K - ELK RIVER 76(4)#B-2

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CONFIDENTIAL

EVALUATION OF

EXPLORATION AND TESTWORK

JULY 1975 - APRIL 1976

ON THE

ELK RIVER COAL PROPERTY

MINING RECORDER
RECEIVED and RECORDED
JUN 4 1976
M.R. #
VICTORIA, B. C.

VOLUME II

APPENDIX 5

COAL LABORATORY TESTWORK

(BIRTLEY ENGINEERING)

(RUHRKOHLE A.G.)

CALGARY/DUSSELDORF
MAY 1976

ELCO MINING LIMITED

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 274

VOLUME II

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BIRTLEY ENGINEERING (CANADA) LTD.

Subsidiary of Great West Steel Industries Ltd.

5112-3rd ST. S.E., CALGARY, ALBERTA T2H 1J6 PHONE 403-253-3719

CORE AND CHANNEL

ANALYSES

FOR THE

1975 ELK RIVER

TEST PROGRAM

January 1976.

March 16, 1976.

ELCO MINING LTD.

1975 BOREHOLE SAMPLE TEST PROCEDURE

The flowsheet for the borehole samples is largly self-explanatory, but this brief commentary may clarify some areas.

Both borehole and channel samples arrived in closed plastic bags containing from 6KG to 20KG of coal. This coal was first air dried prior to being crushed in a jaw crusher and sub-sampled for the further work outlined.

Any coal of 1/4" X 0 size was cornmilled to minus 10 mesh (1.68mm) before being split to a lesser quantity. Samples for petrographic and Hardgrove Grindability analyses were stage crushed from 1/4" X 0 by using the cornmill at progressively smaller and smaller settings between screening to the appropriate sizes.

At first the top-size requested by Elco for petrographic analysis was 16 mesh (1mm) but was later changed to 10 mesh (1.68mm). The analytical size for the Hardgrove is 1/4" X 0 coal stage, crushed so that the portion passing through a 14 mesh (1.19mm) screen and being retained on a 28 mesh (0.66mm) screen is used for the test.

Prepared coal for petrographic analysis which was left over from making mounted specimens was sealed in plastic containers and sent to Rhurkole in Germany.

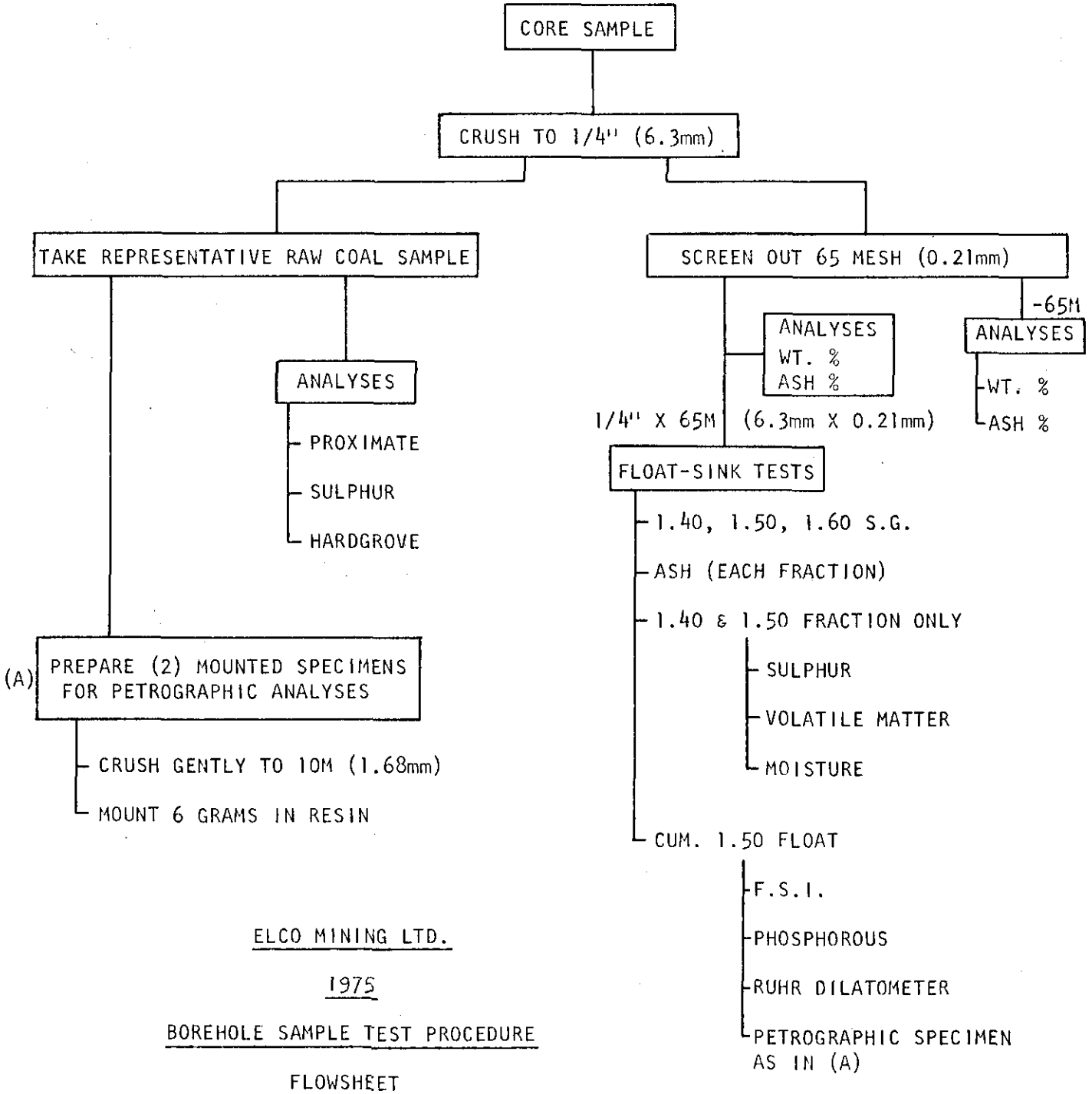
The floats at 1.50 S.G. composite was made up from, a) the 1/4" X 0 floats for dilatometer and petrographic tests, and b) the pulverized minus 60 mesh (0.25mm) for the remaining tests.

All the results were tabulated on the easily followed forms which accompany this commentary.

BIRTLEY ENGINEERING (CANADA) LTD.
Coal Science & Minerals Testing

Frank J Horvat.

Frank J. Horvat,
Manager.



ELCO MINING LTD.

1975

BOREHOLE SAMPLE TEST PROCEDURE

FLOWSHEET

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ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-1

LAB. NO.: 4481

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	15.1	26.5	57.4	0.65	92

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.2	-	91.2	-
65M X 0	8.8	25.1	100.0	-

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	81.5	3.8	1.5	28.2	66.5	0.72	81.5	-
1.40-1.50	4.3	nss	-	-	-	-	-	-
1.50-1.60	2.5	29.2	-	-	-	-	88.3	-
+1.60	11.7	72.5	-	-	-	-	100.0	-

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.2	9	0.06	393	450	21	185	1.057

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-2

LAB. NO.: 4482

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	42.4	19.5	37.3	0.76	67

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.0	-	93.0	-
65M X 0	7.0	53.6	100.0	-

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	35.7	8.5	0.9	27.7	62.9	1.22	35.7	-
1.40-1.50	4.5	nss	-	-	-	-	40.2	-
1.50-1.60	5.3	34.6	-	-	-	-	45.5	-
+1.60	54.5	63.3	-	-	-	-	100.0	-

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.4	8 1/2	0.13	388	455	22	284	1.073

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-6-3

LAB. NO.: 4483

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	34.4	20.4	44.3	0.50	94

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.1	-	87.1	-
65M X 0	12.9	34.5	100.0	-

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.2	5.2	1.1	27.1	66.6	0.76	54.2	-
1.40-1.50	7.1	nss	-	-	-	-	61.3	-
1.50-1.60	3.4	30.5	-	-	-	-	64.7	-
+1.60	35.3	73.2	-	-	-	-	100.0	-

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.3	8	0.04	408	453	7	159	1.050

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-4

LAB. NO.: 4484

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	39.0	21.3	38.7	0.69	93

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.9	41.3	84.9	41.3
65M X 0	15.1	23.9	100.0	38.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	47.1	3.7	2.9	28.0	65.4	0.72	47.1	3.7
1.40-1.50	3.2	18.2	1.9	22.3	57.6	0.52	50.3	4.6
1.50-1.60	1.7	30.1	-	-	-	-	52.0	5.5
+1.60	48.0	80.2	-	-	-	-	100.0	41.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.7	9	0.03	392	447	24	123	1.046

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-5

LAB. NO.: 4485

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	30.6	22.5	46.1	1.00	95

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	76.8	-	76.8	-
65M X 0	23.2	26.8	100.0	-

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	46.9	6.6	1.6	26.8	65.0	1.02	46.9	-
1.40-1.50	8.6	nss	-	-	-	-	55.5	-
1.50-1.60	7.2	29.7	-	-	-	-	62.7	-
+1.60	37.3	72.1	-	-	-	-	100.0	-

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.6	8 1/2	0.05	386	450	23	232	1.067

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-6

LAB. NO.: 4486

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	27.2	21.5	50.2	0.59	97

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.0	27.2	91.0	27.2
65M X 0	9.0	25.4	100.0	27.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	60.8	4.7	1.7	27.1	66.5	0.76	60.8	4.7
1.40-1.50	6.8	17.4	1.7	22.3	58.6	0.65	67.6	6.0
1.50-1.60	3.2	28.0	-	-	-	-	70.8	7.0
+1.60	29.2	76.4	-	-	-	-	100.0	27.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
61.5	8 1/2	0.09	394	451	24	127	1.048

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-6-7

LAB. NO.: 4487

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.2	17.5	22.6	58.7	0.61	128

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	80.6	15.3	80.6	15.3
65M X 0	19.4	16.0	100.0	15.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	73.4	3.9	3.0	25.4	67.7	0.64	73.4	3.9
1.40-1.50	7.5	15.1	2.4	21.4	61.1	0.53	80.9	4.9
1.50-1.60	4.1	27.2	-	-	-	-	85.0	6.0
+1.60	15.0	67.7	-	-	-	-	100.0	15.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
65.2	8	0.04	408	453	7	13	1.016

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-6-8

LAB. NO.: 4488

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	40.8	18.5	39.9	0.55	84

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.6	40.9	88.6	40.9
65M X 0	11.4	23.4	100.0	38.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.3	5.9	1.4	27.3	65.4	0.74	42.3	5.9
1.40-1.50	6.8	21.1	1.1	23.0	54.8	0.68	49.1	8.0
1.50-1.60	4.0	30.8	-	-	-	-	53.1	9.7
+1.60	46.9	76.3	-	-	-	-	100.0	40.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
43.5	8 1/2	0.04	396	454	24	171	1.054

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-7-1

LAB. NO.: 4429

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	13.2	28.4	57.4	0.41	108

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	75.3	10.2	75.3	10.2
65M X 0	24.7	14.2	24.7	11.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	87.1	3.8	5.2	32.0	59.0	0.56	87.1	3.8
1.40-1.50	2.6	19.4	1.7	25.6	53.3	0.39	89.7	4.3
1.50-1.60	0.7	27.8	-	-	-	-	90.4	4.4
+1.60	9.6	64.6	-	-	-	-	100.0	10.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
67.5	8	0.05	390	449	24	173	1.056

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-7-2

LAB. NO.: 4430

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	8.2	30.1	60.8	1.18	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	7.5	92.5	7.5
65M X 0	7.5	16.5	100.0	8.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.9	5.0	1.1	30.9	63.0	1.02	89.9	5.0
1.40-1.50	4.8	19.6	0.8	27.1	52.5	1.05	94.7	5.7
1.50-1.60	2.2	25.0	-	-	-	-	96.9	6.2
+1.60	3.1	49.2	-	-	-	-	100.0	7.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
87.6	8 1/2	0.02	381	453	22	190	1.073

ELCO MINING LTD.

November 19, 1975.

SAMPLE: EB-7-3

LAB. NO.: 4431

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	28.5	24.4	46.2	0.65	58

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.3	31.0	95.3	31.0
65M X 0	4.7	22.7	100.0	30.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	44.8	4.1	0.9	31.0	64.0	0.89	44.8	4.1
1.40-1.50	7.3	25.7	0.7	27.0	46.6	0.69	52.1	7.1
1.50-1.60	7.3	32.9	-	-	-	-	59.4	10.3
+1.60	40.6	61.4	-	-	-	-	100.0	31.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.7	9	0.04	381	453	22	190	1.073

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-7-4

LAB. NO.: 4432

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	25.8	25.2	48.1	0.95	70

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.6	22.9	90.6	22.9
65M X 0	9.4	30.7	100.0	23.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	65.7	3.7	1.1	30.9	64.3	0.87	65.7	3.7
1.40-1.50	4.1	16.3	0.9	26.6	56.2	1.07	69.8	4.4
1.50-1.60	1.3	24.8	-	-	-	-	71.1	4.8
+1.60	28.9	67.4	-	-	-	-	100.0	22.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.2	8 1/2	0.05	388	454	17	230	1.072

ELCO MINING LTD.

November 19, 1975.

SAMPLE: EB-7-5

LAB. NO.: 4433

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	12.2	27.7	59.1	0.70	125

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	71.3	11.0	71.3	11.0
65M X 0	28.7	13.1	28.7	11.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	82.9	2.8	4.4	31.1	61.7	0.64	82.9	2.8
1.40-1.50	4.3	13.6	1.9	26.8	57.7	0.63	87.2	3.3
1.50-1.60	1.3	18.1	-	-	-	-	88.5	3.5
+1.60	11.5	68.1	-	-	-	-	100.0	11.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.2	9	0.05	385	442	27	87	1.038

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-7-6

LAB. NO.: 4434

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	38.8	19.2	41.1	0.44	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.6	41.0	92.6	41.0
65M X 0	7.4	25.8	100.0	39.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	34.5	4.4	1.0	28.8	65.8	0.70	34.5	4.4
1.40-1.50	6.2	14.7	0.9	25.1	59.3	0.52	40.7	6.0
1.50-1.60	6.0	22.7	-	-	-	-	46.7	8.1
+1.60	53.3	69.8	-	-	-	-	100.0	41.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.7	8 1/2	0.04	386	447	17	158	1.063

ELCO MINING LTD.

November 19, 1975.

SAMPLE: EB-7-7

LAB. NO.: 4435

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	19.4	23.8	55.9	0.63	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.8	19.2	91.8	19.2
65M X 0	8.2	13.7	100.0	18.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	70.7	4.3	1.3	28.3	66.1	0.70	70.7	4.3
1.40-1.50	7.3	18.4	1.0	22.9	57.7	0.44	78.0	5.6
1.50-1.60	2.2	29.8	-	-	-	-	80.2	6.3
+1.60	19.8	71.3	-	-	-	-	100.0	19.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.6	8 1/2	0.03	378	443	23	157	1.063

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-7-8

LAB. NO.: 4436

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	10.6	26.3	62.2	0.78	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.8	8.5	93.8	8.5
65M X 0	6.2	8.0	100.0	8.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.2	2.9	1.2	28.6	67.3	0.85	86.2	2.9
1.40-1.50	4.3	21.8	0.9	24.3	53.0	0.52	90.5	3.8
1.50-1.60	1.9	24.2	-	-	-	-	92.4	4.2
+1.60	7.6	60.7	-	-	-	-	100.0	8.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
84.9	8 1/2	0.02	397	458	20	174	1.060

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SAMPLE: EB-7-9

LAB. NO.: 4489

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	64.0	13.9	21.0	0.51	18

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.7	64.2	92.7	64.2
65M X 0	7.3	37.9	100.0	62.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	23.1	4.0	1.5	29.1	65.4	0.96	23.1	4.0
1.40-1.50	2.4	16.0	1.3	25.0	57.7	0.81	25.5	5.1
1.50-1.60	0.9	30.5	-	-	-	-	26.4	6.0
+1.60	73.6	85.1	-	-	-	-	100.0	64.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
23.6	9	0.07	398	454	17	208	1.059

ELCO MINING LTD.

SAMPLE: EB-8-1

LAB. NO.: 4437

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	46.5	20.2	32.3	0.46	72

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.6	47.4	93.6	47.4
65M X 0	6.4	35.5	100.0	46.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	28.9	6.6	1.5	33.9	58.0	0.75	28,9	6.6
1.40-1.50	5.4	22.4	1.2	28.6	47.8	0.65	34.3	9.1
1.50-1.60	4.9	28.2	-	-	-	-	39.2	11.5
+1.60	60.8	70.5	-	-	-	-	100.0	47.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
32.1	7	0.11	387	447	20	157	1.059

ELCO MINING LTD.

SAMPLE: EB-8-2

LAB. NO.: 4438

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	19.0	29.2	50.8	0.61	66

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.3	18.2	91.3	18.2
65M X 0	8.7	28.4	100.0	19.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	73.2	4.7	1.3	33.6	60.4	0.64	73.2q	4.7
1.40-1.50	4.8	21.3	1.1	29.6	48.0	0.65	78.0	5.7
1.50-1.60	3.6	28.9	-	-	-	-	81.6	6.7
+1.60	18.4	68.8	-	-	-	-	100.0	18.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.2	8	0.05	390	450	21	158	1.058

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SAMPLE: EB-8-3

LAB. NO.: 4439

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	32.6	23.7	42.7	0.71	62

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.7	31.9	91.7	31.9
65M X 0	8.3	34.0	100.0	32.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	38.8	8.2	1.6	31.0	59.2	0.83	38.8	8.2
1.40-1.50	13.4	25.6	1.1	26.0	47.3	0.72	52.2	12.7
1.50-1.60	10.9	35.5	-	-	-	-	63.1	16.6
+1.60	36.9	58.1	-	-	-	-	100.0	31.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
47.9	7 1/2	0.03	396	445	10	133	1.053

ELCO MINING LTD.

SAMPLE: EB-8-4

LAB. NO.: 4440

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	12.2	29.8	57.0	0.87	72

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.2	10.9	88.2	10.9
65M X 0	11.8	18.2	100.0	11.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.4	3.6	1.8	33.6	61.0	0.83	86.4	3.6
1.40-1.50	2.8	22.0	1.4	27.6	49.0	1.07	89.2	4.2
1.50-1.60	2.1	31.8	-	-	-	-	91.3	4.8
+1.60	8.7	74.9	-	-	-	-	100.0	10.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.7	8	0.05	393	445	21	123	1.046

ELCO MINING LTD.

SAMPLE: EB-8-5

LAB. NO.: 4441

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	31.6	24.8	42.6	0.61	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.4	31.4	84.4	31.4
65M X 0	15.6	19.8	100.0	29.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	61.5	4.1	3.1	34.2	58.6	0.81	61.5	4.1
1.40-1.50	2.1	15.6	1.8	28.9	53.7	0.66	63.6	4.5
1.50-1.60	1.6	27.1	-	-	-	-	65.2	5.0
+1.60	34.8	80.9	-	-	-	-	100.0	31.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.7	8 1/2	0.04	393	442	25	113	1.039

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SAMPLE: EB-8-6

LAB. NO.: 4442

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	26.4	27.1	45.5	1.02	62

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.3	25.9	90.3	25.9
65M X 0	9.7	20.8	100.0	25.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	48.8	6.2	1.9	34.1	57.8	1.14	48.8	6.2
1.40-1.50	7.5	21.8	1.3	29.2	47.7	1.07	56.3	8.3
1.50-1.60	15.0	31.6	-	-	-	-	71.3	13.2
+1.60	28.7	57.4	-	-	-	-	100.0	25.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
50.8	7 1/2	0.24	389	452	17	179	1.066

ELCO MINING LTD.

SAMPLE: EB-8-7

LAB. NO.: 4443

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	29.0	23.5	46.5	0.70	66

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.6	27.0	89.6	27.0
65M X 0	10.4	28.0	100.0	27.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.1	5.9	1.6	30.3	62.2	0.83	56.1	5.9
1.40-1.50	7.7	17.5	1.4	26.6	54.5	0.76	63.8	7.3
1.50-1.60	4.3	28.4	-	-	-	-	68.1	8.6
+1.60	31.9	66.1	-	-	-	-	100.0	27.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
57.2	8	0.05	411	454	8	33	1.031

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-9-1

LAB. NO.: 4406

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	46.9	21.2	31.0	0.50	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.1	47.0	92.1	47.0
65M X 0	7.9	36.5	100.0	46.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	22.9	9.0	1.4	33.1	56.5	1.00	22.9	9.0
1.40-1.50	9.7	23.8	1.2	28.0	47.0	1.05	32.6	13.4
1.50-1.60	7.9	38.6	-	-	-	-	40.5	18.3
+1.60	59.5	66.5	-	-	-	-	100.0	47.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
30.0	7 1/2	0.08	421	478	13	95	1.051

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-9-2

LAB. NO.: 4407

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	14.1	32.1	52.8	2.44	61

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.3	12.8	93.3	12.8
65M X 0	6.7	28.5	100.0	13.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.7	5.3	1.1	35.7	57.9	1.11	83.7	5.3
1.40-1.50	2.7	22.3	1.3	30.0	46.4	1.29	86.4	5.8
1.50-1.60	1.4	54.6	-	-	-	-	87.8	6.6
+1.60	12.2	57.4	-	-	-	-	100.0	12.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
80.6	6	0.05	380	436	9	138	1.064

ELCO MINING LTD. November 19, 1975.

SAMPLE: EB-9-3

LAB. NO.: 4408

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	32.6	25.5	41.0	0.78	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.4	32.2	91.4	32.2
65M X 0	8.6	27.6	100.0	31.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.6	7.0	1.3	34.5	57.2	0.85	54.6	7.0
1.40-1.50	5.1	24.9	1.1	28.4	45.6	0.76	59.7	8.5
1.50-1.60	4.7	36.7	-	-	-	-	64.4	10.6
+1.60	35.6	71.3	-	-	-	-	100.0	32.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
54.6	7	0.07	388	442	10	99	1.056

ELCO MINING LTD.

November 19, 1975.

SAMPLE: EB-9-4

LAB. NO.: 4409

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	18.2	30.2	50.6	0.92	86

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	17.2	94.4	17.2
65M X 0	5.6	20.8	100.0	17.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	74.9	8.0	1.2	33.5	57.3	1.00	74.9	8.0
1.40-1.50	8.2	20.8	1.1	29.9	48.2	0.96	83.1	9.3
1.50-1.60	6.9	34.8	-	-	-	-	90.0	11.2
+1.60	10.0	71.6	-	-	-	-	100.0	17.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.4	6 1/2	0.04	412	476	9	135	1.067

ELCO MINING LTD.

November 19, 1975.

SAMPLE: EB-9-5

LAB. NO.: 4410

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	68.3	14.3	16.5	0.39	50

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.6	68.6	91.6	68.6
65M X 0	8.4	36.8	100.0	65.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	17.3	7.9	1.4	34.2	56.5	1.00	17.3	7.9
1.40-1.50	1.0	23.2	2.3	29.2	45.3	1.85	18.3	8.7
1.50-1.60	0.5	32.6	-	-	-	-	18.8	9.4
+1.60	81.2	82.3	-	-	-	-	100.0	68.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
16.8	7	0.03	388	442	15	155	1.057

ELCO MINING LTD. December 3, 1975.

SAMPLE: EB-10-1

LAB. NO.: 4511

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	11.9	27.1	60.2	0.37	97

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.3	10.1	88.3	10.1
65M X 0	11.7	14.6	100.0	10.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.9	3.8	2.6	28.8	64.8	0.44	86.9	3.8
1.40-1.50	3.6	18.2	2.0	22.0	57.8	0.39	90.5	4.4
1.50-1.60	1.3	30.6	-	-	-	-	91.8	4.7
+1.60	8.2	70.5	-	-	-	-	100.0	10.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
79.9	7 1/2	0.05	398	446	21	60	1.028

ELCO MINING LTD. December 3, 1975.

SAMPLE: EB-10-2

LAB. NO.: 4512

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	48.8	19.6	30.9	0.40	61

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	47.9	92.5	47.9
65M X 0	7.5	37.0	100.0	47.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	37.0	4.0	1.4	31.7	62.9	0.95	37.0	4.0
1.40-1.50	3.9	9.9	1.3	29.7	59.1	0.85	40.9	4.6
1.50-1.60	1.4	31.2	-	-	-	-	43.2	5.4
+1.60	57.7	79.0	-	-	-	-	100.0	47.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.8	9	0.05	384	450	26	255	1.069

ELCO MINING LTD. December 3, 1975.

SAMPLE: EB-10-3

LAB. NO.: 4513

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	61.1	15.3	22.9	0.94	n.s.s.

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.3	60.2	88.3	60.2
65M X 0	11.7	57.6	100.0	59.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	10.7	4.5	1.4	28.8	65.3	1.37	10.7	4.5
1.40-1.50	2.5	20.0	not sufficient sample				13.2	7.4
1.50-1.60	8.9	33.0	-	-	-	-	22.1	17.7
+1.60	77.9	72.2	-	-	-	-	100.0	60.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
11.7	8 1/2	0.02	390	455	21	296	1.072

ELCO MINING LTD. December 3, 1975.

SAMPLE: EB-10-4

LAB. NO.: 4514

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	22.3	25.0	51.9	0.52	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.4	21.5	90.4	21.5
65M X 0	9.6	21.1	100.0	21.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	71.7	3.3	1.7	28.4	66.6	0.63	71.7	3.3
1.40-1.50	4.5	13.2	1.6	25.9	59.3	0.55	76.2	3.9
1.50-1.60	1.3	31.2	-	-	-	-	77.5	4.3
+1.60	22.5	80.5	-	-	-	-	100.0	21.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
68.9	8 1/2	0.02	389	447	27	227	1.058

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December 3, 1975.

SAMPLE: EB-10-5

LAB. NO.: 4515

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	53.3	17.0	29.0	0.52	50

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.2	49.7	94.2	49.7
65M X 0	5.8	31.5	100.0	48.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	22.2	2.6	1.3	28.4	67.7	0.99	22.2	2.6
1.40-1.50	6.5	6.2	1.5	26.8	65.5	0.89	28.7	3.4
1.50-1.60	6.5	28.4	-	-	-	-	35.2	8.0
+1.60	64.8	72.3	-	-	-	-	100.0	49.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
27.0	8 1/2	0.04	391	444	24	153	1.049

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December 3, 1975.

SAMPLE: EB-10-6

LAB. NO.: 4516

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	9.3	25.3	64.7	0.77	92

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.6	8.8	90.6	8.8
65M X 0	9.4	15.6	100.0	9.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.7	3.1	1.5	26.8	68.6	0.81	86.7	3.1
1.40-1.50	4.3	18.1	1.2	23.7	57.0	0.65	90.9	3.8
1.50-1.60	1.9	28.8	-	-	-	-	92.8	4.3
+1.60	7.2	66.8	-	-	-	-	100.0	8.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
82.4	8 1/2	0.05	398	452	25	128	1.045

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SAMPLE: EB-10-7

LAB. NO.: 4517

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	18.0	23.4	57.8	0.62	86

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.1	18.1	92.1	18.1
65M X 0	7.9	13.1	100.0	17.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	76.4	3.4	2.1	26.4	68.1	0.68	76.4	3.4
1.40-1.50	2.2	16.8	1.6	22.0	59.6	0.63	78.6	3.8
1.50-1.60	1.5	39.8	-	-	-	-	80.1	4.5
+1.60	19.9	73.2	-	-	-	-	100.0	18.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
72.4	8	0.03	399	449	24	117	1.040

ELCO MINING LTD. December 3, 1975.

SAMPLE: EB-10-8

LAB. NO.: 4518

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	40.0	20.4	38.9	0.44	94

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.0	37.7	91.0	37.7
65M X 0	9.0	21.5	100.0	36.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	47.7	4.0	1.4	28.5	66.1	0.65	47.7	4.0
1.40-1.50	7.1	12.2	1.7	27.4	58.7	0.61	54.8	5.1
1.50-1.60	1.8	27.4	-	-	-	-	56.6	5.8
+1.60	43.4	79.4	-	-	-	-	100.0	37.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.9	9	0.04	398	450	15	257	1.058

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-1

LAB. NO.: 4087

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	29.8	26.3	42.9	0.72	69

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.3	30.7	93.3	30.7
65M X 0	6.7	19.1	100.0	29.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.0	5.9	1.5	33.8	58.8	1.05	62.0	5.9
1.40-1.50	2.1	26.0	1.1	28.3	44.6	0.77	64.1	6.6
1.50-1.60	1.0	37.5	-	-	-	-	65.1	7.0
+1.60	34.9	74.8	-	-	-	-	100.0	30.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.8	7 1/2	0.04	388	448	14	172	1.065

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-2

LAB. NO.: 4088

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.2	30.3	25.9	42.6	0.53	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.9	31.8	88.9	31.8
65M X 0	11.1	26.8	100.0	31.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.0	6.8	1.6	34.1	57.5	0.90	49.0	6.8
1.40-1.50	6.3	26.9	1.3	28.0	43.8	0.74	55.3	9.1
1.50-1.60	7.4	36.3	-	-	-	-	62.7	12.3
+1.60	37.3	64.5	-	-	-	-	100.0	31.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.2	7	0.16	367	433	24	182	1.068

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-3

LAB. NO.: 4089

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	45.4	21.8	31.8	0.42	.66

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.0	34.5	95.0	34.5
65M X 0	5.0	26.0	100.0	34.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	52.5	6.2	1.4	33.5	58.9	0.81	52.5	6.2
1.40-1.50	7.0	24.3	1.1	27.6	47.0	0.66	59.5	8.3
1.50-1.60	2.3	36.7	-	-	-	-	61.8	9.4
+1.60	38.2	75.1	-	-	-	-	100.0	34.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.5	8 1/2	0.06	376	442	21	153	1.065

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November 20, 1975.

SAMPLE: EB-11-4

LAB. NO.: 4090

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	30.1	27.0	41.8	0.72	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.4	29.4	92.4	29.4
65M X 0	7.6	24.9	100.0	29.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	60.8	6.9	1.3	32.3	59.5	0.93	60.8	6.9
1.40-1.50	6.4	26.1	1.1	27.0	45.8	0.83	67.2	8.8
1.50-1.60	3.2	34.9	-	-	-	-	70.4	9.9
+1.60	29.6	75.6	-	-	-	-	100.0	29.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.1	8	0.02	373	448	16	150	1.073

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-5

LAB. NO.: 4187

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	32.7	24.5	41.7	0.61	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.7	33.5	95.7	33.5
65M X 0	4.3	28.7	100.0	33.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.2	5.0	1.2	33.5	60.3	0.67	51.2	5.0
1.40-1.50	7.1	24.8	1.0	27.3	46.9	0.68	58.3	7.4
1.50-1.60	5.3	36.0	-	-	-	-	63.6	9.8
+1.60	36.4	75.0	-	-	-	-	100.0	33.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
55.8	8	0.07	377	446	19	151	1.070

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-6

LAB. NO.: 4188

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	23.6	27.7	47.6	0.78	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.4	23.0	93.4	23.0
65M X 0	6.6	21.5	100.0	22.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	58.7	4.9	1.2	33.7	60.2	0.98	58.7	4.9
1.40-1.50	6.7	24.7	1.2	27.5	46.6	0.78	65.4	6.9
1.50-1.60	6.8	36.5	-	-	-	-	72.2	9.7
+1.60	27.8	57.5	-	-	-	-	100.0	23.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
61.1	8	0.09	379	445	17	203	1.073

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-11-7

LAB. NO.: 4189

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	22.0	17.9	59.3	0.32	114

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.1	15.7	89.1	15.7
65M X 0	10.9	23.3	100.0	16.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	77.9	4.5	2.3	33.7	59.5	1.29	77.9	4.5
1.40-1.50	3.1	21.0	1.9	27.7	49.4	1.38	81.0	5.1
1.50-1.60	2.8	37.3	-	-	-	-	83.8	6.2
+1.60	16.2	64.9	-	-	-	-	100.0	15.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
72.2	9	0.02	398	452	5	192	1.064

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-8

LAB. NO.: 4190

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	44.1	21.5	33.5	0.72	60

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	96.1	44.0	96.1	44.0
65M X 0	3.9	39.5	100.0	43.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	43.2	7.5	0.9	33.3	58.3	1.10	43.2	7.5
1.40-1.50	7.0	24.8	1.0	28.0	46.2	1.21	50.2	9.9
1.50-1.60	5.6	35.8	-	-	-	-	55.8	12.5
+1.60	44.2	83.7	-	-	-	-	100.0	44.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
48.2	8	0.11	385	454	18	236	1.076

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-9

LAB. NO.: 4191

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	37.5	23.0	38.6	0.83	56

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	96.6	39.3	96.6	39.3
65M X 0	3.4	31.7	100.0	39.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	38.6	8.6	0.9	31.3	59.2	1.21	38.6	8.6
1.40-1.50	5.3	24.2	0.8	27.2	47.8	1.06	43.9	10.5
1.50-1.60	4.1	40.5	-	-	-	-	48.0	13.0
+1.60	52.0	63.5	-	-	-	-	100.0	39.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.4	8	0.04	370	447	21	225	1.085

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-11-10

LAB. NO.: 4192

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	14.0	30.1	54.8	1.12	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.0	11.6	94.0	11.6
65M X 0	6.0	31.7	100.0	12.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.4	6.2	1.1	32.3	60.4	1.12	86.4	6.2
1.40-1.50	4.7	23.6	1.0	27.9	47.5	1.46	91.1	7.1
1.50-1.60	2.2	36.6	-	-	-	-	93.3	7.8
+1.60	6.7	63.9	-	-	-	-	100.0	11.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
85.6	8	0.08	373	445	21	254	1.081

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SAMPLE: EB-11-11

LAB. NO.: 4193

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.2	9.2	27.3	62.3	0.53	72

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.5	9.2	94.5	9.2
65M X 0	5.5	16.9	100.0	9.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.9	3.4	1.0	29.4	66.2	0.66	89.9	3.4
1.40-1.50	2.5	26.4	1.1	21.8	50.7	0.61	92.4	4.0
1.50-1.60	1.0	34.4	-	-	-	-	93.4	4.3
+1.60	6.6	77.9	-	-	-	-	100.0	9.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
87.3	7	0.06	375	448	15	45	1.046

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SAMPLE: EB-11-12

LAB. NO.: 4194

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	18.0	27.5	53.4	0.25	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.1	18.6	94.1	18.6
65M X 0	5.9	14.1	100.0	18.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	75.4	4.1	1.2	30.6	64.1	0.46	75.4	4.1
1.40-1.50	3.5	18.1	1.1	26.5	54.3	0.41	78.9	4.7
1.50-1.60	2.3	29.1	-	-	-	-	81.2	5.4
+1.60	18.8	75.6	-	-	-	-	100.0	18.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.2	8 1/2	0.04	377	448	16	89	1.063

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November 21, 1975.

SAMPLE: EB-12-1

LAB. NO.: 3957

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	37.4	21.0	40.6	0.87	65

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.8	35.9	92.8	35.9
65M X 0	7.2	38.3	100.0	36.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	50.2	7.5	0.8	28.0	63.7	1.02	50.2	7.5
1.40-1.50	6.7	22.0	0.8	25.0	52.2	0.98	56.9	9.2
1.50-1.60	3.2	35.0	-	-	-	-	60.1	10.6
+1.60	39.9	74.1	-	-	-	-	100.0	35.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.8	8	0.12	376	452	18	139	1.076

ELCO MINING LTD. November 21, 1975.

SAMPLE: EB-12-2

LAB. NO.: 3958

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	39.6	21.0	38.3	0.81	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.2	42.5	93.2	42.5
65M X 0	6.8	30.8	100.0	41.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	31.9	5.6	0.8	29.8	63.8	1.17	31.9	5.6
1.40-1.50	6.3	21.7	0.9	25.2	52.2	0.95	38.2	8.3
1.50-1.60	7.2	34.7	-	-	-	-	45.4	12.4
+1.60	54.6	67.5	-	-	-	-	100.0	42.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
35.6	8 1/2	0.04	374	447	20	236	1.081

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SAMPLE: .EB-12-3

LAB. NO.: 3959

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	35.0	22.1	41.8	0.89	66

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	37.2	94.4	37.2
65M X 0	5.6	35.1	100.0	37.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	50.4	4.5	0.7	31.2	63.6	1.19	50.4	4.5
1.40-1.50	5.3	22.3	0.7	25.6	51.4	0.95	55.7	6.2
1.50-1.60	3.9	35.1	-	-	-	-	59.6	8.1
+1.60	40.4	80.2	-	-	-	-	100.0	37.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.6	8 1/2	0.03	358	444	24	272	1.099

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SAMPLE: EB-12-4

LAB. NO.: 3960

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	32.6	21.9	44.4	0.57	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.7	32.8	91.7	32.8
65M X 0	8.3	22.5	100.0	31.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	53.4	5.4	1.0	29.3	64.3	0.91	53.4	5.4
1.40-1.50	5.2	21.3	1.2	23.8	53.7	0.78	58.6	6.8
1.50-1.60	3.2	32.1	-	-	-	-	61.8	8.1
+1.60	38.2	72.8	-	-	-	-	100.0	32.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.7	8 1/2	0.06	364	445	26	207	1.084

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SAMPLE: EB-12-5

LAB. NO.: 3961

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	21.2	23.4	54.5	0.74	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.1	24.0	94.1	24.0
65M X 0	5.9	16.5	100.0	23.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.4	3.8	0.7	29.5	66.0	1.00	62.4	3.8
1.40-1.50	4.3	22.8	0.7	24.6	51.9	0.72	66.7	5.0
1.50-1.60	5.3	34.8	-	-	-	-	72.0	7.2
+1.60	28.0	67.0	-	-	-	-	100.0	24.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.8	9+	0.05	367	450	23	252	1.092

ELCO MINING LTD. November 21, 1975.

SAMPLE: EB-12-6

LAB. NO.: 3962

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	18.3	25.7	55.2	1.37	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.0	16.2	95.0	16.2
65M X 0	5.0	16.4	100.0	16.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	77.9	3.5	0.8	29.4	66.3	0.95	77.9	3.5
1.40-1.50	0.7	18.7	0.8	25.3	55.2	nss	78.6	3.6
1.50-1.60	0.5	37.6	-	-	-	-	79.1	3.9
+1.60	20.9	63.0	-	-	-	-	100.0	16.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.7	8 1/2	0.02	370	448	24	241	1.085

ELCO MINING LTD. November 21, 1975.

SAMPLE: EB-12-7

LAB. NO.: 3963

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	6.1	28.7	64.3	1.02	115

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.3	6.8	91.3	6.8
65M X 0	8.7	6.8	100.0	6.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	93.2	3.6	1.3	29.4	65.7	1.06	93.2	3.6
1.40-1.50	2.4	21.1	1.1	24.7	53.1	0.78	95.6	4.0
1.50-1.60	0.8	36.5	-	-	-	-	96.4	4.3
+1.60	3.6	74.5	-	-	-	-	100.0	6.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
87.3	9	0.05	366	439	27	209	1.075

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SAMPLE: EB-12-8

LAB. NO.: 3964

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.5	15.3	24.3	58.9	0.66	112

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.6	16.1	88.6	16.1
65M X 0	11.4	15.7	100.0	16.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	74.8	3.2	1.6	28.0	67.2	0.89	74.8	3.2
1.40-1.50	5.0	18.3	1.3	21.5	58.9	0.66	79.8	4.1
1.50-1.60	2.7	28.9	-	-	-	-	82.5	5.0
+1.60	17.5	68.8	-	-	-	-	100.0	16.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
70.7	9	0.06	373	439	24	144	1.062

ELCO MINING LTD. November 21, 1975.

SAMPLE: EB-12-9

LAB. NO.: 3971

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	19.3	22.9	57.0	0.46	93

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.0	21.1	89.0	21.1
65M X 0	11.0	18.0	100.0	20.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	70.4	3.7	1.0	27.1	68.2	0.64	70.4	3.7
1.40-1.50	4.0	19.3	0.8	23.5	56.4	0.53	74.4	4.5
1.50-1.60	3.1	32.0	-	-	-	-	77.5	5.6
+1.60	22.5	74.4	-	-	-	-	100.0	21.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
66.2	8 1/2	0.04	370	444	24	198	1.076

ELCO MINING LTD.

November 21, 1975.

SAMPLE: EB-12-10

LAB. NO.: 3972

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	21.1	22.9	55.3	0.72	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.1	23.6	93.1	23.6
65M X 0	6.9	18.2	100.0	23.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	68.0	4.3	0.8	26.9	68.0	0.81	68.0	4.3
1.40-1.50	4.1	21.9	0.9	22.9	54.3	0.98	72.1	5.3
1.50-1.60	2.4	39.9	-	-	-	-	74.5	6.4
+1.60	25.5	73.7	-	-	-	-	100.0	23.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
67.1	8 1/2	0.02	364	443	27	267	1.086

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-1

LAB. NO.: 4001

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	30.6	32.7	36.0	0.30	67

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.5	29.6	95.5	29.6
65M X 0	4.5	17.2	100.0	29.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.2	5.8	1.7	34.3	58.2	0.74	54.2	5.8
1.40-1.50	2.5	22.9	1.7	28.9	46.5	0.64	56.7	6.6
1.50-1.60	1.5	31.2	-	-	-	-	58.2	7.2
+1.60	41.8	60.8	-	-	-	-	100.0	29.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
54.1	7 1/2	0.07	371	446	27	144	1.067

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-2

LAB. NO.: 4002

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	40.2	22.4	36.4	0.70	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.5	38.9	95.5	38.9
65M X 0	4.5	28.7	100.0	38.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.7	7.0	1.0	33.3	58.7	0.98	42.7	7.0
1.40-1.50	5.9	25.8	1.0	26.9	46.3	0.91	48.6	9.3
1.50-1.60	4.4	35.6	-	-	-	-	53.0	11.5
+1.60	47.0	69.8	-	-	-	-	100.0	38.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.4	7 1/2	0.12	368	447	26	175	1.077

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-3

LAB. NO.: 4027

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	40.5	22.0	35.7	0.45	62

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	42.2	94.4	42.2
65M X 0	5.6	28.8	100.0	41.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.0	7.8	1.2	32.8	58.2	0.76	36.0	7.8
1.40-1.50	7.7	26.9	1.3	26.2	45.7	0.65	43.7	11.1
1.50-1.60	7.5	36.9	-	-	-	-	51.2	14.9
+1.60	48.8	70.8	-	-	-	-	100.0	42.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
41.3	7	0.13	373	443	24	178	1.070

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-4

LAB. NO.: 4028

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	33.8	23.4	41.9	0.74	67

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.3	33.1	94.3	33.1
65M X 0	5.7	28.4	100.0	32.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	45.5	7.9	1.2	31.1	59.8	0.98	45.5	7.9
1.40-1.50	6.8	24.5	1.0	26.8	47.7	1.08	52.3	10.1
1.50-1.60	7.8	35.8	-	-	-	-	60.1	13.4
+1.60	39.9	62.6	-	-	-	-	100.0	33.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.3	8 1/2	0.15	387	446	14	164	1.063

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-5

LAB. NO.: 4029

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	37.4	23.0	38.8	0.85	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.9	38.7	94.9	38.7
65M X 0	5.1	31.7	100.0	38.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	39.2	6.7	1.2	31.9	60.2	1.15	39.2	6.7
1.40-1.50	7.7	22.7	1.1	28.2	48.0	0.96	46.9	9.3
1.50-1.60	3.6	31.7	-	-	-	-	50.5	10.9
+1.60	49.5	67.0	-	-	-	-	100.0	38.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
44.5	7 1/2	0.16	388	451	18	276	1.071

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-6

LAB. NO.: 4030

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	6.2	26.7	66.2	0.70	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.2	5.9	94.2	5.9
65M X 0	5.8	10.4	100.0	6.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	92.3	2.5	1.4	27.3	68.8		92.3	2.5
1.40-1.50	2.5	19.8	1.7	21.8	56.7	-	94.8	3.0
1.50-1.60	0.9	29.3	-	-	-	-	95.7	3.2
+1.60	4.3	65.0	-	-	-	-	100.0	5.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
89.3	6	0.02	394	450	15	182	1.060

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-7

LAB. NO.: 4031

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	20.0	25.3	53.8	0.34	99

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.5	21.0	84.5	21.0
65M X 0	15.5	15.9	100.0	20.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	70.1	4.3	2.4	30.3	63.0	0.59	70.1	4.3
1.40-1.50	4.0	22.4	1.9	23.3	52.4	0.55	74.1	5.3
1.50-1.60	2.6	34.2	-	-	-	-	76.7	6.3
+1.60	23.3	69.4	-	-	-	-	100.0	21.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.6	8	0.07	382	445	22	107	1.053

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-8

LAB. NO.: 4032

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	17.7	26.3	55.3	0.43	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.5	17.4	93.5	17.4
65M X 0	6.5	18.4	100.0	17.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	77.0	3.4	1.6	31.4	63.6	0.59	77.0	3.4
1.40-1.50	3.4	23.8	1.0	23.6	51.6	0.42	80.4	4.3
1.50-1.60	1.4	31.3	-	-	-	-	81.8	4.7
+1.60	18.2	74.4	-	-	-	-	100.0	17.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
75.2	8	0.03	373	448	23	171	1.075

ELCO MINING LTD. December 1975.

SAMPLE: EB-13-9

LAB. NO.: 4033

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	42.8	20.9	35.7	0.42	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.9	42.1	92.9	42.1
65M X 0	7.1	35.6	100.0	41.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.7	7.2	1.4	30.2	61.2	0.76	40.7	7.2
1.40-1.50	6.5	24.0	1.1	25.4	49.5	0.66	47.2	9.5
1.50-1.60	5.5	34.6	-	-	-	-	52.7	12.1
+1.60	47.3	75.5	-	-	-	-	100.0	42.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
43.8	8 1/2	0.11	378	454	24	200	1.077

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-1

LAB. NO.: 4034

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	63.0	14.6	21.5	0.43	83

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.6	65.6	94.6	65.6
65M X 0	5.4	34.6	100.0	63.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	20.7	6.3	1.1	31.9	60.7	0.98	20.7	6.3
1.40-1.50	3.2	22.2	1.2	27.0	49.6	1.04	23.9	8.4
1.50-1.60	2.5	36.2	-	-	-	-	26.4	11.1
+1.60	73.6	85.2	-	-	-	-	100.0	65.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
22.6	8 1/2	0.05	387	449	17	130	1.060

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-2

LAB. NO.: 4035

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	32.7	25.1	41.3	0.57	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.5	36.4	91.5	36.4
65M X 0	8.5	27.8	100.0	35.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	53.0	3.7	1.1	32.8	62.4	0.87	53.0	3.7
1.40-1.50	1.0	7.0	1.0	31.7	60.3	1.17	54.0	3.8
1.50-1.60	0.8	32.1	-	-	-	-	54.8	4.2
+1.60	45.2	75.5	-	-	-	-	100.0	36.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.4	8 1/2	0.02	374	447	22	98	1.077

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-3

LAB. NO.: 4036

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	13.4	29.7	56.0	0.91	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.8	12.7	92.8	12.7
65M X 0	7.2	16.3	100.0	13.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	84.3	6.3	1.9	31.9	59.9	1.08	84.3	6.3
1.40-1.50	5.7	25.5	1.4	26.9	46.2	0.81	90.0	7.5
1.50-1.60	2.7	33.9	-	-	-	-	92.7	8.3
+1.60	7.3	68.9	-	-	-	-	100.0	12.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
83.5	8 1/2	0.10	377	447	24	167	1.068

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-4

LAB. NO.: 4037

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	48.6	19.5	30.9	0.55	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.7	47.1	86.7	47.1
65M X 0	13.3	32.5	100.0	45.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	38.1	6.3	3.2	32.0	58.5	0.96	38.1	6.3
1.40-1.50	4.3	20.6	2.0	26.0	51.4	0.78	42.4	7.8
1.50-1.60	3.1	33.0	-	-	-	-	45.5	9.5
+1.60	54.5	78.5	-	-	-	-	100.0	47.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
36.8	8	0.04	373	437	15	148	1.069

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-14-5

LAB. NO.: 4038

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	16.9	29.1	53.3	0.85	105

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.2	16.2	85.2	16.2
65M X 0	14.8	13.4	100.0	15.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.1	4.0	2.3	33.4	60.3	1.06	83.1	4.0
1.40-1.50	0.9	25.2	2.3	25.0	47.5	no sample left	84.0	4.2
1.50-1.60	0.5	43.9	-	-	-	-	84.5	4.5
+1.60	15.5	80.2	-	-	-	-	100.0	16.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.6	8	0.01	376	436	25	190	1.060

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-6

LAB. NO.: 4037

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	19.7	23.3	56.1	0.61	69

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.8	17.9	93.8	17.9
65M X 0	6.2	11.2	100.0	17.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	75.4	2.1	1.2	28.8	67.9	0.78	75.4	2.1
1.40-1.50	1.6	11.9	1.7	25.9	60.5	0.78	77.0	2.3
1.50-1.60	1.8	28.4	-	-	-	-	78.8	2.9
+1.60	21.2	73.7	-	-	-	-	100.0	17.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
72.2	6	0.01	382	442	16	13	0.993

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-14-7

LAB. NO.: 4040

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	15.3	27.0	56.9	0.83	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.8	18.0	93.8	18.0
65M X 0	6.2	16.9	100.0	17.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	77.7	4.1	1.2	30.7	64.0	0.93	77.7	4.1
1.40-1.50	2.5	21.8	1.6	25.8	50.8	0.78	80.2	4.7
1.50-1.60	1.1	33.8	-	-	-	-	81.3	5.0
+1.60	18.7	74.1	-	-	-	-	100.0	18.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
75.2	8	0.06	381	441	17	141	1.061

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-14-8

LAB. NO.: 4082

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	17.4	27.0	54.6	0.45	109

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.9	14.4	86.9	14.4
65M X 0	13.1	16.2	100.0	14.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	77.8	4.3	2.2	31.2	62.3	0.88	77.8	4.3
1.40-1.50	4.9	24.0	1.5	24.7	49.8	0.66	82.7	5.5
1.50-1.60	3.0	32.2	-	-	-	-	85.7	6.4
+1.60	14.3	62.0	-	-	-	-	100.0	14.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.9	8 1/2	0.06	382	445	17	139	1.063

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-9

LAB. NO.: 4083

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	27.9	23.3	47.9	0.74	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.7	28.9	89.7	28.9
65M X 0	10.3	19.1	100.0	27.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	52.8	4.9	1.1	29.9	64.1	1.04	52.8	4.9
1.40-1.50	5.5	25.2	1.2	23.3	50.3	0.93	58.3	6.8
1.50-1.60	5.4	35.1	-	-	-	-	63.7	9.2
+1.60	36.3	63.4	-	-	-	-	100.0	28.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.3	8	0.04	376	448	19	207	1.078

ELCO MINING LTD.

November 20, 1975.

SAMPLE: EB-14-10

LAB. NO.: 4084

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	25.8	22.9	50.6	0.70	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.9	25.9	88.9	25.9
65M X 0	11.1	18.8	100.0	25.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	61.1	9.8	0.9	28.1	61.2	.96	61.1	9.8
1.40-1.50	11.5	23.1	0.8	23.6	52.5	.70	72.6	11.9
1.50-1.60	4.4	31.5	-	-	-	-	77.0	13.0
+1.60	23.0	69.0	-	-	-	-	100.0	25.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
64.5	8 1/2	0.04	369	444	18	210	1.084

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-11

LAB. NO.: 4085

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	32.6	20.8	45.9	0.66	70

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	35.9	94.4	35.9
65M X 0	5.6	21.4	100.0	35.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	47.1	6.7	1.2	29.1	63.0	0.98	47.1	6.7
1.40-1.50	9.1	25.3	0.8	24.2	49.7	0.78	56.2	9.7
1.50-1.60	3.7	35.9	-	-	-	-	59.9	11.3
+1.60	40.1	72.6	-	-	-	-	100.0	35.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.1	8	0.05	376	444	15	233	1.079

ELCO MINING LTD. November 20, 1975.

SAMPLE: EB-14-12

LAB. NO.: 4086

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	43.5	18.8	36.8	0.64	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	96.0	32.3	96.0	32.3
65M X 0	4.0	21.6	100.0	31.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.7	4.1	1.0	28.9	66.0	1.00	56.7	4.1
1.40-1.50	5.2	18.6	0.9	23.9	56.6	0.78	61.9	5.3
1.50-1.60	2.0	29.3	-	-	-	-	63.9	6.1
+1.60	36.1	78.7	-	-	-	-	100.0	32.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.4	9	0.07	376	445	18	199	1.075

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-1

LAB. NO.: 3797

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	30.1	22.7	46.5	0.94	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.7	31.1	91.7	31.1
65M X 0	8.3	29.7	100.0	31.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	47.3	6.3	0.8	27.0	65.9	1.20	47.3	6.3
1.40-1.50	6.4	23.3	0.7	23.0	53.0	0.90	53.7	8.3
1.50-1.60	8.7	35.1	-	-	-	-	62.4	12.1
+1.60	37.6	62.8	-	-	-	-	100.0	31.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.2	8 1/2	0.05	376	448	25	270	1.078

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-2

LAB. NO.: 3798

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	31.5	19.9	47.6	51	72

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.3	35.4	90.3	35.4
65M X 0	9.7	27.0	100.0	34.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	50.1	4.7	0.9	26.0	68.4	0.75	50.1	4.7
1.40-1.50	5.3	20.6	1.2	22.1	56.1	0.73	55.4	6.2
1.50-1.60	3.2	33.8	-	-	-	-	58.6	7.7
+1.60	41.4	74.6	-	-	-	-	100.0	35.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
50.0	8 1/2	0.03	373	422	21	217	1.053

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-3

LAB. NO.: 3799

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	7.1	26.6	65.6	1.06	122

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.8	7.3	88.8	7.3
65M X 0	11.2	11.1	100.0	7.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	91.9	4.1	1.2	27.5	67.2	1.22	91.9	4.1
1.40-1.50	2.4	20.8	0.9	21.2	57.1	1.64	94.3	4.5
1.50-1.60	1.9	32.6	-	-	-	-	96.2	5.1
+1.60	3.8	64.5	-	-	-	-	100.0	7.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
83.7	8	0.01	369	416	23	284	1.054

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October 2, 1975.

SAMPLE: EB-15-4

LAB. NO.: 3800

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	33.7	20.7	44.9	0.73	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	33.5	92.5	33.5
65M X 0	7.5	30.0	100.0	33.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	50.0	6.6	0.8	27.9	64.7	1.07	50.0	6.6
1.40-1.50	7.6	22.7	0.7	22.8	53.8	0.92	57.6	8.7
1.50-1.60	5.0	36.0	-	-	-	-	62.6	10.9
+1.60	37.4	71.2	-	-	-	-	100.0	33.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.3	8 1/2	0.08	382	492	27	235	1.111

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-5

LAB. NO.: 3801

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	48.3	16.8	34.3	0.49	95

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.1	47.4	91.1	47.4
65M X 0	8.9	47.5	100.0	47.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	35.2	6.1	0.7	25.8	67.4	0.86	35.2	6.1
1.40-1.50	5.4	22.6	0.7	22.0	54.7	0.64	40.6	8.3
1.50-1.60	2.8	35.6	-	-	-	-	43.4	10.1
+1.60	56.6	76.0	-	-	-	-	100.0	47.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.0	8 1/2	0.03	386	494	16	227	1.119

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-6

LAB. NO.: 3802

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	34.6	19.7	45.1	0.62	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.8	35.2	91.8	35.2
65M X 0	8.2	27.6	100.0	34.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.2	7.8	0.7	26.2	65.3	0.71	42.2	7.8
1.40-1.50	10.2	22.6	0.8	21.7	54.9	0.77	52.4	10.7
1.50-1.60	3.4	36.0	-	-	-	-	55.8	12.2
+1.60	44.2	64.3	-	-	-	-	100.0	35.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
48.1	9	0.04	389	458	24	223	1.070

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-7

LAB. NO.: 3803

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	11.7	23.6	64.1	0.71	66

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.3	11.3	87.3	11.3
65M X 0	12.7	25.2	100.0	13.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	84.0	5.1	0.9	25.6	68.4	0.89	84.0	5.1
1.40-1.50	6.1	21.4	1.0	20.5	57.1	0.64	90.1	6.2
1.50-1.60	2.1	36.1	-	-	-	-	92.2	6.9
+1.60	7.8	63.7	-	-	-	-	100.0	11.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.7	9	0.08	391	456	24	208	1.065

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October 2, 1975.

SAMPLE: EB-15-8

LAB. NO.: 3804

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	32.6	19.8	47.0	0.58	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.6	33.1	93.6	33.1
65M X 0	6.4	37.5	100.0	33.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.9	4.5	0.7	26.2	68.6	0.79	54.9	4.5
1.40-1.50	4.1	21.2	0.7	21.2	56.9	0.73	59.0	5.7
1.50-1.60	3.4	33.8	-	-	-	-	62.4	7.2
+1.60	37.6	76.0	-	-	-	-	100.0	33.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
55.2	9	0.09	391	460	24	233	1.071

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-9

LAB. NO.: 3805

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	25.9	20.7	52.8	0.63	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.3	28.7	89.3	28.7
65M X 0	10.7	37.2	100.0	29.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	63.6	4.1	0.8	26.6	68.6	0.66	63.6	4.1
1.40-1.50	3.1	20.5	0.8	21.8	56.9	0.58	66.7	4.9
1.50-1.60	2.2	35.0	-	-	-	-	68.9	5.8
+1.60	31.1	79.4	-	-	-	-	100.0	28.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.6	8 1/2	0.07	394	462	19	227	1.072

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-10

LAB. NO.: 3806

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	31.3	19.4	48.6	0.66	97

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.2	31.9	88.2	31.9
65M X 0	11.8	33.5	100.0	32.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	53.0	5.1	3.5	24.9	66.5	1.35	53.0	5.1
1.40-1.50	3.6	22.5	1.5	21.0	55.0	0.81	56.6	6.2
1.50-1.60	3.7	33.5	-	-	-	-	60.3	7.9
+1.60	39.7	68.5	-	-	-	-	100.0	31.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.9	8	0.06	394	453	24	101	1.045

ELCO MINING LTD.

October 2, 1975.

SAMPLE: EB-15-11

LAB. NO.: 3807

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	7.8	24.0	67.7	0.93	89

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.4	8.0	92.4	8.0
65M X 0	7.6	10.3	100.0	8.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	91.1	4.5	0.8	25.6	69.1	0.96	91.1	4.5
1.40-1.50	2.7	20.2	0.9	21.6	57.3	0.79	93.8	5.0
1.50-1.60	1.9	32.2	-	-	-	-	95.7	5.5
+1.60	4.3	63.1	-	-	-	-	100.0	8.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
86.7	8	0.05	397	456	23	252	1.061

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-12

LAB. NO.: 3808

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	35.4	19.9	44.0	0.71	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.9	34.2	90.9	34.2
65M X 0	9.1	35.2	100.0	34.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	48.6	3.3	0.8	26.8	69.1	0.90	48.6	3.3
1.40-1.50	3.0	21.1	0.7	19.6	58.6	0.64	51.0	4.4
1.50-1.60	2.0	37.6	-	-	-	-	53.6	5.6
+1.60	46.4	67.2	-	-	-	-	100.0	34.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.4	8	0.01	388	454	26	258	1.068

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-13

LAB. NO.: 3809

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	40.6	16.8	41.6	0.71	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	46.3	92.2	46.3
65M X 0	7.8	37.9	100.0	45.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	33.4	6.8	0.8	23.0	69.4	0.96	33.4	6.8
1.40-1.50	8.6	21.2	0.7	20.8	57.3	0.90	42.0	9.7
1.50-1.60	5.9	32.0	-	-	-	-	47.9	12.5
+1.60	52.1	77.3	-	-	-	-	100.0	46.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
38.7	7 1/2	0.11	394	456	24	164	1.057

ELCO MINING LTD. October 2, 1975.

SAMPLE: EB-15-14

LAB. NO.: 3810

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	51.8	16.0	31.4	0.54	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.8	46.9	86.8	46.9
65M X 0	13.2	34.8	100.0	45.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.6	4.3	2.1	24.2	69.4	1.26	40.6	4.3
1.40-1.50	3.1	19.1	1.3	21.1	58.5	1.09	43.7	5.3
1.50-1.60	2.0	29.6	-	-	-	-	45.7	6.4
+1.60	54.3	80.9	-	-	-	-	100.0	46.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.9	7	0.05	397	456	25	111	1.046

ELCO MINING LTD.

September 30, 1975.

SAMPLE: EB-16-1

LAB. NO.: 3680

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	51.2	19.0	28.9	0.67	53

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.9	60.1	88.9	60.1
65M X 0	11.1	43.4	100.0	58.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	21.8	7.9	1.0	31.0	60.1	0.97	21.8	7.9
1.40-1.50	4.8	18.5	1.0	29.2	51.3	0.87	26.6	9.8
1.50-1.60	3.0	30.3	-	-	-	-	29.6	11.9
+1.60	70.4	80.3	-	-	-	-	100.0	60.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
23.6	8	0.07	364	435	14	207	1.084

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-16-2

LAB. NO.: 3681

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	30.3	26.5	42.3	2.30	57

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.9	28.9	87.9	28.9
65M X 0	12.1	37.2	100.0	29.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.0	8.3	0.8	33.2	57.7	1.86	49.0	8.3
1.40-1.50	15.0	23.8	0.9	28.9	46.4	2.23	64.0	11.9
1.50-1.60	9.2	30.6	-	-	-	-	73.2	14.3
+1.60	26.8	69.0	-	-	-	-	100.0	28.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.3	6 1/2	0.15	360	438	12	242	1.097

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-16-3

LAB. NO.: 3682

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	44.4	20.2	34.4	0.87	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.0	43.5	91.0	43.5
65M X 0	9.0	40.0	100.0	43.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	26.0	6.2	1.1	31.8	60.9	1.35	26.0	6.2
1.40-1.50	5.9	23.4	1.0	26.5	49.1	1.05	31.9	9.4
1.50-1.60	16.8	34.9	-	-	-	-	48.7	18.2
+1.60	51.3	67.5	-	-	-	-	100.0	43.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
29.0	8	0.03	362	449	27	257	1.096

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-16-4

LAB. NO.: 3683

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	9.9	29.2	59.8	1.04	82

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.5	9.4	90.5	9.4
65M X 0	9.5	14.9	100.0	9.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.5	3.3	1.2	31.0	65.4	1.08	89.5	3.3
1.40-1.50	1.2	16.1	1.2	27.4	55.3	1.07	90.7	3.5
1.50-1.60	1.0	24.5	-	-	-	-	91.7	3.7
+1.60	8.3	27.8	-	-	-	-	100.0	9.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
82.1	8 1/2	<0.01	364	446	27	194	1.083

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-16-5

LAB. NO.: 3684

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	38.7	21.4	39.0	0.51	69

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.1	40.6	90.1	40.6
65M X 0	9.9	28.0	100.0	39.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.1	5.6	1.3	30.2	62.9	0.83	40.1	5.6
1.40-1.50	6.2	21.8	1.1	25.1	52.0	0.60	46.3	7.8
1.50-1.60	4.2	30.9	-	-	-	-	50.5	9.7
+1.60	49.5	72.2	-	-	-	-	100.0	40.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
41.7	7 1/2	0.10	368	449	26	239	1.087

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-16-6

LAB. NO.: 3685

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	33.5	23.4	42.2	0.64	112

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	31.9	92.2	31.9
65M X 0	7.8	28.5	100.0	31.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.6	4.4	1.1	30.6	63.9	0.95	51.6	4.4
1.40-1.50	6.8	23.3	1.1	25.0	50.6	0.98	58.4	6.6
1.50-1.60	5.4	34.7	-	-	-	-	63.8	9.0
+1.60	36.2	72.2	-	-	-	-	100.0	31.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.8	7	0.07	372	448	23	250	1.084

ELCO MINING LTD. October 1, 1975.

SAMPLE: EB-16-7

LAB. NO.: 3770

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	17.5	23.4	58.1	0.54	68

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.6	16.9	90.6	16.9
65M X 0	9.4	23.9	100.0	17.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	79.5	3.0	1.1	28.5	67.4	0.77	79.5	3.0
1.40-1.50	2.2	15.7	1.0	22.1	61.2	0.62	81.7	3.3
1.50-1.60	0.9	29.3	-	-	-	-	82.6	3.6
+1.60	17.4	79.9	-	-	-	-	100.0	16.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.0	7 1/2	0.03	388	453	22	37	1.020

ELCO MINING LTD. October 1, 1975.

SAMPLE: EB-16-8

LAB. NO.: 3771

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	33.6	22.4	43.2	0.66	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.3	36.1	90.3	36.1
65M X 0	9.7	24.0	100.0	34.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	46.8	5.3	1.3	29.1	64.3	1.01	46.8	5.3
1.40-1.50	6.4	22.4	0.9	24.6	52.1	0.77	53.2	7.4
1.50-1.60	4.2	34.9	-	-	-	-	57.4	9.4
+1.60	42.6	72.1	-	-	-	-	100.0	36.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
48.0	9	0.04	367	443	21	152	1.076

ELCO MINING LTD. October 1, 1975.

SAMPLE: EB-16-9

LAB. NO.: 3772

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	31.6	22.6	45.0	0.75	67

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.6	31.6	94.6	31.6
65M X 0	5.4	26.6	100.0	31.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.0	6.8	0.9	27.6	64.7	0.92	56.0	6.8
1.40-1.50	6.6	21.2	0.7	24.2	53.9	0.86	62.6	8.3
1.50-1.60	2.9	32.1	-	-	-	-	65.5	9.4
+1.60	34.5	73.9	-	-	-	-	100.0	31.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.2	8 1/2	0.04	364	445	27	223	1.085

ELCO MINING LTD.

October 1, 1975.

SAMPLE: EB-16-10

LAB. NO.: 3773

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	9.1	26.3	63.7	1.01	84

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.4	8.3	93.4	8.3
65M X 0	6.6	19.3	100.0	9.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	90.7	4.4	1.1	27.4	67.1	1.05	90.7	4.4
1.40-1.50	3.2	20.1	0.6	22.7	56.6	1.03	93.9	4.9
1.50-1.60	1.4	29.8	-	-	-	-	95.3	5.3
+1.60	4.7	68.5	-	-	-	-	100.0	8.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
87.7	8 1/2	0.07	364	447	28	193	1.083

ELCO MINING LTD. October 1, 1975.

SAMPLE: EB-16-11

LAB. NO.: 3774

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	31.9	22.7	44.6	0.91	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.9	36.3	94.9	36.3
65M X 0	5.1	34.0	100.0	36.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.3	8.7	0.7	28.2	62.4	1.09	40.3	8.7
1.40-1.50	9.6	25.5	0.7	23.9	49.9	0.86	49.9	11.9
1.50-1.60	8.6	35.0	-	-	-	-	58.5	15.3
+1.60	41.5	65.8	-	-	-	-	100.0	36.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
47.4	8	0.05	378	451	15	184	1.081

ELCO MINING LTD. October 1, 1975.

SAMPLE: EB-16-12

LAB. NO.: 3775

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	34.4	21.8	43.0	0.76	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.3	31.7	95.3	31.7
65M X 0	4.7	21.1	100.0	31.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.0	4.4	1.0	26.5	68.1	0.75	62.0	4.4
1.40-1.50	4.1	18.3	0.9	23.2	57.6	0.58	66.1	5.3
1.50-1.60	1.9	30.4	-	-	-	-	68.0	6.0
+1.60	32.0	86.3	-	-	-	-	100.0	31.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.0	8 1/2	0.05	384	453	24	118	1.058

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD.

October 1, 1975.

SAMPLE: EB-16-13

LAB. NO.: 3776

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	33.4	21.0	44.9	0.71	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.3	34.5	92.3	34.5
65M X 0	7.7	29.3	100.0	34.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.0	6.8	1.0	26.0	66.2	0.77	49.0	6.8
1.40-1.50	9.2	24.9	0.8	22.0	52.1	0.66	58.2	9.7
1.50-1.60	5.8	34.6	-	-	-	-	64.0	11.9
+1.60	36.0	74.6	-	-	-	-	100.0	34.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.7	8 1/2	0.05	375	449	25	219	1.077

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-1

LAB. NO.: 3501

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
1/4" X 65M	93.1	19.8	0.9	28.0	51.3	0.69	68	93.1	19.8
65M X 0	6.9	20.4	-	-	-	-	-	100.0	19.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE WT. %	CUMULATIVE ASH %
-1.40	77.2	5.3	0.9	31.8	62.0	0.87	77.2	5.3
1.40-1.50	2.8	25.2	0.9	25.5	48.4	0.67	80.0	6.0
1.50-1.60	1.8	35.3	-	-	-	-	81.8	6.6
+1.60	18.2	75.3	-	-	-	-	100.0	19.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST: SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.5	8	0.21	367	448	24	237	1.088

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-2

LAB. NO.: 3502

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	97.2	25.2	0.7	28.1	46.0	0.69	50	97.2	25.2
65M X 0	2.8	28.0	-	-	-	-	-	100.0	25.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.4	12.5	0.8	31.6	55.1	0.92	55.4	12.5
1.40-1.50	20.7	27.3	0.7	26.9	45.1	0.76	76.1	16.5
1.50-1.60	12.5	38.1	-	-	-	-	88.6	19.6
+1.60	11.4	65.3	-	-	-	-	100.0	24.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.0	6	0.07	363	449	22	204	1.093

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-3

LAB. NO.: 3503

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	85.0	20.8	0.8	26.9	51.5	0.94	129	85.0	20.8
65M X 0	15.0	37.3	-	-	-	-	-	100.0	23.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	76.2	4.9	1.9	31.2	62.0	1.62	76.2	4.9
1.40-1.50	4.2	21.9	1.1	27.8	49.2	1.06	80.4	5.8
1.50-1.60	1.7	29.4	-	-	-	-	82.1	6.3
+1.60	17.9	80.8	-	-	-	-	100.0	19.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
68.3	8	0.03	367	412	23	53	1.050

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-4

LAB. NO.: 3504

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	95.1	22.4	0.9	25.2	51.5	0.77	65	95.1	22.4
65M X 0	4.9	21.3	-	-	-	-	-	100.0	22.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	78.8	3.5	0.9	30.2	65.4	0.95	78.8	3.5
1.40-1.50	1.0	13.7	1.0	27.9	57.4	0.94	79.8	3.6
1.50-1.60	0.5	21.6	-	-	-	-	80.3	3.7
+1.60	19.7	86.6	-	-	-	-	100.0	20.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
75.9	8 1/2	0.03	377	412	28	57	1.015

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-5

LAB. NO.: 3505

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
1/4" X 65M	90.0	15.7	1.0	30.5	52.8	1.64	79	90.0	15.7
65M X 0	10.0	14.8	-	-	-	-	-	100.0	15.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE WT. %	CUMULATIVE ASH %
-1.40	79.5	6.5	1.0	32.8	59.7	1.84	79.5	6.5
1.40-1.50	4.9	24.3	0.9	28.5	46.3	1.84	84.4	7.5
1.50-1.60	3.1	32.9	-	-	-	-	87.5	8.4
+1.60	12.5	56.7	-	-	-	-	100.0	14.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST: SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
76.0	7 1/2	0.12	361	448	28	241	1.093

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-6

LAB. NO.: 3506

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	92.4	7.2	0.9	29.3	62.6	0.78	76	92.4	7.2
65M X 0	7.6	13.3	-	-	-	-	-	100.0	7.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	91.3	2.5	1.1	31.1	65.3	0.97	91.3	2.5
1.40-1.50	2.5	21.8	1.1	26.3	50.8	1.08	93.8	3.0
1.50-1.60	1.1	32.4	-	-	-	-	94.9	3.4
+1.60	5.1	56.1	-	-	-	-	100.0	6.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
86.7	8 1/2	0.01	363	452	28	160	1.083

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-7

LAB. NO.: 3507

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
1/4" X 65M	94.5	53.3	0.7	16.9	29.1	0.46	55	94.5	53.3
65M X 0	5.5	35.5	-	-	-	-	-	100.0	52.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE WT. %	CUMULATIVE ASH %
-1.40	18.8	10.4	0.9	29.6	59.1	1.00	18.8	10.4
1.40-1.50	8.2	27.7	0.8	25.2	46.3	0.76	27.0	15.7
1.50-1.60	6.9	37.6	-	-	-	-	33.9	20.1
+1.60	66.1	71.1	-	-	-	-	100.0	53.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST: SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
25.5	7 1/2	0.14	351	398	30	243	1.051

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-8

LAB. NO.: 3508

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
1/4" X 65M	95.6	12.5	0.8	27.0	59.7	0.71	75	95.6	12.5
65M X 0	4.4	12.8	-	-	-	-	-	100.0	12.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE WT. %	CUMULATIVE ASH %
-1.40	84.6	8.5	0.8	29.4	61.3	0.85	84.6	8.5
1.40-1.50	5.0	25.1	0.7	24.5	49.7	0.74	89.6	9.4
1.50-1.60	2.8	38.0	-	-	-	-	92.4	10.3
+1.60	7.6	70.5	-	-	-	-	100.0	14.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST: SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
85.7	8 1/2	0.07	359	426	29	203	1.068

ELCO MINING LTD. August 14, 1975.

SAMPLE; EB-17-9

LAB. NO.: 3509

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	89.3	33.8	1.0	22.4	42.8	0.62	97	89.3	33.8
65M X 0	10.7	26.6	-	-	-	-	-	100.0	33.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.6	7.9	1.8	29.6	60.7	1.43	55.6	7.9
1.40-1.50	4.6	26.3	1.3	24.6	47.8	1.04	60.2	9.3
1.50-1.60	3.4	35.5	-	-	-	-	63.6	10.7
+1.60	36.4	70.9	-	-	-	-	100.0	32.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.8	8	0.03	348	401	29	218	1.057

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-10

LAB. NO.: 3510

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	94.8	17.5	0.8	26.5	55.2	0.99	-	94.8	17.5
65M X 0	5.2	20.1	-	-	-	-	-	100.0	17.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	81.0	6.0	0.7	30.2	63.1	1.02	81.0	6.0
1.40-1.50	4.6	22.8	0.7	25.2	51.3	0.82	85.6	6.9
1.50-1.60	2.4	35.7	-	-	-	-	88.0	7.7
+1.60	12.0	82.5	-	-	-	-	100.0	16.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
81.1	8 1/2	0.07	362	426	28	191	1.064

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-11

LAB. NO.: 3534

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	95.4	11.2	0.9	25.4	62.5	0.67	70	95.4	11.2
65M X 0	4.6	8.7	-	-	-	-	-	4.6	11.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	90.7	4.2	0.6	26.8	68.4	0.78	90.7	4.2
1.40-1.50	2.9	31.5	0.6	22.0	45.9	0.64	93.6	5.0
1.50-1.60	1.0	34.1	-	-	-	-	94.6	5.4
+1.60	5.4	84.2	-	-	-	-	100.0	9.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
89.3	8	0.09	366	448	31	183	1.077

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-12

LAB. NO.: 3535

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	95.5	22.2	0.8	25.5	51.5	0.92	72	95.5	22.2
65M X 0	4.5	16.8	-	-	-	-	-	100.0	22.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	64.6	7.6	0.7	29.0	62.7	1.08	64.6	7.6
1.40-1.50	10.1	25.7	0.7	24.3	49.3	1.17	74.7	10.0
1.50-1.60	6.0	37.9	-	-	-	-	80.7	12.1
+1.60	19.3	62.8	-	-	-	-	100.0	21.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.3	8 1/2	0.06	373	446	24	239	1.079

ELCO MINING LTD. August 14, 1975.

SAMPLE; EB-17-13

LAB. NO.: 3536

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	90.0	21.4	0.6	27.1	50.9	2.17	90	90.0	21.4
65M X 0	10.0	11.3	-	-	-	-	-	100.0	20.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	68.7	5.2	1.1	27.9	65.8	1.08	68.7	5.2
1.40-1.50	5.1	23.5	0.9	24.1	51.5	1.18	73.8	6.5
1.50-1.60	3.1	34.8	-	-	-	-	76.9	7.6
+1.60	23.1	63.1	-	-	-	-	100.0	20.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
66.4	8 1/2	0.05	379	451	26	56	1.033

ELCO MINING LTD. August 14, 1975.

SAMPLE; EB-17-14

LAB. NO.: 3537

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
								WT. %	ASH %
1/4" X 65M	95.4	30.5	0.7	22.7	44.3	0.81	73	95.4	30.5
65M X 0	4.6	22.5	-	-	-	-	-	100.0	30.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.2	6.9	0.7	28.1	64.3	0.97	51.2	6.9
1.40-1.50	9.6	22.7	0.8	23.8	52.7	0.89	60.8	9.4
1.50-1.60	7.7	35.1	-	-	-	-	68.5	12.3
+1.60	31.5	66.8	-	-	-	-	100.0	29.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
58.0	8 1/2	0.04	368	446	21	260	1.089

ELCO MINING LTD. August 14, 1975.

SAMPLE: EB-17-15

LAB. NO.: 3538

SIZE AND RAW ANALYSIS

SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
1/4" X 65M	92.9	19.2	0.8	24.2	54.4	1.20	95	92.9	19.2
65M X 0	7.1	23.0	-	-	-	-	-	100.0	19.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE WT. %	CUMULATIVE ASH %
-1.40	73.3	5.6	0.7	27.4	66.3	1.15	73.3	5.6
1.40-1.50	8.4	22.2	0.6	22.3	54.9	0.93	81.7	7.3
1.50-1.60	2.5	31.8	-	-	-	-	84.2	8.0
+1.60	15.8	75.1	-	-	-	-	100.0	18.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHE DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
75.9	8 1/2	0.12	369	421	28	224	1.054

ELCO MINING LTD. September 3. 1975.

SAMPLE: EB-18-1

LAB. NO.: 3579

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	17.4	25.9	55.9	1.04	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.1	19.6	94.1	19.6
65M X 0	5.9	22.1	100.0	19.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	73.3	5.0	0.8	28.4	65.8	1.06	73.3	5.0
1.40-1.50	4.2	23.5	0.8	24.7	51.0	0.97	77.5	6.0
1.5041.60	34.3	-	-	-	-	-	80.9	7.2
+1.60	19.1	72.3	-	-	-	-	100.0	19.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
72.9	7 1/2	0.11	373	449	14	278	1.091

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-2

LAB. NO.: 3580

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	26.2	23.2	49.5	0.64	82

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.6	23.4	88.6	23.4
65M X 0	11.4	40.5	100.0	25.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	64.9	6.5	0.9	27.6	65.0	0.76	64.9	6.5
1.40-1.50	6.7	21.1	1.0	24.3	53.6	0.72	71.6	7.9
1.50-1.60	4.5	29.8	-	-	-	-	76.1	9.2
+1.60	23.9	68.7	-	-	-	-	100.0	23.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.4	8	0.17	374	450	25	148	1.070

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-3

LAB. NO.: 3581

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	33.9	22.9	42.4	0.94	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.9	36.5	91.9	36.5
65M X 0	8.1	41.2	100.0	36.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	39.9	6.3	0.7	29.4	63.6	1.27	39.9	6.3
1.40-1.50	7.3	17.7	0.8	25.9	55.6	1.04	47.2	8.1
1.50-1.60	6.0	35.2	-	-	-	-	53.2	11.1
+1.60	46.8	65.3	-	-	-	-	100.0	36.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
43.4	7 1/2	0.05	378	452	26	277	1.079

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-4

LAB. NO.: 3582

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	21.5	27.7	50.1	3.84	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.1	23.0	91.1	23.0
65M X 0	8.9	13.9	100.0	22.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	66.8	5.5	0.6	28.3	65.6	1.01	66.8	5.5
1.40-1.50	4.3	21.5	0.8	24.1	53.6	0.87	71.1	6.4
1.50-1.60	2.6	32.6	-	-	-	-	73.7	7.4
+1.60	26.3	66.8	-	-	-	-	100.0	23.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
64.8	7 1/2	0.05	367	452	25	214	

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-5

LAB. NO.: 3583

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	12.6	25.5	61.1	1.08	83

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	12.5	94.4	12.5
65M X 0	5.6	20.7	100.0	13.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	87.7	8.5	0.7	27.3	63.5	1.12	87.7	8.5
1.40-1.50	3.0	24.2	0.7	23.4	51.7	0.99	90.7	9.0
1.50-1.60	3.6	35.3	-	-	-	-	94.3	10.0
+1.60	5.7	53.3	-	-	-	-	100.0	12.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
85.6	8	0.27	371	455	25	281	1.092

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-6

LAB. NO.: 3584

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	17.8	23.5	57.9	0.83	91

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.0	16.1	91.0	16.1
65M X 0	9.0	17.3	100.0	16.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	68.5	7.6	0.9	25.6	65.9	0.83	68.5	9.6
1.40-1.50	9.6	23.5	0.8	21.4	54.3	0.69	78.1	9.6
1.50-1.60	10.8	34.2	-	-	-	-	88.9	12.5
+1.60	11.1	44.3	-	-	-	-	100.0	16.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.1	7	0.01	377	450	25	143	1.066

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-7

LAB. NO.: 3585

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	19.6	23.0	56.5	0.64	94

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.3	19.0	89.3	19.0
65M X 0	10.7	21.4	100.0	19.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	69.1	4.9	1.2	25.3	68.6	0.85	69.1	4.9
1.40-1.50	6.0	18.8	1.0	22.7	57.5	0.63	75.1	6.0
1.50-1.60	4.6	31.4	-	-	-	-	79.7	7.5
+1.60	20.3	64.2	-	-	-	-	100.0	19.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
67.1	8	0.04	382	456	24	97	1.056

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-8

LAB. NO.: 3586

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	21.4	22.2	55.6	0.74	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.0	23.5	92.0	23.5
65M X 0	8.0	10.9	100.0	22.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	66.9	4.2	0.8	26.1	68.9	0.94	66.9	4.2
1.40-1.50	3.4	21.1	0.6	21.2	57.1	0.66	70.3	5.0
1.50-1.60	2.8	31.9	-	-	-	-	73.1	6.0
+1.60	26.9	70.9	-	-	-	-	100.0	23.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
64.7	9	0.07	376	448	27	223	1.074

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-9

LAB. NO.: 3587

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	14.7	24.1	60.3	0.64	106

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.8	16.2	85.8	16.2
65M X 0	14.2	10.1	100.0	15.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.8	7.9	1.3	25.6	65.2	0.92	83.8	7.9
1.40-1.50	2.0	23.6	0.9	22.0	53.5	0.69	85.8	8.3
1.50-1.60	2.2	35.5	-	-	-	-	88.0	8.9
+1.60	12.0	69.0	-	-	-	-	100.0	16.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
73.6	8	0.06	383	454	16	217	

ELCO MINING LTD. September 3, 1975.

SAMPLE: EB-18-10

LAB. NO.: 3588

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	34.4	20.4	44.3	0.64	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.9	36.4	92.9	36.4
65M X 0	7.1	20.6	100.0	35.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.1	7.2	0.6	25.6	66.6	0.90	36.1	7.2
1.40-1.50	7.6	20.8	0.7	22.9	55.6	0.83	43.7	9.6
1.50-1.60	6.5	35.3	-	-	-	-	50.2	12.9
+1.60	49.8	60.0	-	-	-	-	100.0	36.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.6	7 1/2	0.10	382	448	27	230	1.067

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-19-1

LAB. NO.: 3686

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	34.6	23.9	40.6	0.60	63

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.0	35.8	94.0	35.8
65M X 0	6.0	24.7	100.0	35.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.1	7.2	1.3	31.2	60.3	0.78	49.1	7.2
1.40-1.50	6.8	23.5	1.1	27.2	48.2	0.81	55.9	9.2
1.50-1.60	3.3	35.5	-	-	-	-	59.2	10.6
+1.60	40.8	72.3	-	-	-	-	100.0	35.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.5	7 1/2	0.18	366	451	25	233	1.092

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-19-2

LAB. NO.: 3687

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	25.7	26.1	47.2	1.15	105

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.8	24.6	82.8	24.6
65M X 0	17.2	39.7	100.0	27.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	65.7	4.0	2.3	31.3	62.4	1.66	65.7	4.0
1.40-1.50	2.7	19.0	1.6	28.1	51.3	2.12	68.4	4.6
1.50-1.60	1.7	27.6	-	-	-	-	70.1	5.2
+1.60	29.9	70.1	-	-	-	-	100.0	24.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.6	8 1/2	0.03	372	450	27	202	1.078

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-19-3

LAB. NO.: 3688

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	24.3	28.1	46.6	1.10	112

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	73.0	22.4	73.0	22.4
65M X 0	27.0	24.6	100.0	23.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	73.1	4.1	1.9	32.9	61.1	1.43	73.1	4.1
1.40-1.50	2.5	14.7	1.6	27.7	56.0	1.13	75.6	4.5
1.50-1.60	0.9	28.4	-	-	-	-	76.5	4.7
+1.60	23.5	79.9	-	-	-	-	100.0	22.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
55.2	8	0.03	376	449	23	215	1.077

ELCO MINING LTD. September 30, 1975.

SAMPLE: EB-19-4

LAB. NO.: 3689

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	12.3	29.9	56.9	1.08	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	49.0	13.3	94.0	13.3
65M X 0	6.0	15.7	100.0	13.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.7	3.5	1.4	31.3	63.8	1.20	83.7	3.5
1.40-1.50	1.7	10.6	1.4	28.8	59.2	1.17	85.4	3.6
1.50-1.60	1.0	25.5	-	-	-	-	86.4	3.9
+1.60	13.6	72.7	-	-	-	-	100.0	13.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
80.3	8 1/2	0.07	364	453	26	223	1.094

ELCO MINING LTD.

September 30, 1975.

SAMPLE: EB-19-5

LAB. NO.: 3690

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	8.1	28.5	62.4	0.83	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.1	8.4	93.1	8.4
65M X 0	6.9	8.7	100.0	8.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.5	2.6	1.3	29.3	66.8	0.90	89.5	2.6
1.40-1.50	0.8	13.7	1.2	23.5	61.6	0.71	90.3	2.7
1.50-1.60	0.5	20.1	-	-	-	-	90.8	2.8
+1.60	9.2	64.0	-	-	-	-	100.0	8.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
84.1	8 1/2	0.05	369	446	24	209	1.081

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD.

September 30, 1975.

SAMPLE: EB-19-6

LAB. NO.: 3691

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	10.5	30.4	58.3	0.87	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.8	9.5	93.8	9.5
65M X 0	6.2	13.0	100.0	9.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	87.5	4.3	1.3	31.6	62.8	1.08	87.5	4.3
1.40-1.50	3.5	21.7	1.0	27.3	50.0	0.83	91.0	5.0
1.50-1.60	2.0	32.4	-	-	-	-	93.0	5.6
+1.60	7.0	62.4	-	-	-	-	100.0	9.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
85.4	8	0.06	366	449	20	234	1.094

ELCO MINING LTD.

September 30, 1975.

SAMPLE: EB-19-7

LAB. NO.: 3692

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	15.2	27.5	56.5	1.08	63

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.5	14.8	95.5	14.8
65M X 0	4.5	15.0	100.0	14.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	72.9	5.6	0.9	30.0	63.5	1.10	72.9	5.6
1.40-1.50	10.7	23.9	1.0	25.8	49.3	1.08	83.6	7.9
1.50-1.60	3.1	34.8	-	-	-	-	86.7	8.9
+1.60	13.3	52.9	-	-	-	-	100.0	14.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
79.8	7	0.09	366	448	23	219	1.089

FINAL CORE SAMPLES (B.E.)

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-1

LAB. NO.: 4524

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	15.6	21.2	62.5	1.05	107

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.4	15.3	86.4	15.3
65M X 0	13.6	11.0	100.0	14.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	75.4	4.8	1.9	22.5	70.8	0.98	75.4	4.8
1.40-1.50	7.5	18.1	2.2	19.5	60.2	0.89	82.9	6.0
1.50-1.60	3.1	29.9	-	-	-	-	86.0	6.9
+1.60	14.0	66.9	-	-	-	-	100.0	15.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.6	9	0.11	411	457	7	54	1.043

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-2

LAB. NO.: 4525

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	31.5	18.1	49.7	0.94	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.7	29.4	90.7	29.4
65M X 0	9.3	17.7	100.0	28.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.5	4.3	1.8	24.3	69.6	1.26	56.5	4.3
1.40-1.50	5.3	19.4	1.8	20.2	58.6	1.13	61.8	5.6
1.50-1.60	2.4	33.1	-	-	-	-	64.2	6.6
+1.60	35.8	70.3	-	-	-	-	100.0	29.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.0	9	0.04	402	457	15	167	1.057

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-3

LAB. NO.: 4536

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	25.2	18.9	55.2	0.68	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.3	25.1	90.3	25.1
65M X 0	9.7	20.1	100.0	24.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.1	6.1	1.3	22.0	70.6	0.84	55.1	6.1
1.40-1.50	11.9	19.8	1.9	18.9	59.4	0.81	67.0	8.5
1.50-1.60	6.6	31.8	-	-	-	-	73.6	10.6
+1.60	26.4	65.4	-	-	-	-	100.0	25.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
60.5	8 1/2	0.08	405	462	21	69	1.036

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-4

LAB. NO.: 4527

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	25.4	17.9	56.0	0.70	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.5	24.9	90.5	24.9
65M X 0	9.5	21.6	100.0	24.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	60.4	5.9	1.0	20.9	72.2	0.97	60.4	5.9
1.40-1.50	9.9	20.7	1.3	18.8	59.2	0.87	70.3	8.0
1.50-1.60	5.0	31.9	-	-	-	-	75.3	9.6
+1.60	24.7	71.8	-	-	-	-	100.0	24.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.6	8	0.07	413	468	18	22	1.006

ELCO MINING LTD.

December 8, 1975.

SAMPLE: EB-31-5

LAB. NO.: 4528

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	12.7	18.9	67.7	0.55	93

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.2	12.0	89.2	12.0
65M X 0	10.8	14.6	100.0	12.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.5	4.8	1.5	20.2	73.5	0.72	83.5	4.8
1.40-1.50	5.0	17.7	not sufficient sample				88.5	5.5
1.50-1.60	2.0	27.7	-	-	-	-	90.5	6.0
+1.60	9.5	68.8	-	-	-	-	100.0	12.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.9	7	0.03	414	-	12	12	-

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-6

LAB. NO.: 4529

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	29.8	16.7	52.7	0.65	83

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	30.8	92.2	30.8
65M X 0	7.8	25.5	100.0	30.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	52.9	5.4	1.0	20.5	73.1	0.83	52.9	5.4
1.40-1.50	6.9	20.5	1.6	18.6	59.3	0.63	59.8	7.1
1.50-1.60	4.6	31.8	-	-	-	-	64.4	8.9
+1.60	35.6	70.4	-	-	-	-	100.0	30.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
55.1	9	0.08	407	465	20	89	1.044

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-7

LAB. NO.: 4530

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	30.5	16.0	52.9	0.37	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.3	29.5	94.3	29.5
65M X 0	5.7	29.1	100.0	29.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	57.9	5.5	1.1	19.1	74.3	0.65	57.9	5.5
1.40-1.50	6.1	21.2	1.0	17.6	60.2	0.55	64.0	7.0
1.50-1.60	5.5	33.3	-	-	-	-	69.5	9.1
+1.60	30.5	76.1	-	-	-	-	100.0	29.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
60.4	5	0.01	429	468	13	-	-

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-8

LAB. NO.: 4531

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	33.0	24.0	42.4	0.37	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.0	33.7	94.0	33.7
65M X 0	6.0	23.8	100.0	33.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	43.0	6.7	0.9	18.8	73.6	0.57	43.0	6.7
1.40-1.50	11.4	18.1	0.9	17.0	64.0	0.47	54.4	9.1
1.50-1.60	7.7	28.5	-	-	-	-	62.1	11.5
+1.60	37.9	70.2	-	-	-	-	100.0	33.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
51.1	3 1/2	0.07	423	477	12	-	-

ELCO MINING LTD. December 8, 1975.

SAMPLE: EB-31-9

LAB. NO.: 4532

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	30.7	17.5	51.2	0.33	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.0	30.4	91.0	30.4
65M X 0	9.0	20.9	100.0	29.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.3	6.2	1.9	19.0	72.9	0.52	55.3	6.2
1.40-1.50	9.5	17.0	2.4	17.6	63.0	0.49	64.8	7.8
1.50-1.60	3.2	27.9	-	-	-	-	68.0	8.7
+1.60	32.0	76.5	-	-	-	-	100.0	30.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.0	6 1/2	0.12	422	-	12	-12	-

ELCO MINING LTD.

December 8, 1975.

SAMPLE: EB-31-10

LAB. NO.: 4533

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	21.9	15.9	61.6	0.52	101

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	20.7	92.2	20.7
65M X 0	7.8	19.3	100.0	20.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.2	6.0	3.2	18.7	72.1	0.78	56.2	6.0
1.40-1.50	8.8	18.0	2.4	17.2	62.4	0.70	65.0	7.6
1.50-1.60	7.7	28.8	-	-	-	-	72.7	9.9
+1.60	27.3	49.7	-	-	-	-	100.0	20.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.9	2 1/2	0.08	421	450	12	-	-

ELCO MINING LTD. December 12, 1975.

SAMPLE: EB-31-11

LAB. NO.: 5119

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	39.3	14.2	45.9	0.50	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.9	39.2	92.9	39.2
65M X 0	7.1	26.8	100.0	38.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	37.1	11.1	0.5	18.3	70.1	0.72	37.1	11.1
1.40-1.50	17.1	26.8	0.5	16.2	56.5	0.63	54.2	16.1
1.50-1.60	5.4	37.3	-	-	-	-	59.6	18.0
+1.60	40.4	70.4	-	-	-	-	100.0	39.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
50.4	8		408	475	18	28	1.017

ELCO MINING LTD. December 14, 1975.

SAMPLE: EB-31-12

LAB. NO.: 5120

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	30.2	15.5	54.0	0.33	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.8	27.5	91.8	27.5
65M X 0	8.2	15.7	100.0	26.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	60.2	7.9	0.5	17.4	74.2	0.41	60.2	7.9
1.40-1.50	7.6	13.7	0.5	17.2	68.6	0.35	67.8	8.6
1.50-1.60	3.2	36.3	-	-	-	-	71.0	9.8
+1.60	29.0	70.8	-	-	-	-	100.0	27.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.2	3 1/2		417	477	21	-21	-

ELCO MINING LTD. December 12, 1975.

SAMPLE: EB-31-13

LAB. NO.: 5121

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	24.1	18.2	57.2	0.35	120

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.0	21.0	82.0	21.0
65M X 0	18.0	21.0	100.0	21.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	63.9	5.4	1.2	19.4	74.0	0.37	63.9	5.4
1.40-1.50	9.6	17.4	1.1	17.0	64.5	0.28	73.5	7.0
1.50-1.60	4.0	27.2	-	-	-	-	77.5	8.0
+1.60	22.5	65.7	-	-	-	-	100.0	21.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
60.3	8 1/2		408	476	28	12	0.970

CHANNEL SAMPLES (B.E.)

ELCO MINING LTD. September 3, 1975.

SAMPLE: Channel Sample Adit 2-A

LAB. NO.: 3673

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	32.9	16.6	49.9	0.53	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.5	33.3	90.5	33.3
65M X 0	9.5	17.0	100.0	31.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	45.3	6.4	0.6	20.0	73.0	0.60	45.3	6.4
1.40-1.50	13.0	18.0	0.6	16.6	64.8	0.53	58.3	9.0
1.50-1.60	4.8	29.6	-	-	-	-	63.1	10.6
+1.60	36.9	72.3	-	-	-	-	100.0	33.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.8	9	0.03	378	432	22	47	1.025

ELCO MINING LTD. September 3, 1975.

SAMPLE: Channel Sample Adit 2-B

LAB. NO.: 3674

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	42.4	14.2	42.6	0.46	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	83.3	40.3	83.3	40.3
65M X 0	16.7	21.1	100.0	37.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	38.9	7.2	0.7	19.7	72.4	0.62	38.9	7.2
1.40-1.50	12.2	14.8	0.6	16.7	67.9	0.55	51.1	9.0
1.50-1.60	4.8	27.3	-	-	-	-	55.9	10.6
+1.60	44.1	77.9	-	-	-	-	100.0	40.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.6	7 1/2	0.02	377	425	21	25	1.005

ELCO MINING LTD. September 3, 1975.

SAMPLE: Channel Sample Adit #3, Bulk Sample Face

LAB. NO.: 3676

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	42.7	12.4	44.2	0.37	91

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	77.4	50.6	77.4	50.6
65M X 0	22.6	19.0	100.0	43.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.2	5.9	1.5	18.4	74.2	0.83	36.2	5.9
1.40-1.50	5.1	11.1	1.1	17.7	70.1	0.56	41.3	6.5
1.50-1.60	4.7	19.7	-	-	-	-	46.0	7.9
+1.60	54.0	87.0	-	-	-	-	100.0	50.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
32.0	8	0.07	400	465	28	3	.943

ELCO MINING LTD. September 3, 1975.

SAMPLE: Channel Sample Adit 3, Bulk Face +4'

LAB. NO.: 3675

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	32.9	14.1	52.4	0.41	93

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.7	34.6	91.7	34.6
65M X 0	8.3	13.2	100.0	32.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.1	4.8	1.3	18.6	75.3	0.75	51.1	4.8
1.40-1.50	11.0	12.7	1.2	16.6	69.5	0.62	62.1	6.2
1.50-1.60	1.8	27.7	-	-	-	-	63.9	6.8
+1.60	36.1	83.7	-	-	-	-	100.0	34.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.9	7 1/2	0.13	421	470	20	0	.948

ELCO MINING LTD. October 23, 1975.

SAMPLE: 3rd Channel Sample behind Bulk Sample, Seam 3

LAB. NO.: 3965

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	31.2	14.0	54.1	0.36	98

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.0	29.1	88.0	29.1
65M X 0	12.0	14.8	100.0	27.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.9	5.9	1.6	20.6	71.9	0.78	62.9	5.9
1.40-1.50	7.6	16.9	0.9	16.5	65.7	0.55	70.5	7.1
1.50-1.60	2.1	27.2	-	-	-	-	72.6	7.7
+1.60	27.4	85.9	-	-	-	-	100.0	29.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.0	7 1/2	0.05	402	462	24	10	0.972

ELCO MINING LTD. December 4, 1975.

SAMPLE: Seam 4, Channel Sample #1, South Side

LAB. NO.: 4519

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	29.6	15.0	54.7	0.33	103

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.9	30.5	82.9	30.5
65M X 0	17.1	17.8	100.0	28.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	53.9	5.0	3.0	18.5	73.5	0.39	53.9	5.0
1.40-1.50	10.5	13.5	3.6	17.8	65.1	0.44	64.4	6.4
1.50-1.60	2.8	24.8	-	-	-	-	67.2	7.2
+1.60	32.8	78.4	-	-	-	-	100.0	30.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.4	2 1/2	0.02	435	-	12	-12	-

ELCO MINING LTD. December 4, 1975.

SAMPLE: Seam 4, Channel Sample #2, North Side

LAB. NO.: 4520

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	28.3	15.3	55.7	0.31	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.3	28.9	84.3	28.9
65M X 0	15.7	15.6	100.0	26.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	57.5	4.9	2.8	18.4	73.9	0.35	57.5	4.9
1.40-1.50	9.8	14.4	2.4	17.3	65.9	0.37	67.3	6.3
1.50-1.60	2.9	22.0	-	-	-	-	70.2	6.9
+1.60	29.8	80.6	-	-	-	-	100.0	28.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.7	2	0.02	428	-	13	-13	-

ELCO MINING LTD.

December 8, 1975.

SAMPLE: Seam 4A - Bulk Sample #2, Northern Face

LAB. NO.: 4535

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	35.7	14.3	49.3	0.46	86

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.4	37.6	85.4	37.6
65M X 0	14.6	16.5	100.0	34.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	43.9	6.1	2.3	18.7	72.9	0.62	43.9	6.1
1.40-1.50	9.6	17.0	3.2	17.3	62.5	0.63	53.5	8.1
1.50-1.60	4.4	29.6	-	-	-	-	57.9	9.7
+1.60	42.1	75.9	-	-	-	-	100.0	37.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
45.7	7	0.01	415	478	22	-12	0.806

ELCO MINING LTD. December 8, 1975.

SAMPLE: Seam 4A - Bulk Sample #1, Southern Face

LAB. NO.: 4534

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	34.4	14.3	50.6	0.46	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.4	36.4	85.4	36.4
65M X 0	14.6	15.5	100.0	33.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.5	5.5	3.1	18.9	72.5	0.50	42.5	5.5
1.40-1.50	9.8	18.5	3.7	16.6	61.2	0.70	52.3	7.9
1.50-1.60	8.4	30.1	-	-	-	-	60.7	11.0
+1.60	39.3	75.7	-	-	-	-	100.0	36.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
44.7	7 1/2	0.01	411	474	21	4	0.953

ELCO MINING LTD. December 3, 1975.

SAMPLE: Seam #5 Channel Sample - Adit 4 + 4A North Side

LAB. NO.: 4411

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	55.4	12.0	31.7	0.46	-

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.6	55.8	90.6	55.8
65M X 0	9.4	27.3	100.0	53.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	12.1	5.3	0.7	21.0	73.0	1.07	12.1	5.3
1.40-1.50	4.8	19.2	1.0	20.6	59.2	0.89	16.9	9.2
1.50-1.60	6.1	38.8	-	-	-	-	23.0	17.1
+1.60	77.0	67.3	-	-	-	-	100.0	55.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
15.3	8	0.10	411	464	4	69	1.057

ELCO MINING LTD. September 3, 1975.

SAMPLE: Channel Sample Adit #6

LAB. NO.: 3677

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	15.9	16.7	66.4	0.69	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.3	20.6	95.3	20.6
65M X 0	4.7	9.0	100.0	20.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	58.3	8.3	0.7	17.4	73.6	0.77	58.3	8.3
1.40-1.50	13.0	15.6	0.8	16.6	67.0	0.76	71.3	9.6
1.50-1.60	7.3	30.8	-	-	-	-	78.6	11.6
+1.60	21.4	53.9	-	-	-	-	100.0	20.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
67.9	3	0.14	432	-	14	-14	-

ELCO MINING LTD. October 1, 1975.

SAMPLE: Channel Sample Adit #7-1

LAB. NO.: 3710

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	43.9	13.4	41.7	.39	68

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.8	46.8	85.8	46.8
65M X 0	14.2	21.8	100.0	43.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	26.2	6.0	1.7	19.1	73.2	0.99	26.2	6.0
1.40-1.50	11.0	16.7	1.4	16.7	65.2	0.74	37.2	9.2
1.50-1.60	7.6	25.3	-	-	-	-	44.8	11.9
+1.60	55.2	75.2	-	-	-	-	100.0	46.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
31.9	4 1/2	0.05	417	-	18	-18	-

ELCO MINING LTD. October 3, 1975.

SAMPLE: Channel Sample Adit #7-2

LAB. NO.: 3711

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	45.1	14.2	39.9	0.39	89

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	80.5	45.9	80.5	45.9
65M X 0	19.5	24.5	100.0	41.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	30.2	5.7	1.5	19.1	73.7	0.94	30.2	5.7
1.40-1.50	8.5	15.8	1.1	17.0	66.1	0.62	38.7	7.9
1.50-1.60	5.0	24.6	-	-	-	-	43.7	9.8
+1.60	56.3	73.9	-	-	-	-	100.0	45.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
31.2	4 1/2	0.06	441	-	9	-9	-

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample - 1st of Adit 8, Bulk Sample Face

LAB. NO.: 3783

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	34.9	15.2	49.1	0.34	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.5	35.7	85.5	35.7
65M X 0	14.5	14.2	100.0	32.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.4	5.1	1.7	19.7	73.5	0.87	49.4	5.1
1.40-1.50	7.5	17.4	1.3	17.5	63.8	0.55	56.9	6.7
1.50-1.60	4.1	29.2	-	-	-	-	61.0	8.2
+1.60	39.0	78.7	-	-	-	-	100.0	35.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
48.6	5 1/2	0.04	409	-	17	-17	-

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample #2, Adit 8

LAB. NO.: 3811

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	28.3	16.2	54.7	0.36	83

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.9	32.2	88.9	32.2
65M X 0	11.1	14.8	100.0	30.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	52.5	4.8	1.0	19.7	74.5	0.58	52.5	4.8
1.40-1.50	9.3	17.1	1.0	17.5	64.4	0.59	61.8	6.7
1.50-1.60	4.1	28.6	-	-	-	-	65.9	8.0
+1.60	34.1	78.8	-	-	-	-	100.0	32.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
54.9	6 1/2	0.09	409	474	21	-16	0.647

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample #1, Adit 9

LAB. NO.: 3812

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	23.8	16.9	58.6	0.34	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.4	27.4	90.4	27.4
65M X 0	9.6	12.1	100.0	25.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.7	5.1	0.7	19.6	74.6	0.54	55.7	5.1
1.40-1.50	10.2	17.8	0.7	17.3	64.2	0.32	65.9	7.1
1.50-1.60	5.1	28.7	-	-	-	-	71.0	8.6
+1.60	29.0	73.3	-	-	-	-	100.0	27.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.6	4 1/2	0.03	407	-	20	-20	-

ELCO MINING LTD. October 23, 1975.

SAMPLE: 2nd Channel Sample behind Bulk Sample, Seam 9

LAB. NO.: 3966

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	20.5	18.9	60.0	0.32	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.7	22.1	90.7	22.1
65M X 0	9.3	11.5	100.0	21.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.5	4.8	0.6	20.4	74.2	0.51	62.5	4.8
1.40-1.50	9.9	18.0	0.5	17.6	63.9	0.36	72.4	6.6
1.50-1.60	4.0	27.9	-	-	-	-	76.4	7.7
+1.60	23.6	68.7	-	-	-	-	100.0	22.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
65.7	7	0.03	414	468	16	-13	0.628

ELCO MINING LTD. October 1, 1975.

SAMPLE: Channel Sample Adit #10-1

LAB. NO.: 3712

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	26.4	17.6	54.9	0.28	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.0	27.3	85.0	27.3
65M X 0	15.0	15.0	100.0	25.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.3	4.7	0.9	20.7	73.7	0.55	62.3	4.7
1.40-1.50	8.0	17.3	1.0	18.7	63.0	0.41	70.3	6.1
1.50-1.60	2.6	26.6	-	-	-	-	72.9	6.9
+1.60	27.1	82.3	-	-	-	-	100.0	27.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.8	8	0.03	408	468	17	-4	0.900

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD. October 1, 1975.

SAMPLE: Channel Sample Adit #10-2

LAB. NO.: 3713

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	27.5	17.5	54.1	0.35	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	83.0	29.2	83.0	29.2
65M X 0	17.0	13.6	100.0	26.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	59.1	4.9	0.9	21.5	72.7	0.47	59.1	4.9
1.40-1.50	5.5	16.5	1.0	18.6	63.9	0.46	64.6	5.9
1.50-1.60	3.9	24.2	-	-	-	-	68.5	6.9
+1.60	31.5	77.7	-	-	-	-	100.0	29.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.6	8	0.05	412	474	17	4	.958

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample #1, North Side, Seam 12

LAB. NO.: 3785

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
.7	40.9	16.6	41.8	.55	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.9	47.9	88.9	47.9
65M X 0	11.1	18.5	100.0	44.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.1	5.8	1.0	22.6	70.6	.83	36.1	5.8
1.40-1.50	5.2	21.2	.8	19.2	58.8	.78	41.3	7.7
1.50-1.60	3.5	33.0					44.8	9.7
+1.60	55.2	78.9					100.0	47.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
36.7	9	0.06	390	453	24	69	1.038

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample 2, South Side, Seam 12

LAB. NO.: 3784

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
.7	34.1	16.8	48.4	.64	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.8	34.7	90.8	34.7
65M X 0	9.2	18.5	100.0	33.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	52.4	5.3	1.0	22.8	70.9	.93	52.4	5.3
1.40-1.50	5.1	21.1	.7	19.1	59.1	.87	57.5	6.7
1.50-1.60	3.8	33.0					61.3	8.3
+1.60	38.7	76.4					100.0	34.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.2	8 1/2	0.05	394	456	13	77	1.055

ELCO MINING LTD. October 2, 1975.

SAMPLE: Channel Sample #3, South Side Top, Seam 12

LAB. NO.: 3786

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
.7	36.9	16.9	45.5	.68	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.3	44.6	89.3	44.6
65M X 0	10.7	18.0	100.0	41.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.2	5.1	.9	22.7	71.3	.89	40.2	5.1
1.40-1.50	5.6	20.7	.9	19.7	58.7	.98	45.8	7.0
1.50-1.60	3.3	33.2					49.1	8.8
+1.60	50.9	79.2					100.0	44.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.9	9	0.05	389	450	25	102	1.046

ELCO MINING LTD.

SAMPLE: First Channel Sample Seam 13 + 13A, Bulk Sample Face

LAB. NO.: 4041

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	42.8	16.2	40.2	0.64	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.3	41.4	92.3	41.4
65M X 0	7.7	27.8	100.0	40.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	45.0	5.5	1.6	24.4	68.5	0.91	45.0	5.5
1.40-1.50	4.5	19.4	2.6	20.2	57.8	0.80	49.5	6.8
1.50-1.60	2.0	31.8	-	-	-	-	51.5	7.7
+1.60	48.5	77.2	-	-	-	-	100.0	41.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
54.7	8 1/2	0.06	395	452	11	98	1.057

ELCO MINING LTD.

SAMPLE: 2nd Channel Sample Seam 13 + 13A, Behind Bulk Sample

LAB. NO.: 4042

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	53.5	13.9	31.9	0.55	77

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.4	55.3	91.4	55.3
65M X 0	8.6	31.7	100.0	53.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	33.3	5.8	1.2	24.0	69.0	0.93	33.3	5.8
1.40-1.50	4.5	19.8	1.4	20.7	58.1	0.67	37.8	7.5
1.50-1.60	1.7	28.8	-	-	-	-	39.5	8.4
+1.60	60.5	86.0	-	-	-	-	100.0	55.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
34.5	8	0.08	392	454	13	115	1.062

ELCO MINING LTD. November 20, 1975.

SAMPLE: 1st Channel Sample Seam 13D - Bulk Sample Face

LAB. NO.: 4091

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	67.2	13.2	18.8	0.64	65

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.2	57.3	90.2	57.3
65M X 0	9.8	40.8	100.0	55.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	20.8	6.8	1.4	23.5	68.3	1.17	20.8	6.8
1.40-1.50	5.1	20.7	1.1	20.6	57.6	1.10	25.9	9.5
1.50-1.60	3.8	36.8	-	-	-	-	29.7	13.0
+1.60	70.3	76.0	-	-	-	-	100.0	57.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
23.4	8 1/2	0.09	403	456	13	45	1.035

ELCO MINING LTD. November 20, 1975.

SAMPLE: 2nd Channel Sample Seam 13D - Bulk Sample Face +5'

LAB. NO.: 4092

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	64.6	12.7	21.9	0.81	69

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.4	59.3	92.4	59.3
65M X 0	7.6	38.3	100.0	57.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	17.5	7.6	1.1	23.2	68.1	1.14	17.5	7.6
1.40-1.50	4.9	23.0	0.9	19.6	56.5	1.06	22.4	11.0
1.50-1.60	2.9	31.9	-	-	-	-	25.3	13.4
+1.60	74.7	74.9	-	-	-	-	100.0	59.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
20.7	8	0.11	399	457	17	54	1.037

ELCO MINING LTD. November 20, 1975.

SAMPLE: 1st Channel Sample - Seam 13E, Bulk Sample Face

LAB. NO.: 4093

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
-	-	-	-	-	92

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.4	62.5	91.4	62.5
65M X 0	8.6	40.5	100.0	60.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	12.4	7.2	1.9	24.7	66.2	1.37	12.4	7.2
1.40-1.50	4.1	23.6	1.7	21.5	53.2	1.25	16.5	11.3
1.50-1.60	4.6	33.4	-	-	-	-	21.1	16.1
+1.60	78.9	74.9	-	-	-	-	100.0	62.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
15.1	9	0.02	399	452	14	156	1.055

ELCO MINING LTD. November 20, 1975.

SAMPLE: 2nd Channel Sample Seam 13E, Bulk Sample Face +4'

LAB. NO.: 4094

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	69.5	13.4	16.3	0.49	68

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.6	62.4	94.6	62.4
65M X 0	5.4	42.3	100.0	61.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	9.1	6.7	1.5	25.4	66.4	1.25	9.1	6.7
1.40-1.50	5.2	23.1	0.9	20.2	55.8	0.93	14.3	12.7
1.50-1.60	10.3	33.7	-	-	-	-	24.6	21.5
+1.60	75.4	75.7	-	-	-	-	100.0	62.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
13.5	9	0.04	381	458	30	143	1.064

ELCO MINING LTD. November 20, 1975.

SAMPLE: 1st Channel Sample Seam 13F, Bulk Sample Face

LAB. NO.: 4095

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	64.2	13.9	21.0	0.81	62

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.7	60.4	89.7	60.4
65M X 0	10.3	29.4	100.0	57.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	23.3	5.5	1.6	25.7	67.2	1.61	23.3	5.5
1.40-1.50	4.0	18.8	1.1	22.4	5.77	1.78	27.3	7.4
1.50-1.60	1.6	33.3	-	-	-	-	28.9	8.9
+1.60	71.1	81.3	-	-	-	-	100.0	60.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
24.5	9	0.05	398	456	26	236	1.058

ELCO MINING LTD. November 20, 1975.

SAMPLE: 2nd Channel Sample Seam 13F, Bulk Sample Face + 4.4'

LAB. NO.: 4096

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	70.6	12.3	16.2	2.29	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	63.8	94.4	63.8
65M X 0	5.6	33.5	100.0	62.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	17.1	5.8	1.3	25.3	67.6	1.46	17.1	5.8
1.40-1.50	3.8	24.8	1.1	20.9	53.2	1.59	20.9	9.3
1.50-1.60	1.7	31.0	-	-	-	-	22.6	10.9
+1.60	77.4	79.3	-	-	-	-	100.0	63.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
19.7	9	0.06	398	456	23	212	1.058

ELCO MINING LTD. November 20, 1975.

SAMPLE: 1st Channel Sample Seam 13G - Bulk Sample Face

LAB. NO.: 4097

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	41.9	16.1	41.3	0.45	92

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.6	49.0	87.6	49.0
65M X 0	12.4	27.0	100.0	46.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	37.1	5.9	2.2	23.5	68.4	1.29	37.1	5.9
1.40-1.50	4.7	20.2	1.7	19.8	58.3	0.95	41.8	7.5
1.50-1.60	4.0	27.5	-	-	-	-	45.8	9.3
+1.60	54.2	82.5	-	-	-	-	100.0	49.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
36.6	9	0.06	406	456	18	54	1.030
			403	469	25	41	1.019

ELCO MINING LTD. November 20, 1975.

SAMPLE: 2nd Channel Sample Seam 13G - Bulk Sample Face +3'

LAB. NO.: 4098

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	33.0	17.8	48.5	0.72	104

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.4	27.4	88.4	27.4
65M X 0	11.6	18.0	100.0	26.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	63.1	6.8	2.3	23.6	67.3	1.19	63.1	6.8
1.40-1.50	7.9	19.8	1.6	20.2	58.4	0.91	71.0	8.2
1.50-1.60	2.8	28.7	-	-	-	-	73.8	9.0
+1.60	26.2	79.3	-	-	-	-	100.0	27.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
62.8	8 1/2	0.08	403	469	25	41	1.019

ELCO MINING LTD. October 23, 1975.

SAMPLE: 1st Channel Sample, Seam 14-C

LAB. NO.: 3967

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	22.3	21.4	55.4	0.78	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	22.1	92.5	22.1
65M X 0	7.5	17.7	100.0	21.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	69.8	4.9	0.4	26.8	67.9	0.89	69.8	4.9
1.40-1.50	4.0	22.0	0.6	21.5	55.9	0.74	73.8	5.8
1.50-1.60	2.6	32.9	-	-	-	-	76.4	6.7
+1.60	23.6	72.0	-	-	-	-	100.0	22.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
68.3	9	0.05	381	446	24	243	1.069

ELCO MINING LTD. October 23, 1975.

SAMPLE: 2nd Channel Sample Seam 14-C

LAB. NO.: 3975

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	24.4	20.7	54.0	0.78	84

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.3	29.8	94.3	29.8
65M X 0	5.7	19.8	100.0	29.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	60.0	5.7	0.6	26.2	67.5	0.90	60.0	5.7
1.40-1.50	7.3	22.6	0.8	21.7	54.9	0.85	67.3	7.5
1.50-1.60	3.1	32.2	-	-	-	-	70.4	8.6
+1.60	29.6	80.1	-	-	-	-	100.0	29.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.5	8 1/2	0.007	370	449	21	261	1.089

ELCO MINING LTD. October 23, 1975.

SAMPLE: 1st Channel Sample, Seam 14-D

LAB. NO.: 3968

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	29.6	19.0	50.5	0.75	99

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.6	35.1	84.6	35.1
65M X 0	15.4	17.1	100.0	32.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.4	3.6	1.7	25.9	68.8	1.00	56.4	3.6
1.40-1.50	1.9	18.6	1.2	21.2	59.0	0.98	58.3	4.1
1.50-1.60	1.3	28.2	-	-	-	-	59.6	4.6
+1.60	40.4	80.1	-	-	-	-	100.0	35.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.3	9	0.03	384	448	23	143	1.059

ELCO MINING LTD. October 23, 1975.

SAMPLE: 2nd Channel Sample, Seam 14-D

LAB. NO.: 3969

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	31.6	19.0	48.4	0.91	99

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	80.8	38.4	80.8	38.4
65M X 0	19.2	16.4	100.0	34.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.4	4.2	1.4	28.0	66.4	1.02	51.4	4.2
1.40-1.50	3.3	21.6	1.1	21.5	55.8	0.85	54.7	5.2
1.50-1.60	1.9	28.5	-	-	-	-	56.6	6.0
+1.60	43.4	80.6	-	-	-	-	100.0	38.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
44.2	9	0.04	382	445	23	179	1.063

ELCO MINING LTD. October 23, 1975.

SAMPLE: 1st Channel Sample, Sea, 14 + 14A, South Side

LAB. NO.: 3973

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	44.6	17.8	36.5	0.59	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.1	46.8	94.1	46.8
65M X 0	5.9	23.4	100.0	45.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.3	4.2	0.7	26.8	68.3	0.81	40.3	4.2
1.40-1.50	3.4	21.0	1.0	21.7	56.3	0.81	43.7	5.5
1.50-1.60	2.2	33.0	-	-	-	-	45.9	6.8
+1.60	54.1	80.8	-	-	-	-	100.0	46.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
41.1	9	0.06	368	453	19	272	1.099

ELCO MINING LTD. October 23, 1975.

SAMPLE: 2nd Channel Sample, Seam 14 + 14A, North Side

LAB. NO.: 3974

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.1	44.6	16.7	37.6	0.68	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	97.0	47.2	97.0	47.2
65M X 0	3.0	24.2	100.0	46.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	37.2	4.4	0.7	27.1	67.8	0.85	37.2	4.4
1.40-1.50	4.3	22.9	0.8	22.5	53.8	1.04	41.5	6.3
1.50-1.60	2.1	32.1	-	-	-	-	43.6	7.6
+1.60	56.4	77.8	-	-	-	-	100.0	47.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.3	9	00.7	369	450	24	274	1.090

ELCO MINING LTD.

SAMPLE: First Channel Sample Seam 15, North Side

LAB. NO.: 4003

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	46.9	17.7	34.6	0.56	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.0	47.3	90.0	47.3
65M X 0	10.0	22.8	100.0	44.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.7	5.5	1.5	26.4	66.6	0.85	36.7	5.5
1.40-1.50	4.4	21.9	1.2	21.4	55.5	0.81	41.1	7.3
1.50-1.60	3.1	33.9	-	-	-	-	44.2	9.1
+1.60	55.8	77.5	-	-	-	-	100.0	47.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
37.0	9	0.07	399	456	25	89	1.039

ELCO MINING LTD.

SAMPLE: Second Channel Sample Seam 15, South Side

LAB. NO.: 4004

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	42.8	18.0	38.3	0.64	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.5	41.1	89.5	41.1
65M X 0	10.5	20.4	100.0	38.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.6	5.3	1.5	26.8	66.4	0.76	42.6	5.3
1.40-1.50	4.7	21.7	1.2	22.6	54.5	0.89	47.3	6.9
1.50-1.60	3.4	31.3	-	-	-	-	50.7	8.6
+1.60	49.3	74.5	-	-	-	-	100.0	41.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.3	8 1/2	0.04	395	460	28	99	1.044

ELCO MINING LTD. December 3, 1975.

SAMPLE: Seam 16, Channel Sample #1, Bulk Sample Face

LAB. NO.: 4490

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	40.9	20.0	38.1	0.46	68

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.8	44.3	90.8	44.3
65M X 0	9.2	20.8	100.0	42.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.6	6.0	1.4	29.7	62.9	0.76	40.6	6.0
1.40-1.50	6.0	22.3	1.0	24.2	52.5	0.78	46.6	8.2
1.50-1.60	4.2	33.3	-	-	-	-	50.8	10.3
+1.60	49.2	79.5	-	-	-	-	100.0	44.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.3	8	0.10	390	456	22	170	1.064

ELCO MINING LTD.

December 3, 1975.

SAMPLE: Seam 16, Channel Sample #2, Bulk Sample Face + 5.4'

LAB. NO.: 4491

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	41.8	19.4	37.8	0.63	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.2	44.5	89.2	44.5
65M X 0	10.8	18.1	100.0	41.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.3	6.5	1.6	30.0	61.9	0.83	40.3	6.5
1.40-1.50	6.6	23.5	1.2	25.6	49.7	0.75	46.9	8.9
1.50-1.60	4.8	34.3	-	-	-	-	51.7	11.3
+1.60	48.3	80.0	-	-	-	-	100.0	44.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
41.8	8	0.13	383	448	24	203	1.066

ELCO MINING LTD. December 3, 1975.

SAMPLE: Seam 16E, Channel Sample #1, Bulk Sample Face

LAB. NO.: 4492

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	20.6	23.6	54.8	0.71	72

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.3	20.1	93.3	20.1
65M X 0	6.7	13.1	100.0	19.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	67.8	5.3	0.9	28.1	65.7	0.86	67.8	5.3
1.40-1.50	8.3	22.6	1.1	23.9	52.4	0.83	76.1	7.2
1.50-1.60	4.8	32.1	-	-	-	-	80.9	8.7
+1.60	19.1	68.6	-	-	-	-	100.0	20.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.0	7 1/2	0.10	379	433	25	87	1.038
			379	432	24	97	1.041

ELCO MINING LTD. December 3, 1975.

SAMPLE: Seam 16E, Channel Sample #2, Bulk Sample Face + 5.4'

LAB. NO.: 4493

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.3	31.6	21.2	45.9	0.63	74

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.1	31.7	93.1	31.7
65M X 0	6.9	18.1	100.0	30.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	53.5	5.3	0.9	27.9	65.9	0.76	53.5	5.3
1.40-1.50	8.2	22.2	0.9	24.8	52.1	0.85	61.7	7.5
1.50-1.60	4.9	32.0	-	-	-	-	66.6	9.3
+1.60	33.4	76.4	-	-	-	-	100.0	31.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
57.4	8	0.16	394	455	25	112	1.048
			387	454	30	102	1.045

ELCO MINING LTD. December 3, 1975.

SAMPLE: Seam 16G, Channel Sample #1, Bulk Sample Face

LAB. NO.: 4494

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.2	39.5	18.9	40.4	0.72	95

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.4	39.9	84.4	39.9
65M X 0	15.6	20.6	100.0	36.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	45.1	5.3	2.8	28.1	63.8	0.87	45.1	5.3
1.40-1.50	5.1	17.4	2.3	25.2	55.1	0.83	50.2	6.5
1.50-1.60	3.4	27.2	-	-	-	-	53.6	7.8
+1.60	46.4	77.0	-	-	-	-	100.0	39.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
42.4	8	0.05	390	447	17	70	1.043

ELCO MINING LTD. December 3, 1975.

SAMPLE: Channel Sample #2, Seam 16G, Bulk Sample Face + 5.4'

LAB. NO.: 4495

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	34.1	21.2	43.9	0.70	103

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.9	38.9	82.9	38.9
65M X 0	17.1	23.3	100.0	36.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.7	5.9	2.6	28.5	63.0	0.86	49.7	5.9
1.40-1.50	4.8	18.0	2.5	25.0	54.5	0.96	54.5	7.0
1.50-1.60	2.3	27.9	-	-	-	-	56.8	7.8
+1.60	43.2	79.7	-	-	-	-	100.0	38.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
45.2	8 1/2	0.08	387	445	24	131	1.051

ELCO MINING LTD. December 3, 1975.

SAMPLE: 1st Channel Sample Seam 17, Bulk Sample Face

LAB. NO.: 4418

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.5	17.2	26.4	54.9	0.65	82

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.0	17.1	87.0	17.1
65M X 0	13.0	14.5	100.0	16.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	76.1	2.8	1.1	31.0	65.1	0.88	76.1	2.8
1.40-1.50	2.9	16.7	1.2	23.6	58.5	0.85	79.0	3.3
1.50-1.60	1.5	27.8	-	-	-	-	80.5	3.8
+1.60	19.5	72.3	-	-	-	-	100.0	17.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
68.7	8 1/2	0.10	383	453	26	173	1.066

ELCO MINING LTD. December 3, 1975.

SAMPLE: 2nd Channel Sample Seam 17, Bulk Sample Face + 9'

LAB. NO.: 4419

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.6	25.5	24.6	48.3	0.56	99

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.1	22.6	82.1	22.6
65M X 0	17.9	12.8	100.0	20.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	69.1	2.9	1.3	29.7	66.1	0.81	69.1	2.9
1.40-1.50	3.4	16.0	1.7	24.7	57.6	1.00	72.5	3.5
1.50-1.60	1.5	31.8	-	-	-	-	74.0	4.1
+1.60	26.0	75.3	-	-	-	-	100.0	22.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
59.5	8 1/2	0.07	390	453	30	128	1.049

ELCO MINING LTD. December 3, 1975.

SAMPLE: 1st Channel Sample Seam 17A, Bulk Sample Face

LAB. NO.: 4444

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	45.7	18.6	34.8	0.61	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.9	48.8	91.9	48.8
65M X 0	8.1	27.9	100.0	47.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	36.5	5.0	1.1	30.0	63.9	0.85	36.5	5.0
1.40-1.50	4.9	23.5	0.9	24.7	50.9	-	41.4	7.2
1.50-1.60	4.0	32.5	-	-	-	-	45.4	9.4
+1.60	54.6	81.5	-	-	-	-	100.0	48.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
38.0	9	0.06	384	456	24	191	1.071

ELCO MINING LTD. December 3, 1975.

SAMPLE: 2nd Channel Sample Seam 17A, Bulk Sample Face + 9'

LAB. NO.: 4445

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	37.3	20.7	41.2	0.68	59

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.9	36.5	93.9	36.5
65M X 0	6.1	20.3	100.0	35.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	50.5	4.7	1.2	30.6	63.5	0.77	50.5	4.7
1.40-1.50	4.9	19.8	0.9	25.0	54.3	0.74	55.4	6.0
1.50-1.60	3.8	33.5	-	-	-	-	59.2	7.8
+1.60	40.8	78.2	-	-	-	-	100.0	36.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.0	8	0.05	383	453	26	173	1.066

ELCO MINING LTD. December 3, 1975.

SAMPLE: 1st Channel Sample Seam 18, Bulk Sample Face

LAB. NO.: 4416

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	34.4	25.3	39.3	0.48	77

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.0	34.5	90.0	34.5
65M X 0	10.0	14.5	100.0	32.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.5	3.8	2.0	30.9	63.3	0.88	55.5	3.8
1.40-1.50	2.4	23.5	1.2	25.9	49.4	0.85	57.9	4.6
1.50-1.60	1.7	31.7	-	-	-	-	59.6	5.4
+1.60	40.4	77.5	-	-	-	-	100.0	34.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
52.1	9	0.04	395	440	20	65	1.029

ELCO MINING LTD. December 3, 1975.

SAMPLE: 2nd Channel Sample Seam 18, Bulk Sample Face +12'

LAB. NO.: 4417

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.2	26.9	25.8	46.1	0.59	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.9	28.8	89.9	28.8
65M X 0	10.1	15.1	100.0	27.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	61.5	4.3	2.3	31.6	61.8	1.05	61.5	4.3
1.40-1.50	4.6	20.1	1.9	nss	nss	nss	66.1	5.4
1.50-1.60	2.0	35.0	-	-	-	-	68.1	6.3
+1.60	31.9	77.0	-	-	-	-	100.0	28.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
-	8 1/2	0.05	378	453	27	146	1.066

ELCO MINING LTD.

SAMPLE: EB-27-1 December 1975.

LAB. NO.: 4888

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	9.1	29.6	60.7	0.69	111

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	83.8	8.5	83.8	8.5
65M X 0	16.2	8.7	100.0	8.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	91.9	3.1	2.0	30.8	64.1	0.74	91.9	3.1
1.40-1.50	1.1	22.8	1.2	26.5	49.5	0.75	93.0	3.3
1.50-1.60	0.4	32.7	-	-	-	-	93.4	3.5
+1.60	6.6	79.9	-	-	-	-	100.0	8.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
77.9	9	0.06	366	444	30	168	1.072

ELCO MINING LTD.

SAMPLE: EB-27-2

LAB. NO.: 4889

December 1975.

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	8.8	27.4	63.3	0.46	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.4	8.0	95.4	8.0
65M X 0	4.6	10.7	100.0	8.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	91.5	3.9	1.0	28.0	67.1	0.56	91.5	3.9
1.40-1.50	1.8	23.8	1.1	19.5	55.6	0.15	93.3	4.3
1.50-1.60	1.1	33.2	-	-	-	-	94.4	4.6
+1.60	5.6	65.7	-	-	-	-	100.0	8.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
89.0	9	0.07	374	452	27	109	1.060

ELCO MINING LTD.

SAMPLE: EB-27-3 December 1975.

LAB. NO.: 4890

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	16.9	26.7	55.9	0.44	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	97.6	15.3	97.6	15.3
65M X 0	2.4	12.4	100.0	15.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	82.6	3.8	0.8	29.1	66.3	0.58	82.6	3.8
1.40-1.50	1.7	21.1	0.8	24.4	53.7	0.52	84.3	4.1
1.50-1.60	0.4	47.2	-	-	-	-	84.7	4.4
+1.60	15.3	75.9	-	-	-	-	100.0	15.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
82.3	9	0.06	386	456	30	185	1.064

ELCO MINING LTD.

SAMPLE: EB-27-4

LAB. NO.: 4891

December 1975.

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	15.9	27.7	56.1	1.00	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	96.6	17.6	96.6	17.6
65M X 0	3.4	11.9	100.0	17.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	75.7	5.1	0.8	27.6	66.5	0.70	57.7	5.1
1.40-1.50	3.7	26.5	0.7	25.7	47.1	0.67	79.4	6.1
1.50-1.60	1.0	30.4	-	-	-	-	80.4	6.4
+1.60	19.6	63.6	-	-	-	-	100.0	17.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
76.7	8 1/2	0.10	381	455	28	198	1.071

ELCO MINING LTD.

SAMPLE: EB-27-5

December 1975.

LAB. NO.: 4892

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	40.3	19.	39.7	0.56	80

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.8	36.9	91.8	36.9
65M X 0	8.2	21.4	100.0	35.6.

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.5	5.9	1.1	27.1	65.9	0.84	54.5	5.9
1.40-1.50	3.7	21.4	0.8	23.3	54.5	0.63	58.2	6.9
1.50-1.60	2.4	33.3	-	-	-	-	60.6	7.9
+1.60	39.4	81.5	-	-	-	-	100.0	36.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.4	9	0.08	394	456	16	190	1.066

ELCO MINING LTD.

SAMPLE: EB-27-6 December 1975.

LAB. NO.: 4893

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	14.9	24.9	59.9	0.52	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.8	14.3	89.8	14.3
65M X 0	10.2	15.9	100.0	14.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	84.1	4.8	0.8	27.7	66.7	0.58	84.1	4.8
1.40-1.50	2.2	22.9	0.8	22.5	53.8	0.51	86.3	5.3
1.50-1.60	1.2	31.3	-	-	-	-	87.5	5.6
+1.60	12.5	74.7	-	-	-	-	100.0	14.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
77.5	8 1/2	0.09	390	456	7	163	1.077

ELCO MINING LTD.

SAMPLE: EB-27-7

December 1975.

LAB. NO.: 4894

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	36.4	22.7	40.6	0.78	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.3	30.5	94.3	30.5
65M X 0	5.7	20.4	100.0	29.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	56.2	5.2	0.8	27.2	66.8	0.86	56.2	5.2
1.40-1.50	5.0	21.3	0.7	22.9	55.1	0.78	61.2	6.5
1.50-1.60	2.4	28.9	-	-	-	-	63.6	7.4
+1.60	36.4	70.8	-	-	-	-	100.0	30.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
57.7	9	0.14	390	456	16	184	1.070

ELCO MINING LTD.

SAMPLE: EB-27-8 December 1975.

LAB. NO.: 5137

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	25.1	20.7	53.6	0.48	92

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.9	14.5	89.9	14.5
65M X 0	10.1	14.5	100.0	14.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	82.6	4.3	1.1	24.6	70.0	0.39	82.6	4.3
1.40-1.50	4.0	21.0	0.8	20.4	57.8	0.31	86.6	5.1
1.50-1.60	1.4	33.3	-	-	-	-	88.0	5.5
+1.60	12.0	80.0	-	-	-	-	100.0	14.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
77.9	9	0.04	403	458	25	49	1.021

ELCO MINING LTD.

SAMPLE: EB-27-9 December 1975.

LAB. NO.: 5138

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	21.1	21.1	57.4	0.78	89

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.5	17.0	94.5	17.0
65M X 0	5.5	16.3	100.0	17.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	76.1	5.2	0.6	24.9	69.3	0.90	76.1	5.2
1.40-1.50	5.5	19.9	0.8	20.8	58.5	1.02	81.6	6.2
1.50-1.60	5.6	43.8	-	-	-	-	87.2	8.6
+1.60	12.8	74.4	-	-	-	-	100.0	17.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
77.1	9	0.05	393	457	26	247	1.065

ELCO MINING LTD.

SAMPLE: EB-33-1 December 1975.

LAB. NO.: 5139

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	56.7	15.5	27.2	0.37	60

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	59.0	92.5	59.0
65M X 0	7.5	35.4	100.0	57.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	28.2	5.9	1.1	24.4	68.6	0.67	28.2	5.9
1.40-1.50	4.0	26.6	0.8	23.8	48.8	nss	32.2	8.5
1.50-1.60	3.3	39.5	-	-	-	-	35.5	11.4
+1.60	64.5	85.3	-	-	-	-	100.0	59.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
29.8	9	0.11	389	456	22	110	1.056

ELCO MINING LTD.

SAMPLE: EB-33-2

LAB. NO.: 5970

December 1975.

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	52.0	19.5	27.8	0.31	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.5	47.6	95.5	47.6
65M X 0	4.5	31.8	100.0	46.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	38.0	6.7	0.8	29.6	62.9	0.53	38.0	6.7
1.40-1.50	3.3	22.6	0.6	25.7	51.1	0.58	41.3	8.0
1.50-1.60	5.0	34.6	-	-	-	-	46.3	10.8
+1.60	53.7	79.2	-	-	-	-	100.0	47.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
39.4	9	0.14	381	454	12	25	1.086

ELCO MINING LTD.

SAMPLE: EB-33-3 December 1975.

LAB. NO.: 5971

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	51.0	17.4	30.7	0.75	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.9	40.0	94.9	40.0
65M X 0	5.1	28.5	100.0	39.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	37.3	5.8	0.8	27.6	65.8	1.25	37.3	5.8
1.40-1.50	5.8	23.6	0.7	23.8	51.9	1.23	43.1	8.2
1.50-1.60	5.5	35.2	-	-	-	-	48.6	11.3
+1.60	51.4	67.2	-	-	-	-	100.0	40.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.9	+9	0.09	379	455	18	239	1.085

ELCO MINING LTD.

SAMPLE: EB-33-4 December 1975.

LAB. NO.: 5972

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	24.8	22.6	51.7	0.46	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.5	15.4	87.5	15.4
65M X 0	12.5	10.8	100.0	14.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	83.5	3.8	1.8	27.2	67.2	0.63	83.5	3.8
1.40-1.50	1.8	21.8	1.0	22.3	54.9	0.44	85.3	4.2
1.50-1.60	1.0	34.0	-	-	-	-	86.3	4.5
+1.60	13.7	83.8	-	-	-	-	100.0	15.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
74.6	+9	0.04	383	452	26	93	1.049

ELCO MINING LTD.

SAMPLE: EB-33-5 December 1975.

LAB. NO.: 5973

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	10.2	23.5	65.4	0.37	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.6	9.2	90.6	9.2
65M X 0	9.4	10.0	100.0	9.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.7	3.5	0.7	24.7	71.1	0.44	89.7	3.5
1.40-1.50	2.8	19.7	0.6	20.3	59.4	0.28	92.5	4.0
1.50-1.60	0.8	32.7	-	-	-	-	93.3	4.2
+1.60	6.7	78.4	-	-	-	-	100.0	9.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
83.8	9	0.02	388	458	24	61	1.037

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-1

LAB. NO.: 4895

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	20.1	24.6	55.0	0.68	108

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.9	19.9	82.9	19.9
65M X 0	17.1	12.2	100.0	18.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	70.5	6.0	1.2	25.1	67.7	0.93	70.5	6.0
1.40-1.50	6.0	27.8	1.0	21.8	49.4	0.63	76.5	7.7
1.50-1.60	4.2	40.3	-	-	-	-	80.7	9.4
+1.60	19.3	63.9	-	-	-	-	100.0	19.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
63.4	9	0.06	385	453	24	198	1.068

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-2

LAB. NO.: 4896

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	58.7	15.3	25.5	0.55	79

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.0	56.5	88.0	56.5
65M X 0	12.0	35.9	100.0	54.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	31.1	4.5	1.0	24.8	69.7	0.79	31.1	4.5
1.40-1.50	2.5	16.2	0.8	22.2	60.8	0.73	33.6	5.4
1.50-1.60	1.2	35.3	-	-	-	-	34.8	6.4
+1.60	65.2	83.3	-	-	-	-	100.0	56.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
29.6	9	0.06	387	454	16	183	1.072

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-3

LAB. NO.: 4897

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	47.4	16.8	35.1	0.61	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.7	51.1	89.7	51.1
65M X 0	10.3	34.4	100.0	49.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	34.0	9.1	1.1	24.0	65.8	0.84	34.0	9.1
1.40-1.50	4.9	23.9	1.0	21.9	53.2	0.86	38.9	11.0
1.50-1.60	1.1	32.3	-	-	-	-	40.0	11.6
+1.60	60.0	77.5	-	-	-	-	100.0	51.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
34.9	8 1/2	0.12	388	453	28	150	1.056

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-4

LAB. NO.: 4898

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	13.3	23.0	63.3	0.81	114

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	81.7	11.8	81.7	11.8
65M X 0	18.3	9.1	100.0	11.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	85.4	3.2	1.1	24.9	70.8	0.97	85.4	3.2
1.40-1.50	2.4	18.9	0.7	19.9	60.5	0.64	87.8	3.6
1.50-1.60	1.1	29.2	-	-	-	-	88.9	3.9
+1.60	11.1	75.1	-	-	-	-	100.0	11.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.7	9	0.04	399	457	26	177	1.053

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-5

LAB. NO.: 4899

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	35.9	18.3	45.3	0.65	98

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	80.4	28.0	80.4	28.0
65M X 0	19.6	28.8	100.0	28.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	64.2	8.0	0.9	23.0	68.1	1.08	64.2	8.0
1.40-1.50	5.7	24.7	not sufficient sample			0.74	69.9	9.4
1.50-1.60	2.7	34.7	-	-	-	-	72.6	10.3
+1.60	27.4	74.9	-	-	-	-	100.0	28.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.2	9	0.08	392	457	26	134	1.054

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-6

LAB. NO.: 4900

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	43.6	16.9	39.1	0.55	102

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.4	40.5	84.4	40.5
65M X 0	15.6	33.1	100.0	39.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.6	5.2	1.1	23.7	70.0	0.81	51.6	5.2
1.40-1.50	3.7	19.4	0.8	23.8	56.0	0.60	55.3	6.2
1.50-1.60	1.0	33.9	-	-	-	-	56.3	6.6
+1.60	43.7	84.2	-	-	-	-	100.0	40.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.7	9	0.10	396	459	25	104	1.047

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-7

LAB. NO.: 5140

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	46.3	21.3	32.0	0.39	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.2	46.5	91.2	46.5
65M X 0	8.8	32.0	100.0	45.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.1	4.6	1.3	22.6	71.5	0.75	42.1	4.6
1.40-1.50	1.2	21.4	1.1	19.7	57.8	0.65	43.3	5.1
1.50-1.60	0.9	28.8	-	-	-	-	44.2	5.5
+1.60	55.8	79.0	-	-	-	-	100.0	46.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
39.5	9	0.09	411	473	19	15	0.992

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-8

LAB. NO.: 5141

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
					112

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	80.6	11.8	80.6	11.8
65M X 0	19.4	17.8	100.0	13.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	89.0	5.1	1.3	23.8	69.8	0.67	89.0	5.1
1.40-1.50	2.2	15.7	0.9	20.3	63.1	0.77	91.2	5.4
1.50-1.60	0.5	30.3	-	-	-	-	91.7	5.5
+1.60	8.3	80.0	-	-	-	-	100.0	11.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
73.5	9	0.08	393	458	26	79	1.040

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-9

LAB. NO.: 5142

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	78.1	8.7	12.6	0.13	50

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.5	79.9	93.5	79.9
65M X 0	6.5	69.2	100.0	79.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	2.8	6.7	0.9	22.3	70.1	nss	2.8	6.7
1.40-1.50	0.8	23.0	1.0	19.4	56.6	nss	3.6	10.3
1.50-1.60	0.4	33.0	-	-	-	-	4.0	12.6
+1.60	96.0	82.7	-	-	-	-	100.0	79.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
3.4	9	0.10	393	460	27	53	1.026

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-10

LAB. NO.: 5143

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	28.6	17.0	53.8	0.44	100

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	79.7	26.9	79.7	26.9
65M X 0	20.3	19.6	100.0	25.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	64.1	5.4	1.5	20.9	72.2	0.79	64.1	5.4
1.40-1.50	6.9	17.4	1.0	18.6	63.0	0.58	71.0	6.6
1.50-1.60	1.9	31.6	-	-	-	-	72.9	7.2
+1.60	27.1	79.9	-	-	-	-	100.0	26.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.5	7	0.04	399	470	23	-20	0.461

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-11

LAB. NO.: 5144

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	46.2	13.2	40.1	0.57	58

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.4	45.3	94.4	45.3
65M X 0	5.6	41.8	100.0	45.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	0.3	19.4	1.4	-	n.s.s.	-	0.3	19.4
1.40-1.50	0.2	26.0	1.9	-	n.s.s.	-	0.5	22.0
1.50-1.60	29.6	35.2	-	-	-	-	30.1	35.0
+1.60	69.9	49.7	-	-	-	-	100.0	45.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
0.5			not sufficient sample				

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-12

LAB. NO.: 5145

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	61.3	11.7	26.4	0.31	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.7	67.3	84.7	67.3
65M X 0	15.3	27.8	100.0	61.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	19.3	5.7	1.3	20.4	72.6	0.74	19.3	5.7
1.40-1.50	1.2	19.9	1.1	18.0	61.0	0.65	20.5	6.5
1.50-1.60	1.0	30.7	-	-	-	-	21.5	7.7
+1.60	78.5	83.6	-	-	-	-	100.0	67.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
17.4	9	0.09	406	473	26	0	0.929

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-13

LAB. NO.: 5146

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	51.7	20.9	26.9	0.26	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.1	53.1	86.1	53.1
65M X 0	13.9	32.6	100.0	50.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	31.5	5.6	1.3	18.9	74.2	0.63	31.5	5.6
1.40-1.50	1.4	21.2	1.2	17.3	60.3	0.53	32.9	6.3
1.50-1.60	0.6	32.2	-	-	-	-	33.5	6.7
+1.60	66.5	76.5	-	-	-	-	100.0	53.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
28.3	3	0.03	421	464	10	-10	-

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-14

LAB. NO.: 5147

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	34.5	18.1	47.0	0.37	71

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.1	37.4	90.1	37.4
65M X 0	9.9	18.3	100.0	35.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	43.7	7.6	1.1	18.9	72.4	0.53	43.7	7.6
1.40-1.50	6.4	17.7	1.1	18.6	62.6	0.51	50.1	8.9
1.50-1.60	6.2	27.8	-	-	-	-	56.3	11.0
+1.60	43.7	71.5	-	-	-	-	100.0	37.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
45.1	3	0.10	466	488	2	-2	-

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-15

LAB. NO.: 5148

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	53.2	12.8	33.5	0.39	76

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.4	62.3	87.4	62.3
65M X 0	12.6	31.5	100.0	58.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	19.9	10.8	1.7	19.4	68.1	0.65	19.9	10.8
1.40-1.50	5.2	27.4	1.5	16.8	54.3	0.46	25.1	14.2
1.50-1.60	6.2	34.8	-	-	-	-	31.3	18.3
+1.60	68.7	82.4	-	-	-	-	100.0	62.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
21.9	8	0.04	415	441	5	-5	-

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-16

LAB. NO.: 5974

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	29.6	16.2	53.5	0.37	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.3	33.1	86.3	33.1
65M X 0	13.7	15.6	100.0	30.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.3	6.6	1.3	19.1	73.0	0.46	54.3	6.6
1.40-1.50	8.5	19.5	1.0	17.2	62.3	0.28	62.8	8.3
1.50-1.60	3.4	27.9	-	-	-	-	66.2	9.4
+1.60	33.8	79.7	-	-	-	-	100.0	33.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
54.2	4 1/2	0.12	418		18 @ 498°	-	-

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-17

LAB. NO.: 5975

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	66.0	10.6	22.6	0.26	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.1	68.9	91.1	68.9
65M X 0	8.9	47.9	100.0	67.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	8.6	5.8	1.4	19.1	73.7	0.88	8.6	5.8
1.40-1.50	2.5	17.1	1.3	17.5	64.1	0.81	11.1	8.3
1.50-1.60	2.8	28.6	-	-	-	-	13.9	12.4
+1.60	86.1	78.0	-	-	-	-	100.0	68.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
10.1	+9	0.19	412	470	26	24	0.997

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-18

LAB. NO.: 5976

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	27.9	16.2	55.4	0.64	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	85.3	20.0	85.3	20.0
65M X 0	14.7	19.7	100.0	20.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	72.8	6.6	1.6	19.2	72.6	0.74	72.8	6.6
1.40-1.50	5.6	14.7	1.1	17.9	66.3	0.70	78.4	7.2
1.50-1.60	2.4	28.2	-	-	-	-	80.8	7.8
+1.60	19.2	71.5	-	-	-	-	100.0	20.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
66.9	9	0.04	411	472	19	17	0.996

ELCO MINING LTD. December 1975.

SAMPLE: EB-36-19

LAB. NO.: 5977

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	40.4	13.8	45.1	0.29	

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.8	41.9	88.8	41.9
65M X 0	11.2	26.7	100.0	40.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	44.7	7.0	0.9	17.2	74.9	0.49	44.7	7.0
1.40-1.50	6.9	18.0	0.8	16.3	64.9	0.37	51.6	8.5
1.50-1.60	3.3	27.8	-	-	-	-	54.9	9.6
+1.60	45.1	81.1	-	-	-	-	100.0	41.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
45.8	3 1/2	0.05	425	478	13	-13	-

ELCO MINING LTD. December, 1975.

SAMPLE: EB-39-1

LAB. NO.: 5983

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	21.6	26.2	51.2	0.50	77

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	21.2	92.2	21.2
65M X 0	7.8	14.1	100.0	20.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	76.3	3.5	2.9	30.2	63.4	0.60	76.3	3.5
1.40-1.50	1.7	19.6	1.5	26.1	52.8	0.58	78.0	3.9
1.50-1.60	0.9	33.0	-	-	-	-	78.9	4.2
+1.60	21.1	84.8	-	-	-	-	100.0	21.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.9	8 1/2	0.05	385	446	23	183	1.060

ELCO MINING LTD. December 1975.

SAMPLE: EB-39-2

LAB. NO.: 5984

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	39.6	22.4	37.1	0.52	63

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	95.6	38.3	95.6	38.3
65M X 0	4.4	25.3	100.0	37.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	51.8	4.3	1.2	29.9	64.6	0.89	51.8	4.3
1.40-1.50	3.8	18.3	1.3	23.8	56.6	0.65	55.6	5.3
1.50-1.60	1.5	31.2	-	-	-	-	57.1	5.9
+1.60	42.9	81.4	-	-	-	-	100.0	38.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
53.2	7 1/2	0.04	385	453	12	200	1.078

ELCO MINING LTD. December 1975.

SAMPLE: EB-39-3

LAB. NO.: 5985

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	41.9	22.5	34.8	1.47	61

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.7	42.2	94.7	42.2
65M X 0	5.3	30.0	100.0	41.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	41.3	5.3	1.3	31.1	62.3	1.43	41.3	5.3
1.40-1.50	8.1	10.8	1.0	29.4	58.8	1.49	49.4	6.2
1.50-1.60	0.8	32.3	-	-	-	-	50.2	6.6
+1.60	49.8	78.1	-	-	-	-	100.0	42.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.8	8 1/2	0.12	379	450	22	253	1.078

ELCO MINING LTD. December 1975.

SAMPLE: EB-39-4

LAB. NO.: 5986

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	46.4	16.5	36.4	0.37	67

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.2	46.3	94.2	46.3
65M X 0	5.8	44.2	100.0	46.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	47.3	4.7	1.2	26.3	67.8	0.50	47.3	4.7
1.40-1.50	1.8	20.3	1.0	22.9	55.8	0.48	49.1	5.3
1.50-1.60	1.1	31.2	-	-	-	-	50.2	5.8
+1.60	49.8	87.1	-	-	-	-	100.0	46.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.3	3 1/2	0.13	396	455	11	18	1.017

ELCO MINING LTD. December 1975.

SAMPLE: EB-39-5

LAB. NO.: 5987

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	50.0	18.7	30.4	0.30	56

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	96.2	54.1	96.2	54.1
65M X 0	3.8	42.6	100.0	53.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	34.5	4.2	1.2	29.5	65.1	0.52	34.5	4.2
1.40-1.50	1.3	23.7	1.0	25.6	49.7	0.70	35.8	4.9
1.50-1.60	1.5	35.6	-	-	-	-	37.3	6.1
+1.60	62.7	82.7	-	-	-	-	100.0	54.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
34.4	8	0.13	382	455	19	211	1.078

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-39-6

LAB. NO.: 6620

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	70.3	11.9	17.1	0.37	56

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.6	64.7	94.6	64.7
65M X 0	5.4	50.6	100.0	63.9

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	18.7	4.8	0.4	26.8	68.0	0.44	18.7	4.8
1.40-1.50	3.3	17.1	0.5	22.5	59.9	0.65	22.0	6.6
1.50-1.60	2.2	31.9	-	-	-	-	24.2	8.9
+1.60	75.8	82.5	-	-	-	-	100.0	64.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
20.8	8	0.05	374	460	29	68	1.043

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-39-7

LAB. NO.: 6621

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	7.5	26.5	65.0	0.88	88

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.4	7.3	93.4	7.3
65M X 0	6.6	7.7	100.0	7.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	92.0	2.8	1.0	27.9	68.3	1.09	92.0	2.8
1.40-1.50	2.0	18.6	0.7	22.6	58.1	0.51	94.0	3.1
1.50-1.60	0.8	26.6	-	-	-	-	94.8	3.3
+1.60	5.2	79.3	-	-	-	-	100.0	7.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
87.8	9	0.03	392	453	27	143	1.052

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-42-1

LAB. NO.: 6611

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	46.6	15.9	36.6	0.58	75

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.7	45.6	88.7	45.6
65M X 0	11.3	19.2	100.0	42.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	44.8	3.8	1.6	24.6	70.0	0.84	44.8	3.8
1.40-1.50	2.7	20.9	1.2	21.5	56.4	0.63	47.5	4.8
1.50-1.60	2.0	32.1	-	-	-	-	49.5	5.9
+1.60	50.5	84.5	-	-	-	-	100.0	45.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUN DILATATION %	G.-NO.
42.1	9	0.07	399	454	25	84	1.036

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-42-2

LAB. NO.: 6612

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	9.5	18.2	71.7	0.44	111

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	84.9	9.4	84.9	9.4
65M X 0	15.1	10.9	100.0	9.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	82.3	5.0	1.2	19.6	74.2	0.49	82.3	5.0
1.40-1.50	9.2	17.4	0.8	16.1	65.7	0.28	91.5	6.2
1.50-1.60	3.0	27.6	-	-	-	-	94.5	6.9
+1.60	5.5	51.4	-	-	-	-	100.0	9.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
77.7	8 1/2	0.07	417	470	24	20	0.995

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-42-3

LAB. NO.: 6613

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	29.6	19.1	50.7	0.74	87

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.3	25.9	89.3	25.9
65M X 0	10.7	24.3	100.0	25.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	57.8	6.7	0.6	26.9	65.8	1.00	57.8	6.7
1.40-1.50	10.4	22.7	0.7	20.5	56.1	0.90	68.2	9.1
1.50-1.60	4.1	31.8	-	-	-	-	72.3	10.4
+1.60	27.7	66.4	-	-	-	-	100.0	25.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
60.9	9	0.07	392	460	23	155	1.063

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-42-4

LAB. NO.: 6614

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	41.7	16.1	41.3	0.56	98

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.6	41.0	82.6	41.0
65M X 0	17.4	40.0	100.0	40.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	39.9	6.0	1.1	23.1	69.8	0.94	39.9	6.0
1.40-1.50	9.3	20.6	1.0	18.6	59.8	0.79	49.2	8.8
1.50-1.60	5.3	31.6	-	-	-	-	54.5	11.0
+1.60	45.5	76.9	-	-	-	-	100.0	41.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.6	8 1/2	0.11	410	459	27	37	1.009

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-42-5

LAB. NO.: 6615

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
1.0	67.9	11.7	19.4	1.07	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.0	65.8	92.0	65.8
65M X 0	8.0	46.7	100.0	64.3

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	15.7	5.9	1.0	nss	-	1.37	15.7	5.9
1.40-1.50	3.7	21.0	1.0	20.6	57.4	2.76	19.4	8.8
1.50-1.60	4.2	32.7	-	-	-	-	23.6	13.0
+1.60	76.4	82.1	-	-	-	-	100.0	65.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
17.8	8 1/2	0.04	410	474	29	6	0.995

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-1

LAB. NO.: 7217

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	40.2	19.5	39.8	4.78	73

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.5	37.5	93.5	37.5
65M X 0	6.5	23.4	100.0	36.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	40.3	5.2	0.6	22.2	72.0	0.90	40.3	5.2
1.40-1.50	6.3	22.4	0.6	18.2	58.8	0.60	46.6	7.5
1.50-1.60	4.9	35.6	-	-	-	-	51.5	10.2
+1.60	48.5	66.4	-	-	-	-	100.0	37.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
43.6	9	0.09	398	460	19	100	1.052

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-2

LAB. NO.: 7218

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	32.3	1.81	49.1	0.44	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.5	32.9	92.5	32.9
65M X 0	7.5	15.0	100.0	31.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.6	5.6	0.6	20.7	73.1	0.58	54.6	5.6
1.40-1.50	5.9	21.1	0.5	18.0	60.4	0.46	60.5	7.1
1.50-1.60	3.4	31.4	-	-	-	-	63.9	8.4
+1.60	36.1	76.2	-	-	-	-	100.0	32.9

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
56.0	7 1/2	0.06	405	465	25	2	0.944

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-3

LAB. NO.: 7219

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	23.9	18.0	57.7	0.50	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	93.1	21.6	93.1	21.6
65M X 0	6.9	14.1	100.0	21.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	54.8	6.4	0.5	19.4	73.7	0.63	54.8	6.4
1.40-1.50	16.0	18.1	0.4	18.0	63.5	0.54	70.8	9.0
1.50-1.60	7.0	28.3	-	-	-	-	77.8	10.8
+1.60	22.2	59.6	-	-	-	-	100.0	21.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
65.9	3	0.08	419	-	22	-	-

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-4

LAB. NO.: 7220

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	10.1	19.7	69.9	0.39	108

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.3	11.0	90.3	11.0
65M X 0	9.7	6.0	100.0	10.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	81.8	5.8	0.9	20.2	73.1	0.44	81.8	5.8
1.40-1.50	8.3	17.9	0.7	17.8	63.6	0.33	90.1	6.9
1.50-1.60	3.1	28.9	-	-	-	-	93.2	7.6
+1.60	6.8	57.6	-	-	-	-	100.0	11.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
81.4	7	0.12	407	456	24	-24	-

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-5

LAB. NO.: 7221

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.4	29.7	19.4	50.5	0.60	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	94.5	27.6	94.5	27.6
65M X 0	5.5	16.0	100.0	27.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	55.7	5.3	0.4	21.8	72.5	0.75	55.7	5.3
1.40-1.50	8.5	21.2	0.4	19.7	58.7	0.61	64.2	7.4
1.50-1.60	3.7	31.6	-	-	-	-	67.9	8.7
+1.60	32.1	67.5	-	-	-	-	100.0	27.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
60.7	9	0.11	408	476	29	116	1.048

Birtley Engineering
Subsidiary of Great West Steel Industries

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-6

LAB. NO.: 7222

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	45.4	13.4	40.5	0.42	89

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.7	43.1	90.7	43.1
65M X 0	9.3	22.4	100.0	41.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	46.7	6.1	2.2	20.3	71.4	0.65	46.7	6.1
1.40-1.50	7.3	19.3	1.0	17.6	62.1	0.49	54.0	7.9
1.50-1.60	1.7	27.9	-	-	-	-	55.7	8.5
+1.60	44.3	86.6	-	-	-	-	100.0	43.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.0	7	0.10	409	-	18	-	-

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-7

LAB. NO.: 7223

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.5	73.8	9.0	16.7	0.16	64

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.0	75.4	92.0	75.4
65M X 0	8.0	51.1	100.0	73.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	11.3	6.6	0.5	19.2	73.7	0.59	11.3	6.6
1.40-1.50	4.4	17.6	0.3	17.0	65.1	0.48	15.7	9.7
1.50-1.60	2.3	29.6	-	-	-	-	18.0	12.2
+1.60	82.0	89.3	-	-	-	-	100.0	75.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
14.4	3	0.03	413	-	17	-	-

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-8

LAB. NO.: 7224

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	20.0	16.7	63.0	0.42	84

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.1	18.7	92.1	18.7
65M X 0	7.9	10.6	100.0	18.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	67.4	6.2	0.5	17.7	75.6	0.49	67.4	6.2
1.40-1.50	14.1	16.1	0.3	16.5	67.1	0.43	81.5	7.9
1.50-1.60	3.3	29.1	-	-	-	-	84.8	8.7
+1.60	15.2	74.1	-	-	-	-	100.0	18.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
75.1	2	0.08	423	-	16	-	-

Birtley Engineering

Subsidiary of Great West Steel Industries

ELCO MINING LTD.

March 2, 1976.

SAMPLE: EB-47-9

LAB. NO.: 7225

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	63.8	9.9	25.5	0.16	78

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.2	64.2	92.2	64.2
65M X 0	7.8	29.3	100.0	61.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	28.3	5.0	1.3	20.1	73.6	0.54	28.3	5.0
1.40-1.50	2.4	17.2	1.0	16.6	65.2	0.39	30.7	6.0
1.50-1.60	0.6	19.3	-	-	-	-	31.3	6.2
+1.60	68.7	90.6	-	-	-	-	100.0	64.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
28.3	9	0.02	409	469	22	43	1.023

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-47-10

LAB. NO.: 7226

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	81.2	7.0	11.2	0.22	63

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.3	83.4	92.3	83.4
65M X 0	7.7	46.6	100.0	80.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	7.6	6.8	1.0	19.4	72.8	0.56	7.6	6.8
1.40-1.50	1.3	16.9	0.9	17.3	64.9	0.53	8.9	8.3
1.50-1.60	0.8	28.9	-	-	-	-	9.7	10.0
+1.60	90.3	91.3	-	-	-	-	100.0	83.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
8.2	7 1/2	0.03	414	469	19	10	0.981

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-51-1

LAB. NO.: 7075

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	14.2	17.9	67.2	0.48	122

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	89.2	12.5	89.2	13.5
65M X 0	10.8	13.1	100.0	13.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	86.4	3.0	1.9	20.3	78.4	0.54	86.4	3.0
1.40-1.50	1.0	16.0	not sufficient sample				87.4	3.2
1.50-1.60	0.5	24.9	-	-	-	-	87.9	3.3
+1.60	12.1	87.6	-	-	-	-	100.0	13.5

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
78.0	+9	0.03	401	467	22	46	1.028

ELCO MINING LTD.

March 2, 1976.

SAMPLE: EB-51-2

LAB. NO.: 7227

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	60.4	15.0	23.8	0.25	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	67.0	69.3	67.0	69.3
65M X 0	33.0	35.0	100.0	58.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	8.4	8.3	1.7	20.6	69.4	0.62	8.4	8.3
1.40-1.50	3.0	23.9	1.2	16.9	58.0	0.46	11.4	12.4
1.50-1.60	4.0	34.9	-	-	-	-	15.4	18.2
+1.60	84.6	78.6	-	-	-	-	100.0	69.3

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
7.6	8	0.01	406	467	21	45	1.026

ELCO MINING LTD. March 2, 1976.

SAMPLE: EB-51-3

LAB. NO.: 7228

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	42.1	7.6	49.5	0.62	98

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	65.7	52.4	65.7	52.4
65M X 0	34.3	17.9	100.0	40.6

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	32.1	11.9	1.5	17.4	69.2	0.56	32.1	11.9
1.40-1.50	5.9	14.6	1.3	16.6	67.5	0.52	38.0	12.3
1.50-1.60	3.9	32.7	-	-	-	-	41.9	14.2
+1.60	58.1	80.0	-	-	-	-	100.0	52.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
25.0	3	0.01	406	-	23	-	-

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-52-1

LAB. NO.: 6616

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	46.8	12.9	39.4	0.37	90

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	78.9	43.7	78.9	43.7
65M X 0	21.1	26.0	100.0	40.0

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	42.2	4.7	1.6	18.8	74.9	0.68	42.2	4.7
1.40-1.50	3.6	15.9	1.4	16.9	65.8	0.65	45.8	5.6
1.50-1.60	1.7	28.4	-	-	-	-	47.5	6.4
+1.60	52.5	77.5	-	-	-	-	100.0	43.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
36.1	8 1/2	0.06	392	459	18	166	1.068

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-52-2

LAB. NO.: 6617

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	16.2	20.9	62.0	0.77	93

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.1	14.4	92.1	14.4
65M X 0	7.9	18.3	100.0	14.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	80.5	5.4	0.9	23.6	70.1	0.82	80.5	5.4
1.40-1.50	5.3	22.5	0.8	19.2	57.5	0.63	85.8	6.5
1.50-1.60	3.0	33.0	-	-	-	-	88.8	7.4
+1.60	11.2	69.9	-	-	-	-	100.0	14.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
79.0	9	0.06	390	455	29	173	1.058

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-52-3

LAB. NO.: 6618

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	38.1	19.1	42.1	0.35	86

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	86.8	33.8	86.8	33.8
65M X 0	13.2	23.1	100.0	32.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.1	5.6	0.7	19.3	74.4	0.58	49.1	5.6
1.40-1.50	8.1	17.6	0.6	14.6	67.2	0.55	57.2	7.3
1.50-1.60	1.6	28.3	-	-	-	-	58.8	7.9
+1.60	41.2	70.9	-	-	-	-	100.0	33.8

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
49.7	9	0.02	401	469	27	54	1.027

ELCO MINING LTD. March 4, 1976.

SAMPLE: EB-52-4

LAB. NO.: 6619

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	21.8	17.7	59.9	0.58	82

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.1	21.1	91.1	21.1
65M X 0	8.9	27.5	100.0	21.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	62.9	7.5	0.6	19.0	72.9	0.51	62.9	7.5
1.40-1.50	11.7	16.8	0.6	16.7	65.9	0.45	74.6	9.0
1.50-1.60	4.0	28.0	-	-	-	-	78.6	9.9
+1.60	21.4	62.0	-	-	-	-	100.0	21.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
68.0	8 1/2	0.02	412	476	25	43	1.019

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-1

LAB. NO.: 7076

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	10.7	19.3	69.4	0.46	102

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	87.3	10.7	87.3	10.7
65M X 0	12.7	18.5	100.0	11.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	80.9	6.5	1.1	19.5	72.9	0.47	80.9	6.5
1.40-1.50	10.8	19.6	0.6	18.2	61.6	0.36	91.7	8.0
1.50-1.60	3.4	27.3	-	-	-	-	95.1	8.7
+1.60	4.9	49.9	-	-	-	-	100.0	10.7

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
80.1	6	0.14	415	-	16% @ 510°	-	-

ELCO MINING LTD.

February 13, 1976.

SAMPLE: EB-53-2

LAB. NO.: 7077

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	32.4	16.4	50.5	0.43	84

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	78.2	35.4	78.2	35.4
65M X 0	21.8	21.6	100.0	32.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	49.8	7.5	0.7	19.4	72.4	0.57	49.8	7.5
1.40-1.50	9.6	20.6	0.7	17.6	61.1	0.44	59.4	9.6
1.50-1.60	5.8	30.6	-	-	-	-	65.2	11.5
+1.60	34.8	80.1	-	-	-	-	100.0	35.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
46.5	7 1/2	0.15	420	478	23	-7	0.892

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-3

LAB. NO.: 7078

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	12.8	17.3	69.2	0.49	81

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	90.9	12.4	90.9	12.4
65M X 0	9.1	19.7	100.0	13.1

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	84.4	7.3	0.5	18.3	73.9	0.57	84.4	7.3
1.40-1.50	9.0	17.5	0.5	16.8	65.2	0.39	93.4	8.3
1.50-1.60	1.0	29.4	-	-	-	-	94.4	8.5
+1.60	5.6	77.2	-	-	-	-	100.0	12.4

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
84.9	3 1/2	0.07	425	465	19	-19	-

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-4

LAB. NO.: 7079

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.7	19.7	15.6	64.0	0.46	85

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	91.6	19.6	91.6	19.6
65M X 0	8.4	18.0	100.0	19.5

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	64.4	8.3	1.0	17.2	73.5	0.48	64.4	8.3
1.40-1.50	16.2	19.6	0.7	14.8	64.9	0.32	80.6	10.6
1.50-1.60	4.8	31.3	-	-	-	-	85.4	11.7
+1.60	14.6	65.6	-	-	-	-	100.0	19.6

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
73.8	3	0.12	416	469	8	-8	-

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-5

LAB. NO.: 7080

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.3	8.2	18.7	72.8	0.41	139

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	88.8	7.0	88.8	7.0
65M X 0	11.2	13.2	100.0	7.7

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	96.1	5.3	2.9	19.5	72.3	0.39	96.1	5.3
1.40-1.50	1.6	18.4	1.6	15.9	64.1	0.26	97.7	5.5
1.50-1.60	0.5	27.2	-	-	-	-	98.2	5.6
+1.60	1.8	80.9	-	-	-	-	100.0	7.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
86.8	8	0.06	402	465	25	8	0.964

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-6

LAB. NO.: 7081

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.9	44.1	13.5	41.5	0.25	86

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	82.3	44.2	82.3	44.2
65M X 0	17.7	36.0	100.0	42.8

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	39.8	7.3	0.9	18.8	73.0	0.46	39.8	7.3
1.40-1.50	9.0	17.2	0.7	16.3	65.8	0.34	48.8	9.1
1.50-1.60	2.1	29.0	-	-	-	-	50.9	9.9
+1.60	49.1	79.7	-	-	-	-	100.0	44.2

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
40.2	8 1/2	0.01	397	466	25	28	1.004

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-7

LAB. NO.: 7082

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.8	27.8	18.6	52.8	0.44	77

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4 X 65M	92.3	29.1	92.3	29.1
65M X 0	7.7	20.2	100.0	28.4

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	63.9	7.8	0.6	19.9	71.7	0.59	63.9	7.8
1.40-1.50	6.3	22.1	0.6	17.2	60.1	0.36	70.2	9.1
1.50-1.60	2.0	29.6	-	-	-	-	72.2	9.7
+1.60	27.8	79.7	-	-	-	-	100.0	29.1

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
64.8	9	Trace	392	466	27	75	1.042

ELCO MINING LTD. February 13, 1976.

SAMPLE: EB-53-8

LAB. NO.: 7083

HEAD RAW ANALYSIS

R.M. %	ASH %	V.M. %	F.C. %	S. %	H.G.I.
0.6	25.7	18.3	55.4	1.72	89

SIZE ANALYSIS

SIZE FR.	WT. %	ASH %	CUMULATIVE	
			WT. %	ASH %
1/4" X 65M	94.6	24.0	94.6	24.0
65M X 0	5.4	28.1	100.0	24.2

SINK-FLOAT ANALYSIS: 1/4" X 65M

S.G.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	CUMULATIVE	
							WT. %	ASH %
-1.40	65.6	6.2	0.7	22.7	70.4	0.81	65.6	6.2
1.40-1.50	9.9	15.4	0.7	20.2	63.7	2.11	75.5	7.4
1.50-1.60	3.0	22.6	-	-	-	-	78.5	8.0
+1.60	21.5	82.4	-	-	-	-	100.0	24.0

COMPOSITE 1/4" X 65M Floats @ 1.50 S.G.

TOTAL YIELD %	F.S.I.	P.	RUHR DILATOMETER TEST				
			SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (C°)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
71.4	9	Trace	379	466	27	225	1.088

CHANNEL SAMPLES (R.A.G.)

3.2.2 Channel-Samples

Channel-samples as received from Canada (Birtley Engineering) were air-dryed and the moisture determined.

Then the sample was split for raw-coal and clean-coal analysis.

Raw Coal Analysis: The material was crushed to minus 2.0 mm and split. From one part of the sample the 1.2-0.6 mm fraction was recovered for grindability testing. The other split was further crushed to minus 0.2 mm, followed by a full scale raw-coa analysis (moisture, ash, vol. matter, sulphur, phosphorous, cal. value, ash fusion and ash analysis).

Clean Coal Analysis: The material was screened at 0.2 mm, and undersize analysed for ash and sulphur. From the oversize a certain proportion was set aside for possible double-checking. Then the oversize material underwent sink-float analysis, separating at gravities of 1.45 and 1.8 S.G. respectively. Following that the resulting three gravity fractions were crushed to minus 2.0 mm first.

The 1.45 S.G. fraction was split into three parts. One was further reduced to minus 1.0 mm for later maceral analysis and reflection measurements. The second was reduced to minus 0.4 mm for Gieseler fluidity testing. The third part was crushed to minus 0.2 mm for a subsequent full scale clean coal analysis (ash, sulphur, vol. matter, phosphorous, F.S.I., Ruhr-Dilatometer testing, carbon, hydrogen, nitrogen, cal. value and ash fusion).

The 1.45 - 1.8 and + 1.8 S.G. fractions were crushed to minus 2.0 mm and finally 0.2 mm for subsequent ash and sulphur analysis.

Analyses results (sizing, gravity, assay) were recorded on form sheets.

ELK RIVER COAL PROJECT

Flow Sheet for Laboratory Testing of Channel Samples by R.A.G.

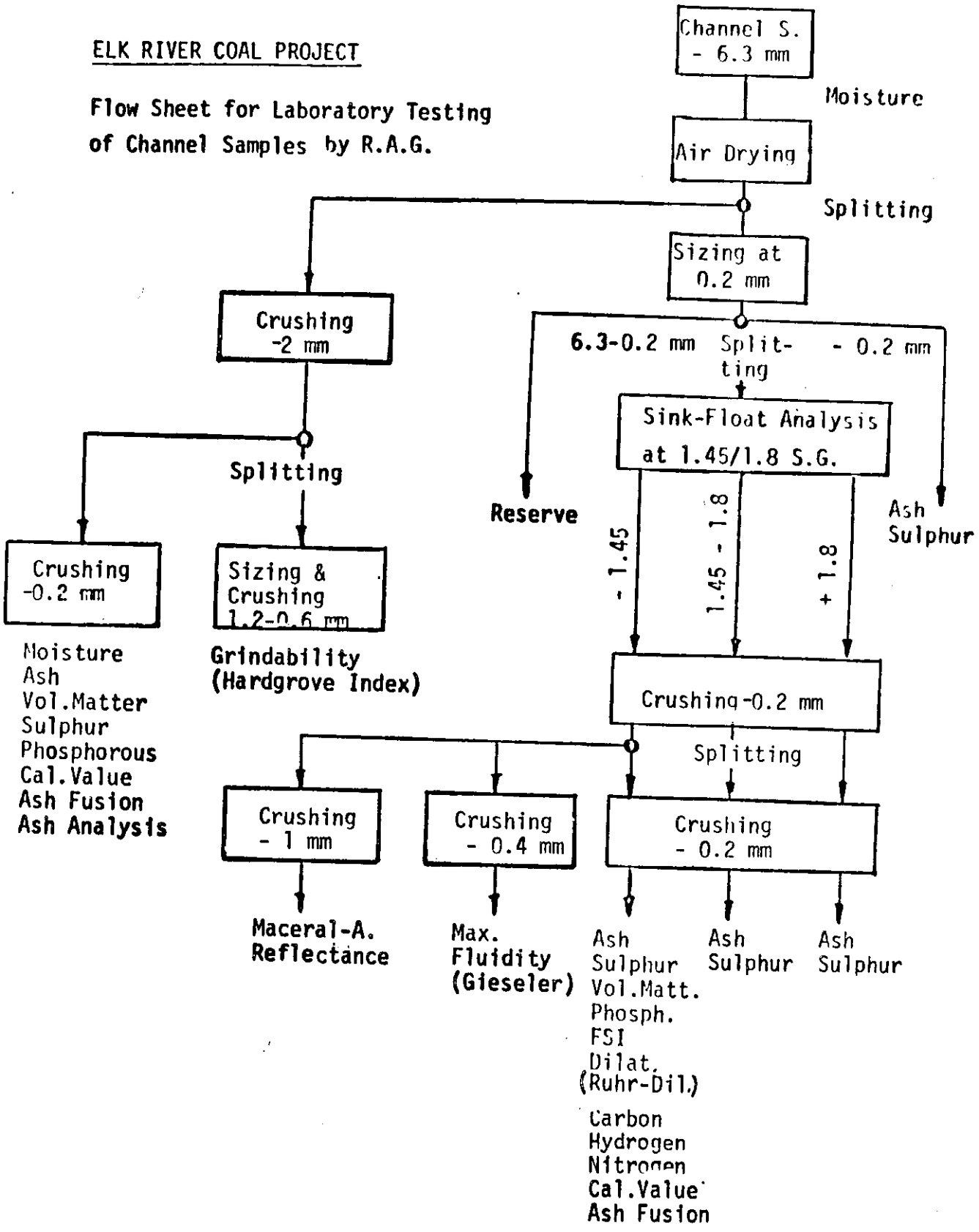
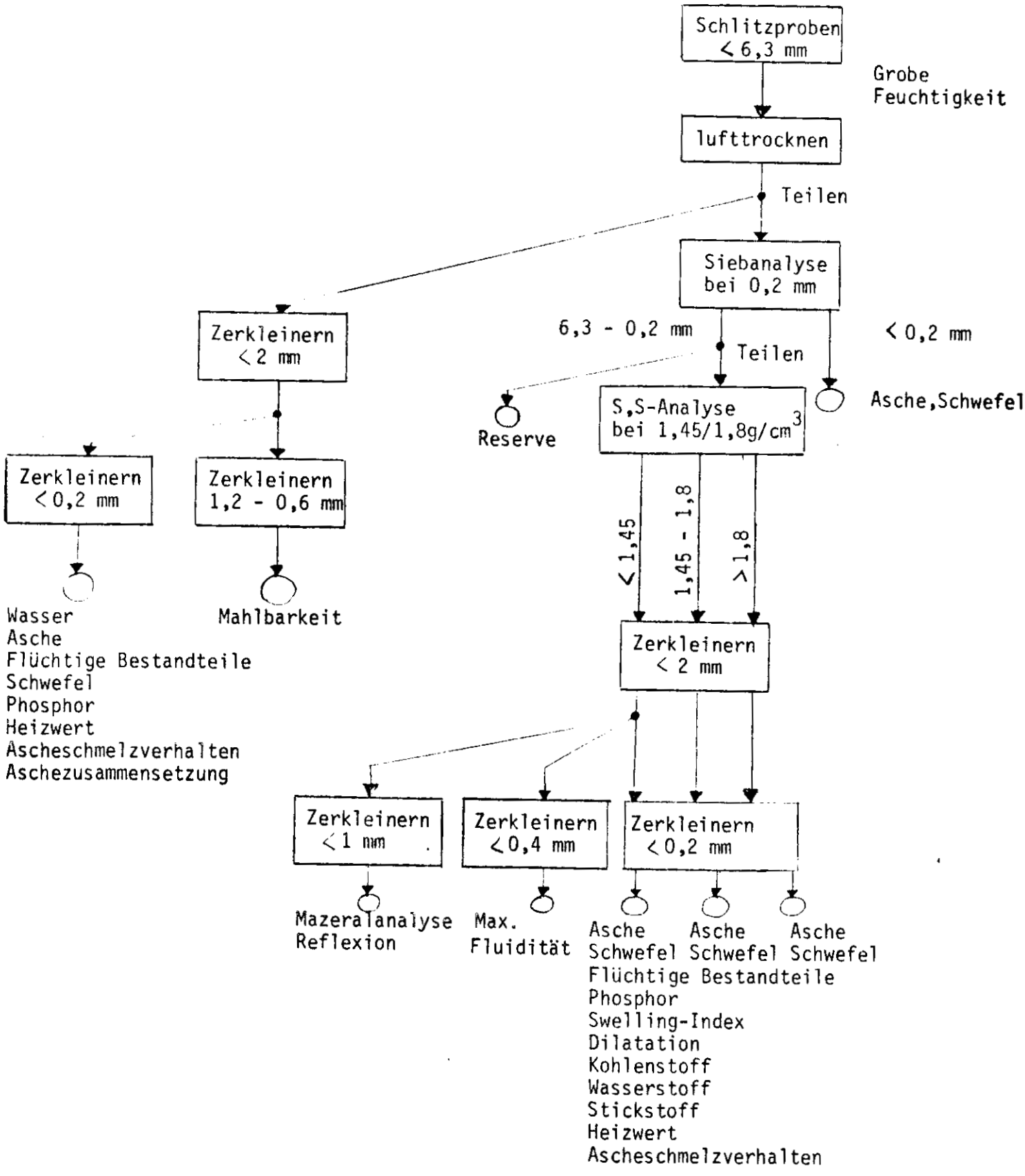


Figure 3

ELK-RIVER-COAL-PROJECT

ERGEBNISSE der SCHLITZPROBEN


Schlitzproben < 6,3 mm
Grobe Feuchtigkeit
lufttrocknen
Teilen
Siebanalyse bei 0,2 mm
6,3 - 0,2 mm
< 0,2 mm
Teilen
Asche,Schwefel
Reserve
S,S-Analyse bei 1,45/1,8g/cm3
Zerkleinern < 2 mm
Zerkleinern < 0,2 mm
Zerkleinern 1,2 - 0,6 mm
< 1,45
1,45 - 1,8
> 1,8
Wasser
Asche
Flüchtige Bestandteile
Schwefel
Phosphor
Heizwert
Ascheschmelzverhalten
Aschezusammensetzung
Mahlbarkeit
Zerkleinern < 2 mm
Zerkleinern < 1 mm
Zerkleinern < 0,4 mm
Zerkleinern < 0,2 mm
Mazeralanalyse
Reflexion
Max. Fluidität
Asche
Schwefel
Asche
Schwefel
Asche
Schwefel
Flüchtige Bestandteile
Phosphor
Swelling-Index
Dilatation
Kohlenstoff
Wasserstoff
Stickstoff
Heizwert
Ascheschmelzverhalten

ELK RIVER COAL PROJECT

Flow Sheet for Laboratory Testing of Channel Samples by R.A.G.

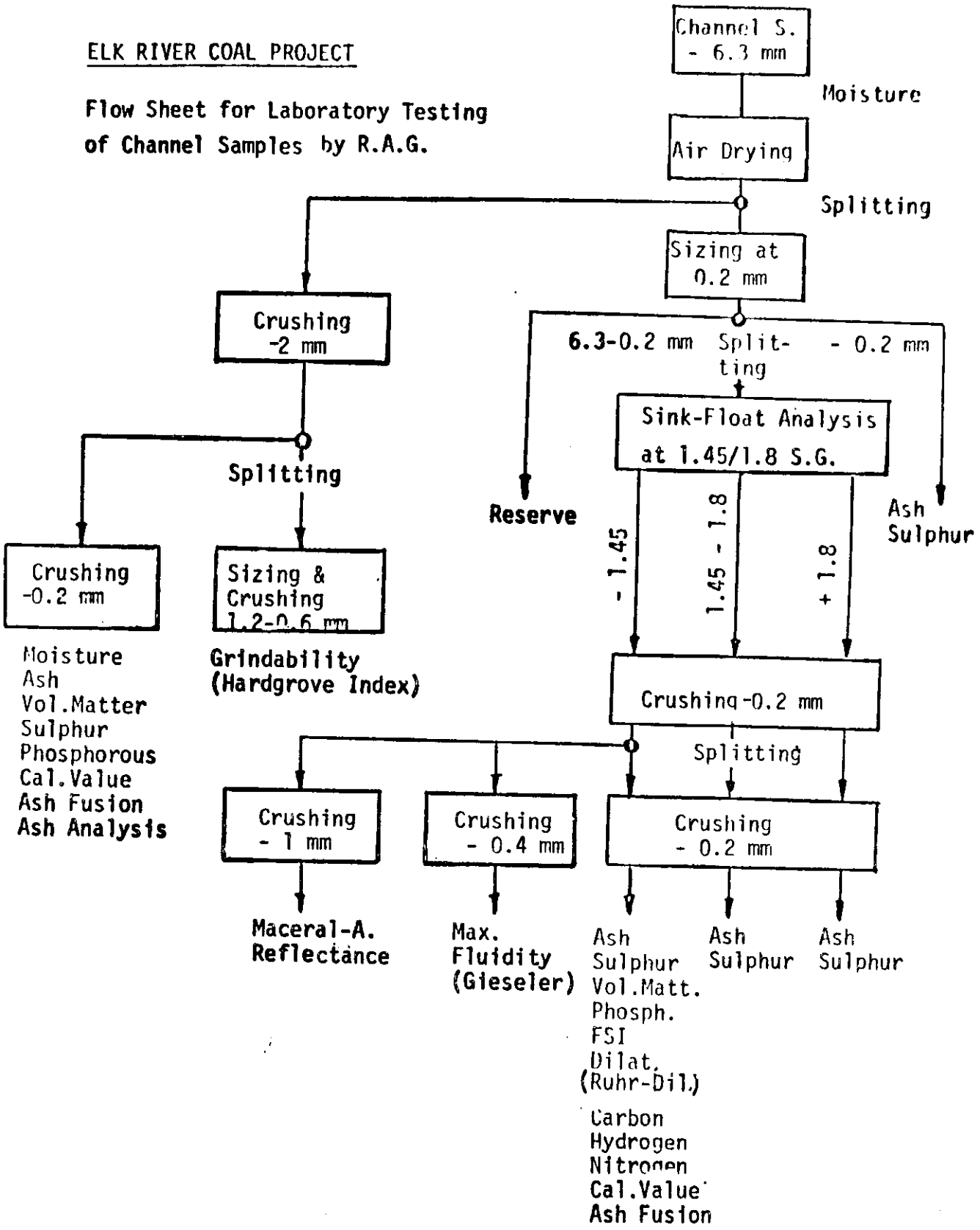


Figure 3

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/W

Elk-River-Coal-Project

Untersuchungsergebnisse an Rohkohlen:

Bezeichnung der Probe		Schlitz-probe 2A Adit 2	Schlitz-probe 2B Adit 2	Bulk Sample Face Adit 3	Bulk Face +4" Adit 3	Flöz 3 Nr. 3 3965	Flöz 4 Nr. 1 4519	Flöz 4 Nr. 2 4520	Flöz 4A Nr. 1 4534	Flöz 4A Nr. 2 4535	Flöz 5 Nr. 1 4411	Schlitz-probe 6 Adit 6
Gewicht der Probe	g	n.b. *)	n.b. *)	n.b. *)	n.b. *)	1330	5030	4900	5430	5820	2210	n.b. *)
Wasser	% i.roh	2.5	3.9	3.4	2.6	1.6	1.1	1.0	0.8	1.3	1.3	5.7
Asche	% i.wf	31.2	41.7	44.2	34.4	30.2	29.1	26.7	35.5	36.6	51.7	16.3
Fl. Bestandteile	% i.wf	16.0	13.9	11.9	13.4	14.4	14.8	14.6	13.7	13.4	12.1	16.6
Schwefel	% i.wf	0.47	0.44	0.37	0.42	0.45	0.34	0.36	0.49	0.47	0.61	0.69
Phosphor	% i.wf	0.022	0.020	0.111	0.183	0.049	0.039	0.036	0.015	0.019	0.057	0.090
Heizwert (kcal/kg)	i.roh	5428	4480	4368	5245	5685	5697	5944	5207	5103	3699	6528
	i.wf	5582	4685	4542	5401	5787	5767	6010	5254	5178	3755	6958
	i.waf	(8116)	(8039)	(8146)	(8234)	(8290)	(8137)	(8196)	(8150)	(8161)	(7778)	(8309)
Ascheschmelzverhalten in oxid. Atmosphäre												
Erweichungstemp.	°C	1300	1290	1370	1310	1360	1320	1300	1380	1400	1350	1300
Halbkugeltemp.	°C	1520	1570	1590	1530	1600	1560	1590	1640	1640	1640	1600
Fließtemp.	°C	1560	1600	1610	1570	1700	1590	1620	1660	1670	1650	1640
Mahlbarkeit n. Hardgrove	°H	94	90	101	102	112	97	98	95	92	74	92

Anm.: *) n.b. = nicht bestimmt

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Rohkohlen

Bezeichnung der Probe		Adit 7 Nr. 1 3710	Adit 7 Nr. 2 3711	Flöz 8 Nr. 1 3783	Flöz 8 Nr. 2 3811	Flöz 9 Nr. 1 3812	Flöz 9 Nr. 2 3966	Adit 10 Nr. 1 3712	Adit 10 Nr. 2 3713	Flöz 12 Nr. 1 3785	Flöz 12 Nr. 2 3784	Flöz 12 Nr. 3 3786
Gewicht der Probe	g	6240	6080	4884	4704	4915	1300	5740	4870	5000	5185	5769
Wasser	% i.roh	1.6	1.3	0.8	0.8	0.8	1.5	1.7	1.3	0.9	0.9	0.9
Asche	% i.wf	43.2	42.6	36.8	30.2	24.9	25.5	25.9	25.4	41.1	40.6	39.5
Fl.Bestandteile	% i.wf	13.0	13.5	13.8	15.1	16.0	17.5	17.2	17.6	15.8	16.2	16.2
Schwefel	% i.wf	0.43	0.44	0.36	0.39	0.38	0.39	0.40	0.41	0.66	0.67	0.72
Phosphor	% i.wf	0.057	0.066	0.056	0.088	0.028	0.031	0.045	0.073	0.109	0.079	0.072
Heizwert (kcal/kg)	i.roh	4437	4465	5043	5691	6098	5924	5943	5964	4613	4743	4790
	i.wf	4519	4531	5088	5742	6152	6023	6056	6050	4660	4791	4839
	i.waf	(7957)	(7887)	(8052)	(8225)	(8196)	(8085)	(8174)	(8114)	(7910)	(8062)	(8000)
Ascheschmelzverhalten in oxid. Atmosphäre												
Erweichungstemp.	°C	1350	1300	1330	1300	1370	1350	1320	1310	1320	1330	1300
Halbkugeltemp.	°C	1650	1590	1620	1610	1690	1620	1630	1640	1600	1590	1590
Fließtemp.	°C	1660	1620	1650	1630	>1700	1650	1670	1680	1640	1610	1610
Mahlbarkeit n. Hardgrove	°H	85	90	84	89	80	86	85	81	77	81	79

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/X

Elk-River-Coal-Project

Untersuchungsergebnisse an Rohkohlen

Bezeichnung der Probe		Flöz 13+13A Nr.1 4041	Flöz 13+13A Nr.2 4042	Flöz 13 D Nr.1 4091	Flöz 13 D Nr.2 4092	Flöz 13 E Nr.1 4093	Flöz 13 E Nr.2 4094	Flöz 13 F Nr.1 4095	Flöz 13 F Nr.2 4096	Flöz 13 G Nr.1 4097	Flöz 13 G Nr.2 4098
Gewicht der Probe	g	1570	1600	1560	1640	1470	1810	1120	1700	1320	1580
Wasser	% i.roh	1.3	1.2	1.0	1.2	1.0	1.0	1.3	1.1	1.0	0.9
Asche	% i.wf	42.8	52.3	61.8	58.8	62.0	59.4	60.7	61.5	43.0	36.6
Fl.Bestandteile	% i.wf	16.0	14.4	13.0	12.9	10.4	13.5	12.9	13.0	15.1	16.8
Schwefel	% i.wf	0.74	0.74	0.76	0.91	0.73	0.73	0.89	2.25	0.67	0.76
Phosphor	% i.wf	0.070	0.106	0.093	0.080	0.047	0.068	0.110	0.114	0.120	0.152
Heizwert (kcal/kg)	i.roh	4544	3664	2729	3023	2807	2993	2865	2733	4757	5064
	i.wf	4612	3716	2762	3067	2841	3029	2910	2770	4609	5115
	i.waf	(8070)	(7766)	(7230)	(7437)	(7474)	(7462)	(7397)	(7202)	(8089)	(8072)
Ascheschmelzverhalten in oxid. Atmosphäre											
Erweichungstemp.	°C	1280	1270	1210	1250	1240	1240	1290	1270	1290	1260
Halbkugeltemp.	°C	1540	1520	1450	1530	1540	1500	1590	1530	1560	1490
Fließtemp.	°C	1580	1570	1500	1580	1600	1540	1610	1570	1590	1530
Mahlbarkeit n. Hardgrove	°H	92	88	85	81	102	105	74	77	103	114

Qualitätsstelle/RAG

Essen, den 23. März 1976
UPZ/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Rohkohlen

Bezeichnung der Probe		Flöz 14 C Nr.1 3967	Flöz 14 C Nr.2 3975	Flöz 14 D Nr.1 3968	Flöz 14 D Nr.2 3969	Flöz 14+14A Nr.1 3973	Flöz 14+14A Nr.2 3974	Flöz 15 Nr.1	Flöz 15 Nr.2	Flöz 16 Nr.1 4490	Flöz 16 Nr.2 4491
Gewicht der Probe	g	1440	1430	1200	1150	1570	1510	6950	6200	4460	4020
Wasser	% i.roh	2.6	1.9	5.1	4.1	2.7	2.1	1.4	1.5	1.1	1.2
Asche	% i.wf	23.3	27.4	34.8	43.5	43.5	45.4	48.8	43.3	42.9	43.5
Fl.Bestandteile	% i.wf	21.6	20.9	18.3	16.9	17.5	17.0	16.2	17.2	19.3	18.9
Schwefel	% i.wf	0.80	0.81	0.90	1.06	0.70	0.75	0.64	0.68	0.69	0.76
Phosphor	% i.wf	0.039	0.051	0.044	0.067	0.076	0.078	0.096	0.079	0.116	0.151
Heizwert (kcal/kg)	i.roh	6124	5805	4953	4234	4335	4195	3899	4403	4504	4447
	i.wf	6303	5929	5251	4440	4471	4298	3963	4479	4561	4508
	i.waf	(8216)	(8166)	(8056)	(7857)	(7913)	(7878)	(7740)	(7901)	(7988)	(7980)
Ascheschmelzverhalten in oxid. Atmosphäre											
Erweichungstemp.	°C	1280	1310	1300	1260	1290	1250	1290	1260	1260	1270
Halbkugeltemp.	°C	1600	1600	1600	1610	1550	1590	1540	1540	1500	1540
Fließtemp.	°C	1630	1640	1630	1630	1590	1600	1560	1570	1570	1580
Mahlbarkeit n. Hardgrove	°H	94	95	111	98	84	80	80	79	71	76

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an

Bezeichnung der Probe		Flöz 6 B Nr.1 4492	Flöz 16 E Nr.2 4493	Flöz 16 G Nr.1 4494	Flöz 16 G [illegible]	Flöz 17 Nr.1 4438	Flöz 17 Nr.2 4439	Flöz 17 A Nr.1 4444	Flöz 17 A Nr.2 [illegible]	Flöz [illegible] 4416	Flöz 18 Nr.2 [illegible]
Gewicht der Probe	g	[illegible]	[illegible]	[illegible]		[illegible]	1060	[illegible]	[illegible]	600	[illegible]
Wasser	%	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]				[illegible]
Asche	%	[illegible]		[illegible]	[illegible]	[illegible]	25.0	[illegible]		[illegible]	[illegible]
Fl.Bestandteile	%	[illegible]	20.8	19.3	19.8	26.3	24.4	19.0	20.9	[illegible]	[illegible]
Schwefel	%	[illegible]	[illegible]	0.77	0.77	[illegible]	0.88	0.97	[illegible]		[illegible]
Phosphor	%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.091	[illegible]		0.075
Heizwert (kcal/kg)		[illegible]	[illegible]	4881	4967	[illegible]	5717	4277	[illegible]	4864	5477
		[illegible]	5440	4981	5145	6604	5945	[illegible]	[illegible]	4970	5613
		[illegible]	(8086)	(8018)	(8095)	(8046)	(7931)	(7857)	(7849)	(7864)	(8045)
Aschenschmelzverhalten in oxid. Atmosphäre											
Erweichungstemp.	°C	1260	1250	1290	1300	[illegible]	[illegible]	1240	1240	[illegible]	[illegible]
Halbkugeltemp.	°C	1510	1520	[illegible]	1530	290	[illegible]	1520	1560	1270	[illegible]
Fließtemp.	°C	1550	1560	1540	1560	1310	[illegible]	1580	1600	1300	[illegible]
Mahlbarkeit n. Hardgrove	°H	77	75	97	98	89	[illegible]	68	70	[illegible]	[illegible]

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnis

Bezeichnung der Probe			Schlitz-probe 2A Adit 2	Schlitz-probe 2B Adit 2	Bulk Sample Face Adit 3	Bulk Face +4" Adit 3	Flöz 3 Nr. 3 3965	Flöz 4 Nr. 1 4519	Flöz 4 Nr. 2 4520	Flöz 4A Nr. 1 4534	Flöz 4A Nr. 2 4535	Flöz 5 Nr. 1 4411	Schlitz-probe 6 Adit 6
6.3 - 0.2 mm	%		89.0	84.0	81.9	82.8	85.9	84.5	84.3	85.9	85.5	88.9	75.4
< 0.2 mm	%		11.0	16.0	18.1	17.2	14.1	15.5	15.7	14.1	14.5	11.1	24.6
< 0.2 mm	Asche	% i.wf	17.1	24.2	27.9	24.8	16.1	17.6	14.2	16.2	16.5	30.3	9.6
< 0.2 mm	Schwefel	% i.wf	0.56	0.56	0.52	0.46	0.71	0.54	0.53	0.70	0.76	0.91	0.[illegible]

Schwimm-Sink-Analysen

Anteil der Dichtestufe													
< 1.45	g/ml	%	51.6	37.1	50.8	57.0	63.3	61.4	67.4	46.7	49.2	14.5	69.0
1.45 - 1.8	g/ml	%	17.3	11.6	6.3	5.7	7.0	8.7	7.8	19.3	16.0	24.0	1[illegible].9
> 1.8	g/ml	%	29.9	50.1	41.9	36.2	29.4	29.4	24.5	33.7	34.4	61.0	10.2

Asche der Dichtestufe													
< 1.45	g/ml	% i.wf	8.0	8.5	6.1	5.2	5.6	6.5	6.4	7.0	7.5	7.5	7.[illegible]
1.45 - 1.8	g/ml	% i.wf	31.6	28.5	26.7	24.9	25.4	25.2	26.1	31.6	32.8	37.2	3[illegible].1
> 1.8	g/ml	% i.wf	79.2	80.5	88.8	89.7	88.9	81.8	86.6	80.9	81.2	73.4	6[illegible].1

Schwefel in der Dichtestufe													
< 1.45	g/ml	% i.wf	0.55	0.56	0.47	0.51	0.53	0.39	0.38	0.64	0.61	1.10	0.7[illegible]
1.45 - 1.8	g/ml	% i.wf	0.43	0.52	0.50	0.47	0.44	0.31	0.32	0.47	0.44	0.74	0.[illegible]
> 1.8	g/ml	% i.wf	0.30	0.27	0.15	0.13	0.22	0.19	0.17	0.22	0.24	0.38	0.[illegible]

Qualitätsstelle/RAG

Essen, den 23. März 197
FP2/Dr.Br/W

Elk-River-Coal-Project

Untersuchungsergebnis

Bezeichnung der Probe			Adit 7 Nr. 1 3710	Adit 7 Nr. 2 3711	Flöz 8 Nr. 1 3783	Flöz 8 Nr. 2 3811	Flöz 9 Nr. 1 3812	Flöz 9 Nr. 2 3966	Adit 10 Nr. 1 3712	Adit 10 Nr. 2 3713	Flöz 12 Nr. 1 3785	Flöz 12 Nr. 2 3784	Flöz 12 Nr. 3 3786
6.3 - 0.2 mm	%		85.8	82.6	86.8	86.8	89.4	94.3	89.6	89.2	86.5	86.7	83.7
< 0.2 mm	%		14.2	17.4	13.2	13.2	10.6	5.7	10.4	10.8	13.5	13.3	16.3
< 0.2 mm	Asche	% i.wf	21.4	21.0	14.5	14.4	11.7	13.8	16.3	14.5	19.0	17.6	16.6
< 0.2 mm	Schwefel	% i.wf	0.57	0.61	0.48	0.47	0.47	0.48	0.61	0.61	0.93	0.96	0.92
Schwimm-Sink-Analysen													
Anteil der Dichtestufe													
< 1.45	g/ml	%	31.7	32.2	51.4	58.7	63.8	63.7	66.8	64.1	44.1	42.7	39.9
1.45 - 1.8	g/ml	%	22.0	20.5	10.7	12.3	12.6	14.3	7.1	8.7	10.3	12.8	13.4
> 1.8	g/ml	%	45.9	41.1	37.7	28.7	23.0	21.4	25.3	26.7	45.3	44.2	45.9
Asche der Dichtestufe													
< 1.45	g/ml	% i.wf	8.2	7.3	6.0	6.0	6.3	6.0	5.8	5.8	5.9	6.0	6.2
1.45 - 1.8	g/ml	% i.wf	28.9	30.3	33.6	31.9	31.3	31.9	30.9	31.7	35.4	36.0	36.7
> 1.8	g/ml	% i.wf	84.3	81.7	84.6	81.9	83.3	77.5	86.2	82.7	82.1	81.5	79.8
Schwefel in der Dichtestufe													
< 1.45	g/ml	% i.wf	0.62	0.63	0.47	0.49	0.50	0.48	0.45	0.46	0.48	0.45	0.82
1.45 - 1.8	g/ml	% i.wf	0.43	0.48	0.34	0.38	0.32	0.35	0.38	0.40	0.71	0.78	1.08
> 1.8	g/ml	% i.wf	0.20	0.21	0.17	0.16	0.17	0.18	0.20	0.17	0.39	0.38	0.43

Qualitätsstelle/RAG

Essen, den 23. März 1976
HP2/Dr.Br/W

Elk-River-Coal-Project

Untersuchungsergebnis

Bezeichnung der Probe			Flöz 13+13A Nr.1 4041	Flöz 13+13A Nr.2 4042	Flöz 13 D Nr.1 4091	Flöz 13 D Nr.2 4092	Flöz 13 E Nr.1 4093	Flöz 13 E Nr.2 4094	Flöz 13 F Nr.1 4095	Flöz 13 F Nr.2 4096	Flöz 13 G Nr.1 4097	Flöz 13 G Nr.2 4098
6.3 - 0.2 mm	%		88.9	89.2	93.0	92.6	92.3	91.0	90.0	90.7	88.5	88.4
< 0.2 mm	%		11.1	10.8	7.0	7.4	7.7	9.0	10.0	9.3	11.5	11.6
< 0.2 mm	Asche	% i.wf	30.0	32.6	43.5	40.6	42.5	44.1	30.7	37.1	24.2	21.0
< 0.2 mm	Schwefel	% i.wf	1.17	1.21	1.30	1.39	1.10	1.01	1.68	2.25	0.92	1.13
Schwimm-Sink-Analysen												
Anteil der Dichtestufe												
< 1.45	g/ml	%	46.0	37.7	18.9	18.1	13.2	11.5	20.7	17.5	45.2	59.9
1.45 - 1.8	g/ml	%	8.7	7.0	9.4	14.8	16.4	23.7	5.3	8.4	9.5	6.9
> 1.8	g/ml	%	45.0	54.0	71.3	66.8	70.3	64.6	73.3	73.4	44.9	32.9
Asche der Dichtestufe												
< 1.45	g/ml	% i.wf	6.0	6.7	8.6	9.0	9.7	8.6	5.9	7.6	7.0	8.1
1.45 - 1.8	g/ml	% i.wf	35.0	32.6	35.6	37.3	37.7	34.9	32.0	30.1	33.7	31.2
> 1.8	g/ml	% i.wf	82.3	86.7	81.2	78.2	80.1	80.0	83.0	79.8	85.0	87.9
Schwefel in der Dichtestufe												
< 1.45	g/ml	% i.wf	0.94	0.93	1.11	1.12	1.23	1.14	1.55	1.55	0.89	0.95
1.45 - 1.8	g/ml	% i.wf	0.74	0.71	1.05	1.33	0.99	0.80	1.56	1.64	0.74	0.80
> 1.8	g/ml	% i.wf	0.45	0.53	0.52	0.70	0.49	0.58	0.85	2.49	0.28	0.33

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/W

Elk-River-Coal-Project

Untersuchungsergebnis

Bezeichnung der Probe			Flöz 14 C Nr.1 3967	Flöz 14 C Nr.2 3975	Flöz 14 D Nr.1 3968	Flöz 14 D Nr.2 3969	Flöz 14+14A Nr.1 3973	Flöz 14+14A Nr.2 3974	Flöz 15 Nr.1	Flöz 15 Nr.2	Flöz 16 Nr.1 4490	Flöz 16 Nr.2 4491
6.3 - 0.2 mm	%		91.1	91.0	85.9	85.3	91.4	92.3	88.8	90.2	89.8	87.5
< 0.2 mm	%		8.9	9.0	14.1	14.7	8.6	7.7	11.2	9.8	10.2	12.5
< 0.2 mm	Asche	% i.wf	18.8	21.1	18.4	18.6	24.4	26.1	23.0	21.2	21.3	19.4
< 0.2 mm	Schwefel	% i.wf	0.90	0.96	0.94	1.07	0.96	1.17	1.02	1.01	1.01	1.12
Schwimm-Sink-Analysen												
Anteil der Dichtestufe												
< 1.45	g/ml	%	71.1	65.8	54.3	46.6	42.6	39.0	35.0	39.3	44.9	43.1
1.45 - 1.8	g/ml	%	9.9	9.6	4.0	5.2	8.5	10.4	10.8	13.8	14.0	13.5
> 1.8	g/ml	%	18.3	24.0	41.2	47.0	48.3	50.0	53.7	46.5	40.6	43.0
Asche der Dichtestufe												
< 1.45	g/ml	% i.wf	5.3	6.4	3.5	4.6	5.8	5.8	6.5	6.0	7.7	8.1
1.45 - 1.8	g/ml	% i.wf	39.2	34.6	32.5	30.4	36.4	37.4	37.5	37.2	36.9	37.2
> 1.8	g/ml	% i.wf	83.6	82.3	83.1	83.3	82.8	81.6	81.5	80.3	83.3	85.2
Schwefel in der Dichtestufe												
< 1.45	g/ml	% i.wf	0.94	0.95	1.00	1.01	0.84	0.83	0.81	0.85	0.83	0.84
1.45 - 1.8	g/ml	% i.wf	0.71	0.68	0.79	0.98	0.84	1.11	0.78	0.86	0.60	0.66
> 1.8	g/ml	% i.wf	0.29	0.44	0.63	1.04	0.43	0.52	0.50	0.48	0.56	0.57

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/W

Elk-River-Coal-Project

Untersuchungsergebnis

Bezeichnung der Probe			Flöz 16 E Nr.1 4492	Flöz 16 E Nr.2 4493	Flöz 16 G Nr.1 4494	Flöz 16 G Nr.2 4495	Flöz 17 Nr.1 4418	Flöz 17 Nr.2 4419	Flöz 17 A Nr.1 4444	Flöz 17 A Nr.2 4445	Flöz 18 Nr.1 4416	Flöz 18 Nr.2 4417
6.3 - 0.2 mm	%		93.3	92.8	84.2	83.8	87.6	82.8	92.8	93.0	88.4	89.5
< 0.2 mm	%		6.7	7.2	15.8	16.2	12.4	17.2	7.2	7.0	11.6	10.5
< 0.2 mm	Asche	% i.wf	14.2	18.8	21.0	23.6	16.6	13.6	27.2	22.5	15.1	15.4
< 0.2 mm	Schwefel	% i.wf	1.10	1.06	1.05	0.99	0.91	0.80	1.19	1.13	0.79	0.89

Schwimm-Sink-Analysen

Anteil der Dichtestufe												
< 1.45	g/ml	%	71.1	58.2	44.4	51.5	77.8	67.2	44.8	53.7	53.6	61.6
1.45 - 1.8	g/ml	%	13.8	14.5	13.2	7.7	4.8	5.2	8.9	10.8	6.4	7.9
> 1.8	g/ml	%	14.7	26.9	41.8	40.2	16.8	26.6	45.6	35.0	39.6	30.0
Asche der Dichtestufe												
< 1.45	g/ml	% i.wf	5.8	6.1	5.6	6.4	3.9	3.7	5.7	5.4	4.8	5.5
1.45 - 1.8	g/ml	% i.wf	35.8	36.5	33.4	32.3	35.6	34.6	37.7	38.0	33.4	39.0
> 1.8	g/ml	% i.wf	75.7	81.9	81.9	80.7	75.2	78.1	86.2	85.6	80.7	81.3
Schwefel in der Dichtestufe												
< 1.45	g/ml	% i.wf	0.85	0.83	0.93	0.97	0.78	0.73	0.90	0.87	0.75	0.79
1.45 - 1.8	g/ml	% i.wf	0.74	0.73	0.88	0.85	0.91	0.79	0.67	0.65	0.78	0.80
> 1.8	g/ml	% i.wf	0.74	0.39	0.55	0.38	0.58	0.50	0.33	0.48	0.25	0.29

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Reinkohlen (0.2 - 6.35 mm / <1.45 g/ml)

Bezeichnung der Probe		Schlitz-probe 2A Adit 2	Schlitz-probe 2B Adit 2	Bulk Sample Face Adit 3	Bulk Face +4" Adit 3	Flöz 3 Nr. 3 3965	Flöz 4 Nr. 1 4519	Flöz 4 Nr. 2 4520	Flöz 4A Nr. 1 4534	Flöz 4A Nr. 2 4535	Flöz 5 Nr. 1 4411	Schlitz-probe 6 Adit 6
Anteil	%	51.6	37.1	50.8	57.0	63.3	61.4	67.4	46.7	49.2	14.5	69.8
Wasser	% i.an	0.7	0.7	0.8	0.9	0.4	0.4	0.4	0.3	0.3	0.6	0.8
Asche	% i.wf	8.1	8.3	6.2	5.3	5.6	6.5	6.4	7.0	7.5	7.5	0.7
Fl.Bestandteile	% i.waf	20.6	20.3	19.4	18.9	19.5	17.9	17.8	19.2	18.5	21.2	18.5
Schwefel	% i.wf	0.54	0.57	0.50	0.49	0.53	0.39	0.38	0.64	0.61	1.10	0.70
Phosphor	% i.wf	0.013	0.011	0.058	0.067	0.030	0.017	0.023	0.005	0.005	0.074	0.106
Swelling-Index		8	7 1/2	8	7	6 1/2	1	1	7	4 1/2	9	3 1/2
Dilatationsverlauf												
Erweichungstemp.	°C	389	380	394	401	392	413	422	404	389	391	419
Verfestigungstemp.	°C	472	448	467	467	482	-	-	481	461	476	-
Kontraktion	%	33	29	28	23	32	23	16	32	32	22	27
Dilatation	%	24	22	12	-2	-3	-	-	5	-11	53	-
G-Zahl		0.985	0.989	0.967	0.917	0.889	-	-	0.940	0.852	1.042	-
Max. Fluidität	DDPM	462	12	18	3	20	-	-	16	6	71	-
Mazeralgruppen-Analyse												
Vitrinit	%	33	37	60	41	60	39	39	60	55	89	31
Exinit	%	0	0	0	0	0	0	0	1	0	0	0
Inertinit	%	62	54	38	57	32	58	57	31	38	4	65
Minerale	%	5	9	2	2	8	3	4	8	7	7	4
Reflexionsmessung												
$\bar{R}_m$		1.47	1.45	1.46	1.48	1.53	1.44	1.44	1.45	1.44	1.38	1.44
∅ Fl.Best. des Vitrinits	% i.waf	22	23	22	22	21	23	23	23	23	24	23

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Reinkohlen (0.2 - 6.35 mm / <1.45 g/ml)

Bezeichnung der Probe		Adit 7 Nr. 1 3710	Adit 7 Nr. 2 3711	Flöz 8 Nr. 1 3783	Flöz 8 Nr. 2 3811	Flöz 9 Nr. 1 3812	Flöz 9 Nr. 2 3966	Adit 10 Nr. 1 3712	Adit 10 Nr. 2 3713	Flöz 12 Nr. 1 3785	Flöz 12 Nr. 2 3784	Flöz 12 Nr. 3 3786
Anteil	%	31.7	32.2	51.4	58.7	63.8	63.7	66.8	64.1	44.1	42.7	39.9
Wasser	% i.an	0.7	0.6	0.6	0.7	0.6	0.5	0.8	0.7	0.6	0.7	0.6
Asche	% i.wf	8.2	7.3	6.0	5.9	6.3	6.0	5.8	5.8	5.9	6.0	6.2
Fl.Bestandteile	% i.waf	19.3	19.4	19.6	19.8	19.9	19.8	21.8	21.9	24.0	24.3	24.3
Schwefel	% i.wf	0.62	0.63	0.47	0.49	0.50	0.48	0.45	0.46	0.48	0.45	[illegible]
Phosphor	% i.wf	0.042	0.053	0.021	0.073	0.022	0.021	0.024	0.037	0.041	0.044	[illegible]
Swelling-Index		4	3 1/2	5 1/2	6	3	3 1/2	6	6	8	8 1/2	8
Dilatationsverlauf												
Erweichungstemp.	°C	428	401	404	407	401	428	410	394	385	398	374
Verfestigungstemp.	°C	-	-	481	479	-	491	485	467	467	485	458
Kontraktion	%	34	33	31	31.	32	33	36	32	25	29	28
Dilatation	%	-	-	-21	-16	-	-24	-16	-10	71	108	75
G-Zahl		-	-	0.689	0.797	-	0.697	0.821	0.861	1.048	1.060	[illegible]
Max. Fluidität	DDPM	2	2	4	6	2	3	6	8	195	230	210
Mazeralgruppen-Analyse												
Vitrinit	%	53	48	49	55	45	51	52	57	74	74	75
Exinit	%	0	0	0	0	0	0	0	0	0	1	1
Inertinit	%	40	44	45	39	49	46	43	35	22	18	18
Minerale	%	7	8	6	6	6	3	5	8	4	7	6
Reflexionsmessung												
$\overline{R}_m$		1.46	1.43	1.45	1.45	1.41	1.41	1.32	1.32	1.35	1.30	1.31
≙ Fl.Best. des Vitrinits	% i.waf	22	23	23	22	23	23	25	25	24	25	25

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Reinkohlen (0.2 - 6.35 mm / <1.45 g/ml)

Bezeichnung der Probe		Flöz 13+13A Nr.1 4041	Flöz 13+13A Nr.2 4042	Flöz 13 D Nr.1 4091	Flöz 13 D Nr.2 4092	Flöz 13 E Nr.1 4093	Flöz 13 E Nr.2 4094	Flöz 13 F Nr.1 4095	Flöz 13 F Nr.2 4096	Flöz 13 G Nr.1 4097	Flöz 13 G Nr.2 4098
Anteil	%	46.0	37.7	18.9	18.1	13.2	11.5	20.7	17.5	45.2	59.9
Wasser	% i.an	0.6	0.6	0.5	0.6	0.7	0.5	0.5	0.5	0.6	0.6
Asche	% i.wf	6.0	6.7	8.6	9.0	9.7	8.6	5.9	7.6	7.0	8.1
Fl.Bestandteile	% i.waf	24.9	25.4	24.4	24.3	26.2	26.1	26.7	27.2	24.8	24.4
Schwefel	% i.wf	0.94	0.93	1.11	1.12	1.23	1.14	1.55	1.55	0.89	0.95
Phosphor	% i.wf	0.048	0.075	0.075	0.098	0.013	0.028	0.050	0.068	0.058	0.075
Swelling-index		8 1/2	8	7 1/2	8	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8
Dilatationsverlauf											
Erweichungstemp.	°C	383	382	388	374	380	373	377	380	385	382
Verfestigungstemp.	°C	473	476	466	449	485	475	466	481	473	452
Kontraktion	%	32	32	30	30	24	25	25	17	35	25
Dilatation	%	93	95	22	40	172	176	217	213	68	58
G-Zahl		1.054	1.057	0.986	1.013	1.101	1.099	1.091	1.111	1.034	1.035
Max. Fluidität	DDPM	270	300	140	140	410	675	1500	1480	120	130
Mazeralgruppen-Analyse											
Vitrinit	%	75	73	63	65	86	85	85	83	72	69
Exinit	%	1	1	1	2	1	0	3	2	1	0
Inertinit	%	16	19	26	24	1	4	4	5	18	23
Minerale	%	8	7	10	9	12	11	8	10	9	8
Reflexionsmessung											
$\bar{R}_m$		1.19	1.17	1.22	1.22	1.18	1.20	1.19	1.20	1.24	1.23
% Fl.Best. des Vitrinits	% i.waf	28	29	27	27	28	28	28	28	27	27

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Reinkohlen (0.2 - 6.35 mm / <1.45 g/ml)

Bezeichnung der Probe		Flöz 14 C Nr.1 3967	Flöz 14 C Nr.2 3975	Flöz 14 D Nr.1 3968	Flöz 14 D Nr.2 3969	Flöz 14+14A Nr.1 3973	Flöz 14+14A Nr.2 3974	Flöz 15 Nr.1	Flöz 15 Nr.2	Flöz 16 Nr.1 4490	Flöz 16 Nr.2 4491
Anteil	%	71.1	65.8	54.3	46.6	42.6	39.0	35.0	39.3	44.9	43.1
Wasser	% i.an	0.5	0.5	0.7	0.6	0.5	0.5	0.6	0.9	0.6	0.6
Asche	% i.wf	5.3	6.4	3.5	4.6	5.8	5.8	6.5	6.0	7.7	8.1
Fl.Bestandteile	% i.waf	27.5	27.8	26.4	26.4	28.3	28.1	27.1	27.1	31.5	31.6
Schwefel	% i.wf	0.94	0.95	1.00	1.01	0.84	0.83	0.81	0.85	0.83	0.84
Phosphor	% i wf	0.034	0.053	0.018	0.034	0.068	0.067	0.059	0.041	0.079	0.119
Swelling-Index		8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	8 1/2	7 1/2	7	8	8
Dilatationsverlauf											
Erweichungstemp.	°C	377	362	377	362	356	371	368	374	371	350
Verfestigungstemp.	°C	484	467	466	457	457	481	452	458	478	460
Kontraktion	%	28	22	21	23	27	28	31	30	34	33
Dilatation	%	192	209	112	129	186	191	77	68	181	177
G-Zahl		1.102	1.114	1.078	1.088	1.102	1.106	1.046	1.041	1.094	1.103
Max. Fluidität	DDPM	1023	1000	355	405	1600	1800	470	27	2900	2600
Mazeralgruppen-Analyse											
Vitrinit	%	82	79	79	79	71	78	64	63	77	75
Exinit	%	4	5	3	2	8	4	3	2	9	6
Inertinit	%	7	8	15	15	16	12	28	30	6	8
Minerale	%	7	8	3	4	5	6	5	5	8	11
Reflexionsmessung											
$\bar{R}_m$		1.21	1.17	1.20	1.19	1.16	1.14	1.15	1.13	0.99	0.99
% Fl.Best. des Vitrinits	% i.waf	28	28	28	28	29	29	29	29	33	33

Qualitätsstelle/RAG

Essen, den 23. März 1976
UP2/Dr.Br/K

Elk-River-Coal-Project

Untersuchungsergebnisse an Reinkohlen (0.2 - 6.35 mm / <1.45 g/ml)

Bezeichnung der Probe		Flöz 16 E Nr.1 4492	Flöz 16 E Nr.2 4493	Flöz 16 G Nr.1 4494	Flöz 16 G Nr.2 4495	Flöz 17 Nr.1 4418	Flöz 17 Nr.2 4419	Flöz 17 A Nr.1 4444	Flöz 17 A Nr.2 4445	Flöz 18 Nr.1 4416	Flöz 18 Nr.2 4417
Anteil	%	71.1	58.2	44.4	51.5	77.8	67.2	44.8	53.7	53.6	61.6
Wasser	% i.an	0.5	0.6	0.7	0.6	0.7	0.7	0.6	0.5	0.8	0.8
Asche	% i.wf	5.7	6.1	5.6	6.4	3.9	3.7	5.7	5.4	4.8	5.5
Fl.Bes.andteile	% i.waf	28.7	29.5	28.9	29.7	30.1	29.7	31.6	31.4	32.7	32.7
Schwefel	% i.wf	0.85	0.83	0.93	0.97	0.78	0.73	0.90	0.87	0.75	0.79
Phosphor	% i.wf	0.085	0.127	0.045	0.069	0.084	0.054	0.039	0.034	0.037	0.049
Swelling-Index		7	7 1/2	7 1/2	8	8	7 1/2	8	8	8	8
Dilatationsverlauf											
Erweichungstemp.	°C	368	362	359	359	374	376	353	359	356	358
Verfestigungstemp.	°C	454	460	458	460	458	466	451	460	455	460
Kontraktion	%	33	34	37	34	35	36	33	35	32	33
Dilatation	%	46	77	67	135	64	64	182	152	161	157
G-Zahl		1.018	1.048	1.036	1.080	1.030	1.028	1.092	1.091	1.089	1.089
Max. Fluidität	DDPM	660	630	530	1210	335	415	3400	3600	2900	3300
Mazeralgruppen-Analyse											
Vitrinit	%	54	56	62	70	74	72	69	72	80	77
Exinit	%	6	4	4	2	7	6	6	5	7	8
Inertinit	%	34	34	30	19	16	21	19	19	8	11
Minerale	%	6	6	4	9	3	1	6	4	5	4
Reflexionsmessung											
$\bar{R}_m$		1.02	1.02	1.03	1.01	0.99	0.98	0.98	0.96	0.95	0.92
∅ Fl.Best. des Vitrinits	% i.waf	32	32	32	32	33	33	33	34	34	35

K - ELK RIVER 76(4)B-3

EVALUATION OF
EXPLORATION AND TESTWORK
JULY 1975 - APRIL 1976
ON THE
ELK RIVER COAL PROPERTY

VOLUME II

APPENDIX 6

COAL WASHABILITY TESTWORK
(BIRTLEY ENGINEERING)

MINING RECORDER
RECEIVED AND RECORDED
1976
L.I.R. #
VICTORIA, B. C.

CALGARY/DUSSELDORF
MAY 1976

GEOLOGICAL BRANCH
ASSESSMENT REPORT

ELCO MINING LIMITED

00 274

GWS

BIRTLEY ENGINEERING (CANADA) LTD.

Subsidiary of Great West Steel Industries Ltd.

5112-3rd ST. S.E., CALGARY, ALBERTA T2H 1J6 PHONE 403-253-3719

Report No. CS-0080

A REPORT

TO

ELCO MINING LTD.

ON THE

ANALYSES AND WASHING OF

BULK SAMPLES FROM THE

ELK RIVER DEPOSIT

Fall, 1975

Submitted By:

F. J. Horvat, Manager
Coal Science & Minerals Testing Division
of
Birtley Engineering (Canada) Ltd.

January 14th, 1976

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113	Sink-Float Analysis - 1/2" X 28M	224
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GWS

BIRTLEY ENGINEERING (CANADA) LTD.

Subsidiary of Great West Steel Industries Ltd.

5112-3rd ST. S.E., CALGARY, ALBERTA T2H 1J6 PHONE 403-253-3719

A REPORT TO ELCO MINING LTD. ON THE ELK RIVER BULK TESTING PROGRAM FOR FALL, 1975

1. INTRODUCTION

In June of 1975, principals of Exploration Und Bergbau GmbH, Techman Ltd. and Birtley Engineering (Canada) Ltd. met to discuss the proposed 1975 Elk River Coal Testing Program. In attendance were Doctors G. Juranek, G. Langer, J. Kasperczyk, H. Gruss of Exploration Und Bergbau, Mr. Brian Raymond, Mr. J. Abbot of Techman, and Doctors G. Norton and D. Symonds, Mr. Frank Horvat of Birtley.

The purpose of discussion was to derive a program compatible with the best available facilities and that would fulfil the primary aim of the project which was to provide detailed washability information and an adequate tonnage of clean coal for coking tests. Several revisions were made to the original work flow sheet with the final draft taking the form presented in Figure 1.

The first of fifteen bulk samples arrived at the Coal Science & Minerals Testing Division plant in the first week in August, with the final delivery being made November 10. The total delivered weight of coal, as tallied from scaled truck loads, was 372 metric tons, of which 207 metric tons were washed in the pilot plant facility.

Two weighted raw coal composites were made up from bulk sample retains, according to instructions from Dr. Kasperczyk, dated October 8, 1975 (Tables 171 & 172). These composites of ten metric tons each were processed exactly as outlined for the bulk samples.

Mr. Siegfried Galasch, retained by Elco Mining Ltd. as a liaison, was present at the Coal Science & Minerals Testing operations site for the duration of the program.

The short time schedule, predicated by the approach of cold weather and the possibility of the coals becoming oxidized, necessarily imposed an atmosphere of urgency on the project. Nevertheless, in spite of some setbacks, it was brought to a satisfactory conclusion for the parties involved.

2. SAMPLING

The responsibility for the handling of the bulk samples began for Birtley Engineering (Canada) Ltd., upon delivery to the Coal Science & Minerals Testing Division plant site. A steel mixing plate, 10 meters X 12 meters, was made available for reception of the truck load lots. Upon completion of delivery, the bulk sample was thoroughly homogenized by using a front end loader in a fashion simulating the coning and quartering technique until the desired splits were extracted.

The reserve raw split and the retained coal for the Elco and Stelco composite washes was placed in poly-lined barrels with dry-ice, and stored outdoors. (The dry-ice was later omitted upon being advised by Dr. Kasperczyk). A total of 588 drums of raw coal were in storage before any composites were made.

The twelve barrels of coal reserved for washability work were processed according to the flow sheet (Figure 1) as soon after sampling as was practicable. The remaining coal was washed immediately after sampling in the three circuit pilot plant.

3. WASHABILITY WORK

Prior to primary screening, the samples were weighed on a TOLEDO platform scale with a capacity of 250Kg. The large (5cm range) size analysis was performed manually on square opening, wire mesh screens 120cm X 240cm in dimension. Fine screening, i.e. 28M X 0(.60mm X 0) was performed on a vibrating deck screen or by using standard 8" (20.3cm) diameter testing sieves in conjunction with a ro-tap.

Drying was accomplished by using a fan circulated cabinet or a concrete drying pad with electric heating coils imbedded below the surface. In either case the heat generated did not exceed 35° - 40° C.

To subsample coal larger than the 0.5" (1.27cm) top-size, the manual coning and quartering method was used whereas for smaller top-size coal, totally enclosed splitters with stainless steel grids 3/4" (1.90cm) or 3/8" (0.95cm) apart were used as dictated by sample bulk and top-size.

Coarse coal [+3/4" (1.90cm)] was crushed for the purpose of sub-sampling by either a 3" X 5" laboratory jaw crusher or the 5" X 8" plant jaw crusher. Comminuation of coal with a top-size of less than 1/4" (0.64cm) was effected by use of a serrated plate motorized corn mill. This corn mill was also used for stage crushing of samples slated for petrographic analysis and Hardgrove Grindability tests.

Samples which required the analytical size consist of minus 60M (0.25mm) were pulped by using a Holmes perforated screen, impeller type pulverizer, totally enclosed to eliminate dusting loss. These pulverized samples were placed in plastic containers with air tight snap tops, on which the identification was recorded.

Float-sink liquids of appropriate gravities were made up by using proportions of iosol 2429 (0.78 S.G.), perchlorethlene (1.62 S.G.) and certigrav (2.20 S.G.). (Certigrav is a dibromo-ethane based organic liquid). The size of the apparatus for performing float-sink separations necessarily varies with the top-size of the coal being treated and the top-size dictates the minimum weight of sample to be used. The float-sink for this program was performed using containers as large as 75 litre capacity for the 2" top-size coal, and as small as separatory funnels of 2 litre capacity for 28M top-size coal.

Washability curves were drawn from primary data for the 2" X 1/2" (5.1cm X 1.27cm) raw coal as well as for the 3/4" X 28M (1.90cm X 0.59cm) and 28M X 65M (0.59cm X 0.21cm) crushed to minus 3/4" raw coal.

The 1/2" X 28M (1.27cm X 0.59cm) raw curves were drawn from calculations derived from the washability results aformentioned, and simulate the removal of material from the 3/4" X 28M coal which was introduced from the 2" X 3/4" raw coal being crushed to minus 3/4". Prior to accepting

this procedure, it was found that the amount of 3/4" x 1/2" material found in the raw, crushed to minus 3/4", was in the range of 2% and could be considered negligible. It was also assumed for the purpose of the calculations, that the amount of 1/2" x 28 mesh raw would be in the same range as the 3/4" x 28 mesh crushed and the total of the 2" x 1/2" and 3/4" x 28 mesh would equal 100%. See Appendix A for details.

The washability for 3/4" x 28 mesh, 28 mesh x 65 mesh and the 65 mesh x 0 raw crushed coal was deemed necessary in order to compare the results of the plant washes for which 3/4" x 0 coal forms the feed. These sizes dove-tail with the plant heavy-media, water cyclone and froth flotation circuits.

4. PILOT PLANT WASHING

Figure 2 is the flowsheet of the Coal Science & Minerals Testing pilot plant. Raw coal is dumped by a front end loader into a hopper at ground level, which has a heavy 2" square screen installed to ensure that the bucket elevator receiving the feed does not handle oversize material. The 2" oversize coal is crushed manually to pass the 2" screen, but "rock" is collected in barrels and reported as shale fo the heavy media circuit. The bucket elevator discharges the minus 2" feed at a rate of 5 to 7 metric tons per hour, into a rotary 3/4" screen on the third deck. The 3/4" oversize falls via a chute into a 5" x 8" jaw crusher where it is crushed to minus 3/4" and recycled through the feed system. The 3/4" x 0 screen underflow is washed with water onto a 28 mesh sieve bend and slot screen for desliming.

The 3/4" x 28 mesh coal is the feed to the 14" DSM Heavy Media come on the second deck. The slurry of coal and correct medium is pumped to the

cyclone from the mixing tube at a pressure of 9 to 10 P.S.I. The overflow and underflow products are discharged onto a common, but split 28M slot screen preceded by a 28M sieve bend where the magnetite is washed off into the correct and dilute medium tanks directly below. Additional clean spray water and baffles across the clean coal stream ensure that a minimum of magnetite is retained on the clean product. The clean coal and shale are collected in barrels by means of individual chutes for weighing.

The dilute medium is pumped to a thickening cone on the third deck from where it is fed to a 30" magnetic separator. The recovered magnetite is sluiced back to the correct medium tank. The specific gravity of the medium is monitored manually, using a density meter, and adjusted for loss by adding cyclone grade magnetite directly to the correct medium tank.

The 28M X 0 coal collected in the slimes tank ground level, is pumped to the thickening cone on the third deck. From this point it can be fed directly to the froth circuit or as is usual, to the water cyclone system.

Coal to the 6" DSM water cyclone is pumped at a pulp density of 10% to 20% from the cyclone feed tank at a pressure of 20 F.S.I., and a flow rate of 85 Imperial gallons per minute. A mechanically adjustable vortex finder facilitates settings for a desired ash content.

The underflow or waste product is routed to the static thickener while the overflow is fed by gravity to a rapped 0.25mm sieve bend. The sieve bend overflow is the water cyclone product at approximately 65M oversize, and directed to the Eimco disc filter for dewatering.

The sieve bend underflow flows by gravity to the thickening cyclone feed tank, from where it is pumped to the 20° - 8" cyclone. This thickening cone serves a dual purpose; 1) it removes undesireable -325M slimes from the flotation feed. 2) it provides a feed of proper density (20% - 30% solids) to the froth cells.

The flotation circuit consists of two Birtley-Humboldt multi-wobble cells in series. Since these cells were installed on September 12, 1975, there appears to be a marked improvement in tailings ash contents, indicating excellent recovery of froth product. A rotary reagent feeder introduces 4:1 Kerosene: Methylisobutylcarbinol into the circuit at the feed entry point for better conditioning.

The tailings join the water cyclone underflow in the static thickener to form the thickener tails. The froth enters the Eimco disc filter and is dewatered along with the sieve bend overflow to form the filter cake or fines product. This and the heavy media clean coal are combined to form the clean coal product or clean mix. This product is analysed as outlined in the flow sheet (Figure 1).

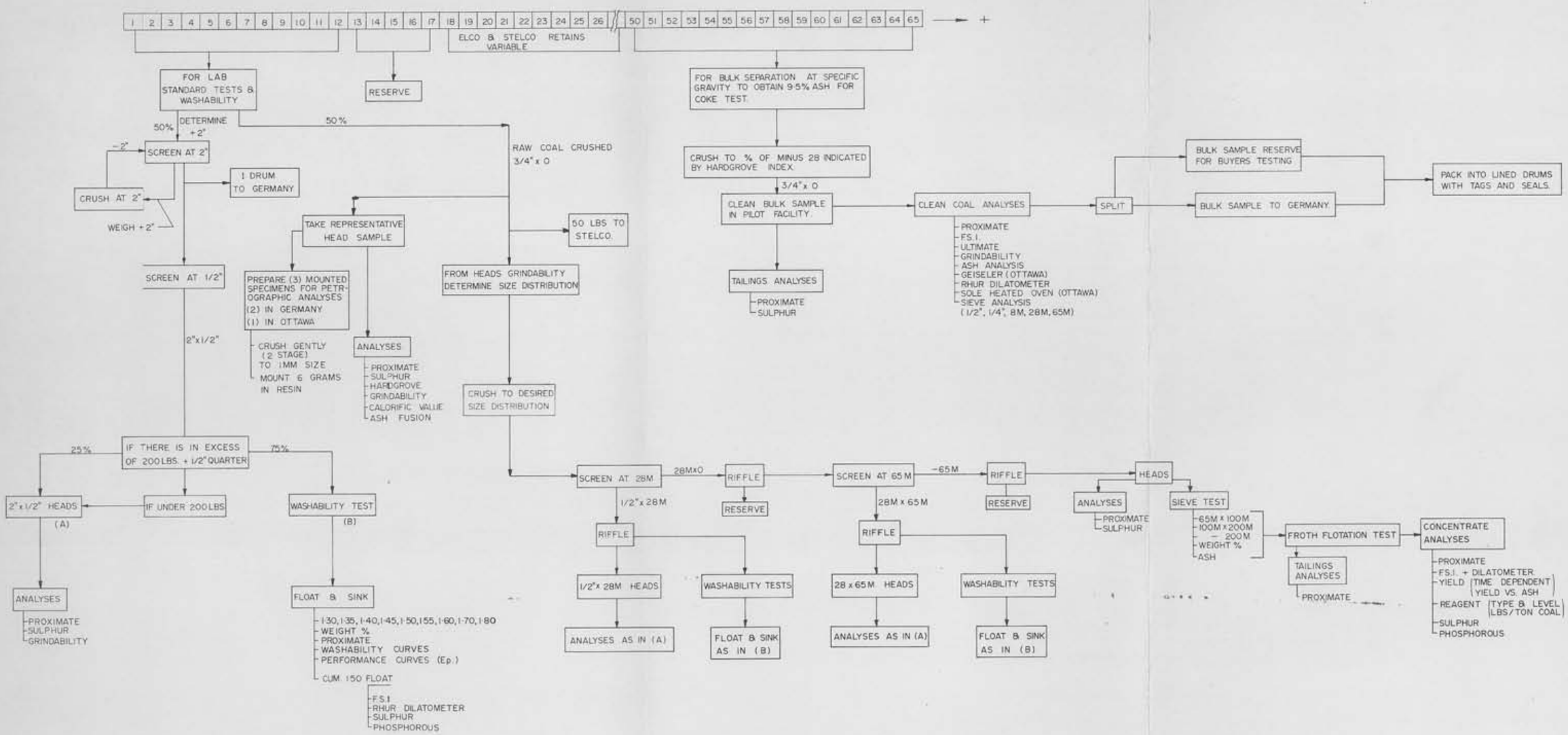
Each circuit was sampled for feed, product and waste in addition to the 0.25mm sieve bend overflow and filter cake. Each sample was analysed for ash content and Free Swelling Index. Size analyses were performed on fines circuit samples at 65M and 100M. Float-sink of the Heavy Media Clean Coal and Shale, and the water cyclone plus 100M overflow and underflow provide the necessary data to calculate the probable error curves for the two circuits. A detailed summary of the washing results is provided for each seam.

Unavoidably, due to the high pressure aspect of the program, some analytical determinations are missing, as will be evident from the blank spaces on the forms. Some of these determinations will be completed where samples are available and the replacement sheets will be forwarded at that time.

The heavy media clean coal and the filter cake were thoroughly homogenized and the resultant clean mix sampled and analysed. A clean coal analysis sheet contains the requested determinations.

For shipping purposes, clean 45 gallon drums were double lined with polyethylene bags, the coal placed into the barrels, a tag fixed inside, and lids securely put on. The destination was stencilled on the outside of the drums and all the drums save the initial shipment placed in bulk containers for overseas transport.

FIGURE 1



NOTE · (1) ALL HEAD SAMPLES WILL BE RETAINED AND STORED IN A MANNER TO INHIBIT OXIDATION.
(2) DRUM COSTS AND PACKING FOR HEAD SAMPLES AND CLEAN COAL TO BE INCLUDED.
(3) LABELS TO BE INSIDE LINER, ATTACHED TO LINER SEAL AND TO BE PAINTED ON BARRELS.

FIGURE 1.

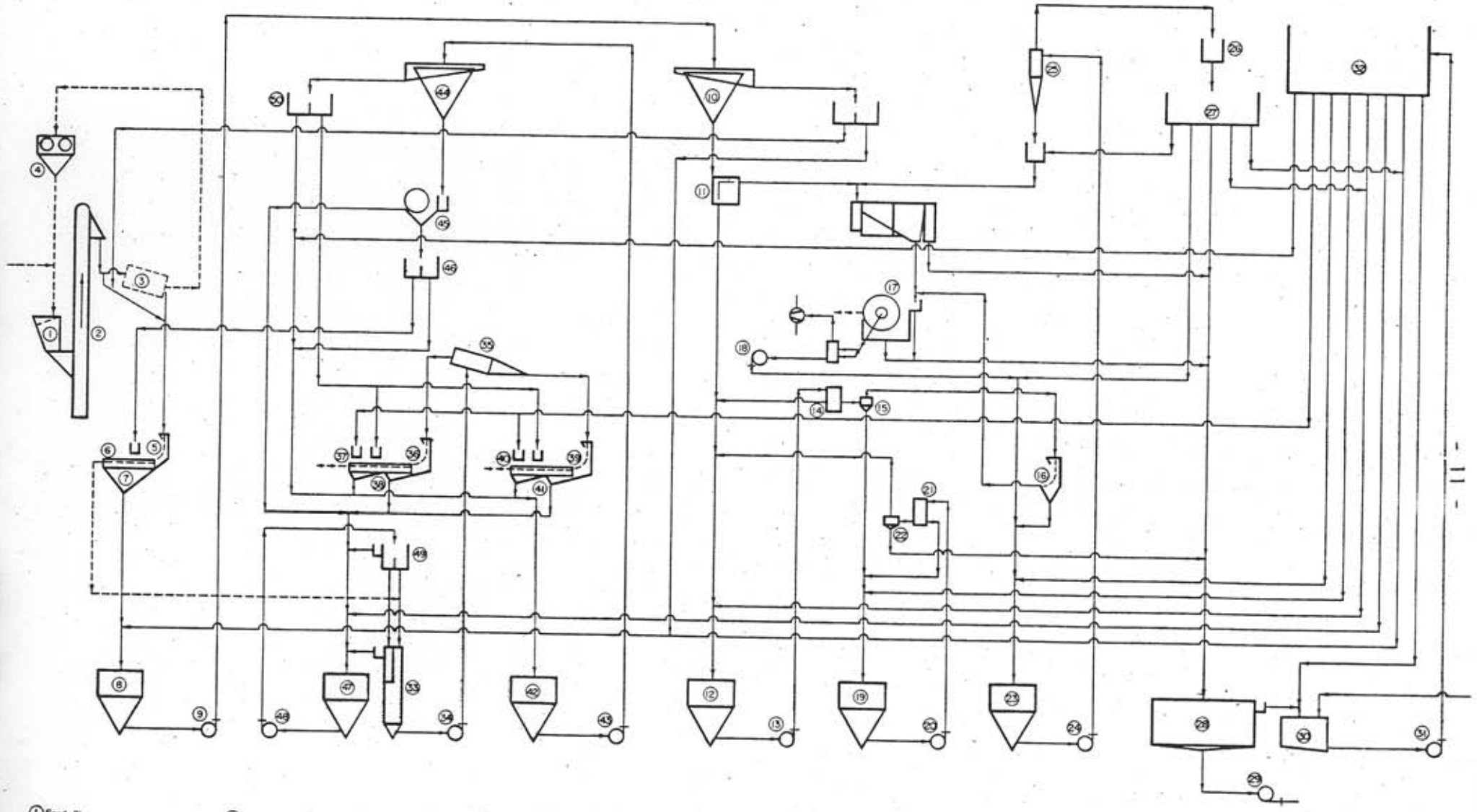
BIRTLEY ENGINEERING (CANADA) LTD.

THE FINAL BULK SAMPLE FLOWSHEET FOR ELCO MINING LTD. FOR 1975 ELK RIVER PROGRAMME

DRAWN BY: B.B. Butler 13 JAN. 76

SCALE: N.T.S.

DWG. No: BC/73



1. Feed Bin
2. Elevator
3. Rotary Screen
4. Jaw Crusher
5. Sieve Bend
6. Desilming Screen
7. Underflow Collector
8. 28M-O Raw Coal Collection Tank
9. Pump
10. Settling Cone
11. Diverter
12. Primary Water Only Cyclone Feed Tank
13. Pump
14. Distributor
15. Primary Water Only Cyclone
16. Sieve Bend
17. Vacuum Filter
18. Filtrate Water Pump
19. Secondary Water Only Cyclone Feed Tank
20. Pump
21. Distributor
22. Secondary Water Only Cyclone
23. Thickening Cyclone Feed Tank
24. Pump
25. Thickening Cyclone
26. Overflow Distributor
27. Head Box
28. Thickener
29. Waste Disposal Pump
30. Clarified Water Collection Tank
31. Clarified Water Pump
32. Clarified Water Head Box
33. Cyclone Feed Tank
34. Pump
35. D.S.M. Cyclone
36. Sieve Bend
37. C.C. Drain and Rinse Screen
38. Underflow Collector
39. Sieve Bend
40. Discard Drain and Rinse Screen
41. Underflow Collector
42. Dilute Medium Tank
43. Pump
44. Settling Cone
45. Magnetic Separator
46. Splitter Box
47. Correct Medium Tank
48. Pump
49. Distribution Box
50. Splitter Box

FIGURE 2

TEST PLANT FLOWSHEET

COAL SCIENCE & MINERALS TESTING

DIV. OF BIRTLEY ENGINEERING (CANADA) LTD. CALGARY, ALTA.

SAMPLE: Adit No. 2

LAB. NO.: 3396

TABLE 1

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTU/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	SF	Hs.	F.I.
0.6	37.2	15.0	47.2	0.39	9490	88	oxid.	1445+	-	-	-
							red.	1445+	-	-	-

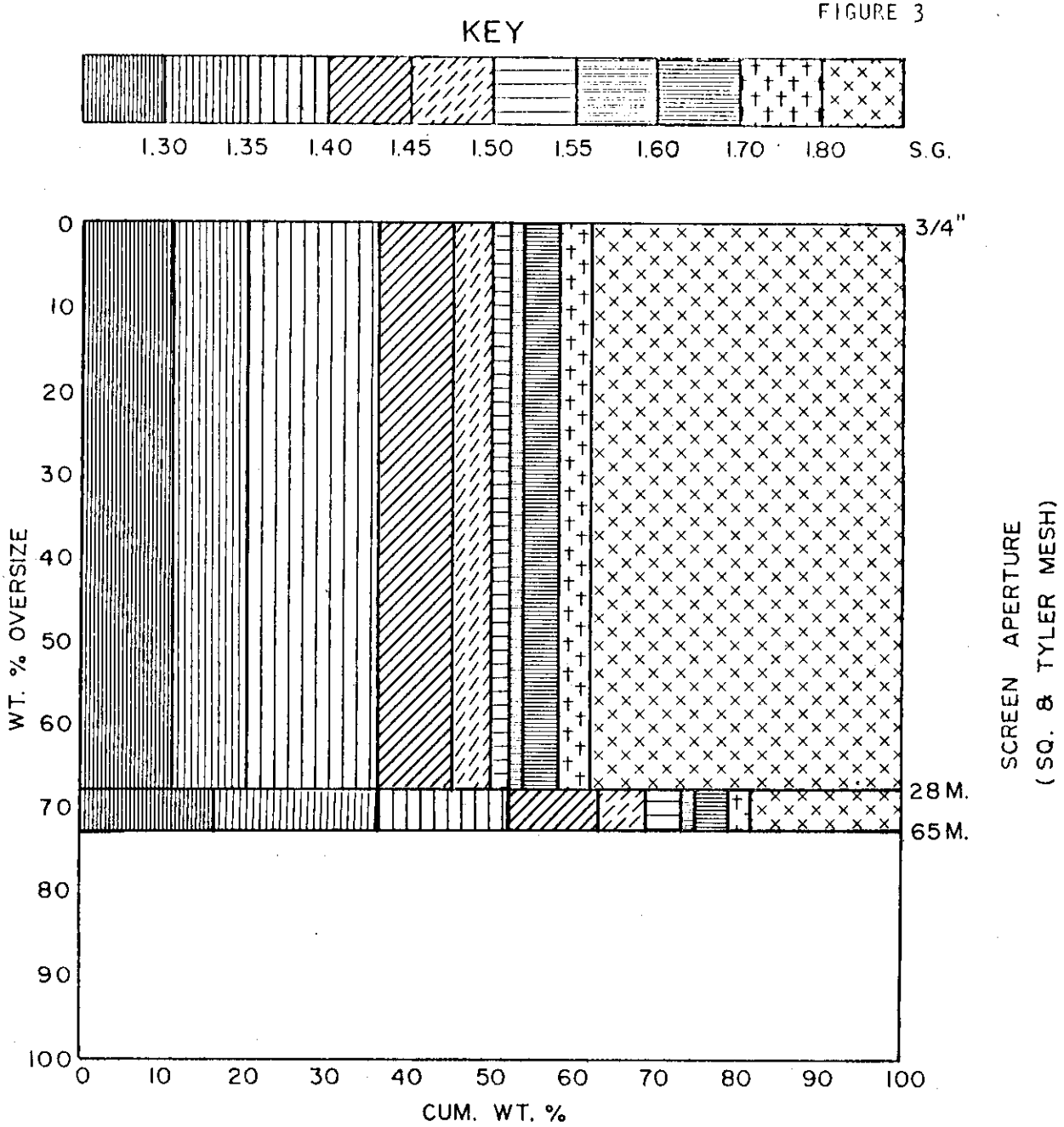
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
I	2" X 1/2"	17.9	57.8	0.8	13.3	28.1	0.31	69	17.9	-
	1/2" X 0	82.1	-	-	-	-	-	-	100.0	-
II	3/4" X 28M	67.9	41.8	0.6	14.5	43.1	0.37	80	67.9	41.8
	28M X 65M	4.9	24.1	0.7	17.3	57.9	0.48	123	72.8	40.6
	65M X 100M	8.6	25.6	-	-	-	-	-	81.4	39.0
	100M X 200M	10.1	19.5	-	-	-	-	-	91.5	36.9
	200M X 0	8.5	16.6	-	-	-	-	-	100.0	35.2
III	65M X 0	27.2	20.0	0.7	18.0	61.3	0.53	-	-	-

I - Size consist of raw coal as received, +2" WT. % = 4.5
Wt. % 1/2" x 28 Mesh = 66.3

II - Size consist of raw coal crushed to pass 3/4" screen.
Wt. % 3/4" x 1/2" = 1.7

III - 65 Mesh x 0 off analysis II.

FIGURE 3



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 2
DATE	OCT, 10, 1975	SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.2 LAB NO.3396 2" X .5"

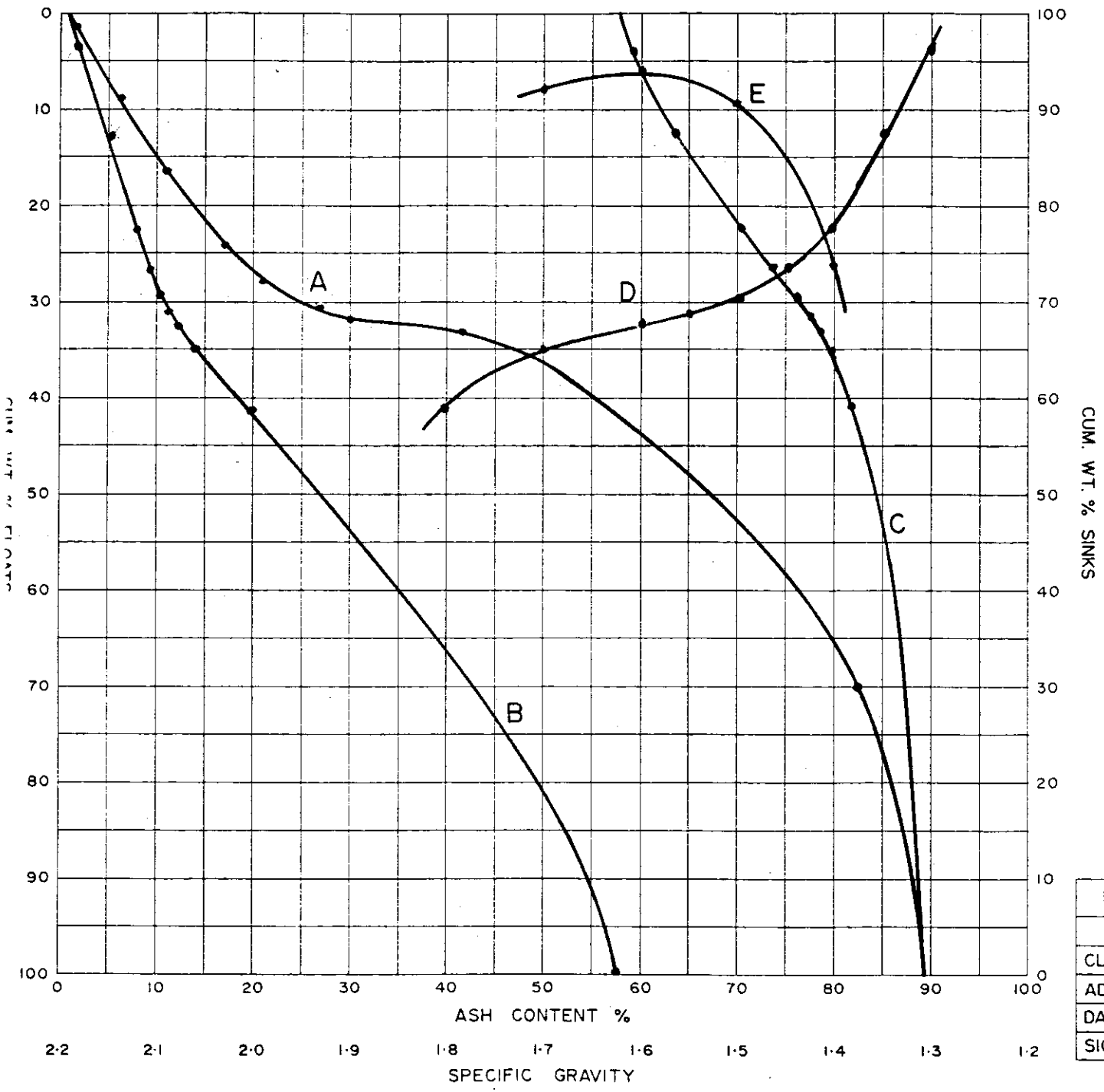
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	3.60	2.80	.10	.10	3.60	2.80	56.93	96.40	59.05	1.30	0.00
1.35	9.30	6.90	.64	.74	12.90	5.76	56.28	87.10	64.62	1.40	26.10
1.40	9.90	11.20	1.11	1.85	22.80	8.12	55.17	77.20	71.47	1.50	9.70
1.45	3.90	17.50	.68	2.53	26.70	9.49	54.49	73.30	74.34	1.60	5.60
1.50	3.00	21.20	.64	3.17	29.70	10.67	53.86	70.30	76.61	1.70	8.40
1.55	2.00	27.30	.55	3.72	31.70	11.72	53.31	68.30	78.05	1.80	0.00
1.60	.80	30.40	.24	3.96	32.50	12.18	53.07	67.50	78.62	1.90	0.00
1.70	2.80	42.70	1.20	5.15	35.30	14.60	51.87	64.70	80.17	2.00	0.00
1.80	5.60	53.50	3.00	8.15	40.90	19.93	48.88	59.10	82.70	2.10	0.00
9.99	59.10	82.70	48.88	57.03	100.00	57.03	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 2

FIGURE 4

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 2 2" x 1/2"
DATE	OCT, 7, 1975
SIGNED	K. M. LAU

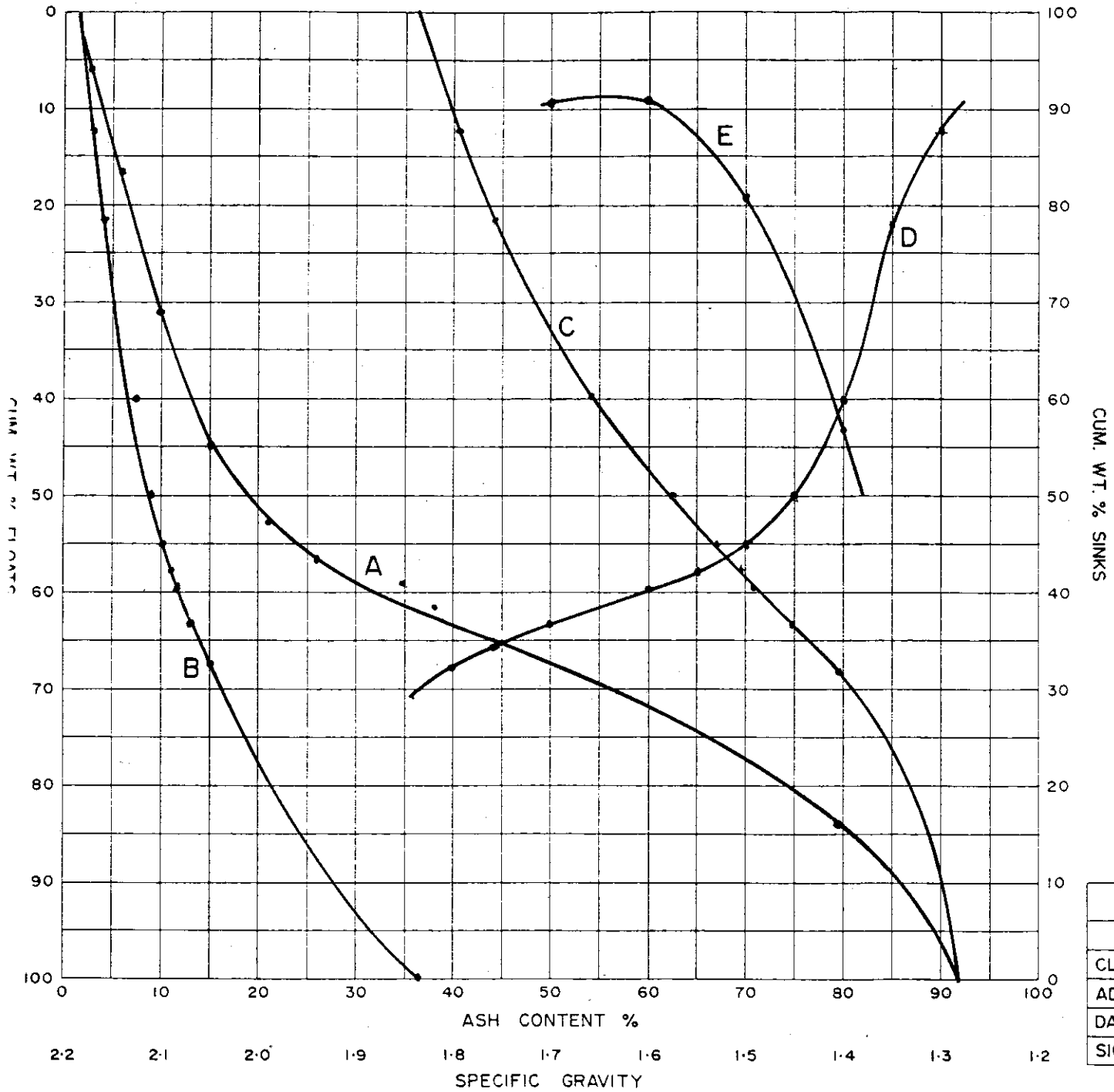
ELCO MINING LTD ADIT NO.2 LAB NO.3396 .5" X 28M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	12.40	2.60	.32	.32	12.40	2.60	35.21	87.60	40.19	1.30	0.00
1.35	9.30	5.90	.55	.87	21.70	4.01	34.66	78.30	44.27	1.40	42.80
1.40	18.30	10.10	1.85	2.72	40.00	6.80	32.81	60.00	54.69	1.50	19.30
1.45	9.90	15.20	1.50	4.22	49.90	8.47	31.31	50.10	62.49	1.60	8.40
1.50	5.30	20.90	1.11	5.33	55.20	9.66	30.20	44.80	67.41	1.70	8.80
1.55	2.50	26.30	.66	5.99	57.70	10.33	29.54	42.30	69.84	1.80	0.00
1.60	1.60	34.90	.56	6.55	59.30	11.04	28.98	40.70	71.21	1.90	0.00
1.70	4.30	37.80	1.63	8.17	63.60	12.85	27.36	36.40	75.16	2.00	0.00
1.80	4.50	44.40	2.00	10.17	68.10	14.94	25.36	31.90	79.50	2.10	0.00
9.99	31.90	79.50	25.36	35.53	100.00	35.53	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 3

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 2 1/2" x 28 M.
DATE	OCT, 9, 1975
SIGNED	K. M. Lau

FIGURE 5

ELCO MINING LTD ADIT NO.2 LAB NO.3396 .75" X 28 M

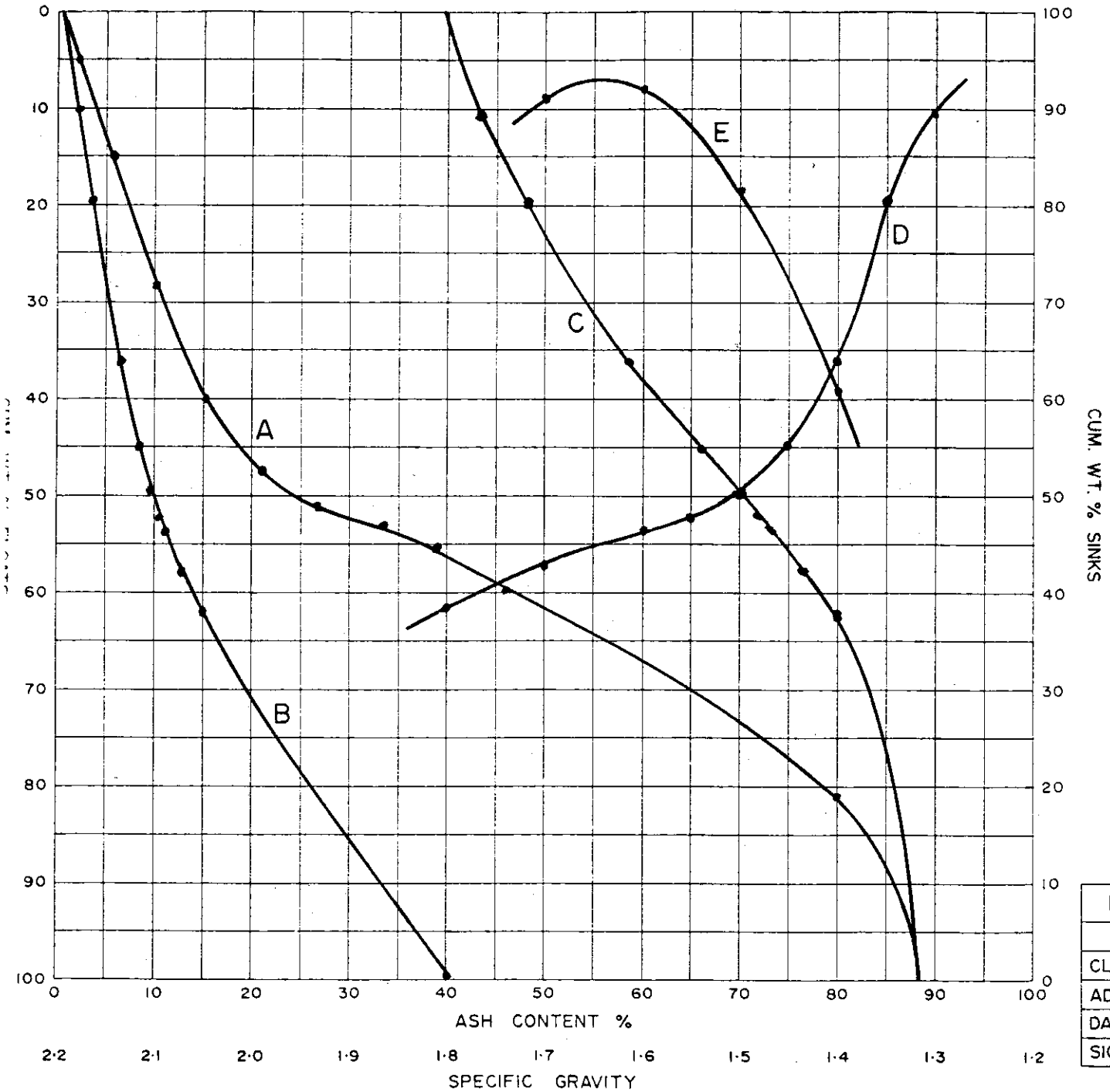
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	10.50	2.60	.27	.27	10.50	2.60	39.83	89.50	44.51	1.30	0.00
1.35	9.30	6.10	.57	.84	19.80	4.24	39.26	80.20	48.96	1.40	39.30
1.40	16.50	10.20	1.68	2.52	36.30	6.95	37.58	63.70	59.00	1.50	17.30
1.45	8.70	15.40	1.34	3.86	45.00	8.58	36.24	55.00	65.39	1.60	7.80
1.50	4.80	20.90	1.00	4.87	49.80	9.77	35.24	50.20	70.20	1.70	8.70
1.55	2.40	26.50	.64	5.50	52.20	10.54	34.60	47.80	72.39	1.80	0.00
1.60	1.40	34.40	.48	5.98	53.60	11.16	34.12	46.40	73.54	1.90	0.00
1.70	4.00	38.50	1.54	7.52	57.60	13.06	32.58	42.40	76.84	2.00	0.00
1.80	4.70	46.70	2.19	9.72	62.30	15.60	30.39	37.70	80.60	2.10	0.00
9.99	37.70	80.60	30.39	40.11	100.00	40.11	0.00	0.00	I	2.20	0.00

BIRTLEY ENGINEERING

TABLE 4

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 2 3/4" x 28M.
DATE	OCT, 7, 1975
SIGNED	K. M. LAU

FIGURE 6

ELCO MINING LTD ADIT NO.2 LAB NO.3396 28M X 65M

---DIRECT---					---CUM FLOATS---		---CUM SINKS---		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	16.20	1.20	.19	.19	16.20	1.20	23.06	83.80	27.51	1.30	0.00
1.35	20.00	4.20	.84	1.03	36.20	2.86	22.22	63.80	34.82	1.40	52.90
1.40	16.00	8.60	1.38	2.41	52.20	4.62	20.84	47.80	43.60	1.50	22.70
1.45	10.70	12.90	1.38	3.79	62.90	6.03	19.46	37.10	52.45	1.60	9.50
1.50	6.20	19.80	1.23	5.02	69.10	7.26	18.23	30.90	59.01	1.70	6.40
1.55	3.80	24.20	.92	5.94	72.90	8.15	17.31	27.10	63.89	1.80	0.00
1.60	2.00	29.50	.59	6.53	74.90	8.72	16.72	25.10	66.63	1.90	0.00
1.70	3.70	36.20	1.34	7.87	78.60	10.01	15.38	21.40	71.89	2.00	0.00
1.80	2.70	43.40	1.17	9.04	81.30	11.12	14.21	18.70	76.00	2.10	0.00
9.99	18.70	76.00	14.21	23.25	100.00	23.25	0.00	.00	0.00	2.20	0.00

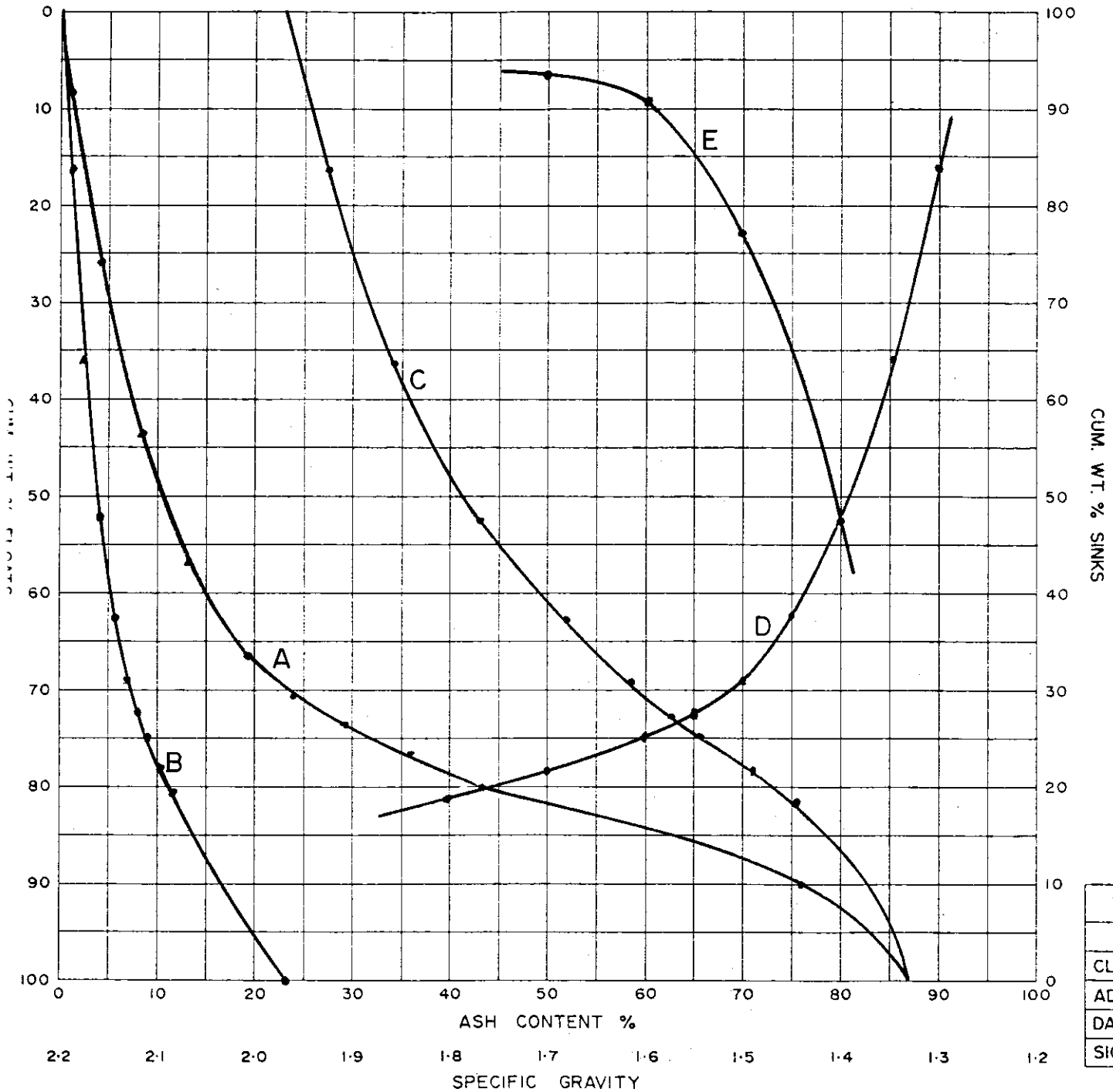
BIRTLEY ENGINEERING

TABLE 5

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 7

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 2 28M. x 65M.
DATE	OCT, 8, 1975
SIGNED	K. M. LAU

TABLE 6

ELCO MINING LTD.

SAMPLE: Adit No. 2

LAB. NO.: 3396

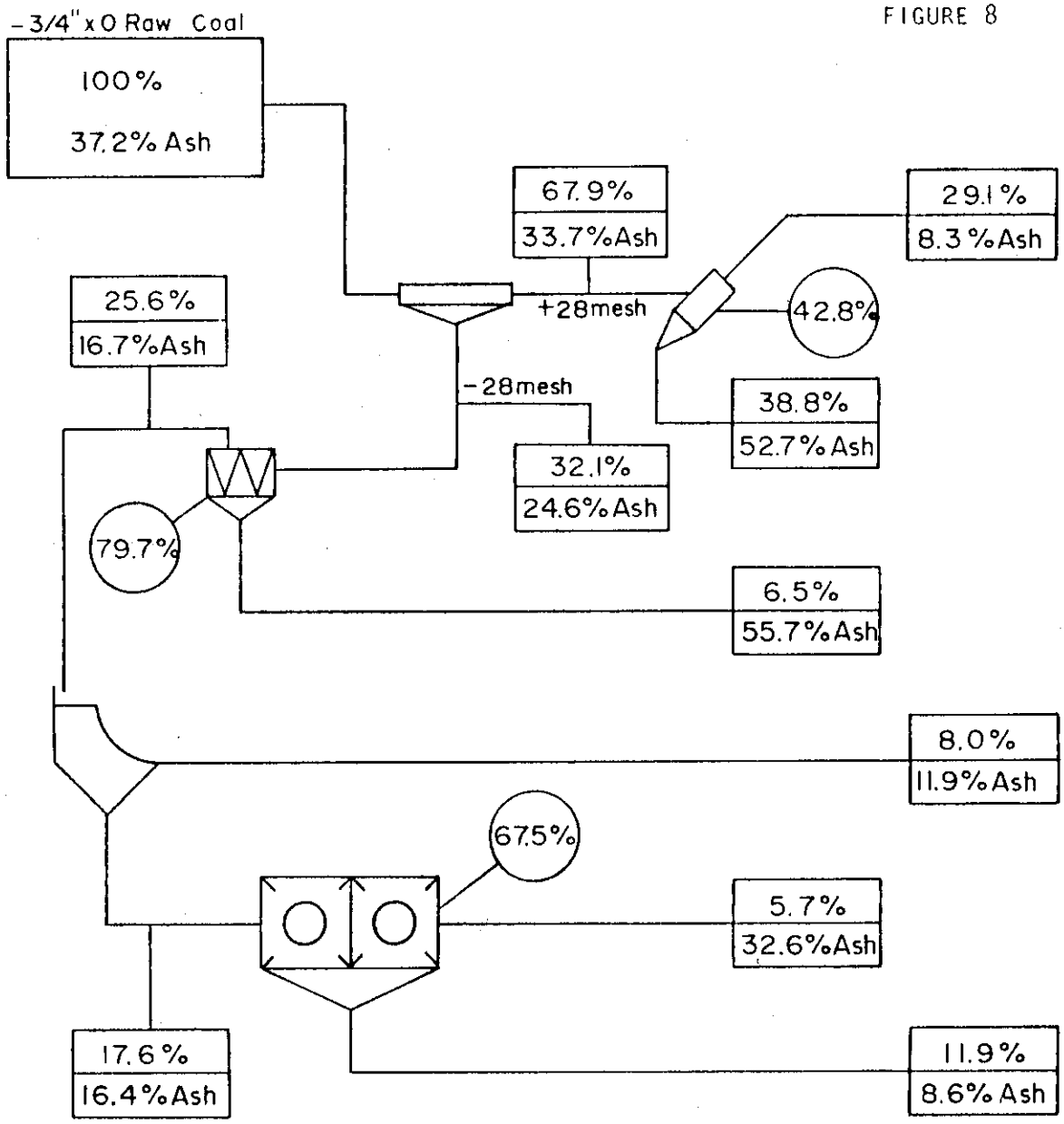
ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	7 1/2	0.56	0.04	402	--	3	-3	--
3/4" X 28M	8	0.60	0.03	392	463	21	18	0.994
28M X 65M	9	0.74	0.03	394	465	24	52	1.032

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	F.C. %	S %	P %	FSI	Cumulative	
									Wt. %	Ash %
Stage I	69.6	9.8	.6	19.2	70.4	.62	0.03	9	69.6	9.8
Stage II	10.1	18.3	.6	17.8	63.3	.61	0.04	8	80.0	10.9
Tails	20.0	55.9	.9	13.7	29.5	--	--	--	100.0	19.9

F. F. Parameters

Pulp Density	10%
Reagent	4:1 = Ker.:MIBC
Dosage Rate	0.48 lb./T
Conditioning Time	1 Minute
Stage I	1st Minute Froth
Stage II	2nd Minute Froth

FIGURE 8



OVERALL YIELD = 49.0%

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No 2	DEC. 19/75
	Drawn L. BAILEY

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 2 LAB NO. 3395 DATE OF WASH September 3, 1975.

Raw Coal Analysis: Ash % 37.2 Hardgrove Grindability Index 88

Delivered Bulk Weight 27.5 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 2 LAB NO. 3395

1. S. G. of Separation (a) Washability 1.42
   (b) Plant 1.38

2. Feed Ash Content A.D.B. 33.7 %

3. Clean Coal Estimated Weight 3.74 M.T.

4. Clean Coal Analysis (A.D.B.) Ash 8.3 % F.S.I. 9

5. Reject Estimated Weight 6.62 M.T.

6. Reject Analysis (A.D.B.) Ash 52.7 % FSI 1

7. Estimated 3/4" x 28M in Circuit (3+5) 10.36 M.T.

8. Actual 3/4" x 28 Mesh from Washability Data 67.9 %

9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 36.2 %

10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 42.8 %

11. Yield Clean Coal (Washability) 44 %

12. +2" Rock Oversize Nil M. T.

ELCO MINING LTD.

TABLE 7

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 2 LAB NO. 3395

1. Vortex Finder Clearance (VFC) 2.54 CM 1 Inches
2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.
3. Feed Rate 21.8 $M^3/Hr.$ 80 IG/Min.
4. Feed Pulp Density 150 g/l. Approx. 15 % Solids W/V
5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	67.2	24.9	9	67.2	24.9	24.6	8 1/2
	65M x 100M (.15 CM)	6.8	15.4	9	74.0	24.0		
	100M x 0	26.0	23.1	8 1/2	100.0	23.8		
O'FLOW	+65M	31.3			31.3		16.7	8 1/2
	65M x 100M	13.0			44.3	14.4		
	100M x 0	55.7	18.5	8 1/2	100.0	16.7		
U'FLOW	+65M	75.5			75.5		55.7	1 1/2
	65M x 100M	10.0			85.5	55.1		
	100M x 0	14.5	59.0	1	100.0	55.7		
S B O	+65M	94.6	11.8	9	94.6	11.8	11.9	9
	65M x 100M	1.8	17.6	9	96.4	11.9		
	100M x 0	3.6	14.1	9	100.0	12.0		

6. Yield - Total W.O. Cyclone Circuit = 79.7
7. Est. Yield of 28 x 65 Mesh Coal = 24.9
   (as % of 28 Mesh x 0 Feed)

ELCO MINING LTD. TABLE 8

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 2 LAB NO. 3395

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 140-230 g/l 14-23 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	11.7	12.3	9	11.7	12.3	16.4	8 1/2
	65M x 100M (.15 CM)	15.5	12.7	9	27.2	12.5		
	100M x 0	72.8	17.8	8 1/2	100.0	16.4		
CONC.	+65M (.21 CM)	9.5	7.1	9	9.5	7.1	8.6	9
	65M x 100M (.15 CM)	14.4	7.0	9	25.9	7.0		
	100M x 0	76.1	9.2	9	100.0	8.7		
TAILS	+65M (.21 CM)	34.3	21.6	5 1/2	34.3	21.6	32.6	3 1/2
	65M x 100M (.15 CM)	24.6	24.4	6	58.9	22.8		
	100M x 0	41.1	47.6	1 1/2	100.0	33.0		

4. Impeller Type - Denver

5. Yield Calculated (Ash Balance) 67.5 %

6. Yield (Washability) 65.0 %

7. 65M x 0 (Washability) 27.2 %

ELCO MINING LTD.

BULK WASHING DATA

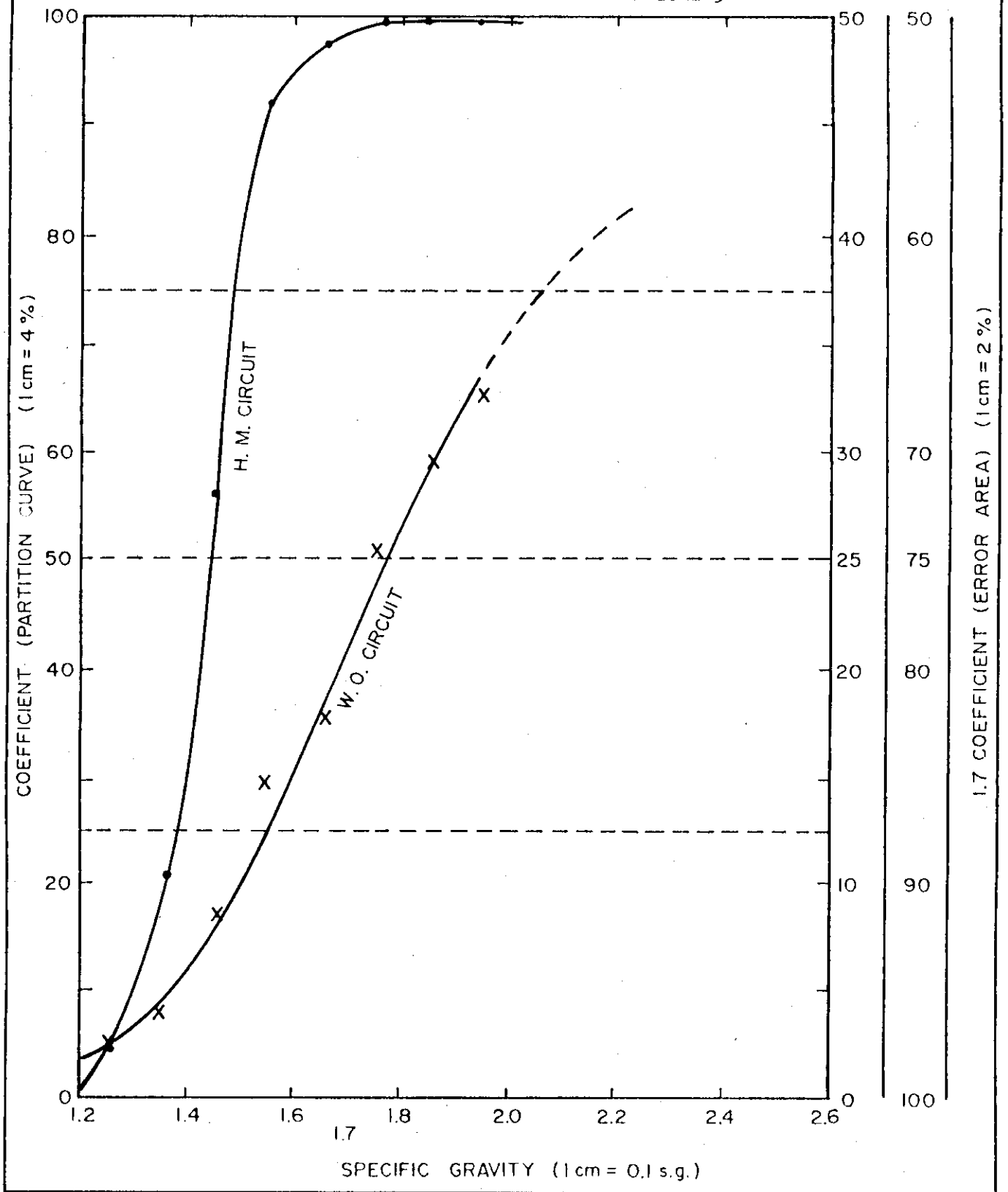
TABLE 9

ADIT/SEAM NO. 2 LAB NO. 3395

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	24.4	24.4	1.0	1.0	20.0	20.0	3.5	3.5
1.30-1.40	61.7	81.1	11.9	12.9	50.2	70.2	14.2	17.7
1.40-1.50	13.1	99.2	12.9	25.8	14.6	84.8	10.0	27.7
1.50-1.60	0.7	99.7	7.6	33.4	4.9	89.7	6.7	34.4
1.60-1.70	0.1	100.0	6.8	40.2	3.0	92.7	5.4	39.8
1.70-1.80	-	-	6.0	46.2	1.7	94.4	5.7	45.5
1.80-1.90	-	-	4.6	50.8	0.9	95.3	4.2	49.7
1.90-2.00	-	-	3.7	54.5	0.7	96.0	4.3	54.0
+2.00	-	-	45.5	100.0	4.0	100.0	46.0	100.0

FIGURE 9



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 2	JAN. 6/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 2 LAB. NO. 3395 DATE OF WASH September 3, 1975.

a) Raw Coal

Delivered Wt.	=	27.5 M.T.
Ash %	=	37.2
Hardgrove Grindability Index	=	88
Estimated Washed Weight	=	14.9 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 67.9 %

Effective S. G. = 1.45

Raw Feed	33.7 %	Ash 4 1/2	F.S.I.
Clean Coal	8.3 %	Ash 9	F.S.I.
Reject	52.7 %	Ash 1	F.S.I.

Calculated Yield = 42.8 %

Weighed Yield = 36.2 %

c) Water-Only Cyclone Circuit

Raw Feed	24.6 %	Ash 8 1/2	F.S.I.
Overflow	16.7 %	Ash 8 1/2	F.S.I.
Underflow	55.7 %	Ash 1 1/2	F.S.I.

Calculated Yield = 79.7

% of +65 Mesh in O/F = 31.3 %

Sieve Bend Overflow	11.9 %	Ash 9	F.S.I.

d) Froth Flotation Circuit

Raw Feed	16.4 %	Ash 8 1/2	F.S.I.
Concentrates	8.6 %	Ash 9	F.S.I.
Tails	32.6 %	Ash 3 1/2	F.S.I.

Calculated Yield = 67.5 %

ELCO MINING LTD.

TABLE 10

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 2 LAB. NO. 3395

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 1.1 ASH % 9.2 VM % 19.2 FC % 70.5 S% 0.49 FSI 9

(ii) Dilatometer

Softening °C 400 Max. Dil. °C 461 Max Cont. % 21

Max. Dil. % 59 G. No. = 1.027

(iii) Hardgrove Grindability Index = 109

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
14	2.38	10	1.70	5	0.85	0.6	0.102	-	-	.4	30	5

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 11

SAMPLE: Clean Coal - Adit No. 2

LAB. NO.: 3395

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
1.1	9.2	19.2	70.5	9	109

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	1.3	1.3
1/2" X 1/4"	9.3	10.6
1/4" X 8M	15.8	26.4
8M X 28M	29.2	55.6
28M X 65M	21.3	76.9
65M X 0	23.1	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
400	461	21	59	1.027

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.38	81.22	4.21	1.20	0.60	9.25	3.14

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.04	0.14	0.17	0.62	4.68	24.06	66.04	0.24	0.47	1.88

SAMPLE: Adit No. 3

LAB. NO.: 3540

TABLE 12

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.7	21.9	16.1	61.3	0.44	12210	109	oxid.	1390	1445+	-	-
							red.	1330	1445	1445+	-

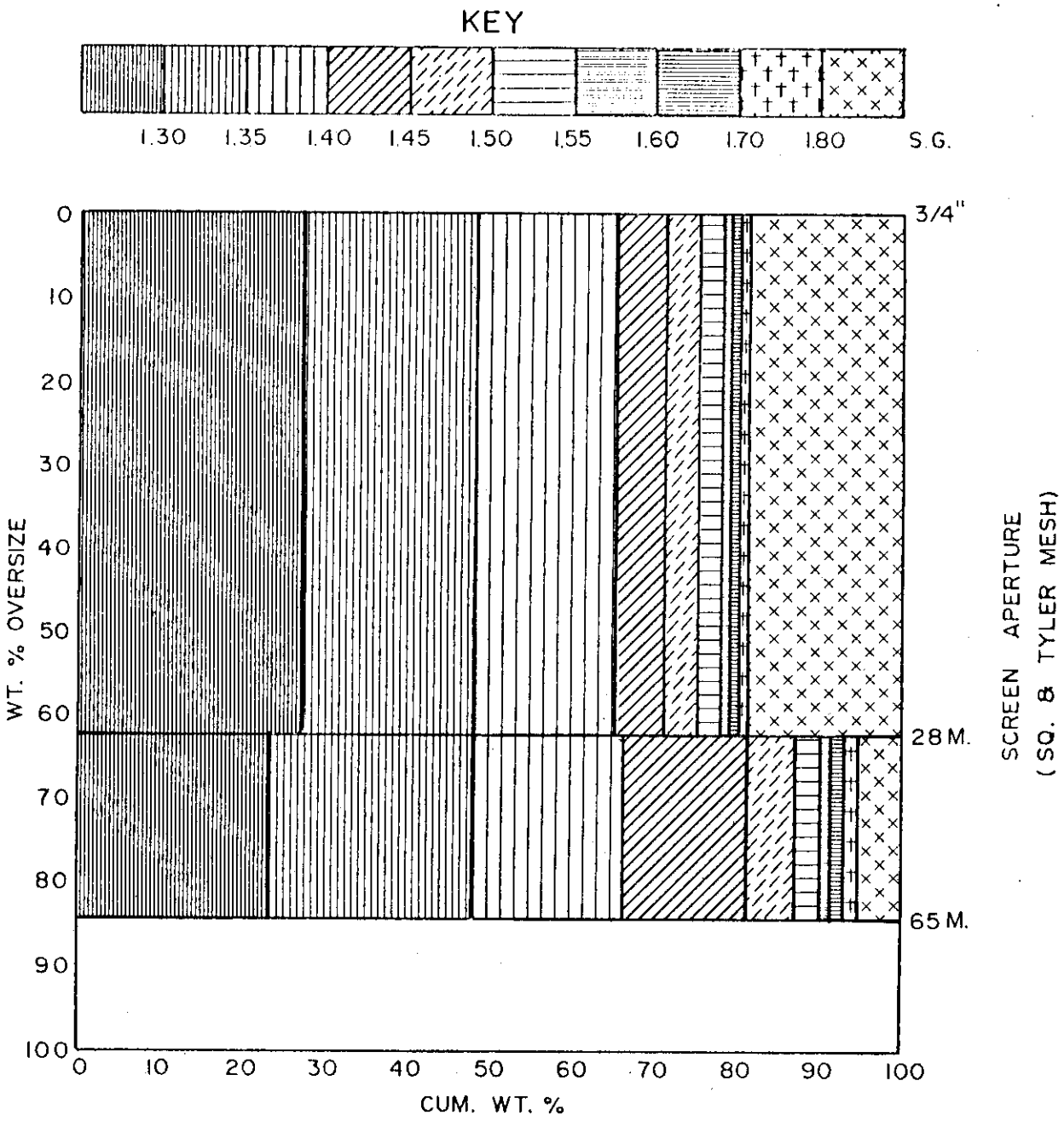
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	13.6	68.8	0.5	9.6	21.1	0.23	63	13.6	-
	1/2" X 0	86.4	-	-	-	-	-	-	100.0	-
II	3/4" X 28M	62.3	23.7	0.5	16.0	59.8	0.53	104	62.3	23.7
	28M X 65M	22.3	11.1	0.6	18.1	70.2	0.56	136	84.6	20.4
	65M X 100M	4.9	11.6	-	-	-	-	-	89.5	19.9
	100M X 200M	6.6	10.5	-	-	-	-	-	96.1	19.2
	200M X 0	3.9	10.8	-	-	-	-	-	100.0	18.9
III	65M X 0	15.4	11.0	0.6	18.2	70.2	0.55	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 7.7
Wt. % 1/2" x 28 Mesh = 62.5

II - Size consist of raw coal crushed down to minus 3/4"
Wt. % 3/4" x 1/2" = 1.6

III - 65 Mesh x 0 material off analysis II

FIGURE 10



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 3
DATE	OCT, 7, 1975	SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.3 LAB NO.3540 2" X .5"

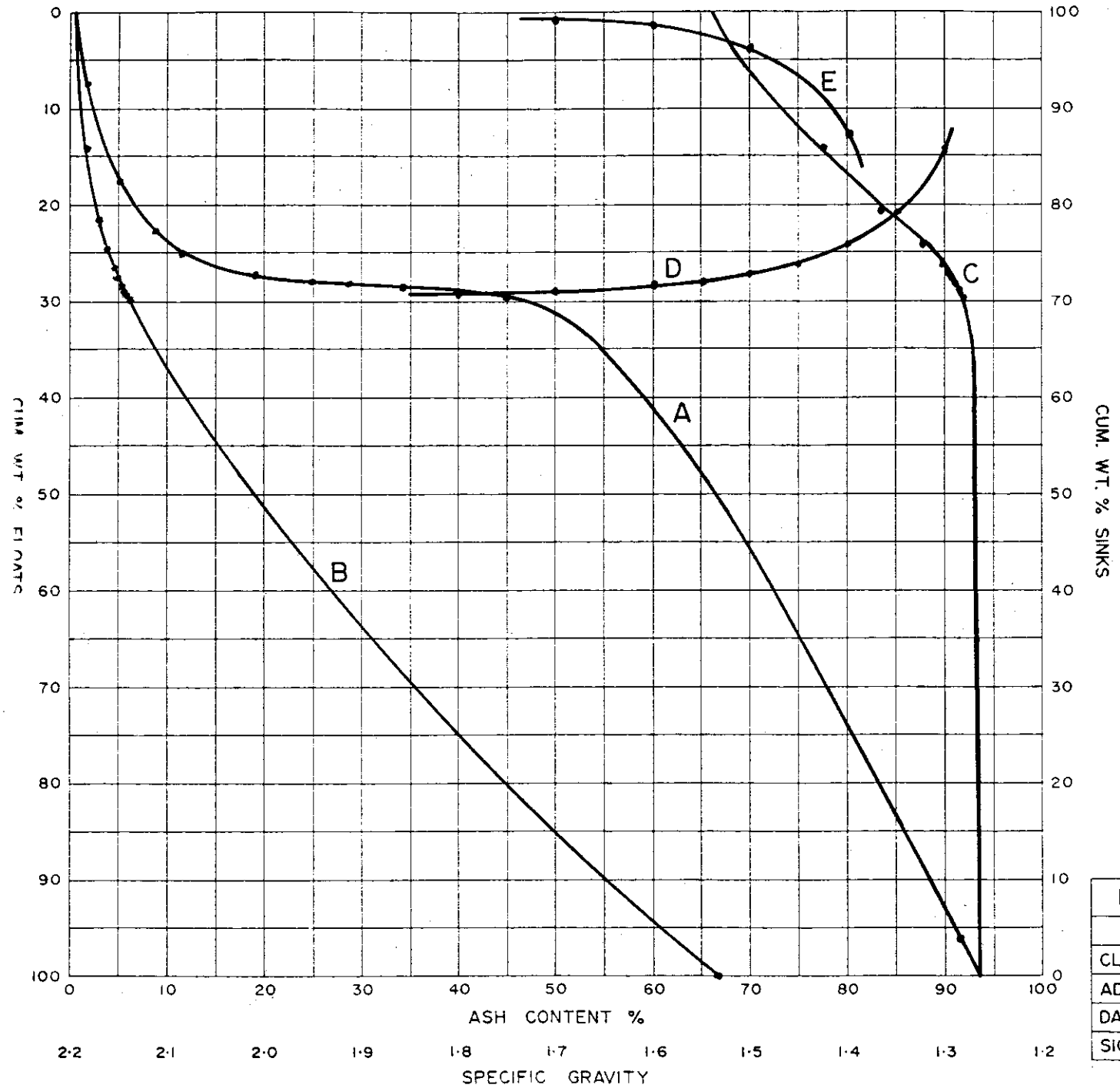
---DIRECT---					---CUM FLOATS---		---CUM SINKS---		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	14.00	2.20	.31	.31	14.00	2.20	67.09	86.00	78.01	1.30	0.00
1.35	7.00	5.40	.38	.69	21.00	3.27	66.71	79.00	84.44	1.40	13.30
1.40	3.20	9.40	.30	.99	24.20	4.08	66.41	75.80	87.61	1.50	4.30
1.45	2.40	12.10	.29	1.28	26.60	4.80	66.12	73.40	90.08	1.60	1.60
1.50	.70	19.30	.14	1.41	27.30	5.17	65.98	72.70	90.76	1.70	.60
1.55	.90	25.00	.23	1.64	28.20	5.81	65.76	71.80	91.58	1.80	0.00
1.60	.30	29.10	.09	1.72	28.50	6.05	65.67	71.50	91.84	1.90	0.00
1.70	.40	34.50	.14	1.86	28.90	6.44	65.53	71.10	92.17	2.00	0.00
1.80	.20	45.20	.09	1.95	29.10	6.71	65.44	70.90	92.30	2.10	0.00
9.99	70.90	92.30	65.44	67.39	100.00	67.39	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGILEERING

TABLE 13

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity - Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 11

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 3 2" x 1/2"
DATE	OCT, 7, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.3 LAB NO.3540 .5" X 28 MESH

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	30.59	2.10	.64	.64	30.59	2.10	12.29	69.41	17.70	1.30	0.00
1.35	23.89	4.90	1.17	1.81	54.48	3.33	11.12	45.52	24.42	1.40	55.38
1.40	19.29	9.30	1.79	3.61	73.77	4.89	9.32	26.23	35.55	1.50	16.09
1.45	7.60	13.50	1.03	4.63	81.37	5.69	8.30	18.63	44.53	1.60	5.30
1.50	4.60	19.30	.89	5.52	85.97	6.42	7.41	14.03	52.80	1.70	2.70
1.55	2.40	25.00	.60	6.12	88.36	6.93	6.81	11.64	58.53	1.80	0.00
1.60	1.50	28.30	.42	6.54	89.86	7.28	6.39	10.14	63.01	1.90	0.00
1.70	1.40	34.90	.49	7.03	91.26	7.71	5.90	8.74	67.51	2.00	0.00
1.80	1.30	41.80	.54	7.58	92.56	8.13	5.35	7.44	72.00	2.10	0.00
9.99	7.44	72.00	5.35	12.93	100.00	12.93	0.00	0.00	I	2.20	0.00

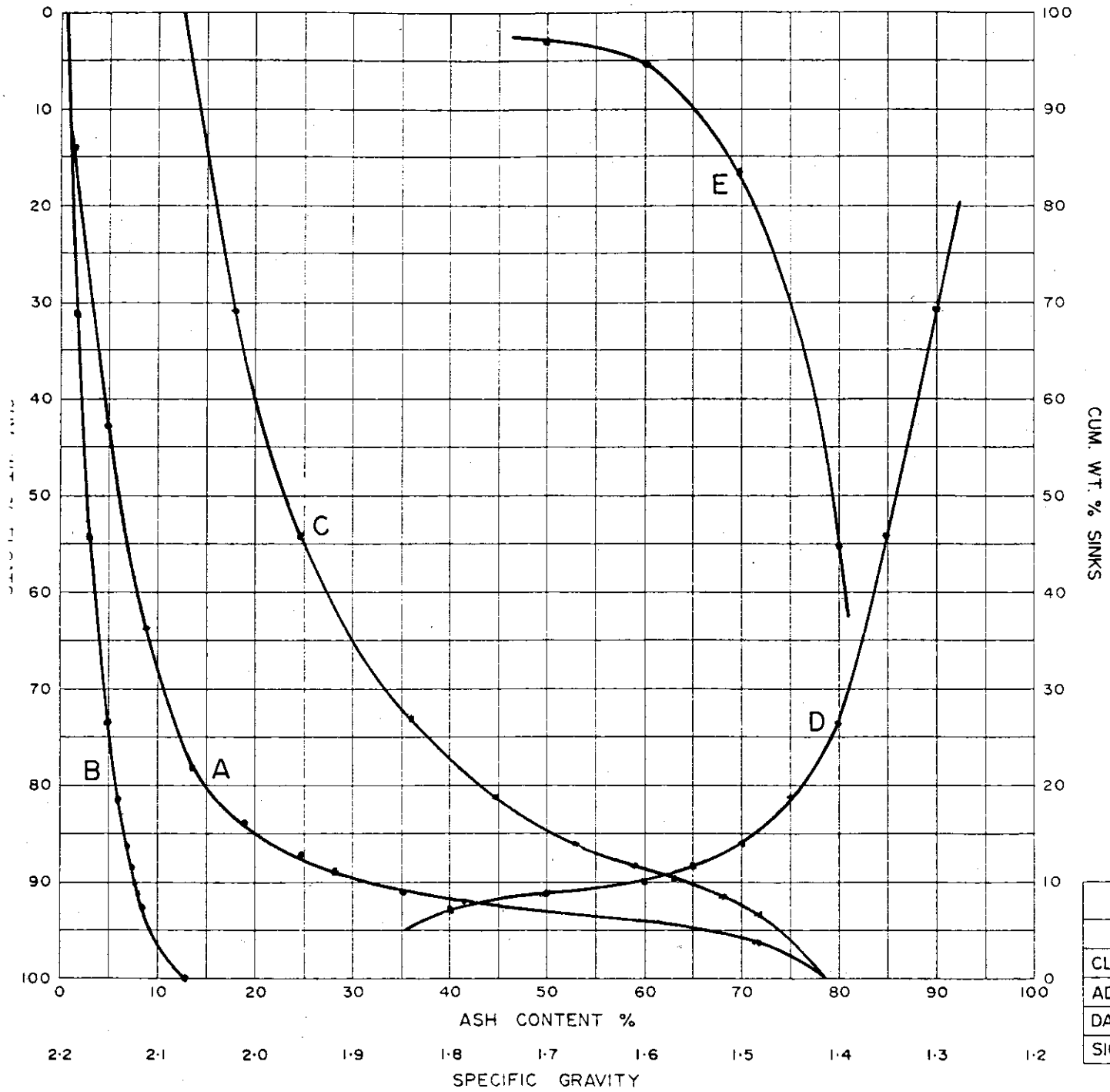
BIRTLEY ENGINEERING

TABLE 14

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 12

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 3 1/2" x 28M.
DATE	OCT, 9, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIP NO.7 LAB NO.3540 .75" X 28 MES

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	27.60	2.10	.58	.58	27.60	2.10	22.07	72.40	30.48	1.30	0.00
1.35	20.90	4.90	1.02	1.60	48.50	3.31	21.05	51.50	40.87	1.40	47.90
1.40	16.40	9.30	1.53	3.13	64.90	4.82	19.52	35.10	55.62	1.50	14.00
1.45	6.70	13.50	.90	4.03	71.60	5.63	18.62	28.40	65.55	1.60	4.60
1.50	3.90	19.30	.75	4.79	75.50	6.34	17.86	24.50	72.92	1.70	2.30
1.55	2.10	25.00	.53	5.31	77.60	6.84	17.34	22.40	77.41	1.80	0.00
1.60	1.30	28.30	.37	5.68	78.90	7.20	16.97	21.10	80.43	1.90	0.00
1.70	1.20	34.90	.42	6.10	80.10	7.61	16.55	19.90	83.18	2.00	0.00
1.80	1.10	41.80	.46	6.56	81.20	8.08	16.09	18.80	85.60	2.10	0.00
9.99	18.80	85.60	16.09	22.65	100.00	22.65	0.00	.00	0.00	2.20	0.00

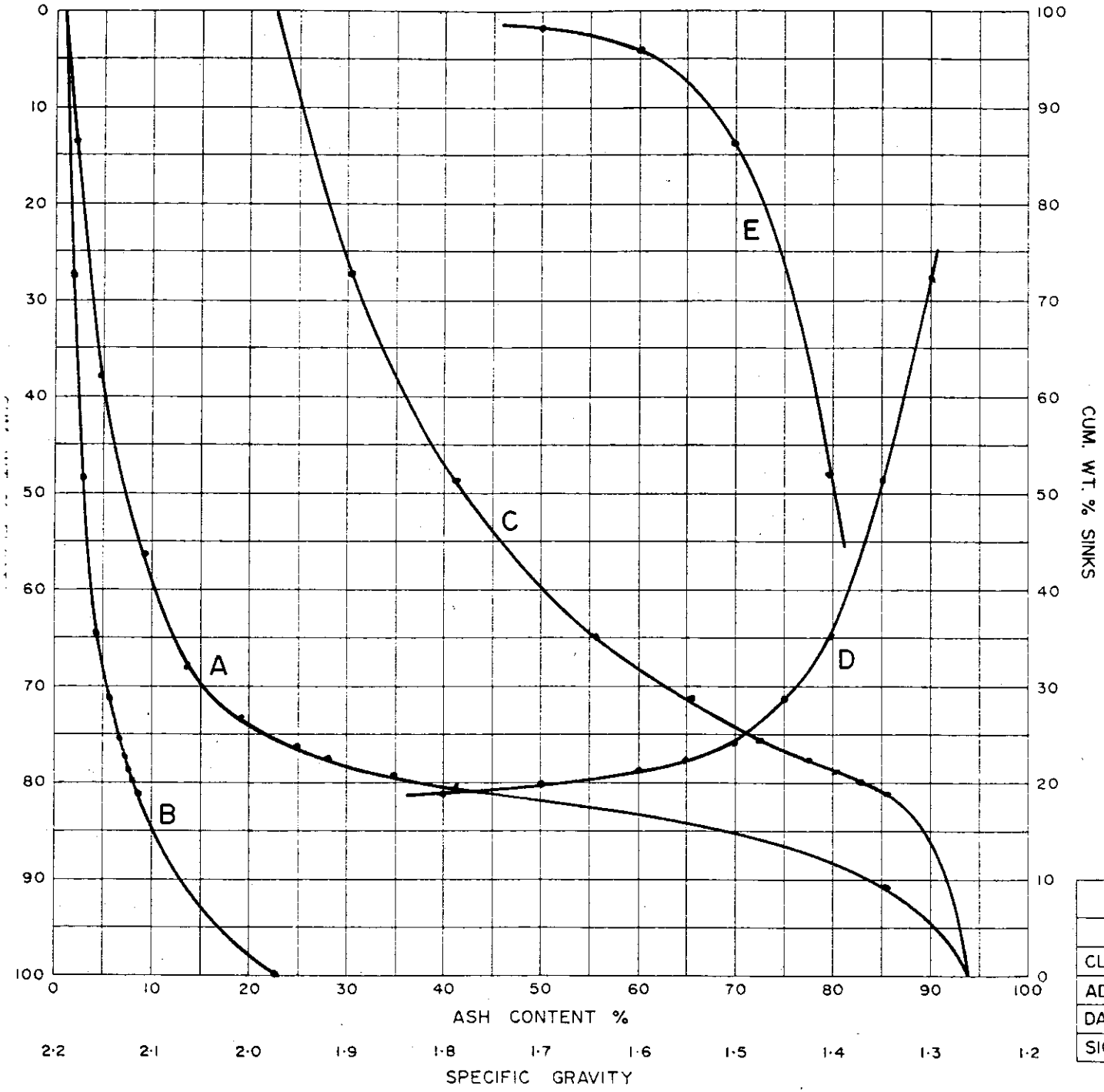
BIRTLEY ENGINEERING

TABLE 15

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 13

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 3 3/4" x 28M.
DATE	OCT, 7, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.3 LAB NO.3540 28M X 65M

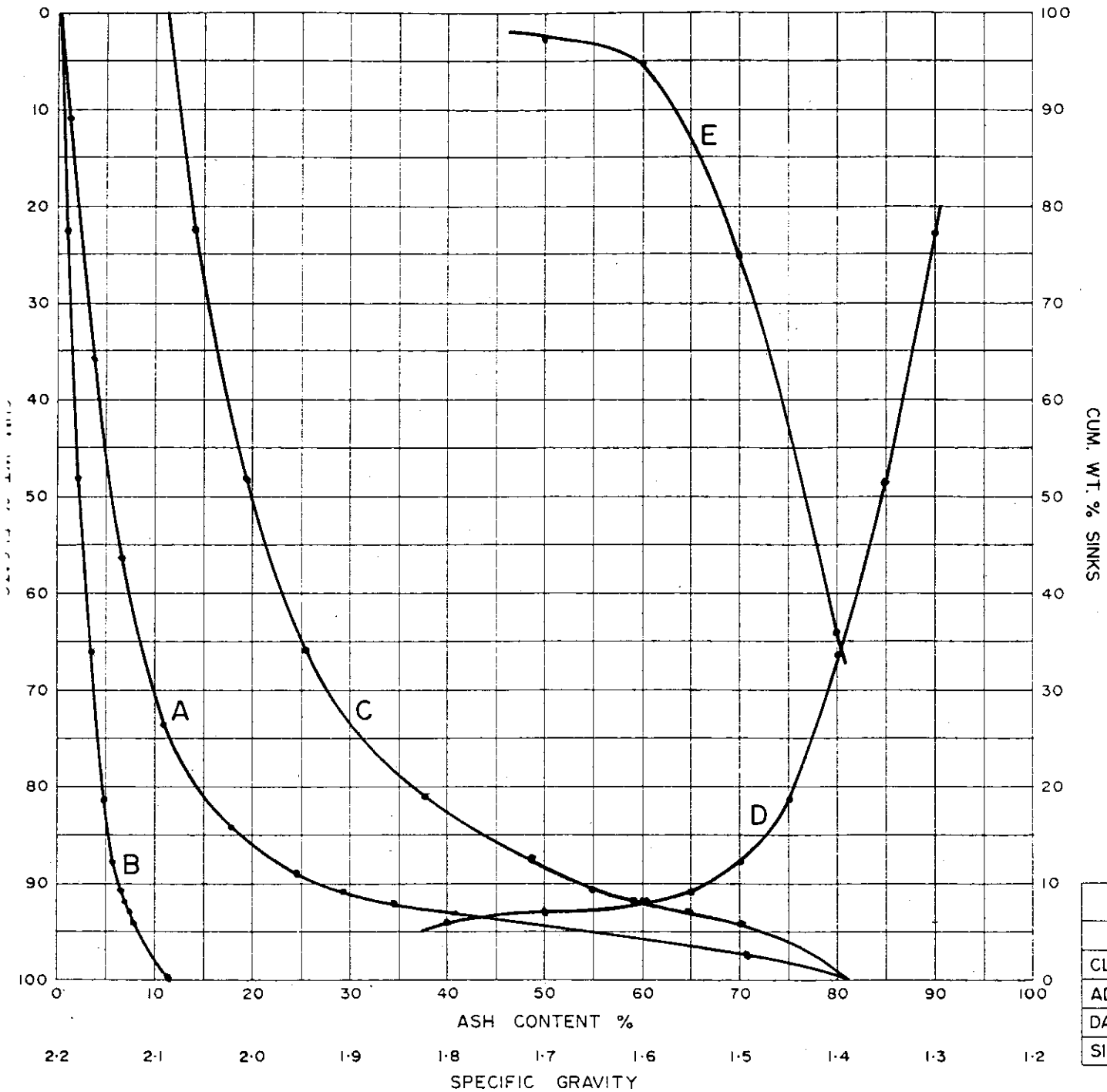
--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	23.10	1.00	.23	.23	23.10	1.00	10.83	76.90	14.08	1.30	0.00
1.35	25.30	3.50	.89	1.12	48.40	2.31	9.94	51.60	19.27	1.40	64.80
1.40	17.90	6.90	1.24	2.35	66.30	3.55	8.71	33.70	25.84	1.50	25.30
1.45	14.90	10.70	1.59	3.95	81.20	4.86	7.11	18.80	37.84	1.60	5.40
1.50	6.70	17.90	1.20	5.15	87.90	5.85	5.92	12.10	48.89	1.70	2.90
1.55	2.50	24.40	.61	5.76	90.40	6.37	5.31	9.60	55.26	1.80	0.00
1.60	1.20	29.00	.35	6.10	91.60	6.66	4.96	8.40	59.01	1.90	0.00
1.70	1.70	34.50	.59	6.69	93.30	7.17	4.37	6.70	65.23	2.00	0.00
1.80	1.20	41.10	.49	7.18	94.50	7.60	3.88	5.50	70.50	2.10	0.00
-9.99	5.50	70.50	3.88	11.06	100.00	11.06	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 16

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 14

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 3 28M. x 65M.
DATE	OCT., 7, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 17

SAMPLE: Adit No. 3

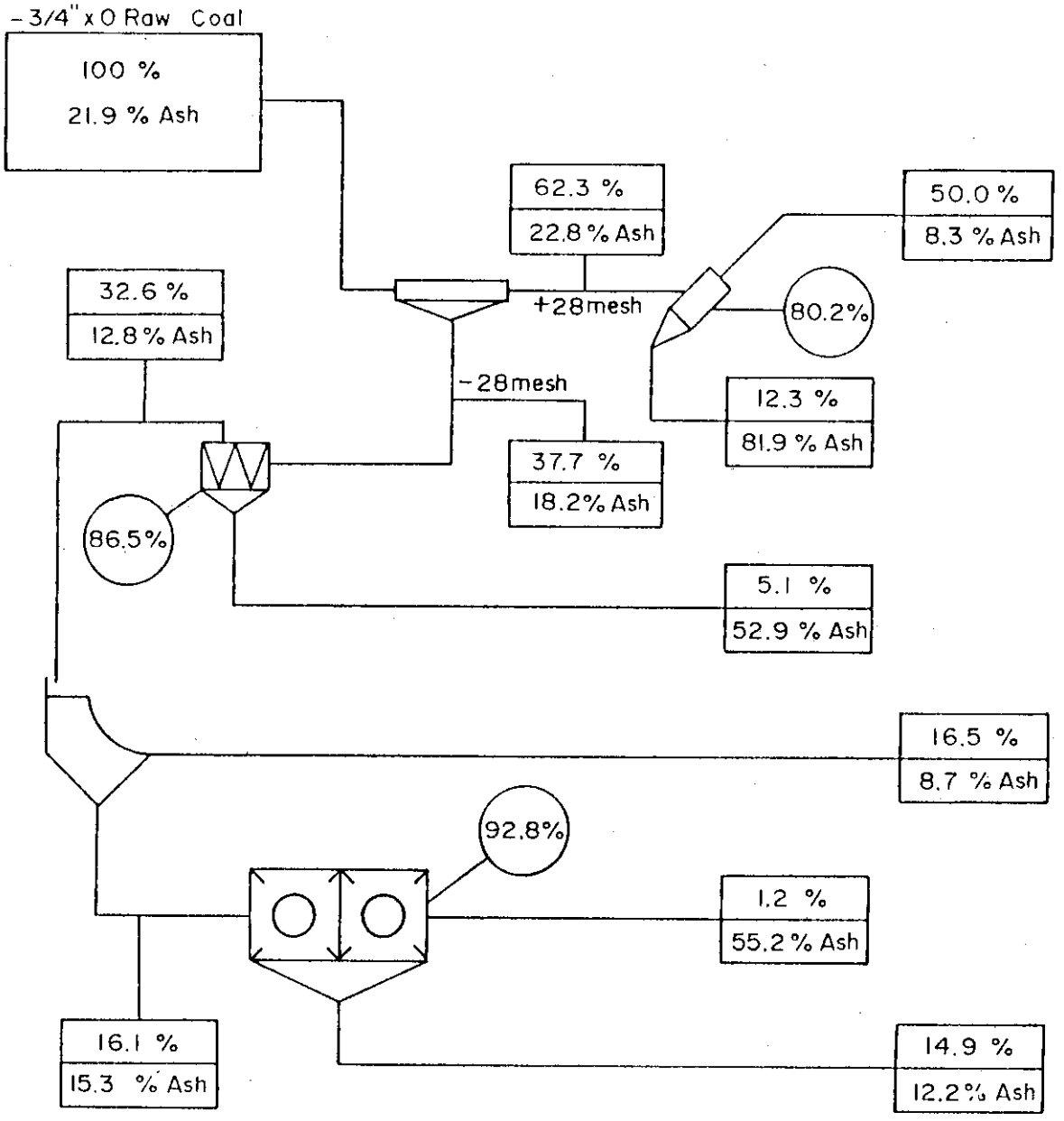
LAB. NO.: 3540

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8 1/2	0.97	0.16	397	458	13	15	1.005
3/4" X 28M	7 1/2	0.94	0.15	413	474	23	9	0.971
28M X 65M	8 1/2	0.91	0.05	416	469	23	8	0.972

FROTH FLOTATION TEST 65M x 0 III										
Product	Wt %	Ash %	R.M. %	V.M.%	FC %	S. %	P. %	FSI	Cumulative Wt %	Cumulative Ash %
Stage I	80.3	7.5	.6	18.5	73.4	.55	0.08	8 1/2	80.3	7.5
Stage II	10.5	10.5	.6	18.3	70.6	.67	0.09	7 1/2	90.8	7.8
Tails	9.2	41.9	.7	15.7	41.7	--	--	--	100.0	11.0

F. F. Parameters - See Adit No. 2

FIGURE 15



OVERALL YIELD = 81.4 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 3	DEC. 19/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 3 LAB NO. 3539 DATE OF WASH September 8, 1975.

Raw Coal Analysis: Ash % 21.9 Hardgrove Grindability Index 109

Delivered Bulk Weight 11.7 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 3 LAB NO. 3539

1. S. G. of Separation (a) Washability 1.75
   (b) Plant 1.73
2. Feed Ash Content A.D.B. 22.8 %
3. Clean Coal Estimated Weight 2.21 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.3 % F.S.I. 8 1/2
5. Reject Estimated Weight 0.815 M.T.
6. Reject Analysis (A.D.B.) Ash 81.9 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit 3.02 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 62.3 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 78.8 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 80.2 %
11. Yield Clean Coal (Washability) 80.2 %
12. +2" Rock Oversize .430 M.T.

ELCO MINING LTD. TABLE 18

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 3 LAB NO. 3539

1. Vortex Finder Clearance (VFC) 0.6 CM 1/4 Inches
2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.
3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.
4. Feed Pulp Density 100-120 g/l. 10-12 % Solids W/V
5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	52.7	12.4	7 1/2	52.7	12.4	18.2	6 1/2
	65M x 100M (.15 CM)	13.4	13.1	8 1/2	66.1	12.5		
	100M x 0	33.9	24.3	4 1/2	100.0	16.5		
O'FLOW	+65M	36.7	-	-	36.7	-	12.8	8 1/2
	65M x 100M	13.9	-	-	50.6	9.1		
	100M x 0	49.4	16.6	6 1/2	100.0	52.9		
U'FLOW	+65M	57.6	-	-	57.6		52.9	1
	65M x 100M	10.7	-	-	68.3	47.5		
	100M x 0	31.7	64.5	1	100.0	52.9		
S B O	+65M	-	-	-	-	-	8.7	8 1/2
	65M x 100M	-	-	-	-	-		
	100M x 0	-	-	-	-	-		

6. Yield - Total W.O. Cyclone Circuit = 86.5 %
7. Est. Yield of 28 x 65 Mesh Coal = 31.7 %
   (as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 19

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 3 LAB NO. 3539

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-280 g/l 15-28 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	9.5	9.3	8 1/2	9.5	9.3	15.3	8 1/2
	65M x 100M (.15 CM)	15.8	8.7	9	25.3	8.9		
	100M x 0	74.7	17.6	7	100.0	15.4		
CONC.	+65M (.21 CM)						12.2	8 1/2
	65M x 100M (.15 CM)							
	100M x 0							
TAILS	+65M (.21 CM)	28.4	46.6	3	28.4	46.6	55.2	1 1/2
	65M x 100M (.15 CM)	13.0	29.9	7 1/2	41.4	41.4		
	100M x 0	58.6	66.0	1 1/2	100.0	55.8		

4. Impeller Type -

5. Yield Calculated (Ash Balance) 92.8 %

6. Yield (Washability) 90 %

7. 65M x 0 (Washability) 15.4 %

ELCO MINING LTD.

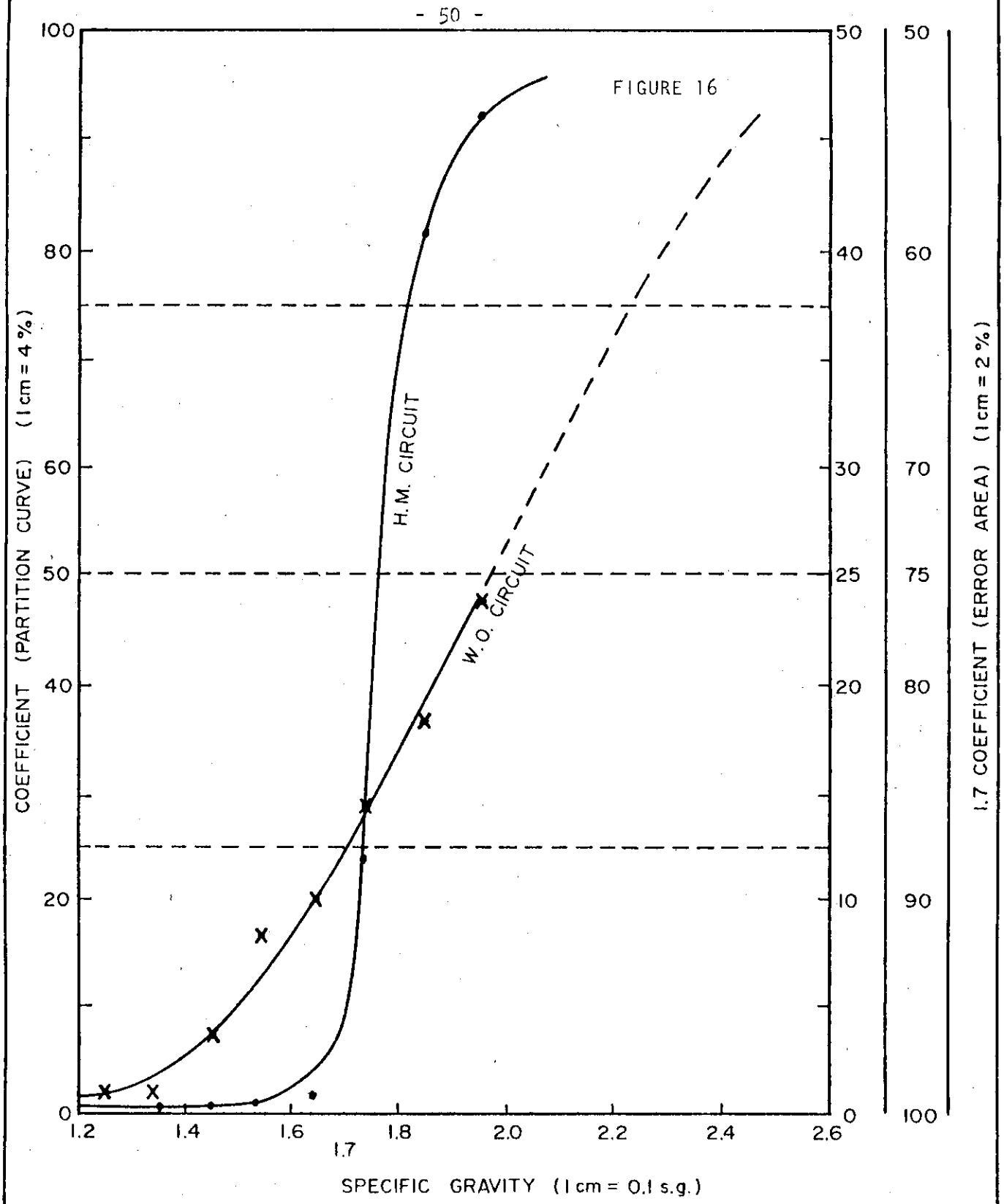
TABLE 20

BULK WASHING DATA

ADIT/SEAM NO. 3 LAB NO. 3539

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	29.1	29.1	0.6	0.6	29.4	29.4	7.3	7.3
1.30-1.40	46.7	75.8	1.5	2.1	44.1	75.5	10.6	17.9
1.40-1.50	17.7	93.5	0.5	2.6	17.0	90.5	13.7	31.6
1.50-1.60	3.6	97.1	0.2	2.8	5.1	95.6	10.5	42.1
1.60-1.70	1.6	98.7	0.1	2.9	1.8	97.4	4.6	46.7
1.70-1.80	1.0	99.7	1.3	4.2	0.8	98.2	3.5	50.2
1.80-1.90	0.2	99.9	3.8	8.0	0.5	98.7	3.0	53.2
1.90-2.00	0.1	100.0	5.0	13.0	0.3	99.0	2.8	56.0
+2.00	-		87.0	100.0	1.0	100.0	44.0	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 3	JAN. 10/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 3 LAB. NO. 3539 DATE OF WASH September 8, 1975.

a) Raw Coal

Delivered Wt.	=	11.7 M.T.
Ash %	=	21.9
Hardgrove Grindability Index	=	109
Estimated Washed Weight	=	4.85 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 37.7 %

Effective S. G. = 1.73

Raw Feed	22.8 %	Ash 6 1/2	F.S.I.
Clean Coal	8.3 %	Ash 8 1/2	F.S.I.
Reject	81.9 %	Ash 1/2	F.S.I.

Calculated Yield = 80.2

Weighed Yield = 78.8

c) Water-Only Cyclone Circuit

Raw Feed	18.2 %	Ash 6 1/2	F.S.I.
Overflow	12.8 %	Ash 8 1/2	F.S.I.
Underflow	52.9 %	Ash 1	F.S.I.

Calculated Yield = 86.5 %

% of +65 Mesh in O/F = 36.7

Sieve Bend Overflow	8.7 %	Ash 8 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	15.3 %	Ash 8 1/2	F.S.I.
Concentrates	12.2 %	Ash 8 1/2	F.S.I.
Tails	55.2 %	Ash 1 1/2	F.S.I.

Calculated Yield = 92.8 %

ELCO MINING LTD.

TABLE 21

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 3 LAB. NO. 3539

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 5 ASH % 9.3 VM % 18.6 FC % 71.6 S% .53 FSI 8

(ii) Dilatometer

Softening °C 415 Max. Dil. °C 474 Max Cont. % 19

Max. Dil. % 25 G. No. = 1.009

(iii) Hardgrove Grindability Index = 118

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
8	1.36	5	0.85	3	0.51	0.6	0.102			1.4	18	3.06

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD. TABLE 22

SAMPLE: Clean Coal - Adit No. 3

LAB. NO.: 3539

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.5	9.3	18.6	71.6	8	118

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	0.8	0.8
1/2" X 1/4"	7.0	7.8
1/4" X 8M	22.6	30.4
8M X 28M	35.2	65.6
28M X 65M	17.3	82.9
65M X 0	17.1	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
415	474	19	25	1.009

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.38	81.49	4.30	0.98	0.53	9.48	2.84

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.05	0.13	0.17	4.90	9.65	27.71	50.52	0.27	3.40	1.69

SAMPLE: Adit No. 4

LAB. NO.: 4720

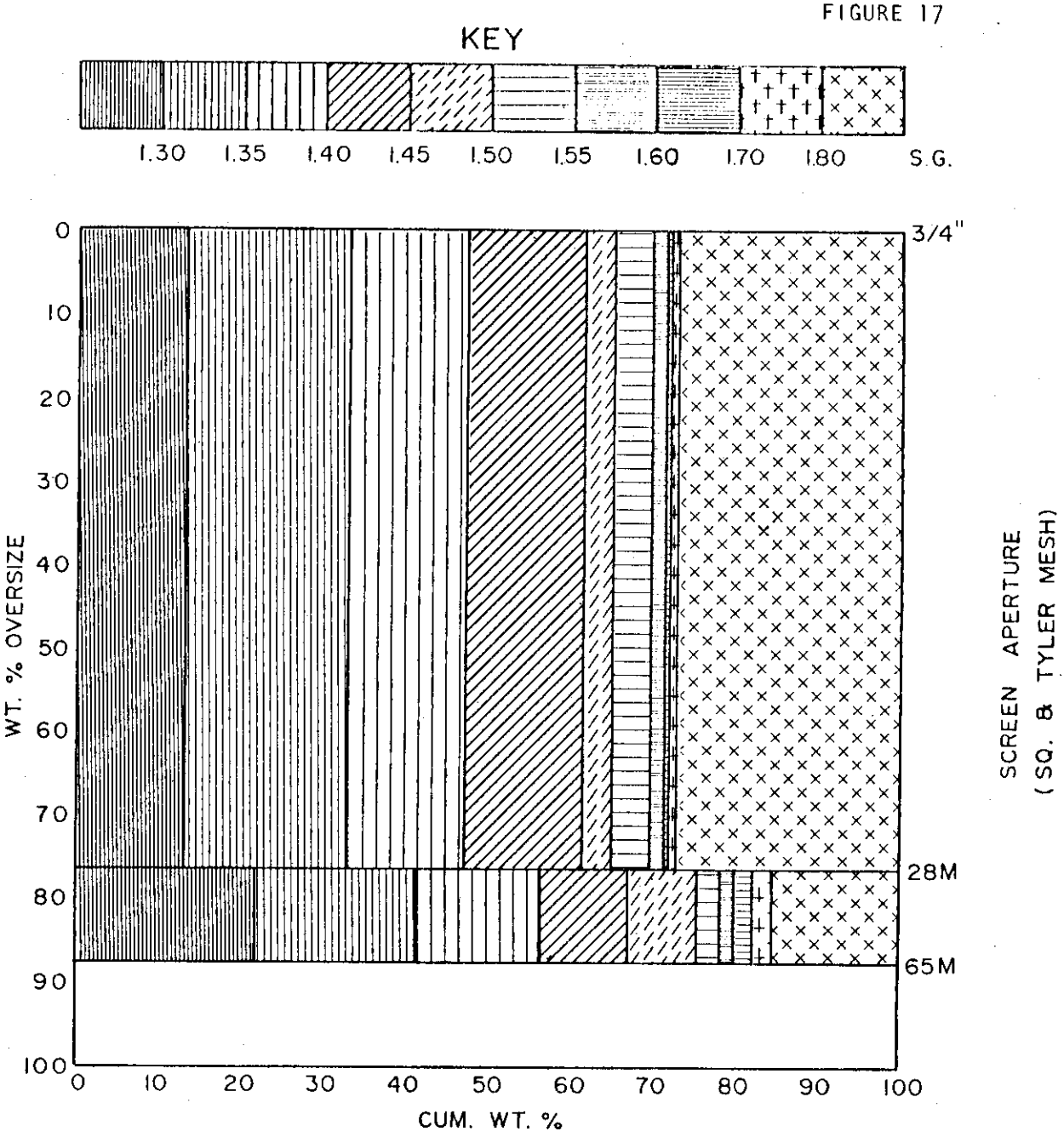
TABLE 23

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.6	27.7	16.0	55.7	0.34	11200	96	oxid.	1470+	-	-	-
							red.	1430	1470+	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	17.9	34.0	1.3	14.3	50.4	0.24	88	-	-
	1/2" X 0	82.1	-	-	-	-	-	-	-	-
II	3/4" X 28M	76.2	28.7	0.8	15.6	54.9	0.26	90	76.2	28.7
	28M X 65M	11.3	18.8	0.8	17.5	62.9	0.35	117	87.5	27.4
	65M X 100M	2.3	16.2	-	-	-	-	-	89.8	27.1
	100M X 200M	6.9	15.7	-	-	-	-	-	96.7	26.3
	200M X 0	3.3	16.4	-	-	-	-	-	100.0	26.0
III	65M X 0	12.5	16.2	0.6	17.4	65.8	0.63	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 4.0
WT. % 1/2" X 28M = 61.0
II - Size consist of raw coal crushed to - 3/4" X 1/2" = 1.6
III - 65M X 0 off II

FIGURE 17



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT №	ADIT 4
DATE	DEC. 18/75	SIGNED	G. Barker

ELCO MINING LTD. ADIT NO. 4 LAB. NO.4720 2" X 1/2"

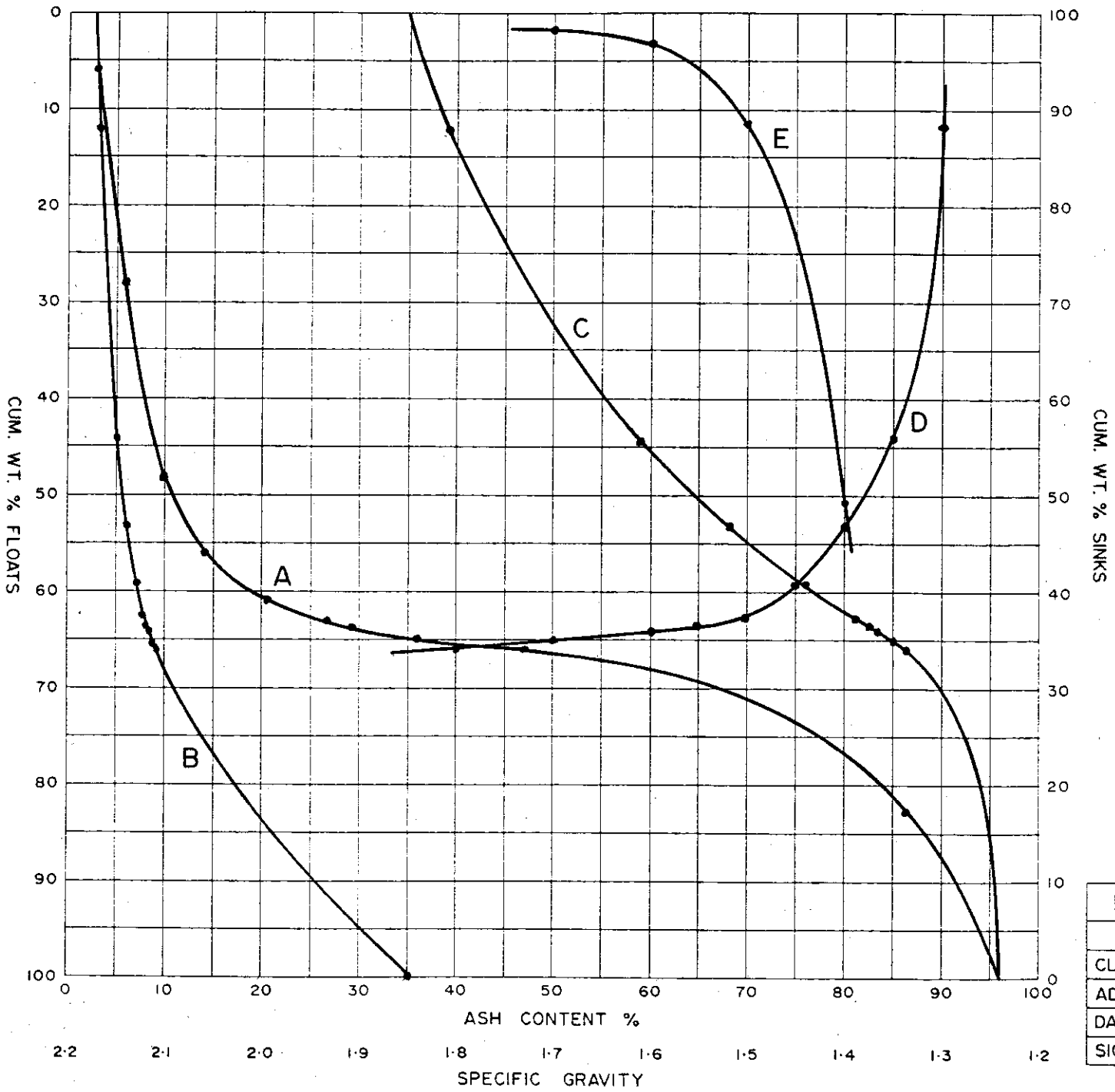
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	12.30	3.00	.37	.37	12.30	3.00	34.55	87.70	39.39	1.30	0.00
1.35	32.10	6.00	1.93	2.30	44.40	5.17	32.62	55.60	58.67	1.40	50.40
1.40	8.90	9.80	.87	3.17	53.30	5.94	31.75	46.70	67.99	1.50	10.80
1.45	5.90	14.00	.33	3.99	59.20	6.75	30.92	40.80	75.80	1.60	2.80
1.50	3.50	20.30	.71	4.70	62.70	7.50	30.21	37.30	81.00	1.70	2.10
1.55	1.10	26.60	.29	5.00	63.80	7.83	29.92	36.20	82.66	1.80	0.00
1.60	.30	29.10	.09	5.08	64.10	7.93	29.83	35.90	83.10	1.90	0.00
1.70	1.40	36.10	.51	5.59	65.50	8.53	29.33	34.50	85.01	2.00	0.00
1.80	.70	46.90	.33	5.92	66.20	8.94	29.00	33.80	85.80	2.10	0.00
9.99	33.80	85.80	29.00	34.92	100.00	34.92	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 24

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 4 2" x 1/2"
DATE	DEC. 11, 1975
SIGNED	K. M. LAU

FIGURE 18

ELCO MINING LTD. ADIT 4 LAB. NO.4720 1/2" X 28M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	13.85	1.61	.22	.22	13.85	1.61	26.40	86.15	30.65	1.30	0.00
1.35	15.80	2.97	.47	.69	29.65	2.33	25.93	70.35	36.86	1.40	52.08
1.40	15.37	6.52	1.00	1.69	45.02	3.76	24.93	54.98	45.34	1.50	28.65
1.45	17.54	11.03	1.93	3.63	62.56	5.80	23.00	37.44	61.42	1.60	7.85
1.50	3.37	18.08	.61	4.24	65.93	6.43	22.39	34.07	65.71	1.70	1.33
1.55	5.63	20.04	1.13	5.37	71.56	7.50	21.26	28.44	74.75	1.80	0.00
1.60	2.11	26.18	.55	5.92	73.67	8.03	20.71	26.33	78.64	1.90	0.00
1.70	.11	36.60	.04	5.96	73.78	8.08	20.66	26.22	78.81	2.00	0.00
1.80	1.22	38.72	.47	6.43	75.00	8.58	20.19	25.00	80.77	2.10	0.00
9.99	25.00	80.77	20.19	26.62	100.00	26.62	0.00	.00	0.00	2.20	0.00

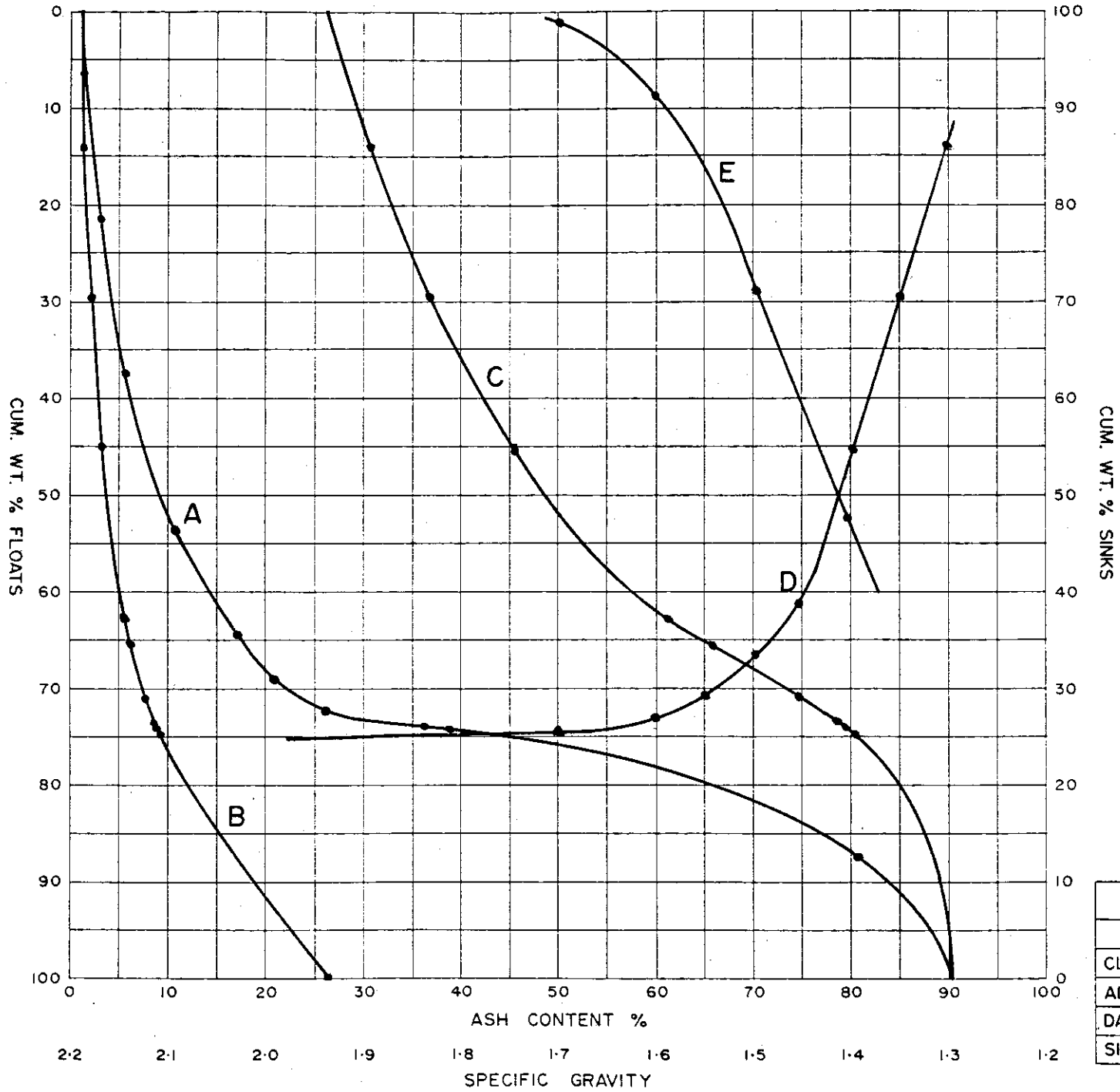
BIRTLEY ENGINEERING

TABLE 25

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 19

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT NO. 4 1/2" x 28 M.
DATE	DEC. 23, 75
SIGNED	G. Barker.

ELCO MINING LTD. ADIT NO. 4 LAB. NO.4720 3/4" X 28M

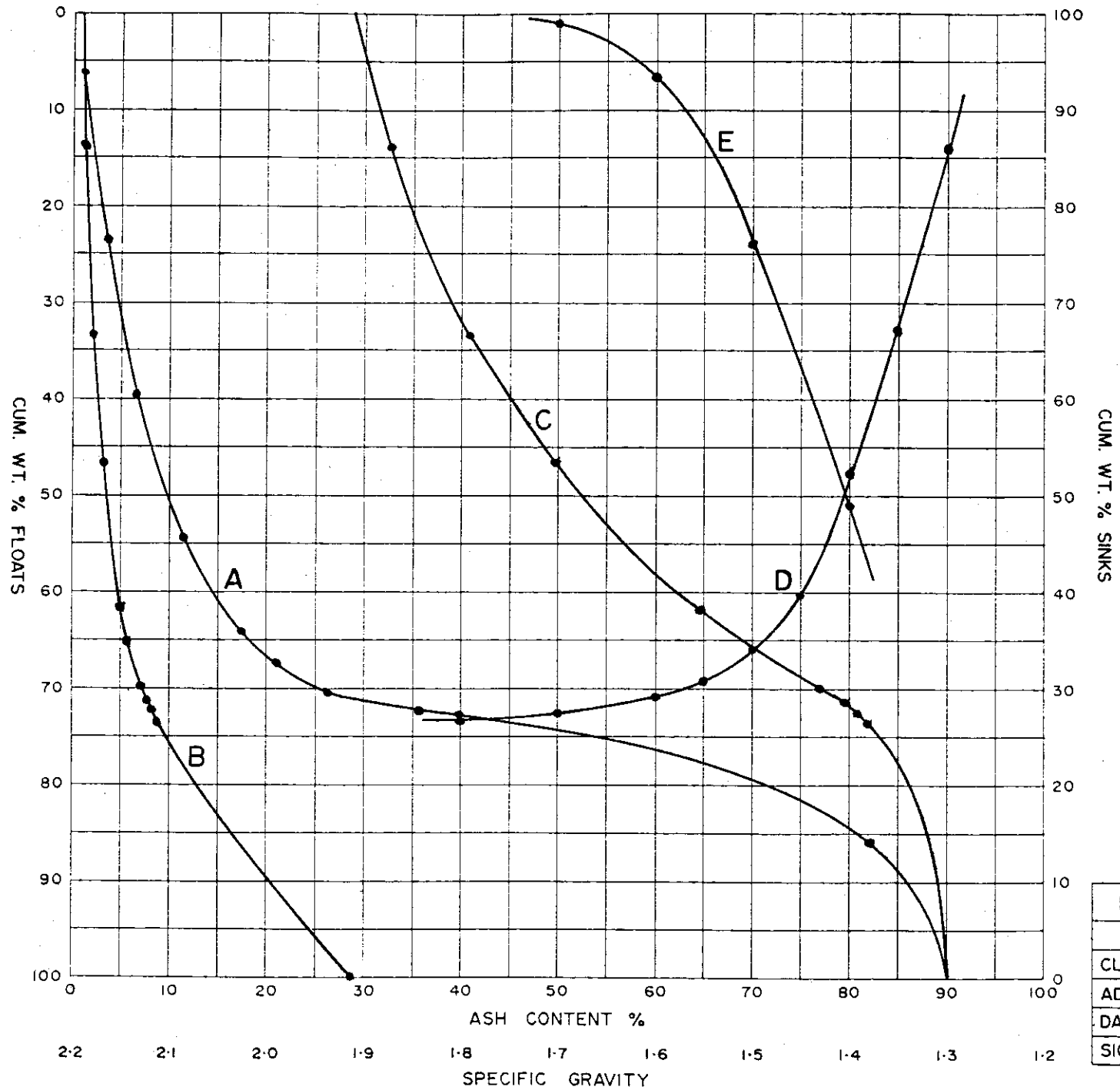
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	13.50	1.90	.26	.26	13.50	1.90	28.25	86.50	32.66	1.30	0.00
1.35	19.50	4.10	.80	1.06	33.00	3.20	27.45	67.00	40.97	1.40	51.70
1.40	13.90	7.00	.97	2.03	46.90	4.33	26.48	53.10	49.87	1.50	24.60
1.45	14.90	11.30	1.68	3.71	61.80	6.01	24.80	38.20	64.91	1.60	6.70
1.50	3.40	18.60	.63	4.35	65.20	6.66	24.16	34.80	69.43	1.70	1.50
1.55	4.60	20.40	.94	5.28	69.80	7.57	23.22	30.20	76.90	1.80	0.00
1.60	1.70	26.30	.45	5.73	71.50	8.01	22.78	28.50	79.92	1.90	0.00
1.70	.40	36.20	.14	5.88	71.90	8.17	22.63	28.10	80.54	2.00	0.00
1.80	1.10	39.90	.44	6.31	73.00	8.65	22.19	27.00	82.20	2.10	0.00
9.99	27.00	32.20	22.19	28.51	100.00	28.51	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 26

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 20

BIRTLEY ENGINEERING (CANADA) LTD.		
COAL SCIENCE & MINERALS TESTING		
CLIENT	ELCO	
ADIT/SEAM NO.	ADIT NO. 4	3/4" x 28 M.
DATE	DEC. 23, 75	
SIGNED	J. Barker.	

ELCO MINING LTD. ADIT NO.4 LAB. NO.4720 28 M. X65 M.

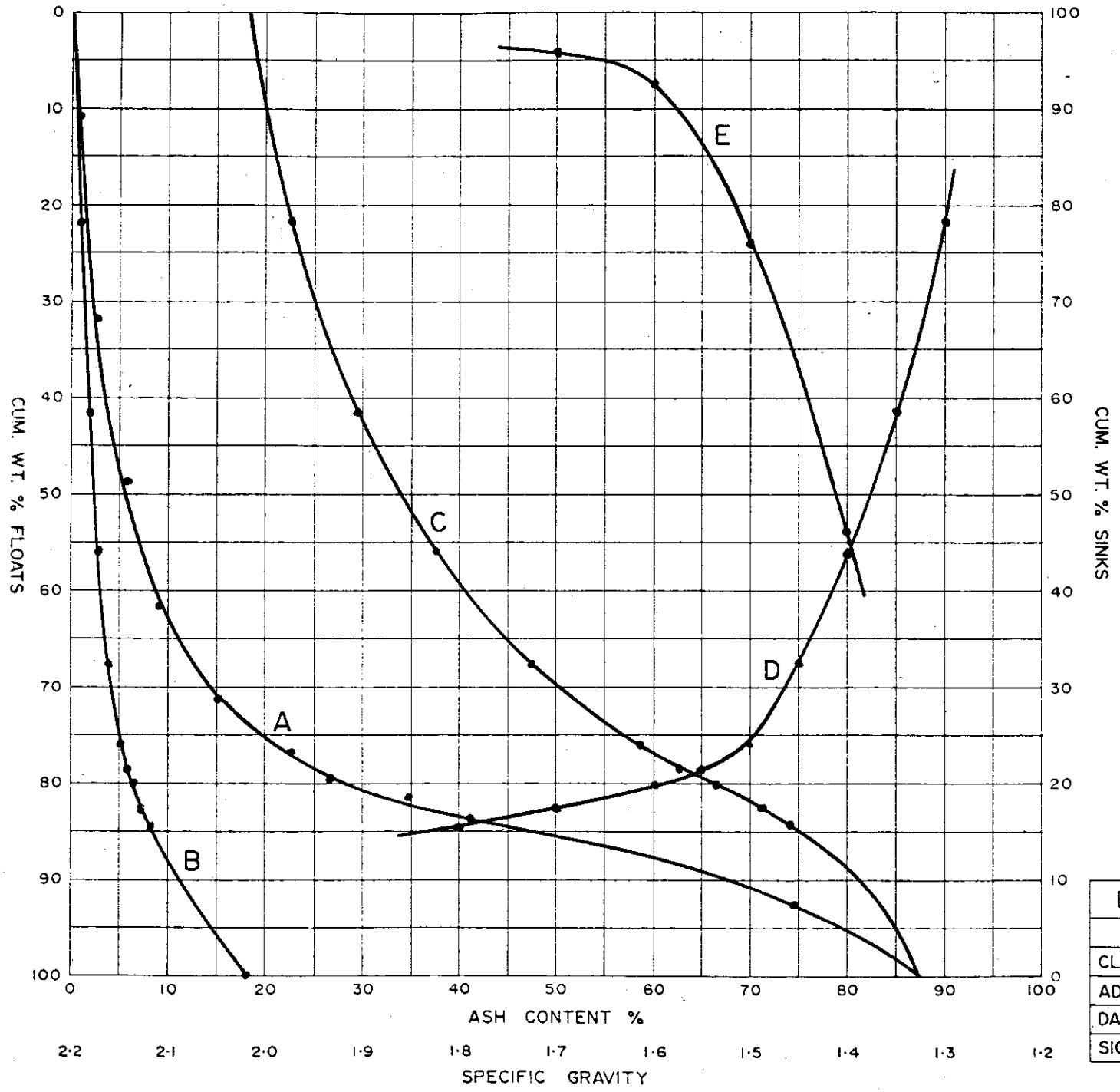
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	21.80	.90	.20	.20	21.80	.90	17.94	78.20	22.94	1.30	0.00
1.35	19.80	3.10	.61	.81	41.60	1.95	17.32	58.40	29.66	1.40	54.00
1.40	14.70	5.90	.87	1.68	56.30	2.98	16.46	43.70	37.66	1.50	24.00
1.45	11.10	9.00	1.00	2.68	67.40	3.97	15.46	32.60	47.42	1.60	7.10
1.50	8.40	15.20	1.28	3.95	75.80	5.22	14.18	24.20	58.60	1.70	4.20
1.55	2.60	22.70	.59	4.54	78.40	5.80	13.59	21.60	62.92	1.80	0.00
1.60	1.90	26.60	.51	5.05	80.30	6.29	13.09	19.70	66.42	1.90	0.00
1.70	2.60	34.70	.90	5.95	82.90	7.18	12.18	17.10	71.25	2.00	0.00
1.80	1.60	40.70	.65	6.60	84.50	7.81	11.53	15.50	74.40	2.10	0.00
9.99	15.50	74.40	11.53	18.13	100.00	18.13	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 27

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 21

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 4 28M. x 65 M.
DATE	DEC 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 28

SAMPLE: Adit No. 4

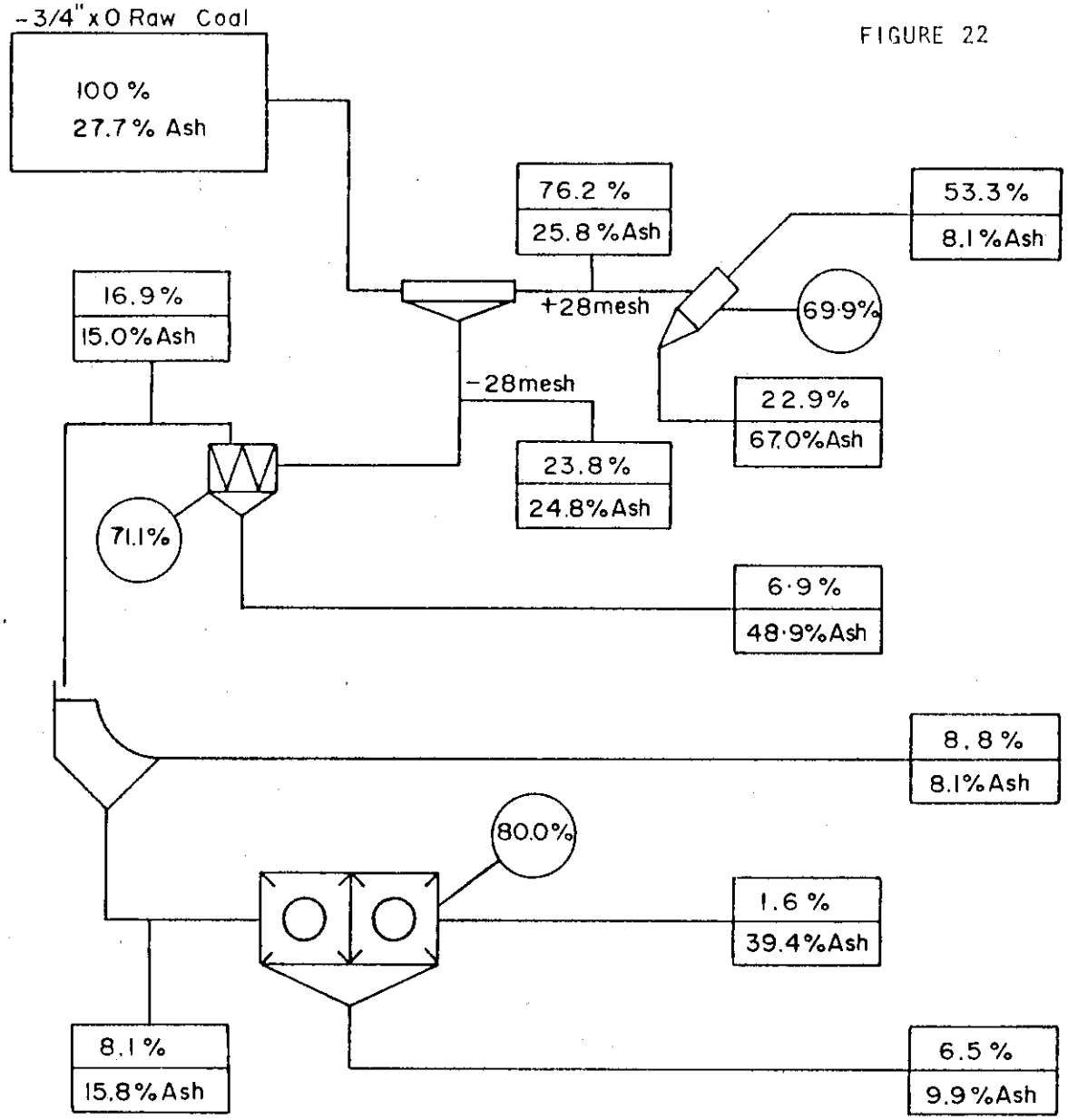
LAB. NO.: 4720

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	3 1/2	0.37	0.04	435	--	19	-19	--
3/4" X 28M	7	0.50	0.03	430	--	16	-16	--
28M X 65M	3	0.50	0.02	420	--	20	-20	--

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M.%	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	79.8	8.1	0.5	18.6	72.8	.61		7	79.8	8.1
Stage II	7.4	20.3	0.7	16.9	62.1	.55		3	87.2	9.1
Tails	12.8	60.8	0.8	12.8	25.6	--	--	--	100.0	15.7

F. F. Parameters - See Adit No. 2

FIGURE 22



OVERALL YIELD = 68.6 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 4	DEC. 19/75
	Drawn L. BAILEY

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 4 LAB NO. 4719 DATE OF WASH November 10, 1975.

Raw Coal Analysis: Ash % 77.7 Hardgrove Grindability Index 96

Delivered Bulk Weight 35.9 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 4 LAB NO. 4719

1. S. G. of Separation (a) Washability 1.57
   (b) Plant _____

2. Feed Ash Content A.D.B. 25.8 %

3. Clean Coal Estimated Weight 7.31 M.T.

4. Clean Coal Analysis (A.D.B.) Ash 8.1 % F.S.I. 4

5. Reject Estimated Weight 2.89 M.T.

6. Reject Analysis (A.D.B.) Ash 67.0 % FSI 4

7. Estimated 3/4" x 28M In Circuit (3+5) 10.20 M.T.

8. Actual 3/4" x 28 Mesh from Washability Data 76.2 %

9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 71.7 %

10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 69.9 %

11. Yield Clean Coal (Washability) 71.5 %

12. +2" Rock Oversize .272 M.T.

ELCO MINING LTD.

TABLE 29

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 4 LAB NO. 4719

1. Vortex Finder Clearance (VFC) 8.89 CM 3 1/2 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 120 g/l. 12 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	67.1	23.3	4	67.1	23.3	24.8	4
	65M x 100M (.15 CM)	10.5	18.8	6 1/2	77.6	22.7		
	100M x 0	22.4	28.6	3	100.0	24.0		
O'FLOW	+65M	52.0	8.0		52.0		15.0	6
	65M x 100M	12.0			64.0	8.9		
	100M x 0	36.0	25.8	3	100.0			
U'FLOW	+65M	72.1			72.1		48.9	1
	65M x 100M	7.7			79.8	45.9		
	100M x 0	20.2	60.8		100.0			
S B O	+65M	88.5	7.3	6 1/2	88.5	7.3	8.1	7
	65M x 100M	4.1	9.1	7	92.6	7.4		
	100M x 0	7.4	14.6	5	100.0	7.9		

6. Yield - Total W.O. Cyclone Circuit = 71.1 %

7. Est. Yield of 28 x 65 Mesh Coal = 37.0 %
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 30

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 4 LAB NO. 4719

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 200 g/l 20 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	16.1	8.4	7 1/2	16.1	8.4	15.8	6
	65M x 100M (.15 CM)	20.4	9.2	8	36.5	8.8		
	100M x 0	63.5	19.0	4 1/2	100.0	15.3		
CONC.	+65M (.21 CM)	4.9	10.5	7 1/2	4.9	10.5	9.9	7 1/2
	65M x 100M (.15 CM)	7.9	6.4	8 1/2	12.8	8.0		
	100M x 0	87.2	9.9	7	100.0	9.7		
TAILS	+65M (.21 CM)	27.6	18.4	3 1/2	27.6	18.4	39.4	2
	65M x 100M (.15 CM)	19.1	23.2	4	46.7	20.4		
	100M x 0	53.3	53.4	1 1/2	100.0	38.0		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 80.0 %

6. Yield (Washability) 88 %

7. 65M x 0 (Washability) 11.3 %

ELCO MINING LTD.

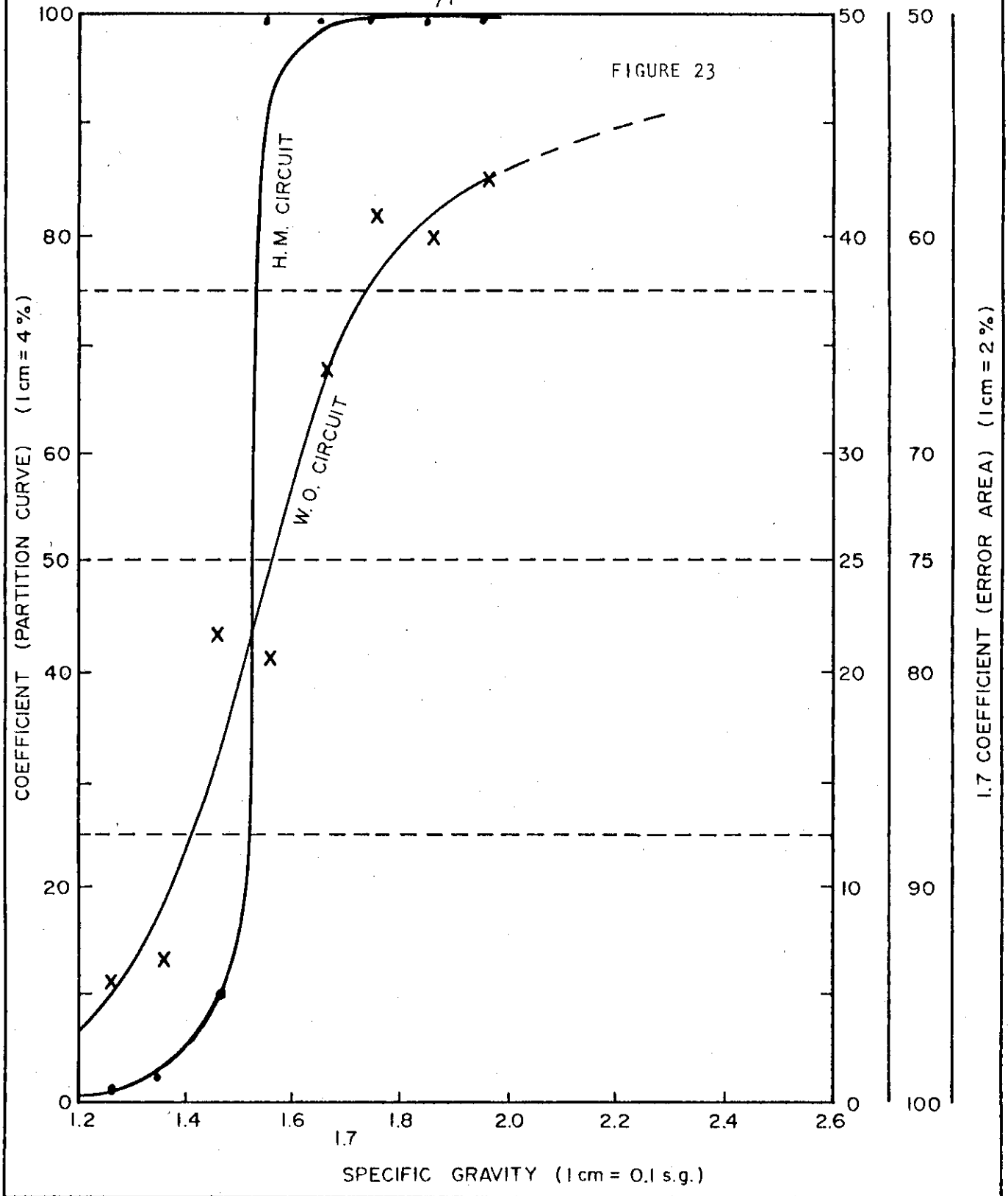
TABLE 31

BULK WASHING DATA

ADIT/SEAM NO. 4 LAB NO. 4719

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	27.1		0.7	0.7	31.6	31.6	6.6	6.6
1.30-1.40	46.8		2.3	3.0	42.9	74.5	11.0	17.6
1.40-1.50	26.1		6.3	9.3	15.8	90.3	20.6	38.2
1.50-1.60	-		8.7	18.0	5.7	96.0	6.9	45.1
1.60-1.70	-		5.5	23.5	1.5	97.5	5.4	50.5
1.70-1.80	-		4.1	30.7	0.7	98.2	5.4	55.9
1.80-1.90	-		3.1	100.0	0.5	98.7	3.4	59.3
1.90-2.00	-		69.3		0.3	99.0	3.1	62.4
+2.00	-				1.0	100.0	37.6	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 4	JAN. 10/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 4 LAB. NO. 4719 DATE OF WASH November 10, 1975.

a) Raw Coal

Delivered Wt.	=	35.9 M.T.
Ash %	=	27.7 %
Hardgrove Grindability Index	=	96
Estimated Washed Weight	=	13.4 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 76.2 %

Effective S. G. = 1.52

Raw Feed	25.8 %	Ash 2	F.S.I.
Clean Coal	8.1 %	Ash 4	F.S.I.
Reject	67.0 %	Ash 1/2	F.S.I.

Calculated Yield = 69.9 %

Weighed Yield = 71.7 %

c) Water-Only Cyclone Circuit

Raw Feed	24.8 %	Ash 4	F.S.I.
Overflow	15.0 %	Ash 6	F.S.I.
Underflow	48.9 %	Ash 1	F.S.I.

Calculated Yield = 71.1 %

% of +65 Mesh in O/F = 52 %

Sieve Bend Overflow	8.1 %	Ash 7	F.S.I.

d) Froth Flotation Circuit

Raw Feed	15.8 %	Ash 6	F.S.I.
Concentrates	9.9 %	Ash 7 1/2	F.S.I.
Tails	39.4 %	Ash 2	F.S.I.

Calculated Yield = 80 %

ELCO MINING LTD.

BULK WASHING SUMMARY (Cont.) TABLE 32

ADIT/SEAM NO. 4 LAB. NO. 4719

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% .7 ASH % 8.3 VM % 17.8 FC % 73.2 S% 15 FSI 4

(ii) Dilatometer

Softening °C ____ Max. Dil. °C ____ Max Cont. % ____

Max. Dil. % ____ G. No. = ____

(iii) Hardgrove Grindability Index = 107

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
16	3.29	19	3.91	5	1.03	0.6	0.123			0.4	41	8.43

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 33

SAMPLE: Clean Coal - Adit No. 4

LAB. NO.: 4719

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.7	8.3	17.8	73.2	4	107

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	2.4	2.4
1/2" X 1/4"	17.2	19.6
1/4" X 8M	27.2	46.8
8M X 28M	34.0	80.8
28M X 65M	8.7	89.5
65M X 0	10.5	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
434	---	14	-14	--

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.54	82.26	4.21	1.16	0.41	8.50	2.92

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.08	1.01	0.30	0.70	9.65	28.16	56.94	0.21	0.68	1.96

SAMPLE: Adit No. 6

LAB. NO.: 3500

TABLE 34

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
1.0	23.8	16.5	58.7	0.71	11870	84	oxid.	1375	1445+	-	-
							red.	1320	1445	1445+	-

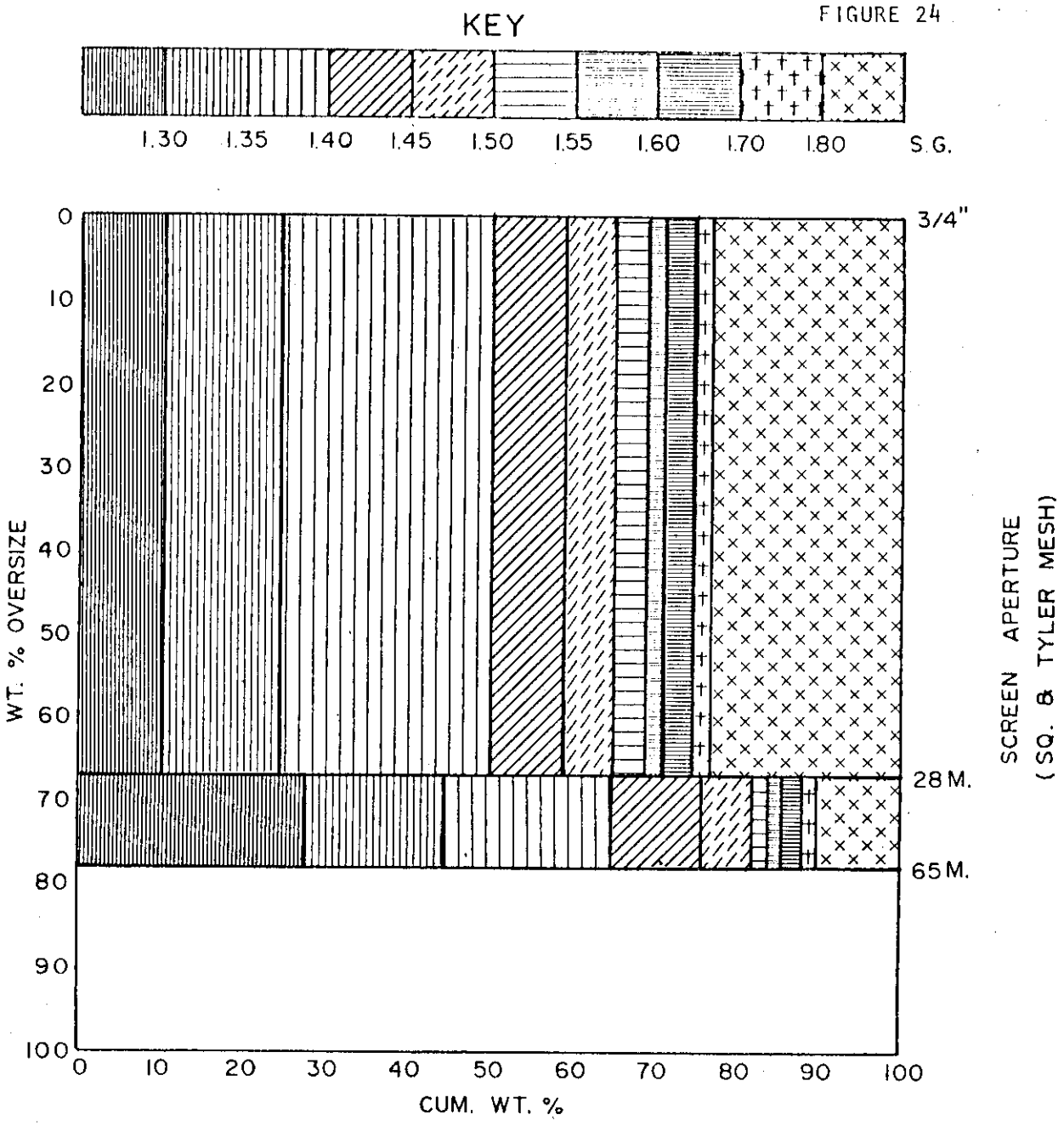
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	20.0	43.7	0.7	14.0	41.6	0.46	71	20.0	-
	1/2" X 0	80.0	-	-	-	-	-	-	100.0	-
II	3/4" X 28M	66.8	29.7	0.9	15.1	54.3	0.43	76	66.8	29.7
	28M X 65M	11.1	14.7	0.7	17.6	67.0	0.81	110	77.9	27.6
	65M X 100M	6.1	15.8	-	-	-	-	-	84.0	26.7
	100M X 200M	7.0	13.5	-	-	-	-	-	91.0	25.7
	200M X 0	9.0	11.8	-	-	-	-	-	100.0	24.4
III	65M X 0	22.1	13.1	0.9	17.9	68.1	0.83	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 5.4
Wt. % 1/2" x 28 Mesh = 67.2

II - Size consist of raw coal crushed down to -3/4"
Wt. % 3/4" x 1/2" = 2.0

III - 65 Mesh x 0 off size analysis II

FIGURE 24



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 6
DATE	OCT, 10, 1975	SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.6 LAB NO.3500 2" X .5"

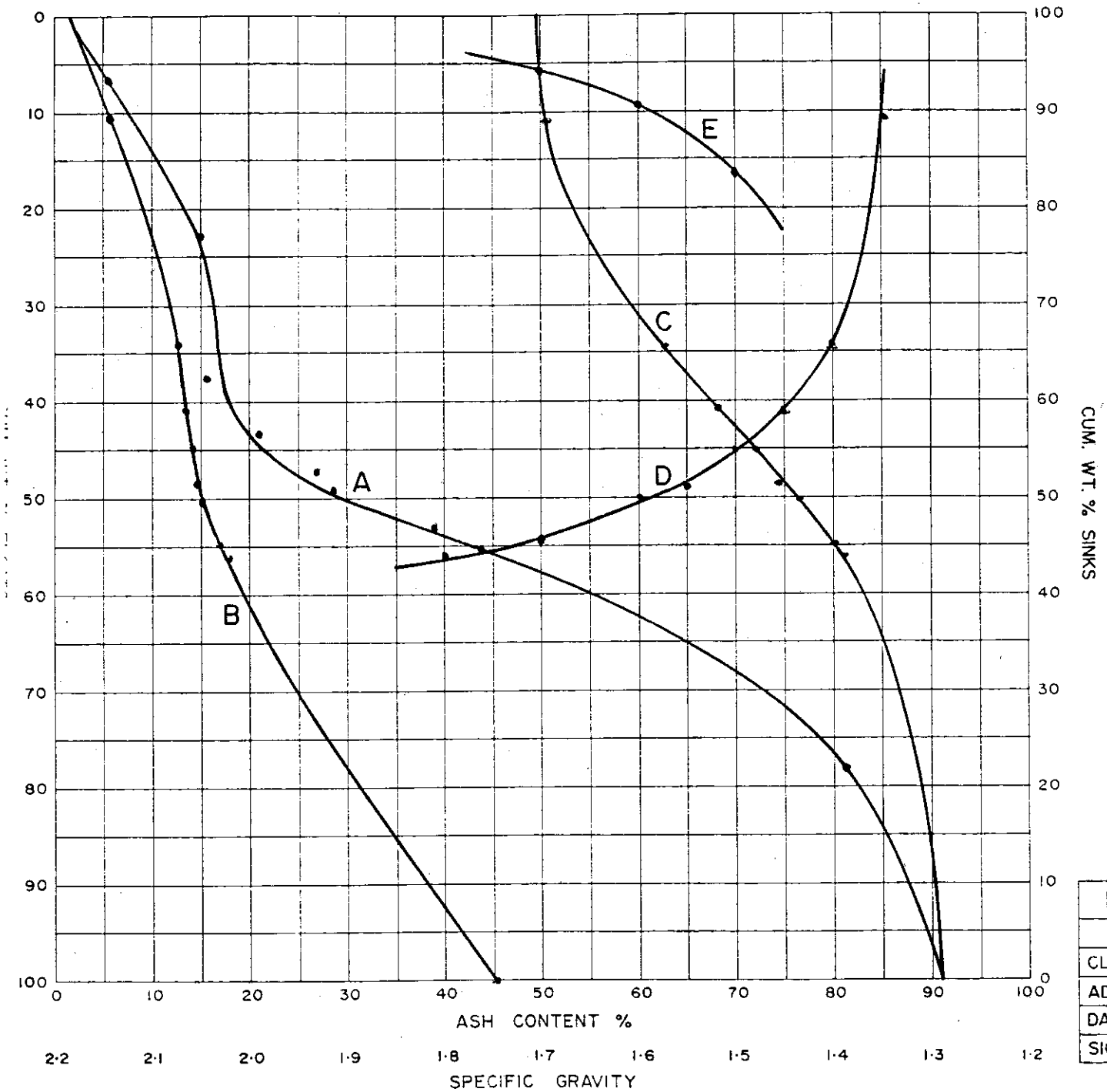
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	0.00	0.00	0.00	0.00	0.00	I	45.75	100.00	45.75	1.30	0.00
1.35	10.70	6.60	.71	.71	10.70	6.60	45.04	89.30	50.44	1.40	45.30
1.40	23.70	15.20	3.60	4.31	34.40	12.53	41.44	65.60	63.17	1.50	16.00
1.45	6.70	15.40	1.03	5.34	41.10	12.99	40.41	58.90	68.60	1.60	9.20
1.50	4.20	21.10	.89	6.23	45.30	13.75	39.52	54.70	72.25	1.70	5.80
1.50	2.60	27.80	.72	6.95	47.90	14.51	38.80	52.10	74.46	1.80	0.00
1.60	2.50	28.10	.70	7.65	50.40	15.18	38.09	49.60	76.80	1.90	0.00
1.70	4.10	39.10	1.60	9.25	54.50	16.98	36.49	45.50	80.20	2.00	0.00
1.80	1.70	44.10	.75	10.00	56.20	17.80	35.74	43.80	81.60	2.10	0.00
9.99	43.80	81.60	35.74	45.75	100.00	45.75	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 35

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 6 2" x 1/2"
DATE	OCT, 9, 1975
SIGNED	K. M. LAU

FIGURE 25

ELCO MINING LTD ADIT NO.6 LAB NO.3500 .5" X 28MESH

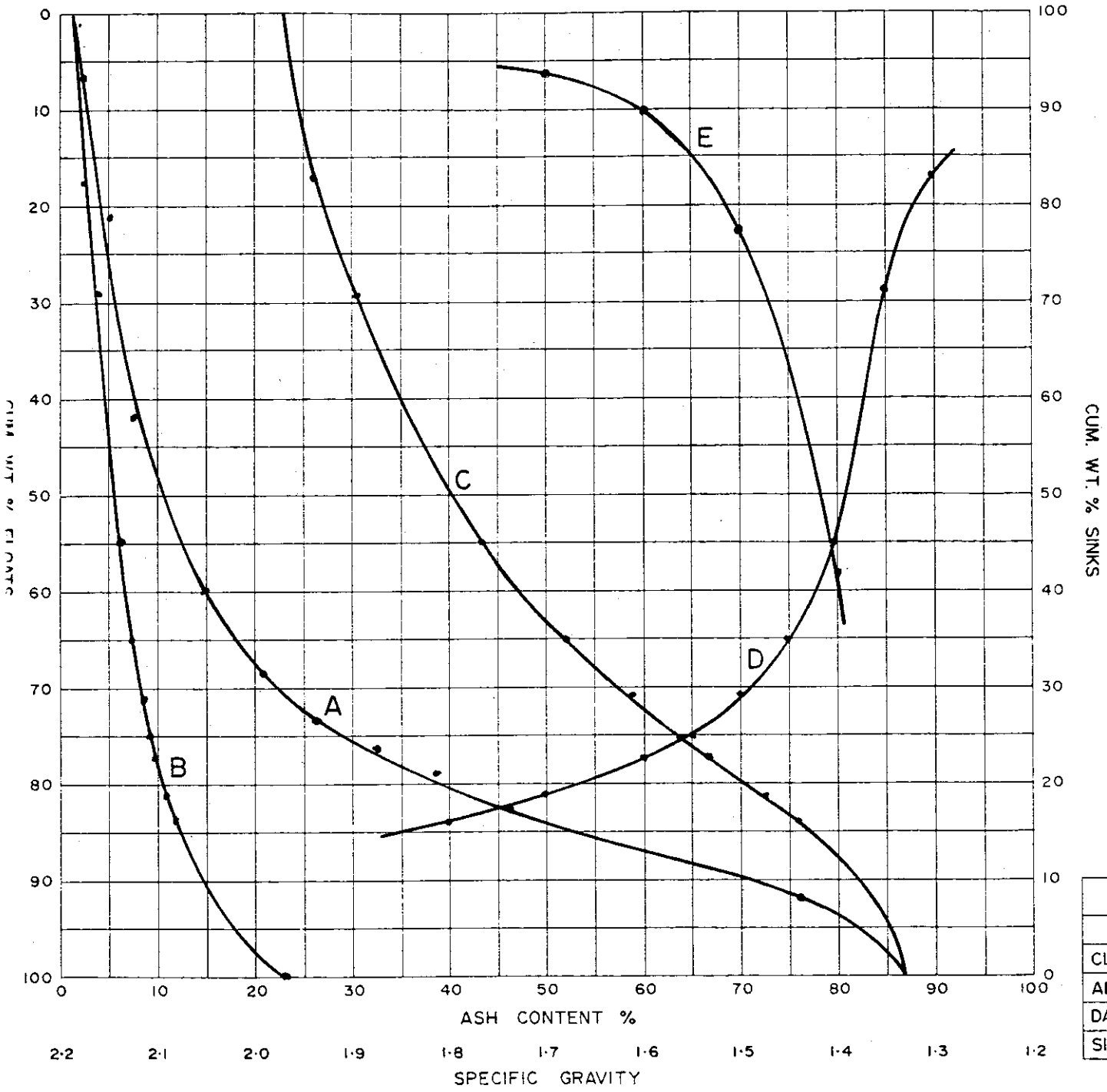
--DIRECT--			--CUM FLOATS--			--CUM SINKS--			+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	13.40	2.40	.32	.32	13.40	2.40	22.48	86.60	25.96	1.30	0.00
1.35	15.49	5.50	.85	1.17	28.89	4.06	21.63	71.11	30.42	1.40	57.90
1.40	25.90	7.40	1.92	3.09	54.80	5.64	19.72	45.20	43.61	1.50	22.30
1.45	10.10	14.90	1.51	4.60	64.90	7.08	18.21	35.10	51.88	1.60	9.80
1.50	6.40	20.70	1.32	5.92	71.30	8.30	16.89	28.70	58.83	1.70	6.30
1.55	3.60	25.90	.93	6.85	74.90	9.15	15.95	25.10	63.55	1.80	0.00
1.60	2.20	32.40	.71	7.57	77.10	9.81	15.24	22.90	66.54	1.90	0.00
1.70	4.00	39.00	1.56	9.13	81.10	11.25	13.68	18.90	72.37	2.00	0.00
1.80	2.30	46.20	1.06	10.19	83.40	12.22	12.62	16.60	76.00	2.10	0.00
9.99	16.60	76.00	12.62	22.81	100.00	22.81	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 36

FIGURE 26

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 6 1/2" x 28 M.
DATE	OCT, 9, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.6 LAB NO.3500 .75" X 28 M

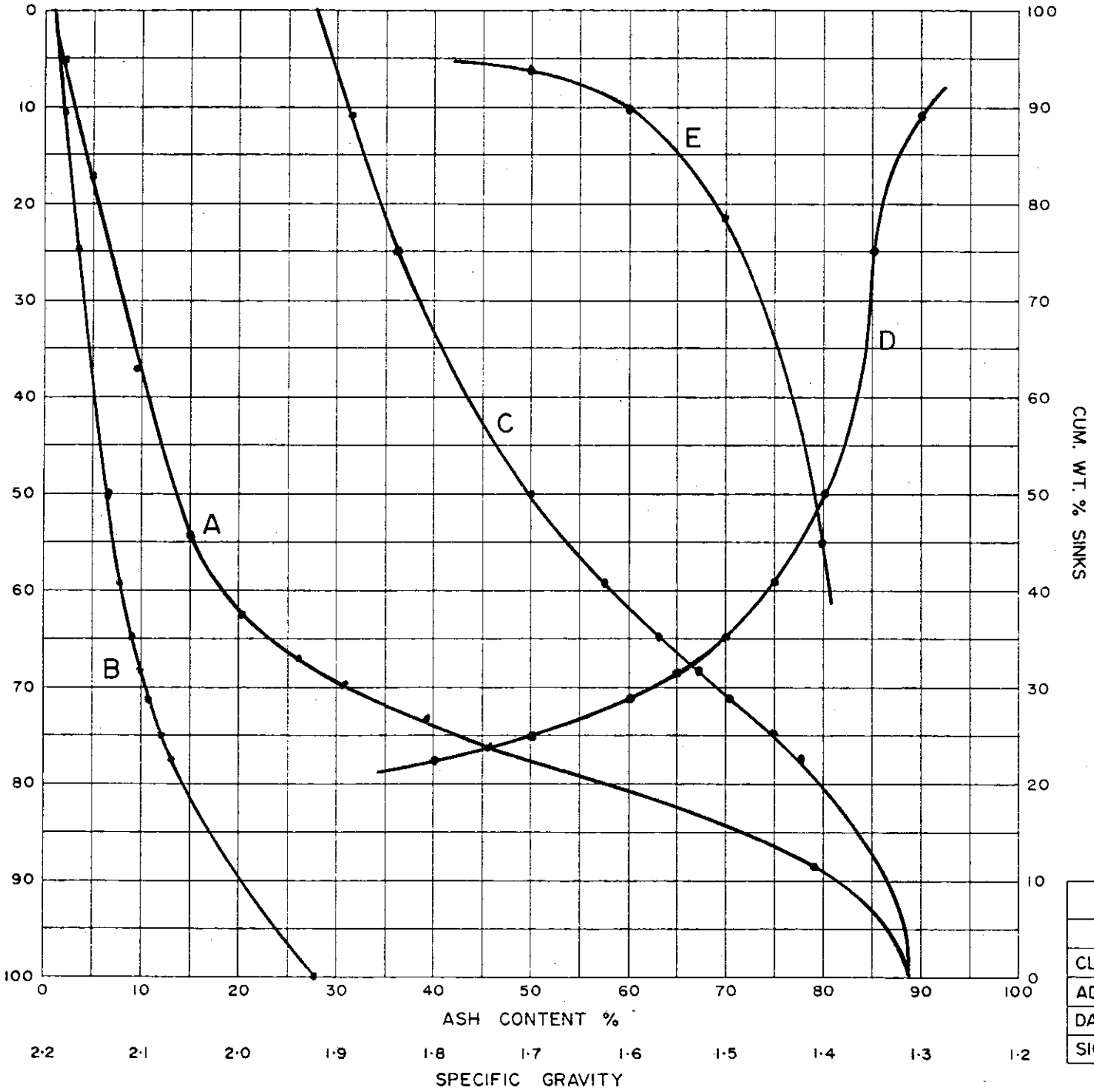
--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	10.30	2.40	.25	.25	10.30	2.40	27.37	89.70	30.51	1.30	0.00
1.35	14.40	5.70	.82	1.07	24.70	4.32	26.55	75.30	35.26	1.40	55.00
1.40	25.40	9.10	2.31	3.38	50.10	6.75	24.24	49.90	48.57	1.50	20.90
1.45	9.30	15.00	1.40	4.77	59.40	8.04	22.84	40.60	56.26	1.60	9.70
1.50	5.90	20.80	1.23	6.00	65.30	9.19	21.61	34.70	62.29	1.70	6.20
1.55	3.40	26.20	.89	6.89	68.70	10.03	20.72	31.30	66.21	1.80	0.00
1.60	2.30	31.30	.72	7.61	71.00	10.72	20.00	29.00	68.98	1.90	0.00
1.70	4.00	39.00	1.56	9.17	75.00	12.23	18.44	25.00	73.77	2.00	0.00
1.80	2.20	25.80	.57	9.74	77.20	12.62	17.88	22.80	78.40	2.10	0.00
9.99	22.80	78.40	17.88	27.62	100.00	27.62	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 37

FIGURE 27

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 6 3/4" x 28 M.
DATE	OCT, 8, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.6 LAB NO.3500 28MESH X 65

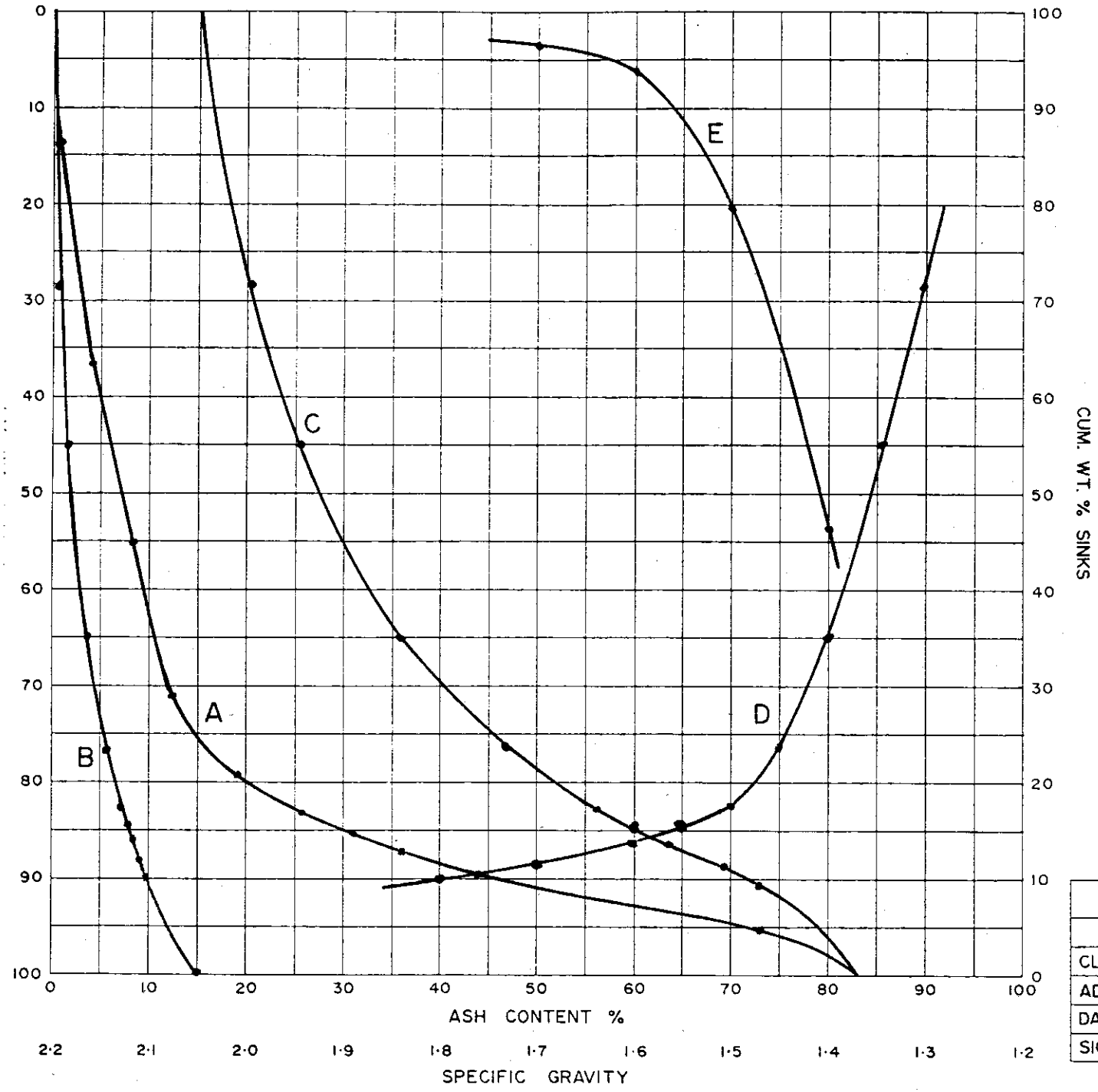
---DIRECT---					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	27.90	.90	.25	.25	27.90	.90	14.80	72.10	20.53	1.30	0.00
1.35	17.20	4.40	.76	1.01	45.10	2.23	14.04	54.90	25.58	1.40	54.50
1.40	20.40	8.30	1.69	2.70	65.50	4.12	12.35	34.50	35.79	1.50	20.60
1.45	11.30	12.60	1.42	4.12	76.80	5.37	10.93	23.20	47.09	1.60	6.30
1.50	5.60	19.20	1.08	5.20	82.40	6.31	9.85	17.60	55.97	1.70	4.10
1.55	2.00	25.40	.51	5.71	84.40	6.76	9.34	15.60	59.88	1.80	0.00
1.60	1.70	31.50	.54	6.24	86.10	7.25	8.81	13.90	63.36	1.90	0.00
1.70	2.60	36.00	.94	7.18	88.70	8.09	7.87	11.30	69.65	2.00	0.00
1.80	1.50	44.50	.67	7.85	90.20	8.70	7.20	9.80	73.50	2.10	0.00
9.99	9.80	73.50	7.20	15.05	100.00	15.05	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 38

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 23

BIRTLEY ENGINEERING (CANADA) LTD.		
COAL SCIENCE & MINERALS TESTING		
CLIENT	ELCO	
ADIT/SEAM NO.	ADIT 6	28 M. x 65 M.
DATE	OCT, 8, 1975	
SIGNED	K. H. LAU	

ELCO MINING LTD.

TABLE 39

SAMPLE: Adit No. 6

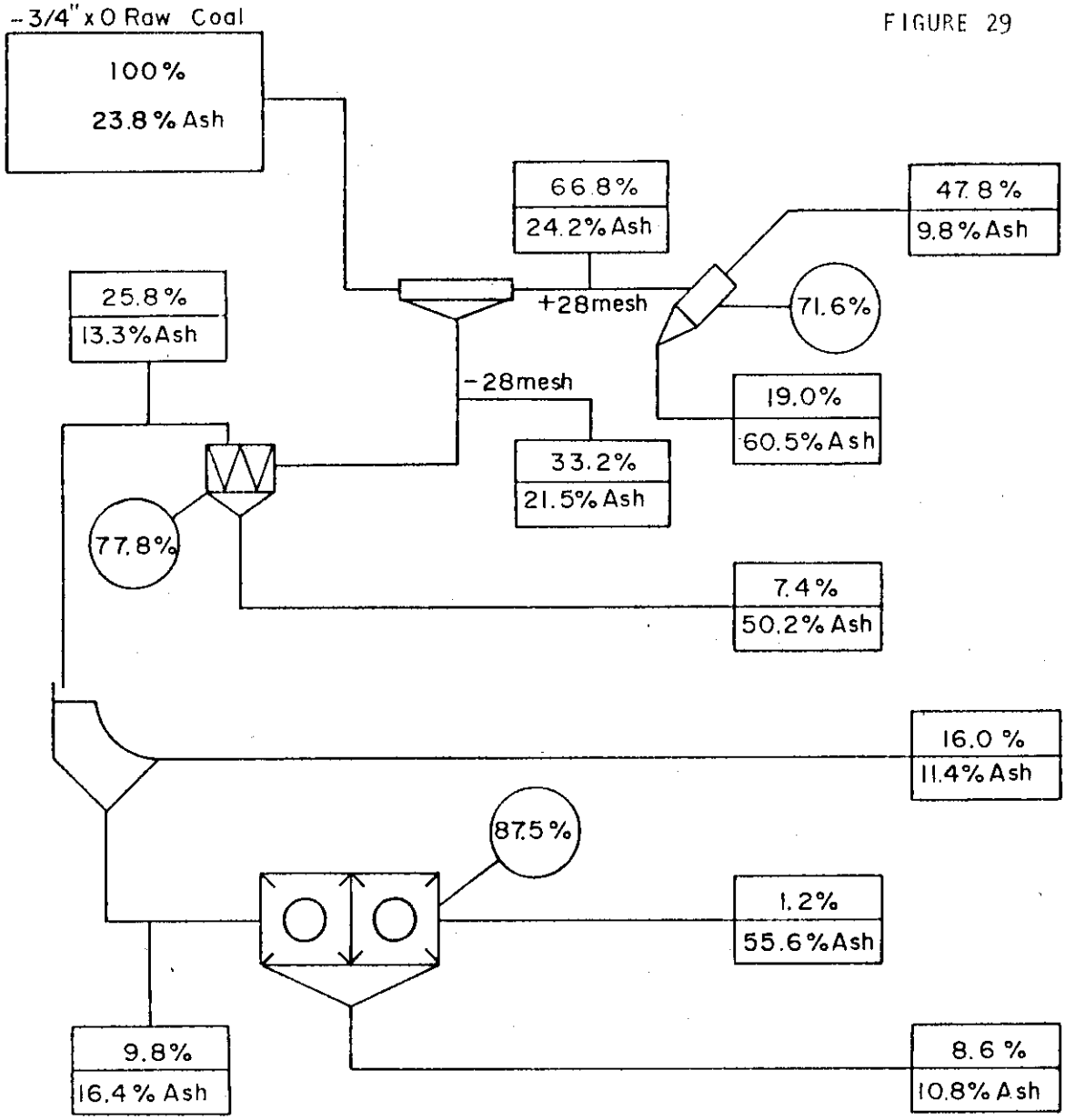
LAB. NO.: 3500

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	1 1/2	0.76	0.20	400	--	9	-9	--
3/4" X 28M	3	0.76	0.14	430	--	11	-11	--
28M X 65M	7 1/2	0.94	0.09	424	--	17	-17	--

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	80.4	8.1	.7	18.2	73.0	.85	0.10	7	80.4	8.1
Stage II	7.7	14.2	.7	17.8	67.3	.78	0.13	4 1/2	88.1	8.6
Tails	11.9	48.5	.8	15.5	35.2	--	--	--	100.0	13.4

F. F. Parameters - See Adit No. 2

FIGURE 29



OVERALL YIELD = 72.4%

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No.6	DEC.19/75
	Drawn L. BAILEY

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 6 LAB NO. 3499 DATE OF WASH August 26, 1975.

Raw Coal Analysis: Ash % 23.8 Hardgrove Grindability Index 84

Delivered Bulk Weight 11.8 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 6 LAB NO. 3499

1. S. G. of Separation (a) Washability 1.46
   (b) Plant 1.39
2. Feed Ash Content A.D.B. 24.2 %
3. Clean Coal Estimated Weight 2.04 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 9.8 % F.S.I. 2 1/2
5. Reject Estimated Weight 1.61 M.T.
6. Reject Analysis (A.D.B.) Ash 60.5 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 3.65 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 66.8 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 55.9 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 66.9 %
11. Yield Clean Coal (Washability) 71.6 %
12. +2" Rock Oversize Nil M.T.

ELCO MINING LTD.

TABLE 40

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 6 LAB NO. 3499

1. Vortex Finder Clearance (VFC) _____ CM _____ Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-120 g/l. 10-12 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)						21.5	1 1/2
	65M x 100M (.15 CM)							
	100M x 0							
O'FLOW	+65M						13.3	4
	65M x 100M							
	100M x 0							
U'FLOW	+65M						52.2	1
	65M x 100M							
	100M x 0							
S B O	+65M						11.4	6
	65M x 100M							
	100M x 0							

6. Yield - Total W.O. Cyclone Circuit = 78.9

7. Est. Yield of 28 x 65 Mesh Coal = 48.2
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 41

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 6 LAB NO. 3499

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-200 g/l 15-20 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)						16.4	3
	65M x 100M (.15 CM)							
	100M x 0							
CONC.	+65M (.21 CM)						10.8	4 1/2
	65M x 100M (.15 CM)							
	100M x 0							
TAILS	+65M (.21 CM)						55.6	1
	65M x 100M (.15 CM)							
	100M x 0							

4. Impeller Type -

5. Yield Calculated (Ash Balance) 87.5 %

6. Yield (Washability) 90.0 %

7. 65M x 0 (Washability) 22.1 %

ELCO MINING LTD.

TABLE 42

BULK WASHING DATA

ADIT/SEAM NO. 6 LAB NO. 3499

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30								
1.30-1.40								
1.40-1.50								
1.50-1.60								
1.60-1.70								
1.70-1.80								
1.80-1.90								
1.90-2.00								
+2.00								

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 6 LAB. NO. 3499 DATE OF WASH August 26, 1975.

a) Raw Coal

Delivered Wt.	=	11.8 M.T.
Ash %	=	23.8
Hardgrove Grindability Index	=	84
Estimated Washed Weight	=	5.5

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 66.8

Effective S. G. = 1.43

Raw Feed	24.2 % Ash	2	F.S.I.
Clean Coal	9.8 % Ash	2 1/2	F.S.I.
Reject	60.5 % Ash	1/2	F.S.I.

Calculated Yield = 71.6

Weighed Yield = 55.9

c) Water-Only Cyclone Circuit

Raw Feed	21.5 % Ash	1 1/2	F.S.I.
Overflow	13.3 % Ash	4	F.S.I.
Underflow	50.2 % Ash	1	F.S.I.

Calculated Yield = 77.8

% of +65 Mesh in O/F = 62 (estimated)

Sieve Bend Overflow	11.4 % Ash	6	F.S.I.

d) Froth Flotation Circuit

Raw Feed	16.4 % Ash	3	F.S.I.
Concentrates	10.8 % Ash	5 1/2	F.S.I.
Tails	55.6 % Ash	1	F.S.I.

Calculated Yield = 87.5

ELCO MINING LTD.

TABLE 43

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 6 LAB. NO. 3499

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 5 ASH % 10.3 VM % 18.2 FC % 71.0 S% 0.64 FSI 3 1/2

(ii) Dilatometer

Softening °C 422 Max. Dil. °C - Max Cont. % 16

Max. Dil. % -16 G. No. = -

(iii) Hardgrove Grindability Index = 88

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
6	1.18	6	1.18	1	0.20	0.3	0.059			1.7	15	2.94

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 44

SAMPLE: Clean Coal -Adit No. 6

LAB. NO.: 3499

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.5	10.3	18.2	71.0	3 1/2	88

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	2.7	2.7
1/2" X 1/4"	11.7	14.4
1/4" X 8M	24.7	39.1
8M X 28M	36.6	75.7
28M X 65M	13.2	88.9
65M X 0	11.1	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
422	-	16	-16	-

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.36	80.31	4.07	1.18	0.68	10.35	3.05

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.07	0.26	0.25	2.87	5.72	26.57	54.88	0.60	2.70	1.55

SAMPLE: Adit No. 7

LAB. NO.: 3717

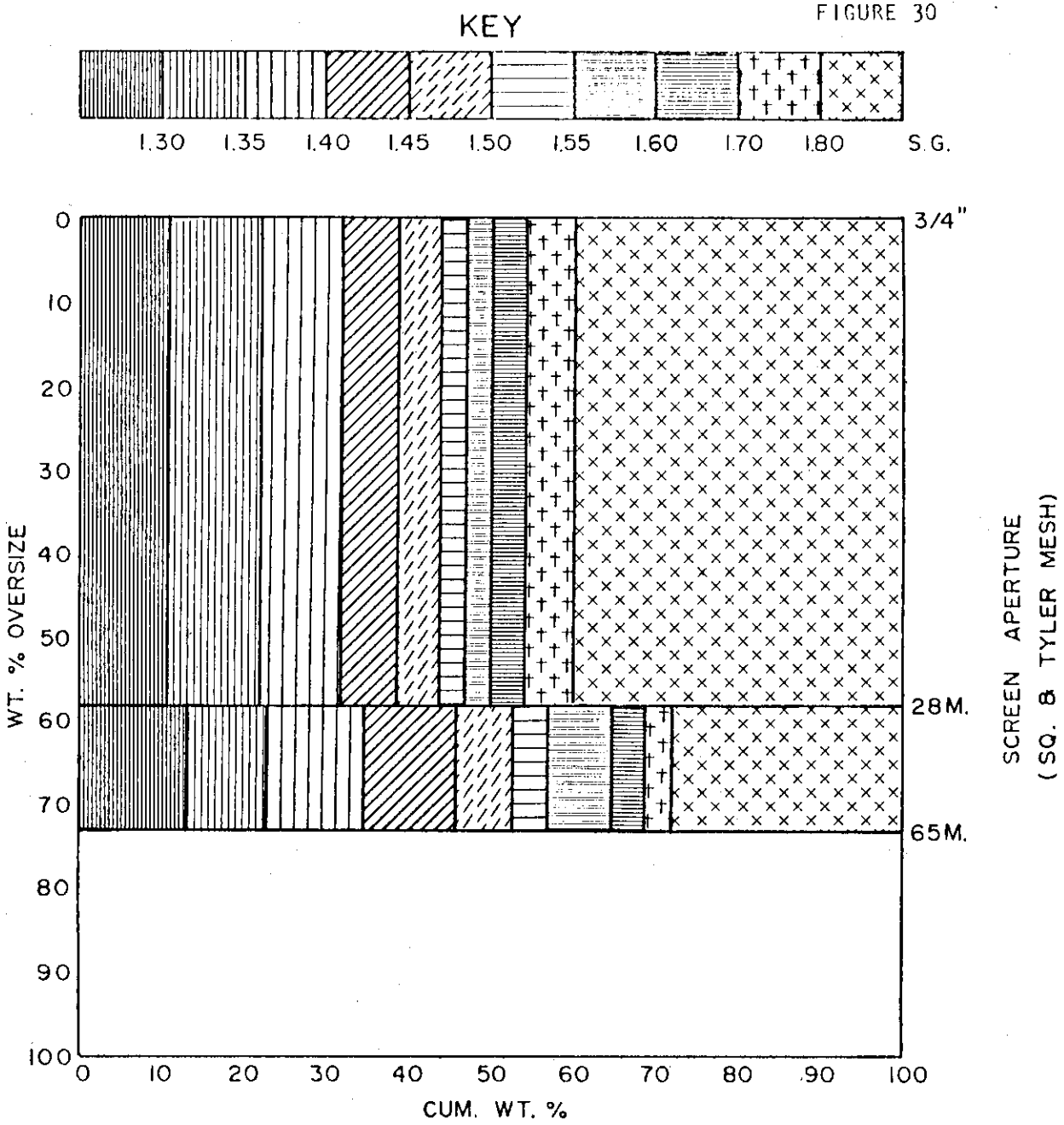
TABLE 45

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
1.1	33.1	15.6	50.2	0.55	10140	69	oxid.	1445+	-	-	-
							red.	1445+	-	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	13.4	53.1	1.0	13.4	32.5	0.35	-	-	-
	1/2" X 0	86.6	-	-	-	-	-	-	-	-
II	3/4" X 28M	58.1	39.3	0.7	14.9	45.1	0.41	82	58.1	39.3
	28M X 65M	15.1	28.8	0.7	16.4	54.1	0.48	-	73.2	37.1
	65M X 100M	5.5	24.9	-	-	-	-	-	78.7	36.3
	100M X 200M	13.0	20.3	-	-	-	-	-	91.7	34.0
	200M X 0	8.3	17.2	-	-	-	-	-	100.0	32.6
III	65M X 0	26.8	19.9	0.7	17.7	61.7	0.48	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 2.9%
II - Size consist of raw coal crushed to -3/4"
III - 65M X 0 from II

FIGURE 30



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 7
DATE	OCT, 14, 1975	SIGNED	K.M. LAU

ELCO MINING LTD ADIT NO.7 LAB NO.3717 2" X .5"

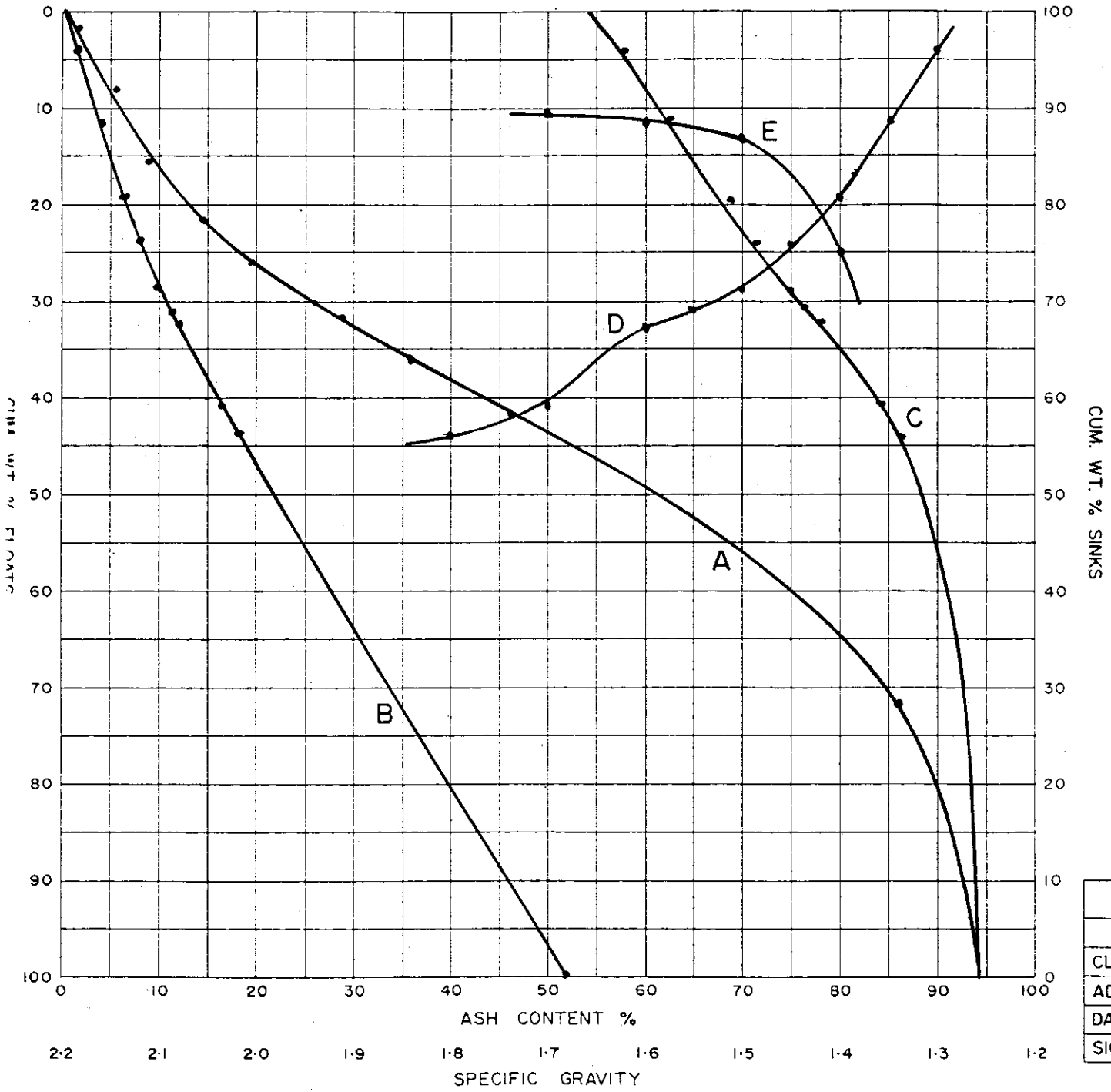
---DIRECT---					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	3.80	2.30	.09	.09	3.80	2.30	56.56	96.20	58.80	1.30	0.00
1.35	7.50	5.90	.44	.53	11.30	4.69	56.12	88.70	63.27	1.40	24.70
1.40	8.10	8.60	.70	1.23	19.40	6.32	55.42	80.60	68.76	1.50	13.30
1.45	4.60	14.20	.65	1.88	24.00	7.83	54.77	76.00	72.06	1.60	12.20
1.50	4.50	19.70	.89	2.77	28.50	9.71	53.88	71.50	75.36	1.70	10.70
1.55	2.50	25.90	.65	3.41	31.00	11.01	53.24	69.00	77.15	1.80	0.00
1.60	1.70	29.20	.50	3.91	32.70	11.96	52.74	67.30	78.36	1.90	0.00
1.70	8.00	35.90	2.87	6.78	40.70	16.66	49.87	59.30	84.09	2.00	0.00
1.80	2.70	46.20	1.25	8.03	43.40	18.50	48.62	56.60	85.90	2.10	0.00
9.99	56.60	85.90	48.62	56.65	100.00	56.65	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 46

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 31

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 7 2" x 1/2"
DATE	OCT, 8, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.7 LAB NO.3717 .5" X 28 M

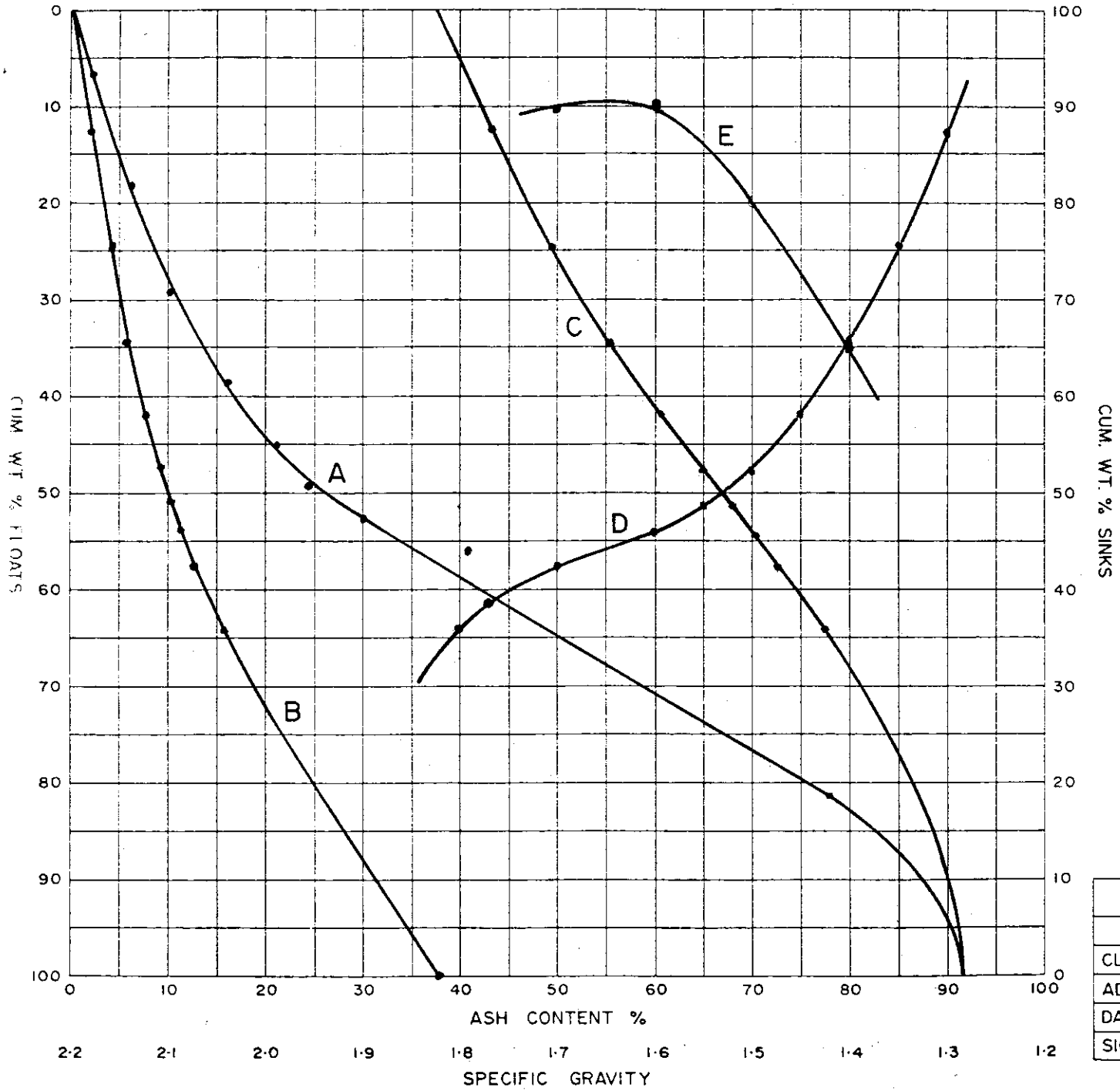
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	12.90	2.83	.37	.37	12.90	2.83	38.15	87.10	43.80	1.30	0.00
1.35	11.70	6.36	.74	1.11	24.60	4.51	37.41	75.40	49.61	1.40	34.90
1.40	9.90	10.27	1.02	2.13	34.50	6.16	36.39	65.50	55.56	1.50	19.80
1.45	7.70	15.91	1.23	3.35	42.20	7.94	35.17	57.80	60.84	1.60	9.70
1.50	5.60	21.24	1.19	4.54	47.80	9.50	33.98	52.20	65.09	1.70	10.10
1.55	3.50	24.38	.85	5.39	51.30	10.51	33.12	48.70	68.01	1.80	0.00
.60	3.00	30.33	.91	6.30	54.30	11.61	32.21	45.70	70.49	1.90	0.00
1.70	3.20	40.97	1.31	7.61	57.50	13.24	30.90	42.50	72.71	2.00	0.00
1.80	6.90	42.16	2.91	10.52	64.40	16.34	27.99	35.60	78.63	2.10	0.00
9.99	35.60	78.63	27.99	38.52	100.00	38.52	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 47

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 32

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 7 1/2" x 28M.
DATE	OCT, 14, 1975
SIGNED	K. M. Lau

ELCO MINING LTD ADIT NO.7 LAB NO.3717 .75" X28 M

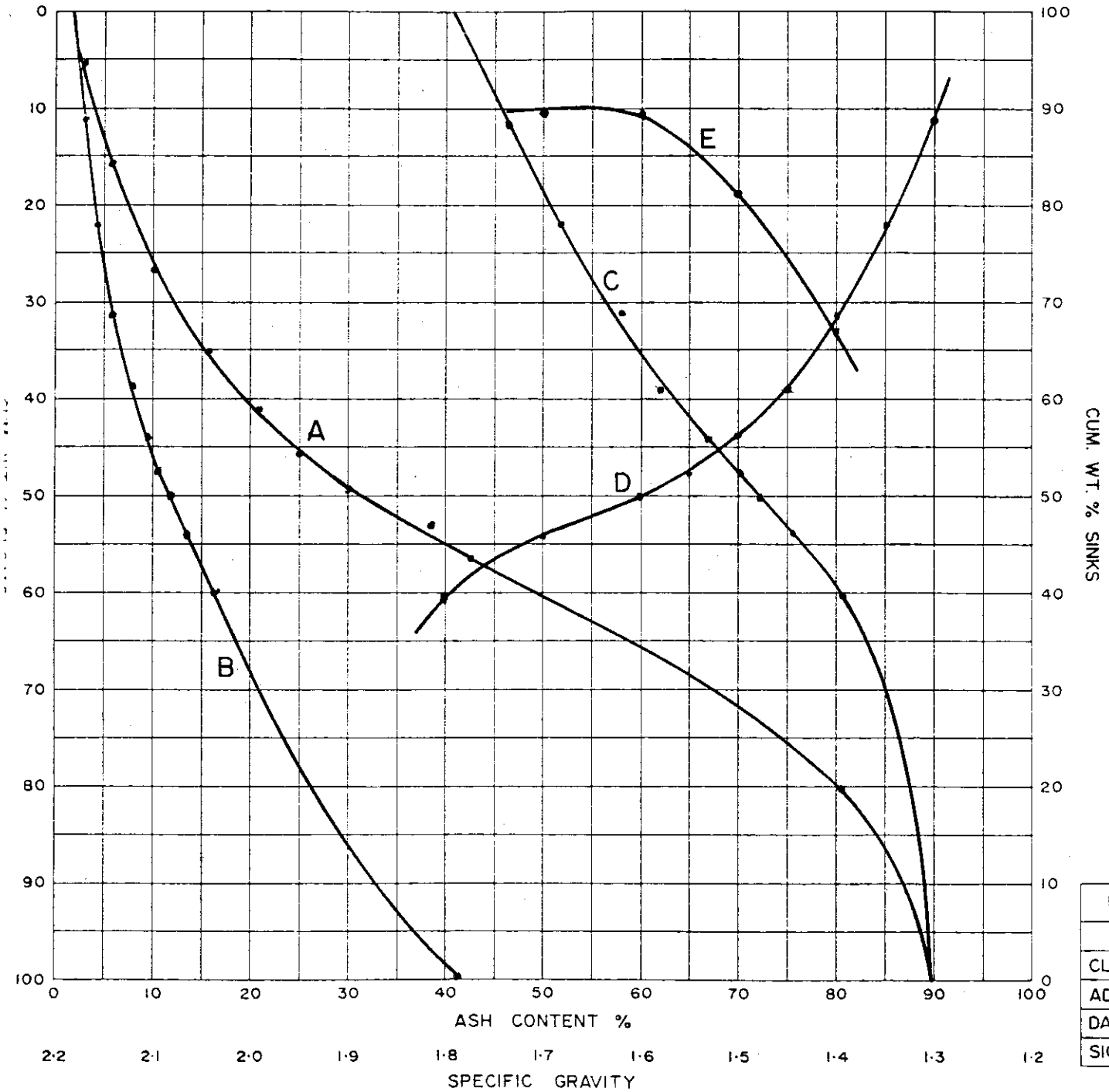
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	11.20	2.80	.31	.31	11.20	2.80	41.59	88.80	46.83	1.30	0.00
1.35	10.90	6.30	.69	1.00	22.10	4.53	40.90	77.90	52.50	1.40	33.00
1.40	9.60	10.00	.96	1.96	31.70	6.10	39.94	68.30	58.48	1.50	18.60
1.45	7.10	15.70	1.11	3.08	38.80	7.93	38.82	61.20	63.44	1.60	10.20
1.50	5.40	21.00	1.13	4.21	44.20	9.52	37.69	55.80	67.54	1.70	10.20
1.55	3.30	24.60	.81	5.02	47.50	10.57	36.88	52.50	70.24	1.80	0.00
1.60	2.80	30.20	.85	5.87	50.30	11.66	36.03	49.70	72.50	1.90	0.00
1.70	4.10	39.10	1.60	7.47	54.40	13.73	34.43	45.60	75.50	2.00	0.00
1.80	6.10	42.50	2.59	10.06	60.50	16.63	31.84	39.50	80.60	2.10	0.00
9.99	39.50	80.60	31.84	41.90	100.00	41.90	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 48

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 7 3/4" x 28 M.
DATE	OCT, 9, 1975
SIGNED	K. M. Lau

FIGURE 33

ELCO MINING LTD ADIT NO.7 LAB NO.3717 28M X 65M

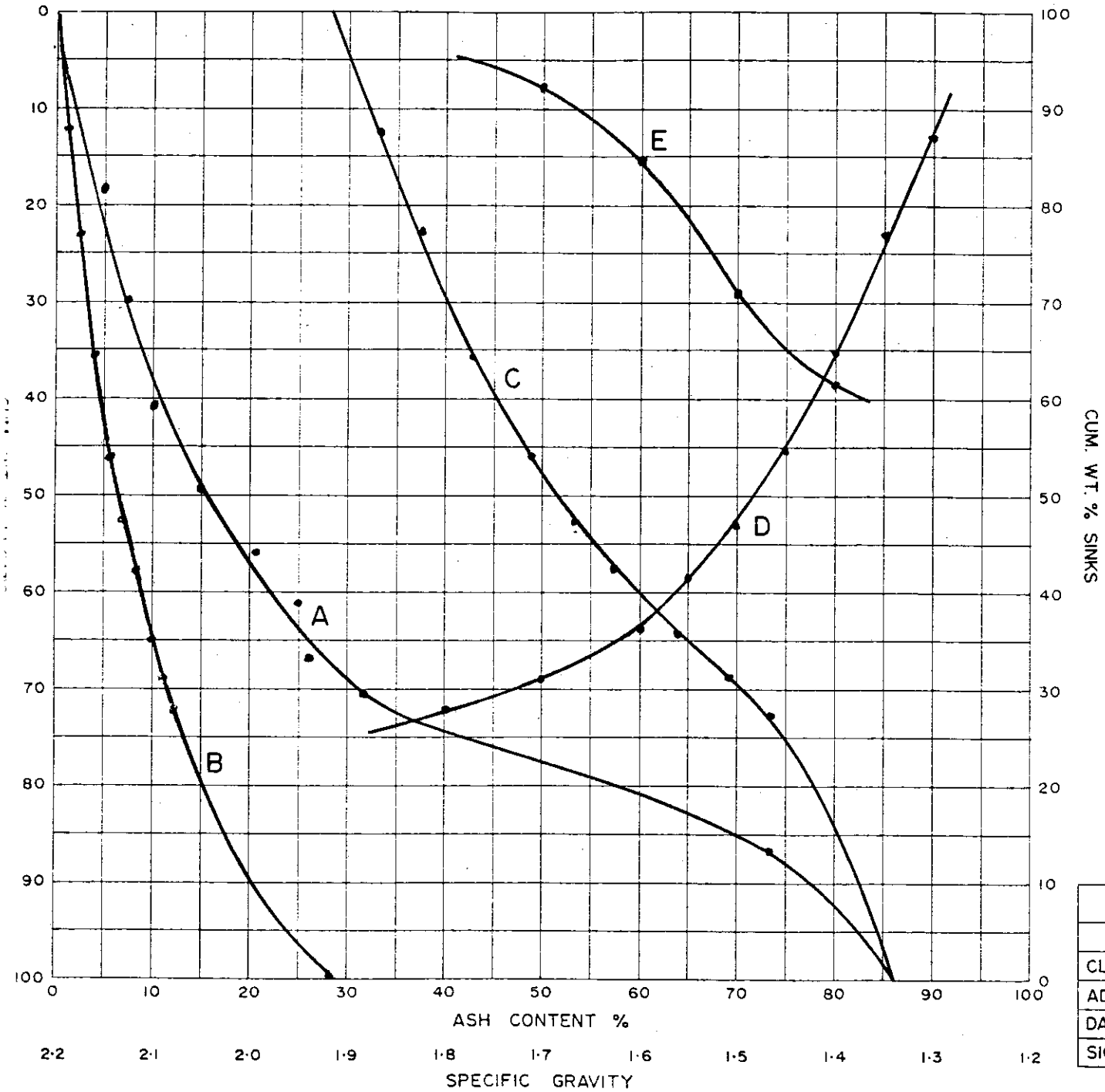
--DIRECT--			--CUM FLOATS--				--CUM SINKS--				+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT	ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8		9	10	11	12
1.30	13.60	1.40	.19	.19	13.60	1.40	28.67		86.40	33.18	1.30	0.00
1.35	9.80	5.10	.50	.69	23.40	2.35	28.17		76.60	36.78	1.40	39.80
1.40	12.10	7.10	.86	1.55	35.50	4.36	27.31		64.50	42.34	1.50	29.40
1.45	10.40	9.30	1.02	2.57	45.90	5.60	26.29		54.10	48.60	1.60	15.30
1.50	7.50	15.20	1.14	3.71	53.40	6.94	25.15		46.60	53.98	1.70	7.30
1.55	4.30	21.10	.91	4.62	57.70	8.00	24.25		42.30	57.32	1.80	0.00
1.60	7.20	25.00	1.80	6.42	64.90	9.89	22.45		35.10	63.95	1.90	0.00
1.70	3.80	25.50	.97	7.38	68.70	10.75	21.48		31.30	68.62	2.00	0.00
1.80	3.50	32.20	1.13	8.51	72.20	11.79	20.35		27.80	73.20	2.10	0.00
9.99	27.80	73.20	20.35	28.86	100.00	28.86	0.00		.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 49

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 34

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 7 28M. x 65M.
DATE	OCT, 8, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 50

SAMPLE: Adit No. 7

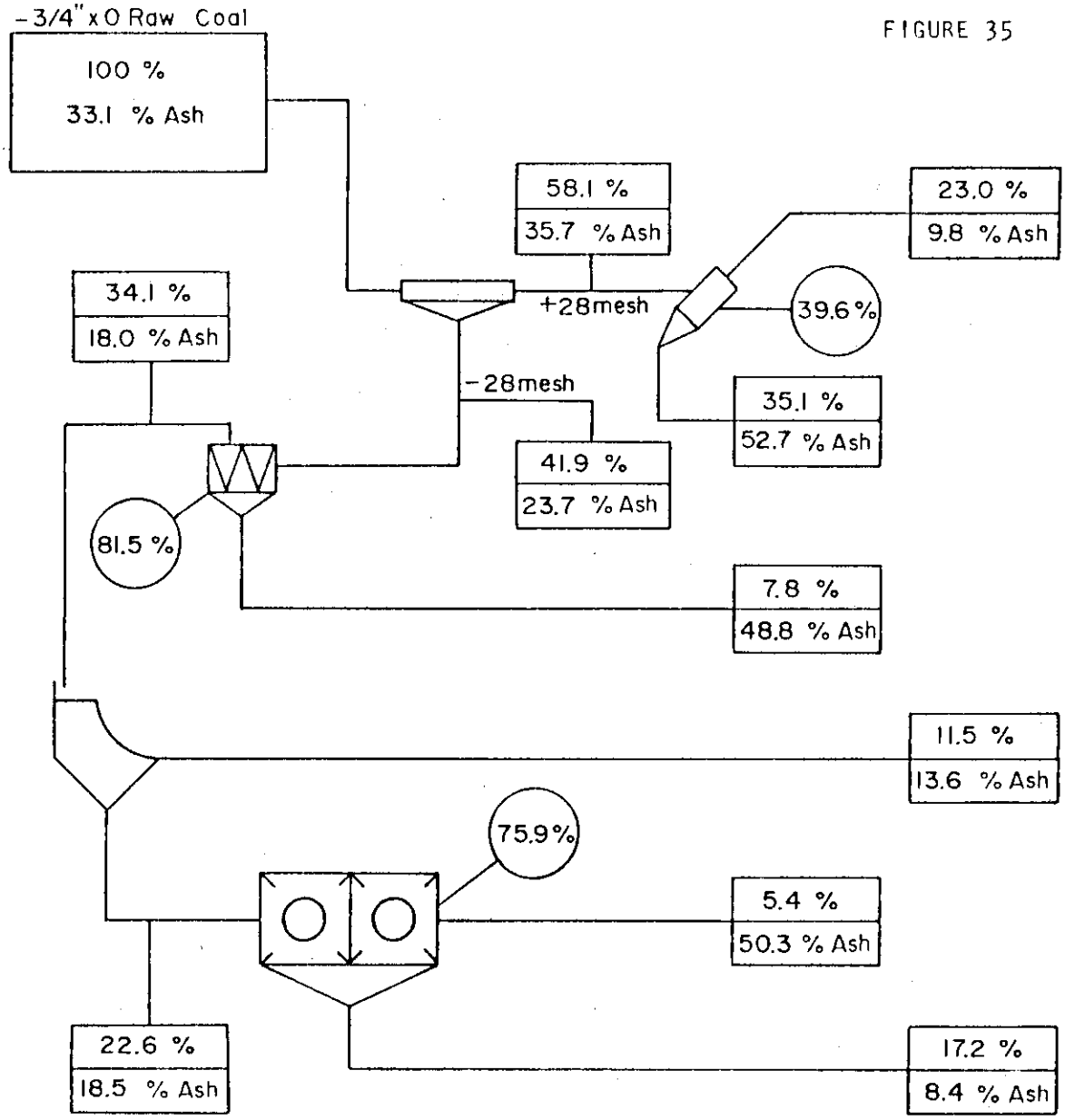
LAB. NO.: 3717

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	2	0.84	0.07	423	--	12	-12	--
3/4" X 28M	3	0.78	0.06	408	--	17	-17	--
28M X 65M	5 1/2	1.02	0.03	409	--	22	-22	--

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	68.2	9.6	0.6	18.6	71.2	.68	0.04	6 1/2	68.2	9.6
Stage II	11.9	19.3	0.6	17.4	62.7	.55	0.05	3 1/2	80.1	11.0
Tails	19.9	52.3	0.6	14.8	32.3	--	--	--	100.0	19.3

F. F. Parameters - See Adit No. 2

FIGURE 35



OVERALL YIELD = 51.7 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 7	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 7 LAB NO. 3716 DATE OF WASH September 13, 1975.

Raw Coal Analysis: Ash % 33.1 Hardgrove Grindability Index 69

Delivered Bulk Weight 17.4 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 7 LAB NO. 3716

1. S. G. of Separation (a) Washability 1.45
   (b) Plant 1.40

2. Feed Ash Content A.D.B. 35.7 %

3. Clean Coal Estimated Weight 1.87 M.T.

4. Clean Coal Analysis (A.D.B.) Ash 9.8 % F.S.I. 3 1/2

5. Reject Estimated Weight 4.95 M.T.

6. Reject Analysis (A.D.B.) Ash 52.7 % FSI 1

7. Estimated 3/4" x 28M In Circuit (3+5) 6.82 M.T.

8. Actual 3/4" x 28 Mesh from Washability Data 58.1 %

9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 27.4 %

10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 39.6 %

11. Yield Clean Coal (Washability) 45 %

12. +2" Rock Oversize Nil M.T.

ELCO MINING LTD.

TABLE 51

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 7 LAB NO. 3716

1. Vortex Finder Clearance (VFC) 5.7 CM 2.25 Inches
2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.
3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.
4. Feed Pulp Density 130-200 g/l. 13-20 % Solids W/V
5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	40.5	22.7	4	40.5	22.7	23.7	3
	65M x 100M (.15 CM)	13.1	22.0	4 1/2	53.6	22.5		
	100M x 0	46.4	23.1	4	100.0	22.8		
O'FLOW	+65M	33.6	15.3	5 1/2	33.6	15.3	18.0	4
	65M x 100M	12.7	18.8	5 1/2	46.3	16.3		
	100M x 0	53.7	19.4	3 1/2	100.0	17.9		
U'FLOW	+65M	65.6	42.4	1	65.6	42.4	48.8	1
	65M x 100M	10.8	49.7	1	76.4	43.4		
	100M x 0	23.6	58.5	1	100.0	47.0		
S B O	+65M	85.2	12.5	6 1/2	85.2	12.5	13.6	5 1/2
	65M x 100M	5.1	15.6	6 1/2	90.3	12.7		
	100M x 0	9.7	14.7	5	100.0	12.9		

6. Yield - Total W.O. Cyclone Circuit = 81.5
7. Est. Yield of 28 x 65 Mesh Coal = 27.4
   (as % of 28 Mesh x 0 Feed)

TABLE 52

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 7 LAB NO. 3716

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 140-220 g/l 14-22 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	11.8	14.6	7	11.8	14.6	18.5	4 1/2
	65M x 100M (.15 CM)	16.6	13.9	6 1/2	28.4	14.2		
	100M x 0	71.6	20.7	4 1/2	100.0	18.9		
CONC.	+65M (.21 CM)	6.2	7.8	8 1/2	6.2	7.8	8.4	8
	65M x 100M (.15 CM)	10.3	6.8	8 1/2	16.5	7.2		
	100M x 0	83.5	8.8	7 1/2	100.0	8.5		
TAILS	+65M (.21 CM)	61.4	44.3	1	61.4	44.3	50.3	1
	65M x 100M (.15 CM)	11.7	50.4	1	73.1	45.3		
	100M x 0	26.9	65.4	1	100.0	50.7		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 75.4 %

6. Yield (Washability) 60 %

7. 65M x 0 (Washability) 26.8 %

ELCO MINING LTD.

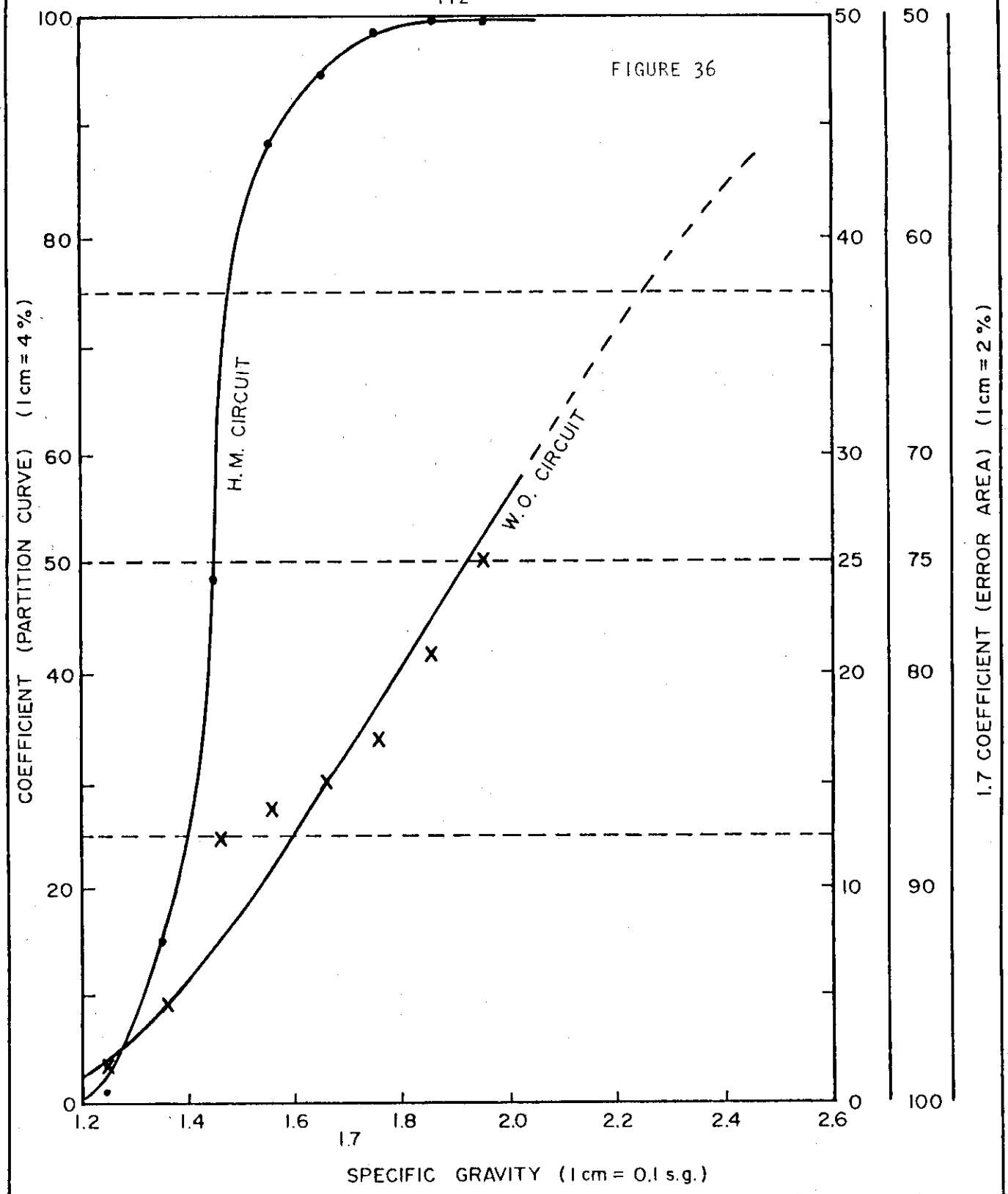
TABLE 53

BULK WASHING DATA

ADIT/SEAM NO. 7 LAB NO. 3716

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	22.1	22.1	1.9	1.9	25.0	25.0	3.2	3.2
1.30-1.40	52.6	74.7	6.1	8.0	33.5	58.5	11.7	14.9
1.40-1.50	21.9	96.6	13.3	21.3	17.3	75.8	19.3	34.2
1.50-1.60	2.4	99.0	12.1	33.4	8.5	84.3	11.1	45.3
1.60-1.70	0.4	99.4	7.0	40.4	4.2	88.5	6.1	51.4
1.70-1.80	0.1	99.5	4.5	44.9	2.8	91.3	5.0	56.4
1.80-1.90	-	-	5.6	50.5	2.2	93.5	5.5	61.9
1.90-2.00	-	-	4.6	55.4	0.9	94.4	3.0	64.9
+2.00	0.5	100.0	44.6	100.0	5.6	100.0	35.1	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 7	JAN. 6/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 7 LAB. NO. 3716 DATE OF WASH September 13, 1975.

a) Raw Coal

Delivered Wt.	=	17.4 M.T.
Ash %	=	33.1
Hardgrove Grindability Index	=	69
Estimated Washed Weight	=	11.3

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 58.1

Effective S. G. = 1.44

Raw Feed	35.7 % Ash	1 1/2	F.S.I.
Clean Coal	9.8 % Ash	3 1/2	F.S.I.
Reject	52.7 % Ash	1	F.S.I.

Calculated Yield = 39.6

Weighed Yield = 27.4

c) Water-Only Cyclone Circuit

Raw Feed	23.7 % Ash	3	F.S.I.
Overflow	18.0 % Ash	4	F.S.I.
Underflow	48.8 % Ash	1	F.S.I.

Calculated Yield = 81.5

% of +65 Mesh in O/F = 33.6

Sieve Bend Overflow	13.6 % Ash	5 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	18.5 % Ash	4 1/2	F.S.I.
Concentrates	8.4 % Ash	8	F.S.I.
Tails	50.3 % Ash	1	F.S.I.

Calculated Yield = 75.9

ELCO MINING LTD.

BULK WASHING SUMMARY (Cont.) TABLE 54

ADIT/SEAM NO. 7 LAB. NO. 3716

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 2.2 ASH % 10.6 VM % 18.2 FC % 69.0 S% 0.55 FSI 6

(ii) Dilatometer

Softening °C 420 Max. Dil. °C - Max Cont. % 19

Max. Dil. % -19 G. No. = -

(iii) Hardgrove Grindability Index = 106

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
7	1.34	5	0.95	2	0.38	0.6	0.114			1.9	16.5	3.15

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 55

SAMPLE: Clean Coal - Adit No. 7

LAB. NO.: 3716

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
2.2	10.6	18.2	69.0	6	106

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	1.2	1.2
1/2" X 1/4"	6.8	8.0
1/4" X 8M	13.6	21.6
8M X 28M	26.9	48.5
28M X 65M	26.8	75.3
65M X 0	24.7	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
420	-	19	-19	-

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.73	79.65	4.18	1.06	0.61	10.88	2.89

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.05	0.26	0.27	0.50	6.43	30.92	56.80	0.31	0.99	2.17

SAMPLE: Adit No. 8

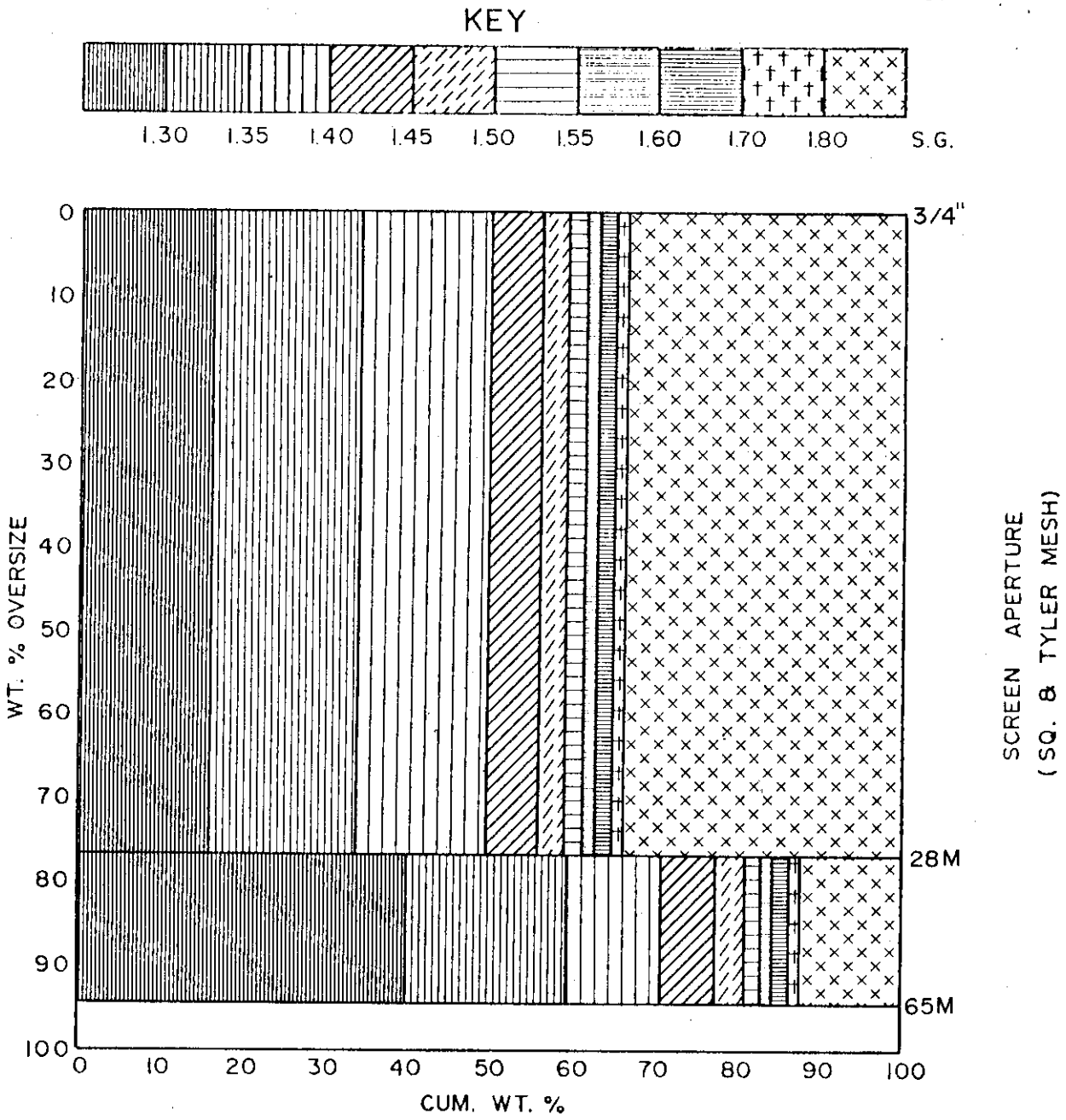
LAB. NO.: 3790

TABLE 56

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.6	31.0	16.3	52.1	0.48	10540	91	oxid.	1470+	-	-	-
							red.	1470+	-	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	26.7	51.9	1.1	11.8	35.2	0.21	67	-	-
	1/2" X 0	73.3	-	-	-	-	-	-	-	-
II	3/4" X 28M	77.0	35.0	1.1	15.0	48.9	0.43	72	77.0	35.0
	28M X 65M	18.9	16.0	1.3	18.0	64.7	0.37	120	95.9	31.3
	65M X 100M	0.8	15.4	-	-	-	-	-	96.7	31.1
	100M X 200M	1.6	14.4	-	-	-	-	-	98.3	30.9
	200M X 0	1.7	13.3	-	-	-	-	-	100.0	30.6
III	65M X 0	4.1	13.7	1.2	18.5	66.6	0.44	-	-	-

FIGURE 37



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT №	ADIT 8
DATE	NOV. 12 / 75	SIGNED	L Bailey

ELCO MINING LTD ADIT #8 LAB NO: 3790 2"X.5

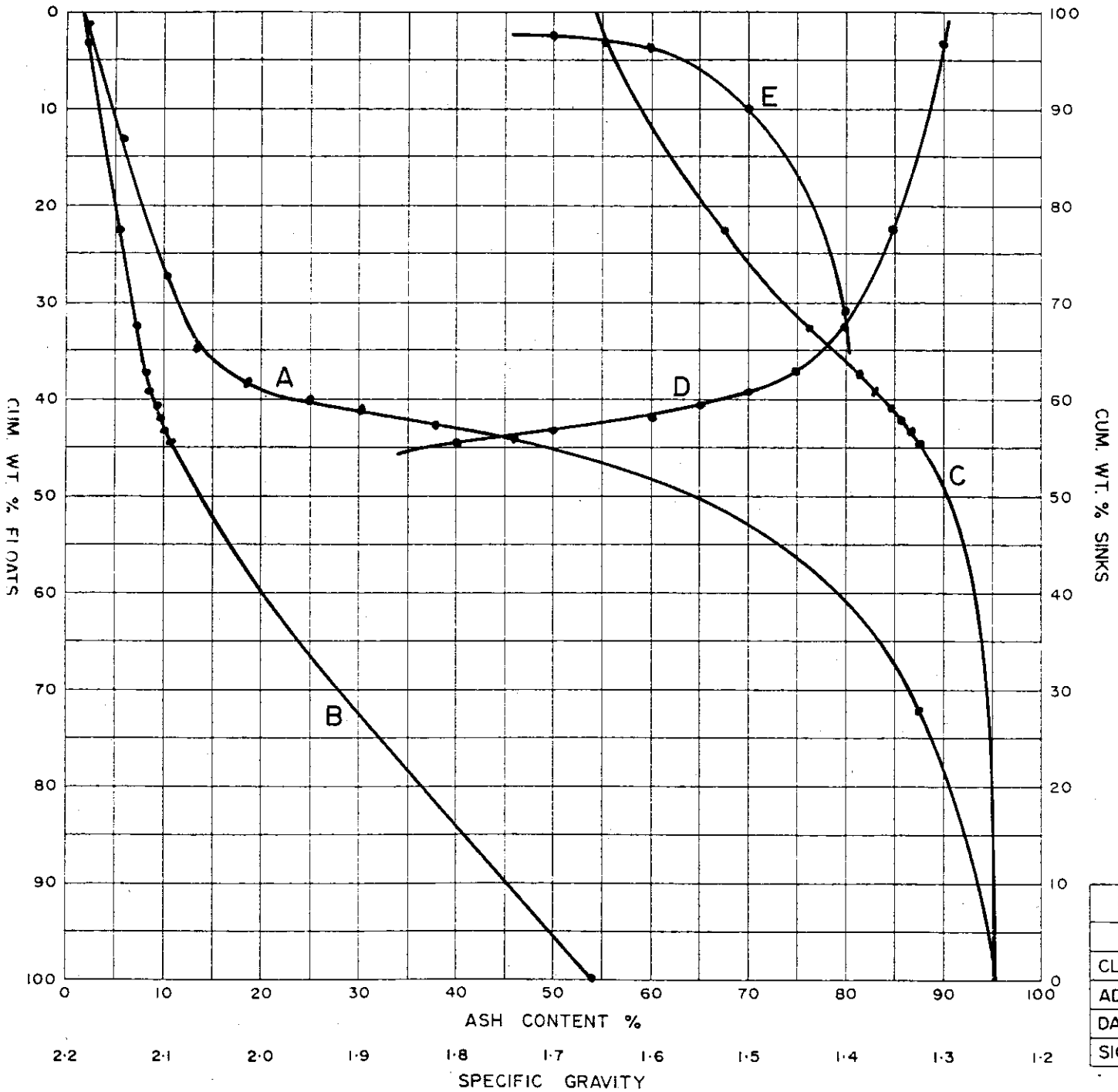
--DIRECT--			--CUM FLOATS--					--CUM SINKS--		+-0.1 DISTR	
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH	TT ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	3.00	2.60	.08	.08	3.00	2.60	53.78	97.00	55.44	1.30	0.00
1.35	19.70	6.00	1.18	1.26	22.70	5.55	52.60	77.30	68.04	1.40	36.20
1.40	9.60	10.60	1.02	2.28	32.30	7.05	51.58	67.70	76.19	1.50	9.70
1.45	5.10	13.30	.68	2.96	37.40	7.90	50.90	62.60	81.31	1.60	4.20
1.50	1.80	18.80	.34	3.29	39.20	8.40	50.56	60.80	83.16	1.70	2.30
1.55	1.50	25.00	.38	3.67	40.70	9.02	50.19	59.30	84.63	1.80	0.00
1.60	1.30	30.50	.40	4.07	42.00	9.68	49.79	58.00	85.85	1.90	0.00
1.70	1.40	37.90	.53	4.60	43.40	10.59	49.26	56.60	87.03	2.00	0.00
1.80	.90	45.70	.41	5.01	44.30	11.30	48.85	55.70	87.70	2.10	0.00
9.99	55.70	87.70	48.85	53.86	100.00	53.86	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 57

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 8 2" x 1/2"
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 38

ELCO MINING LTD ADIT NO.8 LAB NO.3790 .5" X 28 M

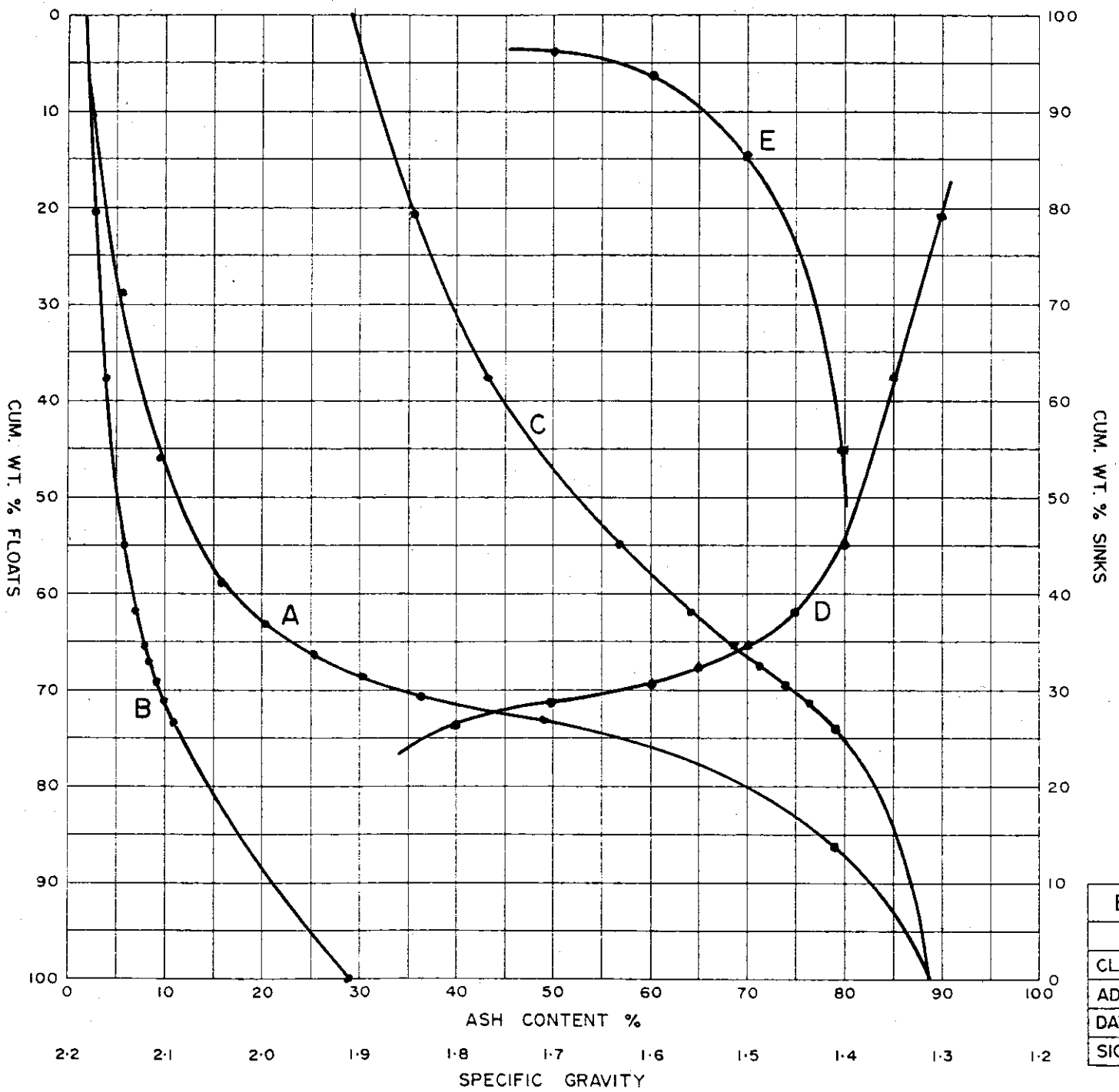
---DIRECT---					---CUM FLOATS---			---CUM SINKS---		←-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	20.10	2.54	.51	.51	20.10	2.54	28.30	79.90	35.42	1.30	0.00
1.35	17.54	6.42	1.13	1.64	37.65	4.35	27.13	62.35	43.58	1.40	45.22
1.40	17.41	9.29	1.62	3.25	55.06	5.91	25.56	44.94	56.87	1.50	14.13
.45	6.38	15.56	1.09	4.34	62.04	7.00	24.47	37.96	64.47	1.60	6.35
1.50	3.28	20.23	.66	5.00	65.32	7.66	23.81	34.68	68.66	1.70	4.33
1.55	2.17	25.49	.55	5.56	67.49	8.23	23.25	32.51	71.54	1.80	0.00
1.60	1.70	30.12	.51	6.07	69.19	8.77	22.74	30.81	73.82	1.90	0.00
1.70	2.48	36.58	.91	6.98	71.67	9.73	21.83	28.33	77.09	2.00	0.00
.80	1.85	48.97	.91	7.88	73.52	10.72	20.93	26.48	79.05	2.10	0.00
9.99	26.48	79.05	20.93	28.81	100.00	28.81	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 58

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 8 1/2" x 28M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 33

ELCO MINING LTD ADIT #8 LAB NO: 3790 .75"X28M

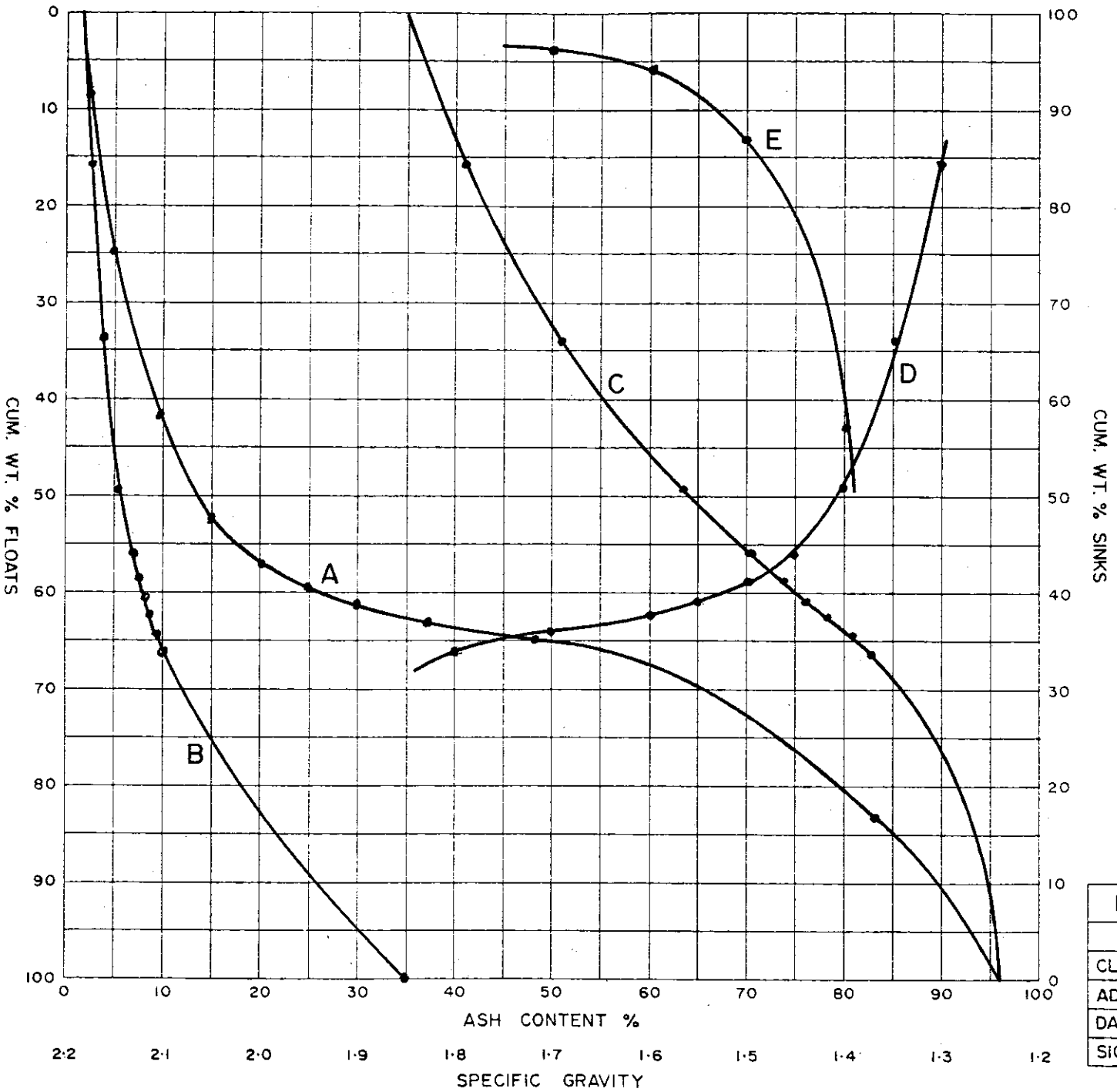
--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	15.70	2.50	.39	.39	15.70	2.50	34.61	84.30	41.05	1.30	0.00
1.35	18.10	4.90	.89	1.28	33.80	3.79	33.72	66.20	50.94	1.40	42.90
1.40	15.40	9.50	1.46	2.74	49.20	5.57	32.26	50.80	63.50	1.50	13.00
1.45	6.50	15.10	.98	3.72	55.70	6.69	31.27	44.30	70.60	1.60	5.80
1.50	2.90	20.00	.58	4.30	58.60	7.34	30.69	41.40	74.14	1.70	3.80
1.55	2.00	25.40	.51	4.81	60.60	7.94	30.19	39.40	76.62	1.80	0.00
1.60	1.60	30.20	.48	5.30	62.20	8.51	29.70	37.80	78.58	1.90	0.00
1.70	2.20	36.80	.81	6.10	64.40	9.48	28.89	35.60	81.16	2.00	0.00
1.80	1.60	48.50	.78	6.88	66.00	10.43	28.12	34.00	82.70	2.10	0.00
9.99	34.00	82.70	28.12	35.00	100.00	35.00	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 59

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 8 3/4" x 28M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 40

ELCO MINING LTD ADIT #8 LAB NO: 3790 28MX65M

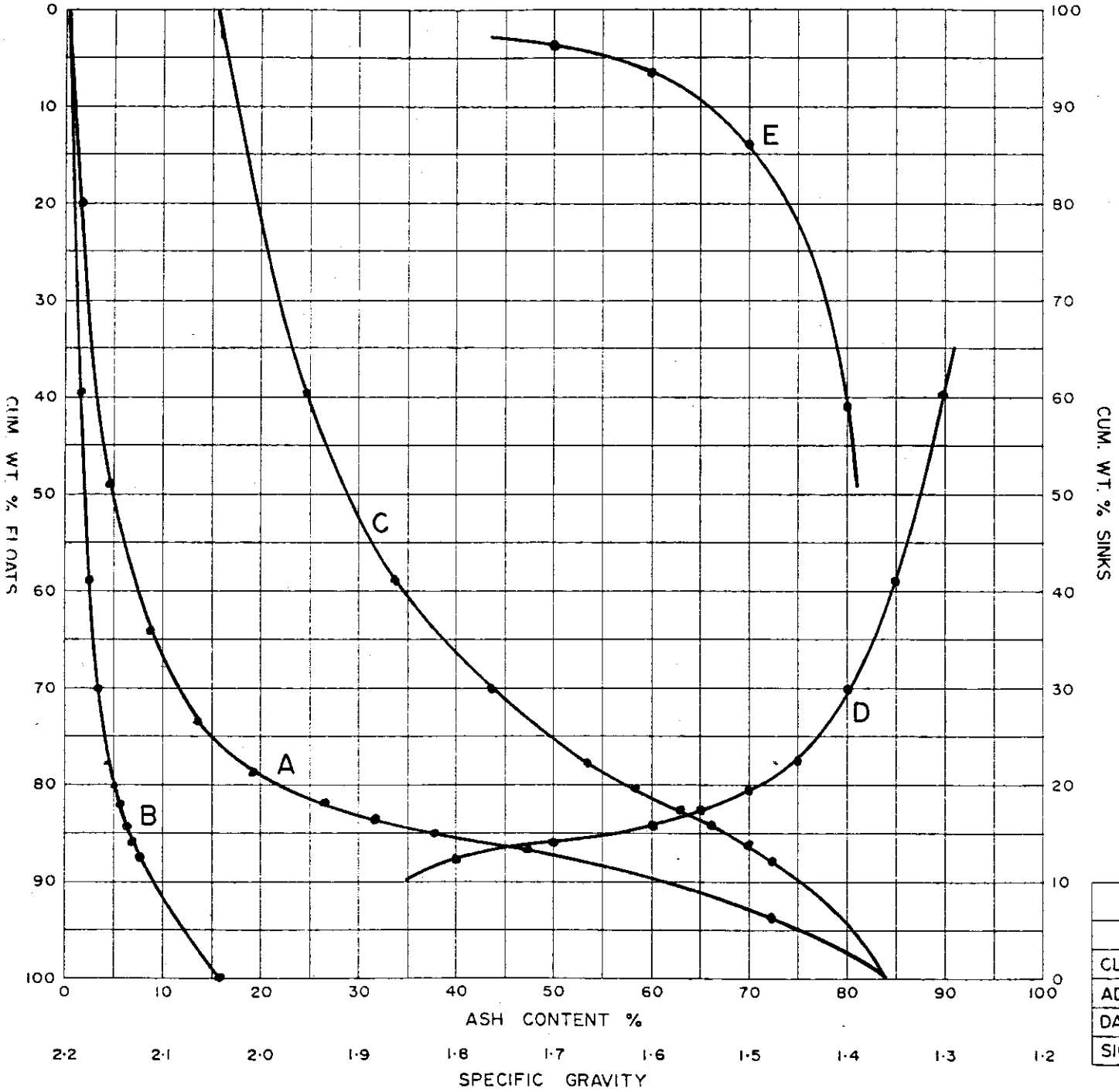
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	39.60	1.60	.63	.63	39.60	1.60	14.94	60.40	24.73	1.30	0.00
1.35	19.20	4.50	.86	1.50	58.80	2.55	14.07	41.20	34.16	1.40	40.80
1.40	11.40	8.50	.97	2.47	70.20	3.51	13.11	29.80	43.98	1.50	13.80
1.45	7.10	13.50	.96	3.43	77.30	4.43	12.15	22.70	53.51	1.60	5.70
1.50	3.10	19.30	.60	4.02	80.40	5.00	11.55	19.60	58.92	1.70	3.40
1.55	2.20	26.60	.59	4.61	82.60	5.58	10.96	17.40	63.01	1.80	0.00
1.60	1.40	31.70	.44	5.05	84.00	6.01	10.52	16.00	65.75	1.90	0.00
1.70	2.10	38.20	.80	5.85	86.10	6.80	9.72	13.90	69.91	2.00	0.00
1.80	1.30	47.70	.62	6.47	87.40	7.41	9.10	12.60	72.20	2.10	0.00
9.99	12.60	72.20	9.10	15.57	100.00	15.57	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 60

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 8 28M. x 65M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 11

ELCO MINING LTD.

TABLE 61

SAMPLE: Adit No. 8

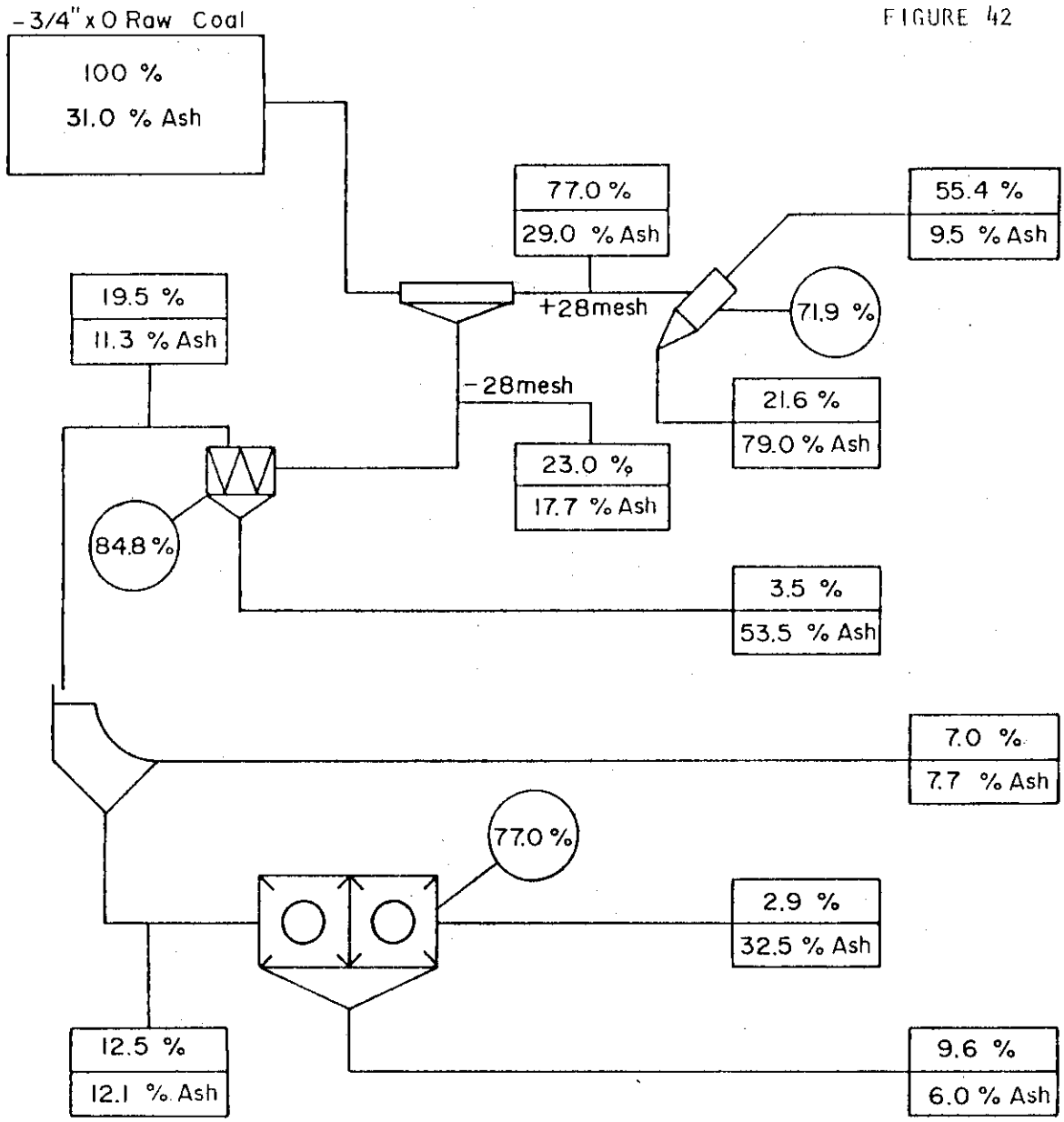
LAB. NO.: 3790

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
				DILATATION TEST				
SIZE FRAC.	F.S.I.	S %	P %	SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	1 1/2	0.55	0.08	447	--	5	-5	--
3/4" X 28M	4 1/2	0.61	0.07	427	--	12	-12	--
28M X 65M	8 1/2	0.66	0.04	419	480	10	0	0.936

FROTH FLOTATION TEST 65M x 0										
									Cumulative	
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Wt %	Ash %
Stage I	82.9	7.3	0.7	19.4	72.6	.44	0.04	9	82.9	7.3
Stage II	7.8	18.7	0.7	17.7	62.9	.41	0.06	5 1/2	90.7	8.3
Tails	9.3	64.8	0.8	11.9	22.5	--	--	--	100.0	13.5

F. F. Parameters - See Adit No. 2

FIGURE 42



OVERALL YIELD = 72 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 8	DEC. 22 / 75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 8 LAB NO. 3789 DATE OF WASH September 9, 1975.

Raw Coal Analysis: Ash % 31.0 Hardgrove Grindability Index 91

Delivered Bulk Weight 27.5 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 8 LAB NO. 3789

1. S. G. of Separation (a) Washability 1.65
   (b) Plant 1.52
2. Feed Ash Content A.D.B. 29.0 %
3. Clean Coal Estimated Weight 7.14 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 9.5 % F.S.I. 5 1/2
5. Reject Estimated Weight 3.08 M.T.
6. Reject Analysis (A.D.B.) Ash 79.0 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 10.22 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 77.0 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 69.9 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 71.9 %
11. Yield Clean Coal (Washability) 64 %
12. +2" Rock Oversize 1.14 M.T.

ELCO MINING LTD. TABLE 62

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 8 LAB NO. 3789

1. Vortex Finder Clearance (VFC) 2.54 CM 1 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-140 g/l. 10-14 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	55.3	17.9	8 1/2	55.3	17.9	17.7	8 1/2
	65M x 100M (.15 CM)	14.1	14.6	9	69.4	17.2		
	100M x 0	30.6	18.1	7 1/2	100.0	17.5		
O'FLOW	+65M	41.0	8.5	8 1/2	41.0	8.5	11.3	8 1/2
	65M x 100M	15.1	9.2	9	56.0	8.7		
	100M x 0	43.9	14.4	7 1/2	100.0	11.2		
U'FLOW	+65M						53.5	1
	65M x 100M							
	100M x 0							
S B O	+65M	84.2	7.7	8 1/2	84.2	7.7	7.7	9
	65M x 100M	8.1	7.8	9	92.3	7.7		
	100M x 0	7.7	10.7	8	100.0	7.9		

6. Yield - Total W.O. Cyclone Circuit = 84.8

7. Est. Yield of 28 x 65 Mesh Coal = 30.5
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 63

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 8 LAB NO. 3789

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density _____ g/l _____ % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	9.6	7.8	9	9.6	7.8	12.1	8
	65M x 100M (.15 CM)	12.8	7.3	9	22.4	7.5		
	100M x 0	77.6	13.5	8 1/2	100.0	12.2		
CONC.	+65M (.21 CM)	7.0	4.8	9	7.0	4.8	6.0	9
	65M x 100M (.15 CM)	14.4	4.1	9	21.4	4.3		
	100M x 0	78.6	6.5	9	100.0	6.0		
TAILS	+65M (.21 CM)	48.0	24.9	5	48.0	24.9	32.5	4
	65M x 100M (.15 CM)	24.2	25.2	4 1/2	72.2	25.0		
	100M x 0	27.8	50.0	2	100.0	32.0		

4. Impeller Type - Denver

5. Yield Calculated (Ash Balance) 77.0 %

6. Yield (Washability) 72 %

7. 65M x 0 (Washability) 4.1 %

ELCO MINING LTD.

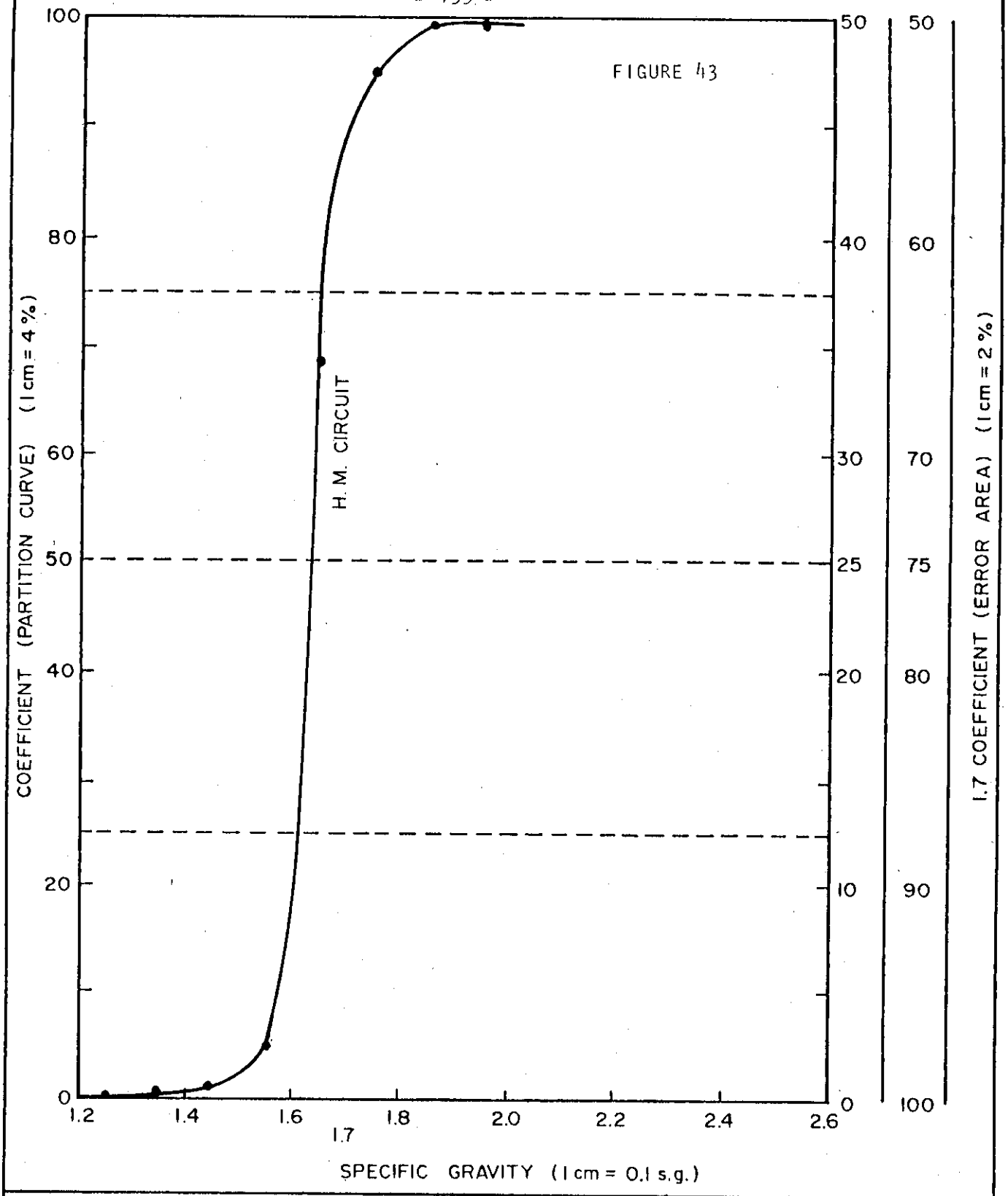
TABLE 64

BULK WASHING DATA

ADIT/SEAM NO. 8 LAB NO. 3789

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	46.6	46.6	0.1	0.1	50.4	50.4	NA	NA
1.30-1.40	41.0	87.6	0.2	0.3	30.7	81.1	NA	NA
1.40-1.50	8.6	96.2	0.2	0.5	9.0	90.1	NA	NA
1.50-1.60	3.0	99.2	0.4	0.9	3.2	93.3	NA	NA
1.60-1.70	0.7	99.9	3.8	4.7	1.9	95.2	NA	NA
1.70-1.80	0.1	100.0	5.0	9.7	1.2	96.4	NA	NA
1.80-1.90	-	-	5.9	15.6	0.9	97.3	NA	NA
1.90-2.00	-	-	5.0	20.6	0.5	97.8	NA	NA
+2.00	-	-	79.4	100.0	2.2	100.0	NA	NA



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 8	JAN. 6/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 8 LAB. NO. 3789 DATE OF WASH September 9. 1975.

a) Raw Coal

Delivered Wt.	=	27.5 M.T.
Ash %	=	31.0 %
Hardgrove Grindability Index	=	91
Estimated Washed Weight	=	13.3 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 77.0 %

Effective S. G. = 1.63

Raw Feed	29.0 % Ash	2 1/2	F.S.I.
Clean Coal	9.5 % Ash	5 1/2	F.S.I.
Reject	79.0 % Ash	1/2	F.S.I.

Calculated Yield = 71.9

Weighed Yield = 69.9

c) Water-Only Cyclone Circuit

Raw Feed	17.7 % Ash	8 1/2	F.S.I.
Overflow	11.3 % Ash	8 1/2	F.S.I.
Underflow	53.5 % Ash	1	F.S.I.

Calculated Yield = 84.8

% of +65 Mesh in O/F = 36 (estimated)

Sieve Bend Overflow	7.7 % Ash	9	F.S.I.

d) Froth Flotation Circuit

Raw Feed	12.1 % Ash	8	F.S.I.
Concentrates	6.0 % Ash	9	F.S.I.
Tails	32.5 % Ash	4	F.S.I.

Calculated Yield = 77.0 %

ELCO MINING LTD.

TABLE 65

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 8 LAB. NO. 3789

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % RM% 0.4 ASH % 9.3 VM %18.5 FC % 71.8 S% 0.40 FSI 6 1/2

(ii) Dilatometer

Softening °C 416 Max. Dil. °C 475 Max Cont. % 21

Max. Dil. % -16 G. No. = 0.671

(iii) Hardgrove Grindability Index = 93

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
12		14				0.6					42	8.34

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 66

SAMPLE: Clean Coal - Adit No. 8

LAB. NO.: 3789

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.4	9.3	18.5	71.8	6 1/2	93

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	3.1	3.1
1/2" X 1/4"	15.9	19.0
1/4" X 8M	24.3	43.3
8M X 28M	30.2	73.5
28M X 65M	12.8	86.3
65M X 0	13.7	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
416	475	21	-16	0.671

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.38	80.85	4.27	1.29	0.47	9.31	3.43

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.04	0.14	0.20	1.54	6.50	29.92	57.54	0.21	1.59	1.82

SAMPLE: Adit No. 9

LAB. NO.: 3834

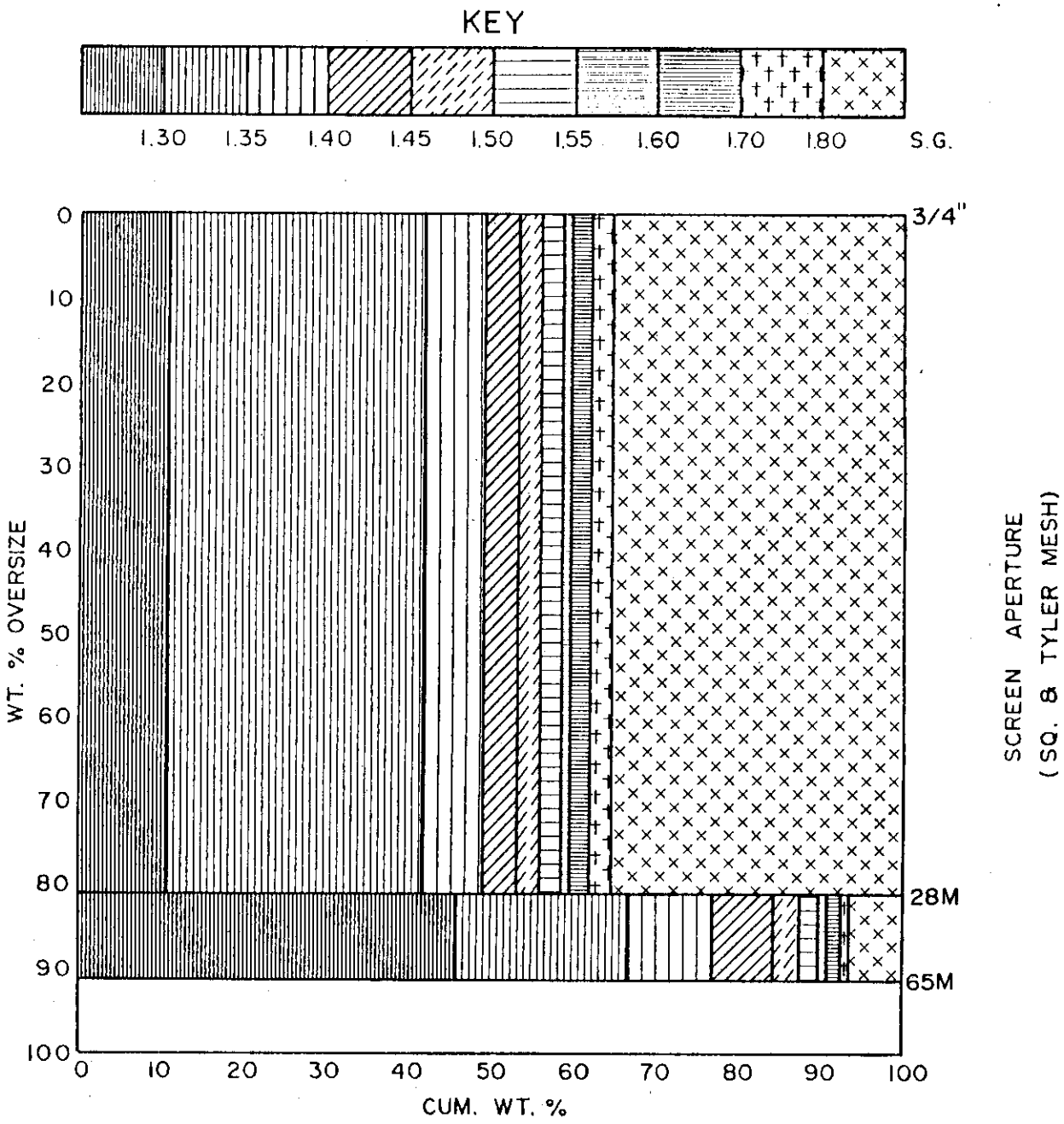
TABLE 67

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.6	24.0	18.5	56.9	0.28	11470	92	oxid.	1470	1470+	-	-
							red.	1365	1445	1465	1465+

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	24.2	36.9	1.0	16.2	45.9	0.28	69	-	-
	1/2" X 0	75.8	-	-	-	-	-	-	-	-
II	3/4" X 28M	81.2	27.0	1.7	17.6	53.7	0.35	83	81.2	27.0
	28M X 65M	10.3	11.9	1.7	19.3	67.1	0.39	114	91.5	25.3
	65M X 100M	1.2	11.6	-	-	-	-	-	92.7	25.1
	100M X 200M	3.8	11.8	-	-	-	-	-	96.5	24.6
	200M X 0	3.5	11.2	-	-	-	-	-	100.0	24.1
III	65M X 0	8.5	11.4	1.9	19.0	67.7	0.41	-	-	-

I - Size consist of raw coal as received, WT. % +2" = 9.9%
II - Size consist of raw coal crushed to - 3/4", WT. % 3/4" X 1/2 = 1.6%
III - 65M X 0 off II

FIGURE 44



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT №	ADIT 9
DATE	NOV. 13/75	SIGNED	L Barley

ELCO MINING LTD ADIT #9 LAB NO: 3834 2" X.5

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	10.80	3.40	.37	.37	10.80	3.40	34.08	89.20	38.21	1.30	0.00
1.35	31.10	6.30	1.96	2.33	41.90	5.55	32.12	58.10	55.29	1.40	45.20
1.40	7.20	12.20	.88	3.20	49.10	6.53	31.24	50.90	61.38	1.50	10.50
1.45	4.10	16.90	.69	3.90	53.20	7.33	30.55	46.80	65.28	1.60	6.00
1.50	2.80	20.80	.58	4.48	56.00	8.00	29.97	44.00	68.11	1.70	4.60
1.55	2.30	26.50	.61	5.09	58.30	8.73	29.36	41.70	70.40	1.80	0.00
1.60	1.30	30.50	.40	5.49	59.60	9.21	28.96	40.40	71.69	1.90	0.00
1.70	2.40	37.70	.90	6.39	62.00	10.31	28.06	38.00	73.83	2.00	0.00
1.80	2.20	45.10	.99	7.38	64.20	11.50	27.06	35.80	75.60	2.10	0.00
9.99	35.80	75.60	27.06	34.45	100.00	34.45	0.00	.00	0.00	2.20	0.00

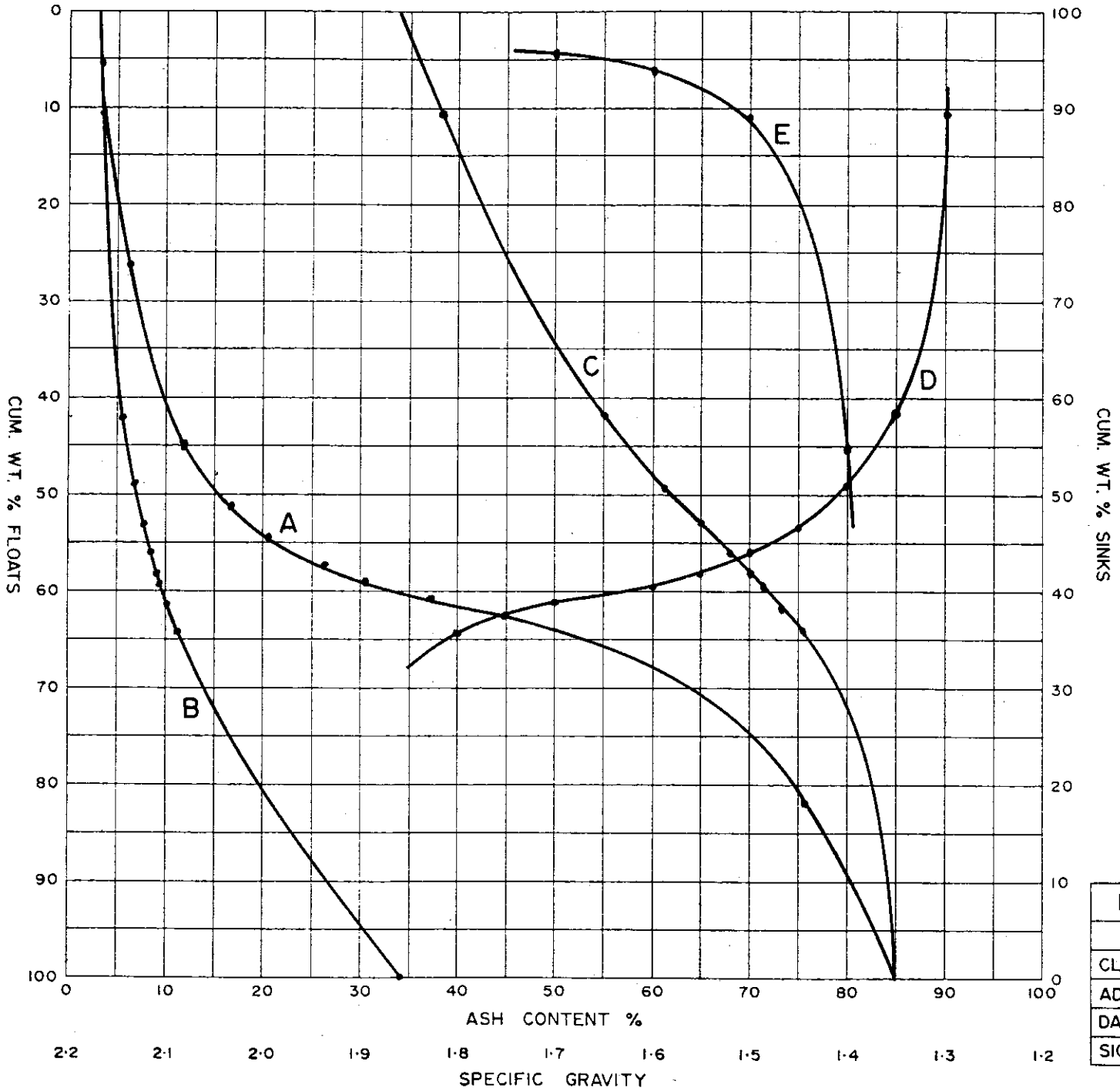
BIRTLEY ENGINEERING

TABLE 68

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 45

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 9 2" x 1/2"
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.9 LAB NO.3834 .5" X 28M

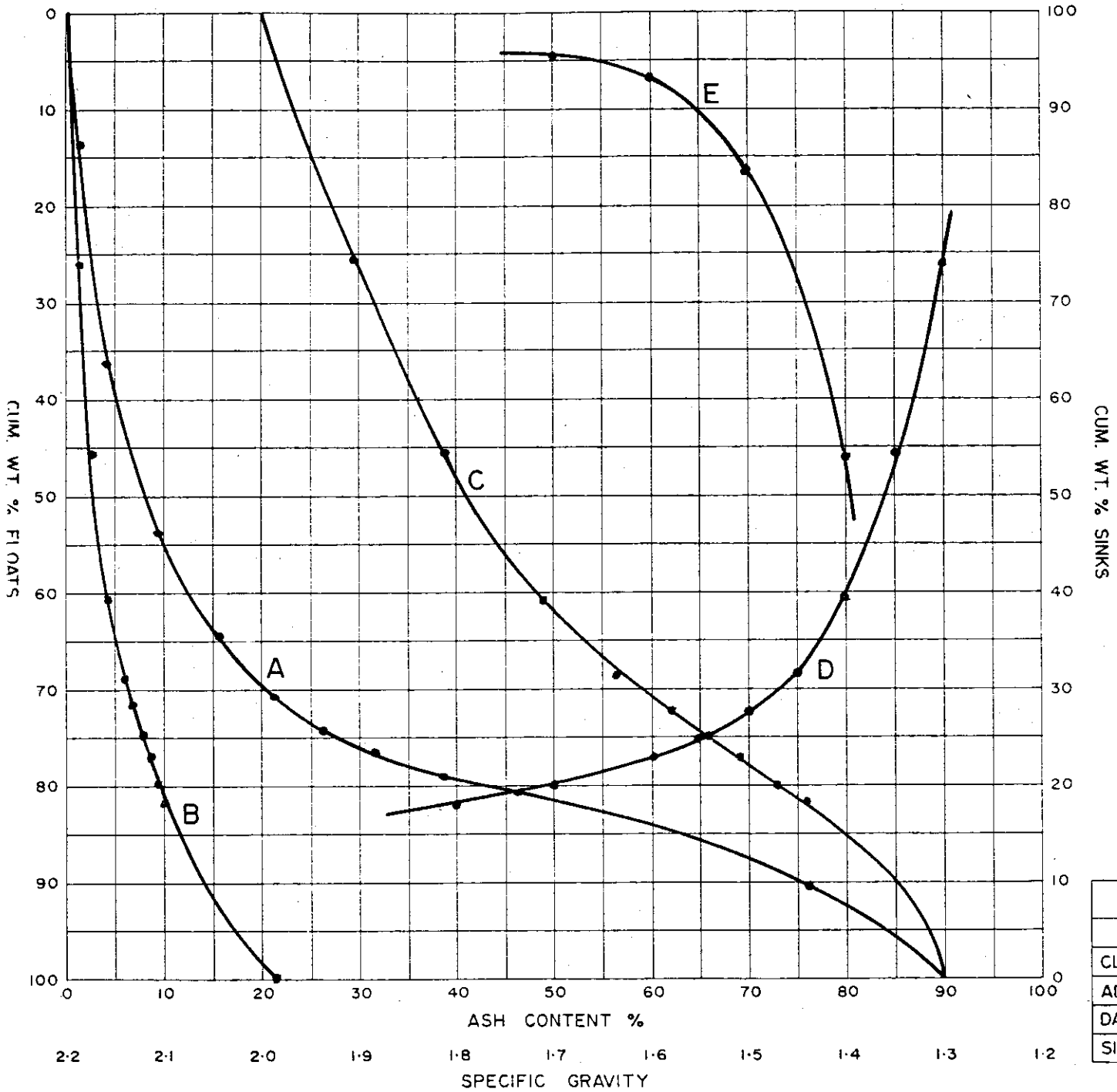
--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR		
			WT>	CUM WT>			SINK WT					
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WP>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	26.50	1.83	.48	.48	26.50	1.83	21.43	73.50	29.15	1.30	0.00
1.35	19.81	4.24	.84	1.32	46.31	2.86	20.59	53.69	38.35	1.40	46.11
1.40	14.21	9.21	1.31	2.63	60.52	4.35	19.28	39.48	48.83	1.50	16.34
1.45	7.36	15.51	1.22	3.85	68.38	5.63	18.06	31.62	57.12	1.60	7.17
1.50	4.23	21.39	.90	4.76	72.61	6.55	17.16	27.39	62.63	1.70	4.06
1.55	2.30	26.24	.60	5.36	74.91	7.16	16.55	25.09	65.97	1.80	0.00
1.60	1.95	31.09	.61	5.97	76.86	7.76	15.95	23.14	68.91	1.90	0.00
1.70	2.92	39.19	1.14	7.11	79.78	8.91	14.80	20.22	73.20	2.00	0.00
1.80	1.94	46.17	.90	8.01	81.72	9.80	13.91	18.28	76.07	2.10	0.00
9.99	18.28	76.07	13.91	21.91	100.00	21.91	0.00	0.00	I	2.20	0.00

BIRTLEY ENGINEERIG

TABLE 69

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 9 1/2" x 28M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

FIGURE 46

ELCO MINING LTD ADIT #9 LAB NO: 3834 .75" X 28M

--DIRECT--			--CUM FLOATS--				--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	22.90	2.00	.46	.46	22.90	2.00	24.33	77.10	31.56	1.30	0.00
1.35	22.40	4.90	1.10	1.56	45.30	3.43	23.24	54.70	42.48	1.40	45.90
1.40	12.60	9.60	1.21	2.77	57.90	4.78	22.03	42.10	52.32	1.50	15.00
1.45	7.00	15.70	1.10	3.86	64.90	5.95	20.93	35.10	59.62	1.60	6.90
1.50	3.90	21.30	.83	4.69	68.80	6.82	20.10	31.20	64.41	1.70	4.80
1.55	2.30	26.30	.60	5.30	71.10	7.45	19.49	28.90	67.44	1.80	0.00
1.60	1.80	31.00	.56	5.86	72.90	8.04	18.93	27.10	69.86	1.90	0.00
1.70	2.80	38.90	1.09	6.95	75.70	9.18	17.84	24.30	73.43	2.00	0.00
1.80	2.00	45.90	.92	7.87	77.70	10.12	16.93	22.30	75.90	2.10	0.00
9.99	22.30	75.90	16.93	24.79	100.00	24.79	0.00	.00	0.00	2.20	0.00

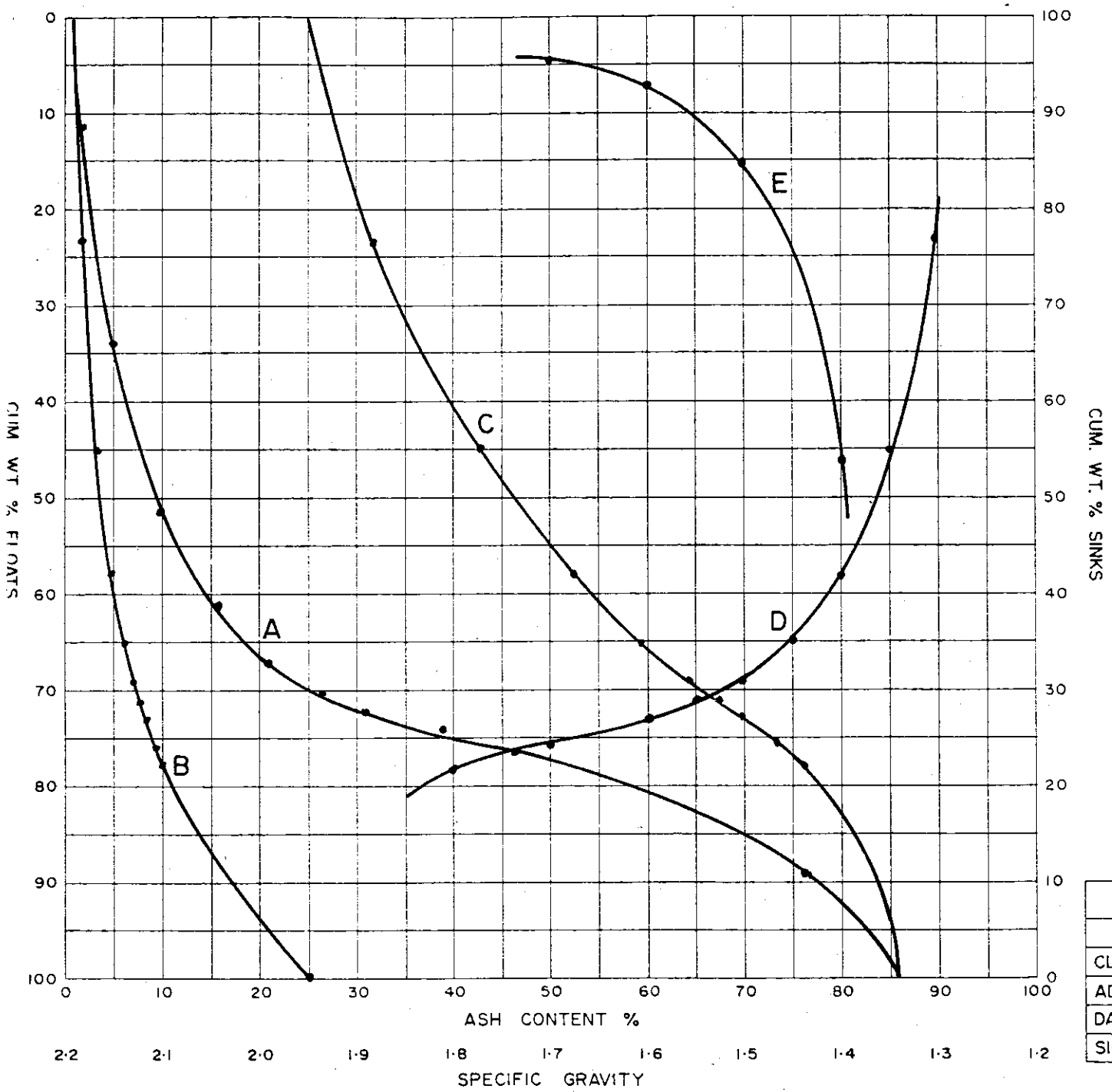
BIRTLEY ENGINEERING

TABLE 70

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 47

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 9 3/4" x 28 M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT #9 LAB NO: 3834 28MX65M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	46.00	1.50	.69	.69	46.00	1.50	9.41	54.00	17.43	1.30	0.00
1.35	20.60	3.80	.78	1.47	66.60	2.21	8.63	33.40	25.84	1.40	41.80
1.40	10.40	8.00	.83	2.30	77.00	2.99	7.80	23.00	33.90	1.50	14.20
1.45	7.20	13.10	.94	3.25	84.20	3.86	6.85	15.80	43.38	1.60	4.70
1.50	3.60	15.50	.56	3.81	87.80	4.33	6.30	12.20	51.61	1.70	2.20
1.55	2.20	23.20	.51	4.32	90.00	4.80	5.79	10.00	57.86	1.80	0.00
1.60	1.20	26.20	.31	4.63	91.20	5.08	5.47	8.80	62.18	1.90	0.00
1.70	1.30	34.70	.45	5.08	92.50	5.49	5.02	7.50	66.94	2.00	0.00
1.80	.90	41.60	.37	5.46	93.40	5.84	4.65	6.60	70.40	2.10	0.00
9.99	6.60	70.40	4.65	10.10	100.00	10.10	0.00	.00	0.00	2.20	0.00

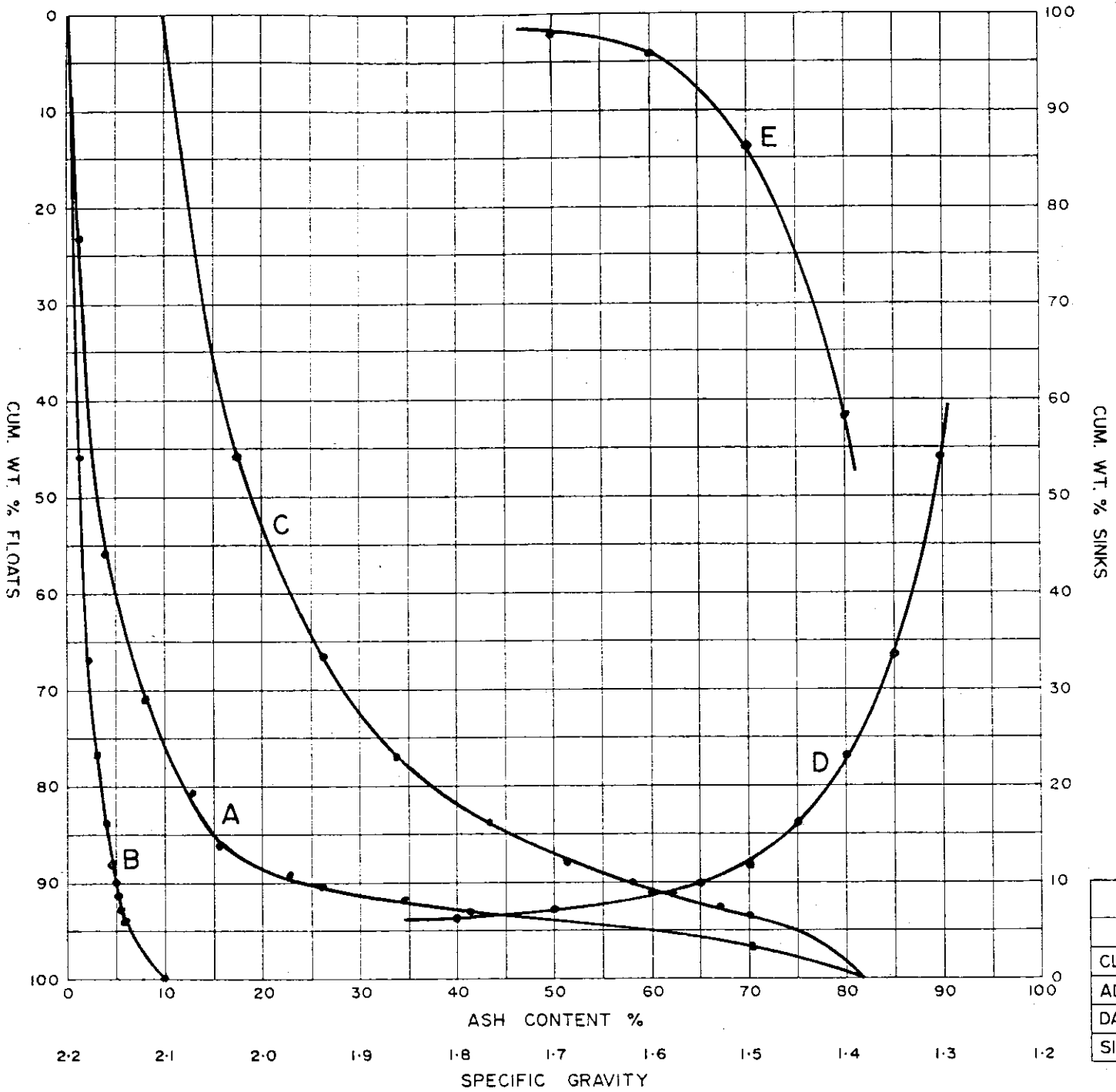
BIRTLEY ENGINEERING

TABLE 71

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 48

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 9 28 M. x 65 M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

SAMPLE: Adit No. 9

LAB. NO.: 3834

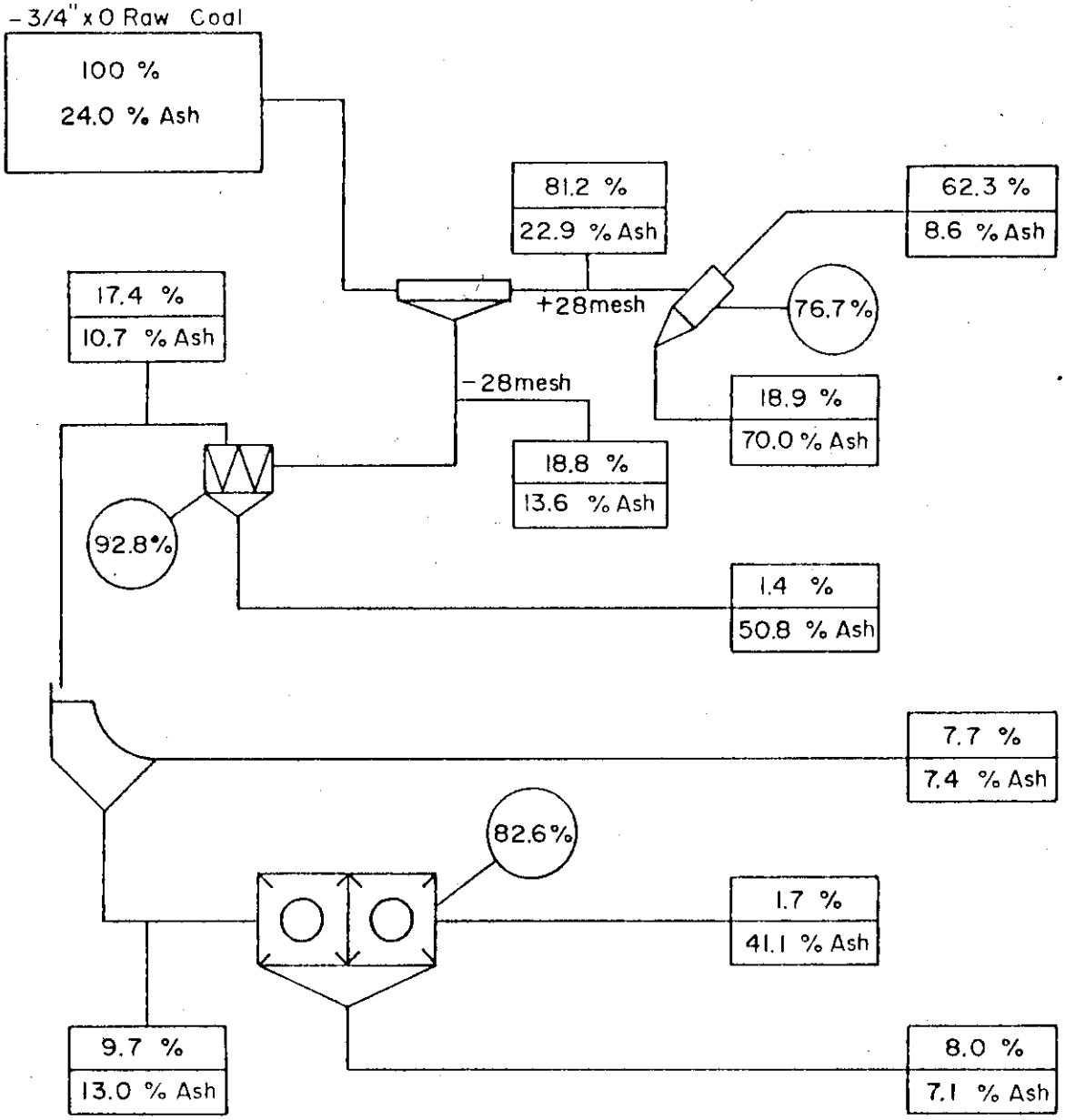
TABLE 72

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
				DILATATION TEST				
SIZE FRAC.	F.S.I.	S %	P %	SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	2	0.52	0.04	428	--	11	-11	--
3/4" X 28M	4	0.57	0.04	411	--	13	-13	--
28M X 65M	8 1/2	0.55	0.03	401	469	18	19	1.002

FROTH FLOTATION TEST 65M x 0										
									Cumulative	
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Wt %	Ash %
Stage I	84.5	6.2	0.7	20.0	73.1	.46	0.04	9	84.5	6.2
Stage II	7.3	14.1	0.8	19.1	66.0	.37	0.05	5 1/2	91.8	6.8
Tails	8.2	57.9	0.8	17.1	24.2	--	--	--	100.0	11.0

F. F. Parameters - See Adit No. 2

FIGURE 49



OVERALL YIELD = 78 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 9	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 9 LAB NO. 3833 DATE OF WASH September 12, 1975.

Raw Coal Analysis: Ash % 24.0 Hardgrove Grindability Index 92

Delivered Bulk Weight 24.1 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 9 LAB NO. 3833

1. S. G. of Separation (a) Washability 1.61
   (b) Plant 1.46
2. Feed Ash Content A.D.B. 22.9 %
3. Clean Coal Estimated Weight 7.25 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.6 % F.S.I. 5 1/2
5. Reject Estimated Weight 2.58 M.T.
6. Reject Analysis (A.D.B.) Ash 70 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit 9.83 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 81.2 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 73.8 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 76.7 %
11. Yield Clean Coal (Washability) 74 %
12. +2" Rock Oversize Nil M.T.

TABLE 73

ELCO MINING LTD.

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 9 LAB NO. 3833

1. Vortex Finder Clearance (VFC) 1.9 CM 0.75 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 110-150 g/l. 11-15 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	64.7	11.2	9	64.7	11.2	13.6	8 1/2
	65M x 100M (.15 CM)	14.5	11.0	8 1/2	79.2	11.2		
	100M x 0	20.8	17.3	7	100.0	12.4		
O'FLOW	+65M	44.2	8.3	9	44.2	8.3	10.7	8 1/2
	65M x 100M	11.6	8.7	9	55.8	8.4		
	100M x 0	44.2	13.9	6	100.0	10.8		
U'FLOW	+65M	72.2	-		72.2		50.8	1 1/2
	65M x 100M	10.9	47.4	2 1/2	83.1	50.5		
	100M x 0	16.9	52.2	1 1/2	100.0	50.8		
S B O	+65M	89.3	7.1	9	89.3	7.1	7.4	8
	65M x 100M	4.5	8.3	8 1/2	93.8	7.2		
	100M x 0	6.2	12.3	7 1/2	100.0	7.5		

6. Yield - Total W.O. Cyclone Circuit = 92.8

7. Est. Yield of 28 x 65 Mesh Coal = 41.0
(as % of 28 Mesh x 0 Feed)

TABLE 74

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 9 LAB NO. 3833

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 180-200 g/l 18-20 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	22.1	7.9	9	22.1	7.9	13.0	8
	65M x 100M (.15 CM)	20.1	8.9	8 1/2	42.2	8.4		
	100M x 0	57.8	15.5	6	100.0	12.5		
CONC.	+65M (.21 CM)						7.1	8 1/2
	65M x 100M (.15 CM)							
	100M x 0							
TAILS	+65M (.21 CM)	58.9	29.2	2	58.9	29.2	41.1	1
	65M x 100M (.15 CM)	16.9	40.6	1 1/2	75.8	31.7		
	100M x 0	24.2	62.2	1	100.0	39.1		

4. Impeller Type - Birtley Double Wobble

5. Yield Calculated (Ash Balance) 82.6 %

6. Yield (Washability) 93 %

7. 65M x 0 (Washability) 11.4 %

ELCO MINING LTD.

TABLE 75

BULK WASHING DATA

ADIT/SEAM NO. 9 LAB NO. 3833

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	NA	NA	NA	NA	55.7	55.7	NA	NA
1.30-1.40	NA	NA	NA	NA	29.1	82.8	NA	NA
1.40-1.50	NA	NA	NA	NA	8.6	91.4	NA	NA
1.50-1.60	NA	NA	NA	NA	3.4	94.8	NA	NA
1.60-1.70	NA	NA	NA	NA	1.8	96.6	NA	NA
1.70-1.80	NA	NA	NA	NA	1.1	97.7	NA	NA
1.80-1.90	NA	NA	NA	NA	0.3	98.0	NA	NA
1.90-2.00	NA	NA	NA	NA	0.2	98.2	NA	NA
+2.00	NA	NA	NA	NA	1.8	100.0	NA	NA

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 9 LAB. NO. 3833 DATE OF WASH September 12, 1975.

a) Raw Coal

Delivered Wt.	=	24.1 M.T.
Ash %	=	24.0
Hardgrove Grindability Index	=	92
Estimated Washed Weight	=	12.10 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 81.2

Effective S. G. =

Raw Feed	22.9 %	Ash 2	F.S.I.
Clean Coal	8.6 %	Ash 5 1/2	F.S.I.
Reject	70.0 %	Ash 1/2	F.S.I.

Calculated Yield = 76.7 %

Weighed Yield = 73.8 %

c) Water-Only Cyclone Circuit

Raw Feed	13.6 %	Ash 8 1/2	F.S.I.
Overflow	10.7 %	Ash 8 1/2	F.S.I.
Underflow	50.8 %	Ash 1 1/2	F.S.I.

Calculated Yield = 92.8 %

% of +65 Mesh in O/F = 44.2 %

Sieve Bend Overflow	7.4 %	Ash 8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	13.0 %	Ash 8	F.S.I.
Concentrates	7.1 %	Ash 8 1/2	F.S.I.
Tails	41.1 %	Ash 1	F.S.I.

Calculated Yield = 82.6 %

ELCO MINING LTD.

TABLE 76

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 9 LAB. NO. 3833

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 0.5 ASH % 8.6 VM % 19.4 FC % 71.5 S% 0.38 FSI 6

(ii) Dilatometer

Softening °C 414 Max. Dil. °C 461 Max Cont. % 23

Max. Dil. % -18 G. No. = 0.694

(iii) Hardgrove Grindability Index = 84

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
11	1.98	7	1.26	2	0.36	0.6	0.108			25.9	46.5	8.37

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 77

SAMPLE: Clean Coal - Adit No. 9

LAB. NO.: 3833

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.5	8.6	19.4	71.5	6	84

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.9	4.9
1/2" X 1/4"	16.0	20.9
1/4" X 8M	22.6	43.5
8M X 28M	31.5	75.0
28M X 65M	12.3	87.3
65M X 0	12.7	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
414	461	23	-18	0.694

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.46	81.83	4.28	1.27	0.47	8.57	3.12

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.08	0.25	0.18	0.67	7.15	31.62	56.14	0.30	0.77	2.42

SAMPLE: Adit No. 10

LAB. NO.: 3709

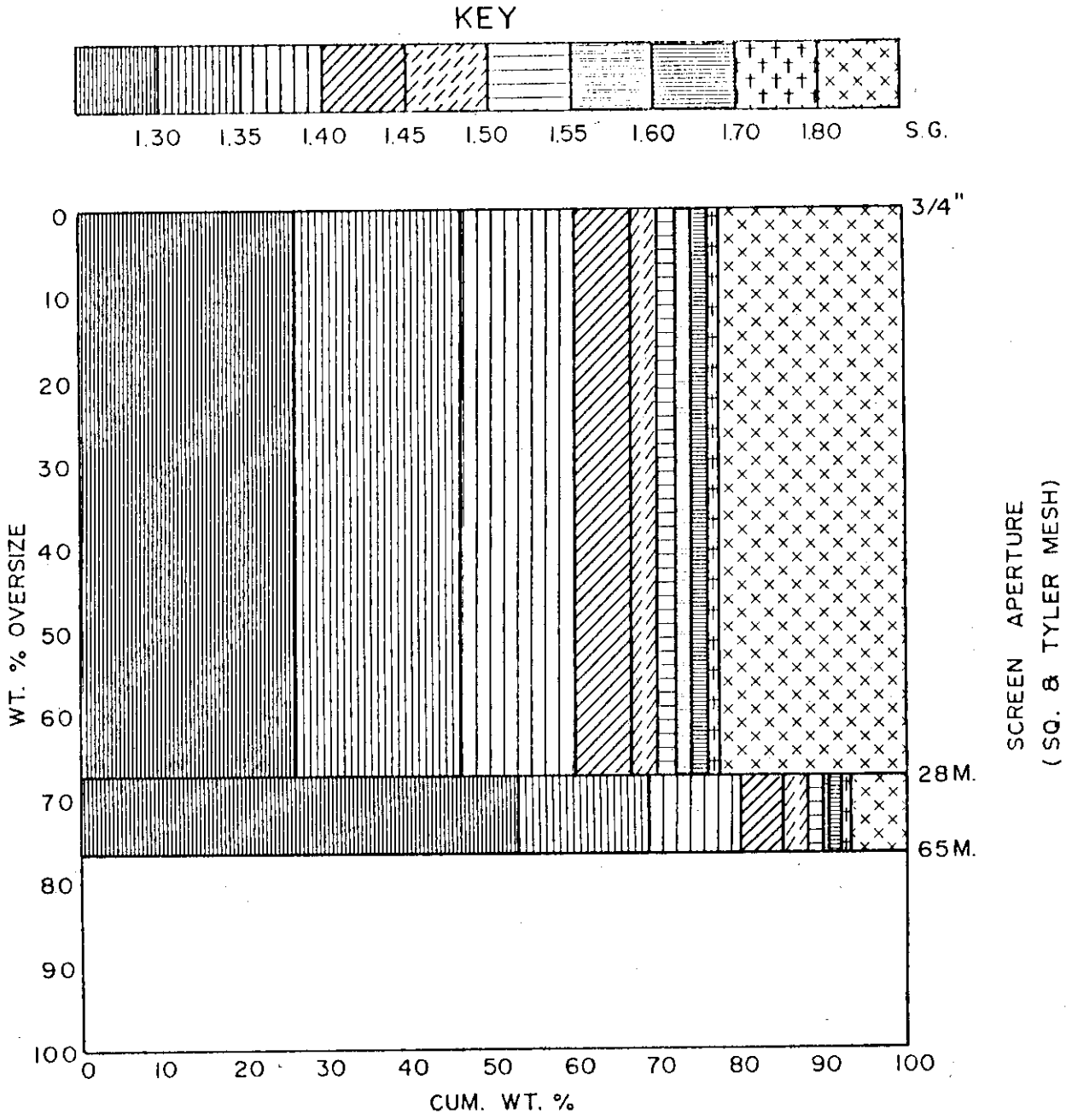
TABLE 78

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
1.4	23.2	18.6	56.8	0.38	11505		oxid.	1445+	-	-	-
							red.	1445+	-	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	16.2	45.4	0.8	16.9	36.9	0.21	69	-	-
	1/2" X 0	83.8	-	-	-	-	-	-	-	-
II	3/4" X 28M	67.1	29.6	0.7	18.2	51.5	0.29	77	67.1	29.6
	28M X 65M	9.4	11.0	0.9	20.4	67.7	0.41	105	76.5	27.3
	65M X 100M	19.1	13.2	-	-	-	-	-	95.6	24.5
	100M X 200M	1.8	11.6	-	-	-	-	-	97.4	24.3
	200M X 0	2.6	10.8	-	-	-	-	-	100.0	23.9
III	65M X 0	23.5	11.8	1.1	20.8	66.3	0.48	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 4.6%
II - Size consist of raw coal crushed down to - 3/4"
III - 65M X 0 off II

FIGURE 50



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 10
DATE	OCT, 14, 1975	SIGNED	K. H. LAU

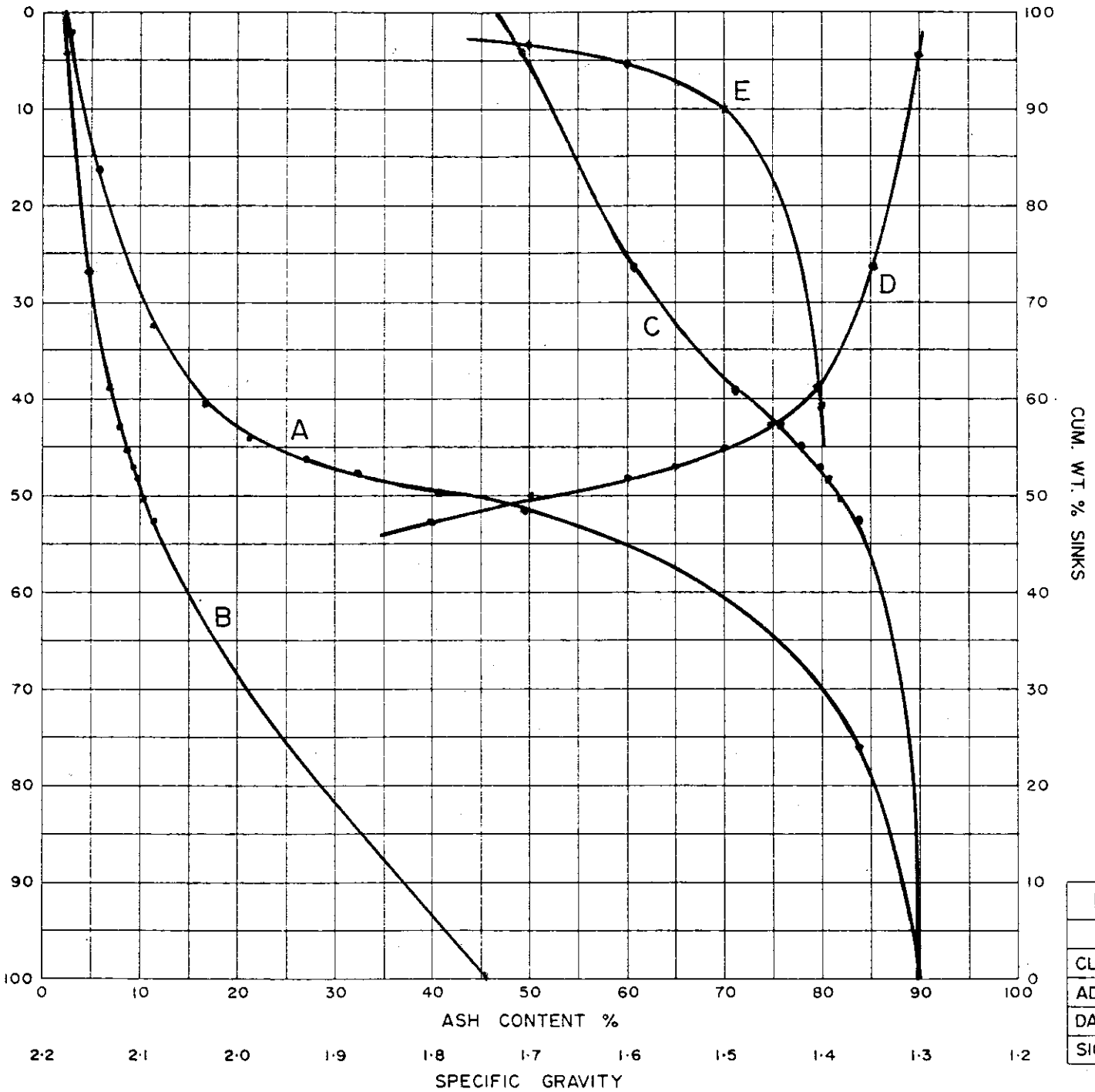
TABLE 79

BLOO MINING LTD ADIT NO.10 LAB NO.8709 2" X .5"

	--DIRECT--				--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	4.70	2.80	.13	.13	4.70	2.80	46.76	95.30	49.07	1.30	0.00
1.35	21.90	5.90	1.29	1.42	26.60	5.35	45.47	73.40	61.95	1.40	40.40
1.40	11.80	10.70	1.26	2.69	38.40	7.00	44.21	61.60	71.77	1.50	9.70
1.45	4.50	16.60	.75	3.43	42.90	8.00	43.46	57.10	76.11	1.60	5.30
1.50	2.20	21.70	.48	3.91	45.10	8.67	42.98	54.90	78.30	1.70	4.20
1.55	1.70	27.30	.46	4.37	46.80	9.35	42.52	53.20	79.92	1.80	0.00
1.60	1.30	32.40	.42	4.80	48.10	9.97	42.10	51.90	81.12	1.90	0.00
1.70	2.30	41.10	.95	5.74	50.40	11.39	41.15	49.60	82.97	2.00	0.00
1.80	1.90	49.60	.94	6.68	52.30	12.78	40.21	47.70	84.30	2.1	0.00
. 9	47.70	84.30	40.21	46.89	100.00	46.89	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 10 2" x 1/2"
DATE	OCT., 8, 1975
SIGNED	K. M. LAU

FIGURE 51

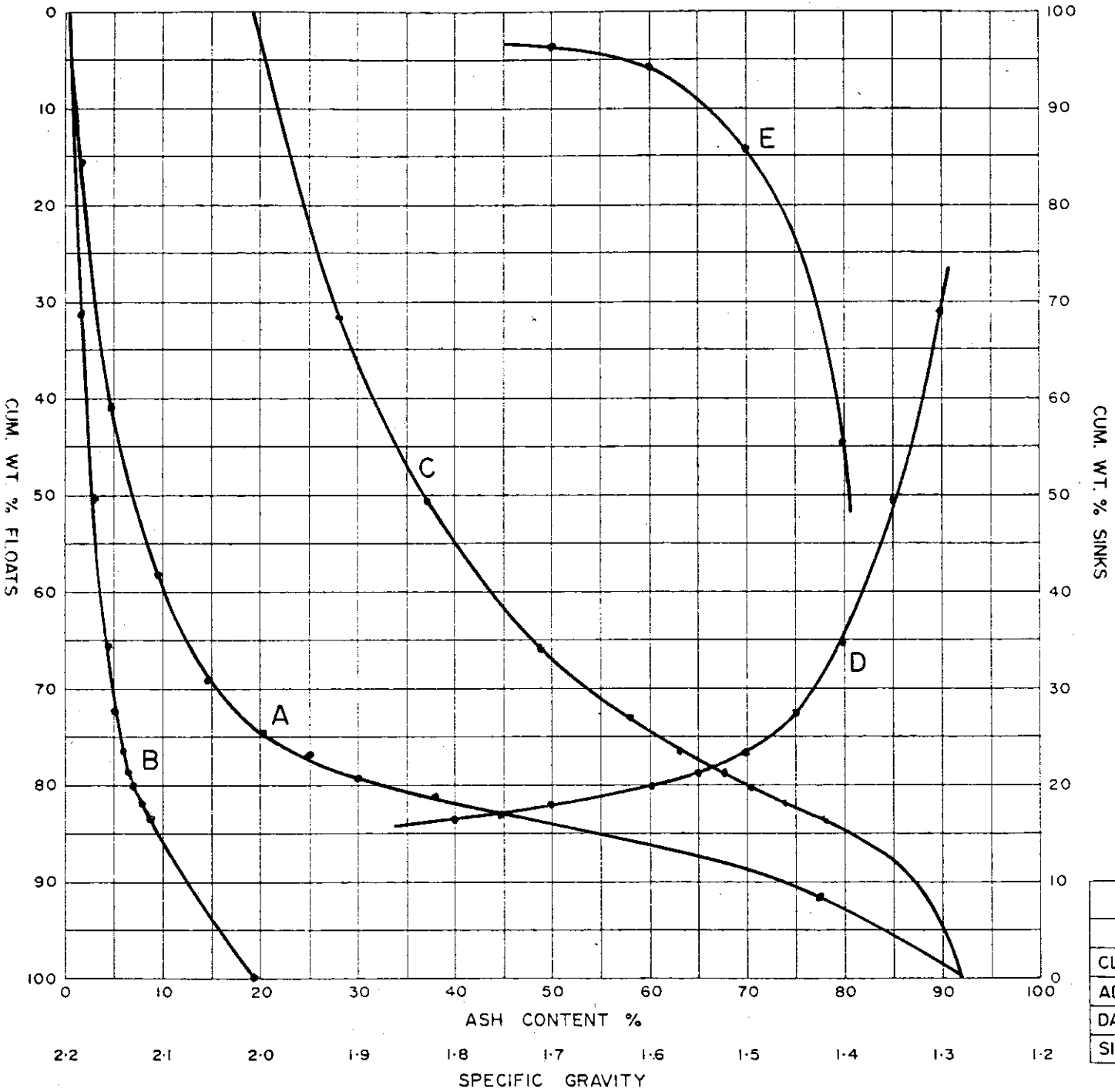
TABLE 80

~ELCO MINING LTD ADIT NO.10 LAB NO.3709 .5" X28 M

---DIRECT---						---CUM FLOATS---		---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	31.80	1.76	.56	.56	31.80	1.76	19.11	68.20	20.08	1.30	0.00
1.35	18.90	4.62	.87	1.43	50.70	2.88	18.24	49.30	37.00	1.40	44.70
1.40	15.10	9.39	1.42	2.85	65.80	4.38	16.82	34.20	49.19	1.50	14.30
1.45	6.90	14.68	1.01	3.86	72.70	5.31	15.81	27.30	57.98	1.60	5.60
1.50	3.80	20.44	.78	4.64	76.50	6.06	15.04	23.50	63.99	1.70	3.80
1.55	2.20	25.16	.55	5.19	78.70	6.60	14.48	21.30	68.00	1.80	0.00
1.60	1.40	30.19	.42	5.61	80.10	7.01	14.06	19.90	70.66	1.90	0.00
1.70	2.00	38.05	.76	6.37	82.10	7.76	13.30	17.90	74.30	2.00	0.00
1.80	1.80	44.69	.80	7.18	83.90	8.56	12.50	16.10	77.61	2.10	0.00
9.99	16.10	77.61	12.50	19.67	100.00	19.67	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 10 1/2" x 28M.
DATE	OCT, 14, 1975
SIGNED	K. M. LAU

FIGURE 52

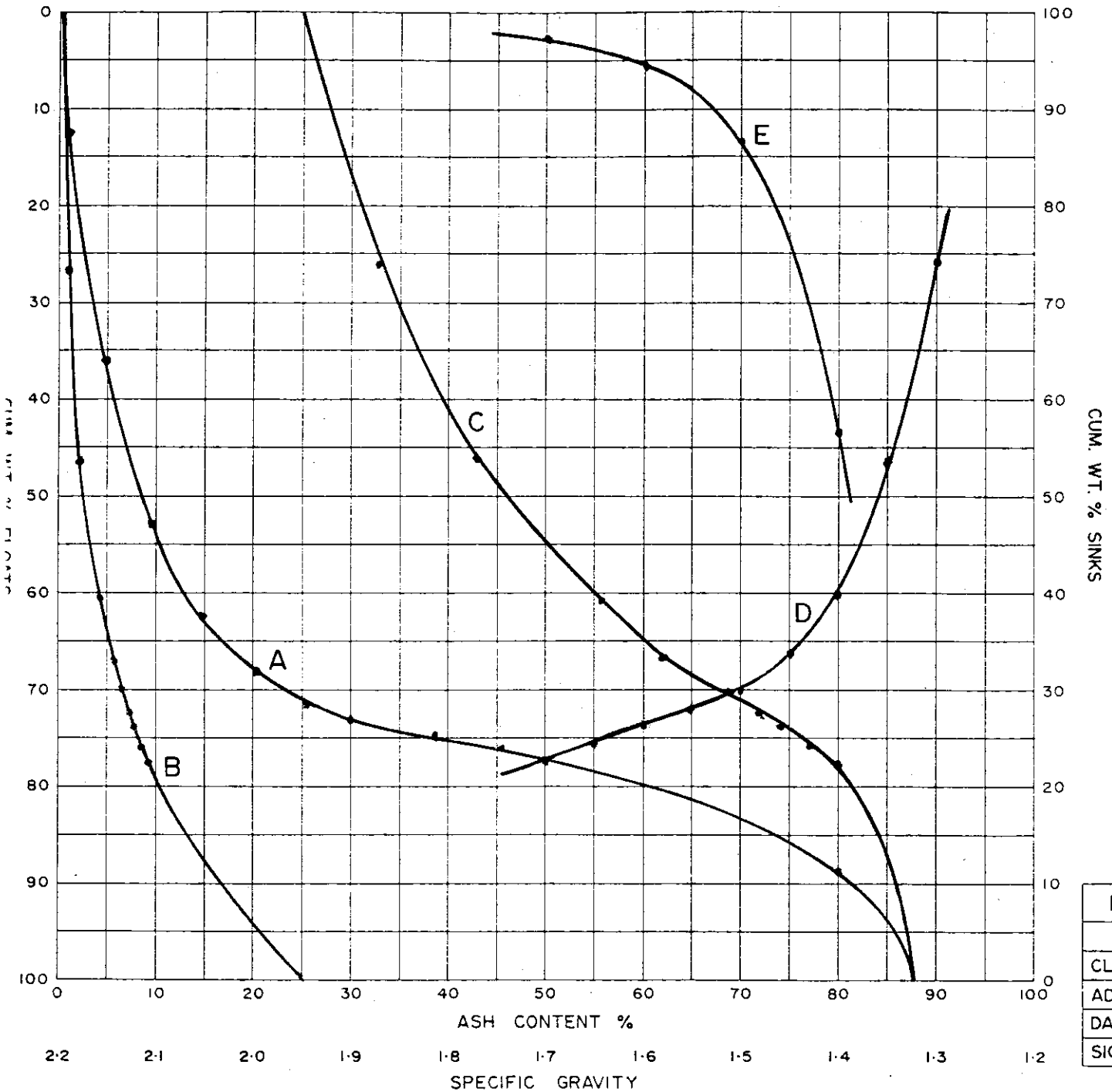
TABLE 81

"ELCO MINING LTD ADIT NPO.10 LAB NO.3709 .75" X 28M

---DIRECT---					---CUM FLOATS---			---CUM SINKS---		---0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	26.50	1.80	.48	.48	26.50	1.80	24.47	73.50	88.29	1.30	0.00
1.35	19.50	4.90	.96	1.43	46.00	3.11	23.51	54.00	43.55	1.40	43.90
1.40	14.50	9.60	1.39	2.82	60.50	4.67	22.12	39.50	56.01	1.50	13.40
1.45	6.40	14.90	.95	3.78	66.90	5.65	21.17	33.10	68.95	1.60	5.60
1.50	3.50	20.60	.72	4.50	70.40	6.39	20.45	29.60	69.08	1.70	3.90
1.55	2.10	25.50	.54	5.03	72.50	6.94	19.91	27.50	72.41	1.80	0.00
1.60	1.40	30.60	.43	5.46	73.90	7.39	19.48	26.10	74.65	1.90	0.00
1.70	2.10	38.70	.81	6.28	76.00	8.26	18.67	24.00	77.80	2.00	0.00
1.80	1.80	45.70	.82	7.10	77.80	9.12	17.85	22.20	80.40	2.10	0.00
9.99	22.20	80.40	17.85	24.95	100.00	24.95	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 10 3/4" x 28 M.
DATE	OCT, 8 , 1975
SIGNED	K. M. LAU

FIGURE 53

ELCO MINING LTD ADIT NO.10 LAB NO.3709 28M X 65M

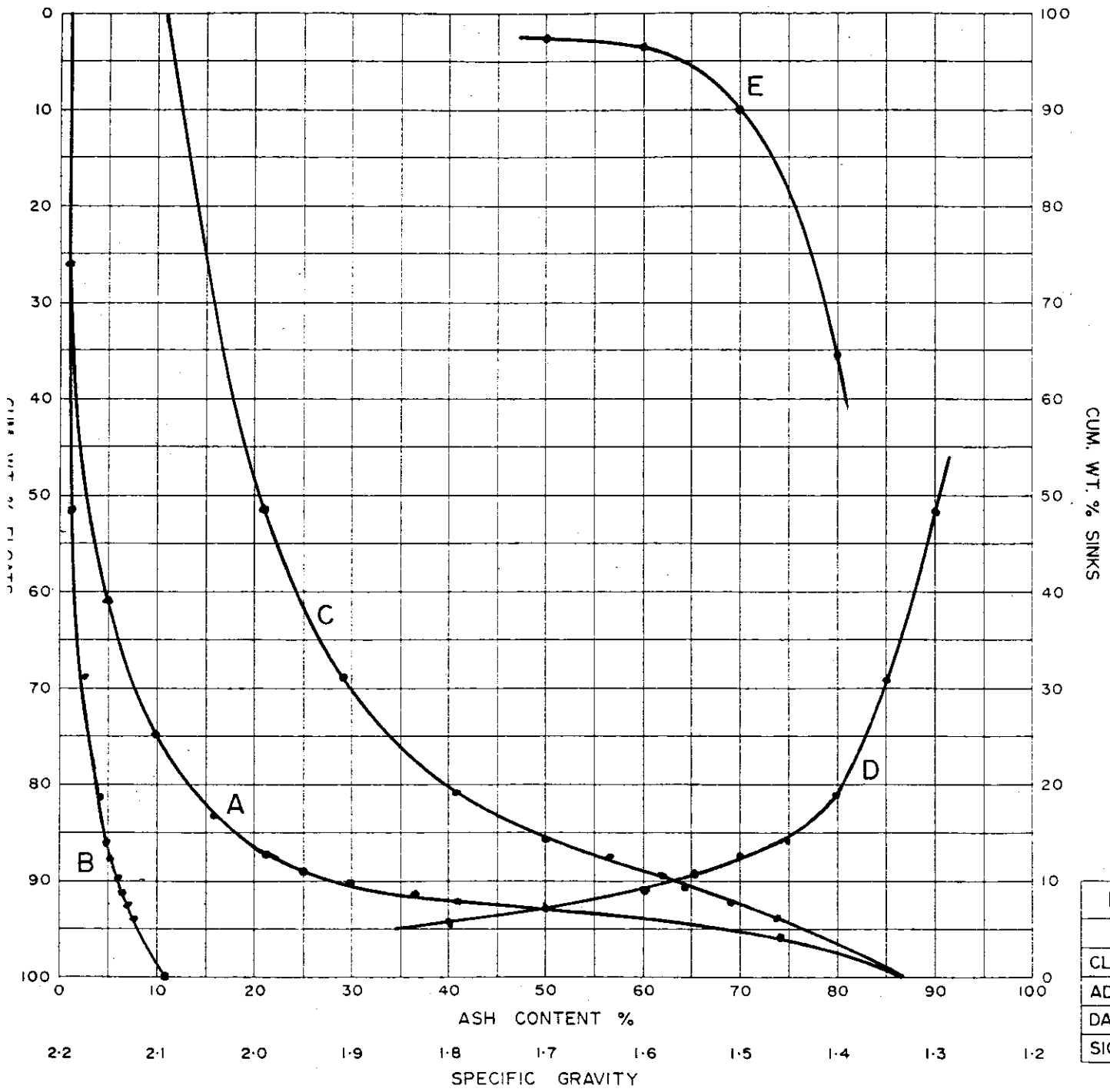
	--DIRECT--					--CUM FLOATS--			--CUM SINKS--			+-0.1 DISTR
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT		WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
~ 1	2	3	4	5		6	7	8	9	10	11	12
~ 1.30	52.80	1.50	.79	.79	52.80		1.50	10.00	47.20	21.18	1.30	0.00
1.35	16.10	5.10	.82	1.61	68.90		2.34	9.17	31.10	29.50	1.40	35.50
1.40	11.70	9.70	1.13	2.75	80.60		3.41	8.04	19.40	41.44	1.50	9.90
1.45	5.10	15.80	.81	3.55	85.70		4.15	7.23	14.30	50.58	1.60	3.70
1.50	2.60	21.30	.55	4.11	88.30		4.65	6.68	11.70	57.09	1.70	2.70
.55	1.60	24.90	.40	4.51	89.90		5.01	6.28	10.10	62.19	1.80	0.00
1.60	.60	29.90	.18	4.69	90.50		5.18	6.10	9.50	64.23	1.90	0.00
~ 1.70	1.50	36.40	.55	5.23	92.00		5.69	5.56	8.00	69.45	2.00	0.00
1.80	1.20	41.40	.50	5.73	93.20		6.15	5.06	6.80	74.40	2.10	0.00
9.99	6.80	74.40	5.06	10.79	100.00		10.79	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 82

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 10 28 M. x 65 M.
DATE	OCT, 8, 1975
SIGNED	K. M. Lau

FIGURE 54

TABLE 83

ELCO MINING LTD.

SAMPLE: Adit No. 10

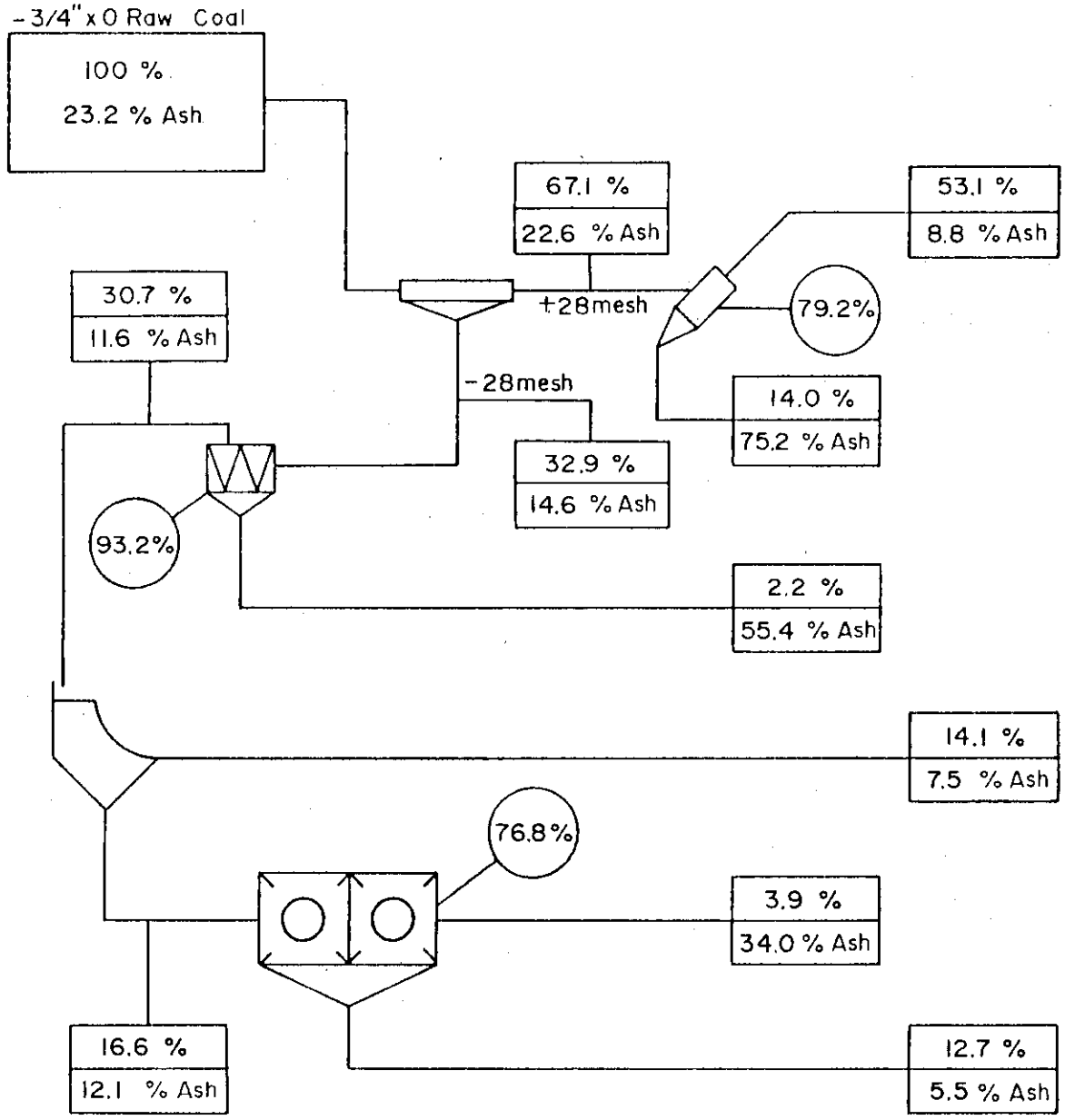
LAB. NO.: 3709

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	3 1/2	0.37	0.05	415	-	17	-17	-
3/4" X 28M	7 1/2	0.48	0.04	404	471	21	- 4	0.899
28M X 65M	9	0.47	0.03	400	468	22	22	1.000

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	48.6	4.8	.8	21.2	73.2	.58	0.03	9	48.6	4.8
Stage II	9.2	8.5	1.0	20.5	70.0	.51	0.04	8 1/2	57.8	5.4
Tails	42.2	19.5	1.3	18.8	60.4	--	--	--	100.0	11.3

F. F. Parameters - See Adit No. 2

FIGURE 55



OVERALL YIELD = 79.9 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 10	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 10 LAB NO. 3703 DATE OF WASH September 15, 1975.

Raw Coal Analysis: Ash % 23.2 Hardgrove Grindability Index _____

Delivered Bulk Weight 25.1 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 10 LAB NO. 3708

1. S. G. of Separation (a) Washability 1.65
   (b) Plant 1.60
2. Feed Ash Content A.D.B. 22.6 %
3. Clean Coal Estimated Weight 8.5 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.8 % F.S.I. 8
5. Reject Estimated Weight 2.95 M.T.
6. Reject Analysis (A.D.B.) Ash 75.2 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 11.45 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 67.1 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 74.2 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 79.2 %
11. Yield Clean Coal (Washability) 76 %
12. +2" Rock Oversize Nil M.T.

TABLE 84

ELCO MINING LTD.

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 10 LAB NO. 3708

1. Vortex Finder Clearance (VFC) 0.6 CM 0.25 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-200 g/l. 10-20 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	55.9	12.2	8 1/2	55.9	12.2	14.6	7
	65M x 100M (.15 CM)	11.5	12.3	8 1/2	67.4	12.2		
	100M x 0	32.6	16.0	6 1/2	100.0	13.5		
O'FLOW	+65M	46.0	8.2	8 1/2	46.0	8.2	11.6	6 1/2
	65M x 100M	11.5	9.6	8 1/2	57.5	8.5		
	100M x 0	42.5	15.8	5	100.0	11.6		
U'FLOW	+65M	76.6	54.0	1 1/2	76.6	54.0	55.4	1
	65M x 100M	10.1	49.7	2	86.7	53.5		
	100M x 0	13.3	64.7	1	100.0	55.0		
S B O	+65M						7.5	8 1/2
	65M x 100M							
	100M x 0							

6. Yield - Total W.O. Cyclone Circuit = 93.2

7. Est. Yield of 28 x 65 Mesh Coal = 42.9
(as % of 28 Mesh x 0 Feed)

TABLE 85

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 10 LAB NO. 3708

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 80-150 g/l 8-10 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	20.6	8.0	8 1/2	20.6	8.0	12.1	6
	65M x 100M (.15 CM)	19.5	9.0	8 1/2	40.1	8.5		
	100M x 0	59.9	16.5	6 1/2	100.0	13.3		
CONC.	+65M (.21 CM)	18.1	4.6	9	18.1	4.6	5.5	8 1/2
	65M x 100M (.15 CM)	14.5	4.4	9	32.6	4.5		
	100M x 0	67.4	6.3	8 1/2	100.0	5.7		
TAILS	+65M (.21 CM)	56.1	26.2	3 1/2	56.1	26.2	34.0	1/1/2
	65M x 100M (.15 CM)	20.0	30.4	2 1/2	76.1	27.3		
	100M x 0	23.9	54.4	1 1/2	100.0	33.8		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 76.8 %

6. Yield (Washability) 58 %

7. 65M x 0 (Washability) 23.5 %

TABLE 86

ELCO MINING LTD.

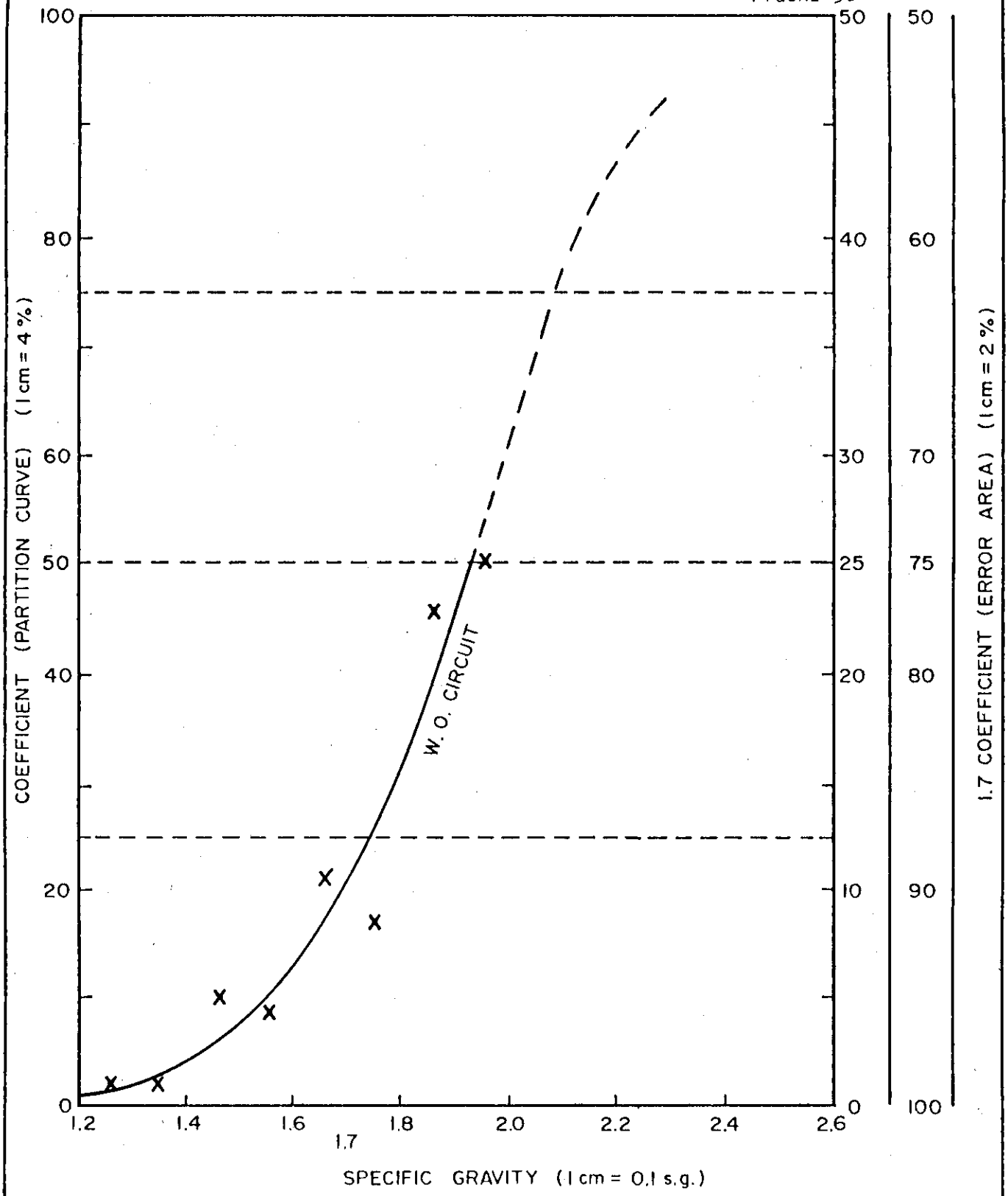
BULK WASHING DATA

ADIT/SEAM NO. 10 LAB NO. 3708

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	NA	NA	1.2	1.2	55.7	55.7	14.7	14.7
1.30-1.40	NA	NA	0.8	2.0	27.8	87.5	6.9	21.6
1.40-1.50	NA	NA	0.3	2.3	5.5	89.0	7.6	29.2
1.50-1.60	NA	NA	0.1	2.4	4.5	93.5	4.9	34.1
1.60-1.70	NA	NA	1.1	3.5	1.0	94.5	3.0	37.1
1.70-1.80	NA	NA	5.5	9.0	1.7	96.2	3.9	41.0
1.80-1.90	NA	NA	5.5	14.5	0.3	96.5	2.9	43.9
1.90-2.00	NA	NA	5.6	20.1	0.3	96.8	3.4	47.3
+2.00	NA	NA	79.9	100.0	3.2	100.0	52.7	100.0

FIGURE 56



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 10	JAN. 10/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 10 LAB. NO. 3708 DATE OF WASH September 15, 1975.

a) Raw Coal

Delivered Wt. = 25.1 M.T.
Ash % = 23.2 %
Hardgrove Grindability Index =
Estimated Washed Weight = 17.1

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 67.1
Effective S. G. = 1.91

Raw Feed	22.6 % Ash	4 1/2 F.S.I.
Clean Coal	8.8 % Ash	8 F.S.I.
Reject	75.2 % Ash	1/2 F.S.I.

Calculated Yield = 79.2
2 Weighed Yield = 74.2

c) Water-Only Cyclone Circuit

Raw Feed	14.6 % Ash	7 F.S.I.
Overflow	11.6 % Ash	6 1/2 F.S.I.
Underflow	55.4 % Ash	1 F.S.I.

Calculated Yield = 93.2
% of +65 Mesh in O/F = 46.0

Sieve Bend Overflow	7.5 % Ash	8 1/2 F.S.I.

d) Froth Flotation Circuit

Raw Feed	12.1 % Ash	6 F.S.I.
Concentrates	5.5 % Ash	8 1/2 F.S.I.
Tails	34.0 % Ash	1 1/2 F.S.I.

Calculated Yield = 76.8 %

ELCO MINING LTD.

TABLE 87

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 10 m LAB. NO. 3708

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 0.6 ASH % 9.2 VM % 20.9 FC % 69.3 S% 7 1/2 FSI ____

(ii) Dilatometer

Softening °C 416 Max. Dil. °C 474 Max Cont. % 20

Max. Dil. % -16 G. No. = 0.630

(iii) Hardgrove Grindability Index = 82

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
14	2.57	14	2.57	4	0.73	0.6	0.110			20.4	53	9.72

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 88

SAMPLE: Clean Coal - Adit No. 10

LAB. NO.: 3708

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.6	9.2	20.9	69.3	7 1/2	82

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.8	4.8
1/2" X 1/4"	12.9	17.7
1/4" X 8M	22.7	40.4
8M X 28M	40.1	80.5
28M X 65M	11.2	91.7
65M X 0	8.3	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
416	474	20	-16	0.630

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.52	80.34	4.41	1.38	0.44	9.29	3.62

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.06	0.18	0.27	0.63	8.29	28.46	56.56	0.35	0.62	1.84

SAMPLE: Adit No. 12

LAB. NO.: 3788

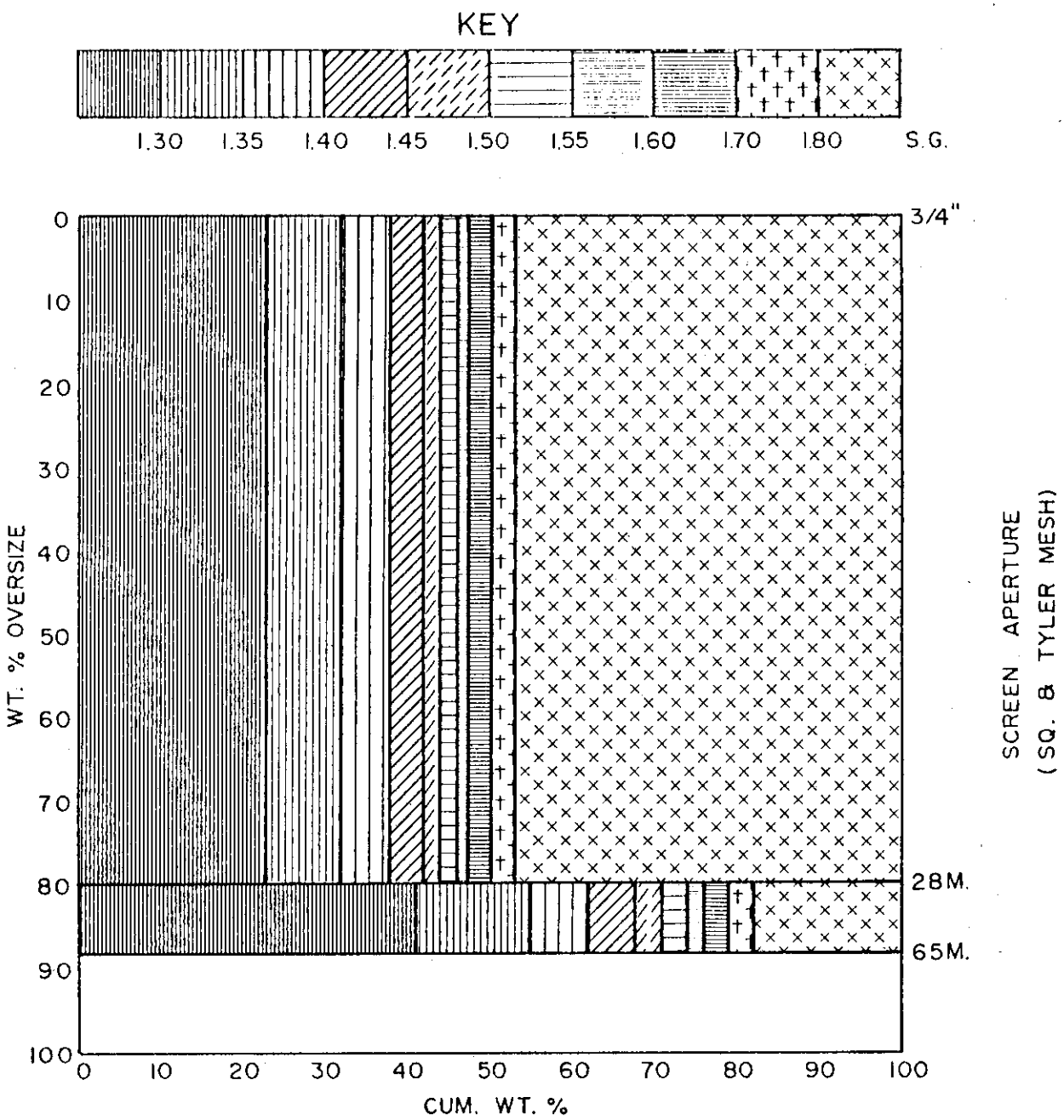
TABLE 89

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.6	42.5	17.0	39.9	0.55	8225	74	oxid.	1470	1470+	-	-
							red.	1350	1455	1465	1465+

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE WT. %	CUMULATIVE ASH %
I	2" X 1/2"	28.3	60.6	1.1	15.1	23.2	0.63	58	28.3	60.6
	1/2" X 0	71.7	31.0	-	-	-	-	-	100.0	39.4
II	3/4" X 28M	79.4	44.3	0.7	16.6	38.4	0.59	73	79.4	44.3
	28M X 65M	8.7	20.4	0.8	20.0	58.8	0.66	126	88.1	41.9
	65M X 100M	2.6	19.2	-	-	-	-	-	90.7	41.3
	100M X 200M	5.2	17.5	-	-	-	-	-	95.9	40.0
	200M X 0	4.1	18.5	-	-	-	-	-	100.0	39.1
III	65M X 0	11.9	17.9	0.8	20.4	60.9	0.91	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 10.6%
II - Size consist of raw coal crushed to - 3/4", 3/4" X 1/2" = 1.5%
III - 65M X 0 off II

FIGURE 57



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT №	ADIT 12
DATE	OCT, 14, 1975	SIGNED	K. M. LAU

ELCO MINI NG LTD ADIT NO.12 LAB NO.3788 2" X .5"

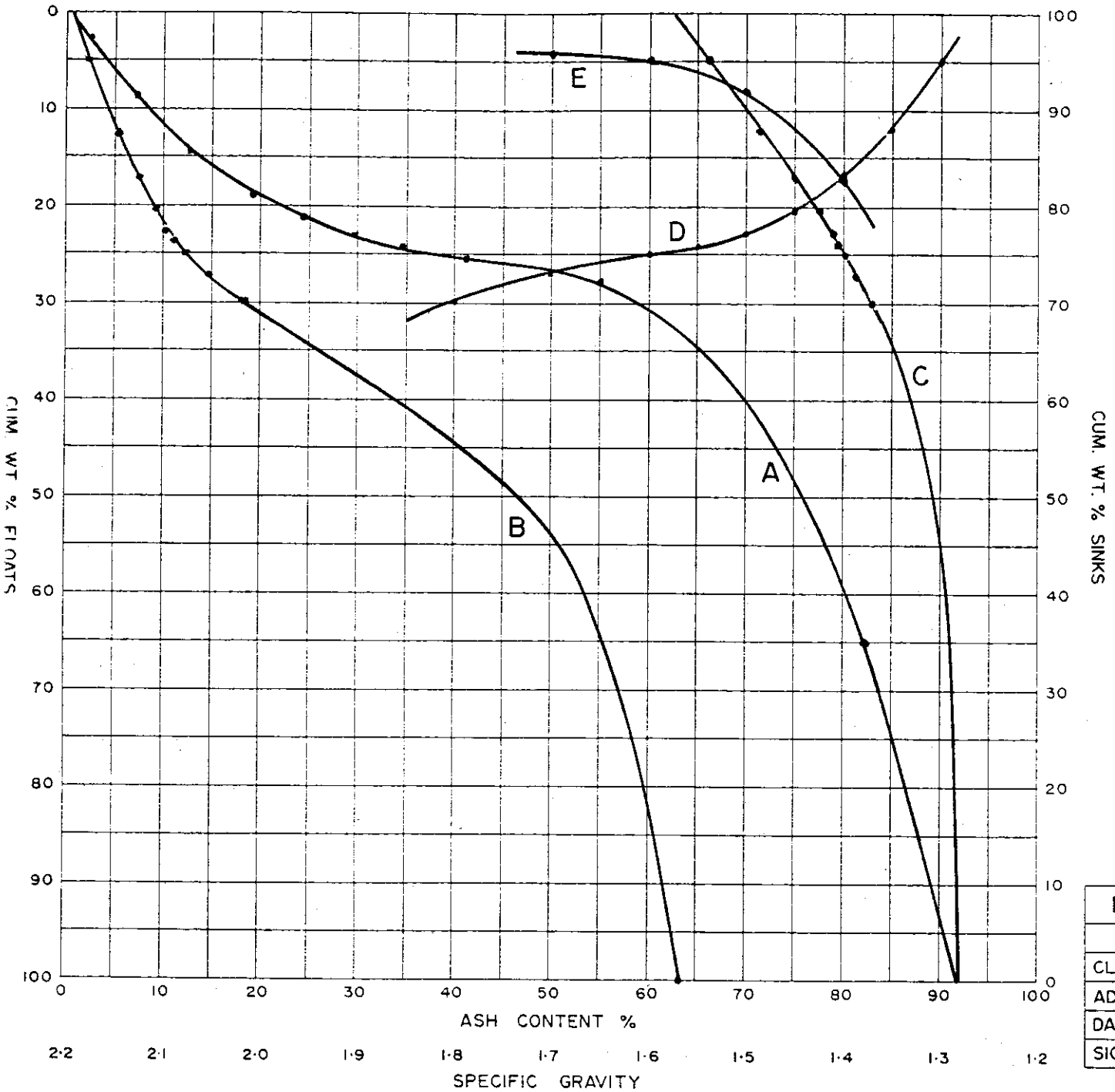
---DIRECT---					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	5.00	2.60	.13	.13	5.00	2.60	63.31	95.00	66.64	1.30	0.00
.35	7.30	7.40	.54	.67	12.30	5.45	62.77	87.70	71.57	1.40	17.30
1.40	4.80	12.70	.61	1.28	17.10	7.48	62.16	82.90	74.98	1.50	7.80
1.45	3.40	18.90	.64	1.92	20.50	9.38	61.52	79.50	77.38	1.60	5.00
1.50	1.80	24.40	.44	2.36	22.30	10.59	61.08	77.70	78.61	1.70	4.60
1.55	1.10	29.60	.33	2.69	23.40	11.48	60.75	76.60	79.31	1.80	0.00
1.60	1.50	34.60	.52	3.21	24.90	12.88	60.23	75.10	80.21	1.90	0.00
1.70	2.40	41.60	1.00	4.20	27.30	15.40	59.24	72.70	81.48	2.00	0.00
1.80	2.20	55.20	1.21	5.42	29.50	18.37	58.02	70.50	82.30	2.10	0.00
9.99	70.50	82.30	58.02	63.44	100.00	63.44	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 90

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 12 2" x 1/2"
DATE	OCT, 10, 1975
SIGNED	K. M. LAU

FIGURE 58

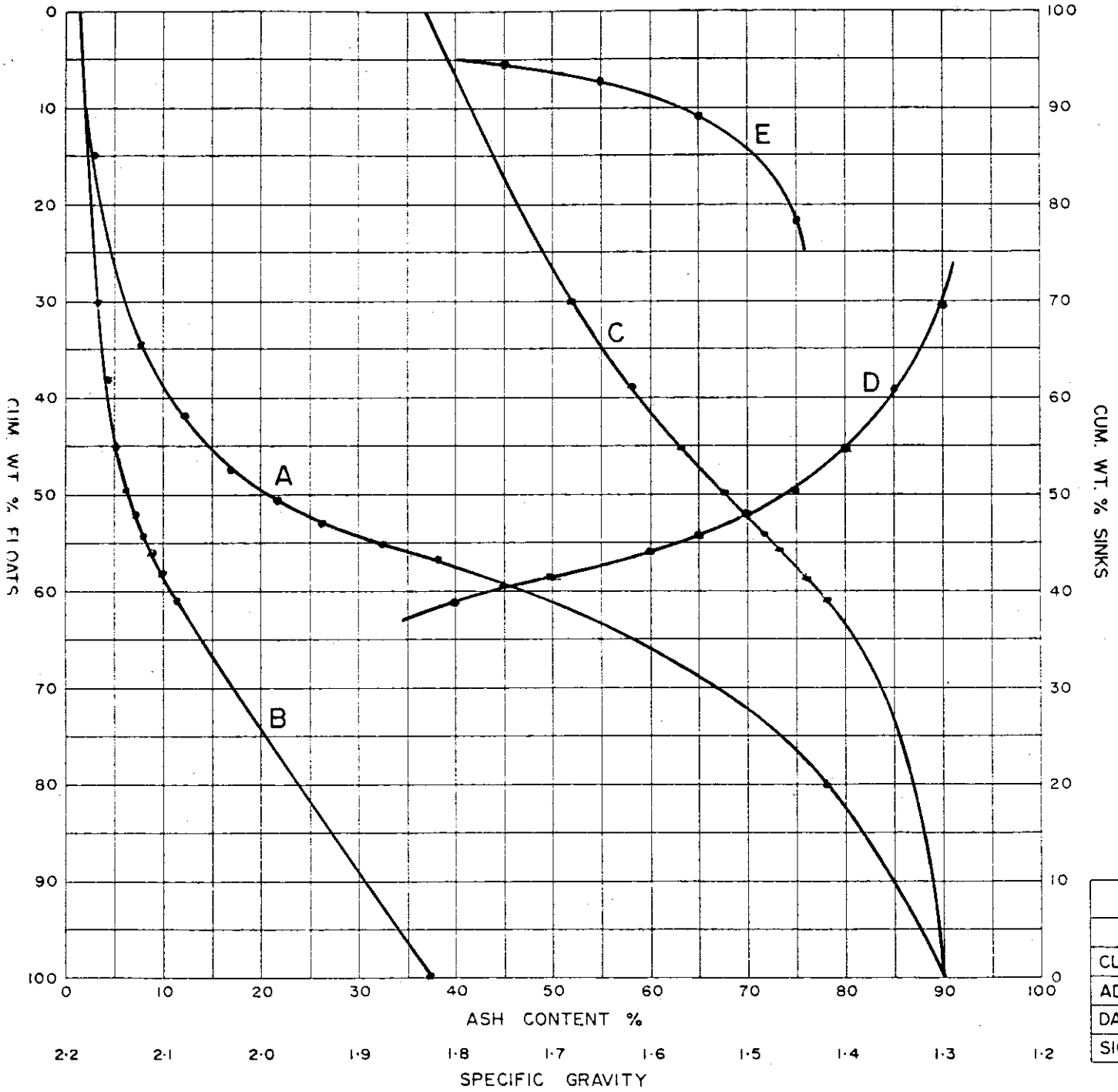
TABLE 91

ELCO MINING LTD ADIT NO.12 LAB NO.3788 .5" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT SH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	30.37	3.02	.92	.92	30.37	3.02	36.26	69.63	52.08	1.30	0.00
1.35	8.38	7.53	.63	1.55	38.75	4.00	35.63	61.25	58.17	1.40	21.63
1.40	6.56	12.32	.81	2.36	45.31	5.20	34.82	54.69	63.67	1.50	10.38
1.45	4.08	16.69	.68	3.04	49.39	6.15	34.14	50.61	67.46	1.60	6.63
1.50	2.61	21.91	.57	3.61	52.00	6.94	33.57	48.00	69.94	1.70	5.68
1.55	2.05	26.62	.55	4.15	54.05	7.69	33.02	45.95	71.87	1.80	0.00
1.60	1.64	32.61	.53	4.69	55.69	8.42	32.49	44.31	73.32	1.90	0.00
1.70	2.94	38.24	1.12	5.81	58.63	9.92	31.37	41.37	75.82	2.00	0.00
1.80	2.74	44.91	1.23	7.04	61.37	11.48	30.14	38.63	78.01	2.10	0.00
9.99	38.63	78.01	30.14	37.18	100.00	37.18	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 12 1/2" x 28M.
DATE	OCT, 10, 1975
SIGNED	K. M. LAU

FIGURE 59

ELCO MINING LTD ADIT NO.12 LAB NO.3788 .75" X 28M

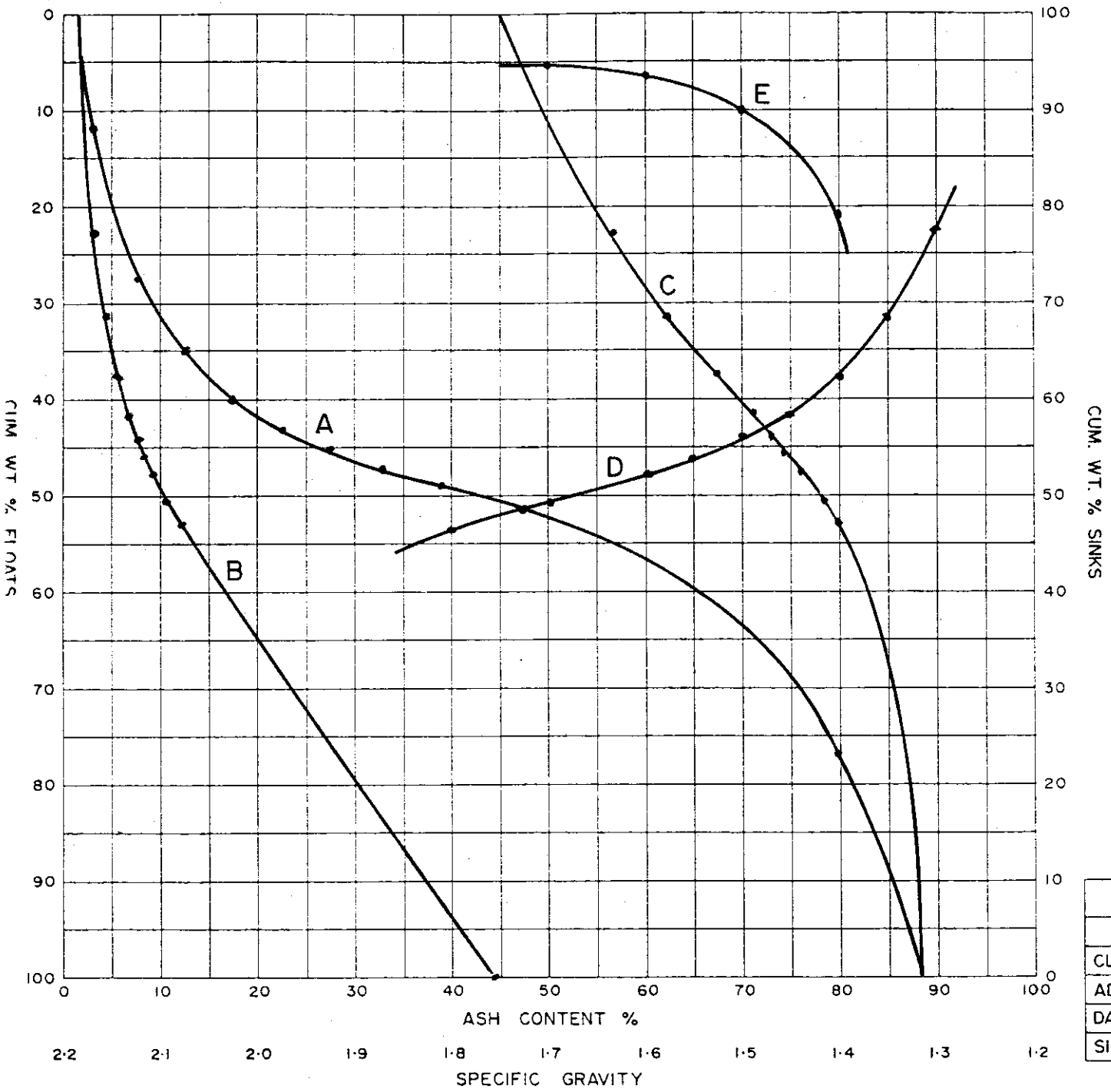
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT SH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	23.70	3.00	.71	.71	23.70	3.00	43.37	76.30	56.84	1.30	0.00
1.35	8.10	7.50	.61	1.32	31.80	4.15	42.76	68.20	62.79	1.40	20.50
1.40	6.10	12.40	.76	2.07	37.90	5.47	42.00	62.10	67.64	1.50	9.70
1.45	3.90	17.20	.67	2.75	41.80	6.57	41.33	58.20	71.02	1.60	6.20
1.50	2.40	22.40	.54	3.28	44.20	7.43	40.80	55.80	73.11	1.70	5.40
1.55	1.80	27.10	.49	3.77	46.00	8.20	40.31	54.00	74.64	1.80	0.00
1.60	1.60	33.10	.53	4.30	47.60	9.04	39.78	52.40	75.91	1.90	0.00
1.70	2.80	39.00	1.09	5.39	50.40	10.70	38.69	49.60	78.00	2.00	0.00
1.80	2.60	47.20	1.23	6.62	53.00	12.49	37.46	47.00	79.70	2.10	0.00
9.99	47.00	79.70	37.46	44.08	100.00	44.08	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 92

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 12 3/4" x 28 M.
DATE	OCT, 10, 1975
SIGNED	K. M. LAU

FIGURE 60

ELCO MINING LTD ADIT NO.12 LAB NO.3788 28M X 65M

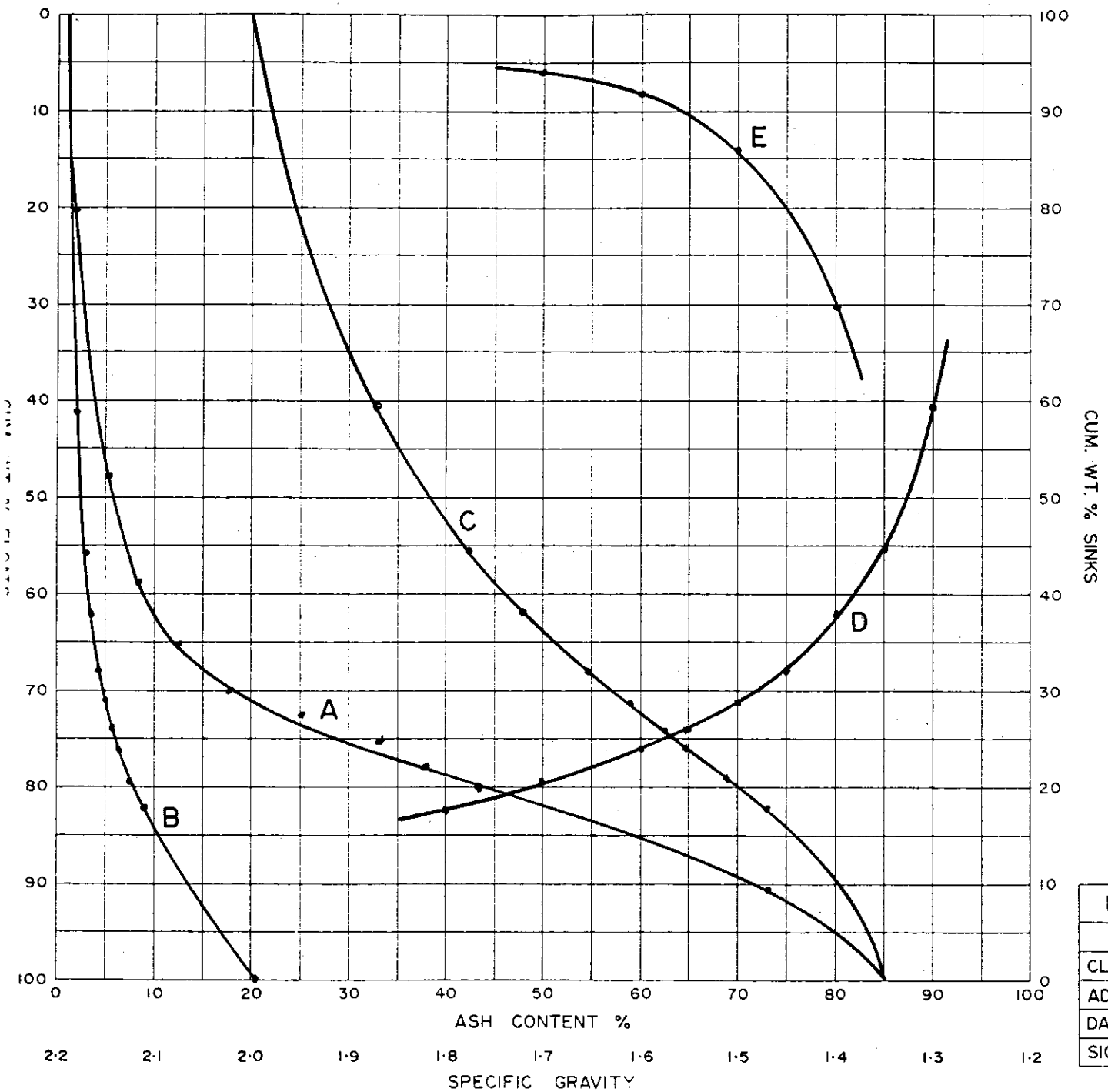
	---DIRECT---				---CUM FLOATS---				---CUM SINKS---		---0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT		WT>	ASH>	SINK WT ASH>		WT>	ASH>	S.G.	WT>
1	2	3	4	5		6	7	8		9	10	11	12
1.30	40.90	2.20	.90	.90		40.90	2.20	19.59		59.10	33.14	1.30	0.00
1.35	14.60	5.00	.73	1.63		55.50	2.94	18.86		44.50	42.37	1.40	30.30
1.40	6.50	8.80	.57	2.20		62.00	3.55	18.28		38.00	48.12	1.50	14.00
1.45	5.90	12.60	.74	2.95		67.90	4.34	17.54		32.10	54.64	1.60	7.90
~ 1.50	3.30	17.80	.59	3.53		71.20	4.96	16.95		28.80	58.86	1.70	5.90
1.55	2.80	25.40	.71	4.24		74.00	5.73	16.24		26.00	62.47	1.80	0.00
1.60	2.00	33.60	.67	4.92		76.00	6.47	15.57		24.00	64.87	1.90	0.00
1.70	3.10	37.90	1.17	6.09		79.10	7.70	14.39		20.90	68.87	2.00	0.00
1.80	2.80	48.50	1.22	7.31		81.90	8.92	13.18		18.10	72.80	2.10	0.00
9.99	18.10	72.80	13.18	20.49		100.00	20.49	0.00		.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 93

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 12 28M. x 65M.
DATE	OCT, 10, 1975
SIGNED	K. M. Lau

FIGURE 61

TABLE 94

ELCO MINING LTD.

SAMPLE: Adit No. 12

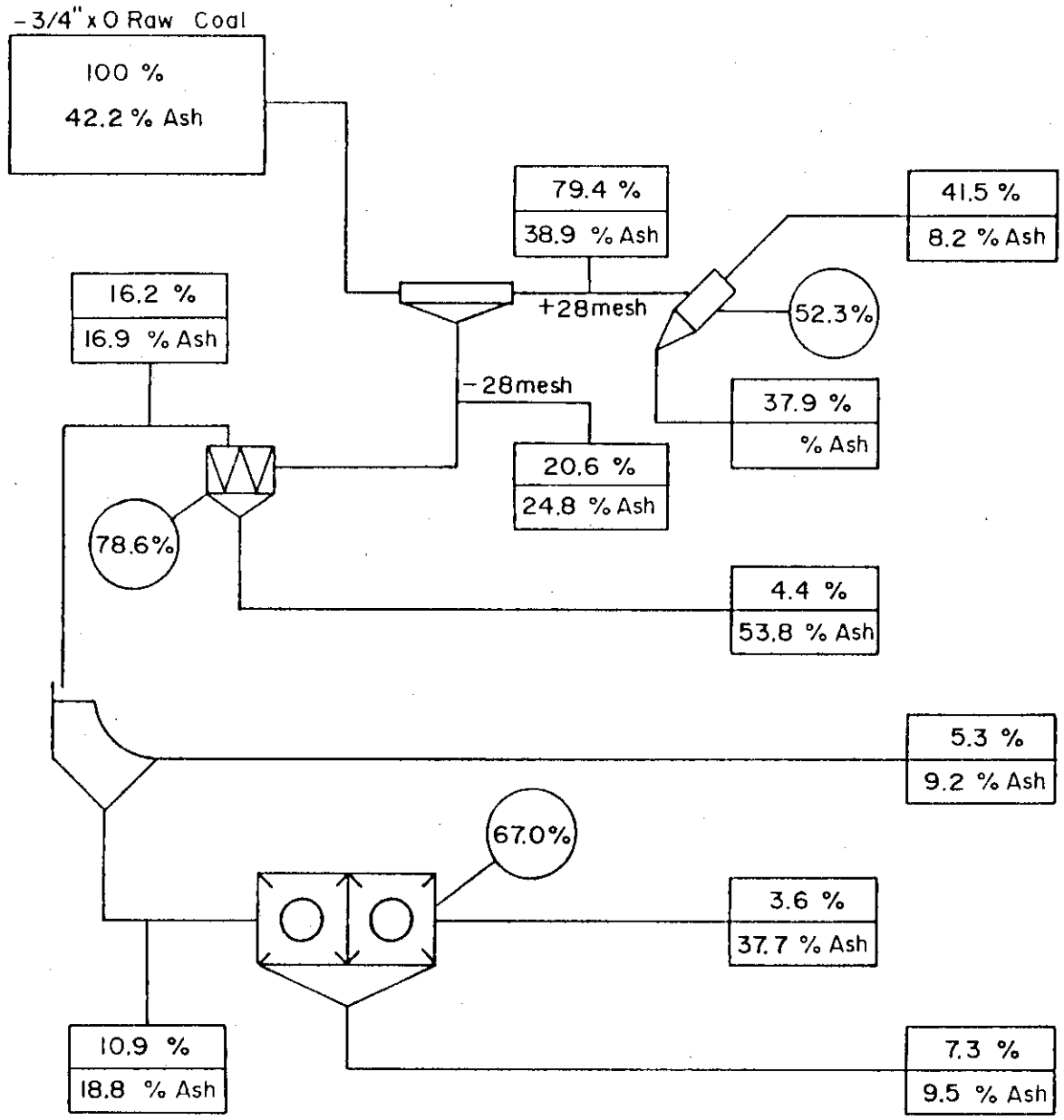
LAB. NO.: 3788

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8	0.85	0.06	399	456	23	8	0.969
3/4" X 28M	9	0.91	0.05	387	447	20	45	1.028
28M X 65M	9	1.08	0.04	402	459	22	62	1.033

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative Wt %	Cumulative Ash %
Stage I	51.3	8.2	0.7	22.4	68.7	.77	0.04	9	51.3	8.2
Stage II	9.8	12.4	0.7	21.9	65.0	.89	0.06	9	61.1	8.9
Tails	38.9	32.5	0.7	17.4	49.4	--	--	--	100.0	18.1

F. F. Parameters - See Adit No. 2

FIGURE 62



OVERALL YIELD = 54.1 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 12	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 12 LAB NO. 3787 DATE OF WASH September 6, 1975.

Raw Coal Analysis: Ash % 42.2 Hardgrove Grindability Index 74

Delivered Bulk Weight 50.3 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 12 LAB NO. 3787

1. S. G. of Separation (a) Washability 1.53
   (b) Plant 1.47
2. Feed Ash Content A.D.B. 38.9 %
3. Clean Coal Estimated Weight 8.44 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.2 % F.S.I. 9
5. Reject Estimated Weight 8.73 M.T.
6. Reject Analysis (A.D.B.) Ash 72.5 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 17.17 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 79.4 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 49.2 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 52.3 %
11. Yield Clean Coal (Washability) 46 %
12. +2" Rock Oversize .716 M.T.

TABLE 95

ELCO MINING LTD.

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 12 LAB NO. 3787

1. Vortex Finder Clearance (VFC) 3.2 CM 1 1/4 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 110-150 g/l. 11-15 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	57.9	25.8	8 1/2	57.9	25.8	24.8	8
	65M x 100M (.15 CM)	13.1	19.4	8 1/2	71.0	24.6		
	100M x 0	29.0	26.6	8	100.0	25.2		
O'FLOW	+65M						16.9	8 1/2
	65M x 100M							
	100M x 0							
U'FLOW	+65M	60.4			60.4		53.8	1
	65M x 100M	12.0			72.4	52.4		
	100M x 0	27.6	57.3	1 1/2	100.0	53.8		
S B O	+65M	86.7	9.2	9	86.7	9.2	9.2	9
	65M x 100M	5.9	16.5	9	92.6	9.7		
	100M x 0	7.4	15.8	9	100.0	10.1		

6. Yield - Total W.O. Cyclone Circuit = 78.6

7. Est. Yield of 28 x 65 Mesh Coal = 25.9 (estimated)
(as % of 28 Mesh x 0 Feed)

TABLE 96

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 12 LAB NO. 3787

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-220 g/l 15-22 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	7.6	11.4	9	7.6	11.4	18.8	8 1/2
	65M x 100M (.15 CM)	16.7	12.2	9	24.3	11.9		
	100M x 0	75.5	20.7	8	100.0	18.6		
CONC.	+65M (.21 CM)	8.5	7.0	9	8.5	7.0	9.5	9
	65M x 100M (.15 CM)	12.1	7.4	9	20.6	7.2		
	100M x 0	79.9	9.8	9	100.0	9.3		
TAILS	+65M (.21 CM)	33.2	23.9	8	33.2	23.9	37.7	5 1/2
	65M x 100M (.15 CM)	13.2	22.4	8	46.4	23.5		
	100M x 0	53.6	53.3	2	100.0	39.5		

4. Impeller Type -

5. Yield Calculated (Ash Balance) 67.0 %

6. Yield (Washability) _____ %

7. 65M x 0 (Washability) _____ %

ELCO MINING LTD.

TABLE 97

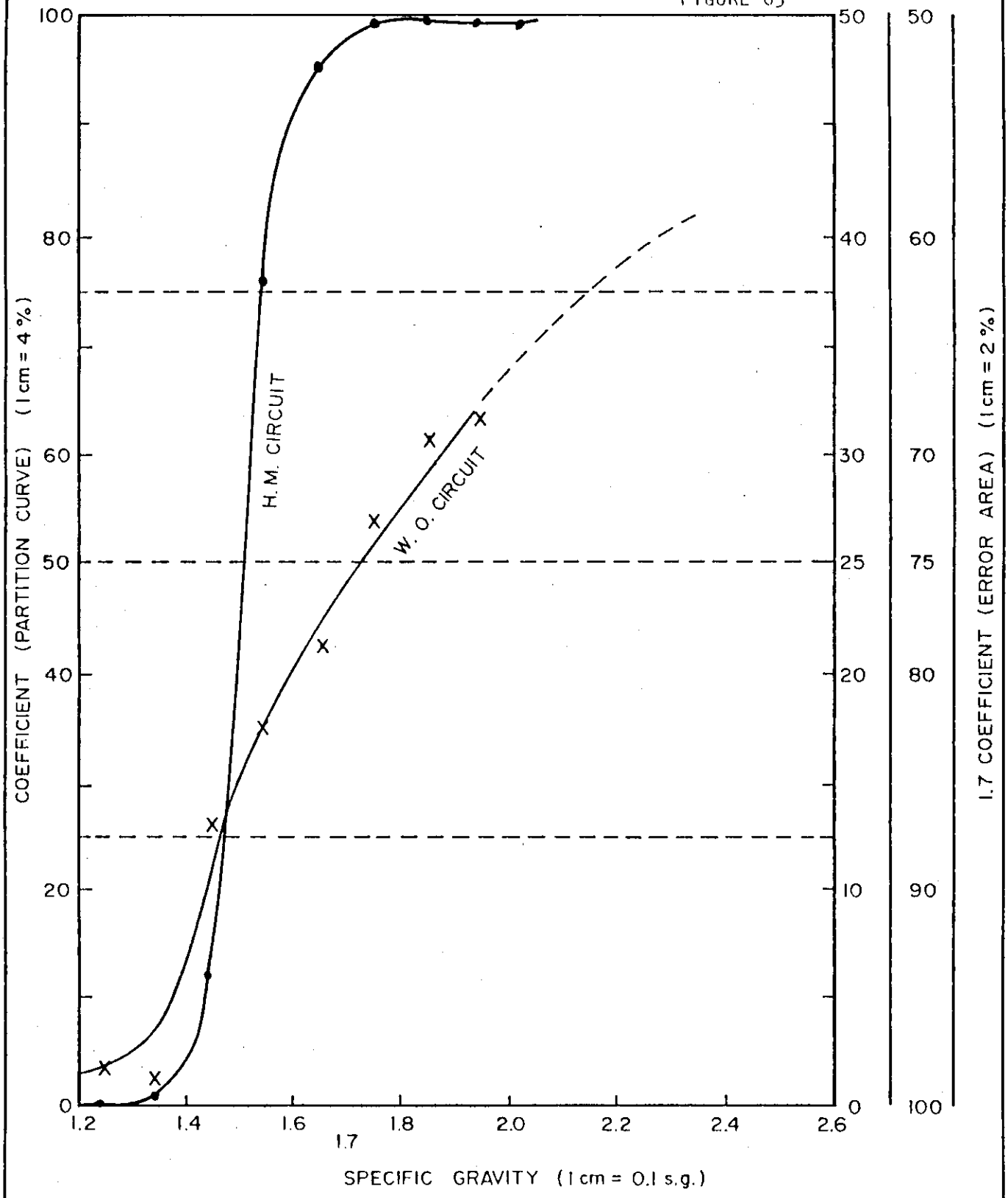
BULK WASHING DATA

ADIT/SEAM NO. 12 LAB NO. 3787

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	63.9	63.9	0.1	0.1	43.9	43.9	5.7	5.7
1.30-1.40	28.1	92.0	0.3	0.4	34.2	78.1	3.2	8.9
1.40-1.50	6.2	98.2	1.0	1.4	9.7	87.8	13.0	21.9
1.50-1.60	1.3	99.5	4.5	5.9	3.9	91.7	7.8	29.7
1.60-1.70	0.4	99.9	7.1	13.0	2.2	93.9	6.0	35.7
1.70-1.80	0.1	100.0	6.7	19.7	1.4	95.3	6.0	41.7
1.80-1.90	-	-	5.7	25.4	0.9	96.2	5.3	47.0
1.90-2.00	-	-	6.4	31.8	0.9	97.1	5.6	52.6
+2.00	-	-	68.2	100.0	2.9	100.0	47.4	100.0

FIGURE 63



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 12	JAN. 6/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 12 LAB. NO. 3787 DATE OF WASH September 6, 1975.

a) Raw Coal

Delivered Wt.	=	50.3
Ash %	=	42.2
Hardgrove Grindability Index	=	74
Estimated Washed Weight	=	21.6

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 79.4

Effective S. G. = 1.45

Raw Feed	38.9 % Ash	5 1/2	F.S.I.
Clean Coal	8.2 % Ash	9	F.S.I.
Reject	72.5 % Ash	1/2	F.S.I.

Calculated Yield = 52.3

Weighed Yield = 49.2

c) Water-Only Cyclone Circuit

Raw Feed	24.8 % Ash	8	F.S.I.
Overflow	16.9 % Ash	8 1/2	F.S.I.
Underflow	53.8 % Ash	1	F.S.I.

Calculated Yield = 78.6

% of +65 Mesh in O/F = 33 (estimated)

Sieve Bend Overflow	9.2 % Ash	9	F.S.I.

d) Froth Flotation Circuit

Raw Feed	18.8 % Ash	8 1/2	F.S.I.
Concentrates	9.5 % Ash	9	F.S.I.
Tails	37.7 % Ash	5 1/2	F.S.I.

Calculated Yield = 67.0

ELCO MINING LTD.

TABLE 98

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 12 LAB. NO. 3787

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % RM% 0.4 ASH % 9.8 VM % 21.6 FC % 68.2 S% 0.68 FSI 9

(ii) Dilatometer

Softening °C 398 Max. Dil. °C 461 Max Cont. % 12

Max. Dil. % 78 G. No. = 1.057

(iii) Hardgrove Grindability Index = 99

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
18	3.06	19	2.23			0.6	0.102			28.4	66	11.22

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

TABLE 99

ELCO MINING LTD.

SAMPLE: Clean Coal - Adit No. 12

LAB. NO.: 3787

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.4	9.8	21.6	68.2	9	99

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	2.5	2.5
1/2" X 1/4"	12.6	15.1
1/4" X 8M	22.7	37.8
8M X 28M	36.8	74.6
28M X 65M	12.0	86.6
65M X 0	13.4	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
398	461	12	78	1.057

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.46	79.96	4.49	1.45	0.74	9.73	3.17

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.04	0.34	0.20	0.58	5.50	26.08	61.68	0.33	1.09	2.31

SAMPLE: Adit No. 13

LAB. NO.: 4026

TABLE 100

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.8	57.1	13.7	28.4	0.74	6145	74	oxid.	1430	1470	1470+	-
							red.	1395	1465	1470+	-

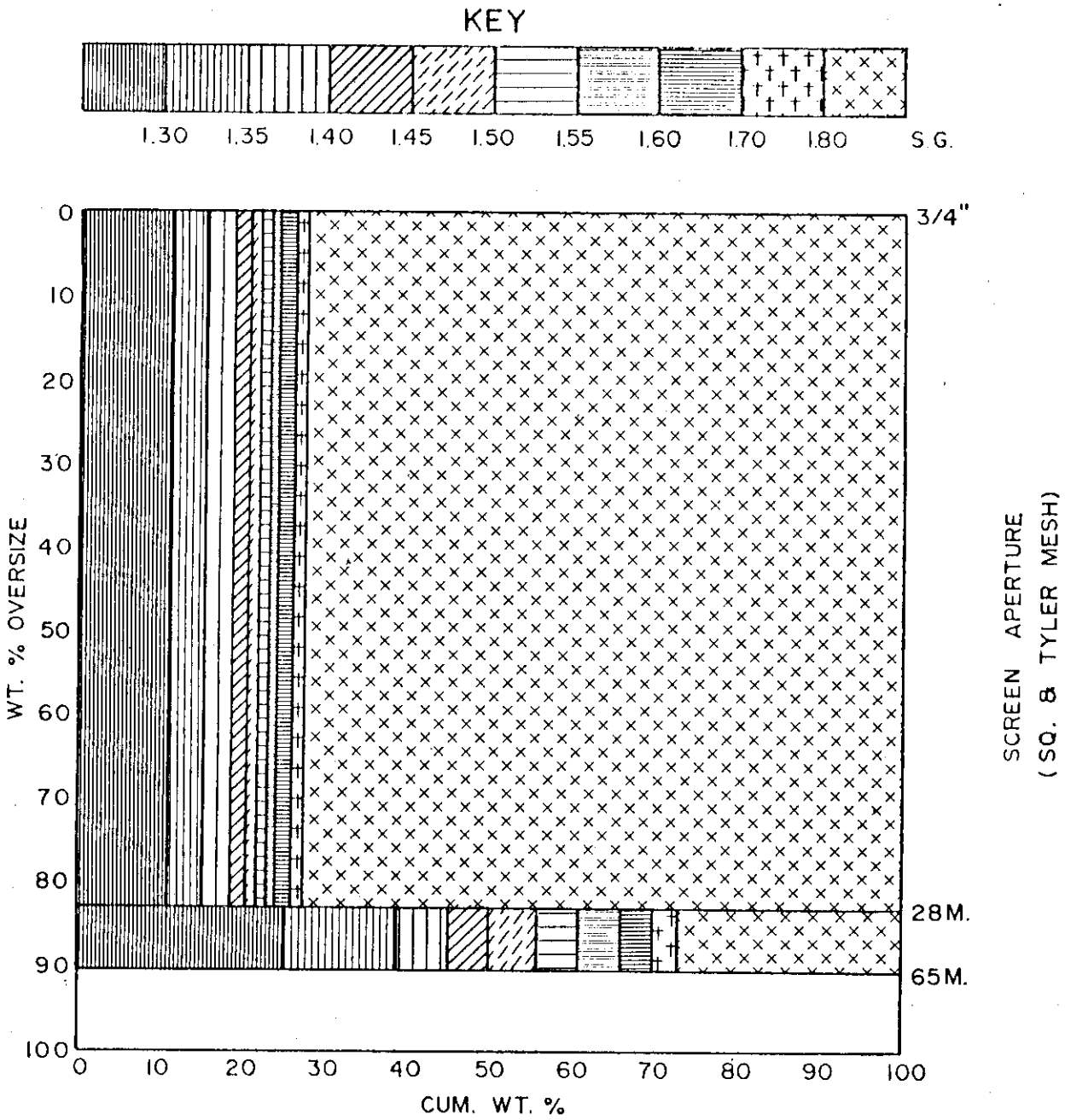
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	19.3	80.4	0.9	9.1	9.6	0.58	52	-	-
	1/2" X 0	80.7	-	-	-	-	-	-	-	-
II	3/4" X 28M	83.0	68.7	1.0	11.6	18.7	0.65	86	83.0	68.7
	28M X 65M	7.4	35.4	0.9	18.2	45.5	1.02	115	90.4	66.0
	65M X 100M	2.3	33.5	-	-	-	-	-	92.7	65.1
	100M X 200M	3.7	32.4	-	-	-	-	-	96.4	63.9
	200M X 0	3.6	33.8	-	-	-	-	-	100.0	62.8
III	65M X 0	9.6	33.0	0.9	19.1	47.0	1.18	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 17.6%

II - Size consist of raw coal crushed to -3/4", WT. % 3/4" X 1/2" = 1.5%

III - 65M X 0 off II

FIGURE 64



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 13
DATE	NOV. 11, 1975	SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.13 LAB NO.4026 2" X .5"

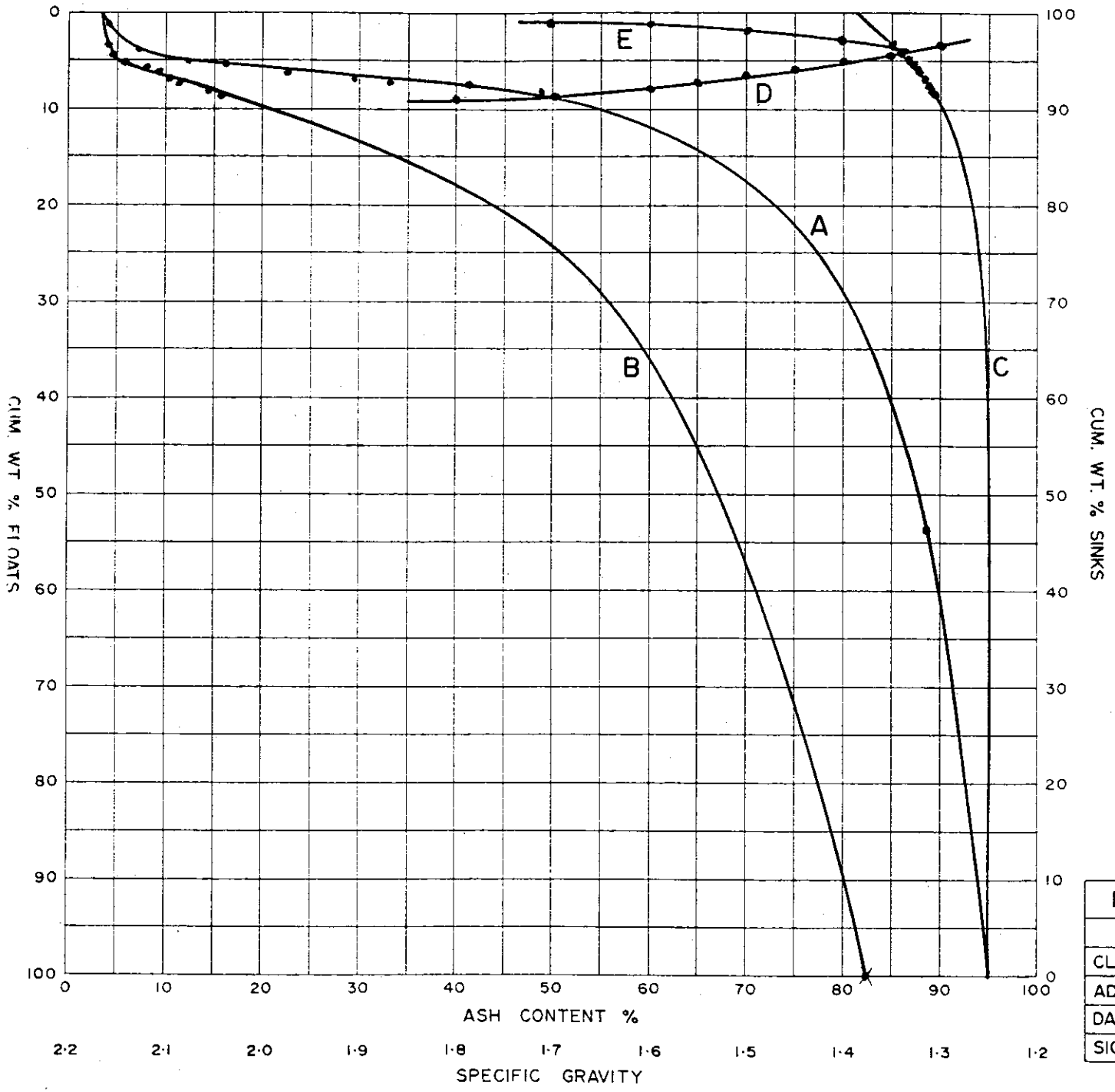
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	3.40	4.10	.14	.14	3.40	4.10	82.24	96.60	85.13	1.30	0.00
1.35	.80	7.20	.06	.20	4.20	4.69	82.18	95.80	85.78	1.40	2.90
1.40	.90	12.80	.12	.31	5.10	6.12	82.06	94.90	86.47	1.50	2.10
1.45	.50	15.90	.08	.39	5.60	6.99	81.98	94.40	86.85	1.60	1.60
1.50	.70	23.10	.16	.55	6.30	8.78	81.82	93.70	87.32	1.70	1.10
1.55	.60	29.50	.18	.73	6.90	10.59	81.65	93.10	87.70	1.80	0.00
1.60	.30	33.60	.10	.83	7.20	11.54	81.55	92.80	87.87	1.90	0.00
1.70	.70	41.10	.29	1.12	7.90	14.16	81.26	92.10	88.23	2.00	0.00
1.80	.40	48.70	.19	1.31	8.30	15.83	81.06	91.70	88.40	2.10	0.00
9.99	91.70	88.40	81.06	82.38	100.00	82.38	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 101

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 13 2" x 1/2"
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 65

ELCO MINING LTD ADIT NO.13 LAB NO.4026 .5" X 28M

---DIRECT---					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	13.19	2.93	.39	.39	13.19	2.93	60.09	86.81	69.22	1.30	0.00
1.35	5.26	6.26	.33	.72	18.46	3.88	59.76	81.54	73.28	1.40	12.31
1.40	3.13	10.77	.34	1.05	21.59	4.88	59.42	78.41	75.78	1.50	6.67
1.45	2.23	16.68	.37	1.42	23.82	5.98	59.05	76.18	77.51	1.60	4.56
1.50	1.69	20.57	.35	1.77	25.51	6.95	58.70	74.49	78.80	1.70	3.69
1.55	1.59	27.31	.43	2.21	27.10	8.14	58.27	72.90	79.92	1.80	0.00
. Ø	1.16	31.69	.37	2.57	28.26	9.11	57.90	71.74	80.70	1.90	0.00
1.70	1.81	38.80	.70	3.28	30.07	10.90	57.20	69.93	81.79	2.00	0.00
1.80	1.88	48.48	.91	4.19	31.95	13.11	56.28	68.05	82.71	2.10	0.00
9.99	68.05	82.71	56.28	60.47	100.00	60.47	0.00	.00	0.00	2.20	0.00

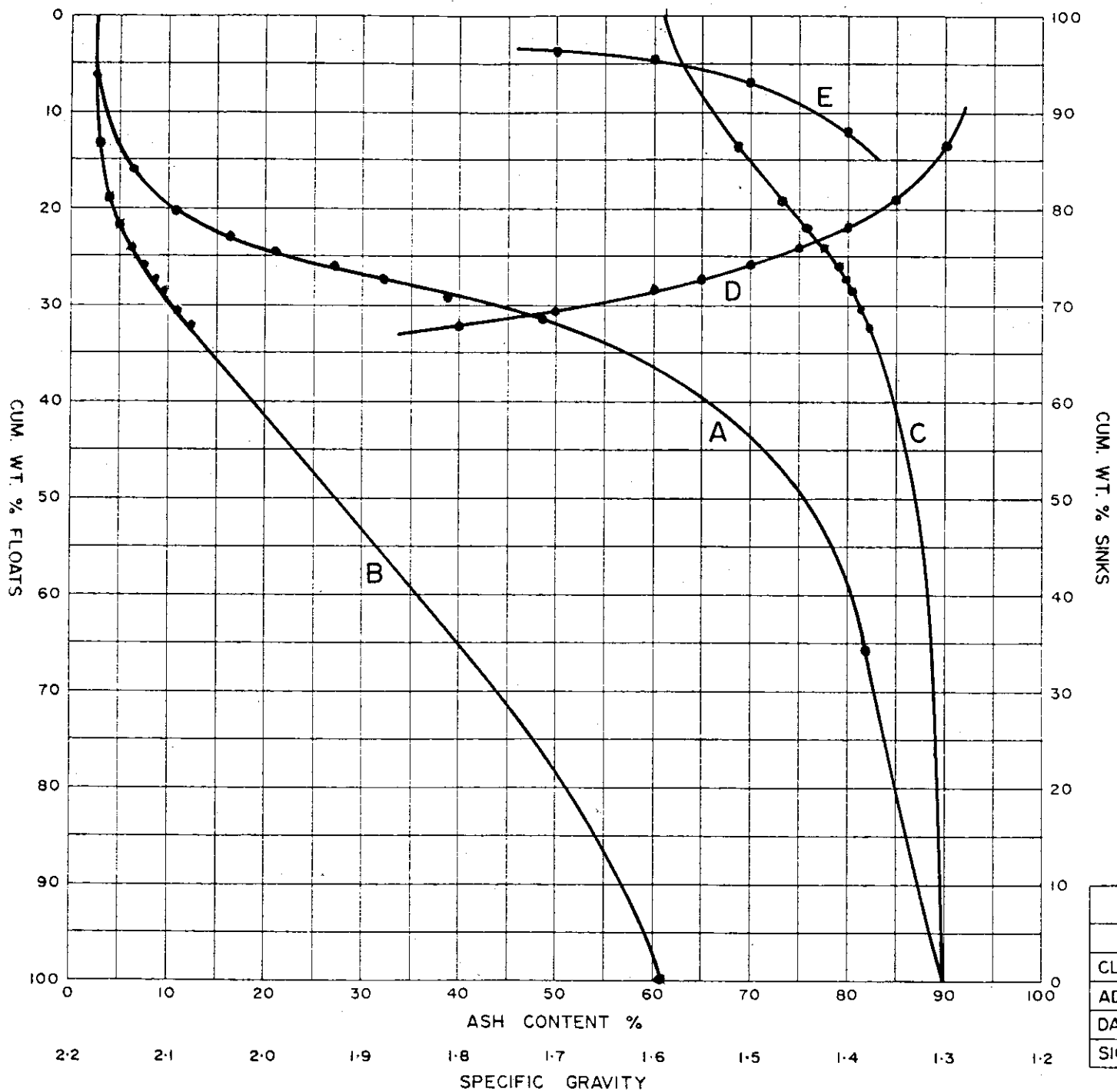
BIRTLEY ENGINEERING

TABLE 102

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 66

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity - Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 13 1/2" x 28M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.13 LAB NO.4026 .75" X 28M

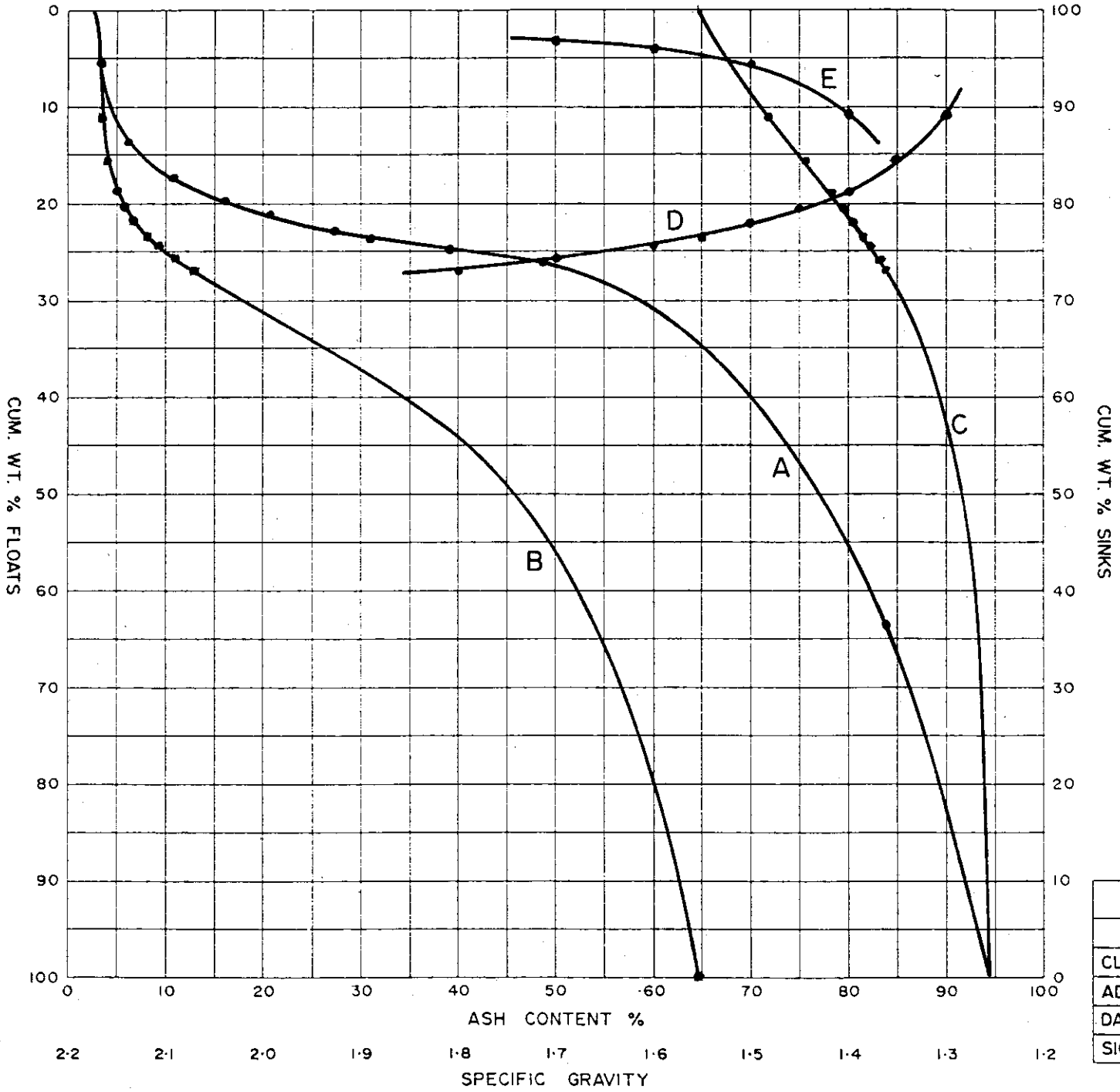
---DIRECT---					---CUM FLOATS---		---CUM SINKS---			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	11.30	3.00	.34	.34	11.30	3.00	64.36	88.70	72.56	1.30	0.00
1.35	4.40	6.30	.28	.62	15.70	3.92	64.08	84.30	76.02	1.40	10.50
1.40	2.70	10.90	.29	.91	18.40	4.95	63.79	81.60	78.17	1.50	5.80
1.45	1.90	16.60	.32	1.23	20.30	6.04	63.47	79.70	79.64	1.60	4.00
1.50	1.50	20.80	.31	1.54	21.80	7.05	63.16	78.20	80.77	1.70	3.20
1.55	1.40	27.50	.39	1.92	23.20	8.29	62.77	76.80	81.74	1.80	0.00
1.60	1.00	31.80	.32	2.24	24.20	9.26	62.46	75.80	82.40	1.90	0.00
1.70	1.60	39.00	.62	2.86	25.80	11.10	61.83	74.20	83.33	2.00	0.00
1.80	1.60	48.50	.78	3.64	27.40	13.29	61.06	72.60	84.10	2.10	0.00
9.99	72.60	84.10	61.06	64.70	100.00	64.70	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 103

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 67

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 13 3/4" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.13 LAB NO.4026 28M X 65M

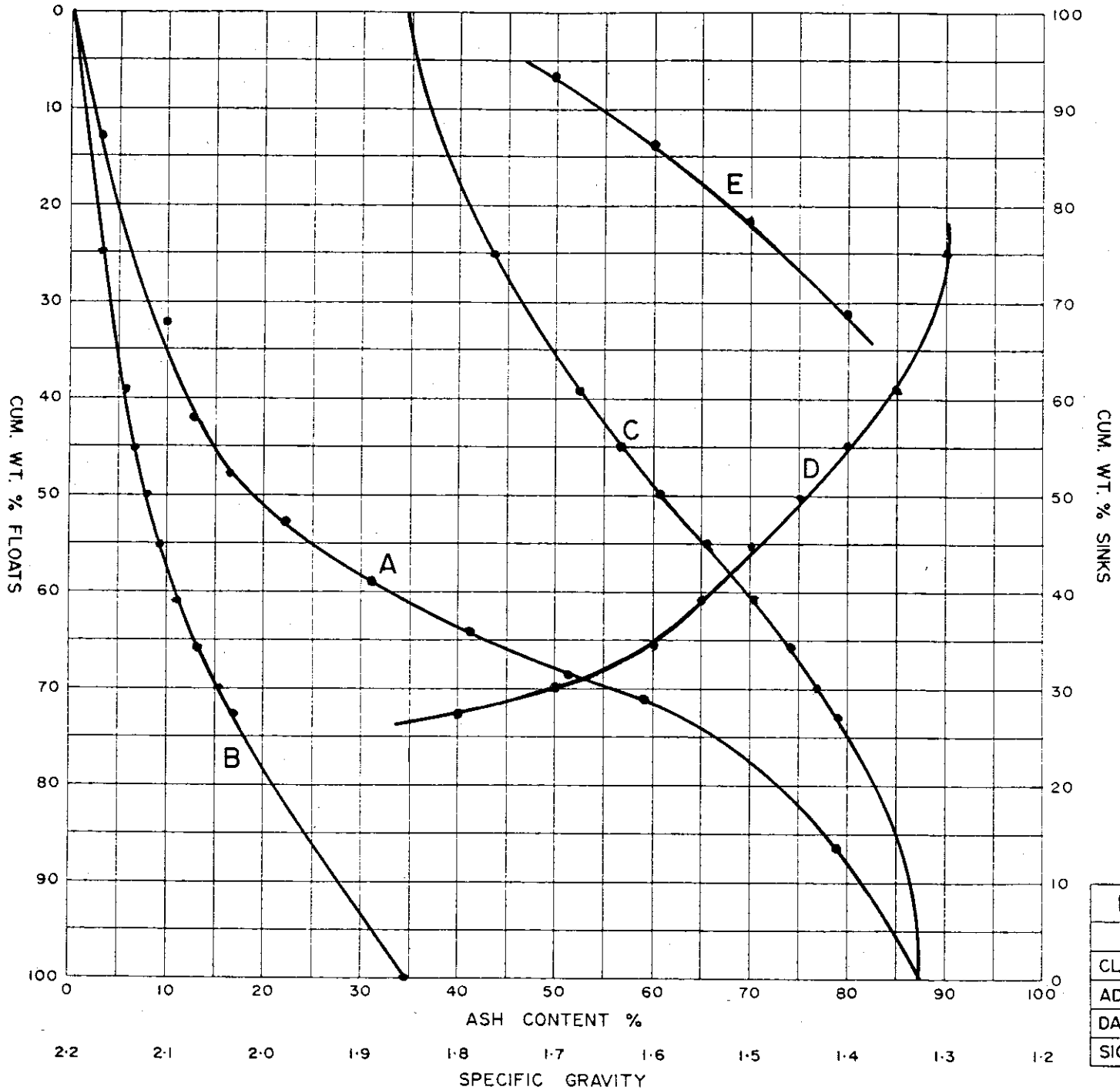
--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	25.00	3.10	.78	.78	25.00	3.10	33.31	75.00	44.41	1.30	0.00
1.35	14.10	10.30	1.45	2.23	39.10	5.70	31.85	60.90	52.30	1.40	30.90
1.40	6.20	12.80	.79	3.02	45.30	6.67	31.06	54.70	56.78	1.50	20.80
1.45	4.50	16.60	.75	3.77	49.80	7.57	30.31	50.20	60.38	1.60	13.90
1.50	6.10	23.00	1.40	5.17	55.90	9.25	28.91	44.10	65.55	1.70	7.00
1.55	5.40	31.60	1.71	6.88	61.30	11.22	27.20	38.70	70.29	1.80	0.00
1.60	4.80	41.80	2.01	8.88	66.10	13.44	25.20	33.90	74.33	1.90	0.00
* 1.70	3.70	51.20	1.89	10.78	69.80	15.44	23.30	30.20	77.16	2.00	0.00
1.80	3.30	58.90	1.94	12.72	73.10	17.40	21.36	26.90	79.40	2.10	0.00
9.99	26.90	79.40	21.36	34.08	100.00	34.08	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 104

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 13 28M. x 65M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

FIGURE 68

ELCO MINING LTD.

SAMPLE: Adit No. 13

LAB. NO.: 4026

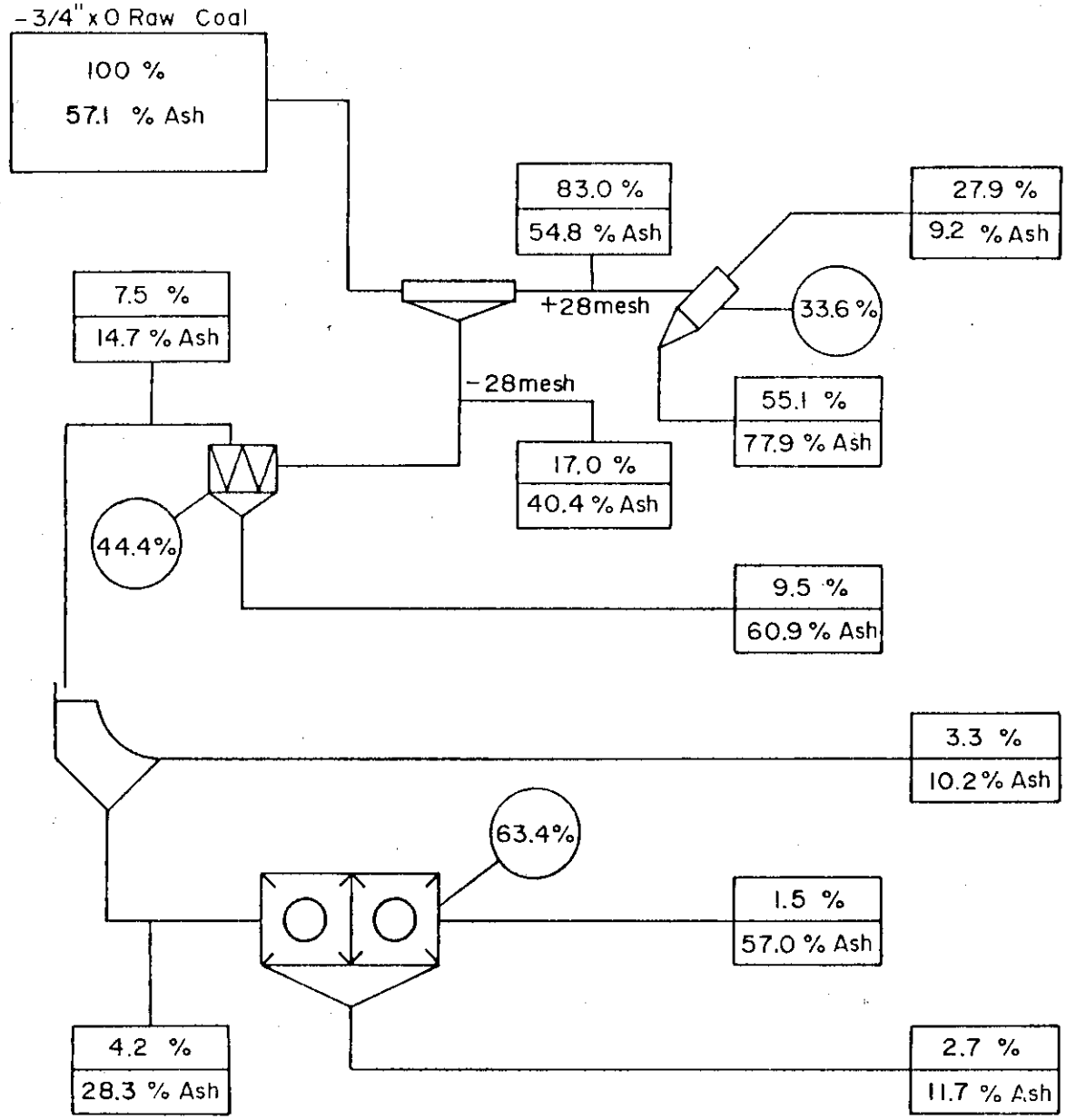
TABLE 105

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8 1/2	0.97	0.07	396	465	26	87	1.045
3/4" X 28M	9	0.95	0.06	395	459	26	77	1.039
28M X 65M	9	1.08	0.04	396	461	26	97	1.046

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	55.3	15.4	0.5	22.4	61.7	1.19	0.05	8 1/2	55.3	15.4
Stage II	10.1	28.7	0.7	19.7	50.9	1.07	0.07	6 1/2	65.4	17.5
Tails	34.6	62.5	0.7	14.0	22.8	--	--	--	100.0	33.0

F. F. Parameters - See Adit No. 2

FIGURE 69



OVERALL YIELD = 33.9 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 13	DEC. 22 / 75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 13 LAB NO. 4025 DATE OF WASH October 6, 1975.

Raw Coal Analysis: Ash % 57.1 Hardgrove Grindability Index 74

Delivered Bulk Weight 29.4 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 13 LAB NO. 4025

1. S. G. of Separation (a) Washability 1.56
   (b) Plant 1.44
2. Feed Ash Content A.D.B. 54.8 %
3. Clean Coal Estimated Weight 2.21 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 9.2 % F.S.I. 8 1/2
5. Reject Estimated Weight 8.39 M.T.
6. Reject Analysis (A.D.B.) Ash 77.9 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 10.60 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 83.0 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 20.8 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 33.6 %
11. Yield Clean Coal (Washability) 24 %
12. +2" Rock Oversize 1.63 M.T.

TABLE 106

ELCO MINING LTD.

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 13 LAB NO. 4025

1. Vortex Finder Clearance (VFC) 7.0 CM 2 3/4 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 120-170 g/l. 12-17 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	61.8	40.4	5	61.8	40.4	40.4	6
	65M x 100M (.15 CM)	11.3	34.6	7	73.1	39.5		
	100M x 0	26.9	40.3	5 1/2	100.0	39.7		
O'FLOW	+65M	43.8	8.7	9	43.8	8.7	14.7	9
	65M x 100M	16.4	10.8	9	60.2	9.2		
	100M x 0	39.8	20.1	8	100.0	13.6		
U'FLOW	+65M	74.2	-	-	-	-	60.9	1
	65M x 100M	8.5	-	-	82.7	59.8		
	100M x 0	17.3	66.2	1	100.0	60.9		
S B O	+65M	85.9					10.2	8 1/2
	65M x 100M	7.3						
	100M x 0	6.8						

6. Yield - Total W.O. Cyclone Circuit = 44.4 %

7. Est. Yield of 28 x 65 Mesh Coal = 19.4 %
(as % of 28 Mesh x 0 Feed)

TABLE 107

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 13 LAB NO. 4025

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 230 g/l 23 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	14.9	16.9	8 1/2	14.9	16.9	28.3	7 1/2
	65M x 100M (.15 CM)	18.3	18.7	9	33.2	17.9		
	100M x 0	66.8	33.9	8	100.0	28.6		
CONC.	+65M (.21 CM)	6.3	14.0	8 1/2	6.3	14	11.7	9
	65M x 100M (.15 CM)	10.5	13.4	9	16.8	13.6		
	100M x 0	83.2	19.5	8 1/2	100.0	18.1		
TAILS	+65M (.21 CM)	25.8	29.9	6 1/2	25.8	29.9	57.0	1
	65M x 100M (.15 CM)	19.7	41.4	4	45.5	34.9		
	100M x 0	54.5	74.8	1	100.0	56.6		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 63.3 %

6. Yield (Washability) 45 %

7. 65M x 0 (Washability) 9.6 %

TABLE 108

ELCO MINING LTD.

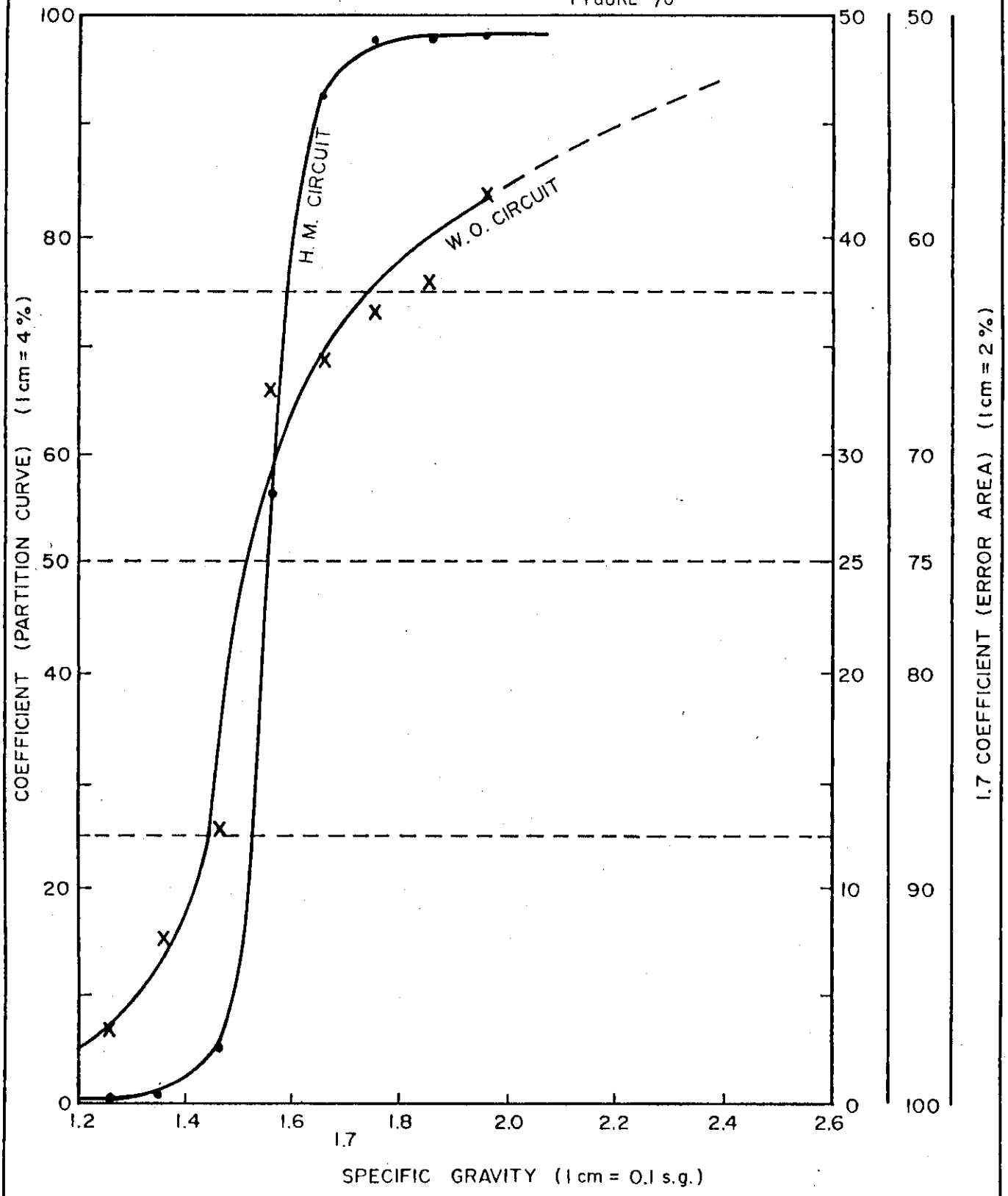
BULK WASHING DATA

ADIT/SEAM NO. 13 LAB NO. 4025

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	53.1	53.1	0.1	0.1	26.1	26.1	1.5	1.5
1.30-1.40	27.5	80.6	0.2	0.3	25.8	51.9	3.4	4.9
1.40-1.50	15.8	96.4	0.5	0.8	17.2	69.1	4.0	8.9
1.50-1.60	2.8	99.2	1.8	2.6	10.8	79.9	14.2	23.1
1.60-1.70	0.3	99.5	1.9	4.5	5.2	85.1	7.7	30.8
1.70-1.80	0.1	99.6	2.3	6.8	3.0	88.1	5.6	36.4
1.80-1.90	0.1	99.7	2.6	9.4	2.4	90.5	5.2	41.6
1.90-2.00	0.1	99.8	3.4	12.8	1.6	92.1	5.9	47.5
+2.00	0.2	100.0	87.2	100.0	7.9	100.0	52.5	100.0

FIGURE 70



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 13	JAN. 10/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 13 LAB. NO. 4025 DATE OF WASH October 6, 1975.

a) Raw Coal

Delivered Wt.	=	29.4 M.T.
Ash %	=	57.1
Hardgrove Grindability Index	=	74
Estimated Washed Weight	=	12.77 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 83.0

Effective S. G. = 1.53

Raw Feed	54.8 %	Ash 4	F.S.I.
Clean Coal	9.2 %	Ash 8 1/2	F.S.I.
Reject	77.9 %	Ash 1/2	F.S.I.

Calculated Yield = 33.6 %

Weighed Yield = 20.8 %

c) Water-Only Cyclone Circuit

Raw Feed	40.4 %	Ash 6	F.S.I.
Overflow	14.7 %	Ash 9	F.S.I.
Underflow	60.9 %	Ash 1	F.S.I.

Calculated Yield = 44.4 %

% of +65 Mesh in O/F = 43.8 %

Sieve Bend Overflow	10.2 %	Ash 8 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	28.3 %	Ash 7 1/2	F.S.I.
Concentrates	11.7 %	Ash 9	F.S.I.
Tails	57.0 %	Ash 1	F.S.I.

Calculated Yield = 63.4 %

ELCO MINING LTD.

TABLE 109

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 13 LAB. NO. 4025

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 1.8 ASH % 11.1 VM % 22.2 FC % 64.9 S% 0.94 FSI 8 1/2

(ii) Dilatometer

Softening °C ____ Max. Dil. °C ____ Max Cont. % ____

Max. Dil. % ____ G. No. = ____

(iii) Hardgrove Grindability Index = 107

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
4	0.84	5	1.05	2	0.41	0.6	0.123			4	12	2.51

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

TABLE 110

ELCO MINING LTD.

SAMPLE: Clean Coal - Adit No. 13

LAB. NO.: 4025

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
1.8	11.1	22.2	64.9	8 1/2	107

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.0	4.0
1/2" X 1/4"	23.8	27.8
1/4" X 8M	17.2	45.0
8M X 28M	31.0	76.0
28M X 65M	13.6	89.6
65M X 0	10.4	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
396	462	23	103	1.051

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.67	77.51	4.47	1.46	0.93	11.23	3.73

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.08	0.71	0.23	0.50	5.36	23.44	64.56	0.27	1.16	2.11

SAMPLE: Adit No. 14

LAB. NO.: 4024

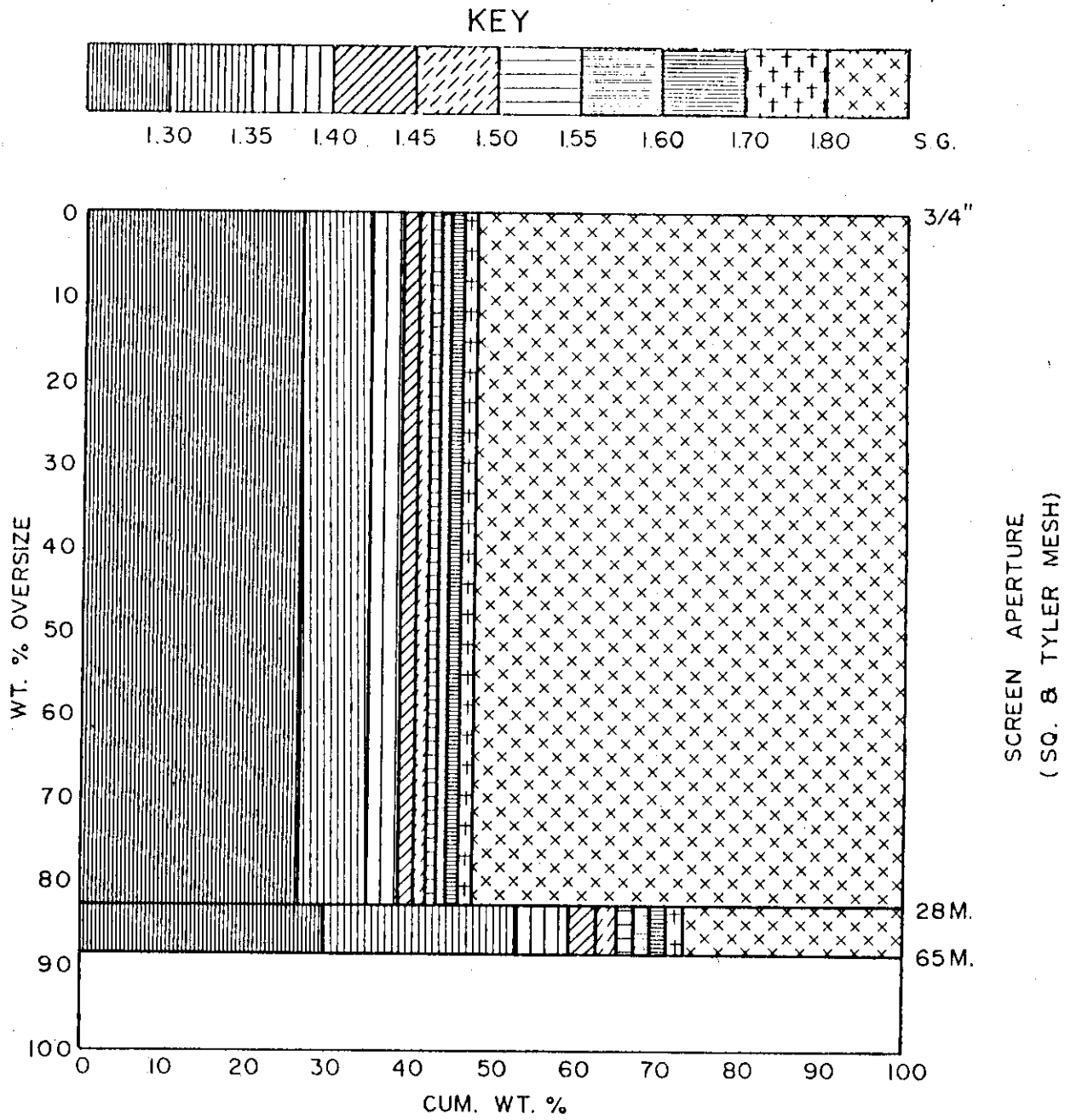
TABLE 111

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.9	49.8	16.7	32.6	0.97	7540	64	oxid.	1470	1470+	-	-
							red.	1390	1470+	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	30.6	65.6	0.9	12.6	20.9	0.55	60	-	-
	1/2" X 0	69.4	-	-	-	-	-	-	-	-
II	3/4" X 28M	82.4	50.0	0.9	16.4	32.7	0.58	79	82.4	50.0
	28M X 65M	7.0	30.2	0.8	21.7	47.3	0.74	113	89.4	48.4
	65M X 100M	6.2	25.8	-	-	-	-	-	95.6	47.0
	100M X 200M	2.6	26.7	-	-	-	-	-	98.2	46.4
	200M X 0	1.8	28.0	-	-	-	-	-	100.0	46.1
III	65M X 0	10.6	26.1	1.0	21.3	51.6	0.56	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 13.4
II - Size consist of raw coal crushed to - 3/4", WT. % 3/4" X 1/2" = 1.6%
III - 65M X 0 off II

FIGURE 71



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT №	ADIT 14
DATE	NOV. 12 / 75	SIGNED	L. BAILEY

ELCO MINING LTD ADIT NO.14 LAB NO.4024 2" X .5"

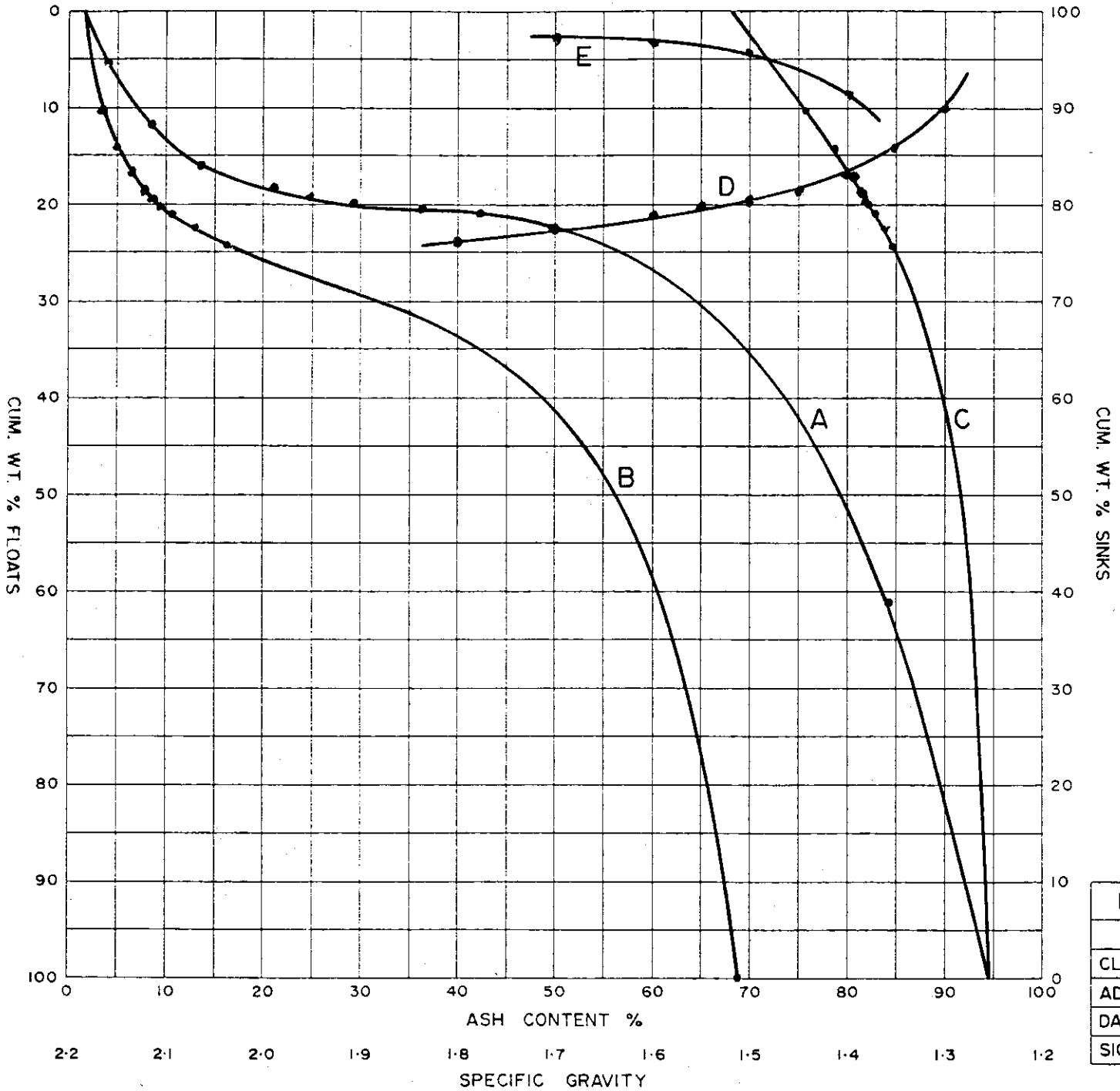
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	10.10	3.70	.37	.37	10.10	3.70	67.64	89.90	75.24	1.30	0.00
1.35	4.00	8.80	.35	.73	14.10	5.15	67.28	85.90	78.33	1.40	8.80
1.40	2.90	14.10	.41	1.13	17.00	6.67	66.88	83.00	80.57	1.50	3.90
1.45	1.10	21.00	.23	1.37	18.10	7.54	66.64	81.90	81.37	1.60	3.50
1.50	.80	24.80	.20	1.56	18.90	8.28	66.45	81.10	81.93	1.70	3.10
1.55	1.30	29.70	.39	1.95	20.20	9.65	66.06	79.80	82.78	1.80	0.00
1.60	.70	36.50	.26	2.21	20.90	10.55	65.80	79.10	83.19	1.90	0.00
1.70	1.50	42.70	.64	2.85	22.40	12.71	65.16	77.60	83.97	2.00	0.00
1.80	1.60	49.50	.79	3.64	24.00	15.16	64.37	76.00	84.70	2.10	0.00
9.99	76.00	84.70	64.37	68.01	100.00	68.01	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 112

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 14 2" x 1/2"
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 72

ELCO MINING LTD ADIT NO.14 LAB NO.4024 .5" X 28M

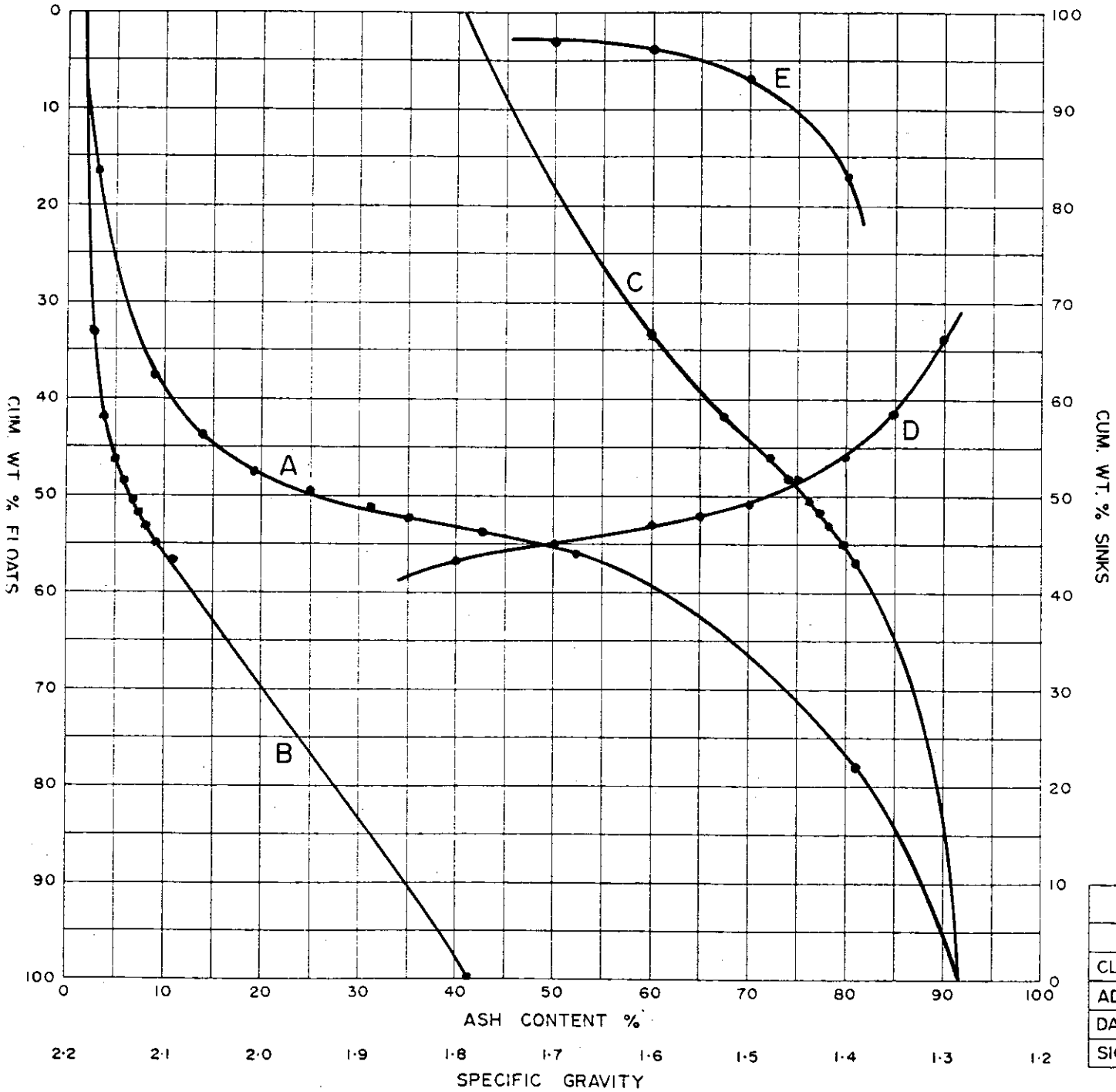
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		--0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	33.42	3.26	1.09	1.09	33.42	3.26	39.97	66.58	60.03	1.30	0.00
1.35	8.52	9.03	.77	1.86	41.94	4.43	39.20	58.06	67.51	1.40	17.16
1.40	4.27	14.23	.61	2.47	46.21	5.34	38.59	53.79	71.74	1.50	6.49
1.45	2.19	19.22	.42	2.89	48.40	5.97	38.17	51.60	73.97	1.60	4.17
1.50	2.17	25.37	.55	3.44	50.58	6.80	37.62	49.42	76.11	1.70	4.05
1.55	1.16	30.97	.36	3.80	51.74	7.34	37.26	48.26	77.19	1.80	0.00
1.60	.97	35.36	.34	4.14	52.71	7.86	36.91	47.29	78.05	1.90	0.00
1.70	2.04	43.21	.88	5.02	54.75	9.17	36.03	45.25	79.62	2.00	0.00
1.80	2.01	52.35	1.05	6.08	56.76	10.70	34.98	43.24	80.89	2.10	0.00
9.99	43.24	80.89	34.98	41.05	100.00	41.05	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 113

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 73

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 14 1/2" x 28M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO. 14 LAB NO.4024 .75" X 28M

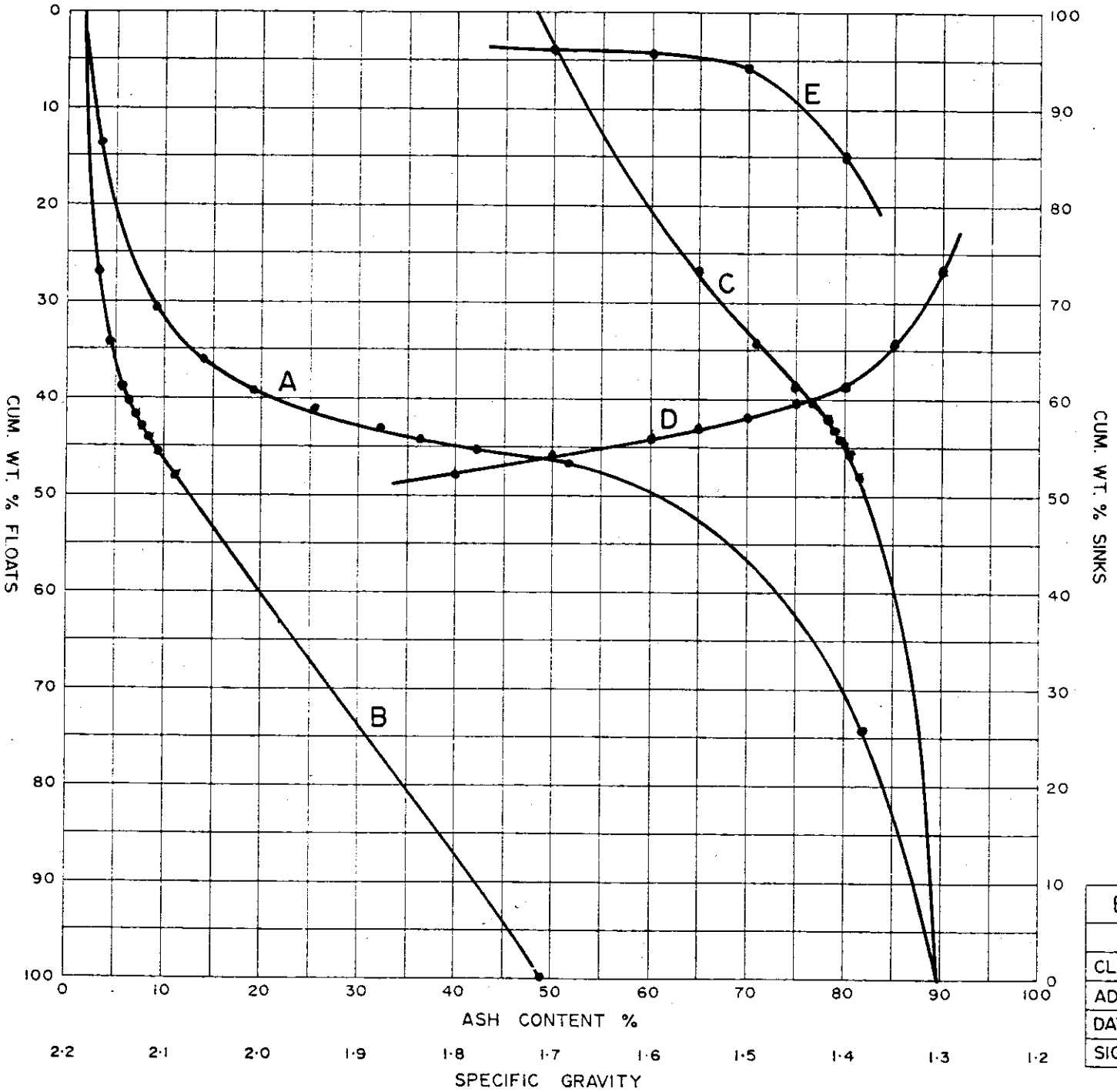
--DIRECT--					--CUM FLOATS--		--CUM SINKS--			--0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	27.10	3.30	.89	.89	27.10	3.30	47.46	72.90	65.10	1.30	0.00
1.35	7.30	9.00	.66	1.55	34.40	4.51	46.80	65.60	71.34	1.40	14.90
1.40	3.90	14.20	.55	2.11	38.30	5.50	46.25	61.70	74.95	1.50	5.80
1.45	1.90	19.50	.37	2.48	40.20	6.16	45.87	59.80	76.71	1.60	4.00
1.50	1.80	25.30	.46	2.93	42.00	6.98	45.42	58.00	78.31	1.70	3.80
1.55	1.20	30.60	.37	3.30	43.20	7.63	45.05	56.80	79.32	1.80	0.00
1.60	.90	35.60	.32	3.62	44.10	8.21	44.73	55.90	80.02	1.90	0.00
1.70	1.90	43.10	.82	4.44	46.00	9.65	43.91	54.00	81.32	2.00	0.00
1.80	1.90	51.70	.98	5.42	47.90	11.31	42.93	52.10	82.40	2.10	0.00
9.99	52.10	82.40	42.93	48.35	100.00	48.35	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 114

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 14 3/4" x 28 M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

FIGURE 74

ELCO MINING LTD ADIT NO.14 LAB NO.4024 28M X 65M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	29.30	2.60	.76	.76	29.30	2.60	26.81	70.70	37.93	1.30	0.00
1.35	23.70	4.40	1.04	1.80	53.00	3.40	25.77	47.00	54.83	1.40	36.00
1.40	5.80	10.30	.60	2.40	58.80	4.09	25.17	41.20	61.10	1.50	10.30
1.45	3.80	15.40	.59	2.99	62.60	4.77	24.59	37.40	65.75	1.60	6.40
1.50	2.70	19.40	.52	3.51	65.30	5.38	24.07	34.70	69.35	1.70	4.40
1.55	2.10	25.10	.53	4.04	67.40	5.99	23.54	32.60	72.20	1.80	0.00
1.60	1.70	29.10	.49	4.53	69.10	6.56	23.04	30.90	74.57	1.90	0.00
1.70	2.60	36.30	.94	5.48	71.70	7.64	22.10	28.30	78.09	2.00	0.00
1.80	1.80	44.10	.79	6.27	73.50	8.53	21.31	26.50	80.40	2.10	0.00
9.99	26.50	80.40	21.31	27.58	100.00	27.58	0.00	.00	0.00	2.20	0.00

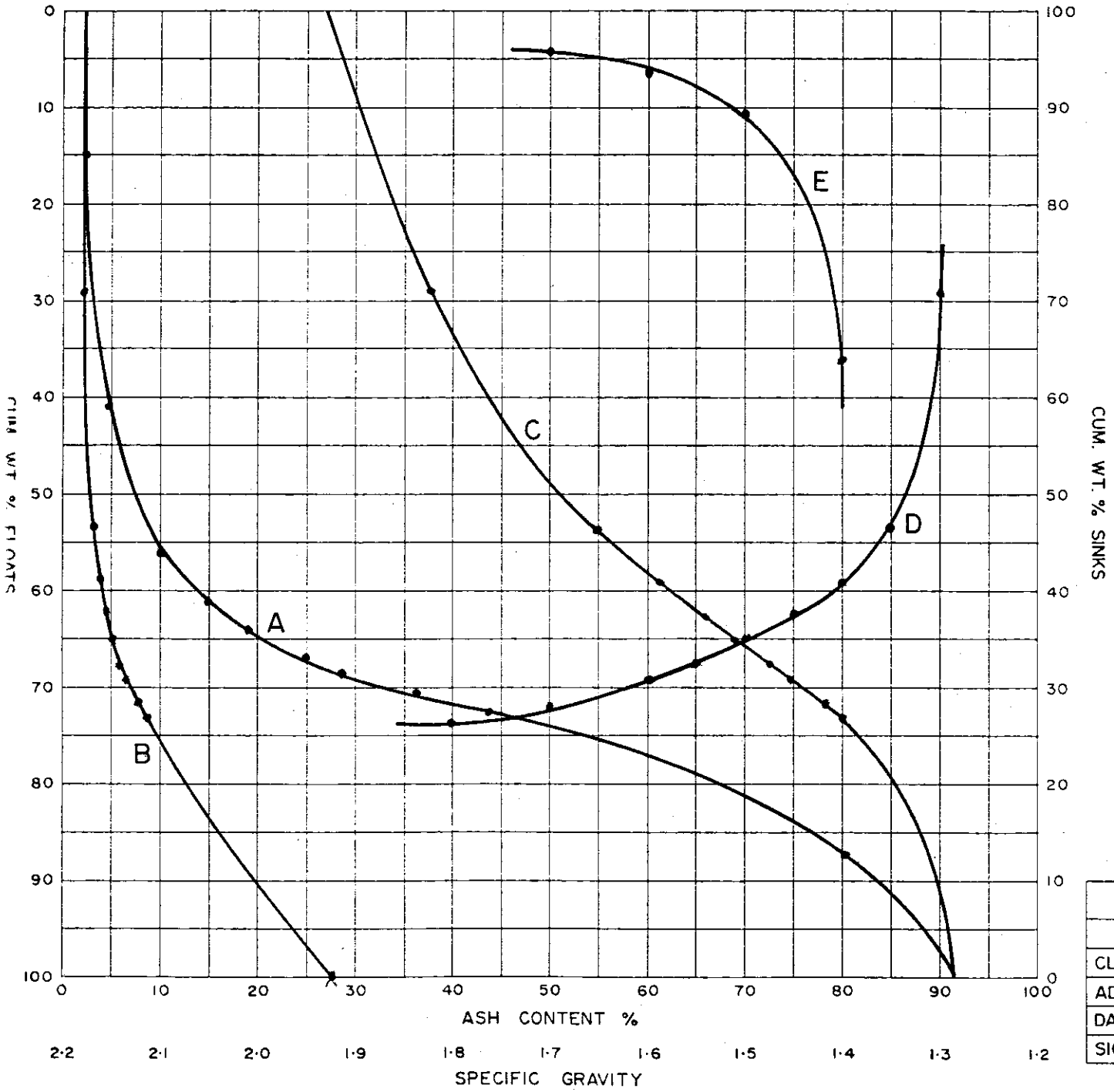
BIRTLEY ENGINEERING

TABLE 115

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 75

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 14 28M. x 65M
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 116

SAMPLE: Adit No. 14

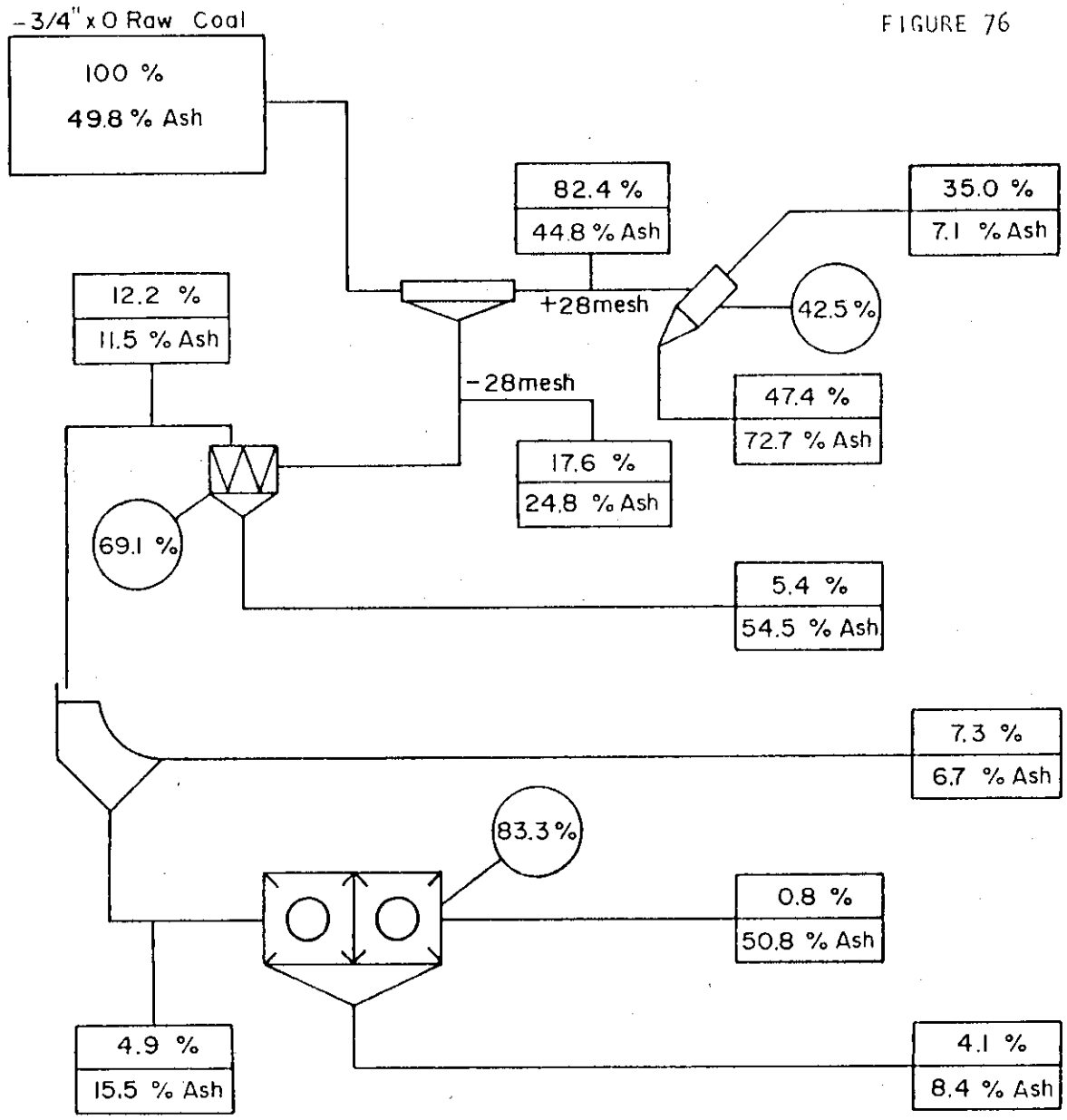
LAB. NO.: 4024

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
				DILATATION TEST				
SIZE FRAC.	F.S.I.	S %	P %	SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8 1/2	0.87	0.10	399	461	5	248	1.074
3/4" X 28M	9	0.78	0.07	392	453	23	218	1.062
28M X 65M	9	0.92	0.05	394	450	21	208	1.057

FROTH FLOTATION TEST 65M x 0										
									Cumulative	
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Wt %	Ash %
Stage I	24.6	9.5	0.8	24.4	65.3	.89	0.04	9	24.6	9.5
Stage II	10.7	15.1	0.7	23.7	60.5	.93	0.05	8 1/2	35.3	11.2
Tails	64.7	34.7	0.5	20.1	44.7	--	--	--	100.0	26.4

F. F. Parameters - See Adit No. 2

FIGURE 76



OVERALL YIELD = 46.4 %

LEGEND:

◯ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 14	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 14 LAB NO. 4023 DATE OF WASH September 29, 1975.

Raw Coal Analysis: Ash % 49.8 Hardgrove Grindability Index 64

Delivered Bulk Weight 20.9 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 14 LAB NO. 4023

1. S. G. of Separation (a) Washability 1.47
   (b) Plant 1.44
2. Feed Ash Content A.D.B. 44.8 %
3. Clean Coal Estimated Weight 2.48 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 7.1 % F.S.I. 8
5. Reject Estimated Weight 3.53 M.T.
6. Reject Analysis (A.D.B.) Ash 72.7 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 6.01
8. Actual 3/4" x 28 Mesh from Washability Data 82.4 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 41.3 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 42.5 %
11. Yield Clean Coal (Washability) 42.0 %
12. +2" Rock Oversize .544 M.T.

ELCO MINING LTD.

TABLE 117

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 14 LAB NO. 4023

1. Vortex Finder Clearance (VFC) 1.9 CM 0.75 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 70-110 g/l. 7-11 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	67.2	24.0	8	67.2	24.0	24.8	8
	65M x 100M (.15 CM)	9.7	19.3	8 1/2	76.9	23.4		
	100M x 0	23.1	32.6	7 1/2	100.0	25.5		
O'FLOW	+65M	59.6	-	-	59.6		11.5	9
	65M x 100M	12.2	-	-	71.8	7.4		
	100M x 0	28.2	21.9	8 1/2	100.0	11.5		
U'FLOW	+65M	77.5	-	-	77.5		54.5	3
	65M x 100M	10.3	-	-	87.8	52.7		
	100M x 0	12.2	67.5	1	100.0	54.5		
S B O	+65M	92.6	6.2	9	92.6	6.2	6.7	9
	65M x 100M	3.6	11.5	9	96.2	6.4		
	100M x 0	3.8	22.4	7 1/2	100.0	7.0		

6. Yield - Total W.O. Cyclone Circuit = 69.1

7. Est. Yield of 28 x 65 Mesh Coal = 41.2
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 118

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 14 LAB NO. 4073

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 120-150 g/l 12-15 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	20.5	8.4	9	20.5	8.4	15.5	8
	65M x 100M (.15 CM)	19.1	9.0	9	39.6	8.2		
	100M x 0	60.4	20.9	8	100.0	16.1		
CONC.	+65M (.21 CM)	19.3	5.5	9	19.3	5.5	8.4	9
	65M x 100M (.15 CM)	18.4	6.6	9	37.7	6.0		
	100M x 0	62.3	10.7	9	100.0	8.9		
TAILS	+65M (.21 CM)	43.5	33.6	6	43.5	37.6	50.8	3 1/2
	65M x 100M (.15 CM)	15.8	41.1	4	59.3	35.6		
	100M x 0	40.7	72.6	1	100.0	50.7		

4. Impeller Type - Denver

5. Yield Calculated (Ash Balance) 83.2 %

6. Yield (Washability) 20 %

7. 65M x 0 (Washability) 10.6 %

ELCO MINING LTD.

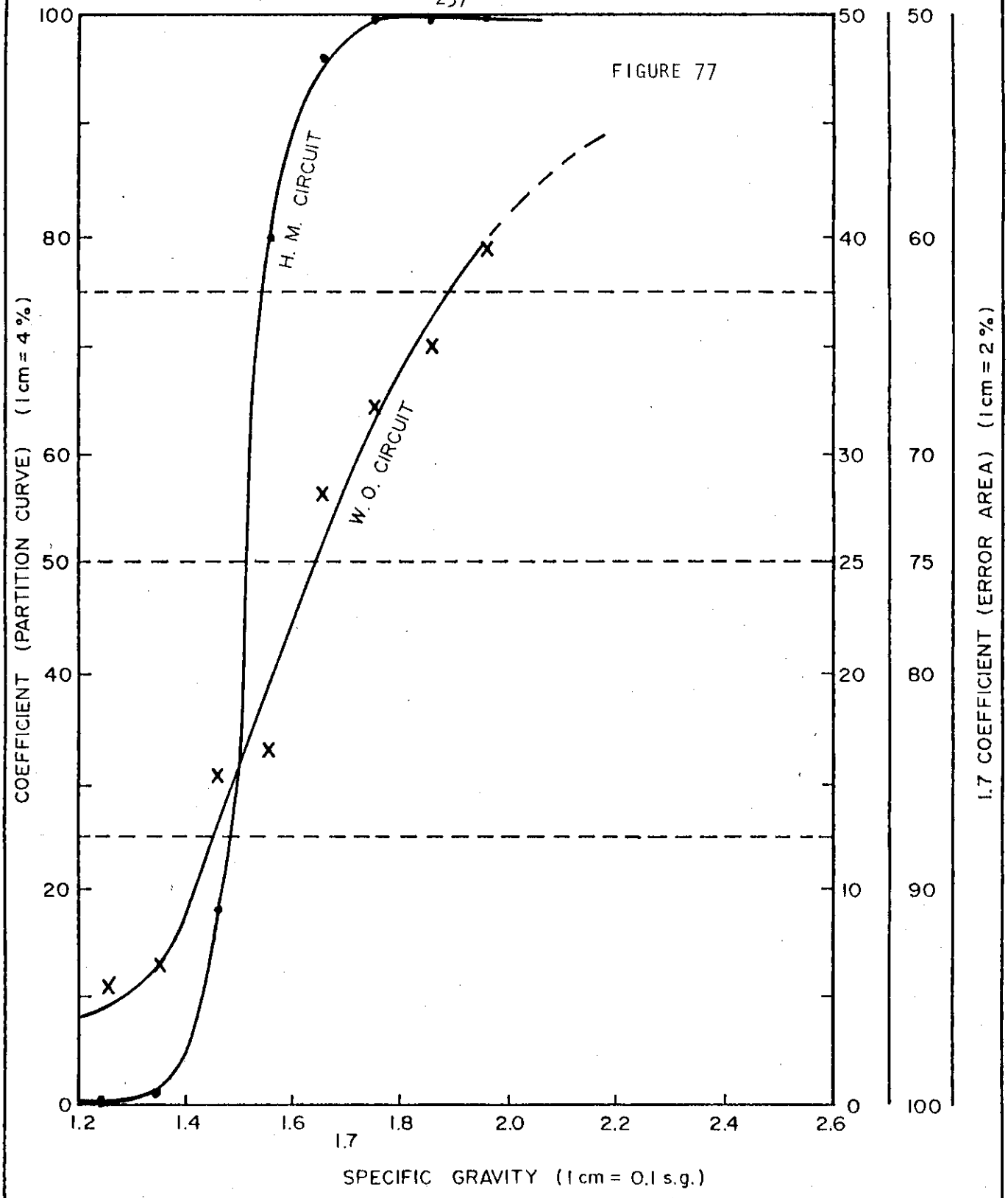
TABLE 119

BULK WASHING DATA

ADIT/SEAM NO. 14 LAB NO. 4073

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	63.4	63.4	0.2	0.2	60.6	60.6	14.9	14.9
1.30-1.40	27.5	90.9	0.2	0.4	16.2	76.8	4.5	19.4
1.40-1.50	7.4	98.3	1.2	1.6	8.8	85.6	7.2	26.6
1.50-1.60	1.3	99.6	3.8	5.4	6.5	92.1	6.0	32.6
1.60-1.70	0.2	99.2	4.1	9.5	3.2	95.3	7.8	40.4
1.70-1.80	-	-	3.9	13.4	1.7	97.0	5.6	46.0
1.80-1.90	-	-	4.2	17.6	1.2	98.2	5.2	51.2
1.90-2.00	-	-	5.4	23.0	0.6	98.8	4.2	55.4
+2.00	0.2	100.0	77.0	100.0	1.2	100.0	44.6	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 14	JAN. 10/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 14 LAB. NO. 4023 DATE OF WASH September 29, 1975.

a) Raw Coal

Delivered Wt.	=	20.9 M.T.
Ash %	=	49.8
Hardgrove Grindability Index	=	64
Estimated Washed Weight	=	7.3

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 82.4

Effective S. G. = 1.50

Raw Feed	44.8 %	Ash 5	F.S.I.
Clean Coal	7.1 %	Ash 8	F.S.I.
Reject	72.7 %	Ash 1/2	F.S.I.

Calculated Yield = 42.5

Weighed Yield = 41.3

c) Water-Only Cyclone Circuit

Raw Feed	24.8 %	Ash 8	F.S.I.
Overflow	11.5 %	Ash 9	F.S.I.
Underflow	54.5 %	Ash 3	F.S.I.

Calculated Yield = 69.1

% of +65 Mesh in O/F = 59.6

Sieve Bend Overflow	6.7 %	Ash 9	F.S.I.

d) Froth Flotation Circuit

Raw Feed	15.5 %	Ash 8	F.S.I.
Concentrates	8.4 %	Ash 9	F.S.I.
Tails	50.8 %	Ash 3 1/2	F.S.I.

Calculated Yield = 83.3

ELCO MINING LTD.

TABLE 120

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 14 LAB. NO. 4023

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 1.2 ASH % 7.8 VM % 24.8 FC % 66.2 S% 0.83 FSI 9

(ii) Dilatometer

Softening °C ____ Max. Dil. °C ____ Max Cont. % ____

Max. Dil. % ____ G. No. = ____

(iii) Hardgrove Grindability Index = 100

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
7	1.19	8	1.36	3	0.51	0.6	0.102			0.4	19	3.23

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 121

SAMPLE: Clean Coal - Adit No. 14

LAB. NO.: 4023

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
1.2	7.8	24.8	66.2	9	100

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.0	4.0
1/2" X 1/4"	21.3	25.3
1/4" X 8M	21.2	46.5
8M X 28M	29.1	75.6
28M X 65M	10.5	86.1
65M X 0	13.9	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
394	458	23	209	1.064

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.66	80.41	4.87	1.66	0.84	7.85	3.71

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.07	0.60	0.30	1.54	8.15	23.82	59.36	0.46	1.48	2.06

SAMPLE: Adit No. 15

LAB. NO.: 4022

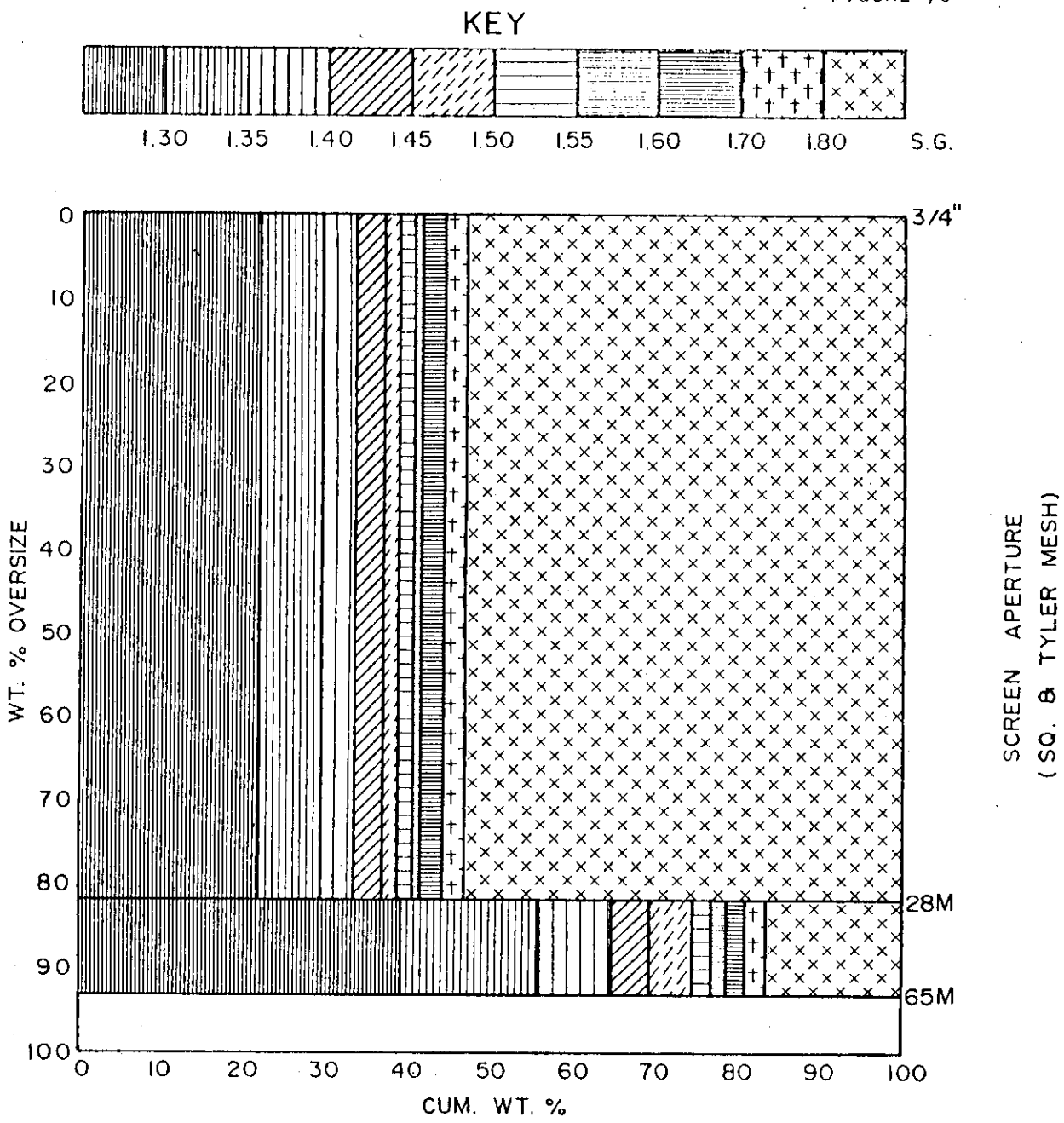
TABLE 122

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.8	44.3	17.7	37.2	0.63	8100	78	oxid.	1430	1470	1470+	-
							red.	1355	1440	1455	1455+

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	34.1	61.2	0.6	13.9	24.3	0.45	67	-	-
	1/2" X 0	65.9	-	-	-	-	-	-	-	-
II	3/4" X 28M	82.0	46.8	0.8	17.0	35.4	0.96	69	82.0	46.8
	28M X 65M	11.9	21.7	0.9	22.3	55.1	0.75	139	93.9	43.6
	65M X 100M	1.2	21.8	-	-	-	-	-	95.1	43.3
	100M X 200M	3.5	21.1	-	-	-	-	-	98.6	42.6
	200M X 0	1.4	23.6	-	-	-	-	-	100.0	42.3
III	65M X 0	6.1	21.9	0.9	22.4	54.8	0.92	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 11.1
II - Size consist of raw coal crushed to - 3/4", WT. % 3/4" X 1/2" = 2.0%
III - 65M X 0 off II

FIGURE 78



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT Nº	ADIT 15
DATE	NOV. 13/75	SIGNED	L Bailey

ELCO MINING LTD ADIT NO.15 LAB NO.4022 2" X .5"

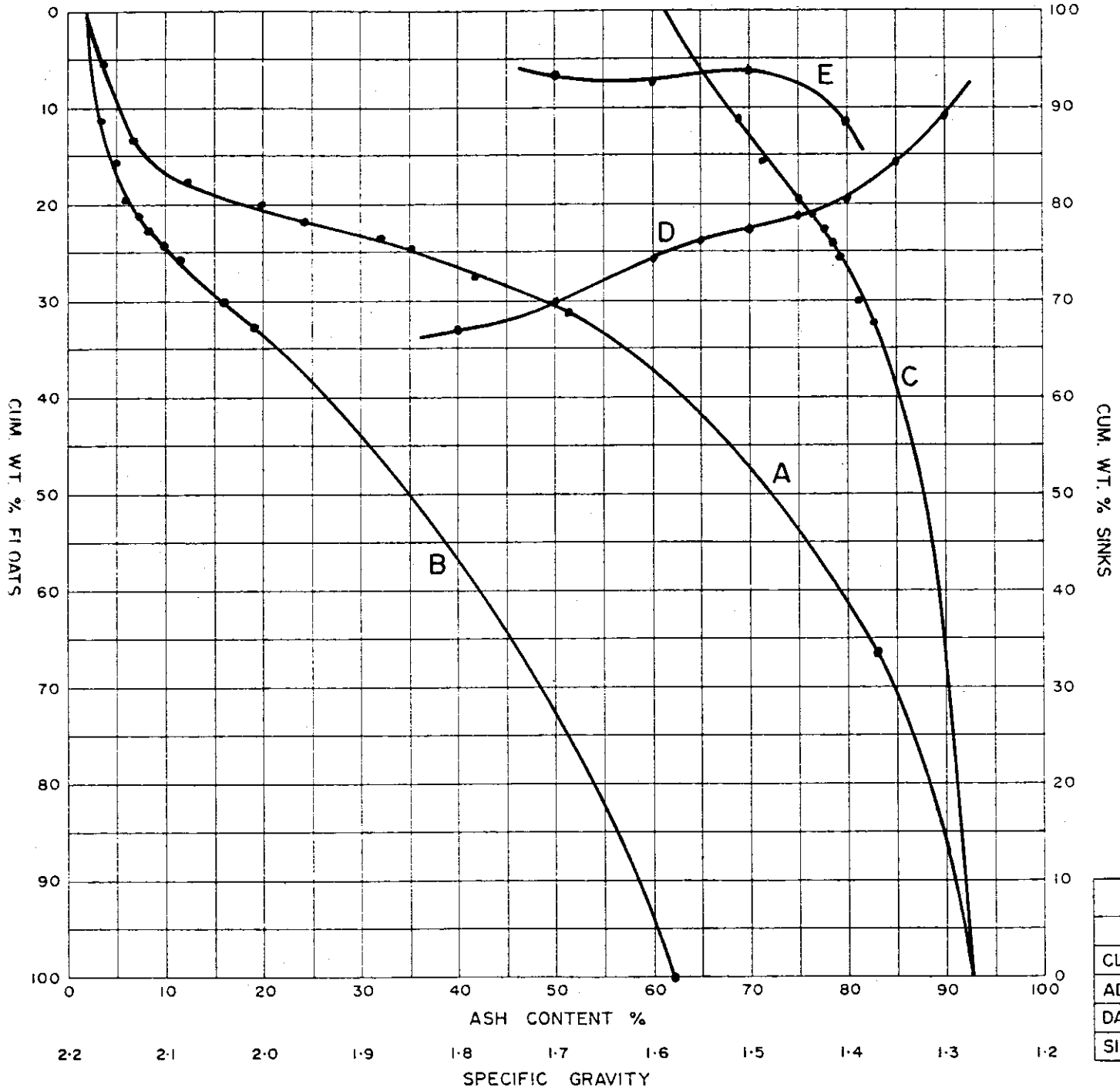
---DIRECT---					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	11.20	4.20	.47	.47	11.20	4.20	61.56	88.80	69.33	1.30	0.00
1.35	4.40	7.10	.31	.78	15.60	5.02	61.25	84.40	72.57	1.40	11.10
~ 1.40	3.80	12.00	.46	1.24	19.40	6.39	60.79	80.60	75.43	1.50	6.20
1.45	1.60	20.10	.32	1.56	21.00	7.43	60.47	79.00	76.55	1.60	7.40
1.50	1.30	24.60	.32	1.88	22.30	8.43	60.15	77.70	77.42	1.70	6.90
1.55	1.70	32.00	.54	2.42	24.00	10.10	59.61	76.00	78.43	1.80	0.00
1.60	1.60	35.20	.56	2.99	25.60	11.67	59.04	74.40	79.36	1.90	0.00
~ 1.70	4.10	41.70	1.71	4.70	29.70	15.82	57.33	70.30	81.56	2.00	0.00
1.80	2.80	51.60	1.44	6.14	32.50	18.90	55.89	67.50	82.80	2.10	0.00
~ 9.99	67.50	82.80	55.89	62.03	100.00	62.03	0.00	0.00	I	2.20	0.00

BIRTLEY ENGINEERING

TABLE 123

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 15 2" x 1/2"
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

FIGURE 79

ELCO MINING LTD ADIT NO.15 LAB NO.4022 .5" X 28M

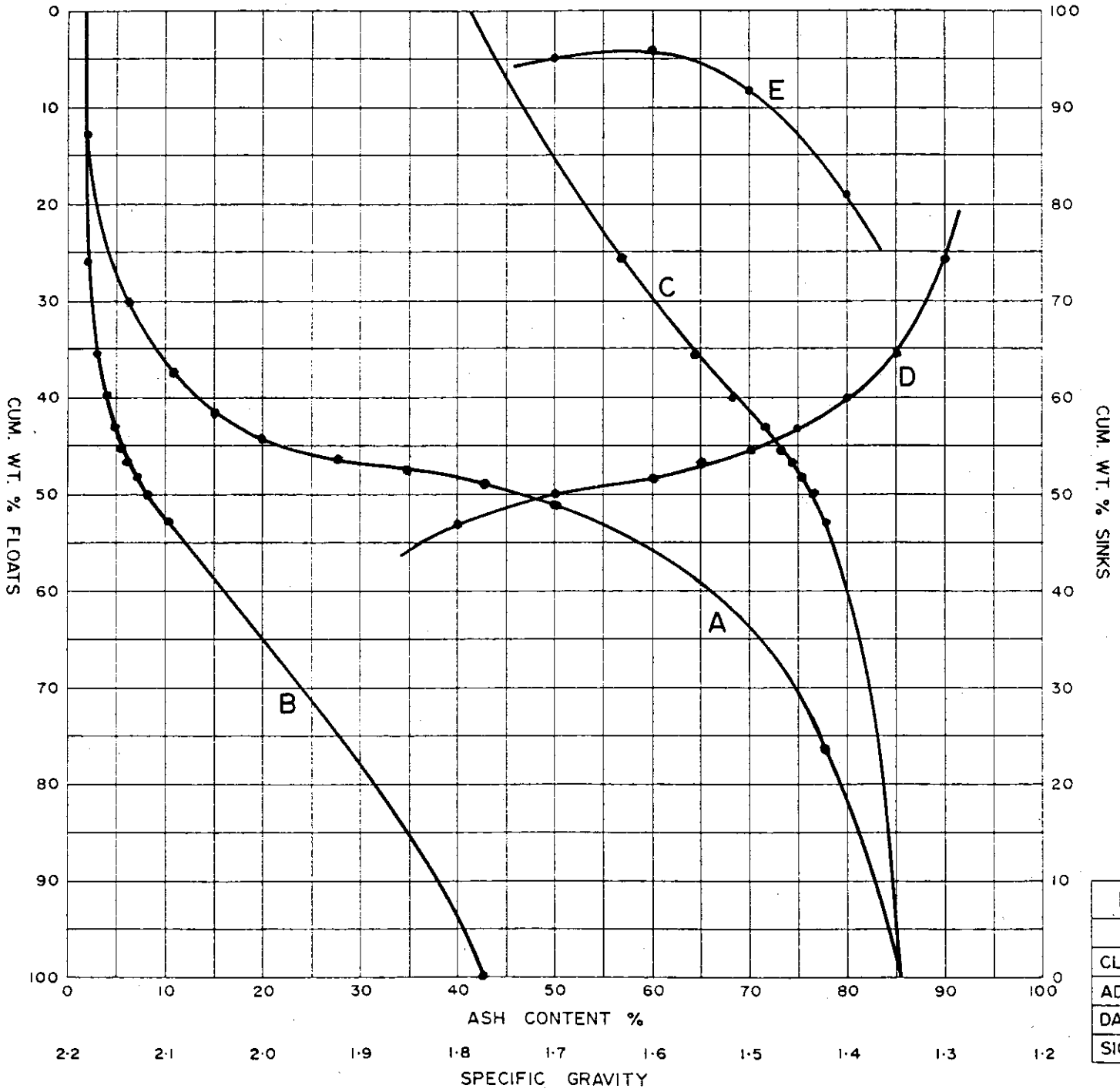
--DIRECT--			--CUM FLOATS--			--CUM SINKS--			+-0.1 DISTR		
S.G.	WT%	ASH%	WT% ASH TT	CUM WT% ASHTT	WT%	SINK WT ASH%	ASH%	WT%	ASH%	S.G.	WT%
1	2	3	4	5	6	7	8	9	10	11	12
1.30	26.36	1.96	.52	.52	26.36	1.96	42.09	73.64	57.15	1.30	0.00
1.35	9.07	6.14	.56	1.07	35.43	3.03	41.53	64.57	64.32	1.40	19.16
1.40	4.36	10.77	.47	1.54	39.79	3.88	41.06	60.21	68.19	1.50	8.03
1.45	3.58	15.24	.55	2.09	43.37	4.82	40.51	56.63	71.54	1.60	4.56
1.50	2.15	20.22	.43	2.52	45.52	5.54	40.08	54.48	73.57	1.70	5.06
1.55	1.27	28.11	.36	2.88	46.79	6.16	39.72	53.21	74.65	1.80	0.00
1.60	1.03	34.87	.36	3.24	47.82	6.78	39.36	52.18	75.44	1.90	0.00
1.70	2.26	43.10	.97	4.21	50.08	8.42	38.39	49.92	76.90	2.00	0.00
1.80	2.30	50.18	1.41	5.62	52.38	10.63	36.98	47.12	78.49	2.10	0.00
9.99	47.12	78.49	36.98	42.60	100.00	42.60	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 124

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 15 1/2" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

FIGURE 80

ELCO MINING LTD ADIT NO.15 LAB NO.4022 .75" X 28M

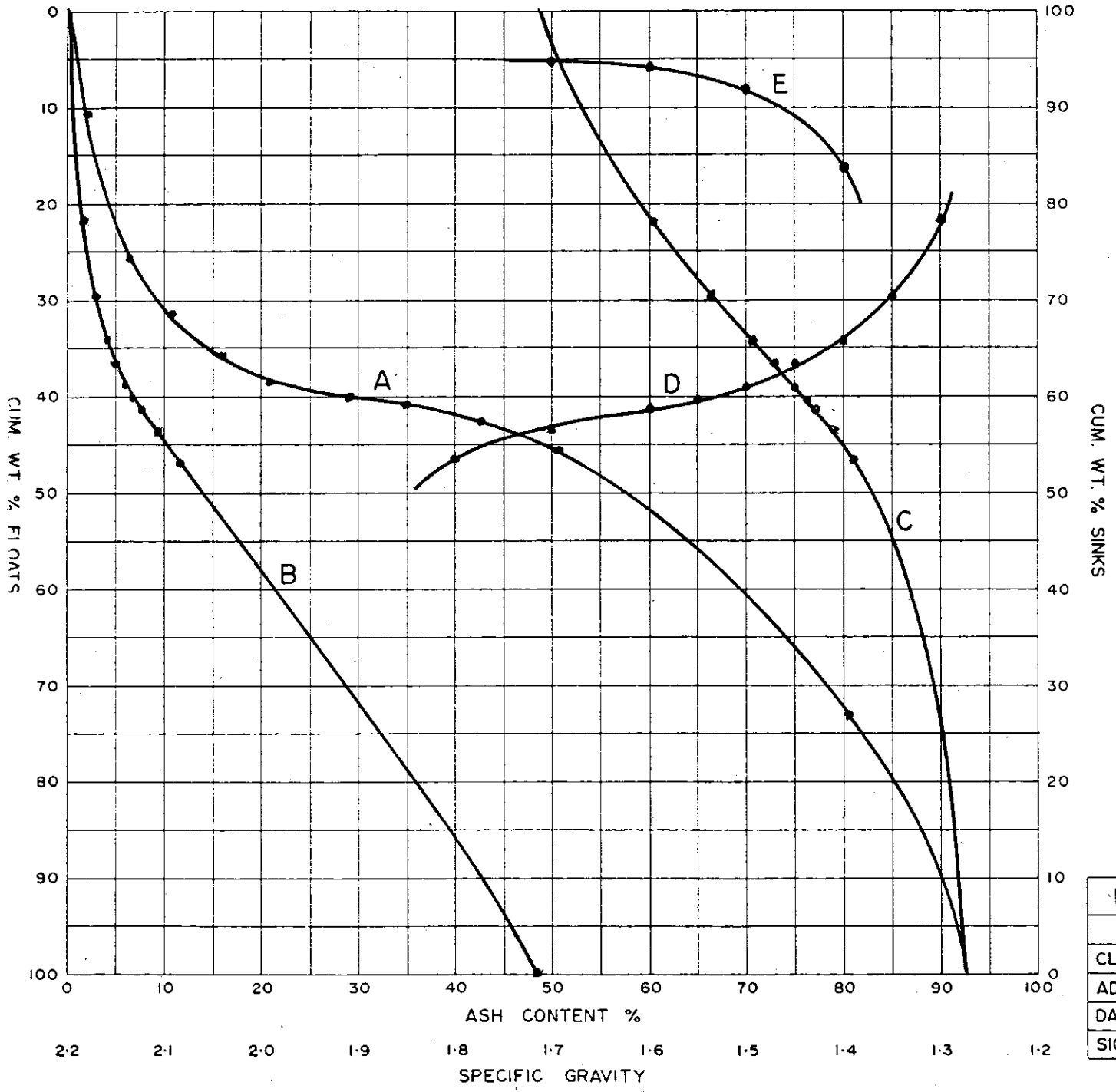
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	21.90	2.30	.50	.50	21.90	2.30	47.81	78.10	61.21	1.30	0.00
1.35	7.70	6.30	.49	.99	29.60	3.34	47.32	70.40	67.22	1.40	16.80
1.40	4.20	11.10	.47	1.46	33.80	4.30	46.85	66.20	70.78	1.50	7.50
1.45	3.00	16.00	.48	1.94	36.80	5.26	46.37	63.20	73.38	1.60	5.40
1.50	1.90	21.10	.40	2.34	38.70	6.04	45.97	61.30	75.00	1.70	5.60
1.55	1.40	29.50	.41	2.75	40.10	6.86	45.56	59.90	76.06	1.80	0.00
1.60	1.20	35.00	.42	3.17	41.30	7.67	45.14	58.70	76.90	1.90	0.00
1.70	2.80	42.50	1.19	4.36	44.10	9.88	43.95	55.90	78.62	2.00	0.00
1.80	2.80	50.60	1.42	5.78	46.90	12.31	42.53	53.10	80.10	2.10	0.00
9.99	53.10	80.10	42.53	48.31	100.00	48.31	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 125

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 15 3/4" x 28M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 81

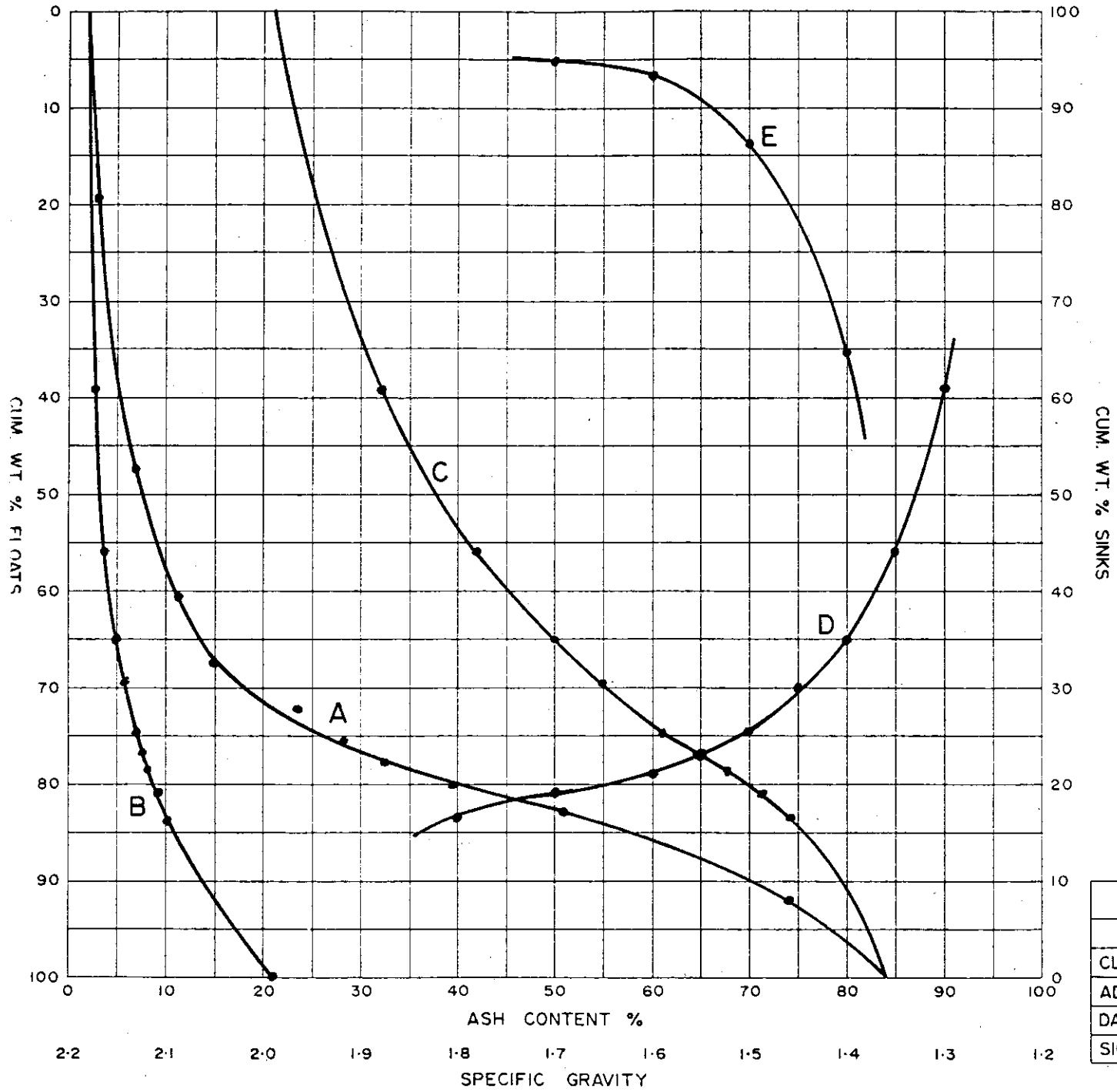
ELCO MONING LTD ANIT NO.15 LAB NO.4022 28M X 65M

	--DIRECT--				--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH	TT ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	39.10	3.20	1.25	1.25	39.10	3.20	19.73	60.90	32.39	1.30	0.00
~ 1.35	16.90	6.70	1.13	2.38	56.00	4.26	18.59	44.00	42.26	1.40	35.50
1.40	9.10	11.60	1.06	3.44	65.10	5.28	17.54	34.90	50.25	1.50	13.40
1.45	4.40	14.90	.66	4.09	69.50	5.89	16.88	30.50	55.35	1.60	6.60
~ 1.50	5.10	24.30	1.24	5.33	74.60	7.15	15.64	25.40	61.58	1.70	5.10
1.55	2.20	27.30	.61	5.95	76.80	7.74	15.03	23.20	64.79	1.80	0.00
1.60	1.70	32.50	.55	6.50	78.50	8.28	14.48	21.50	67.34	1.90	0.00
1.70	2.70	39.60	1.07	7.57	81.20	9.32	13.41	18.80	71.33	2.00	0.00
1.80	2.40	51.00	1.22	8.79	83.60	10.52	12.19	16.40	74.30	2.10	0.00
9.99	16.40	74.30	12.19	20.98	100.00	20.98	0.00	0.00	I	2.20	0.00

BIRTLEY ENGINEERING

TABLE 126

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 82

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 15 28M. x 65M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 127

SAMPLE: Adit No. 15

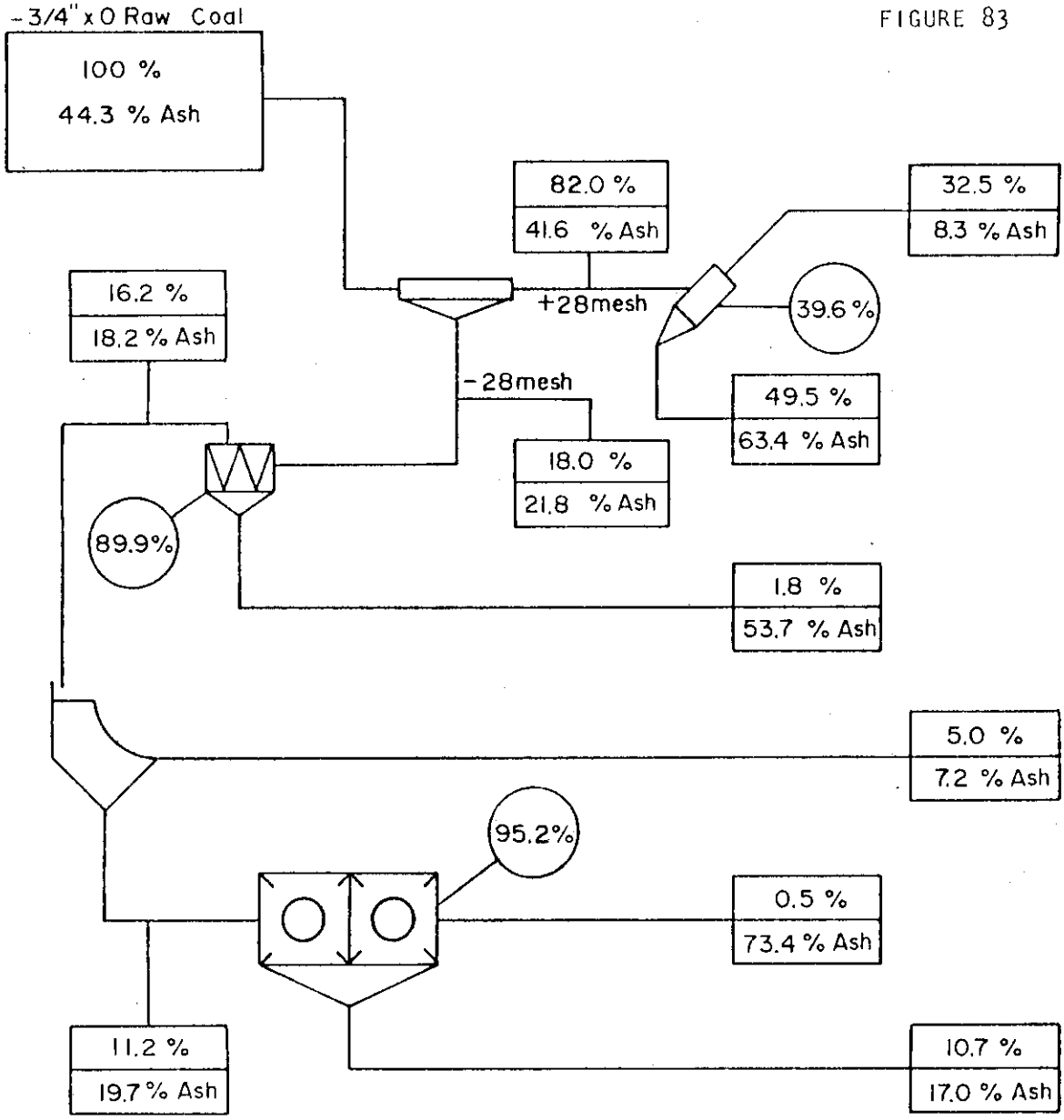
LAB. NO.: 4022

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8	0.88	0.07	399	466	5	96	1.075
3/4" X 28M	8 1/2	0.80	0.05					
28M X 65M	9	1.02	0.04	397	459	19	137	1.058

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I	Cumulative	
									Wt %	Ash %
Stage I	51.8	8.8	0.6	25.3	65.3	.72	0.03	9	51.8	8.8
Stage II	9.9	18.3	0.7	23.1	57.9	.78	0.04	7 1/2	61.7	10.3
Tails	38.3	38.1	0.8	20.3	40.8	--	--	--	100.0	21.0

F. F. Parameters - See Adit No. 2

FIGURE 83



OVERALL YIELD = 48.2 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 15	DEC. 22 / 75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 15 LAB NO. 4021 DATE OF WASH September 27, 1975.

Raw Coal Analysis: Ash % 44.3 Hardgrove Grindability Index 78

Delivered Bulk Weight 20.4 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 15 LAB NO. 4021

1. S. G. of Separation (a) Washability 1.59
   (b) Plant 1.40
2. Feed Ash Content A.D.B. 41.6 %
3. Clean Coal Estimated Weight 2.46 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.3 % F.S.I. 9
5. Reject Estimated Weight 2.98 M.T.
6. Reject Analysis (A.D.B.) Ash 63.4 % FSI 1
7. Estimated 3/4" x 28M In Circuit (3+5) 5.44
8. Actual 3/4" x 28 Mesh from Washability Data 82.0 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 45.2 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 39.6 %
11. Yield Clean Coal (Washability) 42 %
12. +2" Rock Oversize .544 M.T.

ELCO MINING LTD.

TABLE 128

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 15 LAB NO. 4021

1. Vortex Finder Clearance (VFC) 5.7 CM 2.25 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 70-110 g/l. 7-11 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)						21.8 (estimated)	
	65M x 100M (.15 CM)							
	100M x 0							
O'FLOW	+65M						18.2 (estimated)	
	65M x 100M							
	100M x 0							
U'FLOW	+65M	72.9			72.9		53.7	2 1/2
	65M x 100M	8.4			82.3	49.9		
	100M x 0	17.7	71.3	1	100.0	53.7		
S B O	+65M	86.7	6.6	9	86.7	6.6	7.2	9
	65M x 100M	6.6	9.7	9	93.3	6.8		
	100M x 0	6.7	17.8	7 1/2	100.0	7.6		

6. Yield - Total W.O. Cyclone Circuit = 89.9

7. Est. Yield of 28 x 65 Mesh Coal = 27.9 (estimated)
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 129

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 15 LAB NO. 4021

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-200 g/l 15-20 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	13.5	8.1	9	13.5	8.1	19.7	8 1/2
	65M x 100M (.15 CM)	20.3	9.3	8 1/2	33.8	8.8		
	100M x 0	66.2	23.6	8	100.0	18.6		
CONC.	+65M (.21 CM)	17.3	11.0	8 1/2	17.3	11.0	17.0	8 1/2
	65M x 100M (.15 CM)	22.6	10.6	9	39.9	10.8		
	100M x 0	60.4	19.0	7 1/2	100.0	15.7		
TAILS	+65M (.21 CM)	21.7	46.5	2	21.7	46.5	73.4	1
	65M x 100M (.15 CM)	10.6	45.3	3 1/2	32.3	46.1		
	100M x 0	67.7	85.0	1/2	100.0	72.4		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 95.2 %

6. Yield (Washability) 90 %

7. 65M x 0 (Washability) 6.1 %

ELCO MINING LTD.

TABLE 130

BULK WASHING DATA

ADIT/SEAM NO. 15 LAB NO. 4021

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30			0.1	0.1			2.1	2.1
1.30-1.40			0.5	0.6			4.8	6.9
1.40-1.50			2.1	2.7			13.5	20.4
1.50-1.60			3.0	5.7			16.4	36.8
1.60-1.70			4.3	10.0			7.4	44.2
1.70-1.80			4.8	14.8			5.8	50.0
1.80-1.90			4.6	19.4			5.6	55.6
1.90-2.00			6.4	26.3			5.6	61.2
+2.00			73.7	100.0			38.8	100.0

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 15 LAB. NO. 4021 DATE OF WASH September 27, 1975.

a) Raw Coal

Delivered Wt. = 20.4 M.T.
Ash % = 44.3
Hardgrove Grindability Index = 78
Estimated Washed Weight = 6.63

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 82 %
Effective S. G. =

Raw Feed	41.6 %	Ash 5	F.S.I.
Clean Coal	8.3 %	Ash 9	F.S.I.
Reject	63.4 %	Ash 1	F.S.I.

Calculated Yield = 39.6 %
Weighed Yield = 45.2 %

c) Water-Only Cyclone Circuit

Raw Feed	(estimated) 21.8 %	Ash	F.S.I.
Overflow	(estimated) 18.2 %	Ash	F.S.I.
Underflow	53.7 %	Ash 2 1/2	F.S.I.

Calculated Yield = 89.9
% of +65 Mesh in O/F = 31 (estimated)

Sieve Bend Overflow	7.2 %	Ash 9	F.S.I.

d) Froth Flotation Circuit

Raw Feed	19.7 %	Ash 8 1/2	F.S.I.
Concentrates	17.0 %	Ash 9	F.S.I.
Tails	73.4 %	Ash 1 1/2	F.S.I.

Calculated Yield = 95.2 %

ELCO MINING LTD.

TABLE 131

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 15 LAB. NO. 4021

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 0.9 ASH % 7.8 VM % 24.8 FC % 66.5 S% 0.85 FSI 8 1/2

(ii) Dilatometer

Softening °C ____ Max. Dil. °C ____ Max Cont. % ____

Max. Dil. % ____ G. No. = ____

(iii) Hardgrove Grindability Index = 100

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
5	1.02	7	1.43	3	0.61	0.6	0.122			0.4	16	3.26

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 132

SAMPLE: Clean Coal -Adit No. 15

LAB. NO.: 4021

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.9	7.8	24.8	66.5	8 1/2	100

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.3	4.3
1/2" X 1/4"	21.8	26.1
1/4" X 8M	14.9	41.0
8M X 28M	23.3	64.3
28M X 65M	14.8	79.1
65M X 0	20.9	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
384	459	30	105	1.052

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.58	80.60	4.77	1.60	0.75	7.74 ~~74.7~~	3.96

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.07	0.57	0.27	1.36	8.51	23.44	60.30	0.48	1.28	2.39

SAMPLE: Adit No. 16

LAB. NO.: 4479

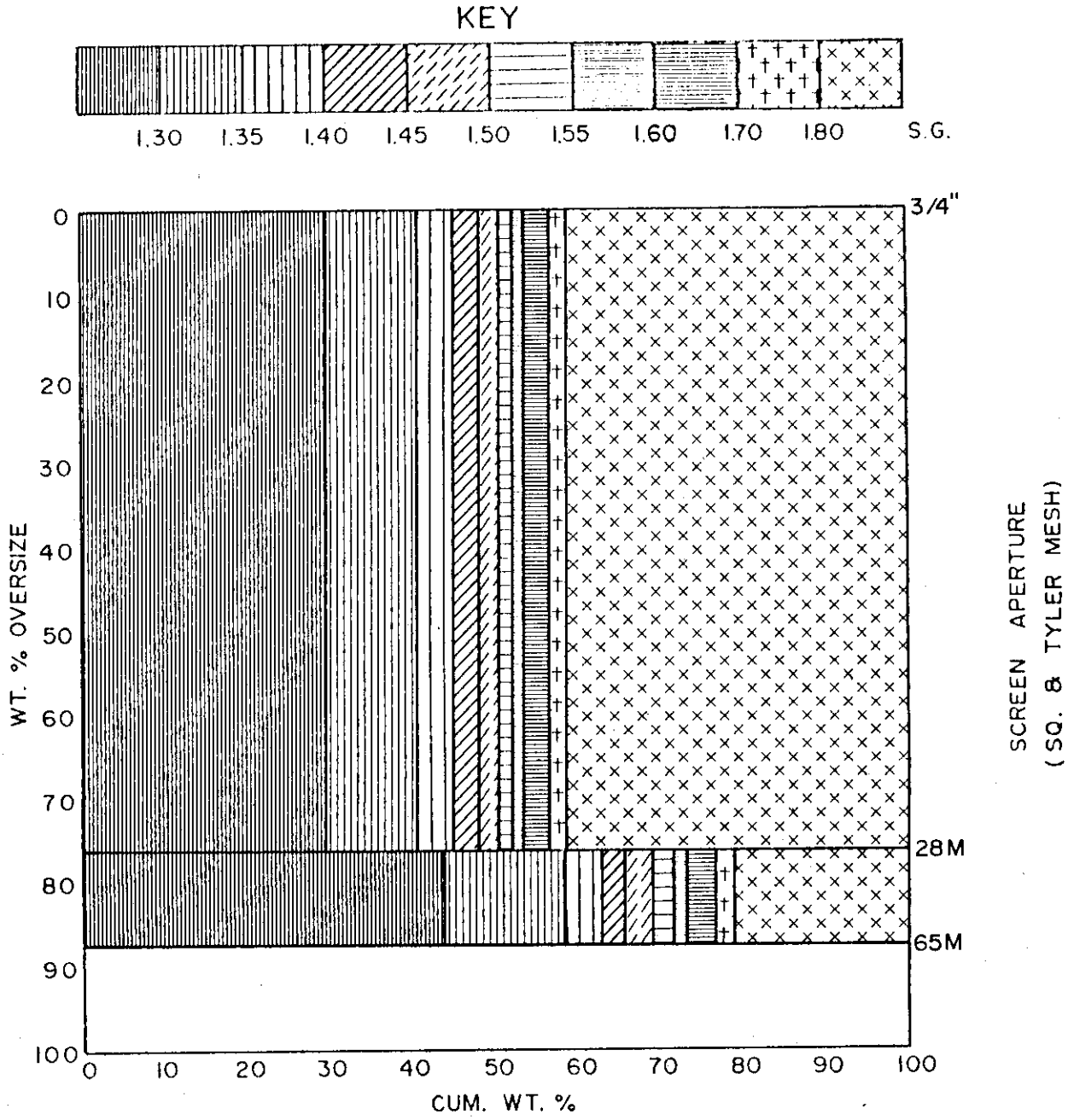
TABLE 133

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.7	39.7	19.9	39.7	0.78	8890	77	oxid.	1390	1470	1470+	-
							red.	1300	1400	1455	1470+

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	28.9	62.2	1.3	13.6	22.9	0.57	59	-	-
	1/2" X 0	71.1	-	-	-	-	-	-	-	-
II	3/4" X 28M	76.4	42.6	0.7	19.3	37.4	0.65		76.4	42.6
	28M X 65M	11.3	25.0	0.8	23.9	50.3	0.78	-	87.7	40.3
	65M X 100M	4.5	21.6	-	-	-	-	-	92.2	39.4
	100M X 200M	4.2	20.9	-	-	-	-	-	96.4	38.6
	200M X 0	3.6	22.2	-	-	-	-	-	100.0	38.0
III	65M X 0	12.3	20.9	0.8	24.6	53.7	0.98	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 13.9%
II - Size consist of raw coal crushed to - 3/4". WT. % 1/2" X 28M(-2") = 51.6%
III - 65M X 0 off II

FIGURE 84



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT №	ADIT 16
DATE	NOV. 13/75	SIGNED	L. BAILEY

TABLE 134

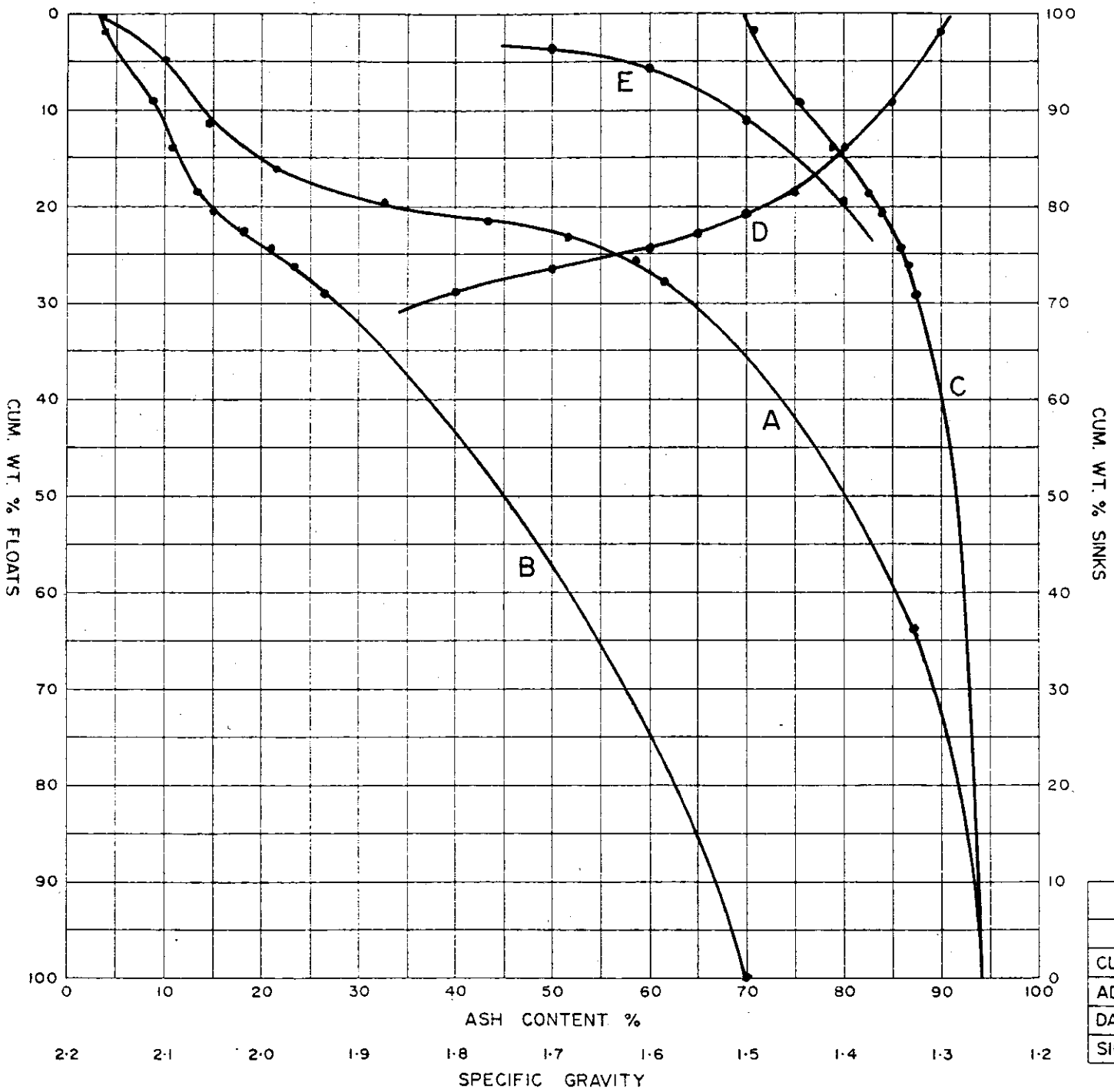
ELCO MINING LTD ADIT NO.16 LAB NO.4479 2" X .5"

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
			WT> ASH	CUM WT> ASHTT			SINK WT ASH>				
S.G.	WT>	ASH>			WT>	ASH>		WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	1.23	3.80	.05	.05	1.23	3.80	69.72	98.77	70.59	1.30	0.00
1.35	7.89	9.80	.77	.82	9.12	8.99	68.95	90.88	75.87	1.40	19.44
1.40	4.67	14.60	.68	1.50	13.79	10.89	68.26	86.21	79.18	1.50	10.89
1.45	4.44	21.70	.96	2.47	18.23	13.52	67.30	81.77	82.31	1.60	5.78
1.50	2.44	32.60	.80	3.26	20.68	15.78	66.50	79.32	83.84	1.70	4.00
1.55	2.00	43.70	.87	4.14	22.68	18.24	65.63	77.32	84.87	1.80	0.00
1.60	2.00	51.50	1.03	5.17	24.68	20.94	64.60	75.32	85.76	1.90	0.00
1.70	1.78	58.60	1.04	6.21	26.45	23.47	63.56	73.55	86.42	2.00	0.00
1.80	2.22	61.80	1.36	7.57	28.67	26.40	62.20	71.33	87.20	2.10	0.00
9.99	71.33	87.20	62.20	69.77	100.00	69.77	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

FIGURE 85

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 16 2" x 1/2"
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MININGLTD ADIT NO.16 LAB NO.4479 .5" X 28M

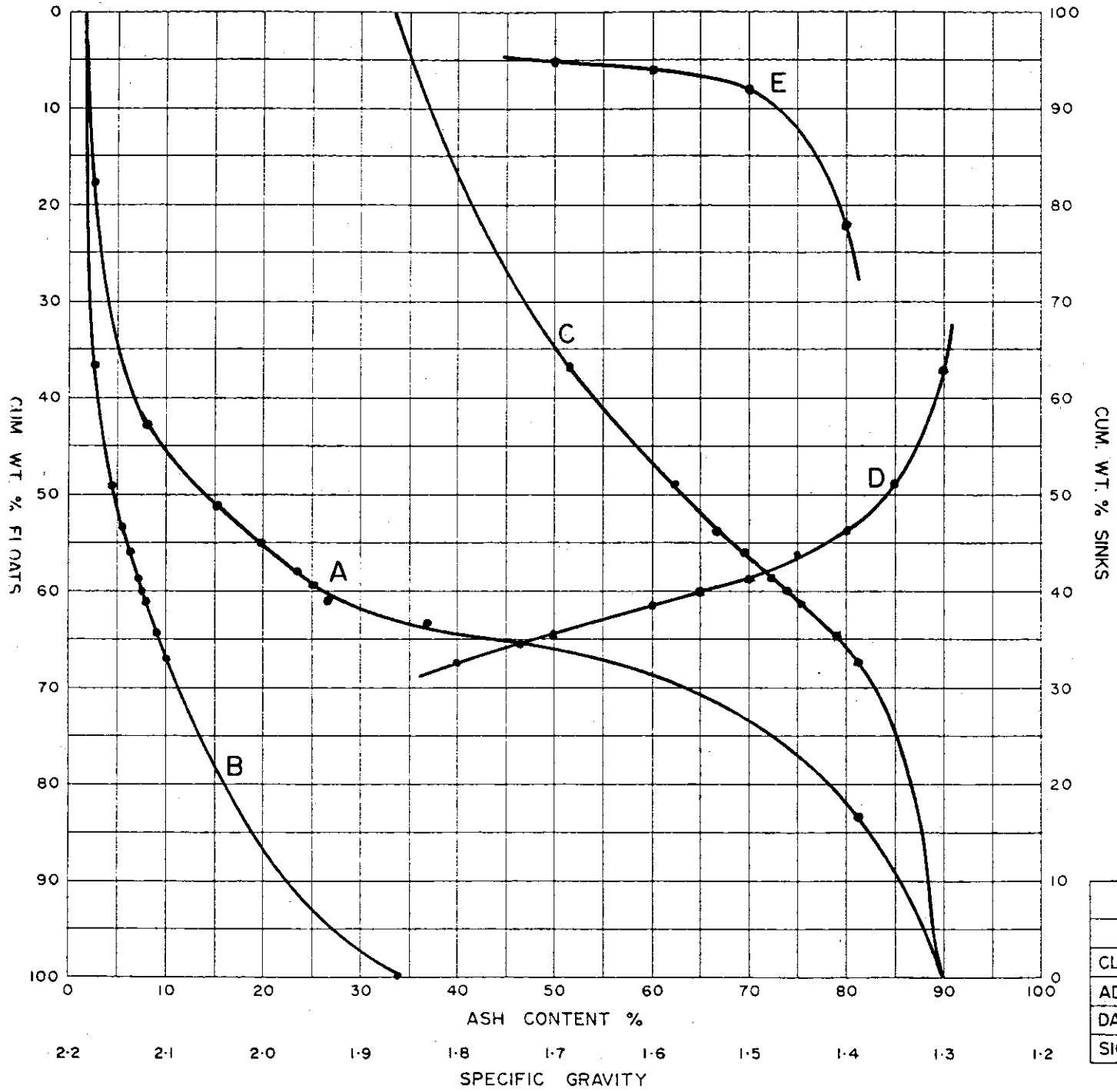
---DIRECT---					---CUM FLOATS---		---CUM SINKS---		+--0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	36.58	3.13	1.15	1.15	36.58	3.13	32.72	63.42	51.60	1.30	0.00
1.35	12.19	8.33	1.02	2.16	48.77	4.43	31.71	51.23	61.90	1.40	22.03
1.40	4.75	15.40	.73	2.89	53.52	5.40	30.98	46.48	66.65	1.50	7.86
1.45	2.62	19.96	.52	3.41	56.14	6.08	30.45	43.86	69.43	1.60	5.93
1.50	2.47	23.65	.58	4.00	58.61	6.82	29.87	41.39	72.17	1.70	5.30
1.55	1.52	25.04	.38	4.38	60.13	7.28	29.49	39.87	73.96	1.80	0.00
1.60	1.25	26.01	.33	4.70	61.38	7.66	29.16	38.62	75.51	1.90	0.00
1.70	3.16	37.11	1.17	5.88	64.54	9.11	27.99	35.46	78.93	2.00	0.00
1.80	2.14	47.08	1.01	6.88	66.68	10.32	26.99	33.32	80.98	2.10	0.00
9.99	33.32	80.98	26.99	33.87	100.00	33.87	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 135

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 16 1/2" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

FIGURE 86

ELCO MINING LTD ADIT NO.16 LAB NO.4479 .75" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	29.60	3.20	.95	.95	29.60	3.20	40.96	70.40	58.18	1.30	0.00
1.35	10.80	8.60	.93	1.88	40.40	4.64	40.03	59.60	67.16	1.40	20.80
1.40	4.60	15.20	.70	2.58	45.00	5.72	39.33	55.00	71.51	1.50	8.40
1.45	3.00	20.60	.62	3.19	48.00	6.65	38.71	52.00	74.45	1.60	5.70
1.50	2.40	25.90	.62	3.81	50.40	7.57	38.09	49.60	76.80	1.70	4.80
1.55	1.60	30.80	.49	4.31	52.00	8.28	37.60	48.00	78.33	1.80	0.00
1.60	1.40	35.00	.49	4.80	53.40	8.98	37.11	46.60	79.63	1.90	0.00
1.70	2.70	40.60	1.10	5.89	56.10	10.51	36.01	43.90	82.03	2.00	0.00
1.80	2.10	50.80	1.07	6.96	58.20	11.96	34.94	41.80	83.60	2.10	0.00
9.99	41.80	83.60	34.94	41.91	100.00	41.91	0.00	.00	0.00	2.20	0.00

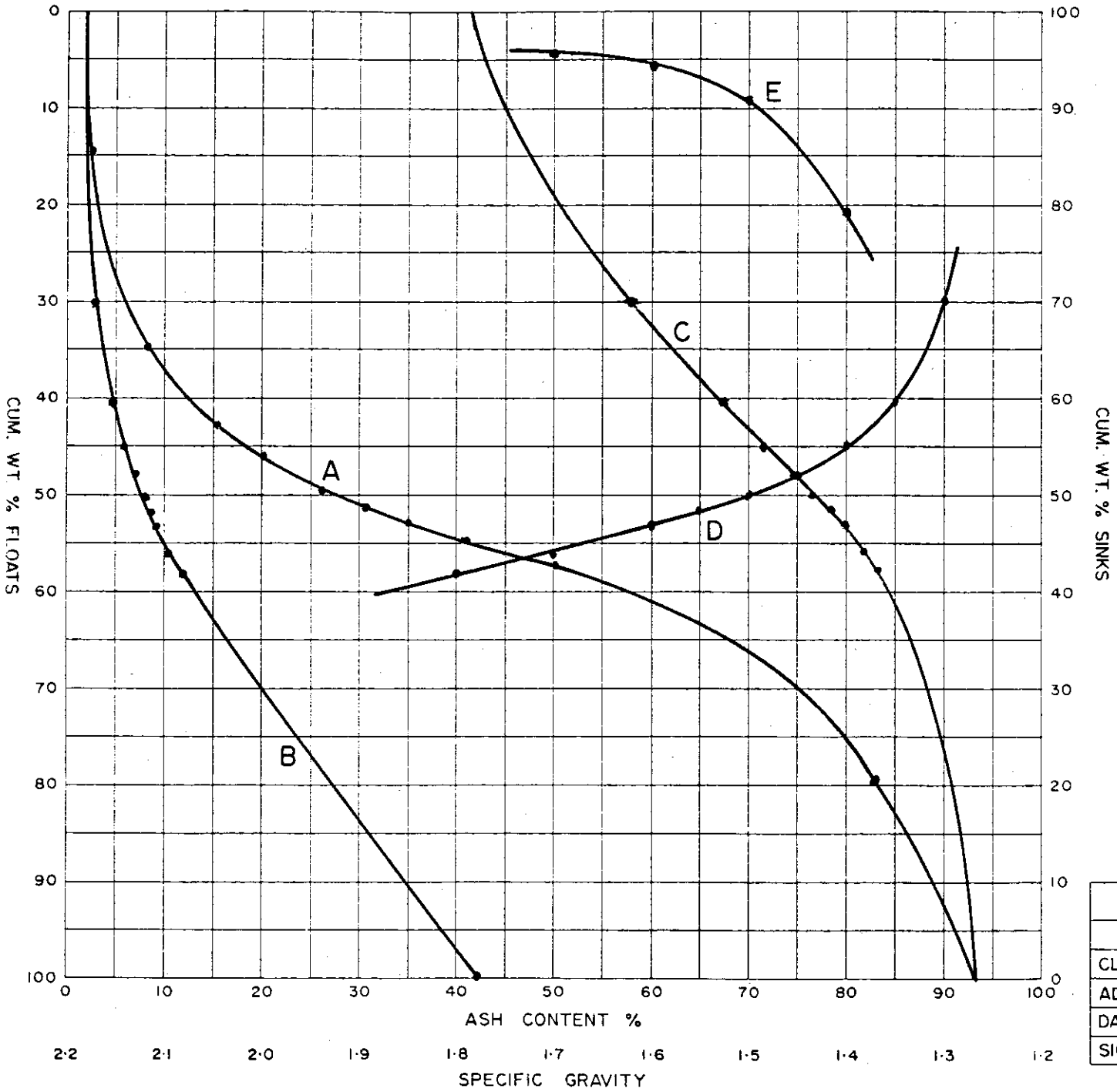
BIRTLEY ENGINEERING

TABLE 136

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 87

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 16 3/4" x 28 M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.16 LAB NO.4479 28M X 65M

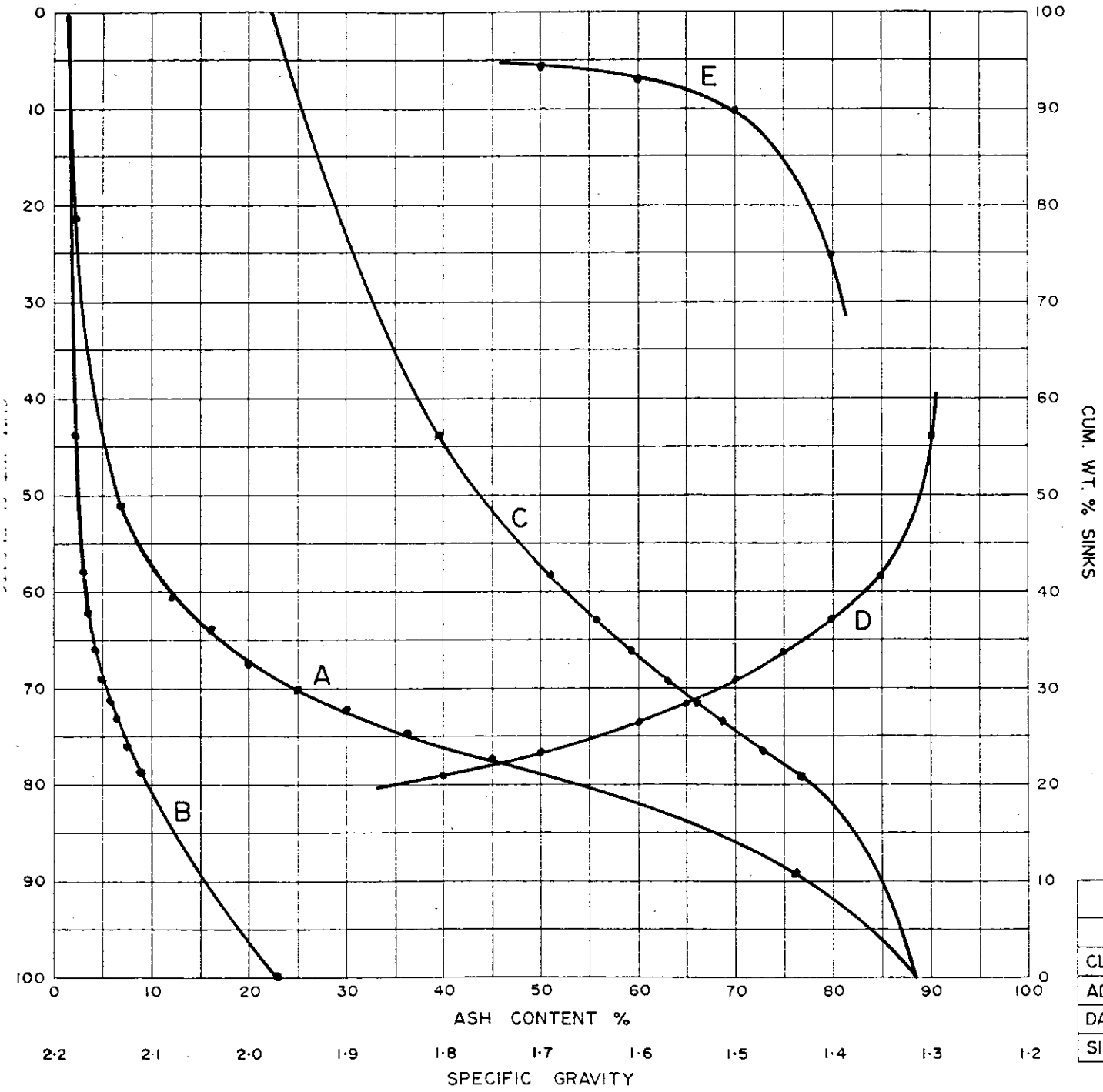
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	43.90	2.00	.88	.88	43.90	2.00	22.19	56.10	39.56	1.30	0.00
1.35	14.40	6.60	.95	1.83	58.30	3.14	21.24	41.70	50.94	1.40	25.30
1.40	4.40	12.10	.53	2.36	62.70	3.77	20.71	37.30	55.52	1.50	10.40
1.45	3.10	16.00	.50	2.86	65.80	4.34	20.21	34.20	59.11	1.60	7.10
1.50	3.40	20.20	.69	3.54	69.20	5.12	19.53	30.80	63.40	1.70	5.70
1.55	2.30	25.20	.58	4.12	71.50	5.77	18.95	28.50	66.48	1.80	0.00
1.60	1.60	29.90	.48	4.60	73.10	6.29	18.47	26.90	68.66	1.90	0.00
1.70	3.20	36.10	1.16	5.76	76.30	7.54	17.31	23.70	73.06	2.00	0.00
1.80	2.50	44.70	1.12	6.87	78.80	8.72	16.20	21.20	76.40	2.10	0.00
9.99	21.20	76.40	16.20	23.07	100.00	23.07	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 137

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 16 28M. x 65M.
DATE	NOV. 11, 1975
SIGNED	K. M. LAU

FIGURE 88

ELCO MINING LTD.

TABLE 138

SAMPLE: Adit No. 16

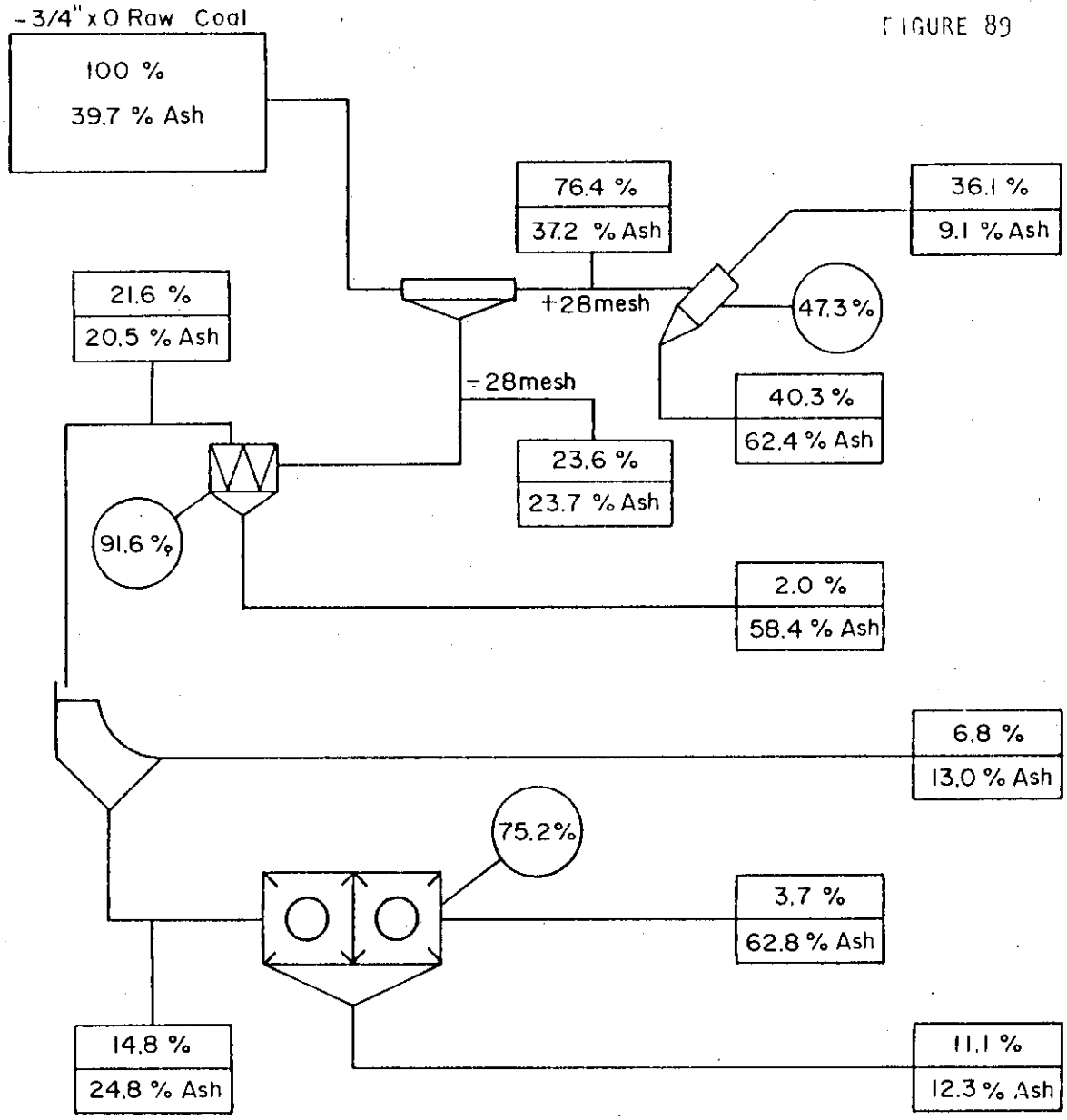
LAB. NO.: 4479

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8	0.72	0.16	384	456	20	88	1.057
3/4" X 28M	8	0.76	0.12	390	447	22	150	1.053
28M X 65M	9	0.83	0.07	397	456	22	118	1.050

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	64.2	9.5	0.9	27.6	62.0	.84	0.07	8	64.2	9.5
Stage II	6.1	19.6	0.7	24.7	55.0	.93	0.10	7	70.3	10.4
Tails	29.7	45.5	0.5	19.2	34.8	--	--	--	100.0	20.8

F. F. Parameters - See Adit No. 2

FIGURE 89



OVERALL YIELD = 54.0 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 16	DEC. 22/75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 16 LAB NO. 4478 DATE OF WASH October 30, 1975.

Raw Coal Analysis: Ash % 39.7 Hardgrove Grindability Index 77

Delivered Bulk Weight 26.2 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 16 LAB NO. 4478

1. S. G. of Separation (a) Washability 1.57
   (b) Plant 1.51
2. Feed Ash Content A.D.B. 37.2 %
3. Clean Coal Estimated Weight 5.10 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 9.1 % F.S.I. 6
5. Reject Estimated Weight 6.41 M.T.
6. Reject Analysis (A.D.B.) Ash 62.4 % FSI 1
7. Estimated 3/4" x 28M In Circuit (3+5) 11.51
8. Actual 3/4" x 28 Mesh from Washability Data 76.4 %
9. Yield Clean Coal (Weighted): $\frac{3}{3+5}$ 44.3 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6-2}{6-4}$ 47.3 %
11. Yield Clean Coal (Washability) 53 %
12. +2" Rock Oversize .272 M.T.

ELCO MINING LTD. TABLE 139

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 16 LAB NO. 4478

1. Vortex Finder Clearance (VFC) 1.9 CM .75 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 120-150 g/l. 12-15 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	45.9	22.2	8	45.9	22.2	27.7	6 1/2
	65M x 100M (.15 CM)	12.2	17.5	8 1/2	58.1	21.2		
	100M x 0	41.9	28.0	5 1/2	100.0	24.1		
O'FLOW	+65M	31.6	-	-	31.6	-	20.5	7 1/2
	65M x 100M	14.2	-	-	45.8	14.0		
	100M x 0	54.2	26.0	6	100.0	20.5		
U'FLOW	+65M	75.6	-	-	75.6	-	58.4	1
	65M x 100M	8.8	-	-	84.4	58.8		
	100M x 0	15.6	56.1	1 1/2	100.0	58.4		
S B O	+65M	88.6	12.5	8 1/2	80.6	12.1	13.0	8
	65M x 100M	4.8	14.6	8	93.4	12.6		
	100M x 0	6.6	22.6	6	100.0	13.3		

6. Yield - Total W.O. Cyclone Circuit = 91.6 %

7. Est. Yield of 28 x 65 Mesh Coal = 28.9 %
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 140

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 16 LAB NO. 4478

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 200-270 g/l 20-27 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	14.9	15.1	8	14.9	15.1	24.8	6 1/2
	65M x 100M (.15 CM)	16.9	14.9	8	31.8	15.0		
	100M x 0	68.2	28.4	6 1/2	100.0	24.1		
CONC.	+65M (.21 CM)	8.8	8.9	9	8.8	8.9	12.3	7 1/2
	65M x 100M (.15 CM)	16.3	8.7	8	25.1	8.8		
	100M x 0	74.9	13.9	7 1/2	100.0	12.6		
TAILS	+65M (.21 CM)	26.2	34.8	4 1/2	26.2	34.8	62.8	1
	65M x 100M (.15 CM)	15.6	47.4	2	41.8	39.5		
	100M x 0	58.2	81.1	1/2	100.0	63.7		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 75.2 %

6. Yield (Washability) 80 %

7. 65M x 0 (Washability) 12.3 %

ELCO MINING LTD.

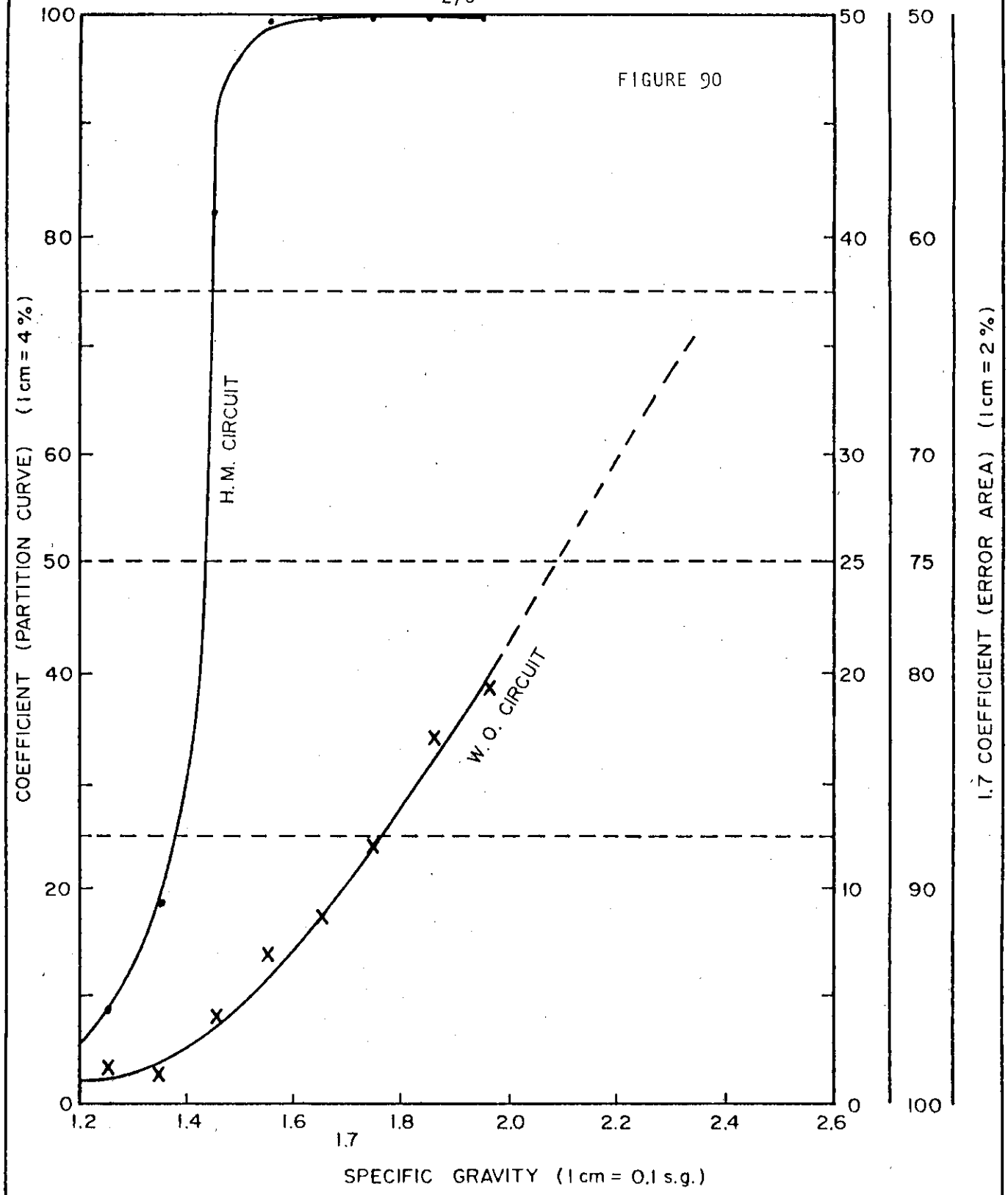
TABLE 141

BULK WASHING DATA

ADIT/SEAM NO. 16 LAB NO. 4478

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	78.6	78.6	5.8	5.8	43.5	43.5	7.5	7.5
1.30-1.40	19.4	98.0	3.8	9.6	24.9	68.4	3.6	11.1
1.40-1.50	2.0	100.0	8.7	18.3	10.4	78.8	4.7	15.8
1.50-1.60	-	-	9.1	27.4	5.0	83.8	4.6	20.4
1.60-1.70	-	-	5.5	32.9	4.2	88.0	4.7	25.1
1.70-1.80	-	-	6.6	39.5	3.0	91.0	5.0	30.1
1.80-1.90	-	-	2.0	41.5	2.0	93.0	5.5	35.6
1.90-2.00	-	-	4.9	46.4	1.9	94.9	6.3	41.9
+2.00	-	-	53.6	100.0	5.1	100.0	58.1	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 16	JAN. 6/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 16 LAB. NO. 4478 DATE OF WASH October 30, 1975

a) Raw Coal

Delivered Wt. = 26.2 M.T.
Ash % = 39.7
Hardgrove Grindability Index = 77
Estimated Washed Weight = 15.06

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 76.4
Effective S. G. = 1.42

Raw Feed	37.2 %	Ash 6	F.S.I.
Clean Coal	9.1 %	Ash 8	F.S.I.
Reject	62.4 %	Ash 1	F.S.I.

Calculated Yield = 47.3 %
Weighed Yield = 44.3 %

c) Water-Only Cyclone Circuit

Raw Feed	23.7 %	Ash 6 1/2	F.S.I.
Overflow	20.5 %	Ash 7 1/2	F.S.I.
Underflow	58.4 %	Ash 1	F.S.I.

Calculated Yield = 91.6
% of +65 Mesh in O/F = 31.6

Sieve Bend Overflow	13.0 %	Ash 8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	24.8 %	Ash 6 1/2	F.S.I.
Concentrates	12.3 %	Ash 7 1/2	F.S.I.
Tails	62.8 %	Ash 1	F.S.I.

Calculated Yield = 75.2

ELCO MINING LTD.

TABLE 142

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 16 LAB. NO. 4478

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 0.7 ASH % 10.6 VM % 26.3 FC % 62.4 S% 0.7 FSI 8

(ii) Dilatometer

Softening °C 379 Max. Dil. °C 456 Max Cont. % 25

Max. Dil. % 127 G. No. = 1.065

(iii) Hardgrove Grindability Index = 87

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
7		10		3		0.6				4.1		

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 142

SAMPLE: Clean Coal - Adit No. 16

LAB. NO.: 4478

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.7	10.6	26.3	62.4	8	87

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	1.9	1.9
1/2" X 1/4"	8.8	10.7
1/4" X 8M	21.4	32.1
8M X 28M	34.7	66.8
28M X 65M	9.0	75.8
65M X 0	24.2	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
379	456	25	127	1.065

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.57	78.07	4.76	1.42	0.79	10.69	3.70

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.08	0.69	0.40	1.92	12.65	21.93	55.02	0.67	2.00	1.97

SAMPLE: Adit No. 17

LAB. NO.: 4472

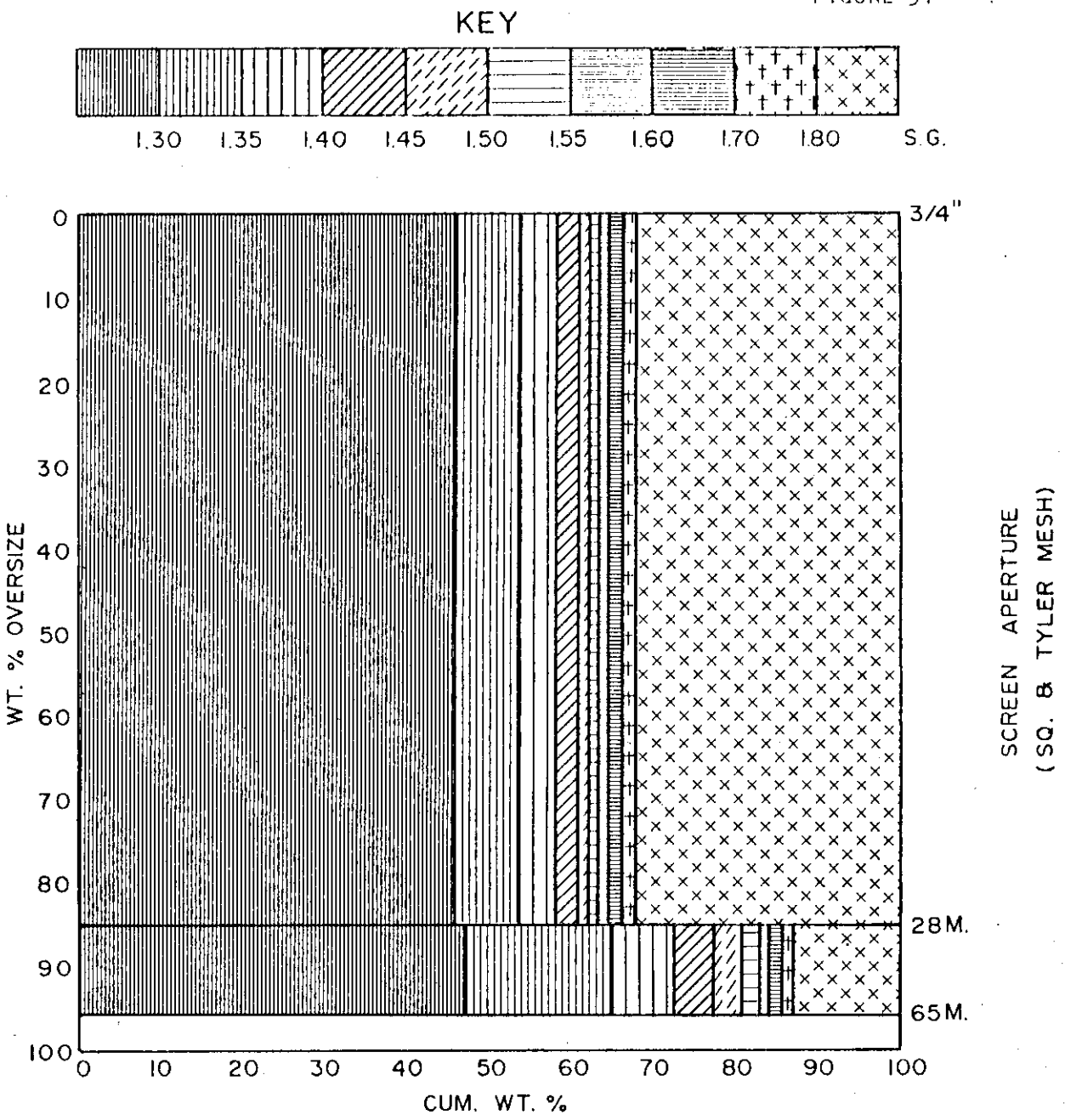
TABLE 144

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
1.0	35.9	21.9	41.2	0.71	9660	72	oxid.	1470	1470+	-	-
							red.	1390	1470+	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	28.6	64.3	1.5	15.7	18.5	0.44	54	-	-
	1/2" X 0	71.4	-	-	-	-	-	-	-	-
II	3/4" X 28M	85.2	35.9	1.1	22.3	40.7	0.59	78	85.2	35.9
	28M X 65M	9.6	18.1	1.1	25.6	55.2	0.74	125	94.8	34.1
	65M X 100M	1.4	18.1	-	-	-	-	-	96.2	33.9
	100M X 200M	2.0	18.3	-	-	-	-	-	98.2	33.5
	200M X 0	1.8	23.2	-	-	-	-	-	100.0	33.4
III	65M X 0	5.2	19.9	1.0	25.0	54.1	0.87	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 12.1%
II - Size consist of raw coal crushed down to - 3/4", WT. % 3/4" X 1/2 = 1.5%
III - 65M X 0 off II

FIGURE 91



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO	SEAM/ADIT Nº	ADIT 17
DATE	NOV. 14, 1975	SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.17 LAB NO.4472 2" X .5"

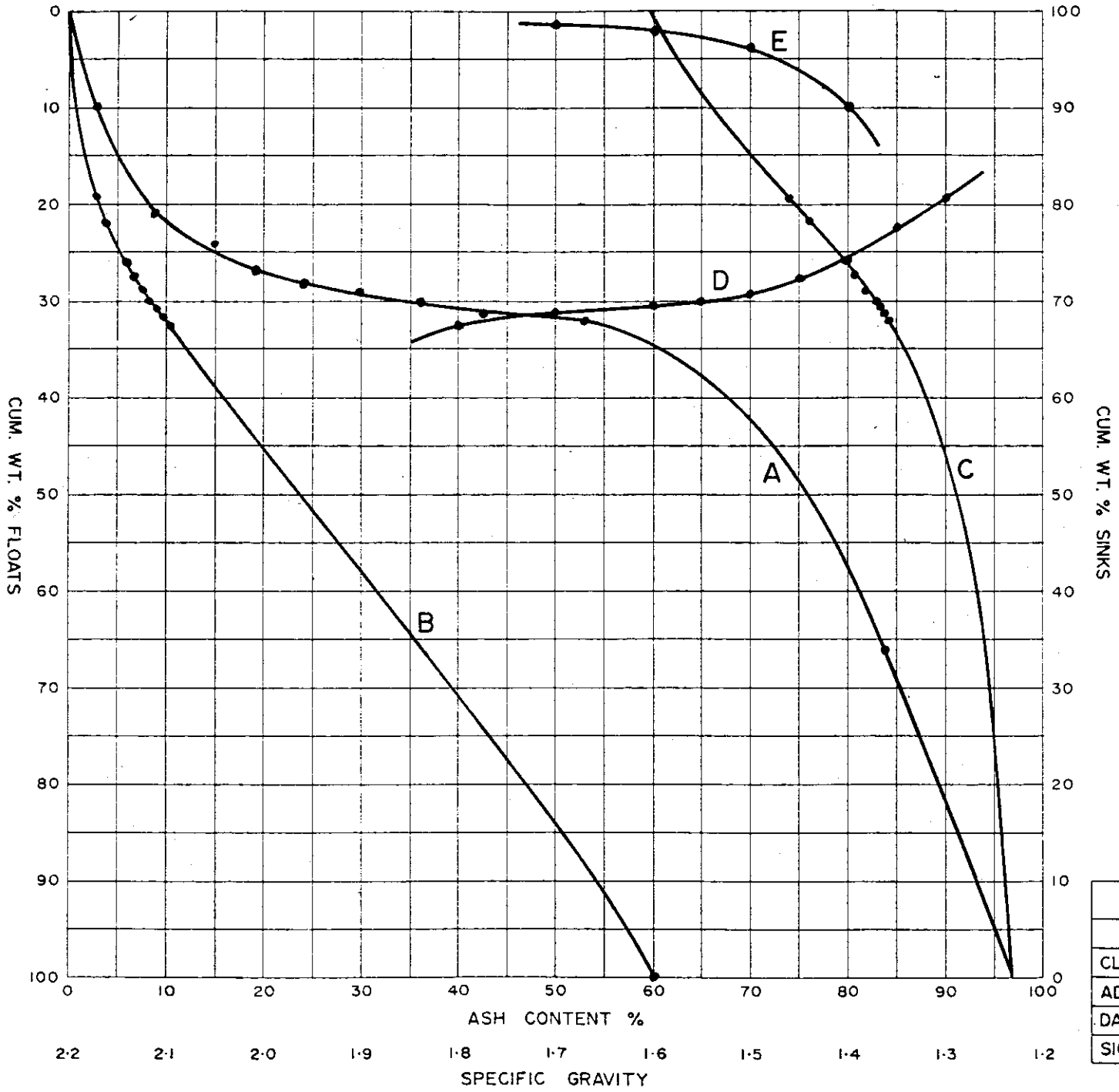
--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	19.40	3.40	.66	.66	19.40	3.40	59.72	80.60	74.10	1.30	0.00
1.35	2.50	8.70	.22	.88	21.90	4.01	59.50	78.10	76.19	1.40	9.50
1.40	4.50	15.30	.69	1.57	26.40	5.93	58.82	73.60	79.91	1.50	4.10
1.45	.90	19.20	.17	1.74	27.30	6.37	58.64	72.70	80.66	1.60	2.50
1.50	1.60	24.30	.39	2.13	28.90	7.36	58.25	71.10	81.93	1.70	1.80
1.55	.90	30.00	.27	2.40	29.80	8.04	57.98	70.20	82.60	1.80	0.00
1.60	.70	35.80	.25	2.65	30.50	8.68	57.73	69.50	83.07	1.90	0.00
1.70	.90	43.20	.39	3.04	31.40	9.67	57.34	68.60	83.59	2.00	0.00
1.80	.90	53.00	.48	3.51	32.30	10.88	56.87	67.70	84.00	2.10	0.00
9.99	67.70	84.00	56.87	60.38	100.00	60.38	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 145

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 92

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 17 2" x 1/2"
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.17 LAB NO.4472 .5" X 28M

---DIRECT---					---CUM FLOATS---		---CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	54.78	1.83	1.00	1.00	54.78	1.83	22.03	45.22	48.78	1.30	0.00
1.35	9.58	8.16	.78	1.78	64.36	2.77	21.25	35.64	59.63	1.40	18.71
1.40	4.23	13.13	.56	2.34	68.59	3.41	20.70	31.41	65.89	1.50	7.43
1.45	3.17	19.86	.63	2.97	71.76	4.14	20.07	28.24	71.05	1.60	4.50
1.50	1.73	25.61	.44	3.41	73.49	4.64	19.63	26.51	74.02	1.70	3.54
1.55	1.30	30.74	.40	3.81	74.79	5.10	19.23	25.21	76.25	1.80	0.00
1.60	1.23	35.68	.44	4.25	76.01	5.59	18.79	23.99	78.33	1.90	0.00
1.70	1.97	42.85	.84	5.09	77.98	6.53	17.94	22.02	81.50	2.00	0.00
1.80	1.57	51.69	.81	5.91	79.55	7.42	17.13	20.45	83.79	2.10	0.00
9.99	20.45	83.79	17.13	23.04	100.00	23.04	0.00	-.00	0.00	2.20	0.00

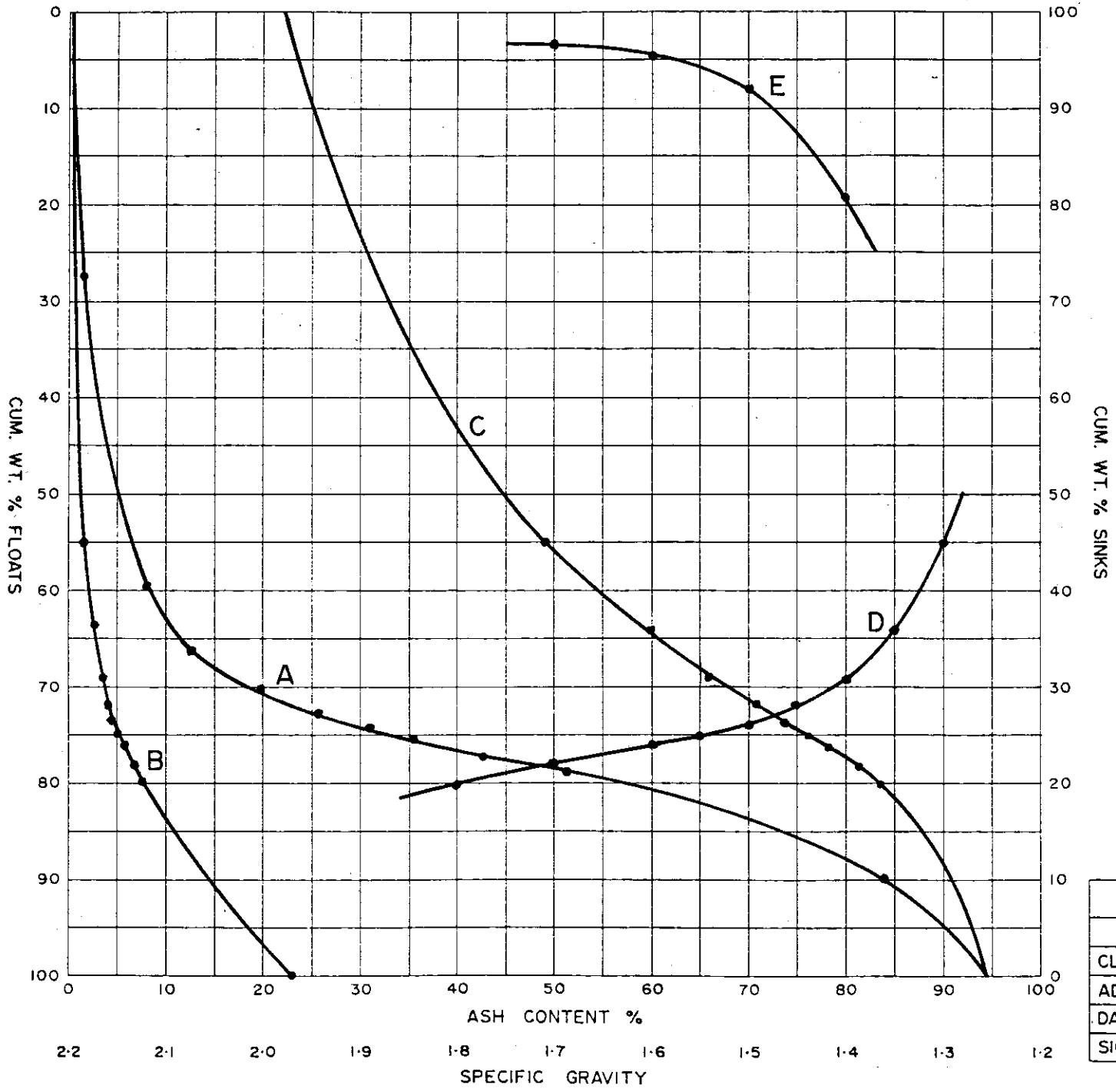
BIRTLEY ENGINEERING

TABLE 146

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 93

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 17 1/2" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.17 LAB NO.4472 .75" X 28M

--DIRECT--				--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	45.90	2.60	1.19	1.19	45.90	2.60	31.49	54.10	58.21	1.30	0.00
1.35	7.80	8.20	.64	1.83	53.70	3.41	30.85	46.30	66.63	1.40	16.40
1.40	4.30	13.70	.59	2.42	58.00	4.18	30.26	42.00	72.05	1.50	6.60
1.45	2.60	19.80	.51	2.94	60.60	4.85	29.75	39.40	75.50	1.60	4.00
1.50	1.70	25.30	.43	3.37	62.30	5.40	29.32	37.70	77.76	1.70	3.10
1.55	1.20	30.60	.37	3.73	63.50	5.88	28.95	36.50	79.31	1.80	0.00
1.60	1.10	35.70	.39	4.13	64.60	6.39	28.56	35.40	80.67	1.90	0.00
1.70	1.70	42.90	.73	4.86	66.30	7.32	27.83	33.70	82.57	2.00	0.00
1.80	1.40	51.90	.73	5.58	67.70	8.25	27.10	32.30	83.90	2.10	0.00
9.99	32.30	83.90	27.10	32.68	100.00	32.68	0.00	.00	0.00	2.20	0.00

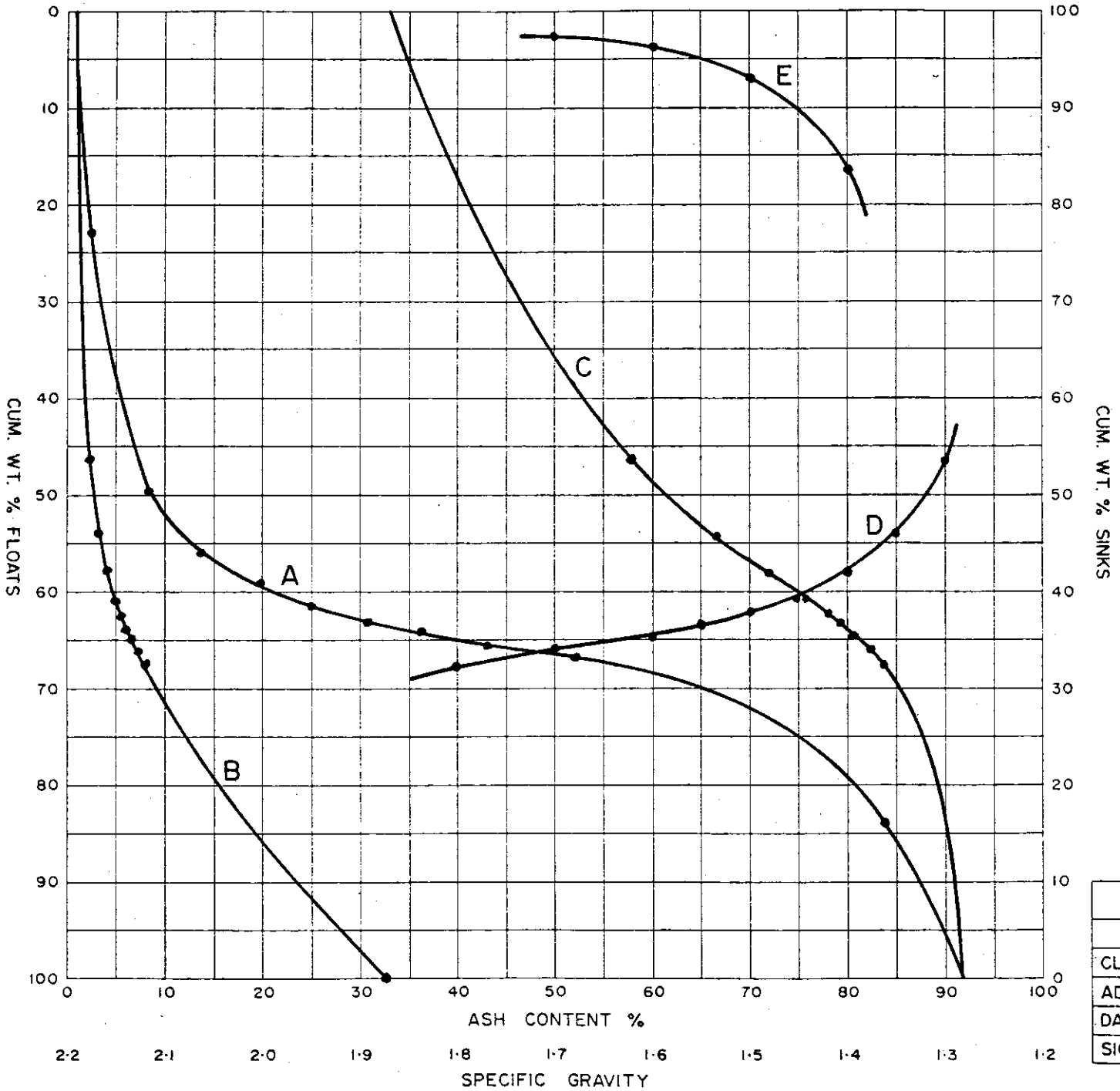
BIRTLEY ENGINEERING

TABLE 147

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 94

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 17 3/4" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.17 LAB NO.4472 28M X 65M

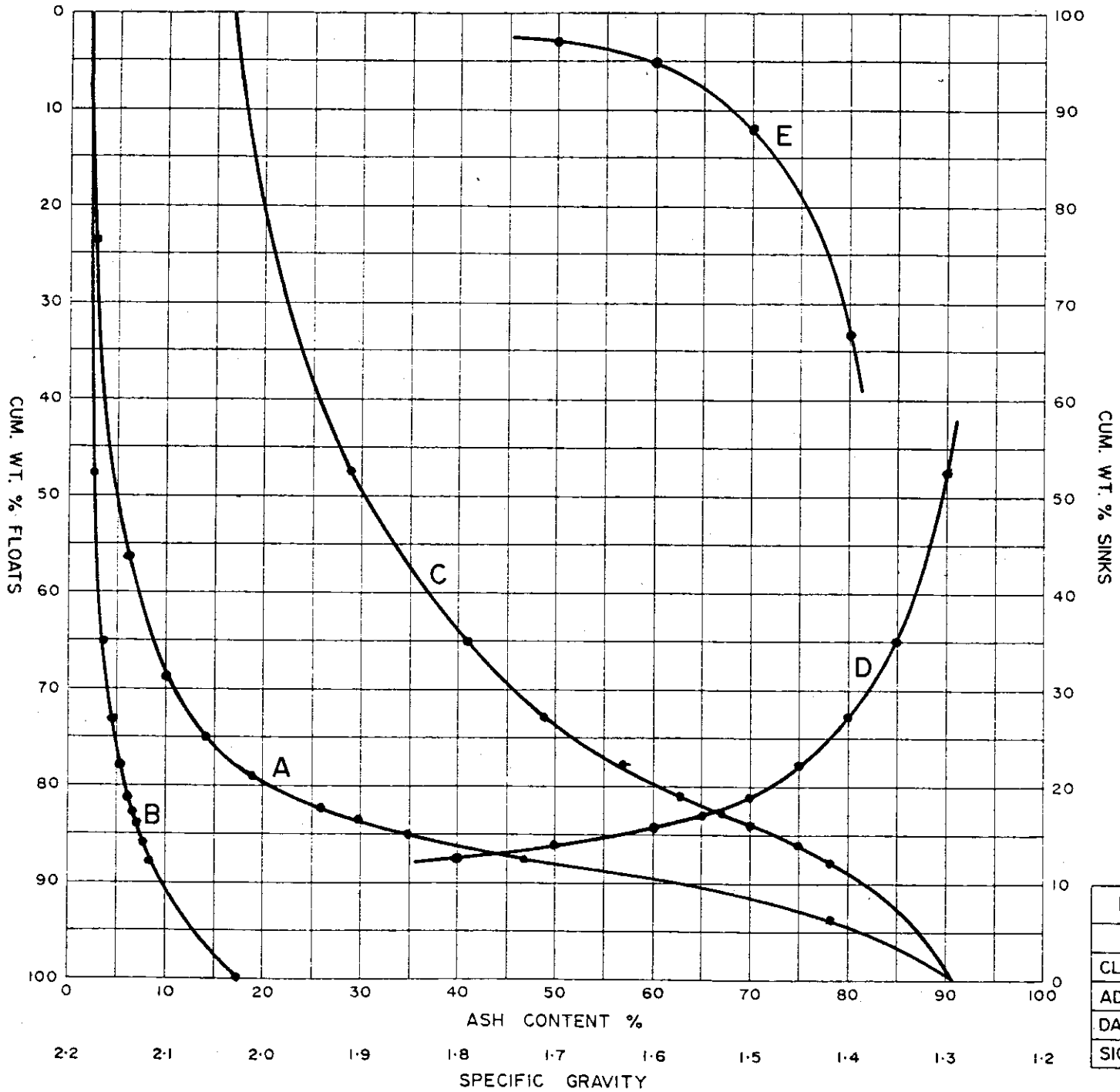
--DIRECT--			--CUM FLOATS--			--CUM SINKS--				+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	47.30	3.40	1.61	1.61	47.30	3.40	15.31	52.70	29.05	1.30	0.00
1.35	18.00	6.40	1.15	2.76	65.30	4.23	14.16	34.70	40.79	1.40	33.50
1.40	7.40	10.10	.75	3.51	72.70	4.82	13.41	27.30	49.11	1.50	11.40
1.45	5.00	14.20	.71	4.22	77.70	5.43	12.70	22.30	56.94	1.60	5.20
1.50	3.10	19.20	.60	4.81	80.80	5.96	12.10	19.20	63.04	1.70	3.30
1.55	1.90	26.20	.50	5.31	82.70	6.42	11.61	17.30	67.08	1.80	0.00
1.60	1.40	29.80	.42	5.73	84.10	6.81	11.19	15.90	70.36	1.90	0.00
1.70	1.90	35.10	.67	6.39	86.00	7.44	10.52	14.00	75.15	2.00	0.00
1.80	1.40	46.80	.66	7.05	87.40	8.07	9.87	12.60	78.30	2.10	0.00
9.99	12.60	78.30	9.87	16.92	100.00	16.92	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 148

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 17 28M. x 65M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

FIGURE 95

ELCO MINING LTD. TABLE 149

SAMPLE: Adit No. 17

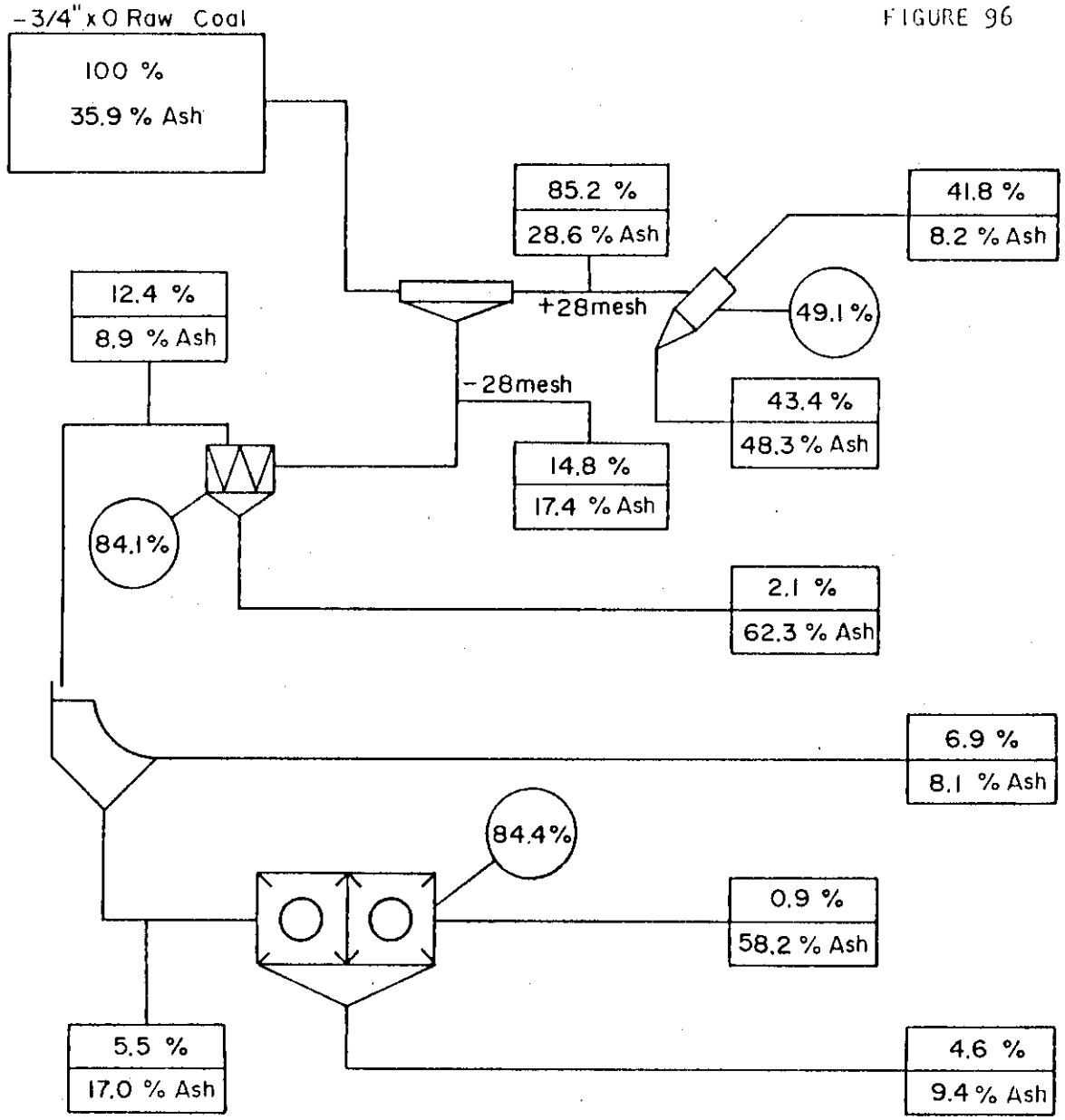
LAB. NO.: 4472

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8	0.74	0.10	396	463	21	129	1.059
3/4" X 28M	8	0.80	0.07	389	458	27	139	1.058
28M X 65M	8 1/2	0.81	0.05	390	450	19	114	1.054

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	51.1	7.4	0.6	27.7	64.3	.85	0.05	8 1/2	51.1	7.4
Stage II	6.0	17.4	0.8	25.4	56.4	1.07	0.06	6	57.1	8.5
Tails	42.9	34.1	0.6	22.4	42.9	--	--	--	100.0	19.5

F. F. Parameters - See Adit No. 2

FIGURE 96



OVERALL YIELD = 53.3 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 17	DEC. 22 / 75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 17 LAB NO. 4471 DATE OF WASH October 23, 1975.

Raw Coal Analysis: Ash % 35.9 Hardgrove Grindability Index 72

Delivered Bulk Weight 22.5 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 17 LAB NO. 4471

1. S. G. of Separation (a) Washability 1.75
   (b) Plant 1.47
2. Feed Ash Content A.D.B. 28.6 %
3. Clean Coal Estimated Weight 8.17 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.2 % F.S.I. 8
5. Reject Estimated Weight 6.68 M.T.
6. Reject Analysis (A.D.B.) Ash 48.3 % FSI 1
7. Estimated 3/4" x 28M In Circuit (3+5) 14.85 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 85.2 %
9. Yield Clean Coal (Weighted): $\frac{3}{3+5}$ 55.0 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6-2}{6-4}$ 49.1 %
11. Yield Clean Coal (Washability) 67.7 %
12. +2" Rock Oversize 3.12 M .T.

ELCO MINING LTD.

TABLE 150

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 17 LAB NO. 4471

1. Vortex Finder Clearance (VFC) 1.3 CM .50 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-130 g/l. 10-13 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	52.1	13.5	8 1/2	52.1	13.5	17.4	7
	65M x 100M (.15 CM)	11.8	13.3	8 1/2	63.9	13.5		
	100M x 0	36.1	22.4	7 1/2	100.0	16.7		
O'FLOW	+65M						8.9	8 1/2
	65M x 100M							
	100M x 0							
U'FLOW	+65M	79.3					62.3	1
	65M x 100M	7.7						
	100M x 0	13.0	65.0	1				
S B O	+65M	86.1	8.0	7 1/2	86.1	8.0	8.1	8
	65M x 100M	6.9	10.0	8 1/2	92.9	8.1		
	100M x 0	7.1	15.0	8 1/2	100.0	8.6		

6. Yield - Total W.O. Cyclone Circuit = 84.1

7. Est. Yield of 28 x 65 Mesh Coal = 47.1 (estimated)
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD.

TABLE 151

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 17 LAB NO. 4471

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density _____ g/l 20-25 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)						17.0	8 1/2
	65M x 100M (.15 CM)							
	100M x 0							
CONC.	+65M (.21 CM)						9.4	8 1/2
	65M x 100M (.15 CM)							
	100M x 0							
TAILS	+65M (.21 CM)						58.2	1
	65M x 100M (.15 CM)							
	100M x 0							

4. Impeller Type -

5. Yield Calculated (Ash Balance) 84.4 %

6. Yield (Washability) 65 %

7. 65M x 0 (Washability) 5.2 %

ELCO MINING LTD.

TABLE 152

BULK WASHING DATA

ADIT/SEAM NO. 17 LAB NO. 4471

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30							6.0	6.0
1.30-1.40							9.2	15.2
1.40-1.50							3.0	18.2
1.50-1.60							3.6	21.8
1.60-1.70							3.1	24.9
1.70-1.80							3.7	28.6
1.80-1.90							4.0	32.6
1.90-2.00							4.0	36.6
+2.00							63.4	100.0

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 17 LAB. NO. 4471 DATE OF WASH October 23, 1975.

a) Raw Coal

Delivered Wt.	=	22.5 M.T.
Ash %	=	35.9 %
Hardgrove Grindability Index	=	72
Estimated Washed Weight	=	17.4 M.T.

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 85.2

Effective S. G. =

Raw Feed	28.6 %	Ash 7	F.S.I.
Clean Coal	8.2 %	Ash 8	F.S.I.
Reject	48.3 %	Ash 1	F.S.I.

Calculated Yield = 49.1

Weighed Yield = 55.0

c) Water-Only Cyclone Circuit

Raw Feed	17.4 %	Ash 7	F.S.I.
Overflow	8.9 %	Ash 8 1/2	F.S.I.
Underflow	62.3 %	Ash 1	F.S.I.

Calculated Yield = 84.1

% of +65 Mesh in O/F = 56 (estimated)

Sieve Bend Overflow	8.1 %	Ash 8	F.S.I.

d) Froth Flotation Circuit

Raw Feed	17.0 %	Ash 8 1/2	F.S.I.
Concentrates	9.4 %	Ash 8 1/2	F.S.I.
Tails	58.2 %	Ash 1	F.S.I.

Calculated Yield = 84.4

ELCO MINING LTD.

BULK WASHING SUMMARY (Cont.)

TABLE 153

ADIT/SEAM NO. 17 LAB. NO. 4471

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % RM% 1.2 ASH % 7.1 VM % 28.0 FC %63.7 S% 71 FSI 8

(ii) Dilatometer

Softening °C 377 Max. Dil. °C 455 Max Cont. % 13

Max. Dil. % 145 G. No. = 1.085

(iii) Hardgrove Grindability Index = 76

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
9	1.49	13	2.15	3	0.496	0.6	0.99			35.4	61	10.08

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 154

SAMPLE: Clean Coal - Adit No. 17

LAB. NO.: 4471

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
1.2	7.1	28.0	63.7	8	76

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	2.9	2.9
1/2" X 1/4"	15.5	18.4
1/4" X 8M	29.4	47.8
8M X 28M	32.9	80.7
28M X 65M	8.6	89.3
65M X 0	10.7	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
377	455	13	145	1.085

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.81	80.51	4.96	1.52	0.80	6.97	4.43

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.07	0.47	0.27	1.96	16,42	21.17	54.84	0.43	2.19	1.75

SAMPLE: Adit No. 18

LAB. NO.: 4405

TABLE 155

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
1.0	34.2	23.2	41.6	0.57	9815	82	oxid.	1310	1340	1380	1450
							red.	1240	1300	1330	1400

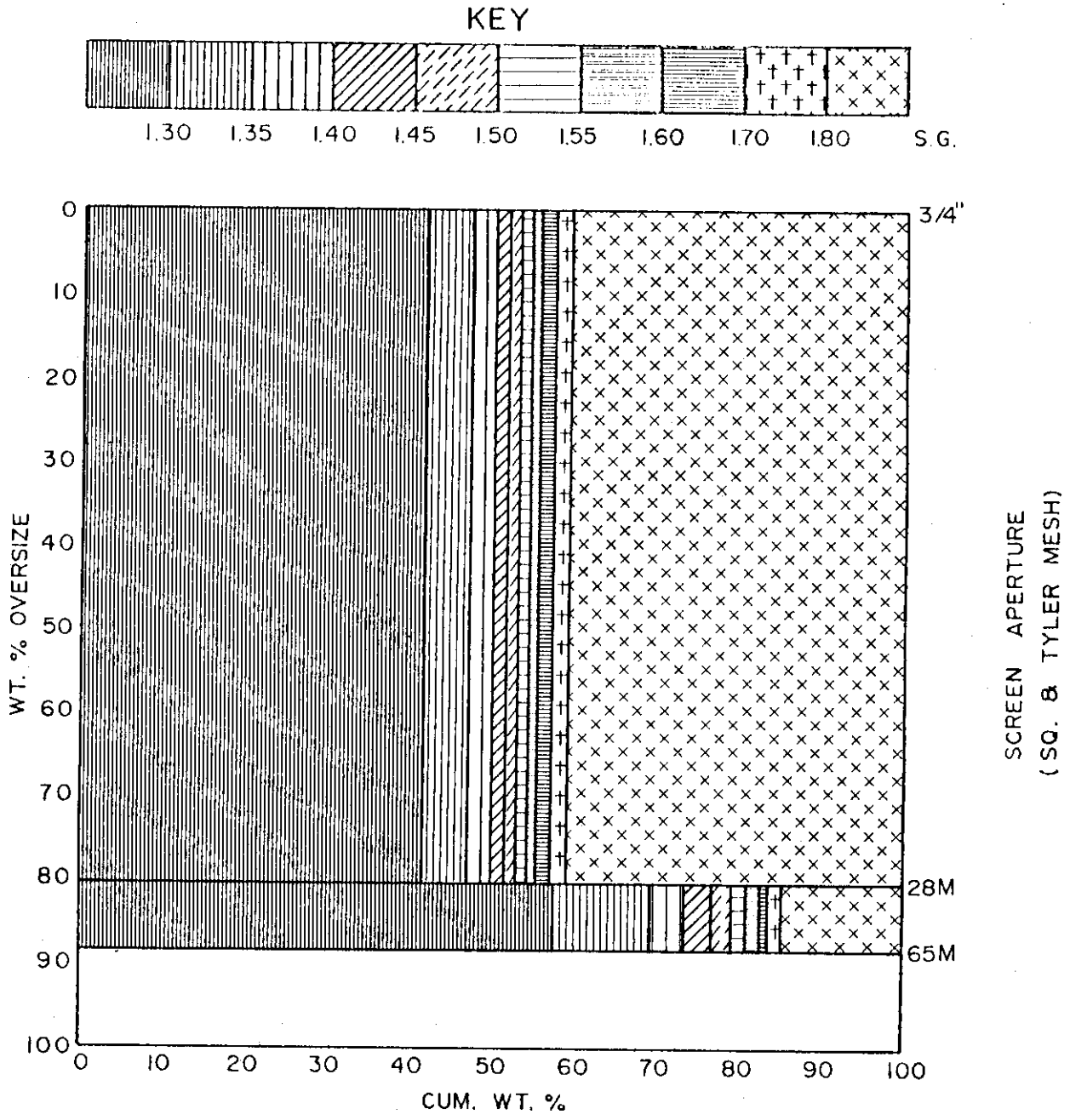
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	18.0	56.4	0.8	18.4	24.4	0.39	68	-	-
	1/2" X 0	82.0	-	-	-	-	-	-	-	-
II	3/4" X 28M	80.4	38.4	0.8	22.4	38.4	0.55	85	80.4	38.4
	28M X 65M	8.0	18.3	0.9	27.1	53.7	0.65	-	88.4	36.6
	65M X 100M	3.6	16.2	-	-	-	-	-	92.0	35.8
	100M X 200M	5.8	15.4	-	-	-	-	-	97.8	34.6
	200M X 0	2.2	17.5	-	-	-	-	-	100.0	34.2
III	65M X 0	11.6	16.2	1.0	27.1	55.7	0.85	-	-	-

I - Size consist of raw coal as received, WT. % + 2" = 13.4
WT. % of 1/2" X 28M = 56.7 of raw (-2") coal as received.

II - Size consist of raw coal crushed to - 3/4"

III - 65M X 0 off II

FIGURE 97



BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT Nº	ADIT 18
DATE	NOV. 14/75	SIGNED	L. BAILEY

ELCO MINING LTD ADIT NO.18 LAB NO.4405 2" X .5"

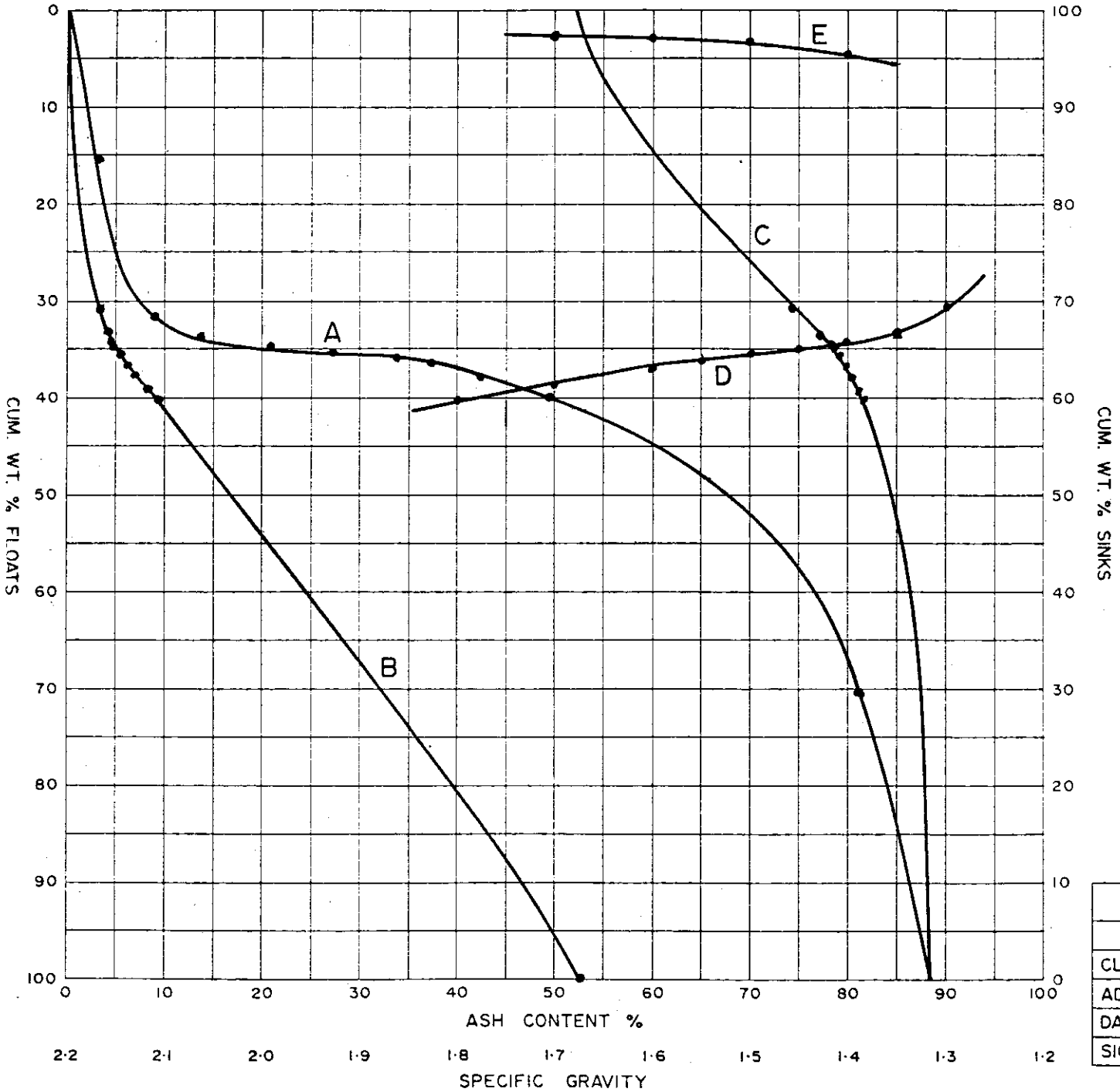
--DIRECT--					---CUM FLOATS---			---CUM SINKS---		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	30.90	3.60	1.11	1.11	30.90	3.60	51.54	69.10	74.59	1.30	0.00
1.35	2.50	9.10	.23	1.34	33.40	4.01	51.31	66.60	77.05	1.40	4.80
1.40	1.00	14.30	.14	1.48	34.40	4.31	51.17	65.60	78.01	1.50	3.00
1.45	.50	20.70	.10	1.59	34.90	4.55	51.07	65.10	78.45	1.60	3.30
1.50	.80	27.20	.22	1.80	35.70	5.05	50.85	64.30	79.08	1.70	2.80
1.55	.90	33.70	.30	2.11	36.60	5.76	50.55	63.40	79.73	1.80	0.00
1.60	.80	36.90	.30	2.40	37.40	6.42	50.25	62.60	80.28	1.90	0.00
1.70	1.60	42.40	.68	3.08	39.00	7.90	49.57	61.00	81.27	2.00	0.00
1.80	1.20	49.80	.60	3.68	40.20	9.15	48.98	59.80	81.90	2.10	0.00
9.99	59.80	81.90	48.98	52.65	100.00	52.65	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 156

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 18 2" x 1/2"
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

FIGURE 98

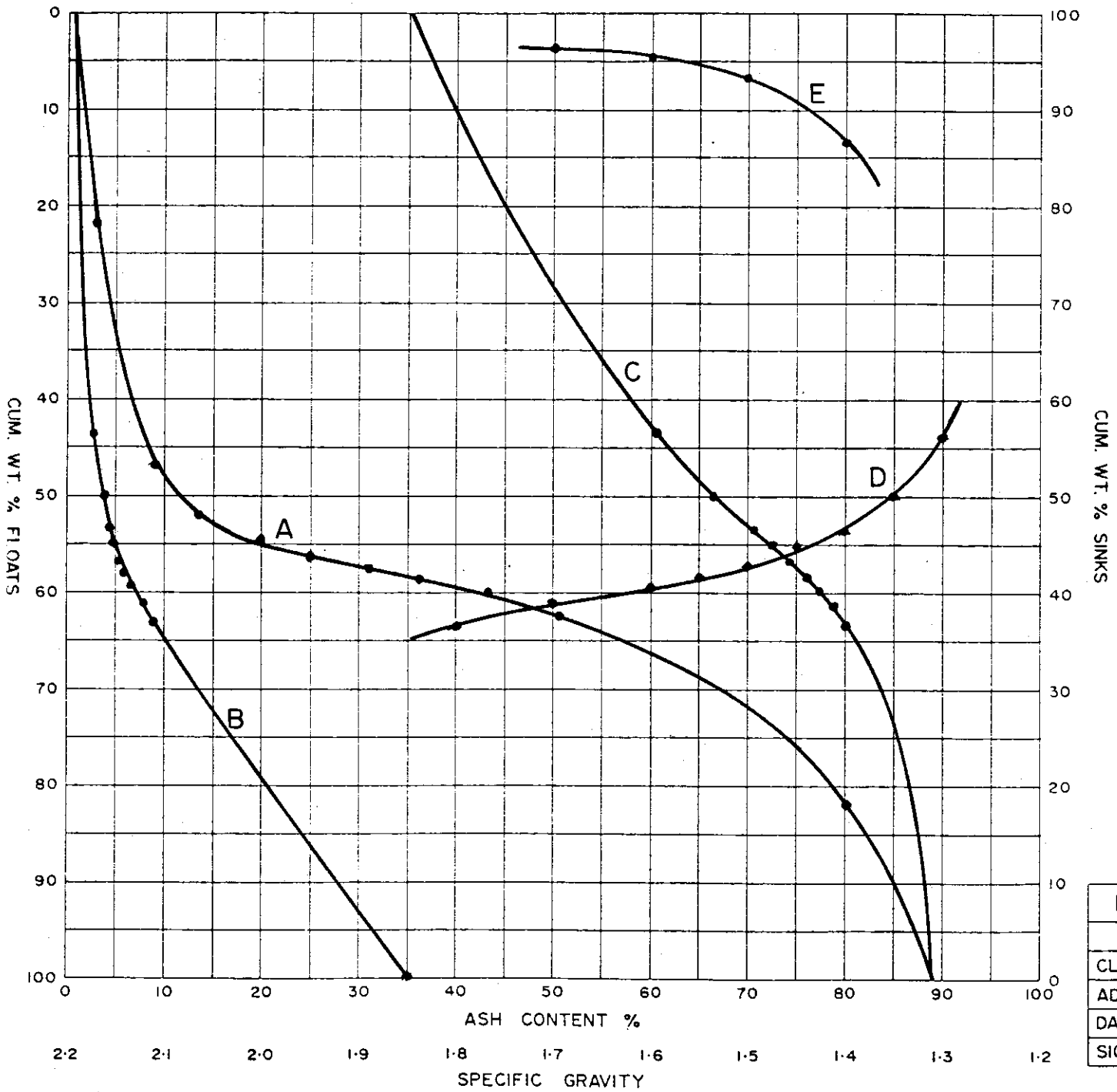
TABLE 157

ELCO MINING LTD ADIT NO 18 LAB NO.4405 .5" X 28M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	44.00	3.13	1.38	1.38	44.00	3.13	33.91	56.00	60.56	1.30	0.00
1.35	5.93	9.10	.54	1.92	49.93	3.84	33.37	50.07	66.65	1.40	12.88
1.40	3.57	13.37	.50	2.41	53.49	4.51	32.88	46.51	70.70	1.50	5.82
1.45	1.85	20.06	.37	2.78	55.34	5.03	32.51	44.66	72.80	1.60	4.65
1.50	1.53	25.08	.38	3.17	56.87	5.57	32.13	43.13	74.49	1.70	4.14
1.55	1.27	30.69	.39	3.56	58.14	6.12	31.74	41.86	75.82	1.80	0.00
1.60	1.17	35.86	.42	3.98	59.31	6.70	31.32	40.69	76.97	1.90	0.00
1.70	2.21	43.44	.96	4.94	61.52	8.02	30.36	38.48	78.90	2.00	0.00
1.80	1.93	50.59	.98	5.91	63.45	9.32	29.38	36.55	80.39	2.10	0.00
9.99	36.55	80.39	29.38	35.29	100.00	35.29	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 18 1/2" x 28M.
DATE	NOV. 13, 1975
SIGNED	K. M. LAU

FIGURE 99

ELCO MINING LTD ADIT NO.18 LAB NO.4405 .75" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	41.60	3.20	1.33	1.33	41.60	3.20	37.14	58.40	63.60	1.30	0.00
1.35	5.30	9.10	.48	1.81	46.90	3.87	36.66	53.10	69.04	1.40	11.40
1.40	3.10	13.90	.43	2.24	50.00	4.49	36.23	50.00	72.46	1.50	5.30
1.45	1.60	20.10	.32	2.57	51.60	4.97	35.91	48.40	74.19	1.60	4.40
1.50	1.40	25.30	.35	2.92	53.00	5.51	35.55	47.00	75.65	1.70	3.90
1.55	1.20	31.10	.37	3.29	54.20	6.08	35.18	45.80	76.81	1.80	0.00
1.60	1.10	36.00	.40	3.69	55.30	6.67	34.78	44.70	77.82	1.90	0.00
1.70	2.10	43.30	.91	4.60	57.40	8.01	33.88	42.60	79.52	2.00	0.00
1.80	1.80	50.50	.91	5.51	59.20	9.30	32.97	40.80	80.80	2.10	0.00
9.99	40.80	80.80	32.97	38.47	100.00	38.47	0.00	.00	0.00	2.20	0.00

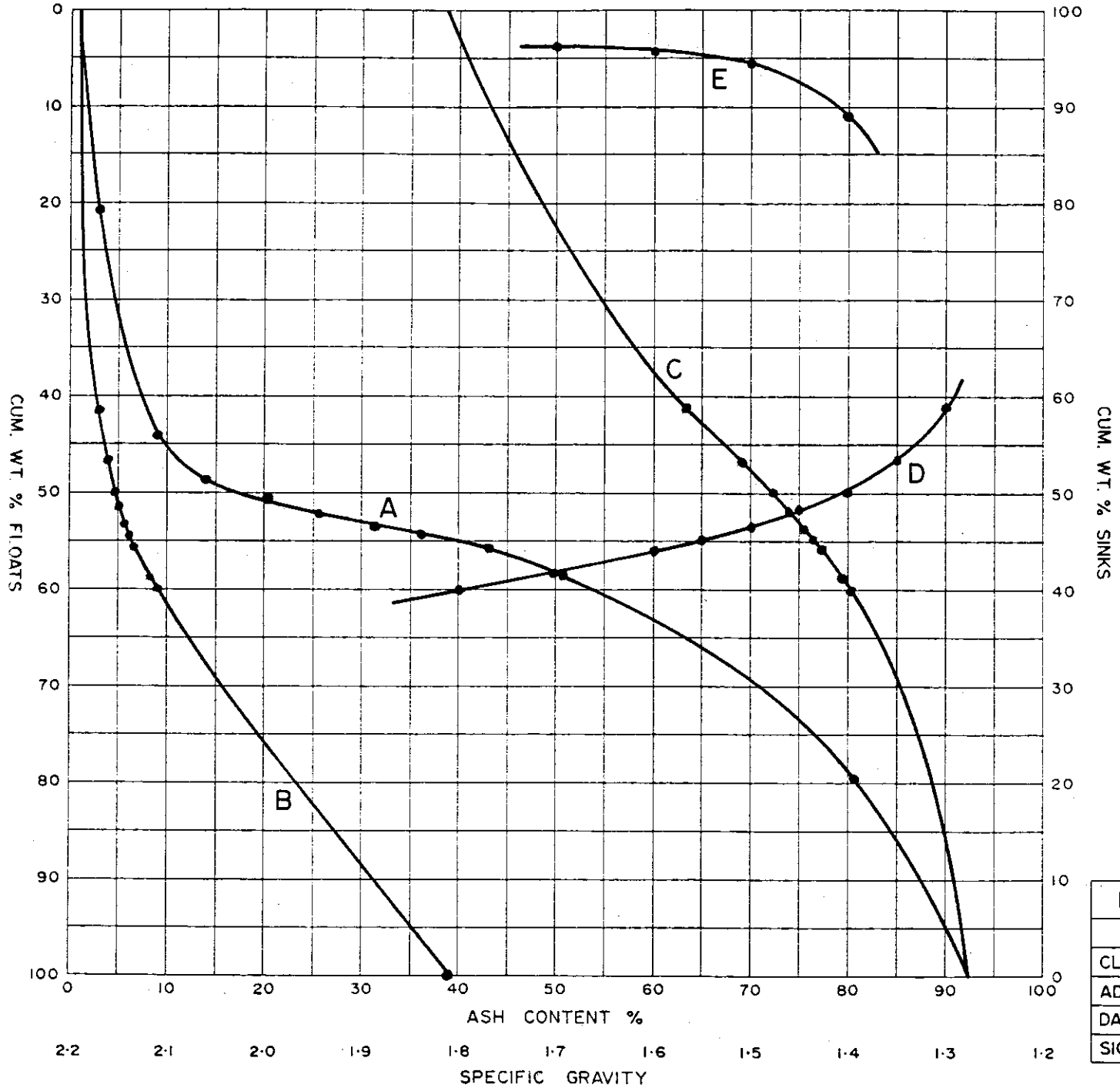
BIRTLEY ENGINEERING

TABLE 158

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 100

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 18 3/4" x 28 M.
DATE	NOV. 12, 1975
SIGNED	K. M. LAU

ELCO MINING LTD ADIT NO.18 LAB NO.4405 28M X 65M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	SINK WT ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	57.50	2.20	1.27	1.27	57.50	2.20	15.46	42.50	36.38	1.30	0.00
1.35	11.70	7.60	.89	2.15	69.20	3.11	14.57	30.80	47.31	1.40	21.60
1.40	4.20	13.40	.56	2.72	73.40	3.70	14.01	26.60	52.67	1.50	9.10
1.45	3.30	15.70	.52	3.24	76.70	4.22	13.49	23.30	57.90	1.60	4.60
1.50	2.40	22.20	.53	3.77	79.10	4.76	12.96	20.90	62.00	1.70	3.20
1.55	2.00	29.10	.58	4.35	81.10	5.36	12.38	18.90	65.49	1.80	0.00
1.60	1.40	32.40	.45	4.80	82.50	5.82	11.92	17.50	68.13	1.90	0.00
1.70	1.20	35.80	.43	5.23	83.70	6.25	11.49	16.30	70.51	2.00	0.00
1.80	2.00	42.00	.84	6.07	85.70	7.09	10.65	14.30	74.50	2.10	0.00
9.99	14.30	74.50	10.65	16.73	100.00	16.73	0.00	.00	0.00	2.20	0.00

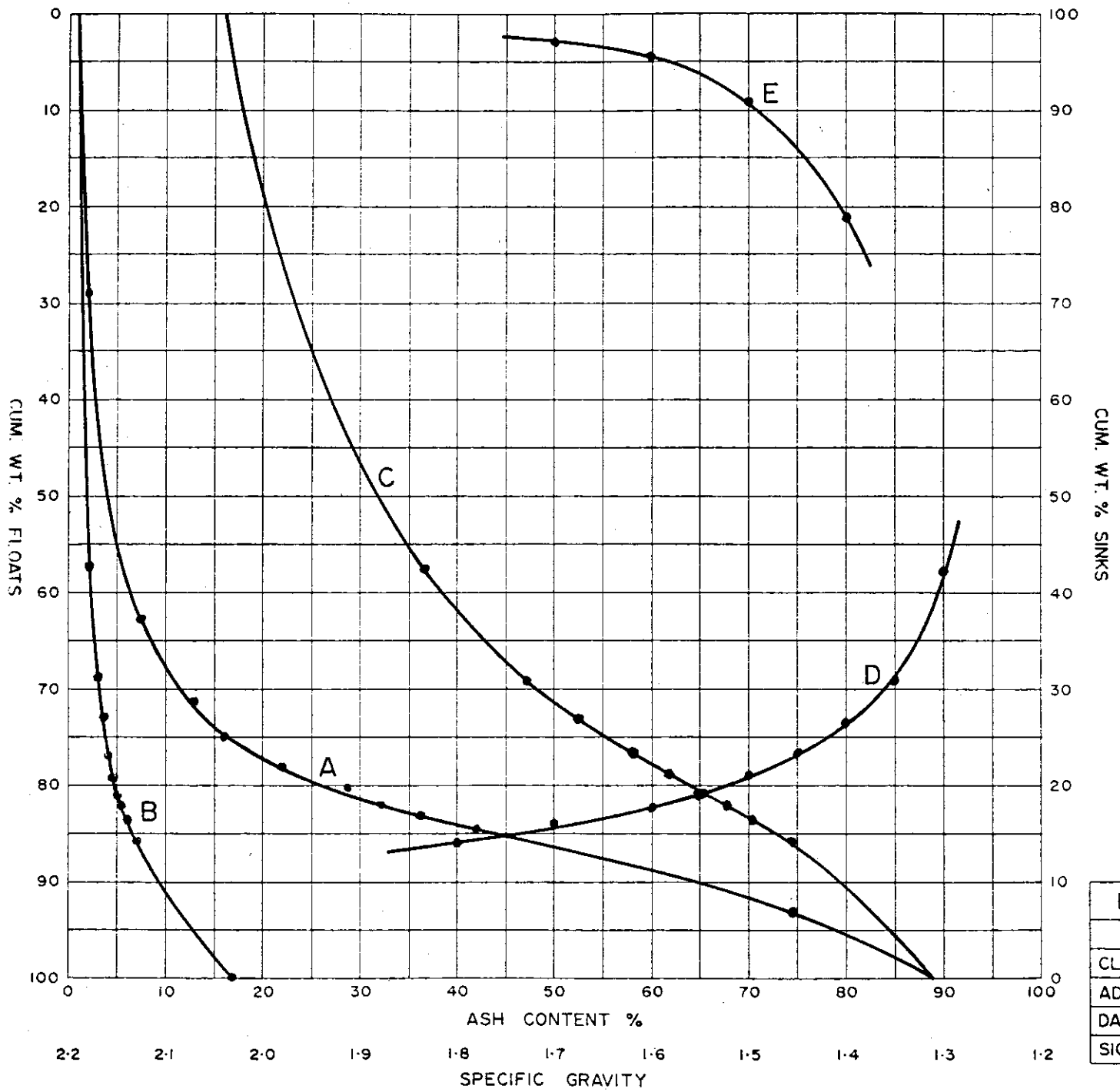
BIRTLEY ENGINEERING

TABLE 159

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 101

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	ADIT 18 28M. x 65M.
DATE	NOV. 12 , 1975
SIGNED	K. M. LAU

TABLE 160

ELCO MINING LTD.

SAMPLE: Adit No. 18

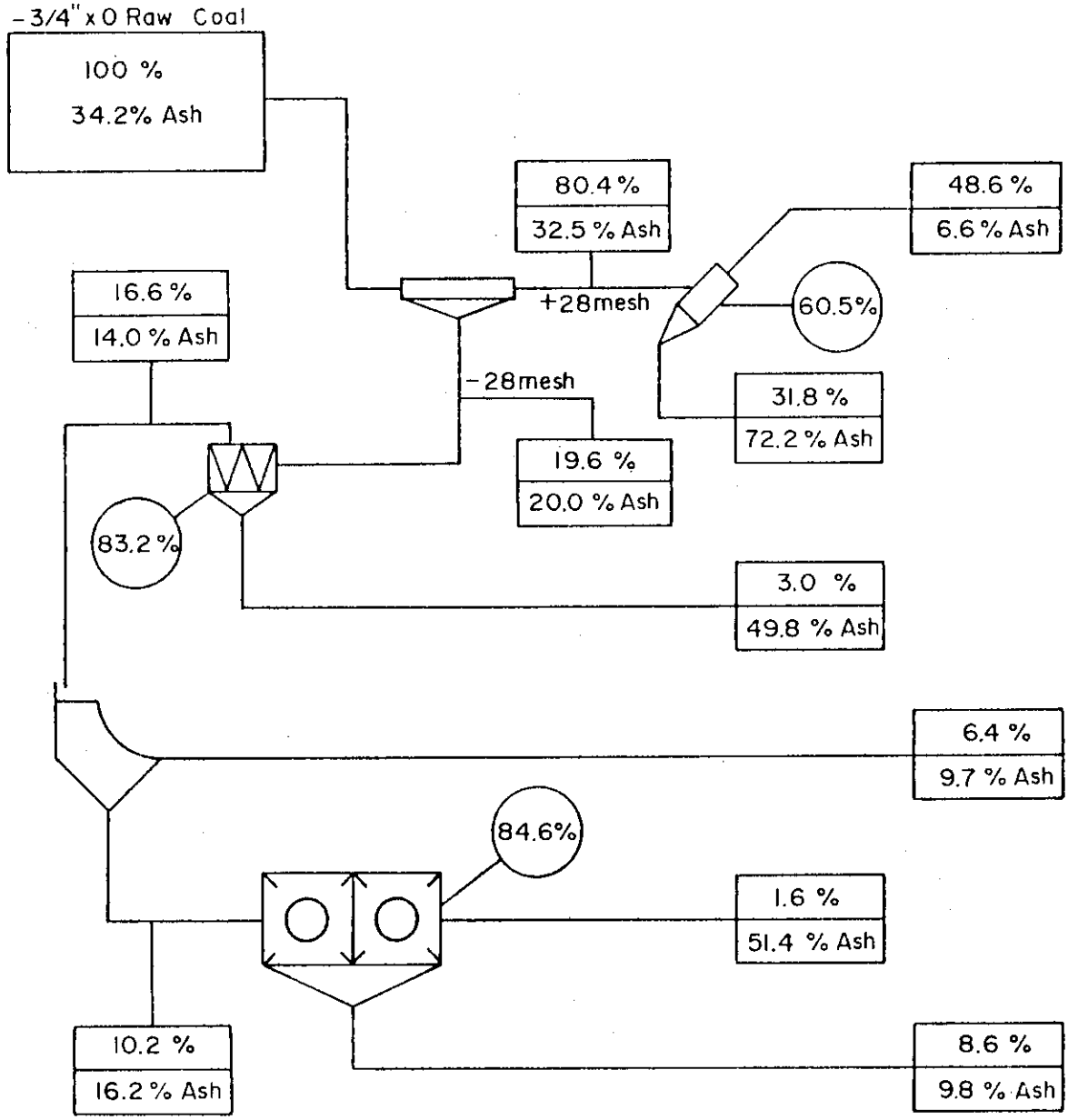
LAB. NO.: 4405

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	8	0.83	0.05	398	443	10	8	0.994
3/4" X 28M	8 1/2	0.72	0.05	392	454	24	153	1.056
28M X 65M	9	0.81	0.04	389	448	23	148	1.054

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	46.4	8.2	0.9	28.8	62.1	.66	0.04	9	46.4	8.2
Stage II	12.6	13.5	0.9	27.2	58.4	.74	0.05	8 1/2	59.0	9.3
Tails	41.0	27.0	0.9	25.2	46.9	--	--	--	100.0	16.6

F. F. Parameters - See Adit No. 2

FIGURE 102



OVERALL YIELD = 63.6 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT No. 18	DEC. 22 / 75
	Drawn K. M. LAU

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM 18 LAB NO. 4404 DATE OF WASH October 10, 1975.

Raw Coal Analysis: Ash % 34.2 Hardgrove Grindability Index 82

Delivered Bulk Weight 30.7 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. 18 LAB NO. 4404

1. S. G. of Separation (a) Washability 1.57
   (b) Plant 1.48
2. Feed Ash Content A.D.B. 32.5 %
3. Clean Coal Estimated Weight 7.48 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 6.6 % F.S.I. 8
5. Reject Estimated Weight 5.58 M.T.
6. Reject Analysis (A.D.B.) Ash 72.2 % FSI 1/2
7. Estimated 3/4" x 28M In Circuit (3+5) 13.06 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 80.4 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 57.3 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 60.5 %
11. Yield Clean Coal (Washability) 55 %
12. +2" Rock Oversize 2.72 M.T.

TABLE 161

ELCO MINING LTD.

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. 18 LAB NO. 4404

1. Vortex Finder Clearance (VFC) 5.7 CM 2.25 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-130 g/l. 10-13 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	54.5	21.6	8	54.5	21.6	20.0	8
	65M x 100M (.15 CM)	11.7	17.2	8 1/2	66.2	20.8		
	100M x 0	33.8	24.2	8	100.0	21.9		
O'FLOW	+65M	38.4			38.4		14.0	9
	65M x 100M	10.2			48.6	4.4		
	100M x 0	51.4	23.1	7 1/2	100.0	14.0		
U'FLOW	+65M	73.4			73.4		49.8	1 1/2
	65M x 100M	8.4			81.8	47.3		
	100M x 0	18.2	61	1 1/2	100.0	49.8		
S B O	+65M	89.2	8.5	9	89.2	8.5	9.7	8 1/2
	65M x 100M	4.4	14.9	8	93.6	8.8		
	100M x 0	6.4	22.8	7 1/2	100.0	9.7		

6. Yield - Total W.O. Cyclone Circuit = 83.2

7. Est. Yield of 28 x 65 Mesh Coal = 31.9
(as % of 28 Mesh x 0 Feed)

TABLE 162

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. 18 LAB NO. 4404

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-180 g/l 15-18 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)						16.2	8
	65M x 100M (.15 CM)							
	100M x 0							
CONC.	+65M (.21 CM)	9.4	8.9	8 1/2	9.4	8.9	9.8	8 1/2
	65M x 100M (.15 CM)	16.2	6.7	8 1/2	25.6	7.5		
	100M x 0	74.4	11.2	8 1/2	100.0	10.3		
TAILS	+65M (.21 CM)	41.5	37.5	5 1/2	41.5	37.5	51.4	2 1/2
	65M x 100M (.15 CM)	16.7	37.1	5	58.2	37.4		
	100M x 0							

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 84.6 %

6. Yield (Washability) 60 %

7. 65M x 0 (Washability) _____ %

TABLE 163

ELCO MINING LTD.

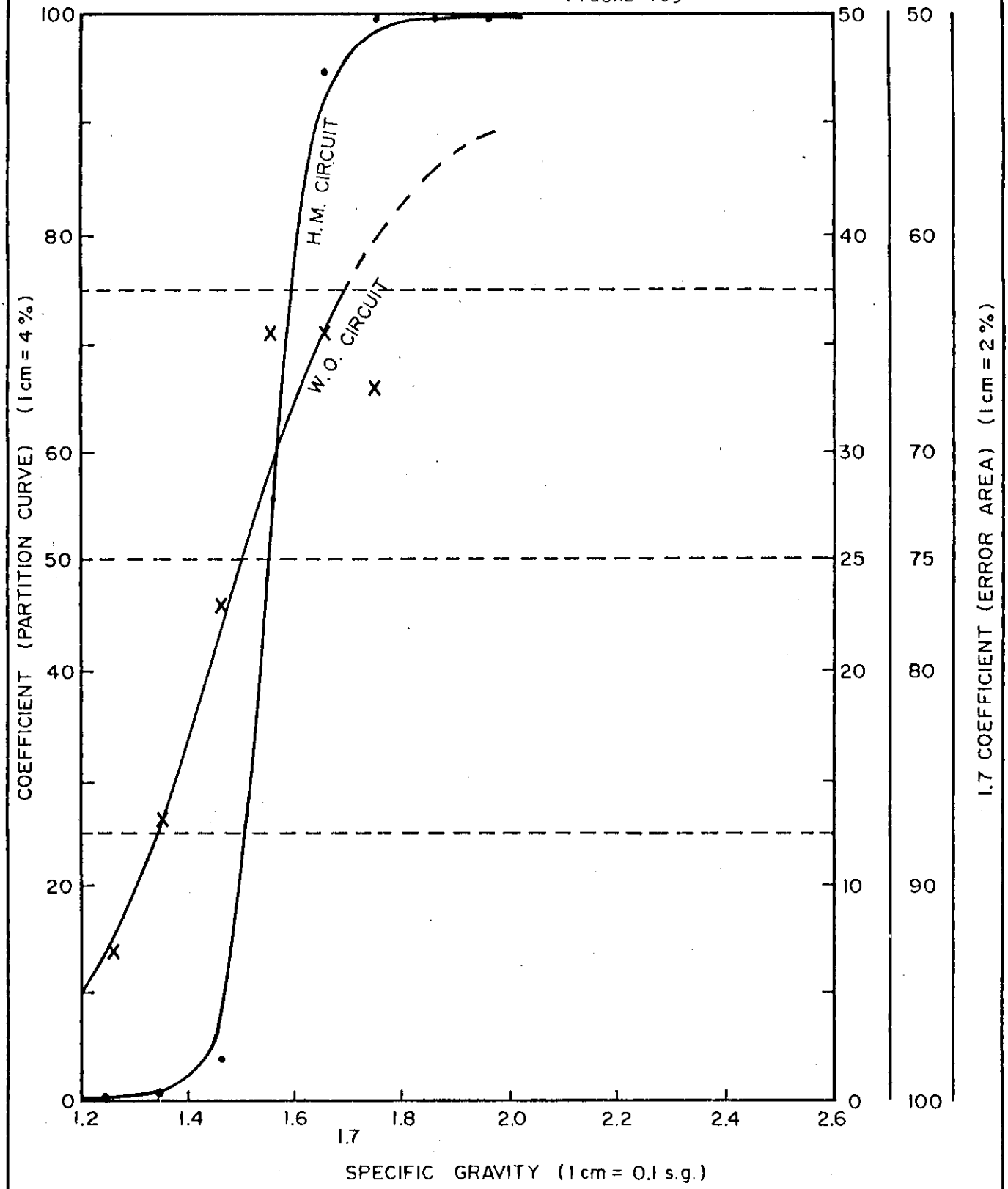
BULK WASHING DATA

ADIT/SEAM NO. 18 LAB NO. 4404

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	71.4	71.4	0.3	0.3	75.2	75.2	20.3	20.3
1.30-1.40	20.8	92.2	0.3	0.6	15.7	90.9	9.1	29.4
1.40-1.50	5.9	98.1	0.4	1.0	4.7	95.6	6.5	35.9
1.50-1.60	1.7	99.8	3.4	4.4	1.2	96.8	4.9	40.8
1.60-1.70	0.2	100.0	6.5	10.9	1.3	98.1	5.2	46.0
1.70-1.80	-	-	6.0	16.9	1.9	100.0	6.1	52.1
1.80-1.90	-	-	4.6	21.5			4.5	56.6
1.90-2.00	-	-	4.9	26.4			4.8	61.4
+2.00	-	-	73.6	100.0			38.6	100.0

FIGURE 103



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST ADIT 18	JAN. 12/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. 18 LAB. NO. 4404 DATE OF WASH October 10, 1975.

a) Raw Coal

Delivered Wt.	=	30.7
Ash %	=	34.2
Hardgrove Grindability Index	=	82
Estimated Washed Weight	=	16.2

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 80.4

Effective S. G. = 1.55

Raw Feed	32.5 %	Ash 5 1/2	F.S.I.
Clean Coal	6.6 %	Ash 8	F.S.I.
Reject	72.2 %	Ash 1/2	F.S.I.

Calculated Yield = 60.5

Weighed Yield = 57.3

c) Water-Only Cyclone Circuit

Raw Feed	20.0 %	Ash 8	F.S.I.
Overflow	14.0 %	Ash 9	F.S.I.
Underflow	49.8 %	Ash 1 1/2	F.S.I.

Calculated Yield = 83.2

% of +65 Mesh in O/F = 38.4

Sieve Bend Overflow	9.7 %	Ash 8 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	16.2 %	Ash 8	F.S.I.
Concentrates	9.8 %	Ash 8 1/2	F.S.I.
Tails	51.4 %	Ash 2 1/2	F.S.I.

Calculated Yield = 84.6

ELCO MINING LTD.

TABLE 164

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. 18 LAB. NO. 4404

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % RM% 2.1 ASH % 7.0 VM % 28.8 FC % 62.1 S% 0.73 FSI 8 1/2

(ii) Dilatometer

Softening °C 390 Max. Dil. °C 460 Max Cont. % 25

Max. Dil. % 187 G. No. = 1.067

(iii) Hardgrove Grindability Index =

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
9	1.53	12	2.04	3	0.510	0.6	0.102			33.9	58.5	

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

SAMPLE: Clean Coal - Adit No. 18

LAB. NO.: 4404

TABLE 165

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
2.1	7.0	28.8	62.1	8 1/2	95

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	5.3	5.3
1/2" X 1/4"	24.1	29.4
1/4" X 8M	15.9	45.3
8M X 28M	22.2	67.5
28M X 65M	24.3	91.8
65M X 0	8.2	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
390	460	25	187	1.067

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.96	79.56	5.11	1.72	0.77	7.31	4.57

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.06	0.60	0.36	1.40	10.08	24.19	57.48	0.33	1.40	1.99

SAMPLE: Composite - Alternate Plan (A)

LAB. NO.: 4762

TABLE 166

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.7	32.1	17.6	49.6	0.46	10170	83	oxid.	1470+	-	-	-
							red.	1400	1470+	-	-

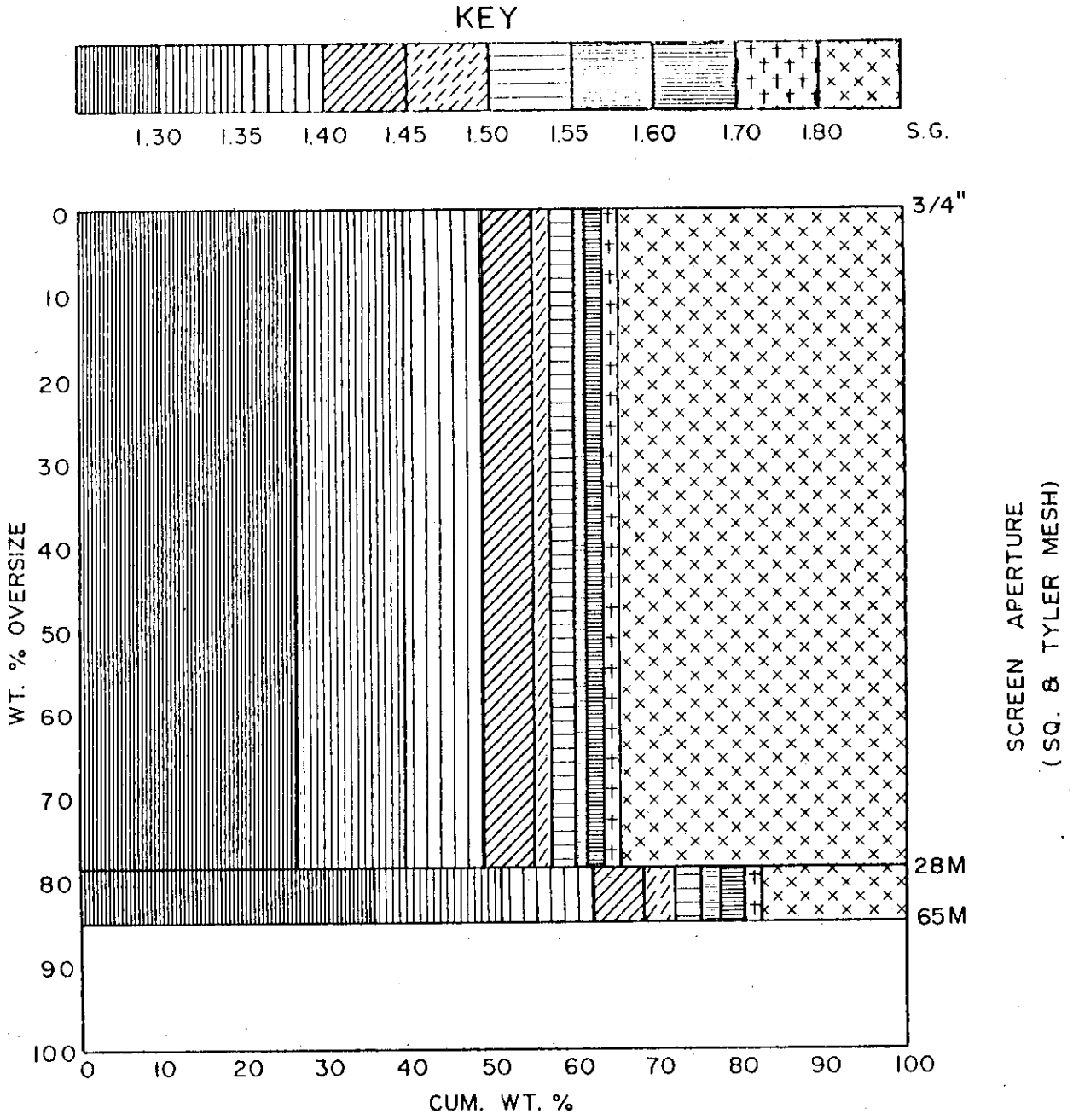
	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	23.3	52.3	0.8	14.5	32.4	0.39	69	-	-
	1/2" X 0	76.7	-	-	-	-	-	-	-	-
II	3/4" X 28M	78.6	35.5	0.9	16.8	46.8	0.48	84	78.6	35.5
	28M X 65M	6.2	20.7	0.6	19.5	59.2	0.57	114	84.8	34.4
	65M X 100M	9.3	18.9	-	-	-	-	-	94.1	32.9
	100M X 200M	4.5	17.6	-	-	-	-	-	98.6	32.2
	200M X 0	1.4	18.8	-	-	-	-	-	100.0	32.0
III	65M X 0	15.2	18.4	0.7	19.7	61.2	0.70	-	-	-

I - Size consist of raw coal crushed to -2", WT. % +2" = 6.8%
WT. % 1/2" X 28M = 59.1%

II - Size consist of raw coal crushed to - 3/4"

III - 65M X 0 off II

FIGURE 104



Composite Alternate Plan A Lab. No. 4762

BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT Nº	PLAN A
DATE	DEC 18/75	SIGNED	J. Barker.

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (A) LAB NO.4762 2" X 1/2"

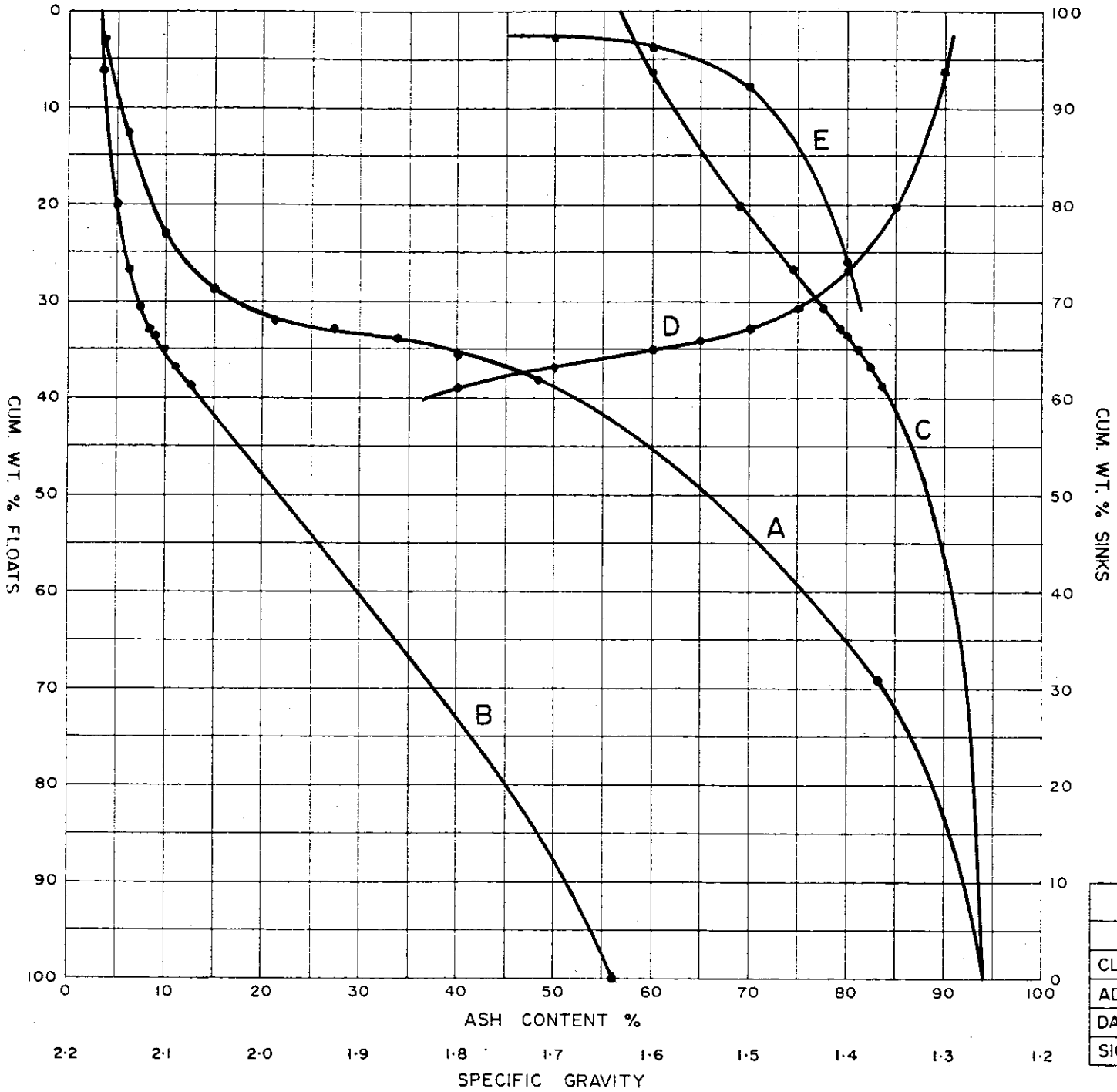
—DIRECT—					--CUM FLOATS—			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	6.30	3.40	.21	.21	6.30	3.40	55.98	93.70	59.75	1.30	0.00
1.35	13.40	6.20	.83	1.05	19.70	5.30	55.15	80.30	68.68	1.40	26.50
1.40	7.30	9.30	.72	1.76	27.00	6.52	54.44	73.00	74.57	1.50	8.20
1.45	3.60	15.30	.55	2.31	30.60	7.55	53.39	69.40	77.64	1.60	4.10
1.50	2.20	21.60	.48	2.79	32.80	8.50	53.41	67.20	79.48	1.70	3.60
1.55	.80	27.60	.22	3.01	33.60	8.95	53.19	66.40	80.10	1.80	0.00
1.60	1.60	34.10	.55	3.55	35.20	10.09	52.64	64.80	81.24	1.90	0.00
1.70	1.70	40.20	.68	4.24	36.90	11.48	51.96	63.10	82.35	2.00	0.00
1.80	1.90	48.40	.92	5.16	38.80	13.29	51.04	61.20	83.40	2.10	0.00
9.99	61.20	83.40	51.04	56.20	100.00	56.20	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 167

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

2" x 1/2"

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.–ALTERNATE PLAN (A)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

FIGURE 105

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (A) LAB NO.4762 1/2" X 28M

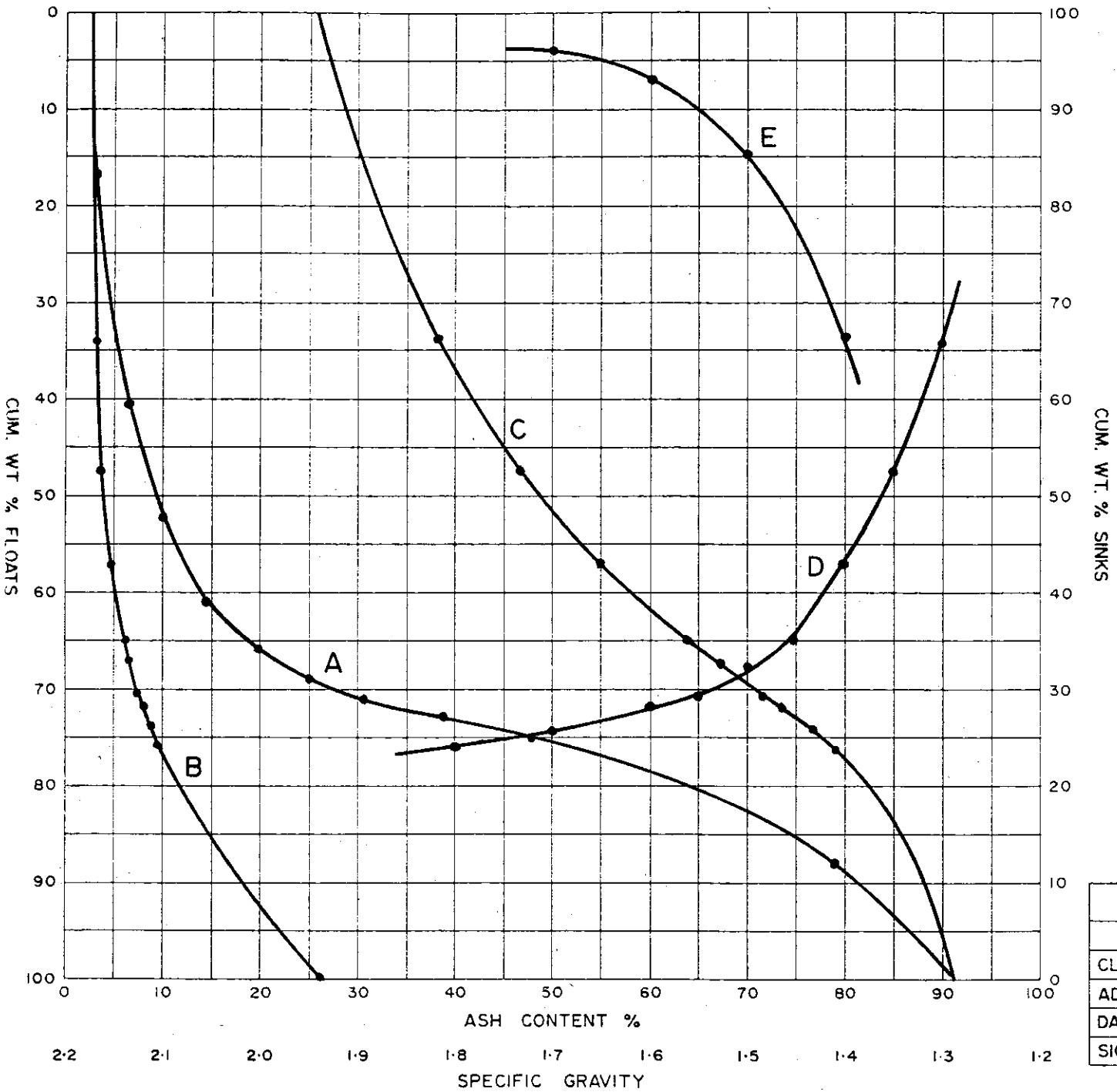
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	33.91	2.76	.94	.94	33.91	2.76	25.16	66.09	38.07	1.30	0.00
1.35	13.68	5.92	.81	1.75	47.59	3.67	24.35	52.41	46.46	1.40	33.61
1.40	9.67	9.67	.94	2.68	57.26	4.68	23.42	42.74	54.79	1.50	14.75
1.45	7.64	14.35	1.10	3.78	64.90	5.82	22.32	35.10	63.59	1.60	6.89
1.50	2.62	20.14	.53	4.30	67.52	6.38	21.79	32.48	67.09	1.70	4.02
1.55	2.89	24.94	.72	5.03	70.41	7.14	21.07	29.59	71.21	1.30	0.00
1.60	1.60	30.61	.49	5.52	72.01	7.66	20.58	27.99	73.53	1.90	0.00
1.70	2.40	38.54	.92	6.44	74.41	8.66	19.66	25.59	76.81	2.00	0.00
1.80	1.62	47.67	.77	7.21	76.03	9.49	18.88	23.97	78.78	2.10	0.00
9.99	23.97	78.78	18.88	26.10	100.00	26.10	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 168

FIGURE 106

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity - Yield Curve

E ± 0·1 S. G. Distribution Curve

1/2" x 28 M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.-ALTERNATE PLAN (A)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

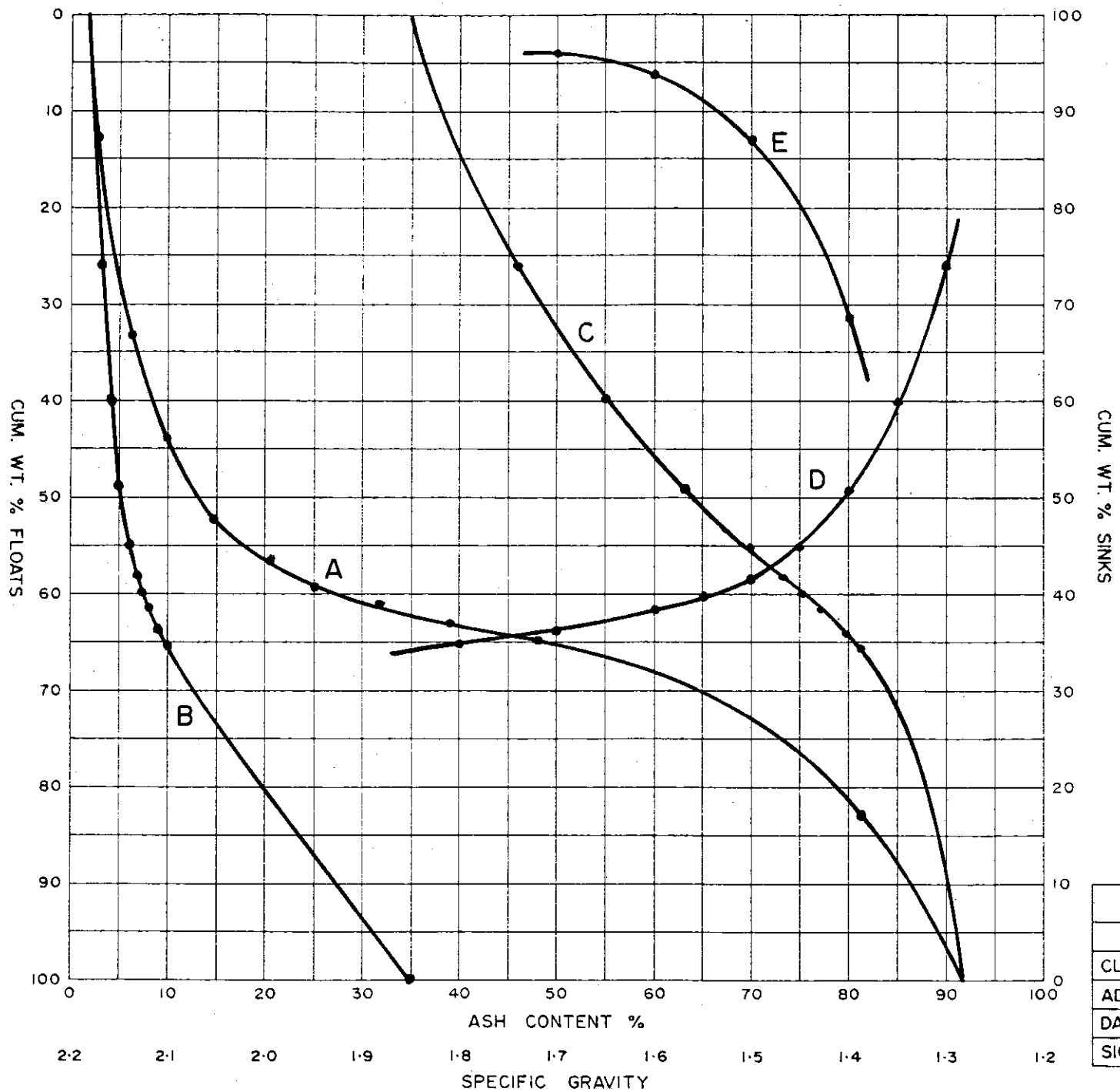
ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (A) LAB NO.4762 3/4" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	26.10	2.80	.73	.73	26.10	2.80	33.88	73.90	45.84	1.30	0.00
1.35	13.60	6.00	.82	1.55	39.70	3.90	33.06	60.30	54.83	1.40	31.60
1.40	9.00	9.70	.87	2.42	48.70	4.97	32.19	51.30	62.75	1.50	12.90
1.45	6.50	14.50	.94	3.36	55.20	6.09	31.25	44.80	69.75	1.60	6.10
1.50	2.50	20.50	.51	3.87	57.70	6.72	30.73	42.30	72.66	1.70	3.90
1.55	2.30	25.20	.58	4.45	60.00	7.42	30.16	40.00	75.39	1.80	0.00
1.60	1.60	31.60	.51	4.96	61.60	8.05	29.65	38.40	77.21	1.90	0.00
1.70	2.20	38.90	.86	5.82	63.80	9.12	28.79	36.20	79.54	2.00	0.00
1.80	1.70	47.90	.81	6.63	65.50	10.12	27.98	34.50	81.10	2.10	0.00
9.99	34.50	81.10	27.98	34.61	100.00	34.61	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 169

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity-Yield Curve

E ± 0·1 S. G. Distribution Curve

3/4" x 28 M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.-ALTERNATE PLAN (A)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

FIGURE 107

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (A) LAB NO.4762 28M X 65M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	35.50	1.40	.50	.50	35.50	1.40	19.87	64.50	30.81	1.30	0.00
1.35	15.20	4.80	.73	1.23	50.70	2.42	19.14	49.30	38.83	1.40	36.50
1.40	11.40	8.40	.96	2.18	62.10	3.52	18.18	37.90	47.98	1.50	15.60
1.45	6.10	12.30	.75	2.93	68.20	4.30	17.43	31.80	54.82	1.60	8.50
1.50	3.80	16.90	.64	3.58	72.00	4.97	16.79	28.00	59.97	1.70	4.50
1.55	3.20	23.70	.76	4.34	75.20	5.76	16.03	24.80	64.65	1.80	0.00
1.60	2.50	28.80	.72	5.06	77.70	6.51	15.31	22.30	68.67	1.90	0.00
1.70	2.80	36.00	1.01	6.06	80.50	7.53	14.30	19.50	73.36	2.00	0.00
1.80	1.70	45.70	.78	6.84	82.20	8.32	13.53	17.80	76.00	2.10	0.00
9.99	17.80	76.00	13.53	20.37	100.00	20.37	0.00	.00	0.00	2.20	0.00

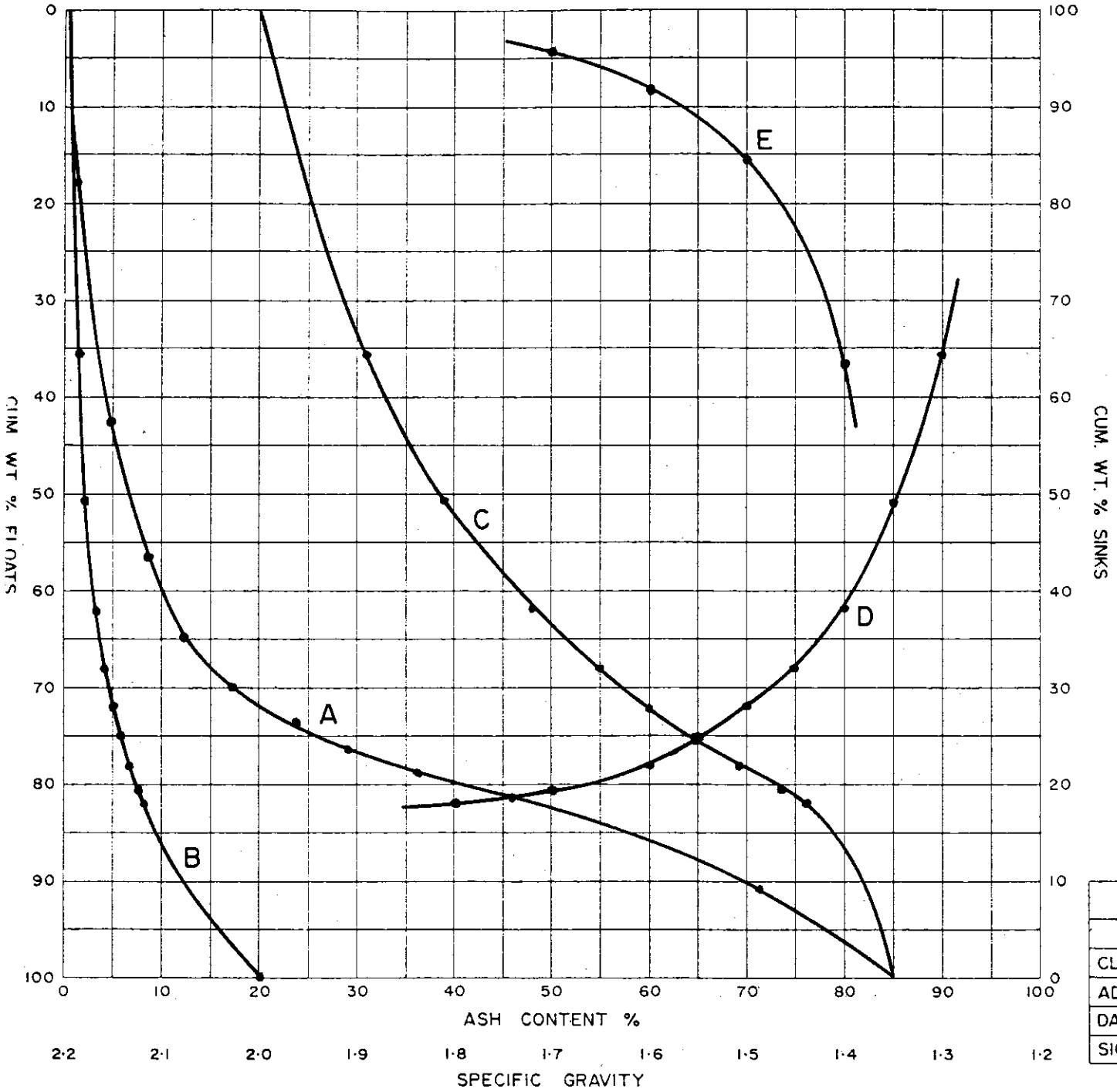
BIRTLEY ENGINEERING

TABLE 170

Birtley Engineering

FIGURE 108

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

28 M. x 65 M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.–ALTERNATE PLAN (A)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

SAMPLE: Composite Alternative Plant (A)

LAB. NO.: 4762

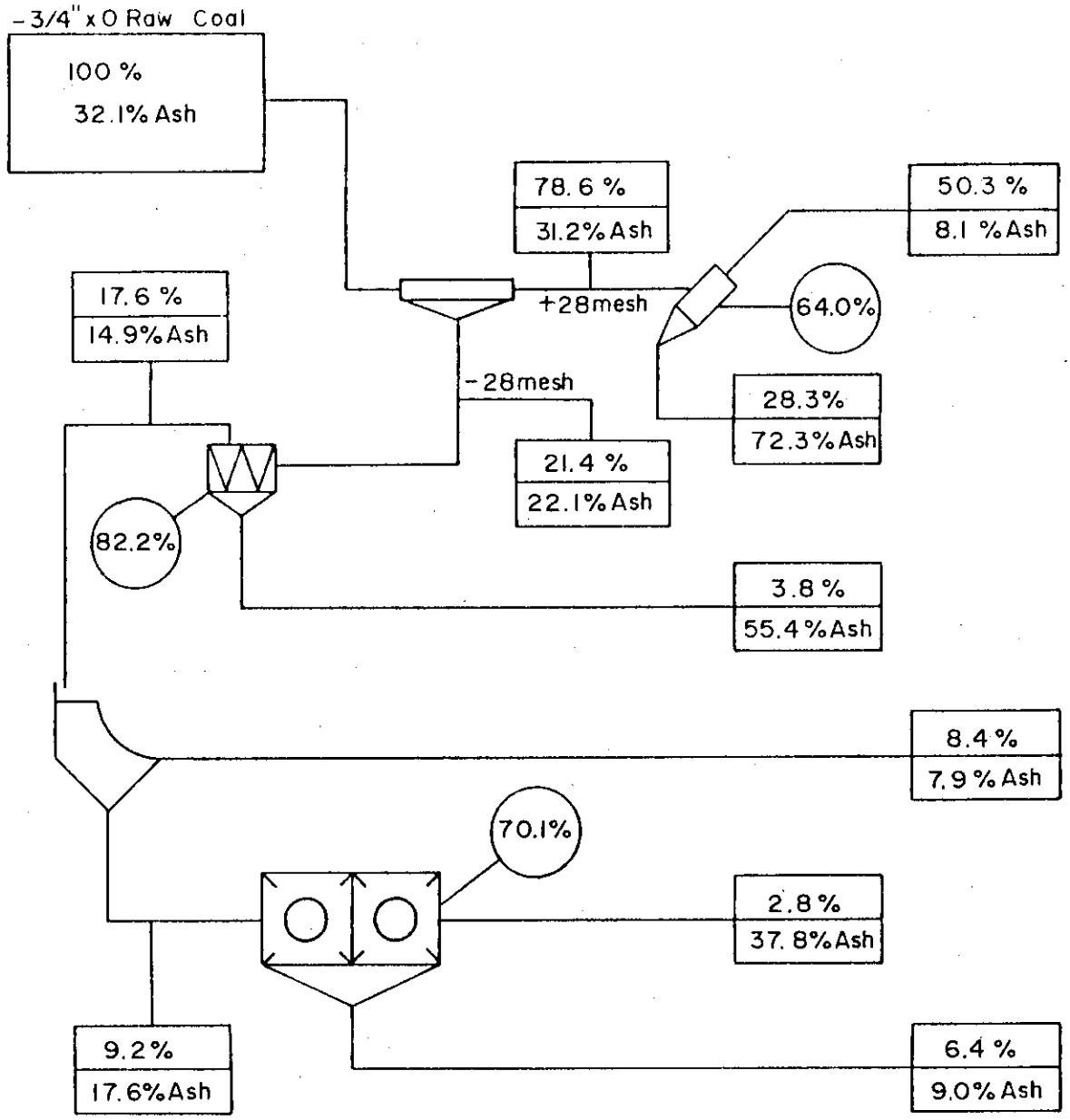
TABLE 171

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	4 1/2	0.46		418	448	4	--	--
3/4" X 28M	7	0.66		402	473	21	-3	0.902
28M X 65M	8	0.63		405	470	8	10	1.008

FROTH FLOTATION TEST 65M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	50.8	6.6	0.4	21.6	71.4	.63		8 1/2	50.8	6.6
Stage II	11.1	12.3	0.4	20.6	66.7	.61		7 1/2	61.9	7.6
Tails	38.1	34.5	0.4	17.9	47.2	--	--	--	100.0	17.9

F. F. Parameters - See Adit No. 2

FIGURE 109



OVERALL YIELD = 65.1 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD SUMMARY OF BULK WASHING TEST COMPOSITE 'A'	DEC. 19/75
	Drawn L. BAILEY

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM Composite A LAB NO. 4761 DATE OF WASH November 18, 1975.

Raw Coal Analysis: Ash % 32.1 Hardgrove Grindability Index 83

Delivered Bulk Weight 10.26 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. Composite A LAB NO. 4761

1. S. G. of Separation (a) Washability 1.57
   (b) Plant 1.50
2. Feed Ash Content A.D.B. 31.2 %
3. Clean Coal Estimated Weight 3720 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.1 % F.S.I. 7
5. Reject Estimated Weight 2842 M.T.
6. Reject Analysis (A.D.B.) Ash 72.3 % FSI 1
7. Estimated 3/4" x 28M In Circuit (3+5) 6.562 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 78.6 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 56.7 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 64.0 %
11. Yield Clean Coal (Washability) 62 %
12. +2" Rock Oversize .502 M.T.

ELCO MINING LTD.

TABLE 172

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. Composite A LAB NO. 4761

1. Vortex Finder Clearance (VFC) 4.4 CM 1.75 Inches
2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.
3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.
4. Feed Pulp Density 100-150 g/l. 10-15 % Solids W/V
5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	56.6	20.3	6 1/2	56.6	20.3	22.1	7
	65M x 100M (.15 CM)	9.0	18.9	7 1/2	65.6	20.1		
	100M x 0	34.4	24.6	5 1/2	100.0	21.7		
O'FLOW	+65M	48.0			48.0		14.9	7 1/2
	65M x 100M	18.7			66.7	12.6		
	100M x 0	33.3	19.4	5	100.0	14.9		
U'FLOW	+65M						55.4	1 1/2
	65M x 100M							
	100M x 0							
S B O	+65M	94.9	7.9	8	94.9	7.9	7.9	8 1/2
	65M x 100M	1.8	12.0	8	96.7	8.0		
	100M x 0	3.3	17.5	7 1/2	100.0	8.3		

6. Yield - Total W.O. Cyclone Circuit = 82.2
7. Est. Yield of 28 x 65 Mesh Coal = 39.5
   (as % of 28 Mesh x 0 Feed)

TABLE 173

ELCO MINING LTD.

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. Composite A LAB NO. 4761

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 160-200 g/l 16-20 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	20.8	9.4	8	20.8	9.4	17.6	7 1/2
	65M x 100M (.15 CM)	25.1	9.9	8 1/2	45.9	9.4		
	100M x 0	54.1	23.6	5 1/2	100.0	17.1		
CONC.	+65M (.21 CM)	3.3	12.7	7	3.3	12.7	9.0	7 1/2
	65M x 100M (.15 CM)	2.9	8.9	8	6.2	10.9		
	100M x 0	93.8	9.7	7 1/2	100.0	9.8		
TAILS	+65M (.21 CM)	40.5	23.9	3 1/2	40.5	23.9	37.8	2 1/2
	65M x 100M (.15 CM)	17.4	31.3	3	57.9	26.1		
	100M x 0	42.1	51.2	1 1/2	100.0	36.7		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 70.1 %

6. Yield (Washability) 70 %

7. 65M x 0 (Washability) 15.2 %

TABLE 174

ELCO MINING LTD.

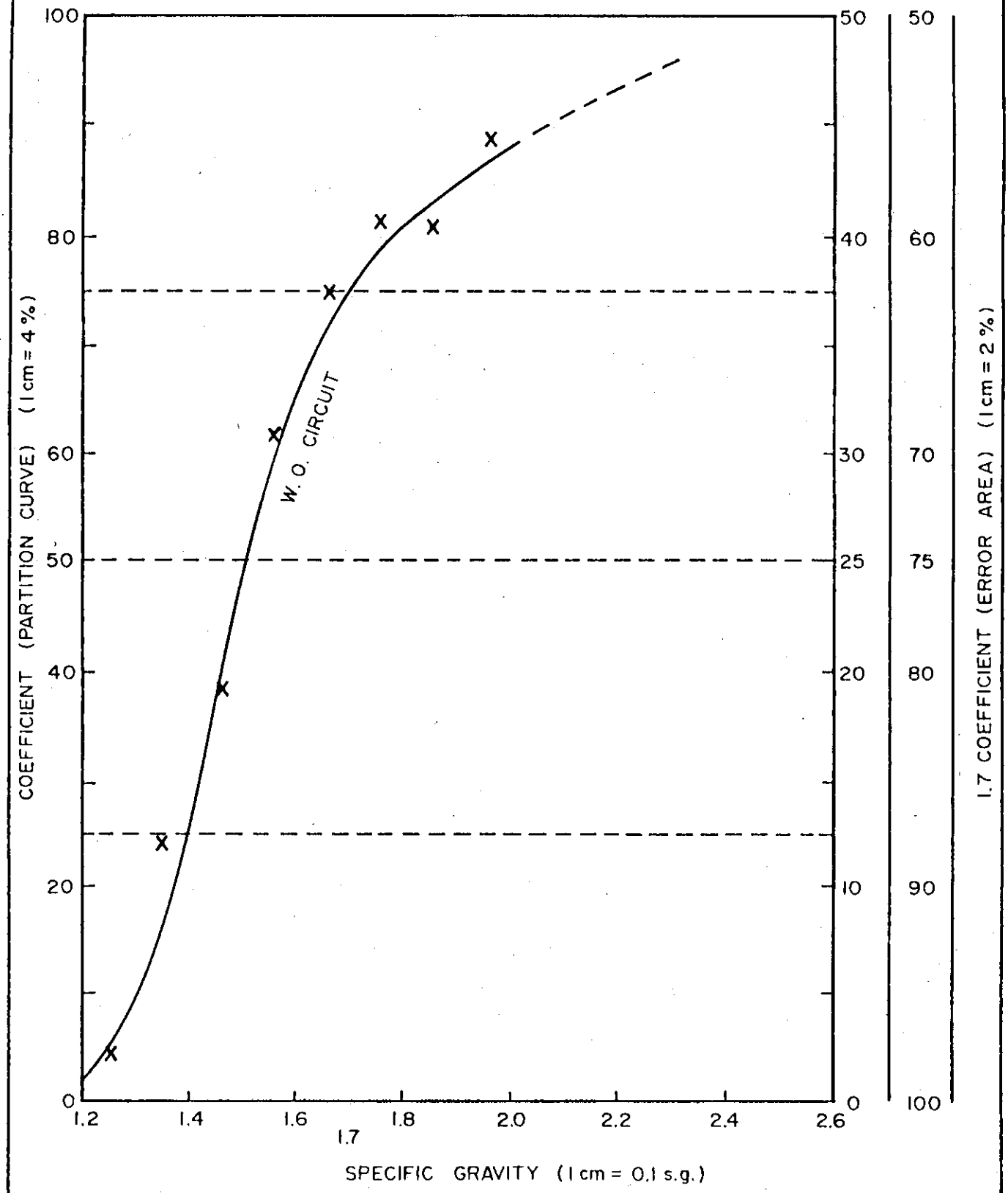
BULK WASHING DATA

ADIT/SEAM NO. Composite A LAB NO. 4761

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30					41.9	41.9	2.5	2.5
1.30-1.40					39.8	81.7	15.7	18.2
1.40-1.50					10.7	92.4	8.4	26.6
1.50-1.60					2.7	95.1	5.6	32.2
1.60-1.70					1.2	96.3	4.6	36.8
1.70-1.80					0.9	97.2	4.8	41.6
1.80-1.90					0.7	97.9	3.7	45.3
1.90-2.00					0.4	98.3	4.0	49.3
+2.00					1.7	100.0	50.7	100.0

FIGURE 175



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST COMPOSITE ALTERNATE PLAN (A)	JAN. 12 / 76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. Composite A LAB. NO. 4761 DATE OF WASH November 18, 1975.

a) Raw Coal

Delivered Wt.	= 10.3
Ash %	= 32.1
Hardgrove Grindability Index	= 8.3
Estimated Washed Weight	= 9.1

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 78.6

Effective S. G. = 1.50

Raw Feed	31.2	% Ash 5	F.S.I.
Clean Coal	8.1	% Ash 7	F.S.I.
Reject	72.3	% Ash 1	F.S.I.

Calculated Yield = 64.0

Weighed Yield = 56.7

c) Water-Only Cyclone Circuit

Raw Feed	22.1	% Ash 7	F.S.I.
Overflow	14.9	% Ash 7 1/2	F.S.I.
Underflow	55.4	% Ash 1 1/2	F.S.I.

Calculated Yield = 82.2

% of +65 Mesh in O/F = 48

Sieve Bend Overflow	7.9	% Ash 8 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	17.6	% Ash 7 1/2	F.S.I.
Concentrates	9.0	% Ash 7 1/2	F.S.I.
Tails	37.8	% Ash 2 1/2	F.S.I.

Calculated Yield = 70.1

ELCO MINING LTD.

TABLE 176

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. Composite A LAB. NO. 4761

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 5 ASH % 8.3 VM % 21.4 FC % 69.8 S% ____ FSI 7 1/2

(ii) Dilatometer

Softening °C 40.5 Max. Dil. °C 462 Max Cont. % 16

Max. Dil. % 20 G. No. = 1.007

(iii) Hardgrove Grindability Index = 97

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
12	2.03	-				13	2.20			1	26	4.40

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

TABLE 178

Re: Elk River Coal Quality Tests

Proportioning of Raw Coal Composites for Pilot Washing

The two raw coal composites according to Alternative A and C of 10 tons each to be washed separately by Birtley Engineering will be proportioned as follows:

1. Alternative Plan A

		Proportion of Raw Coal Composite		
Sample No.	Seam No.	%	Tons	Bbls.*
RC-1	2	8.8	0.88	5
RC-2	3	3.6	0.36	2
RC-3	4	15.8	1.58	9
RC-4	6	2.9	0.29	1.5
RC-5	7	2.3	0.23	1.5
RC-6	8	8.7	0.87	5
RC-7	9	6.9	0.69	4
RC-8	10	12.4	1.24	7
RC-10	12	6.7	0.67	4
RC-11	13	6.8	0.68	4
RC-12	14	5.7	0.57	3
RC-13	15	5.7	0.57	3
RC-14	16	4.3	0.43	2.5
RC-15	17	4.3	0.43	2.5
RC-16	18	5.1	0.51	3
		100.0	10.00	57

*) approximately 180 kg/bbl.

ELCO MINING LTD.

TABLE 177

SAMPLE: Clean Coal - Adit No. Composite "A"

LAB. NO.: 4761

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.5	8.3	21.4	69.8	7 1/2	97

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.6	4.6
1/2" X 1/4"	21.0	25.6
1/4" X 8M	25.6	51.2
8M X 28M	32.8	84.0
28M X 65M	7.7	91.7
65M X 0	8.3	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
405	462	16	20	1.007

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.52	81.51	4.52	1.37	0.65	8.61	2.82

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.09	0.84	0.86	0.92	8.08	23.82	58.26	0.56	1.30	1.64

SAMPLE: Composite - Alternate Plan (C)

LAB. NO.: 4764

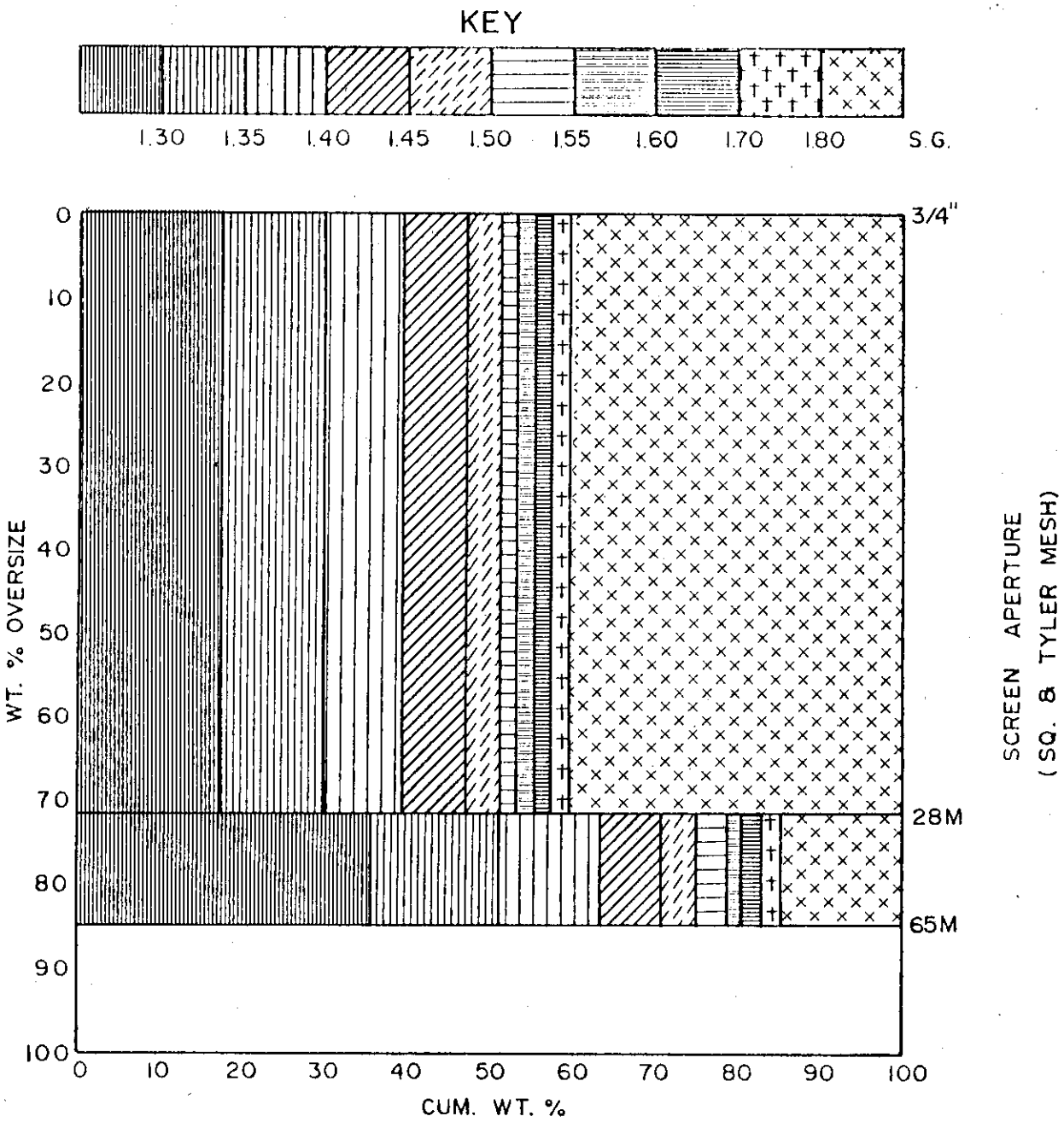
TABLE 177

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	FR.
0.7	33.9	16.5	48.9	0.46	10,000	83	oxid.	1470+	-	-	-
							red.	1430	1470+	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	21.8	54.3	1.0	14.0	30.7	0.37	64	-	-
	1/2" X 0	78.2	-	-	-	-	-	-	-	-
II	3/4" X 28M	71.8	41.3	0.8	14.9	43.0	0.39	81	71.8	41.3
	28M X 65M	13.0	18.8	0.7	18.9	61.6	0.48	114	84.8	37.9
	65M X 100M	3.7	15.7						88.5	36.9
	100M X 200M	6.7	16.8						95.2	35.5
	200M X 0	4.8	17.6						100.0	34.6
III	65M X 0	15.2	16.8	0.7	19.0	63.5	0.63			

I - Size consist of raw coal crushed to -2", WT. % + 2" = 7.8%
WT. % 1/2" X 28M = 56.9%
II - Size consist of raw coal crushed to - 3/4", WT. % 3/4" X 1/2 = 1.6%
III - 65M X 0 off II

FIGURE 111



Composite Alternate Plan C Lab. No. 4764

BIRTLEY ENGINEERING (CANADA) LTD. COAL SCIENCE AND MINERALS TESTING Calgary, Alberta.			
Title: SIZE AND DENSITY DISTRIBUTION DIAGRAM			
CLIENT	ELCO MINING	SEAM/ADIT Nº	PLAN C
DATE	DEC. 18 / 75	SIGNED	Y. Barker.

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (C) LAB NO.4764 2" X 1/2"

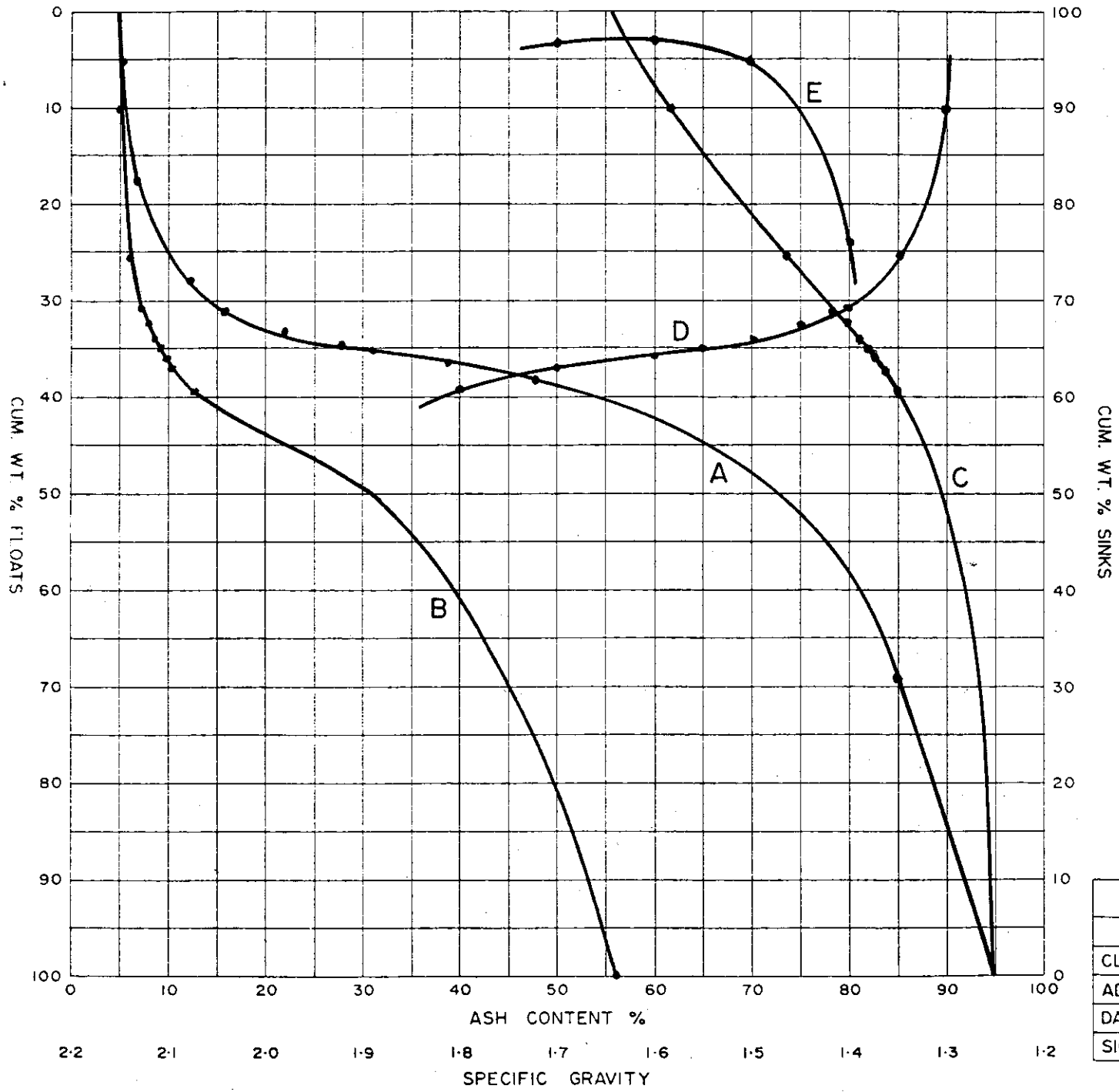
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	9.70	5.30	.51	.51	9.70	5.30	55.80	90.30	61.79	1.30	0.00
1.35	15.80	6.90	1.09	1.60	25.50	6.29	54.71	74.50	73.43	1.40	24.20
1.40	5.30	12.50	.66	2.27	30.80	7.36	54.05	69.20	78.10	1.50	5.10
1.45	1.60	15.70	.25	2.52	32.40	7.77	53.79	67.60	79.58	1.60	3.40
1.50	1.50	22.00	.33	2.85	33.90	8.40	53.46	66.10	80.88	1.70	3.50
1.55	1.10	27.70	.30	3.15	35.00	9.01	53.16	65.00	81.78	1.80	0.00
1.60	.90	31.10	.28	3.43	35.90	9.56	52.88	64.10	82.50	1.90	0.00
1.70	1.40	38.70	.54	3.97	37.30	10.66	52.34	62.70	83.47	2.00	0.00
1.80	2.10	48.10	1.01	4.98	39.40	12.65	51.33	60.60	84.70	2.10	0.00
9.99	60.60	84.70	51.33	56.31	100.00	56.31	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 178

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 112

2" x 1/2"

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP. – ALTERNATE PLAN (C)
DATE	DEC. 12 / 75
SIGNED	K. M. LAU

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (C) LAB NO.4764 1/2" X 28M

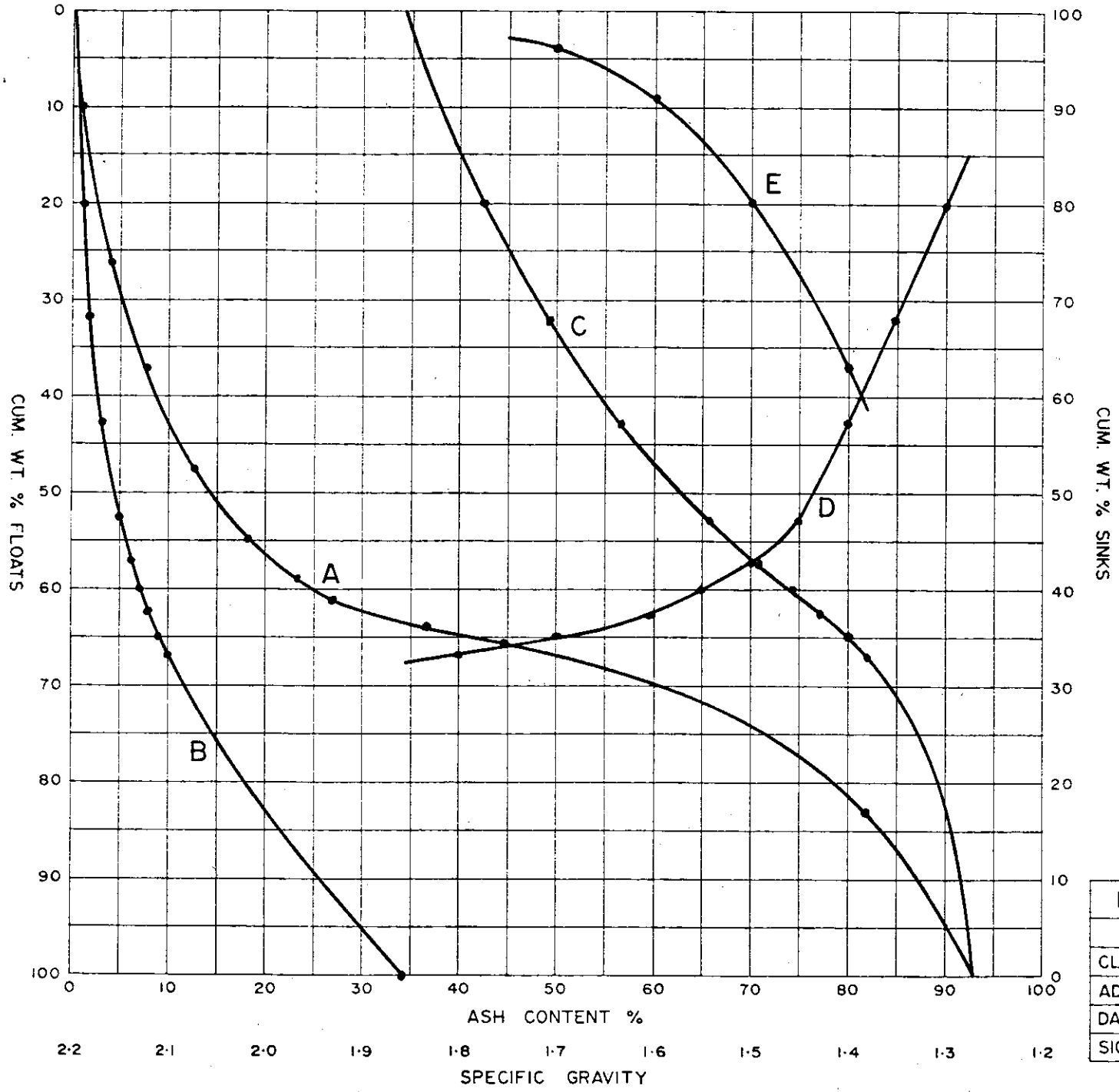
—DIRECT—					—CUM FLOATS—			—CUM SINKS—		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	20.35	1.28	.26	.26	20.35	1.28	33.86	79.65	42.51	1.30	0.00
1.35	11.10	4.12	.46	.72	31.45	2.28	33.41	68.55	48.73	1.40	36.65
1.40	11.11	7.65	.85	1.57	42.56	3.68	32.56	57.44	56.68	1.50	19.75
1.45	9.90	12.73	1.26	2.83	52.46	5.39	31.30	47.54	65.83	1.60	7.82
1.50	4.54	18.40	.84	3.66	57.00	6.43	30.46	43.00	70.84	1.70	4.20
1.55	3.17	23.62	.75	4.41	60.17	7.33	29.71	39.83	74.60	1.80	0.00
1.60	2.14	27.27	.58	5.00	62.31	8.02	29.13	37.69	77.28	1.90	0.00
1.70	2.51	36.51	.92	5.91	64.82	9.12	28.21	35.18	80.19	2.00	0.00
1.80	1.69	44.55	.75	6.66	66.51	10.02	27.46	33.49	81.99	2.10	0.00
9.99	33.49	81.99	27.46	34.12	100.00	34.12	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 179

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

1/2" x 28M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.–ALTERNATE PLAN (C)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

FIGURE 113

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (C) LAB NO.4764 3/4" X 28M

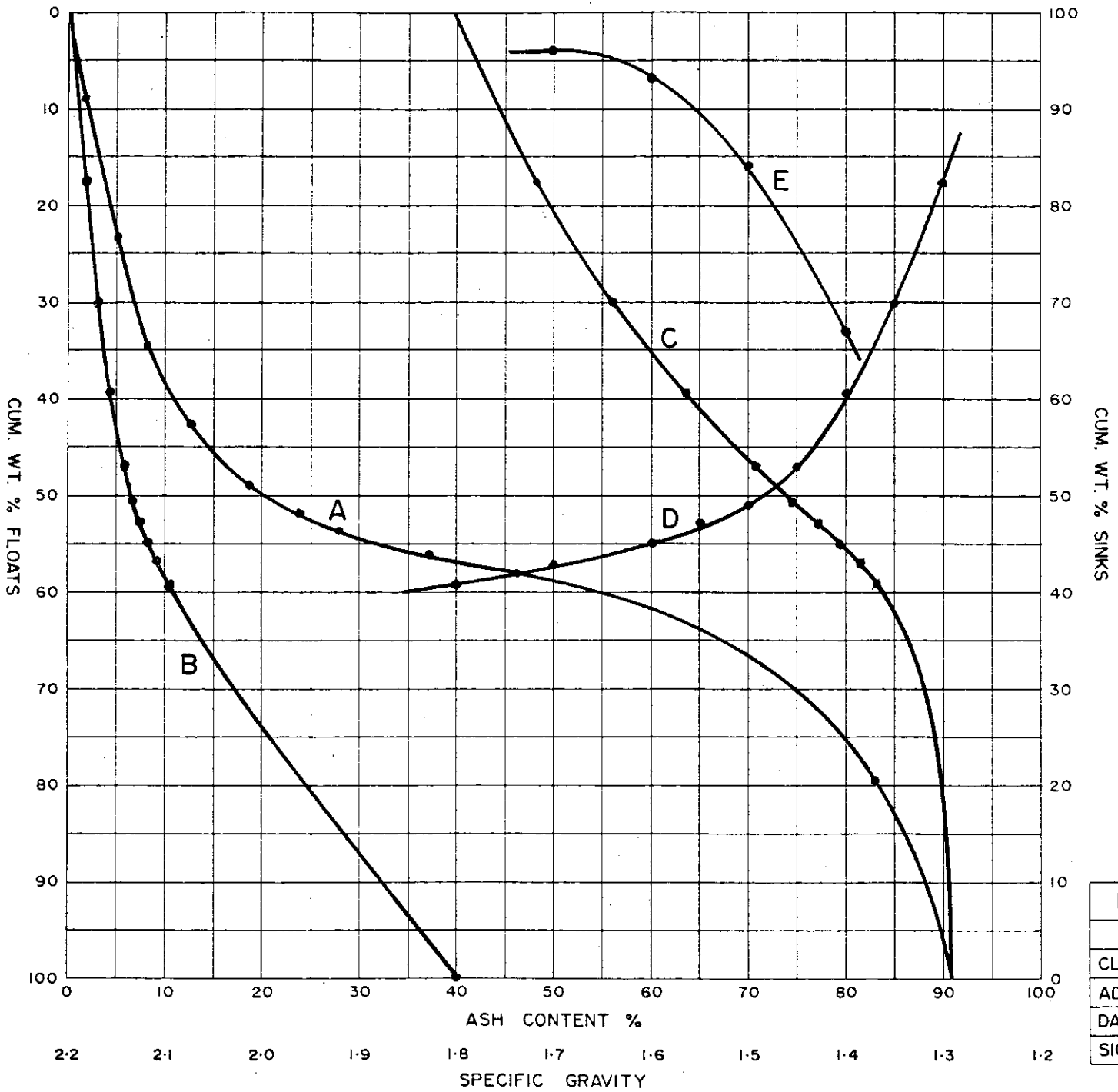
--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASH	TT WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	17.40	1.90	.33	.33	17.40	1.90	39.94	82.60	48.35	1.30	0.00
1.35	12.40	5.10	.63	.96	29.80	3.23	39.31	70.20	55.99	1.40	33.20
1.40	9.50	8.40	.80	1.76	39.30	4.48	38.51	60.70	63.44	1.50	15.70
1.45	7.60	12.90	.98	2.74	46.90	5.85	37.53	53.10	70.67	1.60	6.60
1.50	3.70	18.80	.70	3.44	50.60	6.79	36.83	49.40	74.56	1.70	4.00
1.55	2.60	24.10	.63	4.06	53.20	7.64	36.21	46.80	77.36	1.80	0.00
1.60	1.80	27.80	.50	4.56	55.00	8.30	35.71	45.00	79.35	1.90	0.00
1.70	2.20	36.90	.81	5.38	57.20	9.40	34.89	42.80	81.53	2.00	0.00
1.80	1.80	45.70	.82	6.20	59.00	10.51	34.07	41.00	83.10	2.10	0.00
9.99	41.00	83.10	34.07	40.27	100.00	40.27	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 180

Birtley Engineering
Subsidiary of Great West Steel Industries

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

FIGURE 114

3/4" x 28 M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP.–ALTERNATE PLAN (C)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

ELCO MINING LTD. COMPOSITE-ALTERNATE PLAN (C) LAB NO.4764 28M X 65M

—DIRECT—					--CUM FLOATS—			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> TT ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	34.80	1.60	.56	.56	34.80	1.60	18.37	65.20	28.17	1.30	0.00
1.35	16.20	4.80	.78	1.33	51.00	2.62	17.59	49.00	35.90	1.40	40.10
1.40	12.40	8.50	1.05	2.39	63.40	3.77	16.54	36.60	45.18	1.50	16.80
1.45	7.00	12.60	.38	3.27	70.40	4.65	15.65	29.60	52.89	1.60	7.90
1.50	4.50	18.60	.84	4.11	74.90	5.48	14.32	25.10	59.04	1.70	4.60
1.55	3.40	24.30	.33	4.93	78.30	6.30	13.99	21.70	64.48	1.30	0.00
1.60	1.90	31.10	.59	5.52	80.20	6.89	13.40	19.80	67.68	1.90	0.00
1.70	2.60	37.40	.97	6.50	82.80	7.85	12.43	17.20	72.26	2.00	0.00
1.80	2.00	46.10	.92	7.42	84.80	8.75	11.51	15.20	75.70	2.10	0.00
9.99	15.20	75.70	11.51	18.93	100.00	18.93	0.00	.00	0.00	2.20	0.00

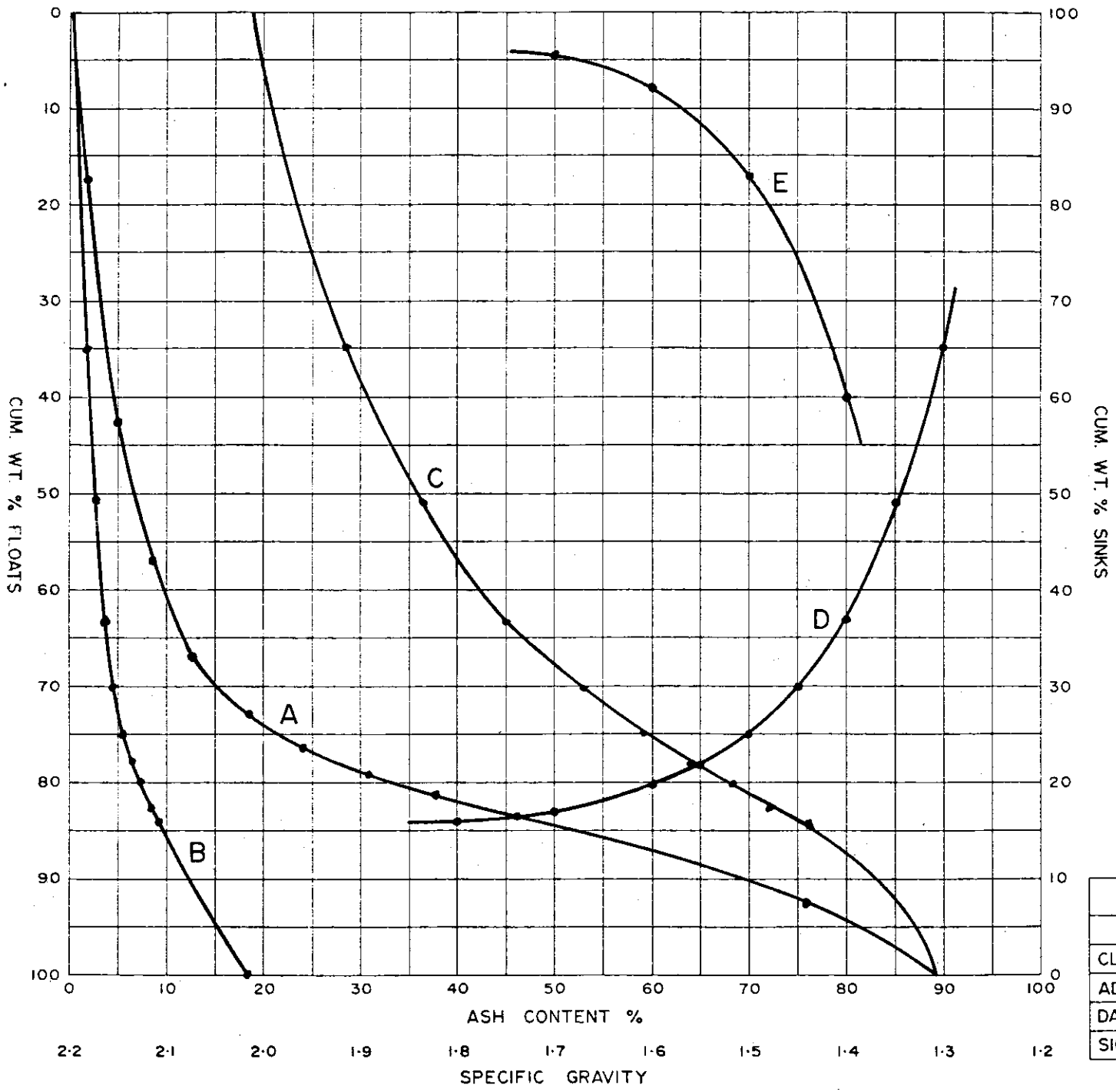
BIRTLEY ENGINEERING

TABLE 181

Birtley Engineering
Subsidiary of Great West Steel Industries

FIGURE 115

THE CLASSICAL WASHABILITY CURVES



A Primary Curve

B Clean Coal Curve

C Discard Curve

D Specific Gravity – Yield Curve

E ± 0·1 S. G. Distribution Curve

28 M. x 65 M.

BIRTLEY ENGINEERING (CANADA) LTD.	
COAL SCIENCE & MINERALS TESTING	
CLIENT	ELCO
ADIT/SEAM NO.	COMP. – ALTERNATE PLAN (C)
DATE	DEC. 15, 1975
SIGNED	K. M. LAU

ELCO MINING LTD.

TABLE 182

SAMPLE: Composite - Alternate Plan (C)

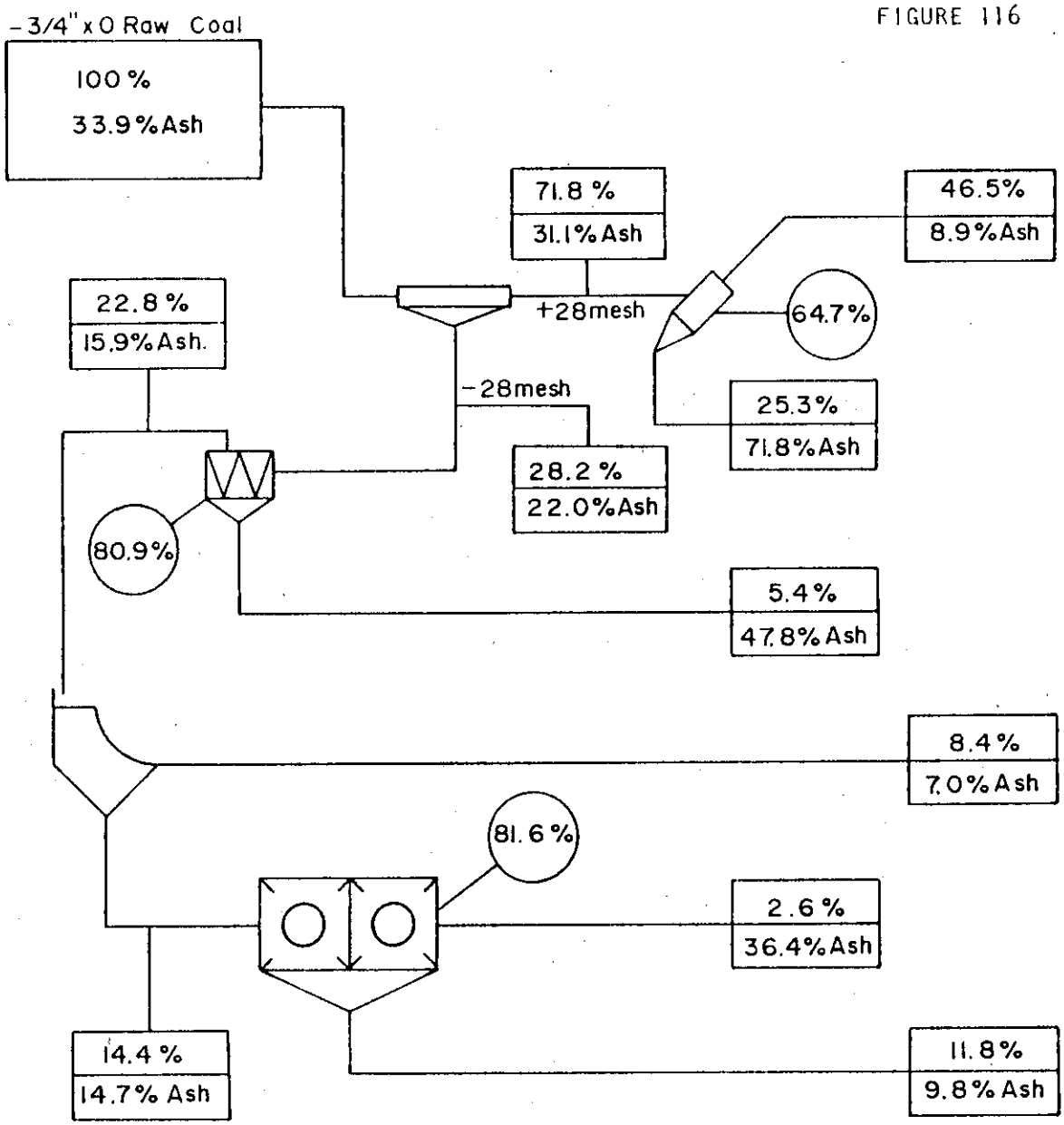
LAB. NO.: 4764

ANALYSES ON CUMULATIVE FLOATS @ 1.50 S.G.								
SIZE FRAC.	F.S.I.	S %	P %	DILATATION TEST				
				SOFTENING TEMP. (°C)	MAXIMUM DILATAT. TEMP. (°C)	MAXIMUM CONTRACT. %	MAXIMUM DILATAT. %	G.-NO.
2" X 1/2"	3	0.43		421	468	18	--	--
3/4" X 28M	6	0.52		408	471	8	4	0.977
28M X 65M	8 1/2	0.61		407	468	12	51	1.045

FROTH FLOTATION TEST 65 M x 0										
Product	Wt %	Ash %	R.M. %	V.M. %	FC %	S. %	P. %	F.S.I.	Cumulative	
									Wt %	Ash %
Stage I	66.4	7.3	0.3	20.2	72.2	.55		8	66.4	7.3
Stage II	8.3	13.7	0.3	19.7	66.3	.65		7	74.7	8.0
Tails	25.3	42.0	0.4	16.2	41.4	--	--	--	100.0	16.6

F. F. Parameters - See Adit No. 2

FIGURE 116



OVERALL YIELD = 66.7 %

LEGEND:

○ *YIELD % VALUES*

WT	*WEIGHT %*
Ash%	*ASH CONTENT (AIR DRIED)*

BIRTLEY ENGINEERING (CANADA) LTD.

Title	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST COMPOSITE 'C'	DEC. 19/75
	Drawn L. BAILEY

BIRTLEY ENGINEERING (CANADA) LTD.

Coal Science & Minerals Testing Div.

ELCO MINING LTD.

BULK WASHING DATA

ADIT/SEAM Composite C LAB NO. 4763 DATE OF WASH November 19, 1975.

Raw Coal Analysis: Ash % 33.9 Hardgrove Grindability Index 83

Delivered Bulk Weight 10.08 Metric Tons

ELCO MINING LTD.

BULK WASHING DATA

HEAVY MEDIUM CIRCUIT

ADIT /SEAM NO. Composite C LAB NO. 4763

1. S. G. of Separation (a) Washability 1.61
   (b) Plant 1.50
2. Feed Ash Content A.D.B. 31.1 %
3. Clean Coal Estimated Weight 3.565 M.T.
4. Clean Coal Analysis (A.D.B.) Ash 8.9 % F.S.I. 7
5. Reject Estimated Weight 2.630 M.T.
6. Reject Analysis (A.D.B.) Ash 71.8 % FSI 1
7. Estimated 3/4" x 28M In Circuit (3+5) 61.95 M.T.
8. Actual 3/4" x 28 Mesh from Washability Data 71.8 %
9. Yield Clean Coal (Weighted): $\frac{3}{3 + 5}$ 57.5 %
10. Yield Clean Coal (Calculated Ash Balance) - $\frac{6 - 2}{6 - 4}$ 64.6 %
11. Yield Clean Coal (Washability) 56 %
12. +2" Rock Oversize .420 M.T.

ELCO MINING LTD. TABLE 183

BULK WASHING DATA

WATER-ONLY CYCLONE CIRCUIT

ADIT/SEAM NO. Composite C LAB NO. 4763

1. Vortex Finder Clearance (VFC) 4.4 CM 1.75 Inches

2. Feed Pressure 1.4 KG/CM^2 20 P.S.I.

3. Feed Rate 23.2 $M^3/Hr.$ 85 IG/Min.

4. Feed Pulp Density 100-120 g/l. 10-12 % Solids W/V

5. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I.
FEED	+65M (.21 CM)	50.4	20.2	7	50.4	20.2	22.0	5 1/2
	65M x 100M (.15 CM)	9.8	14.3	8	60.2	19.2		
	100M x 0	39.8	23.0	4	100.0	20.7		
O'FLOW	+65M	36.9			36.9		15.9	6
	65M x 100M	8.9			45.8	11.5		
	100M x 0	54.2	19.6	4	100.0	15.9		
U'FLOW	+65M	77.4			77.4		47.8	1 1/2
	65M x 100M	9.8			87.2	45.9		
	100M x 0	12.8	60.5	1	100.0	47.8		
S B O	+65M	91.2	6.7	8 1/2	91.2	6.7	7.0	8 1/2
	65M x 100M	3.4	6.5		94.6	6.6		
	100M x 0	5.4	14.8	5 1/2	100.0	7.1		

6. Yield - Total W.O. Cyclone Circuit = 80.9

7. Est. Yield of 28 x 65 Mesh Coal = 29.9
(as % of 28 Mesh x 0 Feed)

ELCO MINING LTD. TABLE 184

BULK WASHING DATA

FROTH FLOTATION CIRCUIT

ADIT/SEAM NO. Composite C LAB NO. 4763

1. Reagents: Kerosene-Methylisobutylcarbinol (MIBC).

2. Feed Pulp Density 150-190 g/l 15-19 % Solids W/V

3. Sample Analysis:-

	Screen Size	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %	Head Ash	Head F.S.I
FEED	+65M (.21 CM)	18.0	8.0	8	18.0	8.0	14.7	7 1/2
	65M x 100M (.15 CM)	19.9	8.5	8 1/2	39.9	8.3		
	100M x 0	62.1	18.0	7	100.0	14.3		
CONC.	+65M (.21 CM)	6.9	9.9	8	6.9	9.9	9.8	8
	65M x 100M (.15 CM)	7.3	6.5	9	14.2	8.2		
	100M x 0	85.8	10.8	7 1/2	100.0	10.4		
TAILS	+65M (.21 CM)	43.5	20.4	5	43.5	20.4	36.4	3
	65M x 100M (.15 CM)	20.4	27.8	3 1/2	63.9	22.8		
	100M x 0	36.1	55.2	1 1/2	100.0	43.5		

4. Impeller Type - Birtley Multi Wobble

5. Yield Calculated (Ash Balance) 81.6 %

6. Yield (Washability) 80 %

7. 65M x 0 (Washability) 15.2 %

ELCO MINING LTD.

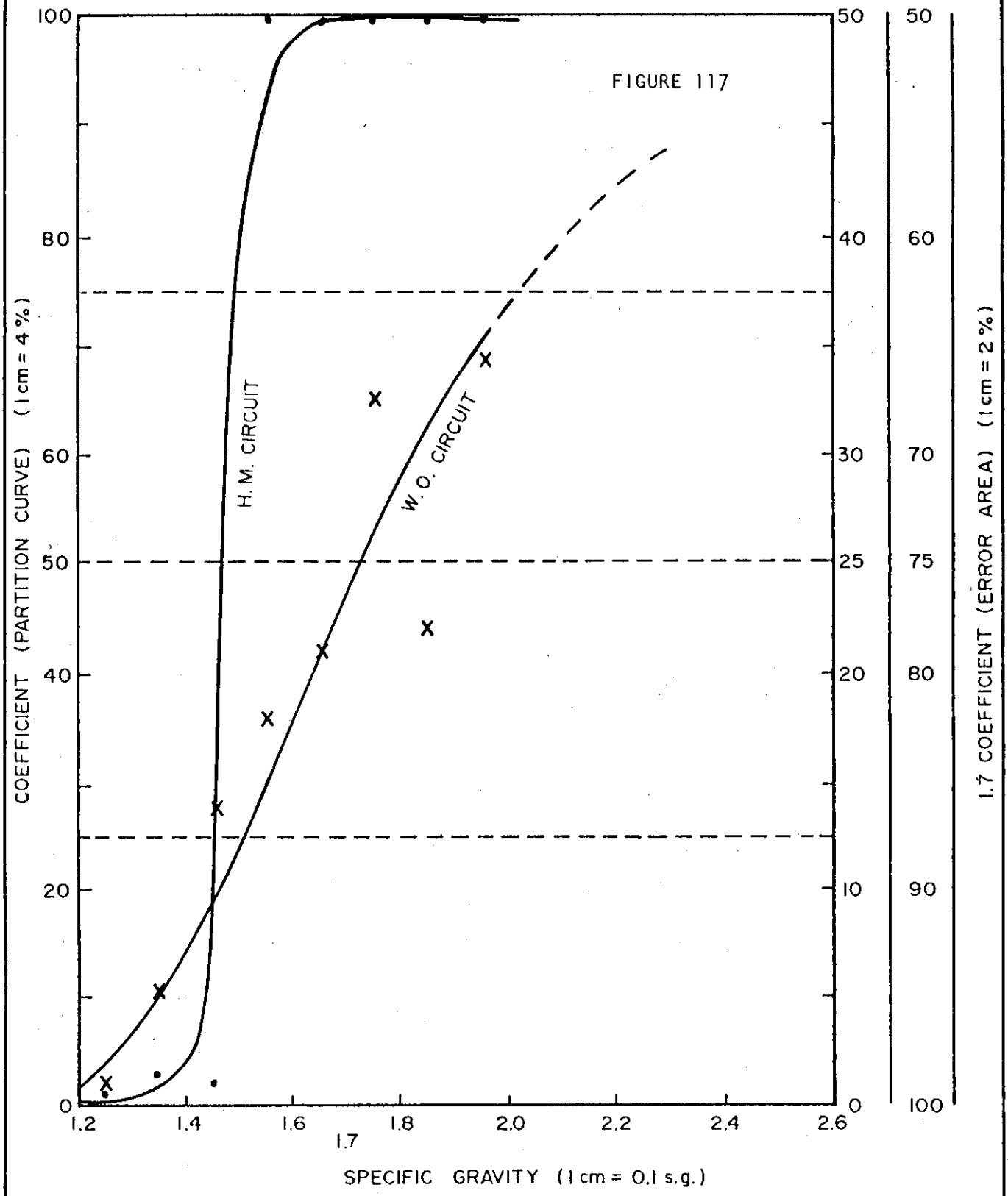
BULK WASHING DATA

TABLE 185

ADIT/SEAM NO. Composite C LAB NO. 4763

Float-Sink for E.P.M.

S. G.	HEAVY MEDIUM CIRCUIT				WATER-ONLY CYCLONE CIRCUIT (+100M)			
	CLEAN COAL		REJECT		OVERFLOW		UNDERFLOW	
	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %	Wt. %	Cum Wt %
-1.30	37.6	37.6	0.7	0.7	38.8	38.8	2.9	2.9
1.30-1.40	32.6	70.2	2.1	2.8	39.1	77.9	17.7	20.6
1.40-1.50	29.8	100.0	1.2	4.0	10.4	88.3	14.7	35.3
1.50-1.60	-	-	3.6	7.6	4.0	92.3	8.0	43.3
1.60-1.70	-	-	5.8	13.4	2.3	94.6	5.9	49.2
1.70-1.80	-	-	7.9	21.3	0.8	96.4	5.2	54.4
1.80-1.90	-	-	4.0	25.3	1.3	97.7	3.6	58.0
1.90-2.00	-	-	2.5	27.8	0.5	98.2	3.9	61.9
+2.00	-	-	72.2	100.0	2.8	100.0	38.1	100.0



BIRTLEY ENGINEERING (CANADA) LTD.

Title:	Date
ELCO MINING LTD. SUMMARY OF BULK WASHING TEST COMPOSITE ALTERNATE PLAN (C)	JAN. 12/76
	Drawn K. M. LAU

ELCO MINING LTD.

BULK WASHING SUMMARY

ADIT/SEAM NO. Composite C LAB. NO. 4763 DATE OF WASH November 19, 1975.

a) Raw Coal

Delivered Wt.	=	10.08 MT
Ash %	=	33.9
Hardgrove Grindability Index	=	83
Estimated Washed Weight	=	8.2

b) Heavy Media Circuit

Estimated Proportion of +28 Mesh in Feed = 71.8

Effective S. G. = 1.46

Raw Feed	31.1 %	Ash 4	F.S.I.
Clean Coal	8.9 %	Ash 7	F.S.I.
Reject	71.8 %	Ash 1	F.S.I.

Calculated Yield = 64.7

Weighed Yield = 57.5

c) Water-Only Cyclone Circuit

Raw Feed	22.0 %	Ash 5 1/2	F.S.I.
Overflow	15.9 %	Ash 6	F.S.I.
Underflow	47.8 %	Ash 1 1/2	F.S.I.

Calculated Yield = 80.9

% of +65 Mesh in O/F = 36.9

Sieve Bend Overflow	7.0 %	Ash 8 1/2	F.S.I.

d) Froth Flotation Circuit

Raw Feed	14.7 %	Ash 7 1/2	F.S.I.
Concentrates	9.8 %	Ash 8	F.S.I.
Tails	36.4 %	Ash 3	F.S.I.

Calculated Yield = 81.6

ELCO MINING LTD.

TABLE 186

BULK WASHING SUMMARY (Cont.)

ADIT/SEAM NO. Composite C LAB. NO. 4763

(e) Clean Coal Mix Analyses

(i) Proximate

ADM % ____ RM% 0.4 ASH % 9.5 VM % 20.2 FC % 69.9 S% ____ FSI 7

(ii) Dilatometer

Softening °C 408 Max. Dil. °C 456 Max Cont. % 17

Max. Dil. % -8 G. No. = 0.866

(iii) Hardgrove Grindability Index = 99

(f) Clean Mix Distribution

RAG		ITALSIDER		ELCO C.C. COMP.		STELCO		SCURRY R.		IN STOCK	TOTAL	
BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	M.T.	BBLS.	BBLS.	M.T.
12	2.16	11	1.98							1	24	4.315

(1 BBL. Clean Coal Weighs Approximately 170 Kg.)

ELCO MINING LTD.

TABLE 187

SAMPLE: Clean Coal - Adit No. Composite "C"

LAB. NO.: 4763

PROXIMATE ANALYSIS				F.S.I.	H.G.I.
R.M. %	ASH %	V.M. %	F.C. %		
0.4	9.5	19.8	70.3	7	9

SIZE ANALYSIS		
SIZE FRACTION	WT. %	CUMULATIVE WT. %
+ 1/2"	4.3	4.3
1/2" X 1/4"	11.4	15.7
1/4" X 8M	31.0	46.7
8M X 28M	31.5	78.2
28M X 65M	11.6	89.8
65M X 0	10.2	100.0

DILATATION TEST				
SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G.-NO.
408	456	17	-8	0.866

ULTIMATE ANALYSIS						
H_2O %	C %	H %	N %	S %	ASH %	O DIFF. %
0.45	80.86	4.32	1.26	0.48	9.38	3.25

MINERAL ANALYSIS OF ASH									
Na_2O %	K_2O %	MgO %	CaO %	Fe_2O_3 %	Al_2O_3 %	SiO_2 %	SO_3 %	P_2O_5 %	TiO_2 %
0.10	0.76	0.85	0.92	11.33	23.92	56.50	0.56	1.21	1.78

ELCO MINING LTD.

TABLE 188

SAMPLE: Alternate Plan "C" - 3/4" X 28M Washability

LAB. NO.: 4764

DILATATION TEST					
S.G. FRACTION	SOFTENING TEMP. (°C)	MAXIMUM DILATATION TEMP. (°C)	MAXIMUM CONTRACTION %	MAXIMUM DILATATION %	G. FACTOR
-1.30	406 400	469 464	22 14	37 28	1.018 1.025
1.30-1.35	409 409	477 477	20 20	-14 -13	0.697 0.734
1.35-1.40	417	482	16	-	-
1.40-1.45	423	477	9	-	-
1.45-1.50	431	480	9	-	-
1.50-1.55	422	480	11	-	-
1.55-1.60	437	480	5	-	-
1.60-1.70	341	486	5	-	-
1.70-1.80	429	450	2	-	-
+1.80					

ELCO MINING LTD.

TABLE 189

SAMPLE: Composite Plan "C" - Composite Floats off 3/4" X 28M Washability

LAB. NO. 4764

COMPOSITE FLOATS @ 1.35 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.5	3.4	21.6	74.5	adb	408	471	20	24	1.007
	3.4	21.7	74.9	db	408	471	20	20	1.000

COMPOSITE FLOATS @ 1.40 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.6	4.5	20.9	74.0	adb	408	474	21	-1	0.924
	4.5	21.0	74.5	db	408	477	20	3	0.946

COMPOSITE FLOATS @ 1.45 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.4	5.8	20.7	73.1	adb	417	477	18	-16	0.467
	5.8	20.8	73.4	db	417	477	20	-18	0.440

COMPOSITE FLOATS @ 1.50									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.7	7.0	20.2	72.1	adb	408	471	8	4	0.977
	7.0	20.3	72.7	db					

TABLE 190

COMPOSITE FLOATS @ 1.55 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.7	7.7	20.7	70.9	adb	417	455	18	-18	-
	7.8	20.8	71.4	db	414	459	19	-19	-

COMPOSITE FLOATS @ 1.60 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.7	8.5	19.9	70.9	adb	411	456	18	-18	-
	8.6	20.0	71.4	db	418	453	17	-17	-

COMPOSITE FLOATS @ 1.70 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.7	9.6	19.8	69.9	adb	417	458	15	-15	-
	9.7	19.9	70.4	db	411	450	16	-16	-

COMPOSITE FLOATS @ 1.80 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX. DILAT. TEMP.	MAX. CONT. %	MAX. DILAT. %	G FACTOR
0.7	10.8	19.5	69.0	adb	408	456	17	-17	-
	10.9	19.6	69.5	db	408	453	17	-17	-

ELCO MINING LTD. TABLE 191

SAMPLE: Alternate Plan "C" - Composite 3/4" X 28M Washability

LAB. NO.: 4764

COMPOSITE FLOATS & SINKS @ 1.80 S.G.									
PROXIMATE ANALYSIS					DILATATION TEST				
R.M. %	ASH %	V.M. %	F.C. %		SOFT. TEMP. (°C)	MAX DILAT. TEMP.	MAX CONT. %	MAX DILAT. %	G FACTOR
0.9	40.6	15.3	43.2	adb	438	471	3	-3	-
	41.0	15.4	43.6	db	435	471	3	-3	-

2. Alternative Plan C

TABLE 192

Sample No.	Seam No.	Proportion of Raw Coal Composite %	Tons	Bbls.
RC-1	2	9.7	0.97	5.5
RC-2	3	4.4	0.44	2.5
RC-3	4	18.1	1.81	10
RC-4	6	4.2	0.42	2.5
RC-5	7	2.9	0.29	1.5
RC-6	8	10.6	1.06	6
RC-7	9	7.8	0.78	4.5
RC-8	10	14.2	1.42	8
RC-10	12	7.6	0.76	4
RC-11	13	8.8	0.88	5
RC-12	14	5.5	0.55	3
RC-13	15	3.6	0.36	2
RC-14	16	1.6	0.16	1
RC-15	17	1.0	0.10	0.5
		100.0	10.00	56

COMMENTS AND CONCLUSIONS

The decision to include a large proportion of rock dilution at the time the bulk samples were taken, to simulate actual mining conditions, while having some merit, had some obvious drawbacks in a testing program of this kind. The mining of the rock and its transportation necessarily added to the in-field costs.

At the testing end for washability work, anything over 2" top-size had to be crushed to minus 2" and at times the amount of rock was considerable. This rock was merely in evidence as a high proportion of sinks at 1.80 S.G., with a very high ash content, and was reflected in lower yield figures.

When these samples were being processed in the wash plant, it was impractical to crush the rock to pass the 2" grizzly screen on the feed hopper so it wash collected, weighed and reported as shale of the heavy media circuit. This led to an erroneous low heavy media feed ash content which could, if necessary, be corrected by calculation. Nevertheless, in order to derive full data of sliming effects of the rock being crushed to minus 3/4" with the resultant contamination of the fines circuits, it would have been necessary to install an auxilliary crusher in the plant feed circuit. In actual practice, much of this extraneous rock would be removed from the R.O.M. at the breaker station.

The inclusion of the extra rock in the seam samples appears to have had a deleterious effect on Hardgrove Grindability determinations of the raw coal. At the relatively high ash contents the H.G.I. readings should be appreciably lower when compared with the clean coal H.G.I. values

It appears as if some autogenous grinding was taking place in the Hardgrove grinding mill with the free rock particles crushing the coal particles thus producing more minus 200 mesh material than would be expected if the high ash components were intergrown.

It is worthwhile to comment on the washability and washing results of Composites A and C, which reflect two (2) alternatives for mining the property, since these represent an proportional distribution of all the seams washed in 1975. Tables 163 and 164 summarize the raw coal and clean coal analyses for all the seams.

The feed ash content of 33% is rather high and the amount of fines represented by the 28M x 0 size fraction would have to be classified as low as is the overall yield of 66%. These values reflect the effect of the rock dilution mentioned.

The area of concern regarding Composites A and C arises when the Dilatometer Test results on the clean coal are compared with a G-Factor of 1.007 for A and 0.866 for C. The respective ash contents of 8.3 and 9.5 would have some bearing on this discrepency. The greater effect would be the result of larger proportions of marginal quality coal in the C composite

from seams 4, 6, 7, 8, 9, and 10 and smaller proportions of better quality coal from seams 14, 15, 16 and 17 and none from seam 18.

Comparison of Petrographic Determinations and Dilatometer Results for all the clean coals should lead to an explanation of this problem as well as to verify that F.S.I. Determinations have some value in a test program of this kind. However, without Petrographic Determinations and Dilatometer Tests, accepting the face value of the F.S.I. as an indication of coking capabilities for the clean coal of seams 8, 9, and 10 when compared with seams 2, 3, 12, 13, 14, 15, 16, 17, and 18, would lead to an incorrect assumption that all the clean coals would produce a good coke.

Overall the testing program appears to have provided the information which was sought. However, an area still appears unresolved --- that of the possibility of oxidizing of the coal from the time of extraction of the in situ coal to the actual coke oven tests. It would be in Elco Mines Ltd. best interests if resolution of this problem were considered in any future testing programs.

TABLE 193

ELCO MINING LTD.

CLEAN COAL SUMMARY TABLE

ADIT/SEAM NO.	OVERALL YIELD	ASH %	R.M. %	V.M. %	F.C. %	F.S.I.	SUL.	G. FACTOR	H.G.I.
COMP A	65.1	8.3	0.5	21.4	69.8	7 1/2	0.65	1.007	97
COMP C.	66.7	9.5	0.4	19.8	70.3	7	0.48	0.866	99
2	49.0	9.2	1.1	19.2	70.5	9	0.49	1.027	109
3	81.4	9.3	0.5	18.6	71.6	8	0.53	1.009	118
4	68.6	8.3	0.7	17.8	73.2	4	0.35	N/D	107
6	72.4	10.3	0.5	18.2	71.0	3 1/2	0.64	N/D	88
7	51.7	10.6	2.2	18.2	69.0	6	0.55	N/D	106
8	72.0	9.3	0.4	18.5	71.8	6 1/2	0.40	0.671	93
9	78.0	8.6	0.5	19.4	71.5	6	0.38	0.694	84
10	79.9	9.2	0.6	20.9	69.3	7 1/2	0.45	0.630	82
12	54.1	9.8	0.4	21.6	68.2	9	0.68	1.057	99
13	33.9	11.1	1.8	22.2	64.9	8 1/2	0.94	1.051	107
14	46.4	7.8	1.2	24.8	66.2	9	0.83	1.064	100
15	48.2	7.8	0.9	24.8	66.5	8 1/2	0.85	1.052	100
16	54.0	10.6	0.7	26.3	62.4	8	0.70	1.065	87
17	53.3	7.1	1.2	28.0	63.7	8	0.71	1.085	76
18	63.6	7.0	2.1	28.8	62.1	8 1/2	0.73	1.067	95

ELCO MINING LTD.

3/4" X 0 RAW COAL SUMMARY TABLE

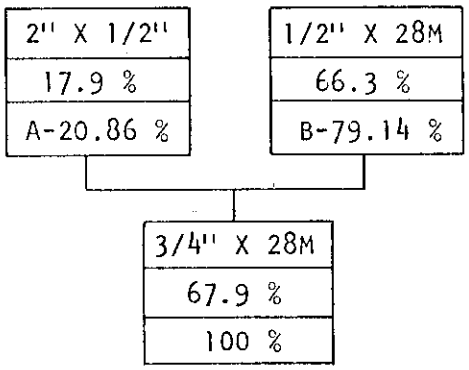
TABLE 194

SEAM/ADIT NO.	RAW-ASH %	% - 28 MESH	HARD GROVE GRINDABILITY
COMP A	32.1	21.4	83
COMP C	33.9	28.2	83
2	37.2	32.1	88
3	21.9	37.7	109
4	27.7	23.8	96
6	23.8	33.2	84
7	33.1	41.9	69
8	31.0	23.0	91
9	24.0	18.8	92
10	23.2	32.9	82
12	42.5	20.6	74
13	57.1	17.0	74
14	49.8	17.6	64
15	44.3	18.0	78
16	39.7	23.6	77
17	35.9	14.8	72
18	34.2	19.6	82

APPENDIX A

For the purpose of calculating the primary washability data, i.e. the Wt. % and Ash % of each S.G. fraction, for the 1/2" X 28 mesh coal from the determined values of the 2" X 1/2" fractions of 2" X 0 coal, and the 3/4" X 28 mesh fraction of the 2" X 0 coal crushed to minus 3/4", certain assumptions were made. Based on analytical figures from the first three seams washed, i.e. seams 2, 3, and 6, it was assumed for consistancy, 1) that the 3/4" X 1/2" size in the 3/4" X 0 crushed coal was in the range of 2% and could be considered negligible. In other words, the 3/4" X 0 crushed coal could be considered to be 1/2" X 0 crushed coal. 2) that the size consist 3/4" X 28 mesh crushed was virtually the same as the 1/2" X 28 mesh fraction of the 2" X 0 raw. Please refer to the size and raw analysis sheets for seam 2 as an example. These are included in this Appendix for convenience.

The sum of the 2" X 1/2" Wt. % and the 3/4" X 28 mesh Wt. % values were calculated to 100% of which the resultant 3/4" X 28 mesh value was taken to be the 1/2" X 28 mesh fraction of 2" X 28 mesh. This is represented schematically to illustrate the fact that the fraction 2" X 1/2" on being crushed was distributed in the 3/4" X 28 mesh coal.



The values A and B are now used to calculate the Wt. percentage of the S.G. fractions from 1.30 to 1.80 for the 1/2" X 28 mesh from the formula:

$$x = \frac{Cx100 - (E \times A)}{B}$$

where:-

x is the unknown Wt. % in column 2 of the 1/2" X 28M washability sheet.

C is the determined Wt. % in column 2 of the 3/4" X 28M washability sheet.

E is the determined Wt. % in column 2 of the 2" X 1/2" washability sheet.

A is the calculated value of the 2" X 1/2" size fraction as illustrated schematically.

B is the calculated value of the 1/2" X 28M size fraction as illustrated schematically.

To finalize, let us determine the value for the 1.30 S.G. Wt. % for 1/2" X 28 mesh in column 2, represented by x.

$$x = \frac{10.50 \times 100 - (3.60 \times 20.86)}{79.14}$$

simplified x = 12.40

All the S.G. fractions are similarily calculated and the values recorded as in column 2 of the 1/2" X 28 mesh washability sheet.

The unknown ash values for the S.G. fractions of the 1/2" X 28 mesh are calculated using the formula:

$$y = \frac{GX100 - (H \times A)}{B \times X}$$

where:-

y is the unknown ash content of a given S.G. fraction.

G is the product of values C X D of columns 2 and 3 from the 3/4" X 28 mesh washability sheet and represents ash units.

H is the product of values E X F of columns 2 and 3 from the 2" X 1/2" washability sheet and represents ash units.

A is the calculated value of the 2" X 1/2" size fraction as illustrated schematically.

B is the calculated value of the 1/2" X 28 mesh size fractions as illustrated schematically.

X is the value in column 2 of the 1/2" X 28 mesh washability sheet previously calculated.

To finalize, let us determine the Ash % value for the 1.30 S.G. fraction for the 1/2" X 28 mesh in column 3, represented by y.

$$y = \frac{27.30X100 - (10.08 \times 20.86)}{79.14 \times 12.40}$$

simplified y = 2.60

All the ash values for the remaining S.G. fractions are similarily calculated and recorded as in column 3 of the 1/2" X 28 mesh washability sheet.

The primary data as recorded in columns 2 and 3 of the 1/2" X 28 mesh washability sheet is now computed in the usual manner to produce the attendant washability curves.

A slight discrepency is evident when these calculations are made manually and compared with the computer figure. This is explained by the fact that the computer carries calculations to twelve (12) decimals, whereas manual computations are usually carried to two or three decimal points.

SAMPLE: Adit No. 2

LAB. NO.: 3396

TABLE 1

HEAD RAW ANALYSIS											
R.M. %	ASH %	V.M. %	F.C. %	S. %	BTO/LB	H.G.I.	ASH FUSION TEMPERATURES (°C)				
							ATMOS	I.D.	Sf	Hs.	Fl.
0.6	37.2	15.0	47.2	0.39	9490	88	oxid.	1445+	-	-	-
							red.	1445+	-	-	-

	SIZE AND RAW ANALYSIS									
	SIZE FRAC.	WT. %	ASH %	R.M. %	V.M. %	F.C. %	S. %	H.G.I.	CUMULATIVE	
									WT. %	ASH %
I	2" X 1/2"	17.9	57.8	0.8	13.3	28.1	0.31	69	17.9	-
	1/2" X 0	82.1	-	-	-	-	-	-	100.0	-
II	3/4" X 28M	67.9	41.8	0.6	14.5	43.1	0.37	80	67.9	41.8
	28M X 65M	4.9	24.1	0.7	17.3	57.9	0.48	123	72.8	40.6
	65M X 100M	8.6	25.6	-	-	-	-	-	81.4	39.0
	100M X 200M	10.1	19.5	-	-	-	-	-	91.5	36.9
	200M X 0	8.5	16.6	-	-	-	-	-	100.0	35.2
III	65M X 0	27.2	20.0	0.7	18.0	61.3	0.53	-	-	-

I - Size consist of raw coal as received, +2" WT. % = 4.5
Wt. % 1/2" x 28 Mesh = 66.3

II - Size consist of raw coal crushed to pass 3/4" screen.
Wt. % 3/4" x 1/2" = 1.7

III - 65 Mesh x 0 off analysis II.

ELCO MINING LTD ADIT NO.2 LAB NO.3396 .75" X 28 M

---DIRECT---					---CUM FLOATS---			---CUM SINKS---		---0.1 DISTR	
S.G.	WT%	ASH%	WT% ASH	CUM WT% TT ASHTT	WT%	SINK WT ASH%	ASH%	WT%	ASH%	S.G.	WT%
1	2	3	4	5	6	7	8	9	10	11	12
	C	D									
1.30	10.50	2.60	.27	.27	10.50	2.60	39.80	39.50	44.51	1.30	0.00
1.35	9.30	6.10	.57	.84	19.80	4.24	39.26	80.20	48.96	1.40	39.30
1.40	16.50	10.20	1.68	2.52	36.30	6.95	37.58	63.70	59.00	1.50	17.30
1.45	8.70	15.40	1.34	3.86	45.00	8.58	36.24	55.00	65.39	1.60	7.80
1.50	4.30	20.90	1.00	4.87	49.30	9.77	35.24	50.20	70.20	1.70	8.70
1.55	2.40	26.50	.64	5.50	52.20	10.54	34.60	47.80	72.39	1.80	0.00
1.60	1.40	34.40	.48	5.98	53.60	11.16	34.12	46.40	73.54	1.90	0.00
1.70	4.00	38.50	1.54	7.52	57.60	13.06	32.58	42.40	76.84	2.00	0.00
1.80	4.70	46.70	2.19	9.72	62.30	15.60	30.39	37.70	80.60	2.10	0.00
9.99	37.70	80.60	30.39	40.11	100.00	40.11	0.00	0.00	I	2.20	0.00

BIRTLEY ENGINEERING

TABLE 4

Birtley Engineering
Subsidiary of Great West Steel Industries

ELCO MINING LTD ADIT NO.2 LAB NO.3396 2" X .5"

--DIRECT--					--CUM FLOATS--		--CUM SINKS--		+-0.1 DISTR		
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
	E	F									
1.30	3.60	2.80	.10	.10	3.60	2.80	56.93	96.40	59.05	1.30	0.00
1.35	9.30	6.90	.64	.74	12.90	5.76	56.28	87.10	64.62	1.40	26.10
1.40	9.80	11.20	1.11	1.85	22.80	8.12	55.17	77.20	71.47	1.50	9.70
1.45	3.90	17.50	.68	2.53	26.70	9.49	54.49	73.30	74.34	1.60	5.60
1.50	3.00	21.20	.64	3.17	29.70	10.67	53.86	70.30	76.61	1.70	8.40
1.55	2.00	27.30	.55	3.72	31.70	11.72	53.31	68.30	78.05	1.80	0.00
1.60	.80	30.40	.24	3.96	32.50	12.18	53.07	67.50	78.62	1.90	0.00
1.70	2.80	42.70	1.20	5.15	35.30	14.60	51.87	64.70	80.17	2.00	0.00
1.80	5.60	53.50	3.00	8.15	40.90	19.93	48.88	59.10	82.70	2.10	0.00
9.99	59.10	82.70	48.88	57.03	100.00	57.03	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 2

Birtley Engineering
Subsidiary of Great West Steel Industries

ELCO MINING LTD ADIT NO.2 LAB NO.3396 .5" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH	CUM WT> ASH TT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
	x	y									
1.30	12.40	2.60	.32	.32	12.40	2.60	35.21	87.60	40.19	1.30	0.00
1.35	9.30	5.90	.55	.87	21.70	4.01	34.66	78.30	44.27	1.40	42.80
1.40	18.30	10.10	1.85	2.72	40.00	6.80	32.81	60.00	54.69	1.50	19.30
1.45	9.90	15.20	1.50	4.22	49.90	8.47	31.31	50.10	62.49	1.60	8.40
1.50	5.30	20.90	1.11	5.33	55.20	9.66	30.20	44.80	67.41	1.70	8.80
1.55	2.50	26.30	.66	5.99	57.70	10.38	29.54	42.30	69.84	1.80	0.00
1.60	1.60	34.90	.56	6.55	59.30	11.04	28.98	40.70	71.21	1.90	0.00
1.70	4.30	37.80	1.63	8.17	63.60	12.85	27.36	36.40	75.16	2.00	0.00
1.80	4.50	44.40	2.00	10.17	68.10	14.94	25.36	31.90	79.50	2.10	0.00
9.99	31.90	79.50	25.36	35.53	100.00	35.53	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

TABLE 3

Birtley Engineering
Subsidiary of Great West Steel Industries

K-ELK RIVER 76(4)B-4

CENTRAL

EVALUATION OF

EXPLORATION AND TESTWORK

JULY 1975 - APRIL 1976

ON THE

ELK RIVER COAL PROPERTY

MINING RECORDER
RECEIVED and RECORDED
JUL 1 1976
F.I.N. #
VICTORIA, B. C.

VOLUME II

APPENDIX 7

COAL QUALITY ANALYSIS

(TECHMAN)

CALGARY/DUSSELDORF

MAY 1976

GEOLOGICAL BRANCH
ASSESSMENT REPORT

ELCO MINING LIMITED

00 274

ELK RIVER COKING COAL PROJECT

COAL QUALITY ANALYSIS

Prepared for;

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MARCH 1976

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EXECUTIVE SUMMARY

COAL QUALITY REPORT

ELK RIVER COAL PROJECT

The drilling and testing program carried out in 1975 was designed to confirm and consolidate previous data. Overall, the effects of dilution were measured and the coal quality was found to be unaffected. In some of the previously marginal seams, deepening of adits actually improved the anticipated clean coal characteristics as well as the coking indicators.

The raw coal characteristics which were previously established with dilution excluded have now been confirmed with dilution included. Earlier drilling and bulk testing programs established the raw coal ash content at 20 to 22%, with a range of 7 to 33% on the individual seams. The 1975 program determined that the average ash content would be about 33% with a range of 17 to 57% on the individual seams. The characteristics of the coal in the recent programs were established using mining scheme A (all the seams being mined) and mining scheme C (emphasis on mining seams 2 to 13).

Because the previous samples contained only 15.5% minus 28 mesh (0.6 mm) coal, and because no washabilities were run on the fines, the 1975 program was designed to more closely represent the anticipated plant feed size distribution, and was analysed according to the circuits which would probably clean the coal. In order to closely approximate the plant feed size distribution, the coal was crushed initially to 2", washability was run on the 2" x ½" material, then the total coal was crushed to 3/4". By crushing to 3/4" top size, a more representative amount of fines was created, and washabilities were run

at 3/4" x 28M, 28 x 65M, then the 65M x 0 was frothed. Since the fines and the 2" x ½" were not considered as representative of the true picture, the ½" x 28M could then be calculated.

The raw coal characteristics were as follows:

	Average Raw Coal		Range of Raw Coal	
Size	Wt.%	Ash%	Wt.%	Ash%
2" x ½"	22.2	51.4	5-22	21-70
½" x 28M	53.5	32.3	53-58	15-36
28M x 65M	10.6	17.9	12-20	14-30
65 x 0	13.5	17.7	13-22	12.5-30
2" x0	100.0	33.0		15-45

The average washabilities for mining scheme A and C were developed, and found to differ very little. Because of the nature of the deposit, variation in the quantities of any of the seams in the blend will not greatly affect the overall washability. They may, however, significantly change the coking indicators of the blend. Table EI shows the average washabilities according to mining scheme A. The near gravity material is not excessive, and overall pit to rail recovery should be about 61% at 9.5% ash. Pilot plant testing confirmed that a product ash of 9.0% may even be feasible at 58.8% pit to rail recovery.

TABLE EI

WTD. AVERAGE WASHABILITY

ELK RIVER COAL

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats Wt.%	Cumulative Floats Ash%	Cumulative Sinks Wt.%	Cumulative Sinks Ash%	±0.1 S.G. Corrected to 1.8 S.G. Float
MINING SCHEME "A" (2" x ½")							
1.3	8.78	2.91	8.78	2.91	91.22	56.10	
1.35	13.72	6.63	22.50	5.18	77.50	64.86	
1.4	6.88	11.39	29.38	6.63	70.62	70.07	63.3
1.45	3.46	16.08	32.84	7.63	67.16	72.85	33.6
1.5	2.09	21.36	34.93	8.45	65.07	74.50	19.6
1.55	1.46	27.19	36.39	9.20	63.61	75.59	9.9
1.6	1.08	31.36	37.47	9.84	62.53	76.37	11.2
1.7	2.08	38.08	39.55	11.32	60.45	77.67	9.4
1.8	1.81	46.36	41.36	12.86	58.64	78.64	
+1.8	58.64	78.64	100.00	51.43			
	100.0						
MINING SCHEME "A" (½" x 28M)							
1.3	25.16	2.35	25.16	2.35	74.84	42.38	
1.35	12.97	5.89	38.13	3.55	61.87	50.03	
1.4	11.57	10.23	49.70	5.11	50.30	59.19	51.7
1.45	7.57	14.43	57.27	6.34	42.73	67.12	35.6
1.5	3.26	21.17	60.53	7.14	39.47	70.91	21.0
1.55	1.93	25.55	62.46	7.71	37.54	73.24	11.5
1.6	1.59	32.19	64.05	8.32	35.94	75.07	8.3
1.7	2.18	38.25	66.23	9.30	33.77	77.44	6.4
1.8	2.18	45.84	68.41	10.46	31.59	79.60	
+1.8	31.59	79.60	100.00	32.31			
	100.00						
MINING SCHEME "A" (28 x 65M)							
1.3	35.25	1.73	35.25	1.73	64.75	26.73	
1.35	18.11	4.92	53.36	2.81	46.64	35.21	
1.4	11.24	8.86	64.60	3.86	35.40	43.58	48.8
1.45	7.66	13.01	72.26	4.83	27.74	52.02	30.6
1.5	4.81	18.84	77.07	5.71	22.93	56.18	19.6
1.55	2.52	25.29	79.59	6.33	20.41	63.12	9.7
1.6	1.83	30.23	81.42	6.86	18.51	66.64	7.8
1.7	2.37	36.65	83.79	7.70	16.21	70.75	4.9
1.8	1.80	44.13	85.59	8.47	14.41	74.05	
+1.8	14.41	74.05	100.00	17.92			
	100.00						

In addition to the washability of the coarser fractions, the froth flotation characteristics of the 65 mesh x 0 (0.22 mm) were established as is shown in Figure EI. The recent pilot testing showed that the Birtley "Wobblepeller" produced lower ash and higher recoveries than other conventional flotation machines. The pilot plant tests correlated reasonably well with the laboratory tests. Figure EI demonstrates that a 9.65% ash product can be achieved from a 17.7% raw coal feed at a 75% recovery. Bulk samples tested prior to 1975 indicated higher product ash at similar recoveries on the total minus 28 mesh (0.6 mm) fraction. Recent testing however has proved that the combination of compound water cyclones on the 28 x 65M fraction and froth flotation of the 65M x 0 fraction will substantially improve the product quality of Elk River coal.

The sampling and testing in the 1975 program were more accurate than previous programs, which is indicated by the relatively straight elementary ash versus specific gravity curves.

The fluid properties of the various seams showed improvement over earlier programs. The average free swelling index increased from 6½ to 7¼. Seams #4a, 7, 8, 9 and 10 showed improvement once the adits were deepened, thus their Gieseler Fluidity should increase. Table EII shows the summary of the FSI and fluidity of the various seams and compares them to MAF volatile matter. The upper seams which are higher in volatile matter, are also much more fluid, so their presence in the blend results in superior coking properties.

FIGURE E-1

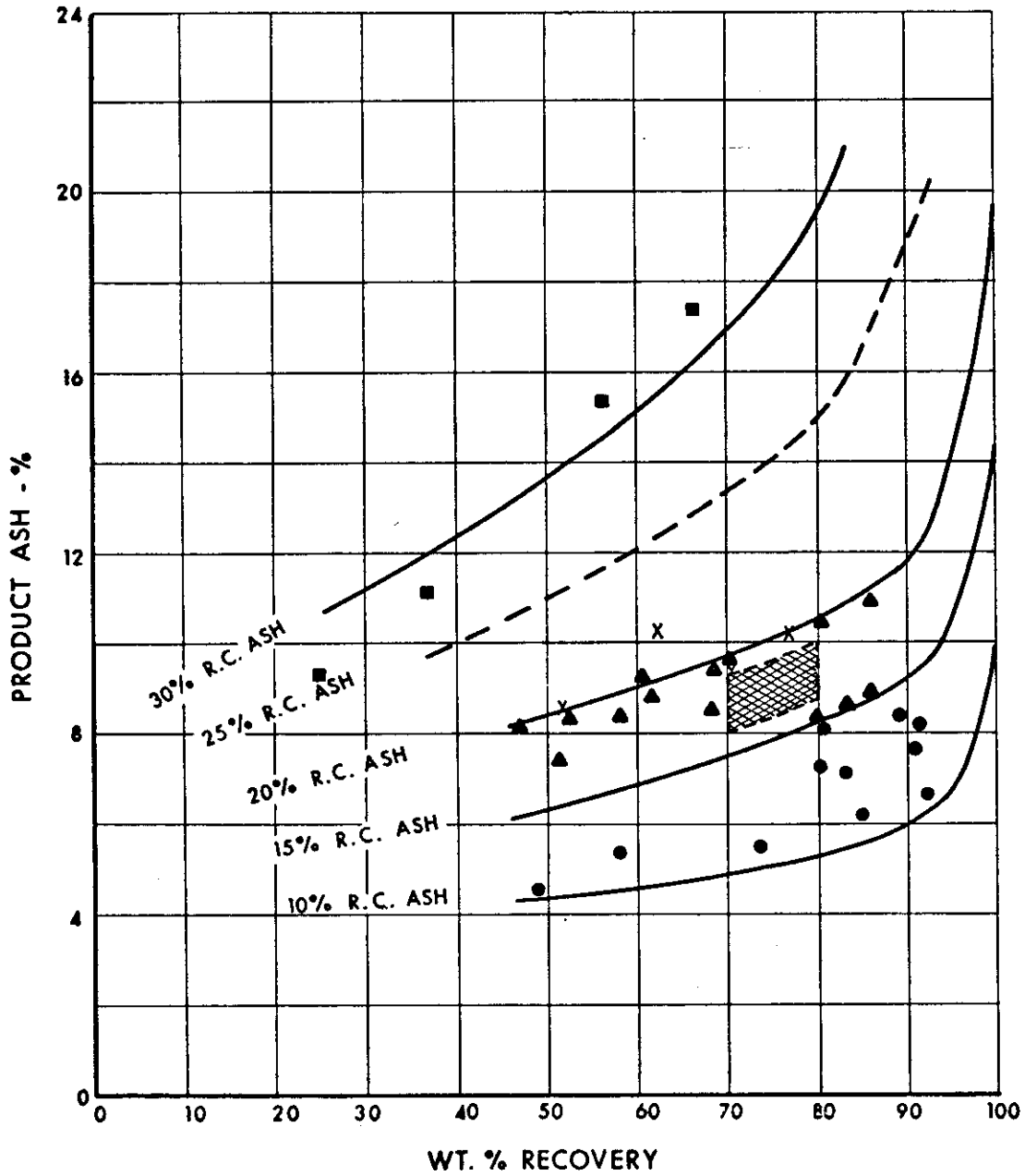
FROTH FLOTATION TEST RESULTS (1975)

PRODUCT ASH vs. RECOVERY AS A FUNCTION OF RAW COAL ASH CONTENT (65 MESH × 0)

LEGEND

RAW COAL ASH

- ○ <10% ASH
- ● 10 - 15% ASH
- ▲ 15 - 20% ASH
- X 20 - 25% ASH
- ■ >25% ASH



ANTICIPATED AREA OF OPERATION

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TABLE EII

FLUID PROPERTIES OF ELK RIVER COAL

Seam	MAF Volatile Matter (%)	1971 Clean Coal Maximum Fluidity DDPM	1971 Pilot Test FSI	Anticipated Range of FSI	1975 Pilot Test FSI
2	21.2	20	5½	5½ - 9	9
3	20.5	5.9	7½	7 - 8	8
4	20.2	3.5	5¾	5 - 8	8
6	19.9	0.9	6	2½ - 6	3½
7	20.4	1.8	6	3½ - 6	7
8	21.1	2.9	3½	3 - 6½	6½
9	21.1	1.5	4½	3½ - 6	6
10	22.8	1.9	4½	4½ - 8	7½
12	25.8	84	8	7 - 9	9
13	26.1	259	8	7½ - 9	8½
14	28.8	1,175	8	7½ - 9	9
15	28.2	330	7½	7½ - 8½	8½
16	30.7	1,260	7½	7½ - 8½	8
17	31.8	1,150	8	8 - 8½	8
18	34.2	3,125	7	7½ - 8½	8½

As far as the chemical properties of the Elk River coals were concerned, few changes were observed over the earlier data. The product sulphur will be about 0.5 to 0.6%, and the phosphorous less than 0.06% of the clean coal. The alkalinity of the coal is very low and should not exceed 0.10% of the clean coal. Ash fusion initial deformation temperatures are 1300°C plus which is about normal for Western Canadian coal.

The Hardgrove Grindability Index was developed extensively during the 1975 bulk testing program to provide backup information for size distribution. On the average the information confirmed the 35% minus 28 mesh (0.6 mm), but on individual seams, some of the other factors such as friability probably had a greater influence on the coal quality.

In conclusion, the 1975 program demonstrated that dilution did not adversely effect the washability of the Elk River coal, and that the overall clean coal quality was somewhat better than previous testing had indicated. Washabilities were developed on size fractions which would correspond to those anticipated in the preparation plant. The results demonstrate that a product ash of 9.0 to 9.5% is feasible at 20 to 23% volatile matter, 5½ FSI, and 0.6% sulphur.

INTRODUCTION

The purpose of this report is to summarize and evaluate all of the coal quality work done to date on the Elk River lease. Included in the study is all the data developed by North American Coal Co. in 1968, Scurry Rainbow Oil Ltd. in 1969, Morrison-Knudsen in 1970-71, and Elco Mining in 1975. The earlier information lacked continuity and excluded dilution and partings. The 1975 testing program was set up to clarify and unify previous data and to produce coal for coke oven testing.

Included in this report is a summary of the raw coal, washability, pilot testing, and clean coal characteristics on a seam basis of the drillhole, adit and trench samples. These results are then evaluated in terms of the two most feasible mining schemes which have been described in detail in earlier Techman reports. The effects of such things as dilution and oxidation were determined, and found not to be detrimental to coal quality. In general the 1975 bulk testing program proved the Elk River coal to be superior to that previously anticipated. Overall, the project can be viable from a coal quality standpoint.

SAMPLING & TESTING PROGRAM

In order to avoid the previous problems experienced by Western Canadian coal operators in determining the washability, size distribution, and raw coal characteristics, a special sampling and testing program was developed to obtain accurate design data. The details of this program were outlined in the Techman "Supplementary Report on Coal Preparation, June, 1975".

1) Objectives

The primary objectives of the 1975 program were as follows:

(a) To supply washability data which would more closely represent the actual plant flowsheet for the following size fractions.

i. 2" x ½" - heavy media bath (equivalent by weight to 4" x ½" fraction.

ii. ½" x 28 mesh - heavy media cyclones

iii. 28 mesh x 65 mesh - water only cyclones

iv. 65 mesh - froth flotation

All previous testing data was split into ±28 mesh fractions.

(b) To include the partings and dilution in the plant feed sample, since they could have detrimental effects on the washability. Partings were previously excluded from the samples and the effects of dilution could not be accurately estimated.

SAMPLING & TESTING PROGRAM

(c) To set up a washability which more closely approximated the actual plant feed size distribution, thereby ensuring the relevance of the washability data.

(d) To set up a preliminary channel sampling program which would ensure that bulk samples were taken beyond any oxidation zones which had detrimental effects on previous coke tests.

(e) To develop a drillhole evaluation program which would meld with the bulk testing and indicate the representativeness of the bulk tests.

(f) To develop sufficient background data so that the size distribution of the plant feed could be determined.

2) Bulk Sample Evaluation

Predetermined amounts of raw coal containing the anticipated dilution were extracted from adits 2 to 10 and trenches 12 to 18, then trucked to a mixing pad in Calgary. The coal was coned and mixed thoroughly with a Bobcat loader before a sample was split out for washability testing. The remainder of the coal was washed in a three-circuit pilot plant (14" heavy media cyclone, 6" DSM water cyclones, and froth flotation) to produce clean coal for coke testing.

The bulk sampling program was carried out according to Techman scheme 1572-02, Figure 1. The coal was crushed to 2" and a sample of 2" x ½"

NOTE : FOR "BULK" OR LARGE SCALE TEST THE FOLLOWING PROCEDURES APPLY FOR EACH SEAM.
ORIGINAL BULK SAMPLE TO BE DELIVERED FROM FIELD IN SCALED TRUCKS.
SAMPLES TO BE BLENDED BY LABORATORY & PRODUCTS STORED IN DRUMS (APPRQX. 400 LBS. EACH)

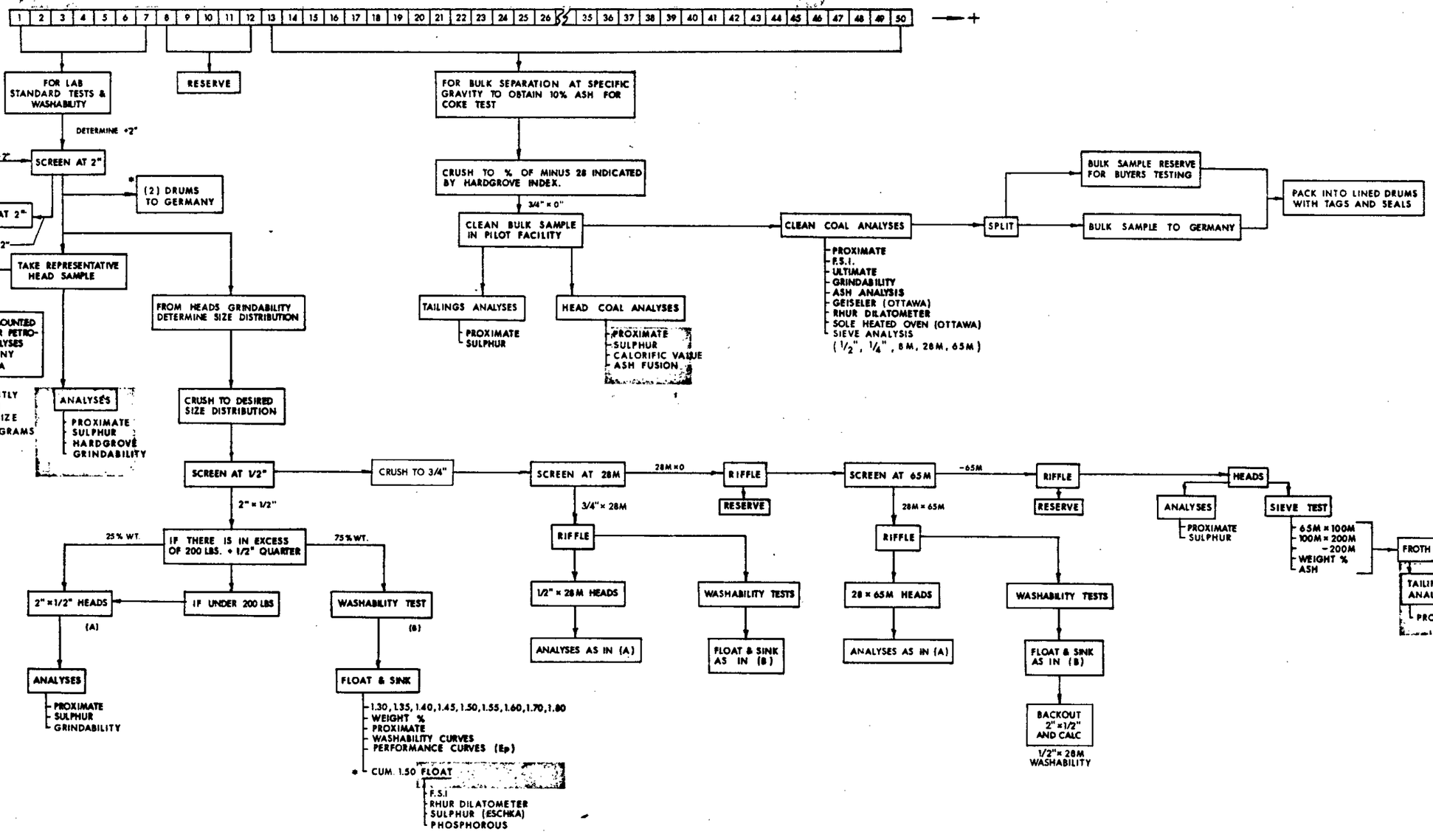


FIGURE - 1

NOTE : (1) ALL HEAD SAMPLES WILL BE RETAINED AND STORED WITHOUT OXIDATION.
(2) DRUM COST AND PACKING FOR HEAD SAMPLES AND CLEN COAL TO BE INCLUDED.
(3) LABELS TO BE INSIDE LINER, ATTACHED TO LINER SEAL AND TO BE PAINTED ON BARRELS.

REV.2
REVISIONS:
CHANGED DELIVERY SYSTEM FROM BARRELS TO SCALED TRUCKS.
ADDED INSTRUCTIONS FOR LABORATORY BLENDING & PACKING.
CHANGED TOP SIZE TO 2" IN LAB STANDARD TESTS.
ADDED NOTES 1, 2, & 3.
ADDED INSTRUCTIONS RE - PETROGRAPHIC SPECIMENS.
CLARIFIED ANALYSES ON FROTH FLOTATION TESTS
ADDED SIEVE ANALYSES TO CLEAN COAL ANALYSES.
REVISED HEAD COAL ANALYSES
ADDED CUM. 1.50 ANALYSES TO FLOAT AND SINK
DATE JUNE 23/75 APPROVED

REV.1
REVISIONS:
INCREASED No OF BBLS FROM 5 TO 7 FOR LAB STANDARD TESTS.
INCREASED No OF MOUNTED PETROGRAPHIC SPECIMENS FROM 2 TO 3
ADDED AS NOTED
DATE JUNE 12/75 APPROVED

TECHMAN LTD.

SCALE NO SCALE	DRAWN BY J. K.	PROJ. No.
DATE JUNE 1975	APPROVED	TM 113

BULK SAMPLE TEST PROCEDURES

ELCO MINING LTD. DRWG. No. 1572-02

SAMPLING & TESTING PROGRAM

coal extracted for further testing. Based on the Hardgrove Grindability Index, the sample was further crushed to 3/4" so that a representative amount of 28 mesh x 0 coal would be produced. The 3/4" x 28 mesh fraction was analysed, then the 2" x ½" fraction (which would normally be mostly +28 mesh) was back calculated out of the 3/4" x 28 mesh fraction. The remaining calculated washability will be representative of the ½" x 28 mesh actual plant feed. This procedure is unusual in washery design, but it is very necessary in order to gain insight into the true washability of the feed to the various circuits.

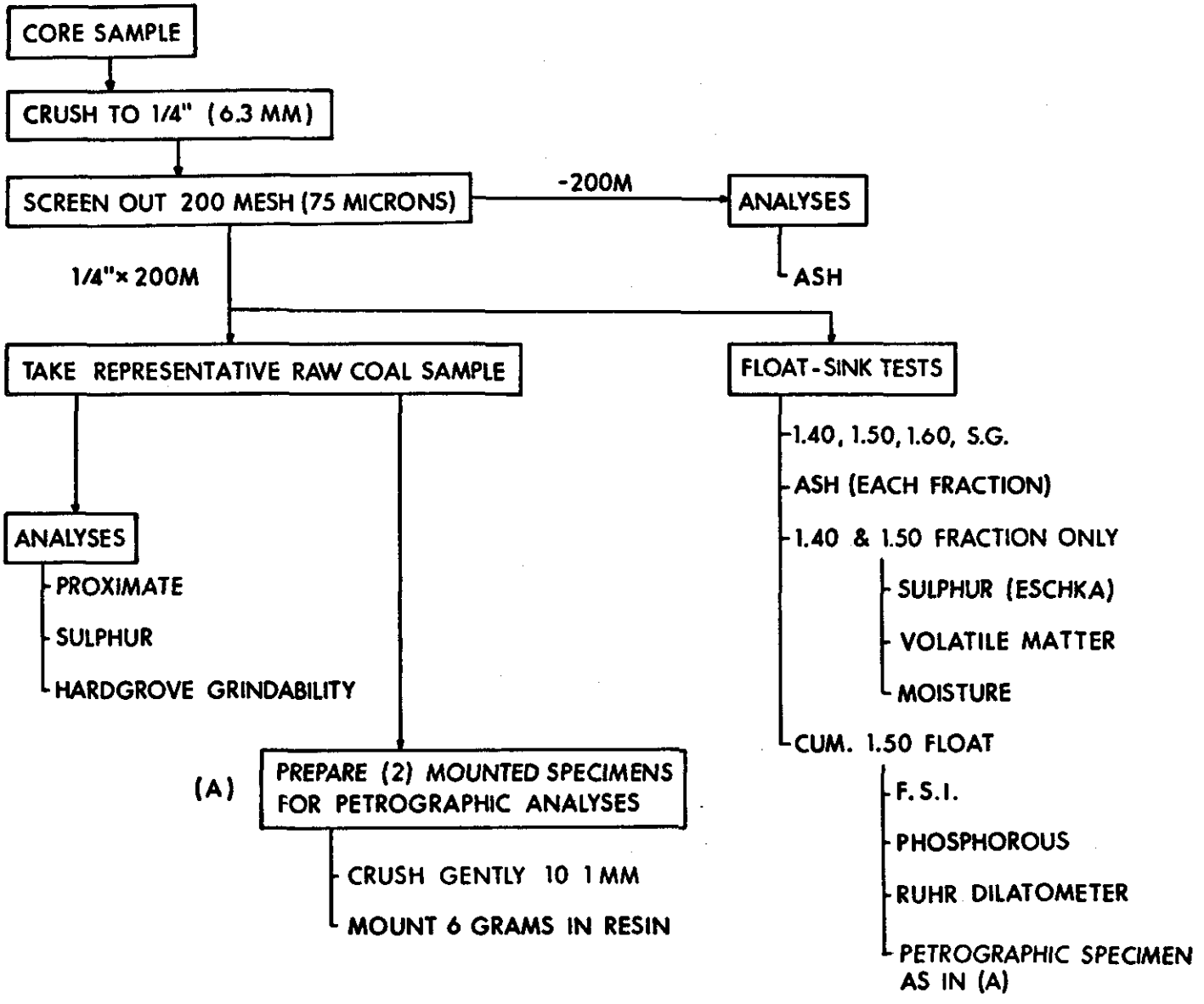
In general, the washability data was produced with few problems. A minor problem occurred with the sulphur analyses at 1.50 S.G. float. The initial test contained a residual amount of perchlorethylene (float-sink media) which produced perchloric acid in the Leco analyser and thereby gave erroneously high sulphur levels. This was corrected by doing eschka sulphurs on the float fractions.

Overall the entire sampling and testing program ran very smoothly and the results were much more indicative of the actual operating conditions than those previously generated. The location of the bulk samples is shown on the map enclosed as Exhibit I at the back of this report.

3) Drillhole Evaluation

Because of the wide spacing of previous boreholes, a 9200 foot drilling program was also set up (another program will follow in undeveloped areas) to confirm previous data and to ensure the representativeness of the bulk samples. The cores from this program were analysed at three (3) specific gravity levels as is shown in Figure 2. By analysing at various specific gravities, insight can be gained as to amount of near

BOREHOLE SAMPLE TEST PROCEDURE



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gravity material which will be present, as well confirming the washability data.

The location of the drill holes and trenches are shown on the map enclosed as Exhibit I.

4) Channel Sample Evaluation

Prior to extracting the bulk samples, channel samples were taken to ensure that the oxidation zone had been passed, and to give insight as to the raw coal ash content. Channel samples were processed in much the same manner as the core samples as outlined in the "Supplementary Report on Coal Preparation" by Techman Ltd., June 1975.

COAL QUALITY SUMMARY

Overall the quality of the Elk River coals indicates that it can produce an acceptable blend of coking coal.

1) Raw Coal Ash Content

In order to establish the raw coal ash content, it was necessary to evaluate the possible mining methods, and to make some reasonable assumption as to what the dilution might be. The Techman "Report on Coal Preparation, March, 1975" assumed a dilution of about 24.8% by weight, which would result in a feed ash of 30-35%. With refined mining techniques, the dilution could possibly be reduced to 10% by weight; however, to ensure that the washability data developed in 1975 was more representative of the anticipated plant feed, six inches of hanging wall and in some cases six inches of footwall were included with each bulk sample. Because of the very hard nature of footwall and hanging wall, and because the contacts are very distinct (with the exception of the footwall of seam 9, and minor fringes of shale and clay in other seams), the coals tested were conservative as far as ash content was concerned.

Table 1 compares the raw coal ash content of previous data to that developed during the 1975 drilling and bulk testing program. The raw coal ash content of the bulk samples increased by about 12%. Similarly the drill hole sample ash increased by about 6% on seams 12 to 18. Because of the very hard and heavy nature of the dilution, the washability of the recent bulk samples has not been adversely affected, and has actually improved on several seams. As a result, the raw coal ash content of the recent bulk tests can be considered as representative of the Elk River run of mine coal even with the sigma (σ) values added to previous coal quality tests.

TABLE 1

RAW COAL ASH CONTENT

SEAM	DRILL HOLE DATA 1970-1971 ASH%	DRILL HOLE DATA 1970-1971 σ	DRILL HOLE DATA 1975 ASH%	DRILL HOLE DATA 1975 σ	WASHABILITY DATA 1970-71 ASH%	WASHABILITY DATA 1975 ASH%
2	19.4	7.6			14.2	37.2
3	12.5	3.5			16.1	21.9
4	20.8	9.6			25.7	27.7
5	--	--			--	--
6	19.8	7.4			14.3	23.8
7	20.3	7.4			31.6	33.1
8	19.9	8.7			26.5	31.0
9	20.1	7.4			21.7	17.1
10	16.8	7.9			18.0	23.2
11	24.2	11.1			--	--
12	22.9	9.3	24.4	--	25.4	42.5
13	20.5	9.7	39.9	12.3	33.2	57.1
14	19.2	8.8	26.9	5.4	22.7	49.8
15	27.5	9.3	34.1	15.7	30.5	44.3
16	25.3	11.6	21.5	6.5	16.2	39.7
17	13.5	4.6	27.7	8.9	7.0	35.9
18	24.9	7.1	21.9	10.3	22.7	34.2
19			32.7	8.4	27.1	--
20			39.6	13.7		--
21			34.2	--		--
Average	20.5	8.2	30.3	10.2	22.1	34.6
Wt. Scheme 'A'	19.9	8.5			22.3	33.8
Wt. Scheme 'C'	20.0	8.4			22.9	32.9

Scheme 'A' - Techman, Report on Preparation, March 1975.
Scheme 'C' - Techman, Mining Concept, etc., September 1975.

COAL QUALITY SUMMARY

Tables 2, 3, 4 and 5 show the raw coal ash contents for the various size fractions for all the washability data to date. The raw coal ash content reported for the 1975 pilot plant tests was determined by reconstituting the refuse and clean coal rather than using the number presented on the "Summary of Bulk Washing Tests". The reason for not accepting the Birtley figure is that the values never add up to the actual total raw coal ash. In general they are about 3% lower due to the exclusion of the pilot plant feed oversize in some cases, and sampling error in others.

Once again, the previous data (1970 to 1971) was somewhat misleading because the partings and dilution were excluded for testing purposes, and the size distribution included a low percentage of -28 mesh coal. A summary of the recent washability data, although it was still lower in fines than the plant will be designed for, is much more representative of the anticipated plant feed. The +½" material is quite high, but is within the upper limit of design.

Average Raw Coal	Wt.%	Ash%
2" x ½"	22.2%	51.4%
½" x 28 mesh	53.5%	32.3%
28 x 65 mesh	10.6%	17.9%
65 x 0 mesh	13.5%	17.7%
2" x 0	100.0%	33.0%

During the 1975 testing program extreme care was taken to ensure the validity of the samples as well as the testing, and as a result the

TABLE 2

RAW COAL ASH CONTENT
(2" x 1/2")

SEAM	WASHABILITY (+28 Mesh) 1970-1971 WT.%	ASH%	WT.%	ASH%	WASHABILITY 1975 WT.%	ASH%
2	77.5	28.2	86.1	14.1	17.9	57.8
3	75.0	9.4	82.2	16.0	13.6	68.8
4	83.2	30.1	79.4	27.4	17.9	34.0
6	87.1	19.7	85.5	14.4	20.0	43.7
7	84.1	23.6	90.8	31.9	13.4	53.1
8	79.5	26.5	77.8	30.1	26.7	51.9
9	78.0	16.9	87.2	23.4	24.2	36.9
10	83.3	19.4	83.9	19.0	16.2	45.4
12	74.1	29.5	75.0	28.8	28.3	60.6
13			88.7	33.9	19.3	80.4
14			87.0	23.8	30.6	65.6
15			85.7	32.1	34.1	61.2
16			87.5	16.7	28.9	62.2
17			91.5	6.3	28.6	64.3
18			85.0	23.2	34.2	23.2
Average	80.2	22.6	84.5	22.7	23.6	53.9
Wt. Scheme 'A'			82.6	24.5	22.2	51.4
Wt. Scheme 'C'			82.9	25.3	21.5	53.5

TABLE 3

RAW COAL ASH CONTENT
(½" x 28M)

SEAM	(+28 Mesh) WASHABILITY 1971 WT.%	ASH%	WASHABILITY 1975 WT.%	ASH%	(+28 Mesh) PILOT TESTS 1975 WT.%	ASH%
2	86.1	14.1	50.0	35.5	67.9	36.6
3	82.2	16.0	48.7	12.9	37.7	23.9
4	79.4	27.4	58.3	26.6	76.2	24.8
6	85.5	14.4	46.8	22.8	66.8	32.2
7	90.8	31.9	44.7	38.5	58.1	40.9
8	77.8	30.1	50.3	28.2	77.0	36.4
9	87.2	23.4	56.0	21.9	81.2	23.8
10	83.9	19.0	50.9	19.7	67.1	28.1
12	75.0	28.8	51.1	37.2	79.4	40.9
13	88.7	33.9	63.7	60.5	83.0	62.9
14	87.0	23.8	51.8	41.1	82.4	45.6
15	85.7	32.1	47.9	42.6	82.0	41.8
16	87.5	16.7	47.5	33.9	76.4	44.6
17	91.5	6.3	56.6	23.0	85.2	31.4
18	85.0	23.2	62.4	35.3	80.4	37.3
Average	84.5	22.7	52.4	32.0	73.4	36.7
Wt. Scheme 'A'	82.6	24.5	53.5	32.5	74.9	35.4
Wt. Scheme 'C'	82.9	25.3	53.1	32.0	73.6	34.8

TABLE 4

RAW COAL ASH CONTENT
(28M x 65M)

SEAM	WASHABILITY (-28 Mesh) 1970-1971 WT.%	ASH%	WT.%	ASH%	WASHABILITY 1975 WT.%	ASH%	PILOT TESTS 1975 WT.%	ASH%
2	22.5	17.7	14.0	12.3	4.9	24.1	14.5	22.7
3	25.0	10.6	17.2	18.2	22.3	11.1	28.2	16.5
4	16.8	18.3	20.6	16.6	11.3	18.8	15.7	24.8
6	12.9	12.1	14.5	13.0	11.1	14.7	23.4	23.7
7	15.9	13.5	9.2	24.0	15.1	28.8	19.3	37.5
8	20.5	13.2	22.2	14.0	18.9	16.0	10.5	16.5
9	22.0	9.5	12.8	13.0	10.3	11.9	9.1	11.2
10	16.7	11.6	16.1	11.8	9.4	11.0	16.3	12.2
12	26.0	16.5	25.0	14.9	8.7	20.4	9.7	24.6
13			11.3	27.1	7.4	35.4	12.8	29.2
14			13.0	16.1	7.0	30.2	12.7	23.4
15			14.3	12.2	11.9	21.7	6.8	19.5
16			12.5	11.1	11.3	25.0	8.8	23.7
17			8.5	14.2	9.6	18.1	9.0	17.0
18			15.0	15.4	8.0	18.3	9.4	21.6
Average	19.8	13.7	15.1	15.6	11.1	20.4	13.7	21.6
Wt. Scheme 'A'			16.5	15.2	10.6	17.9	12.5	20.9
Wt. Scheme 'C'			17.1	15.5	12.1	17.6	14.1	21.0

TABLE 5

RAW COAL ASH CONTENT
(65M x 0)

SEAM	(-28 Mesh) WASHABILITY 1971 WT%	ASH%	WASHABILITY 1975 WT%	ASH%	PILOT TESTS 1975 WT%	ASH%
2	14.0	12.3	27.2	20.0	17.6	16.4
3	17.2	18.2	15.4	11.0	20.6	15.3
4	20.6	16.6	12.5	16.2	8.1	15.8
6	14.5	13.0	22.1	13.1	9.8	16.4
7	9.2	24.0	26.8	19.9	22.6	18.5
8	22.2	14.0	4.1	13.7	12.5	12.1
9	12.8	13.0	6.5	11.4	9.7	13.0
10	16.1	11.8	23.5	11.8	16.6	12.1
12	25.0	14.9	11.9	17.9	10.9	18.8
13	11.3	27.1	9.6	33.0	4.2	28.3
14	13.0	16.1	10.6	26.1	4.9	22.5
15	14.3	12.2	6.1	21.9	11.2	19.7
16	12.5	11.1	12.3	20.9	14.8	24.8
17	8.5	14.2	5.2	19.9	5.5	17.0
18	15.0	15.4	11.6	16.2	10.2	16.2
Average	15.1	15.6	13.7	18.2	11.9	17.8
Wt. Scheme 'A'	16.5	15.2	13.5	17.7	11.4	17.0
Wt. Scheme 'C'	17.1	15.5	14.3	17.4	10.9	16.7

COAL QUALITY SUMMARY

analyses are considered to be representative of actual mining conditions and therefore need not be adjusted.

The total variation in the plant feed as indicated by the bulk tests is from a raw coal ash content of about 17 to 50%. Assuming that coal will be mined on three seams simultaneously, the maximum and minimum run of mine coal as listed below could occur:

	Maximum Ash	Minimum Ash
2" x ½"	70%	21%
½" x 28 mesh	36%	15%
28 x 65 mesh	30%	14%
65 x 0 mesh	30%	12.5%
Total	45%	15%

Because of the problems which often occur in strip mines which utilize very large equipment, the maximum ash levels should not be understated. The maximum values listed previously are suitable for process equipment design, but may not be for refuse handling conveyor design. During the initial years, the plant feed ash will undoubtedly be higher than they will once the mine labour force stabilizes and people become properly trained. This means that some excess capacity will have to be designed into the plant, but at least it will not take four years and extensive modification to reach design tonnages as it did some other Western Canadian producers.

COAL QUALITY SUMMARY

The drill hole data developed during the 1975 program is included as Table 9 in Appendix "A". Standard deviations were calculated according to the formula

$$\sigma = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n}}$$

where x , the arithmetic mean value of a set of data is calculated simply as

$$\bar{x} = \frac{\Sigma x}{n}$$

for n pieces of information

The mining schemes referred to as scheme 'A' and 'C' throughout this report are tabulated in previous reports*.

---

* Mining Scheme 'A' - "Techman; Report on Preparation & Preliminary Flowsheet, March 1975", p.11.

Mining Scheme 'C' - "Techman; Mining Concept and Preliminary Cost Estimate, etc., September 1975", p.7.

COAL QUALITY EVALUATION

The raw coal characteristics of the numerous Elk River coal seams was established in the previous section. Since the bulk samples now compare favourably with the drill hole samples on a raw coal basis, they should also be comparable at various specific gravities. Drill hole data developed on the 1.50 S.G. float coal was chosen because this is usually close to the optimum cut point in a heavy media type washery. At 1.50 S.G., the near gravity material is low enough that the product ash and recovery are acceptable.

Once the weight and ash distribution have been established, then the other physical and chemical properties of the coal can be considered.

1) Ash Evaluation

The ash contents of the cumulative 1.50 S.G. float are shown in Table 6. Initial tests indicated that the spread in ash content was from 3.6 to 13.5% on the coaly sections. Once the dilution was included (1975 program), the ash contents changed on some of the samples, but overall the coal was somewhat better (7.3% average compared to 7.6%. Seams 3, 4, 7, 8, 10 and 18 showed improvement, while some of the others increased slightly in ash. The high dilution in the upper seams had no effect on the 1.50 S.G. float, so the detrimental effects of near gravity material normally associated with high dilution on Western Canadian coals should not occur at Elk River.

The weight percent of 1.50 S.G. float shown in Table 7 demonstrates the extent of the dilution in the bulk samples. Some increase in the ± 0.1 S.G. material occurred (Table 8) but these are not significant since the cut point will most likely be between 1.50 and 1.55 S.G.

When operating a heavy media plant, it is considered prudent to keep

TABLE 6

BULK SAMPLE & DRILL HOLE COMPARISON

(1.50 Float Ash Content)
(+28 Mesh Fraction)

SEAM	1971 & Earlier Drill Holes	1975 Drill Holes	U.K. Test Work Mar.'71	Cyclone Engineer. Tests. Mar.'71	Birtley Bulk Tests Oct.'71	Birtley Bulk Tests Dec.'75
2	9.35		11.6	10.9	8.81	9.8
3	6.98		--	6.7	7.46	6.3
4	8.11		9.5	7.8	7.05	6.7
5	--		--	--	--	--
6	8.49		9.2	8.8	8.22	9.2
7	8.40		10.0	8.8	13.09	9.5
8	7.46		6.9	7.0	8.15	7.3
9	7.26		6.7	8.1	6.71	6.8
10	6.34		6.9	6.1	7.20	6.4
11	8.01		--	--	--	--
12	7.17	5.7	9.1	6.1	6.94	7.4
13	6.92	5.75			7.46	7.1
14	6.82	6.23			7.29	7.0
15	5.95	5.70			7.96	6.0
16	6.06	5.98			5.63	7.6
17	4.67	5.80			3.61	5.4
18	5.18	5.70			6.85	5.5
19	3.14	7.90			7.81	
Avg.	7.07				7.52	7.2
Wt. Average Scheme						
'A'	7.49				7.61	7.3
'C'	7.50				7.60	7.3

TABLE 7

BULK SAMPLE & DRILL HOLE COMPARISON

(WT% 1.50 Float) (+28 Mesh)

SEAM NO.	1975 DRILL HOLES	BIRTLEY BULK TESTS OCT. 1971	BIRTLEY BULK TESTS DEC. 1975
2		83.4	49.8
3		82.3	75.5
4		69.0	65.2
5		---	---
6		88.2	65.3
7		53.0	44.2
8		62.4	58.6
9		80.4	70.4
11		---	---
12	72.1	66.0	44.2
13	55.5	51.7	21.8
14	62.7	69.7	42.0
15	54.4	53.7	38.7
16	70.7	77.6	50.4
17	65.6	87.2	62.3
18	74.9	73.6	53.0
19	60.6	---	---
Average	64.6	71.3	54.0
Scheme 'A'		71.0	55.1
Scheme 'C'		70.5	56.0

TABLE 8

SUMMARY OF NEAR GRAVITY MATERIAL

(Corrected to 1.8 S.G. Float)

+28 M E S H C O A L

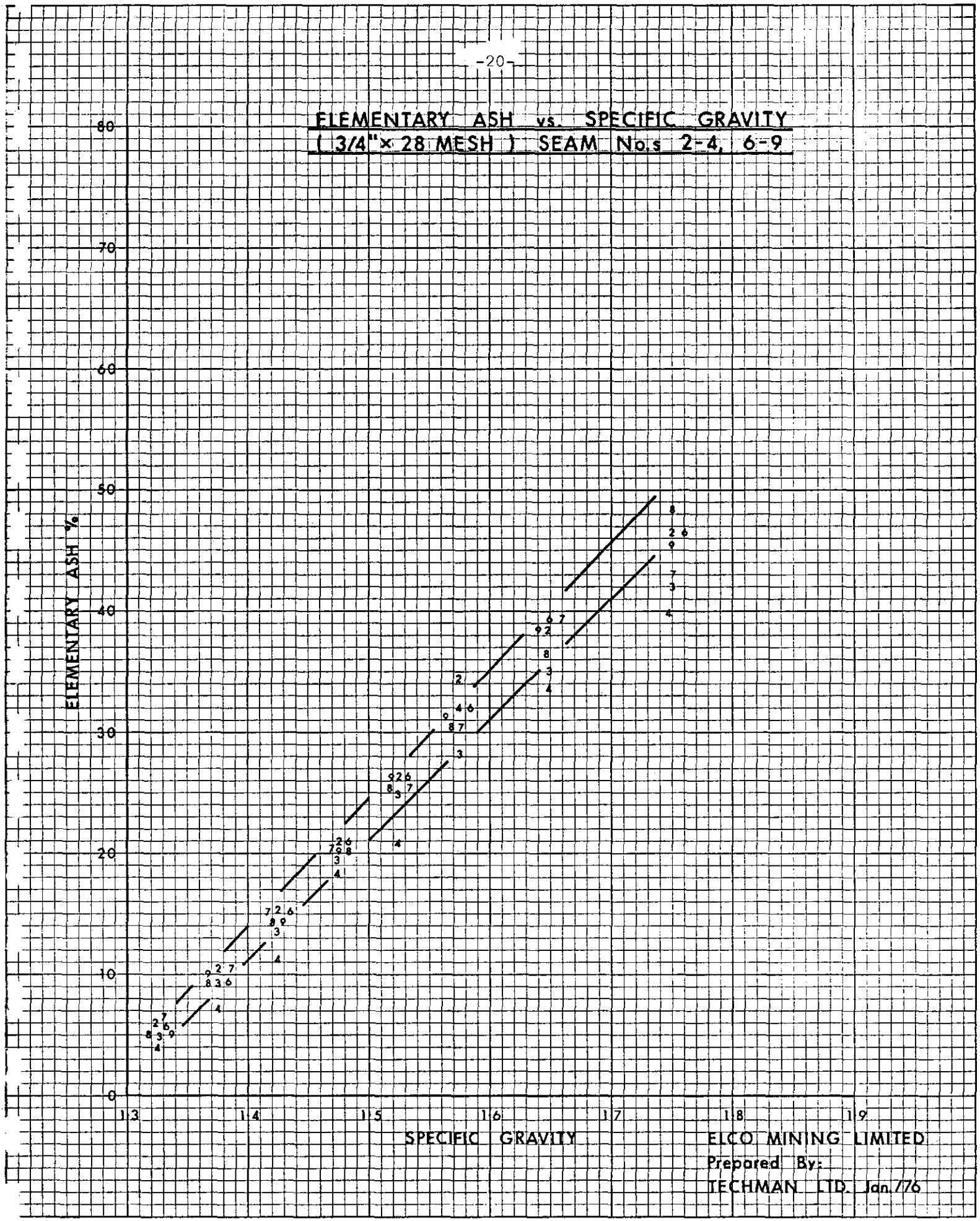
SEAM NO.	1971 BULK TESTS			1975 BULK TESTS		
	1.45	1.5	1.55	1.45	1.50	1.55
	Specific Gravity			Specific Gravity		
2	58.6	33.1	16.7	52.0	27.8	17.0
3	30.2	15.6	9.2	35.8	17.2	9.7
4	41.4	18.3	10.5	50.4	33.7	13.6
4A	24.3	11.3	8.2			
6	36.0	16.9	11.2	57.0	27.1	17.6
7	55.4	38.9	29.5	42.0	30.7	22.6
8	34.9	19.7	14.7	40.6	19.7	11.5
9	21.9	16.1	9.7	33.2	19.3	12.1
10	26.5	13.2	6.6	34.1	17.2	10.4
12	18.2	12.7	9.1	26.8	18.3	13.6
13	27.3	20.3	16.6	27.4	21.2	17.2
14	21.3	14.6	11.4	18.4	12.1	9.8
15	24.4	19.4	18.4	22.4	16.0	12.6
16	17.7	14.3	11.8	19.9	14.4	11.7
17	7.9	6.4	5.6	14.5	9.7	7.2
18	16.5	12.6	8.5	12.3	9.0	8.1
Average	28.9	17.7	12.4	32.5	19.6	13.0
Wt. Scheme 'A'	29.9	17.3	11.6	34.6	20.9	12.8
Wt. Scheme 'C'	31.6	18.2	12.0	38.2	22.7	13.5

the near gravity material below 20% so that sudden surges in the volumes of material reporting to heavy media cyclones have been sized for normal operation. Any excessive increases in sinks cause the higher ash coals to be displaced to product. Since only seam 7 has 22.6% near gravity material at 1.55 S.G. float, and since more than one working face will be washed at the same time, this should not be a significant problem (as it is with the "Turnbull" seam at Fording River Coal).

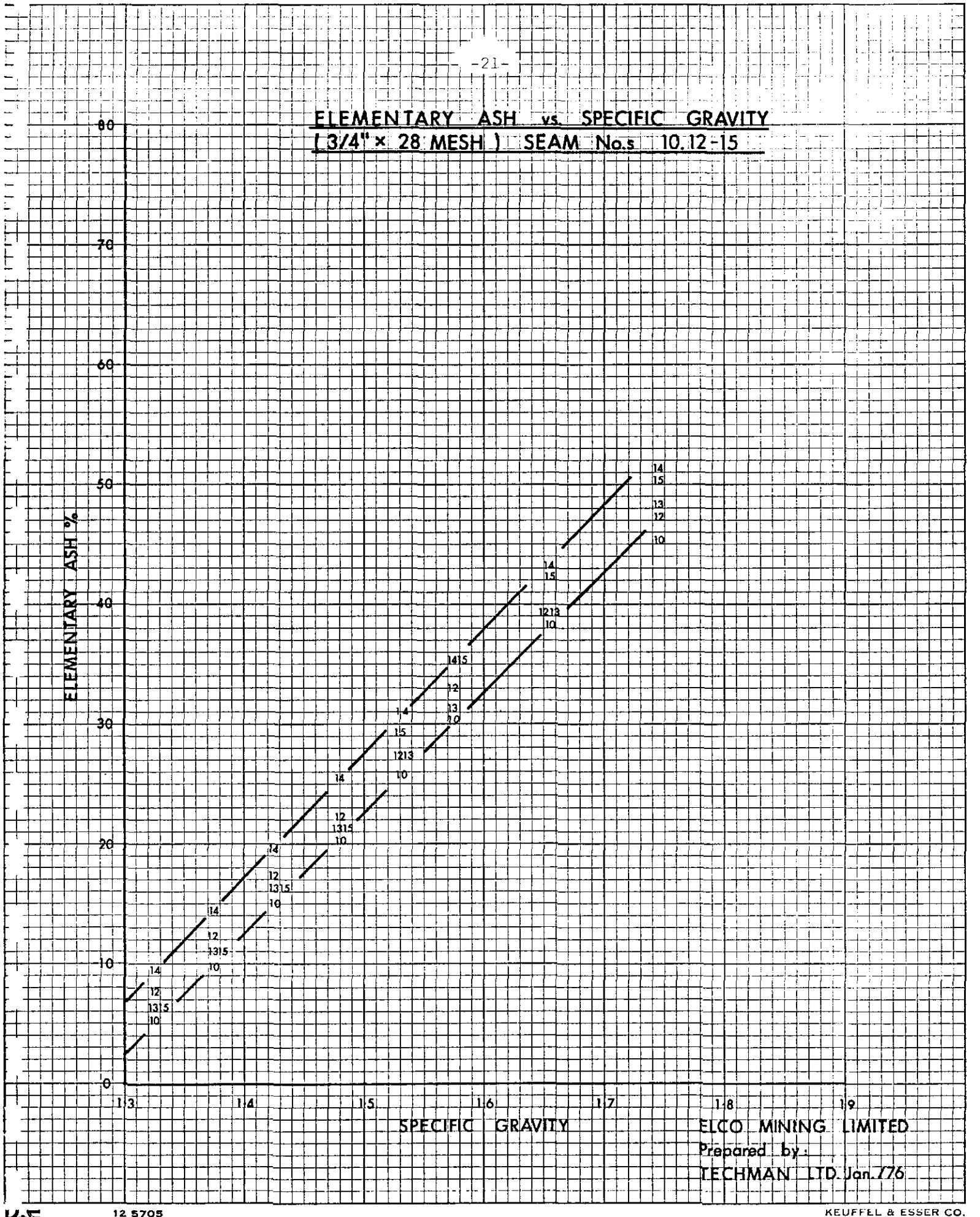
Also, plotted as Figures 3, 4 and 5 are the elementary ash versus specific gravity curves derived from the 1975 bulk testing program. The results during this program plot considerably straighter than those of the previous program (1971) which indicates that more care was taken with the sink float testing this time around.

Of particular interest in these curves is the fact that the elementary ash is higher on the upper seams (14 to 18) at any specific gravity. This is unexpected since the upper seams are high in volatile and vitrinite. Also, associated with higher proportions of vitrinite is a decrease in inertite, the higher ash component. One might expect the same ash content or perhaps a lower ash content in higher volatile coals at constant specific gravity. Possibly, the answer is that the fusinite (higher in ash) is embedded in the vitrinite in the upper seams and is thereby buoyed up, whereas in the lower seams it is not. This phenomena should be clarified by the petrographers, since the implications are that in the upper seams, a higher specific gravity cut point may produce a better quality coal for coke production.

FIGURE 3

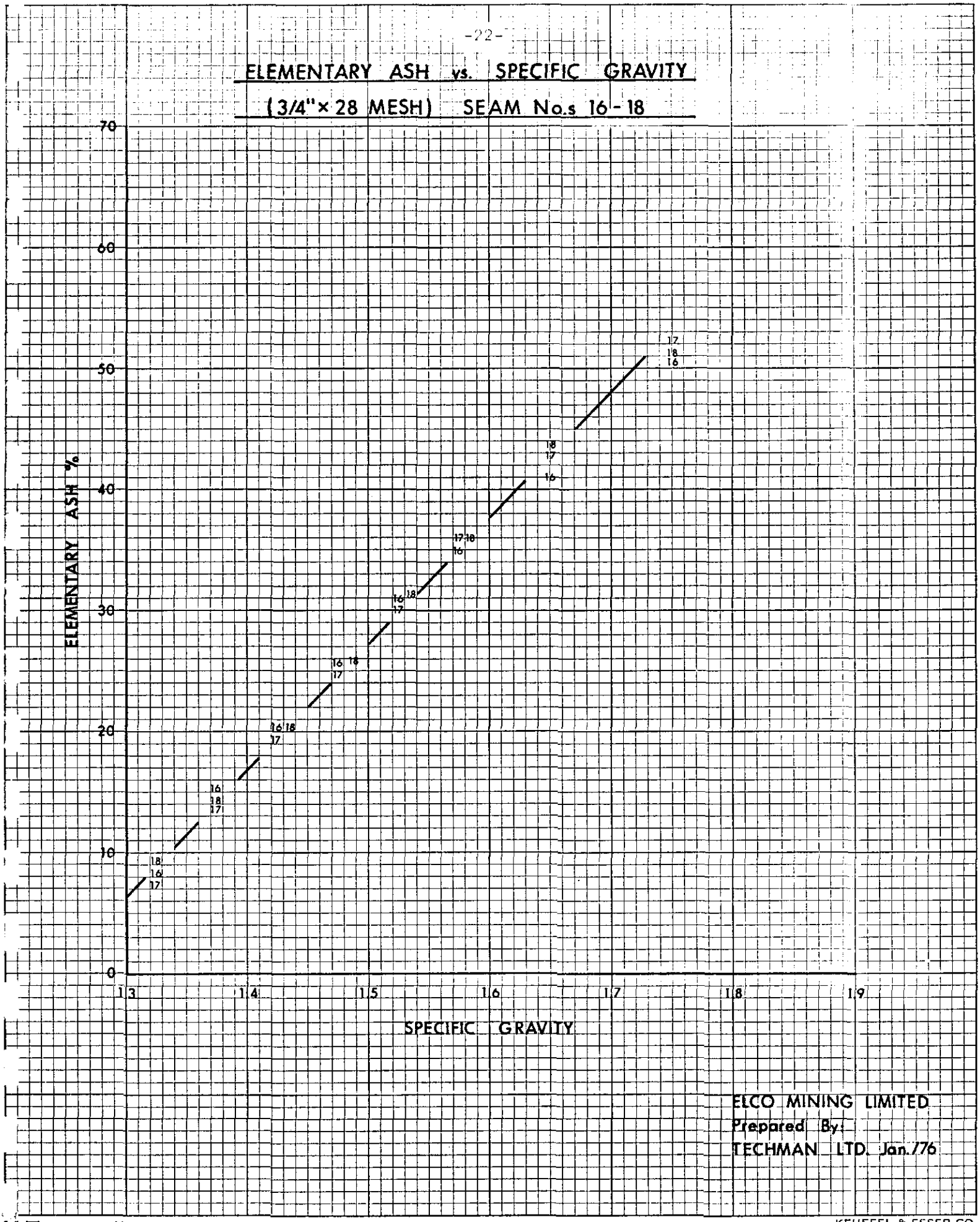


K+E 12 5705
10 X 10 TO THE INCH
KEUFFEL & ESSER CO.
MADE IN U.S.A.



K+E 12 5705
10 X 10 TO THE INCH
KEUFFEL & ESSER CO.
MADE IN U.S.A.

FIGURE 5



K+E 12 5708 10 X 10 TO THE INCH
KEUFFEL & ESSER CO. MADE IN U.S.A.

COAL QUALITY EVALUATION

Considering the above factors, and the fact that the float coal and the upper seams have a much lower ash content at 1.50 S.G. than the lower seams, it may be prudent to construct a dual circuit plant which can operate at two different gravities (even though the M curves theoretically produce a higher yield by optimizing at one specific gravity).

2) Channel Samples

In order to confirm that the bulk samples would be taken beyond the oxidation level, several channel samples were cut across the entire width of the coal seam. These samples were analysed as raw coal, then floated at 1.50 S.G. The float coal's plastic properties were then analysed and were reported in Table 10 in Appendix B.

Table 10 summarizes the channel sample raw coal ash and plastic properties of the 1.50 S.G. float coal, and compares them to the bulk samples. Channel samples were only considered as confirming information in this report because of the inherent problems of obtaining a uniform cut across an entire face. However, the averages of all the above mentioned properties are very close, which indicates that the channel samples were very carefully taken. The raw coal ash content, which varies considerably from channel sample to bulk sample, averages 34.4% ash compared to 34.6% ash; therefore, one can rely on the blended raw coal properties as being fairly accurate. The plastic properties compare reasonably well, and it is interesting to note that the bulk sample clean coal had slightly higher free swelling indices and dilation than the 1.50 S.G. float coal.

COAL QUALITY EVALUATION

3) Free Swelling Index

One of the indications of the ability of a coal to coke is the free-swelling index (FSI), and it is generally the only plastic property of coal which is written into a coal contract. Other fluid property tests such as the Gieseler and RUHR Dilatometer tests are more significant in determining coking properties; however, because of their complexity they are not usually done by the average North American coal operator.

Enclosed as Table 11 is a summary of the free swelling indices of all the test work done to date. Tests were conducted on the composite 1.50 float coals on the drill hole and bulk samples. Also included were the FSI's of the clean coal from the pilot plant tests. The drill holes and 1970-71 bulk tests indicated an average FSI of 5½ - 6 with low FSI's in seams 4 to 10. The 1975 testing program showed much better swelling properties on seams 4A, 7, 8, 9 and 10 with only seams 6 and 4 still producing a low FSI (3½). The sigma variation on the early drill hole data was 1½ (Scheme 'A') and ½ on the holes drilled in 1975.

Several studies on the effects of blending oxidized coals with high FSI coals in Western Canada have indicated that the FSI is depressed much lower than the calculated average of the two coals in a blend. This same phenomena was demonstrated on Elk River coals in the Emkay, March 1971 report (Appendix B, Exhibit 23). Also, problems have arisen in testing the FSI of Elk River coals (Exhibit 25) which leads one to believe that variations in results between a buyer and seller may also occur. Therefore, caution should be exercised in signing agreements to deliver coal with an FSI greater than 5½, even though recent bulk testing indicated that free swelling index was no longer a problem.

TABLE 11

FREE SWELLING INDEX

BULK SAMPLE & DRILL HOLE COMPARISON

SEAM	1971 & Earlier Drill Holes 1.50 Float	1975 Drill Holes 1.50 Float	EMR Test Work March 1971	BIRTLEY Bulk Tests March 1971	BIRTLEY Pilot Test March 1971	1.50 Float BIRTLEY Bulk Test Dec. 1975	BIRTLEY Pilot Test Dec. 1975
2	7-1/4		8	8	5-1/2	8	9
3	7-3/4		7	7	7-1/2	7-1/2	8
4	3-1/4		5	6-1/4	5-1/4	6-1/2	8
5							
6	4-1/4		2-1/2	5	6	4	3-1/2
7	4-1/4		5-1/2	5	6	3-1/2	6
8	3-1/2		5-1/2	3	3-1/2	5-1/2	6-1/2
9	3-3/4		4	4-1/2	4-1/2	5	6
10	5-1/2		7	5	4-1/2	8	7-1/2
11	6-3/4						
12	7	8	9	8	8	9	9
13	7-1/2	7-3/4		7-1/2	8	9	8-1/2
14	7-1/2	8-1/4		8-1/2	8	9	9
15	8	8-1/2		7-1/2	7-1/2	8-1/2	8-1/2
16	8-1/2	8-1/4		7-1/2	7-1/2	8	8
17	8-1/2	8-1/4		8	8	8	8
18	8-1/2	8		7	7-1/2	8-1/2	8-1/2
19	7-1/2	7-3/4		8	8		
Average	6-1/2	8	6	7-1/2	6-1/2	7-1/4	7-1/2
Wt.Avg.							
'A'	5-1/2			6-1/2	6	7-1/4	7-3/4
'C'	5-1/2			6-1/4	5-3/4	7	7-3/4

Note: Bulk sample FSI on +28 Mesh fraction and pilot test FSI on clean coal mix.

COAL QUALITY EVALUATION

Several detailed studies have been conducted on the extent of oxidation and its influence on the Elk River coals. Emkay constructed sufficient tests to demonstrate that the Elk River coal seams showed little sign of oxidation beyond depths of 20 feet (50 feet is normal in Western Canada), with the exception of drill hole 6 in seam 8. They also conducted tests across seam 2 to demonstrate that no oxidation has been attributed to "the presence of a compact glacial till layer over the rock surface at the outcrop, effectively preventing any water or air circulating in this area".

To ensure that oxidation was not a problem, the 1975 bulk testing program employed analysis of a sequence of channel samples prior to bulk sampling. Free swelling indices and RUHR dilatometer tests were conducted ahead of the bulk samples. The results were that no oxidation was present in any of the adit or trench samples.

Considerable improvement was noted in the FSI of the washed coals from adits 2, 4, 8, 9 and 10, which could have been partially oxidized initially. The coal in adit 6 showed a 3½ FSI compared to a 6 FSI in the 1971 bulk testing program. Part of the difference can be accounted for by the fact that the 1971 bulk sample had a clean coal of 8.7% ash compared to the 1975 10.3% ash.

COAL QUALITY EVALUATION

4) Gieseler Fluidity

Table 12 shows the summary of the Gieseler fluidity data which was produced by the Department of Energy, Mines and Resources in Ottawa. Seams 2, 3 and 4 have some degree of fluidity which is about what is expected for low volatile coals in Western Canada. The maximum fluidity on seams 6 through 10 is very low and might be considered an indication of poor coking ability if it were not for the fact that the coke stability indices on all but seam 6 were over 50. Seams 12 through 19 show respectable fluidities for medium and high volatile bituminous coals in Western Canada.

A possible explanation of the low fluidity figures and the high coke stability index is that the Gieseler Plastometer is greatly influenced by the surface characteristics of the coal. The low volatile and lower medium volatile Western Canadian coals tend to surface oxidize rather quickly thereby reducing their apparent fluidity, but not their actual fluid properties in the coking process. Figure 6 shows the effect of oxidation on a medium volatile coking coal under exaggerated oxidation conditions (i.e. heating to 105°C). In four days the Gieseler fluidity dropped from 5000 DDPM (maximum) to 1 DDPM (maximum) and the total fluid range decreased from 125°C to 65°C.

TABLE 12

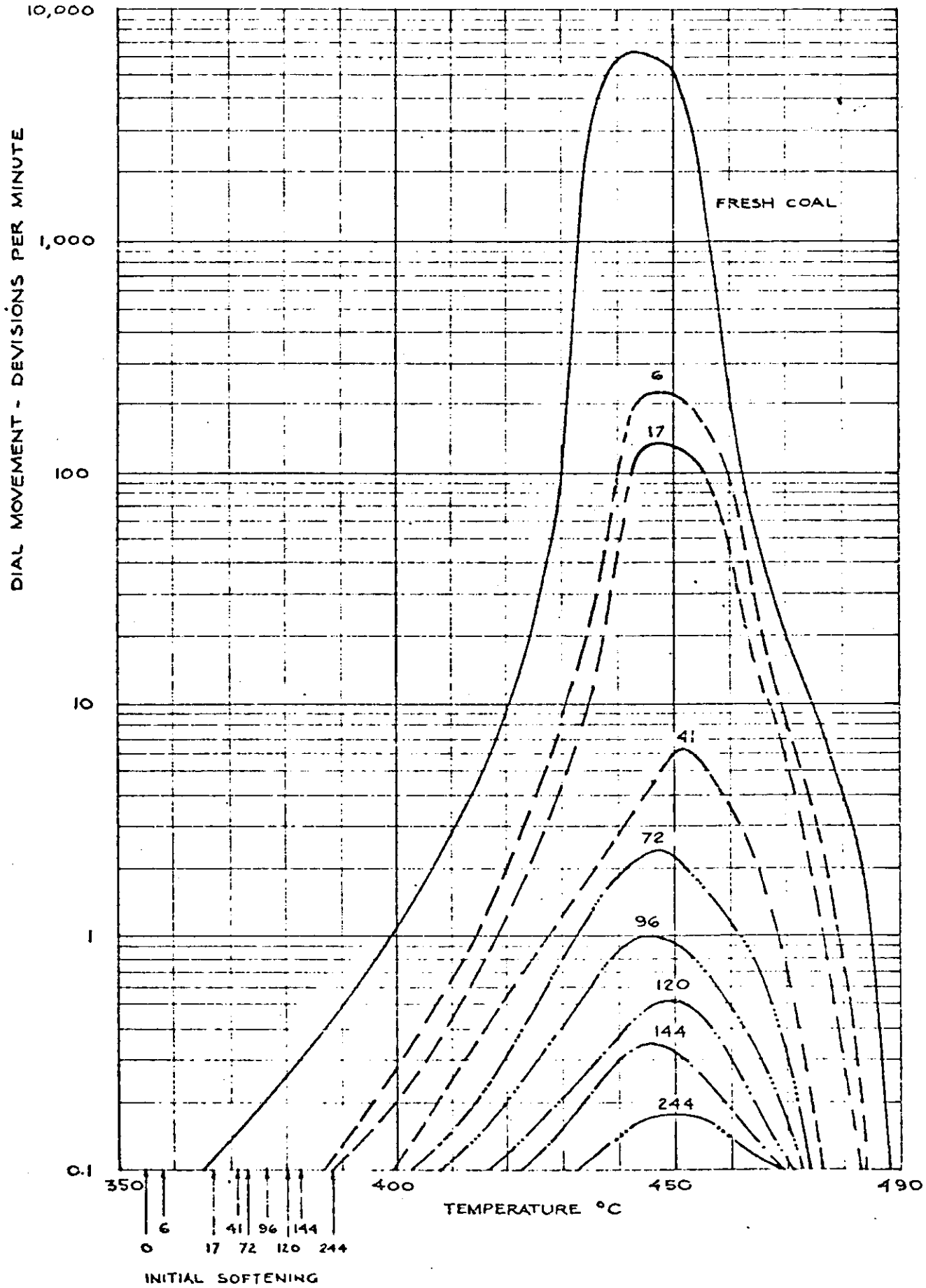
GIESELER FLUIDITY

SEAM	DESCRIPTION (EMR)	Softening Temp. (°C)	Final Fluid Temp. (°C)	Melting Range (°C)	Maximum Fluidity DDPM	Volatile Matter MAF
	1970					
2	December	447	500	53	20	21.2
3	December	447	479	32	5.9	20.5
4	December	459	490	31	3.5	20.2
6	December	---	---	--	0.9	19.9
7	December	465	485	29	1.8	20.4
8	December	458	484	26	2.9	21.1
9	December	459	488	20	1.5	21.1
10	December	458	482	24	1.9	22.8
12	December	436	497	61	84	25.8
	1971					
13	December	422	494	72	259	26.1
14	November	410	492	82	1,175	28.8
15	November	418	490	72	330	28.2
16	November	410	486	76	1,260	30.7
17	November	410	484	74	1,150	31.8
18	November	403	484	81	3,125	34.2
19	November	404	488	84	5,650	33.5

FIGURE 6

MINUS 35-MESH COAL OXIDIZED AT 105°C
NUMBER OF HOURS OXIDATION INDICATED
BY FIGURES ON THE CURVES

GIESELER HEATING RATE = 3°C PER MINUTE



COAL QUALITY EVALUATION

5) Volatile Matter

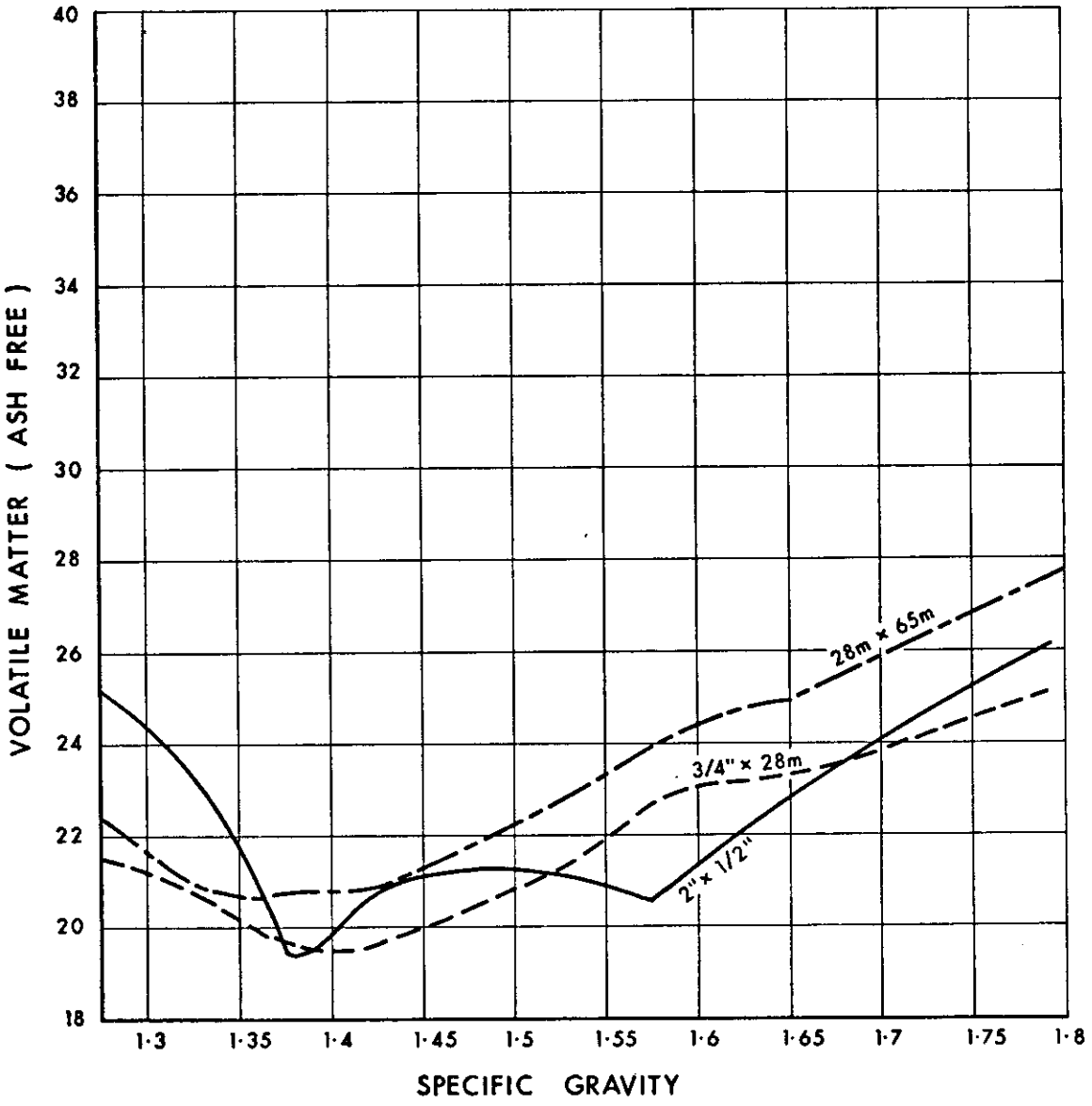
The Elk River coals vary in volatile matter considerably over seam 2 to 21. Basically the coals can be classified as low volatile bituminous (seams 2 to 10), medium volatile bituminous (seams 12 to 15), and high volatile bituminous (seams 16 to 21). Because of the wide range of volatile matter, some seams are short of coking properties while others have an excess. Therefore, a blend of all the seams (which will yield a strong coke) is required to obtain a single coal suitable for coking without further blending. Blending will also stabilize the preparation plant feed.

The Elk River coals have been classified roughly into three groups by moisture ash free volatile matter, but as Figures 7 to 12 illustrate, this number is dependent on size of the fraction as well as the specific gravity at which it was calculated. These curves demonstrate several things:

(a) The very light, hard, highest volatile clarains (bright coal) are concentrated below 1.35 S.G., thus the increased volatile matter at the lower gravities. Note that in adit 6 the 2" x ½" fraction has no material below 1.3 S.G., and has been classified in the field as dull coal, whereas seam 2 shows an extensive amount of clarain in this fraction.

(b) One would expect that the softest, heavier fusains would appear in the finer, higher density fractions and that the harder (but still soft), lighter vitrains (higher volatile matter bright coal) would appear in the coarser sizes in larger amounts. This is particularly evident in seams 10 to

VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No. 2



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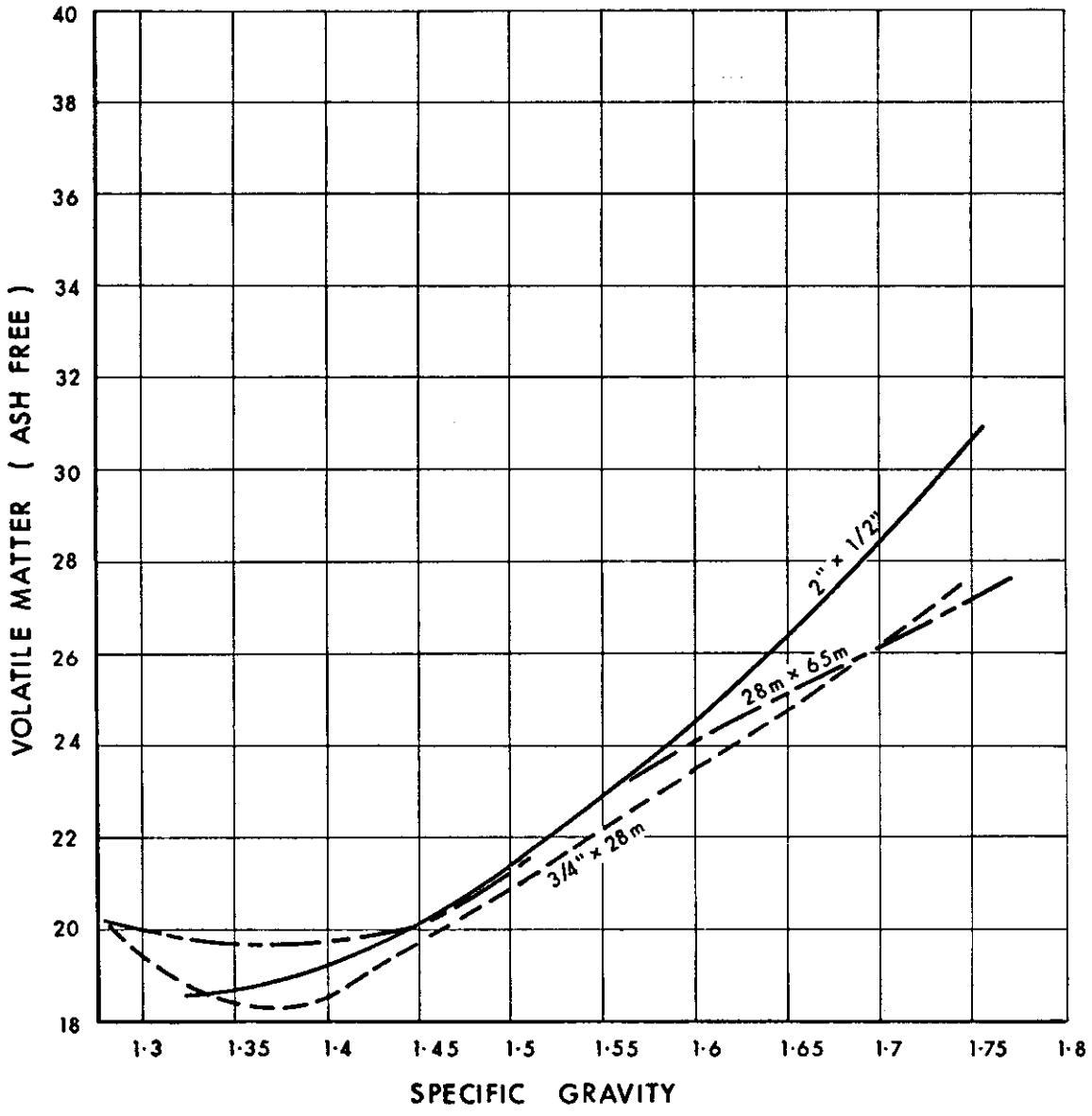
VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No. 6



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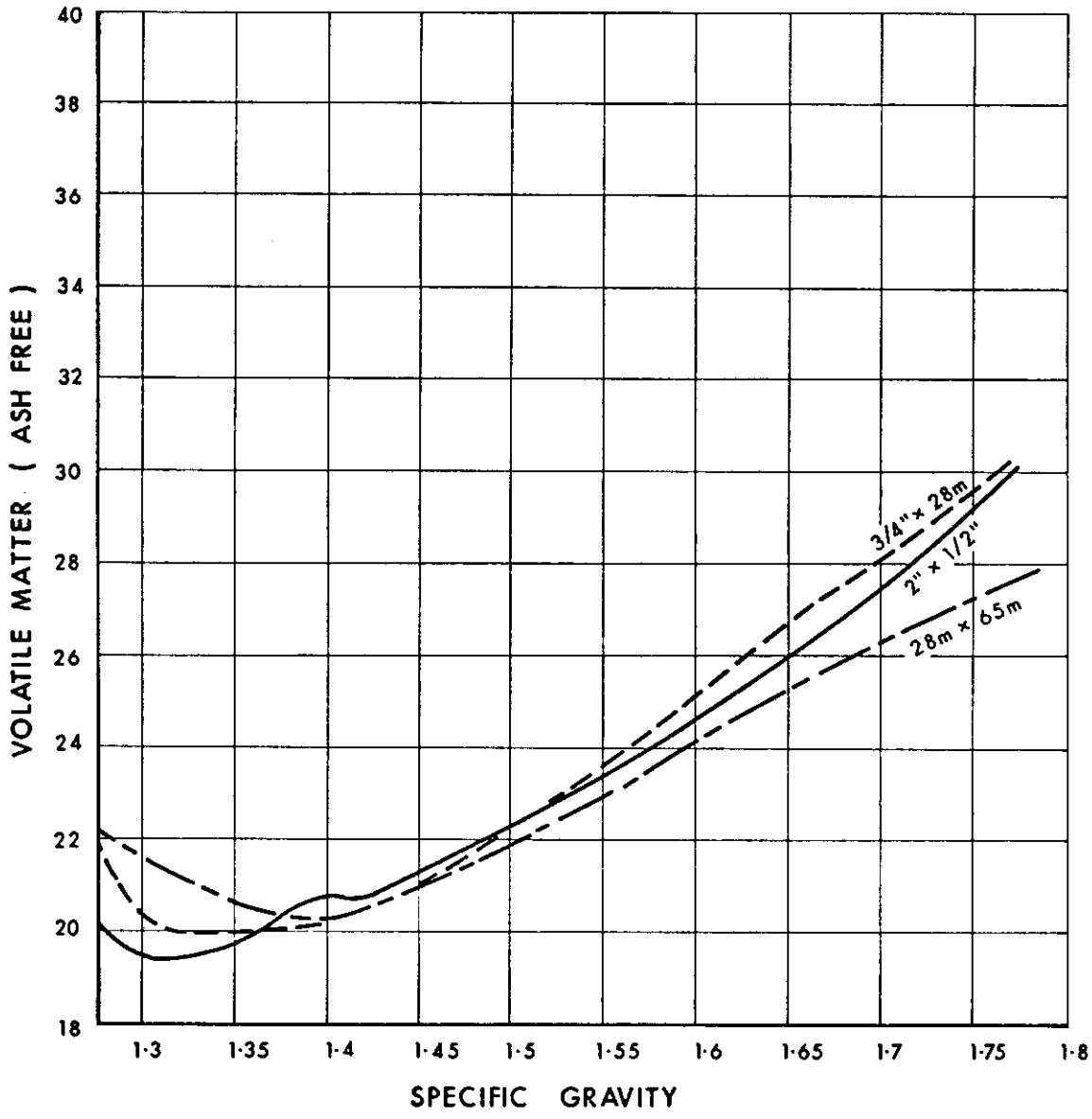
VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No.9



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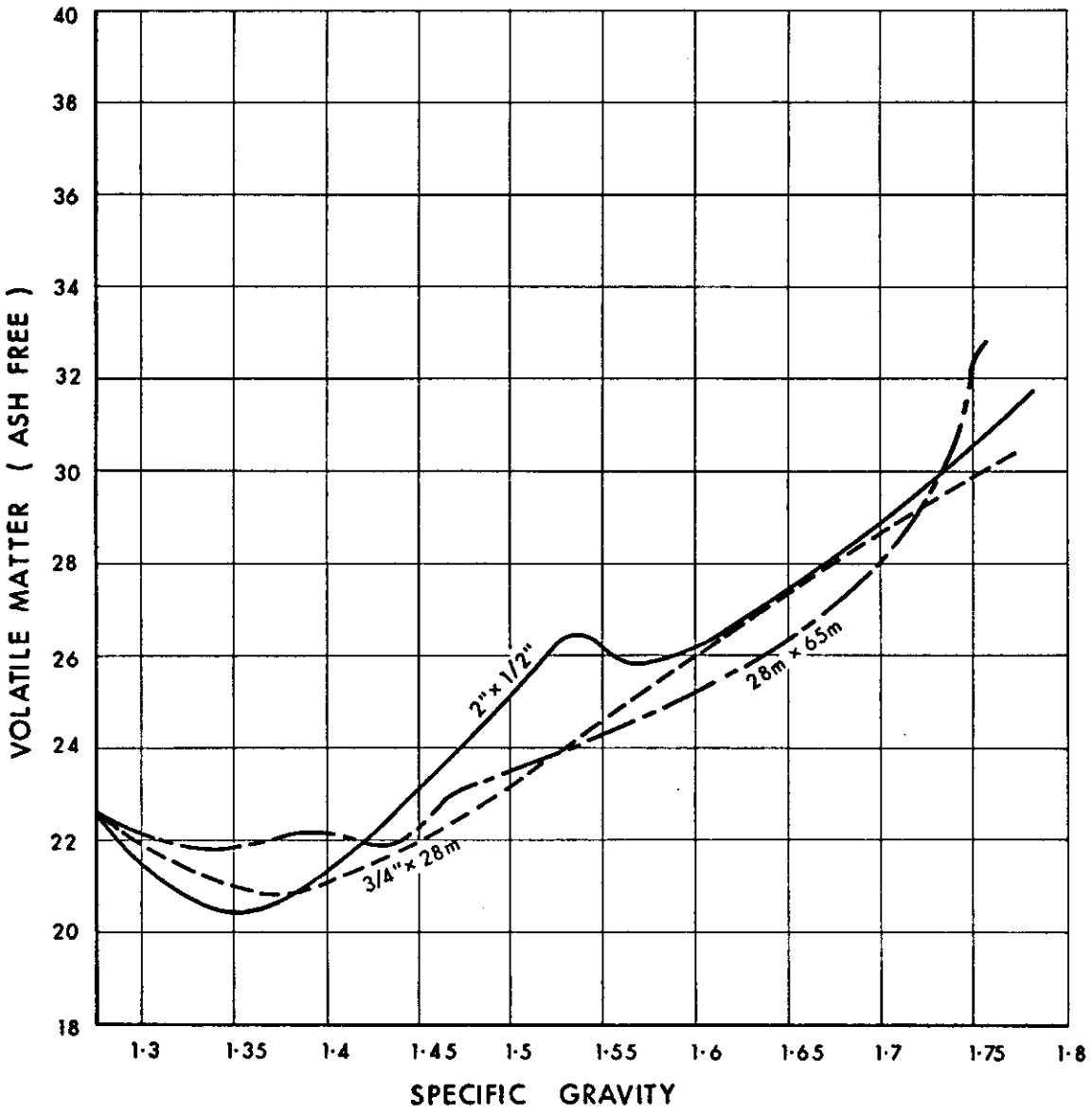
VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No. 10



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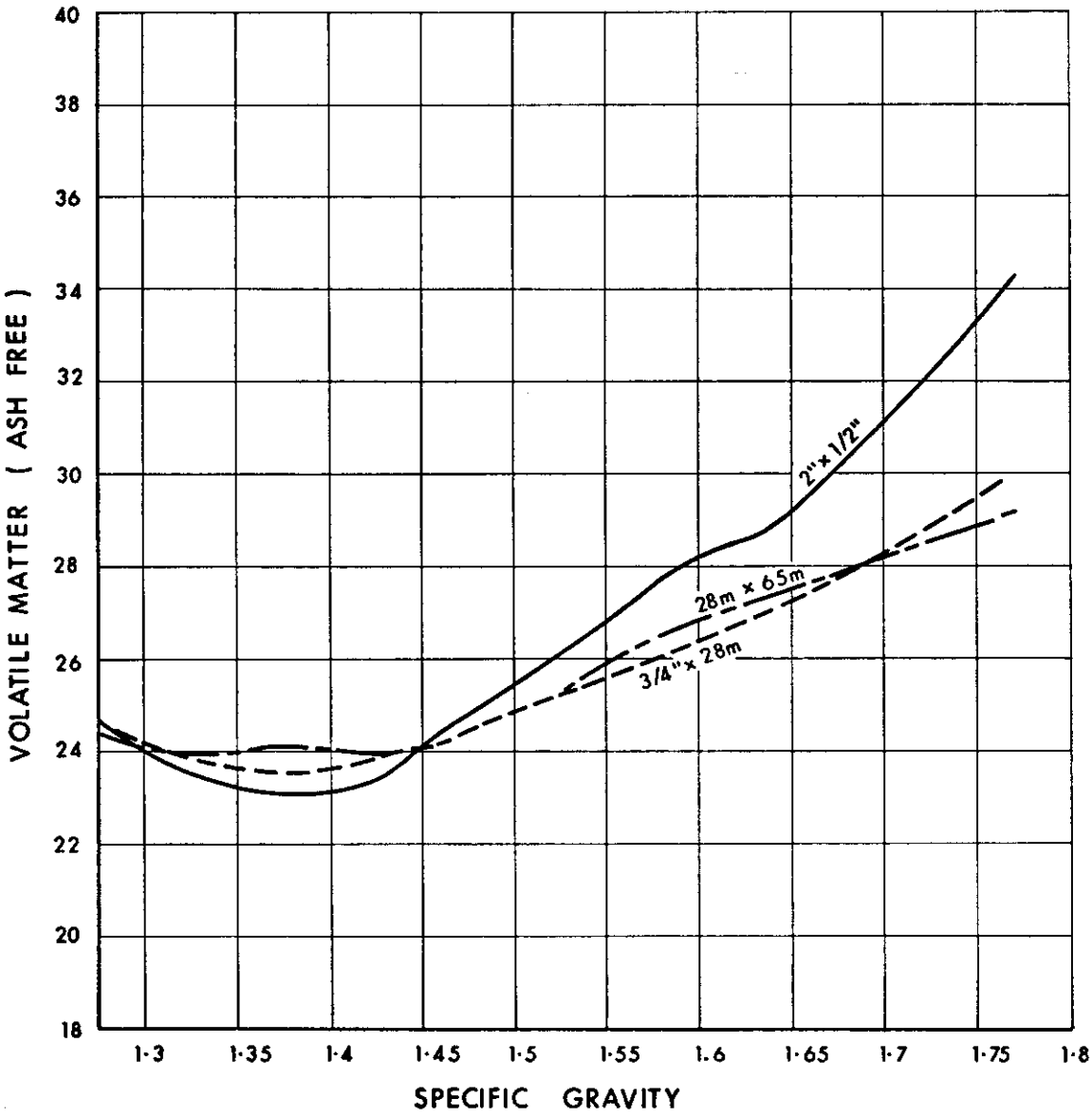
VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No.12



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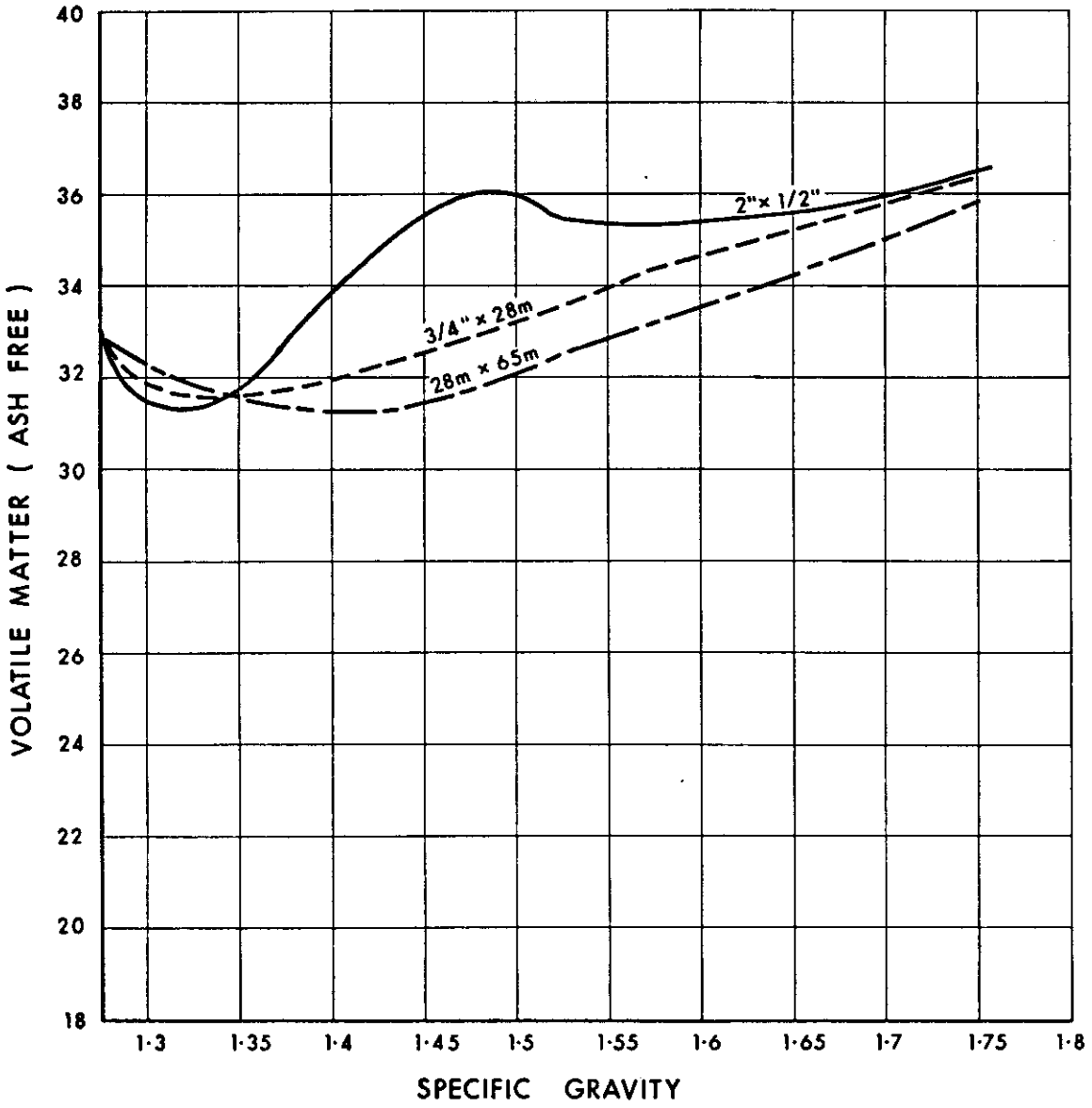
VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY
SEAM No.18



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COAL QUALITY EVALUATION

21. In seam 2 (Figure 7) the 3/4" x 28 mesh fraction is noticeably lower in volatile matter than the 28 x 65 mesh fraction, indicating that some of the vitrains are much softer in this seam (perhaps due to oxidation).

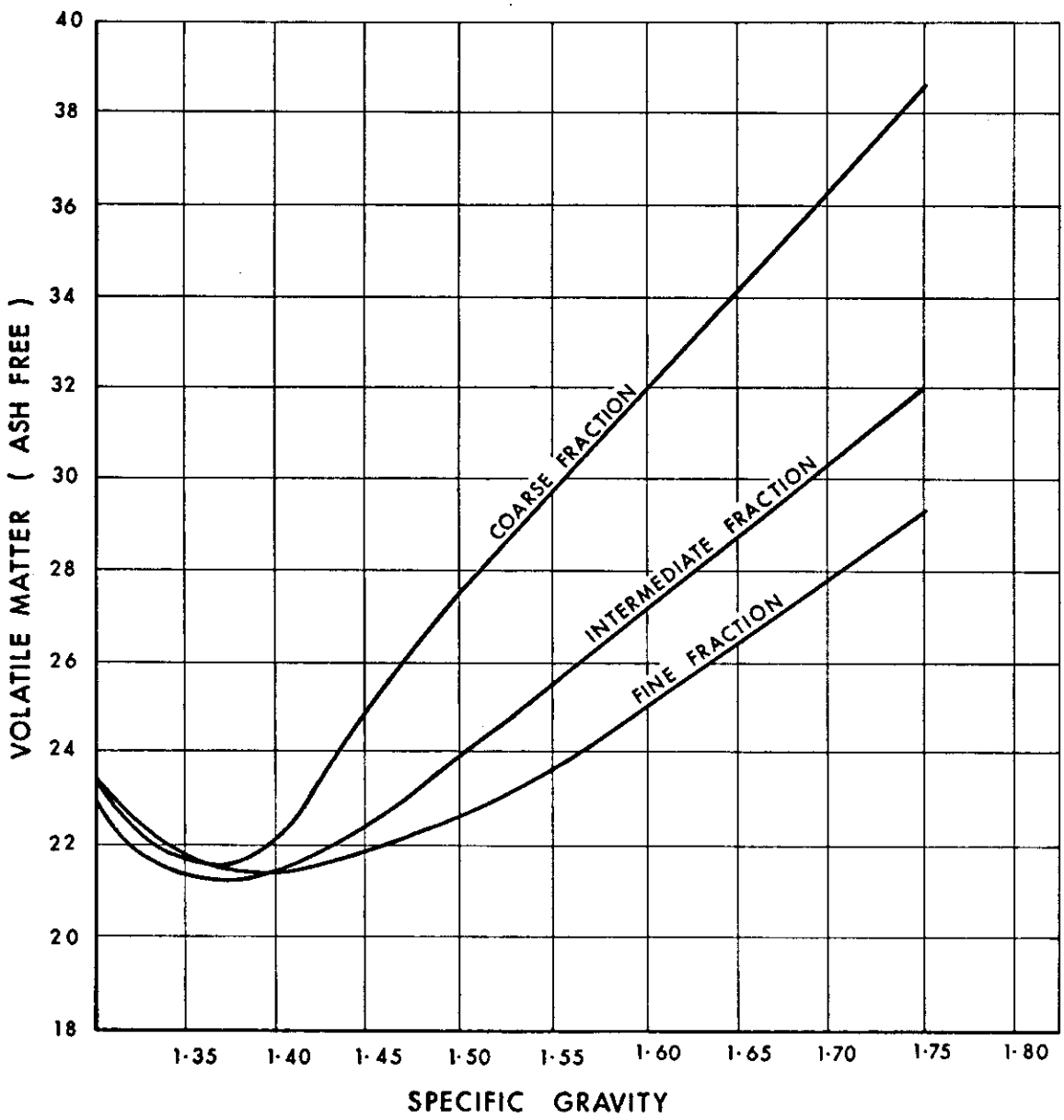
(c) Durains (dull coal) being a hard, heavy petrographic coal constituent, and containing higher volatile matter than fusains, are concentrated at the higher specific gravities. They are particularly evident in seams 2, 10 and 18 (Figures 7, 10 and 12) in the 2" x ½" fractions. Seams 6 to 9 are very low in volatile indicating an excess of durains and fusains, thus the curves are relatively uniform. Seam 12 shows a uniform curve, also reflecting the absence of durains.

(d) Volatile matter of various size fractions differs at constant specific gravity, thus one might anticipate differences in the volatile content of diamond drill cores, reverse circulation samples, and bulk samples because of the lower recovery of the drill hole samples.

(e) Basically, there is not as much variation in the ash free volatile of the various size fractions of Elk River coals as a more typical Western Canadian medium volatile coal.

VOLATILE MATTER (ASH FREE) vs. SPECIFIC GRAVITY FLOAT

TYPICAL MEDIUM VOLATILE WESTERN CANADIAN COAL



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COAL QUALITY EVALUATION

6) Sulphur Content

The Emkay, March 1971 report states that the variations in clean coal sulphur content will be between 0.44 and 0.58%. The sulphur content of the upper seams (12 to 18) is higher than that of the lower seams (2 to 11) so a blend of clean coal would be required to meet the sulphur specification (i.e. 0.6% sulphur in contract). Sulphur is not, however, a significant factor in the Elk River coal.

The sulphur content is summarized in Table 14. In general, the product sulphur appears to be about 0.5 to 0.6%, which is quite high for Western Canadian coals. Sulphur tests were conducted by the eschka method, so the results should be accurate. Some difficulties were observed with testing the sink float coal in a conventional Leco analyser (the perchlorethylene forms perchloric acid and reports as sulphur); however, the results will be corrected by the eschka method. Because of the low percentage of sulphur in the coal, the results are very often inaccurate. As an example, the sulphurs run on the various size fractions seldom balance with the raw coal sulphur.

The bulk of the sulphur in Western Canadian coals is generally organic, (80% organic, 20% pyritic) as appears to be the case with Elk River coals. The only seams with noticeable amounts of pyrite were 13E and 13F. The raw coal, because of its high ash content, was lower in sulphur than the product. On an ash free basis, the product was actually lower in sulphur. Because of the nature of organic sulphur, most of it volatilizes during coking, so it does not adversely affect the blast furnace product. Thus, the sulphur in Elk River coals should not present any problems.

TABLE 14

SULPHUR CONTENT

SEAM NO.	1.50 Specific Gravity			Clean Coal 1975 Pilot Tests	Raw Coal Pilot Tests
	M-K Drill-holes	M-K Bulk Samples	E & B 1975 Drillholes		
2	0.45	0.52		0.49	0.39
3	0.51	0.54		0.53	0.44
4	0.40	0.52		0.35	0.34
5					
6	0.72	0.75		0.64	0.71
7	0.63	0.60		0.55	0.55
8	0.51	0.42		0.40	0.48
9	0.49	0.43		0.38	0.28
10	0.49	0.38		0.45	0.38
11	0.65				
12	0.72	0.64	0.60	0.68	0.55
13	0.82	0.86	0.57	0.94	0.74
14	0.76	0.81	0.71	0.83	0.97
15	0.67	0.81	0.58	0.85	0.63
16	0.73	0.80	0.93	0.70	0.78
17	0.76	0.68	0.68	0.71	0.71
18	0.62	0.69	0.52	0.73	0.57
Average	0.62	0.63	0.66	0.62	0.57
Wt. Scheme 'A'	0.56	0.56		0.57	0.52
Wt. Scheme 'C'	0.56	0.56		0.54	0.49

COAL QUALITY EVALUATION

7) Phosphorous

Even more important than the sulphur content of the Elk River coals is the phosphorous content. Table 15 summarizes the P_2O_5 as a percent of ash, as well as the phosphorous as a percent of clean coal. The 1971 results as developed by the Department of Energy, Mines & Resources in Ottawa showed good correlation to the 1975 clean coal data. Only seams 3, 6 and 16 show very high phosphorous levels, and fortunately those seams are quite thin. The average phosphorous content is about 0.05% of the clean coal and should not exceed 0.065% during mining.

TABLE 15

PHOSPHOROUS CONTENT

SEAM NO.	1971 PILOT TESTS P_2O_5 (%) in C.C. ASH	1971 EMR TESTS CLEAN COAL PHOSPHOROUS (%)	1975 PILOT TESTS P_2O_5 (%) in C.C. ASH	1975 PILOT TESTS CLEAN COAL PHOSPHOROUS (%)
2	0.3	0.014	0.47	0.019
3	2.8	0.101	3.40	0.139
4	1.1	0.041	0.68	0.025
6	4.1	0.162	2.70	0.122
7	1.2	0.045	0.94	0.044
8	2.2	0.066	1.59	0.065
9	1.2	0.038	0.77	0.029
10	0.8	0.022	0.62	0.025
12	1.5	0.059	1.09	0.047
13	1.5	0.067	1.16	0.057
14	1.3	0.057	1.48	0.051
15	1.5	0.061	1.28	0.044
16	2.3	0.097	2.00	0.093
17	1.4	0.046	2.19	0.068
18	1.1	0.051	1.40	0.043
19	1.6	0.064	---	---
Average	1.62	0.062	1.45	0.058
Wt. Scheme 'A'	1.42	0.053	1.21	0.048
Wt. Scheme 'C'	1.43	0.052	1.13	0.046
Composite 'A'			1.30	0.047
Composite 'C'			1.21	0.051

COAL QUALITY EVALUATION

8) Alkalinity

The alkalinity of the Elk River coals is very low, as is shown in Table 16. The 1975 bulk testing program showed the total sodium and potassium oxide in the clean coal to be 0.04%, which is lower than all the other Western Canadian coals. The 1975 results are also substantially lower than were those of the Department of Energy, Mines & Resources in 1971, which can either be attributed to deepening of the adits and trenches or problems with testing at the very low values indicated.

Also of interest is the unusual phenomena that the K_2O is about five times as high as Na_2O which is completely reverse of what is normally expected in Western Canada. Possibly, the high potassium is associated with minerals such as glauconite or potassium illite.

TABLE 16

ALKALI

SEAM NO.	1971 EMR TESTS				1975 PILOT TESTS			
	NaO% of ASH	KO% of ASH	Total % of ASH	Total % of C.C.	NaO% of ASH	KO% of ASH	Total % of ASH	Total % of C.C.
2			0.7	0.07	0.04	0.14	0.18	0.02
3			0.7	0.06	0.05	0.13	0.18	0.02
4			0.7	0.06	0.08	1.01	1.09	0.09
6			0.3	0.03	0.07	0.26	0.33	0.03
7			0.8	0.07	0.05	0.26	0.31	0.03
8			1.6	0.11	0.04	0.14	0.18	0.02
9			0.7	0.05	0.08	0.25	0.33	0.03
10			1.0	0.06	0.06	0.18	0.24	0.02
12			1.3	0.12	0.04	0.34	0.38	0.04
13	0.1	1.8	1.9	0.19	0.08	0.71	0.79	0.09
14	0.2	1.4	1.6	0.16	0.07	0.60	0.67	0.05
15	0.2	1.0	1.2	0.11	0.07	0.57	0.64	0.05
16	0.3	1.5	1.8	0.17	0.08	0.69	0.77	0.08
17	0.2	0.9	1.1	0.08	0.07	0.47	0.54	0.04
18	0.2	1.4	1.6	0.17	0.06	0.60	0.66	0.05
19	0.2	1.8	2.0	0.18				
Average			1.19	0.11	0.06	0.42	0.48	0.04
Wt. Scheme 'A'					0.06	0.46	0.52	0.046
Wt. Scheme 'C'					0.06	0.43	0.49	0.045
Composite 'A'					0.09	0.84	0.93	0.08
Composite 'C'					0.10	0.76	0.86	0.08

COAL QUALITY EVALUATION

9) Pilot Plant Testing

Pilot washing of all the bulk samples was carried out in the test facility at Coal Science in Calgary, with the results included in the "Fall 1975" report. The purpose of these pilot washings was to produce a clean coal bulk sample for large scale coking tests. In no way was this testing to be interpreted as an equipment performance evaluation, although some of the results can be used as guidelines for plant design.

Table 17 summarizes the yield and ash of the various pilot plant components. The overall plant yield of 51.7% at 8.9% product ash is very low, but for understandable reasons.

(a) The raw coal mixing and handling section of the unit had a considerable amount of spillage.

(b) For the initial part of a run, the pilot plant was operated at lower specific gravity cut point than was optimum, and as a result some coal was lost.

(c) During the operation of the heavy media cyclone, the feed pressure often fluctuated and sometimes even caused the cyclone to collapse sending all the material to refuse. Also, the cyclone feed rate is about 3 tph whereas the cyclone capacity is 35 tph , so the equipment has an extensive excess of capacity.

(d) The sieve bend screen on cyclone overflow blinded periodically during the first few bulk tests until an improvised rapper

TABLE 17

PILOT PLANT WASH SUMMARY*

(*Totals in Percent)

SEAM NO.	HEAVY MEDIA CIRCUIT			WATER CYCLONE CIRCUIT			FROTH FLOTATION		PRODUCT			FEED
	ACTUAL YIELD	THEOR-ETICAL YIELD	ASH	ACTUAL YIELD	THEOR-ETICAL YIELD	ASH	ACTUAL YIELD	ASH	ASH BAL-ANCE YIELD	ACTUAL COMB-INED YIELD	COMB-INED ASH	ASH
2	36.2	44	8.3	75.3	82	11.9	67.5	8.6	49.0	34.1	9.2	37.2
3	78.8	83	8.3	79.9	95	8.7	92.8	12.2	81.6	85.0	9.3	21.9
4	71.7	71.5	8.1	59.1	86	8.1	80.0	9.9	68.6	68.6	8.3	27.7
6	55.9	67	9.8	74.0	92	11.4	87.5	10.8	72.4	44.6	10.3	23.8
7	27.4	45	9.8	70.1	75	13.6	75.9	8.4	51.7	32.0	10.6	33.1
8	61.3	64	9.5	78.2	88	7.7	77.0	6.0	72.0	56.4	9.3	31.0
9	75.2	73	8.6	91.2	97	7.4	82.6	7.1	78.0	61.7	8.6	17.1
10	70.9	76	8.8	89.8	95	7.5	76.8	5.5	79.9	64.6	9.2	23.2
12	49.2	46	8.2	64.4	83	9.2	67.0	9.5	54.1	51.9	9.8	42.5
13	21.8	24	9.2	57.6	58	10.2	63.3	11.7	33.9	19.7	11.1	57.1
14	41.3	42	7.1	63.9	69	6.7	83.2	8.4	46.4	44.3	7.8	49.8
15	41.7	42	8.3	---	75	7.2	64.9	7.5	48.2	44.7	7.8	44.3
16	44.3	53	9.1	76.4	85	13.0	75.2	12.3	54.0	53.1	10.6	39.7
17	58.8	70	8.2	82.2	87	8.1	84.4	9.4	53.3	54.3	6.9	35.9
18	57.3	55	6.6	68.6	90	9.7	84.6	9.8	63.6	61.2	7.0	34.2
Average	52.8	57.0	8.5	68.7	83.8	9.4	77.5	9.1	60.4	51.7	9.1	34.6
Wt. Avg.												
Scheme 'A'	55.8	58.5	8.4	72.7	84.5	8.9	76.6	8.8	62.0	53.7	8.9	33.8
Scheme 'C'	56.4	59.2	8.6	71.8	84.5	8.9	76.0	8.6	63.2	53.5	9.2	32.9
Composite												
Scheme 'A'	56.7	62.0	8.1	---	82.2	7.9	70.1	9.0	65.1	52.7	8.3	32.1
Scheme 'C'	57.5	56.0	8.9	---	80.8	7.0	81.6	9.8	66.7	50.0	9.5	33.9

was constructed which helped improve 28 x 65 mesh recovery.

(e) The vaccum filter could not be completely drained at the end of the run so the sludge had to be collected and settled in drums. The materials handling and decanting in this area resulted in some losses.

(f) The froth flotation pulp was held until a 10% by weight solids was achieved, then fed to the froth cells. The froth cells were then well attended throughout the run and reagent adjusted accordingly. Since Western Canadian coals are very hydrophobic, the added pulp circulation probably improved the floatability of the coal, so in actual operation the froth flotation recovery could be lower.

(g) No accurate method other than ash balance was available for determining the weights of the various products and feed.

(h) Because the coal is very friable, fines were always lost to the heavy and dilute media.

Overall the ash balance is probably the best indicator of the commercial scale plant recovery, and it may also be low because of the problems experienced in the heavy media cyclone circuit. The two composite runs indicate that the yields should be about 65%. This compares favourably with the product evaluation which suggests that an 8.75% ash could be achieved at 64% recovery on a plant feed ash of 28.6%.

COAL QUALITY EVALUATION

10) Pilot Plant Performance

Even though the pilot plant is not a good indicator of commercial plant operation, it is interesting to note the equipment performance, (Table 18) shows the probable error exhibited by the heavy media and water cyclone during the pilot plant tests. The values were obtained from the "Birtley Fall 1975" report, but the curves were replotted to include the data nearest the 25 to 75% level. Probable error was calculated as follows.

$$ep = \frac{\text{S.G. (75\% level)} - \text{S.G. (25\% level)}}{2}$$

The probable error for the 14" DSM heavy media cyclones ranged from 0.02 to 0.07 (average: 0.043) which is about what one expects from a commercial 24-28" cyclone. The probable error for the 6" DSM water cyclone ranged from 0.16 to 0.33 (average: 0.24) which is generally considered poor for modern compound water cyclones. The anticipated performance of a single stage compound water cyclone should be about 0.15 to 0.20 and results as low as 0.12 have been achieved for short periods.

It is interesting to note that the composite "A" bulk test gave an ash balance yield for the heavy media cyclone which was higher than the theoretical yield (64 vs. 62%), and similarly on composite 'C' which

was about the same type of coal (as far as washability was concerned), the ash balance yield was about the same (64.6%) for a theoretical yield of 56%. The probable error on the water cyclone varied from 0.15 on composite 'A' to 0.29 on composite 'C', which gives some idea of the influence of the samplers and operators on a plant.

TABLE 18

PILOT PLANT TESTING

PROBABLE ERROR

SEAM NO.	HEAVY MEDIA CYCLONE	D.S.M. WATER CYCLONE
2	0.06	0.15
3	0.05	0.27
4	0.02	0.16
6	---	---
7	0.07	0.33
8	0.04	---
9	---	---
10	---	0.23
12	0.04	0.21
'13	0.05	0.19
14	0.04	0.22
15	---	---
16	0.04	0.31
17	---	---
18	0.04	0.18
Average	0.043	0.23
Composite 'A'	---	0.15
Composite 'C'	0.03	0.29

COAL QUALITY EVALUATION

11) Composite Samples

Since two mine plans were being considered, two composite samples (mixed proportionately according to the mine plans) were prepared for bulk testing. A description of these blends is included in the "Birtley Report, Fall, 1975". A summary of the composite bulk tests and comments is included below.

(a) Size Distribution:

The simulated size distribution was produced by crushing all the coal to 3/4". The fines content is lower than that expected for plant design but is about the same as the average blend.

Size	Wt.% Scheme 'A'	Wt.% Scheme 'C'
2" x ½"	23.3	21.8
½" x 28M	55.3	50.0
28M x 65M	6.2	13.0
65M x 0	15.2	15.2

One might expect from the calculated average -28 mesh that the fines in mining scheme 'C' would not differ greatly from those in scheme 'A'; however, they increased from 21.4% to 28.2%, which is substantial. The plus 2" fraction was also slightly higher in scheme 'C' which is probably due to sampling error since mining scheme 'C' should produce more dilution.

COAL QUALITY EVALUATION

(b) Washability:

The raw coal ash content of the two samples indicated that blend 'A' was 32.1%, which was lower than the 33.9% in blend 'C'. Once again, the figures were reversed from what was expected, which probably resulted from mixing error in the original samples. However, the differences were not significant.

The 2" x ½", or ½" x 28M washability in composite 'A' was quite a bit better than the calculated average, and slightly poorer in composite 'C' which would tend to grossly overstate the differences between the two mining schemes.

(c) Pilot Test:

The variation in coal quality was further exaggerated by the reduced recovery and much lower ash products in composite 'A'. If one compares the 3/4" x 28M washability to the Birtley calculated ash balance, it becomes very apparent that the ash balance is a meaningless figure.

	Washability 3/4" x 28M		Ash Balance from Pilot Plant	
	Wt.%	Ash%	Wt.%	Ash%
Composite 'A'	62	8.1	64.0	8.1
Composite 'C'	56	8.9	64.7	8.9

COAL QUALITY EVALUATION

The weighed yields are much more representative of the plant performance and they are as follows:

	Washability		Weighed Balance	
	Wt.%	Ash%	Wt.%	Ash%
Composite 'A'	62	8.1	56.7	8.1
Composite 'C'	56	8.9	57.5	8.9

(d) Product Evaluation:

Besides having problems with the calculated yields from the pilot test, the product evaluation is suspect. From the weighed yields and product analyses, the following applies:

	Wt.%.	Ash%	Yield %
Composite 'A'			
HM Circuit (1.50 S.G.)	78.6	8.1	56.7
CWC Circuit	12.2	7.9	82.2
Froth Flotation	9.2	9.0	70.1
Combined Product (calculated)	100.0	8.2	61.0
Actual Product (weighed)		8.3	48.4
Composite 'C'			
HM Circuit (1.46 S.G.)	71.8	8.9	57.5
CWC Circuit	13.8	7.0	80.9
Froth Flotation	14.4	9.8	81.6
Combined Product (calculated)	100.0	8.7	64.2
Actual Product (weighed)		9.5	52.7

COAL QUALITY EVALUATION

There is an unusually large difference in the product ash as calculated compared to the sampled product in composite 'C'.

Overall the only conclusion that can be drawn from the composite samples is that the sampling or mixing has introduced serious error into the results. Observation of the tests by Mr. B. Raymond of Techman indicated that some error occurred in the froth flotation product ash in that the entire weir was not sampled, but overall the tests ran quite smoothly. The yield in the fine coal circuit was very high (near theoretical) and heavy media cyclone performance was good. The large variation in product ash was not indicated by the "quick ash" taken during the plant operation.

The other factors such as grindability index, phosphorous, sulphur and free swelling index showed good agreement with the calculated averages. Some difference in dilatation was expected since the coal in seams 2 to 10 is deficient in coking properties; however, the difference was not anticipated to be as dramatic as the dilatometer tests on various specific gravity float composites indicated. If the Elk River clean coal must produce a good coking coal product without further blending, then a significant proportion of seams 12 to 18 must be included in the mix.

COAL QUALITY EVALUATION

12) Miscellaneous Chemical Properties of the Elk River Coals

The next section describes the physical and chemical properties of the Elk River coal. In general no problems are predicted with any of the coals in that the preparation facility will be fed a uniform blend of the individual seams.

Table 19 shows the ultimate analysis of the Elk River coals. The mineral ash is shown in Table 20 and the ash fusion temperatures in Table 21. The sulphur is somewhat high on individual seams, as is the alkalinity, but the average is acceptable for a coking coal blend. The ash fusion temperatures are 1300°C plus (+2372°F) which is about the same as all Western Canadian coals. The mineral ash analysis has changed slightly from the 1970-71 testing in that the alkalinity is quite low in the recent samples, and the Fe_2O_3 has increased substantially. It will be interesting to compare the Birtley test results with those of the Department of Energy, Mines and Resources in Ottawa.

TABLE 19

ULTIMATE ANALYSIS

SEAM	H_2O	C	H	N	S	ASH	O
2	0.38	81.22	4.21	1.20	0.60	9.25	3.14
3	0.38	81.49	4.30	0.98	0.53	9.48	2.84
4	0.54	82.26	4.21	1.16	0.41	8.50	2.92
6	0.36	80.31	4.07	1.18	0.68	10.35	3.05
7	0.73	79.65	4.18	1.06	0.61	10.88	2.89
8	0.38	80.85	4.27	1.29	0.47	9.31	3.43
9	0.46	81.83	4.28	1.27	0.47	8.57	3.12
10	0.52	80.34	4.41	1.38	0.44	9.29	3.62
12	0.46	79.96	4.49	1.45	0.74	9.73	3.17
13	0.67	77.51	4.47	1.46	0.93	11.23	3.73
14	0.66	80.41	4.87	1.66	0.84	7.85	3.71
15	0.58	80.60	4.77	1.60	0.75	7.47	3.96
16	0.57	78.07	4.76	1.42	0.79	10.69	3.70
17	0.81	80.51	4.96	1.52	0.80	6.97	4.43
18	0.96	79.56	5.11	1.72	0.77	7.31	4.57
Average	0.56	80.30	4.54	1.36	0.66	9.13	3.49
Wt.Avg.							
'A'	0.55	80.58	4.45	1.35	0.61	8.9	3.44
'C'	0.50	80.70	4.36	1.30	0.58	9.2	3.29

TABLE 20

MINERAL ASH

SEAM	PRODUCT ASH	Na_2O	K_2O	MgO	CaO	Fe_2O_3	Al_2O_3	SiO_2	P_2O_5
2	9.2	0.04	0.14	0.17	0.62	4.68	24.06	66.04	0.47
3	9.3	0.05	0.13	0.17	4.90	9.65	27.71	50.52	3.40
4	8.3	0.08	1.01	0.30	0.70	9.65	28.16	56.94	0.68
6	10.3	0.07	0.26	0.25	2.87	5.72	26.57	54.88	2.70
7	10.6	0.05	0.26	0.27	0.50	6.43	30.92	56.80	0.99
8	9.3	0.04	0.14	0.20	1.54	6.50	29.92	57.54	1.59
9	8.6	0.08	0.25	0.18	0.67	7.15	31.62	56.14	0.77
10	9.2	0.06	0.18	0.27	0.63	8.29	28.46	56.56	0.62
12	9.8	0.04	0.34	0.20	0.58	5.50	26.08	61.68	1.09
13	11.1	0.08	0.71	0.23	0.50	5.36	23.44	64.56	1.16
14	7.8	0.07	0.60	0.30	1.54	8.15	23.82	59.36	1.48
15	7.8	0.07	0.57	0.27	1.36	8.51	23.44	60.30	1.28
16	10.6	0.08	0.69	0.40	1.92	12.65	21.93	55.02	2.00
17	7.1	0.07	0.47	0.27	1.96	16.42	21.17	54.84	2.19
18	7.0	0.06	0.60	0.36	1.40	10.08	24.19	57.48	1.40
Average	9.1	0.06	0.42	0.26	1.45	8.32	26.10	57.91	0.058
Wt.Avg.									
'A'	8.9	0.06	0.46	0.28	1.17	8.05	26.50	58.49	0.048
'C'	9.2	0.06	0.43	0.24	1.10	7.38	27.17	58.72	0.046

TABLE 21

ASH FUSION TEMPERATURES (°C)

	OXIDIZING				REDUCING			
SEAM	ID	SP	Hs	FL	ID	SP	Hs	FL
2	1445+				1445+			
3	1390	1445+			1330	1445	1445+	
4	1470+				1430	1470+		
6	1375	1445+			1320	1445	1445+	
7	1445+				1445+			
8	1470+				1470+			
9	1470	1470+			1365	1445	1465	1465+
10	1445+		1470+		1445+			
12	1470	1470+			1350	1455	1465	1465+
13	1430	1470	1470+		1395	1465	1470+	
14	1470	1470+	1470+		1390	1470+		
15	1430	1470+			1355	1440	1455	1455+
16	1390	1470	1380	1450	1300	1400	1455	1470+
17	1470	1470+			1390	1470+		
18	1310	1340			1240	1300	1330	1400
Composite								
'A'	1470+				1400	1470+		
'C'	1470+				1430	1470+		

COAL QUALITY EVALUATION

13) Hardgrove Grindability Index

Hardgrove grindability tests were conducted on a large number of the Elk River coal samples. Fundamentally the test is conducted in a grinding apparatus which simulates a ball mill. A 50 gm sample of 16 x 30M coal is ground and the product sieved at 200M. Since a fair amount of the material will pass the 200M sieve, and since the coal particles are somewhat flat for Western Canadian coals, the screening will present problems, and the data may be somewhat scattered. Perhaps wet screening and collection of only the coarse fraction (calculate fines by difference) would render the results more accurate.

Theoretically the grindability index of coal on a constant ash basis should be correlatable to size distribution expected in any fixed system of materials handling. Figures 14 to 17 show the plots of grindability index versus ash content for seams 2 to 18. The clean coal samples show reasonable correlation with the Ottawa test results of 1971.

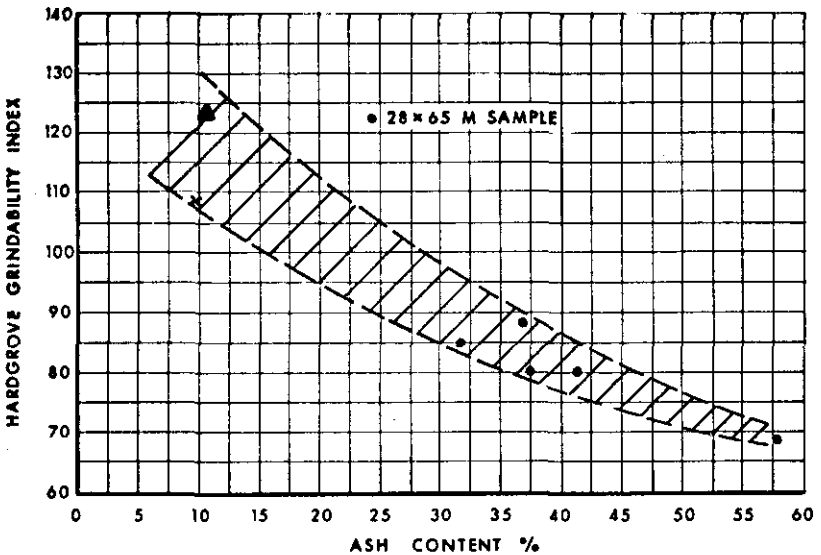
The higher ash samples perhaps exhibit the characteristics of the rock rather than that of the coal, or, they more likely indicate that the coal size distribution will vary considerably in any one seam. If this is the case, it would be very difficult to split coals on the basis of hard and soft, to feed to two separate sections of the plant. Perhaps it would be more reasonable to screen all the raw coals and screen the high dilution separately in a unit which could operate with variable feed. That way, a heavy media vessel or jig might be utilized to perform a rougher cut (high specific gravity) on the coarse coal, and the rock can be eliminated from the plant feed.

HARDGROVE GRINDABILITY INDEX vs. ASH CONTENT FOR ELK RIVER COAL

LEGEND

- ▲ EMR 1971 DATA
- ● WASHABILITY & CHANNEL SAMPLES
- X PILOT PLANT RUNS 1975
- □ DRILL HOLE DATA 1975

SEAM No. 2



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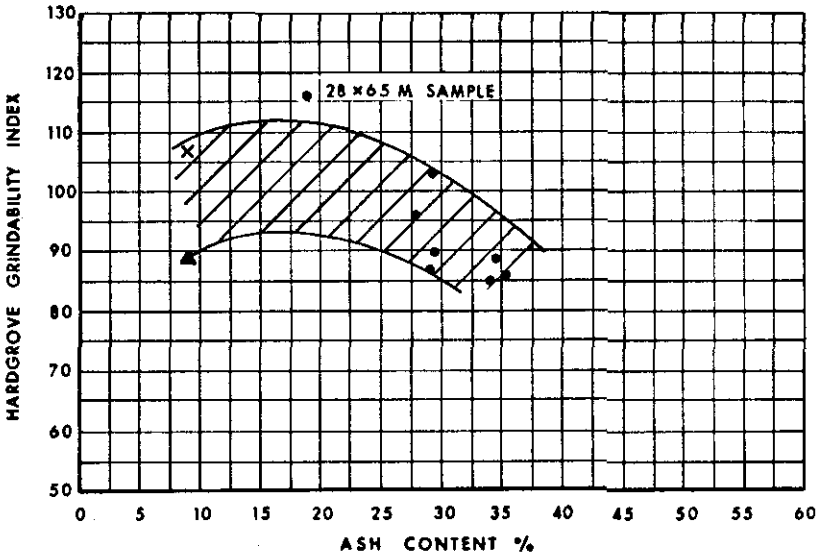

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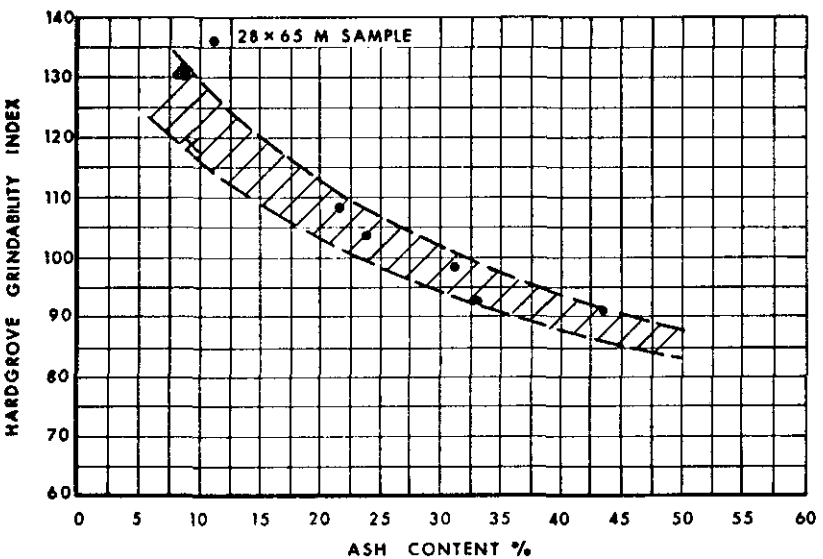

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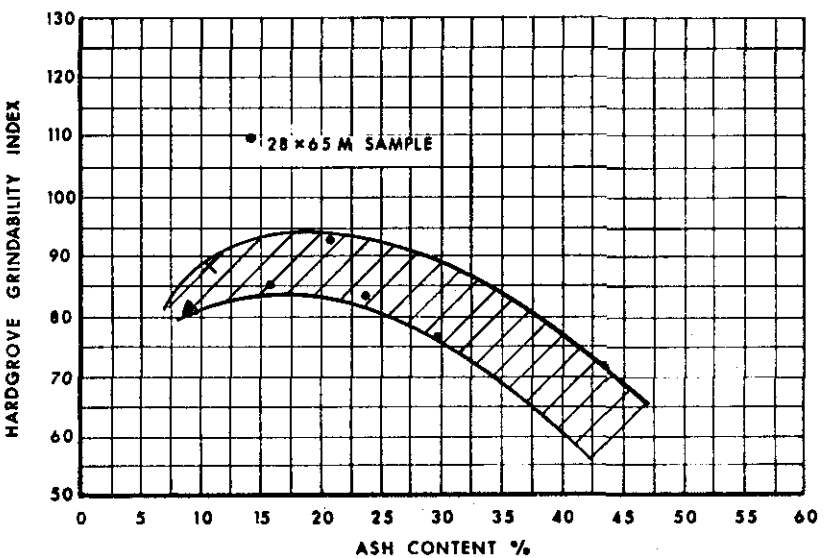

ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Jan. /76

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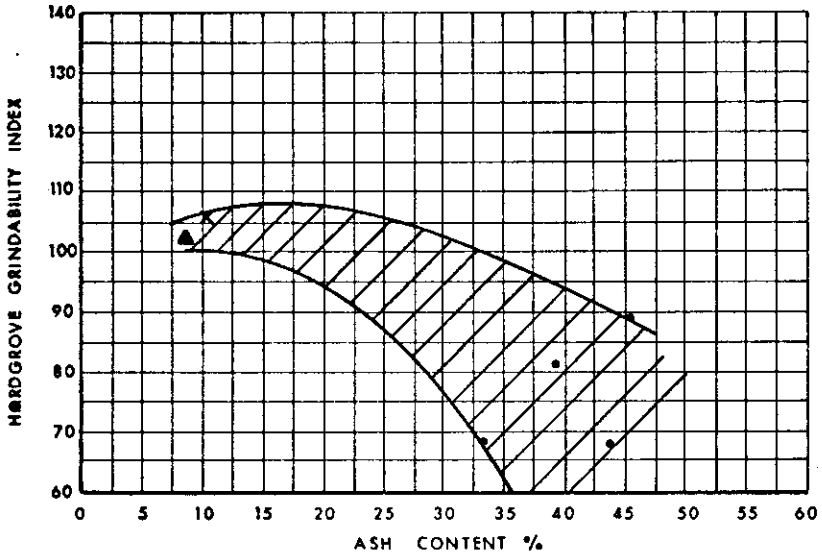
HARDGROVE GRINDABILITY INDEX vs. ASH CONTENT FOR ELK RIVER COAL

LEGEND

- ▲ EMR 1971 DATA
- • WASHABILITY & CHANNEL SAMPLES
- X PILOT PLANT RUNS 1975
- □ DRILL HOLE DATA 1975

SEAM No. 7



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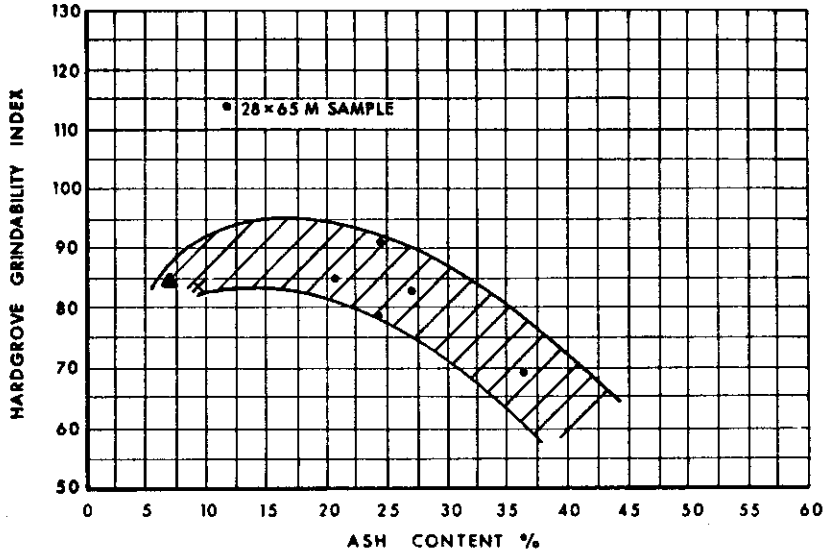

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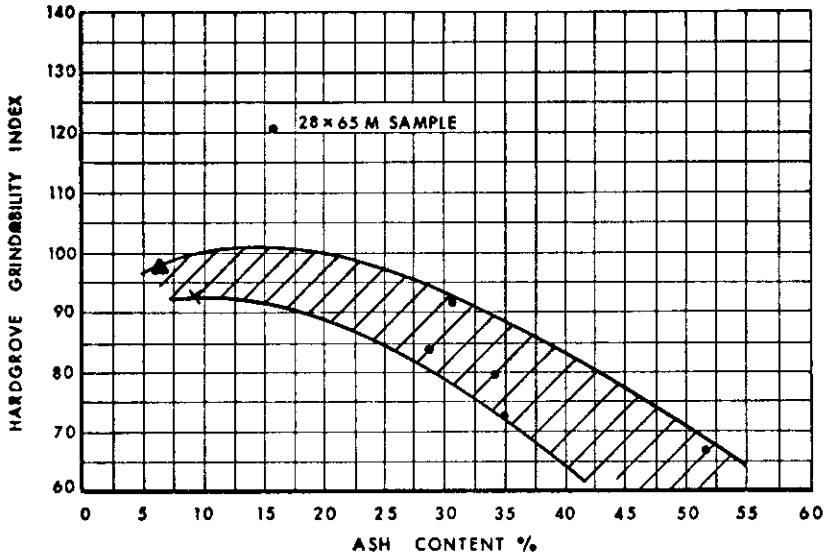
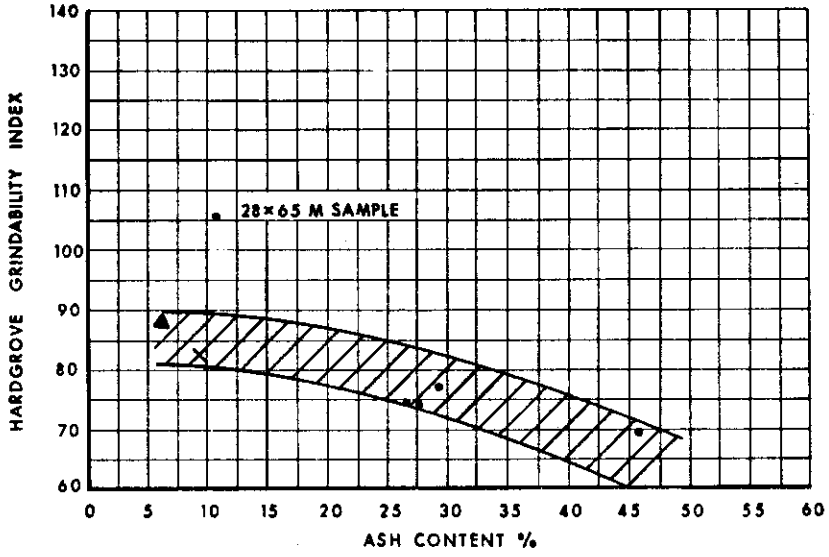


SEAM No. 10



ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Jan. /76

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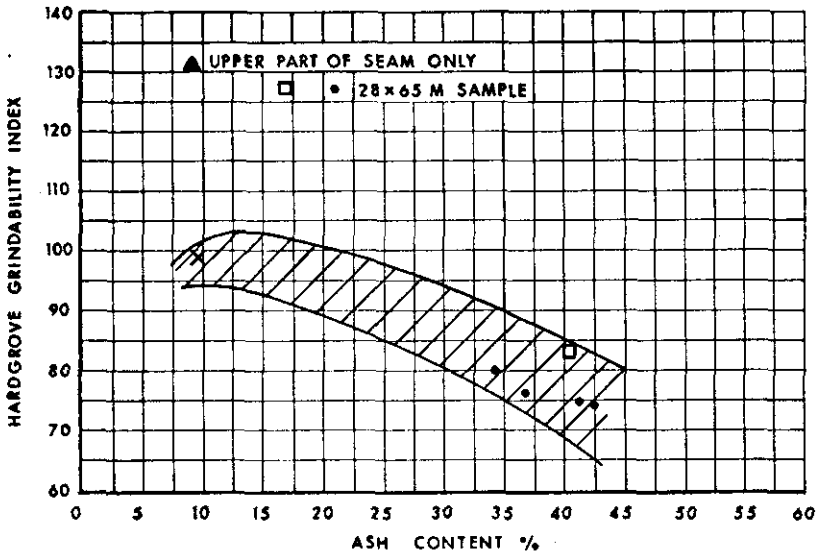
HARDGROVE GRINDABILITY INDEX vs. ASH CONTENT FOR ELK RIVER COAL

LEGEND

- ▲ EMR 1971 DATA
- • WASHABILITY & CHANNEL SAMPLES
- × PILOT PLANT RUNS 1975
- □ DRILL HOLE DATA 1975

SEAM No. 12



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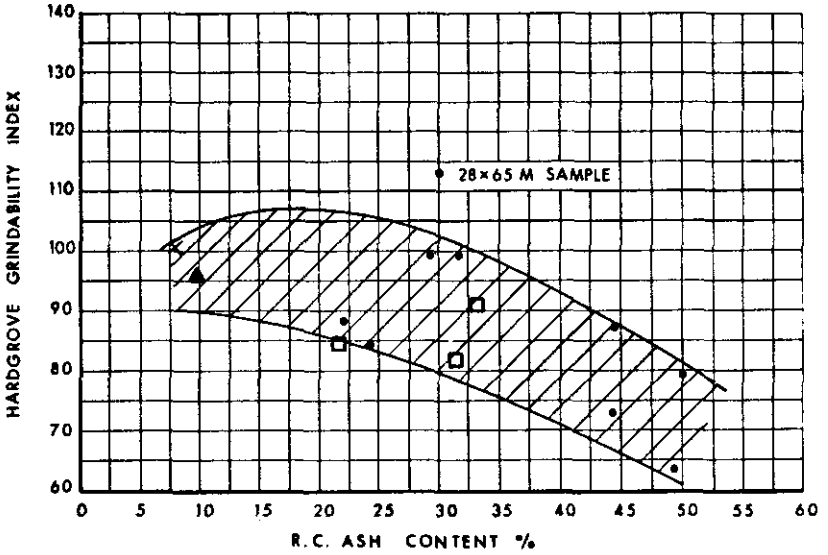

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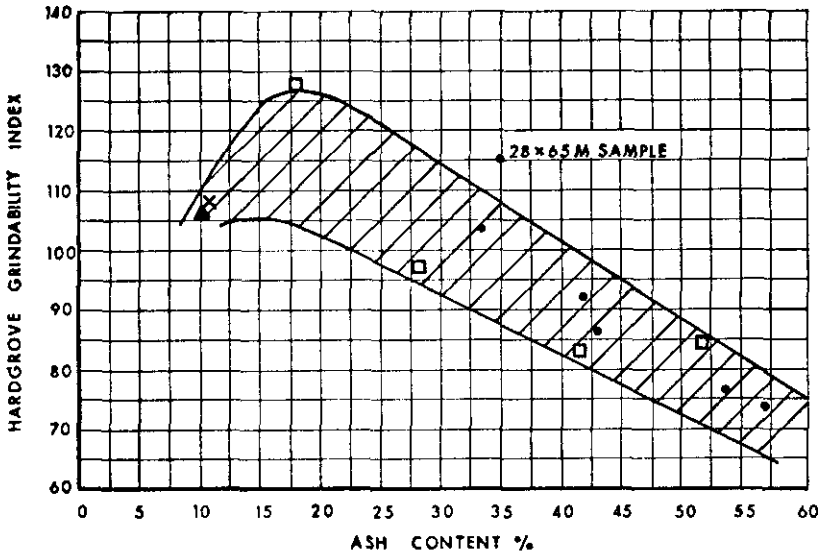

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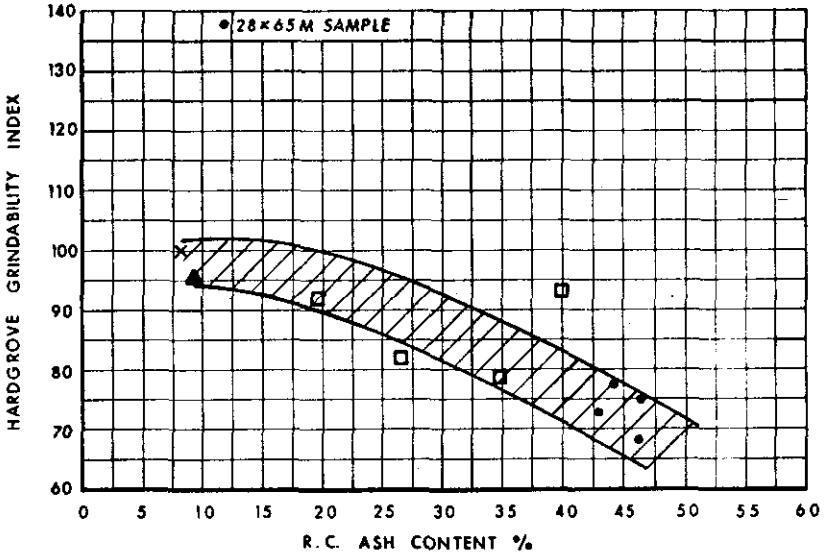

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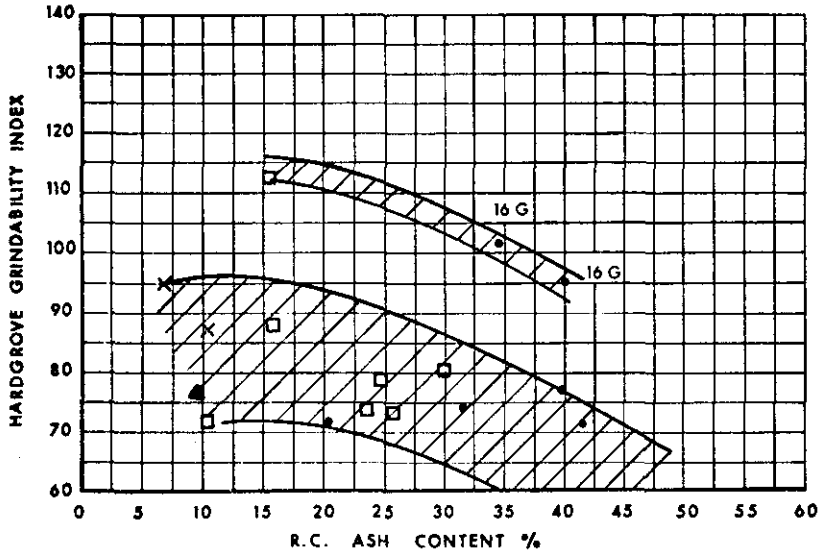
HARDGROVE GRINDABILITY INDEX vs. ASH CONTENT FOR ELK RIVER COAL

LEGEND

- ▲ EMR 1971 DATA
- ● WASHABILITY & CHANNEL SAMPLES
- × PILOT PLANT RUNS 1975
- □ DRILL HOLE DATA 1975

SEAM No. 16



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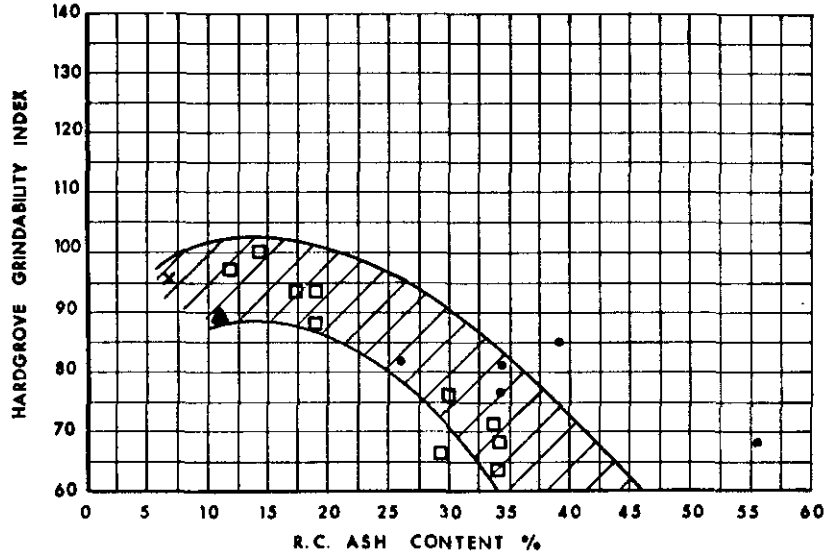
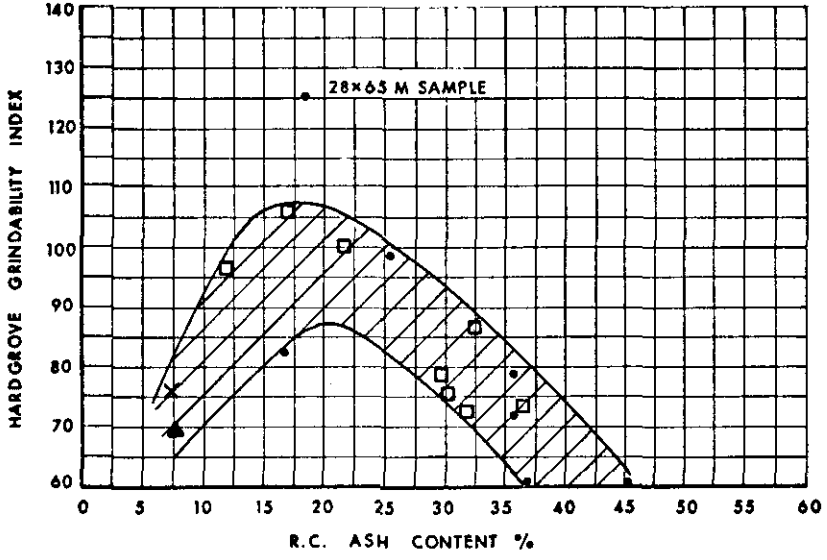


SEAM No. 17



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COAL QUALITY CONSIDERATION FOR PLANT DESIGN

After summarizing all the test work done to date, some reasonable assumptions must be made to predict the coal quality which should be used for plant design. Obviously one cannot incorporate the washability and drill hole data generated for each seam in the entire design; therefore, a set of data showing the range of variation expected in the plant operation has been prepared. For this reason it is not important that each bulk sample have precisely the estimated amount of dilution or fines content. Such values are not usually achieved for extended periods in practice anyway. It is much more important to appreciate the extent of variations in the plant feed, and to design in the flexibility which will allow the plant to operate with adverse conditions of coal quality. Therefore, the data developed to-date is considered to be sufficient to predict the minimum, average, and maximum washability that is necessary for design of the Elk River preparation plant.

1) Coal Formation

The anticipated Elk River mine is located on the east side of a large gently folded syncline (gently folded by Western Canadian standards) in the heart of the Elk Valley. The coal measures are located in the Lower Cretaceous, Kootenay formation and are generally quite uniform considering the oregenic activity in the area. Minor cross faulting has been observed in some of the adits and boreholes, but no major upheavals (which might adversely affect the coal quality) are expected in the mining area. In adit 3, a displacement of one foot in the coal seam has caused the coal to thicken near the fault and the coal quality has actually improved.

COAL QUALITY CONSIDERATION

Because the coal was folded into a synclinal structure, it does exhibit horizontal fracturing which caused the coal particulates to be somewhat plate-like. The extent of folding is not as severe as some of the other coal producing areas of Western Canada so a good part of the coal is still blocky, and thus should not weather so quickly. This phenomena should allow one to more accurately predict the performance of the coal cleaning equipment than was thought earlier.

Coal oxidation is somewhat of a problem in Western Canada; however, the Elk River mining area has been largely covered with glacial till and because the coal is gently folded it has been impervious to ground water perculation, so oxidation depths are minimal and not really significant to the overall reserves. A few of the areas on the steeper slopes of Little Weary Ridge may show oxidation depths beyond the 10 to 15 feet which is the norm. In particular, seam 10 in the area of adit 10 was oxidized to about 45 feet deep. Here the coal was very friable and slickensided.

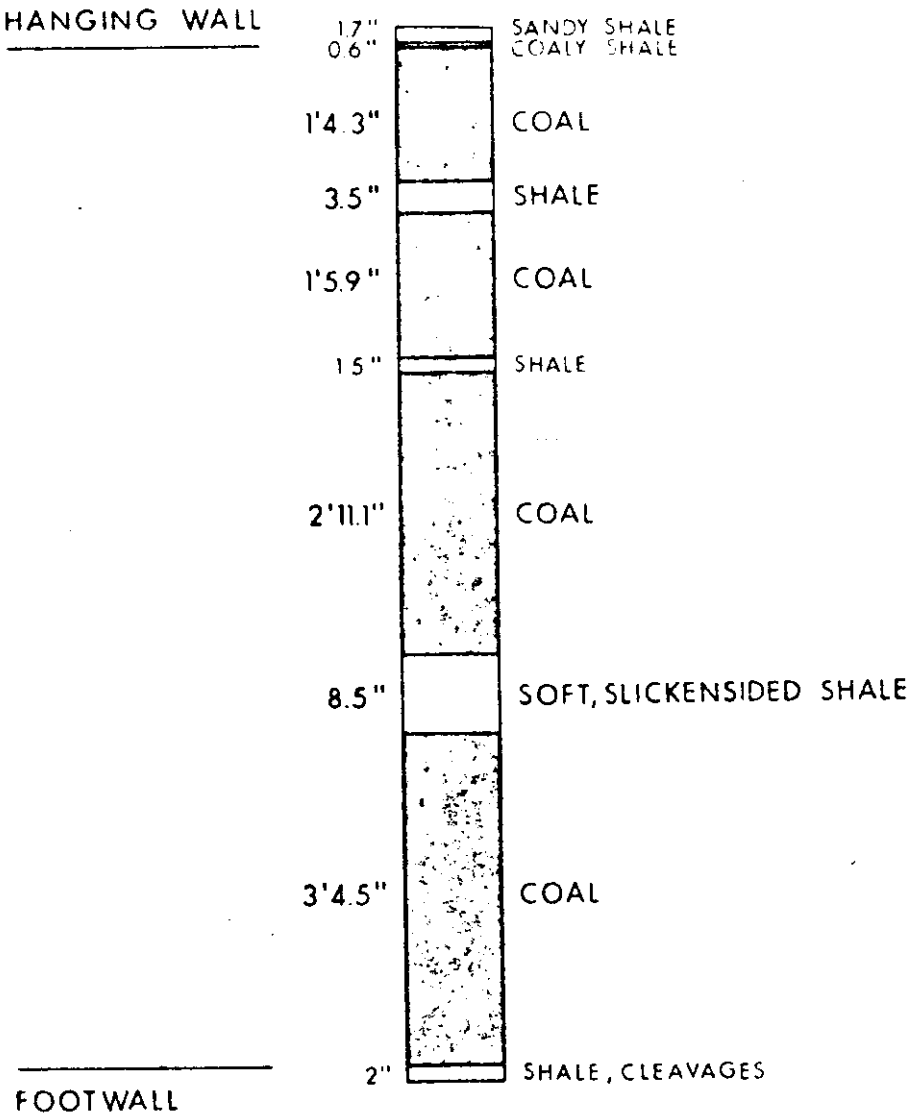
Because of extensive oregenic activity and the depositional characteristics of the coal in the area, the seams thicken and thin at random. Much of the time the seams even split, which causes a considerable dilultion problem during mining. As a result, the 1975 bulk testing program took all of these features of the coal deposit into account and the dilution was included in the bulk samples.

The following is a description of the coal quality of each seam and the lithology of the coal seams comprising each bulk sample. A similar description was presented in the "Techman Report on Preparation and Preliminary Flowsheet, March 1975".

COAL QUALITY CONSIDERATION

Seam 1 This seam is very thin and does not comprise a significant part of the reserve, so no information has been developed on it.

Seam 2 Seam 2 varies considerably in quality across the mining area The amount of dilution expected is, however, quite low because of the distinct contacts. To ensure that the bulk sample would be representative of the coal, all the partings were included along with 6 inches of footwall and hanging wall. The raw coal ash of 37.2% included all the shale and coal bands which would normally become a part of the raw coal. If the mining scheme should change and the dilution increase, then the additional material would be 2.6 S.G. rock which would either be rejected by the rotary breaker or appear in the 2" x ½" size fraction. The pilot test demonstrated that a 9.5% ash product with a 9 FSI could be achieved at about 65% recovery. The grindability index is still high, and this seam will produce an extensive amount of fines. The coking properties of this seam should be very good, although the clean coal ash may vary up to 11.5%. Only one drill hole (NA-B) showed a 4½ FSI washed coal which might have been a poor sample because of the depth from which it was recovered (643-656').



SEAM No. 2

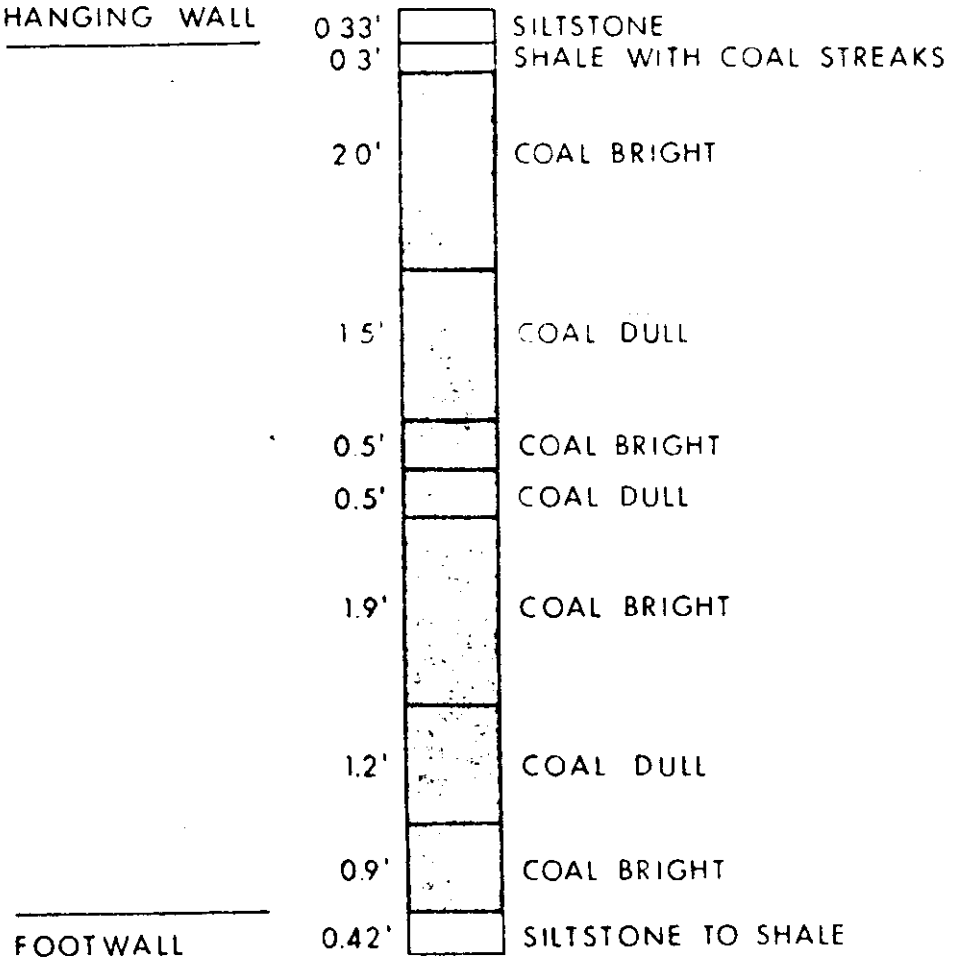
ADIT No. 2

BULK SAMPLE	- THICKNESS	:	10'7.6"
TOTAL SEAM	- THICKNESS	:	10'3.3"
TOTAL COAL	- THICKNESS	:	9'1.8"
TOTAL PARTINGS	- THICKNESS	:	1'1.5"
TOTAL ROOF AND FLOOR IN SAMPLE		:	4.3"

COAL QUALITY CONSIDERATION

Seam 3 The quality of seam 3 proved to be very good, as was expected. The coal was very fine (about 40% of the seam was dull coal), but a consistent low ash, high FSI product can be expected from this seam. The sample was taken near a one foot fault, which had no adverse effects on the coal quality. About 9 inches of siltstone was included in the bulk sample along with 4 inches of coaly shale. Once again the contacts were very hard and distinct and any further dilution would be 2.6 S.G. siltstone.

This seam is quite high in phosphorous, so it should be blended at all times.



SEAM No.3

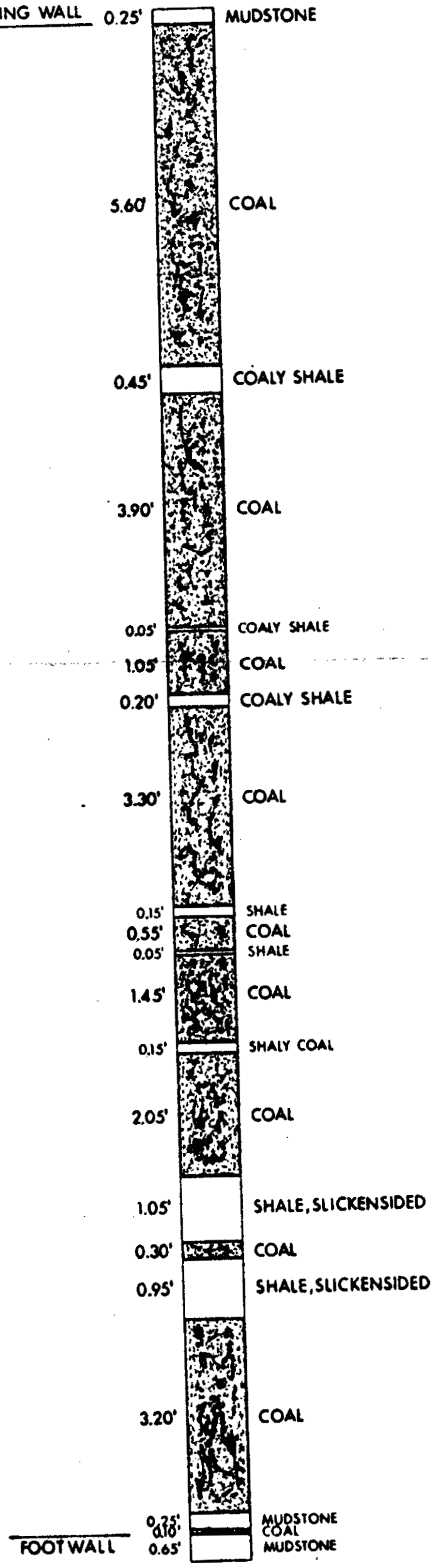
ADIT No.3

BULK SAMPLE	- THICKNESS	:	9.55'
TOTAL SEAM	- THICKNESS	:	8.80'
TOTAL COAL	- THICKNESS	:	8.50'
TOTAL PARTINGS	- THICKNESS	:	0.30'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.75'

COAL QUALITY CONSIDERATION

Seam 4 and 4A

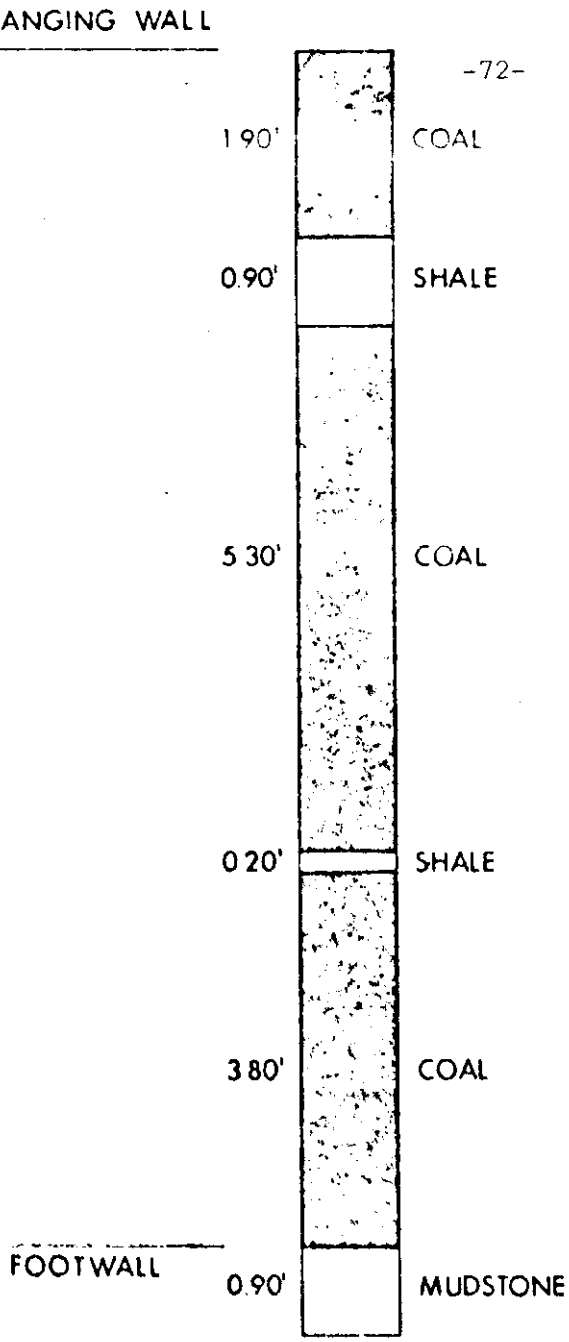
The raw coal characteristics of seam 4 will vary considerably over the mining area as will the quality of the washed coal. This seam generally yields a low FSI; however, the coke test still showed a 50.3 stability index which indicated that the FSI was not a true measure of the coking properties of this seam. The raw coal ash content of the bulk sample was 27.7% including 0.9 feet of mudstone dilution on each seam and several shale partings. The clean coal yield should be over 70% on this seam, with a cut point of 1.52 to 1.55 S.G. The washability of the coal did not change significantly from the old adit to the new adit, which indicates that even though the raw coal characteristics change from seam to seam, the product should be fairly consistent. The grindability index increased from 89 to 107, which showed that the size distribution of the coal in seam 4 might fluctuate considerably over the mining area. The contacts are once again very distinct and hard, so any further dilution will not affect the washability significantly.



SEAM No. 4

ADIT No. 4 + 4A (ROCK ADIT)

BULK SAMPLE	- THICKNESS	: 25.70'
TOTAL SEAM	- THICKNESS	: 24.80'
TOTAL COAL	- THICKNESS	: 21.50'
TOTAL PARTINGS	- THICKNESS	: 3.30'
TOTAL ROOF AND FLOOR IN SAMPLE		: 0.90'



SEAM No 4A

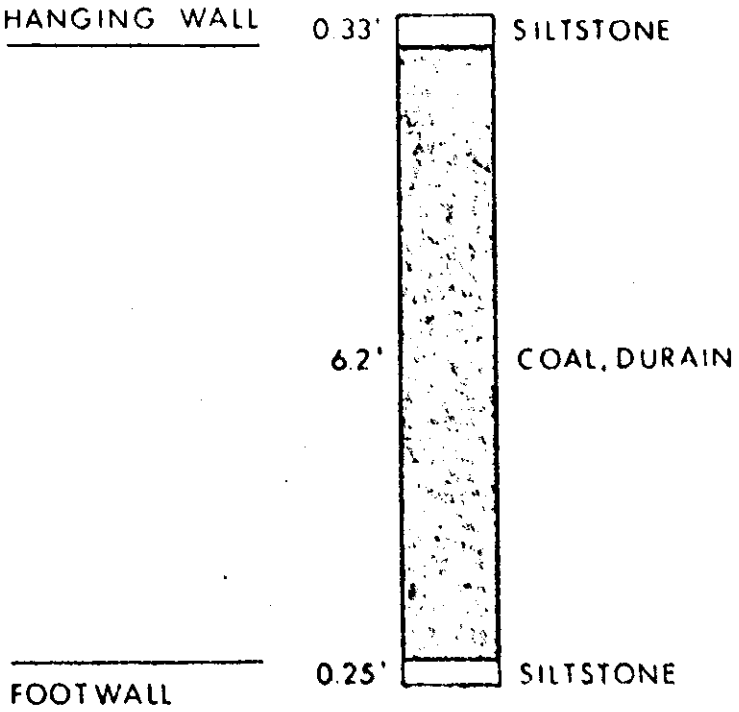
ADIT No 4+4A (ROCK ADIT)

BULK SAMPLE	- THICKNESS	: ——	13.0'
TOTAL SEAM	- THICKNESS	: ——	12.1'
TOTAL COAL	- THICKNESS	: ——	11.0'
TOTAL PARTINGS	- THICKNESS	: ——	1.1'
TOTAL ROOF AND FLOOR IN SAMPLE		: ——	0.90'

COAL QUALITY CONSIDERATION

Seam 5 This seam was sampled in adit 4 and 4A, and showed a very high raw coal ash but, 9.2% on the 1.50 S.G. float coal. The Ruhr dilatometer test indicated that this seam should coke very well. In general, the seam is very thin so it doesn't represent a substantial part of the reserves.

Seam 6 Seam 6 is very high in durain and exhibits poor coking properties. The contacts are very hard and distinct, so increased dilution on this seam will not affect the washability. The raw coal as well as clean coal will vary considerably in ash. The phosphorous content of this seam is also quite high, so the coal should be blended. This seam would lend itself well to a thermal coal market should one develop. The durain in this seam is very hard so the anticipated fines content of the seam is quite low.



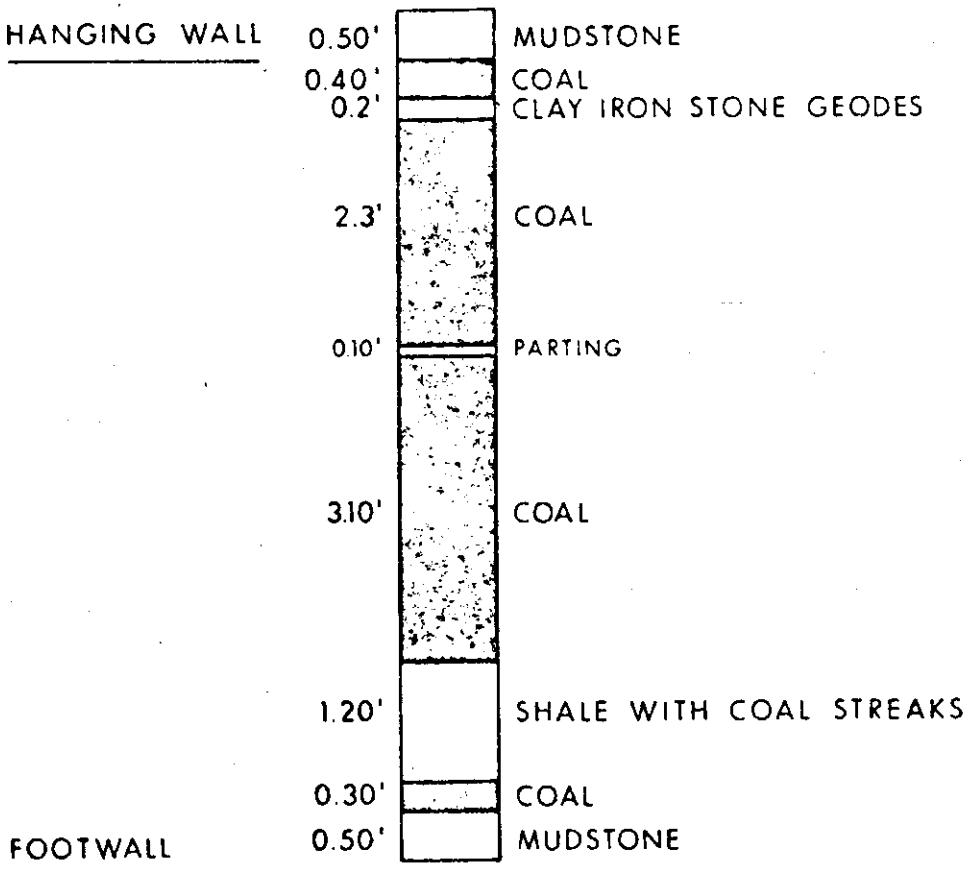
SEAM No.6

ADIT No.6

BULK SAMPLE	- THICKNESS	:	6.78'
TOTAL SEAM	- THICKNESS	:	6.20'
TOTAL COAL	- THICKNESS	:	6.20'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.58'

COAL QUALITY CONSIDERATION

Seam 7 The raw coal ash content of seam 7 was fairly high because of the inclusion of 1.7 feet of shale and mudstone in the footwall to recover 0.3 feet of coal. The clean coal ash content of the bulk sample was 10.6%, but could have been lower if the 6 inch DSM water cyclone had operated properly. The amount of near gravity material in the 1975 bulk sample was also very high (30% at 1.50 S.G.); however, the coal cleaned better than had been previously estimated in the "Techman, Report on Preparation and Preliminary Flowsheet, March 1975". If the lower 2 feet of dilution could be eliminated during mining, this seam could become one of the better seams in the blend.



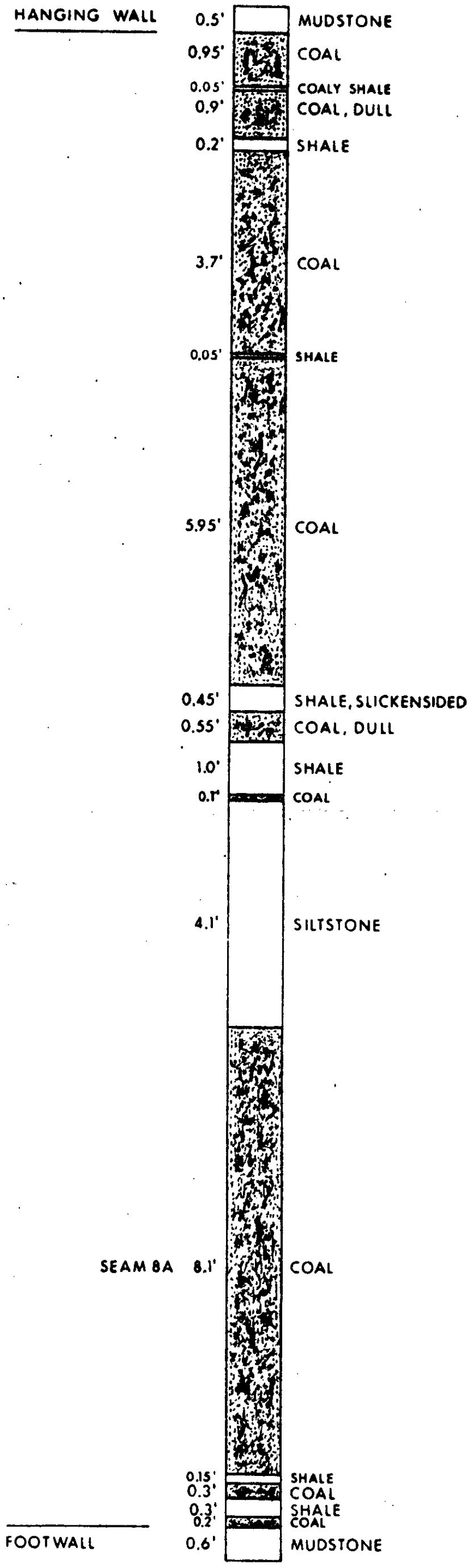
SEAM No.7

ADIT No.7

BULK SAMPLE	- THICKNESS	:	8.6'
TOTAL SEAM	- THICKNESS	:	7.6'
TOTAL COAL	- THICKNESS	:	6.10'
TOTAL PARTINGS	- THICKNESS	:	1.50'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.0'

COAL QUALITY CONSIDERATION

Seam 8 The raw coal ash content of seams 8 and 8A is expected to be quite high and variable because of the parting between the seams. In actual mining it may be possible to remove the 5.2 foot middle parting section, but for the bulk test it was included. In general the clean coal ash content could be reduced from the 9.3% obtained in the 1975 pilot plant test to about 8%. The contacts are once again very distinct mudstone and siltstone so dilution will not adversely affect the washability.



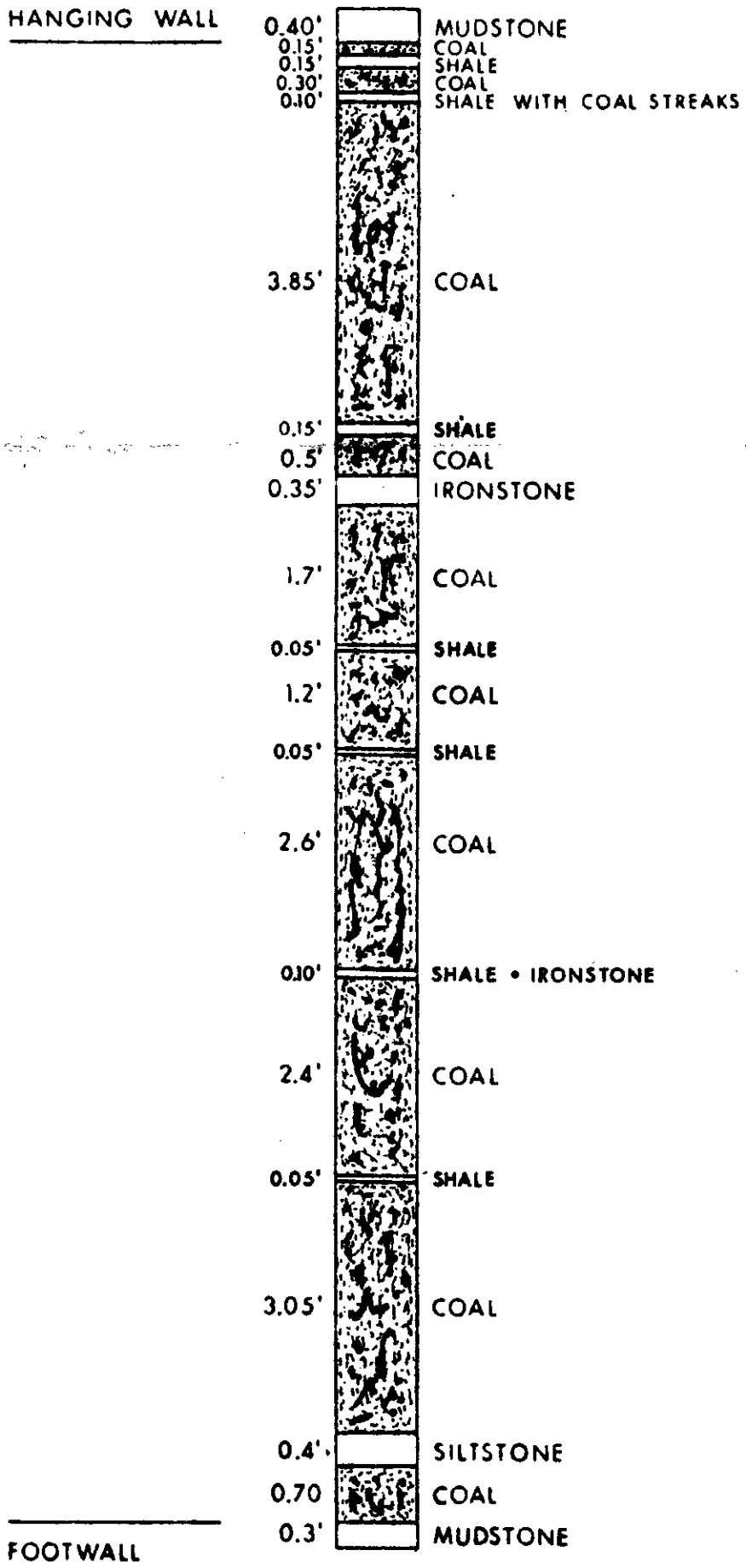
SEAM No. 8 + 8A

ADIT No. 8 + 8A

BULK SAMPLE	- THICKNESS	:	28.15'
TOTAL SEAM	- THICKNESS	:	27.05'
TOTAL COAL	- THICKNESS	:	20.75
TOTAL PARTINGS	- THICKNESS	:	6.30'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.1'

COAL QUALITY CONSIDERATION

Seam 9 The coal in seam 9 is quite high in raw coal ash because of the extensive number of coal partings and the shaley hanging wall. This seam does, however, clean fairly easily and should produce an 8.5 to 9.0% ash product consistently. The coal is high in durain and cokes very poorly. It is very hard and should produce few fines. This seam along with seam 6 would also be a good thermal coal. Dilution may be more extensive in this seam because of the indistinct contacts and very hard nature of the coal; however, the dilution material is once again 2.6 S.G. mudstone and will not adversely affect the washability.



SEAM No 9

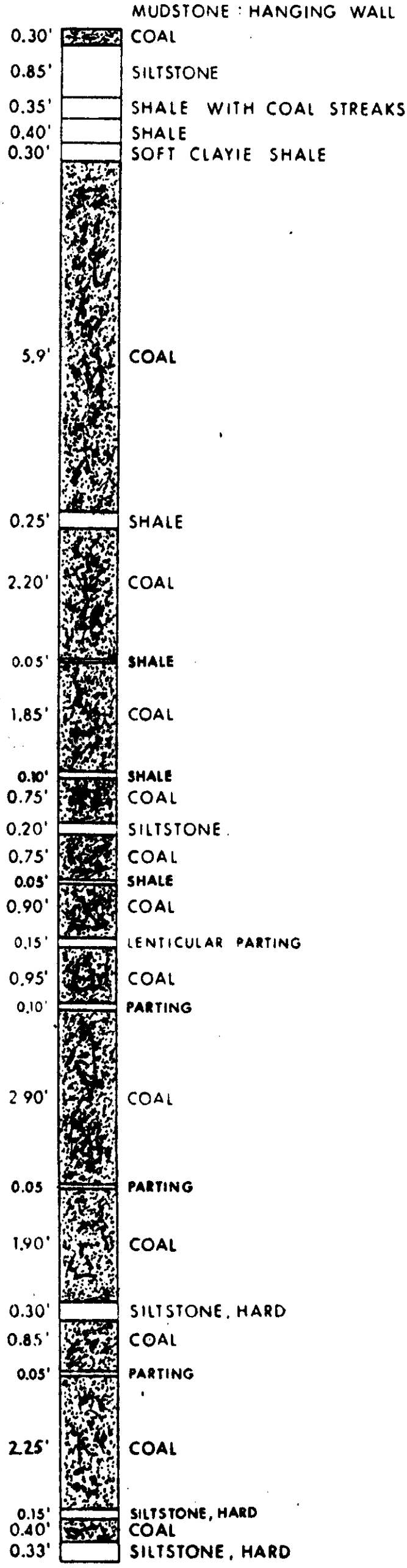
ADIT No 9

BULK SAMPLE	- THICKNESS	:	18.55'
TOTAL SEAM	- THICKNESS	:	17.85'
TOTAL COAL	- THICKNESS	:	16.45'
TOTAL PARTINGS	- THICKNESS	:	1.40'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.70'

COAL QUALITY CONSIDERATION

Seam 10 The washability of this seam is fairly good, so it should be easy to consistently produce a 9.0% ash product. The hanging wall has 1.9 feet of shale and siltstone which will be difficult to remove from the raw coal, and the footwall is very hard siltstone. The seam contains several finger size partings, but in general it is of very good quality. The grindability index is 82 on this seam, however, from the physical appearance and feel of the coal in the field, the fines content of this seam will be quite high. The washability test was conducted at 1.60 S.G., so it is reasonable to assume that the product ash can be lowered. The ash balance from the 1975 bulk washing summary (p.175) would indicate that the product ash was probably 8.0 rather than the 9.2% reported.

HANGING WALL



FOOTWALL

SEAM No. 10

ADIT No. 10

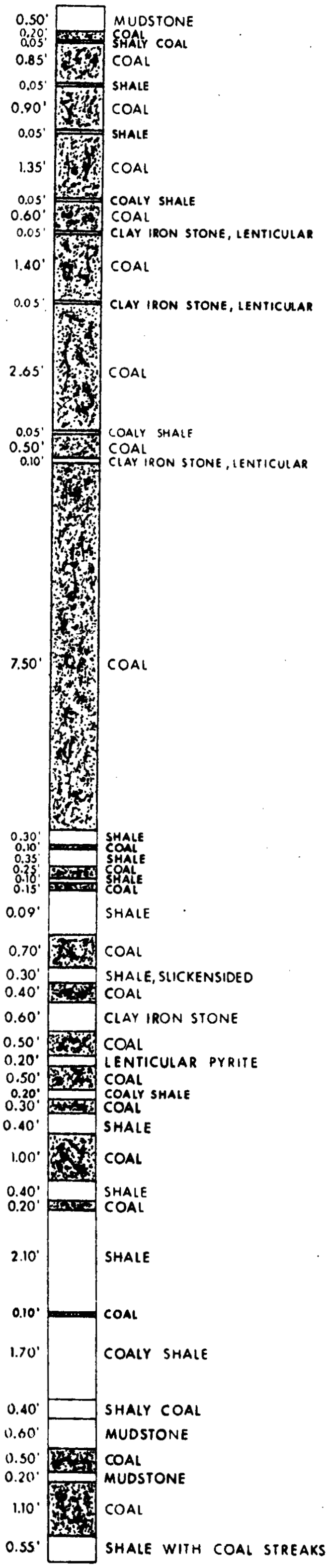
BULK SAMPLE	- THICKNESS	:	25.58'
TOTAL SEAM	- THICKNESS	:	25.25'
TOTAL COAL	- THICKNESS	:	21.90'
TOTAL PARTINGS	- THICKNESS	:	3.35'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.33'

COAL QUALITY CONSIDERATION

Seam 11 This seam is a split off of seam 12. It varies considerably in raw coal and washed coal ash, but produces a good FSI (> 6) consistently. The seam also varies greatly in thickness.

Seam 12 The raw coal ash content of seam 12 is very high (42%) because of the large number of partings in the bottom section of the seam. The upper part of the seam was very soft coal (high in fines) and produced a low ash product with a 56 coke stability index. The RUHR dilatometer test and FSI would indicate a similar stability for the entire seam. When the lower part of the seam was included in the 1975 program, the product ash only increased from 9.0 to 9.8% so the clean coal quality was not greatly affected. The raw coal ash will vary across the mining area; however, some of the dilution could possibly be removed during the mining. If the lower part of the seam is mined, the parting may require blasting which will create additional fines to those already projected.

HANGING WALL



FOOTWALL

SEAM No. 12

TRENCH EB-T16-1975

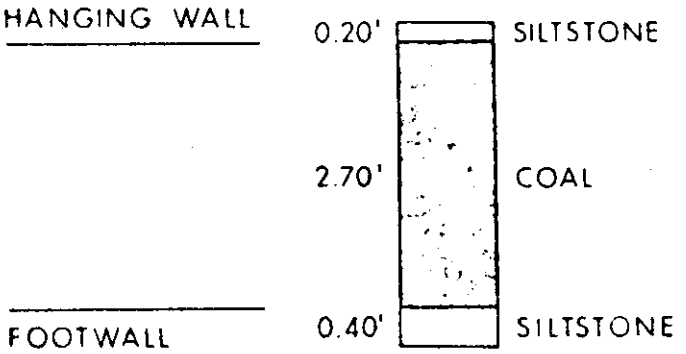
BULK SAMPLE	- THICKNESS	:	32.00'
TOTAL SEAM	- THICKNESS	:	31.50'
TOTAL COAL	- THICKNESS	:	21.75'
TOTAL PARTINGS	- THICKNESS	:	9.75'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.50'

COAL QUALITY CONSIDERATION

Seam 13 Seam 13 consists of six major members from 1.9 to 3.1 feet thick in the trench. The raw coal ash content was 57.1% because of the high amount of dilution, and this will continue to be the case during mining. A product ash of 11.1% was achieved which was far higher than indicated by the drill hole data, but was anticipated because of the high dilution. Also, the clean coal sulphur content is quite high (0.94%) as is the trend in the upper seams.

Because of the thin variable nature of seam 13, it will be difficult to realize all of the tonnage in this seam. The higher volatile matter will help to minimize the amount of fines created; however, in order to blast the rock alongside the coal, a lot of fines will undoubtedly result.

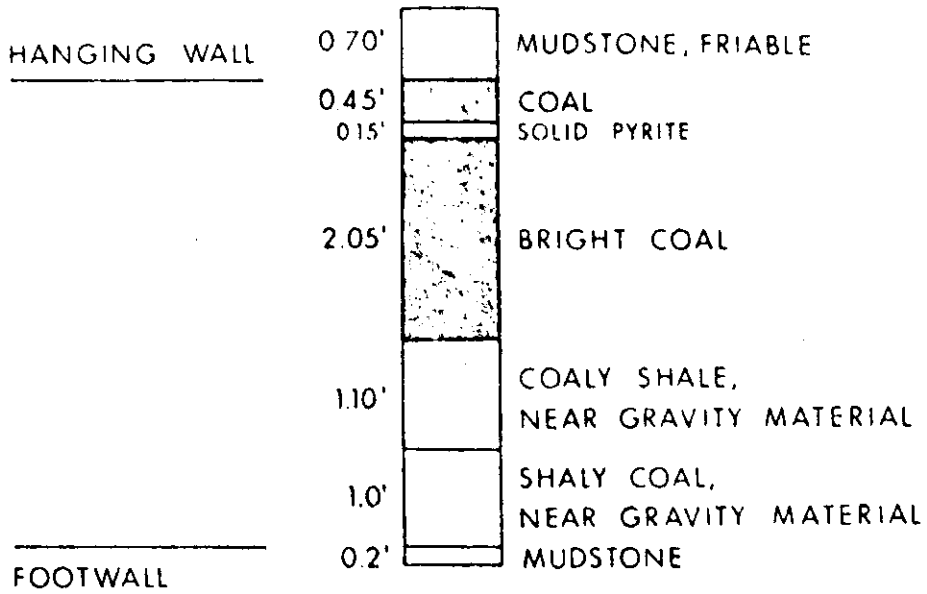
The higher volatile matter in the upper seams should result in an excess of coking properties which will offset the shortfall of coking properties in the lower seams.



SEAM No. 13G

TRENCH EB-T16-1975

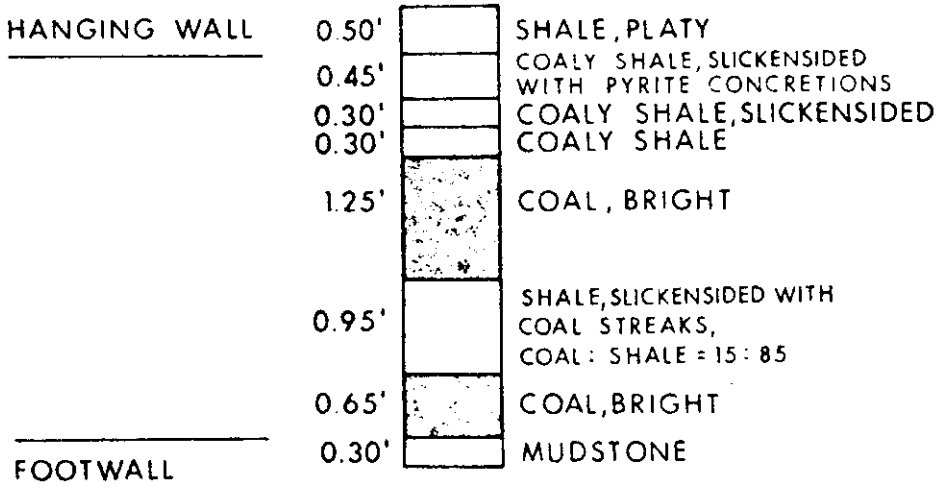
BULK SAMPLE	- THICKNESS	:	3.30'
TOTAL SEAM	- THICKNESS	:	2.70'
TOTAL COAL	- THICKNESS	:	2.70'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.60'



SEAM No 13F

TRENCH EB - T16 - 1975

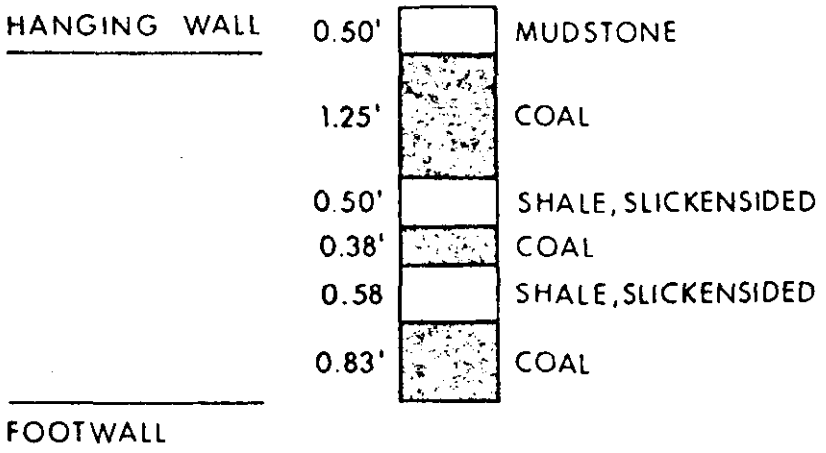
BULK SAMPLE	- THICKNESS	:	5.65'
TOTAL SEAM	- THICKNESS	:	4 75'
TOTAL COAL	- THICKNESS	:	2 50'
TOTAL PARTINGS	- THICKNESS	:	2.25'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.90'



SEAM No. 13E

TRENCH EB-T16-1975

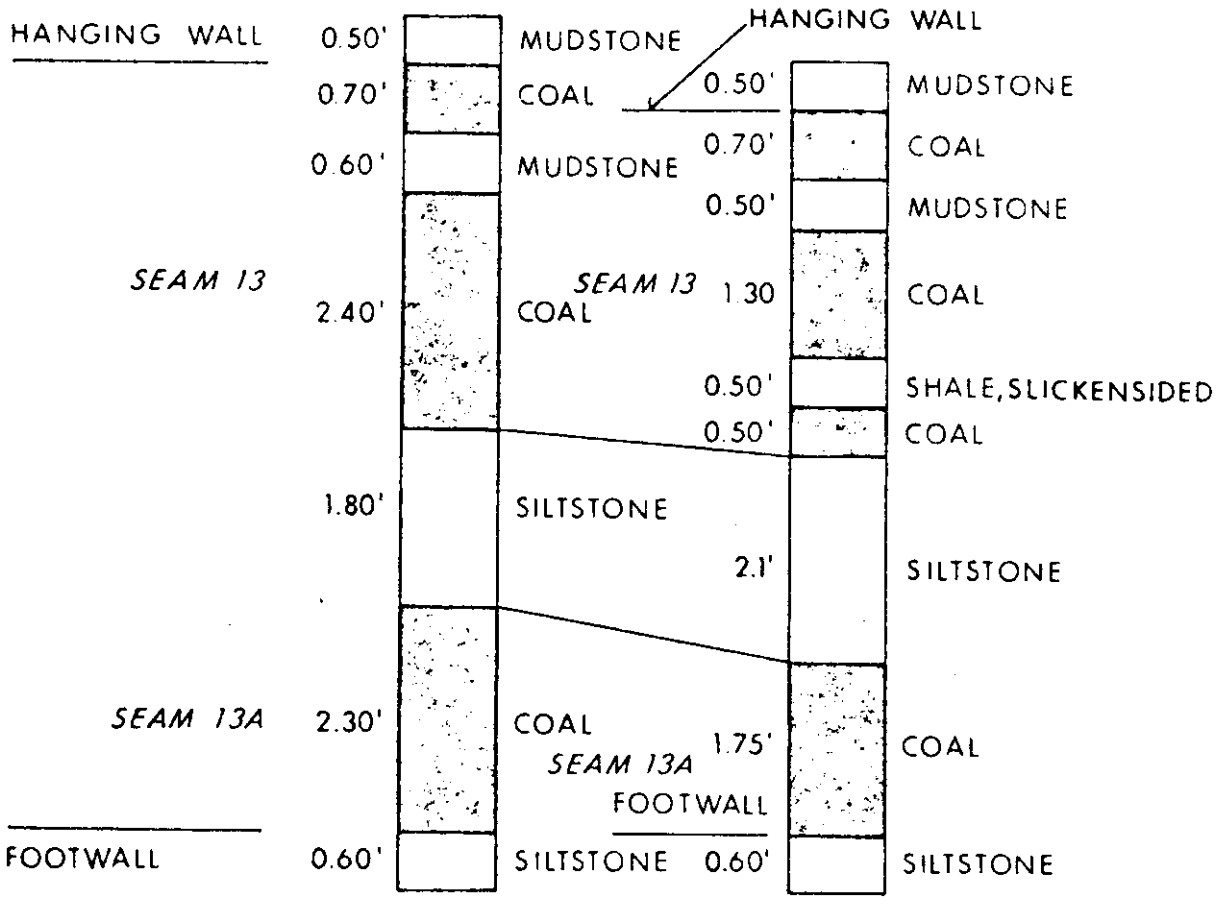
BULK SAMPLE	- THICKNESS	:	4.70'
TOTAL SEAM	- THICKNESS	:	3.90'
TOTAL COAL	- THICKNESS	:	1.90'
TOTAL PARTINGS	- THICKNESS	:	2.00'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.80'



SEAM No. 13D

TRENCH EB - T16 - 1975

BULK SAMPLE	- THICKNESS	:	4.04'
TOTAL SEAM	- THICKNESS	:	3.54'
TOTAL COAL	- THICKNESS	:	2.46'
TOTAL PARTINGS	- THICKNESS	:	1.08'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.50'



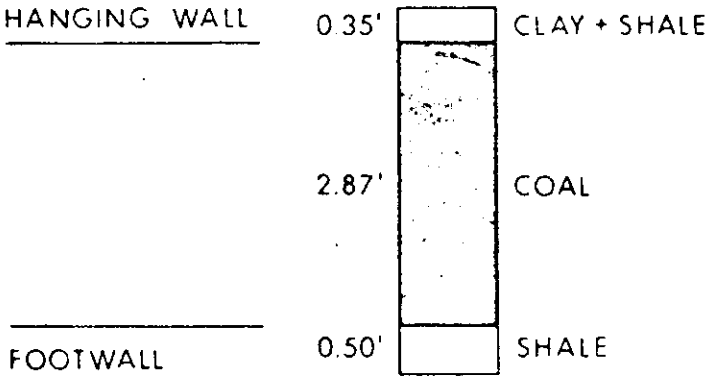
SEAM No. 13+13A, TWO DIFFERENT GEOLOGICAL SECTIONS AT CHANNAL - SAMPLE - FACES

TRENCH EB - T16 - 1975

BULK SAMPLE	- THICKNESS	:	8.9' - 8.45' Ø 8.68'
TOTAL SEAM	THICKNESS	:	7.8' - 7.35' Ø 7.58'
TOTAL COAL	THICKNESS	:	5.4' - 4.25' Ø 4.83'
TOTAL PARTINGS	THICKNESS	:	2.4' - 3.10' Ø 2.75'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.10' - 1.10' Ø 1.10'

COAL QUALITY CONSIDERATION

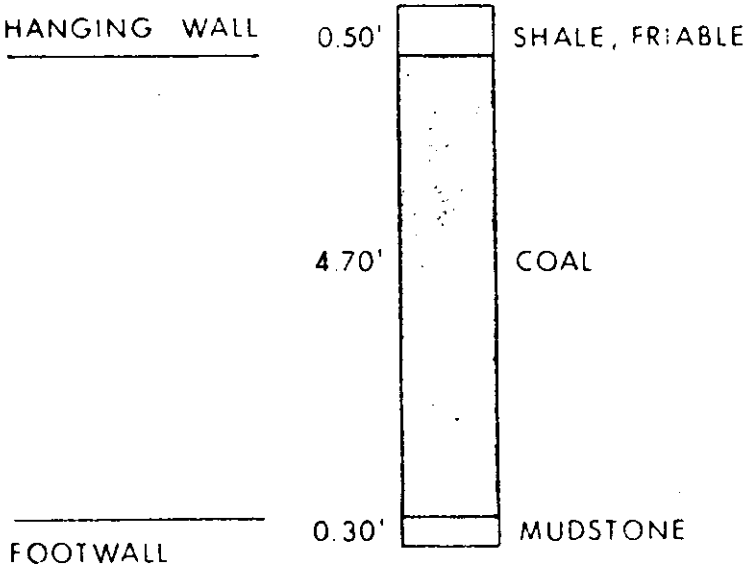
Seam 14 The coal in seam 14 is also badly banded; however, with a raw coal ash content of 49.8% it cleaned to 7.8% ash at 1.50 S.G. This indicates that the dilution had very little effect on the washability of the coal. The contacts on this seam are primarily shale, so a large amount of dilution will also occur during mining. The drill holes indicate that this seam will not always produce a 7.8% ash, and that an 8.5 to 9.0% ash product is more likely.



SEAM No. 14D

TRENCH EB - T16 - 1975

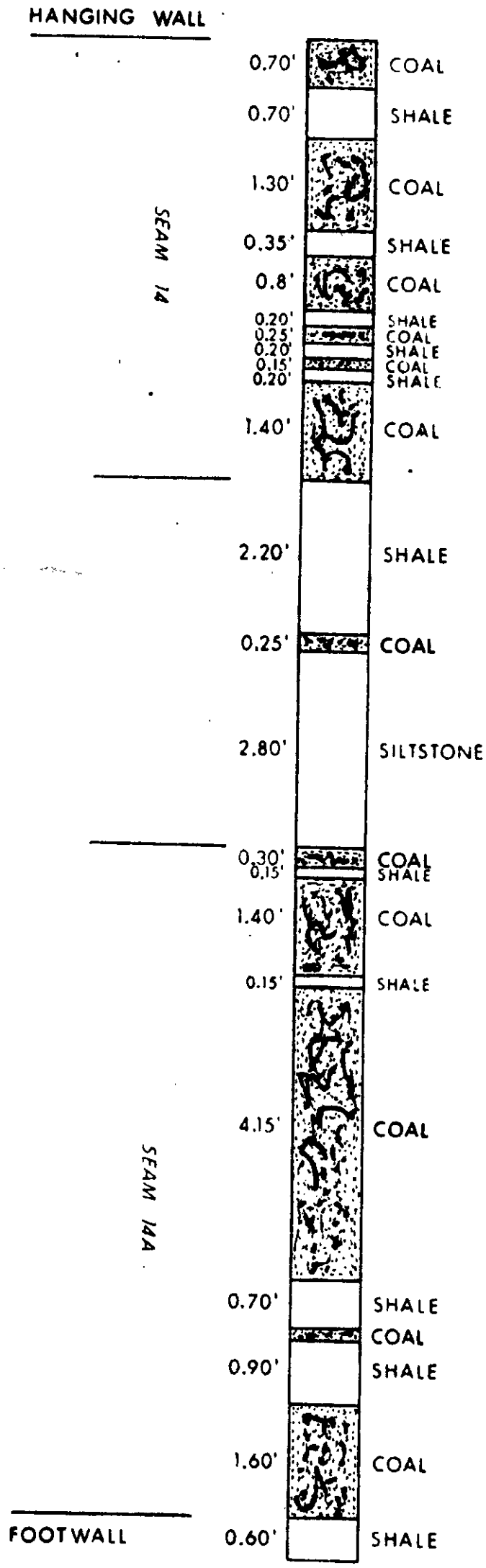
BULK SAMPLE	- THICKNESS	:	3.72'
TOTAL SEAM	- THICKNESS	:	2.87'
TOTAL COAL	- THICKNESS	:	2.87'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.85'



SEAM No. 14C

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	:	5.50'
TOTAL SEAM	- THICKNESS	:	4.70'
TOTAL COAL	- THICKNESS	:	4.70'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.80'



SEAM No. 14 • 14A

TRENCH EB - T16 - 1975

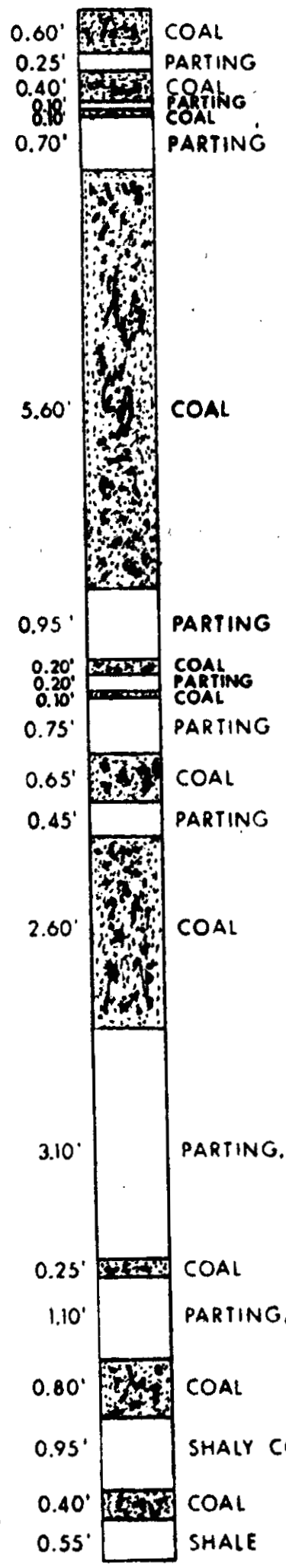
BULK SAMPLE	- THICKNESS	:	21.60'
TOTAL SEAM	- THICKNESS	:	21.00'
TOTAL COAL	- THICKNESS	:	12.45'
TOTAL PARTINGS	- THICKNESS	:	8.55'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.60'

COAL QUALITY CONSIDERATION

Seam 15 Seam 15 is similar in quality to seams 13 and 14 and it too has a large quantity of dilution. It is interesting to note that the fine coal from this seam floated almost totally in the froth cells (product ash was 17.0%). This is quite often the case with higher volatile coals which have an oily surface appearance.

Most of parting materials and contacts on this seam are slickensided shales which will be difficult to distinguish during the night time mining operations. If these partings require blasting, the coal seam may be badly broken up (excessive amounts of fines could be produced), and the product ash could be very high.

HANGING WALL



FOOTWALL

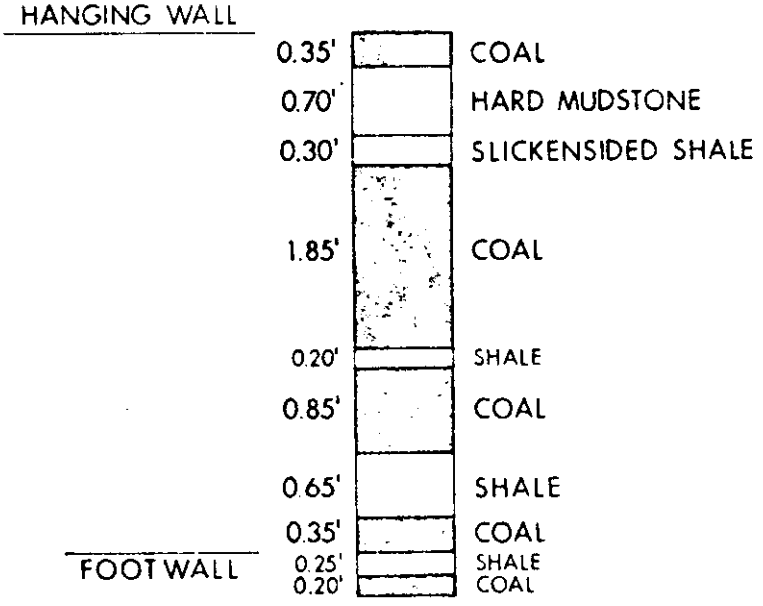
SEAM No 15

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	:	20.80'
TOTAL SEAM	- THICKNESS	:	20.25'
TOTAL COAL	- THICKNESS	:	11.70'
TOTAL PARTINGS	- THICKNESS	:	8.55'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'

COAL QUALITY CONSIDERATION

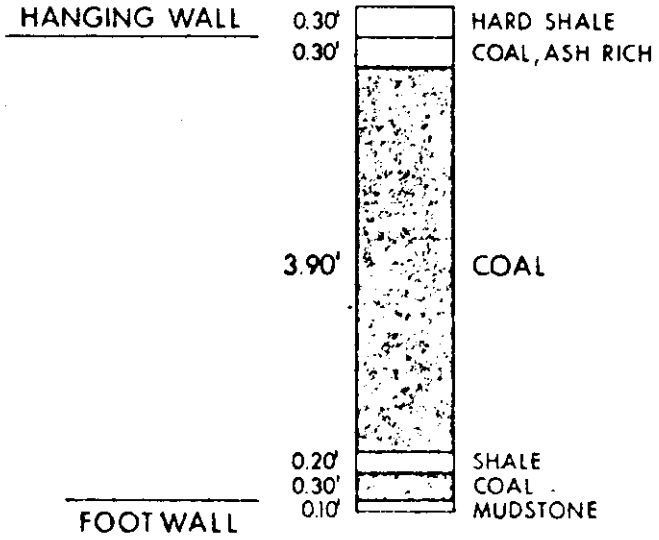
Seam 16 Seam 16 also included a lot of dilution; however, the product ash was 10.6% with a heavy media cut point of 1.42 specific gravity. Also, the phosphorous content was fairly high in this seam, so it should be blended with seams other than 3 or 6. The 1975 infill drilling to the north indicated that seam 16 thickens considerably in spots, and the raw coal ash content is fairly low, so a better product could result in part of the mine at least. Also, the coal quality would improve if only 16E and 16G seams were mined.



SEAM No.16

TRENCH EB - 16 - 1975

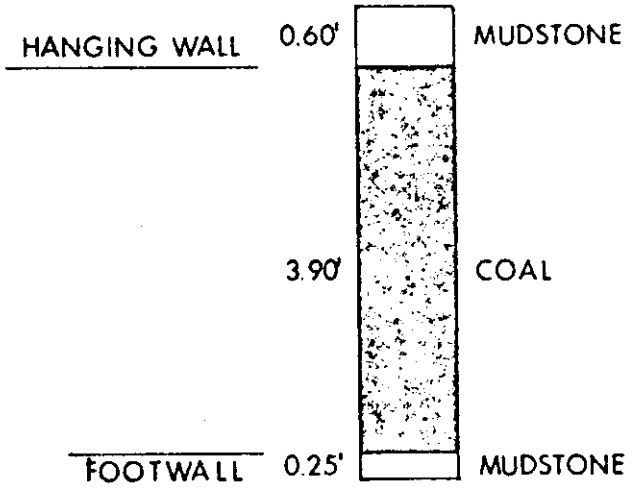
BULK SAMPLE	- THICKNESS	:	5.70'
TOTAL SEAM	- THICKNESS	:	5.25'
TOTAL COAL	- THICKNESS	:	3.40'
TOTAL PARTINGS	- THICKNESS	:	1.85'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.45'



SEAM No. 16E

TRENCH EB - 16 - 1975

BULK SAMPLE	-	THICKNESS	: 5.10'
TOTAL SEAM	-	THICKNESS	: 4.70'
TOTAL COAL	-	THICKNESS	4.50'
TOTAL PARTINGS	-	THICKNESS	0.20'
TOTAL ROOF AND FLOOR IN SAMPLE			: 0.40'



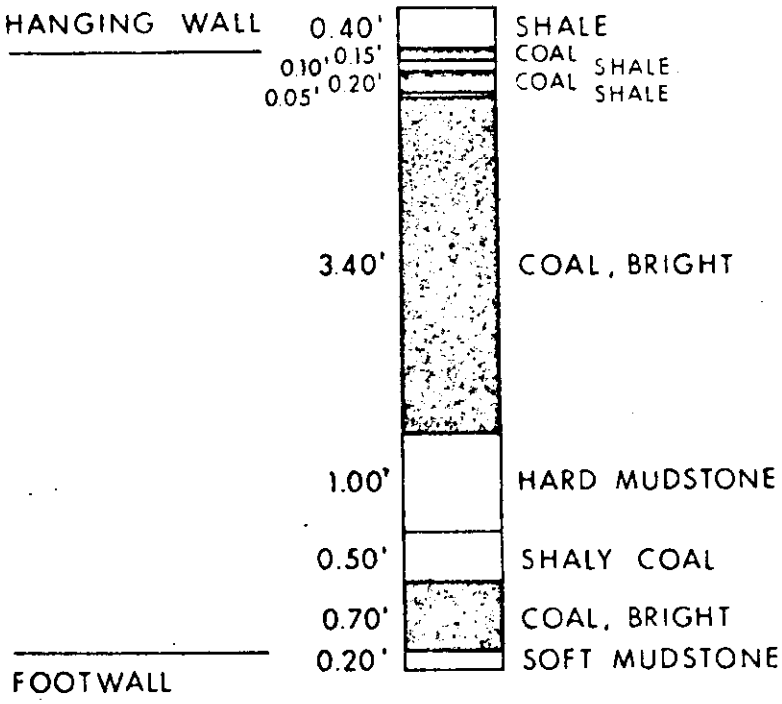
SEAM No. 16G

TRENCH EB - 16 - 1975

BULK SAMPLE	- THICKNESS	:	4.75'
TOTAL SEAM	- THICKNESS	:	3.90'
TOTAL COAL	- THICKNESS	:	3.90'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.85'

COAL QUALITY CONSIDERATION

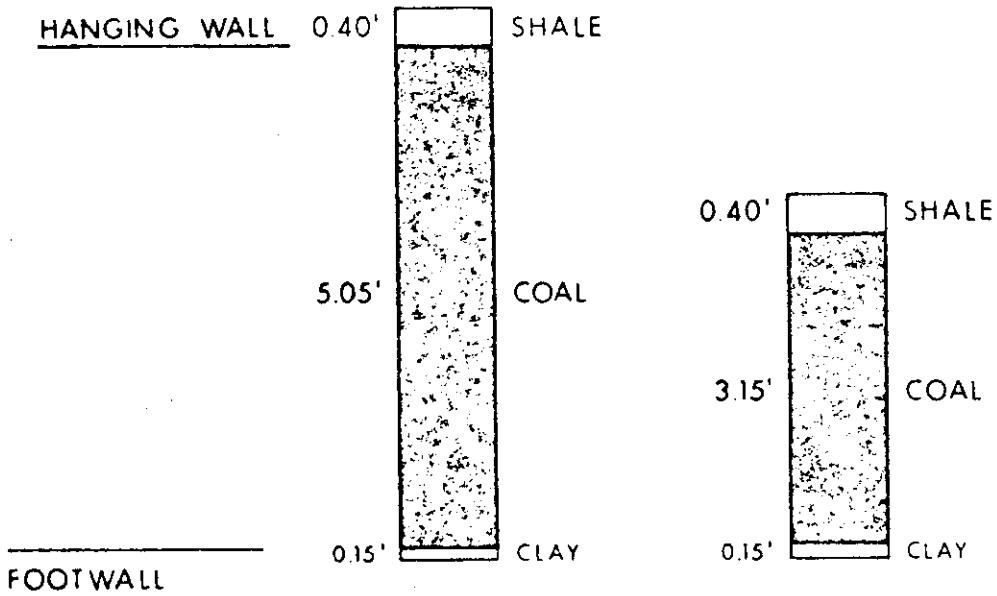
Seam 17 The raw coal ash content of bulk sample 17 was 35.9% which included all the dilution which might be encountered during mining. The product ash was 7.1% compared to the samples in the bulk summary (p.299) which indicated an 8.3% product ash. The 1975 drilling as well as earlier drilling all indicated that the coal in this seam would be low in ash. The contacts are shale and clay, which may tend to increase the dilution, and adversely affect the washability. Overall, this seam exhibits an excess of coking properties and will blend well with the lower seams.



SEAM 17A

TRENCH EB-T17-1975

BULK SAMPLE	- THICKNESS	:	6.70'
TOTAL SEAM	- THICKNESS	:	6.10'
TOTAL COAL	- THICKNESS		4.45'
TOTAL PARTINGS	- THICKNESS	:	1.65'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.60'



SEAM No. 17, TWO GEOLOGICAL ASSESSMENTS, 1st + 2nd CHANNAL-SAMPLE

TRENCH EB-T17-1975

BULK SAMPLE	- THICKNESS	:	5.60' - 3.70'	Ø 4.65'
TOTAL SEAM	- THICKNESS	:	5.05' - 3.15'	Ø 4.10'
TOTAL COAL	- THICKNESS	:	5.05' - 3.15'	Ø 4.10'
TOTAL PARTINGS	- THICKNESS	:	——	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'	Ø 0.55'

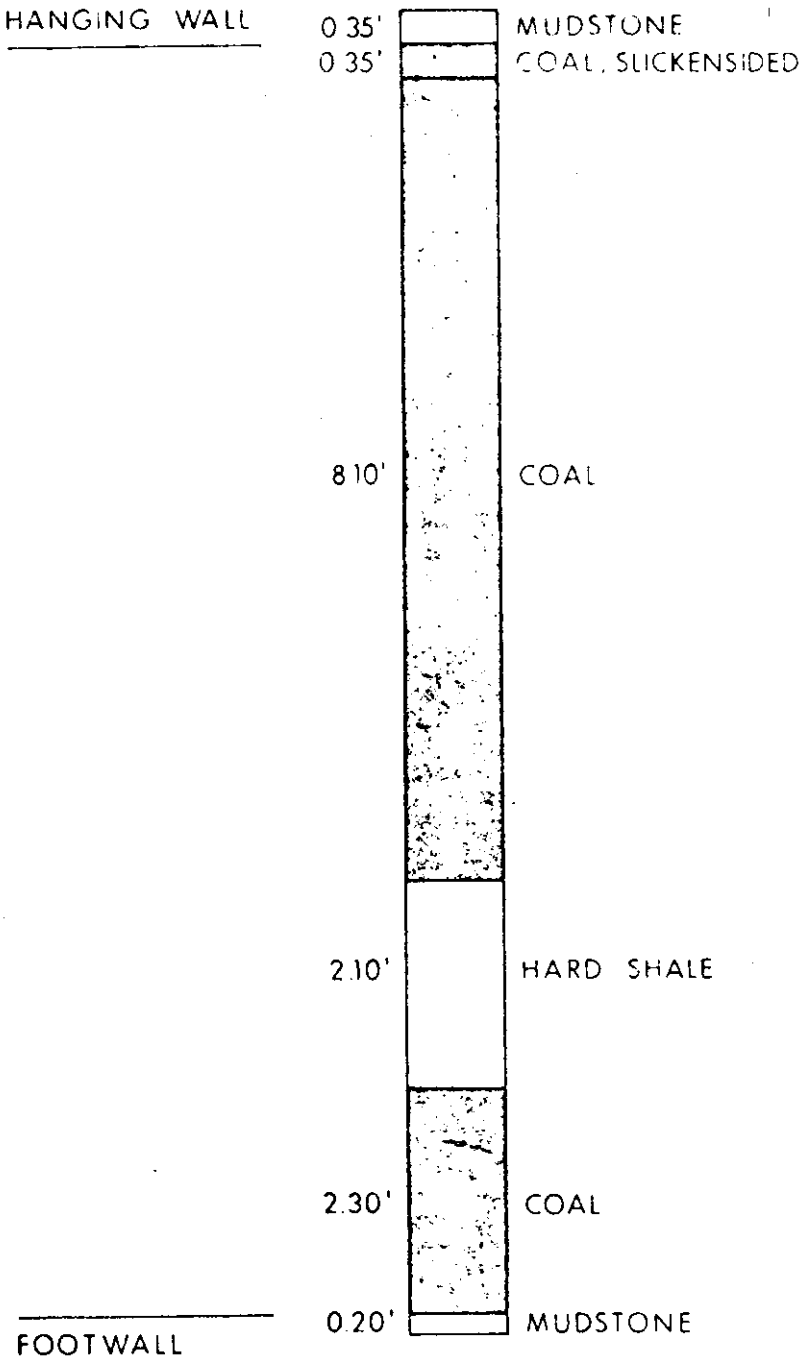
COAL QUALITY CONSIDERATION

Seam 18 This seam is somewhat variable in raw coal characteristics throughout the mining area. The bulk sample tested showed a 35.9% ash content, and a clean coal ash of 7.0% at 62% recovery. The specific gravity of separation was 1.55, so very little can be gained by increasing the recovery. The drill hole data also supported the washability data. Included with the coal was 0.55 feet of footwall and hanging wall dilution, along with 2.10 feet of parting. Once again, the contacts are distinct hard mudstone so any further dilution will be 2.6 S.G. rock, which will not adversely affect the washability.

With a clean coal volatile matter of 28.8% and 8½ FSI, and high dilatation this seam with its excess of coking properties will blend well with the lower seams.

Seam 19 Seam 19 thickens quite extensively in some parts of the north end of the mining area (see plot Exhibit I). It is higher in raw coal ash than seam 18, but it should produce a good quality high volatile coking coal (Appendix A).

Seam 20 This seam also thickens to the north and may be recovered to a greater extent than was previously thought in mining scheme 'A'. In general, it's quality is similar to that of seam 19.



SEAM No. 18

TRENCH EB-T17-1975

BULK SAMPLE	- THICKNESS	:	13.40'
TOTAL SEAM	- THICKNESS	:	12.85'
TOTAL COAL	- THICKNESS	:	10.75'
TOTAL PARTINGS	- THICKNESS	:	2.10'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'

COAL QUALITY CONSIDERATION

3) Washability

The washability of the numerous Elk River coal seams varies considerably from seam to seam, and possibly from area to area in each individual seam. As a result, a precise washability which would represent the average of all the coal mined over the life of the project is rather meaningless for plant design, but necessary for product evaluation. More important is the best and worst washabilities which should be designed for so that the plant can be flexible and handle the daily variations in coal quality.

During the 1975 bulk testing program, dilution was added to the coal in sometimes greater and sometimes lesser proportions than might occur during mining so that the overall coal quality would be as representative as possible of the actual mined coal. The dilution will undoubtedly vary considerably from area to area depending on the geological conditions, operator training, equipment, weather, visibility and all other factors; so any further assessment of the dilution is not necessary. Because of the nature of the dilution, any additions will merely increase the 2.60 S.G. fraction and will not adversely affect the product. As a result, no attempt has been made in this report to alter the washabilities developed during the 1975 bulk testing program, as they are considered to be the best possible representation of the coal in place as it will be mined. Drill hole data was evaluated and compared to bulk test data, but because of the inherent problems of drill core recovery and testing of incomplete samples, the bulk samples must be used to determine the range of ore quality for plant design. The previous sections in this report on raw coal characteristics and ash evaluation showed that the drill hole data compared well with the earlier bulk tests, when the dilution was excluded from both, so the bulk samples data developed during the

recent program would also compare well.

(a) Average Condition:

Considering the previous cross sections of the various coal seams, it is obvious that the dilution is adequately represented in the bulk samples. Therefore, the average conditions can be most easily calculated by assuming that the 16% dilution condition was followed (Techman, March 1974) and reserves were then weighed accordingly. This assumption is not precisely correct for each seam, but on the average, the raw coal ash content compared within a few percent.

Tables 22, 23 and 24* show the weighted average washabilities of the various size fractions. The 2" x ½" data represents about 22% of the plant feed (see Table 19) which is about what will occur in the maximum coarse condition during actual operation if a 4" top size is assumed, so the results are fairly accurate. The plus 2" material was crushed, so it appeared in the 2" x ½" fraction, when normally about 10 to 20% of this material would be rejected from the rotary breaker. Therefore, the 2" x ½" washability is slightly conservative.

The ½" x 28M fraction was calculated by eliminating the 2" x ½" washability from the +28 mesh material. It was necessary to crush the total coal to 3/4" to feed the pilot plant, and to produce a representative amount of fines. Even with the crushing average fines content was only 25% which was lower than the predicted 35% value. Since the

*See Explanatory Note (1).

TABLE 22

WT. AVERAGE WASHABILITY

ELK RIVER 2" x ½"

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
MINING SCHEME "A"							
1.3	8.78	2.91	8.78	2.91	91.22	56.10	
1.35	13.72	6.63	22.50	5.18	77.50	64.86	
1.4	6.88	11.39	29.38	6.63	70.62	70.07	63.3
1.45	3.46	16.08	32.84	7.63	67.16	72.85	33.6
1.5	2.09	21.36	34.93	8.45	65.07	74.50	19.6
1.55	1.46	27.19	36.39	9.20	63.61	75.59	9.9
1.6	1.08	31.36	37.47	9.84	62.53	76.37	11.2
1.7	2.08	38.08	39.55	11.32	60.45	77.67	9.4
1.8	1.81	46.36	41.36	12.86	58.64	78.64	
+1.8	58.64	78.64	100.00	51.43			
	100.00						
MINING SCHEME "C"							
1.3	6.96	2.94	6.96	2.94	93.04	57.28	
1.35	15.85	6.71	22.81	5.27	77.19	67.75	
1.4	7.33	11.67	30.14	6.89	69.86	73.61	68.7
1.45	3.89	15.51	34.03	7.87	65.97	77.04	35.6
1.5	2.25	21.87	36.28	8.28	63.72	79.25	20.1
1.55	1.50	27.90	37.78	9.48	62.22	80.23	9.9
1.6	1.07	32.10	38.85	10.10	61.15	81.07	10.9
1.7	2.14	39.86	40.99	11.63	59.01	82.58	9.3
1.8	1.84	49.15	42.83	13.23	57.17	84.16	
+1.8	57.17	84.16	100.00	53.50			
	100.00						

TABLE 23

WT. AVERAGE WASHABILITY

ELK RIVER ½" x 28M

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
MINING SCHEME "A"							
1.3	25.16	2.35	25.16	2.35	74.84	42.38	
1.35	12.97	5.89	38.13	3.55	61.87	50.03	
1.4	11.57	10.23	49.70	5.11	50.30	59.19	51.7
1.45	7.57	14.43	57.27	6.34	42.73	67.12	35.6
1.5	3.26	21.17	60.53	7.14	39.47	70.91	21.0
1.55	1.93	25.55	62.46	7.71	37.54	73.24	11.5
1.6	1.59	32.19	64.05	8.32	35.94	75.07	8.3
1.7	2.18	38.25	66.23	9.30	33.77	77.44	6.4
1.8	2.18	45.84	68.41	10.46	31.59	79.60	
+1.8	31.59	79.60	100.00	32.31			
	100.00						
MINING SCHEME "C"							
1.3	21.69	2.28	21.69	2.28	78.31	40.21	
1.35	13.94	5.39	35.63	3.50	64.37	47.74	
1.4	13.11	9.56	48.74	5.13	51.26	57.51	56.7
1.45	8.46	14.85	57.20	6.57	42.80	65.94	39.5
1.5	3.56	20.52	60.76	7.38	39.24	70.07	22.9
1.55	2.06	25.11	62.82	7.97	37.18	72.55	12.2
1.6	1.68	31.75	64.50	8.59	35.50	74.48	8.6
1.7	2.17	37.56	66.67	9.53	33.33	76.89	6.4
1.8	2.22	44.93	68.89	10.67	31.11	79.30	
+1.8	31.11	79.30	100.00	31.98			
	100.00						

TABLE 24

WT. AVERAGE WASHABILITY

ELK RIVER 28M x 65M

Maximum S.G.	Wt. (%)	Ash (%)	Cumulative Floats		Cumulative Sinks		± 0.1 S.G. Corrected to 1.8 S.G. Float
			Wt.%	Ash%	Wt.%	Ash%	
MINING SCHEME "A"							
1.3	35.25	1.73	35.25	1.73	64.75	26.73	
1.35	18.11	4.92	53.36	2.81	46.64	35.21	
1.4	11.24	8.86	64.60	3.86	35.40	43.58	48.8
1.45	7.66	13.01	72.26	4.83	27.74	52.02	30.6
1.5	4.81	18.84	77.07	5.71	22.93	56.18	19.6
1.55	2.52	25.29	79.59	6.33	20.41	63.12	9.7
1.6	1.83	30.23	81.42	6.86	18.51	66.64	7.8
1.7	2.37	36.65	83.79	7.70	16.21	70.75	4.9
1.8	1.80	44.13	85.59	8.47	14.41	74.05	
+1.8	14.41	74.05	100.00	17.92			
	100.00						
MINING SCHEME "C"							
1.3	33.14	1.57	33.14	1.57	66.86	25.59	
1.35	18.55	4.62	51.69	2.61	48.31	33.64	
1.4	12.16	8.37	63.85	3.75	36.15	42.15	51.3
1.45	8.33	12.63	72.18	4.78	27.82	50.97	32.8
1.5	5.08	18.43	77.26	5.67	22.74	58.26	20.8
1.55	2.60	24.97	79.86	6.30	20.14	62.56	10.0
1.6	1.90	30.07	81.76	6.86	18.24	65.91	8.0
1.7	2.41	36.64	84.17	7.71	15.83	70.38	4.9
1.8	1.76	43.88	85.93	8.45	14.07	73.70	
+1.8	14.07	73.70	100.00	17.63			
	100.00						

COAL QUALITY CONSIDERATION

washability of the -28 mesh fines is somewhat better than that of the ½" x 28M fraction, the coarser fraction will probably have slightly better washability at the expense of the finer fraction. Once again, no adjustments have been made to the weighted average washability of the finer fractions since these types of calculations require assumptions which may not be accurate.

Included as Appendix "C" (Figures 25 to 36) are the washability and probable error curves derived from the weighted average data. These curves clearly demonstrate that there is very little difference in the washability characteristics of the coal from mining scheme 'A' to scheme 'C'. From this one can assume that slight alterations in mine planning or dilution will not greatly affect the plant operation. More important than changes in washability will be the effects of mine planning on the coking characteristics of the coal.

COAL QUALITY CONSIDERATION

(b) Best Condition:

Having established the average washability for plant design, it is now possible to determine the best washability within reasonable limits which can be assumed for plant design. The best washability is important in that it will dictate the size of the clean coal circuitry, as well as parts of the coal cleaning equipment. Since the elementary ash versus specific gravity curves are relatively constant, only the weight percent of the fractions will change. Basically, one can assume that at times there will be no dilution in the mined coal (especially when thicker seams are being mined) and that the raw coal fractions below 1.80 S.G. are proportionately the same.

Tables 25 and 26* show the best washability anticipated during the Elk River mining. The product ash will remain the same, and recoveries will be 80 to 85%.

*See Explanatory Note (2)

TABLE 25

M I N I N G S C H E M E ' A '

BEST WASHABILITY

SIZE	WT%	ASH%
2" x ½"	10	20.75
½" x 28M	55	15.0
28M x 65M	20	14.0
65M x 0	15	12.5
2" x 0	100	15.0

2" x ½"

MAXIMUM S.G.	Wt. (%)	ASH (%)	Cumulating Floats		Cumulative Sinks	
			WT%	ASH%	WT%	ASH%
1.30	18.68	2.91	18.68	2.91	81.32	25.46
1.35	29.19	6.63	47.87	5.18	52.13	35.05
1.40	14.64	11.39	62.51	6.63	37.49	44.29
1.45	7.36	16.08	69.87	7.63	30.13	51.17
1.50	4.45	21.36	74.32	8.45	25.68	56.35
1.55	3.11	27.19	77.43	9.20	22.57	60.37
1.60	2.30	31.36	79.73	9.84	20.17	63.98
1.7	4.43	38.08	84.16	11.32	15.84	70.85
1.8	3.85	46.36	88.01	12.86	11.99	78.64
+1.8	11.99	78.64	100.00	20.75		
	100.00					

TABLE 26

BEST WASHABILITY

½" x 28M

	WT	ASH	Cumulative Floats		Cumulative Sinks	
Maximum S.G.	(%)	(%)	WT%	ASH%	WT%	ASH%
1.30	34.36	2.35	34.36	2.35	65.64	21.62
1.35	17.71	5.89	52.07	3.55	47.93	27.44
1.40	15.80	10.23	67.87	5.11	32.13	35.89
1.45	10.34	14.43	78.21	6.34	21.79	46.08
1.50	4.45	21.17	82.66	7.14	17.34	52.47
1.55	2.64	25.55	85.30	7.71	14.70	57.30
1.6	2.17	32.19	87.47	8.32	12.53	61.63
1.7	2.98	38.25	90.45	9.30	9.55	68.99
1.8	2.98	45.84	93.43	10.46	6.57	79.60
+1.8	6.57	79.60	100.00	15.00		

28M x 65M

	WT	ASH	Cumulative Floats		Cumulative Sinks	
Maximum S.G.	(%)	(%)	WT%	ASH%	WT%	ASH%
1.30	37.71	1.73	37.71	1.73	62.29	21.41
1.35	19.38	4.92	57.09	2.81	42.91	28.89
1.40	12.03	8.86	69.12	3.86	30.88	36.70
1.45	8.20	13.01	77.32	4.83	22.68	45.26
1.50	5.15	18.84	82.47	5.71	17.53	53.00
1.55	2.97	25.29	85.44	6.33	14.56	59.01
1.6	1.96	30.23	87.40	6.86	12.60	63.53
1.7	2.54	36.65	89.94	7.70	10.06	70.32
1.8	1.93	44.13	91.87	8.47	8.13	80.32
+1.8	8.13	80.32	100.00	14.00		

COAL QUALITY CONSIDERATION

(c) Worst Condition:

The worst condition which should be designed for is one in which the raw coal is severely diluted (i.e. only the smaller seams are being mined or the shot rock and coal slump together off of the mine face). The worst assessment of dilution in the Techman, March 1975 report showed 25% by weight dilution or an increase of 9%. The standard deviation from the drill hole data was 8.5%, therefore 9% increase in the dilution material should adequately cover the worst design condition. About 50% of the additional dilution will be rejected by the rotary breaker.

By worst design, it is not implied that the refuse conveyor be limited to that condition, since it can often be sized beyond the rejects capacity of the cleaning equipment with very little added cost to the plant. The refuse conveyor should be designed on its own merits since there are conditions under which the rejects can comprise 100% of the plant feed, and the digging out of a refuse conveyor can be a costly and time consuming affair.

Tables 27 and 28* show the adjusted washability for the worst design condition. Most of the 4.5% increase in material will appear in the 2" x ½" fraction, and a small amount in the ½" x 28M fraction. No dilution is expected in the -28M fraction because of the hard, coarse nature of the sandstone, siltstone and mudstone.

*See Explanatory Note (3)

TABLE 27

WORST WASHABILITY

SIZE	WT.%	ASH%
2" x ½"	20	71.75
½" x 28M	50	35.61
28M x 65M	15	17.92
65M x 0	15	17.70
2" x 0	100	37.50

2" x ½"

Maximum S.G.	Wt. (%)	Ash (%)	Cumulating Floats		Cumulative Sinks	
			WT.%	ASH%	WT.%	ASH%
1.30	6.19	2.91	6.19	2.91	93.81	76.28
1.35	9.68	6.63	15.87	5.18	84.13	84.30
1.40	4.85	11.39	20.72	6.63	79.28	88.77
1.45	2.44	16.08	23.16	7.63	76.84	91.08
1.50	1.47	21.36	24.63	8.45	75.37	92.44
1.55	1.03	27.19	25.66	9.20	74.34	93.34
1.6	.76	31.36	26.42	9.84	73.58	93.98
1.7	1.47	38.08	27.89	11.43	72.11	95.12
1.8	1.27	46.36	29.16	12.86	70.84	96.00
+1.8	70.84	96.00	100.00	71.75		
	100.00					

TABLE 28

WORST WASHABILITY

½" x 28 Mesh

MAXIMUM	WT.%	ASH	Cumulative Floats		Cumulative Sinks	
S.G.	(%)	(%)	WT.%	ASH%	WT.%	ASH%
1.30	23.85	2.35	23.85	2.35	76.15	46.01
1.35	12.29	5.89	36.14	3.55	63.86	53.75
1.40	10.97	10.23	47.11	5.11	52.89	62.78
1.45	7.17	14.43	54.28	6.34	45.72	70.36
1.50	3.09	21.17	57.37	7.14	42.63	73.92
1.55	1.83	25.55	59.20	7.71	40.80	76.09
1.6	1.51	32.19	60.71	8.32	39.29	77.78
1.7	2.07	38.25	62.78	9.30	37.12	80.20
1.8	2.07	45.84	64.85	10.46	35.15	82.00
+1.8	35.15	82.00	100.00	35.61		

COAL QUALITY CONSIDERATION

(d) Dilution:

Because the original bulk samples were defined, and the present samples are also defined, the dilution can be assessed by difference between the two samples. Although the washability of the dilution is not essential to determining the overall washability of the Elk River coals, it can be assessed as a matter of interest. Table 29 shows the washability of the 3/4" x 28M dilution from adit 10.*

The original bulk sample compared to the present bulk sample was as follows:

		1970	1975
Wt.%	3/4" x 28M	83.9%	67.1%
Ash%		18.30%	24.95%
Wt.%	Parting & Dilution		25.5%
Wt.%	Dilution over 1970 Sample (at 85% ash)		18.0%

The fines fraction of both samples had about the same 11% ash content, so it is reasonable to assume that almost all of the dilution appeared in the +28 mesh fraction. This calculation is somewhat emperical since each fraction from bulk sample to bulk sample cannot be balanced. However, the overall ash balance is good so the washability will be fairly accurate. Note that the anticipated dilution in the "Techman

*See Explanatory Note (4)

TABLE 29

DILUTION - ADIT #10

(3/4" x 28 Mesh Fraction)

MAXIMUM S.G.	Wt (%)	ASH (%)	Cumulative Floats		Cumulative Sinks	
			WT%	ASH%	WT%	ASH%
1.30						
1.35					100.0	85.0
1.40	0.3	12.0	0.3	12.0	99.7	85.2
1.45	2.6	17.0	2.9	16.5	97.1	87.0
1.50	3.2	23.3	6.1	20.1	93.9	89.2
1.60	2.5	30.4	8.6	23.1	91.4	90.8
1.70	6.0	41.0	14.6	30.4	85.4	94.3
1.80	2.8	46.3	17.4	33.0	82.6	96.0
+1.80	82.2	96.0	100.0	85.0		
	100.0					

COAL QUALITY CONSIDERATION

Report, September, 1975, p.12" was only 6.2% on Seam 10 whereas the actual dilution was about 18%.

Table 30* summarizes the data assumed in estimating the dilution to be 85% ash. Note that the increase in dilution compared to the total calculated dilution assuming the coal is 17.5% ash and the new dilution which was added during the 1975 testing program are very similar. Thus, the assumptions concerning the dilution are indeed correct. Therefore, should further changes in the mine planning be made and the dilution decreases, which it may well, the new washability can easily be calculated. Because of the very heavy nature of the dilution, it will have almost no effect on product quality, and will report to tailings in the cleaning circuit. Thus if the dilution in the plant feed decreases by 5%, the plant recovery will increase 5%. Techman recommends that the dilution not be backed out of the feed because a 5% increase in recovery will decrease the tailings handling facility by 15% and a 15% excess capacity in this area is very inexpensive in terms of the overall project. A shortfall of 15% in the overall plant capacity could result, which would be disasterous to the project.

*See Explanatory Note (5)

TABLE 30

DILUTION

(% by Wt.)

SEAM	Increase in Dilution Over 1970-71 Bulk Samples	Total Dilution from Seam Descriptions (*)	Total Calculated Dilution (**)
2	32.4	6.4	29.2
3	8.4	17.6	6.5
4	3.4	21.6	15.1
6	13.4	13.9	9.3
7	2.8	16.0	23.1
8	21.2	38.1	20.0
9	(7.3)	18.0	(0.6)
10	7.8	22.5	8.4
12	28.7	44.8	27.0
13	46.1	58.9	58.7
14	43.5	48.2	47.9
15	25.3	57.3	39.7
16	34.2	35.4	32.9
17	37.1	26.6	27.3
18	18.5	29.8	24.7
Average	21.0	30.3	24.6
Wt.Avg.			
Scheme 'A'	20.0	30.0	23.3
Scheme 'C'	18.4	28.9	21.8

*Includes all partings.

**Assuming coal has 1.45 S.G. (17.5% Ash) & Rock Dilution has 2.50 S.G. (85.0% Ash)

COAL QUALITY CONSIDERATION

4) Size Distribution

In order to properly design a washery, the size distribution of the plant feed must be accurately assessed. However, experience has shown in the Western Canadian coal industry that the normal methods of determining size distribution are not functional. As a result, all the present washeries had undersized fines circuits initially. In order to ensure that the same thing does not occur at Elk River, the amount of fines present in the plant feed was estimated based on Western Canadian coal experience, and a program laid out which would develop Hardgrove Grindability data sufficiently to confirm those predictions.

It is common in the mineral dressing industry to use work index to measure the degree of crushing that will occur if energy is applied to a mineral. Similarly the Hardgrove Grindability Index is a measure of the strength of coal materials. Unfortunately, by its very contrasting softness compared with the hard rocky intrusive materials, the Hardgrove Index on high ash coals probably reflects the properties of the rock rather than that of the coal. Perhaps a better measure of the size distribution would be a tumbler test similar to that of the Harhoff drum being developed in Germany. At any rate, the curves developed earlier point out that some correlation does exist and Figure 18 developed on other Western Canadian coals confirms the prediction that the Elk River blend of coals will produce 35 to 40% -28 mesh (0.6 MM).

Table 31 compares the Grindability Indices of the 1971 bulk samples to those of 1975. All the seams show reasonable correlation except 2, 3, 4 and 12. Seam 2 was to be driven beyond the oxidation zone and would be expected to be harder. Seam 3 was sampled near a slight fault so it would normally be softer (and the bulk sample was); however, the coal

TABLE 31

SIZE DISTRIBUTION AS A FUNCTION OF GRINDABILITY INDEX

SEAM	1971 EMR Values	1975 Bulk Samples	Estimated (%) -28 Mesh
2	124	109	47
3	131	118	59
4	89	107	46
7	81	88	30
7	103	106	45
8	97	93	33
9	85	84	27
10	88	82	26
12	132*	99*	38
13	106	107	46
14	96	100	39
15	97	100	39
16	78	87	29
17	70	76	22
18	89	95	35
19	71		
Average	96	97	37
'A'	97.7	97.1	37.6
'C'	100.8	98.4	38.7

(*) The 1971 value was high because only the upper part of the seam was sampled.

FIGURE 18

MINUS 28 MESH (0.6 MM) FINES AS A FUNCTION OF GRINDABILITY INDEX OF 9% ASH CLEAN COAL

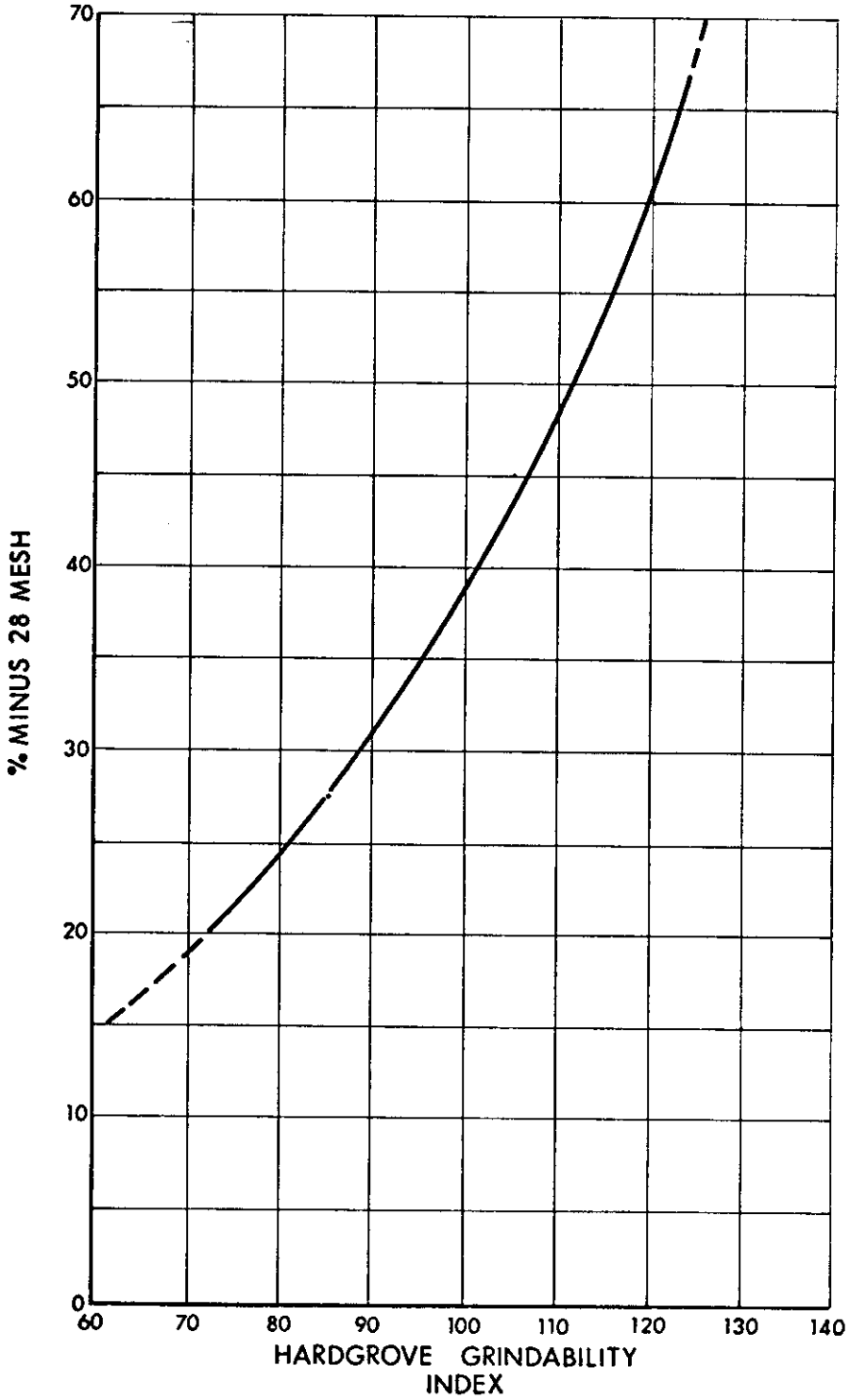


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TABLE 32

SIZE DISTRIBUTION

SEAM	Pilot Plant Feed		Washability Data 1975		Predicted Fines
	+2" Oversize	Estimated from Wash			
		28M x 0	+2"	28M x 0	28M x 0
2	0	30.7	4.5	32.1	45
3	11.9	27.7	7.7	37.7	60
4	2.0		4.0	23.8	40
6	0	45.2	5.4	33.2	35
7	0	40.6	2.9	41.9	35
8	7.1	30.8	8.5	23.0	25
9	0	14.3	9.9	18.8	20
10	0	27.3	4.6	32.9	60
12	3.3	24.8	10.6	20.6	40
13	12.8	12.0	17.6	17.0	45
14	2.6	23.2	13.4	17.6	30
15	7.5	24.5	11.1	18.0	30
16	1.8	35.8	13.9	23.6	30
17	16.0	22.7	12.1	14.8	25
18	16.7	24.8	13.4	19.6	25
Average	5.4	27.5	9.3	24.8	36.3
Wt. Scheme 'A'			8.7	24.1	37.5
Wt. Scheme 'C'			7.9	26.3	39.5
Composite 'A'	4.9	21.4	6.8	21.4	
Composite 'C'	4.2	28.2	7.8	28.2	

COAL QUALITY CONSIDERATION

quality improved so the physical coal characteristics also changed. The Hardgrove Index should have been considerably higher. Seam 4 was sampled in a different area, so it's characteristics also changed. Seam 12 was sampled in total in 1975, so harder material was introduced to the sample.

Table 32 compares the oversize and undersize from the pilot tests to that of the washability data. The oversize on the pilot tests consisted of that material which would not pass the 2" feed bin screen after pounding with the loader bucket. After examining this material, it would be a fair assumption that up to 40% of it would be discarded by a rotary breaker. The 28 mesh x 0 estimated value from the pilot plant tests was determined by dividing the filter cake weight by the total clean coal weight. This number is very crude, but it is an indication that the pilot tests produced more fines than the single crushing to 3/4" of the coal for washability testing (i.e. the fines content is more a function of handling than it is of uniform crushing).

After considering all of the above mentioned indicators, a judgement factor was applied to the data, and the fines content predicted. This judgement value assumed that normal mining practices would prevail and that the coal would not be excessively grouzed or ripped by dozers.

Table 33 summarizes the size distribution in the current washability data. During this program, the coal was crushed to produce a more representative size distribution and those results are shown in Figure 19. The weighted average amount of +2" material in scheme 'A' is 8.7%, and by the nature of the rock, about 10 to 20% of this material will report as breaker reject. During the washability tests, this material was not discarded, so it did introduce slightly more dilution into the plant feed. The 2" x ½" fraction comprises 22.2% of the plant

TABLE 33

SIZE DISTRIBUTION

(Based on 1975 Washability Data)

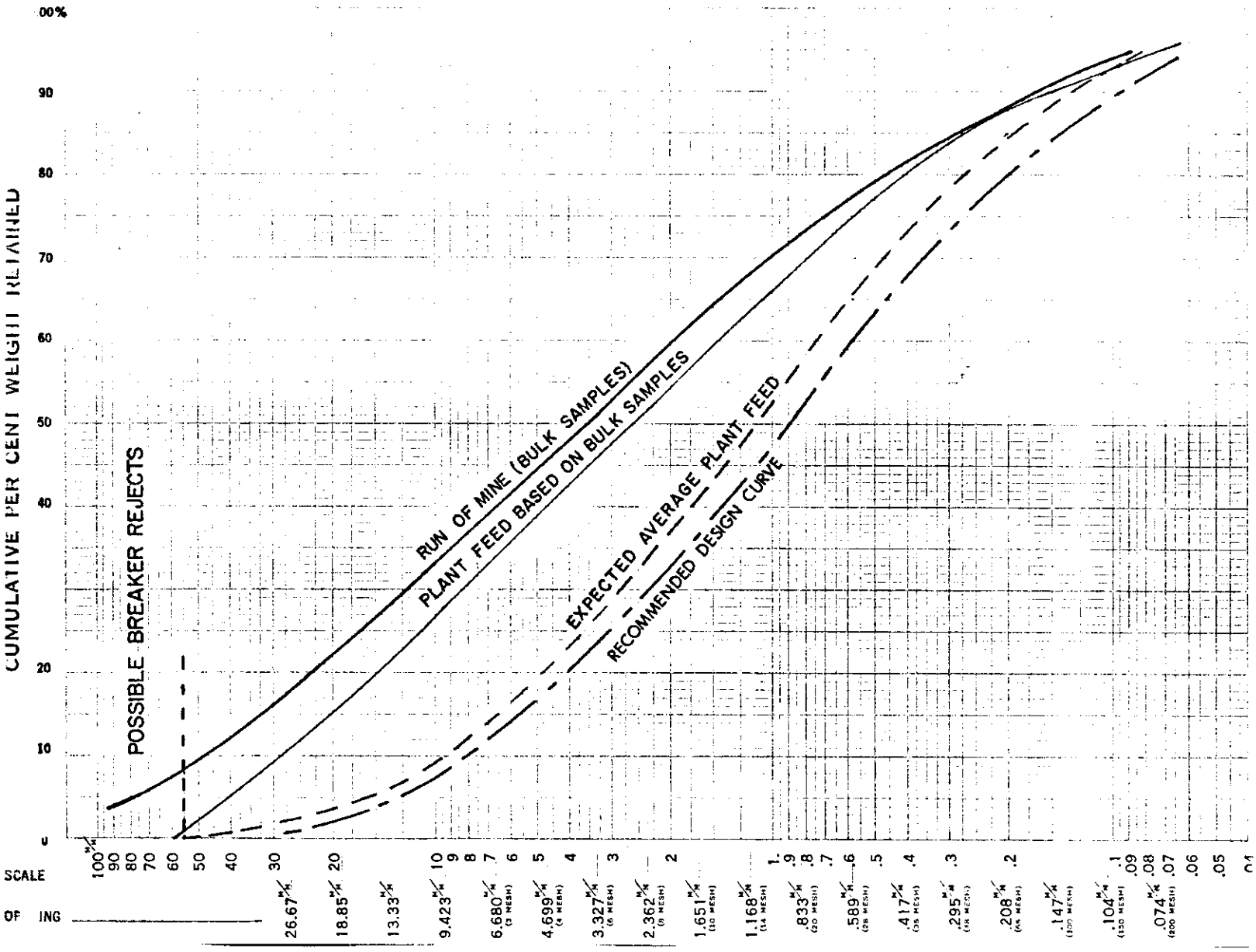
Seam	Oversize in Bulk Samples[1]	Plant Feed[1]			
	+2"	2" x ½"	½" x 28M	28 x 65M	65M x 0
2	4.5	17.9	50.0	4.9	27.2
3	7.7	13.6	48.7	22.3	15.4
4	4.0	17.9	58.3	11.3	12.5
6	5.4	20.0	46.8	11.1	22.1
7	2.9	13.4	44.7	15.1	26.8
8	8.5	26.7	50.3	18.9	4.1
9	9.9	24.2	56.0	10.3	6.5
10	4.6	16.2	50.9	9.4	23.5
12	10.6	28.3	51.1	8.7	11.9
13	17.6	19.3	63.7	7.4	9.6
14	13.4	30.6	51.8	7.0	10.6
15	11.1	34.1	47.9	11.9	6.1
16	13.9	28.9	47.5	11.3	12.3
17	12.1	28.6	56.6	9.6	5.2
18	13.4	18.0	62.4	8.0	11.6
Average	9.3	23.6	52.4	11.1	13.7
Wt. Avg. 'A'	8.7	22.2	53.5	10.6	13.5
Wt. Avg. 'C'	7.9	21.5	53.1	12.1	14.3
Scheme 'A'	8.0	20.4	49.4	9.8	12.4

(1) The breaker rejects will probably be 10-20% of the +2" fraction

(2) Plant feed is normalized to 100%.

FIGURE 19

ELK RIVER SIZE DISTRIBUTION CURVE



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COAL QUALITY CONSIDERATION

feed, and in practice this is very high for Western Canadian coals. Normally +½" material comprises less than 10% of the plant feed; however, for design purposes it would be wise to use 22% so that surges in dilution can easily be handled.

The ½" x 28M fraction will normally comprise 58% of the feed, for design purposes, 60% should be sufficient. The fines fraction only constituted 24.1% of the feed; however, a higher fines content of 40% minus 28 mesh (0.6 MM) should be assumed for design. Table 34 summarizes the anticipated size variations in the plant feed. The total plant surge capacity should be about 20% and this should be built into the coarse coal circuit so that the surge effects of dilution rock do not interrupt the heavy media cyclone operation.

TABLE 34

SIZE DISTRIBUTION FOR PLANT DESIGN

Plant Feed Size	Avg. Plant Feed	Max. Coarse Plant Feed	Max. Fine Plant Feed	Maximum Capacity of All Sizes
4" x ½"	7	22	5	22
½" x 28M	58	53	55	58
28M x 65M	20	12	18	40
65 x 0	15	13	22	40
				120

COAL QUALITY CONSIDERATION

5) Froth Flotation

Froth flotation tests were conducted at 10% pulp density, and a reagent level of 0.48 lbs./ton (4:1 kerosene to MIBC), on all the bulk samples taken during the 1975 test program. Tests were conducted on 65 mesh x 0 coal in a standard WEMCO laboratory cell with a one minute conditioning time and (2) one minute floats. The results of these tests are plotted as Figure 20. In general, for the same raw coal ash level, the ash content of the minus 65 mesh coal is lower at recoveries above 75% than it was for tests conducted on 28 mesh x 0 coal (Figure 21). This is quite surprising since one normally expects more interference from the clays and ultra fines on the fine coal floats. Also, Figure 22 which represents the minus 65 mesh flotation results from the pilot plant tests, confirms that this phenomena is correct. In these tests, the product ash falls within the laboratory curves for raw coal ash contents below 20%, and for higher ash contents the results are better than laboratory predictions. Overall, one can anticipate a good low ash fine coal product which is not the usual case for Western Canadian coals. Froth ash contents below 9% are unusual. To project the laboratory and pilot plant results compared to actual plant operation, a factor of 0.5% ash [1] at 20% feed ash and 0.75% at 10% and 15% ash should be added to the test data. Recoveries will in general be the same. The higher ash content is attributable to colder water in the froth circuit, larger flotation cells, and higher reagent levels (to maximize recoveries at all times), and the general inflexibility of a large scale commercial operation.

(1) This correlation was developed at another operating mine in Western Canada.

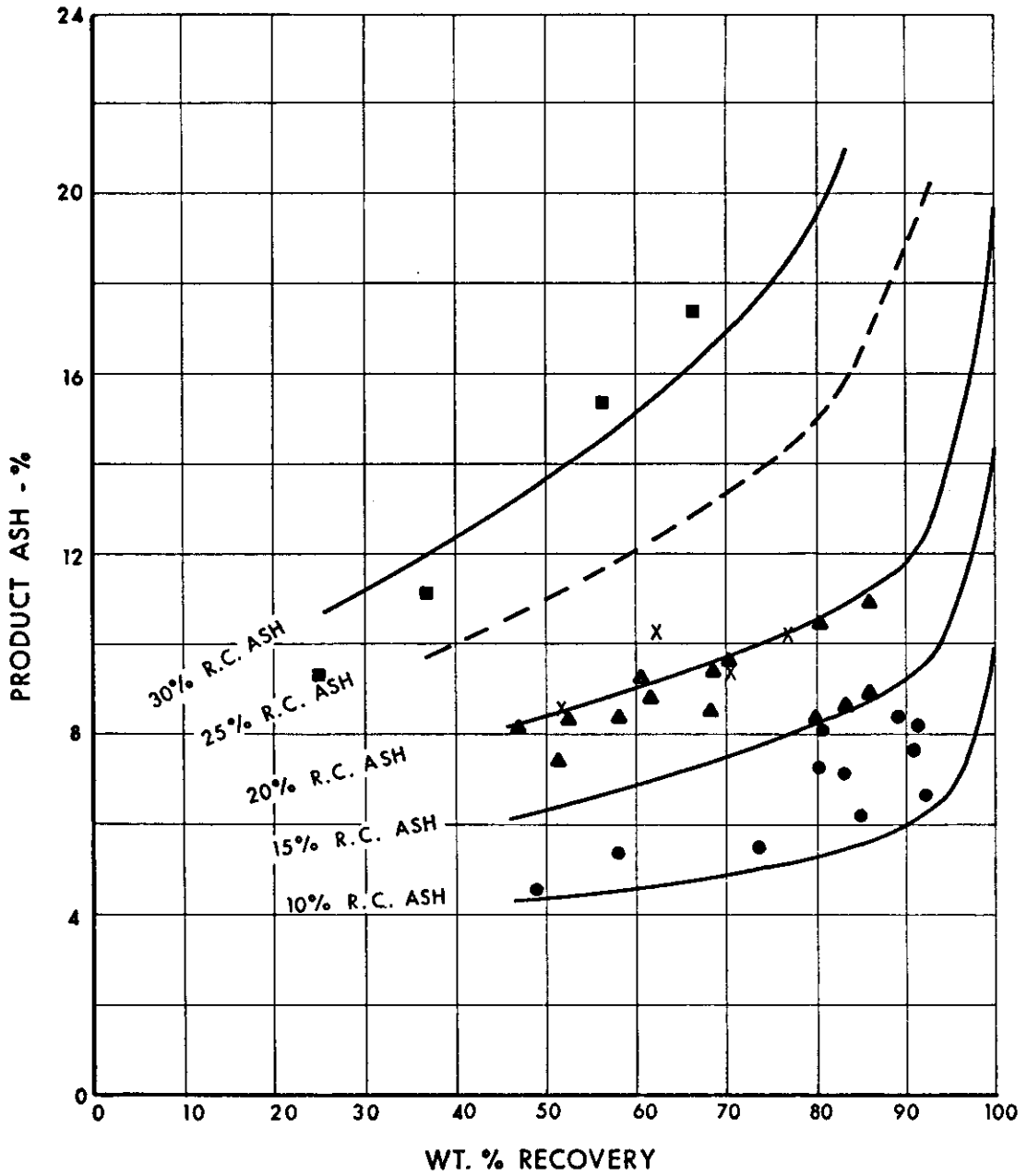
FROTH FLOTATION TEST RESULTS (1975)

PRODUCT ASH vs. RECOVERY AS A FUNCTION OF RAW COAL ASH CONTENT (65 MESH × 0)

LEGEND

RAW COAL ASH

- ○ <10% ASH
- ● 10 - 15% ASH
- ▲ 15 - 20% ASH
- X 20 - 25% ASH
- ■ > 25% ASH



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FROTH FLOTATION TEST RESULTS (1971)

PRODUCT ASH vs. RECOVERY AS A FUNCTION OF RAW COAL ASH CONTENT (28 MESH × 0 COAL)

LEGEND

RAW COAL ASH

- ○ < 10% ASH
- ● 10 - 15% ASH
- ▲ 15 - 20% ASH
- X 20 - 25% ASH
- ■ > 25% ASH

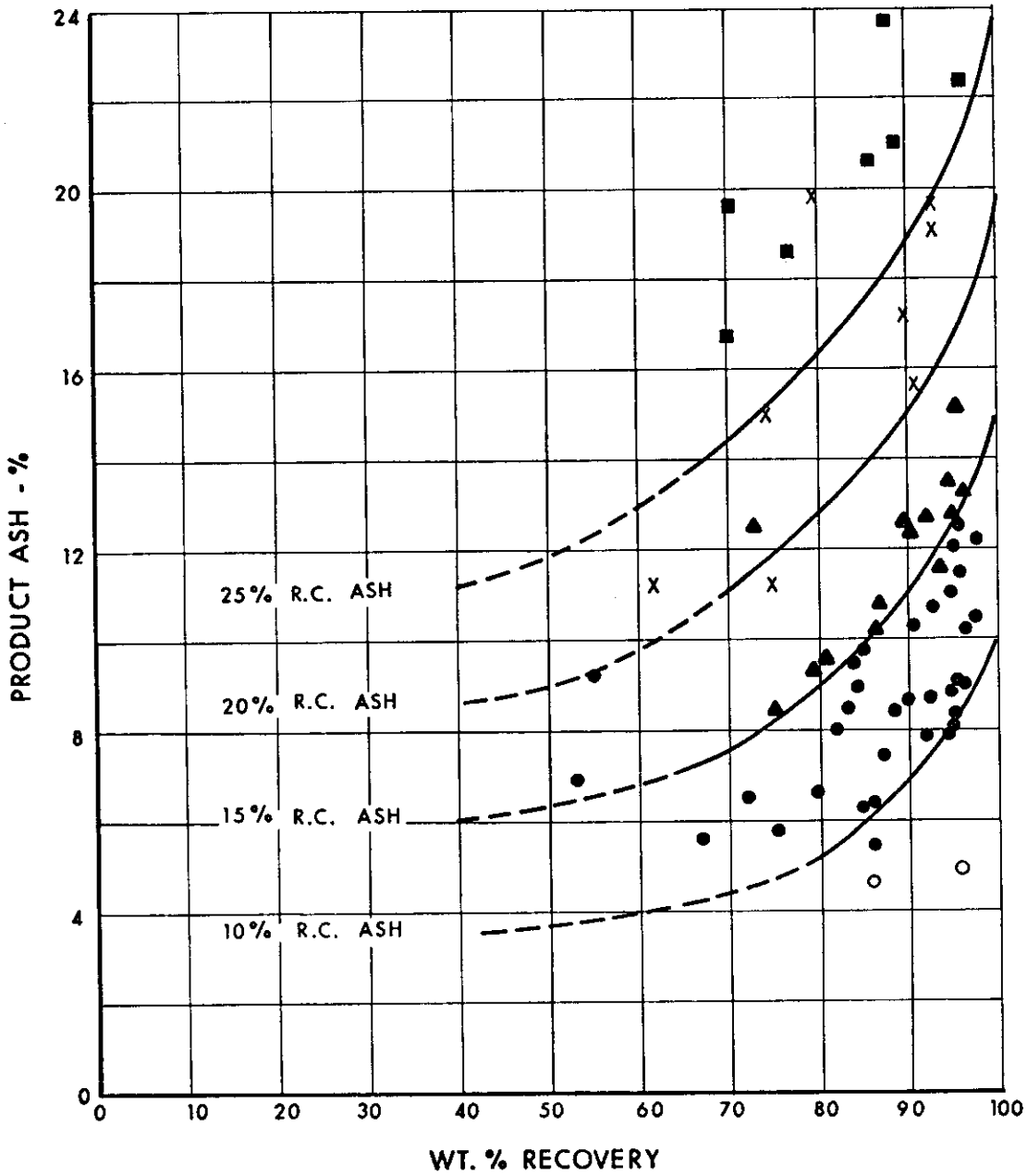

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FIGURE 22

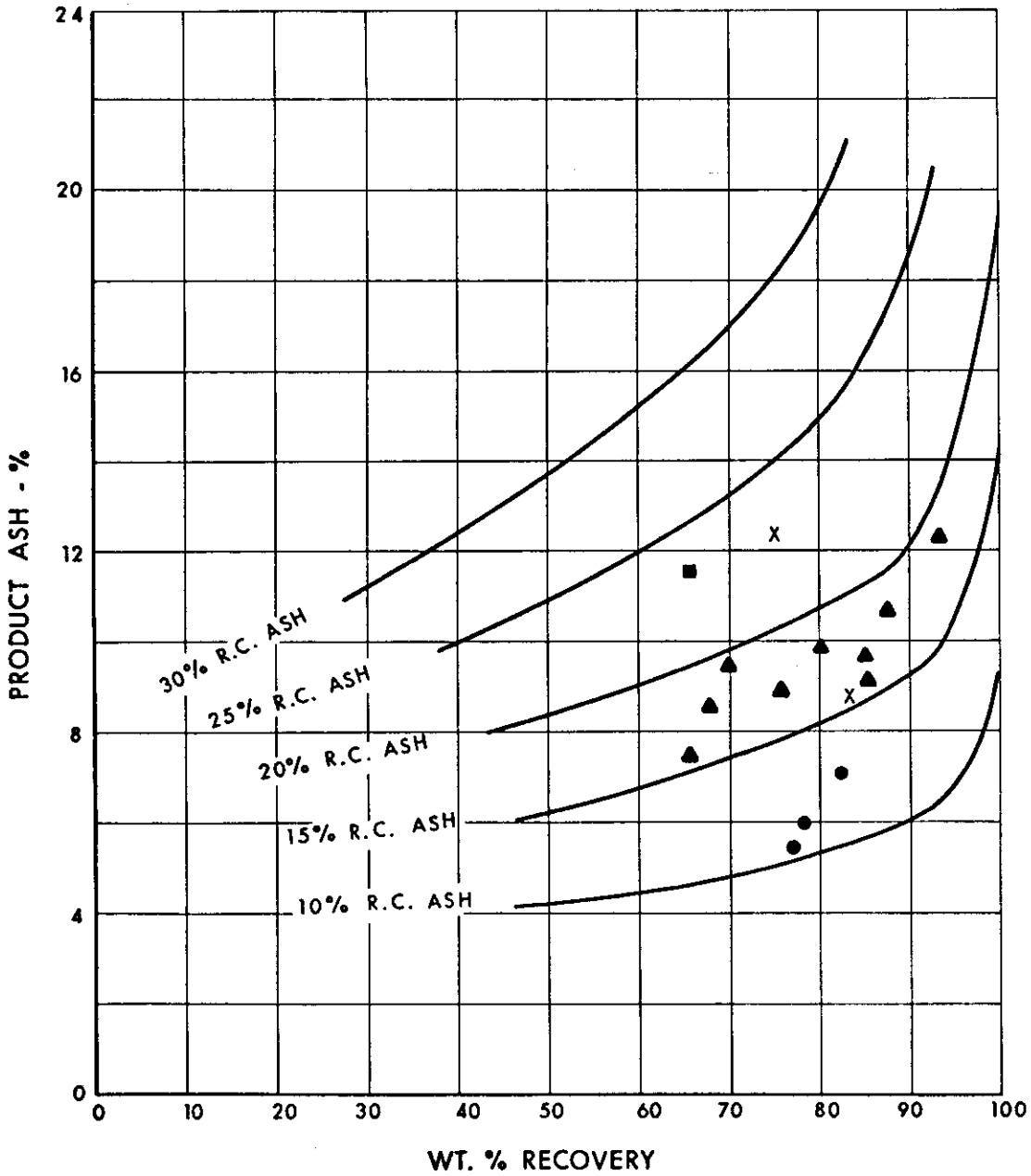
FROTH FLOTATION TEST RESULTS (1975)

PRODUCT ASH vs. RECOVERY AS A FUNCTION OF RAW COAL ASH CONTENT (PILOT PLANT TESTS) (65 MESH × 0)

LEGEND

RAW COAL ASH

- ○ < 10 % ASH
- ● 10 - 15 % ASH
- ▲ 15 - 20 % ASH
- X 20 - 25 % ASH
- ■ > 25 % ASH



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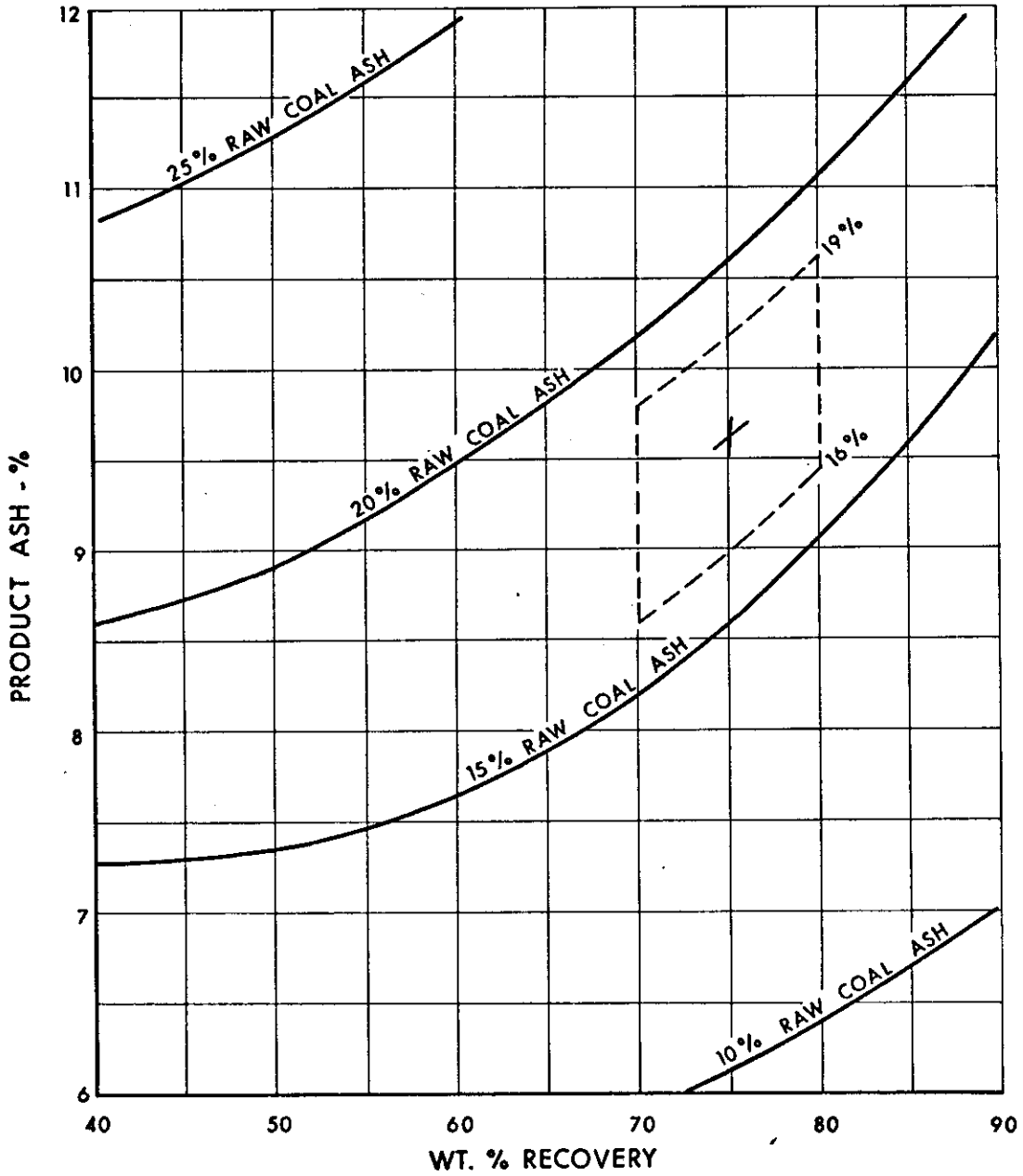
COAL QUALITY CONSIDERATION

Another phenomena frequently observed in Western Canadian coals is a higher product ash content at recoveries of 30 to 40% than at recoveries in the 50 to 60% range. This has not been observed on the Elk River coals, because all the test results show much higher recoveries. Figure 23 shows the anticipated plant recovery and product ash at various raw coal ash contents. The probable area of plant operation for purposes of product evaluation is shown as a box within the curves. These curves assume that the thickener is covered, otherwise, with a -30°C plant feed and +2°C water, froth flotation is prohibitive and recoveries are very poor. If raw coal storage silos are used, the plant feed may not be exposed to the severe cold that open storage receives, and thickener covers are not required.

PREDICTED PLANT FLOTATION ASH AND RECOVERY



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COAL QUALITY CONSIDERATION

6) Product Evaluation

The most important factor in preparation plant design is the quality of product which must be produced. Too severe product specifications cause drastic decreases in recovery and cause what should be good paying mines to loose money. Three of the five metallurgical coal mines in Western Canada lost money during their early years of operation and had to raise their product ash level to meet contract tonnages. In all cases the washability data indicated that a low ash product could be achieved at a high recovery.

The washability of the Elk River coal should not reflect these problems since dilution and operating conditions have been adequately assessed. Figures 25 to 30 in Appendix C were used to assess the product quality. Table 31 shows the product evaluation for the average condition. The weight percent and ash percent of the various fractions were not altered according to size distribution (as outlined on page 130) since such an alteration would require recalculating the washability data. Thus, the product ash and yield can be derived from the probable error curves in Appendix C. Since the coal will be finer than what is shown in Table 35, the probable error values have been chosen on the conservative side so that the product evaluation is not erroneously low. Also, the probable erros have not been chosen using the conventional Dutch State Mines formulas relating to particle size distribution, since these formulas don't account for the shape of the coal particles (flat instead of cubical) or for the amount of near gravity material present. Western Canadian coal experience indicates that probable errors approaching the calculated error are seldom achieved, especially in heavy media cyclones. Perhaps the near gravity material produces a middlings bed in the heavy media cyclone which causes a hindered separation effect just as it does in the hydrocyclone.

TABLE 35

PRODUCT EVALUATION

ELK RIVER

(Wt. According to Average Washability)

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH %	YIELD (%)
MINING SCHEME "A"							
Heavy Media Bath	4" x ½"	22.2	51.4	1.55	0.04	10.04	36.5
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.55	0.08	8.65	60.7
Compound Water Cyclones	28M x 65M	10.6	17.9	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product	2" x 0	100.0	33.0			9.0	58.8
MINING SCHEME "C" (Assuming the Same Cutpoint as Scheme "A")							
Heavy Media Bath	4" x ½"	21.2	53.5	1.55	0.04	10.8	38.6
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.55	0.08	8.75	61.0
Compound Water Cyclones	28M x 65M	12.0	17.6	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product	2" x 0	100.0	32.8			9.1	59.9
(Assuming the Same Product Ash as Scheme "A")							
Heavy Media Bath	4" x 0	21.2	53.5	1.52	0.04	10.4	36.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.54	0.08	8.65	60.2
Compound Water Cyclones	28M x 65M	12.0	17.6	1.70	0.15	8.0	75.5
Froth Flotation	65M x 0	14.2	17.4			9.65	76.0
Combined Product	2" x 0	100.0	32.8			9.0	59.3

COAL QUALITY CONSIDERATION

The theoretical versus actual probable errors are as follows assuming the theoretical values are calculated using the Dutch State Mines formulas:

Heavy Media Vessel (1.55 S.G.)

$$e_p = 0.017\ d_p - 0.05$$
$$= 0.021$$

Heavy Media Cyclone (1.55 S.G.)

$$e_p = 0.027\ d_p - 0.01$$
$$= 0.027\ (1.55\ \text{MM}) - 0.01$$
$$= 0.034$$

Compound Water Cyclones

e_p = 0.12 is the best reported separation for a Western Canadian coal preparation plant.

	Theoretical	Actual
Heavy media vessel	0.021	0.04
Heavy media cyclone	0.034	0.08
Two-stage compound water cyclone	0.12	0.15

COAL QUALITY CONSIDERATION

Part of the justification for using probable error values approximately double the theoretical values is that the theoretical values are always based on a system adjusted for a uniform feed with no misplaced material (i.e. no fines in the heavy media cyclone circuit).

In the case of a heavy media vessel, it is impossible to account for the imperfect mixing (variation in media density) across the vessel, and the effects of poorly sized magnetite. The only source of magnetite in Western Canada is Craigmont Mines, which does not produce a graded sized dense media such as one would purchase in the Eastern United States. In addition to the above problems, the heavy media cyclones are usually adapted to an optimum amount of refuse and overflow and wide variations in refuse volume (i.e. 20% by weight rejects to 50% rejects) cause the cyclones to perform inefficiently. Also, because of the fine nature of the Western Canadian coals, misplaced material (i.e. minus 28 mesh coal) is always present in variable amounts in the heavy media cyclone circuit, which tends to act as media thereby changing the separation specific gravity as well as hindering separation by increasing the viscosity of the media. Fortunately, the Elk River coal seams have very little clay content which also increases the media viscosity. Only seams 7, 12, 14D and 17 have fine bands of clay which are often common among Western Canadian coals. Because of the high magnetite consumption (sometimes greater than 15 pounds per ton of clean coal), many of the Western Canadian coal operators have reduced their media to coal ratio from 5:1 which is normal, to as low as 3½:1 so that media recovery is much easier. At reduced ratios, any surges in rejects in the heavy media cyclone circuit will actually plug the cyclones. Disregarding operator error, the technical problems associated with the operation of a heavy media plant warrant conservative probable error and design conditions when assessing the plant's capability to clean coal. Therefore, the average plant product ash may not be the most economically desirable product.

COAL QUALITY CONSIDERATION

In addition to the average product, it is important to realize the flexibility of heavy media coal cleaning equipment. As examples, Tables 36 and 37 show the lowest cleaning density (based on reaching the 20% near gravity material beyond which separation becomes formidable according to BIRD) and the highest cleaning density. The lowest density yields an 8.3% ash product with a 55% recovery in mining scheme 'A' while the higher density yields a 9.5% ash product at 61% recovery. The specific gravity of 1.6 was chosen as the highest practical operating density because the ash, above this density, is greater than 35%, so very little increase in recovery would result in a much higher product ash.

The average washability indicates that a product ash of 9.0% can be produced at about 59% recovery with a feed ash of 33%. As can be seen from the calculations changing the mining scheme 'C' had almost no effect on the recovery or ash. It looks possible that a 9.0% ash product can be achieved; however, past experience in the Elk Valley has been that a 9.5% product is more viable with no penalties in the contract until 10.0%. In this way, the inherent problems of equipment and "greenhorn" operators can be covered. Also, the froth flotation product could easily increase to 12% ash which would result in a product ash increase of about 0.45% as is demonstrated in Table 38.

In summary, a reasonable product for Elk River coal would be as follows:

Ash - 9.5% - with no penalty until 10.0%
Volatile Matter - 20-23% (scheme 'A')
19-22% (scheme 'C')
Free swelling index - 5½ with no penalty until three shipments are at fault in a year
Sulphur - 0.6% after the first shipment is faulted.

TABLE 36

PRODUCT EVALUATION

ELK RIVER

(MINIMIZING PRODUCT ASH)

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH %	YIELD (%)
MINING SCHEME "A"							
Heavy Media Bath	4" x ½"	22.2	51.4	1.50	0.04	9.8	34.5
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.48	0.08	7.75	55.5
Compound Water Cyclones	28M x 65M	10.6	17.9	1.60	0.15	7.3	71.5
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product	2" x 0	100.0	33.0			8.3	55.1
MINING SCHEME "C"							
Heavy Media Bath	4" x ½"	21.2	53.5	1.50	0.04	10.2	35.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.48	0.08	7.75	55.5
Compound Water Cyclones	28M x 65M	12.0	17.6	1.60	0.15	7.3	71.5
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product	2" x 0	100.0	32.8			8.4	56.5

TABLE 37

PRODUCT EVALUATION

ELK RIVER

(MAXIMIZING RECOVERY)

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	SPECIFIC GRAVITY CUT	PROBABLE ERROR	PRODUCT ASH	YIELD (%)
MINING SCHEME "A"							
Heavy Media Bath	4" x ½"	22.2	51.4	1.60	0.04	11.5	38.2
Heavy Media Cyclones	½" x 28M	53.7	32.3	1.60	0.08	9.2	63.5
Compound Water Cyclones	28M x 65M	10.6	17.9	1.80	0.15	8.65	78.7
Froth Flotation	65M x 0	13.5	17.7			9.65	75.0
Combined Product		100.0	33.0			9.5	61.0
MINING SCHEME "C"							
Heavy Media Bath	4" x ½"	21.2	53.5	1.60	0.04	11.9	39.5
Heavy Media Cyclones	½" x 28M	52.6	32.0	1.60	0.08	9.25	64.0
Compound Water Cyclones	28M x 65M	12.0	17.6	1.80	0.15	8.65	79.0
Froth Flotation	65M x 0	14.2	17.4			9.55	75.0
Combined Product		100.0	32.8			9.6	62.2

TABLE 38

PRODUCT EVALUATION

ELK RIVER

(Wt. According to Average Size Distribution)

CIRCUIT EQUIPMENT	SIZE FRACTION	WT. (%)	RAW COAL ASH %	PRODUCT ASH %	YIELD (%)
MINING SCHEME "A"					
Heavy Media Bath	4" x ½"	7	51.4	10.4	36.5
Heavy Media Cyclones	½" x 28M	58	32.3	8.65	60.7
Compound Water Cyclones	28M x 65M	20	17.9	8.0	75.7
Froth Flotation	65M x 0	15	17.7	9.65	75.0
Combined Product	2" x 0	100	28.6	8.75	64.2
MINING SCHEME "A"					
Heavy Media Bath	4" x ½"	7	51.4	10.4	36.5
Heavy Media Cyclones	½" x 28M	58	32.3	8.65	60.7
Compound Water Cyclones	28M x 65M	20	17.9	8.0	75.7
Froth Flotation	65M x 0	15	17.7	12.0	85.0
Combined Product	2" x 0	100	28.6	9.2	65.7

COAL QUALITY CONSIDERATION

Figure 24 describes the yield as a function of raw coal ash and product ash. This figure was developed by plotting the product ash and recovery from the average washability conditions, then calculating the dilution material decrease at lower plant feed ash. The dilution ash is assumed to be 85% down to a raw coal ash content of 20%. As an example, the recovery at 20% raw coal ash for a 9.0% ash product is calculated as follows:

$$33 \times 100 = 20X + (100 - X)\,85$$

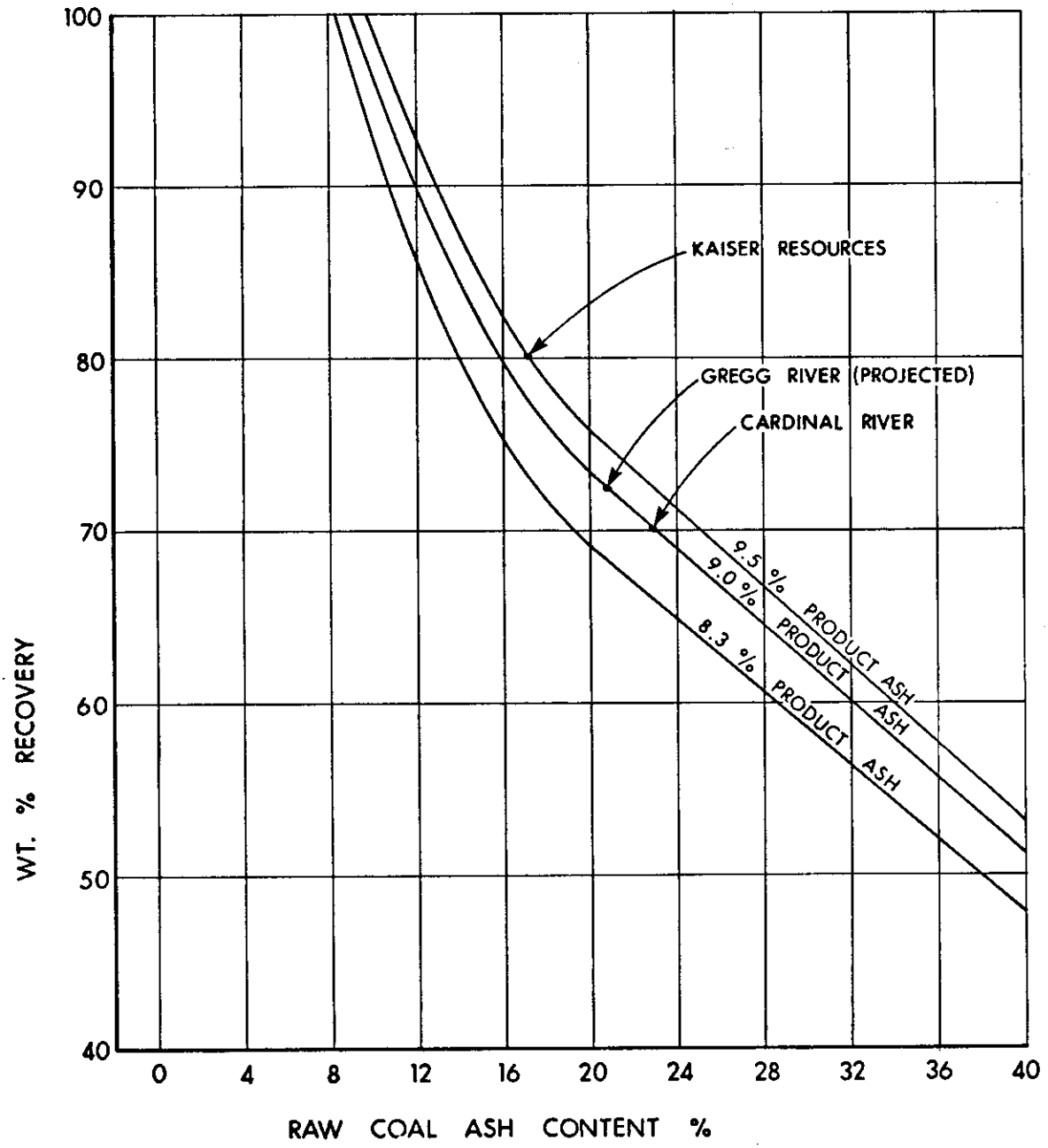
$$X = 80\% \text{ (Coal remaining after dilution is excluded)}$$

$$\text{Recovery} = \frac{58.8\% \text{ (at 33\% R.C. Ash)}}{0.8 \text{ (at 20\% R.C. Ash)}}$$

$$= \underline{\underline{73.5\%}}$$

At a 20% feed ash, 73.5% recovery is a very reasonable recovery number. The curve fits the Kaiser and Cardinal River data, and the projected Gregg River data.

ANTICIPATED ELK RIVER
RECOVERY AS A FUNCTION
OF RAW COAL ASH AND
PRODUCT ASH



ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Feb./76

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The 1975 Elk River drilling and bulk sampling program confirmed that the quality of coal in this area is very good. Even with the high amount of dilution which will be added during mining, with a feed ash of 33%, a 9.0 to 9.5% ash product can be produced at about 60% recovery. Minor problems of localized high sulphur and phosphorous can be overcome by blending. Fluctuation in plant feed ash will be experienced in the coarse coal circuit, but the rest of the plant should have a fairly constant feed.

Overall, the program was conducted smoothly according to plan, and the results indicate that the Elk River Coal property will be one of the best of the recently proposed properties for development.

CONCLUSION AND RECOMMENDATIONS

Recommendations

1) Grindability Index appears to be a viable method of correlating the size distribution of unoxidized coal at a constant ash level from property. An attempt should be made to develop the data in conjunction with an existing mine so that the size distribution factors can be correlated with real mining conditions. Perhaps an approach should be made to Fording River Coals to exchange grindability information. Fording may be interested in allowing Elco Mining to size their plant feed and develop grindability information on their product. This would ensure that size distribution adopted at Elk River would reflect the actual mining conditions It should also ensure conservative design since Fording River mine their coal with ripper dozers, front end loaders, or a dragline, which should produce more fines than an hydraulic shovel. An even better approach may be to run tumbler tests in the Harhoff drum which has been used in Germany.

2) Should the composite samples turn out to be the only basis on which Stelco will accept the Elk River data, then another composite sample should be assembled and washed at a different laboratory to rectify the discrepancies which appeared in the current bulk tests. After evaluating all the other test results, the averaged data should be more meaningful, and hopefully a rerun should not be necessary.

3) The association of the fusinite with the vitrinite should be established for all the Elk River coal seams. Perhaps the vitrinite, fusinite concentration versus specific gravity for a few typical seams such as 2, 4, 7, 10, 12 and 18 would be useful in determining

CONCLUSION AND RECOMMENDATIONS

what the cut point should be for preparation plant operation. The cut point may be dictated by other factors; however, these results may show that a 1.60 S.G. cut on the upper seams would produce a better quality product for coking than a 1.50 S.G. cut point.

4) Probability error curves should be developed on the 1975 washability data for future reference and quick evaluations of the effect of changes in mining schemes on the product. These curves were not supplied by Birtley because they consider the Dutch State Mines information as confidential. They can, however, be supplied by Cyclone Engineering Sales, who have a computer program to do these types of curves.

5) A breaker test should be run on a fresh sample of Elk River coal to determine what amount of material will be rejected prior to the plant. This will also help to refine the existing plant feed data. During the breaker test, ash should be run on the feed and products. If an appreciable amount of coal is found in the rejects (which Techman does not expect) a washability should be run. About 20 tons of coal should be run through either the Fording River or Byron Creek Collieries breaker stations. In this way, no assumptions will have to be made as to the validity of testing, and the results will not have to be scaled up to commercial size.

6) A pilot test should be run on two-stage compound water cyclone circuit (composite sample) so that the actual performance of such a circuit can be better calculated.

CONCLUSIONS AND RECOMMENDATIONS

Suggested Flowsheet Changes

As a result of the coal quality work in this report, some suggested revisions of the original Techman flowsheet are in order.

Firstly, the concept of a hard coal and soft coal section of the plant is not a good one because of the variability in softness of the coal. All the coal should be cleaned in duplicate circuits or in a split off of the main plant feed conveyor. Parallel circuits are desirable, because at such large tonnages distribution to a single circuit causes poor space utilization and reduces the flexibility of the plant (i.e. part of the plant can be maintained while the other part operates when parallel circuits are employed). The idea of two thermal dryers instead of one is very valid if the dryers must be coal fired. If gas is available, a single dryer is the cheapest approach. Operating a pulvizer system for one large coal fired dryer is more difficult because of inherent problems of large scale equipment.

The raw coal blending beds should be maintained using conveyors "Coleman" feeders, and front end loaders because of flexibility and high availability of the smaller, well proven equipment. Raw coal silos are not desirable unless they are used as a surge bin for plant feed (i.e. 8000 ton capacity) since the surge between the plant and the mine cannot always be controlled. Also, large stacker reclaimers are not desirable because of their complexity and poor performance when operated continuously in cold climates. Because there is no shortage of space at Elk River, the ground should be utilized initially. If it is not and covered storage is installed, it may be very difficult to convince environmentalists that open storage is necessary at a later date should it become so. The Department of Environment in Alberta is already very reluctant to allow any open storage of coal.

CONCLUSIONS AND RECOMMENDATIONS

Because the dilution appears to be the single most controversial and difficult factor in determining the performance of the Elk River preparation plant, a large jig should be considered as a viable primary rock remover, especially since water for the circuit will be available from the hydraulic mine coal feed. If all the coal is fed first through a jig, only one rotary breaker would be required (i.e. 8" openings). The jig would operate as a scalper (i.e. 1.6-1.8 S.G. cat). Then the jig concentrate should be crushed to 2" and screened at 28 mesh (0.6 MM). The 2" x 28M coal could then be cleaned in heavy media cyclones, and the heavy media bath would be eliminated. The fine coal would be cleaned in a circuit similar to that presented in the March 1975 Techman report. The obvious advantages of such a circuit would be that the heavy media vessel circuit would be eliminated, the breaker station would only require one rotary breaker, and the quality of coal fed to the preparation plant would be uniform so that a more precise and perhaps lower product ash could easily be achieved. In addition, jigs are well known in Germany, and familiarization of the owners with this type of coal cleaning plant will be much easier.

If a fine coal centrifuge is desired (we do not recommend their use), the CMI modified EB-36 shown in the preliminary Kaiser flowsheet (meeting of February 13th) should be replaced by a Bird solid bowl (screw type) centrifuge with ceramic liners similar to the proven model in use at Cardinal River Coal Ltd. The problem with the EB-36 is that basket life is poor and maintenance is high. The product moisture will be 18 to 24% using the EB-36 whereas the Bird 36x96 will yield a consistent 12% moisture product which reduces the thermal dryer requirements slightly. Centrifuges are very expensive in terms of lost production time on a plant, so Techman recommends that the fine coal all be dewatered in a conventional well proven disc filter. Also, experience at Cardinal River was that once the

coarser 28 x 65 mesh coal was taken away from the disc filters, a substantial decrease in filter cake thickness occurred, so that a 100% gain of the centrifuge capacity could not be achieved in the combined circuit.

EXPLANATORY NOTES

(1) The average scheme 'A' washability was developed by considering the reserve figures shown in mining scheme 'A' - "Techman; Report on Preparation and Preliminary Flowsheet, March 1975", p.11; and weighting all the washabilities against those reserve figures. Also considered was the weight percent of each of the fractions in the overall washability.

As an example, the weight percent of each size was first calculated by taking the sum of the products for each diluted seam tonnage (i.e. normalized seam tonnage x wt.% each fraction = wt.% of each fraction of the washability).

The ash is calculated similarly by summing the products of normalized seam tonnage x wt.% each fraction x ash% each fraction ÷ sum of weight %'s. The rest of the washability is calculated the same as a normal washability.

Similarly, each washability was weighted according to the reserves in the respective mining schemes.

(2) The best washability is calculated from the average washability by assuming that the dilution will not always be included in the plant feed. The ash content and proportionate weight percents of the 1.80 specific gravity float fractions will remain proportionately the same. Only the +1.80 specific gravity sinks are assumed to decrease and for purposes of this calculation the ash is said to be constant.

In actual fact the best washability may be proportioned slightly differently with a lower +1.80 specific gravity ash, but error

(if any) can not be calculated. When one recognizes the purpose of the "Best Washability", the true value is not worth debating. The best washability is not meant to reflect a possible long range condition which might occur for long periods. It is used primarily to size the various circuits in the plant. Combined with the worst washability, it sets the range for design anticipated in the plant.

(3) The worst washability is calculated by adding further dilution to the average condition. Once again, the weight and ash of the 1.80 specific gravity fractions remains proportionately the same and 100% ash rock is added to the 1.80 sink fraction. The 28 x 65 mesh fraction remains unchanged, because it is felt that little change would occur in the fines because of the coarse nature of the added rock.

(4) Adit #10 was chosen because all the values could be calculated since the wt.% and ash% were roughly proportionate. This could not be done for seams 2 and 4 (the only other ones attempted). If an overall assessment of dilution is required, then the weighted average washability of the 1971 bulk samples could be calculated and the differences between the two assessed. An assumption would have to be made that the dilution all appeared in the plus 28 mesh fraction.

(5) The column on increase in dilution was arrived at as follows:

(a) the increase in dilution over the 1970 to 1971 bulk samples was calculated by assuming the dilution material was 82% ash as per the seam 10 calculation. Dilution was then calculated by dividing the raw coal difference in ash (1975 minus 1971) by 0.82 then correcting to the earlier raw coal

ash free basis only. This column can then be used as a test comparison to the total calculated dilution column. If the two columsn compared favourably as they did, then the assumed ash content of the dilution is quite accurate.

(b) The dilution from each seam in the middle column was calculated from the lithological description shown in the seam description section of this report. It was calculated by assuming the specific gravity of the measured coal sections was 1.45 and the partings, footwall and hanging wall was 2.50. As an example, on seam 3

$$\text{Dilution} = \frac{(0.30' + 0.75') \times 2.50 \times 100}{(8.5') \times 1.45 + (.30' + .75') \times 2.50} = 17.6\%$$

(c) The total calculated dilution was done by assuming the coal had an ash content of 17.5% and dilution 85%. As an example, seam 4

$$100 \times 27.7\ \text{R.C. Ash} = (\text{Dilution})85 + (100\text{-Dilution})17.5$$

$$\text{Dilution} = 15.1\%$$

APPENDICES

TABLE 9

DRILL HOLE SUMMARY

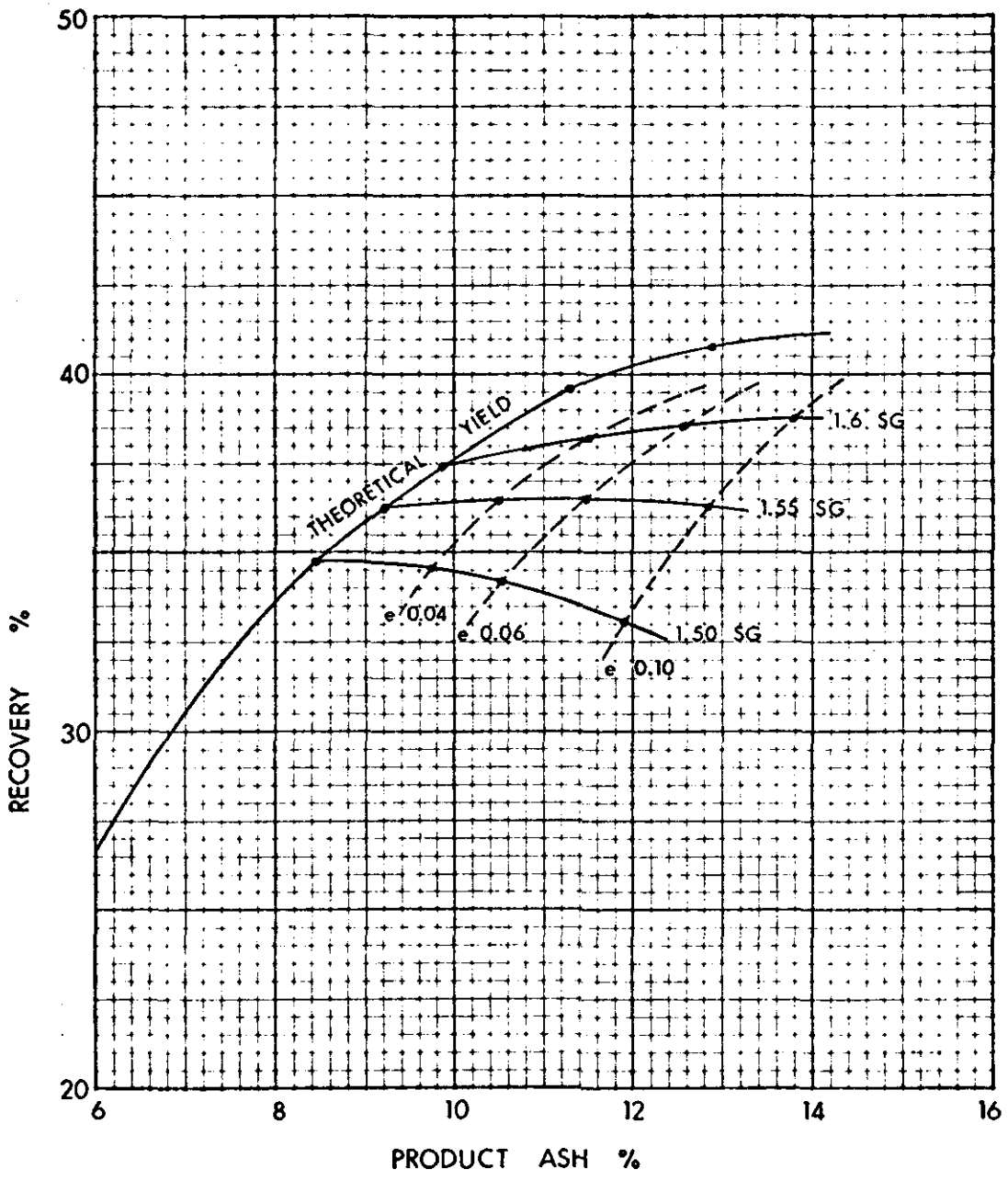
SEAM No.		Total Footage	Ash % WF	VM % WF	S %WF	Yield %	Ash %MF	VM %MF	FSI
12	EB-6	32.3'	24.4	21.7	0.60	72.1	5.7	27.5	8
13	EB-6	18.4'	27.7	21.7	0.60	67.6	6.1	28.8	8½
	EB-15	18.9'	52.2	16.1	0.54	43.7	5.4	25.9	7
WT. Average (by footage)		18.6'	40.1	18.9	0.57	55.5	5.8	27.3	7 3/4
14	EB-6	40.6'	32.9	22.4	0.69	59.6	4.7	29.8	8½
	EB-12	9.5'	21.3	23.1	0.73	72.1	5.3	28.4	8½
	EB-15	12.0'	31.6	19.6	0.77	56.9	7.0	26.6	8
	EB-18	14.0'	21.9	22.8	0.68	70.5	7.9	27.9	8
WT. Average (by footage)		19.0	29.2	22.1	0.71	62.7	5.7	28.8	8¼
15	EB-7	43.2'	64.7	14.1	0.52	25.5	5.2	30.7	9
	EB-10	14.0'	40.3	20.5	0.44	54.8	5.2	30.4	9
	EB-12	22.0'	19.5	23.1	0.46	74.4	4.6	28.5	8½
	EB-15	29.2'	26.7	20.7	0.65	65.8	5.7	27.5	8½
	EB-16	19.0'	34.4	21.8	0.76	63.7	6.6	28.2	8½
	EB-18	12.8'	18.7	23.6	0.72	77.3	6.9	27.5	8
WT. Average (by footage)		34.1'	39.0	19.4	0.58	54.4	5.6	29.0	8½
16	EB-7	14.2'	25.6	22.7	0.59	65.7	5.5	30.0	8½
	EB-10	12.6'	16.0	24.1	0.67	81.7	3.9	28.0	8
	EB-12	9.5'	15.5	24.7	0.67	79.8	4.2	29.3	9
	EB-15	25.2'	32.0	20.7	0.65	57.1	7.4	28.3	8½
	EB-16	15.9'	22.9	24.3	0.89	73.1	7.0	29.6	8½
	EB-17	44.9'	24.4	24.6	1.18	70.9	7.8	29.9	8½
	EB-18	14.1'	25.2	24.9	1.45	67.1	7.3	30.5	7½
	EB-19	10.7'	10.6	29.0	0.92	88.7	4.7	31.7	8
WT. Average (by footage)		18.4'	23.4	24.0	0.93	70.7	6.6	29.6	8¼
17	EB-7	10.3'	17.0	27.1	0.80	81.1	3.8	33.1	8½
	EB-10	28.5'	32.0	23.0	0.53	62.3	4.2	30.1	8½
	EB-12	6.3'	12.1	27.5	1.20	87.5	3.9	30.8	9
	EB-13	9.2'	36.2	27.5	0.42	56.2	7.6	33.1	8
	EB-14	18.0'	38.1	20.4	0.67	62.0	7.0	30.9	8½
	EB-16	19.6'	29.9	23.0	0.64	61.1	6.0	30.9	8
	EB-17	6.5'	34.1	22.6	0.63	60.2	9.5	32.8	8
	EB-19	7.7'	21.8	27.9	1.13	74.6	4.4	33.6	8½
WT. Average (by footage)		13.3'	29.8	23.5	0.68	65.6	5.6	31.9	8¼
18	EB-7	27.8'	14.4	28.4	0.50	86.4	4.8	34.7	8
	EB-8	6.4'	29.3	27.7	0.71	63.8	7.4	32.8	8
	EB-10	19.8'	12.0	27.1	0.37	90.5	4.5	30.6	7½
	EB-11	19.8'	18.2	27.8	0.25	78.9	4.8	32.3	8
	EB-12	17.4'	33.8	22.2	0.74	54.0	6.7	31.8	8½
	EB-13	15.5'	17.5	25.8	0.41	78.1	5.4	32.4	7½
	EB-14	17.0'	17.8	26.4	0.56	80.9	4.7	32.4	8
	EB-16	20.6'	33.5	23.2	0.67	54.2	6.4	32.7	8
	EB-17	5.6'	7.3	27.6	0.79	93.8	3.0	32.3	8½
	EB-19	5.5'	34.9	24.1	0.61	55.9	9.3	34.3	7½
WT. Average (by footage)		15.5'	21.1	26.0	0.52	74.9	5.4	32.6	8
19	EB-8	33.9'	31.0	25.4	0.66	60.0	6.8	36.4	8
	EB-11	24.2'	25.8	24.9	0.69	69.9	6.7	34.4	8
	EB-12	4.0'	37.8	21.2	0.88	56.9	9.3	30.6	8
	EB-13	6.3'	35.9	23.4	0.81	49.6	9.8	34.6	8
	EB-14	14.6'	31.2	25.2	0.70	63.6	6.2	35.0	8
	EB-16	11.5'	48.0	20.5	0.97	33.1	10.6	35.2	7
	EB-17	7.4'	19.5	28.0	1.17	81.8	5.9	33.3	8
WT. Average (by footage)		14.6'	31.4	24.6	0.76	60.6	7.3	35.0	8
20	EB-9	19.1'	37.6	24.4	0.93	54.0	9.2	37.6	6½
	EB-11	15.8'	32.9	26.0	0.63	61.8	8.4	36.3	8
	EB-13	8.4'	41.8	22.2	0.45	43.7	11.2	36.0	7
	EB-14	6.7'	63.6	14.7	0.43	23.9	8.5	34.4	NA
	EB-17	6.6'	21.9	28.3	0.70	78.6	9.6	34.8	7
21	EB-13	12.3'	34.2	29.5	0.44	54.0	7.5	36.5	7½

TABLE 10

CHANNEL SAMPLE SUMMARY

SEAM	RAW COAL ASH %		1.50 Specific Gravity Float					
			FREE SWELLING INDEX		CONTRACTION		DILATION	
	Channels	Bulk	Channels	C.C. Bulk	Channel	C.C. Bulk	Channel	C.C. Bulk
2A	32.9		9		22		47	
2B	42.4	37.2	7½	9	21	21	25	59
3	42.7		8		28		3	
3 (+4')	32.9	21.9	7½	8	20	19	0	25
3 (Behind)	31.2		7½		24		10	
4 (South)	29.2		2½		12		-12	
4 (North)	28.3		2		13		-13	
4A (North)	35.7	27.7	7	4	22		-12	
4A (South)	34.4		7½		21		4	
5	55.4		8		4		69	
6	15.9	23.8	3	3½	14	16	-14	-16
7-1	43.9		4½		18		-18	
7-2	45.1	33.1	4½	6	9	19	- 9	-19
8-1	34.9		5½		17		-17	
8-2	28.3	31	6½	6½	21	21	-16	-16
9	23.8	24.0	4½	6	20	23	-20	-18
9 (Behind)	20.5		7		16		-13	
10-1	26.4		8		17		- 4	
10-2	27.5	23.2	8	7½	17	20	4	-16
12 (North)	40.9		9		24		69	
12 (South)	34.1	42.5	8½	9	13	12	77	78
12 (South Top)	36.9		9		25		10	
13 + 13A	42.8		8½		11		98	
13 + 13A (Behind	53.5		8		13		115	
13D	67.2		8½		13		45	
13D (+5')	64.6	57.1	8	8½	17	23	54	103
13E	62.0		8		14		156	
13E (+4')	69.5		9		30		143	
13F	64.2		9		26		236	
13F (+4.4')	70.6		9		23		212	
13G	41.9		9		25		48	
13G (+3')	33.0		8½		25		41	
14C-1	22.3		9		24		243	
14C-2	24.4		8½		21		261	
14D-1	29.6	49.8	9	9	23	23	143	209
14D-2	31.6		9		23		179	
14 + 14A (South)	44.6		9		19		272	
14 + 14A (North)	44.6		9		24		274	
15 (North)	46.9	44.3	9	8½	25	30	89	105
15 (South)	42.8		8½		28		99	
16-1	40.9		8		22		170	
16 (+5.4')	41.8		8		24		203	
16E	20.6	39.7	7½	8	24	25	92	127
16E (+5.4')	31.6		8		28		108	
16G	39.5		8		17		70	
16G (+5.4')	34.1		8½		24		131	
17	17.2		8½		26		173	
17 (+9')	25.5	35.9	8½	8	30	13	128	145
17A	45.7		9		24		191	
17A (+9')	37.3		8		26		173	
18	34.4		9		20		65	
18 (+12')	26.9	34.2	8½	8½	27	25	146	187
Average	34.4	34.6	7¼	7½	22	20	60	68

YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'A' 2" × 1/2" COAL



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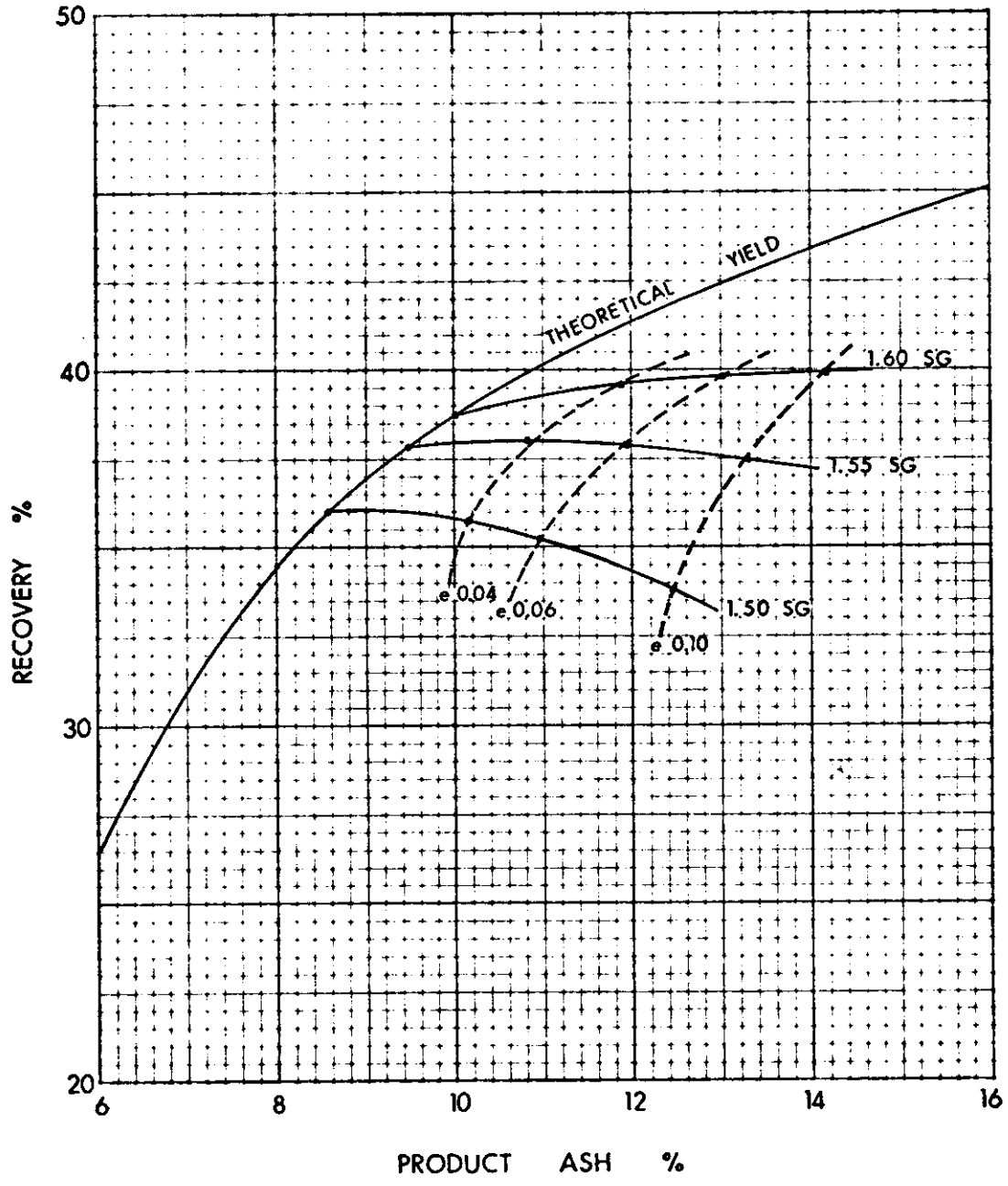
TECHMAN LTD. Feb./76

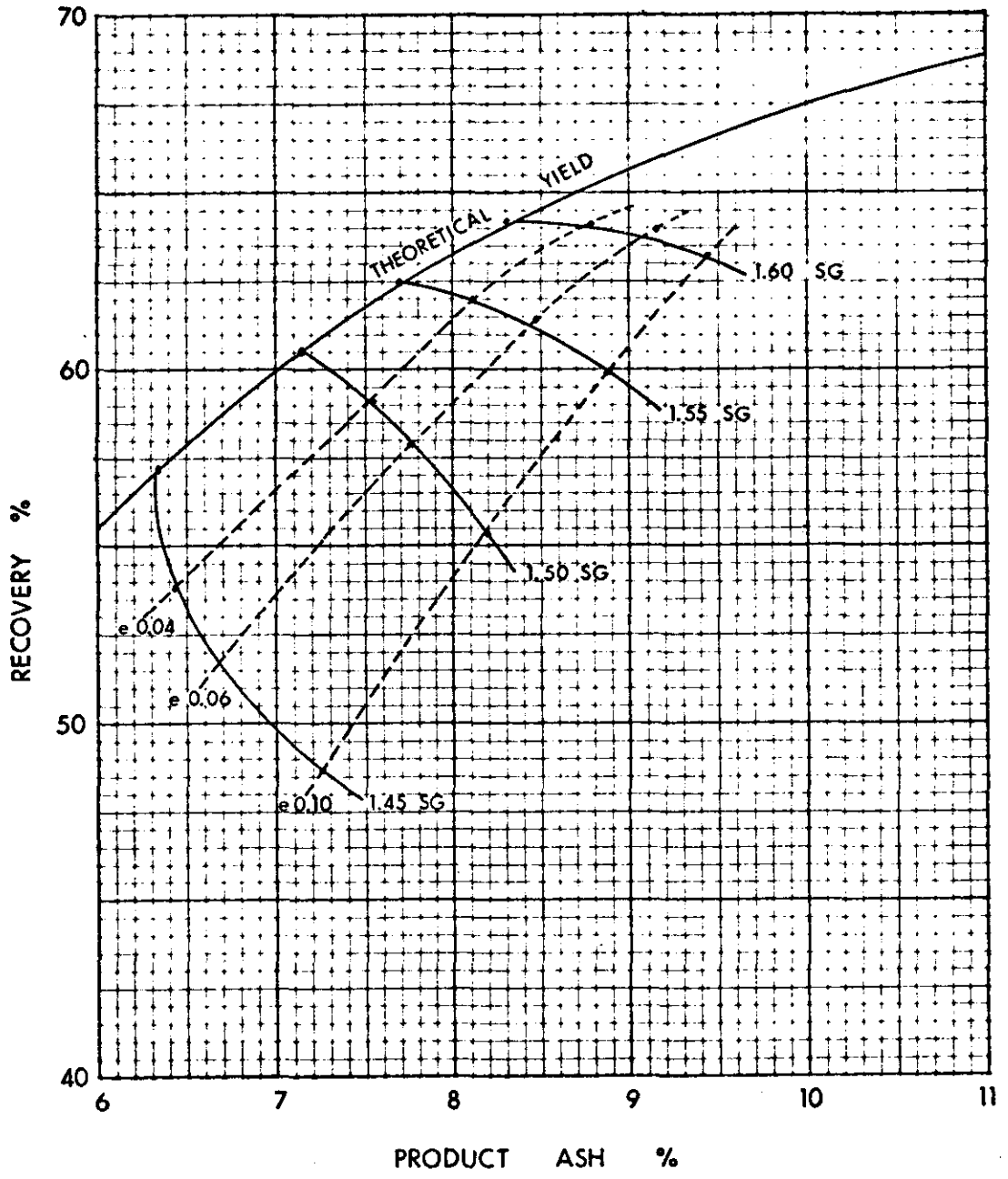
FIGURE 26

YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'C' 2" × 1/2" COAL



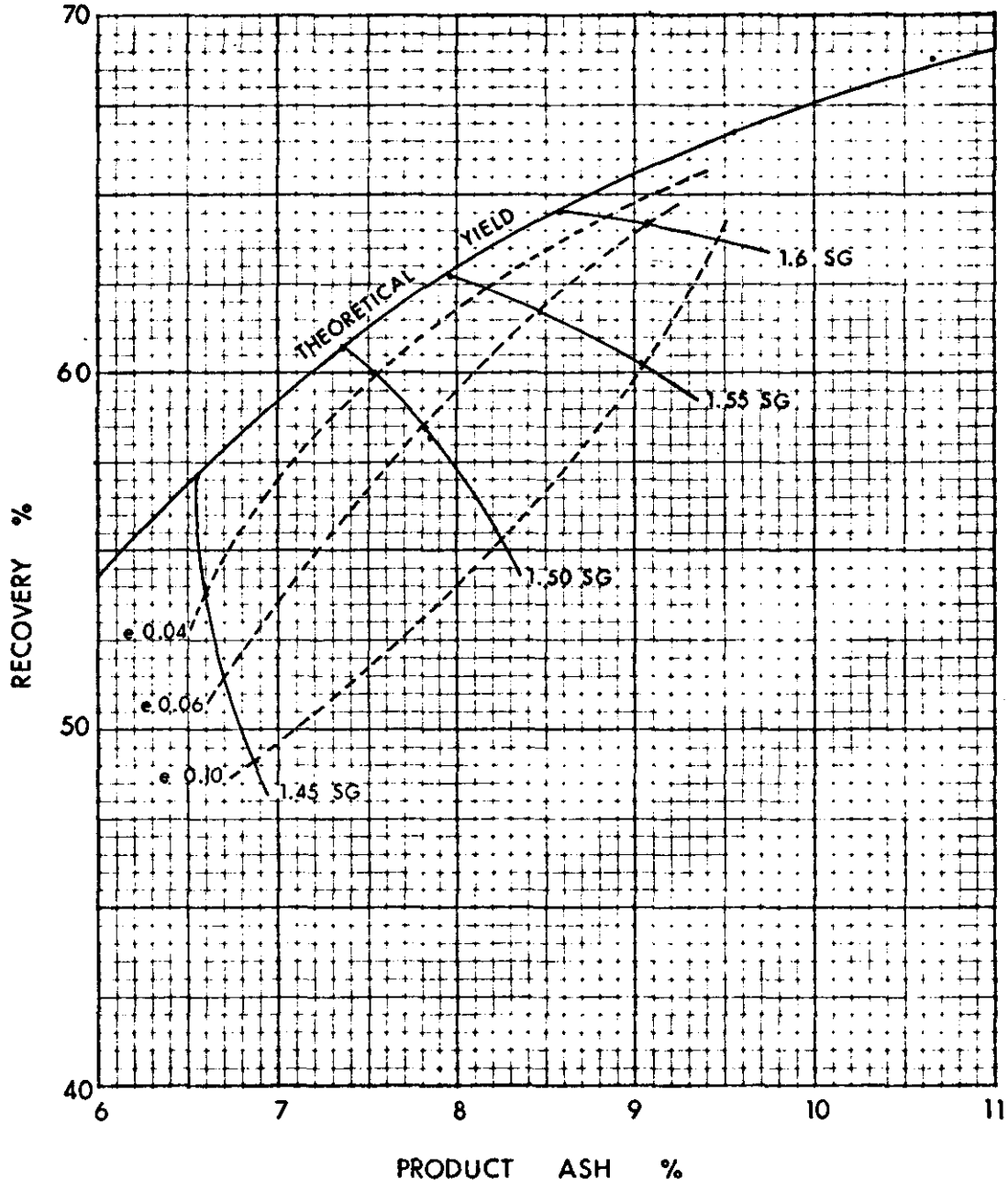
ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Feb./76

YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'A' 1/2" × 28 MESH



ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Feb./76

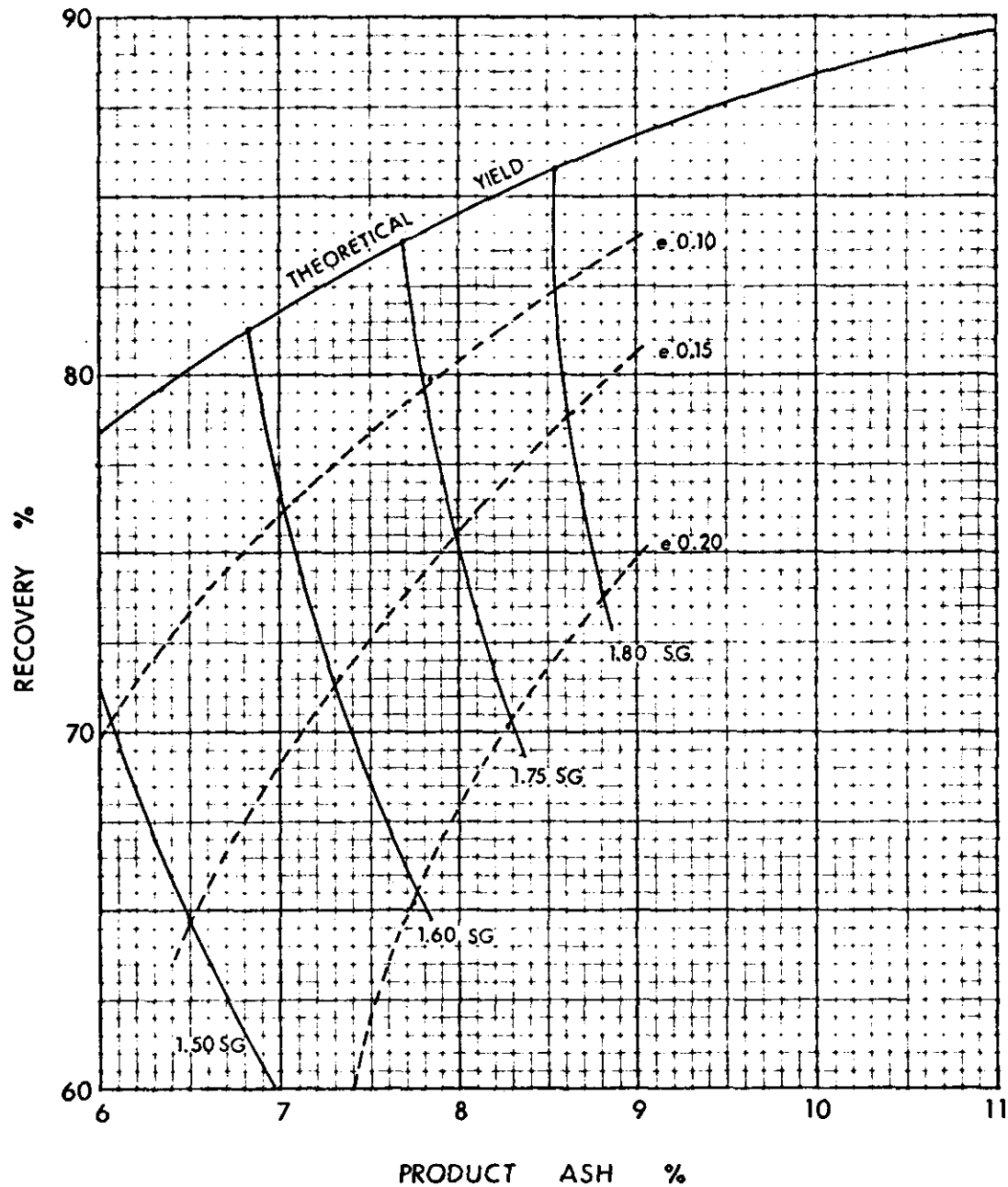
YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'C' 1/2"×28 MESH



ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Feb./76

FIGURE 29

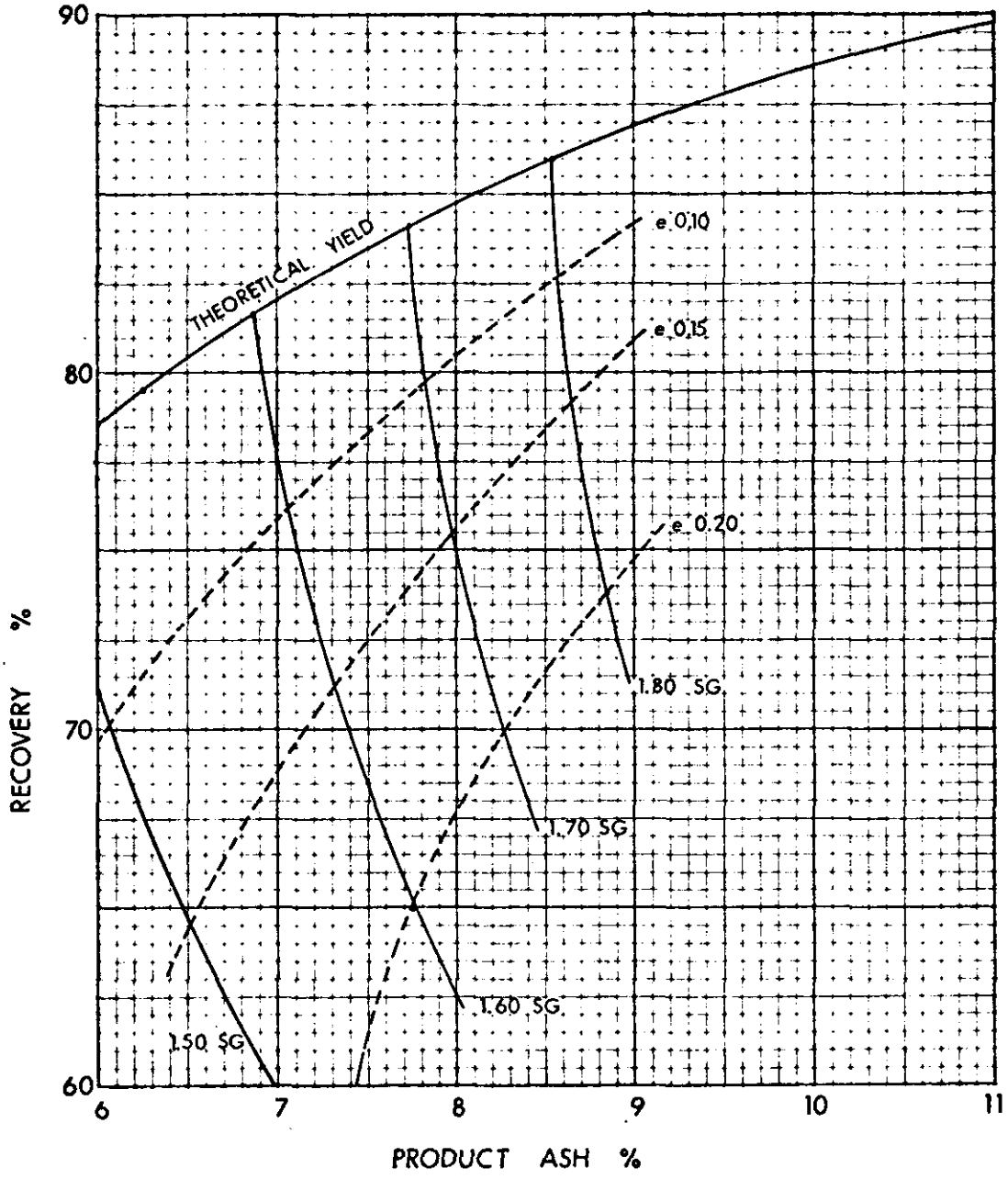
YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'A' 28M × 65 MESH



ELCO MINING LIMITED
Prepared By:
TECHMAN LTD. Feb./76

FIGURE 30

YIELD ASH CURVE
FOR WT. AVERAGE COAL
SCHEME 'C' 28M × 65 MESH



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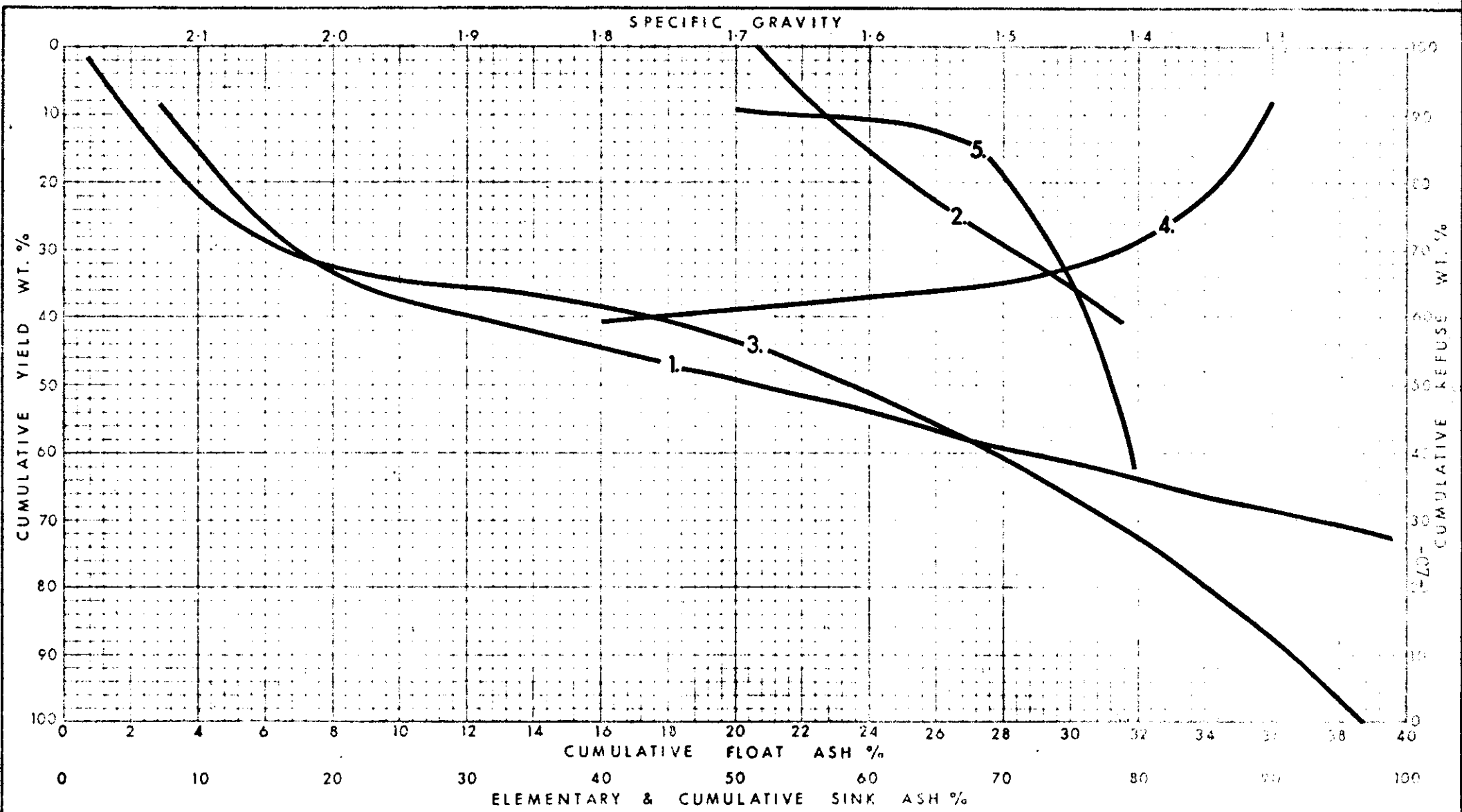


FIGURE 31

LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

AVERAGE WASHABILITY

MINING SCHEME 'A'
2" × 1/2"

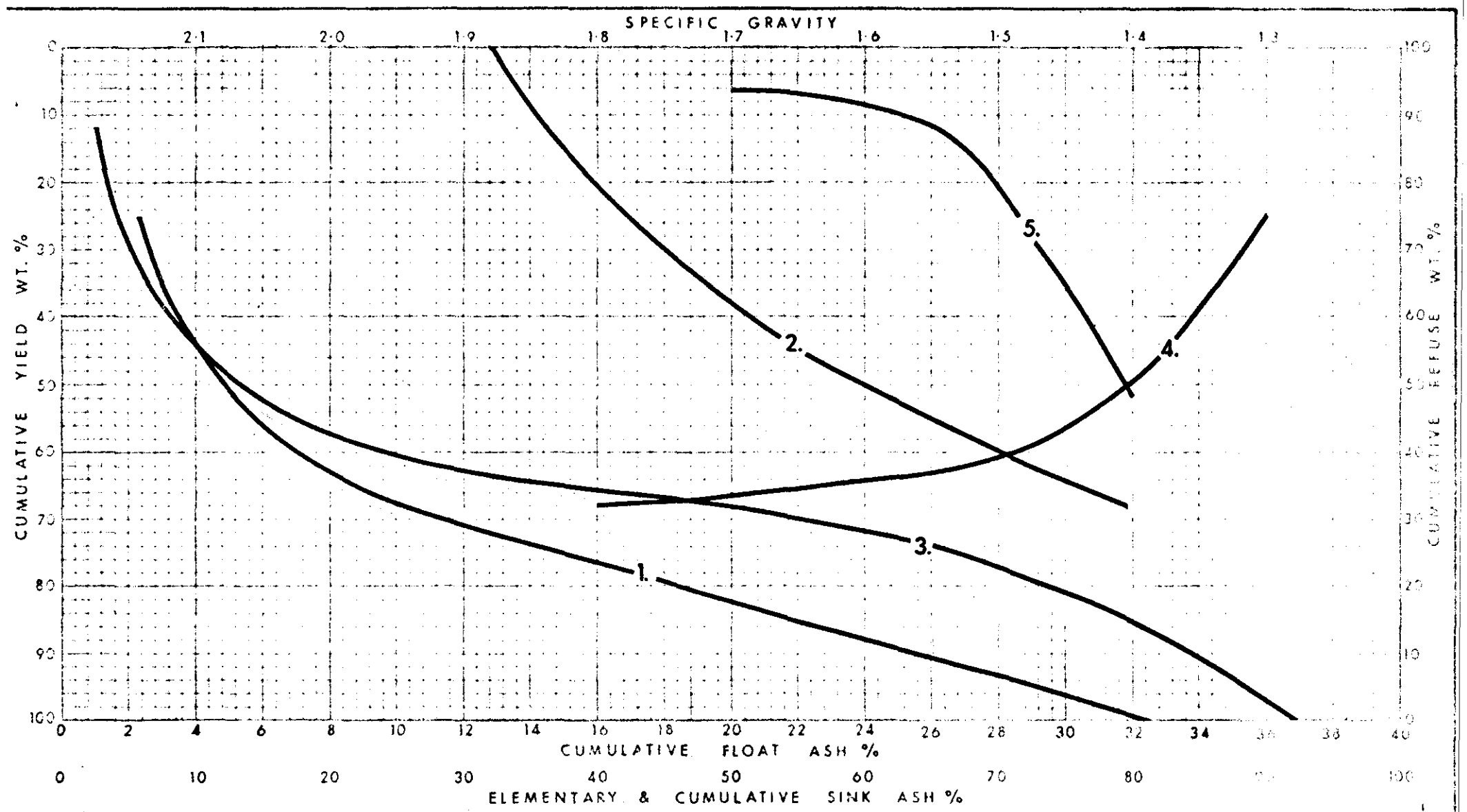


FIGURE 32

LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

TECHM

AVERAGE WASHABILITY

MINING SCHEME 'A'
1/2" × 28 MESH

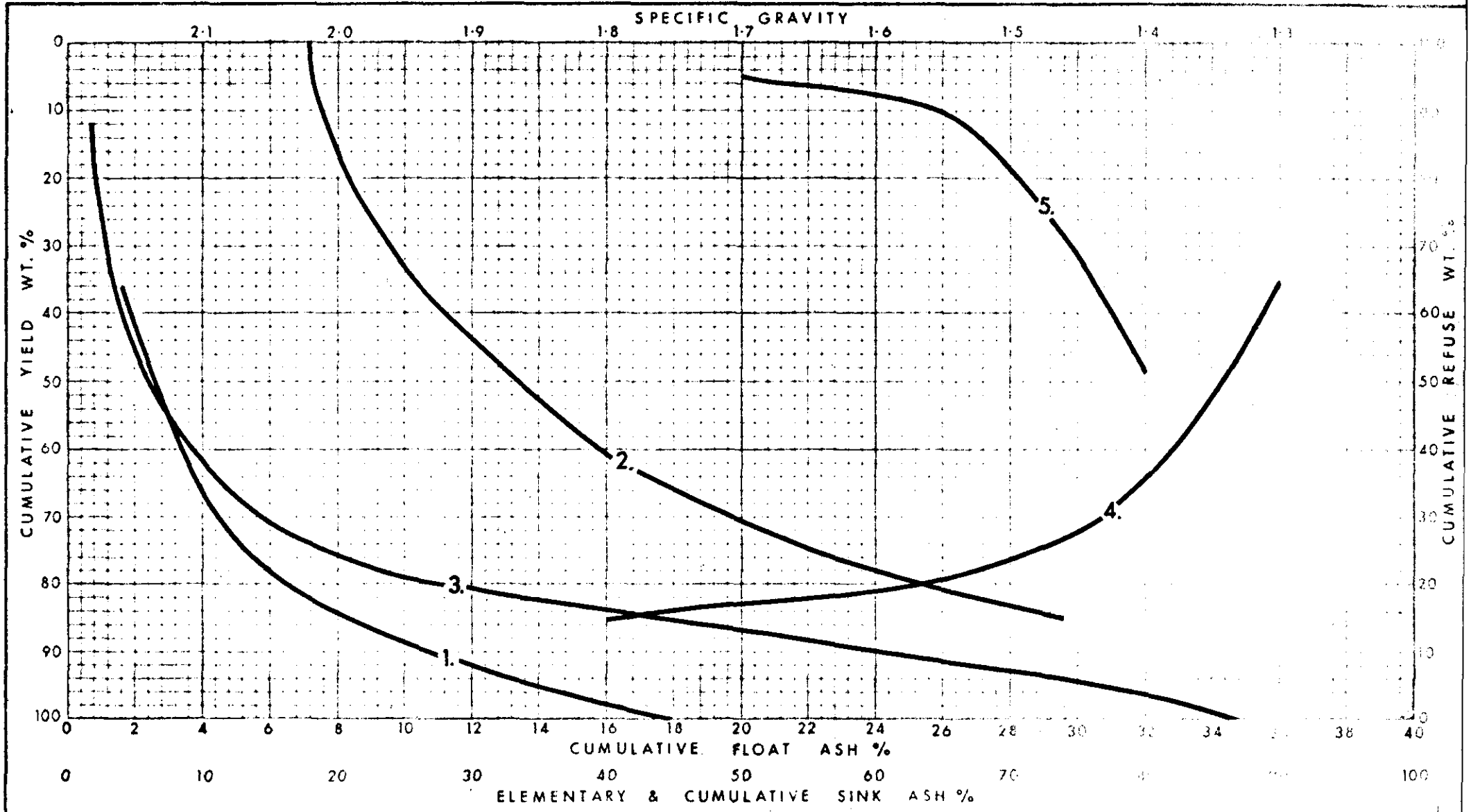


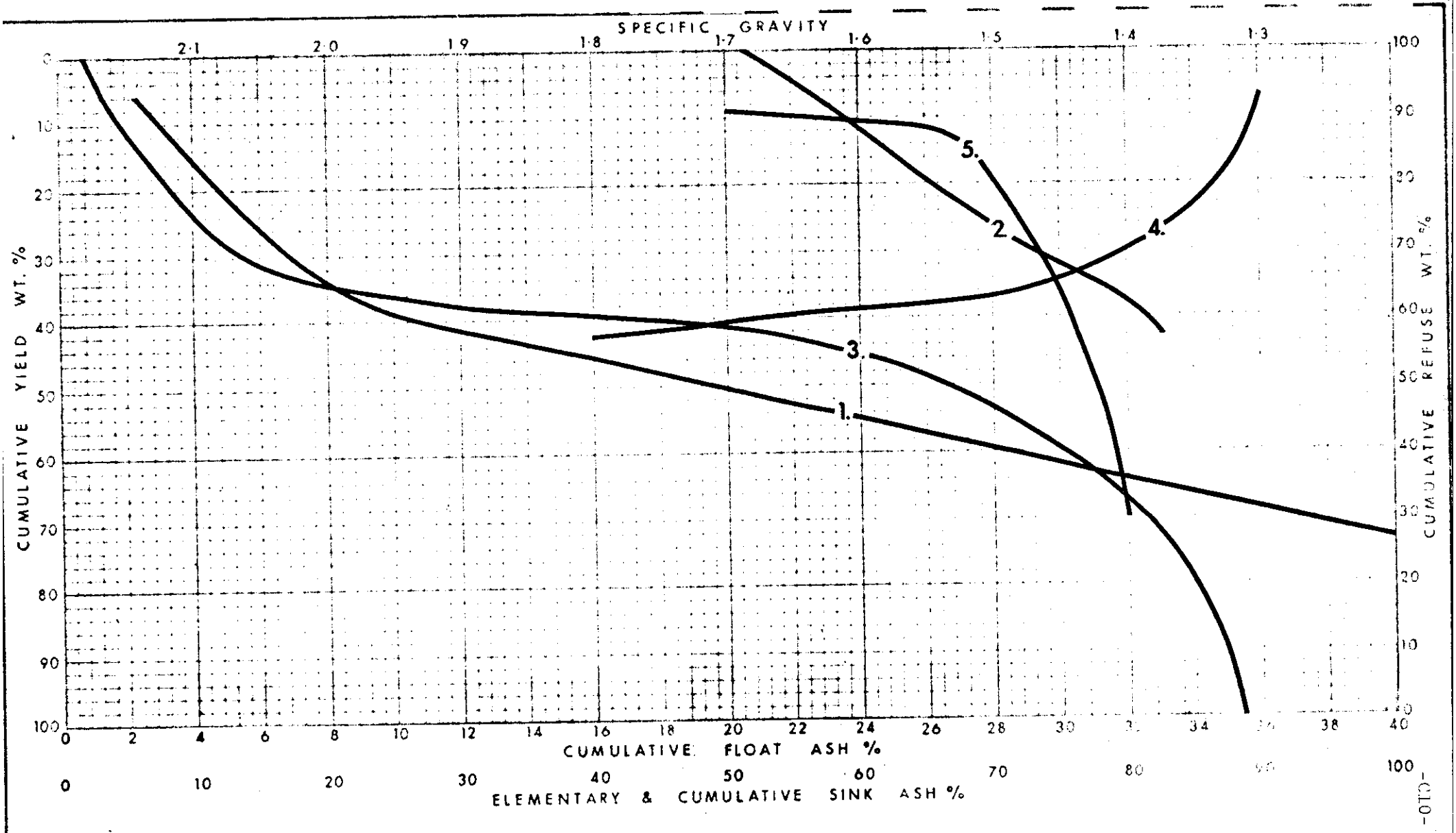
FIGURE 33

LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

AVERAGE WASHABILITY

MINING SCHEME 'A'
28 × 65 MESH



LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

AVERAGE WASHABILITY

MINING SCHEME 'C'
2" × 1/2"

FIGURE 34

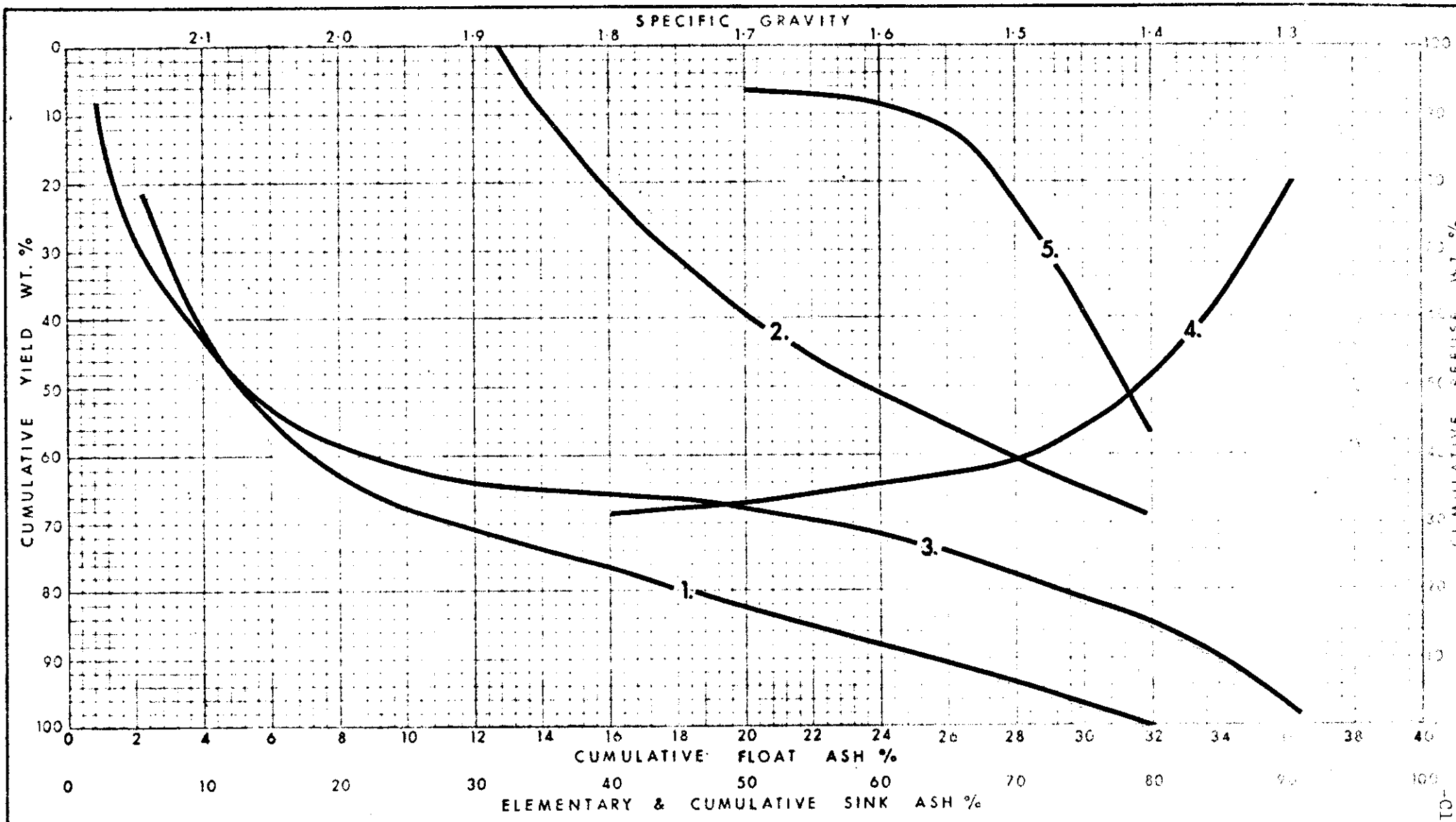


FIGURE 35

LEGEND

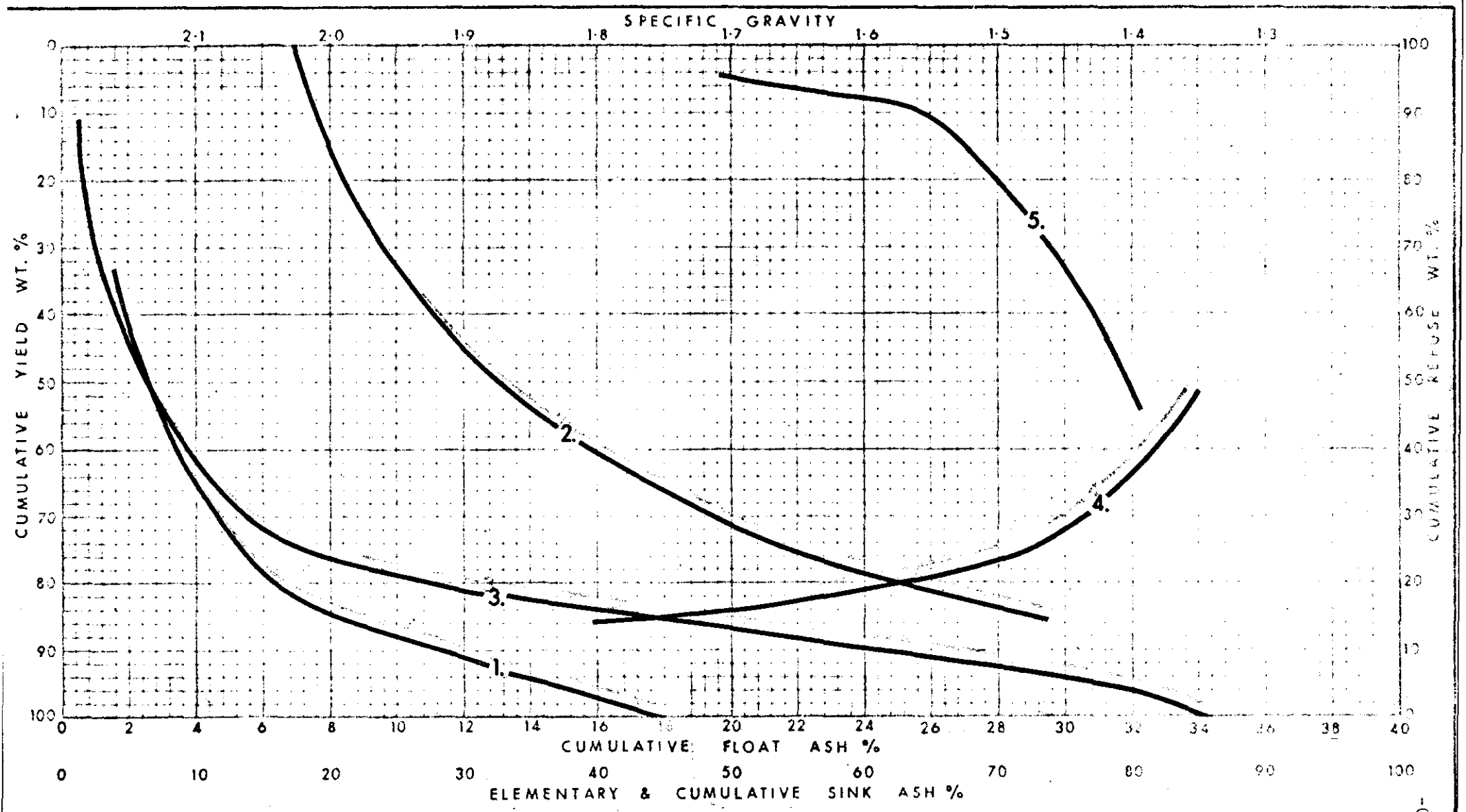
1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

TECHNICAL SERVICES

SCALE | DRAWN BY
DATE | APPROVED

AVERAGE WASHABILITY

MINING SCHEME 'C'
1/2"×28 MESH



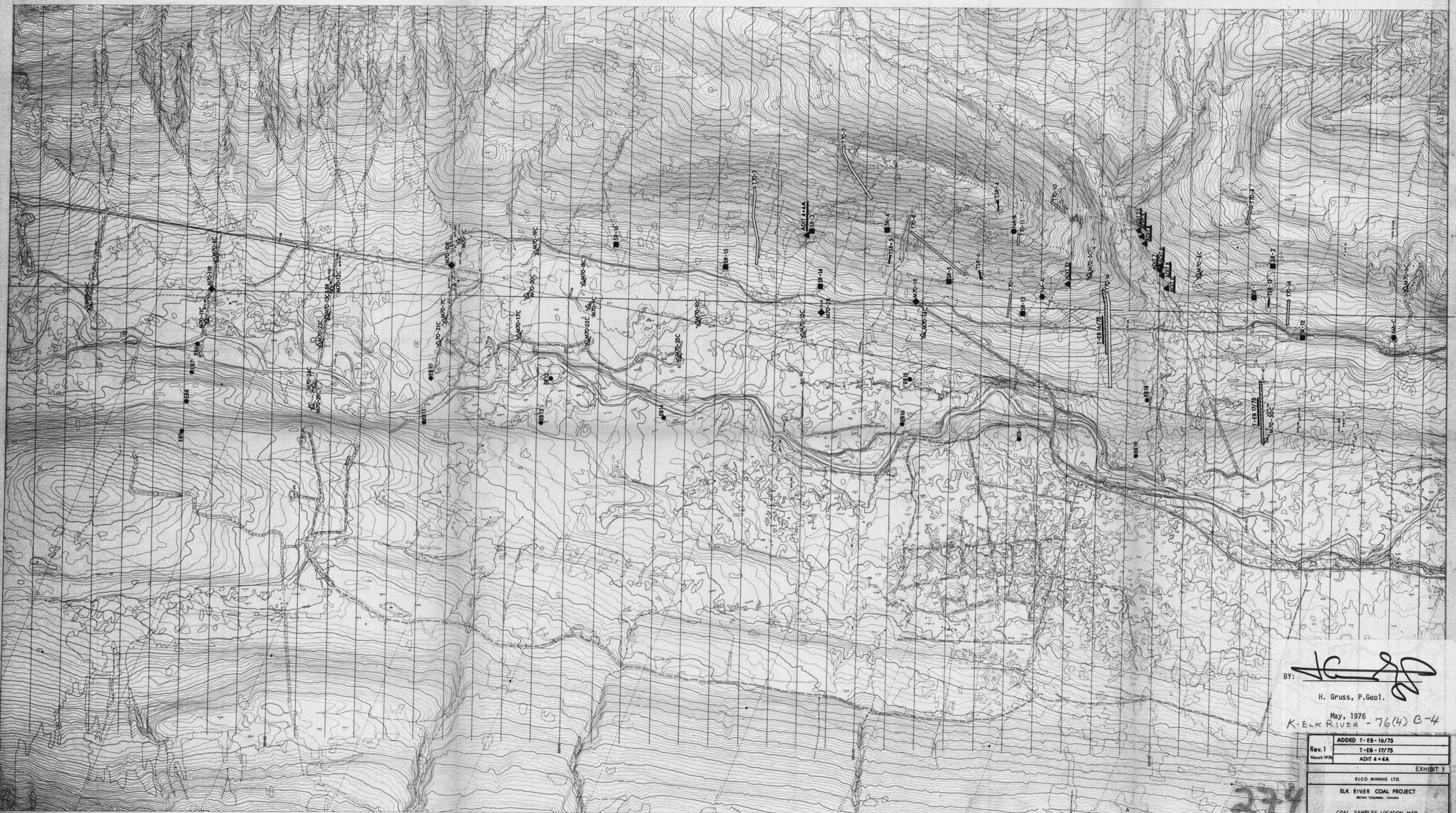
LEGEND

1. CUMULATIVE FLOAT ASH CURVE
2. CUMULATIVE SINK ASH CURVE
3. ELEMENTARY ASH CURVE
4. SPECIFIC GRAVITY CURVE
5. ±0·1 SPECIFIC GRAVITY DISTRIBUTION CURVE

FIGURE 36

AVERAGE WASHABILITY

MINING SCHEME 'C'
28×65 MESH


BULK SAMPLE LEGEND
TSR-SERIES - SCURRY-RAINBOW TRENCH
T-70-SERIES - 1970 TRENCHES
ADIT-SERIES - BULK SAMPLE ADITS (1973)
T-EB-SERIES - ELCO MINING TRENCHES (1975)
DRILLHOLE LEGEND
NA-SERIES - NORTH AMERICAN COAL COMPANY DRILLHOLE
SR-SERIES - SCURRY-RAINBOW DRILLHOLE
M-70-"R" SERIES - ROTARY DRILLHOLE (1970)
M-70-"C" SERIES - CORED DRILLHOLE (1970)
EB-SERIES - EXPLORATION UND BERGBAU DRILLHOLE (1975)
BY:
H. Gruss, P.Geol.
May, 1976
K-ELK RIVER - 76(4) B-4
Rev. 1 March 1976
ADDED T-EB-16/75
T-EB-17/75
ADIT 4+4A
EXHIBIT 1
ELCO MINING LTD.
ELK RIVER COAL PROJECT
BRITISH COLUMBIA, CANADA
COAL SAMPLES LOCATION MAP
FEB. 1976
TECHMAN LTD.
1443-01
TM-137
274

K-Elk River 76(4)B
FROM VOLUME I

COAL ANALYSIS DATA.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 274

4.2 Seam Development and Coal Quality

4.2.1 Seam No. 1

This seam is very thin (1 - 2' = 0.3 - 0.6 m) and enbedded into the basal sandstone.

It does not comprise a significant part of the reserve, so no information has been developed on it.

4.2.2 Seam No. 2

Seam No. 2 is developed across the entire mining area at a distance of approximately 50 - 70' (15 - 20 m) above the basal sandstone.

Its thickness varies between 22.5' (6.75 m) at section 340+00 and 11' (3.3 m) at section 240+00. Another reduction in thickness has been recorded in the southern part of the property where 8' (2.4 m) were measured at section 110+00.

Average seam thickness within the pit area calculates with 14.19' (4.25 m) for Alternative "A" and 14.42 (4.33 m) for Alternative "C" respectively. Partings are included.

Seam No. 2 represents a rather compact seam with only one thin parting developed within the pit area. North of section 360+00 the coal divides into several plies intercalated with partings.

Accompanying rocks mainly represent shales and sandy shales with distinct contacts at the hanging and footwalls.

SEAM NO. 2

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	12	21.2(dab)	15.9	20.4	4.5			4	20.6(dab)	21.4(dab)
% Ash "	12	9.4	7.0	11.8	4.8			4	8.7	9.3
% F.S.I.	12	7	4½	9	4½			4	8	9
	From Cokability Tests:									
% Vol.M. (d.a.b.)		22.1						4	20.7	-
$\overline{R}$ max.		1.50						2	1.46	-
% Vol.Vitr. (d.b.)		22.6						2	22.5	-
F.S.I.		8				Not Tested		4	8	-
% F.C. (d.a.b.)		-						2	78.8	70.5
% Dil. (max.)		26						4	29.5	59
% Contr. (max.)		17						4	26.3	21
G. Value		1.016						4	1.001	1.027
% P (d.b.)		0.014						2	0.012	0.019
% S "		-						4	0.57	0.50
H.G.I.		-						-	-	109
% Yield 1.45		-						2	44.3	-
" 1.50		-						2	54.7	(341)

*) O/C Area "A" only

In earlier testings seam No. 2 proved to produce a low volatile, medium ash coking coal with good to very good coking properties.

This seam was tested again by bulk- and channel-sampling, and results proved to be some above the average recorded in earlier findings. From this point of view results and conclusions drawn from the ELCO bulk sample have to be considered some better than the average coal produced from this seam in a future mine.

The seam ash is very variable and the raw coal ash will be increased by approximately 10% (weight) of dilution originating from partings and the hanging / footwalls. Therefore, the clean coal ash may vary up to 11.5%.

The grindability-index of the seam is high and will create an extensive amount of fines.

Seam No. 2 is expected to comprise the below coal reserves (non-oxidized coal only):

In st:	TECHMAN	ELCO
Coal in Place		A: 15,468,224.6 C: 13,778,152.7
R.C. recoverable:	A: 16,077,496 C: 14,646,000	A: 15,239,721.3 C: 13,594,764.3
C.C. product:		A: 8,397,086.4 C: 7,490,715.1

4.2.3 Seam No. 3

Seam No. 3 is developed across the entire mining area and is

SEAM NO. 3

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	10	21.3(dab)	16.1	22.9	6.8			6	19.9(dab)	20.6(dab)
% Ash "	10	7.6	6.3	8.1	1.8			6	6.2	9.3
% F.S.I.	10	7	6	9	3			6	7½	8
	From Cokability Tests:									
% Vol.M. (d.a.b.)		21.2						6	19.9	-
$\overline{R}$ max.		1.49				Not Tested		3	1.49	-
% Vol.Vitr. (d.b.)		22.8						3	21.6	-
F.S.I.		7						6	7½	-
% F.C. (d.a.b.)								3	80.0	71.6
% Dil. (max.)		-1						6	3	25
% Contr. (max.)		23						6	26	19
G. Value		0.93						6	0.894	1.009
% P (d.b.)		0.100						3	0.051	0.141
% S "		-						6	0.64	0.53
H.G.I.		-						-	-	118
% Yield 1.45		-						3	56.9	-
" 1.50		-						3	58.0	(85.0)

*) O/C Area "A" only

situated approximately 60 - 80' (18 - 24 m) above seam No. 2.

Between actions 180+00 and 280+00 it is represented by only one split of alternating dull and bright coal and minor shaly partings.
Its thickness across the pit area is 7.61 (2.30 m) for Alternative "A" or 7.25 (2.20 m) for Alternative "C" respectively, and the seam maintains this development also south of the pit limits in Big Weary Ridge. In the north, between sections 280+00 and 360+00 seam No. 3 splits into 2 - 4 individual units with two of them showing minable thicknesses (2 ' / 8.9 ' = 0.6 / 2.7 m).

Accompanying rock represents shales and siltstones with hard and distinct contacts to the coal.

In earlier as well as ELCO's testing seam No. 3 proved to produce a low volatile and low ash coking coal with good coking properties. A permanently high content in phosphorous, however, will cause some implications with regards to future blending of this seams' coal during mining and preparation.

Furtheron, No. 3 seam coal shows a high grindability-index and is expected to create an extensive amount of fines.

ELCO's testwork resulted in quality data some above but close to the average to be expected for the entire production from this seam in a future mine.

A dilution in the range of 18 - 19% (weight) has been calculated for the ROM product, however, a consistant low ash content in the washed coal may be expected.

Coal reserves of No. 3 seam have been assessed as below (non-oxidized coal only):

In st:	TECHMAN	ELCO
Coal in Place:		A: 8,077,726.8 C: 7,409,823.1
R.C. recoverable:	A: 6,726,129 C: 6,673,000	A: 7,859,242.2 C: 6,838,594.0
C.C. Product:		A: 6,515,311.8 C: 5,669,194.4

4.2.4 Seam No.4

Seam No. 4 (and 4A) are developed across the entire mining area at a distance of approximately 70' (21 m) above No. 3 seam and 200' (60 m) above the basal sandstone.

This seam appears in two major units of which the lower (seam No. 4A) only is represented in the northern part of the property i.e. north of section 220+00. The upper (seam No. 4) is continuant all through Little and Big Weary Ridge separated from seam No. 4A by a band of silt and mudstone approximately 30' (9.0 m) thick.

Seam No. 4A is subdivided into two splits between sections 270+00 and 310+00 of which, however, generally only one proves to be developed in mineable thickness. This is also relevant for seam No. 4 showing frequently two splits one of them mineable. The average seam thickness for seam 4 is 20.90' (6.3 m) and 6.33' (1.90 m) for seam 4A in case of Alternative "A". For Alternative "C" seam 4 calculates to 21.13' (6.35 m) and seam 4A to 6.54 (1.95 m) respectively.

The rock accompanying these seams represents shales, mudstones and siltstones with relatively distinct and hard contacts to the coal.

SEAM NO. 4 + 4A

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	17	19.5(dab)	15.4	20.3	4.9			8	19.4(dab)	19.6(dab)
% Ash "	17	10.0	5.2	14.3	9.1			8	7.1	8.4
% F.S.I.	17	5½	1	6	5			8	4	4
	From Cokability Tests:									
% Vol.M. (d.a.b.)		20.9						8	19.4	-
$\overline{R}$ max.		1.49						4	1.44	-
% Vol.Vitr. (d.b.)		22.8				Not Tested		4	23.0	-
F.S.I.		5						8	4	-
% F.C. (d.a.b.)		-						4	79.3	73.2
% Dil. (max.)		-26						8	-5	-14
% Contr. (max.)		29						8	21	14
G. Value		0.460						8	0.444	nil
% P (d.b.)		0.041						4	0.013	0.025
% S "		-						8	0.50	0.35
H.G.I.		-						-	-	107
% Yield 1.45		-						4	56.2	-
" 1.50		-						4	59.4	(68.6)

*) O/C Area "A" only

In earlier testings the combined seams No. 4 + 4A proved to produce a low volatile coking coal with a considerable variation in ash content and coking properties over the area, the latter being in the low quality range. This is also applicable with regards to the grindability of the coal creating a varying amount of fines.

Differing between seam No. 4 and 4A the first one would produce an inferior coking coal with a lower ash-level than the second one with a coking coal comparable to No. 3 seam.

The bulk-sample No. 4 + 4A as tested by ELCO proved to be fairly close in its quality to the average coal expected from this seam in a future mine.

In the ROM coal rock dilution of approximately 12% (weight) is to be expected but with no significant effect on the washability.

Coal reserves of No. 4 and 4A seam compute as below (non - oxidized coal only):

In st:	TECHMAN	ELCO
Coal in Place:		A: 25,935,923.0 C: 22,738,655.6
R.C. Recoverable:	A: 29,592,847 C: 27,162,000	A: 25,570,939.5 C: 20,620,827.3
C.C. Product:		A: 19,229,346.5 C: 15,506,862.1

4.2.5 Seam No. 5

This seam situated approximately 130' (40 m) above seam No. 4 generally shows a development too thin for being worked.

Tested by ELCO in their tunnel No. 4 + 4A, a high ash coal with good coking properties is indicated:

Composite ¼" x 65M Floats ca. 1.50 S.G.

Yield	15.3 %
Ash	9.2 %
F.S.I.	8
P	0.10%
Max. Contr.	4 %
Max. Dilat.	69 %
G-Value	1.057

The only part of the property with a workable thickness (2.8 - 3.2' = 0.85 - 0.95 m) of No. 5 seam is between sections 200+00 and 240+00.

Coal reserves (non-oxidized coal only) expected there amount as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 1,079,769.6 C: 1,079,769.6
R.C. recoverable:	A: 2,266,545 C: 2,325,000	A: 1,240,614.2 C: 1,240,614.2
C.C. Product:		A: 189,914.0 C: 189,814.0

SEAM NO. 5

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)								1	12.0	
% Ash "								1	55.4	
% F.S.I.								1	8	
	From Cokability Tests:									
% Vol.M. (d.a.b.)								1	12.0	
$\overline{R}$ max.								-	-	
% Vol.Vitr. (d.b.)								-	-	
F.S.I.						Not Tested		1	31.7	
% F.C. (d.a.b.)								1	69	
% Dil. (max.)										
% Contr. (max.)								1	4	
G. Value								1	1.057	
% P (d.b.)								1	0.1	
% S "								1	0.46	
H.G.I.								-	-	
% Yield 1.45								-	-	
" 1.50								1	15.3	

*) O/C Area "A" only

4.2.6 Seam No. 6

Seam No. 6 is developed across the entire mining area and is situated approximately 60 - 90' (17 - 27 m) above seam No. 4 and 4A or 300 - 400' (90 - 120 m) above the basal sandstone respectively.

The interval between seams No. 6 and No. 4 and 4A is represented mainly by shales in the lower part grading into siltstones towards seam No. 6 .

Over the entire open pit area the seam develops 6.28' (1.90 m) thickness for Alternative "A" as well as for Alternative "C" respectively. Within sections 280+00 and 300+00 seam No. 6 appears reduced below workable dimensions.

At the southern end of the future mining area (sections 200+00 and south) the seam develops 2 - 3 splits being workable individually with coal thicknesses of ca. 4.6' (1.4 m). This situation seams to continue into Big Weary Ridge for some distance until one single split only appears again.

Accompanying rock i.e. siltstones and shales appear to form hard and distinct contacts to the coal.

Due to earlier testings seam No. 6 proves to produce a low volatile coking coal being high in durain and showing a considerable variation in ash. Phosphorous is above average and would be unacceptably high if the coal was used unblended on its own.

SEAM NO. 6

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	6	19.2(dab)	14.9	19.4	4.5			2	18.9(dab)	20.4(dab)
% Ash "	6	9.0	6.6	12.6	6.0			2	8.7	10.4
% F.S.I.	6	3½	1½	8½	7			2	3	3½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		20.8						2	18.9	-
$\overline{R}$ max.		1.48						1	1.44	-
% Vol.Vitr. (d.b.)		23.0				Not Tested		1	23	-
F.S.I.		2½						2	3	-
% F.C. (d.a.b.)		-						1	80.7	71.0
% Dil. (max.)		-20						2	-7	-16
% Contr. (max.)		20						2	20	16
G. Value		nil						1	nil	nil
% P (d.b.)		0.161						1	0.106	0.122
% S "		-						2	0.74	0.64
H.G.I.		-						-	-	88
% Yield 1.45		-						1	69.8	-
" 1.50		-						1	71.3	(44.6)

*) O/C Area "A" only

Generally, low F.S.I. values indicate poor and inferior coking properties of this seam's coal which, however, would serve well as blending coal when mixed with the better seams of the sequence.

The bulk sample of seam No. 6 as tested by ELCO proved to be close to the average quality of this seam established earlier.

In the ROM coal a rock dilution of approximately 32 % (weight) is to be expected. Due to the distinct coal / rock contacts this would not affect the washability of this seam's coal.

Coal reserves of No. 6 seam (non - oxidized coal only) compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 5,119,990.0 C: 4,892,937.6
R.C. recoverable:	A: 6,115,897 C: 6,331,000	A: 4,940,267.1 C: 3,865,403.8
C.C. Product:		A: 3,300,098.4 C: 2,582,093.1

4.2.7 Seam No. 7

This seam generally is developed as one split of moderate thickness averaging with 5.35' (1.60 m) for alternatives "A" and "C", respectively. It is represented all over the mining area and extends to the south through Big Weary Ridge.

Due to its low thickness, however, the seam does not prove workable in certain areas (sections 210+00, 320+00, 360+00)

Seam No. 7 is situated approximately 30' (9 m) above seam No. 6 and 400' (120 m) above the basal sandstone. Mudstones and shales cover the interval between seam No. 6 and 7, and the seam is accompanied by the same types of rock at its roof and floor. It also shows shaly partings of minor thickness. During mining this rock will create a considerable amount of dilution. Being near gravity material it will have its affects on the washability of the coal.

Earlier testings show that seam No. 7 would produce a low volatile coking coal with a considerably high ash content and poor coking properties. The bulk samples as extracted and tested by ELCO showed coking properties some better than the average established so far and expected from lab testing of channel samples. This indicates that the coal cleans better than anticipated.

The rock dilution expected for ROM coal is supposed to be in the scale of 15% (weight).

SEAM NO. 7

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	9	20.8(dab)	16.8	21.5	4.7			4	20.0(dab)	20.9(dab)
% Ash "	9	10.8	5.7	11.3	5.6			4	8.2	10.8
% F.S.I.	9	4	1½	5½	4			4	4	6
	From Cokability Tests:									
% Vol.M. (d.a.b.)		21.2				Not Tested		4	20.0	-
$\bar{R}$ max.		1.46						2	1.44	-
% Vol.Vitr. (d.b.)		23.2						2	22	-
F.S.I.		5½						4	4	-
% F.C. (d.a.b.)		-						2	79.3	69.0
% Dil. (max.)		-23						2	-13	-19
% Contr. (max.)		23						4	10	19
G. Value		nil						4	nil	nil
% P (d.b.)		0.045						2	0.048	0.047
% S "		-						4	0.75	0.56
H.G.I.		-						-	-	106
% Yield 1.45		-						2	32.0	-
" 1.50		-						2	38.0	32.0

*) O/C Area "A" only

Coal reserves of No. 7 seam (non oxidized coal only) compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 4,133,439.7
		C: 4,060,088.6
R.C. recoverable:	A: 4,226,663	A: 4,005,435.5
	C: 4,325,000	C: 3,938,148.3
C.C. Product:		A: 2,106,859.1
		C: 2,071,466.0

4.2.8 Seam No. 8 and 8A

This seam is developed constantly through the entire property i.e. from its southern end at Big Weary Ridge to the northern end of the anticipated mining area (northern Little Weary Ridge). One of its characteristics is the distinct splitting of the seam into two members with the lower one called "No. 8A" frequently.

The thicknesses average for seam 8 and 8A with 12.82' (3.85 m) and 9.50' (2.85 m)for alternative "A" and 12.72' (3.80 m) and 8.80' (2.65 m) for alternative "C" respectively. Both the splits are separated by 4' (1.22 m) to 35' (10.67 m) of siltstones and shales, the latter ones also forming minor partings within the coal. Shales and mudstones representing the hanging and footwall rocks of the seams show distinct contacts to the coal.

This type of rocks also covers the interval to seam No. 7 approximately 50' (15 m) thick. The distance of No. 8A seam to the basal sandstone is approximately 450' (137 m).

SEAM NO. 8 + 8A

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	23	20.5(dab)	15.4	20.9	5.5			4	20.45(dab)	20.5(dab)
% Ash "	23	6.7	5.7	11.9	6.2			4	6.4	9.3
% F.S.I.	23	6	1	8	7			4	6	6½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		21.7						4	20.45	-
$\bar{R}$ max.		1.45				Not Tested		2	1.45	-
% Vol.Vitr. (d.b.)		23.3						2	23	-
F.S.I.		5½						4	6	-
% F.C. (d.a.b.)		-						2	78.8	71.8
% Dil. (max.)		-23						4	-18	-16
% Contr. (max.)		23						4	26	21
G. Value		nil						4	0.533	0.671
% P (d.b.)		0.045						2	0.047	0.064
% S "		-						4	0.60	0.40
H.G.I.		-						-	-	93
% Yield 1.45		-						2	55.1	-
" 1.50		-						2	59.4	56.4

*) O/C Area "A" only

Due to earlier testings seams No. 8 and 8A prove to produce a low volatile coking coal with a generally low ash level and moderate coking properties. Channel samples as tested by ELCO met the average established in earlier testings. the bulksamples, however, resulted in a higher ash content than the channelsamples. This is considered an effect caused by the high amount of dilution included into this sample, and the washing characteristics of the pilot plant different to the treatment of channel samples.

With an actual dilution of approximately 15% (weight) expected in a future mine the ash content of the washed coal would be close to the calculated average across the entire mining area.

The coal reserves (non oxidized coal only) for seam No. 8 and 8A compute as below:

In st:	TECHMAN	ELCO
Coal in Place		A: 15,695,781.6
		C: 14,291,500.5
R.C. recoverable:	A: 17,493,792	A: 15,352,215.5
	C: 15,987,000	C: 14,040,904.6
C.C. Product		A: 10,178,515.9
		C: 9,309,119.8

Due to earlier testings seams No. 8 and 8A prove to produce a low volatile coking coal with a generally low ash level and moderate coking properties. Channel samples as tested by ELCO met the average established in earlier testings, the bulksamples, however, resulted in a higher ash content than the channelsamples. This is considered an effect caused by the high amount of dilution included into this sample, and the washing characteristics of the pilot plant different to the treatment of channel samples.

With an actual dilution of approximately 15% (weight) expected in a future mine the ash content of the washed coal would be close to the calculated average across the entire mining area.

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In st:	TECHMAN	ELCO
Coal in Place		A: 15,695,781.6
		C: 14,291,500.5
R.C. recoverable:	A: 17,493,792	A: 15,352,215.5
	C: 15,987,000	C: 14,040,904.6
C.C. Product		A: 10,178,515.9
		C: 9,309,119.8

4.2.9 Seam No. 9

Seam No. 9 is developed across the entire property. Generally it shows one compact coal seam averaging with 16.14' (4.85 m) in alternative "A" and 16.25' (4.90 m) in alternative "C" in thickness, intercalated with several shaly partings of minor thickness. Often, however, this seam develops one or two additional splits of workable thickness as on sections 220+00 and 280+00 respectively.

The approximately 100' (30 m) interval between seams No. 8 and 9 represents mudstones and shales, as well as the hanging and footwalls of seam No. 9 and its partings. The distance from this seam to the basal sandstone varies between 640' and 800' (200 - 240 m).

Earlier testing proved seam No. 9 to produce a low volatile coking coal of a medium grade ash content and poor coking properties. ELCO's channel samples were very close to the average calculated for the entire mining area, and the bulk sample extracted may be considered representative for the coal produced from this seam in future.

The coal washed from ELCO's bulk sample, however, proved to be slightly higher in ash. This may be contributed to the hard coal of this seam high in durain, and the indistinct coal/rock contacts creating a higher percentage of dilution than calculated with 8.5% (weight) approximately in a future ROM coal. Also in this case the different treatment of channel and bulk samples has to be considered.

SEAM NO. 9

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	21	20.9(dab)	16.9	23.6	6.7			4	20.5(dab)	21.3(dab)
% Ash "	21	6.9	5.2	9.5	4.3			4	6.5	8.6
% F.S.I.	21	4½	1½	9	7½				4½	6
	From Cokability Tests:									
% Vol.M. (d.a.b.)		21.6						4	20.5	-
$\overline{R}$ max.		1.42				Not Tested		2	1.41	-
% Vol.Vitr. (d.b.)		23.7						2	23	-
F.S.I.		4½						4	4½	-
% F.C. (d.a.b.)		-						2	78.7	71.5
% Dil. (max.)		-28						4	-14	-18
% Contr. (max.)		28						4	25	23
G. Value		nil						4	0.356	0.694
% P (d.b.)		0.038						2	0.021	0.029
% S "		-						4	0.49	0.38
H.G.I.		-						-	-	84
% Yield 1.45		-						2	63.7	-
" 1.50		-						2	69.1	61.7

*) O/C Area "A" only

The coal reserves for seam No. 9 compute as below (non oxidized coal only):

In st:	TECHMAN	ELCO
Coal in Place:		A: 11,750,968.4 C: 10,574,097.1
R.C. recoverable:	A: 12,594,590 C: 11,793,000	A: 11,597,936.1 C: 10,433,314.5
C.C. Product:		A: 8,547,679.0 C: 7,689,352.8

4.2.10 Seam No. 10

Seam No. 10 represents one of the thicker and important seams within the coal measures. It is developed all over the property from its southern to northern end. North of section 240+00 this seam appears fairly compact with only one important parting either in its upper or lower part. South of section 240+00 seam No. 10 splits up into 2 - 3 individual units separated by shales and siltstones. This situation appears to continue to the south covering the entire Big Weary Ridge.

The average true thickness of seam No. 10 over the entire open pit area is 29.03' (8.80 m) for alternative "A" and 29.94' (9.0 m) for alternative "C" respectively. The interval between seams No. 9 and 10 is approximately 100 - 150' (30 - 45 m) thick and consists of a sequence of sandstone, siltstones and shales. Relatively hard siltstones and shales from the immediate contact to the coal. The interval between No. 10 seam and the basal sandstone measures with 700 - 1000' (210 - 300 m).

Earlier testings indicated that seam No. 10 would produce a low volatile coking coal with a relatively low ash level on the average. Coking properties were regarded to vary substantially and to be rather poor on the average.

SEAM NO. 10

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	17	21.8(dab)	18.0	23.8	5.8			4	19.8(dab)	23.2(dab)
% Ash "	17	6.8	4.1	9.7	5.6			4	6.0	9.3
% F.S.I.	17	5½	1½	8½	7				7.0	7½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		23.4						4	19.8	-
$\overline{R}$ max.		1.32				Not Tested		2	1.32	-
% Vol.Vitr. (d.b.)		26.0						2	23	-
F.S.I.		7½						4	7.0	-
% F.C. (d.a.b.)		-						2	77.5	69.3
% Dil. (max.)		-24						4	-7	-16
% Contr. (max.)		26						4	26	20
G. Value		0.361						4	0.885	0.630
% P (d.b.)		0.022						2	0.031	0.025
% S "		-						4	0.48	0.45
H.G.I.		-						-	-	82
% Yield 1.45		-						2	65.5	-
" 1.50		-						2	67.5	64.6

*) O/C Area "A" only

Channel- as well as bulk samples taken and tested by ELCO proved better in quality than the average recorded and calculated so far for this seam across the entire mining area as well as in earlier bulk testings. ELCO's results indicating good coking properties, therefore, may not be considered quite representative for the entire coal volume mined from seam No. 10 in future.

The washability of seam No. 10 is regarded fairly good and a 9% ash product may be expected consistently. From the physical appearance in the field a higher amount of fines seems to be expected than the grindability of 81 would indicate.

The dilution in the ROM product is expected to run with approximately 8% (weight) as an overall average for this seam.

Coal reserves (non oxidized coal only) of seam No. 10 compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 18,739,478.3 C: 16,548,821.8
R.C. recoverable:	A: 18,614,809 C: 17,286,000	A: 18,557,862.0 C: 16,386,503.1
C.C. Product:		A: 14,456,574.5 C: 12,765,085.9

4.2.11 Seam No. 11

Seam No. 11 is developed only in the northern part of the future mining area, i.e. north of section 260+00.

There it forms 2 - 3 individual splits with one or even two of them in minable dimensions. The seam thickness averages with 17.78'(5.35 m) for alternative "A" and 17.30' (5.20 m)

for alternative "C", and intercalated partings are shales and siltstones.

Seam No. 11 is situated approximately 60' (18 m) above seam No. 10 and approximately 800' (240 m) above the basal sandstone.

Earlier testings show that seam No. 11 would produce a low to medium volatile coking coal with a medium to high ash level and good coking properties.

Due to the relatively low reserve figures for this seam and its development restricted to the northernmost part of the property this coal was not extracted and tested at a bulk sample scale neither at an earlier stage nor by ELCO.

The coal quality is expected to be close to that of seam No. 12, and in composite samples No. 11 seam coal was represented by the applicable amount of No. 12 seam coal.

Dilution of this seam is expected to run as high as 18% (weight) in the ROM product due to shaly partings and hanging/footwall rocks to be included into mining.

Coal reserves (non oxidized coal only) for No. 11 seam compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 4,475,539.7 C: 2,483,371.5
R.C. recoverable:	A: 4,782,052 C: 4,050,000	A: 4,398,950.2 C: 2,438,419.8
C.C. Product:		A: 2,331,443.6 C: 1,280,170.4

SEAM NO. 11

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	11	22.8(dab)	18.5	22.2	3.7					
% Ash "	11		6.2	10.3	4.1					
% F.S.I.	11		6	8½	2½					
	From Cokability Tests:									
% Vol.M. (d.a.b.)										
$\overline{R}$ max.										
% Vol.Vitr. (d.b.)										
F.S.I.										
% F.C. (d.a.b.)		UNTESTED				Not Tested				
% Dil. (max.)										
% Contr. (max.)										
G. Value										
% P (d.b.)										
% S "										
H.G.I.										
% Yield 1.45										
" 1.50										

*) O/C Area "A" only

4.2.12 Seam No. 12

This seam could be traced all over the property, however, two areas of different development have been recorded so far. North of section 200+00 seam No. 12 forms a rather compact seam subdivided by narrow shale partings into 2 - 3 individual units with an average combined coal thickness of 20.09' (6.03 m) for alternative "A" and 19.79' (5.95 m) for alternative "C" respectively.

South of section 200+00 the seam develops two splits of minable dimensions separated by shales of increasing thickness, and in southern Big Weary Ridge only the lower one of the No. 12 splits appears to be represented with a coal thickness of approximately 15' (4.5 m).

Seam No. 12 lies ca. 800' (240 m) above the basal sandstone and 80' (24 m) above seam No. 10. The interval between No. 10 and 12 is formed by siltstones and shales, with the latter ones making up the partings within the seam, in particular in its bottom section.

Due to earlier testwork seam No. 12 would produce a low to medium volatile coking coal of a considerably varying ash level, however, with excellent coking properties.

The bulk sample extracted and treated by ELCO corresponds very well with the calculated average quality of this seam and, therefore, the bulk sample's quality may be considered representative for the entire coal volume to be mined in a future pit.

Dilution for this seam has been calculated to be in the scale of 18% (weight) in a ROM product mainly due to the several partings.

SEAM NO. 12

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	15	22.8(dab)	17.9	24.7	6.8	2	28.25(dab)	6	20.5(dab)	24.0(dab)
% Ash "	15	9.2	4.2	11.9	7.7	2	6.6	6	6.6	9.8
% F.S.I.	15	9	4½	10	5½	2	8	6	9	9
	From Cokability Tests:									
% Vol.M. (d.a.b.)		26.0				2	28.25	6	20.5	-
$\overline{R}$ max.		1.25				-	-	3	1.32	-
% Vol.Vitr. (d.b.)		27.2				-	-	3	25	-
F.S.I.		9				2	8	6	9	-
% F.C. (d.a.b.)		-				2	71.55	3	75.7	68.2
% Dil. (max.)		71				2	92	6	84	78
% Contr. (max.)		25				2	15	6	24	12
G. Value		1.041				2	1.035	6	1.049	1.057
% P (d.b.)		0.059				-	-	3	0.047	0.047
% S "		-				2	0.70	6	0.72	0.68
H.G.I.		-				2	49	-	-	99
% Yield 1.45		-				-	-	3	42.2	-
" 1.50		-				2	54.35	3	48.2	51.9

*) O/C Area "A" only

Coal reserves (non oxidized coal only) of seam No. 12 compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 12,481,701.8 C: 10,773,688.5
R.C. recoverable:	A: 12,188,226 C: 11,429,000	A: 12,252,209.4 C: 10,570,430.5
C.C. Product:		A: 5,942,321.6 C: 5,126,658.8

4.2.13 Seam No. 13

This seam again is developed all over the property. Similar to seam No. 12 it shows only one minable split north of section 230+00. South of this section, however, the seam subdivides into a multitude of individual units with many of them in minable dimensions (5). Their average coal thickness calculates with 6.01' (1.83 m) for alternative "A" and 5.81' (1.77 m) for alternative "C" there, and this pattern of seam development appears to continue all through Big Weary Ridge.

The interval to underlying seam No. 12 is approximately 100' (30 m) thick and comprises shales and siltstones mainly. These types of rocks also form the partings between the individual members of seam No. 13, and their combined thickness is as high as that of the combined coal. The distance of seam No. 13 to the basal sandstone is approximately 1000' (300 m).

According to earlier testwork seam No. 13 proved to produce a low to medium volatile coking coal with an ash level varying considerably and excellent coking properties. ELCO's bulk sample data coincide with this assessment, and this bulk sample again

SEAM NO. 13

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	12	24.6(dab)	20.0	25.8	5.8	2	27.35(dab)	20	25.9(dab)	25.5(dab)
% Ash "	12	9.2	4.2	11.1	6.9	2	5.7	20	8.5	11.3
% F.S.I.	12	9	2	9½	7½	2	8	20	8½+	8½+
	From Cokability Tests:									
% Vol.M. (d.a.b.)		26.7				2	27.35	20	25.9	-
$\overline{R}$ max.		1.24				-	-	10	1.20	-
% Vol.Vitr. (d.b.)		27.4				-	-	10	27.7	-
F.S.I.		9				2	8+	20	8½+	-
% F.C. (d.a.b.)		-				2	72.5	20	73.4	64.9
% Dil. (max.)		104				2	119	20	115	103
% Contr. (max.)		24				2	24	20	25	23
G. Value		1.051				2	1.047	20	1.052	1.051
% P (d.b.)		0.066				-	-	10	0.059	0.057
% S "		-				2	1.02	20	1.18	0.96
H.G.I.		-				2	91	-	-	107
% Yield 1.45		-				-	-	10	28.3	-
" 1.50		-				2	49.7	10	32.7	19.7

*) O/C Area "A" only

may be considered representative for the entire coal volume produced from this seam in a future mine. This sample also takes into account the high dilution to be expected due to the several partings. Dilution has been calculated with approximately 26% (weight) for seam No. 13.

Coal reserves (non oxidized coal only) for seam No. 13 compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 12,223,974.2 C: 11,310,155.7
R.C. recoverable:	A: 14,011,081 C: 13,196,000	A: 11,857,885.2 C: 10,988,521.9
C.C. Product:		A: 2,917,039.8 C: 2,703,176.4

4.2.14 Seam No. 14

As seams No. 12 and 13 also seam No. 14 represents a sequence of several coal splits intercalated with partings of shale and mudstones. Up to 5 splits are developed in minable thickness locally with an average coal thickness of 6.02' (1.83 m) for alternative "A" and 5.76' (1.76 m) for alternative "C" respectively.

No. 14 seam lies approximately 60' above seam No. 13 the interval comprising shales and mudstones mainly. The thickness down to the basal sandstone is ca. 1,100' (335 m).

Earlier testings show that seam No. 14 would produce a medium volatile coking coal with a fairly high ash content and good to excellent coking properties. Channel- and bulk-samples tested by ELCO coincide in their results with the earlier data, and ELCO's bulk-sample may be considered representative for the entire coal volume mined from this seam in a future pit.

SEAM NO. 14

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	8	25.6(dab)	22.0	26.0	4.0	9	28.4(dab)	12	27.9(dab)	27.2(dab)
% Ash "	8	9.2	4.4	9.9	5.5	9	6.4	12	6.0	7.9
% F.S.I.	9	9	5½	9	3½	13	8½	12	9	8½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		29.3				9	28.4	12	27.9	-
$\overline{R}$ max.		1.17				-	-	6	1.17	-
% Vol.Vitr. (d.b.)		28.8				-	-	6	28.3	-
F.S.I.		8½				13	8½	12	9	-
% F.C. (d.a.b.)		-				13	57.2	12	71.6	64.9
% Dil. (max.)		186				13	210	12	199	103
% Contr. (max.)		27				13	22	12	26	23
G. Value		1.075				13	1.065	12	1.088	1.064
% P (d.b.)		0.056				-	-	6	0.051	0.051
% S "		-				9	0.89	12	0.92	0.84
H.G.I.		-				9	88	-	-	107
% Yield 1.45		-				-	-	6	53.2	-
" 1.50		-				13	57.2	6	56.6	44.3

*) O/C Area "A" only

The higher ash content in the ELCO bulk-sample results from the high proportion of dilution which is expected to run at a rate of approximately 27% (weight) in a future ROM product. Also the difference between treatment of bulk- and channel-samples explains the higher ash level in the bulk-sample.

Coal reserves (non oxidized coal only) for seam No. 14 compute as below:

In st:	TECHMAN	ELCO
Coal in Place		A: 8,382,580.2 C: 5,871.259.9
R.C. recoverable:	A: 12,150,311 C: 8,260,000	A: 8,042,383.1 C: 5,687,334.0
C.C. Product		A: 3,409,970.4 C: 2,411,429.6

4.2.15 Seam No. 15

Seam No. 15 is developed all over the property, and its subdivision into several individual splits is one of the characteristics of this seam. Between sections 200+00 and 220+00 only one split of minable thickness is predominant, however, to the north as well as to the south up to 4 minable plies develop over a stratigraphic thickness of approximately 50' (15 m).

Their average thickness for alternative "A" is 9.01' (2.75 m) and for alternative "C" 8.09' (2.47 m). The interval between seams No. 14 and 15 is approximately 65' (20 m) thick and consist of shales, mudstones and mainly siltstones. Partings within the seam generally are shales. The interval between seam No. 15 and the basal sandstone measures with 1,300' (400 m).

SEAM NO. 15

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	7	26.5(dab)	22.6	25.8	3.2	13	28.4(dab)	4	27.9(dab)	27.2(dab)
% Ash "	7	8.1	4.5	8.8	4.3	13	6.8	4	6.7	7.9
% F.S.I.	7	9	7½	9	1½	13	8½	4	8	8½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		29.3				13	28.4	4	27.9	
$\overline{R}$ max.		1.17				-	-	2	1.14	
% Vol.Vitr. (d.b.)		28.8				-	-	2	29	
F.S.I.		8				13	8½	4	8	
% F.C. (d.a.b.)		-				13	71.7	2	71.4	64.9
% Dil. (max.)		76				13	179	4	83	103
% Contr. (max.)		26				13	23	4	28	23
G. Value		1.041				13	1.067	4	1.043	1.052
% P (d.b.)		0.061				-	-	2	0.050	0.044
% S "		-				13	0.86	4	0.82	0.86
H.G.I.		-				9	74	-	-	107
% Yield 1.45		-				-	-	2	37.2	-
" 1.50		-				13	52.7	2	44.2	44.7

*) O/C Area "A" only

Due to earlier testwork seam No. 15 would produce a medium volatile coking coal of a medium ash level and very good coking properties. Channel-samples analysed by ELCO coincide very well with the average recorded earlier. The higher product ash in the bulk sample again is due to the high amount of dilution expected to run with approximately 25% in the ROM coal, as well as the washing procedures of the bulk sample different to channel-samples. Considering also this factor the ELCO bulk-sample coal may be regarded representative for the average coal produced from this seam in a future mine.

Coal reserves (non oxidized coal only) of seam No. 15 calculate as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 10,951,978.4 C: 6,297,164.4
R.C. recoverable:	A: 10,883,043 C: 5,464,000	A: 10,741,077.4 C: 6,168,917.9
C.C. Product:		A: 4,747,556.2 C: 2,726,661.7

4.2.16 Seam No. 16

Seam No. 16 is developed at least across the northern part of the property i.e. Little Weary Ridge, and at Big Weary Ridge it disappears frequently. In the north seam No. 16 generally comprises 4 - 5 individual splits of 5.09' (1.55 m) for alternative "A" and 4.98' (1.52 m) for alternative "C" average thickness within a stratigraphic interval of approximately 75' (23 m).

SEAM NO. 16

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	3	27.8(dab)	24.9	26.2	1.3	27	29.8(dab)	12	30.6(dab)	29.2(dab)
% Ash "	3		5.2	7.2	2.0	27	6.8	12	7.1	10.7
% F.S.I.	3	8½	8	9	1	27	8½	12	8	8
	From Cokability Tests:									
% Vol.M. (d.a.b.)		31.4				27	29.8	12	30.6	-
$\overline{R}$ max.		1.09				-	-	6	1.01	-
% Vol.Vitr. (d.b.)		30.9				-	-	6	32.3	-
F.S.I.		8½				27	8½	12	8	-
% F.C. (d.a.b.)		-				27	70.0	6	68.8	62.4
% Dil. (max.)		130				27	205	11	118	127
% Contr. (max.)		29				27	23	11	29	25
G. Value		1.061				27	1.074	11	1.057	1.065
% P (d.b.)		0.096				-	-	6	0.087	0.093
% S "		-				27	0.95	12	0.86	0.70
H.G.I.		-				23	81	-	-	87
% Yield 1.45		-				-	-	6	52.2	-
" 1.50		-				27	66.3	6	50.0	53.1

*) O/C Area "A" only

This interval mainly consists of siltstones and shales, the latter ones generally in contact with the coal. This distance to the underlying seam No. 15 measures only 50' (15 m), and to the basal sandstone 1500' (450 m) approximately.

Earlier testwork proved seam No. 16 to produce a medium volatile coking coal of moderate ash level and excellent coking properties. Testing of channel-samples by ELCO arrived to the same assessment, and only the ELCO bulk-sample again resulted in a high product ash due to the same reasons as in other seams.

Dilution is expected to be with 43% (weight) very high, and also the phosphorous content of this seam would require careful blending.

From this point of view ELCO's bulk sample coal may be considered fairly representative for the average coal mined from this seam in a future pit. Fill-in drilling of ELCO, however, indicates that seam No. 16 thickens considerably in spots resulting in a lower raw coal ash and also in a better product.

Coal reserves (non oxidized coal only) of seam No. 16 compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 7,819,251.8 C: 2,326,123.5
R.C. recoverable:	A: 9,329,564 C: 2,381,000	A: 7,549,830.3 C: 2,250,773.7
C.C. Product:		A: 3,571,069.7 C: 1,064,616.0

4.2.17 Seam No. 17

Seam No. 17 lies approximately 30' (9 m) above seam No. 16 only and is developed across the entire property. It is subdivided into up to five individual members, several of them in minable thickness within a stratigraphic interval of 100' (30 m). The average coal thickness of the minable members calculates with 5.91' (1.80 m) for alternative "A" and 5.94' (1.81 m) for alternative "C" respectively.

Shales, siltstones and sandstones form the intervals between the individual coal splits with shales and mudstones as the immediate contacts by the coal.

Due to earlier testwork seam No. 17 would produce a medium volatile coking coal with a low product ash and excessive coking properties.

Results of ELCO's borehole and channel-samples are in agreement with this assessment, and also ELCO's bulk sample may be considered representative for the coal volume and average quality produced from this seam in a future mine.

Dilution is expected to run with 27% (weight) approximately in the ROM coal possibly affecting the washability of this seam adversely and increasing the product ash.

Coal reserves (non oxidized coal only) of seam No. 17 compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 6,454,045.5 C: 1,200,076.6
R.C. recoverable:	A: 9,564,308 C: 1,374,000	A: 6,268,592.6 C: 1,165,255.6
C.C. Product:		A: 4,181,151.3 C: 777,225.5

SEAM NO. 17

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	3	28.4(dab)	26.0	28.0	2.0	23	32.0(dab)	8	31.3(dab)	30.7(dab)
% Ash "	3		2.7	6.1	3.4	23	6.4	8	4.9	7.2
% F.S.I.	3	8½	7½	9	1½	23	8½	8	8	8
	From Cokability Tests:									
% Vol.M. (d.a.b.)		31.3				23	32.0	8	31.3	-
$\bar{R}$ max.		1.08				-	-	4	0.98	-
% Vol.Vitr. (d.b.)		31.0				-	-	4	33.3	-
F.S.I.		8½				-	8½	8	8	-
% F.C. (d.a.b.)		-				23	67.7	-	-	63.7
% Dil. (max.)		140				23	211	7	133	145
% Contr. (max.)		27				23	25	7	32	13
G. Value		1.067				23	1.072	7	1.060	1.085
% P (d.b.)		0.046				-	-	4	0.053	0.069
% S "		-				23	0.95	7	0.83	0.72
H.G.I.		-				20	83	-	-	76
% Yield 1.45		-				-	-	4	60.9	-
" 1.50		-				23	55.1	4	62.1	54.3

*) O/C Area "A" only

4.2.18 Seam No. 18

This seam is developed across the entire property again. It is situated ca. 100' (30 m) above seam No. 17 and separated from that by mainly siltstones and interbedded shales. The stratigraphic interval between seam No. 18 and the basal sandstone measures with approximately 1700' (520 m).

Over a stratigraphic interval of 50' (15 m) seam No. 18 develops up to five individual coal splits with several of them in minable thickness. The average split thickness for alternative "A" is 7.20' (2.19 m) and 8.10' (2.47 m) for alternative "C".

Due to earlier testwork seam No. 18 produces a medium to high volatile coking coal with a constantly low ash level and excessive coking properties. ELCO's borehole- as well as channel-samples coincide with this assessment. This is also applicable for ELCO's bulk sample disregarding the somewhat higher ash resulting from a different treatment during washing. Therefore, the clean coal produced from ELCO's bulk sample may be considered representative for the product mined and washed from this seam on an average in a future mine.

Dilution is calculated to run with 41% (weight) in a future ROM product on the average caused by the several partings and coal/rock contacts. This rock mainly represents hard mudstones and shales with distinct contacts, and no adverse affects on the washability of the coal are expected.

SEAM NO. 18

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	3	29.9(dab)	26.8	29.1	2.3	18	32.4(dab)	3	32.7(dab)	31.6(dab)
% Ash "	3		4.2	6.1	1.9	18	5.9	4	5.1	7.2
% F.S.I.	3	8½	8	8½	½	19	8	4	8	8½
	From Cokability Tests:									
% Vol.M. (d.a.b.)		35.0				18	32.4	3	32.7	-
$\overline{R}$ max.		1.02				-	-	2	0.93	-
% Vol.Vitr. (d.b.)		32.5				-	-	2	0.35	-
F.S.I.		8½				19	8	4	8	-
% F.C. (d.a.b.)		-				19	63.8	1	67.1	62.1
% Dil. (max.)		200				19	170	3	128	187
% Contr. (max.)		30				19	22	3	28	25
G. Value		1.090				19	1.068	3	1.069	1.067
% P (d.b.)		0.051				-	-	2	0.42	0.044
% S "		-				18	0.88	2	0.77	0.75
H.G.I.		-				-	-	-	-	95
% Yield 1.45		-				-	-	2	57.6	-
" 1.50		-				19	63.8	2	62.0	61.2

*) O/C Area "A" only

Coal reserves (non oxidized coal only) of seam No. 18 have been calculated as below:

In st:		TECHMAN		ELCO
Coal in Place:			A:	5,820,718.8
			C:	252,593.4
R.C. recoverable:	A:	9,568,941	A:	5,591,279.5
	C:	116,000	C:	247,262.7
C.C. Product:			A:	3,824,435.2
			C:	169,127.7

4.2.19 Seam No. 19

Seam No. 19 is situated approximately 80' (24 m) above seam No. 18 separated by an interval of siltstones and shales. The basal sandstone lies approximately 1,800' (550 m) below seam No. 19.

As the foregoing seams also No. 19 is generally subdivided into 4 - 5 individual splits over a stratigraphic interval of 50' (15 m), and separated by partings of silt- and mudstones. At the present it appears that the coal splits in the northern part of the property are better developed than in the south around section 180+00. No data are available for Big Weary Ridge. The average split thickness for alternative "A" is 3.45' (1.05 m). Alternative "C" has no seam No. 19 outcropping in the pit area.

Due to the poor development of this seam within the section tested by ELCO no bulk sample was extracted in the scope of 1975/76 fieldworks. Earlier testwork, however, indicates that seam No. 19 again would produce a medium to high volatile coking coal with a considerable low ash content and very good coking properties. This could be proven also by assaying

SEAM NO. 19

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	2	27.9(dab)	26.0	27.7	1.7	25	34.9(dab)			
% Ash "	2		2.2	3.9	0.9	25	7.5			
% F.S.I.	2	7½	7	8	1	25	8			
	From Cokability Tests:									
% Vol.M. (d.a.b.)		33.8				25	34.9			
$\overline{R}$ max.		1.03				-	-			
% Vol.Vitr. (d.b.)		32.0				-	-			
F.S.I.		8½				25	8			
% F.C. (d.a.b.)		-				25	65.0	NOT TESTED		
% Dil. (max.)		208				25	170			
% Contr. (max.)		27				25	19			
G. Value		1.085				25	1.066			
% P (d.b.)		0.064				-	-			
% S "		-				25	1.05			
H.G.I.		-								
% Yield 1.45		-				25	73			
" 1.50		-				25	59.0			

*) O/C Area "A" only

results obtained from ELCO's borehole-samples. Due to the circumstances and the similarities between No. 18 and 19 seam coals seam No. 19 was represented in composite washing and metallurgical tests by a relevant quantity of No. 18 seam coal.

Due to the several splits and coal/rock contacts a dilution of approximately 33% (weight) is to be expected in the ROM coal produced from this seam in future.

Coal reserves (non oxidized coal only) for No. 19 seam compute as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 2,657,640.2 C:
R.C. recoverable:	A: 2,687,110 C:	A: 2,528,642.4 C:
C.C. Product:		A: 710,548.5 C:

4.2.20 Seam No. 20

Seam No. 20 represents one of the last seams to be considered extractable within No. A mining alternative. It is situated approximately 50' (15 m) above seam No. 19 and 1,900' (580 m) above the basal sandstone. Accompanying rock of this seam again are shales, mud- and siltstones.

The seam appears to develop 3 - 4 individual splits over an interval of approximately 70' (21 m), and generally higher coal thicknesses are indicated for the northern part of the

SEAM NO. 20

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)	1	34.1(dab)	31.8	32.8	1.0	13	36.4(dab)			
% Ash "	1		4.6	4.8	0.2	13	9.4			
% F.S.I.	1	7½	7½	8	½	12	7			
	From Cokability Tests:									
% Vol.M. (d.a.b.)						13	36.4			
$\overline{R}$ max.						-	-			
% Vol.Vitr. (d.b.)						-	-			
F.S.I.						12	7			
% F.C. (d.a.b.)						13	63.4			
% Dil. (max.)		NOT TESTED				13	156		NOT TESTED	
% Contr. (max.)						13	17			
G. Value						13	1.067			
% P (d.b.)						-	-			
% S "						13	0.96			
H.G.I.						13	68			
% Yield 1.45						-	-			
" 1.50						13	53.9			

*) O/C Area "A" only

property rather than the south. The average coal thickness for No. 20 splits is 4.14 (1.26 m) for alternative "A". Alternative "C" has no seam No. 20 outcropping in the open pit area.

Due to earlier and ELCO's testings seam No. 20 will produce a high volatile coking coal again with a relatively low product ash and good coking properties. Due to the development of several splits to be mined, dilution has been calculated to run with 36% (weight) on the average for a future ROM product.

Coal reserves (non oxidized coal only) for seam No. 20 calculate as below:

In st:	TECHMAN	ELCO
Coal in Place:		A: 854,374.7 C:
R.C. recoverable:	A: 2,096,136 C:	A: 503,419.4 C:
C.C. Product:		A: 150,522.4 C:

4.2.21 Mining Plan "A" Average Coal

Analysis data for ELCO's bulk samples as compiled and discussed above are applicable for clean coals received from washing tests performed at a semi-industrial scale in a pilot plant. In the scope of this work each of the seams was treated individually with adjusting plant and washing process in a way that a combined product ash content of 9.5% was aimed for. This target was achieved with variable success in regards to actual ash-content and recovery.

In a future operation ROM coals of the individual seams will have to be blended before washing in order to produce a clean coal of constant quality over the lifetime of the mine. The necessary blending process not only has to consider this fact but also the various coal qualities and volumes to be mined simultaneously on different bench levels. In order to secure this objective a detailed mining plan would have to be established in the feasibility stage of the project.

The wash-plant on the other hand will have to be planned according to this long range average ROM coal in order to produce an optimum clean coal with regards to quality and recovery.

In order to simulate such a long term ROM blend coal and to test its washability at a semi-industrial scale a bulk sample was composed from the individual seams' raw coal at a ratio expected as an average produced in a future open-pit mine over its entire life-time.

Due to the existence of the two alternative mining plans "A" and "C" respectively two composite samples were blended and treated.

Mining plan "A" provides for open-pit mining of seams No's 2 to 20 between sections 180+00 and 370+00 above the valley floor (Little Weary Ridge) and below of that to an average depth of 400' (120 m).

Plan "A" (in thousands):

non oxidized coal only	ccy	st	tonnes
Coal in Place:	146,618	178,874	162,418
Recovered RC:	128,755	157,081	142,630
Dilution:	8,826	17,828	16,188
ROM recovered:	-	174,909	158,817
CC recovered (61.1%)*	-	106,869	99,037

*This recovery results as a calculated average from individual washability tests.

Representative for this coal/rock volume composite "A" sample was blended together considering proportionately ROM products as applicable due to mining-plan "A" for each individual seam:

Mining Plan A:

Sample No.	Seam No.	ROM Product %	Clean Coal Yield * %	Resulting Clean Coal Composite %
RC-1	2	8.8	55.8	8.0
RC-2	3	3.6	85.0	5.0
RC-3	4	15.8	72.6	18.8
RC-4	6	2.9	76.1	3.6
RC-5	7	2.3	56.3	2.1
RC-6	8	8.7	62.3	8.9
RC-7	9	6.9	75.5	8.5
RC-8	10	12.4	73.7	15.0
RC-9	12	6.7	51.4	5.7
RC-11	13	6.8	23.6	2.6
RC-12	14	5.7	44.2	4.1
RC-13	15	5.7	44.5	4.2
RC-14	16	4.3	58.2	4.1
RC-15	17	4.3	65.9	4.6
RC-16	18 & 19	5.1	57.4	4.8
RC-18	Composite "A" Blend	100.0	61.1*	100.0

*) calculated from washability data obtained by Birtley Engineering

Due to expectations composite "A" sample containing a dilution of approximately 20% (weight) produced a low volatile coking coal with a medium ash level and good coking properties.

S E A M N O. COMPOSITE "A"

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)										21.4
% Ash "										8.3
% F.S.I.										7½
	From Cokability Tests:									
% Vol.M. (d.a.b.)										
$\overline{R}$ max.										
% Vol.Vitr. (d.b.)										
F.S.I.										
% F.C. (d.a.b.)										69.8
% Dil. (max.)										20
% Contr. (max.)										16
G. Value										1.007
% P (d.b.)										
% S "										0.65
H.G.I.										97
% Yield 1.45										
" 1.50										52.7

*) O/C Area "A" only

Being puntilious with regards to the representativity of composite "A" sample for plan "A" average quality one has to realize that all the bulk samples' material was extracted more or less along section 190+00. Therefore, a representativity of the bulk-samples' quality data would be given automatically for this particular section but not necessarily for the entire coal volume between sections 180+00 and 370+00. The comparison of bulk samples data and borehole information recorded over the entire area, however, indicates only minor discrepancies. They probably would outweigh each other, and a representativity of bulk and "A" composite samples for the mining plan "A" coal volume may be assumed with sufficient accuracy at the present. Certainty in this respect only can be obtained from additional bulk sampling in other areas and subsequent testing.

4.2.22 Mining Plan "C" Average Coal

Mining Plan "C" represents an alternative concept primarily targeted to the production of a cheaper ROM coal without deteriorating the quality of the washed product coal substantially.

This plan, therefore, eliminates open-pit mining of the upper seams of the sequence charged with an unfavourable overburden ratio and results in a reduction of the minable coal volume.

Mining Plan "C" provides for open-pit mining between sections 180+00 and 335+00 above valley floor (Little Weary Ridge) and 400' (120 m) below of that. Due to the restriction imposed on mining of the higher seams the toe of No. 13 seam on the -400' (-120 m) benchlevel generally was considered the western boundary of the pit.

Those limits result in the below reserve figures (non oxidized coal only):

Plan "C" (in thousands):	cy	st	tonnes
Coal in Place:	111,579	136,126	123,603
R.C. recoverable:	96,418	117,630	106,808
Dilution:	12,846	12,846	11,664
ROM product:	-	130,476	118,472
CC Product (61.7%)*	-	80,503	73,097

Representative for this coal/rock volume composite "C" sample was blended from the individual seam coals considering their proportion in the future overall blend according to mining plan "C".

*This recovery results as a calculated average from individual washability tests.

Mining Plan "C":

Sample No.	Seam No.	ROM Product %	Clean Coal Yield * %	Resulting Clean Coal Composite %
RC-1	2	9.7	55.8	8.8
RC-2	3	4.4	85.0	6.1
RC-3	4	18.1	72.6	21.3
RC-4	6	4.2	76.1	5.2
RC-5	7	2.9	56.3	2.6
RC-6	8	10.6	62.3	10.7
RC-7	9	7.8	75.5	9.5
RC-8	10	14.2	73.7	17.0
RC-9	12	7.6	51.4	6.3
RC-11	13	8.8	23.6	3.4
RC-12	14	5.5	44.2	3.9
RC-13	15	3.6	44.5	2.6
RC-14	16	1.6	58.2	1.5
RC-15	17	1.0	65.9	1.1
RC-19	Blend	100.0	61.7	100.0

*) calculated from washability data obtained by Birtley Engineering.

Due to expectations composite "C" sample containing a dilution of approximately 16% (weight) only produced a somewhat lower volatile coking coal than composite "A", and with a higher ash level. The coking properties proved not as good as composite "A" but still at an acceptable grade.

With regards to the representativity of composite "C" sample to the overall plan "C" coal quality the same remarks and comments are applicable as for composite "A".

S E A M N O. COMPOSITE "C"

CLEAN COAL	Earlier Testings					ELCO Testings *)				
	No. of Samples	Average	Min.	Max.	Range	Borehole S.		Channel S.		Bulk S.
						No. of Samples	Average	No. of Samples	Average	Composite Blend
	From CC Analysis:									
% Vol.M. (d.b.)										19.8
% Ash "										9.5
% F.S.I.										7
	From Cokability Tests:									
% Vol.M. (d.a.b.)										
$\overline{R}$ max.										
% Vol.Vitr. (d.b.)										
F.S.I.										
% F.C. (d.a.b.)										70.3
% Dil. (max.)										-8
% Contr. (max.)										17
G. Value										0.866
% P (d.b.)										0.05
% S "										0.48
H.G.I.										99
% Yield 1.45										-
" 1.50										50.0

*) O/C Area "A" only

4.2.23 Oxidation Checks on Bulk Samples

Trenches:

After a trench was opened and coal outcrops could be properly located a first channel sample was taken across the seam or split excluding any partings. Additional samples were taken with increasing depth of the trench.

Without washing or sink/float treatment this coal underwent F.S.I. testing. The first samples closest to the surface generally proved oxidized, and the trench was deepened until F.S.I. values grew to 8 or higher. Then the bulk sample was extracted.

F.S.I. values of oxidation checks are listed in the below table, and the relevant sampling sites are shown in the drawings for bulk sample locations. (Appendix 3).

Seam 12: FSI Tests Trench Floor: 8½, 8½

Seam 13 +13A: FSI-Tests Trench Floor: 8½, 8½
FSI-Tests Bulk Sample Face Seam 13: 9,9
FSI Tests Bulk Sample Face Seam 13A: 9,9

Seam 13 D: FSI Tests Trench Floor: 3½, 3½
FSI Tests approx. 3' before Bulk Sample Face: 8½, 8½

Seam 13 E: FSI Tests Trench Floor: 2, 2½
FSI Tests on Bulk Sample Face:

1. with Partings: 3, 3½
2. without Partings: 4, 4
3. washed at 1.5 S.G.: 9,9

Seam 13 F: FSI Tests Trench Floor: 8, 7
FSI Tests on Bulk Sample Face: 8, 8½

Seam 13 G:	FSI Tests Trench Floor: 8½, 8½
	FSI Tests Bulk Sample Face: 9, 9
Seam 14:	FSI Tests Trench Floor: 8½, 9
Seam 14 C:	FSI Tests Trench Floor: 2, 2, 2½
	FSI Tests Bulk Sample Face: 8½, 8½
Seam 14 D:	FSI Tests Trench Floor: 4½, 4½
	FSI Tests 2.5' before Bulk Sample Face: 8, 8
	FSI Tests Bulk Sample Face: 9, 9
Seam 15:	FSI Tests Trench Floor: 8, 8½
Seam 16:	FSI Tests Trench Floor: ½, ½
	FSI Tests 2' before Bulk Sample Face: 8½, 9
Seam 16 E:	FSI Tests Trench Floor: 5, 5½
	FSI Tests 2' before Bulk Sample Face: 8, 8
Seam 16 G:	FSI Tests Trench Floor: 6½, 6½, 7
	FSI Tests 2' before Bulk Sample Face: 7½, 8
Seam 17:	FSI Tests Trench Floor: 2½, 3
	FSI Tests Bulk Sample Face: 8½, 9
Seam 17A:	FSI Tests Trench Floor: 8½, 9
	FSI Tests 2' before Bulk Sample Face: 8½, 9
Seam 18:	FSI Tests Trench Floor: 7½, 7½
	FSI Tests Bulk Sample Face: 8½, 8½

Tunnels:

When driving new adits or extending existing tunnels, samples were taken from fresh coal faces in 5' (1.5 m) intervals excluding any partings.

Without washing or sink/float treatment these samples underwent F.S.I. testing. As soon as the F.S.I. values proved stable the latest coal face was inspected by the geologist and checked visually for traces of oxidation.

In case the face proved entirely unoxidized due to these criteria the seam was exposed by cross-cutting on its entire width and a bulk sample extracted.

F.S.I. values of oxidation checks are recorded on the following table.

Table 5

F.S.I. Values from Oxidation Checks in Tunnels

Location	Adit 2	3	6	7	8	9	10
Face	9		5½	3½	6½		
+ 3'	8						
+ 5'		5½	2½	3½	6	8	1½
+ 6'	7						
+10'		8½	1½	5½	6½	7½	1½
+12'	7						
+15'		7½	5	5	6	5½	1½
+19'	8½						
Crosscut	7½						
+20'		7½	2½	4½	5	7	1½
+25'		7½	4	4½	5½	7½	1½
+30'		8½	3½,3	3½		3	1½
+35'		6	2½				1½
+40'		6½	2				1½
+45'		8½	3½				2
+50'		9	5				2
+55'		8½	4½				2½
+60'		6½	2½				5
+65'		6½					5½
+70'		7					8
+75'		7					7½
+80'		5					8½
+85'		7					8½
+90'		5					9
+95'		5					8½
+100'							8
+105'							9
+110'							8½
+115'							9
+120'							9
+125'							9
+130'							9

4.2.24 CONCLUSIONS

In the foregoing seam descriptions comparison has been made between analyses results obtained from borehole-samples, channel-samples and bulk samples on a seam individual basis.

These results will be reviewed under the particular aspects of coal preparation in Volume 1(b) of this report and more detailed in a separate appendix Volume No. 7.

Besides of that it appears appropriate to summarize certain results of analysis comparison in a less sophisticated manner in order to arrive to certain thumb-rules in order to assess and interprete future borehole analysis results. This is specially with regards to the recovery and quality of a coal washed from the relevant borehole intersection at a commercial scale.

Such a comparison has to be based on the results obtained from 137 Elco borehole-samples over seams 12-20. These samples represented a 95 - 100% core-recovery of the intersected coal seams or splits respectively with minor partings included, however, excluding any dilution from the hanging and footwalls.

On an average (arithmetic) the 137 samples tested arrived to a 57% CC yield (1.50 S.G. float), assaying with 6.4% ash, 29.5% volatiles (d.a.b.) and a F.S.I. of 8½.

The same seams (12 - 18) were sampled by 35 channel-samples inclusive dilution from splits, hanging and footwalls as expected in a future mine. Undergoing the same testing procedure at the laboratory a clean coal quality was produced on an average (arithmetic) very close to the one of the borehole samples (6.4% ash, 28.1% volatiles, F.S.I. 8). Only the average recovery of the channel-samples proved lower due to the dilution in their raw coal.

TABLE 6

ELCO TEST RESULTS - SUMMARY

SEAM NO.	BOREHOLE - S. (137)				CHANNEL - S. (54)				BULK - S. (15+2)					
	1.50 Float	% Ash (db)	% Vol (dab)	F.S.I.	1.50 Float	% Ash (comb)	% Vol (dab)	F.S.I.	Overall Yield	% Ash (ad) comb.	% Vol (dab)	F.S.I.	G-Value	Production Yield at 9.5% Ash Target
2					54.7	8.7	20.7	8	49.0	9.3	21.4	5	1.027	55.1
3					58.0	6.2	19.9	7½	81.4	9.3	20.6	8	1.009	82.9
4 + 4A					59.4	7.1	19.4	4	68.6	8.4	19.6	4	ND	75.2
6					71.3	8.7	18.9	3	72.4	10.4	20.4	3½	ND	66.8
7					38.0	8.2	20.0	4	51.7	10.8	20.9	6	ND	52.6
8					59.4	6.4	20.5	6	72.0	9.3	20.5	6½	0.671	66.3
9					69.1	6.5	20.5	4½	78.0	8.6	21.3	6	0.694	73.7
10					67.5	6.0	19.8	7	79.9	9.3	21.2	7½	0.630	77.9
12	54.3	6.6	28.3	8	48.2	6.6	20.5	9	54.1	9.3	24.0	9	1.057	48.5
13	49.7	5.7	27.4	8	32.7	8.5	25.9	8½	33.9	11.3	25.5	8½	1.051	24.6
14	57.2	6.4	28.4	8½	56.6	6.0	27.9	9	46.4	7.9	27.2	9	1.064	42.4
15	52.7	6.8	28.4	8½	44.2	6.7	27.9	8	48.2	7.9	27.2	8½	1.052	44.2
16	66.3	6.8	23.8	8½	50.0	7.1	30.6	8	54.0	10.7	29.7	8	1.065	47.3
17	51.1	6.4	32.0	8½	62.1	4.9	31.3	8	53.3	7.2	30.7	8	1.085	65.7
18	63.8	5.9	32.4	8	62.0	5.1	32.7	8	63.6	7.2	31.6	8½	1.067	68.4
2 - 10 ("C" appr.)					59.7	7.2	20.0	5½	69.1	9.4	20.7	6½	0.504	68.8
12 - 18	57.0	6.4	29.5	8½	50.8	6.4	28.1	8	50.5	8.7	28.0	8½	1.063	48.9
2 - 18 ("A" appr.)					55.5	6.8	23.8	7	60.4	9.0	24.1	7½	0.765	59.5
"A" Blend									*65.1 **52.7	8.3	23.7	7½	1.007	(60.05)
"C" Blend									*66.7 **50.0	9.5	22.2	7	0.866	(60.96)

* ash balance yield
** actual combined yield

(weighed averages, non-oxidized coal)

Therefore, the conclusion may be drawn that dilution did not deteriorate the quality of a clean coal effectively when borehole and channel-samples of Elk River coal were treated at a laboratory scale under the same procedures.

Comparing now at the next step averages received from the total number of 54 channel-samples with the average (arithmetic) of 15 washability-tests (diluted bulk samples) of the same seams and locations it becomes evident that

a) the product ash is approximately 2.5% higher in the bulk-samples than in the channel-samples, whereas, volatiles and F.S.I. remain substantially unchanged on the channel-samples level.

b) due to the higher product ash also the yield rises by approximately 5%.

In general terms one can say that in comparison with a channel-sample an increase of 1% ash in a clean coal received from a washability test increases also the yield by approximately 2%.

With regards to borehole-samples a washability test would produce a clean coal product very similar in its volatiles and F.S.I. figures to the ones received by lab testing of a borehole-sample of the same seam intersection.

The ash content, however, would increase by approximately 2.5% between a borehole-sample and the washability figure of a diluted bulk-sample received from the same seam intersection. Also here, the increase in ash content is accompanied by a yield increase of double to triple that size.

Furtheron, the conclusion can be drawn that within the same seam intersection the difference in ash content and yield between the washability test of a diluted bulk sample and the ones of laboratory tested borehole and channel samples

represents merely the effects of a different method of treatment.

Evidence also supports the conclusion that for Elk River coal dilution does not deteriorate substantially the quality of a washed product regardless of the treatment method applied (lab or washability testing).

Finally, and with regards to a product washed at an industrial scale from Elk River coal it is expected that the average yield figure as received in washability-tests would be reproduced and achieved also in a future plant if a product ash of 9.5% is targeted for. Probably the ash would prove lower in practice.

CLEAN COAL RESERVES (ALTERNATIVE "A")

SEAM	ROM-PRODUCT (NON-OXIDIZED) (ST)	PLANT YIELD (WEIGHT %)	CLEAN COAL (NON-OXIDIZED) (ST)	ROM-PRODUCT (OXIDIZED) (ST)	PLANT YIELD (WEIGHT %)	CLEAN COAL (OXIDIZED) (ST)	TOTAL CLEAN COAL (NON-OXID. & OXID (ST)
2	15,239,721.3	55.1	8,397,086.4	439,072.4	55.1	241,928.9	8,639,015.3
3	7,859,242.2	82.9	6,515,311.8	362,998.4	82.9	300,925.7	6,816,237.5
4-4A	25,570,939.5	75.2	19,229,346.5	1,575,407.9	75.2	1,184,706.7	20,414,053.2
5	1,240,614.2	15.3*	189,914.0	97,583.9	15.3*	14,945.6	204,859.6
6	4,940,267.1	66.8	3,300,098.4	419,135.3	66.8	279,982.4	3,580,080.8
7	4,005,435.5	52.6	2,106,859.1	425,609.8	52.6	223,870.8	2,330,729.9
8-8A	15,352,215.5	66.3	10,178,515.9	1,140,479.0	66.3	756,137.6	10,934,656.5
9	11,597,936.1	73.7	8,547,679.0	678,036.1	73.7	499,712.6	9,047,391.6
10	18,557,862.0	77.9	14,456,574.5	1,106,372.5	77.9	861,864.2	15,318,438.7
11	4,398,950.2	53.0**	2,331,443.6	115,479.4	53.0**	61,204.1	2,392,647.7
12	12,252,209.4	48.5	5,942,321.6	642,805.2	48.5	311,760.5	6,254,082.1
13	11,857,885.2	24.6	2,917,039.8	919,492.7	24.6	226,195.2	3,143,235.0
14	8,042,383.1	42.4	3,409,970.4	532,610.1	42.4	225,826.7	3,635,797.1
15	10,741,077.4	44.2	4,747,556.2	796,618.0	44.2	352,105.2	5,099,661.4
16	7,549,830.3	47.3	3,571,069.7	637,705.5	47.3	301,634.7	3,872,704.4
17	6,268,592.6	66.7	4,181,151.3	354,027.6	66.7	236,136.4	4,417,287.7
18	5,591,279.5	68.4	3,824,435.2	540,257.7	68.4	369,536.3	4,193,971.5
19	1,528,642.4	28.1***	710,548.5	298,817.2	28.1***	83,967.6	794,516.1
20	503,419.4	29.9****	150,522.4	184,394.1	29.9****	55,133.8	205,656.2
21	402,047.1	25.9*****	104,130.2	24,261.1	25.9*****	6,283.6	110,413.8
22	66,087.2	25.0******	16,521.8				16,521.8
24	21,167.8	25.0******	5,292.0				5,292.0
	174,587,805.0			11,291,263.9			
As Per Assumption of:							
Techman		60.05	104,833,391.3		58.40	6,593,858.6	111,427,249.9
Kaiser Canada Min:		59.0	103,006,805.0		59.0	6,661,845.7	109,668,650.7
Kaiser Canada Av:		64.7	112,958,309.8		64.7	7,305,447.7	120,263,757.5
Kaiser Canada Max:		70.4	122,909,814.7		70.4	7,949,049.8	130,858,864.5

Remarks:

- • From Channel sample, washed at 1.50 S.G.
- ** 1970 drill hole information, washed at 1.50 S.G. = 62.2% Yield - 9.2 Weight % Dilution (calculated as weight % of recovered raw coal in tab 9..)
- *** Mk - overall washing - yield of 60.6 - 32.5 weight % dilution (calculated as weight % of recovered raw coal in tab 9.)
- **** 1975 Drill hole information, washed at 1.50 = 53.9% Yield - 24.0 weight % dilution (calculated as weight % of recovered raw coal in tab 9.)
- ***** No information at all, 25% washing yield anticipated)

TABLE 8

CLEAN COAL RESERVES (ALTERNATIVE "C")

SEAM	ROM-PRODUCT (NON-OXIDIZED) (ST)	PLANT YIELD (WEIGHT %)	CLEAN COAL (NON-OXIDIZED) (ST)	ROM-PRODUCT (OXIDIZED) (ST)	PLANT YIELD (WEIGHT %)	CLEAN COAL (OXIDIZED) (ST)	TOTAL CLEAN COAL (NON-OXID. & OXID.) (ST)
2	13,594,764.3	55.1	7,490,715.1	512,650.5	55.1	282,470.4	7,773,185.5
3	6,838,594.0	82.9	5,669,194.4	364,816.4	82.9	302,432.8	5,971,627.2
4-4A	20,620,927.3	75.2	15,506,862.1	1,575,458.0	75.2	1,184,744.4	16,691,606.5
5	1,240,614.2	15.3*	189,814.0	97,683.9	15.3*	14,945.6	204,759.6
6	3,865,408.8	66.8	2,582,093.1	419,135.3	66.8	279,982.4	2,862,075.5
7	3,938,148.3	52.6	2,071,466.0	425,609.8	52.6	223,870.8	2,295,336.8
8-8A	14,040,904.6	66.3	9,309,119.8	1,063,163.8	66.3	704,877.6	10,013,997.4
9	10,433,314.5	73.7	7,689,352.8	678,036.1	73.7	499,712.6	8,189,065.4
10	16,386,503.1	77.9	12,765,085.9	1,116,426.2	77.9	869,696.0	13,634,781.9
11	2,438,419.8	52.5**	1,280,170.4	115,479.4	52.5**	60,626.7	1,340,797.1
12	10,570,430.5	48.5	5,126,658.8	575,051.5	48.5	278,900.0	5,405,558.8
13	10,988,521.9	24.6	2,703,176.4	919,492.7	24.6	226,195.2	2,929,371.6
14	5,637,334.0	42.4	2,411,429.6	500,532.0	42.4	212,225.6	2,623,655.2
15	6,168,917.9	44.2	2,726,661.7	581,925.8	44.2	257,211.2	2,983,872.9
16	2,250,773.7	47.3	1,064,616.0	778,529.6	47.3	368,244.5	1,432,860.5
17	1,165,255.6	66.7	777,225.5	294,450.5	66.7	196,398.5	973,624.0
18	247,262.7	68.4	169,127.7	111,900.3	68.4	76,539.8	245,667.5
	130,475,995.2			10,130,341.8			
As Per Assumption of:							
Techman		60.96	79,532,769.3		59.61	6,039,074.1	85,571,843.4
Kaiser Canada, Min.		59.0	76,980,837.2		59.0	5,976,901.7	82,957,738.9
Kaiser Canada, Av.		64.7	84,417,968.9		64.7	6,554,331.1	90,972,300.0
Kaiser Canada, Max.		70.4	91,855,100.6		70.4	7,131,760.6	98,986,861.2

Remarks:

* From Channel-sample, washed at 1.50 S.G.

** 1970 Drillhole information, washed at 1.50 S.G. = 62.2% Yield - 9.7 Weight % Dilution (calculated as weight % of recoverable in tab .....)

ELCO's figures compare favourably with TECHMAN's and the negligible differences (approximately 1.01% for total recoverable raw coal in place) are within accuracy of measurements and calculations.

ELCO's assessment totals in a

combined ROM-product of (oxidized coal incl.)	185,879,068.9 st
total waste material handled of	1,033,232,850.5 bcy.

These figures result in a overburden ratio of

5.56 bcy/st.

If the oxidized coal is included into the total waste material (9,551,543.6 bcy recovered oxidized raw coal + 617,033.3 bcy dilution rock) the overburden ratio increases to 5.98. Total ROM product is then 174,587,805.0 st against 1,043,401,427.4 bcy of total waste material.

If the dilution rock of the non-oxidized coal and oxidized coal are included into the total waste material (9,442,899.8 bcy dilution + 9,551,543.6 bcy recovered oxidized raw coal) the overburden ratio increases to 6.70. The recovered raw coal is then 157,080,928.6 st, and the total waste material 1,052,227,293.9 bcy.

To calculate the expected clean coal tonnage the relevant plant yields as obtained from the washability testwork for the individual seams were applied. This, as explained earlier included the expected dilution in a future ROM product, and the method of coal reserves calculation simulates and corresponds to this dilution. For details see the following tabulation.

4.3.2 Mining Plan "C" Area:

For alternative "C" the calculation resulted in the below total volume of materials. For comparison again the relevant TECHMAN-figures are quoted.

Below Oxidation Level:

(non oxidized)	ELCO	TECHMAN
Raw Coal in Place (st)	136,125,830.5	144,982,000
Recovered Raw Coal (st) (raw coal in place minus mining loss)	117,630,438.7	127,807,000
Run of mine product (st) (recovered raw coal plus dilution)	130,475,996.2	152,798,000
Total Waste (bcy)	597,076,933.2	704,187,909

Above Oxidation Level:

(oxidized)		
Raw coal in Place (st)	10,415,102.2	3,258,000
Recovered Oxidized Raw Coal (st) (oxidized raw coal in place of minus mining loss)	9,088,146.2	
Run of Mine Product (st) (recovered oxidized raw coal plus dilution)	10,130,341.8	
Total Overburden (bcy) (glacial till and slope debris plus rock overburden plus mining loss-oxidized)	99,493,007.2	

ELCO's figures again compare favourably with the ones established by TECHMAN and the differences (ca. 6.5% for total raw coal reserves in place) are within accuracy of measurements and calculations.

ELCO's assessment totals in a

combined ROM product of (incl. ox coal)	140,606,337.0 st
total waste material to be handled of	696,569,940.4 bcy.

These figures result in an overburden ratio of

4.95 bcy/st.

If the oxidized coal is included into the total waste material (7,449,300.2 bcy recovered oxidized raw coal + 510,987.9 bcy dilution rock) the overburden ratio increases to 5.40. Total run of mines product is then 130,475,995.2 st against 704,530,218.5 bcy of total waste material.

If the dilution rock and oxidized coal are included into the total waste material (6,869,179.2 bcy dilution rock + 7,449,300.2 bcy recovered - oxidized raw coal) then the overburden ratio increases to 6.04. The recovered raw coal is then 117,630,428.7 st against 710,888,419.8 bcy of total waste material.

To calculate the expected clean coal tonnage the same procedure was applied as with alternative "A", resulting in the following tabulation.

4.3.3 Underground Reserves (Hydraulic)
Big Weary Ridge

Applying the earlier quoted parameters the following recoverable clean coal reserves were calculated by MONTAN CONSULTING GmbH. for a hydraulic underground mine:

Section	Number of good quality Coking Coal Seams (FSI 7)	Average Seam (m)	Thickness Coal (m)	Recoverable CC-Reserves (FSI 7) 1000 tonnes
1. Elco Lease, above drainage	1	4.0	2.9	1,800
2. Elco Lease	7	4.8	4.2	11,000
3. Fording Lease, *) above drainage	6	3.6	3.4	8,000
TOTAL:				20,800

This calculation, however, only comprises good quality coking coal seams (F.S.I. = 7 and plus) considered as a sweetener for lower grade alternative "C" open pit coal. Total reserves recoverable by hydraulic underground mining are substantially higher.

Due to heavy faulting in certain areas and the relatively wide spacing of boreholes the above reserves are to be considered as drill indicated.

*) Approximately 1/3 of the reserves are estimated to be in the ELCO-Lease west of Fordings lease boundary. Due to the fact that ELCO's and FORDING's reserves appear to be developed as one unit and extracted in one mine no attempt was made to calculate coal volumes for both companies individually.

Considering a clean coal output of approximately 450,000 st (0.4 million tonnes) p.a. drill indicated clean coal reserves at Big Weary Ridge would provide a life time for hydraulic underground mining of approximately 51 years. This, however, would require an agreement with FORDING COAL Ltd. to mine within their lease area north of Aldridge Creek.

It has to be part of future studies to establish within the overall development scheme the merits of selective mining of good quality coking coal by hydraulic means against the costs envolved.

Besides of this alternative it has to be pointed out that Big Weary Ridge also represents an excellent open pit situation.

Recent drillings between stations 100 + 00 and 180 + 00 alone indicate reserves of approximately

130,000,000 st recoverable raw coal

or 70 - 80,000,000 st of clean coal.

A potential of similar magnitude may be expected between stations 000 + 00 and 100 + 00 in case coal reserves of FORDING COAL Ltd.'s license L 6385 (approximately 25,000,000 st) would become available.

There seems to be sufficient potential at the Elk River Coal Property to support two major open-pit mines with a combined output of 8 million st p.a. over a period of 25 - 30 years. This means that the open pit operation as invisaged in mining plans "A" or "C" one time could be backed up by a second and independant open-pit development of similar scale at Big Weary Ridge.

SUMMARY OF COAL AND WASTE CALCULATION

COAL AND WASTE ROCK BELOW OXIDATION LEVEL

SEAM NO.	AVERAGE LENGTH ALONG DIP (FT)	AVERAGE TRUE THICKNESS (FT)	DISTANCE OF SEAM ALONG STRIKE (FT)	RAW COAL VOLUME IN SEAM (BCYD)	RAW COAL TONNAGE IN PLACE (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED RAW COAL AND DILUTION ROCK = ROM (SHT)	WASTE (BCYD)	RECOVERED WASTE = WASTE MINUS DILUTION ROCK (BCYD)	TOTAL WASTE = RECOVERED WASTE + MINING LOSS (BCYD)
SEAM 2		10.92		12678872.6	15468224.6	1088668.1	1328175.1	14140049.5	544392.0	1099671.8	15239721.3	29030988.4	27931316.6	29019984.7
SEAM 3		5.87		6621087.5	8077726.8	1040964.1	1269976.2	6807760.6	520540.4	1051491.6	7859242.2	50492820.4	49972280.0	51013244.1
SEAM 4A		5.63		4165253.8	5081609.6	710517.6	866831.5	4214778.1	355304.2	717714.5	4932492.6	37872208.0	37516903.8	38227421.4
SEAM 4		19.00		17093699.5	20854313.4	1023753.4	1249979.2	19604334.2	511937.0	1034112.7	20638446.9	35302558.7	34790621.7	35814375.1
SEAM 5		3.00		1079769.6	1317318.9	365498.5	445908.2	871410.7	182774.0	369203.5	1240614.2	46754214.7	46571440.7	46936939.2
SEAM 6		4.56		4196713.1	5119990.0	838937.2	1023503.4	4096486.6	417713.1	843780.5	4940267.1	41363000.7	40945287.6	41784224.8
SEAM 7		5.35		3388065.3	4133439.7	609898.8	744076.5	3389363.2	304986.3	616072.3	4005435.5	37448164.5	37143178.2	37753077.0
SEAM 8A		8.05		5095037.5	6215945.8	647611.3	790085.8	5425860.0	323843.2	654163.3	6080023.3	31716274.9	31062111.6	31709722.9
SEAM 8		9.92		7770357.2	9479835.8	747172.1	911550.0	8568285.8	348468.5	703906.4	9272192.2	20634604.6	20286136.1	21033308.2
SEAM 9		13.45		9631941.3	11750968.4	729142.3	889553.6	10861414.8	364614.5	736521.3	11597936.1	53973159.7	53608545.2	54337687.5
SEAM 10		17.07		15360228.1	18739478.3	865259.2	1055616.2	17683862.1	432673.2	873999.9	18557862.0	58375920.0	57943246.8	58808506.0
SEAM 11		9.88		3668475.2	4475539.7	364904.3	445183.3	4030356.4	182472.2	368593.8	4398950.2	23307187.2	23124715.0	23489619.3
SEAM 12		9.13		10230903.1	12481701.8	1093444.3	1334002.1	11147699.7	546787.0	1104509.7	12252209.4	42875892.1	42329105.1	43422549.4
SEAM 13		6.01		10019651.0	12223974.2	1744775.2	2128625.7	10095348.5	872542.9	1762536.7	11857885.2	53774748.2	52902205.3	54646980.5
SEAM 14		6.02		6870967.4	8382580.2	1253780.9	1529612.7	6852967.5	588819.6	1189415.6	8042383.1	37129677.1	36540857.5	37794638.4
SEAM 15		9.01		8977031.5	10951978.4	1004881.7	1225955.7	9726022.7	502502.3	1015054.7	10741077.4	52968691.7	52466189.4	53471071.1
SEAM 16		5.09		6409222.8	7819251.8	1283612.6	1566007.4	6253244.4	641874.2	1296585.9	7549830.3	66584418.0	65942543.8	67226156.4
SEAM 17		5.91		5290201.0	6454045.5	883722.1	1078141.0	5375904.5	441924.8	892688.1	6268592.6	52123994.1	51682069.3	52565791.4
SEAM 18		7.20		4771082.0	5820718.8	692622.8	844999.8	4975719.0	304732.9	615560.5	5591279.5	41522612.2	41217879.3	40525256.5
SEAM 19		3.45		2178393.6	2657640.2	614576.2	749783.0	1907887.2	307319.4	620785.2	2528642.4	27647789.0	27340469.6	27955045.8
SEAM 20		4.14		700307.1	854374.7	157373.8	191996.0	662378.7	78692.7	158959.3	503419.4	20033684.4	19954991.7	20112365.5
SEAM 21		3.79		342923.2	418366.3	77747.7	94852.2	323514.1	38877.0	78533.0	402047.1	7718232.8	7679355.8	7757103.5
SEAM 22		3.33		57157.7	69732.4	17369.4	21190.7	48541.7	8685.9	17545.5	66087.2	1699883.9	1691198.0	1708567.4
SEAM 24		3.19		21350.0	26047.0	6777.4	8268.4	17778.6	3389.2	6846.2	21167.8	441891.8	438502.6	445280.0
TOTAL ALL SEAMS ALTERNATIVE "A"				146618691.1	178874802.3	17863111.0	21793873.7	157080928.6	8825866.5	17828252.0	174587805.0	870792617.1	861081150.7	877558916.1

OXIDIZED COAL AND OVERBURDEN ABOVE OXIDATION LEVEL

SEAM NO.	OXIDIZED RAW COAL (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED OXIDIZED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED OXIDIZED RAW COAL + DILUTION ROCK = ROM (SHT)	GLACIAL TILL + SLOPE DEBRIS (BCYD)	ROCK OVERBURDEN (BCYD)	RECOVERED OVERBURDEN = OVERBURDEN MINUS DILUTION (BCYD)	TOTAL OVERBURDEN = RECOVERED OVERBURDEN + MINING LOSS (BCYD)
SEAM 2	525305.0	35341.2	43116.3	482188.7	17612.9	35699.3	439072.4				
SEAM 3	373258.0	48885.0	59639.7	313618.3	24445.6	49380.1	362998.4				
SEAM 4A	339294.7	40109.0	48933.0	290361.7	20057.1	40515.3	330867.0				
SEAM 4	1255988.6	54545.7	66545.8	1189442.8	27276.3	55098.1	1244540.9				
SEAM 5	103781.4	29054.0	35445.9	68335.5	14528.9	29348.4	97683.9				
SEAM 6	434105.0	71317.0	87006.7	347098.3	35661.9	72037.0	419135.3				
SEAM 7	441968.0	58333.0	71166.3	370801.7	27132.7	54808.1	425609.8				
SEAM 8A	526293.7	67965.0	82917.3	443376.4	33986.8	68653.3	512029.7				
SEAM 8	637734.6	44242.3	53975.6	583759.0	22123.9	44690.3	628449.3				
SEAM 9	686460.3	40138.7	48969.2	637491.1	20071.8	40545.0	678036.1				
SEAM 10	1118372.0	57169.6	69746.9	1048625.1	28587.8	57747.4	1106372.5				
SEAM 11	117049.5	7481.1	9126.9	107922.6	3741.0	7556.8	115479.4				
SEAM 12	656613.1	58141.4	70932.5	585680.6	28279.5	57124.6	642805.2				
SEAM 13	948006.1	135852.7	165740.3	782265.8	67934.1	137226.9	919492.7				
SEAM 14	540463.7	73938.5	90205.0	450258.7	40768.0	82351.4	532610.1				
SEAM 15	811364.0	70255.9	85712.2	725651.8	35313.8	70966.2	796618.0				
SEAM 16	658224.0	99547.9	121448.4	536775.6	49965.3	100929.9	637705.5				
SEAM 17	394656.7	66432.0	81047.4	313509.3	33211.7	40518.3	354027.6				
SEAM 18	551861.2	55286.2	67449.2	484412.0	27646.4	55845.7	540257.7				
SEAM 19	314684.4	75597.3	92228.7	222455.7	37802.7	76361.5	298817.2				
SEAM 20	191872.9	35628.1	43466.3	148406.6	17815.6	35987.5	184394.1				
SEAM 21	25626.3	6502.6	7933.2	17693.1	3251.5	6568.0	24261.1				
SEAM 22											
SEAM 24											
TOTAL ALL SEAMS ALTERNATIVE "A"	11652883.2	1231764.2	1502752.8	10150130.4	617033.3	1219969.1	11291263.9	78894893.3	76164310.2	154442170.2	155673934.4

SUMMARY OF COAL AND WASTE CALCULATION

COAL AND WASTE ROCK BELOW OXIDATION LEVEL

SEAM NO.	AVERAGE LENGTH ALONG DIP (FT)	AVERAGE TRUE THICKNESS (FT)	DISTANCE OF SEAM ALONG STRIKE (FT)	RAW COAL VOLUME IN SEAM (BCYD)	RAW COAL TONNAGE IN PLACE (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED RAW COAL AND DILUTION ROCK = ROM (SHT)	WASTE (BCYD)	RECOVERED WASTE = WASTE MINUS DILUTION ROCK (BCYD)	TOTAL WASTE = RECOVERED WASTE + MINING LOSS (BCYD)
SEAM 2		12.98		11293568.6	13778153.7	873764.8	1065993.1	12712160.6	436932.5	882603.7	13594764.3	23339630.2	22902697.7	23776462.5
SEAM 3		5.95		6073625.5	7409823.1	1229918.7	1500500.8	5908322.3	460035.5	929271.7	6838594.0	46746238.8	45286203.3	47516122.0
SEAM 4A		5.72		3770710.1	4600266.3	2105024.4	2568129.8	2032136.5	319185.1	644753.9	2676890.4	33416845.6	33097660.5	35202884.9
SEAM 4		19.06		14867532.2	18138389.3	955367.0	1165547.8	16972841.5	480740.3	971095.4	17943936.9	29495983.7	29015243.4	29970610.4
SEAM 5		3.00		1079769.6	1317318.9	365498.5	445908.2	871410.7	182774.0	369203.5	1240614.2	46754214.7	46571440.7	46936939.2
SEAM 6		4.82		4010604.6	4892937.6	770690.2	940229.8	3070374.8	393581.2	795034.0	3865408.8	36663614.0	36270032.8	37040713.0
SEAM 7		5.35		3327941.5	4060088.6	580995.5	708814.5	3351274.1	290531.8	586874.2	3938148.3	37400295.7	51109763.9	37690759.4
SEAM 8A		6.99		4292212.5	5236499.3	551586.6	672935.7	4563563.6	305829.7	617776.0	5181339.6	23564515.7	23258686.0	23810272.6
SEAM 8		11.22		7422132.1	9055001.2	689016.1	841599.6	8214401.6	319387.8	645163.4	8859565.0	18962162.4	18642774.6	19331790.7
SEAM 9		13.30		8667292.7	10574097.1	670785.8	818358.7	9755738.4	335433.7	677576.1	10433314.5	50773182.8	50437749.7	51108536.1
SEAM 10		17.30		13564608.0	16548821.8	773341.4	943476.5	15605345.3	386711.8	781157.8	16386503.1	45659161.8	45272450.0	46045791.4
SEAM 11		8.46		2035550.4	2483371.5	214170.2	261287.6	2222083.9	107097.0	216335.9	2438419.8	16883238.9	16776141.9	16990312.1
SEAM 12		8.48		8830892.2	10773688.5	968434.8	1181490.5	9592198.0	484273.5	978232.5	10570430.5	36057937.5	35573664.0	36542098.8
SEAM 13		5.81		9270619.4	11310155.7	1638709.7	1999469.8	9310685.9	830611.9	1677836.0	10988521.9	47805130.4	46974518.5	48613428.2
SEAM 14		5.76		4812608.1	5871259.9	885986.6	1080903.7	4790356.2	444048.4	896977.8	5687334.0	31087938.7	30643890.3	31529876.9
SEAM 15		8.09		5161610.2	6297164.4	612707.2	747502.8	5549661.6	306562.5	619256.3	6168917.9	33391855.3	33085292.8	33698000.0
SEAM 16		4.98		1906658.6	2326123.5	359569.3	438674.6	1887449.0	179863.7	363324.7	2250773.7	26885679.7	26705816.0	27065388.3
SEAM 17		5.94		983669.4	1200076.6	165706.6	202259.7	997817.0	82890.4	167438.6	1165255.6	11039739.6	10956849.2	11122635.8
SEAM 18		8.10		207043.8	252593.4	25398.1	30986.7	221607.7	12700.5	25655.0	247262.7	1149567.7	1136867.2	1162265.3
TOTAL ALL SEAMS ALTERNATIVE "C"				111578549.5	136125830.5	14436941.5	17641028.9	117630438.7	6358191.3	12845566.5	130475996.2	597076933.2	590712741.9	605,154,684.6

OXIDIZED COAL AND OVERBURDEN ABOVE OXIDATION LEVEL

SEAM NO.	OXIDIZED RAW COAL (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED OXIDIZED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED OXIDIZED RAW COAL + DILUTION ROCK = ROM (SHT)	GLACIAL TILL + SLOPE DEBRIS (BCYD)	ROCK OVERBURDEN (BCYD)	RECOVERED OVERBURDEN = TOTAL OVERBURDEN MINUS DILUTION (BCYD)	TOTAL OVERBURDEN = RECOVERED + MINING LOSS (BCYD)
SEAM 2	525305.0	35341.2	43116.3	482188.7	15080.1	30461.8	512650.5				
SEAM 3	373258.0	48885.0	59639.7	313618.3	25345.6	51198.1	364816.4				
SEAM 4A	339334.7	40109.0	48933.0	290401.7	20057.1	40515.3	330917.0				
SEAM 4	1255988.6	54545.7	66545.8	1189442.9	27276.3	55098.1	1244541.0				
SEAM 5	103781.4	29054.0	35445.9	68335.6	14528.9	29343.4	97683.9				
SEAM 6	434105.0	71317.0	87006.7	347098.3	35661.9	72037.1	419135.3				
SEAM 7	441968.0	58333.0	71166.3	370801.7	27132.7	54808.1	425609.8				
SEAM 8A	446242.5	54928.7	67013.0	379229.5	27467.8	55485.0	434714.5				
SEAM 8	637734.6	44242.3	53975.6	583759.0	22123.9	44690.3	628449.3				
SEAM 9	686460.3	40138.7	48969.2	637491.1	20071.8	40545.0	678036.1				
SEAM 10	1118372.0	57125.6	69693.2	1048678.8	28587.8	57747.4	1116426.2				
SEAM 11	117049.5	7481.1	9126.9	107922.6	3741.0	7556.8	115479.4				
SEAM 12	656613.1	113677.2	138686.2	517926.9	28279.5	57124.6	575051.5				
SEAM 13	948006.1	135852.7	165740.3	782265.8	67934.1	137226.9	919492.7				
SEAM 14	508715.5	69747.2	85091.6	423623.9	38073.3	76908.1	500532.0				
SEAM 15	596111.2	67584.5	82453.1	513658.1	33795.9	68267.7	581925.8				
SEAM 16	806661.5	106778.2	130269.4	676392.1	50563.1	102137.5	778529.6				
SEAM 17	304318.0	37389.0	45614.6	258703.4	17696.6	35747.1	294450.5				
SEAM 18	115077.2	15138.8	18469.3	96607.9	7570.5	15292.4	111900.3				
TOTAL ALL SEAMS ALTERNATIVE "C"	10415102.2	1087568.9	1326956.1	9088146.2	510987.9	1032195.7	10,130,341.8	30,847,366.5	68,145,370.9	98488833.3	99493007.2

TABLE 9

K- ELK RIVER 76(5) B

CONFIDENTIAL

EVALUATION OF
EXPLORATION AND TESTWORK
JULY 1975 - APRIL 1976
ON THE
ELK RIVER COAL PROPERTY

MINING RECORDER
RECEIVED AND RECORDED
M.R. # VICTORIA, B.C.

VOLUME II

APPENDIX 3

SAMPLING & ANALYSES SUMMARY

TUNNELS

TRENCHES

CALGARY/DUSSELDORF
MAY 1976

ELCO MINING LIMITED

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 274

VOLUME II

APPENDIX 3 - Sampling & Analyses Summary

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1. TUNNELS

Assay Sheet of Channel Samples (Summary) 1

Seam No. 2: Bulk Sample Location (Plan and Section) Columnar Seam Profile of Bulk Sample Washability Test Results of Bulk Sample 2

Seam No. 3: as above 5

Seam No. 4: as above 8

Seam No. 6: as above 12

Seam No. 7: as above 15

Seam No. 8: as above 18

Seam No. 9: as above 21

Seam No. 10: as above 24

2. TRENCHES

Assay Sheet of Channel Samples (Summary)

Seam No. 12: Bulk Sample Location in Trench(section) Columnar Seam Profile of Bulk Sample Washability Test Results of Bulk Sample 27

Seam No. 13: as above 30

Seam No. 14: as above 40

Seam No. 15: as above 46

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APPENDIX 3

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TUNNELS

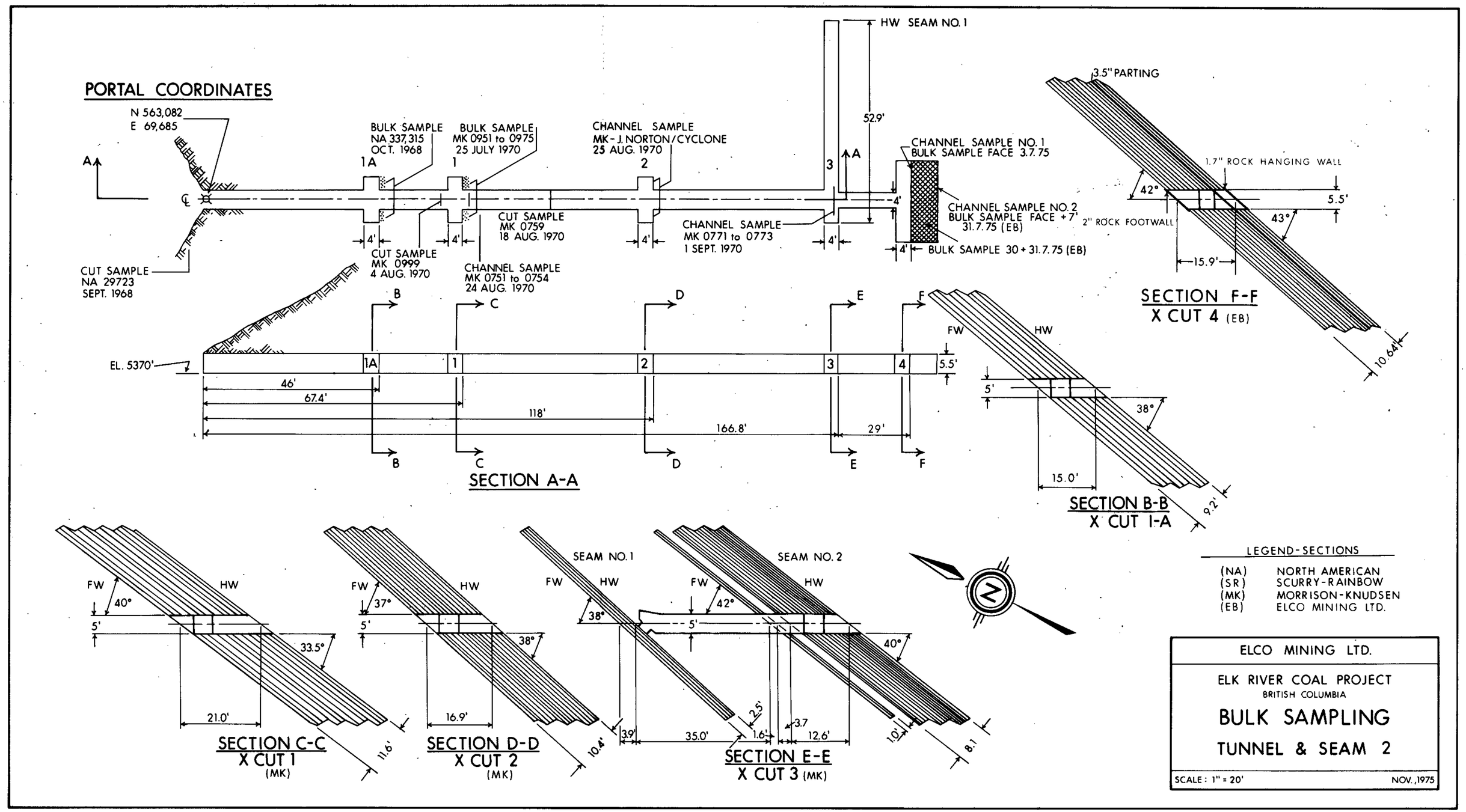
ELCO MINING LIMITED

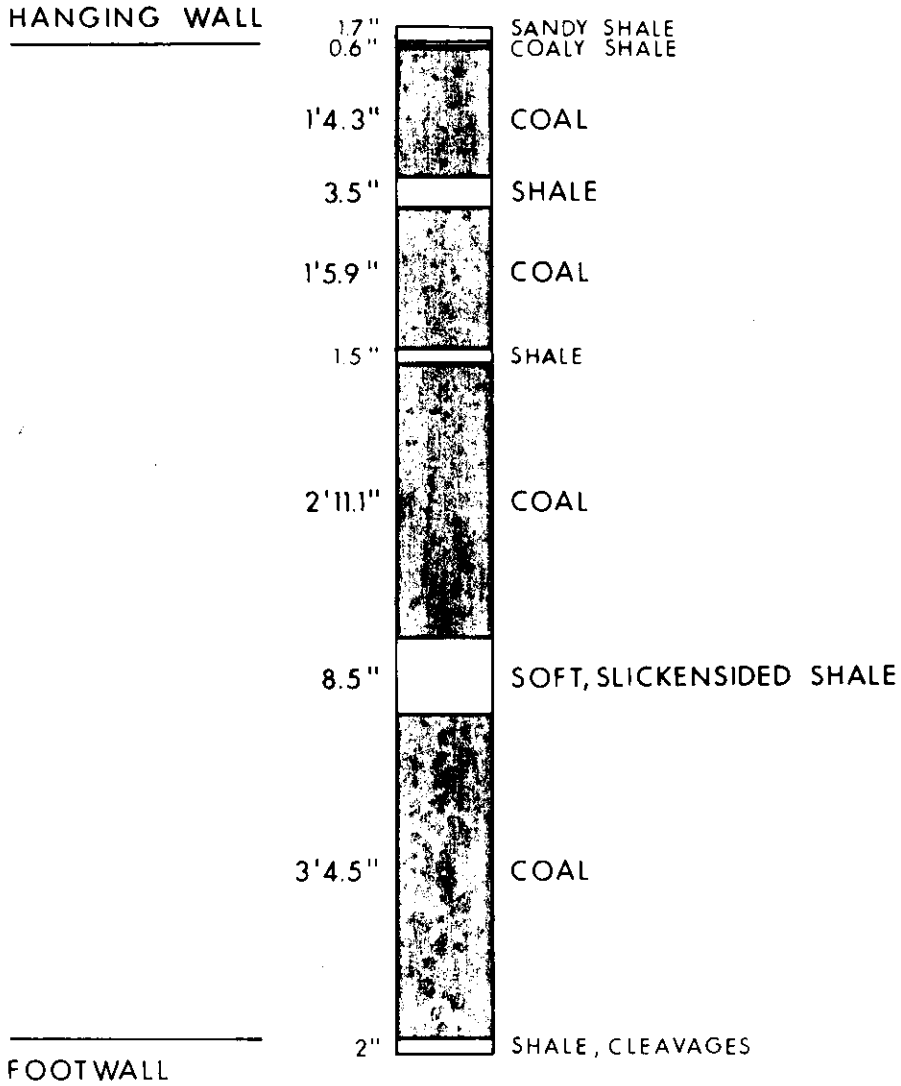
TEST SHEET OF CHANNEL SAMPLES

Seam No.		2	2	3	3	3	4	4	4A	4A	6	7	7	8	8	8	9	9	10	10
Sample No.		2A	2B	No.1	No.2	No.3	No.1	No.2	No.1	No.2	No.1	No.1	No.2	No.1	No.2	No.1	No.1	No.2	No.1	No.2
Sample Location		Adit No. 2	Adit No.2	Adit No.3	Adit No.3	Adit No.3	Adit No.4+4A	Adit No.4+4A	Adit No. 4+4A	Adit No. 4+4A	Adit No. 6	Adit No. 7	Adit No. 7	Adit No. 8	Adit No.8	Adit No.8	Adit No.9	Adit No.9	Adit No.10	Adit No.10
Lab.No.		3673	3674	3676	3675	3965	4519	4520	4534	4535	3677	3710	3711	3783	3811		3812	3966	3712	3713
Laboratory: Montan Consulting																				
Raw Coal																				
Analytical Moisture	%	2.5	3.9	3.4	2.6	1.6	1.1	1.0	0.8	1.3	5.7	1.6	1.3	0.8	0.8	0.8	0.8	1.5	1.7	1.3
Ash	% db	31.2	41.7	44.2	34.4	30.2	29.1	26.7	35.5	36.6	16.3	43.2	42.6	36.8	30.19	24.94	25.5	25.9	25.4
Volatile Matter	% db	16.0	13.9	11.9	13.4	14.4	14.8	14.6	13.7	13.4	16.6	13.0	13.5	13.8	15.1	16.0	17.5	17.2	17.6
Sulphur	% db	0.47	0.44	0.37	0.42	0.45	0.34	0.36	0.49	0.47	0.69	0.43	0.44	0.36	0.39	0.38	0.39	0.40	0.41
Phosphorous	% db	0.022	0.020	0.111	0.183	0.049	0.039	0.036	0.015	0.019	0.090	0.057	0.066	0.056	0.088	0.028	0.031	0.045	0.073
Gross Calorific Value, kcal/kg	air dry	5428	4480	4368	5245	5685	5697	5944	5207	5103	6528	4437	4465	5043	5691	6098	5924	5943	5964
	db	5582	4685	4542	5401	5787	5767	6010	5254	5178	6958	4519	4531	5088	5742	6152	6023	6056	6050
	dab	8116	8039	8146	8238	8290	8137	8196	8150	8161	8309	7957	7887	8052	8225	8196	8085	8174	8114
Ash Fusion in Oxid.Atmosphere																				
Initial Deformation Temp.	°C	1300	1290	1370	1310	1360	1320	1300	1380	1400	1300	1350	1300	1330	1300	1370	1350	1320	1310
Softening Temp. Spherical	°C	1520	1570	1590	1530	1600	1560	1590	1640	1640	1600	1650	1590	1620	1610	1690	1620	1630	1640
Fusion Temp.	°C	1560	1600	1610	1570	1700	1590	1620	1660	1670	1640	1660	1620	1650	1630	>1700	1650	1670	1680
Hardgrove Growing Index.		94	90	101	102	112	97	98	95	92	92	85	90	84	89	80	86	85	81
Size Fraction	%																			
6.3-0.2 mm	%	89.0	84.0	81.9	82.8	85.9	84.5	84.3	85.9	85.5	75.4	85.8	82.6	86.8	86.8	89.4	94.3	89.6	89.2
-0.2 mm	%	11.0	16.0	18.1	17.2	14.1	15.5	15.7	14.1	14.5	24.6	14.2	17.4	13.2	13.2	10.6	5.7	10.4	10.8
Clean Coal (Size Fraction 6.3-0.2mm,1.45 Sink Float S.G.)																				
Yield	%	51.6	37.1	50.8	57.0	63.3	61.4	67.4	46.7	49.2	69.8	31.7	32.2	51.4	58.7	63.8	63.7	66.8	64.1
Analytical Moisture	air dry	0.7	0.7	0.8	0.9	0.4	0.4	0.4	0.3	0.3	0.8	0.7	0.6	0.6	0.7	0.6	0.5	0.8	0.7
Ash	% db	8.1	8.3	6.2	5.3	5.6	6.5	6.4	7.0	7.5	7.7	8.2	7.3	6.0	5.95	6.34	6.0	5.8	5.8
Volatile Matter	% dab	20.6	20.3	19.4	18.9	19.5	17.9	17.8	19.2	18.5	18.5	19.3	19.4	19.6	19.8	19.9	19.8	21.8	21.5
Sulphur	% db	0.57	0.57	0.50	0.49	0.53	0.39	0.38	0.64	0.61	0.70	0.62	0.63	0.47	0.49	0.50	0.48	0.45	0.46
Phosphorous	% db	0.013	0.011	0.058	0.067	0.030	0.017	0.023	0.005	0.005	0.106	0.042	0.053	0.021	0.073	0.022	0.021	0.024	0.037
FSI		8	7½	8	7	6½	1	1	7	4½	3½	4	3½	5½	6	3	3½	6	6
Soft.Temperature	°C	389	380	394	401	392	413	422	404	389	419	428	401	404	407	401	428	410	394
Resolidification Temp.	°C	472	448	467	467	482	-	-	481	461	-	-	-	481	479	-	491	485	467
Contraction	%	33	29	28	23	32	23	16	32	32	27	34	33	31	31	32	33	36	32
Dilatation	%	24	22	12	-2	-3	-	-	5	-11	-	-	-	-21	-16	-	-24	-16	-10
G-Value	%	0.985	0.989	0.697	0.917	0.889	-	-	0.940	0.852	- -	-	-	0.689	0.797	-	0.697	0.821	0.861
Max.Fluidity	DDPM	462	12	18	3	20	n.d.	n.d.	16	6	-	2	2	4	6	2	3	6	8
Vitrinite	%	33	37	60	41	60	39	39	60	55	31	53	48	49	55	45	51	52	57
Exinite	%	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Inertinite	%	62	54	38	57	32	58	57	31	38	65	40	44	45	39	49	46	43	35
Mineral Matter	%	5	9	2	2	8	3	4	8	7	4	7	8	6	6	6	3	5	8
Mean Reflectance	%	1.47	1.45	1.46	1.48	1.53	1.44	1.44	1.45	1.44	1.44	1.46	1.43	1.45	1.45	1.41	1.41	1.32	1.32
Volatile Matter of Vitrinite	%	22	23	22	22	21	23	23	23	23	23	22	23	23	22	23	23	25	25

Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

Raw Coal																			
Analytical Moisture	%	0.6	0.8	0.7	0.6	0.7	0.7	0.7	0.7	0.7	1.0	1.0	0.8	0.8	0.8	0.7	0.6	1.1	0.9
Ash	% db	33.1	42.7	43.0	33.1	31.4	29.8	28.5	34.6	36.0	16.1	44.3	45.5	35.2	28.5	24.0	20.6	26.7	27.8
Volatile Matter	% db	16.7	14.3	12.5	14.2	14.1	15.1	15.4	14.4	14.4	16.9	13.5	14.3	15.3	16.3	17.0	19.0	17.8	17.8
Fixed Carbon	% air dry	49.9	42.6	44.2	52.4	54.5	54.7	55.7	50.6	49.3	66.4	41.7	39.9	49.1	54.7	58.6	60.0	54.9	54.1
Sulphur	% db	0.53	0.46	0.37	0.41	0.36	0.33	0.31	0.46	0.46	0.70	0.39	0.39	0.34	0.36	0.34	0.32	0.28	0.35
Hardgrove Growing Index		85	80	93	91	98	103	87	85	86	93	68	89	79	80	79	85	74	74
Size Fraction																			
¼"x65M		90.5	83.3	77.4	91.7	88.0	82.9	84.3	85.4	85.4	95.3	85.8	80.5	85.5	88.9	90.4	90.7	85.0	83.0
65MxD		9.5	16.7	22.6	8.3	12.0	17.1	15.7	14.6	14.6	4.7	14.2	19.5	14.5	11.1	9.6	9.3	15.0	17.0
Clean Coal (Size Fraction ¼"x65M;1.5 Sink Float S.G.)																			
Yield ¼"x65M	%	58.3	51.1	41.3	62.1	70.5	64.4	67.3	52.3	53.6	71.3	37.2	38.7	56.9	61.8	65.9	72.4	70.3	64.6
Total Yield, excl. 65MxD	%	52.8	42.6	32.0	56.9	62.0	53.4	56.7	44.7	45.7	67.9	31.9	31.2	48.6	54.9	59.6	65.7	59.8	53.6
Analytical Moisture	% air dry	0.6	0.7	1.5	1.3	1.5	3.1	2.7	3.2	2.5	0.7	1.7	1.5	1.6	1.0	0.7	0.6	0.9	0.9
Ash	% db	9.1	9.1	6.6	6.3	7.2	6.6	6.5	8.2	8.3	9.7	9.4	8.0	6.8	6.8	7.2	6.6	6.2	6.0
Volatile Matter	% dab	21.2	21.0	19.9	19.7	22.1	20.3	20.0	20.8	20.5	19.3	20.7	20.5	21.1	21.3	20.8	21.5	22.0	22.5
Fixed Carbon	% dab	78.7	78.9	80.0	80.3	77.8	79.5	79.7	79.0	79.2	80.7	79.3	79.4	78.6	79.0	79.1	78.4	77.9	77.2
Sulphur	% db	0.58	0.60	0.81	0.74	0.77	0.41	0.36	0.56	0.64	0.78	0.94	0.82	0.84	0.59	0.51	0.49	0.53	0.47
Phosphorous	% db																		
FSI		9	7½	8	7½	7½	2½	2	7½	7	3	4½	4½	5½	6½	4½	7	8	8
Softening Temperature	°C	378	377	400	421	402	435	428	411	415	432	417	441	409	409	407	414	408	412
Resolidification Temp.	°C	432	425	465	470	462	-	-	474	478	-	-	-	-	474	-	468	468	474
Contraction	%	22	21	28	20	24	12	13	21	22	14	18	9	17	21	20	16	17	17
Dilatation	%	47	25	3	0	10	-12	-13	4	-12	-14	-18	-9	-17	-16	-20	-13	-4	4
G-Value		1.025	1.005	0.943	0.948	0.972	-	-	0.953	0.806	-	-	-	-	0.647	-	0.628	0.900	0.958


PORTAL COORDINATES
N 563,082
E 69,685
CUT SAMPLE
NA 29723
SEPT. 1968
BULK SAMPLE
NA 337,315
OCT. 1968
BULK SAMPLE
MK 0951 to 0975
25 JULY 1970
CHANNEL SAMPLE
MK-J. NORTON/CYCLONE
25 AUG. 1970
HW SEAM NO. 1
52.9'
CHANNEL SAMPLE NO. 1
BULK SAMPLE FACE 3.7.75
CHANNEL SAMPLE NO. 2
BULK SAMPLE FACE +7'
31.7.75 (EB)
BULK SAMPLE 30+31.7.75 (EB)
CUT SAMPLE
MK 0999
4 AUG. 1970
CUT SAMPLE
MK 0759
18 AUG. 1970
CHANNEL SAMPLE
MK 0751 to 0754
24 AUG. 1970
CHANNEL SAMPLE
MK 0771 to 0773
1 SEPT. 1970
EL. 5370'
46'
67.4'
118'
166.8'
29'
5.5'
SECTION A-A
3.5" PARTING
1.7" ROCK HANGING WALL
2" ROCK FOOTWALL
42°
43°
5.5'
15.9'
10.64'
SECTION F-F
X CUT 4 (EB)
FW
HW
5'
38°
15.0'
9.2'
SECTION B-B
X CUT 1-A
40°
33.5°
21.0'
11.6'
SECTION C-C
X CUT 1
(MK)
37°
38°
16.9'
10.4'
SECTION D-D
X CUT 2
(MK)
SEAM NO. 1
SEAM NO. 2
42°
40°
3.9'
35.0'
2.5'
1.6'
3.7
12.6'
1.0'
8.1'
SECTION E-E
X CUT 3 (MK)
LEGEND-SECTIONS
(NA) NORTH AMERICAN
(SR) SCURRY-RAINBOW
(MK) MORRISON-KNUDSEN
(EB) ELCO MINING LTD.
ELCO MINING LTD.
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
BULK SAMPLING
TUNNEL & SEAM 2
SCALE: 1" = 20'
NOV., 1975



SEAM No. 2

ADIT No. 2

BULK SAMPLE	- THICKNESS	:	10'7.6"
TOTAL SEAM	- THICKNESS	:	10'3.3"
TOTAL COAL	- THICKNESS	:	9'1.8"
TOTAL PARTINGS	- THICKNESS	:	1'1.5"
TOTAL ROOF AND FLOOR IN SAMPLE		:	4.3"

WASHABILITY TEST RESULTS

Seam No. 2
Lab.No. 3396
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulphur %	BTU/LB	H.G.I.
0.6	37.2	15.0	47.2	0.39	9490	88

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulp. %	H.G.I.	Cum.Wei. %	Cum.Ash %
2"x¼"	17.9	57.8	0.8	13.3	28.1	0.31	69	17.9	
¼"x0	82.1							100.0	
3/4"x28M	67.9	41.8	0.6	14.5	43.1	0.37	80	67.9	41.8
28Mx65M	4.9	24.1	0.7	17.3	57.9	0.48	123	72.8	40.6
65Mx100M	8.6	25.6						81.4	39.0
100Mx200M	10.1	19.5						91.5	36.9
200Mx0	8.5	16.6						100.0	35.2
65Mx0	27.2	20.0	0.7	18.0	61.3	0.53			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=17.9%=5.3% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Wei. %	Cum.Ash %
1.30	3.6	2.8	1.1	23.3	72.8	3.6	2.8
1.30-1.35	9.3	6.9	0.7	21.3	71.1	12.9	5.8
1.35-1.40	9.9	11.2	0.6	17.1	71.1	22.8	8.1
1.40-1.45	3.9	17.5	0.6	17.3	64.6	26.7	9.5
1.45-1.50	3.0	21.2	0.6	16.6	61.6	29.7	10.7
> 1.50	29.7	10.7		19.1			
1.50-1.55	2.0	27.3	0.7	15.3	56.7	31.7	11.7
1.55-1.60	0.8	30.4	0.7	14.3	54.6	32.5	12.2
1.60-1.70	2.8	42.7	0.7	13.1	43.5	35.3	14.6
1.70-1.80	5.6	53.5	1.1	11.9	33.5	40.9	19.9
1.80	59.1	82.7	0.7	11.8	4.8	100.0	57.0

SIZE FRACTION 3/4"x28M=57.0%=28.3% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Wei. %	Cum.Ash %
10.5	2.6	1.4	20.9	75.1	10.5	2.6
9.3	6.1	0.9	19.6	73.4	19.8	4.2
16.5	10.2	0.8	17.6	71.4	36.3	7.0
8.7	15.4	0.8	16.6	67.2	45.0	8.6
4.8	20.9	0.9	16.1	62.1	49.8	9.8
49.8	9.8		18.4			
2.4	26.5	0.8	15.5	57.2	52.2	10.5
1.4	34.4	1.0	14.9	49.7	53.6	11.2
4.0	38.5	1.3	14.2	46.0	57.6	13.1
4.7	46.7	1.4	13.1	38.8	62.3	15.6
37.7	80.6	1.9	8.6	8.9	100.0	40.1

SIZE FRACTION 28Mx65M=4.1%=2.8% < 1.5 S.G

Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
16.2	1.2	0.8	21.9	76.1	16.2	1.2
20.0	4.2	0.9	20.1	74.8	36.2	2.9
16.0	8.6	1.4	19.0	71.0	52.2	4.6
10.7	12.9	1.3	18.2	67.6	62.9	6.0
6.2	19.8	1.3	17.4	61.5	69.1	7.3
69.1	7.3		19.7			
3.8	24.2	1.3	17.2	57.3	72.9	8.1
2.0	29.5	1.5	16.9	52.1	74.9	8.7
3.7	36.2	1.9	15.9	46.0	78.6	10.0
2.7	43.4	1.7	15.2	39.7	81.3	11.1
18.7	76.0	1.7	10.2	12.1	100.0	23.3

FROTH-FLOTATION, SIZE FRACTION 65MxO

	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weigh. %	Cum. Ash %
STAGE I	69.9	9.8	0.6	19.2	70.4	69.9	9.8
STAGE II	10.1	18.3	0.6	17.8	63.3	80.0	10.9
TAILINGS	20.0	55.9	0.9	13.7	29.5	100.0	19.9

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

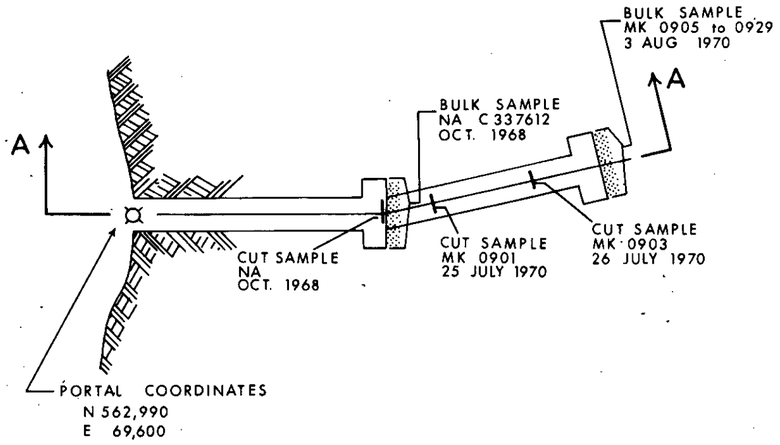
RUHR DILATOMETER RESULTS, 1.5 S.G.

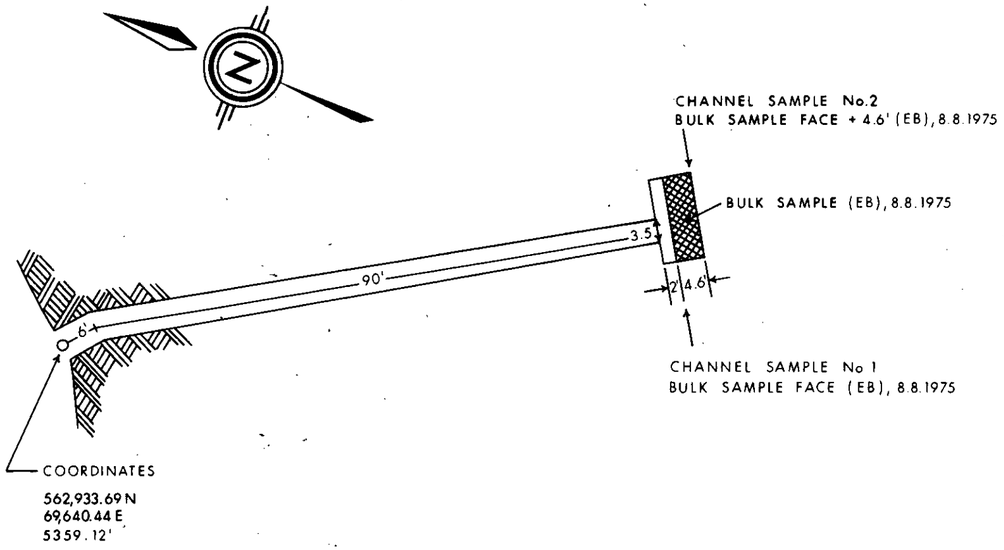
Tot.Sul. %	Phosphor %	FSI	Soften. Tem°C	Resolidif. Temp°C	Contraction %	Dilatation %	G-Val.
0.56	0.04	7½	402	-	3	-3	-

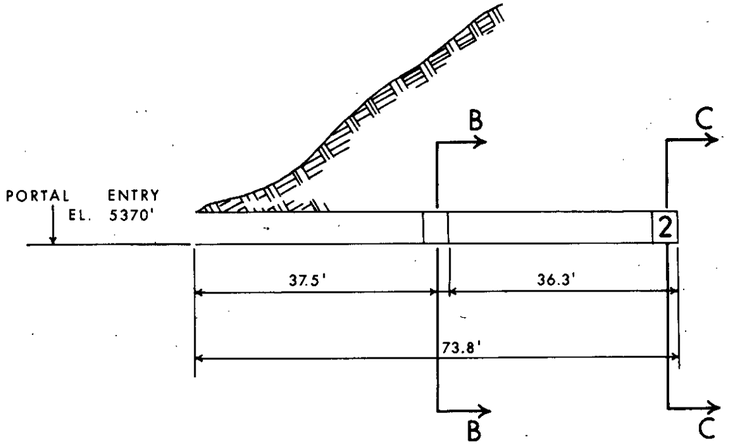
Tot.Sul. %	Phos. %	FSI	Soft. Tem°C	Resol. Tem°C	Contr. %	Dilat. %	G-Value
0.60	0.03	8	392	463	21	18	0.994

Tot.Sul. %	Phos. %	FSI	Soft. Tem°C	Resol. Tem°C	Contract. %	Dilatat. %	G-Value
0.74	0.03	9	394	465	24	52	1.032

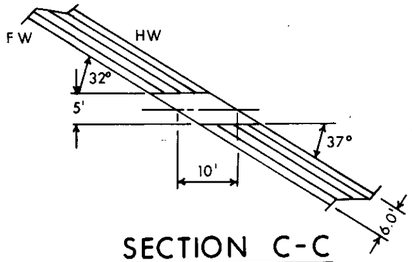
Tot.Sulphur %	Phosphor %	FSI	Soften. Tem°C	Resolidifc. Temp.°C	Contract. %	Dilatat %	G-Value
0.62		9	390	465	28	66	1,037



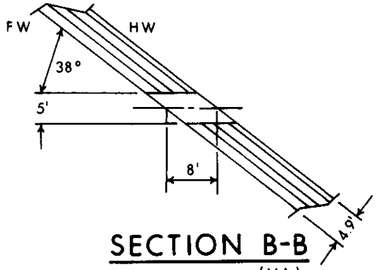




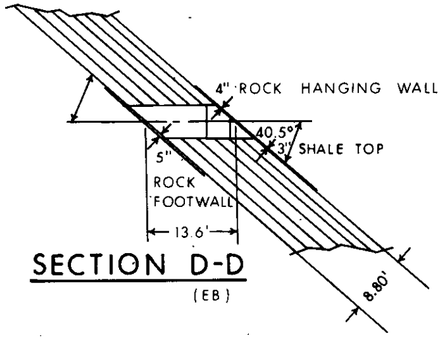
SECTION A-A



SECTION C-C
X CUT NO. 2
(MK)



SECTION B-B
(NA)



SECTION D-D
(EB)

LEGEND SECTIONS

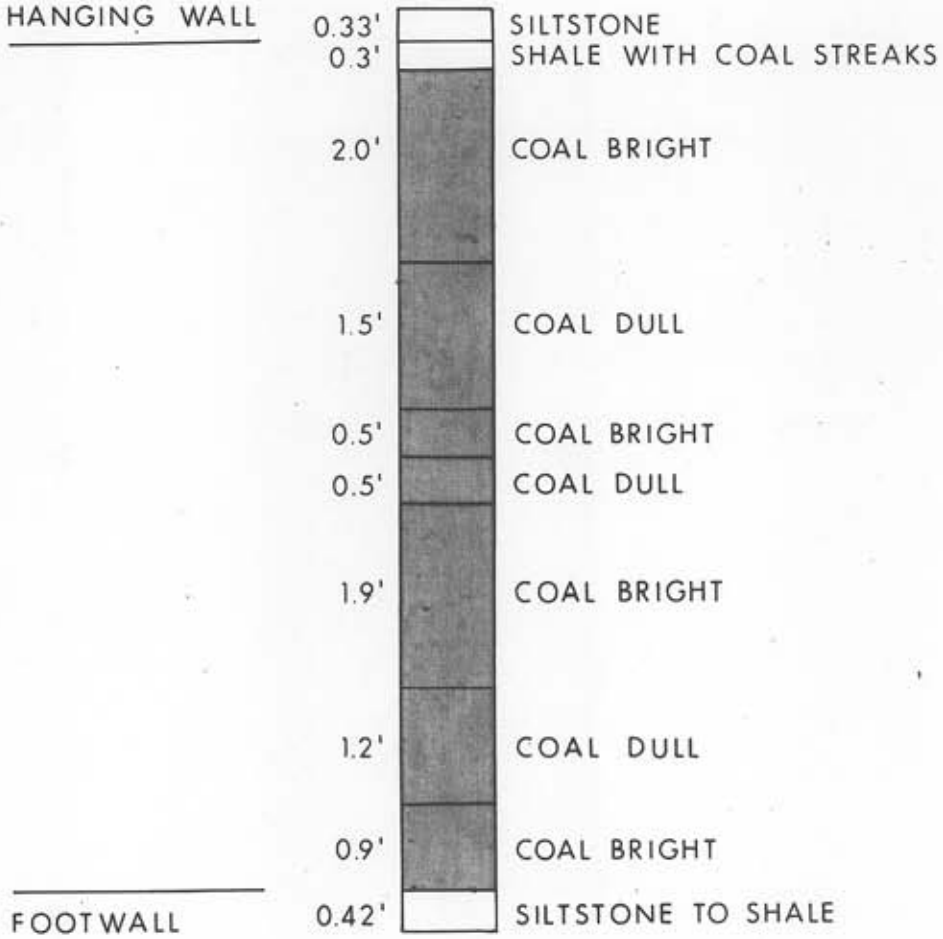
(NA)	NORTH AMERICAN
(SR)	SCURRY - RAINBOW
(MK)	MORRISON - KNUDSEN
(EB)	ELCO MINING LTD.

ELCO MINING LTD.

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

BULK SAMPLING
TUNNEL & SEAM 3

SCALE : 1" = 20' NOV., 1975



SEAM No.3

ADIT No.3

BULK SAMPLE	- THICKNESS :	9.55'
TOTAL SEAM	- THICKNESS :	8.80'
TOTAL COAL	- THICKNESS :	8.50'
TOTAL PARTINGS	- THICKNESS :	0.30'
TOTAL ROOF AND FLOOR IN SAMPLE	:	0.75'

WASHABILITY TEST RESULTS

SEAM NO. 3

LAB.NO. 3540

LABORATORY: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moisture %	Ash %	Vol.Matter %	Fix.Carbon %	Sulphur %	BTU/LB	H.G.I.
0.7	21.9	16.1	61.3	0.44	12210	109

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Sulphur %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x¼"	13.6	68.8	0.5	9.6	21.1	0.23	63	13.6	
¼"x0	86.4							100.0	
3/4"x28M	62.3	23.7	0.5	16.0	59.8	0.53	104	62.3	23.7
28Mx65M	22.3	11.1	0.6	18.1	70.2	0.56	136	84.6	20.4
65Mx100M	4.9	11.6						89.5	19.9
100Mx200M	6.6	10.5						96.1	19.2
200MxO	3.9	10.8						100.0	18.9
65MxO	15.4	11.0	0.6	18.2	70.2	0.55			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=13.6%=3.7%<1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	14.0	2.2	1.9	19.9	76.0	14.0	2.2
1.30-1.35	7.0	5.4	1.7	18.9	74.0	21.0	3.3
1.35-1.40	3.2	9.4	1.0	17.1	72.5	24.2	4.1
1.40-1.45	2.4	12.1	0.9	16.7	70.3	26.6	4.8
1.45-1.50	0.7	19.3	0.7	15.7	64.3	27.3	5.2
> 1.50	27.3	5.2		18.9			
1.50-1.55	0.9	25.0	0.9	15.0	59.1	28.2	5.8
1.55-1.60	0.3	29.1	1.2	14.6	55.1	28.5	6.1
1.60-1.70	0.4	34.5	2.3	14.5	48.7	28.9	6.4
1.70-1.80	0.2	45.2	1.0	11.2	42.6	29.1	6.7
1.80	70.9	92.3	0.9	4.5	2.3	100.0	67.4

SIZE FRACTION 3/4"x28M=54.9%=41.4%<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
27.6	2.1	2.6	20.2	75.1	27.6	2.1
20.9	4.9	2.0	19.4	73.7	48.5	3.3
16.4	9.3	1.4	17.5	71.8	64.9	4.8
6.7	13.5	1.1	16.7	68.7	71.6	5.6
3.9	19.3	1.0	16.1	63.6	75.5	6.3
75.5	6.3		18.9			
2.1	25.0	1.1	15.6	58.3	77.6	6.8
1.3	28.3	1.6	15.1	55.0	78.9	7.2
1.2	34.9	1.6	14.2	49.3	80.1	7.6
1.1	41.8	1.9	13.0	43.3	81.2	8.1
18.8	85.6	1.0	6.4	7.0	100.0	22.7

SIZE FRACTION 28MxO=19.6%=17.3%<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
23.1	1.0	1.3	21.0	76.7	23.1	1.0
25.3	3.5	1.4	19.4	75.7	48.4	2.3
17.9	6.9	2.1	18.6	72.4	66.3	3.5
14.9	10.7	2.2	17.8	69.3	81.2	4.9
6.7	17.9	1.9	17.1	63.1	87.9	5.9
87.9	5.9		19.2			
2.5	24.4	1.6	16.7	57.3	90.4	6.4
1.2	29.0	1.6	16.5	52.9	91.6	6.7
1.7	34.5	2.0	16.3	47.2	93.3	7.2
1.2	41.1	1.6	15.9	41.4	94.5	7.6
5.5	70.5	1.4	13.7	14.4	100.0	11.1

FROTH-FLOTATION, SIZE FRACTION 65MxO

	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
STAGE I	80.3	7.5	0.6	18.5	73.4	80.3	7.5
STAGE II	10.6	10.5	0.6	18.3	70.6	90.8	7.8
TAILINGS	9.2	41.9	0.7	15.7	41.7	100.0	11.0

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1-k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

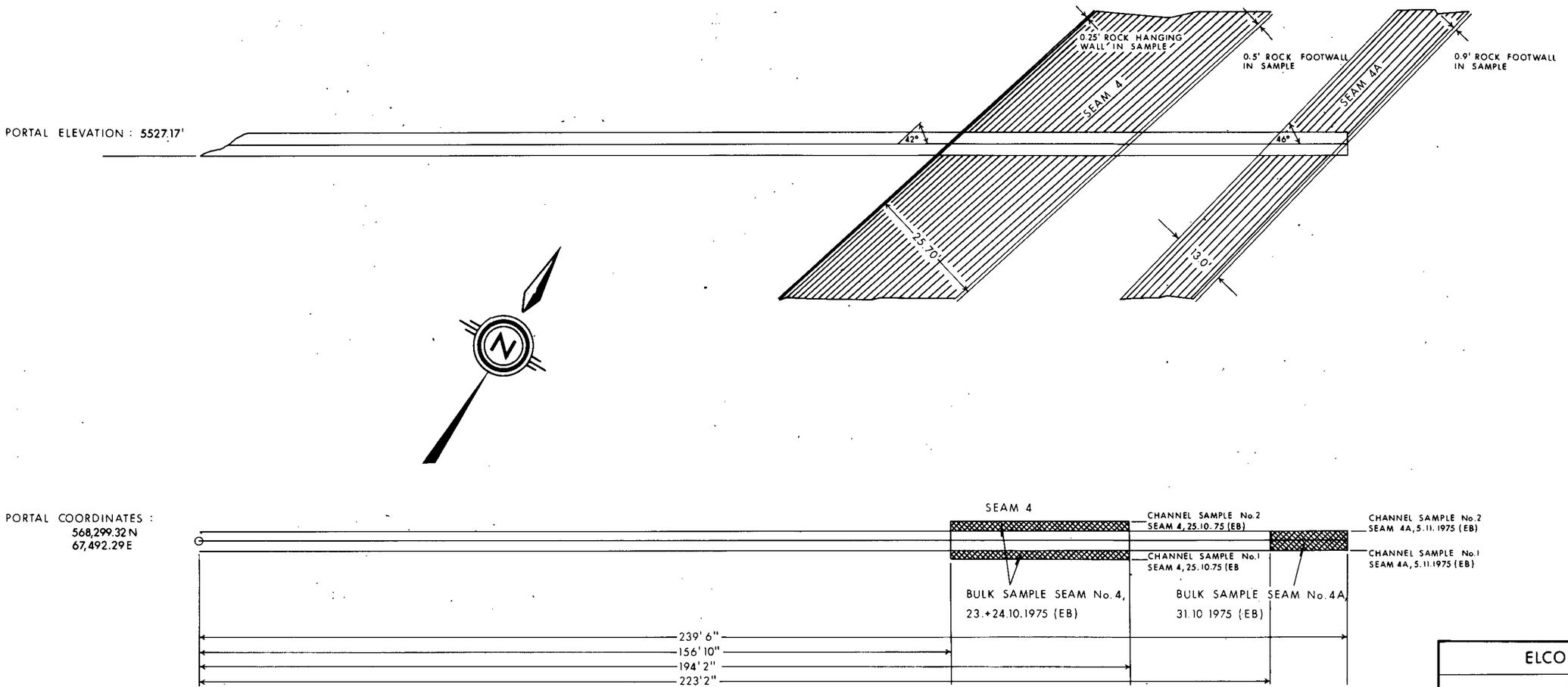
RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resolidifi-cat.Temp.°C	Contract. %	Dilat. %	G-Value
0.97	0.16	8½	397	458	13	15	1.005

Tot.Sul. %	Phosp. %	FSI	Soft. Tem.°C	Resolid. Tem.°C	Contrac. %	Dilatat. %	G-Val.
0.94	0.18	7½	413	474	23	9	0.971

Tot.Sul. %	Phos. %	FSI	Softeg. Temp.°C	Resolid. Temp.°C	Contrac. %	Dilat. %	G-Value
0.91	0.05	8½	416	469	23	8	0.972

Total Sulph. %	Phosphor %	FSI	Softeg. Temp.°C	Resolidifc. Temp.°C	Contract. %	Dilatat. %	G-Value
0.55		8½	413	474	25	17	0.987



LEGEND SECTIONS

(EB) ELCO MINING LTD.

ELCO MINING LTD.

ELK RIVER COAL PROJECT

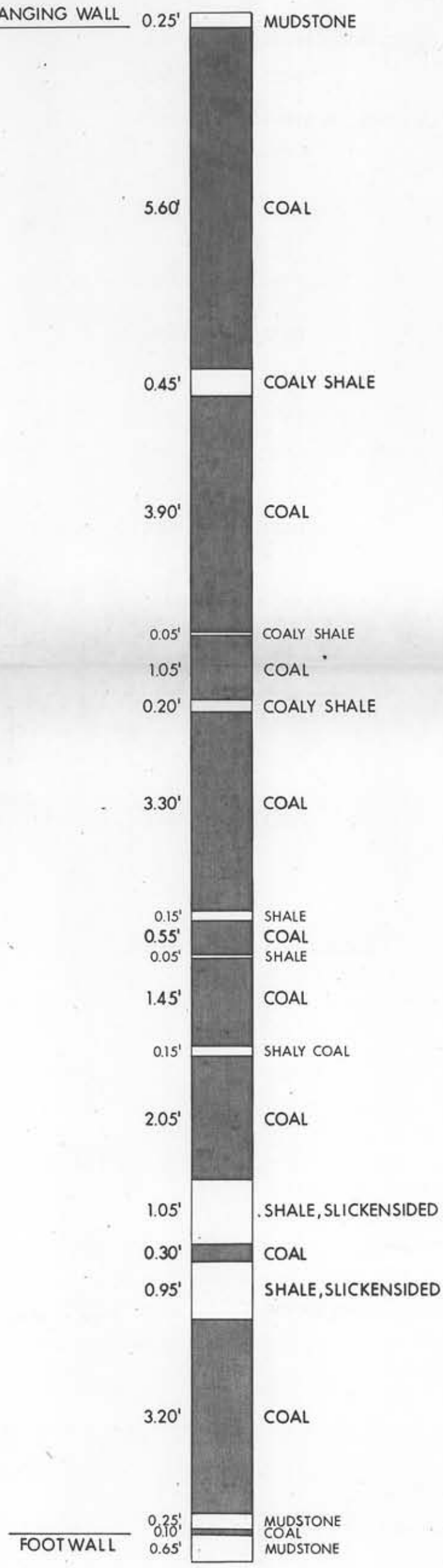
BRITISH COLUMBIA

BULK SAMPLING

TUNNEL & SEAMS 4 + 4A

SCALE : 1" = 20'

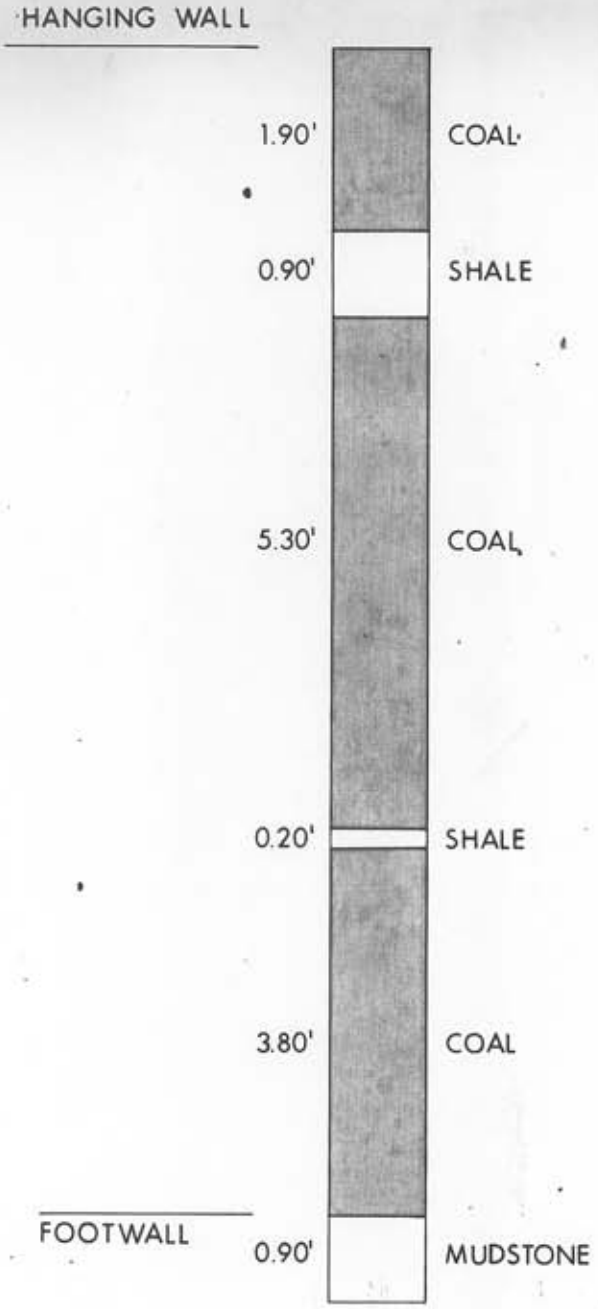
JAN., 1976



SEAM No. 4

ADIT No. 4 + 4A (ROCK ADIT)

BULK SAMPLE	- THICKNESS	:	25.70'
TOTAL SEAM	- THICKNESS	:	24.80'
TOTAL COAL	- THICKNESS	:	21.50'
TOTAL PARTINGS	- THICKNESS	:	3.30'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.90',



SEAM No. 4A

ADIT No. 4+4A (ROCK ADIT)

BULK SAMPLE	- THICKNESS	:	13.0'
TOTAL SEAM	- THICKNESS	:	12.1'
TOTAL COAL	- THICKNESS	:	11.0'
TOTAL PARTINGS	- THICKNESS	:	1.1'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.09'

WASHABILITY TEST RESULTS

SEAM NO. 4
LAB. NO. 4720
LABORATORY: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis):

In.Moisture %	Ash %	Vol.Matter %	Fixed Carbon %	Sulphur %	BTU/LB	H.G.I.
0.6	27.7	16.0	55.7	0.34	11200	96

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fixed Carbon %	Sulphur %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x½"	17.9	34.0	1.3	14.3	50.4	0.24	88		
½"x0	82.1								
								76.2	28.7
3/4"x28M	76.2	28.7	0.8	15.6	54.9	0.26	90	87.5	27.4
28Mx65M	11.3	18.8	0.8	17.5	62.9	0.35	117	89.8	27.1
65Mx100M	2.3	16.2						96.7	26.3
100Mx200M	6.9	15.7						100.0	26.0
200MxO	3.3	16.4							
65MxO	12.5	16.2	0.6	17.4	65.8	0.63			

AIR DRY BASIS

SINK-FLOAT, SIZE FRACTION 2"x½"=17.9%=11.2% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moisture %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	12.3	3.0	1.4	19.4	76.2	12.3	3.0
1.30-1.35	32.1	6.0	0.9	17.3	75.8	44.4	5.2
1.35-1.40	8.9	9.8	0.8	17.3	72.1	53.3	5.9
1.40-1.45	5.9	14.0	1.0	17.2	67.8	59.2	6.7
1.45-1.50	3.5	20.3	0.8	16.8	62.1	62.7	7.5
> 1.50	62.7	7.5		17.7			
1.50-1.55	1.1	26.6	0.8	16.7	55.9	63.8	7.8
1.55-1.60	0.3	29.1	0.8	16.0	54.1	64.1	7.9
1.60-1.70	1.4	36.1	0.7	16.7	46.5	65.5	8.5
1.70-1.80	0.7	46.9	0.7	16.8	35.6	66.2	8.9
1.80	33.8	85.8	0.9	8.3	5.0	100.0	34.9

SIZE FRACTION 3/4"x28M=62.8%=40.9% < 1.5 S.G.

Weight %	Ash %	Inh.Moist. %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
13.5	1.9	2.6	21.3	74.2	13.5	1.9
19.5	4.1	2.8	18.1	75.0	33.0	3.2
13.9	7.0	2.0	17.2	73.8	46.9	4.3
14.9	11.3	2.6	16.6	69.5	61.8	6.0
3.4	18.6	1.3	16.3	63.8	65.2	6.7
65.2	6.7		18.1			
4.6	20.4	1.6	16.5	61.5	69.8	7.6
1.7	32.1	1.0	15.6	51.3	71.5	8.2
0.4	33.5	1.2	15.6	49.7	71.9	8.3
1.1	39.9	1.2	15.0	43.9	73.0	8.8
27.0	82.2	1.5	8.9	7.4	100.0	28.6

SIZE FRACTION 28Mx65M=9.3%=7.0% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
21.8	0.9	1.1	21.4	76.6	21.8	0.9
19.8	3.1	1.7	19.4	75.8	41.6	1.9
14.7	5.9	2.5	18.6	73.0	56.3	3.0
11.1	9.0	3.2	18.4	69.4	67.4	4.0
8.4	15.2	3.0	17.4	64.4	75.8	5.2
75.8	5.2		19.5			
2.6	22.7	2.3	16.3	58.7	78.4	5.8
1.9	26.6	2.7	16.8	53.9	80.3	6.3
2.6	34.7	2.4	15.8	47.1	82.9	7.2
1.6	40.7	3.0	15.6	40.7	84.5	7.8
15.5	74.4	1.9	14.3	9.4	100.0	18.1

FROTH-FLOTATION, SIZE FRACTION 65MxO

	Weight %	Ash %	Inh.Moist. %	Vol.Matter %	Fix. Carbon %	Cum.Weight %	Cum.Ash %
Stage I	79.8	8.1	0.5	18.6	72.8	79.8	8.1
Stage II	7.4	20.3	0.7	16.9	62.1	87.2	9.1
Tailings	12.8	60.8	0.8	12.8	25.6	100.0	15.7

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

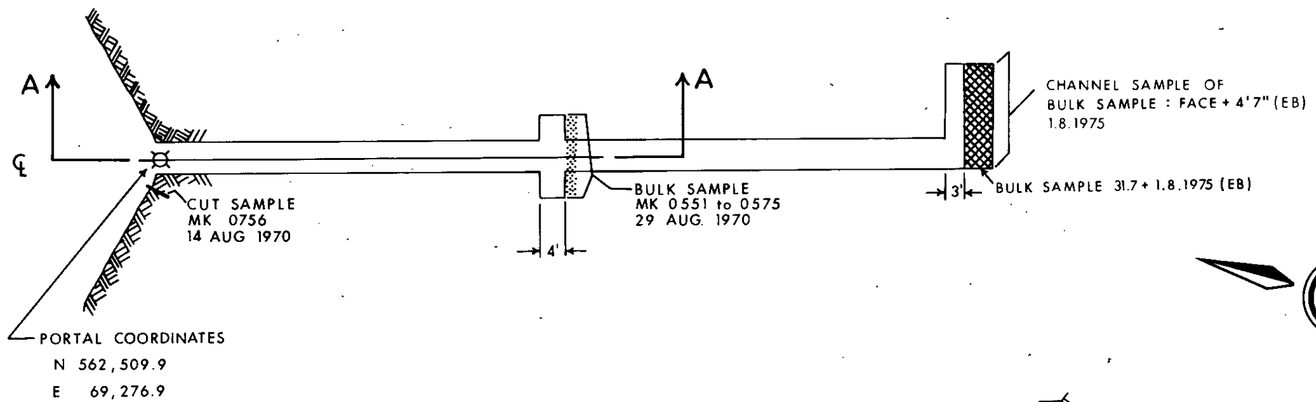
RUHR DILATOMETER RESULTS, 1.5 S.G.

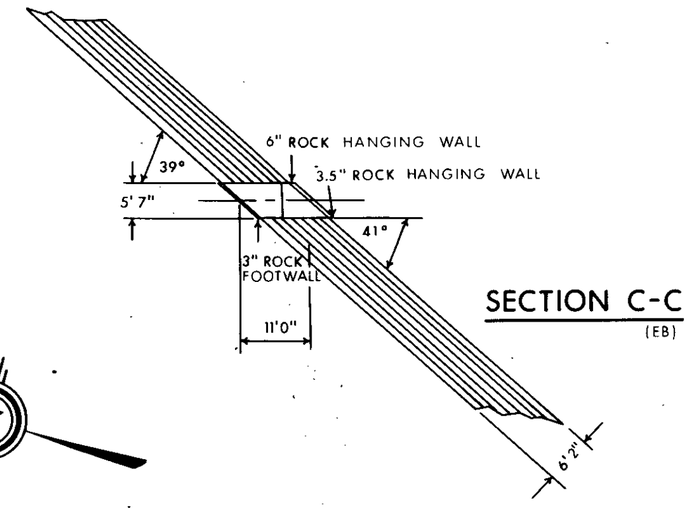
Tot.Sul. %	Phosphor %	FSI	Soft. Tem.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Value
0.37	0.04	3½	435	–	19	-19	–

Tot.Sul. %	Phosp. %	FSI	Soft. Temp.°C	Resolidif. Temp.°C	Contrac. %	Dilat. %	G-Value
0.50	0.03	7	430	–	16	-16	–

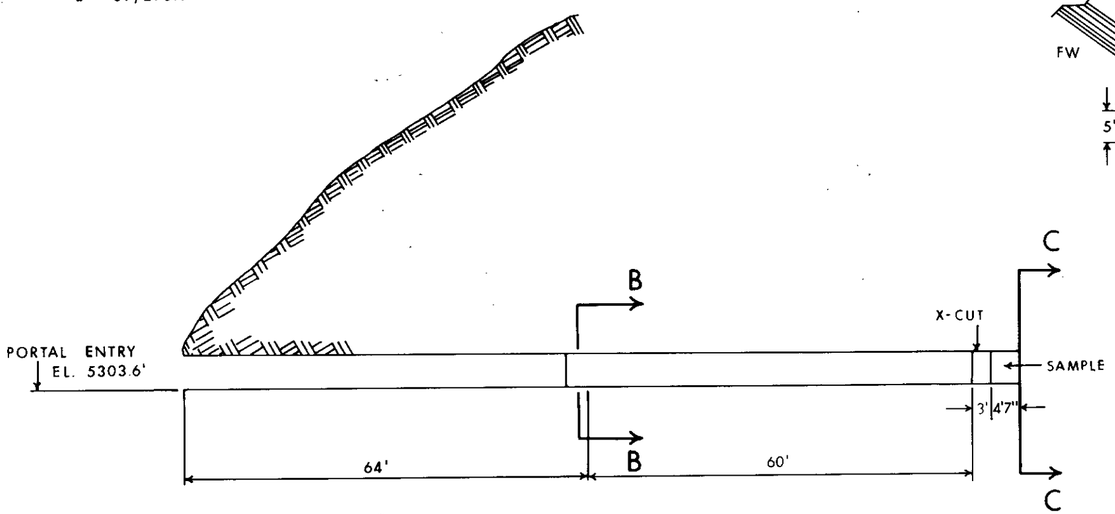
Tot.Sul. %	Phosp. %	FSI	Soft. Temp°C	Resolidif. Temp.°C	Contr. %	Dilat. %	G-Value
0.50	0.02	3	420	—	20	-20	-

Tot.Sul. %	Phosp. %	FSI	Soft. Temp°C	Resolidif. Temp.°C	Contrac. %	Dilat. %	G-Value
0.61		6.5	416	478	26	0	0.935

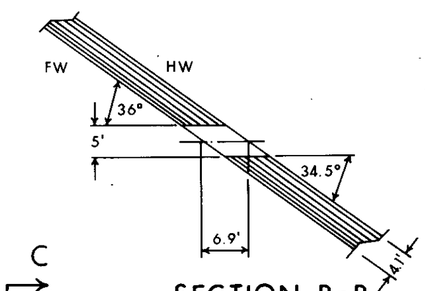




SECTION C-C
(EB)



SECTION A-A



SECTION B-B
(MK)

LEGEND-SECTIONS

(NA)	NORTH AMERICAN
(SR)	SCURRY-RAINBOW
(MK)	MORRISON-KNUDSEN
(EB)	ELCO MINING LTD.

ELCO MINING LTD.

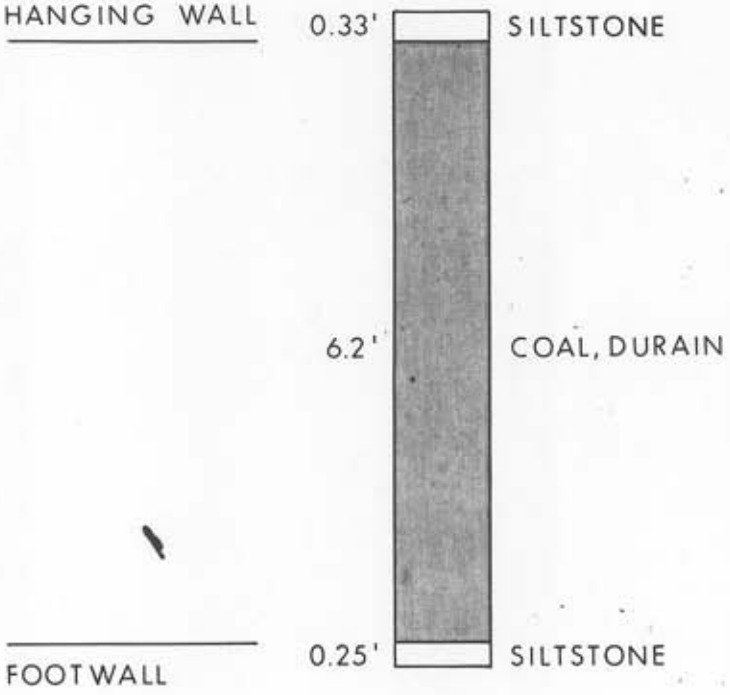
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

BULK SAMPLING

TUNNEL & SEAM 6

SCALE : 1" = 20'

NOV., 1975



SEAM No. 6

ADIT No. 6

BULK SAMPLE	- THICKNESS	:	6.78'
TOTAL SEAM	- THICKNESS	:	6.20'
TOTAL COAL	- THICKNESS	:	6.20'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.58'

WASHABILITY TEST RESULTS

Seam No. 6
Lab.No. 3500
Laboratory: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Matter %	Fixed Carbon %	Sulphur %	BTU/LB	H.G.I.
1.0	23.8	16.5	58.7	0.71	11870	84

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fixed Carbon %	Sulphur %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x½"	20.0	43.7	0.7	14.0	41.6	0.46	71	20.0	
½"x0	80.0							100.0	
3/4"x28M	66.8	29.7	0.9	15.1	54.3	0.43	76	66.8	29.7
28Mx65M	11.1	14.7	0.7	17.6	67.0	0.81	110	77.9	27.6
65Mx100M	6.1	15.8						84.0	26.7
100Mx200M	7.0	13.5						91.0	25.7
200MxO	9.0	11.8						100.0	24.4
65MxO	22.1	13.1	0.9	17.9	68.1	0.83			

AIR DRY BASIS

SINK FLOAT ANALYSIS, SIZE FRACTION 2"x½"=20.0%= 9.1%<1.5 S.G.

Specific Gravity	Weight %	Ash %	Inh.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	-	-	-	-	-		
1.30-1.35	10.7	6.6	0.7	17.3	75.4	10.7	6.6
1.35-1.40	23.7	15.2	0.7	16.4	67.7	34.4	12.5
1.40-1.45	6.7	15.4	0.6	16.4	67.6	41.1	13.0
1.45-1.50	4.2	21.1	0.6	16.4	61.9	45.3	13.7
2 1.50	45.3	13.7		16.6			
1.50-1.55	2.6	27.8	0.6	16.3	55.3	47.9	14.5
1.55-1.60	2.5	28.1	0.6	17.0	54.3	50.4	15.2
1.60-1.70	4.1	39.1	0.6	15.9	44.4	54.5	17.0
1.70-1.80	1.7	44.1	0.7	17.3	37.9	56.2	17.8
1.80	43.8	81.6	0.7	15.8	1.9	100.0	45.7

SIZE FRACTION 2/3"x28M=54.8%=35.8% < 1.5 S.G.

Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
10.3	2.4	1.1	19.6	76.9	10.3	2.4
14.4	5.7	1.0	17.7	75.6	24.7	4.3
25.4	9.1	1.1	16.4	73.4	50.1	6.7
9.3	15.0	1.0	16.3	67.7	59.4	8.0
5.9	20.8	0.8	16.0	62.4	65.3	9.2
65.3	9.2		17.1			
3.4	26.2	0.6	16.0	57.2	68.7	10.0
2.3	31.3	0.9	15.7	52.1	71.0	10.7
4.0	39.0	0.9	15.1	45.0	75.0	12.2
2.2	45.8	0.8	15.0	38.4	77.2	13.2
22.8	78.4	1.1	10.9	9.6	100.0	28.1

SIZE FRACTION 28MxG5M=9.1%=7.5%<1.5 S.G.

Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
27.9	0.9	0.8	20.8	77.5	27.9	0.9
17.2	4.4	0.9	18.9	75.8	45.1	2.2
20.4	8.3	1.2	18.1	72.4	65.5	4.1
11.3	12.6	1.3	17.2	68.9	76.8	5.4
5.6	19.2	1.2	16.8	62.8	82.4	6.3
82.4	6.3		19.0			
2.0	25.4	1.1	16.4	57.1	84.4	6.8
1.7	31.5	1.2	~16.3	51.0	86.1	7.3
2.6	36.0	1.5	16.0	46.5	88.7	8.1
1.5	44.5	1.5	15.2	38.8	90.2	8.7
9.8	73.5	1.5	12.6	12.4	100.0	15.1

FROTH FLOTATION, SIZE FRACTION 65MxO

	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
Stage I	80.4	8.1	0.7	18.2	73.0	80.4	8.1
Stage II	7.7	14.2	0.7	17.8	67.3	88.1	8.6
Tailings	11.9	48.5	0.8	15.5	35.2	100.0	13.4

F.F. PARAMETERS:
PULP DENSITY 10%
REAGENT 4:1=k
DOSAGE RATE 0.48 lb/T
COUDITIONIMG TIME 1 min.
STAGE I 1st min. froth
STAGE II 2nd min. froth

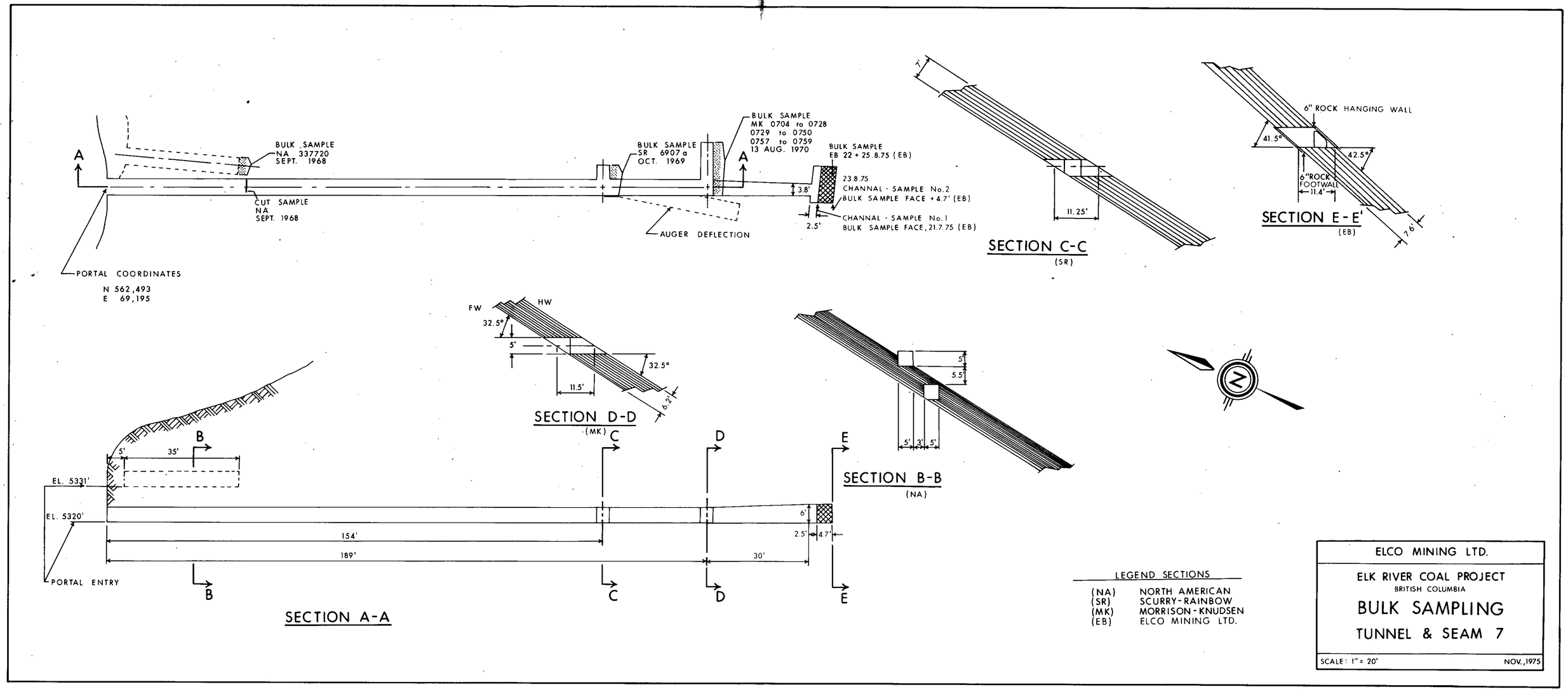
RUHR DILATOMETER RESULTS, 1.5 S.G.

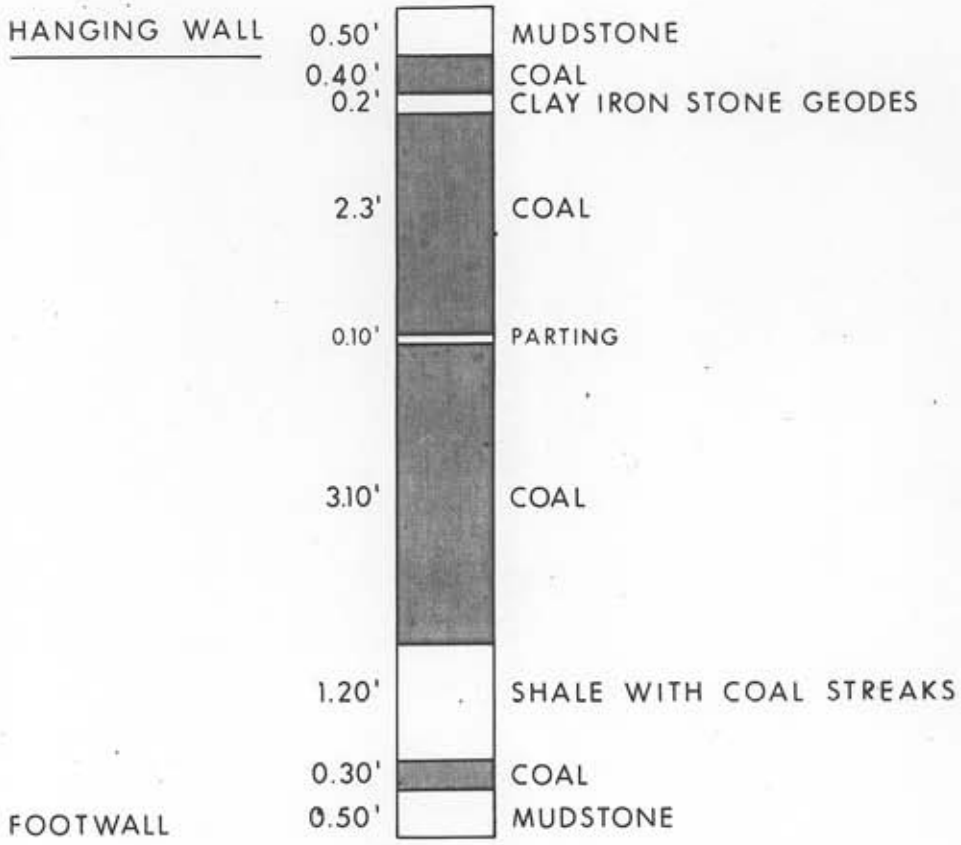
Total Sulphur %	Phosphor %	FSI	Softening °C	Resolid. Temp.°C	Contrac. %	Dilat. %	G-Value
0.76	0.20	1½	400	-	9	-9	-

Tot.Sulp. %	Phosp. %	FSI	Soften. Temp.°C	Resolidi. Temp.°C	Contrac. %	Dilata. %	G-Value
0.76	0.14	3	430	-	11	-11	-

Tot.Sulp. %	Phosp. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contrac. %	Dilat. %	G-Value
0.94	0.09	7½	424	-	17	-17	-

Total Sulph. %	Phosp. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contract. %	Dilatation %	G-Value
0.84		7	408	471	26	-8	0.881


A
BULK SAMPLE
NA 337720
SEPT. 1968
CUT SAMPLE
NA
SEPT. 1968
PORTAL COORDINATES
N 562,493
E 69,195
BULK SAMPLE
SR 6907 a
OCT. 1969
AUGER DEFLECTION
BULK SAMPLE
MK 0704 to 0728
0729 to 0750
0757 to 0759
13 AUG. 1970
A
BULK SAMPLE
EB 22 + 25.8.75 (EB)
23.8.75
CHANNAL - SAMPLE No.2
BULK SAMPLE FACE + 4.7' (EB)
3.8'
2.5'
CHANNAL - SAMPLE No.1
BULK SAMPLE FACE, 21.7.75 (EB)
7'
11.25'
SECTION C-C
(SR)
6" ROCK HANGING WALL
41.5°
42.5°
6"ROCK
FOOTWALL
11.4'
7.6'
SECTION E-E'
(EB)
FW
HW
32.5°
5'
32.5°
11.5'
6.2'
SECTION D-D
(MK)
5'
5.5'
5'
3'
5'
SECTION B-B
(NA)
B
5'
35'
EL. 5331'
EL. 5320'
C
D
E
6'
2.5'
4.7'
154'
189'
30'
PORTAL ENTRY
B
C
D
E
SECTION A-A
LEGEND SECTIONS
(NA) NORTH AMERICAN
(SR) SCURRY-RAINBOW
(MK) MORRISON-KNUDSEN
(EB) ELCO MINING LTD.
ELCO MINING LTD.
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
BULK SAMPLING
TUNNEL & SEAM 7
SCALE: 1" = 20'
NOV.,1975



SEAM No.7

ADIT No.7

BULK SAMPLE	- THICKNESS	:	8.6'
TOTAL SEAM	- THICKNESS	:	7.6'
TOTAL COAL	- THICKNESS	:	6.10'
TOTAL PARTINGS	- THICKNESS	:	1.50'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.0'

WASHABILITY TEST RESULTS

Seam No.: 7
Lab.No.: 3717
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)						
In.Moist. %	Ash %	Vol.Matt. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
1.1	33.1	15.6	50.2	0.55	10140	69

AIR DRY BASIS

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)									
Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x½"	13.4	53.1	1.0	13.4	32.5	0.35			
½"x0	86.6								
3/4"x28M	58.1	39.3	0.7	14.9	45.1	0.41		58.1	39.3
28Mx65M	15.1	28.8	0.7	16.4	54.1	0.48		73.2	37.1
65Mx100M	5.5	24.9						78.7	36.3
100Mx200M	13.0	20.3						91.7	34.0
200MxO	8.3	17.2						100.0	32.6
65MxO	26.8	19.9	0.7	17.7	61.7	0.48			

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x½"=13.4%=3.8% < 1.5 S.G.							
Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	3.8	2.3	2.6	20.7	74.4	3.8	2.3
1.30-1.35	7.5	5.9	1.2	18.4	74.5	11.3	4.7
1.35-1.40	8.1	8.6	1.1	17.3	73.0	19.4	6.3
1.40-1.45	4.6	14.2	0.9	17.0	67.9	24.0	7.8
1.45-1.50	4.5	19.7	0.8	16.9	62.6	28.5	9.7
Σ 1.50	28.5	9.7		17.9			
1.50-1.55	2.5	25.9	0.9	16.6	56.8	31.0	11.0
1.55-1.60	1.7	29.2	1.0	16.6	53.2	32.7	12.0
1.60-1.70	8.0	35.9	0.9	15.9	47.3	40.7	16.7
1.70-1.80	2.7	46.2	1.5	13.9	38.4	43.4	18.5
1.80	56.6	85.9	1.1	7.7	5.3	100.0	56.6

SIZE FRACTION 3/4"x28M=51.4%=22.7% < 1.5 S.G.							
Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
11.2	2.8	1.4	20.9	74.9	11.2	2.8
10.8	6.3	0.9	18.6	74.2	22.1	4.5
9.6	10.0	0.9	18.0	71.1	31.7	6.2
7.1	15.7	0.8	17.7	65.8	38.8	7.9
5.4	21.0	0.6	17.4	61.0	44.2	9.5
44.2	9.5		18.8			
3.3	24.6	0.6	17.1	57.7	47.5	10.6
2.8	30.2	0.6	16.7	52.5	50.3	11.7
4.1	39.1	1.4	15.8	43.7	54.4	13.7
6.1	42.5	1.4	15.0	41.1	60.5	16.6
39.5	80.6	1.4	9.9	8.1	100.0	41.9

SIZE FRACTION 28Mx65M=13.4%=7.2% < 1.5 S.G.							
Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
13.6	1.4	0.8	20.6	77.2	13.6	1.4
9.8	5.7	1.2	20.0	73.7	23.4	2.9
12.1	7.1	1.6	19.5	71.8	35.5	4.4
10.4	9.8	1.8	19.5	68.9	45.9	5.6
7.5	15.2	1.6	18.3	64.9	53.4	6.9
53.4	6.9		19.7			
4.3	21.1	1.4	17.9	59.6	57.7	8.0
7.2	25.0	1.0	17.8	56.2	64.9	9.9
3.8	35.5	1.5	17.6	55.4	68.7	10.7
3.5	32.2	1.5	17.2	49.1	72.2	11.8
27.8	73.2	1.3	11.3	14.2	100.0	28.9

FROTH-FLOTATION, SIZE FRACTION 65MxO							
	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Wei. %	Cum.Ash %
STAGE I	68.2	9.6	0.6	18.6		68.2	9.6
STAGE II	11.9	19.3	0.6	17.4		80.1	11.0
TAILINGS	19.9	52.3				100.0	19.3

F.F. PARAMETERS:

PULP DENSITY	-	10%
REAGENT		4:1+k
DOSAGE RATE		0.48 lb/T
CONDITIONING TIME		1 min.
STAGE I		1st min. froth
STAGE II		2nd min. froth

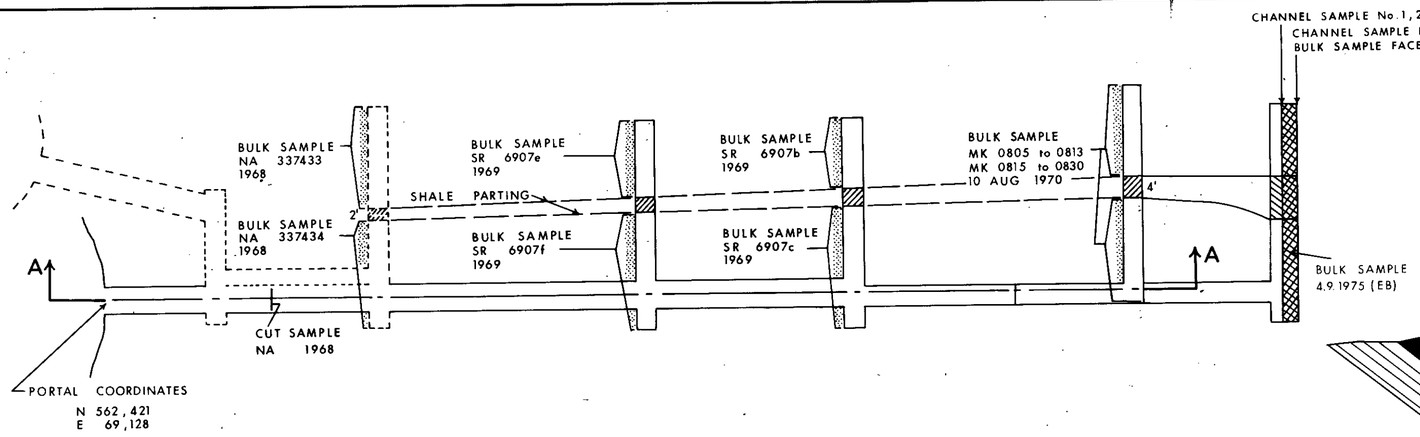
RUHR DILATOMETER RESULTS, 1.5 S.G.

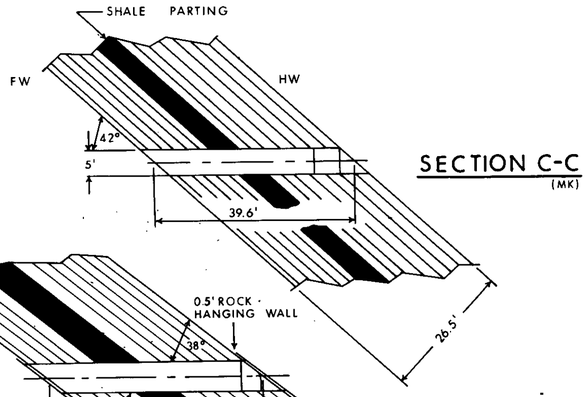
Tot.Sul. %	Phosph. %	FSI	Soften. Tem.°C	Resolidif. Temp.°C	Contrac. %	Dilatat. %	G-Value
0.84	0.07	2	423	-	12	-12	-

Tot.Sul. %	Phosp. %	FSI	Soft. Tem°C	Resolid. Tem.°C	Contr. %	Dilat. %	G-Val.
0.78	0.06	3	408	-	17	-17	-

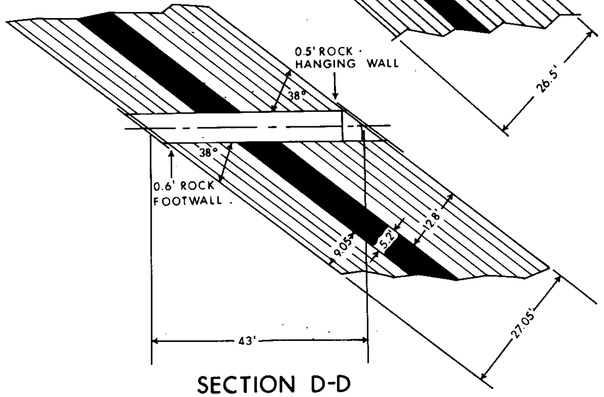
Tot.Sul. %	Phosp. %	FSI	Soften. Tem°C	Resol. Tem°C	Contr. %	Dilat. %	G-Val.
1.02	0.03	5½	409	-	22	-22	-

Tot.Sulp. %	Phos. %	FSI	Soften. Tem°C	Resolid. Tem°C	Contrac. %	Dilatat. %	G-Value
0.66	0.04	6	431	481	23	-12	0.851

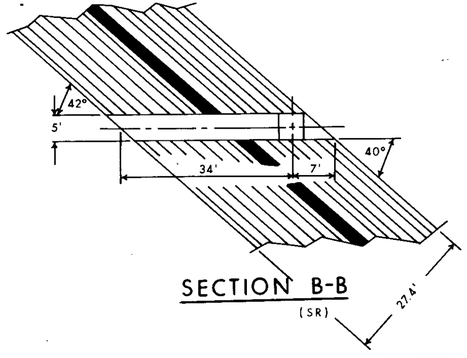




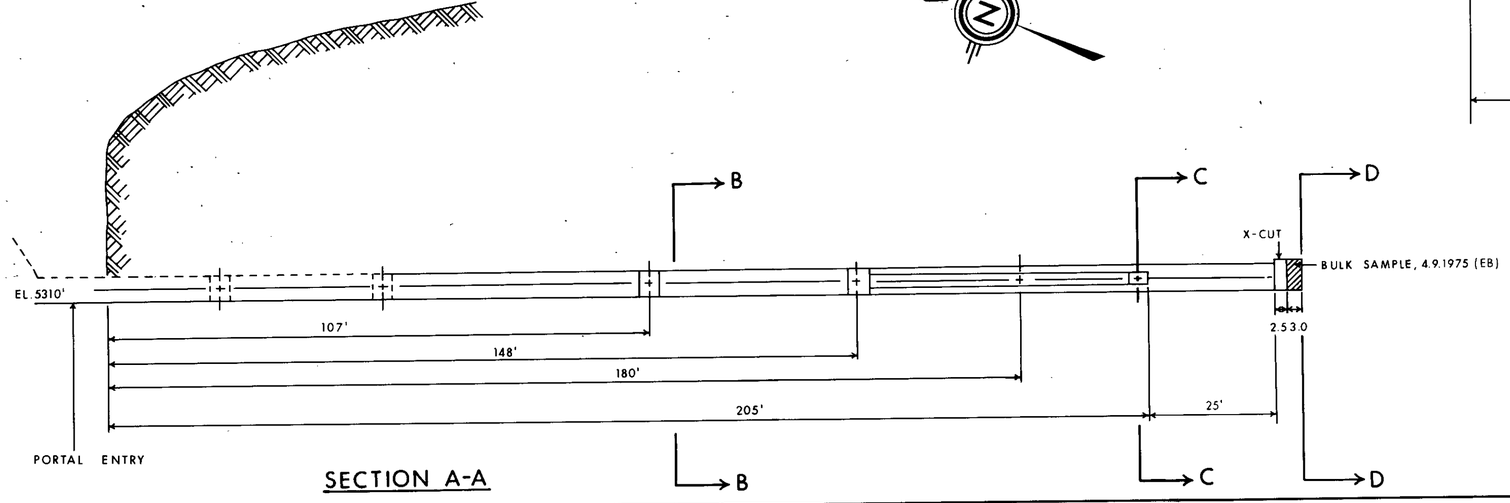
SECTION C-C
(MK)



SECTION D-D
(EB)



SECTION B-B
(SR)



SECTION A-A

LEGEND SECTIONS

(NA)	NORTH AMERICAN
(SR)	SCURRY - RAINBOW
(MK)	MORRISON - KNUDSEN
(EB)	ELCO MINING LTD.

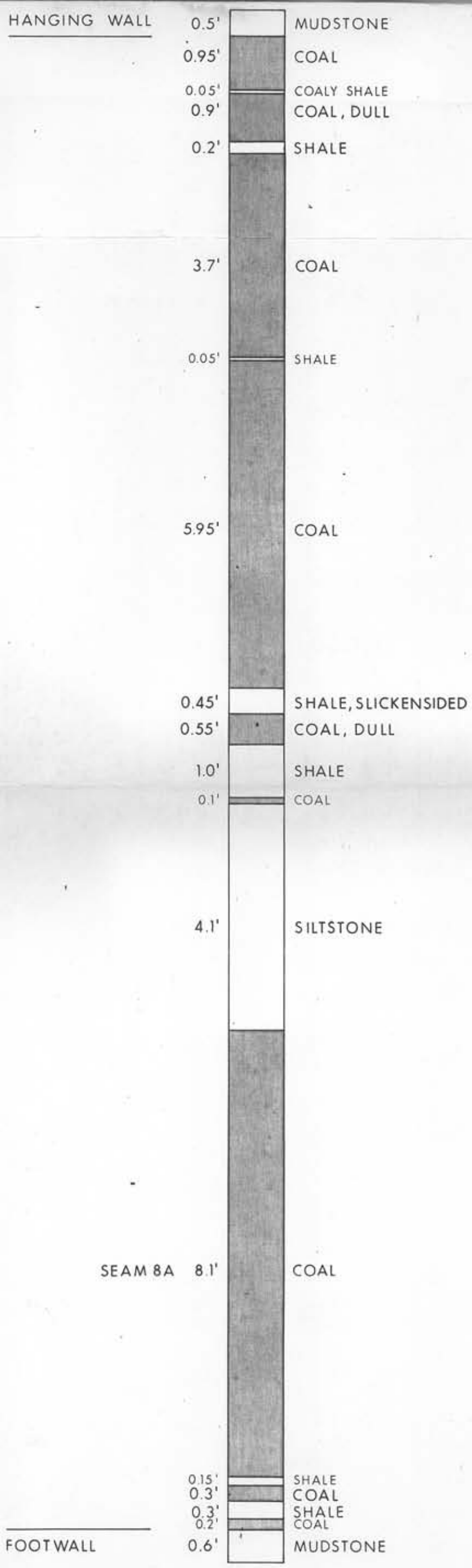
ELCO MINING LTD.

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

BULK SAMPLING
TUNNEL & SEAM 8

SCALE: 1" = 20'

NOV., 1975



SEAM No. 8 + 8A

ADIT No. 8 + 8A

BULK SAMPLE	- THICKNESS	:	28.15'
TOTAL SEAM	- THICKNESS	:	27.05'
TOTAL COAL	- THICKNESS	:	20.75
TOTAL PARTINGS	- THICKNESS	:	6.30'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.1'

WASHABILITY TEST RESULTS

Seam No. 8
Lab.No. 3790
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)						
In.Moisture %	Ash %	Vol.Matter %	Fixed Carbon %	Sulphur %	BTU/LB	H.G.I.
0.6	31.0	16.3	52.1	0.48	10540	91

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)									
Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Sulp. %	H.G.I.	Cum. Weight %	Cum.Ash %
2"x¼"	26.7	51.9	1.1	11.8	35.2	0.21	67		
¼"x0	73.3								
3/4"x28M	77.0	35.0	1.1	15.0	48.9	0.43	72	77.0	35.0
28Mx65M	18.9	16.0	1.3	18.0	64.7	0.37	120	95.9	31.3
65Mx100M	0.8	15.4						96.7	31.1
100Mx200M	1.6	14.4						98.3	30.9
200Mx0	1.7	13.3						100.0	30.6
65Mx0	4.1	13.7	1.2	18.5	66.6	0.44			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=26.7%=10.5% <1.5 S.G.								
Specific Gravity	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	3.0	2.6	1.5	21.3		3.0	2.6
1.30-1.35	19.7	6.0	0.9	18.6		22.7	5.6
1.35-1.40	9.6	10.6	0.7	17.7		32.3	7.1
1.40-1.45	5.1	13.3	0.8	17.6		37.4	7.9
1.45-1.50	1.8	18.8	0.8	17.5		39.2	8.4
Σ 1.50	39.2	8.4		18.4			
1.50-1.55	1.5	25.0	0.7	17.5		40.7	9.0
1.55-1.60	1.3	30.5	0.6	17.4		42.0	9.7
1.60-1.70	1.4	37.9	0.6	16.4		43.4	10.6
1.70-1.80	0.9	45.7	0.7	14.9		44.3	11.3
1.80	55.7	87.7	0.9	6.6		100.0	53.9

SIZE FRACTION 3/4"x28M=56.7%=33.2% <1.5 S.G.							
Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
15.7	2.5	1.4	21.0		15.7	2.5
18.1	4.9	1.1	18.9		33.8	3.8
15.4	9.5	1.1	18.5		49.2	5.6
6.5	15.1	0.9	17.0		55.7	6.7
2.9	20.0	1.0	16.8		58.6	7.3
58.6	7.3		19.0			
2.0	25.4	0.9	16.5		60.6	7.9
1.6	30.2	0.8	16.4		62.2	8.5
2.2	36.8	1.0	15.7		64.4	9.5
1.6	48.5	1.1	14.4		66.0	10.4
34.0	82.7	0.9	7.9		100.0	35.0

SIZE FRACTION 28Mx65M=13.9%=11.2% <1.5 S.G.							
Weight %	Ash %	In.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
39.6	1.6	0.9	21.3		39.6	1.6
19.2	4.5	1.1	19.6		58.8	2.5
11.4	8.5	1.1	18.8		70.2	3.5
7.1	13.5	1.0	17.4		77.3	4.5
3.1	19.3	0.9	17.4		80.4	5.0
80.4	5.0		20.0			
2.2	26.6	0.9	16.3		82.6	5.6
1.4	31.7	0.8	16.2		84.0	6.0
2.1	38.2	1.0	15.7		86.1	6.8
1.3	47.7	1.0	14.9		87.4	7.4
12.6	72.2	1.1	11.1		100.0	15.6

FROTH-FLOTA., SIZE FRACTION 65MxO							
	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
Stage I	82.9	7.3	0.7	19.4		82.9	7.3
Stage II	7.8	18.7	0.7	17.7		90.7	8.3
Tailings	9.3	64.8	0.8	11.9		100.0	13.5

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

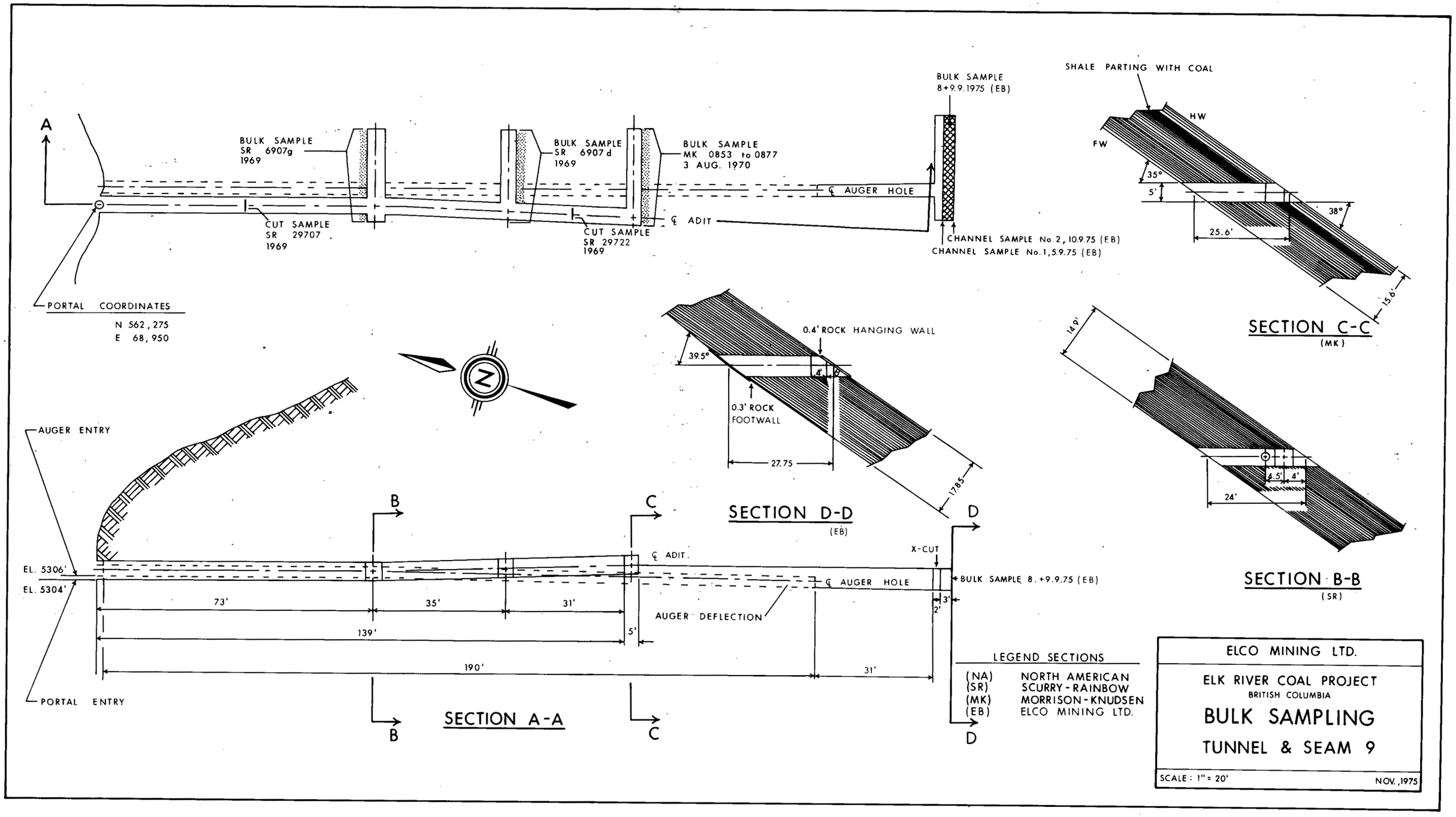
RUHR DILATOMETER RESULTS, 1.5 S.G.

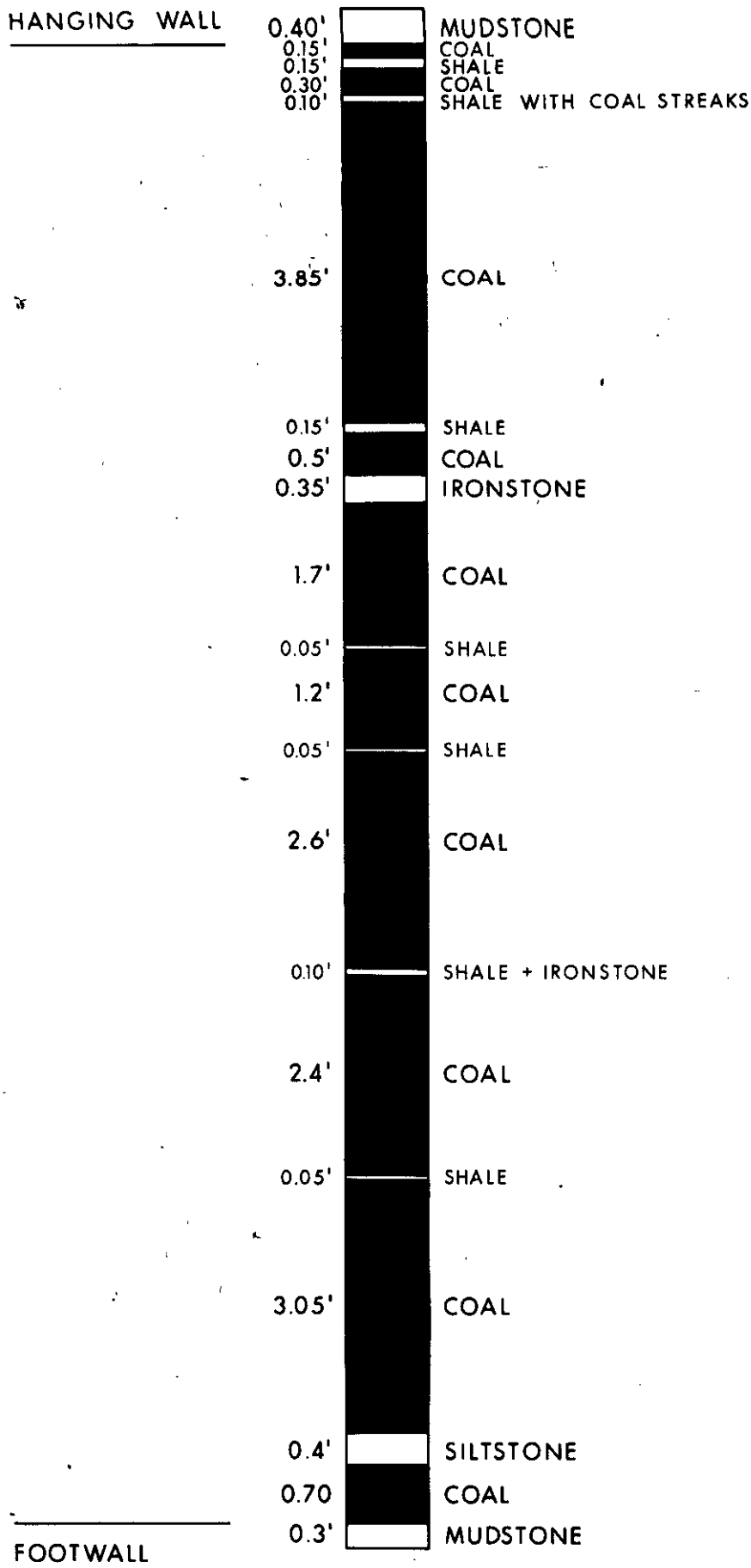
Tot.Sulph. %	Phosphor %	FSI	Soften. Temp.°C	Resolidific. Temp.°C	Contract. %	Dilatat. %	G-Value %
0.55	0.08	1½	447	-	5	-5	-

Tot.Sulph. %	Phosp. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contr. %	Dilat. %	G-Value
0.61	0.07	4½	427	-	12	-12	-

Tot.Sulph. %	Phosp. %	FSI	Soften. Temp.°C	Resolidifc. Temp.°C	Contrac. %	Dilat. %	G-Value
0.66	0.04	8½	419	480	10	0	0.936

Total Sulphur %	Phosphor %	FSI	Softening Temp.°C	Resolidifc. Temp.°C	Contraction %	Dilatation %	G-Value
0.44		8½	416	477	16	28	1.019


A
BULK SAMPLE
SR 6907g
1969
BULK SAMPLE
SR 6907d
1969
BULK SAMPLE
MK 0853 to 0877
3 AUG. 1970
BULK SAMPLE
8+9.9.1975 (EB)
℄ AUGER HOLE
℄ ADIT
CUT SAMPLE
SR 29707
1969
CUT SAMPLE
SR 29722
1969
CHANNEL SAMPLE No.2, 10.9.75 (EB)
CHANNEL SAMPLE No.1, 5.9.75 (EB)
PORTAL COORDINATES
N 562,275
E 68,950
SHALE PARTING WITH COAL
HW
FW
35°
5'
38°
25.6'
15.6'
SECTION C-C
(MK)
0.4' ROCK HANGING WALL
39.5°
4'
6"
0.3' ROCK
FOOTWALL
27.75
17.85
SECTION D-D
(EB)
14.9'
6.5'
4'
24'
SECTION B-B
(SR)
AUGER ENTRY
B
C
D
EL. 5306'
EL. 5304'
℄ ADIT
X-CUT
℄ AUGER HOLE
BULK SAMPLE 8.+9.9.75 (EB)
3'
2'
73'
35'
31'
139'
5'
AUGER DEFLECTION
190'
31'
PORTAL ENTRY
SECTION A-A
LEGEND SECTIONS
(NA) NORTH AMERICAN
(SR) SCURRY-RAINBOW
(MK) MORRISON-KNUDSEN
(EB) ELCO MINING LTD.
ELCO MINING LTD.
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
BULK SAMPLING
TUNNEL & SEAM 9
SCALE : 1" = 20'
NOV.,1975



SEAM No. 9

ADIT No. 9

BULK SAMPLE	- THICKNESS	:	18.55'
TOTAL SEAM	- THICKNESS	:	17.85'
TOTAL COAL	- THICKNESS	:	16.45'
TOTAL PARTINGS	- THICKNESS	:	1.40'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.70'

WASHABILITY TEST RESULTS

SEAM NO. 9
LAB. NO. 3834
LABORATORY: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Matter %	Fix.Carbon %	Sulphur %	BTU/LB	H.G.I.
0.6	18.5	24.0	56.9	0.28	11470	92

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Sulphur %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x¼"	24.2	36.9	1.0	16.2	45.9	0.28	69		
¼"x0	75.8	17.4							
3/4"x28M	81.2	27.0	1.7	17.6	53.7	0.35	83	81.2	27.0
28Mx65M	10.3	11.0	1.7	19.3	67.1	0.39	114	91.5	25.2
65Mx100M	1.2	11.6						92.7	25.0
100Mx200M	3.8	11.8						96.5	24.5
200Mx0	3.5	11.2						100.0	24.0
65Mx0	8.5	11.4	1.9	19.0	67.7	0.41			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=24.2%=13.6% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	10.8	3.4	0.6	19.8		10.8	3.4
1.30-1.35	31.1	6.3	0.7	18.3		41.9	5.6
1.35-1.40	7.2	12.2	0.6	18.0		49.1	6.5
1.40-1.45	4.1	16.9	0.6	17.4		53.2	7.3
1.45-1.50	2.8	20.8	0.7	17.3		56.0	8.0
1.50	56.0	8.0		18.4			
1.50-1.55	2.3	26.5	0.6	17.0		58.3	8.7
1.55-1.60	1.3	30.5	0.6	16.8		59.6	9.2
1.60-1.70	2.4	37.7	0.6	16.3		62.0	10.3
1.70-1.80	2.2	45.1	0.6	16.0		64.2	11.5
1.80	35.8	75.6	0.7	14.6		100.0	34.4

SIZE FRACTION 3/4"x28M=61.9%=42.6% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
22.9	2.0	0.9	21.7		22.9	2.0
22.4	4.9	0.7	19.0		45.3	3.4
12.6	9.6	0.7	18.3		57.9	4.8
7.0	15.7	0.7	17.2		64.9	6.0
3.9	21.3	0.5	17.2		68.8	6.8
68.8	6.8		19.5			
2.3	26.3	0.5	17.0		71.1	7.5
1.8	31.0	0.6	16.6		72.9	8.0
2.8	38.9	0.6	16.2		75.7	9.2
2.0	45.9	0.5	15.9		77.7	10.1
22.3	75.9	0.6	14.9		100.0	24.8

SIZE FRACTION 28Mx65M=6.0% = 5.3% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
46.0	1.5	0.7	21.8		46.0	1.5
20.6	3.8	0.8	20.3		66.6	2.2
10.4	8.0	0.9	18.7		77.0	3.0
7.2	13.1	1.0	18.0		84.2	3.9
3.6	15.5	1.0	17.8		87.8	4.3
87.8	4.3		20.6			
2.2	23.2	1.0	17.2		90.0	4.8
1.2	26.2	1.0	17.0		91.2	5.1
1.3	34.7	1.1	16.6		92.5	5.5
0.9	41.6	1.4	15.9		93.4	5.8
6.6	70.4	1.3	15.7		100.0	10.1

FROTH-FLOTATION, SIZE FRACTION 65Mx0

	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	84.5	6.2	0.7	20.0		84.5	6.2
Stage II	7.3	14.1	0.8	19.1		91.8	6.8
Tailings	8.2	57.9	0.8	17.1		100.0	11.0

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k*
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

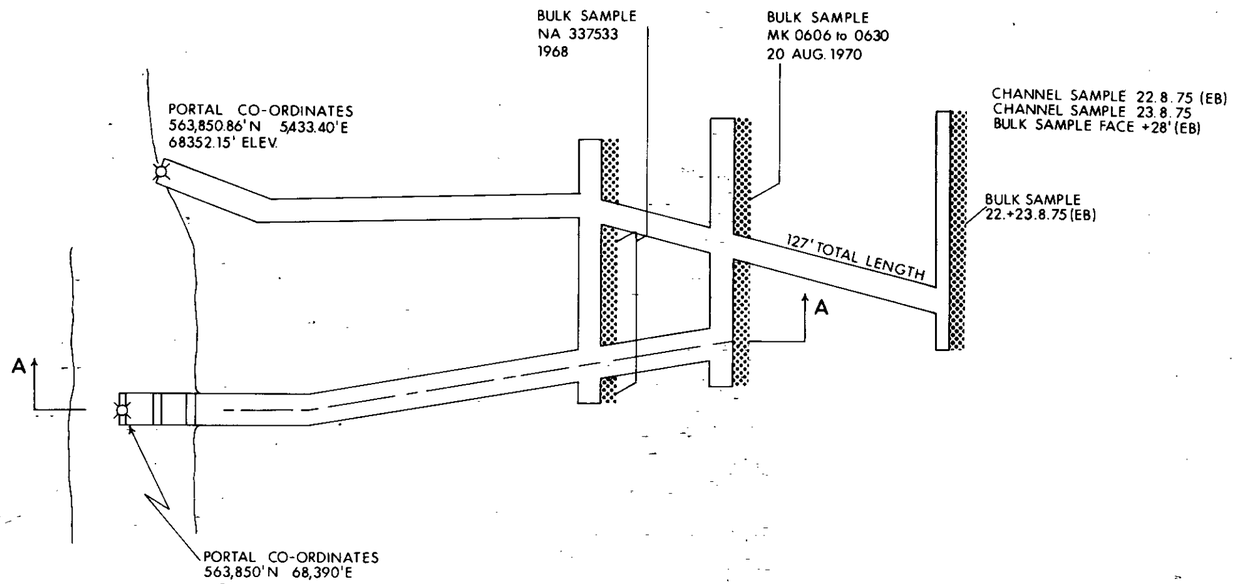
RUHR DILATOMETER RESULTS, 1.5 S.G.

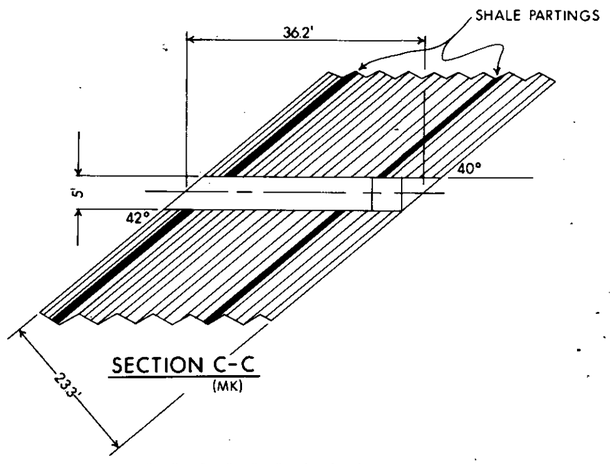
Tot.Sulphur %	Phosph. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contr. %	Dilatat. %	G-Value
0.52	0.04	2	428	-	11	-11	-

Tot.Sul. %	Phosph. %	FSI	Soften. Temp°C	Resolidif. Temp.°C	Contrac. %	Dilat. %	G-Value
0.57	0.03	4	411	-	13	-13	-

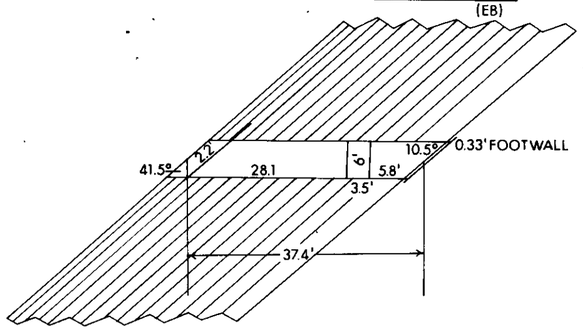
Tot.Sulp. %	Phosphor %	FSI	Soft. Temp°C	Resol. Temp.°C	Contr. %	Dilat. %	G-Val.
0.55	0.04	8½	401	469	18	19	1.002

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp°C	Resolid. Temp°C	Contract. %	Dilat. %	G-Value
0.45		8.5	409	479	14	5	0.964





SECTION C-C
(MK)



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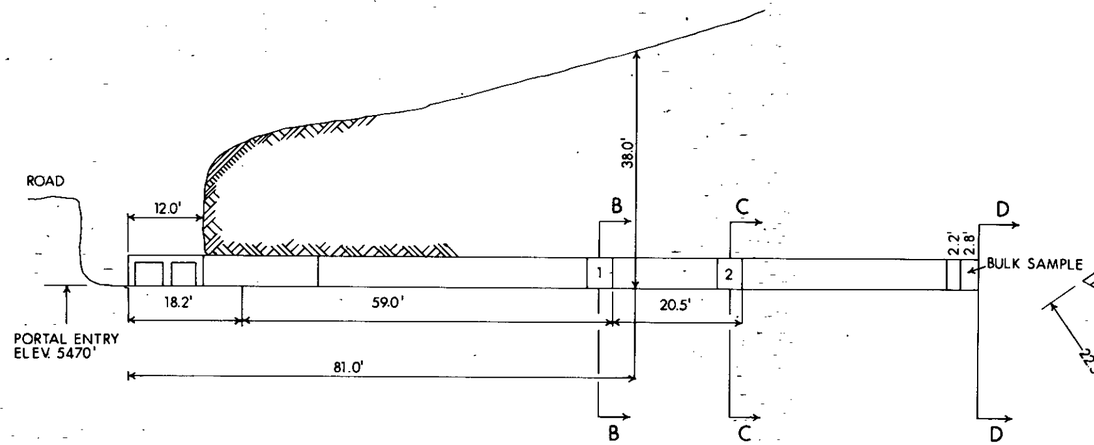
(EB)



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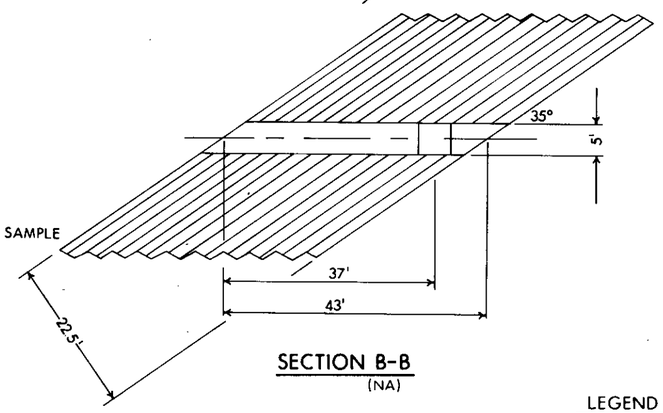


SECTION B-B
(NA)

LEGEND SECTIONS

(NA)	NORTH AMERICAN
(MK)	MORRISON-KNUDSON
(EB)	ELCO MINING

ELCO MINING LTD.

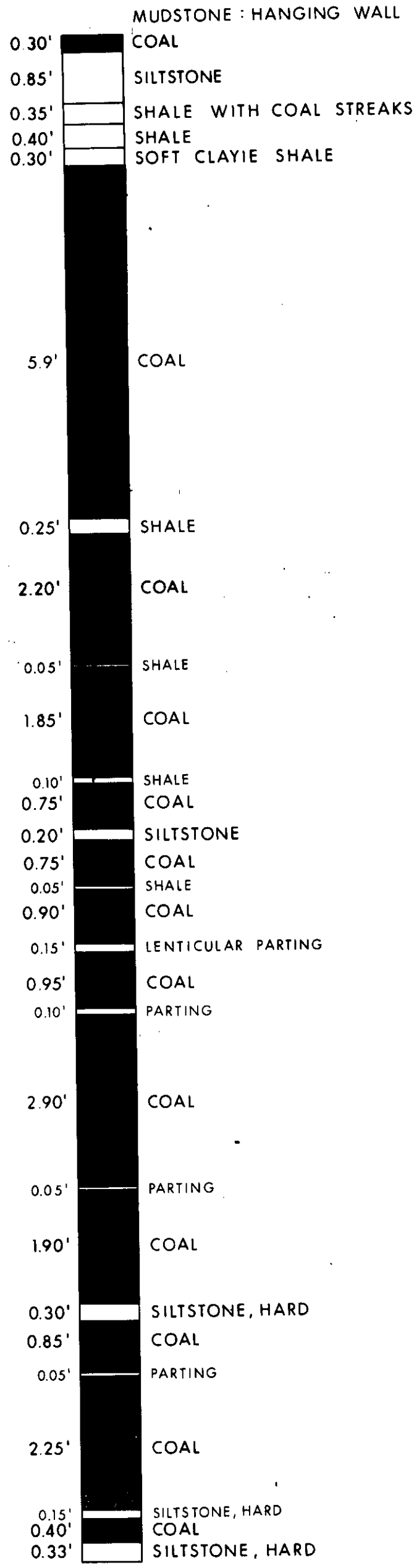
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

BULK SAMPLING
TUNNEL & SEAM 10

SCALE: 1" = 20'

MAR., 1976

HANGING WALL



FOOTWALL

SEAM No. 10

ADIT No. 10

BULK SAMPLE	- THICKNESS	:	25.58'
TOTAL SEAM	- THICKNESS	:	25.25'
TOTAL COAL	- THICKNESS	:	21.90'
TOTAL PARTINGS	- THICKNESS	:	3.35'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.33'

WASHABILITY TEST RESULTS

Seam No. 10

Lab.No. 3709

Laboratory: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis)						
Inh.Moist. %	Ash %	Vol.Matter %	Fixed Carbon %	Sulphur %	BTU/LB	H.G.I.
1.4	23.2	18.6	56.8	0.38	11505	

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)									
Size Fraction	Weight %	Ash %	Inh.Moist. %	Vol.Matter %	Fixed Carbon %	Sulphur %	H.G.I.	Cumulative Weight %	Cumulative Ash %
2"x¾"	16.2	45.4	0.8	16.9	36.9	0.21	69		
¾"x0	83.8								
3/4"x28M	67.1	29.6	0.7	18.2	51.5	0.29	77	67.1	29.6
28Mx65M	9.4	11.0	0.9	20.4	67.7	0.41	105	76.5	27.3
65Mx100M	19.1	13.2						95.6	24.5
100Mx200M	1.8	11.6						97.4	24.3
200MxO	2.6	10.8						100.0	23.9
65MxO	23.5	11.8	1.1	20.8	66.3	0.48			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¾"= 16.2% = 7.3% 1.5 S.G.								
Specific Gravity	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	4.7	2.8	0.6	21.9	74.7	4.7	2.8
1.30-1.35	21.9	5.9	0.6	19.7	73.8	26.6	5.4
1.35-1.40	11.8	10.7	0.8	18.5	70.0	38.4	7.0
1.40-1.45	4.5	16.6	0.8	18.4	64.2	42.9	8.0
1.45-1.50	2.2	21.7	0.8	19.0	58.5	45.1	8.7
Σ 1.50	45.1	8.7		19.5			
1.50-1.55	1.7	27.3	0.7	19.0	53.0	46.8	9.3
1.55-1.60	1.3	32.4	0.7	17.5	49.4	48.1	10.0
1.60-1.70	2.3	41.1	0.8	16.2	41.9	50.4	11.4
1.70-1.80	1.9	49.6	0.7	15.6	34.1	52.3	12.8
1.80	47.7	54.3	0.8	12.1	2.8	100.0	46.9

SIZE FRACTION 3/4"x28M= 57.4% = 40.4 % 1.5 S.G.							
Specific Gravity	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
1.30	26.5	1.8	0.9	21.9	75.4	26.5	1.8
1.30-1.35	19.5	4.9	0.8	20.4	73.9	46.0	3.1
1.35-1.40	14.5	9.6	0.8	18.8	70.8	60.5	4.7
1.40-1.45	6.4	14.9	0.8	18.4	65.9	66.9	5.6
1.45-1.50	3.5	20.6	0.8	18.1	60.5	70.4	6.4
Σ 1.50	70.4	6.4		20.3			
1.50-1.55	2.1	25.5	0.9	17.8	55.8	72.5	6.9
1.55-1.60	1.4	30.6	0.8	17.5	51.1	73.9	7.4
1.60-1.70	2.1	38.7	0.9	17.0	43.4	76.0	8.3
1.70-1.80	1.8	45.7	0.8	16.2	37.3	77.8	9.1
1.80	22.2	80.4	0.7	11.6	7.3	100.0	24.9

SIZE FRACTION 28Mx65M= 8 % = 7.1 % 1.5 S.G.							
Specific Gravity	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
1.30	52.8	1.5	0.9	22.2	75.4	52.8	1.5
1.30-1.35	16.1	5.1	0.9	20.8	73.2	68.9	2.3
1.35-1.40	11.7	9.7	1.1	19.9	69.3	80.6	3.4
1.40-1.45	5.1	15.8	1.1	18.4	64.7	85.7	4.1
1.45-1.50	2.6	21.3	1.3	18.3	59.1	88.3	4.7
Σ 1.50	88.3	4.7		21.3			
1.50-1.55	1.6	24.9	1.2	17.9	56.0	89.9	5.0
1.55-1.60	0.6	29.9	1.3	17.5	51.4	90.5	5.2
1.60-1.70	1.5	36.4	1.3	16.7	45.5	92.0	5.7
1.70-1.80	1.2	41.4	1.3	16.4	40.9	93.2	6.1
1.80	6.8	74.4	1.1	12.5	12.0	100.0	10.8

FROTH-FLOTATION, SIZE FRACTION 65MxO							
	Weight %	Ash %	Inh.Moisture %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
Stage I	48.6	4.8	0.8	21.2	73.2	48.6	4.8
Stage II	9.2	8.5	1.0	20.5	70.0	59.8	5.4
Tailings	42.2	19.5	1.3	18.8	60.4	100.0	11.3

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min
STAGE I	1st min. froth
STAGE II	2nd min. froth

RUHR DILATOMETER RESULTS, 1.5 S.G.

Total Sulphur %	Phosphor %	FSI	Softening Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Value
0.37	0.05	3½	415	-	17	-17	-

Tot.Sul. %	Phosp. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contrac. %	Dilata. %	G-Value
0.48	0.04	7½	404	471	21	-4	0.899

Tot.Sulp. %	Phosp. %	FSI	Soften. Temp.°C	Resolidifc. Temp.°C	Contract. %	Dilat. %	G-Value
0.47	0.03	9	400	468	22	22	1.000

Total Sulph.	Phosp.	FSI	Soften. Temp.°C	Resolidiff. Temp.°C	Contrac. %	Dilatation %	G-Value
0.57		9	401	469	27	37	1.012

TRENCHES

ELCO MINING LIMITED

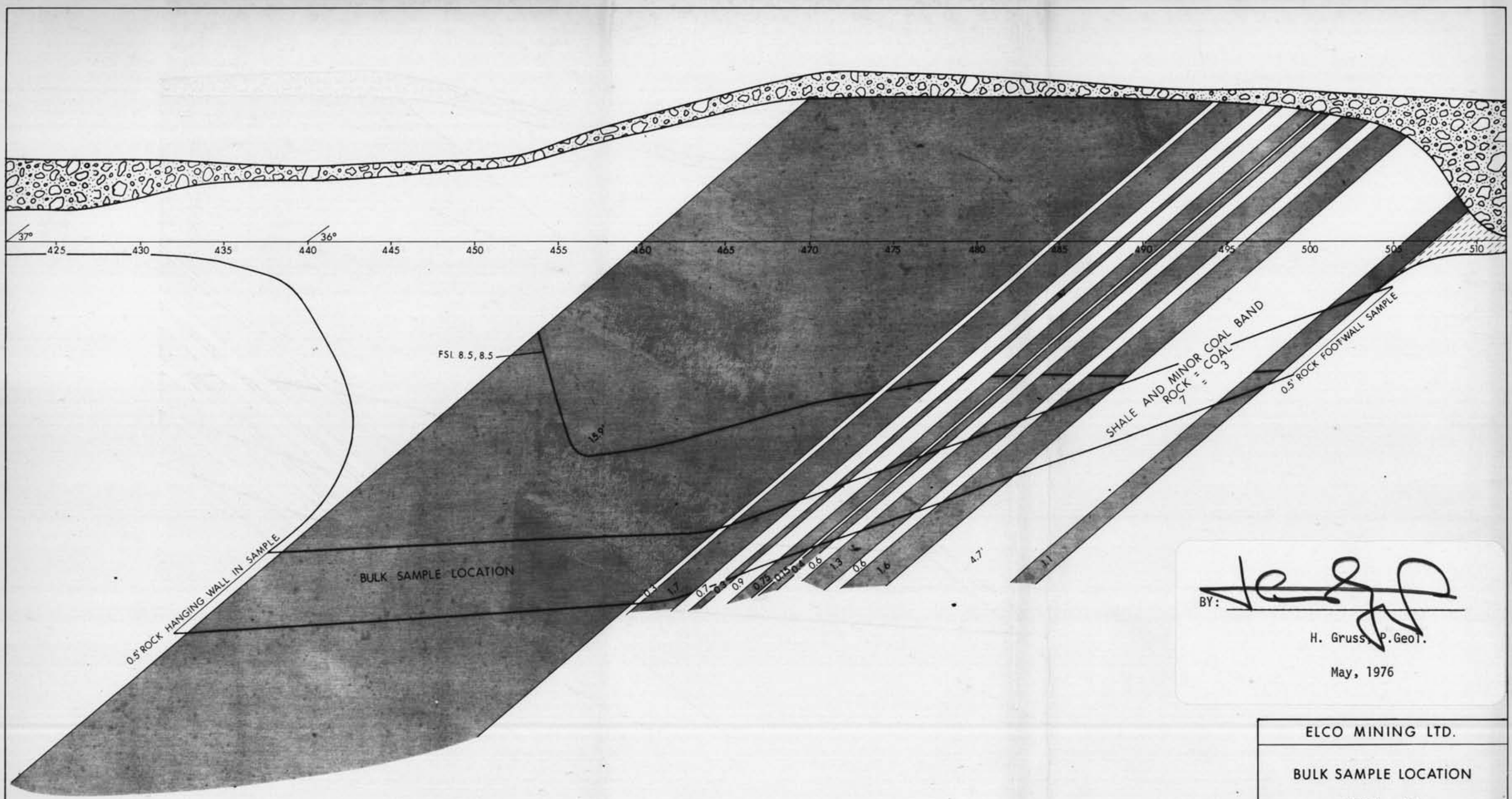
TEST SHEET OF CHANNEL SAMPLES

Seam No.		12	12	12	13+13A	13+13A	13D	13D	13E
Sample No.		No.1	No.2	No.3	No.1	No.2	No.1	No.2	No.1
Sample Location		Trench EB-T16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75
Lab.No.		3785	3784	3786	4041	4042	4091	4092	4093
Laboratory: Montan Consulting									
Raw Coal									
Analytical Moisture	%	0.9	0.9	0.9	1.3	1.2	1.0	1.2	1.0
Ash	% db	41.09	40.57	39.51	42.8	52.3	61.8	58.8	62.0
Volatile Matter	% db	15.8	16.2	16.2	16.0	14.4	13.0	12.9	10.4
Sulphur	% db	0.66	0.67	0.72	0.72	0.74	0.76	0.91	0.73
Phosphorous	% db	0.109	0.079	0.072	0.070	0.106	0.093	0.088	0.047
Gross Calorific Value, kcal/kg	air dry	4613	4743	4790	4544	3664	2729	3023	2807
	db	4660	4791	4839	4612	3716	2762	3067	2841
	daf	7910	8062	8000	8070	7766	7230	7437	7474
Ash Fusion in Oxid.Atmosphere									
Initial Deformation Temp.	°C	1320	1330	1300	1280	1270	1210	1250	1240
Softening Temp. Spherical	°C	1600	1590	1590	1540	1520	1450	1530	1540
Fusion Temp.	°C	1640	1610	1610	1580	1570	1500	1580	1600
Hardgrove Growing Index.		77	81	79	92	88	85	81	102
Size Fraction	%								
6.3-0.2 mm	%	86.5	86.7	83.7	88.9	89.2	93.0	92.6	92.3
-0.2 mm	%	13.5	13.3	16.3	11.1	10.8	7.0	7.4	7.7
Clean Coal (Size Fraction 6.3-0.2mm,1.45 Sink Float S.G.)									
Yield	%	44.1	42.7	39.9	40.6	37.7	18.9	18.1	13.2
Analytical Moisture	air dry	0.6	0.7	0.6	0.6	0.6	0.5	0.6	0.7
Ash	% db	5.90	6.01	6.22	6.0	6.7	8.6	9.0	9.7
Volatile Matter	% daf	24.0	24.3	24.3	24.9	25.4	24.4	24.3	26.2
Sulphur	% db	0.48	0.45	0.82	0.94	0.93	1.11	1.12	1.23
Phosphorous	% db	0.041	0.044	0.057	0.048	0.075	0.075	0.088	0.013
FSI		8	8½	8	8½	8	7½	8	8½
Soft.Temperature	°C	385	388	374	383	382	388	374	380
Resolidification Temp.	°C	467	485	458	473	476	466	449	485
Contraction	%	25	29	28	32	32	30	30	24
Dilatation	%	71	108	75	93	95	22	40	172
G-Value	%	1.048	1.060	1.048	1.054	1.057	0.984	1.013	1.101
Max.Fluidity	DDPM	195	230	210	270	300	140	140	410
Vitrinite	%	74	74	75	75	73	63	65	86
Exinite	%	0	1	1	1	1	1	2	1
Inertinite	%	22	18	18	16	19	26	24	1
Mineral Matter	%	4	7	6	8	7	10	9	12
Mean Reflectance	%	1.35	1.30	1.31	1.19	1.17	1.22	1.22	1.18
Volatile Matter of Vitrinite	%	24	25	25	28	29	27	27	28
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.									
Raw Coal									
Analytical Moisture	%	0.7	0.7	0.7	0.8	0.7	0.8	0.8	NA
Ash	% db	41.2	34.3	37.2	43.2	53.9	67.7	65.1	NA
Volatile Matter	% db	16.7	16.9	17.0	16.3	14.0	13.3	12.8	NA
Fixed Carbon	% air dry	41.8	48.4	45.5	40.2	31.9	NA	NA	NA
Sulphur	% db	0.55	0.65	0.66	0.65	0.55	0.65	0.82	NA
Hardgrove Growing Index		75	80	76	87	77	65	69	92
Size Fraction									
¼"x65M		88.9	90.8	89.3	92.3	91.4	90.2	92.4	91.4
65Mx0		11.1	9.2	10.7	7.7	8.6	9.8	7.6	8.6
Clean Coal (Size Fraction ¼"x65M;1.5 Sink Float S.G.)									
Yield ¼"x65M	%	41.3	57.5	45.8	49.5	37.8	25.9	22.4	16.5
Total Yield, excl. 65Mx0	%	36.7	52.2	40.9	45.7	34.5	23.4	20.7	15.1
Analytical Moisture	% air dry	1.0	1.0	0.9	1.7	1.2	1.3	1.1	1.9
Ash	% db	7.8	6.8	7.1	6.9	7.6	9.6	11.0	11.4
Volatile Matter	% daf	24.5	24.3	24.2	26.1	25.8	25.6	25.4	27.4
Fixed Carbon	% daf	75.6	75.7	75.7	73.4	74.1	74.1	74.4	72.3
Sulphur	% db	0.83	0.93	0.86	0.91	0.91	1.18	1.13	1.37
Phosphorous	% db								
FSI		9	8½	9	8½	8	8½	8	9
Softening Temperature	°C	390	394	389	395	392	403	399	399
Resolidification Temp.	°C	453	456	450	452	454	456	457	452
Contraction	%	24	13	25	11	13	13	17	14
Dilatation	%	69	77	102	98	115	45	54	156
G-Value		1.038	1.055	1.046	1.057	1.062	1.035	1.037	1.055

Seam No.		13E	13F	13F	13G	13G	14+14A	14+14A	14C
Sample No.		No.2	No.1	No.2	No.1	No.2	No.1	No.2	No.1
Sample Location		Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75
Lab.No.		4094	4095	4096	4097	4098	3973	3974	3967
Laboratory: Montan Consulting									
Raw Coal									
Analytical Moisture	%	1.0	1.3	1.1	1.0	0.9	2.7	2.1	2.6
Ash	% db	59.4	60.7	61.5	43.0	36.6	43.5	45.4	23.3
Volatile Matter	% db	13.5	12.9	13.0	15.1	16.8	17.5	17.0	21.6
Sulphur	% db	0.73	0.89	2.25	0.67	0.76	0.70	0.75	0.80
Phosphorous	% db	0.068	0.110	0.114	0.120	0.152	0.076	0.078	0.039
Gross Calorific Value, kcal/kg	air dry	2983	2865	2733	4757	5064	4335	4195	6124
	db	3029	2910	2770	4809	5115	4471	4298	6303
	daf	7462	7397	7202	8089	8072	7913	7878	8216
Ash Fusion in Oxid.Atmosphere									
Initial Deformation Temp.	°C	1240	1290	1270	1290	1260	1290	1250	1280
Softening Temp. Spherical	°C	1500	1590	1530	1560	1490	1550	1590	1600
Fusion Temp.	°C	1540	1610	1570	1590	1530	1590	1600	1630
Hardgrove Growing Index.		105	74	77	103	114	84	80	94
Size Fraction	%								
6.3-0.2 mm	%	91.0	90.0	90.7	88.5	88.4	91.4	92.3	91.1
-0.2 mm	%	9.0	10.0	9.3	11.5	11.6	8.6	7.7	8.9
Clean Coal (Size Fraction 6.3-0.2mm,1.45 Sink Float S.G.)									
Yield	%	11.5	20.7	17.5	45.2	59.9	42.6	39.0	71.1
Analytical Moisture	air dry	0.5	0.8	0.5	0.6	0.6	0.5	0.5	0.5
Ash	% db	8.6	5.9	7.6	7.0	8.1	5.8	5.8	5.3
Volatile Matter	% daf	26.1	26.7	27.2	24.8	24.4	28.3	28.1	27.5
Sulphur	% db	1.14	1.55	1.55	0.89	0.95	0.84	0.83	0.94
Phosphorous	% db	0.028	0.050	0.068	0.058	0.075	0.068	0.067	0.034
FSI		8½	8½	8½	8½	8	8½	8½	8½
Soft.Temperature	°C	373	377	380	385	382	356	371	377
Resolidification Temp.	°C	475	466	481	473	452	457	481	484
Contraction	%	25	25	17	35	25	27	28	28
Dilatation	%	176	217	213	68	58	186	191	192
G-Value	%	1.099	1.091	1.111	1.034	1.035	1.102	1.106	1.102
Max.Fluidity	DDPM	675	1500	1480	120	130	1600	1800	1023
Vitrinite	%	85	85	83	72	69	71	78	82
Exinite	%	0	3	2	1	0	8	4	4
Inertinite	%	4	4	5	18	23	16	12	7
Mineral Matter	%	11	8	10	9	8	5	6	7
Mean Reflectance	%	1.20	1.19	1.20	1.24	1.24	1.16	1.14	1.21
Volatile Matter of Vitrinite	%	28	28	28	27	27	29	29	28
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.									
Raw Coal									
Analytical Moisture	%	0.8	0.9	0.9	0.7	0.7	1.1	1.1	0.9
Ash	% db	70.1	64.8	71.2	42.2	33.2	45.1	45.1	22.5
Volatile Matter	% db	13.5	14.0	12.4	16.2	17.9	18.0	16.9	21.6
Fixed Carbon	% air dry	NA	NA	NA	41.3	NA	36.5	37.6	55.4
Sulphur	% db	0.49	0.82	2.31	0.45	0.73	0.60	0.69	0.79
Hardgrove Growing Index		68	62	76	92	104	87	73	88
Size Fraction									
¼"x65M		94.6	89.7	94.4	87.6	88.4	94.1	97.0	92.5
65Mx0		5.4	10.3	5.6	12.4	11.6	5.9	3.0	7.5
Clean Coal (Size Fraction ¼"x65M;1.5 Sink Float S.G.)									
Yield ¼"x65M	%	14.3	27.3	20.9	41.8	71.0	43.7	41.5	73.8
Total Yield, excl. 65Mx0	%	13.5	24.5	19.7	36.6	62.8	41.1	40.3	68.3
Analytical Moisture	% air dry	1.3	1.5	1.3	2.1	2.2	0.7	0.7	0.4
Ash	% db	12.9	7.6	9.4	7.7	8.4	5.5	6.3	5.8
Volatile Matter	% daf	27.3	27.7	27.4	25.5	25.8	28.1	28.6	28.2
Fixed Carbon	% daf	72.5	72.2	72.6	74.3	73.9	71.8	71.4	71.7
Sulphur	% db	1.15	1.66	1.50	1.28	1.19	0.82	0.88	0.88
Phosphorous	% db								
FSI		9+	9+	9+	9	8½	9	9	9
Softening Temperature	°C	381	398	398	403	403	368	369	381
Resolidification Temp.	°C	458	456	456	469	469	453	450	446
Contraction	%	30	26	23	25	25	19	24	24
Dilatation	%	143	236	212	41	41	272	274	243
G-Value		1.064	1.058	1.058	1.019	1.019	1.099	1.090	1.069

Seam No.		14C	14D	14D	15	15	16	16	16E
Sample No.		No.1	No.1	No.2	No.1	No.2	No.1	No.2	No.1
Sample Location		Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-16-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75
Lab.No.		3975	3968	3969	4003	4004	4490	4491	4492
Laboratory: Montan Consulting									
Raw Coal									
Analytical Moisture	%	1.9	5.1	4.1	1.4	1.5	1.1	1.2	1.5
Ash	% db	27.4	34.8	43.6	48.8	43.3	42.9	43.5	19.7
Volatile Matter	% db	20.9	18.3	16.9	16.2	17.2	19.3	18.9	24.0
Sulphur	% db	0.81	0.90	1.06	0.64	0.68	0.69	0.76	0.82
Phosphorous	% db	0.051	0.044	0.067	0.096	0.079	0.116	0.151	0.104
Gross Calorific Value, kcal/kg	air dry	5805	4963	4234	3899	4403	4504	4447	6476
	db	5929	5251	4440	3963	4479	4561	4508	6584
	daf	8166	8056	7857	7740	7901	7988	7980	8202
Ash Fusion in Oxid.Atmosphere									
Initial Deformation Temp.	°C	1310	1300	1260	1290	1260	1260	1270	1260
Softening Temp. Spherical	°C	1600	1600	1610	1540	1540	1500	1640	1510
Fusion Temp.	°C	1640	1630	1630	1560	1570	1570	1580	1550
Hardgrove Growing Index.		98	111	90	80	79	71	76	77
Size Fraction	%								
6.3-0.2 mm	%	91.0	85.9	85.3	88.8	90.2	89.8	87.5	93.3
-0.2 mm	%	9.0	14.1	14.7	11.2	9.8	10.2	12.5	6.7
Clean Coal (Size Fraction 6.3-0.2mm,1.45 Sink Float S.G.)									
Yield	%	65.8	54.3	46.6	35.0	39.3	44.9	43.1	71.1
Analytical Moisture	air dry	0.5	0.7	0.6	0.6	0.9	0.6	0.6	0.5
Ash	% db	6.4	3.5	4.6	6.5	6.0	7.7	8.1	5.7
Volatile Matter	% daf	27.8	26.4	26.4	27.1	27.1	31.5	31.6	28.7
Sulphur	% db	0.95	1.00	1.01	0.81	0.85	0.83	0.84	0.85
Phosphorous	% db	0.053	0.018	0.034	0.059	0.041	0.079	0.119	0.085
FSI		8½	8½	8½	7½	7	8	8	7
Soft.Temperature	°C	362	377	362	368	374	371	350	368
Resolidification Temp.	°C	467	466	457	452	458	478	460	454
Contraction	%	22	21	23	31	30	34	33	33
Dilatation	%	209	112	129	77	68	181	177	46
G-Value	%	1.114	1.078	1.088	1.046	1.041	1.094	1.103	1.018
Max.Fluidity	DDPM	1000	355	405	470	27	2900	2600	660
Vitrinite	%	79	79	79	64	63	77	75	54
Exinite	%	5	3	2	3	2	9	6	6
Inertinite	%	8	15	15	28	30	6	8	34
Mineral Matter	%	8	3	4	5	5	8	11	6
Mean Reflectance	%	1.17	1.20	1.19	1.15	1.13	0.99	0.99	1.02
Volatile Matter of Vitrinite	%	28	28	28	29	29	33	33	32
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.									
Raw Coal									
Analytical Moisture	%	0.9	0.9	1.0	0.8	0.9	1.0	1.0	1.0
Ash	% db	24.6	24.9	31.9	47.3	43.2	41.3	42.2	20.8
Volatile Matter	% db	20.9	19.2	19.2	17.8	18.2	20.2	19.6	23.8
Fixed Carbon	% air dry	54.0	50.5	48.4	34.6	38.3	38.1	37.8	54.8
Sulphur	% db	0.79	0.76	0.92	0.57	0.65	0.47	0.64	0.72
Hardgrove Growing Index		84	99	99	75	73	68	71	72
Size Fraction									
¼"x65M		94.3	84.6	80.8	90.0	89.5	90.8	89.2	93.3
65Mx0		5.7	15.4	19.2	10.0	10.5	9.2	10.8	6.7
Clean Coal (Size Fraction ¼"x65M;1.5 Sink Float S.G.)									
Yield ¼"x65M	%	67.3	58.3	54.7	41.1	47.3	46.6	46.9	76.1
Total Yield, excl. 65Mx0	%	63.5	49.3	44.2	37.0	42.3	42.3	41.8	71.0
Analytical Moisture	% air dry	0.6	1.7	1.3	1.5	1.5	1.4	1.5	0.9
Ash	% db	7.6	4.2	5.3	7.4	7.0	8.3	9.0	7.3
Volatile Matter	% daf	28.1	27.2	29.5	28.4	28.8	32.8	32.8	30.0
Fixed Carbon	% daf	71.9	72.4	70.3	71.6	71.1	68.1	67.1	69.9
Sulphur	% db	0.90	1.01	1.02	0.86	0.78	0.77	0.83	0.87
Phosphorous	% db								
FSI		8½	9	9	9	8½	8	8	7½
Softening Temperature	°C	370	384	382	399	395	NA	383	379
Resolidification Temp.	°C	449	448	445	456	460	NA	448	432
Contraction	%	21	23	23	25	28	NA	24	24
Dilatation	%	261	143	179	89	99	NA	203	97
G-Value		1.089	1.059	1.063	1.039	1.044	NA	1.066	1.041

Seam No.		16E	16G	16G	17	17	17A	17A	18	18
Sample No.		No.2	No.1	No.2	No.1	No.2	No.1	No.2	No.1	No.2
Sample Location		Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75	Trench EB-17-75
Lab.No.		4493	4495	4495	4418	4419	4444	4445	4416	4417
Laboratory: Montan Consulting										
Raw Coal										
Analytical Moisture	%	2.0	1.8	3.1	3.7	3.6	1.3	1.1	1.8	2.2
Ash	% db	32.7	37.9	36.4	17.9	25.0	44.8	36.3	36.8	30.2
Volatile Matter	% db	20.8	19.3	19.8	26.3	24.4	19.0	20.9	24.3	25.1
Sulphur	% db	0.70	0.77	0.77	0.79	0.88	0.97	0.92	0.58	0.66
Phosphorous	% db	0.132	0.056	0.072	0.113	0.087	0.091	0.084	0.073	0.075
Gross Calorific Value, kcal/kg	air dry	5320	4881	4967	6338	5717	4277	5000	4864	5477
	db	5440	4981	5145	6604	5945	4341	5062	4970	5613
	daf	8086	8081	8095	8046	7981	7857	7949	7864	8045
Ash Fusion in Oxid.Atmosphere										
Initial Deformation Temp.	°C	1250	1290	1300	1210	1200	1240	1240	1180	1200
Softening Temp. Spherical	°C	1520	1520	1530	1290	1290	1520	1560	1270	1310
Fusion Temp.	°C	1560	1540	1560	1310	1330	1580	1600	1300	1370
Hardgrove Growing Index.		75	97	98	89	94	68	70	88	91
Size Fraction	%									
6.3-0.2 mm	%	92.8	84.2	83.8	87.6	82.8	92.8	93.0	88.4	89.5
-0.2 mm	%	7.2	15.8	16.2	12.4	17.2	7.2	7.0	11.6	10.5
Clean Coal (Size Fraction 6.3-0.2mm,1.45 Sink Float S.G.)										
Yield	%	58.2	44.4	51.5	77.8	67.2	44.8	53.7	53.6	61.6
Analytical Moisture	air dry	0.6	0.7	0.6	0.7	0.7	0.6	0.5	0.8	0.8
Ash	% db	6.1	5.6	6.4	3.9	3.7	5.7	5.4	4.8	5.5
Volatile Matter	% daf	29.5	28.9	29.7	30.1	28.7	31.6	31.4	32.7	32.7
Sulphur	% db	0.83	0.93	0.97	0.78	0.73	0.90	0.87	0.75	0.79
Phosphorous	% db	0.127	0.045	0.069	0.084	0.064	0.039	0.034	0.037	0.049
FSI		7½	7½	8	8	7½	8	8	8	8
Soft.Temperature	°C	362	358	359	374	376	353	369	356	358
Resolidification Temp.	°C	460	458	460	458	466	451	470	455	460
Contraction	%	34	37	34	35	36	33	35	32	33
Dilatation	%	77	67	135	64	64	182	152	161	157
G-Value	%	1.048	1.036	1.080	1.030	1.080	1.092	1.091	1.089	1.088
Max.Fluidity	DDPM	830	530	1210	335	416	3400	2600	2900	3300
Vitrinite	%	66	62	70	74	72	68	72	80	77
Exinite	%	4	4	2	7	6	6	5	7	8
Inertinite	%	34	30	19	16	21	19	19	8	11
Mineral Matter	%	6	4	9	3	1	6	4	5	4
Mean Reflectance	%	1.02	1.03	1.01	0.99	0.98	0.98	0.96	0.95	0.92
Volatile Matter of Vitrinite	%	32	32	32	33	33	33	34	34	35
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.										
Raw Coal										
Analytical Moisture	%	1.3	1.2	0.8	1.5	1.6	0.9	0.8	1.0	1.2
Ash	% db	32.0	40.0	34.4	17.5	25.8	46.1	37.6	34.8	27.2
Volatile Matter	% db	21.5	19.1	21.4	26.8	25.8	18.8	20.9	25.6	26.1
Fixed Carbon	% air dry	45.9	40.4	43.9	54.9	48.3	34.8	41.2	39.3	46.1
Sulphur	% db	0.64	0.73	0.71	0.66	0.87	0.61	0.69	0.49	0.60
Hardgrove Growing Index		74	95	103	82	90	59	69	77	81
Size Fraction										
¼"x65M		93.1	84.4	82.9	87.0	82.1	91.9	93.9	90.0	89.9
65Mx0		6.9	15.6	17.1	13.0	17.9	8.1	6.1	10.0	10.1
Clean Coal (Size Fraction ¼"x65M;1.5 Sink Float S.G.)										
Yield ¼"x65M	%	81.7	50.2	54.5	79.0	72.5	41.4	55.4	57.9	66.1
Total Yield, excl. 65Mx0	%	57.4	42.4	45.2	68.7	59.5	38.1	52.0	52.1	59.4
Analytical Moisture	% air dry	0.9	2.7	2.6	1.1	1.3	1.1	1.2	2.0	2.3
Ash	% db	7.6	6.7	7.2	3.3	3.6	7.3	6.1	4.7	5.5
Volatile Matter	% daf	30.0	30.6	31.1	32.1	31.0	32.1	32.4	32.8	NA
Fixed Carbon	% daf	69.9	69.1	68.8	67.9	69.1	68.0	67.5	67.1	NA
Sulphur	% db	0.78	0.89	0.89	0.89	0.83	NA	0.78	0.90	NA
Phosphorous	% db									
FSI		8	8	8½	8½	8½	9	8	9	8½
Softening Temperature	°C	394	390	387	383	390	NA	383	395	NA
Resolidification Temp.	°C	455	447	445	453	453	NA	453	440	NA
Contraction	%	25	17	24	26	30	NA	26	20	NA
Dilatation	%	112	70	131	173	128	NA	173	65	NA
G-Value		1.048	1.043	1.051	1.066	1.049	NA	1.066	1.029	NA



BY:

H. Gruss, P.Geol.

May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 12

Scale : 1" = 5'

HANGING WALL

0.50'	MUDSTONE
0.20'	COAL
0.05'	SHALY COAL
0.85'	COAL
0.05'	SHALE
0.90'	COAL
0.05'	SHALE
1.35'	COAL
0.05'	COALY SHALE
0.60'	COAL
0.05'	CLAY IRON STONE, LENTICULAR
1.40'	COAL
0.05'	CLAY IRON STONE, LENTICULAR
2.65'	COAL
0.05'	COALY SHALE
0.50'	COAL
0.10'	CLAY IRON STONE, LENTICULAR
7.50'	COAL
0.30'	SHALE
0.10'	COAL
0.35'	SHALE
0.25'	COAL
0.10'	SHALE
0.15'	COAL
0.09'	SHALE
0.70'	COAL
0.30'	SHALE, SLICKENSIDED
0.40'	COAL
0.60'	CLAY IRON STONE
0.50'	COAL
0.20'	LENTICULAR PYRITE
0.50'	COAL
0.20'	COALY SHALE
0.30'	COAL
0.40'	SHALE
1.00'	COAL
0.40'	SHALE
0.20'	COAL
2.10'	SHALE
0.10'	COAL
1.70'	COALY SHALE
0.40'	SHALY COAL
0.60'	MUDSTONE
0.50'	COAL
0.20'	MUDSTONE
1.10'	COAL
0.55'	SHALE WITH COAL STREAKS

FOOTWALL

SEAM No. 12

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	: 32.00'
TOTAL SEAM	- THICKNESS	: 31.50'
TOTAL COAL	- THICKNESS	: 21.75'
TOTAL PARTINGS	- THICKNESS	: 9.75'
TOTAL ROOF AND FLOOR IN SAMPLE		: 0.50'

ELCO MINING LIMITED

PAGE

WASHABILITY TEST RESULTS

Seam No. 12
Lab.No. 3788
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
0.6	42.5	17.0	39.5	0.55	8225	74

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weight %	Cum.Ash %
2"x¼"	28.3	60.6	1.1	15.1	23.2	0.63	58		
¼"x0	71.7								
3/4"x28M	79.4	44.3	0.7	16.6	38.4	0.59	73	79.4	44.3
28Mx65M	8.7	20.4	0.8	20.0	58.8	0.66	126	88.1	41.9
65Mx100M	2.6	19.2						90.7	41.3
100Mx200M	5.2	17.5						95.9	40.0
200Mx0	4.1	18.5						100.0	39.1
65Mx0	11.9	17.9	0.8	20.4	60.9	0.91			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=28.3%=6.3% 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weigh. %	Cum.Ash %
1.30	5.0	2.6	1.5	24.1		5.0	2.6
1.30-1.35	7.3	7.4	1.2	21.7		12.3	5.4
1.35-1.40	4.8	12.7	1.2	20.3		17.1	7.5
1.40-1.45	3.4	18.9	1.1	18.9		20.5	9.4
1.45-1.50	1.8	24.4	1.2	18.9		22.3	10.6
½ 1.50	22.3	10.6		21.3			
1.50-1.55	1.1	29.6	0.8	18.5		23.4	11.5
1.55-1.60	1.5	34.6	0.9	18.1		24.9	12.9
1.60-1.70	2.4	41.6	1.0	17.1		27.3	15.4
1.70-1.80	2.2	55.2	1.1	15.0		29.5	18.4
1.80	70.5	82.3	0.9	11.6		100.0	63.4

SIZE FRACTION 3/4"x28M=60.3%=26.7% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
23.7	3.0	1.4	23.9		23.7	3.0
8.1	7.5	1.1	22.1		31.8	4.1
6.1	12.4	1.0	20.5		37.9	5.5
3.9	17.2	1.0	19.7		41.8	6.6
2.4	22.4	0.7	19.1		44.2	7.4
44.2	7.4		22.5			
1.8	27.1	0.9	18.4		46.0	8.2
1.6	33.1	0.8	17.7		47.6	9.0
2.8	39.0	1.0	16.8		50.4	10.7
2.6	47.2	1.0	15.5		53.0	12.5
47.0	79.7	1.0	10.9		100.0	44.1

SIZE FRACTION 28Mx65M=8.5%=6.1% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
40.9	2.2	1.8	23.9		40.9	2.2
14.6	5.0	1.9	22.7		55.5	2.9
6.5	8.8	2.7	21.9		62.0	3.6
5.9	12.6	2.7	20.9		67.9	4.3
3.3	17.8	2.8	20.1		71.2	5.0
71.2	5.0		23.0			
2.8	25.4	2.5	18.9		74.0	5.7
2.0	33.6	2.2	17.7		76.0	6.5
3.1	37.9	3.1	18.0		79.1	7.7
2.8	43.5	3.0	16.3		81.9	8.9
18.1	72.8	1.8	11.7		100.0	20.5

FROTH FLOTATION, SIZE FRACTION 65MxO

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	51.3	8.2	0.7	22.4		51.3	8.2
Stage II	9.8	12.4	0.7	21.9		61.1	8.9
Tailings	38.9	32.5				100.0	18.1

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

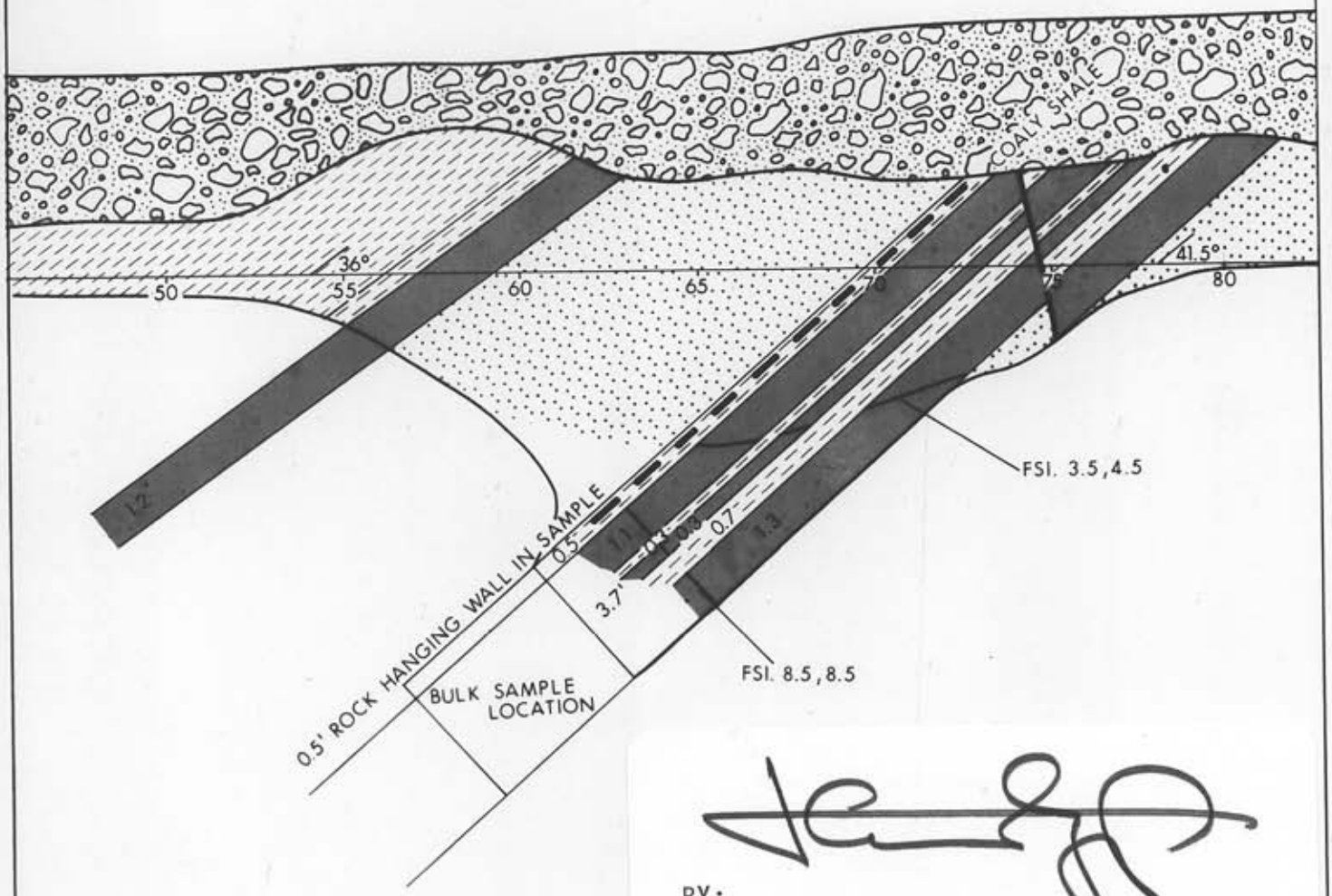
RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contraction %	Dilatat. %	G-Value
0.85	0.06	8	399	456	23	8	0.969

Tot.Sul. %	Phosp. %	FSI	Soft. Temp°C	Resol. Temp°C	Contr. %	Dilat. %	G-Value
0.91	0.05	9+	387	447	20	45	1.028

Tot.Sul. %	Phosph. %	FSI	Soften. Temp°C	Resol. Temp°C	Contr. %	Dilat. %	G-Val.
1.08	0.04	9+	402	459	22	62	1.033

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp°C	Resolidif. Temp.°C	Contrac. %	Dilatat. %	G-Value
0.79	0.04	9	397	463	26	73	1.038



BY: _____

H. Gruss, P.Geol.

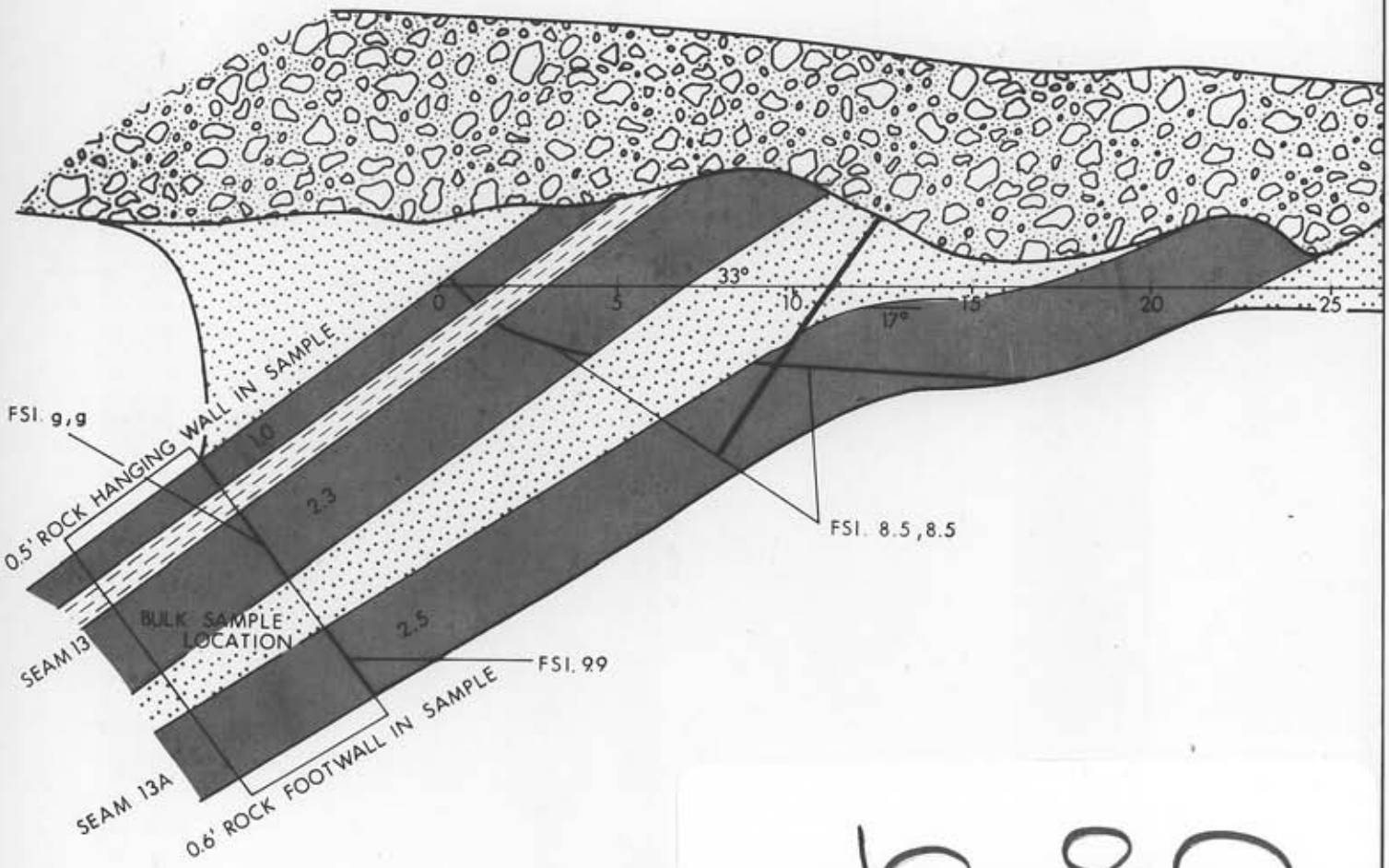
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 13D

Scale : 1" = 5'



BY: _____

H. Gruss, P.Geol.

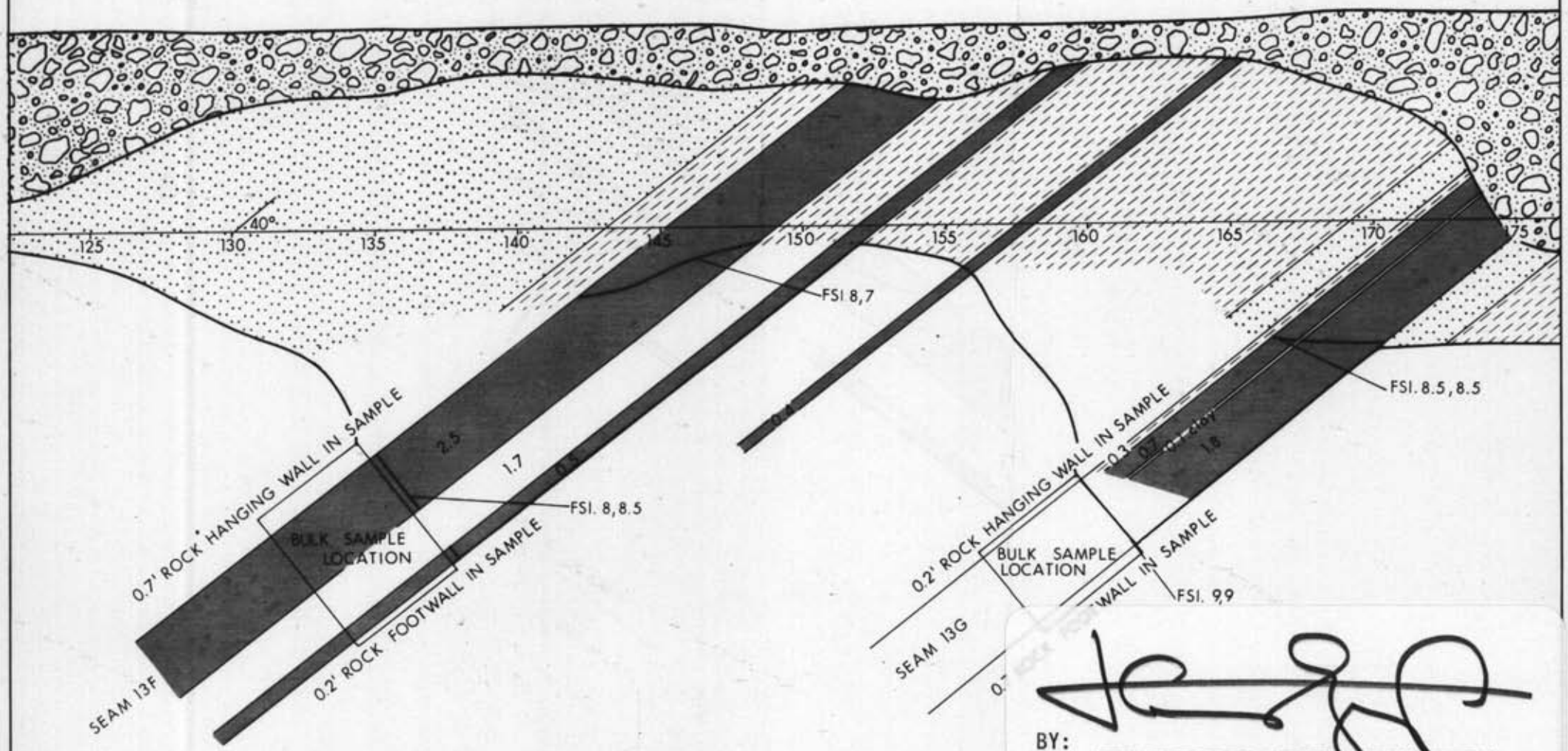
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAMS 13 & 13A

Scale : 1" = 5'



BY: _____

H. Gruss, P.Geol.

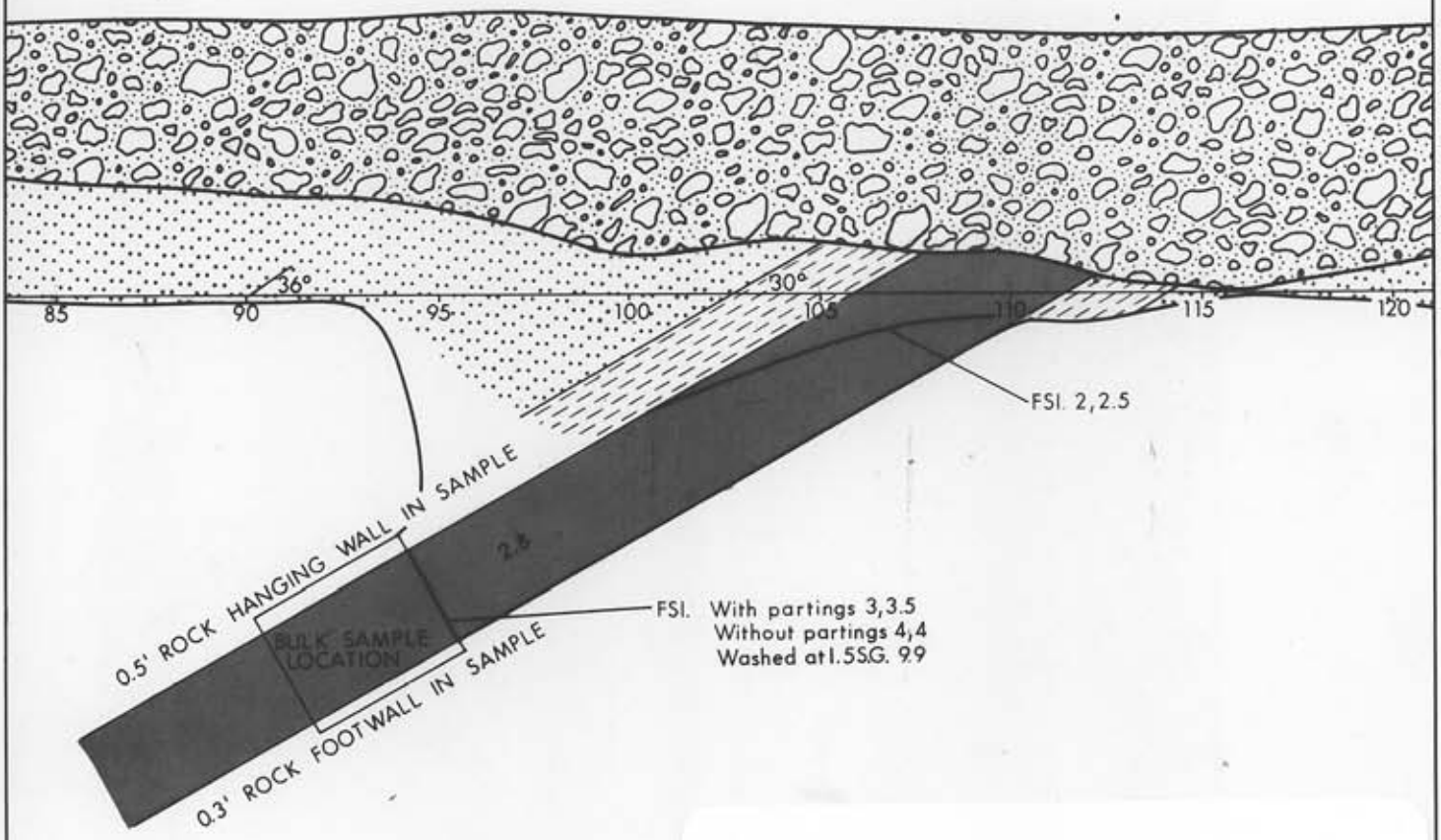
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAMS 13F & 13G

Scale : 1" = 5'



BY:

H. Gruss, P.Geol.

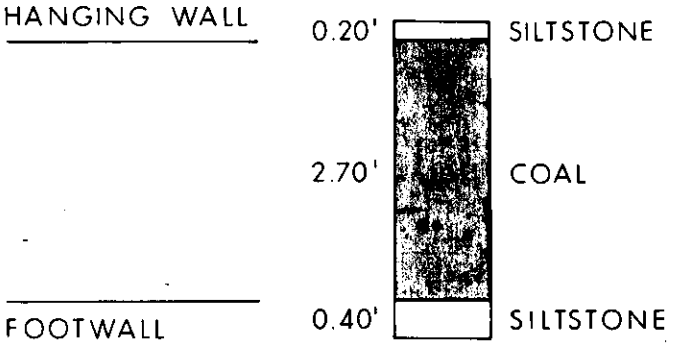
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 13E

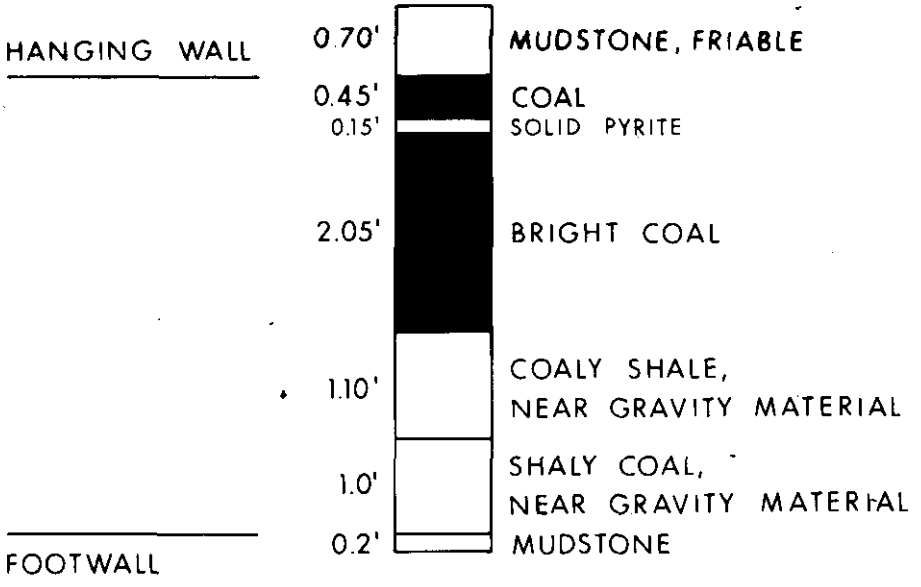
Scale : 1" = 5'



SEAM No. 13 G

TRENCH EB-T16-1975

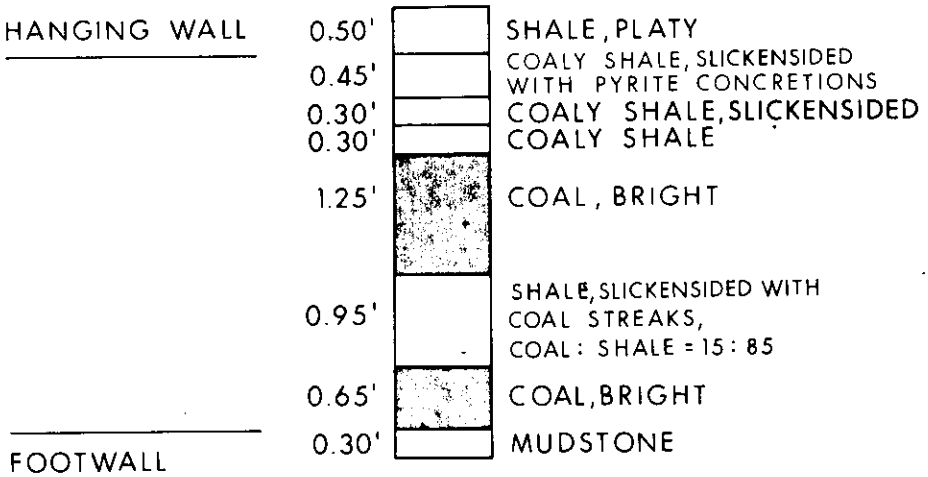
BULK SAMPLE	- THICKNESS :	3.30'
TOTAL SEAM	- THICKNESS :	2.70'
TOTAL COAL	- THICKNESS :	2.70'
TOTAL PARTINGS	- THICKNESS :	——
TOTAL ROOF AND FLOOR IN SAMPLE	:	0.60'



SEAM No. 13F

TRENCH EB - T16 - 1975

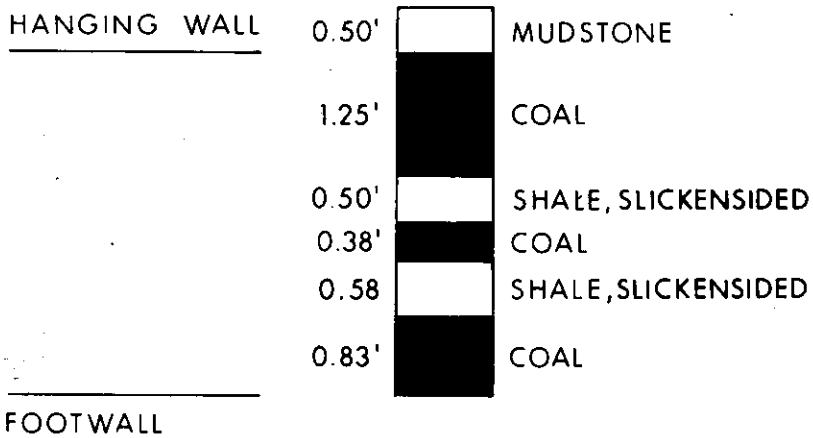
BULK SAMPLE	- THICKNESS	:	5.65'
TOTAL SEAM	- THICKNESS	:	4.75'
TOTAL COAL	- THICKNESS	:	2.50'
TOTAL PARTINGS	- THICKNESS	:	2.25'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.90'



SEAM No. 13E

TRENCH EB-T16-1975

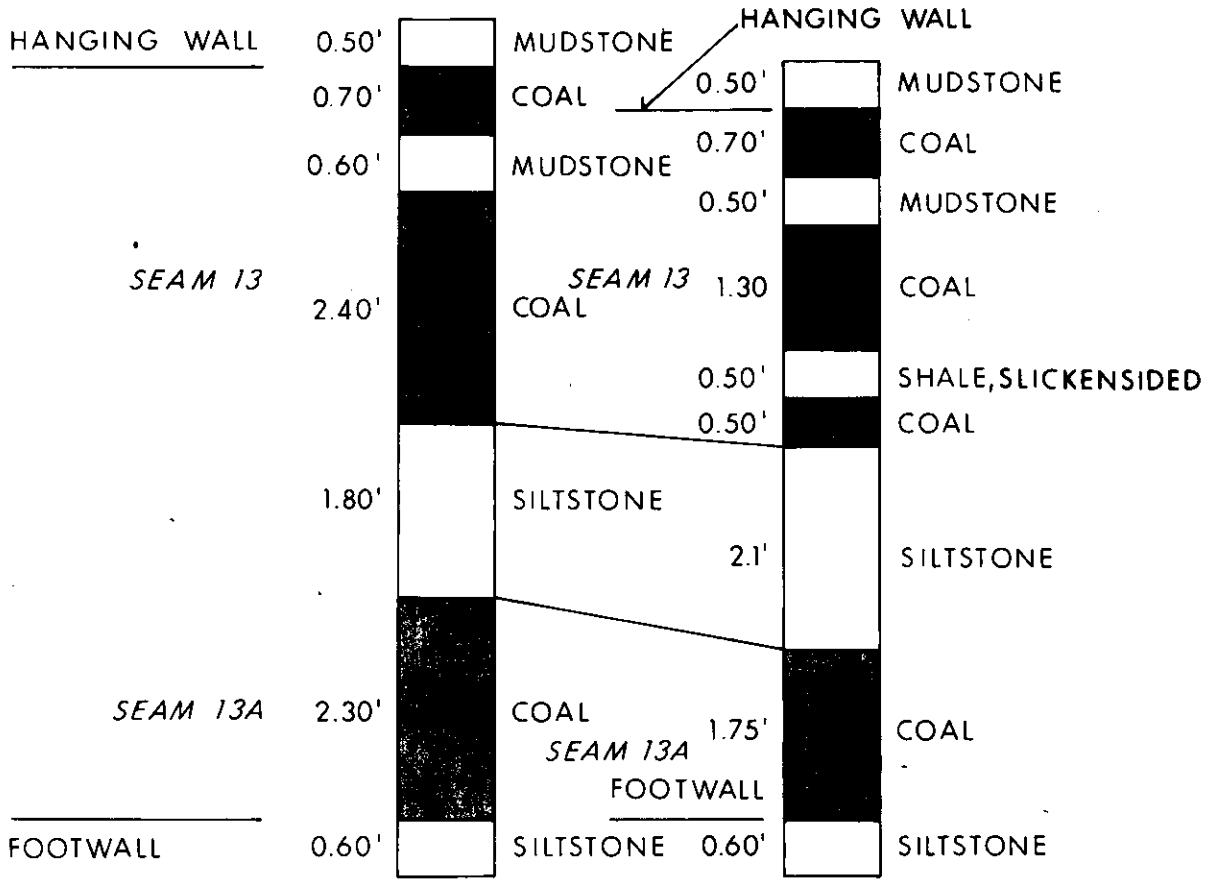
BULK SAMPLE	- THICKNESS	:	4.70'
TOTAL SEAM	- THICKNESS	:	3.90'
TOTAL COAL	- THICKNESS	:	1.90'
TOTAL PARTINGS	- THICKNESS	:	2.00'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.80'



SEAM No. 13D

TRENCH EB - T16 - 1975

BULK SAMPLE	- THICKNESS	:	4.04'
TOTAL SEAM	- THICKNESS	:	3.54'
TOTAL COAL	- THICKNESS	:	2.46'
TOTAL PARTINGS	- THICKNESS	:	1.08'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.50'



SEAM No. 13+13A, TWO DIFFERENT GEOLOGICAL SECTIONS AT CHANNAL - SAMPLE - FACES

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	:	8.9' - 8.45' Ø 8.68'
TOTAL SEAM	THICKNESS	:	7.8' - 7.35' Ø 7.58'
TOTAL COAL	THICKNESS	:	5.4' - 4.25' Ø 4.83'
TOTAL PARTINGS	THICKNESS	:	2.4' - 3.10' Ø 2.75'
TOTAL ROOF AND FLOOR IN SAMPLE		:	1.10' - 1.10' Ø 1.10'

WASHABILITY TEST RESULTS

Seam No. 13
Lab.No. 4026
Laboratory: Birtley Engineering (Canada) Ltd.

HEAD RAW COAL ANALYSIS (air dry basis)

Inh.Moist. %	Ash %	Vol.Matter %	Fixed Carbon %	Sulphur %	BTU/LB	H.G.I.
0.8	57.1	13.7	28.4	0.74	6145	74

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	Inh.Moist. %	Vol.Matter %	Fix.Carbon %	Sulphur %	H.G.I.	Cumulative Weight %	Cumulative Ash %
2"x½"	19.3	80.4	0.9	9.1	9.6	0.58	52		
½"x0	80.7								
3/4"x28M	83.0	68.7	1.0	11.6	18.7	0.65	86	83.0	68.7
28Mx65M	7.4	35.4	0.9	18.2	45.5	1.02	11.5	90.4	66.0
65Mx100M	2.3	33.5						92.7	65.2
100Mx200M	3.7	32.4						96.4	63.9
200MxO	3.6	33.8						100.0	62.8
65MxO	9.6	33.0	0.9	19.1	19.1	1.18			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x½"= 19.3%=1.2%<1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	3.4	4.1	1.7	24.3		3.4	4.1
1.30-1.35	0.8	7.2	1.3	22.8		4.2	4.7
1.35-1.40	0.9	12.8	1.1	21.1		5.1	6.1
1.40-1.45	0.5	15.9	1.0	20.2		5.6	7.0
1.45-1.50	0.7	23.1	1.2	19.6		6.3	8.8
½ 1.50	6.3	8.8		22.8			
1.50-1.55	0.6	29.5	1.1	18.8		6.9	10.6
1.55-1.60	0.3	33.6	1.0	18.2		7.2	11.5
1.60-1.70	0.7	41.1	0.9	16.0		7.9	14.2
1.70-1.80	0.4	48.7	1.1	15.0		8.3	15.8
1.80	91.7	88.4	1.1	7.9		100.0	82.4

SIZE FRACTION 2/3"x28M=69.4%=15.1% <1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	11.3	3.0	2.8	25.1		11.3	3.0
1.30-1.35	4.4	6.3	2.0	23.9		15.7	3.9
1.35-1.40	2.7	10.9	1.8	22.3		18.4	4.9
1.40-1.45	1.9	16.6	1.7	20.4		20.3	6.0
1.45-1.50	1.5	20.8	1.8	20.0		21.8	7.1
½ 1.50	21.8	7.1		23.8			
1.50-1.55	1.4	27.5	1.3	18.8		23.2	8.3
1.55-1.60	1.0	31.8	1.6	18.3		24.2	9.3
1.60-1.70	1.6	39.0	1.7	17.2		25.8	11.1
1.70-1.80	1.6	48.5	1.5	15.5		27.4	13.3
1.80	72.6	84.1	1.2	8.4		100.0	64.7

SIZE FRACTION 28MxX65M = 6.2% = 34.7% <1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fix.Carbon %	Cum.Weight %	Cum.Ash %
1.30	25.0	3.1	1.3	24.7		25.0	3.1
1.30-1.35	14.1	10.3	1.4	23.8		39.1	5.7
1.35-1.40	6.2	12.8	1.6	22.0		45.3	6.7
1.40-1.45	4.5	16.6	1.5	20.8		49.8	7.6
1.45-1.50	6.1	23.0	1.4	20.3		55.9	9.2
½ 1.50	55.9	9.3		23.4			
1.50-1.55	5.4	31.6	1.5	18.8		61.3	11.2
1.55-1.60	4.8	41.8	1.3	17.0		66.1	13.4
1.60-1.70	3.7	51.2	1.6	15.4		69.8	15.4
1.70-1.80	3.3	58.9	1.5	13.8		73.1	17.4
1.80	26.9	79.4	1.5	9.5		100.0	34.1

FROTH FLOTAT., SIZE FRACTION 65MxO

	Weight %	Ash %	In.Moist. %	Vol.Matter %	Fixed Carbon %	Cum.Weight %	Cum.Ash %
Stage I	55.3	15.4	0.5	22.4		55.3	15.4
Stage II	10.1	28.7	0.7	19.7		65.4	17.5
Tailings	34.6	62.5	0.7	14.0		100.0	33.0

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

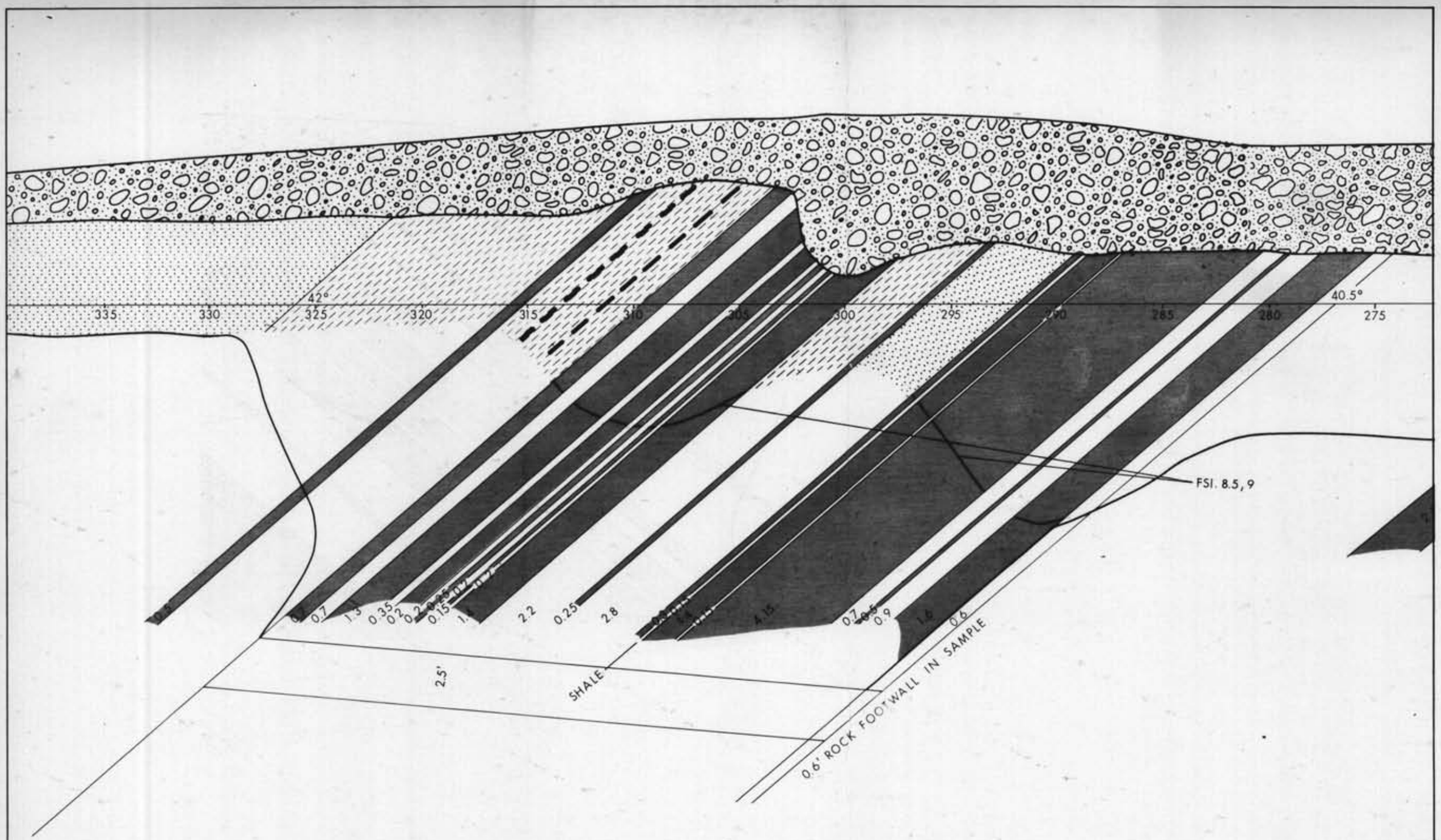
RUHR DILATOMETER RESULTS, 1.5 S.G.

Total Sulphur %	Phosphor %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Value
0.97	0.07	8½	396	465	26	87	1.045

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resol. Temp.°C	Contr. %	Dilat. %	G-Value
0.95	0.06	9	395	459	26	77	1.039

Tot.Sulph. %	Phosph. %	FSI	Soften Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Val.
1.08	0.04	9	396	461	26	97	1.046

Tot. Sulph. %	Phosph. %	FSI	Softening Temp.°C	Resolidif. Temp.°C	Contrac. %	Dilatation %	G-Value
1.17		8	399	465	21	58	1.037

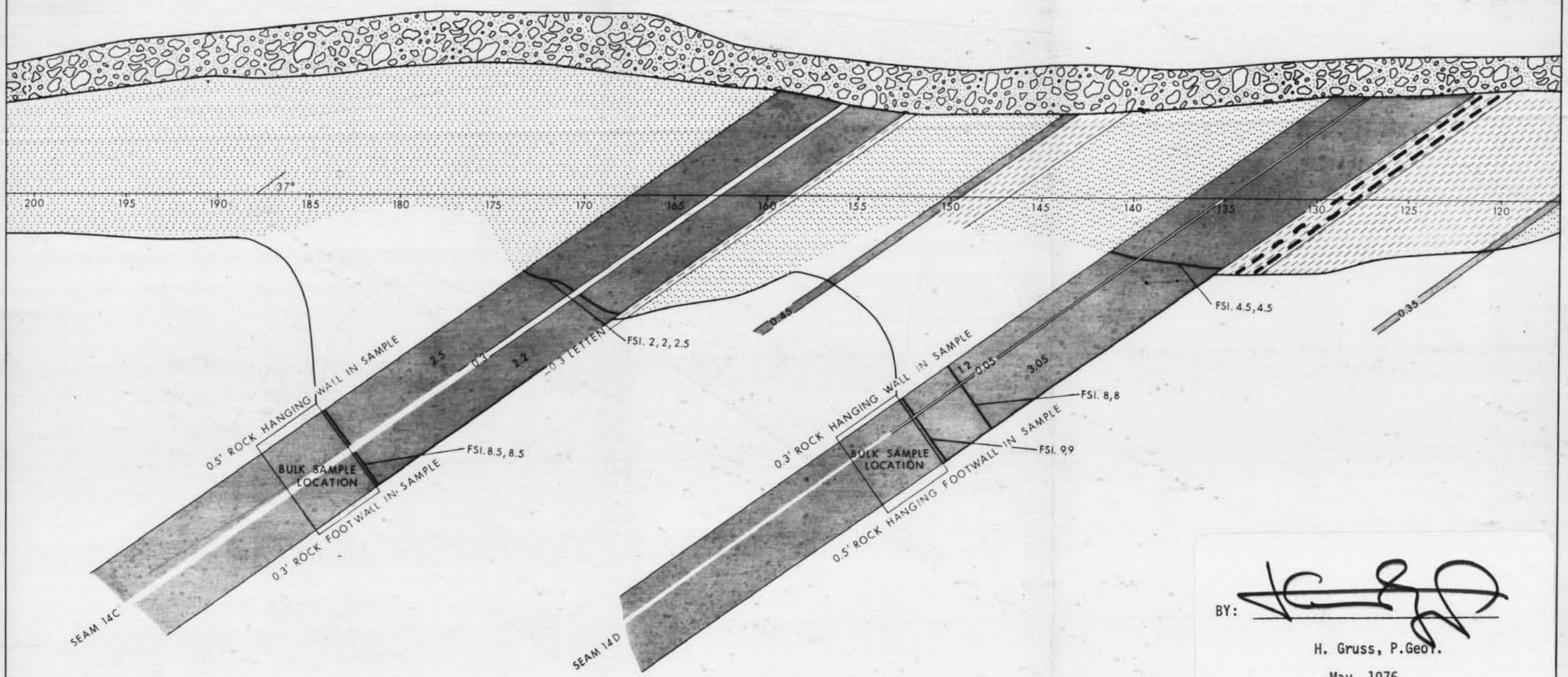


ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 14

Scale : 1" = 5'



BY:

H. Gruss, P.Geol.

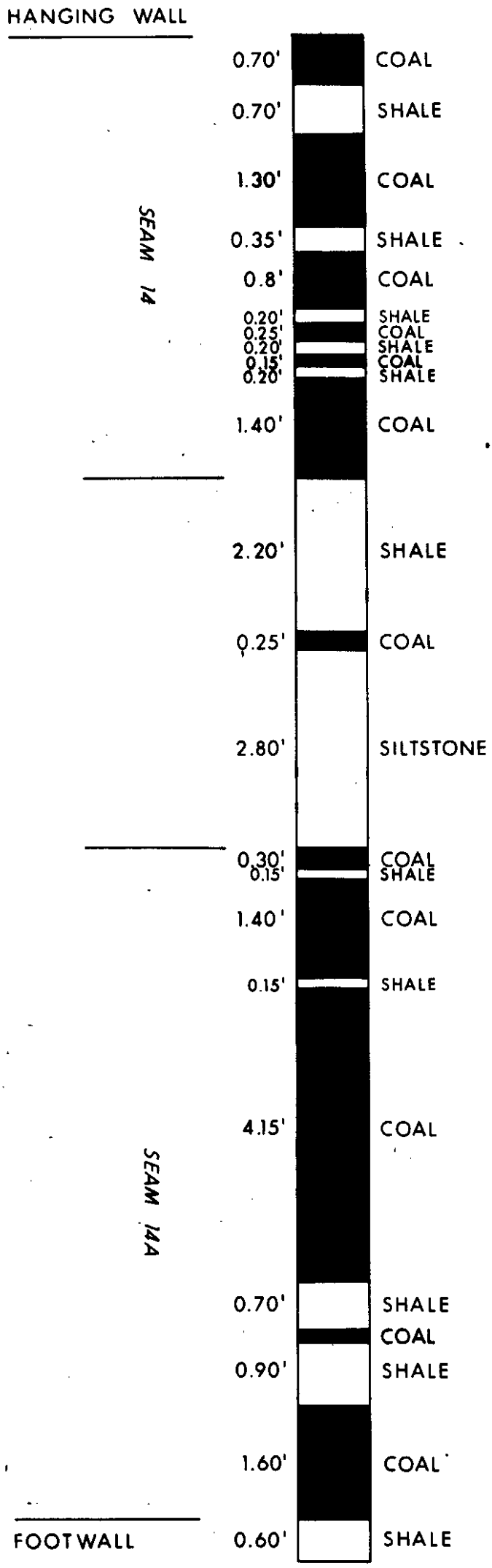
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAMS 14C & 14D

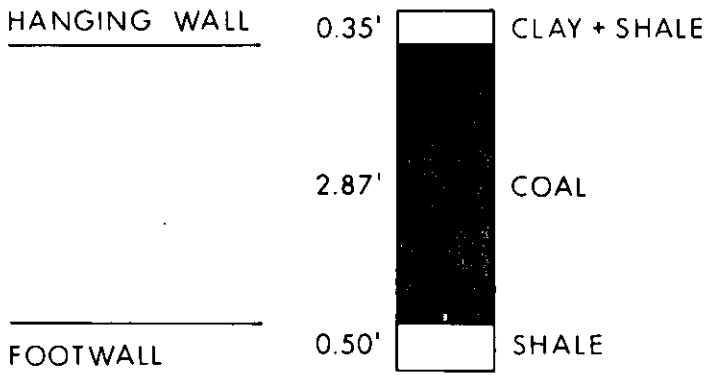
Scale : 1" = 5'



SEAM No. 14 + 14A

TRENCH EB - T16 - 1975

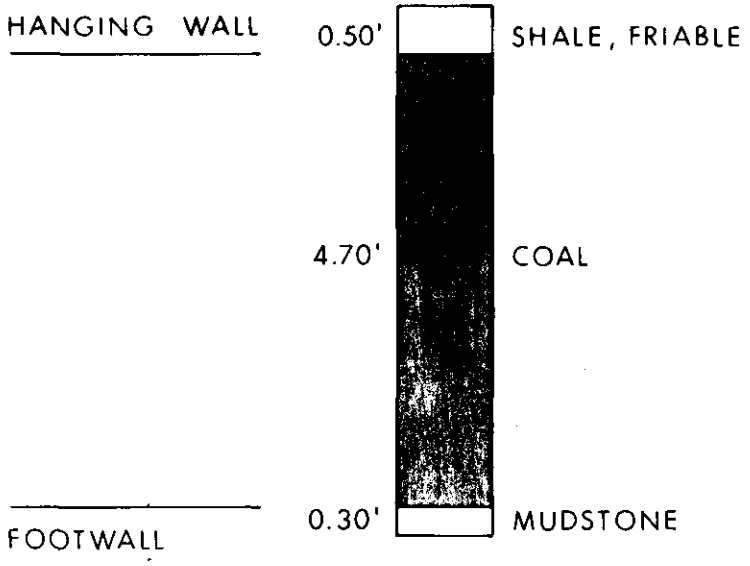
BULK SAMPLE	- THICKNESS	:	21.60'
TOTAL SEAM	- THICKNESS	:	21.00'
TOTAL COAL	- THICKNESS	:	12.45'
TOTAL PARTINGS	- THICKNESS	:	8.55'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.60'



SEAM No. 14D

TRENCH EB - T16 - 1975

BULK SAMPLE	- THICKNESS	: 3.72'
TOTAL SEAM	- THICKNESS	: 2.87'
TOTAL COAL	- THICKNESS	: 2.87'
TOTAL PARTINGS	- THICKNESS	: ——
TOTAL ROOF AND FLOOR IN SAMPLE		: 0.85'



SEAM No. 14C

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	:	5.50'
TOTAL SEAM	- THICKNESS	:	4.70'
TOTAL COAL	- THICKNESS	:	4.70'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.80'

WASHABILITY TEST RESULTS

Seam No.: 14
Lab.No.: 4024
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
0.9	49.8	16.7	32.6	0.97	7540	64

AIR DRY BASIS

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cu.Weigh. %	Cum.Ash %
2"x¾"	30.6	65.6	0.9	12.6	20.9	0.55	60		
¾"x0	69.4								
3/4"x28M	82.4	50.0	0.9	16.4	32.7	0.58	79	82.4	50.0
28Mx65M	7.0	30.2	0.8	21.7	47.3	0.74	113	89.4	48.5
65Mx100M	6.2	25.8						95.6	47.0
100Mx200M	2.6	26.7						98.2	46.4
200Mx0	1.8	28.0						100.0	46.1
65Mx0	10.6	26.1	1.0	21.3	51.6	0.56			

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¾"=30.6%=5.8% <1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	10.1	3.7	1.0	26.3		10.1	3.7
1.30-1.35	4.0	8.8	0.8	24.5		14.1	5.1
1.35-1.40	2.9	14.1	0.9	22.9		17.0	6.7
1.40-1.45	1.1	21.0	0.8	22.0		18.1	7.5
1.45-1.50	0.8	24.8	0.8	22.0		18.9	8.3
2 1.50	18.9	8.3		25.0			
1.50-1.55	1.3	29.7	0.8	21.5		20.2	9.7
1.55-1.60	0.7	36.5	0.9	18.9		20.9	10.6
1.60-1.70	1.5	42.7	0.8	18.8		22.4	12.7
1.70-1.80	1.6	49.5	0.9	16.7		24.0	15.2
1.80	76.0	84.7	1.3	68.0		100.0	68.0

SIZE FRACTION 3/4"x28M=61.3%=25.7% <1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
27.1	3.3	1.2	24.5		27.1	3.3
7.3	0.9	0.9	24.4		34.4	4.5
3.9	1.0	1.0	23.4		38.3	5.5
1.9	1.1	1.1	22.3		40.2	6.2
1.8	1.2	1.2	21.5		42.0	7.0
42.0	7.0		24.2			
1.2	30.6	1.1	20.8		43.2	7.6
0.9	35.6	1.1	19.5		44.1	8.2
1.9	43.1	1.0	18.1		46.0	9.6
1.9	51.7	1.1	15.9		47.9	11.3
52.1	82.4	1.1	8.8		100.0	48.4

SIZE FRACTION 28Mx65M=5.2%=3.4% <1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
29.3	2.6	1.4	27.0		29.3	2.6
23.7	4.4	1.6	25.5		53.0	3.4
5.8	10.3	2.1	23.8		58.8	4.1
3.8	15.4	1.9	23.0		62.6	4.8
2.7	19.4	2.3	22.3		65.3	5.4
65.3	5.4		25.7			
2.1	25.1	2.3	21.4		67.4	6.0
1.7	29.1	2.1	20.3		69.1	6.6
2.6	36.3	2.2	19.5		71.7	7.6
1.8	44.1	2.4	17.6		73.5	8.5
26.5	80.4	1.8	9.3		100.0	27.6

FROTH FLOTATION, SIZE FRACTION 65Mx0

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
Stage I	24.6	9.5	0.8	24.4		24.6	9.5
Stage II	10.7	15.1	0.7	23.7		35.3	11.2
Tailings	64.7	34.7	0.5	20.1		100.0	26.4

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

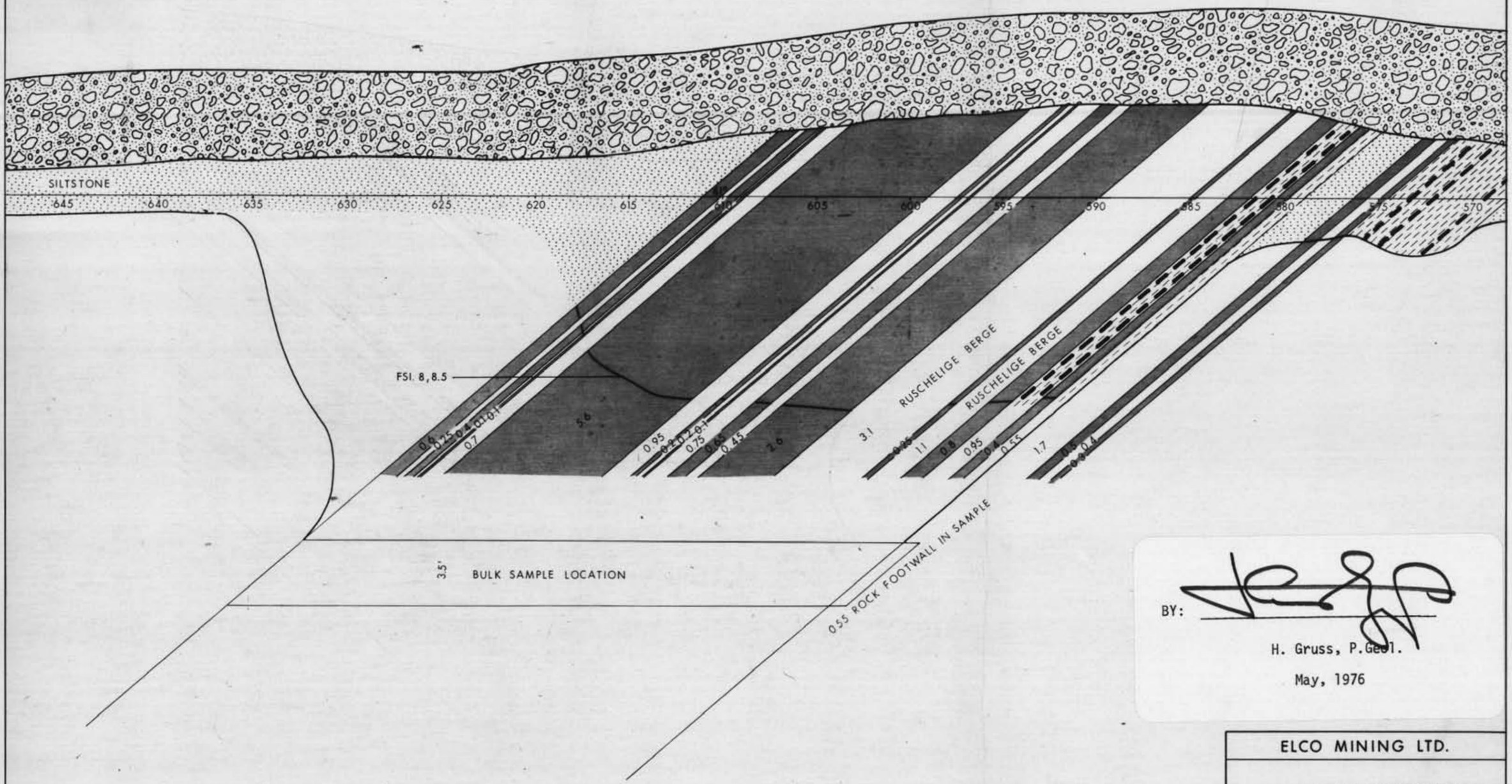
RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contrac. %	Dilatat. %	G-Value
0.87	0.10	8½	399	461	5	248	1.074

Tot.Sul. %	Phosp. %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Val.
0.78	0.07	9	392	453	23	218	1.062

Tot.Sul. %	Phosph. %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Val.
0.92	0.05	9	394	450	21	208	1.057

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contract. %	Dilatat. %	G-Value
0.90		9	390	454	15	158	1.067



BY:

H. Gruss, P.Geol.

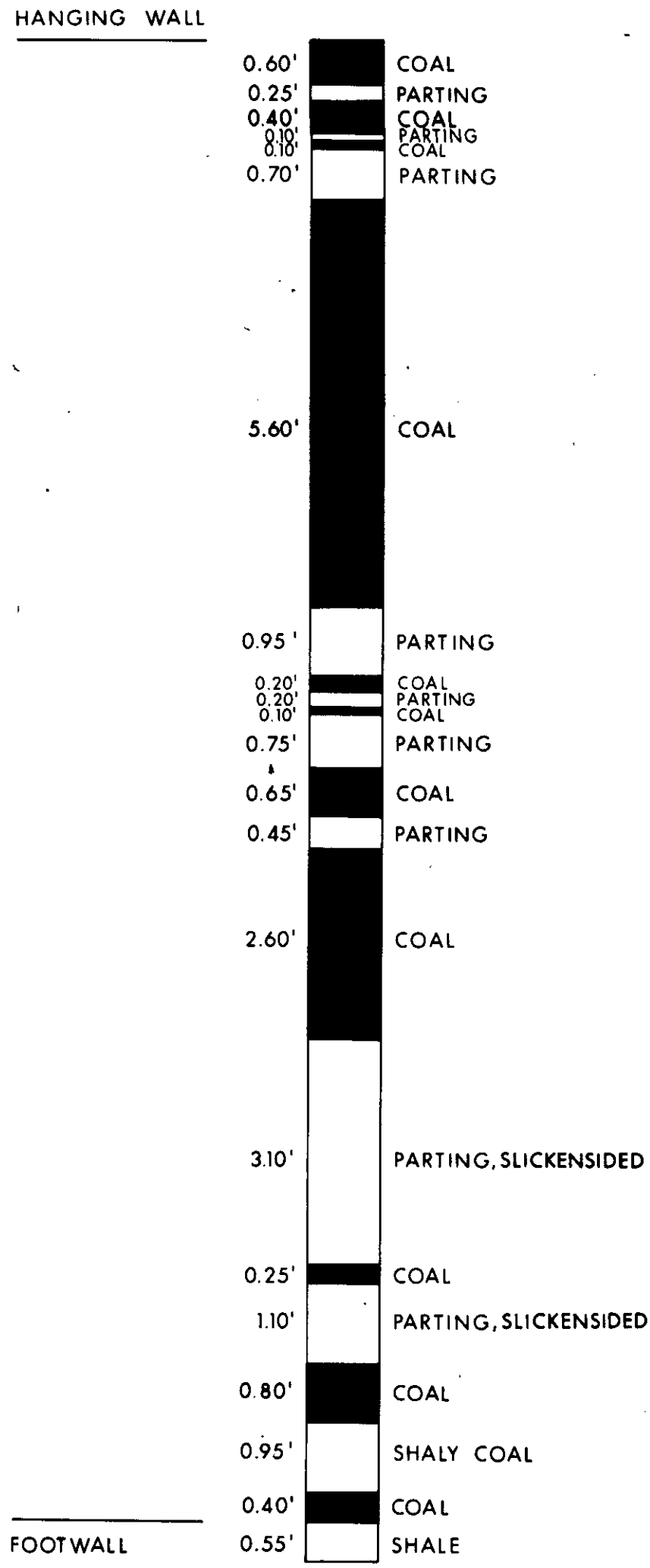
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 15

Scale : 1" = 5'



SEAM No. 15

TRENCH EB-T16-1975

BULK SAMPLE	- THICKNESS	:	20.80'
TOTAL SEAM	- THICKNESS	:	20.25'
TOTAL COAL	- THICKNESS	:	11.70'
TOTAL PARTINGS	- THICKNESS	:	8.55'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'

WASHABILITY TEST RESULTS

Seam No.: 15
Lab.No.: 4022
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
0.9	44.3	17.7	37.2	0.63	8100	69

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x¼"	34.1	61.2	0.6	13.9	24.3	0.45	67		
¼"x0	65.9								
3/4"x28M	82.0	46.8	0.8	17.0	35.4	0.96	69	82.0	46.8
28Mx65M	11.9	21.7	0.9	22.3	55.1	0.75	139	93.9	43.6
65Mx100M	1.2	21.8						95.1	43.3
100Mx200M	3.5	21.1						98.6	42.6
200Mx0	1.4	23.6						100.0	42.3
65Mx0	6.1	21.9	0.9	22.4	54.8	0.92			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=34.1%=7.6% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	11.2	4.2	1.1	26.7		11.2	4.2
1.30-1.35	4.4	7.1	1.0	24.0		15.6	5.0
1.35-1.40	3.8	12.0	0.9	21.6		19.4	6.4
1.40-1.45	1.6	20.1	0.9	21.5		21.0	7.4
1.45-1.50	1.3	24.6	0.9	21.4		22.3	8.4
> 1.50	22.3	84.4		24.6			
1.50-1.55	1.7	32.0	0.9	21.2		24.0	10.1
1.55-1.60	1.6	35.2	0.8	20.3		25.6	11.7
1.60-1.70	4.1	41.7	0.9	19.1		29.7	15.6
1.70-1.80	2.8	51.6	1.0	17.4		32.5	18.9
1.80	67.5	82.8	1.2	8.6		100.0	62.0

SIZE FRACTION 3/4"x28M=59.6%=23.1% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	21.9	2.3	1.6	27.7		21.9	2.3
1.30-1.35	7.7	6.3	1.7	24.6		29.6	3.3
1.35-1.40	4.2	11.1	1.5	22.5		33.8	4.3
1.40-1.45	3.0	16.0	1.3	21.6		36.8	5.3
1.45-1.50	1.9	21.1	1.3	21.3		38.7	6.0
> 1.50	38.7	6.0		25.7			
1.50-1.55	1.4	29.5	1.0	20.0		40.1	6.9
1.55-1.60	1.2	35.0	0.9	19.3		41.3	7.7
1.60-1.70	2.8	42.5	0.9	18.0		44.1	9.9
1.70-1.80	2.8	50.6	0.9	16.6		46.9	12.3
1.80	53.1	80.1	0.1	9.5		100.0	48.3

SIZE FRACTION 28Mx65M=8.7%=6.5% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	39.1	3.2	1.5	26.3		39.1	3.2
1.30-1.35	16.9	6.7	2.1	24.5		56.0	4.3
1.35-1.40	9.1	11.6	2.1	23.1		65.1	5.3
1.40-1.45	4.4	14.9	2.2	22.2		69.5	5.9
1.45-1.50	5.1	24.3	2.2	20.6		74.6	7.2
> 1.50	74.6	7.2		24.9			
1.50-1.55	2.2	27.8	2.1	19.4		76.8	7.7
1.55-1.60	1.7	32.5	1.8	19.4		78.5	8.3
1.60-1.70	2.7	39.6	2.0	18.5		81.2	9.3
1.70-1.80	2.4	51.0	2.1	16.4		83.6	10.5
1.80	16.4	74.3	2.0	13.4		100.0	21.0

FROTH FLOTATION, SIZE FRACTION 65Mx0=

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	51.8	8.8	0.6	25.3		51.8	8.8
Stage II	9.9	18.3	0.7	23.1		61.7	10.3
Tailings	38.3	38.1	0.8	20.3		100.0	21.0

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

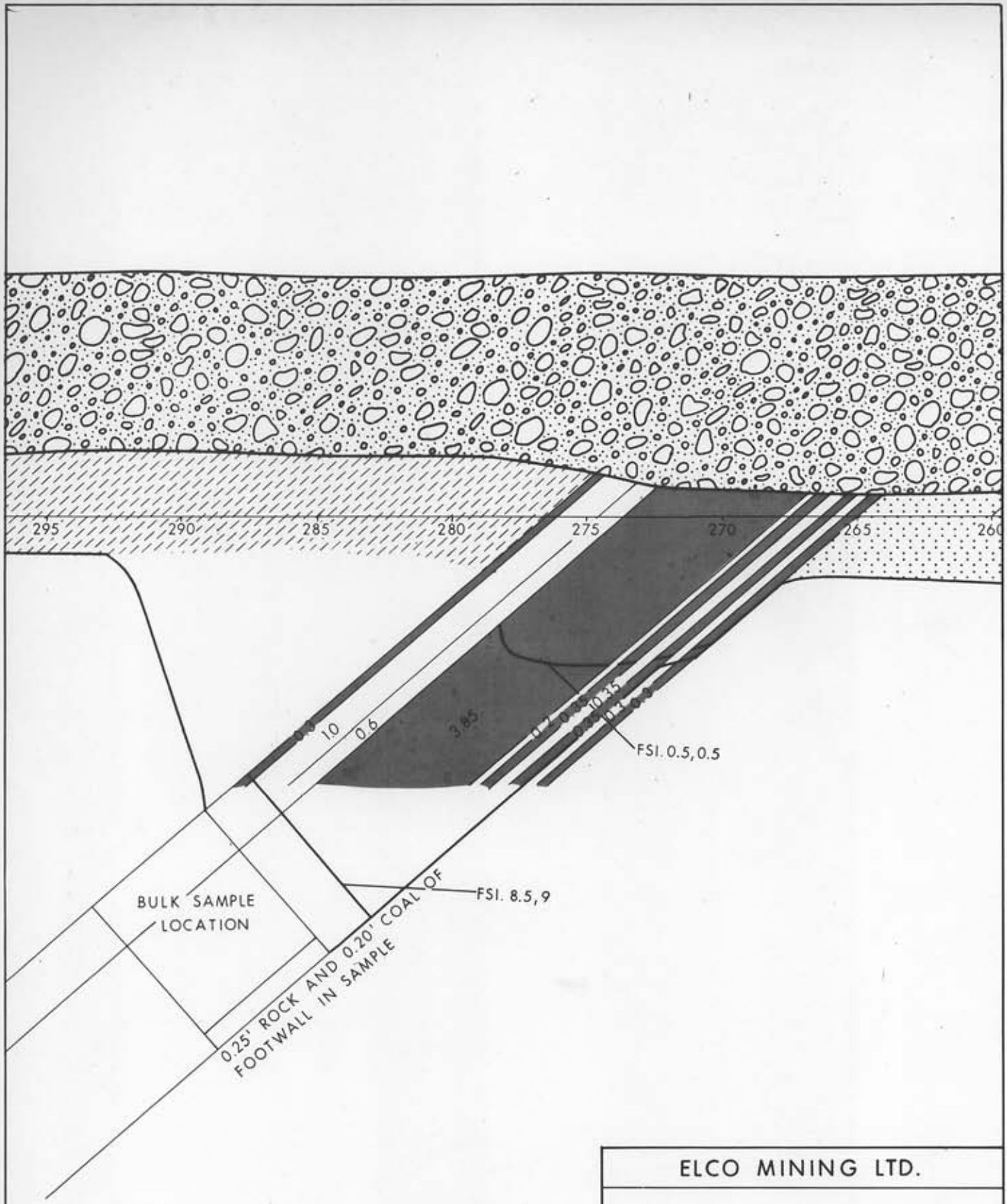
RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sul. %	Phosphor %	FSI	Soften. Tem°C	Resolidific. Tem°C	Contract. %	Dilatati. %	G-Value
0.88	0.07	8	399	466	5	96	1.075

Tot.Sul. %	Phosp. %	FSI	Soft. Tem°C	Resol. Tem°C	Contr. %	Dilat. %	G-Value
0.80	0.05	8½	401	449	18	79	1.037

Tot.Sul. %	Phosph. %	FSI	Soften. Temp.°C	Resol. Temp°C	Contr. %	Dilat. %	G-Val.
1.02	0.04	9	397	459	19	137	1.058

Tot.Sulph. %	Phosph. %	FSI	Soften. Tem°C	Resolidif. Temp.°C	Contract. %	Dilatat. %	G-Value
0.73		9	402	457	27	70	1.029

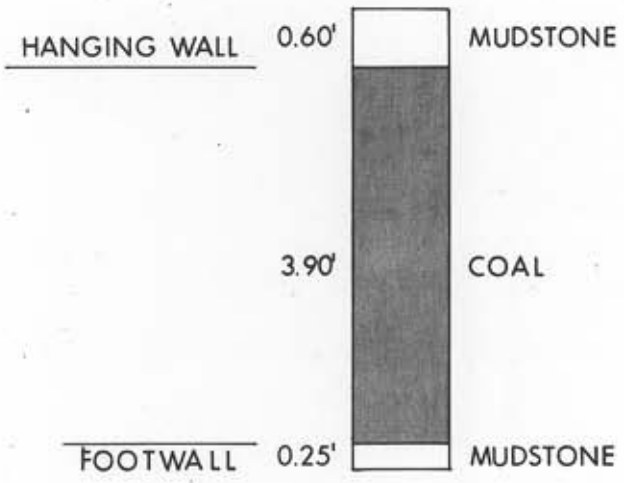


ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 16

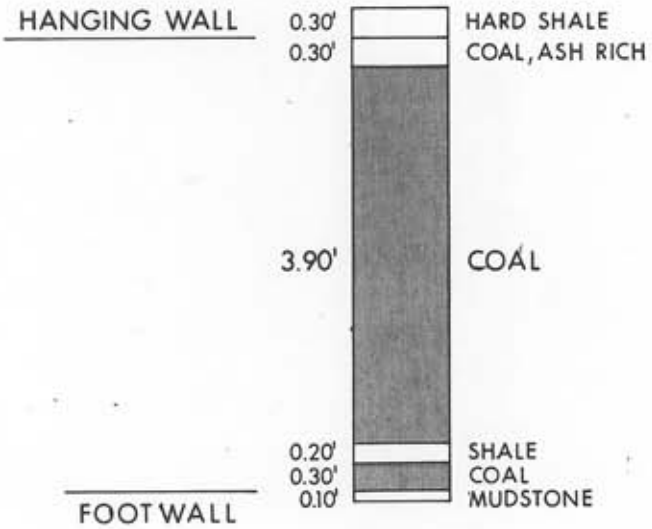
Scale : 1" = 5'



SEAM No. 16G

TRENCH EB - 16 - 1975

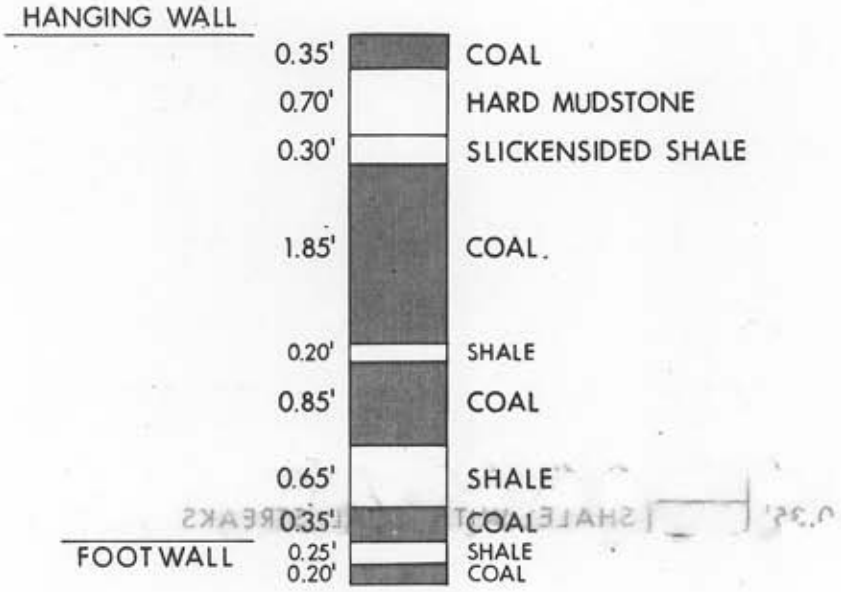
BULK SAMPLE	- THICKNESS	:	4.75'
TOTAL SEAM	- THICKNESS	:	3.90'
TOTAL COAL	- THICKNESS	:	3.90'
TOTAL PARTINGS	- THICKNESS	:	——
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.85'



SEAM No. 16E

TRENCH EB - 16 - 1975

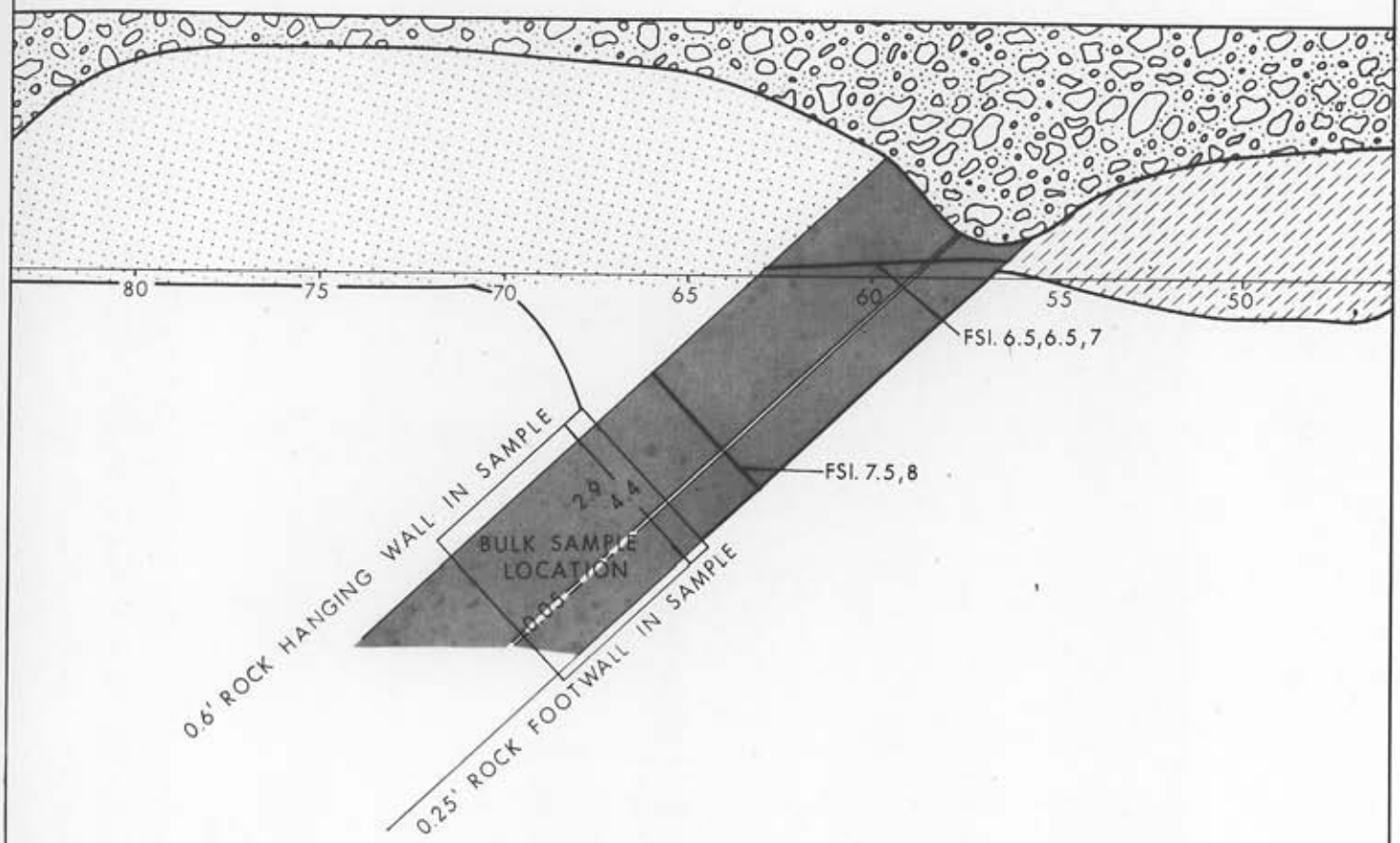
BULK SAMPLE	- THICKNESS	:	5.10'
TOTAL SEAM	- THICKNESS	:	4.70'
TOTAL COAL	- THICKNESS	:	4.50'
TOTAL PARTINGS	- THICKNESS	:	0.20'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.40'



SEAM No.16

TRENCH EB - 16 - 1975

BULK SAMPLE	- THICKNESS	:	5.70'
TOTAL SEAM	- THICKNESS	:	5.25'
TOTAL COAL	- THICKNESS	:	3.40'
TOTAL PARTINGS	- THICKNESS	:	1.85'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.45'

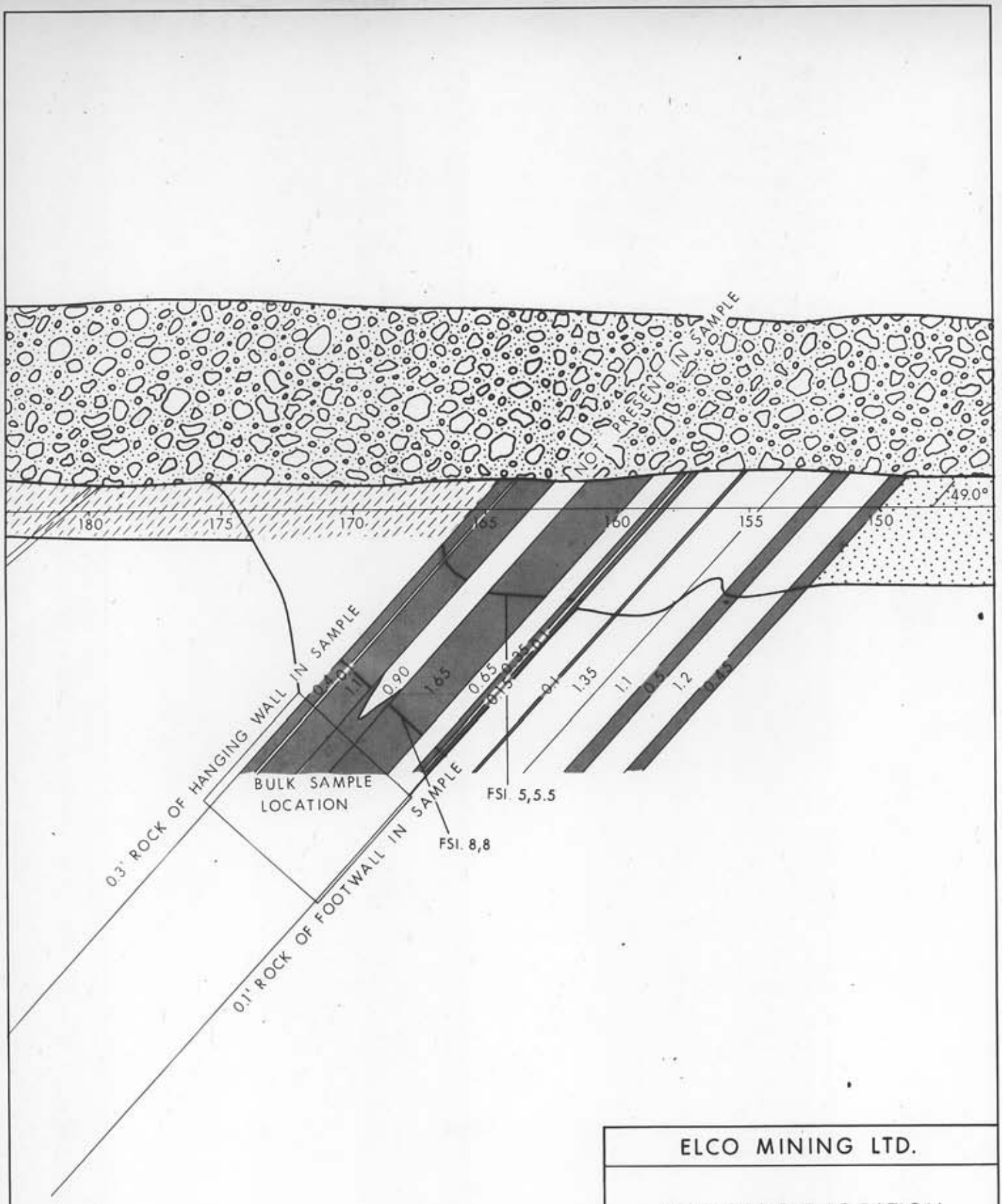


ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 16G

Scale : 1" = 5'



ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 16E

Scale : 1" = 5'

ELCO MINING LIMITED

PAGE

WASHABILITY TEST RESULTS

Seam No.: 16
Lab.No.: 4479
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Matt. %	Fix.Carb. %	Sulphur %	BTU/LB	H.G.I.
0.7	39.7	19.9	39.7	0.78	8890	77

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x¼"	28.9	62.2	1.3	13.6	22.9	0.57	59		
¼"x0	71.1								
3/4"x28M	76.4	42.6	0.7	19.3	37.4	0.65	77	76.4	42.6
28MxS6M	11.3	25.0	0.8	23.9	50.3	0.78		87.7	40.3
65MX100M	4.5	21.8						92.2	39.4
100Mx200M	4.2	20.9						96.4	38.6
200MxO	3.6	22.2						100.0	38.0
65MxO	12.3	20.9	0.8	24.6	53.7	0.98			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=28.9%=8.3S<1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	11.1	3.8	0.9	28.2		11.1	3.8
1.30-1.35	7.2	9.8	0.8	26.2		18.3	6.1
1.35-1.40	4.2	14.6	1.0	25.3		22.5	7.7
1.40-1.45	4.0	21.7	0.9	24.8		26.5	9.8
1.45-1.50	2.2	30.5	0.8	23.3		28.7	11.6
1.50	28.7	11.6		28.5		50.4	7.6
1.50-1.55	1.8	43.7	0.8	20.3		52.2	8.3
1.55-1.60	1.8	51.5	0.8	17.3		54.0	9.0
1.60-1.70	1.6	58.6	0.9	14.9		55.6	10.5
1.70-1.80	2.0	61.3	0.9	14.0		57.6	12.0
1.80	64.1	87.2	0.8	7.7		100.0	41.9

SIZE FRACTION 3/4"x28M=51.6%=26.0S<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
29.6	3.2	1.3	29.5		29.6	3.2
10.8	8.6	1.2	26.8		40.4	4.6
4.6	15.2	1.4	25.7		45.0	5.7
5.0	20.6	1.3	24.7		48.0	6.7
2.4	25.9	1.2	22.2		50.4	7.6
50.4	7.6		28.0			
1.6	30.8	1.1	22.2		52.0	8.3
1.4	35.0	1.1	21.0		53.4	9.0
2.7	40.6	0.9	19.5		56.1	10.5
2.1	50.8	0.8	17.1		58.2	12.0
41.8	83.6	0.6	8.8		100.0	41.9

SIZE FRACTION 28MxS6M=8.0%=5.0S < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
43.9	2.0	1.8	29.7		43.9	2.0
14.4	6.6	1.5	28.2		58.3	3.1
4.4	12.1	2.0	26.3		62.7	3.8
3.1	16.0	2.4	24.9		65.8	4.3
3.4	20.2	2.1	24.6		69.2	5.1
69.2	5.1		28.5			
2.3	25.2	2.6	23.0		71.5	5.8
1.6	29.9	2.8	21.8		73.1	6.3
3.2	36.1	2.5	20.8		76.3	7.5
2.5	44.7	2.1	18.8		78.8	8.7
21.2	76.4	1.5	12.0		100.0	23.1

FROTH-FLOTATION, SIZE FRACTION 65MxO

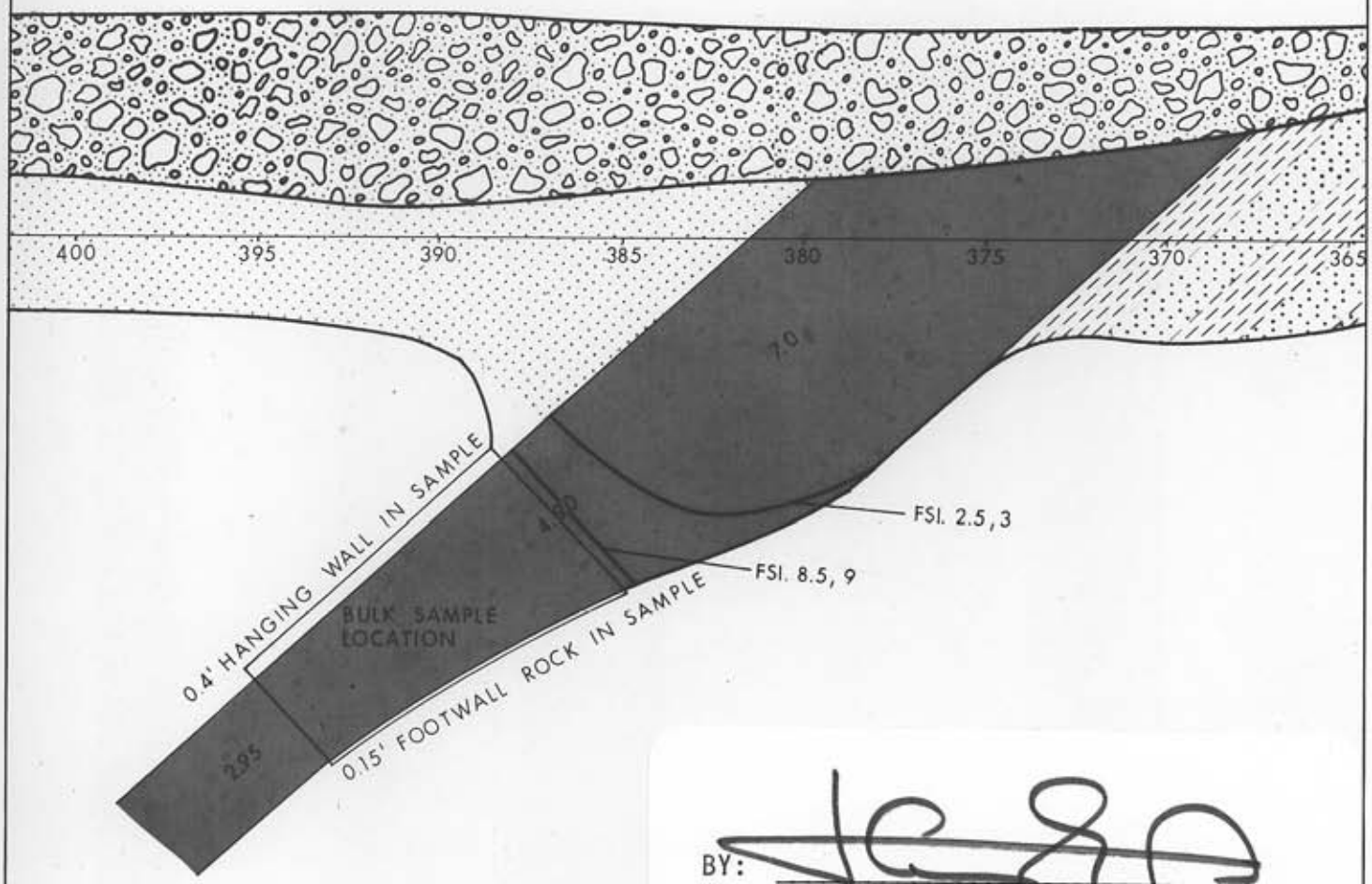
	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	64.2	9.5	0.9	27.6		64.2	9.5
Stage II	6.1	19.6	0.7	24.7		70.3	10.4
Tailings	29.7	45.5	0.5	19.2		100.0	20.8

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosp. %	FSI	Soften. Temp.°C	Resoldif. Temp.°C	Contrac. %	Dilatation %	G-Value
0.72	0.16	8	384	456	20	88	1.057
0.76	0.12	8	390	447	22	150	1.053
0.83	0.07	9	397	456	22	118	1.050
0.99		8	399	459	15	151	1.061



BY:

H. Gruss, P.Geol.

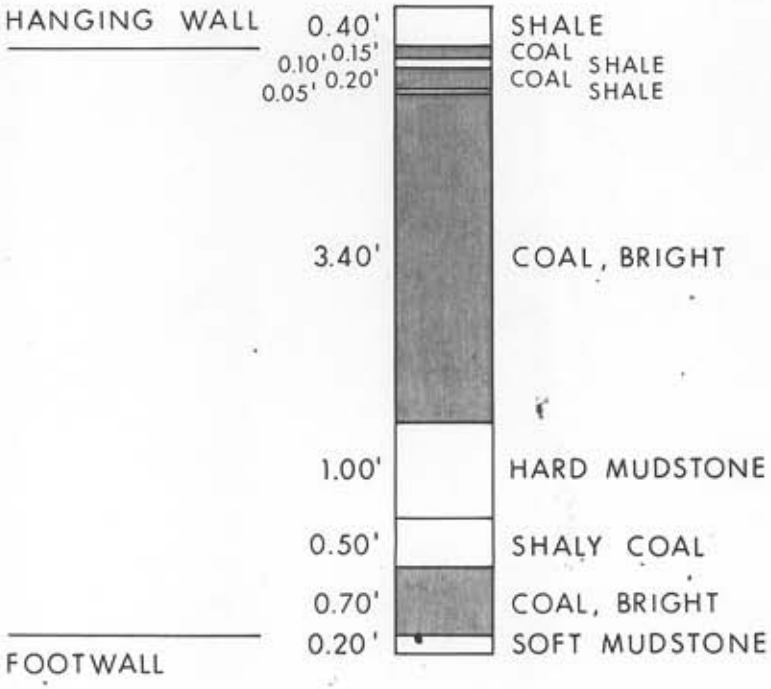
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 17

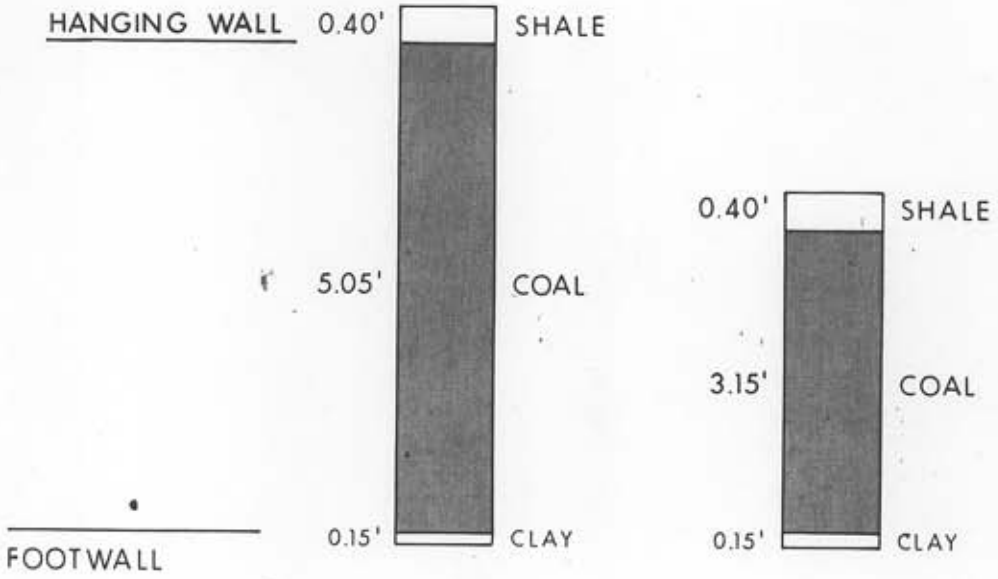
Scale : 1" = 5'



SEAM 17A

TRENCH EB-T17-1975

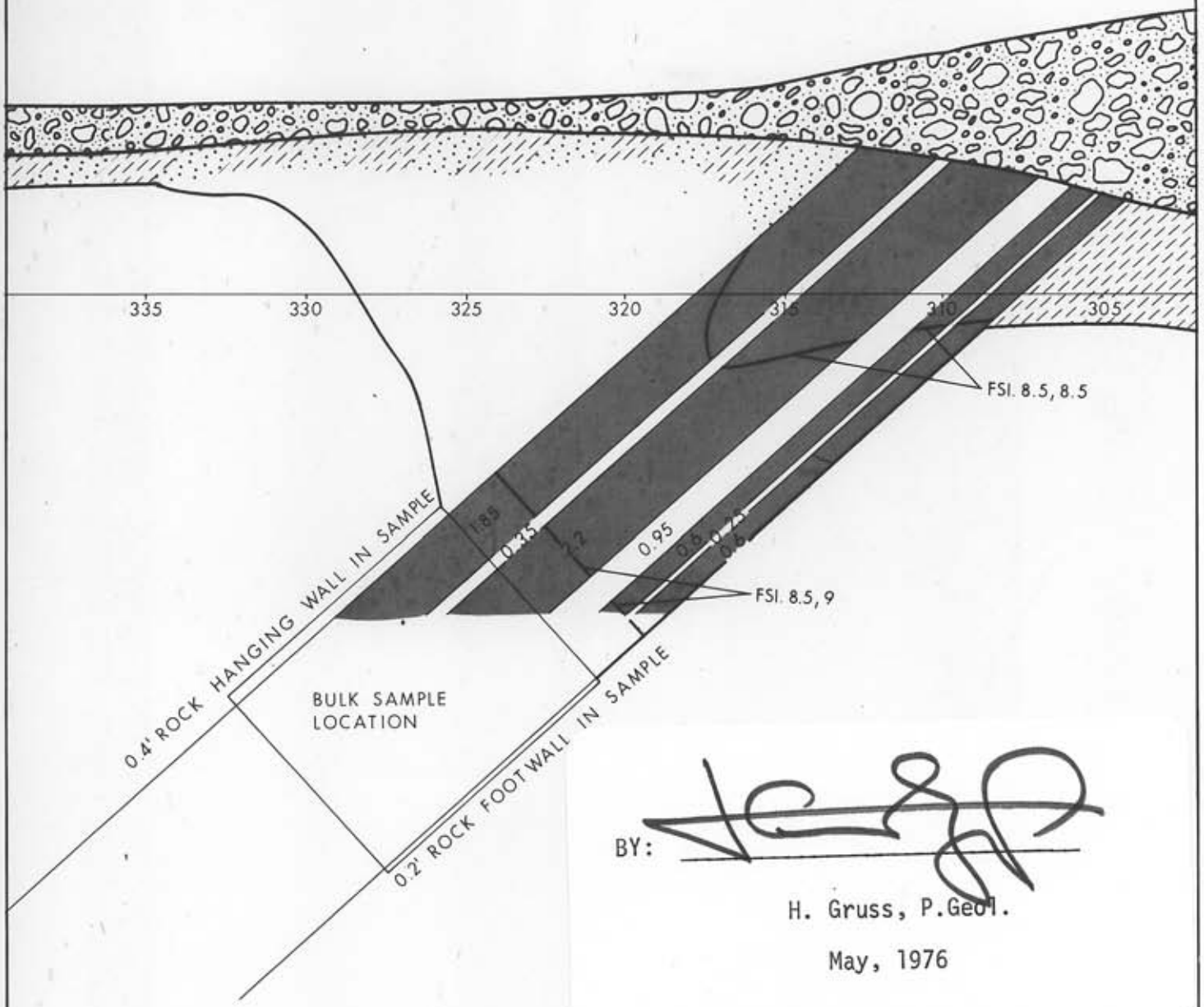
BULK SAMPLE	- THICKNESS	: 6.70'
TOTAL SEAM	- THICKNESS	: 6.10'
TOTAL COAL	- THICKNESS	: 4.45'
TOTAL PARTINGS	- THICKNESS	: 1.65'
TOTAL ROOF AND FLOOR IN SAMPLE		: 0.60'



SEAM No. 17, TWO GEOLOGICAL ASSESSMENTS, 1st + 2nd CHANNAL-SAMPLE

TRENCH EB-T17-1975

BULK SAMPLE	- THICKNESS	:	5.60' - 3.70'	Ø 4.65'
TOTAL SEAM	- THICKNESS	:	5.05' - 3.15'	Ø 4.10'
TOTAL COAL	- THICKNESS	:	5.05' - 3.15'	Ø 4.10'
TOTAL PARTINGS	- THICKNESS	:	—	—
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'	Ø 0.55'



BY:

H. Gruss, P.Geol.

May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 17A

Scale : 1" = 5'

WASHABILITY TEST RESULTS

Seam No.: 17
Lab.No.: 4472
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
1.0	35.9	21.9	41.2	0.71	9660	72

SIZE DISTIRBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x½"	28.6	64.3	1.5	15.7	18.5	0.44	54		
½"x0	71.4								
3/4"x28M	85.2	35.9	1.1	22.3	40.7	0.59	78	85.2	35.9
28Mx65M	9.6	18.1	1.1	25.6	55.2	0.74	125	94.8	34.1
65Mx100M	1.4	18.1						96.2	33.9
100Mx200M	2.0	18.3						98.2	33.6
200MxO	1.8	23.2						100.0	32.9
65MxO	5.2	19.9	1.0	25.0	54.1	0.87			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x½"=28.6%=8.3% < 1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	19.4	3.4	1.1	30.0		19.4	3.4
1.30-1.35	2.5	8.7	1.1	27.2		21.9	4.0
1.35-1.40	4.5	15.3	1.0	25.8		26.4	5.9
1.40-1.45	0.9	19.2	1.0	23.4		27.3	6.4
1.45-1.50	1.6	24.3	0.9	23.4		28.9	7.4
-1.50	28.9	7.4					
1.50-1.55	0.9	30.0	0.8	21.9		29.8	8.0
1.55-1.60	0.7	35.8	0.7	21.8		30.5	8.7
1.60-1.70	0.9	43.2	0.7	19.1		31.4	9.7
1.70-1.80	0.9	53.0	0.8	16.3		32.3	10.9
1.80	67.7	84.0	1.0	10.3		100.0	60.4

SIZE FRACTION 3/4"x28M=61.2%=38.1% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
45.9	2.6	1.4	30.2		45.9	2.6
9.8	8.2	1.1	27.2		53.7	3.4
4.3	13.7	1.2	25.4		58.0	4.2
2.6	19.8	1.0	24.0		60.6	4.8
1.7	25.3	0.9	23.3		62.3	5.4
62.3	5.4					
1.2	30.6	0.8	22.5		63.5	5.9
1.1	35.7	0.7	21.2		64.6	6.4
1.7	42.9	0.7	19.2		66.3	7.3
1.4	51.9	0.7	17.0		67.7	8.2
32.3	83.9	0.9	10.8		100.0	32.7

SIZE FRACTION 28Mx65M=6.9%=5.6%<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
47.3	3.4	1.9	29.6		47.3	3.4
18.0	6.4	2.0	27.6		65.3	4.2
7.4	10.1	2.4	25.5		72.7	4.8
5.0	14.2	2.0	24.5		77.7	5.4
3.1	19.2	2.0	22.7		80.8	6.0
80.8	6.0					
1.9	26.2	2.0	21.5		82.7	6.4
1.4	29.8	1.8	21.3		84.1	6.8
1.9	35.1	2.1	19.3		86.0	7.4
1.4	46.8	2.1	18.3		87.4	8.1
12.6	78.3	1.5	12.5		100.0	16.9

S.G.

Fix.Carb. %	Cum.Weig. %	Cum.Ash %
	47.3	3.4
	65.3	4.2
	72.7	4.8
	77.7	5.4
	80.8	6.0
	82.7	6.4
	84.1	6.8
	86.0	7.4
	87.4	8.1
	100.0	16.9

FROTH-FLOTATION, SIZE FRACTION 65MxO=

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	51.1	7.4	0.6	27.7		51.1	7.4
Stage II	6.0	17.4	0.8	25.4		57.1	8.5
Tailings	42.9	34.1	0.6	22.4		100.0	19.5

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

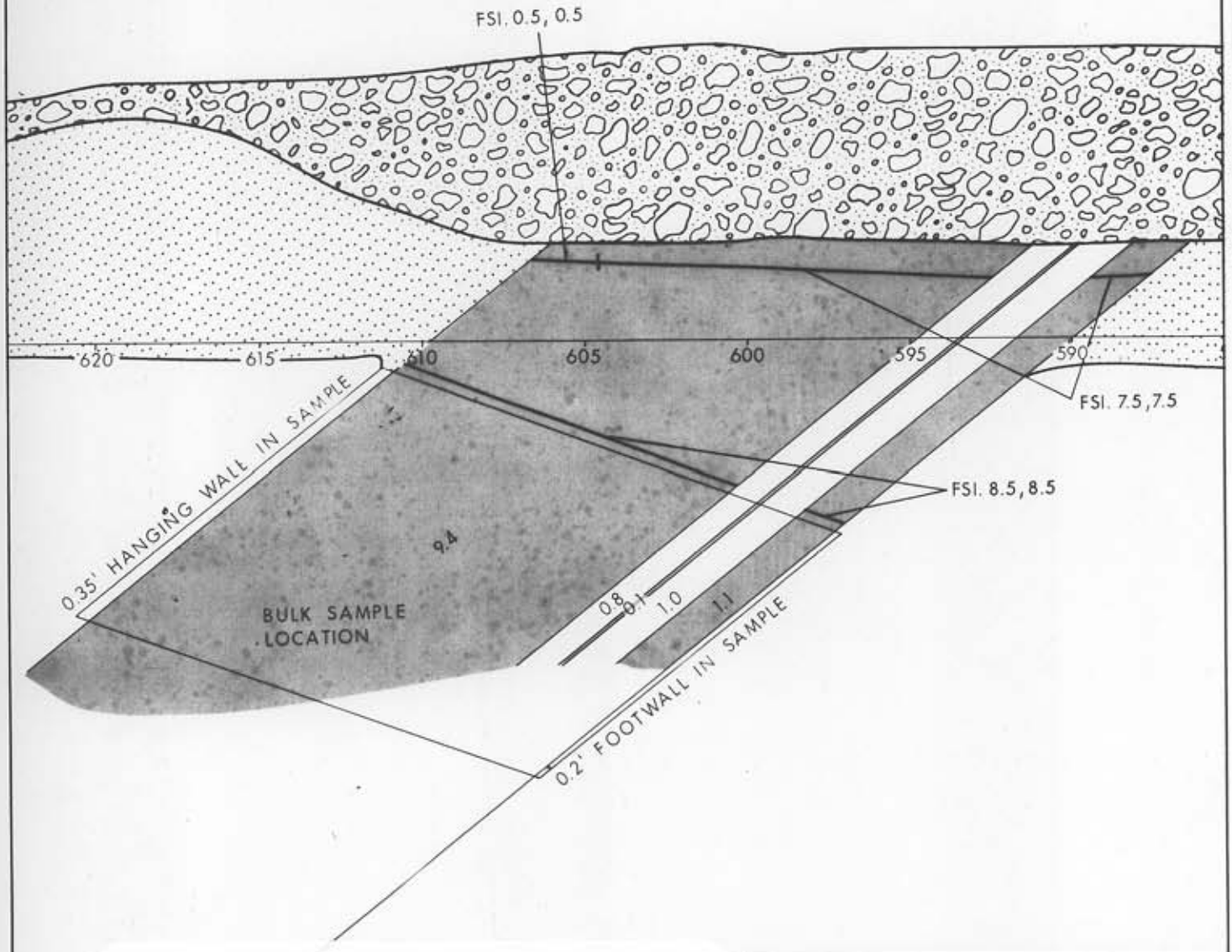
RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosp. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contract. %	Dilatat. %	G-Value
0.74	0.10	8	396	463	21	129	1.059

Tot.Sul. %	Phosp. %	FSI	Soften. Temp.°C	Resolid. Temp.°C	Contr. %	Dilat. %	G-Val.
0.80	0.07	8	389	458	27	139	1.058

Tot.Sulp. %	Phosph. %	FSI	Softening Temp.°C	Resol. Tem°C	Contr. %	Dilat. %	G-Val.
0.81	0.05	8½	390	450	19	114	1.054

Tot.Sulph. %	Phosph. %	FSI	Soften. Temp.°C	Resolidif. Temp.°C	Contract. %	Dilatat. %	G-Value
0.87		8	391	454	28	120	1.049



BY: _____

H. Gruss, P.Geol.

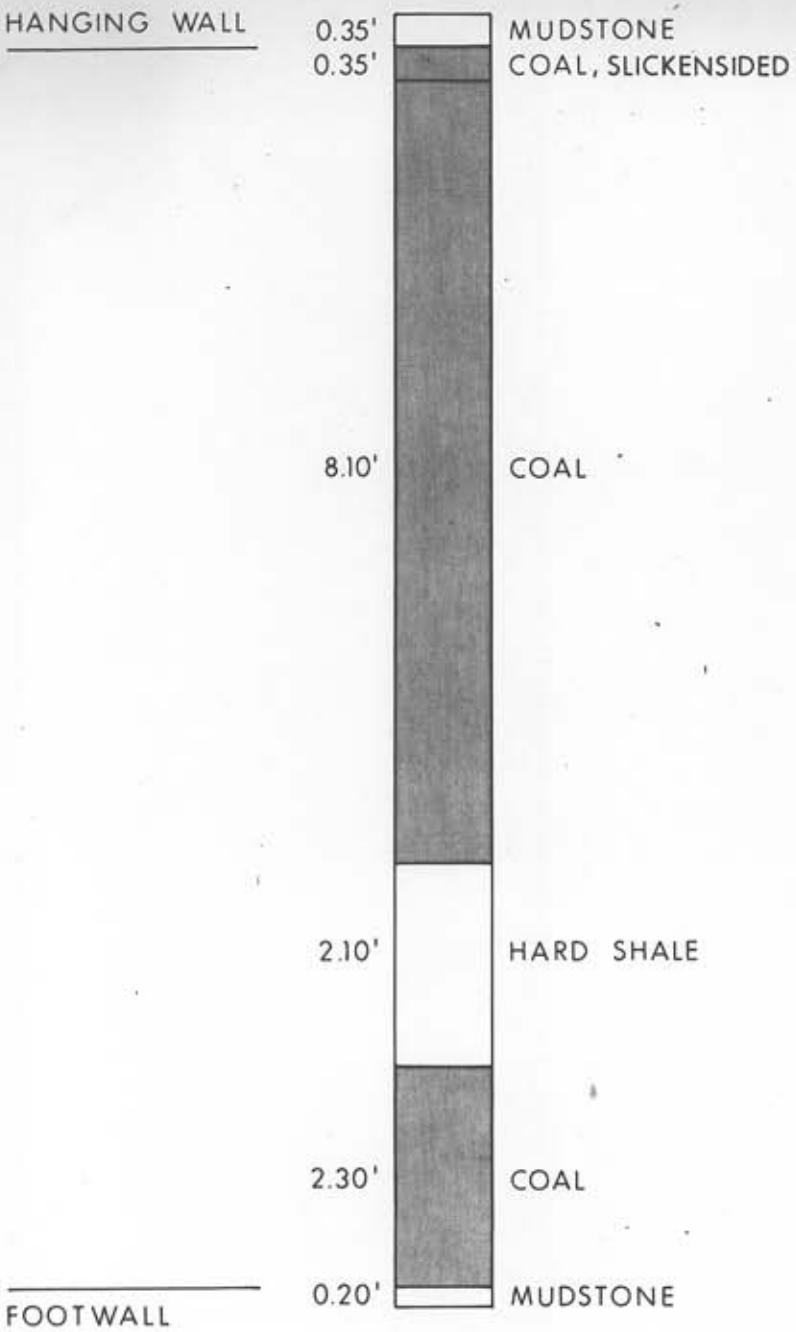
May, 1976

ELCO MINING LTD.

BULK SAMPLE LOCATION

SEAM 18

Scale : 1" = 5'



SEAM No. 18

TRENCH EB-T17-1975

BULK SAMPLE	- THICKNESS	:	13.40'
TOTAL SEAM	- THICKNESS	:	12.85'
TOTAL COAL	- THICKNESS	:	10.75'
TOTAL PARTINGS	- THICKNESS	:	2.10'
TOTAL ROOF AND FLOOR IN SAMPLE		:	0.55'

ELCO MINING LIMITED

PAGE

WASHABILITY TEST RESULTS

Seam No.: 18
Lab.No.: 4405
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS						
In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
1.0	34.2	23.2	41.2	0.57	9660	52

AIR DRY BASIS

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)									
Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x¾"	18.0	56.4	0.8	18.4	18.5	0.39	68		
¾"x0	82.0								
3/4"x28M	80.4	38.4	0.8	22.4	40.7	0.55	85	82.4	38.4
28Mx65M	8.0	18.3	0.9	27.1	55.2	0.65		88.4	36.6
65Mx100M	3.6	16.2						92.0	35.8
100Mx200M	5.8	15.4						97.8	34.6
200MxO	2.2	17.5						100.0	
65MxO	11.4	16.2	1.0	27.1	54.1				

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¾"=18.0%=6.4% <1.5 S.G.							
Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	30.9	3.6	1.1	31.7		30.9	3.6
1.30-1.35	2.5	9.1	1.0	28.4		33.4	4.0
1.35-1.40	1.0	14.3	0.9	28.1		34.4	4.3
1.40-1.45	0.5	20.7	0.8	27.7		34.9	4.5
1.45-1.50	0.8	27.2	0.9	26.2		35.7	5.1
Σ 1.50	35.7	5.1					
1.50-1.55	0.9	33.7	0.8	23.4		36.6	5.8
1.55-1.60	0.8	36.9	0.8	22.3		37.4	6.4
1.60-1.70	1.6	42.4	0.8	20.6		39.0	7.9
1.70-1.80	1.2	49.8	0.9	18.4		40.2	9.2
1.80	59.8	81.9	0.8	12.3		100.0	52.7

SIZE FRACTION 3/4"x28M=56.7%=30.1% <1.5 S.G.							
Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %	
41.6	3.2	2.5	31.9		41.6	3.2	
5.3	9.1	2.0	28.7		46.9	3.9	
3.1	13.9	1.9	27.1		50.0*	4.5	
1.6	20.1	1.4	25.7		51.6	5.0	
1.4	25.3	1.4	24.4		53.0	5.5	
53.0	5.5						
1.2	31.1	1.0	23.4		54.2	6.1	
1.1	36.0	1.0	22.2		55.3	6.7	
2.1	43.3	0.8	20.3		57.4	8.0	
1.8	50.5	0.9	18.0		59.2	9.3	
40.8	80.8	0.8	11.7		100.0	38.5	

SIZE FRACTION 28Mx65M=6.6%=5.2%<1.5 S.G.							
Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %	
57.5	2.2	2.2	31.3		57.5	2.2	
11.7	7.6	2.3	29.4		69.2	3.1	
4.2	13.4	1.6	27.6		73.4	3.7	
3.3	15.7	1.7	26.2		76.7	4.2	
2.4	22.2	1.6	24.7		79.1	4.8	
79.1	4.8						
2.0	29.1	1.6	23.1		81.1	5.4	
1.4	32.4	1.7	23.0		82.5	5.8	
1.2	35.8	2.4	22.0		83.7	6.3	
2.0	42.0	2.3	20.8		85.7	7.1	
14.3	14.5	1.6	12.4		100.0	16.7	

FROTH FLOTATION, SIZE FRACTION 65MxO=							
	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	46.4	8.2	0.9	28.8		46.4	8.2
Stage II	12.6	13.5	0.9	27.2		59.0	9.3
Tailings	41.0	27.0	0.9	25.2		100.0	16.6

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosp. %	FSI	Soften. Tem°C	Resolid. Tem°C	Contract. %	Dilatat. %	G-Value
0.83	0.05	8	398	443	10	8	0.994

Tot.Sul. %	Phosp. %	FSI	Soft. Tem°C	Resolid. Tem°C	Contr. %	Dilat. %	G-Val.
0.72	0.05	8½	392	454	24	153	1.056

Tot.Sulp. %	Phosp. %	FSI	Soften. Tem°C	Resolid. Tem°C	Contr. %	Dilat. %	G-Val.
0.81	0.04	9	389	448	23	148	1.054

Tot.Sul. %	Phosph. %	FSI	Soften. Tem°C	Resolidific. Tem°C	Contract. %	Dilatat. %	G-Value
0.68		9	393	452	18	174	1.061

MASHABILITY TEST RESULTS

Seam No.: Composite A
Lab.No.: 4762
Laboratory: BIRTLEY ENGINEERING(CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulph. %	BTU/LB	H.G.I.
0.7	32.1	17.6	49.6	0.46	10170	83

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulph. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x¼"	23.3	52.3	0.8	14.5	32.4	0.39	69		
¼"x0	76.7								
3/4"x28M	78.6	35.5	0.9	16.8	46.8	0.48	84	78.6	35.5
28Mx65M	6.2	20.7	0.6	19.5	59.2	0.57	114	84.8	34.4
65Mx100M	9.3	18.9						94.1	32.9
100Mx200M	4.5	17.6						98.6	32.2
200MxO	1.4	18.8						100.0	32.0
65MxO	15.2	18.4	0.7	19.7	61.2	0.70			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=23.3%=7.6%<1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
1.30	6.3	3.4	1.2	25.6		6.3	3.4
1.30-1.35	13.4	6.2	0.9	19.8		19.7	5.3
1.35-1.40	7.3	9.8	0.9	18.3		27.0	6.5
1.40-1.45	3.6	15.3	1.0	18.2		30.6	7.6
1.45-1.50	2.2	21.6	0.7	18.1		32.8	8.5
> 1.50	32.8	8.5					
1.50-1.55	0.8	27.6	0.7	18.1		33.6	9.0
1.55-1.60	1.6	34.1	0.7	17.6		35.2	10.1
1.60-1.70	1.7	40.2	0.7	17.0		36.9	11.5
1.70-1.80	1.9	48.4	0.7	15.0		38.8	13.3
1.80	61.2	83.4	0.9	9.6		100.0	56.2

SIZE FRACTION 3/4"x28M=59.1%=34.1% <1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
26.1	2.8	1.8	24.6		26.1	2.8
13.6	6.0	1.2	20.5		39.7	3.9
9.0	9.7	1.0	18.8		48.7	5.0
6.5	14.5	1.1	18.4		55.2	6.1
2.5	20.5	0.7	18.2		57.7	6.7
57.7	6.7					
2.3	25.2	0.9	17.9		60.0	7.4
1.6	31.6	0.9	17.4		61.6	8.1
2.2	38.9	0.8	16.4		63.8	9.1
1.7	47.9	0.9	15.1		65.5	10.1
34.5	81.1	1.1	9.3		100.0	34.6

SIZE FRACTION 28MxO=4.8%=3.5%<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
35.5	1.4	0.8	24.1		35.5	1.4
15.2	4.8	1.3	21.3		50.7	2.4
11.4	8.4	2.0	19.4		62.1	3.5
6.1	12.3	2.7	18.7		68.2	4.3
3.8	16.9	2.5	18.5		72.0	5.0
72.0	5.0					
3.2	23.7	2.6	18.3		75.2	5.8
2.5	28.8	2.0	17.5		77.7	6.5
2.8	36.0	2.0	17.0		80.5	7.5
1.7	45.7	2.1	15.7		82.2	8.3
17.8	76.0	1.4	11.9		100.0	20.4

FROTH-FLOTATION, SIZE FRACTION 65MxO=

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	50.8	6.6	0.4	21.6		50.8	6.6
Stage II	11.1	12.3	0.4	20.6		61.9	7.6
Tailings	38.1	34.5	0.4	17.9		100.0	17.9

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min.froth
STAGE II	2nd min. froth

RUHR DILATOMETER RESULTS, 1.5 S.G.

Tot.Sulph. %	Phosph. %	FSI	Soften. TemoC	Resolid. TemºC	Contraction %	Dilatat. %	G-Value
0.46		4½	418	448	4	-	-

Tot.Sul. %	Phos. %	FSI	Soft. TemºC	Resolid. TemºC	Contr. %	Dilat. %	G-Val.
0.66		7	402	473	21	-3	0.902

Tot.Sul. %	Phosphor %	FSI	Soften. TemºC	Resol. TemºC	Contr. %	Dilat. %	G-Value
0.63		8	405	470	8	10	1.008

Tot.Sulphur %	Phosphor %	FSI	Soften. TemºC	Resolidif. TemºC	Contrac. %	Dilatat. %	G-Value
0.63		8½	417	480	12	14	1.005

WASHABILITY TEST RESULTS

Seam No.: Composite C
Lab.No.: 4164
Laboratory: BIRTLEY ENGINEERING (CANADA) LTD.

HEAD RAW COAL ANALYSIS (air dry basis)

In.Moist. %	Ash %	Vol.Mat. %	Fix.Carb. %	Sulp. %	BTU/LB	H.G.I.
0.7	33.9	16.5	48.9	0.46	10000	83

SIZE DISTRIBUTION AND RAW COAL ANALYSIS (air dry basis)

Size Fraction	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Sulp. %	H.G.I.	Cum.Weig. %	Cum.Ash %
2"x¼"	21.8	54.3	1.0	14.0	30.7	0.37	64		
¼"x0	78.2								
3/4"x28M	71.8	41.3	0.8	14.9	43.0	0.39	81	71.8	41.8
28Mx65M	13.0	18.8	0.7	18.9	61.6	0.48	114	84.8	38.3
65Mx100M	3.7	15.7						88.5	37.3
100Mx200M	6.7	16.8						95.2	35.9
200MxO	4.8	17.6						100.0	35.0
65MxO	15.2	16.8	0.7	19.0	63.5	0.63			

AIR DRY BASIS

SINK-FLOAT ANALYSIS, SIZE FRACTION 2"x¼"=21.8%=4.4%<1.5 S.G.

Specific Gravity	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
1.30	9.7	5.3	1.6	21.3		9.7	5.3
1.30-1.35	15.8	6.9	0.7	18.5		25.5	6.3
1.35-1.40	5.3	12.5	0.7	17.8		30.8	7.4
1.40-1.45	1.6	15.7	0.9	17.5		32.4	7.8
1.45-1.50	1.5	22.0	0.6	17.3		33.9	8.4
Σ 1.50	33.9	8.4					
1.50-1.55	1.1	27.7	0.7	17.1		35.0	9.0
1.55-1.60	0.9	31.1	0.5	17.0		35.9	9.6
1.60-1.70	1.4	38.7	0.6	16.6		37.3	10.7
1.70-1.80	2.1	48.1	0.7	15.6		39.4	12.7
1.80	60.6	84.7	0.9	8.8		100.0	56.3

SIZE FRACTION 3/4"x28M=56.9%=28.8%<1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
17.4	1.9	0.5	22.4		17.4	1.9
12.4	5.1	0.5	20.2		29.8	3.2
9.5	8.4	1.1	18.3		39.3	4.5
7.6	12.9	1.1	17.5		46.9	5.8
3.7	18.8	0.9	17.4		50.6	6.8
50.6	6.8					
2.6	24.1	0.8	17.0		53.2	7.6
1.8	27.8	0.7	16.6		55.0	8.3
2.2	36.9	0.8	15.9		57.2	9.4
1.8	45.7	1.0	15.2		59.0	10.5
41.0	83.1	1.3	8.6		100.0	40.3

SIZE FRACTION 28Mx65M=10.2%=7.6% < 1.5 S.G.

Weight %	Ash %	In.Moist. %	Vol.Matt. %	Fix.Carb. %	Cum.Weig. %	Cum.Ash %
34.8	1.6	0.8	22.5		34.8	1.6
16.2	4.8	1.3	20.1		51.0	2.6
12.4	8.5	1.7	18.8		63.4	3.8
7.0	12.6	2.7	17.9		70.4	4.6
4.5	16.6	2.4	17.7		74.9	5.5
74.9	5.5					
3.4	24.3	2.2	17.7		78.3	6.3
1.9	31.1	2.0	17.2		80.2	6.9
2.6	37.4	2.0	16.5		82.8	7.8
2.0	46.1	1.9	15.0		84.8	8.7
15.2	75.7	1.5	11.5		100.0	18.9

FROTH-FLOTATION, SIZE FRACTION 65MxO=

	Weight %	Ash %	In.Moist. %	Vol.Mat. %	Fix.Carb. %	Cum.Weight %	Cum.Ash %
Stage I	66.4	7.3	0.3	20.2		66.4	7.3
Stage II	8.3	13.7	0.3	19.7		64.7	8.0
Tailings	25.3	42.0	0.4	16.2		100.0	16.6

F.F. PARAMETERS:

PULP DENSITY	10%
REAGENT	4:1=k
DOSAGE RATE	0.48 lb/T
CONDITIONING TIME	1 min.
STAGE I	1st min. froth
STAGE II	2nd min. froth

RUHR DILATOMETER RESULTS,1.5 S.G.

Tot.Sulph. %	Phosp. %	FSI	Soften. Tem°C	Resolid. Tem°C	Contract. %	Dilatation %	G-Value
0.43		3	421	468	18	-	-

Tot.Sul. %	Phos. %	FSI	Soft. Tem°C	Resol. Tem°C	Contr. %	Dilat. %	G-Value
0.52		6	408	471	8	4	0.977

Tot.Sul. %	Phosp. %	FSI	Softening Tem°C	Resol. Tem°C	Contr. %	Dilat. %	G-Val.
0.61		8½	407	468	12	51	1.045

Tot.Sulp. %	Phosph. %	FSI	Soften. Tem°C	Resolidif. Tem°C	Contract. %	Dilatat. %	G-Value
0.56		8	420	482	11	-4	0.872

K · ELK RIVER 76(6) # B

ELCO MINING LIMITED

PAGE

REPORT TO
B.C. DEPARTMENT OF MINES
& PETROLEUM RESOURCES
ACCORDING TO REGULATIONS UNDER THE
COAL ACT, 1974
ON
EVALUATION OF EXPLORATION & TESTWORK
JULY 1975 - APRIL 1976

MINING RECORDER
RECEIVED and RECORDED
AUG 31 1976
M.R. #
VICTORIA, B. C.

COAL LICENSES 421 - 434, inclusive
481 - 489, inclusive
515
771 - 779, inclusive
951 - 957, inclusive

NTS 82 - J - 7

GEOLOGICAL BRANCH
ASSESSMENT REPORT

BY: _____

H. Gruss, P.Geol.

August 26, 1976

00 274

ELK RIVER COAL PROJECT

Open Pit Coal Reserves between Sections 100+00N and 170+00N

Calgary, June 7, 1976

Calgary, June 9, 1976
ST/un

MEMORANDUM

Re: Calculation of the Open Pit Coal Reserves in Big Weary Ridge of the Elk River Deposit between Cross-Sections 100+00N and 170+00N.

The open pit reserves in Big Weary Ridge between cross-sections 100+00N and 170+00N have been calculated with the same parameters that have been used for the calculation of the reserves for open pit alternatives "A" and "C".

Seam 18 has been marked as the base point for the western open pit slope, because no further information of stratigraphically higher semas was available. The depth of the open pit is approximately 400 ft. below valley floor.

The reserves were divided into coal below the 50 ft. deep oxidation zone and coal above the oxidation level.

The following raw coal reserves are present (see also Tab. 1):

113,805,211.8 sht	non-oxidized ROM-coal
4,912,091.2 sht	oxidized ROM-coal
118,717,303.0 sht	total ROM-coal
658,254,973.4 bcy	total waste below oxidation level
80,238,499.4 bcy	total waste above oxidation lebel
738,493,472.8 bcy	total waste

These figures are resulting into a ratio of

6.22 : 1 bcyd total waste - sht ROM-coal.

If the oxidized coal is considered as waste, the ratio is increasing to

6.53 : 1 bcyd total waste : sht ROM-coal.

The ratio therefore is deteriorating slightly in the Big Weary Ridge as compared to open pit alternatives "A" and "C". Also deteriorating is the ratio between stratigraphically higher seams with good cokeability and lower seams with insufficient cokeability.

If a washing plant yield per seam is chosen as for open pit alternative "A" and "C", than the following clean coal reserves can be expected in Big Weary Ridge (figures referring only to non-oxidzed ROM-coal):

SEAM	ROM-COAL SHT	PLANT YIELD WEIGHT-%	CLEAN COAL SHT	% SEAM TO TOTAL RESERVES
2	11,299,958.0	55.1	6,226,276.9	8.74
3	6,140,760.6	82.9	5,090,690.5	7.15
4	8,152,344.4	75.2	6,130,563.0	8.61
6	6,062,218.5	66.8	4,049,562.0	5.69
7	5,763,548.7	52.6	3,031,626.6	4.26
8 + 8 A	14,133,468.8	66.3	9,370,489.8	13.16
9	9,842,360.5	73.7	7,253,819.7	10.19
10	18,243,949.9	77.9	14,212,037.0	19.95
12	10,908,536.5	48.5	5,290,640.2	7.43
13	6,414,676.1	24.6	1,578,010.3	2.22
14	4,431,838.4	42.4	1,879,099.5	2.64
15	2,198,158.3	44.2	971,586.0	1.36
16	3,790,779.2	47.3	1,793,038.6	2.52
17	3,619,726.4	66.7	2,414,357.5	3.39
18	2,802,887.5	68.4	1,917,175.1	2.69
TOTAL:	113,805,211.8	62.57	71,208,972.7	100.0

If the average plant yield of KAISER of 64.7% would be taken into consideration the clean coal reserves increase to 73,631,972.0 sht.

Tab. 2 shows the average quality per seam as received from bore hole information. The weighted average over the clean coal reserves results into the following average quality of all seams combined:

		Weighted Average Seam 2 - 18
Raw Coal		
Inherent Moisture	% ad	0.6
Ash	% db	34.8
Volatile Matter	% db	17.7
Fixed Carbon	% ad	41.17
Sulphur	% db	0.50
Hardgrove Gr. Index		86
Size Fraction		
¼"x65M	weight %	88.8
65MxO	weight %	11.2
Clean Coal (Size Fraction ¼"x65M; 1.5 Sink-Float S.G.)		
Yield ¼"x65M	weight %	60.3
Total Yield, excl. 65MxO	weight %	54.0
Inherent Moisture	% ad	1.2
Ash	% db	7.7
Volatile Matter	% dab	23.3
Fixed Carbon	% dab	76.3
Sulphur	% db	0.68
Phosphorus	% db	0.08
FSI		7.5

BY: _____

H. Gruss, P.Geol.

May, 1976

Table 1

COAL AND WASTE ROCK BELOW OXIDATION LEVEL

SEAM NO.	AVERAGE TRUE SEAM THICKNESS (FT)	RAW COAL VOLUME IN SEAM (BCYD)	RAW COAL TONNAGE IN PLACE (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED RAW COAL + DILUTION ROCK=ROM (SHT)	WASTE	RECOVERED WASTE = WASTE MINUS DILUTION ROCK (BCYD)	RECOVERED WASTE + MINING LOSS (BCYD)
2	8.43	1,724,872.2		204,609.1			102,304.5			-		
2	4.55	4,526,777.8		335,537.1			167,768.6			-		
2	7.27	2,442,451.1		335,944.5			167,972.3			1,308,955.6		
2	14.82	3,762,633.3		253,874.9			126,954.6			-		
TOTAL SEAM 2	8.77	9,456,734.4	11,537,216.0	1,129,965.6	1,378,558.0	10,158,658.0	565,000.0	1,141,300.0	11,299,958.0	1,308,955.6	743,955.6	1,873,921.2
3	17.54	3,514,821.1		200,386.9			100,193.5			4,644,722.2		
3	4.76	1,611,348.2		338,499.9			169,250.0			7,923,851.9		
TOTAL SEAM 3	11.15	5,126,169.3	6,253,926.6	538,886.8	675,441.9	5,596,484.7	269,443.5	544,275.9	6,140,760.6	12,568,574.1	12,299,130.6	12,838,017.4
4	9.00	1,839,500.0		204,386.9			102,193.4			15,790,666.7		
4	11.30	2,816,629.6		249,245.6			124,639.6			15,580,370.4		
4	6.39	2,162,423.7		338,388.8			169,194.4			30,692,907.4		
TOTAL SEAM 4	8.90	6,818,553.3	8,318,635.0	792,021.3	966,266.0	7,352,369.0	396,027.4	799,975.4	8,152,344.4	62,063,944.5	61,667,917.1	62,459,938.4
6	6.35	1,355,372.2		213,442.3			106,721.2			15,578,777.8		
6	6.13	1,081,831.5		176,471.8			88,247.8			17,037,037.0		
6	11.45	2,638,588.9		230,431.8			115,215.9			46,275,780.0		
TOTAL SEAM 6	7.98	5,075,792.6	6,192,467.0	620,345.9	756,822.0	5,435,645.0	310,184.9	626,573.5	6,062,218.5	78,891,594.8	78,581,409.9	79,201,755.8
7	6.61	1,293,356.7		195,664.7			97,832.4			17,626,083.3		
7	6.74	956,081.5		141,844.1			70,931.6			17,060,648.2		
7	11.57	2,571,111.1		222,210.0			111,105.0			10,000,963.0		
TOTAL SEAM 7	8.31	4,820,549.3	5,881,070.2	559,718.8	682,856.9	5,198,213.3	279,869.0	565,335.4	5,763,548.7	44,687,694.5	44,507,825.5	45,067,544.3
8+8A	23.77	3,879,792.2		163,220.6			81,610.3			17,992,777.7		
8+8A	29.87	4,073,383.0		136,362.9			68,190.6			7,018,518.5		
8+8A	4.65	734,355.6		157,917.2			78,958.6			12,158,222.2		
8+8A	14.48	3,012,555.5		212,284.6			106,142.3			406,666.7		
TOTAL SEAM 8+8A	18.19	11,700,086.3	14,274,105.3	669,785.3	817,138.1	13,456,967.2	334,901.8	676,501.6	14,133,468.8	37,576,185.1	37,241,283.3	37,911,068.6
9	17.41	2,734,337.8		157,054.0			78,527.0			16,645,777.8		
9	3.29	512,508.9		155,776.2			77,888.1			2,615,792.2		
9	19.25	797,805.6		41,444.0			20,722.2			1,940,833.3		
9	13.18	1,634,320.0		123,993.2			62,005.0			11,942,963.0		
9	11.49	815,773.3		44,886.4			22,446.2			2,214,111.2		
9	7.79	1,552,229.6		199,248.3			99,624.2			23,698,518.5		
9	6.06	457,866.7		75,551.4			37,775.7			-		
TOTAL SEAM 9	11.21	8,204,841.9	10,009,907.2	797,953.5	973,503.3	9,036,403.9	398,988.4	805,956.6	9,842,360.5	59,057,996.0	58,659,007.6	59,456,961.1
10	6.80	1,038,133.3		152,665.1			76,332.6			8,571,666.7		
10	13.02	1,872,710.0		142,831.9			71,916.0			11,917,125.6		
10	7.61	1,065,823.3		140,054.2			70,027.1			2,977,333.3		
10	12.73	1,515,577.8		119,054.4			59,527.2			8,411,416.7		
10	9.95	749,566.7		75,332.6			37,666.3			11,340,555.6		
10	3.40	239,333.3		73,332.6			36,666.3			5,348,000.0		
10	7.28	526,102.2		72,277.1			36,138.5			2,658,416.7		
10	9.19	1,087,483.3		118,326.8			59,171.4			5,026,111.1		
10	15.93	1,834,900.0		115,178.9			57,597.2			1,872,592.6		
10	11.49	689,400.0		59,996.7			30,002.4			2,291,000.0		
10	4.83	331,302.2		65,588.8			34,299.0			1,677,481.5		
10	5.75	434,018.5		75,477.3			37,743.8			2,013,925.9		
10	2.68	228,594.1		85,291.6			42,651.6			3,380,222.2		
10	19.08	1,319,946.7		69,144.4			34,572.2			12,949,629.6		
10	19.49	2,266,614.8		116,289.9			58,145.0			4,911,111.1		
TOTAL SEAM 10	9.95	15,209,586.2	18,555,695.2	1,484,482.3	1,811,507.6	16,744,187.6	742,456.6	1,499,762.3	18,243,949.9	85,546,588.6	84,804,123.0	86,288,974.3
12	2.41	279,560.0		115,998.8			57,999.4			5,338,666.7		
12	7.17	811,006.7		113,110.0			56,555.0			514,000.0		
12	6.47	459,370.0		70,999.3			35,499.7			2,669,583.3		
12	3.64	251,766.7		69,166.0			34,583.0			4,623,666.7		
12	12.56	1,339,733.3		106,660.8			53,337.6			7,198,148.2		
12	4.98	507,222.2		101,846.3			50,930.0			3,850,740.7		
12	13.02	1,292,355.6		99,253.8			49,633.6			1,410,370.4		
12	3.98	343,017.0		86,180.5			43,096.0			5,069,629.6		
12	8.43	722,482.2		85,699.0			42,855.3			1,202,963.0		
12	9.19	783,532.6		85,254.6			42,633.0			470,555.6		
12	11.49	972,820.0		84,662.0			42,336.7			382,000.0		
12	2.57	83,097.0		32,331.6			16,165.8			5,030,555.6		
12	2.66	1,302,207.4		150,362.1			75,181.1			15,055,555.1		
TOTAL SEAM 12	7.27	9,148,170.7	11,160,768.3	1,201,524.8	1,465,860.3	9,694,908.0	600,806.2	1,213,628.5	10,908,536.5	52,816,435.4	52,215,629.2	53,417,154.0
13	6.07	573,277.8		94,443.5			47,221.8			9,589,166.7		
13	5.66	518,833.3		91,665.8			45,832.9			884,027.8		
13	6.07	404,330.0		66,610.5			33,305.2			6,313,666.7		
13	5.66	376,075.6		66,443.8			33,221.9			392,677.8		
13	3.83	43,974.1		11,480.9			5,741.2			8,208,148.1		
13	3.83	26,172.2		9,443.9			4,722.6			40,285.9		
13	10.72	27,792.6		2,592.5			1,296.4			138,518.5		
13	3.06	230,066.7		75,181.1			37,595.6			15,965,185.2		
13	3.83	286,540.7		74,810.7			37,410.4			374,814.8		
13	11.49	831,110.0		72,329.4			36,169.6			1,587,018.5		
13	2.51	368,133.3		146,658.6			73,329.3			21,588,888.9		
13	4.33	635,868.5		146,843.8			73,421.9			513,981.5		
13	7.51	1,098,685.2		146,288.3			73,144.1			2,933,333.3		
TOTAL SEAM 13	5.74	5,430,860.0	6,625,649.2	1,004,792.8	1,225,847.2	5,399,802.0	502,412.9	1,014,874.1	6,414,676.1	68,549,713.7	68,047,300.8	69,052,093.6
14	6.47	226,450.0		34,999.7			17,499.8			8,309,583.3		
14	6.47	414,798.9		64,110.5			32,055.2			8,413,666.7		
14	7.66	520,596.3		67,959.2			33,984.2			2,702,129.6		
14	9.53	1,378,320.4								6,170,370.4		
14	3.18	457,566.7		144,621.7			72,310.8			4,573,018.5		
14	4.33	195,651.9		143,881.0			71,940.5			8,172,403.7		
				45,182.7			22,591.4					
TOTAL SEAM 14	6.27	3,193,384.2	3,895,928.7	500,754.8	610,920.9	3,285,007.8	250,381.9	505,771.4	3,790,779.2	38,341,172.2	38,090,790.3	38,591,545.1
15	15.37	959,771.1		62,443.8			31,221.9			6,344,444.4		
15	14.55	810,488.9		55,700.6			27,854.1			6,166,666.7		
15	15.41	1,903,991.1		123,548.8			61,774.4			-		
TOTAL SEAM 15	15.11	3,674,251.1	4,482,586.3	241,693.2	294,865.7	4,187,720.6	120,850.4	244,117.8	4,431,838.4	12,511,111.1	13,290,260.7	12,631,953.9
16	5.10	302,033.3		59,221.6			29,610.8			4,447,903.3		
16	5.26	300,988.9		57,221.7			28,610.8			3,157,942.2		
16	3.07	171,237.8		55,777.2			27,888.6			2,090,500.0		
16	4.83	240,426.7		49,775.0			24,890.9			3,773,333.3		
16	4.98	232,400.0		46,664.1			23,335.2			2,648,148.2		
16	2.91	132,997.8		45,701.2			22,853.7			1,666,666.7		
16	4.76	493,629.6		103,698.0			51,849.0			6,192,222.2		
TOTAL SEAM 16	4.42	1,873,714.1	2,285,931.2	418,058.8	510,031.7	1,775,899.5	209,039.0	422,258.8	2,198,158.3	23,976,715.9	23,767,676.9	24,185,735.7
17	9.71	491,434.4		510,610.6			25,305.3			9,692,777.8		
17	6.47	320,624.4		49,555.1			24,777.5			1,732,666.7		
17	2.43	120,015.6		49,388.4			24,694.2			222,500.0		
17	9.96	416,644.4		41,849.6			20,927.6			7,954,074.1		
17	6.89	282,234.8		40,960.7			20,483.1			1,405,333.3		
17	1.53	62,333.3		40,738.5			20,372.0			204,814.8		
17	8.98	663,007.8		73,366.3			36,683.2			10,954,740.8		
17	7.20	512,317.7		71,181.3			35,590.6			2,567,407.4		
17	2.71	181,655.6		67,403.7			33,701.9			635,740.8		
TOTAL SEAM 17	6.21	3,050,468.0	3,721,571.0	485,054.2	591,766.1	3,129,804.9	242,535.4	489,921.5	3,619,726.4	35,370,055.7	35,127,520.3	35,612,574.5
18	15.37	727,040.0		47,332.9			23,666.4			3,145,277.8		
18	17.62	693,053.3		39,331.2			19,668.2			8,674,166.7		
18	16.45	901,703.7		54,811.8			27,405.9			2,604,814.8		
										7,944,444.4		
										4,154,629.7		
										13,071,666.7		
TOTAL SEAM 18	16.48	2,321,797.0	2,632,592.3	141,475.9	172,600.6	2,659,991.7	70,740.5	142,895.8	2,802,887.5	39,595,000.1	39,524,259.6	39,665,735.5
SUMMARY ALL SEAMS												
2	8.77	9,456,734.4	11,537,216.0	1,129,965.6	1,378,558.0	10,158,658.0	565,000.0	1,141,300.0	11,299,958.0	1,308,955.6	743,955.6	1,873,921.2
3	11.15	5,126,169.3	6,253,926.6	538,886.8	657,441.9	5,596,484.7	269,443.5	544,275.9	6,140,760.6	12,568,574.1	12,299,130.6	12,838,017.4
4	8.90	6,818,553.3	8,318,635.0	792,021.3	966,266.0	7,352,369.0	396,027.4	799,975.4	8,152,344.4	62,063,944.5	61,667,917.1	62,459,938.4
6	7.98	5,075,792.6	6,192,467.0	620,345.9	756,822.0	5,435,645.0	310,184.9	626,573.5	6,062,218.5	78,891,594.8	78,581,409.9	79,201,755.8
7	8.31	4,820,549.3	5,881,070.2	559,718.8	682,856.9	5,198,213.3	279,869.0	565,335.4	5,763,548.7	44,687,694.5	44,507,825.5	45,067,544.3
8+8A	18.19	11,700,086.3	14,274,105.3	669,785.3	817,138.1	13,456,967.2	334,901.8	676,501.6	14,133,468.8	37,576,185.1	37,241,283.3	37,911,068.6
9	11.21	8,204,841.9	10,009,907.2	797,953.5	973,503.3	9,036,403.9	398,988.4	805,956.6	9,842,360.5	59,057,996.0	58,659,007.6	59,456,961.1
10	9.95	15,209,586.2	18,555,695.2	1,484,482.3	1,811,507.6	16,744,187.6	742,456.6	1,499,762.3	18,243,949.9	85,546,588.6	84,804,132.0	85,288,974.3
12	7.27	9,148,170.7	11,160,768.3	1,201,524.8	1,465,860.3	9,694,908.0	600,806.2	1,213,628.5	10,908,536.5	52,816,435.4	52,215,629.2	53,417,154.0
13	5.74	5,430,860.0	6,625,649.2	1,004,792.8	1,225,847.2	5,399,802.0	502,412.9	1,014,874.1	6,414,676.1	68,549,713.7	68,047,300.8	69,052,093.6
14	6.27	3,193,384.2	3,895,928.7	500,754.8	610,920.9	3,285,007.8	250,381.9	505,771.4	3,790,779.2	38,341,172.2	38,090,790.3	38,591,545.1
15	15.11	3,674,251.1	4,482,586.3	241,693.2	294,865.7	4,187,720.6	120,850.4	244,117.8	4,431,838.4	12,511,111.1	13,290,260.7	12,631,953.9
16	4.42	1,873,714.1	2,285,931.2	418,058.8	510,031.7	1,775,899.5	209,039.0	422,258.8	2,198,158.3	23,976,715.9	23,767,676.9	24,185,735.7
17	6.21	3,050,468.0	3,721,571.0	485,054.2	591,766.1	3,129,804.9	242,535.4	489,921.5	3,619,726.4	35,370,055.7	35,127,520.3	35,612,574.5
18	16.48	2,321,797.0	2,632,592.3	141,475.9	172,600.6	2,659,991.7	70,740.5	142,895.8	2,802,887.5	39,595,000.1	39,524,259.6	39,665,735.5
TOTAL ALL SEAMS		95,104,958.4	116,028,049.5	10,649,874.0	12,915,986.3	103,112,063.2	5,293,637.9	10,693,148.6	113,805,211.8	652,861,737.3	647,668,099.4	650,954,973.8

OXIDIZED COAL AND OVERBURDEN ABOVE OXIDATION LEVEL

OXIDIZED RAW COAL (SHT)	MINING LOSS (BCYD)	MINING LOSS (SHT)	RECOVERED OXIDIZED RAW COAL (SHT)	DILUTION ROCK (BCYD)	DILUTION ROCK (SHT)	RECOVERED OXIDIZED RAW COAL + DILUTION ROCK = ROM (SHT)	GLACIAL TILL + SLOPE DEBRIS (BCYD)	ROCK OVERBURDEN (BCYD)	RECOVERED OVERBURDEN = TOTAL OVERBURDEN MINUS DILUTION (BCYD)	RECOVERED OVERBURDEN + MINING LOSS (BCYD)
65,707.9	6,388.8			3,194.4				-		
12,541.6	2,259.1			1,129.6				-		
21,023.8	2,370.2			1,185.1				8,955.6		
79,525.9	2,962.8			1,481.6				-		
178,799.2	13,908.9	17,056.7	161,742.5	6,990.7	14,121.2	175,863.7		8,955.6		
49,208.0	4,388.9			2,194.4				132,222.2		
15,485.9	2,666.5			1,333.3				57,925.9		
64,693.9	7,055.4	2,607.6	58,086.3	3,527.7	7,126.0	63,212.3		190,148.1		
51,850.0	4,722.2			2,361.1				252,444.4		
32,985.2	7,407.0			3,703.5				133,333.3		
46,774.8	5,999.7			2,999.8				346,888.9		
131,610.0	18,128.9	22,117.3	109,492.7	9,064.4	18,310.1	127,802.8		732,666.6		
38,305.3	4,944.4			2,472.2				180,444.4		
-	-			-				554,074.1		
264,893.6	18,961.9			9,481.0				3,706,740.8		
303,198.9	23,906.3	29,165.7	274,033.2	11,953.2	24,145.5	298,178.7		4,441,259.3		
44,801.1	5,555.5			2,777.8				492,555.5		
-	-			-				-		
151,609.9	10,740.2			5,370.1				543,926.9		
196,411.0	16,295.7	19,880.8	176,530.2	8,147.9	16,458.8	192,989.0		1,036,482.4		
167,552.1	5,777.7			2,888.9				1,001,000.0		
-	-			-				-		
-	-			-				474,222.2		
104,507.9	4,925.7			2,462.8				-		
272,060.0	10,703.4	13,058.2	259,001.8	5,351.7	10,810.4	269,812.2		1,475,222.2		
127,441.2	5,999.9			3,000.0				594,027.8		
23,636.8	5,888.8			2,944.4				97,166.7		
-	-			-				647,277.8		
35,732.5	2,222.1			1,111.2				80,740.8		
-	-			-				-		
33,439.8	3,518.3			1,759.2				416,888.9		
-	-			-				646,666.7		
220,250.3	17,629.1	21,507.5	198,742.8	8,814.8	10,754.1	209,496.9		2,482,768.7		
49,776.0	5,999.9			3,000.0				333,333.3		
114,720.7	7,222.2			3,611.1				577,111.1		
63,957.8	6,888.8			3,444.4				152,000.0		
264,883.7	17,055.4			8,527.7				570,833.3		
95,763.3	7,888.8			3,944.4				605,500.0		
32,031.8	7,722.2			3,861.1				561,111.1		
69,079.1	7,777.7			3,888.9				278,666.7		
34,881.2	3,111.0			1,555.7				107,407.4		
64,782.0	3,333.2			1,666.8				60,000.0		
-	-			-				-		
-	-			-				-		
-	-			-				-		
-	-			-				-		
250,018.7	10,740.2			5,370.1				-		
-	-			-				301,562.6		
1,029,694.3	77,739.4	94,842.1	945,052.2	38,870.2	78,517.8	1,023,570.0		3,547,525.5		
24,339.0	8,277.7			4,138.9				558,222.2		
79,213.3	9,055.5			4,527.7				38,500.0		
61,939.1	7,777.7			3,888.9				287,111.1		
33,799.4	7,611.0			3,805.5				498,666.7		
59,022.7	3,851.6			1,926.1				244,444.4		
24,752.5	4,073.9			2,037.2				155,555.6		
74,127.2	4,666.4			2,333.5				68,888.9		
21,580.5	4,444.2			2,222.4				241,111.1		
45,709.3	4,444.2			2,222.4				84,444.4		
49,830.2	4,444.2			2,222.4				35,555.6		
62,301.3	4,444.2			2,222.4				31,111.1		
24,386.5	7,777.4			3,888.7				897,222.3		
22,992.9	7,332.9			3,666.5				-		
583,447.9	78,200.9		488,042.8	39,102.6	78,987.3	567,030.1		3,140,833.4		
88,042.0	11,888.7			5,944.4				1,094,888.9		
82,095.2	11,888.7			5,944.4				107,000.0		
55,129.1	7,444.4			3,722.2				705,000.0		
50,638.1	7,333.3			3,666.6				70,194.4		
19,036.5	4,073.9			2,037.2				914,000.0		
19,382.6	4,147.9			2,074.2				20,740.7		
58,126.2	4,444.2			2,222.4				70,370.4		
15,209.3	4,073.9			2,037.2				861,851.9		
19,036.5	4,073.9			2,037.2				24,444.4		
64,897.2	4,629.4			2,315.0				86,370.4		
74,013.3	6,740.4			3,370.2				930,000.0		
-	-			-				-		
110,369.3	6,666.3			3,333.2				93,333.3		
655,975.3	77,405.0		561,541.2	38,704.2	78,182.5	639,723.7		4,978,194.4		
78,056.9	9,888.9			4,944.4				1,301,972.2		
57,447.1	7,277.7			3,689.9				934,444.4		
55,379.0	5,925.6			2,963.2				196,444.4		
69,644.0	6,407.1			3,203.5				270,111.1		
40,650.4	7,555.1			3,777.6				189,444.4		
58,362.1	7,740.3			3,870.2				234,722.2		
349,540.0	44,794.7	54,649.5	294,890.5	22,397.8	45,243.6	340,134.1		3,127,138.7		
148,970.1	7,944.4			3,972.2				741,000.0		
82,180.6	4,629.4			2,315.0				650,370.3		
177,557.9	9,443.9			4,722.0				541,111.1		
408,708.6	22,017.7	26,861.6	381,847.0	11,009.2	22,238.6	404,085.6		1,932,481.4		
50,813.0	8,166.6			4,083.3				531,555.6		
54,189.7	8,444.4			4,222.2				447,222.2		
31,420.4	8,388.8			4,194.4				305,861.1		
18,550.8	3,148.0			1,574.2				291,666.7		
9,000.9	1,481.4			740.8				108,888.9		
5,259.6	1,481.4			740.8				53,333.3		
81,731.0	14,073.3			7,036.7				602,185.2		
250,965.4	45,965.4	55,124.4	195,841.0	22,592.4	45,636.7	241,477.7		2,340,713.0		
105,958.4	8,944.4			4,472.2				1,594,666.7		
71,040.6	8,999.9			4,500.0				303,333.3		
26,681.4	8,999.9			4,500.0				45,000.0		
-	-			-				100,000.0		
-	-			-				-		
-	-			-				-		
-	-			-				793,333.3		
-	-			-				-		
-	-			-				-		
203,680.4	26,944.2	32,871.9	170,808.5	13,472.2	27,213.8	198,022.3		2,836,333.3		
162,512.1	8,666.6			4,333.3				577,777.8		
-	-			-				2,298,305.5		
-	-			-				-		
-	-			-				-		
162,512.1	8,666.6	10,573.3	151,938.8	4,333.3	8,753.3	160,692.1		2,876,083.3		
178,799.2	13,980.9	17,056.7	161,742.5	6,990.7	14,121.2	175,863.7		8,955.6		
64,693.9	7,055.4	8,607.6	56,086.3	7,126.0	7,126.0	63,212.3		190,148.1		
131,610.0	18,128.9	22,117.3	109,492.7	9,064.4	18,310.1	127,802.8		732,666.6		
303,198.9	23,906.3	29,165.7	274,033.2	11,953.2	24,145.5	298,178.7		4,441,259.3		
196,411.0	16,295.7	19,880.8	176,530.2	8,147.9	16,458.8	192,989.0		1,036,482.4		
272,060.0	10,703.4	13,058.2	259,001.8	5,351.7	10,810.4	269,812.2		1,475,222.2		
220,250.3	17,629.1	21,507.5	198,742.8	8,814.8	10,754.1	209,496.9		2,482,768.7		
1,039,894.3	77,739.4	94,842.1	945,052.2	38,870.2	78,517.8	1,023,570.0		3,547,525.5		
583,447.9	78,200.9	78,200.9	488,042.8	39,102.6	78,987.3	567,030.1		3,140,833.4		
655,975.3	77,405.0	54,434.1	561,541.2	38,704.5	78,182.5	639,723.7		4,978,194.4		
408,708.6	22,017.7	26,681.6	381,847.0	11,009.2	22,238.6	404,085.6		1,932,481.4		
250,965.4	45,183.9	55,124.4	195,841.0	22,592.4	45,636.7	241,477.7		2,340,713.0		
349,540.0	44,794.7	54,649.5	294,890.5	22,397.8	45,243.6	340,134.1		3,127,138.7		
203,680.4	26,944.2	32,871.9	170,808.5	13,472.2	27,213.8	198,022.3		2,836,333.3		
162,512.1	8,666.6	10,573.3	151,938.8	4,333.3	8,753.3	160,692.1		2,876,083.3		
5,021,747.3	488,652.1	596,155.8	4,425,591.5	244,332.3	486,499.7	4,912,091.2	44,847,373.7	35,146,805.9	79,749,847.3	80,238,499.4

Table 2

		AVERAGE SEAM 2	AVERAGE SEAM 3	AVERAGE SEAM 4	AVERAGE SEAM 6	AVERAGE SEAM 7	AVERAGE SEAM 8+8A	AVERAGE SEAM 9	AVERAGE SEAM 10	AVERAGE SEAM 12	AVERAGE SEAM 13	AVERAGE SEAM 14	AVERAGE SEAM 15	AVERAGE SEAM 16	AVERAGE SEAM 17	AVERAGE SEAM 18
NO'S OF SAMPLES TESTED		5	5	5	6	4	5	5	14	13	5	3	3	4	3	2
RAW COAL																
INHERENT MOISTURE	% ad	0.7	0.7	0.6	0.7	0.7	0.5	0.5	0.5	0.5	0.7	0.7	0.9	0.7	0.8	1.0
ASH	% db	42.9	31.10	34.4	36.0	41.7	22.2	32.5	38.9	38.5	33.3	9.7	26.5	57.9	46.5	30.9
VOLATILE MATTER	% db	15.3	15.2	15.4	14.7	14.2	18.5	18.5	19.2	16.5	20.3	23.9	21.9	16.2	19.4	24.6
FIXED CARBON	% ad	41.50	53.4	50.0	49.0	43.8	58.9	48.8	42.1	43.1	46.1	65.9	51.1	25.7	33.9	44.2
SULPHUR	% db	0.37	0.43	0.38	0.44	0.41	0.43	0.48	0.53	0.90	0.66	0.50	0.65	0.45	0.72	0.52
HARDGROVE GR. INDEX		79	106	83	87	91	95	79	90	75	79	111	82	58	61	70
SIZE FRACTION																
¼"x65M	weight %	89.0	84.2	86.3	88.2	88.1	89.9	92.7	86.4	89.3	91.4	86.4	89.9	94.4	95.0	93.9
65MxO	weight %	11.0	15.5	13.7	11.8	11.9	10.1	7.3	13.6	10.7	8.6	13.6	10.1	5.6	5.0	6.1
CLEAN COAL (SIZE FRACTION ¼"x65M; 1.5 SINK-FLOAT S.G.)																
YIELD ¼"x65M	weight %	51.9	65.1	58.6	62.5	47.4	74.7	59.2	59.3	50.9	62.9	92.3	75.6	34.7	44.8	66.8
TOTAL YIELD, EXCL. 65MxO	weight %	46.2	55.9	52.9	55.1	41.4	67.1	55.3	50.9	48.2	58.1	79.8	68.2	32.8	42.5	62.6
INHERENT MOISTURE	% ad	0.8	1.6	0.9	1.1	1.8	1.1	1.0	1.1	1.2	0.9	1.3	1.5	0.8	1.2	2.1
ASH	% db	8.7	6.4	9.0	9.4	8.5	7.8	9.2	7.0	8.2	7.1	4.6	4.1	7.9	5.6	4.7
VOLATILE MATTER	% dab	20.8	22.2	19.0	20.6	21.2	21.6	22.2	24.2	25.6	26.8	26.4	28.0	29.2	30.9	32.0
FIXED CARBON	% dab	79.3	77.9	81.0	79.5	78.8	78.4	77.8	73.8	74.4	68.9	73.6	72.1	70.8	69.2	68.2
SULPHUR	% db	0.53	0.53	0.45	0.65	0.71	0.52	0.61	0.83	0.91	1.56	0.45	0.86	0.74	0.84	0.75
PHOSPHORUS	% db	0.02	0.05	0.08	0.05	0.15	0.12	0.06	0.09	0.08	0.07	0.05	0.05	0.10	0.13	0.05
FSI		8.5	7.5	4	6.5	6.5	6.5	5.5	8.5	9	9	9	9	9	6.5	8
SOFTENING TEMP.	°C	403	403	417	410	416	414	416	402	395	394	390	391	381	386	385
RESOLIDIFICATION	°C	469	467	458	468	466	466	461	463	459	460	457	453	456	453	450
CONTRACTION	%	25	25	16	18	20	20	16	21	21	27	26	26	20	17	18
DILATATION	%	42	43	- 3	48	- 3	9	?	78	124	98	83	107	111	161	192
G-VALUE *)		1.015	0.803	0.205	0.616	0.472	0.210	0.213	1.032	0.996	1.038	1.035	1.079	1.068	1.058	1.069

*) Not calculated from Dilatation and Contraction, Arithmetic Average only.