



*Rochester Committee  
for Scientific Information  
Rochester, NY*

*RCSI Bulletin 194  
Environmental Impacts of Salt mining on the Plum Point Creek Area and on Seneca Lake*

*By: James Harper  
February 1976*

THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION  
P. O. Box 5236, River Campus Station  
Rochester, New York 14627

Bulletin #194

February, 1976

Environmental Impacts of Salt Mining  
on the Plum Point Creek Area  
and on Seneca Lake

by  
James Harper

Summary

This report presents evidence of air, water, and soil pollution by waste salt (sodium chloride) from the Morton Salt Company mine at Himrod, N.Y. and discusses the measures taken to abate the problem. Large spills of waste brine, from breaks in holding ponds, have flooded into Plum Point Creek and over part of Plum Point in 1972 and 1974, killing vegetation and spoiling well water. Trout stopped spawning in Plum Point Creek. Salt water percolating from piles of salt and from brine holding ponds degraded well water near the mine. Salt dust from processing operations has damaged vineyards and woodlots downwind.

Seneca Lake water became increasingly polluted by mine runoff between 1941 and 1971, but recent actions by the Department of Environmental Conservation (DEC) stopped the main salt discharges. The lake may be on the way to recovery. The Plum Creek area, however, is still subject to salt damages and to hazards of brine spills, while awaiting a projected reconstruction of facilities at the Himrod mine.

Background: Increase of Salt in Seneca Lake

Seneca Lake extends 37 miles from Geneva to Watkins Glen. Its principal geographic and hydrologic measurements are: width 1 to 3 miles, extreme depth 632 feet, mean depth 290 feet, surface area 66.7 square miles, volume about  $4 \times 10^{12}$  gallons (U. S. Army Engineer's estimate). The drainage basin is 542 square miles, or less than ten times the lake area; therefore flowthrough is slow.

The lake itself intercepts two known salt beds, and its natural salt content is the highest of any of the principal Finger Lakes. Only Lake Onondaga, near Syracuse, is more highly saline than Seneca. The salt is mostly sodium chloride (kitchen salt). Saltiness is measured in terms of the concentration of chloride ions. The U. S. Geological Survey has found that the chloride ion level in Seneca Lake has increased from 105 ppm in 1941 to 190 ppm in 1971. Total dissolved solids increased from 325 ppm to around 460 ppm during the same time (data from Albany, N.Y. Office, U. S. Geological Survey). Data showing a similar increase in salt in Seneca Lake have been collected by William F. Ahrnsbrak, of Hobart and William Smith Colleges,

Geneva, N.Y. (1). The concentration of dissolved solids measured in Seneca Lake in the 1940's was already twice as high as that measured in Lake Ontario. At that time, the chlorides in lake water could have come from natural salt deposits on the bottom of the lake and in the watershed. The great increase seen in the following thirty years was man-made. Salt mines were the principal source of the added salt.

Three companies mine salt in the Seneca Lake watershed. Watkins Salt Co. and International Salt Co. extract salt in water solution, pumping it to the surface for evaporation. This process produces crystallized salt for sale, and a salt brine as waste. The brine was originally disposed of in two ways: some was pumped back underground into deep wells and the remainder was discharged on the surface and ended in the lake. At present, brine can no longer be discharged on the surface, as explained in the discussion, below.

Morton Salt Company began work on a 200 acre surface site plus some 6,000 acres of underground mineral rights near Himrod, N.Y. (Zip 14842) in 1969. Production began in 1970. Unlike the older operations, solid rock salt is taken from a vein about 25 feet thick at a depth of over 2,000 feet to be crushed, sized, and shipped. The salt is sold mainly for highway de-icing and to chemical industries. Projected production was 2½ million tons per year for 1972. This bulletin describes the pollution of water, air and soil by salt from the Himrod mine. Its purpose is to help the current efforts to clean up this source of pollution, and stop the resulting damages to property and to natural resources.

#### Escape of Polluting Salt from the Himrod Mine

The Morton Salt Company mines rock salt at the Himrod Mine. Large quantities of waste salt-bearing rock are continually dumped onto large piles on the surface. These piles are about 70 feet high and cover several acres. Salt dust is picked up from the piles by the wind, to contaminate nearby soil and vegetation. More salt dust gets into the wind when the crude material is crushed and screened to produce marketable rock salt.

Rain dissolves the piled-up salt. The resulting runoff is supposed to be guided to holding ponds. The mine is designed for dry excavation. Water which enters the mine is undesirable and must be pumped out. This salty brine is also collected in large holding ponds behind earthen dams.

The brine is pumped from the ponds into a deep well. This method of disposal puts salt back where it came from, and need not pollute the environment. At present, however, brine also escapes from the ponds in other ways, which pollute the environment. First, brine seeps down continuously through the bottom of the ponds, and contaminates the underground water table, which feeds springs and wells. Second, it is allowed to overflow into Plum Creek, and then into Seneca Lake, when the rate of pumping falls behind the inflow and the ponds are filled to the brim. This may happen because of rain, or because of mechanical failure at the pumps. Third, there is the threat of a large spill of brine in case of a break in the earthen dams. In fact, the dams were not built securely enough, because they have already broken, releasing the brine. Very large spills occurred during Hurricane Agnes in 1972, again on April 2, 1974, and most recently during a rainstorm on September 3, 1974. Each time, brine flooded into Plum Point Creek and then into Seneca Lake.

The volume of the spill from the September, 1974 break was estimated at up to 30 million gallons. This spill also briefly blocked N. Y. Route 14. The brine left in the ponds after the spill contained 13% (or 130 grams per liter) chloride ions (1). This would equal about 21 or 22% salt. The above figures yield an estimate of about fifty million pounds of salt in the spill.

#### Damage to Plum Point Creek

Plum Point Creek flows east along about a 5 mile course from its source at about 1100 feet elevation to its mouth on Seneca Lake at about 455 feet elevation and about 15 miles north of Watkins Glen. The creek drops over a high falls about a mile upstream from the lake. A tributary stream whose watershed includes the waste piles and brine ponds of the Himrod mine joins the creek below the falls.

According to local fishermen, mine pollution has reduced or eliminated populations of trout fry, bait minnows and other aquatic animal life in the creek below the falls. This was the only part of the creek where trout could come from the lake to spawn. The abundant bait minnows above the falls serve as a basis for comparison for the depleted downstream population.

The brine spills increased stream erosion since salt killed some trees whose roots used to stabilize stream banks. A long section of stream bed was also excavated by a bulldozer. This channelization was done to keep future brine spills from overflowing the banks of Plum Creek. Both the loss of trout spawning and the increased erosion reduce the recreational value of Plum Point Creek.

The damage to Plum Point Creek spreads to the nearby parts of Seneca Lake. Erosion introduces suspended particulates which cloud the water, and brine adds to the salt burden. Dr. Ahrnsbrak tested the lake in the aftermath of the brine spill in September, 1974 (1). The brine sank to the bottom and formed a salty pool in the deepest part of the lake, before it dispersed by mixing upward. This kind of salt stratification is known to interfere with the transport of oxygen to the deeper parts of a lake (2, 3). By the same token, it restricts the range of game fish, such as trout, which can not tolerate a shortage of oxygen.

#### Deterioration of Ground Water

Before the Morton salt mine opened, a 12 foot deep well at the Rainbow Cove Motel, on Plum Point and adjacent to Plum Point Creek, had given good quality potable water. By August 15, 1974, even before the damaging September brine spill, the well contained salty water with 290 mg/l sodium and 360 mg/l chloride and 928 mg/l total dissolved solids (U. S. Geological Survey Water Analysis Laboratory, Albany, N.Y. ).

After the September 3, 1974 brine spill, two other wells on Plum Point were tested. One well, across Plum Point Creek from the Rainbow Cove Motel, was sampled in October, 1974. It contained about 2% salt (the chemical measurements were 10,650 mg/l of sodium and 8,300 mg/l of chloride, for a total of 19,000 ppm) (5). The other well, located close to the lakeshore, showed a conductivity of 1800 units (micro mho/cm) on September 20, 1974, corresponding to 0.4% (3,700 ppm) of salt. "If used to water plants, injury to the plants would probably be the result", according to Dr. Good of the New York State College of Agriculture (6).

In summary, the water in the contaminated wells became from eight to forty times more salty than the water in the lake. This water was not only bad tasting; it was unfit to drink by the standards of public health (see Discussion, below).

#### Salt Damage to Wild Plants and Crops

Harmful concentrations of salt have come into contact with economically valuable vegetation by two main routes: flooding into Plum Point Creek and drifting of salt dust through the air to adjacent farms and vineyards.

The following data indicate the degree of salt pollution of the soil by the September, 1974 brine spill. Except for the control, all data are from Plum Point, nearly 1½ miles downstream from the broken dam. With a standard water extract procedure, three samples of lawn soil affected by the spill gave conductivity readings for soluble salts of 750, 2700 and 3600 units. Dr. Good stated that "Levels of this sort are indeed high enough to cause extensive harm to plants growing in such soil". A control soil sample from an unaffected lawn in the neighborhood had a value of 22 (6).

This brine spill damaged and killed trees along the banks of Plum Point Creek. It also flooded part of Plum Point, the delta of the creek, and damaged and killed large shade trees, lawn grass, and garden plants.

In his report of April 10, 1973, Paul F. Higgins, Senior Forester, Region 8, N. Y. State Department of Environmental Conservation, stated that he and David Jessup, Forest Insect and Disease Technician, checked woodlots on two farms exposed to salt dust from crushing and sizing operations at the mine. The following observations pointed to this salt dust as the cause of needle kill on white pine and red cedar. Evergreens on the woodlot edges facing the mine had more needle kill than those in the interior of the woodlot; needle kill on evergreens in the interior of the woodlots increased with height and exposure; trees nearer the mine had more needle kill; and careful inspection revealed no insect or disease damage which could have caused the needle kill (7).

In his October, 1973 summary of work done by Taylor Wine Company in the summer of 1973 in six vineyards in the immediate vicinity of the Morton Salt mine, Seaton C. Mendall, Taylor Vineyard Consultant (8) found these indications of salt dust pollution from the mine: high levels of sodium were found in the leaf blades of grapes at the Fenton Nash and Ross Summerson vineyards in May and June connected with severe leaf scorch and deformation; soil analyses in the 6 vineyards showed a much higher level of sodium present in the vineyards east, northeast and north of the mine than in the vineyards south and west of the mine; prevailing winds in the area are from the south, southwest and west (7). The two vineyards with salt damaged grape leaves are on the same two farms where the evergreens were damaged. Col. Fenton W. Nash (USAF ret.) reported that yields at his vineyard dropped from 3 to 4 tons of grapes per acre in 1970 to 1 ton in 1973.

#### Control of Salt Pollution at Seneca Lake

The Department of Environmental Conservation (DEC) acted to stop the pollution of Seneca Lake by salt mines. All three mines added the equipment they needed to pump all their liquid wastes into deep wells. "Continued operations are expected to contribute minimal pollution to Seneca Lake", according to Paul E. Schmeid, Pure Waters Engineer for the DEC, Region 8. These measures apparently took care of all the surface runoff from the mines of the Watkins Salt Co. and the International Salt Co., and stopped the routine discharges of brine from the Morton Salt Company's Himrod mine. These measures may have already started Seneca Lake on the road to recovery. The lake has been actually becoming less salty during the past two years (1, 4). Measurements will have to be made for several more years before we can be sure of a trend for the better, but it is at least possible that Seneca Lake is recovering from the effect of three decades of pollution by mine wastes.

There is, unfortunately, no matching environmental improvement in the neighborhood of the Himrod mine. Vineyards and woods are still subject to salt damage, some residents cannot drink from established wells, and the soil and the ground waters continue to accumulate contamination seeping from the lagoons and blowing on the wind from the salt piles. Beyond this slow pollution lies the hazard of another major spill from the brine ponds, which threatens the cottages, motel and marina located near Plum Point.

The affected landowners claimed damages for the brine spills of 1972 and 1974. Morton Salt Company paid a fine of \$1,500 to the DEC, and offered approximately \$5,000 to \$15,000 each to affected landowners as settlements for damages. All except one owner have refused the offers because the agreement contains a clause that forever releases the company from further suits. The land owners think that this clause would prevent their recovering damages in the case of future spills.

The DEC has been moving slowly in this matter. According to Mr. Paul Schmeid, "We are currently negotiating orders with Morton Salt Company to resolve all of their known environmental problems. In particular the crushing operation will be located within the mine thereby virtually eliminating the primary source of salt dust. An emergency overflow and spillway will be constructed to preclude failure of the earth dams. The earth dams will be reconstructed and seepage will be collected. The salt mountain will be stabilized or removed". This was the situation on September 29, 1975 (4).

## Discussion

Water is not fit to drink when chloride concentration exceeds 250 ppm. This standard was set by the U. S. Public Health Service. Salt mining came close to making Seneca Lake water undrinkable: had the trend of the past thirty years continued past 1990, the water would have become saltier than 250 ppm, causing damages to cottagers along the lake and to the fishery (2, 3).

The information collected for this Bulletin provides hope that this trend has been reversed, and that the lake is actually becoming cleaner. We can give credit to the Federal Water Pollution Control Act, to its enforcement by a State agency - the DEC, and to the cooperation of the Watkins Salt Co. and the International Salt Co.

The case of the Himrod mine was different, in part, because of differences in technology. Rock salt is mined at Himrod. This is the form of salt used in Rochester and Monroe County to de-ice the roads. The pollution found near Plum Point is of direct interest to RCSI members, as it illustrates the damages to vegetation and water caused by salt runoff, seepage and dust (2, 3).

The Himrod mine does not have a discharge permit to flush brine from its waste lagoons into Plum Point Creek, but it continues to be both a source of salt pollution and a hazard to its downstream neighbors. The plight of these neighbors, and the struggles of the Plum Point Creek Watershed Association against the Morton Salt Company were described in the Geneva Times of July 24, 1975 (Ruth Benedict: "A Long Fight Against Salt Pollution", and "No 'Foot Dragging' in Anti-Pollution Efforts: Morton Plant Manager").

Even at this time, important questions remained unanswered about the pollution control measures negotiated between the DEC and the Morton Salt Company (4). The DEC demanded the construction of new, stronger dikes to hold the brine. However, proper construction to stop breaks and leaks would still not settle the question of how much brine would be or should be allowed to overflow through normal spillways during heavy rains. Also unsettled are the problems of direct permeation of brine into groundwater through the bottoms of ponds and waste piles, or escape of brine runoff from the small mountain of waste rock. The local landowners are holding back on a final settlement of their claims, because they lack confidence that the company will do enough to prevent salt spills, seepage, runoff, and dust pollution.

If these problems are not solved, then the landowners in the area may suffer even more serious economic losses in the future as soil and ground water become increasingly contaminated.

References

- (1) Ahrnsbrak, William F., "A Saline Intrusion Into Seneca Lake", *Limnol. & Oceanog.*, 20(2)275-278. Also, personal communications to James Harper and to RCSI on September 24, 1975.
- (2) Bubeck, R. C. et al., "Run-off of Deicing Salt: Effect on Irondequoit Bay, Rochester, N.Y.; Summary Bulletin", RCSI Bulletin #125, July 1971
- (3) Bubeck, R. C., W. H. Diment, B. L. Deck, A. L. Baldwin and S. D. Lipton, "Run-off of Deicing Salt: Effect on Irondequoit Bay, Rochester, N.Y.", *Science*, 172(3988)1128-32, 6-11-71
- (4) Schmeid, Paul F., Associate Sanitary Engineer, Pure Waters. New York State Department of Environmental Conservation, Region 8, Avon, N.Y. Letter to RCSI, September 29, 1975 with attachments.
- (5) Delta Laboratories, Rochester, N.Y., unpublished report of analysis dated October 22, 1974
- (6) Good, George L., Department of Floriculture and Ornamental Horticulture, New York State College of Agriculture, Cornell University. Letter to James Harper, October 25, 1974. Determinations done by the Department's Soils Laboratory.
- (7) Higgins, Paul F., Senior Forester, New York State Department of Environmental Conservation, unpublished memorandum dated April 10, 1973
- (8) Mendall, Seaton C., Vineyard Consultant for Taylor Wine Company, unpublished memorandum dated October 3, 1973



