810936

MINING PROGRAM

FOR

BABCOCK AREA - QUINTETTE PROJECT

BRITISH COLUMBIA

DENISON MINES LIMITED - ALCO STANDARD CORPORATION

BY

John T. Boyd Company

Mining Engineers

Pittsburgh, Pennsylvania

July 1972

(Includes:
Covering Letter
General Statement
Summarized Findings
Geology and Reserves
Preparation and Quality)

JOHN T. BOYD COMPANY

MINING ENGINEERS AND GEOLOGISTS

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Dear Sirs:

Herewith is our deep coal reserve study and mining plan for the Babcock Mountain Area of the Quintette Project, British Columbia.

Coal reserves have been calculated for Seams D, E, F, I, and J at 6.0 and 7.0 percent ash products based on diamond drilling, rotary drilling and adit sample information. The Babcock Area coal reserves considered have a modest dip generally in the 10.0 to 15.0 percent range, but not exceeding 25.0 percent seam gradient and would be adaptable to high-speed mechanical mining.

The mining plan considers two mines operating concurrently in the D and F Seams, initially, with each mine producing 1.7 million tons of raw coal annually. However, the opportunity for concurrent or alternate mining of the J Seam, or other seams, is available if desired.

Mining costs have been developed for varying ash qualities at respective preparation plant recoveries for the D, F and J Seams. Composite production costs have been prepared for the following cases:

Case 1: D and F Seam Mines
Product: 6.5% ash and 62.5% plant recovery

Case 2: F and J Seam Mines
Product: 7.0% ash and 70.0% plant recovery

Case 3: D and J Seam Mines
Product: 8.0% ash and 74.0% plant recovery

Variations in preparation plant recoveries at various levels of ash products and out-of-seam dilutions have been considered.

Cost sensitivities have been tested for 20 percent variations in mining unit productivity and in number of mining producing units.

Field investigations concerning services of railroad, access roads, townsite, power and communication facilities were not included in this assignment.

Very truly yours,

John T. Boyd
President

General Statement

GENERAL STATEMENT

The Quintette Project consists of 253 coal licenses encompassing 226 square miles of land located approximately 65 air miles southwest of Dawson Creek within the Rocky Mountain Foothills in British Columbia.

The property, approximately 8 miles wide and 30 miles long, extends from Kinuseo Creek in the south to Perry Creek in the north and is underlain, in part, by coal bearing cretaceous sedimentary strata.

The area stratigraphic column in ascending order includes the Nikanassin, Cadomin, Gething, Moosebar, Commotion, Shaftesbury, and Dunnegan Formations. Principal coal seams in the Lower Cretaceous sediments are located in two stratigraphic units, the Gething Formation and the Gates Member of the overlying Commotion Formation.

A joint exploration program on the property has been performed by Denison Mines Limited and World Resources Company, Division of Alco Standard Corporation. Varying amounts of exploration have been conducted in five areas, designated:

Babcock Mountain
Wolverine North
Wolverine South
Quintette
Five Cabin.

The Babcock Mountain reserve area is located in the southern half of the Quintette property, just south of the Murray River, on the northeastern side of the property. Fifteen diamond drill holes, eight rotary drill holes, and ten adits are located in a relatively flat lying zone covering approximately five square miles.

This study selects the Gates Member in the Commotion Formation of the Babcock Mountain area as being most appropriate for underground high-speed mechanical mining. In addition, the reserves within the selected area are approximately 75 percent proven by either drill hole or adit information.

The Babcock Mountain selected reserve area is bounded on the northwest by outcrop, on the southwest and northeast by dipping formation that exceeds the 25 seam gradient, and in the southeast by plus 1500 ft. depth of cover and the extent of drilling information.

Deep coal reserves have been calculated in the Babcock Mountain reserve area for the D, E, F, I, and J Seams at 6.0 and 7.0 percent ash products.

Strip coal reserves or the potential of steeply pitching seams are not within the scope of this assignment.

Depth of cover over the upper selected member or D Seam ranges from outcrop to 1500 feet and averages approximately 700 feet.

Seam thickness and interval between seams range as follows:

Seam	Seam Thickness (feet)			Seam Interval (feet)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
D	17.6	5.8	9.4		(Upper Seam)	
E	12.0	7.3	9.1	64	26	44
F	15.0	6.1	9.5	105	29	62
I	12.6	5.6	8.9	171	24	147
J	26.5	15.5	20.0	48	13	28

Reserves considered in this study are calculated to a maximum mining height of 12 feet based on the general working range of standard continuous mining equipment.

The D Seam outcrop occurs on the northwestern flank of Babcock Mountain at an elevation ranging from 5300 to 5600 ft., with the other seams outcropping at corresponding lower interval elevations. The seams have a modest dip to the southeast, generally in the 10 to 15 percent range. Maximum elevation on Babcock Mountain is 6118 feet.

The preparation plant site and railroad facilities would be located approximately 13,000 ft. to the northwest of the mine portal sites in the Murray River Valley at an elevation of 2600 feet. An overland belt conveyor is planned from the mine portals to the preparation plant site.

The mining plan contemplates the application of continuous miners and shuttle cars, belt conveyor coal haulage, and diesel rubber-tired mantrip and supply services.

Two mines would be operated concurrently in the D and F Seams initially, with each mine producing 1.7 million tons of raw coal annually. The arrangement of the outside facilities would permit the concurrent development of the J Seam, or the substitution of the J Seam or other seams for the D or F Seams, if desired, with a minimum amount of change.

Composite production costs have been prepared for the following combinations of ash product and coal preparation recoveries.

Case 1: D and F Seam Mines

D Seam Ash = 7% @ 65% preparation plant recovery
F Seam Ash = 6% @ 60% preparation plant recovery
Average = 6.5 % Ash and 62.5% preparation plant recovery

Case 2: F and J Seam Mines

F Seam Ash = 6% @ 60% preparation plant recovery
J Seam Ash = 8% @ 80% preparation plant recovery
Average = 7% Ash @ 70% preparation plant recovery

Case 3: D and J Seam Mines

D Seam Ash = 8% @ 68% preparation plant recovery
J Seam Ash = 8% @ 80% preparation plant recovery
Average = 8% Ash @ 74% preparation plant recovery

Improvements in preparation plant recoveries at reduced levels of out-of-seam dilution have been investigated and may significantly lower production costs if supported by actual operating experience. However, cost estimates are based on our best judgement of the amount of out-of-seam dilution that will occur from outcrop adits and drill hole information.

Data concerning mine service facilities, supplied by Denison Mines Limited and World Resources Company, have been included in a Services section of the report, but were not within the scope of the field investigation of this report. These include the following:

17 miles - Access Road, gravel top, all gravel road (from existing Fellers Heights Road) connecting Flatbed Creek to mine site.
1 - Bridge across Flatbed Creek
1 - 12,000 KW Electric Generating Station, natural gas powered, producing at 13,000 volts.
18 miles - Gas Line, 6 in., installed, from wellhead to generating station.
Installation for microwave telephone communication system.
Camp or townsite
Railroad

The above service facilities are assumed to be available when needed for purposes of mine development schedule.

This study develops mine production schedules, labor requirements, capital investments, supply and maintenance costs, and total production costs. A mine development schedule is projected that will be representative in all cases.

The mine development plan includes a non-productive time training program to insure that mine management and equipment operators are skilled in the use of high tonnage continuous mining equipment. A wage consideration for remote area overtime pay has been provided.

Money has been included in the projected capital expenditures for a pilot mine to provide more precise information concerning mining conditions, out-of-seam dilution, and size consist information. The projected pilot mine is located in order to tie in with future mining plans and to serve as a natural drainway.

Prices are as of July 1972, with no escalation provided.

Remote area and weather conditions have been considered in capital and operating costs.

All costs are Canadian dollars. All tons are short tons.

The writers of this report are aware that coal must be produced at minimum cost with maximum safety consistant with maximum seam recovery.

Respectfully submitted,

JOHN T. BOYD COMPANY

By:

James T. Jones

Max C. Scheble

A. G. Gilbert

Robert L. Frantz

John T. Boyd

SUMMARIZED FINDINGS

These summarized findings are supported by the tabulations, plates, schedules, appendices and exhibits presented later in the report.

1. The Quintette Project constitutes 253 coal licenses encompassing 226 square miles of land located approximately 65 air miles southwest of Dawson Creek within the Rock Mountain Foothills in British Columbia.

2. A joint exploration program on the property has been performed by Denison Mines Limited and World Resources Company, Division of Alco Standard Corporation. Varying amounts of exploration have been conducted in five areas, designated, Babcock Mountain, Wolverine North, Wolverine South, Quintette and Five Cabin, as follows:

Babcock Mountain

Rotary drill holes	7
Diamond drill holes	18*
Adits	13
Close center percussive drilling zone	6800 ft. long

* Two outside selected reserve area.

Wolverine North	10 drill holes
Wolverine South	Apart from structural mapping, no additional exploration data available.
Quintette	Apart from structural mapping, no additional exploration data available.
Five Cabin	5 drill holes

3. This report determines the deep coal reserves in a selected Babcock Mountain reserve area having a modest dip generally in the 10.0 to 15.0 percent range, but not exceeding 25 percent seam gradient that would be adaptable to high-speed mechanical mining.

It is not within the scope of this report to include strip coal reserves or the potential of steeply pitching seams.

A "Report on An Evaluation of the Quintette Coal Property for Denison Mines Limited," prepared by Hulbert and Thompson Company Limited, June 1972, consideres a reserve potential of 473 million recoverable tons excluding the Babcock Mountain selected reserve "flat lying" area. A portion of these reserves is considered to have low volatile potential.

4. The summary of recoverable underground reserves in the Babcock Mountain Area Quintette Project is:

Seam No.	Seam Acres		Tons In-Place (000's)	Mining Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash		@ 7% Ash	
	Total	Mineable							(%)	Tons (000's)	(%)	Tons (000's)
D	3,501.3	2,977	56,346	49	27,454	0.6	2,813	30,267	56.0	16,747	65.0	19,767
E	3,078.8	2,617	52,177	70	36,523	0.9	5,194	41,717	50.0	20,818	55.0	23,009
F	3,058.3	2,600	48,555	59	28,682	1.4	8,025	36,707	60.0	21,798	60.0	21,798
I	1,842.5	1,196	20,369	70	14,234	0.7	1,844	16,078	45.0	7,259	53.0	8,540
J	3,148.5	2,623	103,839	35	36,394	0.2	1,156	37,550	67.0	25,112	73.0	27,296
Grand Total	14,629.4	12,013	281,286	51	143,287		19,032	162,319	57.0	91,734	62.0	100,410

5. The reserve is 76 percent in a proven reserve reliability category based on 23 drill holes (rotary and diamond) drilled to date. The remainder of the reserve is in a probable reserve category. Seven holes are required to move the entire reserve into the proven category.

6. Seam thickness and interval between seams range as follows:

Seam	Seam Thickness (feet)			Seam Interval (feet)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
D	17.6	5.8	9.4		(Upper Seam)	
E	12.0	7.3	9.1	64	26	44
F	15.0	6.1	9.5	105	29	62
I	12.6	5.6	8.9	171	24	147
J	26.5	15.5	20.0	48	13	28

7. The proximate analysis of clean coal on the plus 28 mesh product at 5.0 and 7.0 percent moisture based on representative diamond drill samples is:

	(Moisture calculated on approximately 6%)							
	@ Approximately 5% Ash				@ Approximately 7% Ash			
	Recovery (%)	Ash (%)	VM (%)	FC (%)	Recovery (%)	Ash (%)	VM (%)	FC (%)
Seam D								
Average	69.90	5.12	24.04	64.84	76.60	6.75	23.69	63.57
Seam E								
Average	60.84	4.99	23.49	65.53	68.01	6.87	23.00	64.13
Seam F								
Average	70.61	4.81	22.90	66.30	76.63	7.07	22.43	64.50
Seam I								
Average	58.52	4.99	21.88	67.14	72.88	6.95	21.22	65.84
Seam J								
Average	69.25	5.10	21.33	65.58	78.38	6.90	21.01	66.09

8. Sulfur and free swelling index at approximately 7.0% ash and 5.0% total moisture composited for all sizes on diamond drill holes samples are:

	Ash (%)	Sulfur (%)	F.S.I.
Seam D, average	7.28	0.85	5-1/2
Seam E, average	7.38	0.23	7-1/2
Seam F, average	6.94	0.29	7-1/2
Seam I, average	7.28	0.34	7
Seam J, average	7.34	0.22	7

9. The mining plan considers two mines operating concurrently, each mine producing 1,725,000 tons of raw coal annually in the following possible combinations:

Seam	Ash (%)	Recovery (%)	Clean Coal Recoverable Tons (000's)	
Case 1: D and F Seam Mines				
D	7.0	65.0	1,121	
F	6.0	60.0	1,035	
Average	6.5	62.5	2,156	Total
Case 2: F and J Seam Mines				
F	6.0	60.0	1,035	
J	8.0	80.0	1,380	
Average	7.0	70.0	2,415	Total
Case 3: D and J Seam Mines				
D	8.0	68.0	1,173	
J	8.0	80.0	1,380	
Average	8.0	74.0	2,553	Total

10. The approximate composite metallurgical coal quality for the three cases will be:

		Case 1 D & F Seams	Case 2 F & J Seams	Case 3 D & J Seams
Ash	(%)	6.50	7.00	8.00
Volatile Matter	(%)	23.11	21.58	22.20
Fixed Carbon	(%)	64.39	65.42	63.80
Moisture	(%)	6.00	6.00	6.00
Recovery	(%)	62.50	70.00	74.00
Sulfur	(%)	0.57	0.25	0.53
FSI		6-1/2	7-1/4	6-1/4

11. The mining program established two concurrent underground mines, D Seam Mine No. 1 and F Seam Mine No. 2 in Case 1, converging at a common portal arrangement consisting of twin rotary breaker facilities and twin 5000-ton raw coal storage silos before overland storage by belt conveyor to the preparation plant in the Murray River Valley.

Each mine will have individual outcrop portal facilities and underground management. Mining projections, where possible, are arranged to quarter the modest 10 to 15 percent dip of the seams resulting in 6.0 to 9.0 percent mining grades.

12. The main office, raw coal handling, coal preparation and unit train loadout, as well as shops, warehouse and garage facilities, will be combined to serve the two mines.

13. The underground face equipment consists of heavy duty continuous miners, shuttle cars, roof bolters, belt feeders, production and main-line belt conveyors. Supplies and mantrip delivery will consist of diesel rubber-tired equipment.

14. Other mining cases or concurrent mining from the J Seam may be accomplished with minimal change in mining arrangement.

15. The raw coal annual production of 3,450,000 tons is standard for the three cases considered. The operating requirements are:

	Mine	
	No. 1	No. 2
Total Units	7	7
Operating Unit Shifts	15	15
Raw tons per unit operating shift	500	500
Raw tons per day	7,500	7,500
Operating days per year	230	230
Raw tons per year	1,725,000	1,725,000

Manpower Requirements:	
General office	12
General outside, storage, overland belt and powerhouse	16
Preparation plant and refuse	33
Mine maintenance, shops and garages	41
Mine No. 1	219
Mine No. 2	219
Total	540
Average raw tons - per operating man day	27.8
- per total man day	24.8
Average base daily wage - Salary	$52.50
- Union	$36.50
Annual production per man raw coal	6,365

16. The estimated mine cash costs are,

		Raw Coal Costs One Mine - All Seams Raw Tons: 1,725,000		Composite Costs		
		Total Dollars Per Year (000's)	Raw Coal $/Ton	Case 1 D & F Seams** $/Ton	Case 2 F & J Seams*** $/Ton	Case 3 D & J Seams**** $/Ton
	Labor					
1.	Mine Supervision, General and Production	$2,720.5	$1.577	$2.524	$2.254	$2.131
2.	Remote Area Overtime Pay (12% Line 1)	326.5	0.189	0.303	0.270	0.256
3.	Vacation and Holiday (Including Supervision)	232.5	0.135	0.216	0.192	0.182
4.	Welfare*	129.5	0.075*	0.120	0.120	0.120
5.	Total - Labor	3,409.0	1.976	3.163	2.836	2.689
	Supplies and Power					
6.	Mine Operating	2,199.5	1.275	2.040	1.822	1.723
7.	Mine Maintenance	1,544.0	0.895	1.432	1.278	1.210
8.	Mine Extension	155.0	0.090	0.144	0.128	0.121
9.	Mine Power	379.5	0.220	0.352	0.314	0.297
10.	Total - Supplies and Power	4,278.0	2.480	3.968	3.542	3.351
	Other					
11.	Employees Benefits and Payroll Taxes (L1 x 17.5%)	476.0	0.276	0.442	0.394	0.373
12.	Other Taxes (Exclusive of British Columbia and Dominion Taxes)	103.5	0.060	0.096	0.086	0.081
13.	Insurance	103.5	0.060	0.096	0.086	0.081
14.	Royalties*	269.0	0.156*	0.250	0.250	0.250
15.	General Administration and Sales	345.0	0.200	0.320	0.286	0.270
16.	Miscellaneous Expense	107.0	0.060	0.096	0.088	0.084
17.	Total - Other Expense	1,404.0	0.812	1.300	1.190	1.139
18.	Subtotal (L5 + L10 + L17)	9,091.0	5.268	8.431	7.568	7.179
19.	Contingency (8% of L18)	727.0	0.421	0.674	0.605	0.574
20.	Total Cash Cost, f.o.b. mine, before depreciation, Dominion income tax and British Columbia Tax	$9,818.0	$5.689	$9.105	$8.173	$7.753

Royalties

* Based on clean coal tons @ 62.5% recovery, Case 1.

** Average = 6-1/2% Ash @ 62.5% Recovery

*** Average = 7% Ash @ 70% Recovery

**** Average = 8% Ash @ 74% Recovery

17. The initial and replacement capital costs are:

	$ (000's)
Common General Facilities	3,898
Coal Preparation, Storage & Loadout Facilities	17,025
Overland Conveyor and Transfer Station	5,251
Mine No. 1, D Seam*	7,649
Mine No. 2, F Seam	6,582
Miscellaneous including exploration, overhead, engineering, excess mine development cost, contingency and interest during construction	14,193
Total - Initial Capital	54,598
Replacement Capital (20 years)	18,155

* Includes rebuilding equipment common to both mines.

18. Depreciation of initial and replacement capital considered over a 20-year period, including development period, is,

	Raw Coal	Case 1	Case 2	Case 3
Preparation plant recovery (%)	100	62.5	70	74
Production, 20-yr.period, Tons(000's)	63,500	39,665	44,450	46,990
Depreciation, $ per ton:				
Initial	$0.860	$1.376	$1.228	$1.162
Replacement	.286	.458	.408	.386
Total	$1.146	$1.834	$1.636	$1.548

19. Total production cost, f.o.b. mine, including depreciation but before Dominion tax and British Columbia tax, is;

	Raw Coal	Case 1	Case 2	Case 3
Total Cash Cost, $/ton	$5.689 *	$9.105	$8.173	$7.753
Depreciation - per ton	1.146	1.834	1.636	1.548
Total	$6.835	$10.939	$9.809	$9.301

* Welfare and royalty based on clean coal @ 62.5% recovery, Case 1.

20. The development schedule to full production considered in this report is;

	Capital Investment (000's)	Production Raw Tons (000's)
D - 6	$ 9,425	0
D - 5	25,881	0
D - 4	10,221	588
D - 3	4,276	1,530
D - 2	2,400	2,776
D - 1	1,221	3,380
D	1,178	3,448
Total	$54,598	

21. There has been no money provided for working capital in the estimated capital expenditures. The amount required will be a function of the time lag for receipt of payments that may be specified in a long term contract. Interest to cover this money could have a range of $0.10 to $0.25 per ton.

22. Field investigations concerning services of railroad, townsite, access roads, power and communication facilities were not included in this assignment. In addition, it is uncertain what portions of the monies required for services will come from private capital or public funds. Service facilities are assumed to be available when needed for purposes of mine development schedule.

23. Market considerations have not been included in this report.

24. The following plates presented in the text of the report are included here to summarize the variations in recovery and mining costs which may result from various product recoveries and seam combinations, as follows:

(a) Preparation plant product recoveries versus varying amounts of out-of-seam dilution. The basic out-of-seam dilutions from which percent reductions have been considered are,

D Seam = 0.6 ft.
F Seam = 1.4 ft. Draw slate
J Seam = 0.2 ft.

(b) Total mine cash cost versus ash percentage. Mine cost ranges for the ash products considered are;

% Ash	4	5	6	7	8	9
	Mine Cash Cost - $ per Ton					
D Seam	NA	NA	$10.117	$8.773	$8.401	NA
F Seam	$11.070	$10.292	9.471	NA	NA	NA
J Seam	9.623	8.522	7.855	7.203	6.879	NA

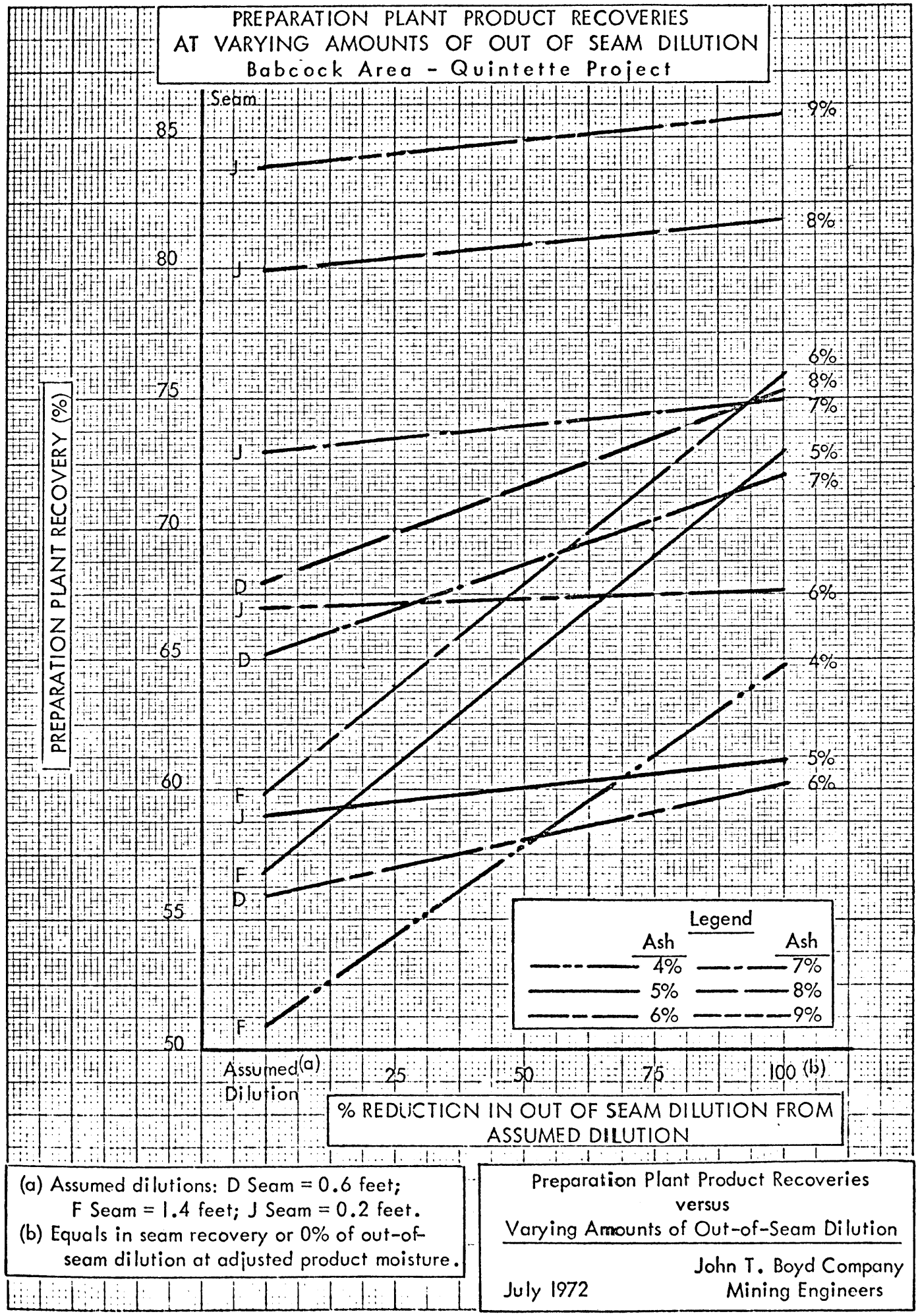
(c) Total mine cash cost versus 4, 5 and 6 production units per mine.

(d) Total mine cash cost versus 400, 500, and 600 tons raw coal per unit production shift.

25. Pilot or experimental mining experience is required to provide more precise information concerning actual continuous miner mining conditions, out-of-seam dilution, size consist information, and permit ultimate mine size determination. The pilot mine should be designed to expedite future mining development, assist in equipment selection, and to serve as a

25. (Continued)

natural drainway for that portion of the reserves located up-dip from the drainway. Cost of the experimental mine, including camp cost, would range from $1.0 to $2.0 million, contingent upon the amount of development accomplished. Equipment acquired for the pilot mine may be utilized later in the initial mine program.



(a) Assumed dilutions: D Seam = 0.6 feet; F Seam = 1.4 feet; J Seam = 0.2 feet.

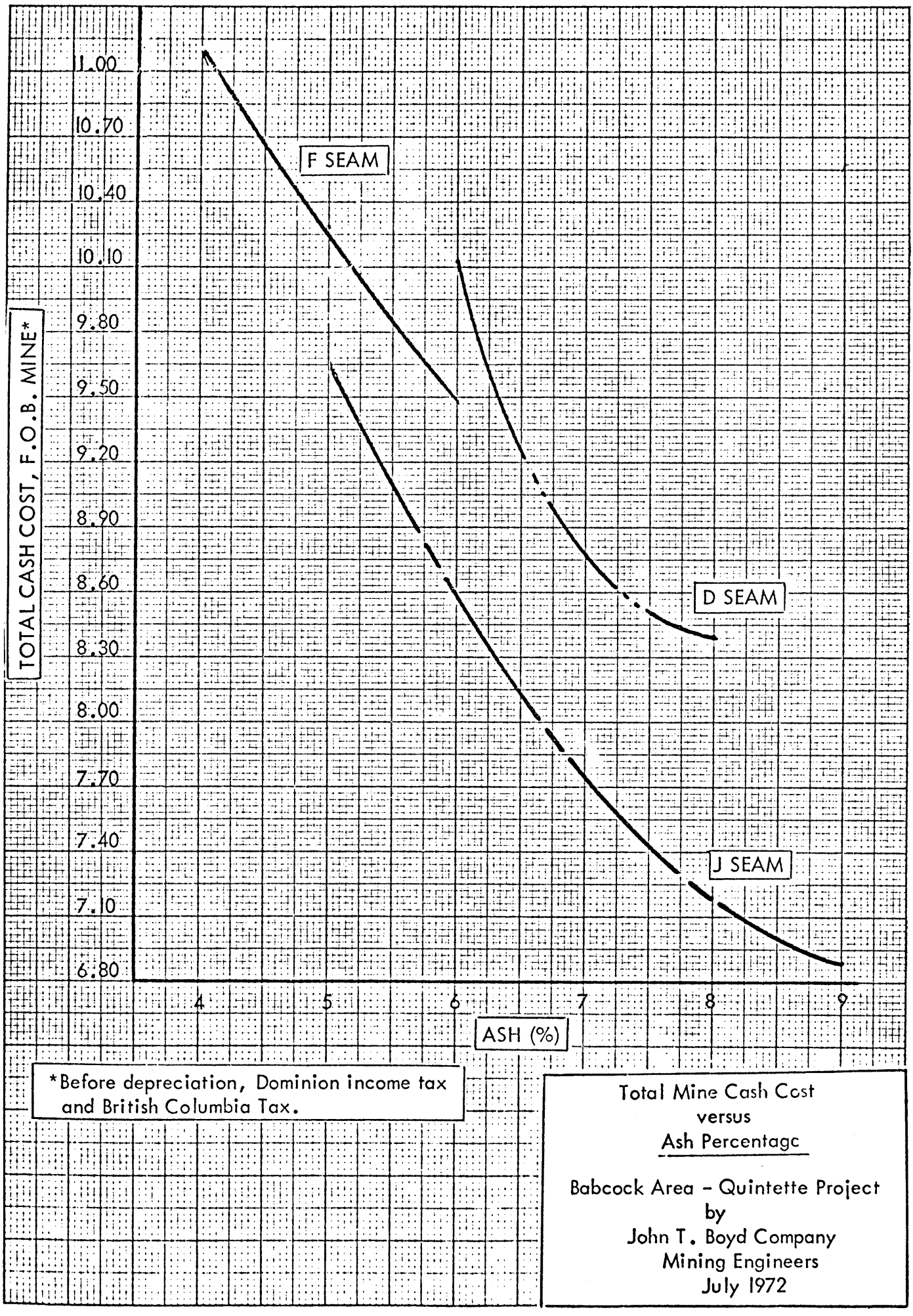
(b) Equals in seam recovery or 0% of out-of-seam dilution at adjusted product moisture.

Preparation Plant Product Recoveries
versus
Varying Amounts of Out-of-Seam Dilution

July 1972

John T. Boyd Company
Mining Engineers

K&E 10 X 10 INCH 6 13 MADE IN U.S.A. KEUFFEL & ESSER CO.

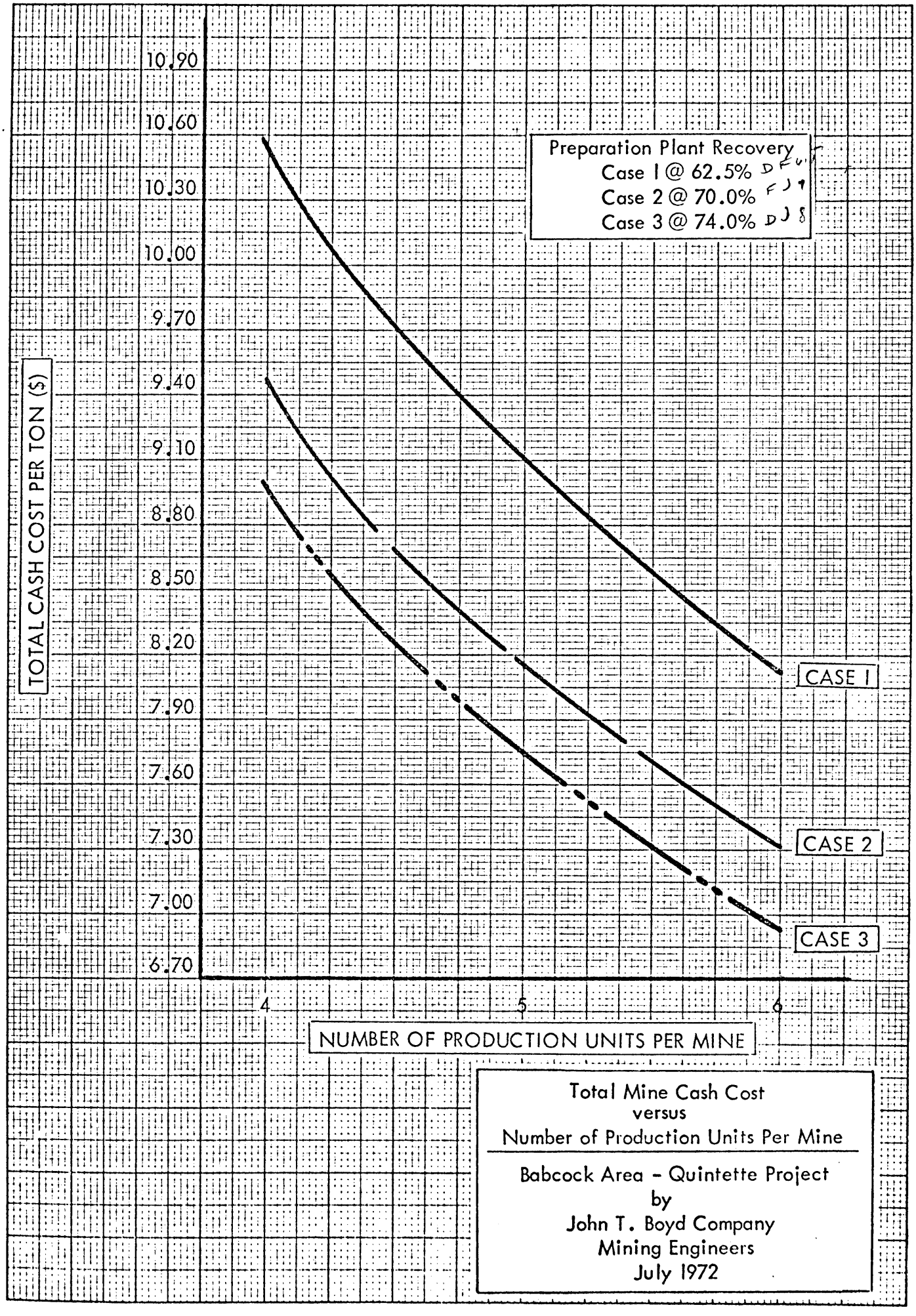


*Before depreciation, Dominion income tax and British Columbia Tax.

Total Mine Cash Cost
versus
Ash Percentage

Babcock Area - Quintette Project
by
John T. Boyd Company
Mining Engineers
July 1972

KEUFFEL & ESSER CO. MADE IN U.S.A.


10.90
10.60
10.30
10.00
9.70
9.40
9.10
8.80
8.50
8.20
7.90
7.60
7.30
7.00
6.70
TOTAL CASH COST PER TON ($)
Preparation Plant Recovery
Case 1 @ 62.5%
Case 2 @ 70.0%
Case 3 @ 74.0%
CASE 1
CASE 2
CASE 3
4
5
6
NUMBER OF PRODUCTION UNITS PER MINE
Total Mine Cash Cost
versus
Number of Production Units Per Mine
Babcock Area - Quintette Project
by
John T. Boyd Company
Mining Engineers
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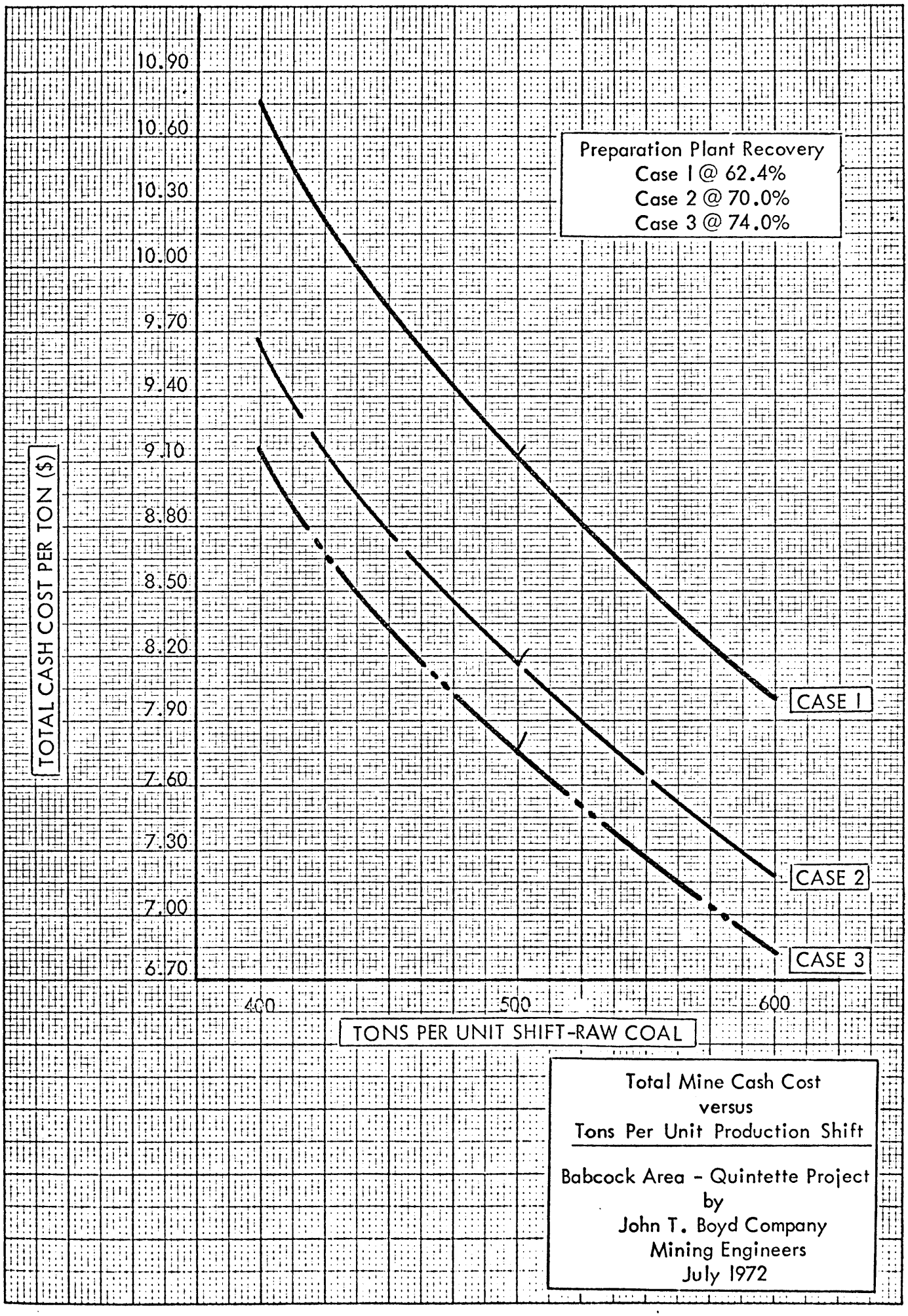


K&E 7 X 10 INCHES 5 13 MADE IN U.S.A. KEUFFEL & ESSER CO.

GEOLOGY AND RESERVES

A joint exploration program by Denison Mines Limited and World Resources Company has been performed on the Quintette Property in British Columbia.

The entire property consisting of 226 square miles was geologically mapped initially to outline those areas where coal measures could be expected and, within those areas, the structural formations which might be amenable to various mining methods. From this information five areas were selected where varying amounts of exploration have been performed.

The five areas selected are designated:

Babcock Mountain
Wolverine North
Wolverine South
Quintette
Five Cabin

The general stratigraphic column encountered in the area includes the Nikanassin, Cadomin, Gething, Moosebar, Commotion, Shaftesbury, and Dunnegan Formations. Principal coal seams in the Lower Cretaceous sediments are located in two stratigraphic units, the Gething Formation and the Gates Member of the overlying Commotion Formation. (See Plate 1).

Exploration to date in addition to structural mapping in the five areas includes;

Babcock Mountain

Rotary drill holes	7
Diamond drill holes	16

Babcock Mountain (continued)

Adits	No.	Seam
	2	D
	2	E
	3	F
	2	G
	3	J
	1	K
	13 - Total	

Close center percussive drilling for outcrop, 6800 ft. zone.

Wolverine North — 10 drill holes

Wolverine South — Apart from structural mapping, no additional exploration data available.

Quintette — Apart from structural mapping, no additional exploration data available.

Five Cabin — 5 drill holes

Reportedly, the structural configuration of the various areas is as follows:

Babcock Mountain:

Described in detail later in this report.

Wolverine North:

A potential underground area with dips varying between 10 and 20 degrees on the southern exposures. More complicated structures along Perry Creek result in beds as steep as 40 degrees. The dip-sloping Gates Strata may contain low ratio strip coal.

Wolverine South:

The greatest reserve in this region would require underground mining although surface mining potential exists on the eastern side. Strata dip

Wolverine South (continued)

steeply along the limbs of folds, flattening over small areas at the crest of folds.

Quintette:

This area of steep dips (50 to 85 degrees) may provide an initial contour type open pit operation. Later, with developing underground techniques, such as hydraulic mining, deep mining reserves might be developed.

Five Cabin Syncline:

This area of dominantly underground potential may provide small surface mining possibilities as well. Bedding dips are steep, varying between 15 and 70 degrees.

A limited amount of strip coal is located in the Babcock Mountain area. Extensive field exploration is required to determine locations for strip coal reserves in the other areas. It is not within the scope of this report to include strip coal reserves or the potential of steeply pitching seams.

A "Report on An Evaluation of the Quintette Coal Property for Denison Mines Limited", prepared by Hulbert and Thompson Company Limited, June 1972, considers a reserve potential of 473 million recoverable tons excluding the Babcock Mountain "flat lying" area. A portion of these reserves is considered to have low volatile potential.

Babcock Mountain Reserves

Location and General:

The Babcock Mountain reserve, located approximately 90 air miles east of Grand Prairie, 65 miles southwest of Dawson Creek, and 65 miles north of Hansard, is one of five principal areas of the Quintette Property as shown on Exhibit 2.

Seams of mineable thickness have been found at eight different horizons in the exploration program just completed on Babcock Mountain. In descending order, these seams are known as D, E, F, G, H, I, J and K. The five principal seams are D, E, F, I and J. Seam G underlies only a small portion of the reserve on the northern or outcrop end of the property. Seam H is found only in Hole R-7106 located along the southwest rim of the reserve area. Seam K is erratic and in several holes is immediately below Seam J and could be a split off the bottom of the J Seam. Only the five principal seam reserves are considered in this report.

Geologic Structure:

The reserve area is located on Babcock Mountain. The seams are in the Gates Member of the Commotion Formation and are located along a monoclinal structure, as shown on the cross-sections in the Exhibit 4 Series in the Exhibits section of this report. The seams dip to the south or southeast over most of the Babcock Mountain area. Grades within the mining area range from 7% to 25%, but the major portion would have a grade of approximately 10% to 15%. The seam contours, the thickness of seam isopachs, and the depth of cover over the

various seams are shown on Exhibits 5A, 5B, 5C, 5D and 5E. These exhibits also show the outcrop of Seams D, E, F and J on the northwestern end of the property. Seam I, which does not underlie the entire mountain, is shown on Exhibit 5D and does not outcrop. Plate 1-A presents a typical columnar section of the Gates Member of the Commotion Formation in the Babcock Mountain area.

Folding of the rock structure along the northeastern and southwestern sides of the mountain limits the area of flat lying mineable reserves adaptable to high-speed mining equipment. In general, the limit of the reserve along these sides was determined by that point where the grade on the seam exceeded 25%, as shown on the cross-sections and defined primarily by surface geology, but not extended substantially beyond drilling information. Along the southeastern boundary, reserve extent was limited either by the amount of drilling or by the 1500 ft. cover line.

It is recognized that successful underground mining can extend beyond a 1500 ft. cover line, but without the benefit of area mining experience the extent of mining recovery must be qualified.

The reserve area appears to be relatively free of major faulting, folding, or structural complexities with the exception of a displacement fault encountered in Drill Hole QBD7205 in the northern portion of the selected reserve area and a possible duplication of the J Seam in the vicinity of Hole No. 7103. Pilot mining is required to fully validate expected mining conditions in the absence of previous mining experience in the various seams in the Babcock Mountain area.

Reserves:

Tabulation 1 (following this text) is a summary of the Babcock Mountain underground reserves in the five seams.

Tabulation 2 (following this text) shows the amount of reserves in the various seams and the tons of recoverable clean coal at both 6% and 7% ash. These tonnages are predicated on mining not more than 12 ft. in a seam even though most of the seams are thicker in many places. This is considered to be the maximum height mineable by modern, high-production, mechanical equipment without special equipment construction that must be field tested.

Approximately 76% of the reserves are within sufficient proximity of existing drill holes or adit information to be considered proven. Eight holes are required to move the remaining reserves into the "proven" classification and define the faulted condition in the vicinity of Drill Hole QBD7205.

A 50% mining recovery factor was used in calculating the reserves in Seam D. It is questionable that the massive sandstone conglomerate overlying this seam can be broken, eliminating the possible extraction of pillars. On Seams E, F, and I, 70% mining recovery factor was used up to a seam thickness of 12 feet. A 60% recovery factor up to a mining height of 12 feet was used for Seam J. It is recognized that considerable investigation should be performed, including the possibility of hydraulic mining, before a maximum overall mining recovery of 30% is considered satisfactory from the J Seam that averages 20 ft. in thickness.

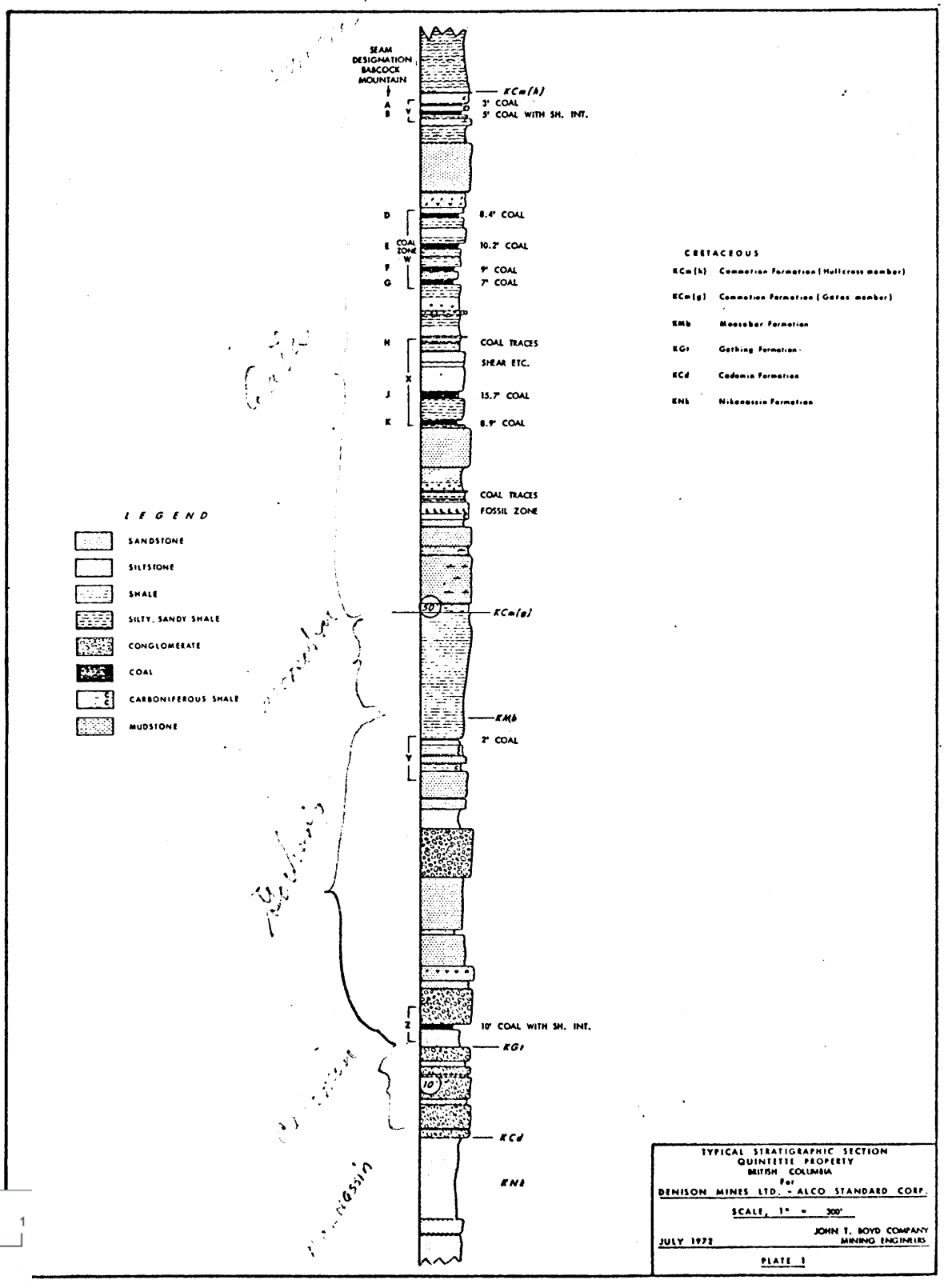
Tabulation 3 shows the proximate analysis on a representative number of diamond drill hole samples of the clean coal at both 5% and 7% ash on the plus 28 mesh product at 6% moisture on the five seams. The series of tabulations (4A through 4E) show the sulfur and free swelling index obtained from washability data at approximately 7% ash and 5% total moisture for the five seams.

Plates 2 through 6A are washability curves for the plus 28 mesh and composite curves of plus 28 mesh and minus 28 mesh flotation product based on the average of 10 diamond drill holes for Seams D, E and J. Nine diamond drill hole samples were used for the F Seam and 8 were used for Seam I. These curves were utilized in determining the in-seam recovery for the clean coal product.

The recoverable tons of clean coal (Tabulations 1 and 2) are predicated on a product containing 6% moisture.

Major seam reserves are,

				Clean Coal Product	
Seam	Thickness Range (ft.)	Acres	Raw Coal Tons (000)	Clean Coal @ 6% Ash Tons (000)	@ 7% Ash Tons (000)
D	6.0 - 17.5	3,501.3	27,454	16,747	19,767
E	7.5 - 11.5	3,078.8	36,523	20,818	23,009
F	6.5 - 14.5	3,058.3	28,682	21,798	21,798
I	6.0 - 12.5	1,949.4	15,876	8,097	8,540
J	16.0 - 25.5	3,148.5	36,394	25,112	27,296
	Totals		144,929	95,572	100,410



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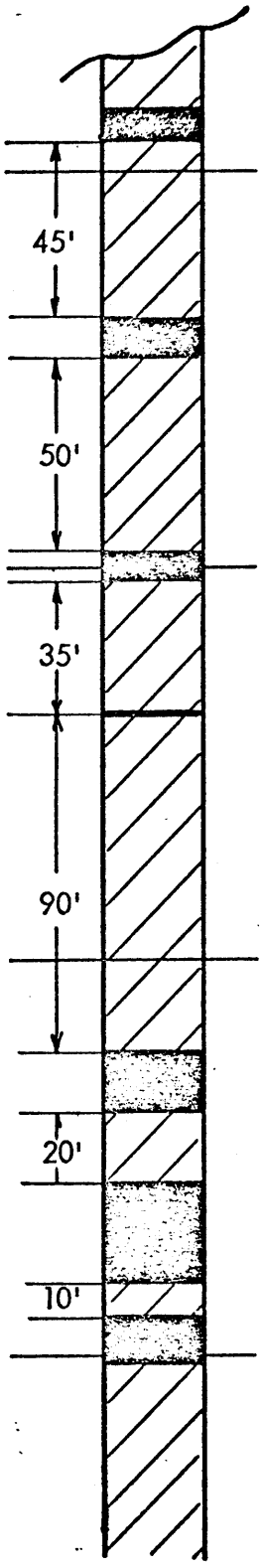


TYPICAL COLUMNAR SECTION
Babcock Area - Quintette Project
British Columbia

For

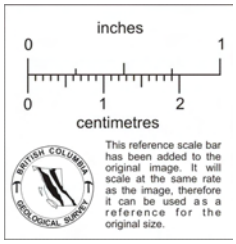
Denison Mines Ltd. - Alco Standard Corp.

Scale, 1" = 50 Feet

John T. Boyd Company
Mining Engineers

July 1972

Plate 1A



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TABULATION 1

SUMMARY OF COAL RESERVES
Babcock Area
QUINTETTE PROJECT
Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION
By
John T. Boyd Company
Mining Engineers
July 1972

Seam No.	Seam Acres		Average Thickness (Feet)			Tons In-Place (000's)	Mining Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash		@ 7% Ash	
	Total	Mineable	Coal	Partings	Total Seam							(%)	Tons (000's)	(%)	Tons (000's)
D	3,501.3	2,977	8.8	0.6	9.4	56,346	49	27,454	0.6	2,813	30,267	56.0	16,747	65.0	19,767
E	3,078.8	2,617	7.3	1.8	9.1	52,177	70	36,523	0.9	5,194	41,717	50.0	20,818	55.0	23,009
F	3,058.3	2,600	8.7	0.8	9.5	48,555	59	28,682	1.4	8,025	36,707	60.0	21,798	60.0	21,798
I	1,842.5	1,196	8.7	0.2	8.9	20,369	70	14,234	0.7	1,844	16,078	45.0	7,259	53.0	8,540
J	3,148.5	2,623	-	-	20.0	103,839	35	36,394	0.2	1,156	37,550	67.0	25,112	73.0	27,296
Grand Total	14,629.4	12,013				281,286	51	143,287		19,032	162,319	57.0	91,734	62.0	100,410

TABULATION 2

ESTIMATED COAL RESERVES BY SEAMS
Babcock Area
QUINTETTE PROJECT
Prepared For
DENNISON MINES LIMITED - ALCO STANDARD CORPORATION
By
John T. Boyd Company
Mining Engineers
July 1972

Seam Height Interval (Feet)	Seam Acres Total	Seam Acres Mineable(1)	Average Thickness (Feet) Coal	Partings	Total Seam	Tons(2) In-Place (000's)	Mining(3) Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash (%)	@ 6% Ash Tons (000's)	@ 7% Ash (%)	@ 7% Ash Tons (000's)
							SEAM D								
5 - 6	4.6	4	-	-	6.0	48	50	24	0.6	4	28	54.0	15	61.0	17
6 - 7	160.7	137	6.1	0.4	6.5	1,790	50	895	0.6	129	1,024	53.0	545	63.0	645
7 - 8	854.1	726	6.7	0.8	7.5	10,950	50	5,475	0.6	686	6,161	54.0	3,340	64.0	3,942
8 - 9	505.1	429	7.7	0.8	8.5	7,334	50	3,667	0.6	405	4,072	55.0	2,237	65.0	2,640
9 - 10	962.0	818	9.0	0.5	9.5	15,627	50	7,814	0.6	773	8,587	55.0	4,765	66.0	5,626
10 - 11	500.5	425	10.5	-	10.5	8,973	50	4,487	0.6	402	4,889	56.0	2,737	66.0	3,231
11 - 12	146.9	125	11.5	-	11.5	2,892	50	1,446	0.6	118	1,564	56.0	882	67.0	1,041
12 - 13	124.0	105	12.5	-	12.5	2,640	46	1,214	0.6	99	1,313	56.0	741	67.0	874
13 - 14	103.3	88	13.5	-	13.5	2,389	43	1,027	0.6	83	1,110	56.0	627	67.0	739
14 - 15	64.3	55	14.5	-	14.5	1,603	40	641	0.6	52	693	56.0	391	67.0	462
15 - 16	43.6	37	15.5	-	15.5	1,154	38	439	0.6	35	474	57.0	268	67.0	316
16 - 17	23.0	20	16.5	-	16.5	664	35	232	0.6	19	251	57.0	142	67.0	167
17 - 18	9.2	8	16.6	0.9	17.5	282	33	93	0.6	8	101	57.0	57	67.0	- 67
Total	3,501.3	2,977	8.8	0.6	9.4	56,346	49	27,454	0.6	2,813	30,267	56.0	16,747	65.0	19,767

(1) Net mineable acres after deducting 15% for geological anomalies, i.e. wants, faults, local steep dips, etc.
(2) Tons calculated on an average of 2,011 tons per acre ft. (raw).
(3) Estimated that no pillars can be extracted in this seam because of the thick sandstone/conglomerate top.
Mineable reserves are predicated on 50% extraction up to a mining height of 12 ft.

Seam Height Interval (Feet)	Seam Acres Total	Seam Acres Mineable(1)	Average Thickness (Feet) Coal	Partings	Total Seam	Tons(2) In-Place (000's)	Mining(3) Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash (%)	@ 6% Ash Tons (000's)	@ 7% Ash (%)	@ 7% Ash Tons (000's)
							SEAM E								
7 - 8	32.1	27	5.8	1.7	7.5	443	70	310	0.9	54	364	49.0	177	54.0	195
8 - 9	1,377.6	1,171	7.0	1.5	8.5	21,779	70	15,245	0.9	2,324	17,569	49.0	8,690	55.0	9,604
9 - 10	1,469.4	1,249	7.5	2.0	9.5	25,962	70	18,173	0.9	2,479	20,652	50.0	10,358	55.0	11,450
10 - 11	153.8	131	8.5	2.0	10.5	3,011	70	2,108	0.9	260	2,368	51.0	1,201	56.0	1,328
11 - 12	45.9	39	9.0	2.5	11.5	982	70	687	0.9	77	764	51.0	392	57.0	432
Total	3,078.8	2,617	7.3	1.8	9.1	52,177	70	36,523	0.9	5,194	41,717	50.0	20,818	55.0	23,009

(1) Net mineable acres after deducting 15% for geological anomalies, i.e. wants, faults, local steep dips, etc.
(2) Tons calculated on an average of 2,188 tons per acre ft. (raw).
(3) Mineable reserves are predicated on 70% extraction.

Seam Height Interval (Feet)	Seam Acres Total	Seam Acres Mineable[1]	Average Thickness (Feet) Coal	Partings	Total Seam	Tons[2] In-Place (000's)	Mining[3] Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash (%)	@ 6% Ash Tons (000's)	@ 7% Ash (%)	@ 7% Ash Tons (000's)
							SEAM F								
6 - 7	68.9	59	6.5	-	6.5	755	60	453	1.4	182	635	54.0	344	54.0	344
7 - 8	355.9	303	7.3	0.2	7.5	4,480	60	2,688	1.4	935	3,623	56.0	2,042	56.0	2,042
8 - 9	638.3	543	7.9	0.6	8.5	9,098	60	5,459	1.4	1,676	7,135	58.0	4,149	58.0	4,149
9 - 10	1,331.7	1,132	8.5	1.0	9.5	21,196	60	12,718	1.4	3,494	16,212	60.0	9,666	60.0	9,666
10 - 11	307.6	261	9.5	1.0	10.5	5,422	60	3,253	1.4	806	4,059	61.0	2,472	61.0	2,472
11 - 12	121.7	103	10.5	1.0	11.5	2,336	60	1,402	1.4	318	1,720	62.0	1,066	62.0	1,066
12 - 13	89.5	76	11.7	0.8	12.5	1,872	55	1,030	1.4	235	1,265	62.0	783	62.0	783
13 - 14	71.2	61	13.5	-	13.5	1,624	51	828	1.4	188	1,016	62.0	629	62.0	629
14 - 15	73.5	62	14.5	-	14.5	1,772	48	851	1.4	191	1,042	62.0	647	62.0	647
Total	3,058.3	2,600	8.7	0.8	9.5	48,555	59	28,682	1.4	8,025	36,707	60.0	21,798	60.0	21,798

(1) Net mineable acres after deducting 15% for geological anomalies, i.e. wants, faults, local steep dips, etc.
(2) Tons calculated on an average of 1,971 tons per acre ft. (raw).
(3) Mineable reserves are predicated on 70% extraction up to a mining height of 12 ft.
(4) Ash on this product will not exceed 6%.

Seam Height Interval (Feet)	Seam Acres Total	Seam Acres Mineable[1]	Average Thickness (Feet) Coal	Partings	Total Seam	Tons[2] In-Place (000's)	Mining[3] Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash (%)	@ 6% Ash Tons (000's)	@ 7% Ash (%)	@ 7% Ash Tons (000's)
							SEAM I								
5 - 6	29.8	19	5.4	0.6	6.0	114	70	153	0.7	29	182	43.0	78	51.0	92
6 - 7	265.2	172	6.5	-	6.5	2,142	70	1,499	0.7	265	1,764	43.0	764	51.0	899
7 - 8	420.6	273	7.5	-	7.5	3,924	70	2,747	0.7	421	3,168	44.0	1,401	52.0	1,648
8 - 9	327.9	213	8.5	-	8.5	3,470	70	2,429	0.7	329	2,758	45.0	1,239	53.0	1,457
9 - 10	243.4	158	9.5	-	9.5	2,876	70	2,013	0.7	244	2,257	46.0	1,027	54.0	1,200
10 - 11	204.8	133	10.5	-	10.5	2,677	70	1,874	0.7	205	2,079	46.0	955	54.0	1,124
11 - 12	320.3	208	11.5	-	11.5	4,583	70	3,208	0.7	320	3,528	46.0	1,636	55.0	1,925
12 - 13	30.5	20	12.3	0.2	12.5	479	65	311	0.7	31	342	47.0	159	55.0	187
Total	1,842.5	1,196	8.7	0.2	8.9	20,369	70	14,234	0.7	1,844	16,078	45.0	7,259	53.0	8,540
						Deduction Due to Suspected Thrust Fault (Not included in above tabulation)									
11 - 12	158.4	103	11.5	-	11.5	2,270	70	1,589	0.7	159	1,748				
10 - 11	23.0	15	10.5	-	10.5	303	70	212	0.7	23	235				
Total	181.4	118	11.4	-	11.4	2,573	70	1,801	0.7	182	1,983				

(1) Net mineable acres after deducting 35% for geological anomalies, i.e. wants, faults, local steep dips. Also deducted for areas where bottom of mining horizon was within 20 ft. of top of "J" Seam.
(2) Tons calculated on an average of 1,916 tons per acre ft. (raw).
(3) Mineable reserves are predicated on 70% extraction up to a mining height of 12 ft.

Seam Height Interval (Feet)	Seam Acres Total	Seam Acres Mineable[1]	Average Thickness (Feet) Coal	Partings[2]	Total Seam	Tons[3] In-Place (000's)	Mining[4] Recovery (%)	Mineable Tons (000's)	Out of Seam Dilution (Feet)	Dilution Tons (000's)	Mineable Coal + Dilution Tons (000's)	Preparation Plant Recovery - Clean Coal @ 6% Ash (%)	@ 6% Ash Tons (000's)	@ 7% Ash (%)	@ 7% Ash Tons (000's)
							SEAM J								
15 - 16	4.6	4	-	-	16.0	127	45	57	0.2	2	59	66.0	39	73.0	43
16 - 17	78.1	15	-	-	16.5	194	42	81	0.2	7	88	64.0	56	69.0	61
17 - 18	273.2	232	-	-	17.5	8,055	40	3,222	0.2	102	3,324	67.0	2,223	73.0	2,416
18 - 19	417.9	355	-	-	18.5	13,031	38	4,952	0.2	157	5,109	67.0	3,417	73.0	3,714
19 - 20	968.9	824	-	-	19.5	31,879	36	11,476	0.2	363	11,839	67.0	7,918	73.0	8,607
20 - 21	681.9	580	-	-	20.5	23,590	34	8,021	0.2	256	8,277	67.0	5,534	73.0	6,017
21 - 22	401.8	341	-	-	21.5	14,547	33	4,801	0.2	150	4,951	67.0	3,313	73.0	3,601
22 - 23	211.2	180	-	-	22.5	8,035	31	2,491	0.2	79	2,570	67.0	1,719	73.0	1,868
23 - 24	66.6	57	-	-	23.5	2,659	30	798	0.2	25	823	67.0	551	73.0	599
24 - 25	29.8	25	-	-	24.5	1,216	29	353	0.2	11	364	67.0	244	73.0	265
25 - 26	11.5	10	-	-	25.5	506	28	142	0.2	4	146	67.0	98	73.0	107
Total	3,148.5	2,623	-	-	20.0	103,839	35	36,394	0.2	1,156	37,550	67.0	25,112	73.0	27,296

(1) Net mineable acres after deducting 15% for geological anomalies, i.e. wants, faults, local steep dips, etc.
(2) These columns are not applicable for this seam. It is planned to mine the best 12 ft. of this seam wherever it may be in the section.
(3) Tons calculated on an average of 1,984 tons per acre ft. (raw).
(4) Estimated that pillars would be extracted with an overall recovery of 60% up to a mining height of 12 ft.

COAL PREPARATION AND QUALITY

The sink-float analyses of the Babcock Mountain samples by Cyclone Engineering Sales Limited have been examined. Separate, simplified, washability curves for Seams D, E, F, I, and J have been prepared. These curves are based on,

(1) The diamond drill cores crushed to minus 1 in. and milled to produce 20% of 28M x 0 material if the original material did not contain at least 20%.

(2) The application of heavy medium cyclones for washing the plus 28M raw coal and froth flotation cells for treatment of the 28M x 0 raw coal.

(3) Correction for washing efficiency and reflect preparation plant performance for the in-seam material. The recovery values do not reflect out-of-seam dilution.

We have not considered sink-float data for the rotary drill samples. This information indicates a substantially lower ash and yield at any given specific gravity. It is our opinion that these results are not attainable in a coal preparation plant nor is it practical to design a plant to produce the results indicated by the rotary drill samples.

This study considers one preparation plant processing coal from both seams together.

The preparation plant will be designed with two parallel circuits and is scheduled to operate three shifts per day. One circuit will be out of service one shift each day for maintenance. This will provide five circuit shifts per day, 230 days per year. Each circuit will process 3000 tons per shift.

Reference is made to the Flow Diagram, Plate 7, following this text.

The run of mine coal from each seam can be processed separately or mixed through rotary breakers making a 3" x 0 raw coal product. The product from each rotary breaker will be conveyed separately to a 5000-ton raw coal storage silo. From the two 5000-ton silos the product can be mixed or blended in varying proportions and conveyed at 1200 t.p.h. to a 5000-ton surge silo at the preparation plant.

The coal preparation plant will be designed to process raw coal at a rate of 900 t.p.h. The feed to the plant will be crushed to 1" x 0 and sized at 28M.

The 1" x 28M material will be processed through a heavy medium cyclone circuit at a rate of 695 t.p.h. and the float product will be centrifugally dried.

The 28M x 0 material will be processed in a froth flotation circuit at a rate of 205 t.p.h. The carbon concentrate will be dewatered by vacuum filtration.

The clean products from each circuit will be combined and thermally dried.

The composite product will be metallurgical coal and will have the following approximate quality:

		Case 1 D & F Seams	Case 2 F & J Seams	Case 3 D & J Seams
Ash	(%)	6.50	7.00	8.00
Volatile Matter	(%)	23.11	21.58	22.20
Fixed Carbon	(%)	64.39	65.42	63.80
Moisture	(%)	6.00	6.00	6.00
Recovery	(%)	62.50	70.00	74.00
Sulfur	(%)	0.57	0.25	0.53
FSI		6-1/2	7-1/4	6-1/4

It is recognized that the coal recovery achieved from a given seam is a function of the product, particularly ash and sulfur, required from that seam. The preparation plant recovery is a function of the coal product required and the amount of out-of-seam dilution that has been introduced into the raw coal in the mining process. Without the benefit of typical or "pilot" mining experience in the Babcock Mountain seams, the amount of out-of-seam dilution that will occur has been estimated from the outcrop adits and the drill hole information.

Tabulation 5 presents the range in recoveries that results from possible variations in out-of-seam dilutions and ash requirements.

Following this page are:

Plates

2: Preparation Plant Product Recoveries Versus Varying Amounts of Out-of-Seam Dilution

Washability Curves for Plus 28 Mesh and Composite Curves of Plus 28 Mesh and Minus 28 Mesh Flotation Product:

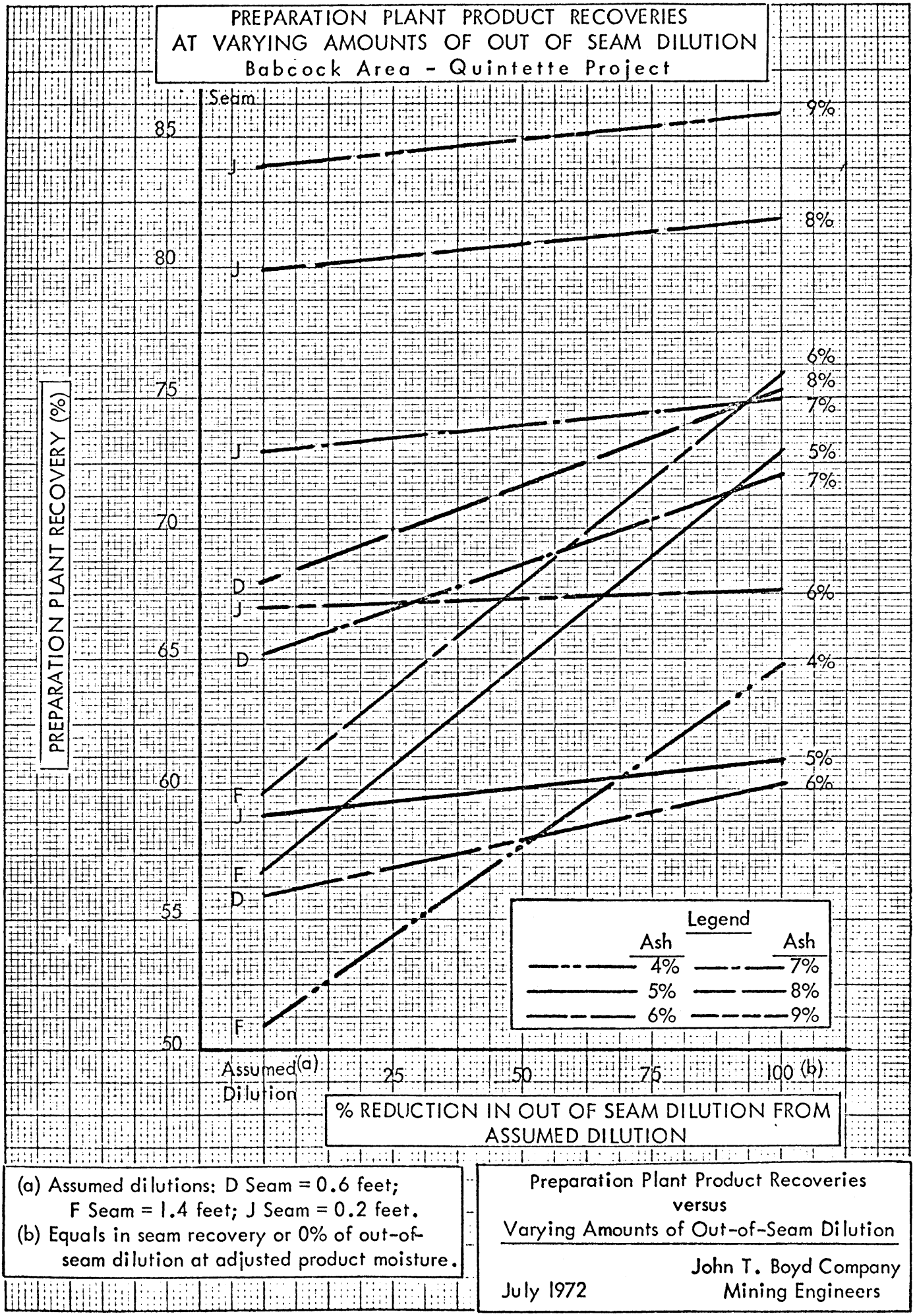
2A: Seam D (average of 14 diamond drill holes)
3: Seam E (average of 13 diamond drill holes)
4: Seam F (average of 12 diamond drill holes)
5: Seam I (average of 9 diamond drill holes)
6: Seam J: (average of 13 diamond drill holes)
6A: Lower J Seam (average of 11 diamond drill holes)
7: Preparation Plant Flow Diagram

Tabulations

3: Proximate Analyses of Clean Coal (plus 28M product)

Sulfur and Free Swelling Index, 7.0 % Ash - 5.0% Moisture:

4-A: Seam D
4-B: Seam E
4-C: Seam F
4-D: Seam I
4-E: Seam J
5: Preparation Plant Product Recoveries at Varying Amounts of Out-of-Seam Dilution



(a) Assumed dilutions: D Seam = 0.6 feet; F Seam = 1.4 feet; J Seam = 0.2 feet.

(b) Equals in seam recovery or 0% of out-of-seam dilution at adjusted product moisture.

Preparation Plant Product Recoveries
versus
Varying Amounts of Out-of-Seam Dilution

July 1972

John T. Boyd Company
Mining Engineers

PLATE 2

K+E 7 X 10 INCH 5 13 7 X 10 INCHES MADE IN U.S.A. KEUFFEL & ESSER CO.

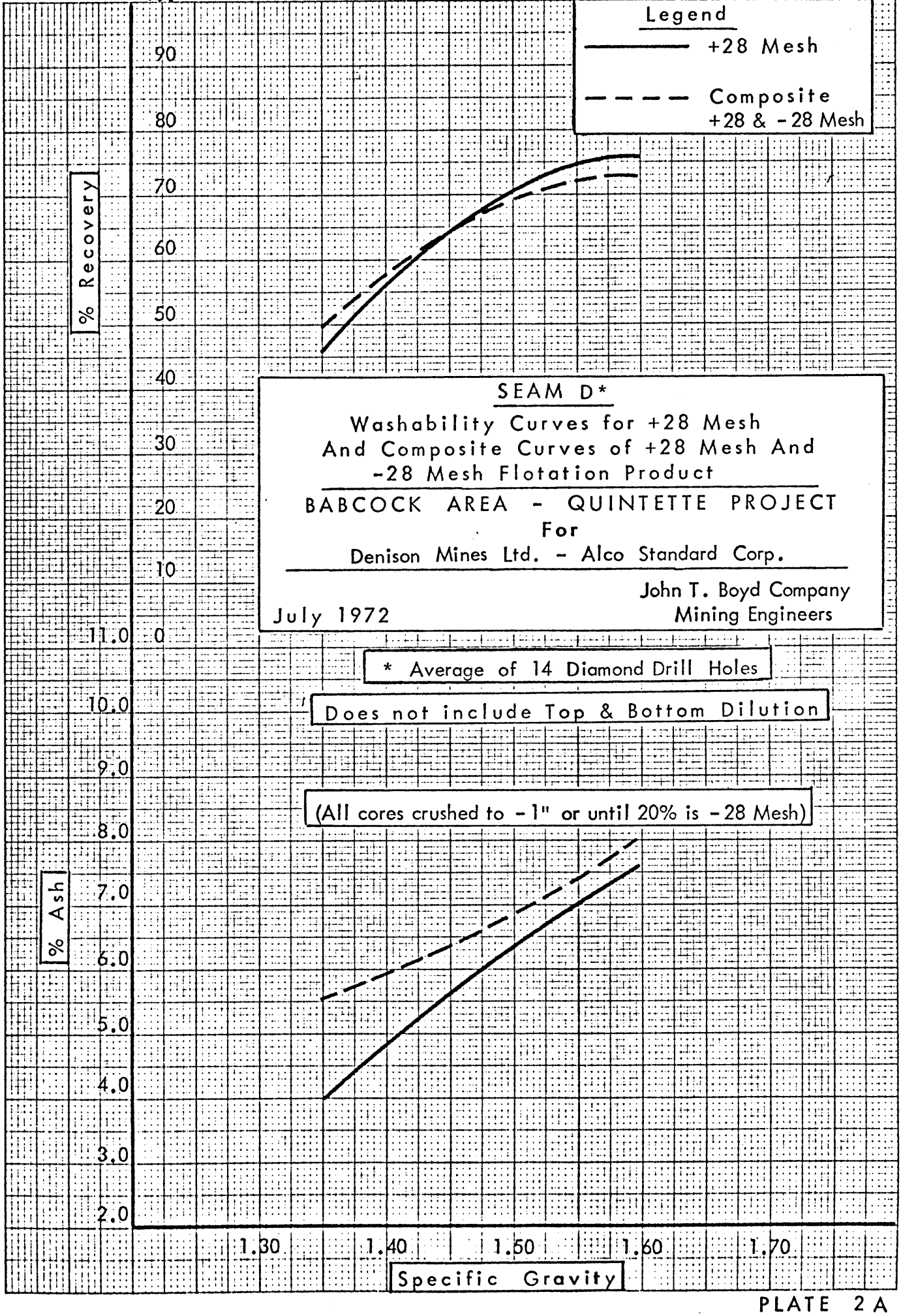

Legend
+28 Mesh
Composite
+28 & -28 Mesh
% Recovery
90
80
70
60
50
40
30
20
10
0
SEAM D*
Washability Curves for +28 Mesh
And Composite Curves of +28 Mesh And
-28 Mesh Flotation Product
BABCOCK AREA - QUINTETTE PROJECT
For
Denison Mines Ltd. - Alco Standard Corp.
John T. Boyd Company
Mining Engineers
July 1972
* Average of 14 Diamond Drill Holes
Does not include Top & Bottom Dilution
(All cores crushed to -1" or until 20% is -28 Mesh)
% Ash
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.30
1.40
1.50
1.60
1.70
Specific Gravity

PLATE 2 A

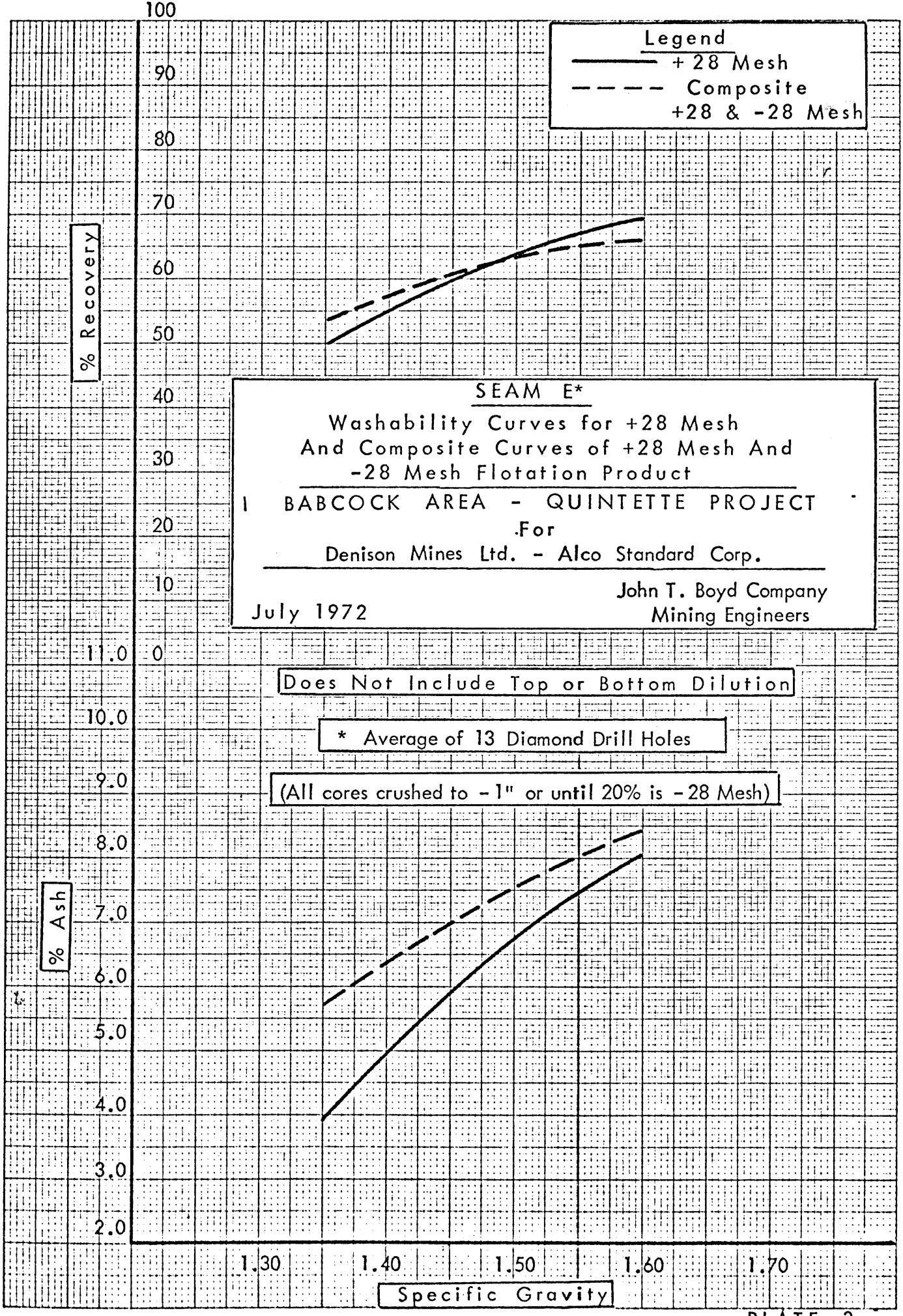
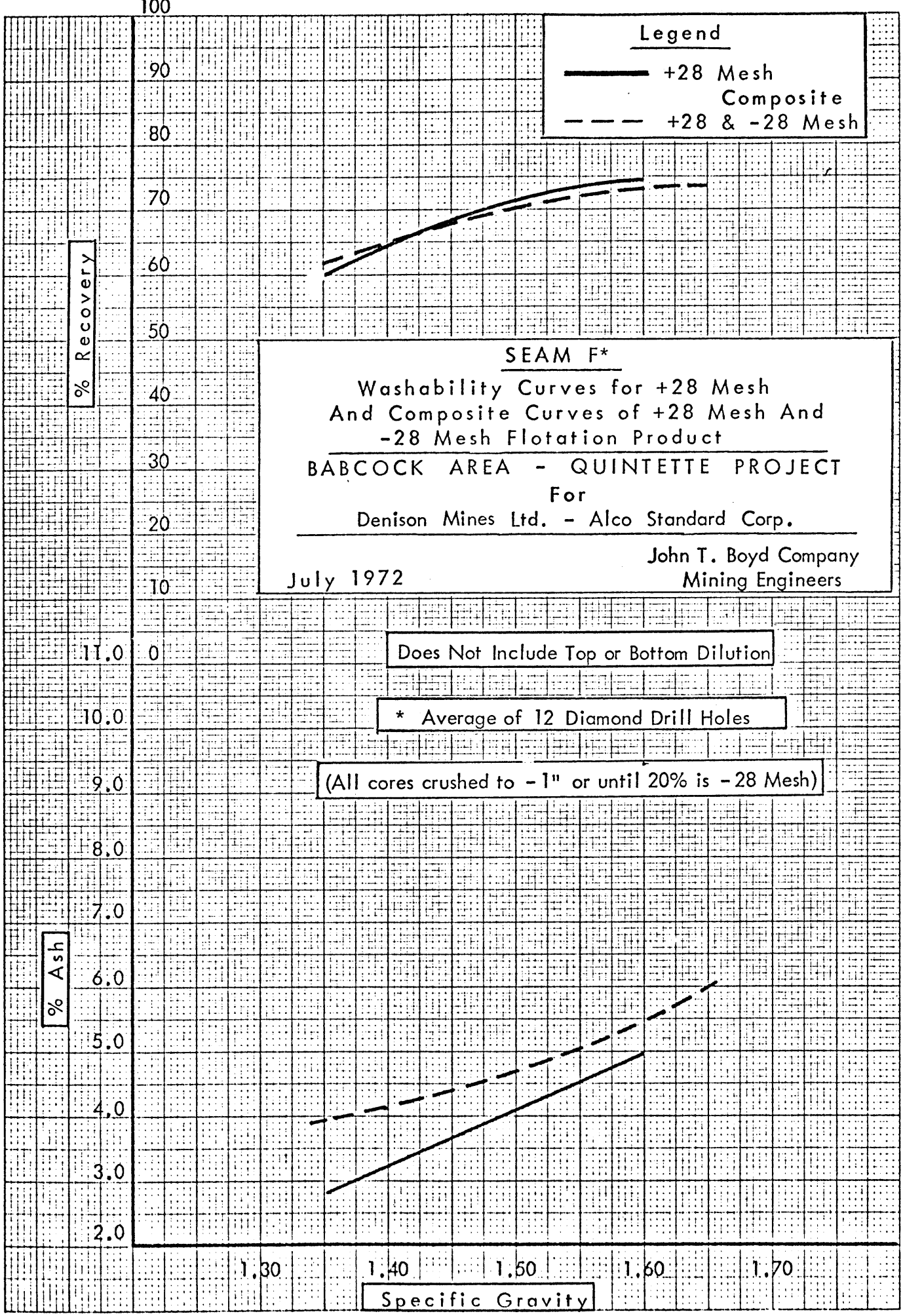

Legend
+28 Mesh
Composite
+28 & -28 Mesh
% Recovery
100
90
80
70
60
50
40
30
20
10
0
SEAM E*
Washability Curves for +28 Mesh
And Composite Curves of +28 Mesh And
-28 Mesh Flotation Product
BABCOCK AREA - QUINTETTE PROJECT
For
Denison Mines Ltd. - Alco Standard Corp.
July 1972
John T. Boyd Company
Mining Engineers
Does Not Include Top or Bottom Dilution
* Average of 13 Diamond Drill Holes
(All cores crushed to -1" or until 20% is -28 Mesh)
% Ash
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.30
1.40
1.50
1.60
1.70
Specific Gravity

PLATE 3



SEAM F*

Washability Curves for +28 Mesh And Composite Curves of +28 Mesh And -28 Mesh Flotation Product

BABCOCK AREA - QUINTETTE PROJECT

For

Denison Mines Ltd. - Alco Standard Corp.

July 1972

John T. Boyd Company
Mining Engineers

Does Not Include Top or Bottom Dilution

* Average of 12 Diamond Drill Holes

(All cores crushed to -1" or until 20% is -28 Mesh)

PLATE 4

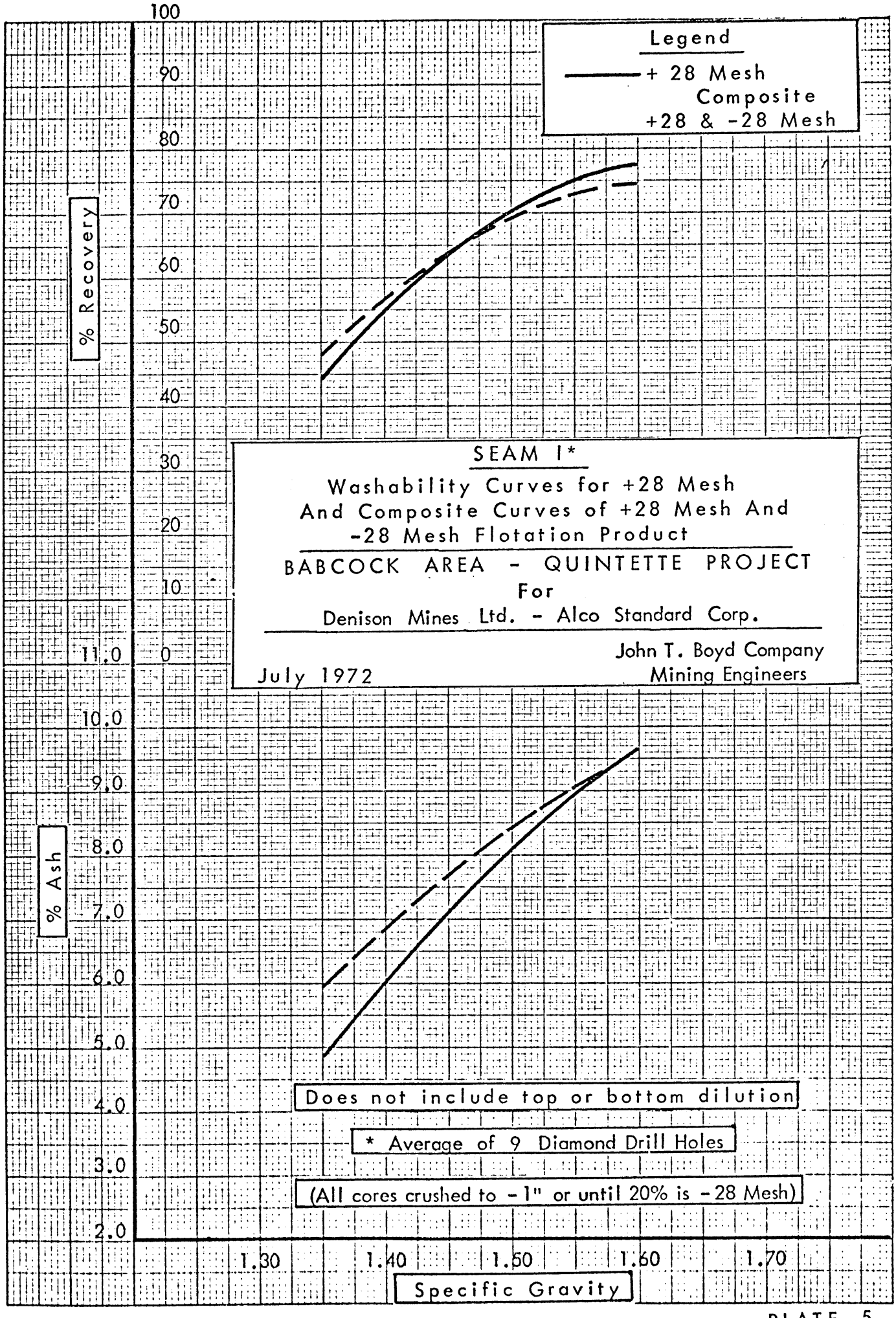

Legend
+ 28 Mesh Composite
+28 & -28 Mesh
% Recovery
100
90
80
70
60
50
40
30
20
10
0
SEAM 1*
Washability Curves for +28 Mesh And Composite Curves of +28 Mesh And -28 Mesh Flotation Product
BABCOCK AREA - QUINTETTE PROJECT
For
Denison Mines Ltd. - Alco Standard Corp.
John T. Boyd Company
Mining Engineers
July 1972
% Ash
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Does not include top or bottom dilution
* Average of 9 Diamond Drill Holes
(All cores crushed to -1" or until 20% is -28 Mesh)
1.30
1.40
1.50
1.60
1.70
Specific Gravity

PLATE 5

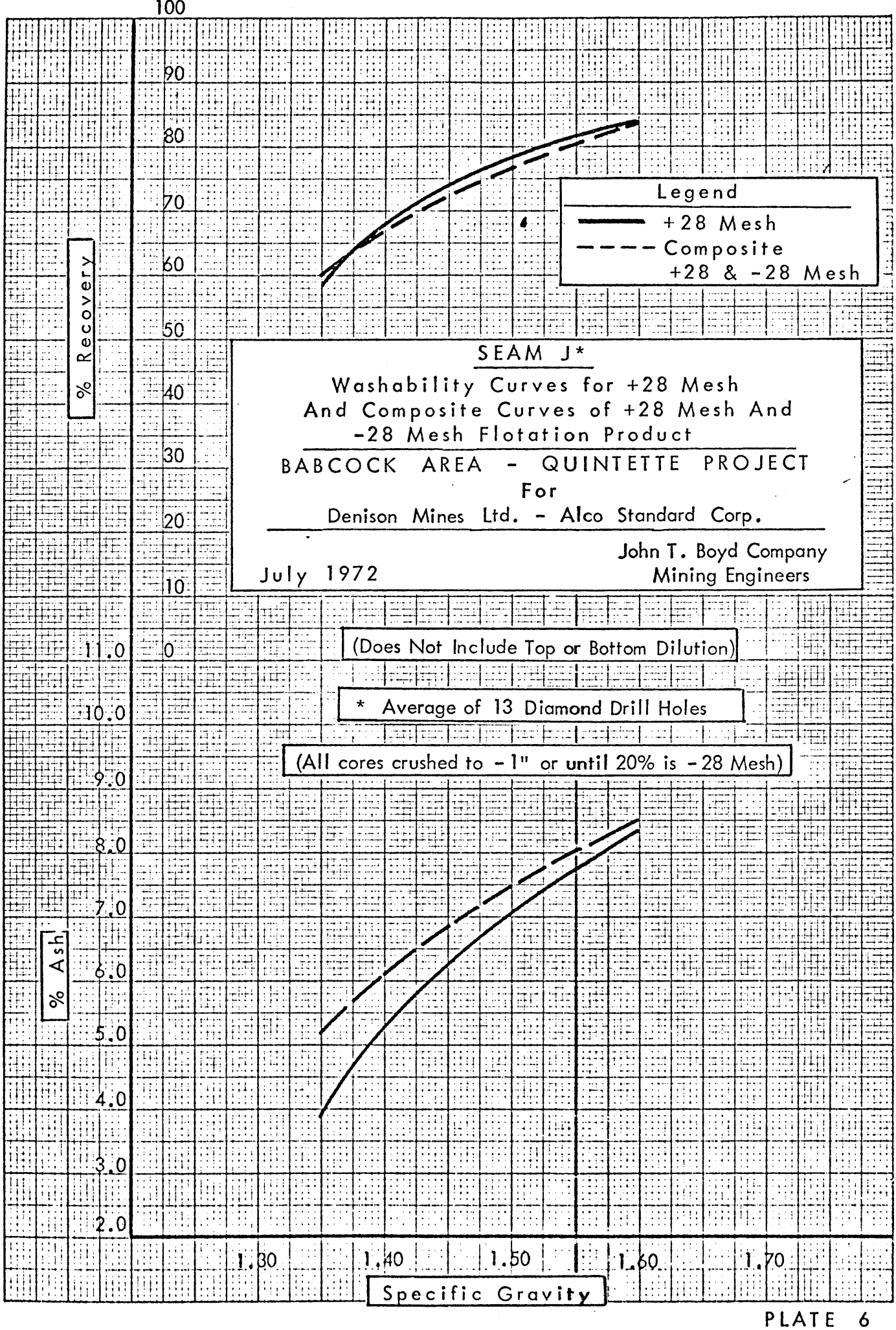

100
90
80
70
60
50
40
30
20
10
0
% Recovery
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
% Ash
1.30
1.40
1.50
1.60
1.70
Specific Gravity
Legend
+28 Mesh
Composite
+28 & -28 Mesh
SEAM J*
Washability Curves for +28 Mesh
And Composite Curves of +28 Mesh And
-28 Mesh Flotation Product
BABCOCK AREA - QUINTETTE PROJECT
For
Denison Mines Ltd. - Alco Standard Corp.
John T. Boyd Company
Mining Engineers
July 1972
(Does Not Include Top or Bottom Dilution)
* Average of 13 Diamond Drill Holes
(All cores crushed to -1" or until 20% is -28 Mesh)

PLATE 6

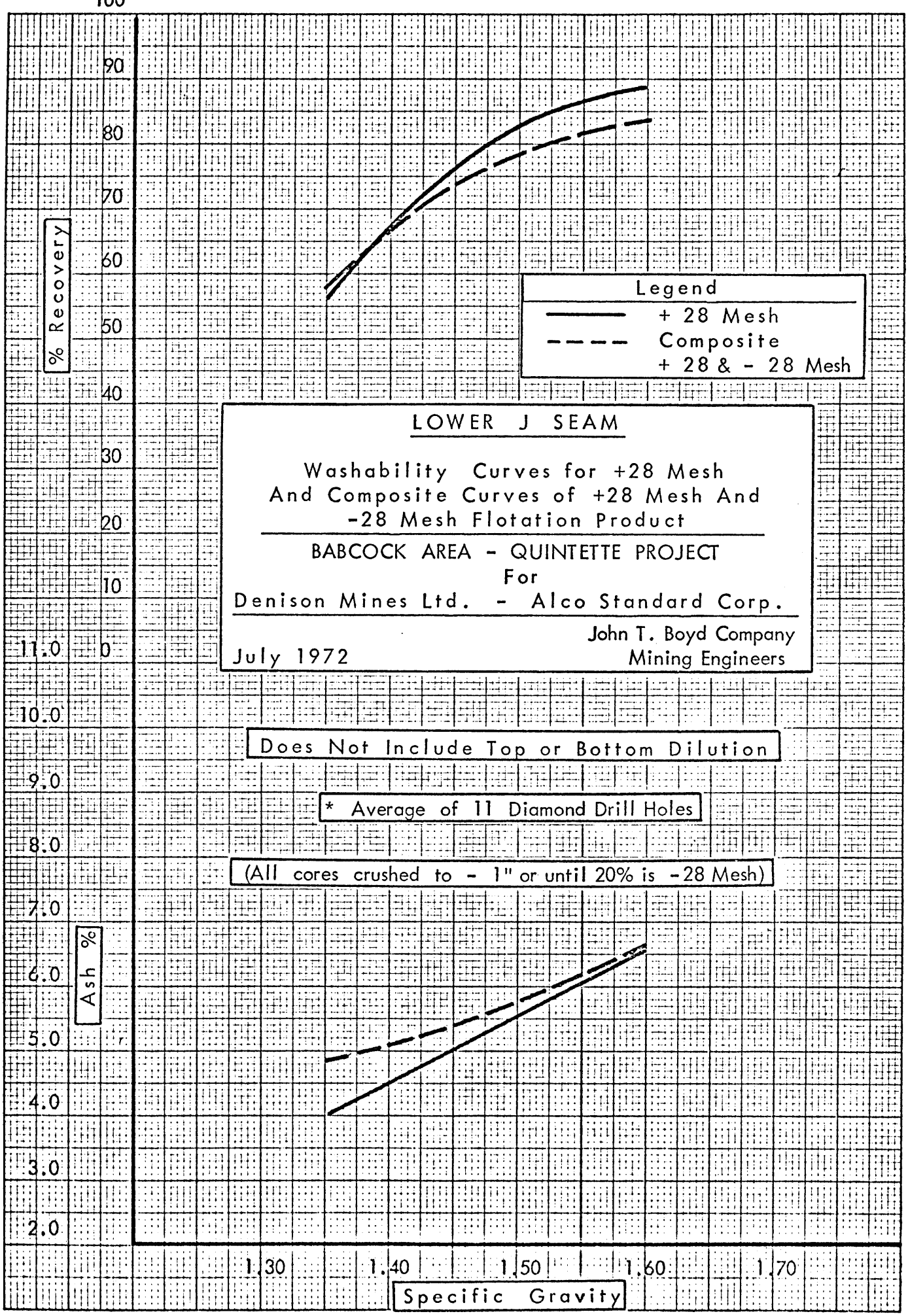
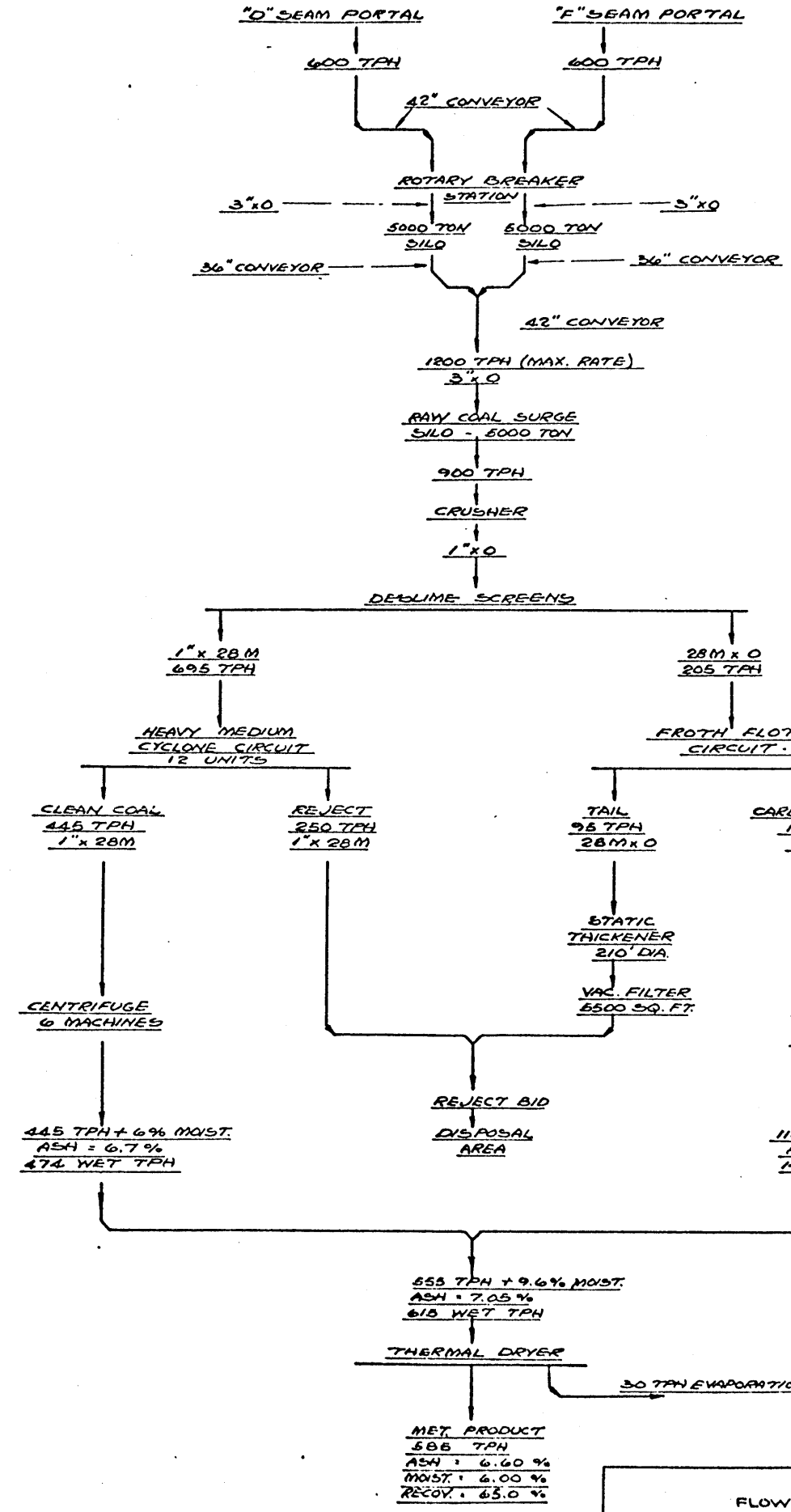

100
90
80
70
60
50
40
30
20
10
0
% Recovery
Legend
+ 28 Mesh
Composite
+ 28 & - 28 Mesh
LOWER J SEAM
Washability Curves for +28 Mesh
And Composite Curves of +28 Mesh And
-28 Mesh Flotation Product
BABCOCK AREA - QUINTETTE PROJECT
For
Denison Mines Ltd. - Alco Standard Corp.
John T. Boyd Company
Mining Engineers
July 1972
Does Not Include Top or Bottom Dilution
* Average of 11 Diamond Drill Holes
(All cores crushed to - 1" or until 20% is -28 Mesh)
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
Ash %
1.30
1.40
1.50
1.60
1.70
Specific Gravity

PLATE 6A



FLOW DIAGRAM
BABCOCK AREA - QUINTETTE PROJECT
BRITISH COLUMBIA
FOR
DENISON MINES LTD. - ALCO STANDARD CORP.

JULY 1972

JOHN T. BOYD COMPANY
MINING ENGINEERS

PLATE 7

TABULATION 3

PROXIMATE ANALYSIS OF CLEAN COAL
ON +28 MESH PRODUCT
Babcock Area
QUINTETTE PROJECT

Prepared For

DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By

John T. Boyd Company
Mining Engineers
July 1972

(Moisture calculated on approximately 6%)

D.D.H. No.	@ Approximately 5% Ash				@ Approximately 7% Ash			
	Recovery (%)	Ash (%)	VM (%)	FC (%)	Recovery (%)	Ash (%)	VM (%)	FC (%)
SEAM D								
7101	81.37	4.95	25.48	63.57	88.30	6.79	25.13	62.08
7102	61.39	5.38	23.87	64.75	69.68	7.26	23.51	63.23
7104	49.75	5.30	24.19	64.51	55.10	7.26	23.60	63.14
7201	82.19	5.06	23.58	65.31	91.99	6.96	23.38	63.66
7203	80.41	5.09	24.17	64.74	85.90	6.43	23.78	63.79
7219	64.26	4.95	22.97	66.08	68.63	5.77	22.71	65.52
Average	69.90	5.12	24.04	64.84	76.60	6.75	23.69	63.57
High	82.19	5.38	25.48	65.36	91.99	7.26	25.13	63.79
Low	49.75	4.95	22.97	63.57	55.10	6.43	23.38	62.08
SEAM E								
7101	64.92	4.84	24.24	64.92	78.12	6.97	23.83	63.20
7102	50.83	4.94	22.47	66.59	57.05	6.89	21.99	65.12
7104	70.38	4.90	23.67	65.43	79.13	7.28	23.11	63.61
7201	52.65	5.28	23.29	65.43	56.95	6.49	22.98	64.53
7203	53.79	5.21	24.53	64.26	62.32	6.62	23.88	63.50
7219	66.85	4.78	22.65	66.57	74.51	6.99	22.21	64.80
Average	60.84	4.99	23.49	65.53	68.01	6.87	23.00	64.13
High	70.52	5.28	24.53	66.59	79,13	7.28	23.88	65.12
Low	50.83	4.78	22.47	64.26	56.95	6.49	21.99	63.20

TABULATION 3 - Continued

(Moisture calculated on approximately 6%)

D.D.H. No.	@ Approximately 5% Ash Recovery (%)	Ash (%)	VM (%)	FC (%)	@ Approximately 7% Ash Recovery (%)	Ash (%)	VM (%)	FC (%)
SEAM F								
7102	63.80	5.31	22.28	66.41	66.82	6.59	22.00	65.41
7201	69.86	4.43	22.84	66.73	80.11	7.48	22.17	64.35
7203	59.46	4.27	23.23	66.50	65.81	7.37	22.58	64.05
7216	74.38	5.23	22.80	65.97	78.46	6.95	22.50	64.55
7217	85.54	4.79	23.33	65.88	91.14	6.96	22.90	64.14
Average	70.61	4.81	22.90	66.30	76.63	7.07	22.43	64.50
High	85.54	5.31	23.33	66.73	91.14	7.48	22.90	65.41
Low	59.46	4.27	22.28	65.88	65.81	6.59	22.00	64.05
SEAM I								
7102	69.46	4.87	20.80	68.33	80.22	7.29	20.22	66.49
7201	41.82	4.47	22.22	67.31	69.47	7.15	21.12	65.73
7203	62.85	5.40	23.41	65.19	71.88	6.66	23.00	64.34
7219	59.95	5.20	21.08	67.72	69.96	6.68	20.53	66.79
Average	58.52	4.99	21.88	67.14	72.88	6.95	21.22	65.84
High	69.46	5.40	23.41	68.33	80.22	7.29	23.00	66.79
Low	41.82	4.47	20.80	65.19	69.47	6.66	20.22	64.34
SEAM J								
7102	55.60	5.44	21.97	66.59	63.74	6.76	21.56	65.68
7104	73.61	4.77	20.75	68.48	84.31	7.57	20.60	65.82
7201	79.35	4.94	20.63	68.43	86.01	6.42	20.55	67.03
7203	68.91	4.78	22.54	66.68	76.33	6.41	22.07	65.52
7219	68.80	5.55	20.75	67.70	81.50	7.35	20.27	66.38
Average	69.25	5.10	21.33	65.58	78.38	6.90	21.01	66.09
High	79.35	5.55	22.54	68.48	86.31	7.57	22.07	67.03
Low	55.60	4.77	20.63	66.59	63.74	6.41	20.27	65.52

TABULATION 4-A

SEAM D

Sulfur and Free Swelling Index
At Approximately 7% Ash and 5% Total Moisture
Babcock Area - Quintette Project

Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By
John T. Boyd Company
Mining Engineers
July 1972

(Composite for all Sizes on Diamond Drill Hole Samples
as Presented by Denison Mines Limited)

D.D.H. No.	Ash (%)	Sulfur (%)	F.S.I.
7101	6.96	0.56	7-1/2
7102	7.06	0.51	6
7104	8.05	0.40	6
7201	6.58	0.45	5
7202	8.59	0.77	5
7203	6.45	2.06	5
7204	6.75	0.58	7
7205	7.92	1.26	5-1/2
7208	9.57	1.30	5-1/2
7212	8.79	0.24	6-1/2
7216	6.90	0.83	4-1/2
7217	6.68	0.57	4-1/2
7218	7.08	0.86	4-1/2
7219	7.38	0.79	6
Average	7.28	0.85	5-1/2
High	8.05	1.30	7-1/2
Low	6.45	0.40	4-1/2

TABULATION 4-B

SEAM E

Sulfur and Free Swelling Index
At Approximately 7% Ash and 5% Total Moisture
Babcock Area - Quintette Project

Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By
John T. Boyd Company
Mining Engineers
July 1972

(Composite for all Sizes on Diamond Drill Hole Samples
as Presented by Denison Mined Limited)

D.D.H. No.	Ash (%)	Sulfur (%)	F.S.I.
7101	6.72	0.21	8
7102	7.55	0.21	7-1/2
7104	7.59	0.27	7-1/2
7201	6.72	0.21	8
7202	8.36	0.26	6
7203	7.15	0.24	7
7204	7.29	0.20	8-1/2
7205	8.00	0.27	7-1/2
7206	NA	NA	NA
7208	7.74	0.20	7
7216	7.15	0.25	6-1/2
7217	7.35	0.21	8
7218	7.62	0.23	6
7219	7.01	0.26	6-1/2
Average	7.40	0.23	7-1/2
High	8.36	0.27	8-1/2
Low	6.72	0.20	6

TABULATION 4-C

SEAM F

Sulfur and Free Swelling Index
At Approximately 7% Ash and 5% Total Moisture
Babcock Area - Quintette Project

Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By
John T. Boyd Company
Mining Engineers
July 1972

(Composite for all Sizes on Diamond Drill Hole Samples
as Presented by Denison Mines Limited)

D.D.H. No.	Ash (%)	Sulfur (%)	F.S.I.
7101	6.51	0.28	7-1/2
7102	6.96	0.26	8-1/2
7104	6.39	0.26	8
7201	6.70	0.54	8
7202	7.69	0.21	7
7203	7.25	0.37	8
7204	6.70	0.54	8
7205	6.57	0.21	7
7208	7.43	0.31	7-1/2
7216	7.13	0.23	7
7217	6.53	0.23	7-1/2
7218	7.96	0.24	7
7219 *	NA	NA	NA
Average	6.98	0.30	7-1/2
High	7.96	0.54	8-1/2
Low	6.39	0.21	7

* Only 10% of the core was recovered.

TABULATION 4-D

SEAM 1

Sulfur and Free Swelling Index
At Approximately 7% Ash and 5% Total Moisture
Babcock Area - Quintette Project

Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION
By
John T. Boyd Company
Mining Engineers
July 1972

(Composite for all Sizes on Diamond Drill Hole Samples
as Presented by Denison Mines Limited)

D.D.H. No.	Ash (%)	Sulfur (%)	F.S.I.
7104	8.05	0.40	6
7201	7.21	0.33	6
7202	8.40	0.36	8-1/2
7203	7.04	0.21	6-1/2
7204	7.08	0.47	8
7217	7.40	0.30	8
7218	6.83	0.28	8
7219	7.34	0.37	7-1/2
Average	7.41	0.34	7-1/2
High	8.40	0.47	8-1/2
Low	6.83	0.21	6

TABULATION 4-E

SEAM J

Sulfur and Free Swelling Index
At Approximately 7% Ash and 5% Total Moisture
Babcock Area - Quintette Project

Prepared For
DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By
John T. Boyd Company
Mining Engineers
July 1972

(Composite for all Sizes on Diamond Drill Hole Samples
as Presented by Denison Mines Limited)

D.D.H. No.	Ash (%)	Sulfur (%)	F.S.I.
7101	ND	ND	ND
7102	8.97	0.21	8-1/2
7104	6.78	0.17	7
7201	6.71	0.19	7
7202	7.79	0.21	7-1/2
7203	6.85	0.14	7
7204	6.86	0.25	7
7205	8.62	0.27	7
7206	6.84	0.15	6-1/2
7208	7.17	0.30	6
7216	6.84	0.38	7
7217	7.30	0.18	7
7218	7.49	0.19	7
7219	7.01	0.15	7
Average	7.33	0.22	7
High	8.97	0.38	8-1/2
Low	6.71	0.14	6

ND - Not Drilled to J Seam

TABULATION 5

PREPARATION PLANT PRODUCT RECOVERIES AT VARYING AMOUNTS OF OUT OF SEAM DILUTION

Babcock Area - Quintette Project

Prepared For

DENISON MINES LIMITED - ALCO STANDARD CORPORATION

By

John T. Boyd Company
Mining Engineers
July 1972

Seam	Recovery At Assumed Dilution[a] (%)	Preparation Plant Recovery @ Varying % Reduction of Assumed Out of Seam Dilution (% Reduction) 25%	50%	75%	In Seam Recovery 100%[b]
		4% Ash			
D	NA	NA	NA	NA	NA
F	51	54	58	61	65
J	NA	NA	NA	NA	NA
		5% Ash			
D	NA	NA	NA	NA	NA
F	57	61	65	69	73
J	59	59	60	60	61
		6% Ash			
D	56	57	58	59	61
F	60	64	68	72	76
J	67	67	67	67	68
		7% Ash			
D	65	67	69	70	72
F	NA	NA	NA	NA	NA
J	73	73	74	74	75
		8% Ash			
D	68	70	72	73	75
F	NA	NA	NA	NA	NA
J	80	80	81	81	82
		9% Ash			
D	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA
J	84	84	85	86	86

(a) Assumed dilutions: D Seam = 0.6 ft.; F Seam = 1.4 ft.; J Seam = 0.2 ft.

(b) Equals in-seam recovery or 0% in out-of-seam dilution at adjusted prod. moisture.

NA - Not Available