

RECLAMATION OF EXPLORATION DISTURBANCES  
AT SAGE CREEK

Paper presented  
by:

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Sage Creek Coal Ltd.

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### INTRODUCTION

Sage Creek Coal Limited was incorporated in 1970 under the Companies' Act of British Columbia. It is managed and 60% owned by Rio Algom Limited in Toronto and 40% owned by Pan Ocean Oil Limited in Calgary.

The Sage Creek Property is located in the southeast corner of British Columbia, about 10 miles west of the Alberta border and about 8 miles north of the United States boundary.

Exploration work has been conducted on the property from 1970 through 1977. Approximately 200 acres of land were disturbed through the establishment of 30 miles of roads, 4,400 feet of trenches, 14 adits and drill sites for 159 holes. These disturbances were concentrated on two large hills which are separated by Cabin Creek. Throughout this paper these hills will be referred to as North Hill and South Hill. Cabin Creek is a tributary of the Flathead River.

Due in part to high expectations for obtaining a sales contract and, in part, to a sequence of field programs which were conducted over the same general area, seeding and fertilizing were not carried out from 1970 through 1976. Rio Algom felt that there was no point in reclaiming land one year that would be redisturbed the following summer. However, erosion control was done through the use of ditches, berms on roadways and water bars; and trenches were recontoured soon after they were excavated.

Reclamation of all disturbances was undertaken during the summer of 1977 and 1978. Most of these disturbances occurred between the 4,300 and 5,500 foot elevations.

## RECLAMATION PROGRAMS

Disturbances were divided into three main areas: the north face of South Hill, the south face of North Hill and general access roads and drill sites. Reclamation was divided into two programs: A 1977 program which concentrated on the first two areas; and a 1978 program which involved general access roads, drill sites and maintenance work on the previous year's reclamation.

### The North Face of South Hill

I will concentrate on the north face of South Hill since this area posed the biggest problem. Surface erosion had occurred in the vicinity of adits.

Since this area was saturated with water, it was impossible to use tracked equipment without site preparation. Preliminary work involved the use of a D6C bulldozer to upgrade roads. This upgrading included cleaning out ditches and construction of water bars and diversion berms.

A layer of rock rip rap was spread in the high moisture content areas in the vicinity of adits. To accomplish this, rock was dozed out of nearby roadway rock cuts. This material was also pushed into washouts to stabilize slopes and to form french drains.

Large trees that were undermined by erosion were cut up and removed from the site. To avoid unnecessary damage and to aid in stabilization, minor forest debris was left on the slopes. In addition, the debris acts as a heavy vegetative mulch.

Final control measures included the construction of a cut-off ditch along the toe of the final slope. Water and fines collected by this ditch are discharged into a small settling pond, and the excess water from this pond is discharged into dense bush for further filtering. After one year's use of this system a sediment fan was formed which contained coal fines. A second settling pond was constructed at the base of the hill before final discharge into Cabin Creek.

Three separate seeding techniques were applied to the north face of South Hill. Steep slopes were hydroseeded, mulched and fertilized using 50 pounds of grass/legume mix, 875 pounds of wood fibre mulch and 200 pounds of 16-20-0 fertilizer per acre. Roads were broadcast seeded with 30 pounds of grass/legume mix and 200 pounds of 16-20-0 fertilizer per acre. Steep inaccessible areas were hand seeded with 30 pounds of grass/legume mix per acre.

The seed mix by weight used in all cases was:

Creeping Red Fescue	-	25%
Kentucky Bluegrass	-	20%
Climax Timothy	-	10%
Perennial Ryegrass	-	10%
Vernal Alfalfa	-	15%
Redtop Fescue	-	5%
Chinook Orchardgrass	-	15%

After one year the seed germination results obtained were very good. The slope stabilization program proved to be quite effective with only minor slumps occurring in some of the washouts and steep road banks. Most of the downhill movement of water was restricted to the ditches and settling ponds.

## The South Face of North Hill

This area is very dry and exposed, with little or no surface water present. Reclamation was designed to restore the aesthetic values of the site and to speed up the restoration of the area to its principal land use. It was felt that establishment of a grass/legume stand on the area would achieve these objectives. Some minor road work and contouring was done using a caterpillar tractor, primarily to provide access for the seeding equipment. Seeding was confined to hydroseeding and mulching. Specifications were similar to the South Hill, with the following seed mixture by weight being used:

Magna Bromegrass	-	25%
Sweet Clover	-	10%
Crested Wheatgrass	-	20%
Creeping Red Fescue	-	20%
Sainfoin	-	15%
Kentucky Bluegrass	-	10%

In addition, 45 pounds per acre of Fall Rye Grain were sown as a cover crop. The rye germinated rapidly and helped to reduce soil temperatures and hold soil and moisture. Otherwise, seed germination on this particularly dry site was not as successful as it was on South Hill.

## Access Roads, Drill Sites and Maintenance of 1977 Program Work

All roads were ditched, water bars were constructed as required, and the areas were seeded, fertilized and harrowed followed by application of the same seed poundage per acre and the same type of fertilizer as was used previously.

Areas from the 1977 program that experienced incomplete stands of grass were either reseeded and fertilized or were hand seeded.

The seed mix used in dry areas was the same as that applied to the south face of North Hill, whereas the seed mix used in wet areas was adjusted slightly from that applied to the north face of South Hill. Since the Alfalfa did not germinate well, it was replaced by Alsike and Double Cut Red Clover in the blend. These were chosen due to our reclamation contractor's success with them at other sites.

#### COSTS

In 1979 dollars, the 1977 program expenditure was \$36,000 for 55 acres, and included substantial dozer time. On this same dollar basis, the 1978 program cost \$38,000 for 145 acres. Based on these past programs, approximate 1979 unit costs would be \$260 per acre for tractor seeding, fertilizer and harrowing; \$165 per acre for hand seeding; and, \$540 per acre for hydroseeding, mulching and fertilizing. The average cost per acre to-date for the program is approximately \$423. However, some maintenance work will be necessary which, it is anticipated, may reach \$500 per acre to completely reclaim the site.

#### ACKNOWLEDGMENT

In conclusion, I would like to thank Alan Lamb of Interior Reforestation for his considerable assistance in the preparation of this paper.

DISCUSSION RELATED TO MIKE TAPICS' PAPER

Stan Weston, Wesago I do not recommend seed mixes which include sweet clover as it inhibits blood clotting, and causes internal and external bleeding in animals, through dicumarin production. Somebody has to be responsible for seeding an area. They may be liable to claims from cattlemen or wildlife people relating to animal mortality.

Alan Lamb, Interior Reforestation Ltd. I have been working on rangelands for about fifteen years and I have never yet lost a cow to sweet clover.

Stan Weston, Wesago Both Bob Duggan and I could bring in cattlemen who will not cut an animal that has been feeding exclusively on sweet clover, until it has been off sweet clover for at least three weeks. During that time, they will feed the animals themselves. I have worked with cattle and cattlemen for over thirty years and I know a little bit about the problem.

Roger Shaneman, Manalta Coal I'll just rephrase that. It is sweet clover silage that is a problem, not range sweet clover.

Stan Weston, Wesago It is sweet clover that grows in the field; and I still say cattle should not eat it.

Paul Ziemkiewicz, Alberta Energy A report from Kingsbury in "Poisonous Plants of the United States and Canada" indicates that the only instances of dicumarin problems are with wetbale or from silage sweet clover, never from field cured sweet clover and never from any animal foraging on green sweet clover.