chemicals and elements from natural rock that can harm humans and wildlife. For example, 2 parts per billion concentrations of copper above background may negatively affect the ability of salmon to locate their spawning grounds.² Other natural rock elements may include aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, molybdenum,

¹ USGS. 2006. Anchorage Water Use. Fact Sheet 2006-3148. USGS Anchorage, AK.

² Hecht, S.A. and 5 coauthors. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper. Technical White Paper. NMFS, Seattle, WA.

nickel, selenium, silver, thallium, zinc, sulfides, and natural radioactive constituents (uranium, thorium, potassium-40).

Process chemicals in tailings may include lime, sodium isopropyl xanthate (e.g. SF-113), dithiophosphate and thionocarbamate (e.g. Aeropromotor AC 6682), methyl isobutylcarbinol (MIBC), and polypropylene glycol methyl ether (Dowfroth 250). Some of these chemicals are recycled but most are discharged with the tailings.

RISK OF LEAKAGE

Copper mines frequently operate for 50 years or more. Tailings impoundments must hold the waste forever and are vulnerable to natural forces such as erosion, landslides and earthquakes. Seepage is collected and returned to the impoundment during operations, but this process usually stops when mining ceases. Inevitably, some of the “chemical soup” seeps out into the surrounding ground and surface waters.

The Bingham Canyon Mine, like Pebble, is a copper/gold/molybdenum mine, currently the largest in North America with an ore body roughly half the size of Pebble. Pollution from the mine has contaminated 60 square miles of groundwater near Salt Lake City, making water unusable for at least 4,300 households. Kennecott Utah Copper Corp., a subsidiary of Rio Tinto, built a multi-million dollar water treatment facility, the largest of its kind in the United States, to treat an estimated 2.7 billion gallons of polluted water annually for at least the next 40 years.



Figure 1. Kennecott Bingham Canyon Mine in Utah. (Left) Tailings impoundment (roughly 9,000 acres) with the Great Salt Lake at the top left. The pit is 0.75 miles deep, 2.5 miles wide, and covers 1,900 acres. (Right) Tailings are shown in the foreground (grey) with Salt Lake City in the background. Operations produced a 60 square-mile groundwater plume under valley to right, mostly from waste rock seepage. As of 2006, Kennecott had spent \$370 million on cleanup and source control, and will be required to pump and treat aquifer water for at least the next 40 years. By 2009, 2.7 billion gallons of water will be treated annually to supply homes unable to use the aquifer.

The proposed Pebble Mine has similar potential to contaminate ground water. It is located in the headwaters of Bristol Bay, a pristine region laced with streams, rivers and lakes. The extensive glacial gravel deposits are highly permeable, a characteristic that contributes to salmon productivity but also provides pathways for water and potentially for mine wastes to move between surface and groundwater and between river basins. Salmon have adapted to the local surface water, naturally pure with extremely low concentrations of dissolved minerals; even minute amounts of contaminants can potentially impact salmon.

Modern metal mining operations throughout the world have degraded water quality and increased competition for water. These impacts often do not become apparent until after mine operations cease.

Text by Moran, R. 2007. Pebble hydrogeology and geochemistry issues.

Further Reading and References

[Department of Environmental Conservation, 2003. Water Quality Standards. 18 AAC 70. \(pdf file 286 kb\)](#)

[Hancock, P. J. 2002. Human impacts on the stream-groundwater exchange zone. Environmental Management 29\(6\):763-781. \(pdf file 768 kb\)](#)

[Hart, R. C. 1992. Experimental studies of food and suspended sediment effects on growth and reproduction of 6 planktonic cladocerans. Journal of Plankton. 14\(10\):1425-1448. \(abstract - pdf file 14 kb\)](#)

[Kuipers, J. R., A. S. Maest, K. A. MacHardy, and G. Lawson. 2006. Comparison of predicted and actual water quality at hardrock mines. The reliability of predictions in Environmental Impact Statements. \(pdf file 1.38 mb\)](#)

[Levinson, M., E. Lee, J. Chung, M. Huttner, C. Danely, C. McKnight, and A. Langlois. 2008. Watching water. A guide to evaluating corporate risks in a thirsty world. JP Morgan. Global Equity Research. \(pdf file 747 kb\)](#)

[U. S. Environmental Protection Agency. 2000. Liquid Assets 2000: America's water resources at a turning point. EPA-840-B-00-001. \(pdf file 868 kb\)](#)

[Weber-Scannell, P. K., and L. K. Duffy. 2007. Effects of total dissolved solids on aquatic organisms: A review of literature and recommendation for salmonid species. American Journal of Environmental Sciences. 3\(1\):1-6. \(pdf file 162 kb\)](#)