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Coal Mining

▲ Coal Mountain Operations: The next twenty years

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ABSTRACT

Coal Mountain Operations is the newest of Fording Coal's operations although it is the oldest in terms of its historical production. In October, 1994, Fording purchased the former Corbin Creek/Byron Creek Mine. The mine is located in southeastern British Columbia, approximately 150 air kilometers from Calgary, Alberta. It was first developed in 1905 and has gone through a variety of owners in its 90-year history.

This paper will deal with the remobilization strategy and the mining plans for the operation which are being implemented to make this operation competitive in the world export coal market.

Introduction

In October 1994, following a due diligence process, Fording Coal Limited purchased Coal Mountain Operations from Corbin Creek Resources, an employee group which had previously owned the mine. The purchase awarded Fording Coal Limited with 100% of the assets, and control of all the coal leases at Coal Mountain.

The mine is located in southeastern British Columbia, southeast of Sparwood at the hamlet of Corbin, (Fig. 1)

Rehiring of laid-off employees started in November 1994, with mining activities also recommencing in November. The coal preparation plant was restarted in December with one shift, went to two shifts in January 1995, and had four-shift, full-time operation in April 1996.

Start-Up Highlights

October 26, 1994	Purchase Coal Mountain Operations
November 15, 1994	Start call back of employees
November 20, 1994	Recommence mining in 14 Pit
December 8, 1994	Plant starts on 1 shift
January 9, 1995	Plant goes to 2 shifts
February 1995	Begin receiving new equipment for mine
Mar. — Apr. 1995	1995 Phase 1 Exploration Program
May 15, 1995	Board of Directors formally approves $75 million capital budget

Bradley R. Johnston graduated from the University of Alberta in 1987 with a B.Sc. Eng. (Co-op). Following graduation he joined Suncor Inc. in Fort McMurray as a temporary engineer in the Mine Efficiency Group. In 1987 he joined Manalta Coal Ltd. at the Utility Mine in Estevan, Saskatchewan. In 1988, he joined Fording Coal Ltd. at the Whitewood Operations in Wabamun, Alberta where he was responsible for reclamation and geotechnical engineering. In 1992, he was appointed chief engineer at Whitewood. In 1994, he transferred to Coal Mountain Operations as chief engineer where he is responsible for all aspects of engineering. He has been a member of CIM since 1983.

Keith D. Streeter graduated with a B.Sc. in mining engineering in 1988. Following graduation he joined Fording Coal Ltd. at Fording River Operations as an Engineer where he held different positions involved in short-range planning including drilling and blasting and coal coordination. In 1993, he transferred to Greenhills Operations where he was responsible for all aspects of short-range planning. Following the start-up of the operation, he returned to Fording River to work on other projects. In 1994, following the purchase of Coal Mountain Operations by Fording, he was again transferred to assist in the start-up and planning of that operation. In May, 1997 he accepted the position of senior mine engineer at Smoky River Coal Ltd., where he is responsible for all aspects of surface mine planning. Has been a member of the CIM since 1990

Fig. 1. Location map.

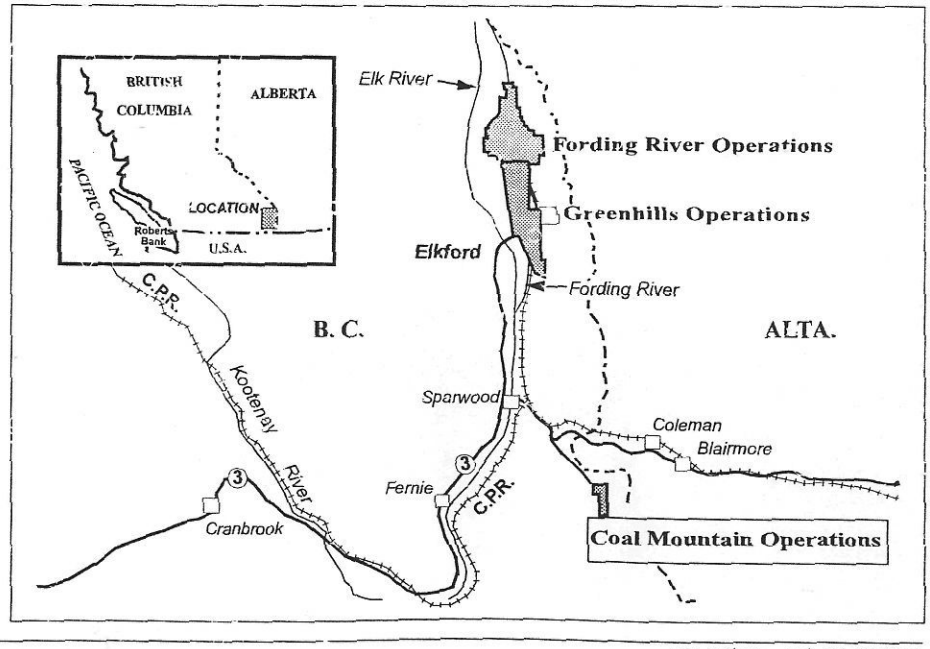
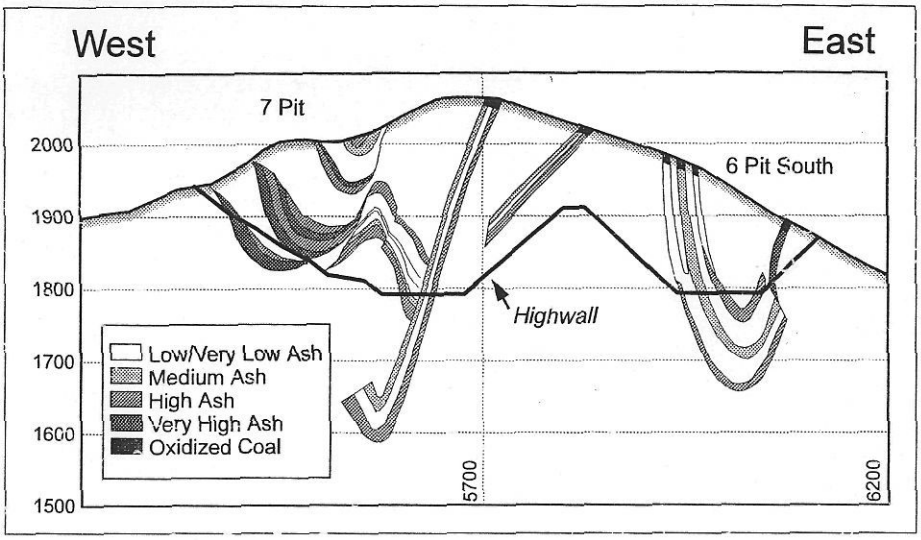


Fig. 2. Cross-section of Coal Mountain Operations.



June 6, 1995	Major flood event at Coal Mountain – Mine shutdown
June 14, 1995	Mine restarted after flood repairs
June 27, 1995	Resume process plant after flood
June 30, 1995	Resume rail service to Coal Mountain Operations after flood repairs
September 1995	Begin major plant enhancements
January 1996	Clean coal briquetter start up.
February 1996	Begin development of bulk test pit in 7 pit area
April 9, 1996	Flotation Circuit starts up
April 25, 1996	Plant goes to four shifts
October 1996	Commission new breaker
July 1997	Overhaul fines circuit
September 1997	Purchase second RH200 shovel

Geology

Coal Mountain Operations is located in southeastern British Columbia. The coal is located in the Mist Mountain Formation of the Kootenay Group.

The predominant coal seam is the "Mammoth Seam" which, in some areas, is 50 m thick.

The formations at Coal Mountain have undergone several deformation periods, are heavily folded and faulted, and are virtually indistinguishable from the original deposition.

Generally, the strike is north, except for a localized area in 14 Pit which strikes northeast. A typical cross-section shown in Figure 2 demonstrates the tight, steeply dipping folds at Coal Mountain, which can be from 45 degrees to vertical.

Coal quality is highly variable in the various coal occurrences, although lower insitu raw ash coals are observed in the troughs of synclines or the peaks of anticlines.

Coal Reserves

Proven and probable reserves are estimated at 42 million tonnes of clean coal, split between thermal and metallurgical coal feeds. There are approximately 3.4 MMTCC in 14 Pit; 16.4 MMTCC in 7 Pit; 17.5 MMTCC in 34 Pit, and 4.3 MMTCC in 6 Pit.

The current strategy is to concentrate on 14 Pit, phasing in 7 Pit in three to four years, and completing the property with 34 Pit. At a production rate of 2.5 million tonnes clean coal, the mine has a life of 16 to 17 years.

To further define and understand reserves and coal quality, Coal Mountain has undertaken two major exploration programs in 1995, a third program in 1996, and a fourth program in 1997.

Mine Plan

As shown in Figure 3, the property has been consolidated then divided into three mining areas: 14 Pit, 7 Pit and 34 Pit.

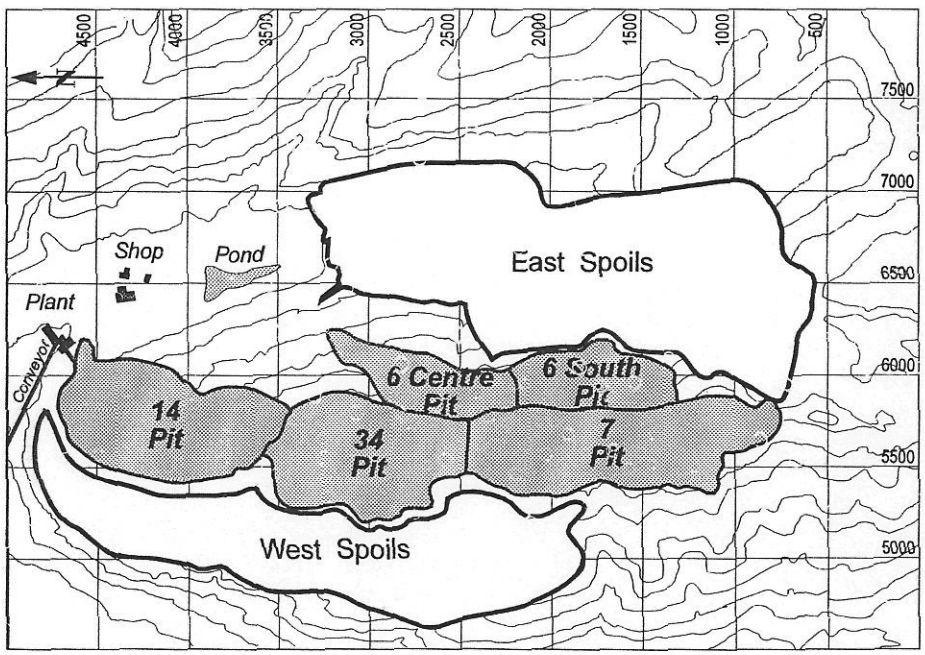
The long-range plan is to mine 14 Pit for the next four to five years with waste to the northeast dumps phasing in 7 Pit in 1996, and mining that pit for seven to eight years with waste to the southeast dumps. 34 Pit would be mined last with spoil from that pit being backfilled into the mined out 14 and 7 Pits.

The plan is to produce 2.0 million tonnes clean coal in 1996 and approximately 2.5 million tonnes clean coal in 1997 and beyond.

At startup, Coal Mountain had short-term concerns with strip ratio and haul distances. In 1998, these will come under control, with the mine operating at a level of 5.5 BCMW/MTCC strip ratio, and a waste haul distance of 1.7 km. These levels will remain stable for approximately five years, at which time they will drop to about 4.5 BCMW/MTCC and 2.0 km.

The mine has also changed from 10-m to 12-m benches to enhance equipment productivities and minimize coal degradation.

Fig. 3. Mine plan schematic.



To assist engineering personnel in carrying out their activities more effectively, Fording Coal Limited has introduced Global Positioning System (GPS) to Coal Mountain. GPS is used as a replacement for conventional surveying techniques in almost all of Coal Mountain Operation's surveying activities. As well, CMO has installed GPS receivers on the RH200 shovel and the 994 loader for grade control purposes. Installation of GPS on Coal Mountain's drill took place in September 1996, which has essentially eliminated field staking for drill patterns.

Coal Quality

Due to the complexity of the geology, rigorous and extensive coal quality programs are required.

Standards were developed by Fording Coal Limited personnel to ensure a high quality product is delivered from the mine to the plant. These standards assist and direct operating personnel in maintaining high coal recovery and minimizing dilution. These standards include: identifying coal contacts, coal trenching, and eliminating old workings from the coal (Figs. 4 to 6). Maintaining these standards requires the extensive use of a backhoe.

Fording Coal Limited has also introduced standards that help prevent the generation of fine coal in the mining process: minimize coal handling, minimize intermediate stockpiles, and minimize coal dozing.

To operate the plant in an efficient and productive manner, it is necessary to have extensive sampling campaigns in the mine. These include exploration drill hole samples, coal trench samples in 10-kg or bulk samples, coal face samples, feeder stockpile samples, and production drill hole samples. These, typically, include, but are not limited to, ash, FSI, LT and mini or full float/sink analyses.

The goal is to completely understand plant feed so as to optimize both coal blending into the plant, and plant performance itself.

Equipment Upgrades

To increase the site productivity and to make the mine economically viable, Fording Coal Limited has purchased and introduced several new pieces of equipment to the mine. Table 1 shows the significant upgrade of equipment made in the mine by Fording Coal Limited.

Due to the relatively small size of Coal Mountain and the projected annual production, it was decided not to electrify the mine. The primary waste mover purchased in 1995 by Fording Coal Limited was the diesel powered O&K RH200 hydraulic shovel, with the two

Fig. 4. Coal contact identification.

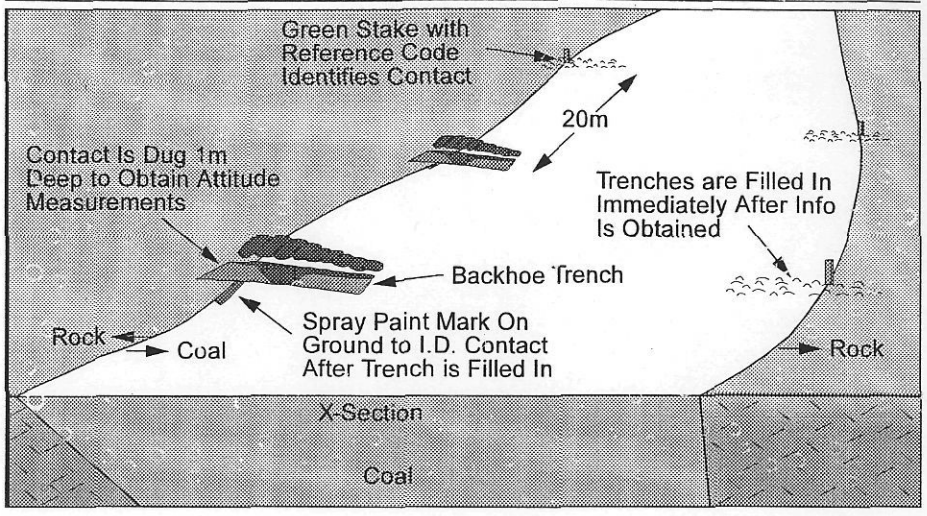


Fig. 5. Coal trenching.

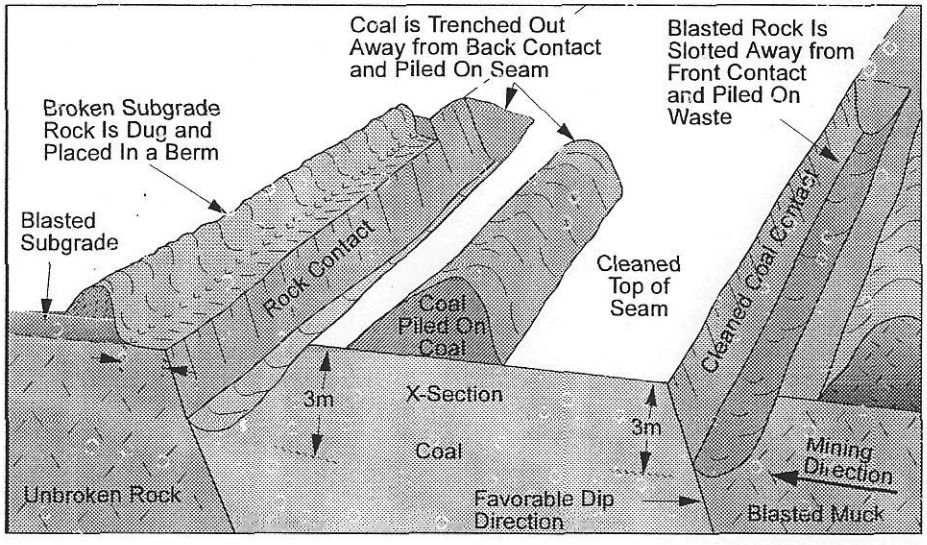
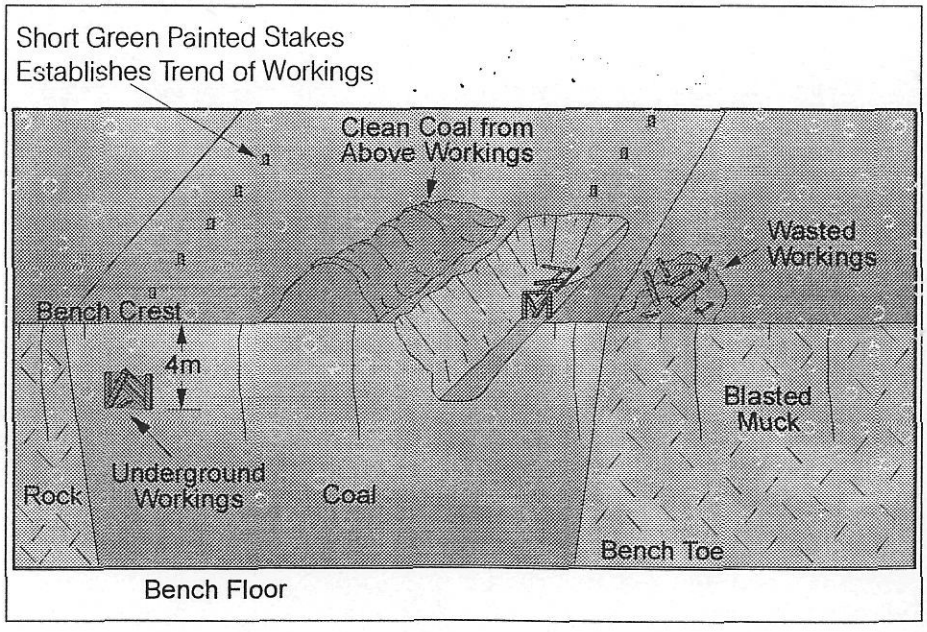


Fig. 6. Coal workings.



Caterpillar 994s as the backup units. Fording Coal Limited also purchased a Drilltech D90KS drill which is capable of drilling a 12 1/4 in. diameter borehole on a 12-m bench single pass and will comfortably handle all Coal Mountain Operation's drilling requirements. In September 1997, Fording Coal Limited added a second O&K RH200 to the fleet.

In 1995, Fording Coal Limited initially purchased five Haulpak 830E 240-ton trucks, with a sixth 830E added in October 1997.

Table 1. Coal Mountain Operations equipment upgrades (current and previous)

CMO fleet	Previous fleet
*1 — O & K RH200 26 m³ excav.	4 — Cat 992 loaders
*1 — O & K RH200 21m³ excav.	4 — Cat 785 150T trucks
*6 — Haulpak 830E haul trucks	2 — Cat 777 85T trucks
*5 — Haulpak 170T coal haul trucks	1 — D10 dozer
3 — Cat 785 150T trucks	2 — Cat D9 Dozers
*2 — Cat 994 loaders 18 m³	2 — Drilltech D80K
2 — Cat 992 loaders	2 — Cat 16G graders
*1 — Cat D11 dozer	1 — Cat 637D scraper
*3 — Cat D10 dozers	
*1 — Drilltech D90KS	
*1 — Redrill SK 60	
*1 — Rubber tire dozer	
*3 — Cat 16G graders	
*1 — Cat 637E scraper	
*1 — Cat 375 backhoe	
* New purchase or rebuilds	

Process Plant

The process plant or heavy media plant is typical of Western Canadian Plants in that raw coal is upgraded through the process of sizing, washing, and dewatering. Heavy media cyclones are utilized on the 51 mm by 0.6 mm size fraction, with two-stage water only cyclones used on the 28 m by 100 m size fraction. The -100 m material is directed to the new flotation circuit.

Several new components for the process plant have been commissioned. They include the new breaker, flotation circuit, and upgraded control systems. In January 1996, a briquetter was added to reduce fine coal handling problems.

There are two main reasons for the installation of a new coal breaker at Coal Mountain. Firstly, the old breaker was mechanically unreliable, and structurally weak. Secondly, due to the geometry of the old location, raw coal was pumped from the ground floor to the top of the plant where it was gravity fed through the circuits. That pumping process degraded the coal and generated fines. The new breaker is a 3.7 m by 8.2 m McLanahan rotary breaker with a 250 tonne hopper. It is located to allow for approximately 100 000 tonnes of raw coal storage, and allows for conveyance of raw coal directly to the top floor of the plant. This system was commissioned in October 1996.

Froth flotation has been introduced to the plant to process the -100 m portion of the raw feed. The system includes the installation of slurry ash analyzers, four 1000 cu. ft Wemco flotation cells, a refuse thickener and two 3.0 m wide Phoenix belt filter presses. The old plant thickener is used to pre-condition the flotation feed, and the existing disc filters are used to dewater the flotation concentrate. Flotation has enhanced both the plant's ability to process raw coals, and to maintain high quality control standards. This system was commissioned in April 1996.

To increase the ability of process plant personnel to control the plant, Fording Coal Limited has installed a state-of-the-art Johnson Yokagawa Centum DCS Distributed Control System. The plant used an Allen-Bradley PLC-3 which has been upgraded to a PLC-5. All discrete logic is handled in the DCS to provide a common maintenance and development interface. The control system has enhanced the plant's flexibility and has allowed for the implementation of advanced control strategies. This system was commissioned in April 1996.

Fording Coal Limited has installed a 10 tph briquetter pilot plant to process fine coal recovered through the dryer cyclones. This system was installed in January 1996, and testing with different roll types and operating conditions is ongoing.

In the summer shutdown in 1997, Fording undertook additional projects to further enhance plant performance. The clean coal dryer underwent a major overhaul with work taking place to increase coal residence time in the dryer. The fines circuit was modified with spirals replacing the secondary water only cyclones. This project will be completed in October 1997.

All of the above systems have allowed greater quality control in the process plant, and have reduced the fines portion of the coal product. Fording Coal Limited has received favorable market reactions to these innovations and improvements at Coal Mountain Operations.

Work Force

At the present time, Coal Mountain Operations employs 185 people on site. After the initial call back of previously laid-off employees, and hiring campaigns to get the workforce to current levels, several initiatives were undertaken to help maintain the high level of employee dedication, motivation and commitment. Those included the introduction of Fording Coal Limited's Standard Practices and Procedures at Coal Mountain, which is a comprehensive guideline to employees to assist them in carrying out their activities on a day-to-day basis. Also, Fording Coal Limited introduced the Gainsharing Program at Coal Mountain in 1995, which is a program that shares a portion of the profit generated by the site with employees when certain pre-determined targets are attained.

Summary

Following is a list of the enhancements made at Coal Mountain Operations. These upgrades have made the operation one of the most productive coal mines in the world, and a stable source of employment for the next twenty years:

- introduction of comprehensive Coal Quality program;
- Significant exploration drilling program to identify and firm up reserves;;
- Consolidation of mine plan;
- Move from 10m to 12m benches;
- Utilize GPS tool in mine;
- Significant equipment upgrades in mine: shovel O & K RH200 (2), loader Caterpillar 994 (2), trucks — Haulpak 830E (6);
- rigorous training of personnel to Fording Coal Standards (SP & P's);
- introduce Gainsharing Program;
- competitive manpower levels on site;
- install briquetter in plant;
- flotation circuit; and
- new breaker.

Acknowledgments

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