

# Standard Sprinkler System Strips Frozen Overburden

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BY USING conventional irrigation sprinklers during a two-month period, Ballarat Mines Ltd. was able to strip 165,000 yd of frozen muck from a placer gold deposit on Dominion Creek, Yukon Territory, Canada.

The area of ground covered by the sprinkler setup came to approximately 200,000 sq ft, with a muck total of about 188,400 cu yd. The material stripped varied, of course, but for the most part had the following cross section:

**upper 10 ft**—brown clay with a large amount of slide (accumulation of loose gravel and boulders washed down from the mountains). Some of the slide measured as much as 18 in. in its greatest dimension;

**lower 20 ft**—gray dry muck with very little ice. This is the type material that, when thawed, is often mistaken for frost.

In addition to these zones, there were scattered areas containing large amounts of rotten wood and stumps.

Ballarat began its project by laying out approximately 2000 ft of pipeline—with flexible Pierce couplings—on the area to be stripped. This line had sprinklers capable of delivering about 50 to 70 gpm spaced at 30- to 40-ft intervals. From the approximately 2000 ft of 11-, 10- and 6-in. line, Ballarat ran 1500 ft of 2- and 3-in. aluminum branch lines. These branch lines were used to pick up areas beyond the reach of the main sprinkler system or to give concentrated water volumes where needed. The entire pipeline system was fed by a 10x12 centrifugal pump rated at 2500 gpm at 140 ft head powered by a 6-71 GMC diesel. With this equipment, the company hoped to wash away the frozen muck and have the entire system slowly sink to the gold-bearing gravel horizon.

## Results

The system's success varied from spectacular when a clear, frozen muck was encountered, to mediocre when in dry clay material, to poor when a mantle of slide collected and protected the surface.

Surprisingly, the sprinklers worked very well in areas where large amounts

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## Costs\*

Fuel and Lubricants.....	\$2566.00
Tractor.....	640.00
Labor.....	1800.00
Depreciation:	
Sprinkler pipe and sprinklers..	600.00
Pump.....	600.00
Total.....	\$6206.00
Net cu yd removed.....	165,767
Cost per cu yd.....	\$ .0374

\*Does not include brush removal and preparation before sprinkling. This would be a variable depending upon the depth of muck to be removed, consistency, etc. In this case, it amounted to .48¢ per yd.

## Analysis of Period and Lost Time Record

Days at full throttle (3000 gpm)....	42
Days at 2/3 throttle (low water supply).....	14
Days at 1/2 throttle (low water, not run at night).....	4
Total days.....	60

During 60-day period:

Lost time due to pipe failure or similar trouble—8 hr.....	.6%
Lost time due to changing sprinklers, moving lines 84 hr.....	6.0%
Total Lost Time.....	6.6%

Note: For at least half of the time shown above, the pump was not shut off to change sprinklers but just throttled down low enough for the change to be made. The company did not have any gate valves in the system. If these had been incorporated into the layout, almost all of the lost time could have been eliminated.

## Comparison of Costs and Performance with Monitor Stripping

	Sprinklers	Monitors
Yards removed...	165,767	185,000
Time (days).....	60	200
Manpower (days).	70	300
Costs (¢ per cu yd).	3.74	8.0

Note: The company previously stripped two seasons in the same area using monitors. In both cases, the cost per cu yd for brush removal and ground preparation prior to stripping was the same—.48¢ per cu yd.

of wood were imbedded in the muck. This is usually an extremely difficult and slow type muck to move; sprinklers were successful because a high

ice content is usually present with rotten wood. Rotten moss and decomposed peat layers also seemed to disintegrate very well.

The slide material proved by far the toughest condition that we encountered. The company estimated efficiency dropped to 5% to 6% of what it would have been in the same muck if the slide were absent.

After having put the system through a rather thorough testing, Ballarat found that muck stripping with sprinklers had the following advantages and disadvantages:

## Advantages

- 1) Low labor requirements. Stripping can be carried on 24 hr per day with only one man during a day shift.
- 2) The system offers efficient means of distributing water at lower pressures than monitors. At lower pressures, less fuel or power is needed for a given quantity of water. Also, there is much less difficulty holding pipelines at the lower pressures, resulting in less downtime from pipe failures.
- 3) Under favorable conditions, the system has an extremely rapid material removal rate—a 60- or 70-ft depth could easily be removed in one season.
- 4) The sprinkler system has less tendency to plug drains because the comparatively small amount of water concentrated in a given area would not carry large pieces of wood or moss to the main drain.
- 5) There is a more efficient use of the thawing action of water when a given quantity of liquid is being distributed over a larger area.

## Disadvantages

- 1) With any amount of slide or gravel in muck, efficiency and water duty drops to about 5% or 6% of what it would be in clear muck.
- 2) The completed stripping operation is never as clean as with a monitor; impossible to boil out gravel as well.

The job of stripping with sprinklers could be greatly improved if a unit were developed that had vertical as well as horizontal movement. Last year's costs at Dominion Creek would have been in the area of 2¢ per yd if this type of tool were available.

The company also found that if the material to be stripped contains large amounts of slide, controlled arc sprinklers should be directed against a vertical face. This would allow the slide material to keep dropping and clearing the face to muck rather than accumulating as a protective mantle over the muck.



AT OPERATION'S outset, Ballarat layed out approximately 2000 ft of pipeline on the 30 ft horizon muck layer to be

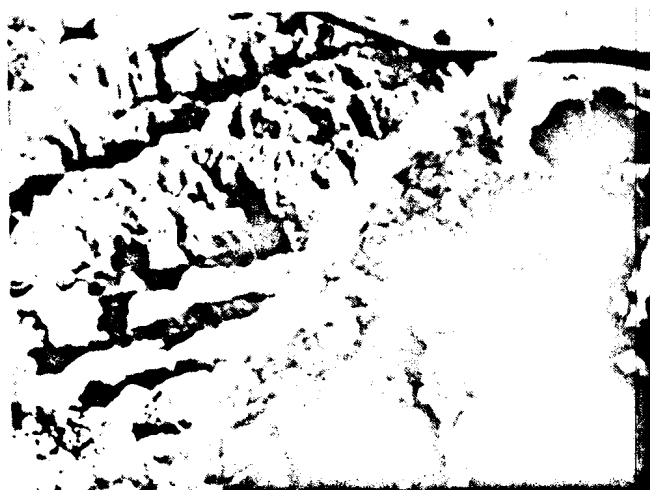
stripped. This Pierce-coupling-equipped line had sprinklers delivering 50 to 70 gpm spaced at 30- to 40-ft intervals.



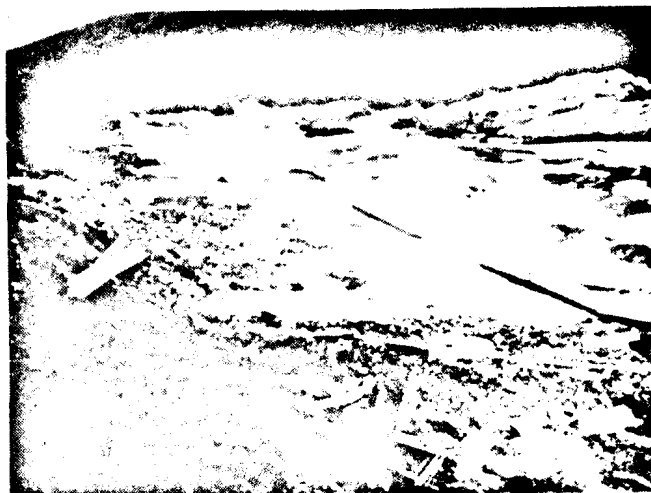
THE SPRINKLERS had been operating for several days; original surface was 6 ft higher than the top of the cribbed shaft.



BALLARAT ran 1500 ft of 2- and 3-in. aluminum branches from the main line to give concentrated volumes where needed.



THE SYSTEM worked better on some areas than others. The easiest to strip were zones of clear ice that had little or no slide.



AFTER approximately two months, this area had its 20-ft overburden stripped to the gravel horizon and was ready for mining.