REPORT ON

WASHABILITY CHARACTERISTICS

OF

COKING COAL

FOR

DENISON MINES LTD.

ADIT #1 - 2

F. SEAM

SEAM SECTION	5' 11" Coal
	1' 3" Dirt
	2' 0" Coal
	9' 2" Total

Submitted by

CYCLONE ENGINEERING SALES LTD.

EDMONTON - ALBERTA - CANADA

Report No.:	RI-71.07.a
Job No.:	S1-84
Dated:	October 5, 1971.

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ADIT #1 - 2.

SUMMARY

The data presented in this report refer to the Washability Characteristics of Denison Mines' Sample Adit #1 - 2.

The analyses indicate that the coal is of medium volatile rank with high coking quality (F.S.I. 6½). The ash of 21.67% is on the high side. However, it is mostly extraneous material which should be very easy to clean out, (20.69% of + 100 m. fraction is + 1.80 and has a specific gravity ash of 76.74%).

All cut points between 1.45 and 1.80 can be used depending on the ash requirements of the clean coal, without affecting the ease of cleaning.

The fines are amenable to froth flotation, but hydrocyclone cleaning could be equally effective as most of the ash is contributed by extraneous high gravity dirt.

The yield of clean coal will be in the neighborhood of 75% with an ash of about 6%. The F.S.I. of the clean coal can be expected to be higher than 8½.

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I. INTRODUCTION

A sample of Adit #1 - 2, weighing 2,111 lb., was received by Cyclone Engineering Sales Ltd. on September 14, 1971.

Prior to analysis, a 1/8 split of the sample was taken and has been retained for possible future use.

The following work was done on the remaining portion of the sample:

1. A size analysis at 2", 1", 1/2", 1/4", 8 m., 28 m. and 100 m.
2. A proximate analysis on all size fractions.
3. A float-sink analysis on all siz fractions, except -100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 1.80.
4. Ash, volatile matter and free swelling index determinations on all specific gravity fractions.
5. Washability curves for all size fractions, except -100 mesh.
6. Washability curves for +100 mesh fraction of the raw sample by re-constituting the data in 5.
7. Froth flotation tests on 28 m. x 100 m. and 100 m. x 0 fractions.

II. CONCLUSIONS AND RECOMMENDATIONS

Most of the dirt in the sample is in the higher size ranges and would be extremely easy to reject during cleaning.

It would be advisable to pay attention to this factor during mining operations.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.

SAMPLE #F1 LOT 2

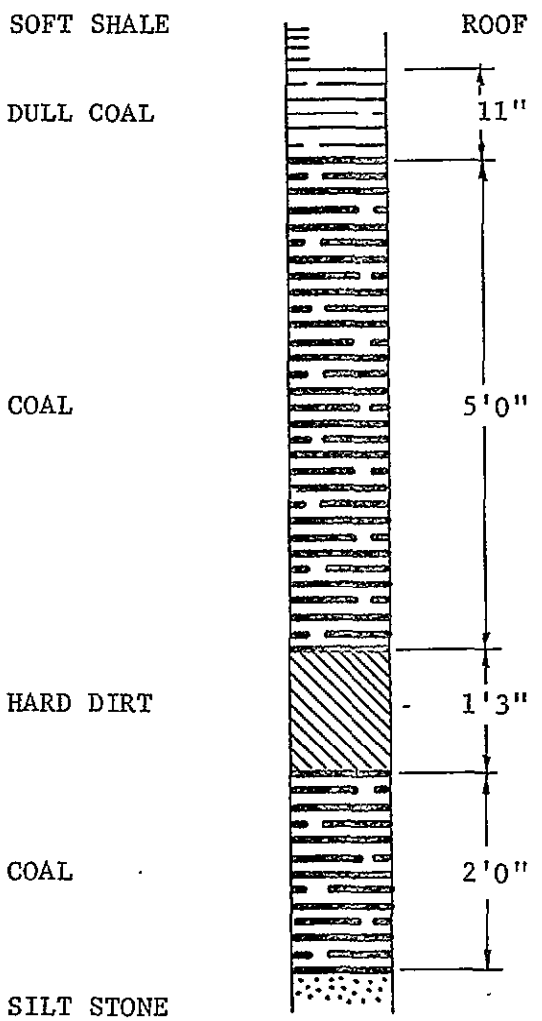


TABLE 1 - ADIT #1 - 2

DENISON MINES LTD.

Classification by Rank

Ash:	22.09%
Volatile Matter:	21.02%
Residual Moisture:	0.62%
Fixed Carbon:	56.27%
Sulphur	0.40%
B.T.U./lb.	11,510
F.S.I.	6½ *
Rank	mvb

TABLE 2 - ADIT #1 - 2

Analyses of Size Fractions

Size	Wt. %	Ash %	V.M.%	R.M.%	F.C.%	S.%	F.S.I.
+2"	14.03	53.37	13.95	0.55	32.13	0.37	1
2" x 1"	14.34	27.92	19.28	0.70	52.10	0.45	4
1" x 1/2"	11.80	20.41	21.27	0.56	57.76	0.29	6
1/2" x 1/4"	11.96	14.87	21.67	0.66	62.80	0.55	6½
1/4" x 8 m.	15.64	13.70	23.16	0.64	62.50	0.54	6½
8 m. x 28 m.	19.87	12.38	23.49	0.61	63.52	0.20	7½
28 m. x 100 m.	9.73	14.42	23.52	0.59	61.47	0.50	7½
- 100 m.	2.63	15.36	23.44	0.57	60.63	0.56	8
Total	100.00	22.09	21.02	0.62	56.27	0.40	6½ *

* actually determined

T A B L E 3 - ADIT #1 - 2

Ash % and Weight % Distribution vs. Size and Specific Gravity

(Figures in Brackets show the Ash Content of Individual Fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+2"	2.62 (3.14)	0.66 (5.73)	0.52 (11.18)	0.09 (14.83)	0.14 (19.69)	0.10 (28.25)	0.68 (37.61)	1.14 (44.23)	8.08 (79.21)	14.03 (52.80)
2" x 1"	5.28 (3.03)	2.26 (5.61)	0.91 (10.51)	0.42 (14.50)	0.23 (20.40)	0.24 (27.52)	0.29 (37.26)	0.58 (44.63)	4.13 (72.07)	14.34 (27.19)
1" x 1/2"	4.92 (2.81)	2.62 (5.08)	0.63 (9.24)	0.35 (13.25)	0.22 (18.80)	0.24 (26.72)	0.32 (37.50)	0.47 (46.57)	2.03 (75.93)	11.80 (20.01)
1/2" x 1/4"	6.27 (3.03)	2.38 (5.08)	0.60 (10.52)	0.31 (14.39)	0.21 (23.25)	0.26 (27.24)	0.33 (38.23)	0.27 (45.62)	1.33 (75.32)	11.96 (14.97)
1/4" x 8m.	9.89 (2.61)	2.18 (5.35)	0.69 (10.46)	0.27 (14.21)	0.15 (18.39)	0.24 (26.10)	0.21 (34.55)	0.29 (43.33)	1.72 (78.68)	15.64 (13.60)
8 m. x 28 m.	13.46 (2.46)	2.42 (5.20)	0.77 (9.78)	0.36 (14.32)	0.20 (22.06)	0.32 (30.25)	0.29 (39.15)	0.23 (46.46)	1.82 (77.40)	19.87 (11.85)
28m. x 100 m.	6.13 (2.10)	1.13 (5.60)	0.44 (10.12)	0.21 (15.73)	0.14 (23.22)	0.25 (30.93)	0.21 (39.78)	0.18 (47.14)	1.04 (75.14)	9.73 (13.67)
Total	48.57 (2.65)	13.65 (5.30)	4.56 (10.24)	2.01 (14.33)	1.29 (20.84)	1.65 (28.23)	2.33 (37.75)	3.16 (45.02)	20.15 (76.74)	97.37 (21.84)
- 100 mesh	This fraction forms 2.63% of the total sample and has an ash content of 15.36%, thus giving a total sample ash value of 21.67%.									

TABLE 4 - ADIT #1 - 2

Weight % & Volatile Matter % Distribution vs. Size and Specific Gravity

(Figures in Brackets show the Volatile Matter Content of Individual Fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+2"	2.62 (25.07)	0.66 (23.99)	0.52 (22.06)	0.09 (19.96)	0.14 (19.93)	0.10 (18.56)	0.68 (15.95)	1.14 (14.90)	8.08 (8.08)	14.03 (13.73)
2" x 1"	5.28 (25.18)	2.26 (23.98)	0.91 (22.06)	0.42 (20.70)	0.23 (19.46)	0.24 (18.32)	0.29 (16.39)	0.58 (13.92)	4.13 (9.67)	14.34 (19.36)
1" x 1/2"	4.92 (25.65)	2.62 (23.04)	0.63 (21.86)	0.35 (21.59)	0.22 (20.06)	0.24 (19.10)	0.32 (16.87)	0.47 (13.89)	2.03 (9.12)	11.80 (20.96)
1/2" x 1/4"	6.27 (2555)	2.38 (22.69)	0.60 (20.90)	0.31 (20.77)	0.21 (19.49)	0.26 (18.11)	0.33 (16.18)	0.27 (13.99)	1.33 (8.42)	11.96 (21.93)
1/4" x 8 m.	9.89 (25.75)	2.18 (22.43)	0.69 (20.28)	0.27 (19.97)	0.15 (19.70)	0.24 (18.33)	0.21 (17.23)	0.29 (15.18)	1.72 (8.94)	15.64 (22.62)
8m. x 28m.	13.46 (26.97)	2.42 (22.50)	0.77 (20.89)	0.36 (20.07)	0.20 (19.50)	0.32 (19.10)	0.29 (17.62)	0.23 (16.10)	1.82 (10.26)	19.87 (24.07)
28m. x 100 m.	6.13 (26.67)	1.13 (23.27)	0.44 (21.38)	0.21 (20.47)	0.14 (20.39)	0.25 (19.66)	0.21 (17.88)	0.18 (17.31)	1.04 (12.40)	9.73 (23.74)
Total	48.57 (26.07)	13.65 (23.01)	4.56 (21.35)	2.01 (20.60)	1.29 (19.75)	1.65 (18.77)	2.33 (16.66)	3.16 (14.74)	20.15 (9.03)	97.37 (20.98)
- 100 mesh	This fraction forms 2.63% of the total sample and has a volatile matter content of 23.44%, thus giving a total sample volatile matter value of 21.04%.									

TABLE 5. ADIT #1 - 2.

Cummulative F.S.I. and Cummulative Weight % vs. Size and Specific Gravity

(Figures in brackets show the Cummulative F.S.I. of Cummulative Fractions).

Size \ Sp.Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+ 2"	2.62 (8)	3.28 (8)	3.80 (7½)	3.89 (7½)	4.03 (7)	4.13 (7)	4.81 (6)	5.95 (5)	14.03 (1)
2" x 1"	5.28 (8)	7.54 (8)	8.45 (8)	8.87 (7½)	9.10 (7½)	9.34 (6½)	9.63 (6½)	10.21 (6½)	14.34 (4)
1" x 1/2"	4.92 (8½)	7.54 (8)	8.17 (8)	8.52 (7½)	8.74 (7)	8.98 (7)	9.30 (7)	9.77 (7)	11.80 (6)
1/2" x 1/4"	6.27 (8½)	8.65 (8)	9.25 (7½)	9.56 (7½)	9.77 (7½)	10.03 (7)	10.36 (6½)	10.63 (6½)	11.96 (6½)
1/4" x 8 m.	9.89 (9)	12.07 (8½)	12.76 (8½)	13.03 (8½)	13.18 (8)	13.42 (8)	13.63 (8)	13.92 (8)	15.64 (6½)
8 m. x 28 m.	13.46 (9)	15.88 (8½)	16.65 (8½)	17.01 (8½)	17.21 (8½)	17.53 (8½)	17.82 (8)	18.05 (8)	19.87 (7½)
28 m. x 100 m.	6.13 (9)	7.26 (9)	7.70 (9)	7.91 (9)	8.05 (9)	8.30 (8½)	8.51 (8½)	8.69 (8)	9.73 (7½)
- 100 m.	Weight % of this fraction is 2.63 and has a F.S.I. of 8. The determined F.S.I. of the sample is 6½.								

T A B L E 6. ADIT #1 - 2.

Washability Data for Adit #1 - 2.
+ 100 m.: 97.37% of Total Sample.
(re-constituted from Size Fractions)

Specific Gravity	Fractional		Cummulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	49.88	2.65	49.88	2.65	100.00	21.84	24.94	2.65
1.30 - 1.35	14.02	5.30	63.90	3.23	50.12	40.94	56.89	5.30
1.35 - 1.40	4.68	10.24	68.58	3.71	36.10	54.78	66.24	10.24
1.40 - 1.45	2.06	14.33	70.64	4.02	31.42	61.41	69.61	14.33
1.45 - 1.50	1.33	20.84	71.97	4.33	29.36	64.71	71.31	20.84
1.50 - 1.60	1.70	28.23	73.67	4.88	28.03	66.80	72.82	28.23
1.60 - 1.70	2.39	37.75	76.06	5.91	26.33	69.29	74.86	37.75
1.70 - 1.80	3.25	45.02	79.31	7.52	23.94	72.43	77.69	45.02
+ 1.80	20.69	76.74	100.00	21.84	20.69	76.74	89.66	76.74
TOTAL	100.00	21.84						

TABLE 6A

Cumulative Volatile Matter for Adit #1 - 2

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt. %	V.M. %	Wt. %	V.M. %	Wt. %	V.M.%
- 1.30	49.88	26.07	49.88	26.07	100.00	20.98
1.30 - 1.35	14.02	23.01	63.90	25.39	50.12	15.91
1.35 - 1.40	4.68	21.35	68.58	25.12	36.10	13.15
1.40 - 1.45	2.06	20.60	70.64	24.99	31.42	11.93
1.45 - 1.50	1.33	19.75	71.97	24.89	29.36	11.33
1.50 - 1.60	1.70	18.77	73.67	24.75	28.03	10.93
1.60 - 1.70	2.39	16.66	76.06	24.49	26.33	10.42
1.70 - 1.80	3.25	14.74	79.31	24.09	23.94	9.80
+ 1.80	20.69	9.03	100.00	20.98	20.69	9.03
Total	100.00	20.98				

TABLE 6B - ADIT #1 - 2

7% Ash of Clean Coal

Yield	77.00%
Floats Gravity	1.78
Near Gravity Material	7.00%
Ash	7.00%
Volatile Matter	24.12%
Residual Moisture	0.60%
Fixed Carbon	68.28%
F.S.I.	7½

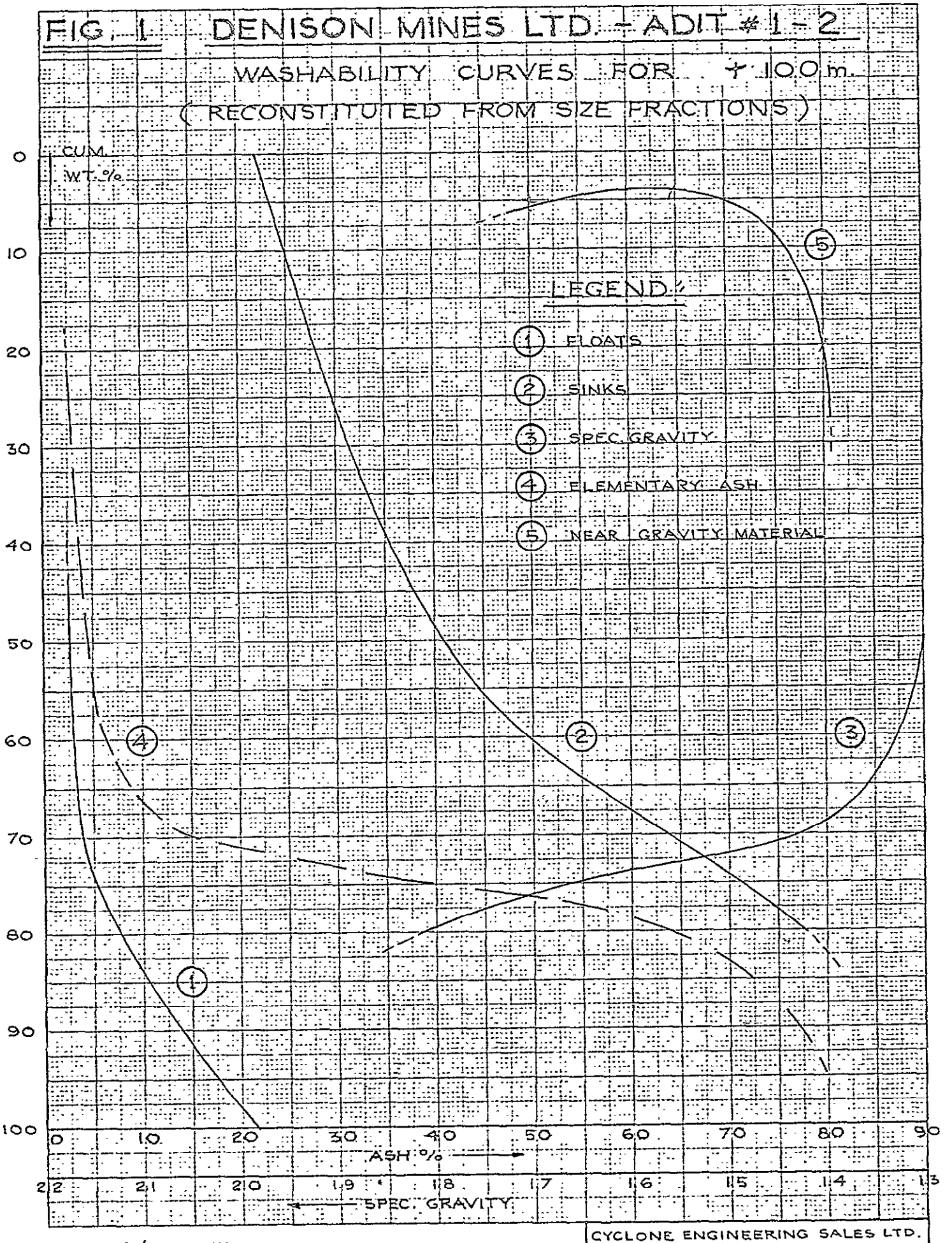


FIG. 1 DENISON MINES LTD. - ADIT #1 - 2
WASHABILITY CURVES FOR +100 m.
(RECONSTITUTED FROM SIZE FRACTIONS)
CUM. WT. %
LEGEND:
1 FLOATS
2 SINKS
3 SPEC. GRAVITY
4 ELEMENTARY ASH
5 NEAR GRAVITY MATERIAL
0
10
20
30
40
50
60
70
80
90
100
0
10
20
30
40
50
60
70
80
90
ASH %
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
SPEC. GRAVITY
OCT. 4 / '71 G.W.L.
CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA
K&E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM.
KEUFFEL & ESSER CO.

TABLE 7 - ADIT #1 - 2

+2" 14.03% of Total Sample

Ash, Volatile Matter & Cummulative E.S.I.

Specific Gravity	Weight %	Ash %	V.M. %	Cum. Weight %	Cum. F.S.I.
- 1.30	18.71	3.14	25.07	18.71	8
1.30 - 1.35	4.70	5.73	23.99	23.41	8
1.35 - 1.40	3.74	11.18	22.06	27.15	7½
1.40 - 1.45	0.67	14.83	19.96	27.82	7½
1.45 - 1.50	0.98	19.69	19.93	28.80	7
1.50 - 1.60	0.68	28.25	18.56	29.48	7
1.60 - 1.70	4.85	37.61	15.95	34.33	6
1.70 - 1.80	8.02	44.23	14.90	42.35	5
+ 1.80	57.65	79.21	8.08	100.00	1
Total	100.00	52.80	13.73		

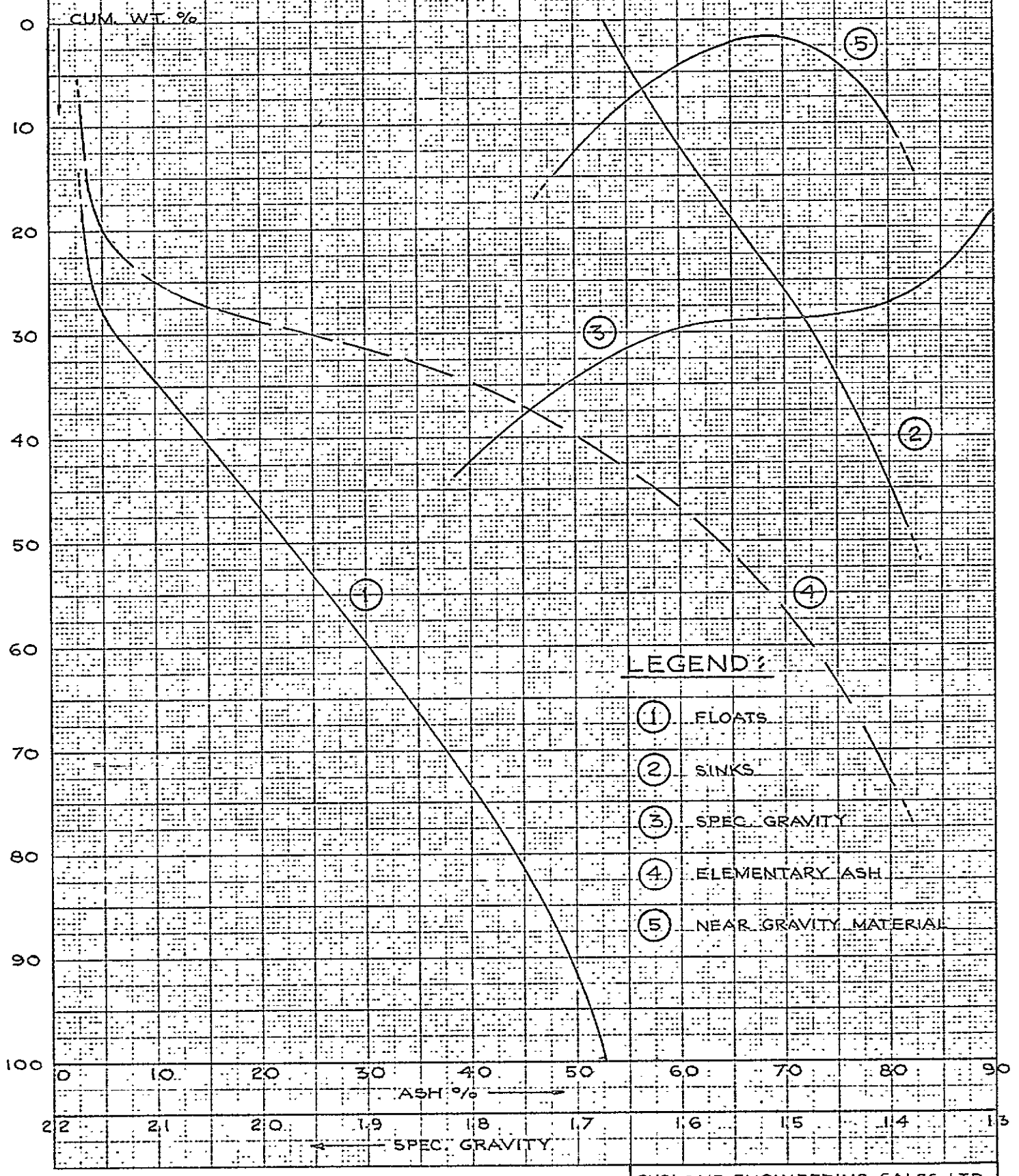
TABLE 8 - ADIT #1 - 2

Washability Data: +2"

Specific Gravity	Fractional		Cummulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	18.71	3.14	18.71	3.14	100.00	52.80	9.35	3.14
1.30 - 1.35	4.70	5.73	23.41	3.66	81.29	64.22	21.06	5.73
1.35 - 1.40	3.74	11.18	27.15	4.70	76.59	67.81	25.28	11.18
1.40 - 1.45	0.67	14.83	27.82	4.94	72.85	70.72	27.48	14.83
1.45 - 1.50	0.98	19.69	28.80	5.44	72.18	71.24	28.31	19.69
1.50 - 1.60	0.68	28.25	29.48	5.97	71.20	71.95	29.14	28.25
1.60 - 1.70	4.85	37.61	34.33	10.44	70.52	72.37	31.91	37.61
1.70 - 1.80	8.02	44.23	42.35	16.84	65.67	74.94	38.34	44.23
+ 1.80	57.65	79.21	100.00	52.80	57.65	79.21	71.18	79.21
Total	100.00	52.80						

FIG. 2 DENISON MINES LTD. - ADIT #1 - 2

WASHABILITY CURVES FOR + 2"



OCT. 4 / 71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K&E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

TABLE 9 - ADIT #1 - 2

2" x 1": 14.34% of Total Sample

Ash, Volatile Matter & Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Wt. %	Cum. F.S.I.
- 1.30	36.85	3.03	25.18	36.85	8
1.30 - 1.35	15.74	5.61	23.98	52.59	8
1.35 - 1.40	6.38	10.51	22.06	58.97	8
1.40 - 1.45	2.93	14.50	20.70	61.90	7½
1.45 - 1.50	1.56	20.40	19.46	63.46	7½
1.50 - 1.60	1.66	27.52	18.32	65.12	7
1.60 - 1.70	2.00	37.26	16.39	67.12	6½
1.70 - 1.80	4.08	44.63	13.92	71.20	6½
+ 1.80	28.80	72.07	9.67	100.00	4
Total	100.00	27.19	19.36		

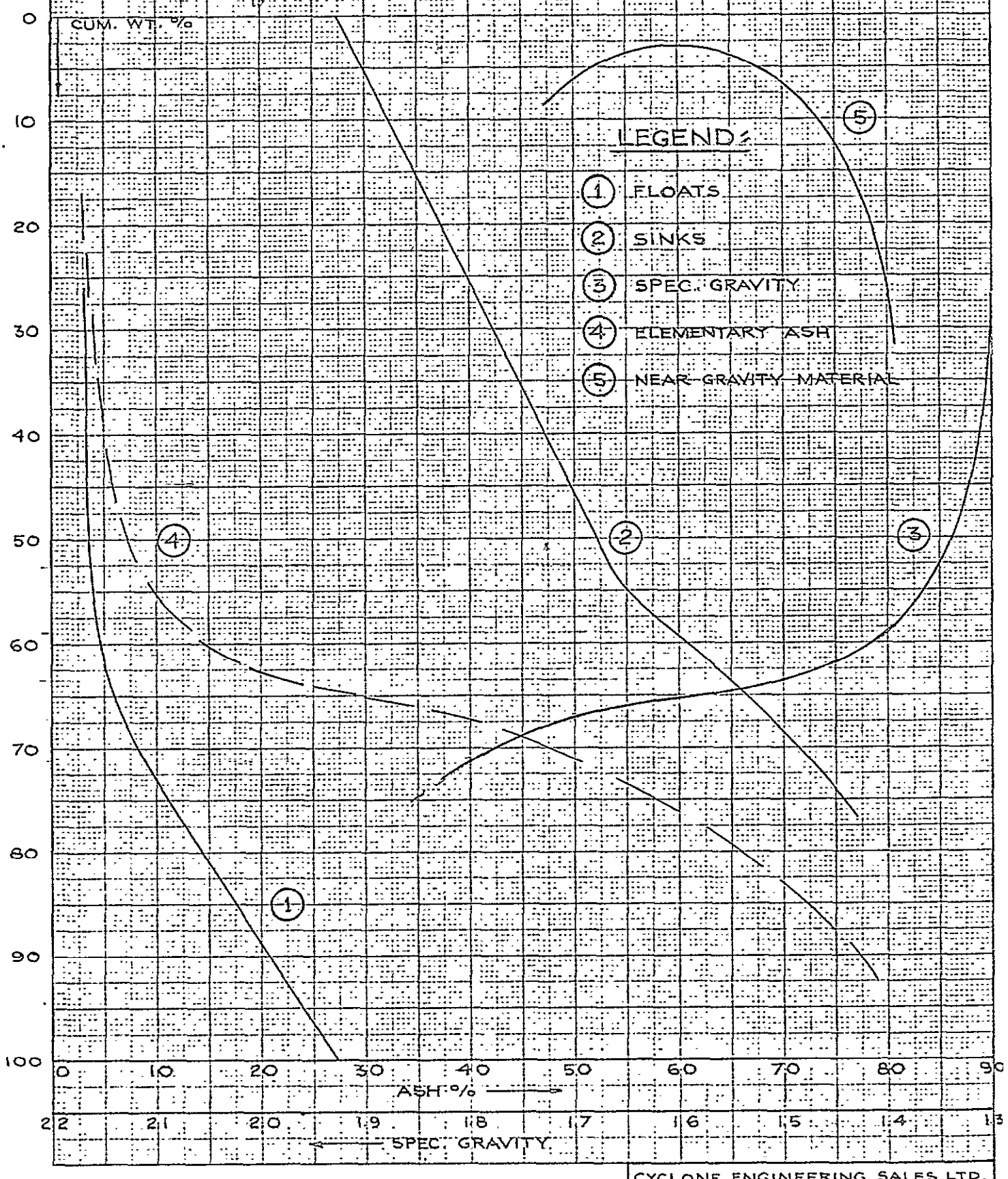
TABLE 10 - ADIT #1 - 2

Washability Date: 2" x 1"

Specific Gravity	Fractional		Cummulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	36.85	3.03	36.85	3.03	100.00	27.19	18.42	3.03
1.30 - 1.35	15.74	5.61	52.59	3.80	63.15	41.29	44.72	5.61
1.35 - 1.40	6.38	10.51	58.97	4.53	47.41	53.14	55.78	10.51
1.40 - 1.45	2.93	14.50	61.90	5.00	41.03	59.77	60.43	14.50
1.45 - 1.50	1.56	20.40	63.46	5.38	38.10	63.25	62.68	20.40
1.50 - 1.60	1.66	27.52	65.12	5.94	36.54	65.08	64.29	27.52
1.60 - 1.70	2.00	37.26	67.12	6.88	34.88	66.86	66.12	37.26
1.70 - 1.80	4.08	44.63	71.20	9.04	32.88	68.67	69.16	44.63
+ 1.80	28.80	72.07	100.00	27.19	28.80	72.07	85.60	72.07
Total	100.00	27.19						

FIG. 3 DENISON MINES LTD. - ADIT #1-2

WASHABILITY CURVES FOR 2" x 1"



OCT. 4 / '71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K+E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

T A B L E 11 - ADIT #1 - 2

1" x 1/2": 11.80% of Total Sample

Ash, Volatile Matter & Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	41.65	2.81	25.65	41.65	8½
1.30 - 1.35	22.16	5.08	23.04	63.81	8
1.35 - 1.40	5.37	9.24	21.86	69.18	8
1.40 - 1.45	3.01	13.25	21.59	72.19	7½
1.45 - 1.50	1.91	18.80	20.06	74.10	7
1.50 - 1.60	2.03	26.72	19.10	76.13	7
1.60 - 1.70	2.67	37.50	16.87	78.80	7
1.70 - 1.80	4.01	46.57	13.89	82.81	7
+ 1.80	17.19	75.93	9.12	100.00	6
Total	100.00	20.01	20.96		

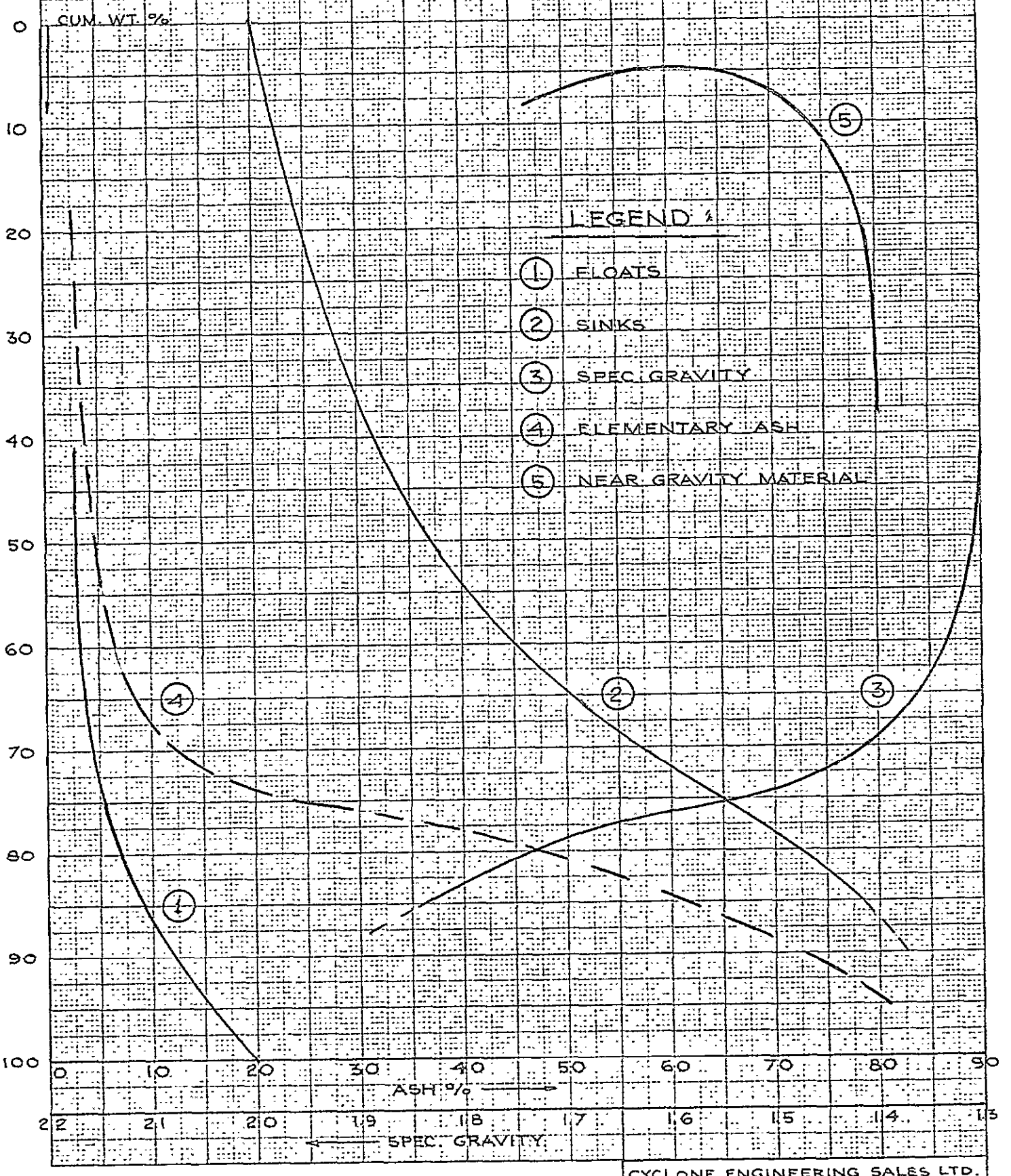
T A B L E 12 - ADIT #1 - 2

Washability data: 1" x 1/2"

Specific Gravity	Fractional		Cummulative				Elementary Ash	
	Wt. %	Ash %	Floats		Sinks		Wt. %	Ash %
			Wt. %	Ash %	Wt. %	Ash %		
- 1.30	41.65	2.81	41.65	2.81	100.00	20.01	20.08	2.81
1.30 - 1.35	22.16	5.08	63.81	3.60	58.35	32.29	52.73	5.08
1.35 - 1.40	5.37	9.24	69.18	4.04	36.19	48.96	66.49	9.24
1.40 - 1.45	3.01	13.25	72.19	4.42	30.82	55.88	70.69	13.25
1.45 - 1.50	1.91	18.80	74.10	4.79	27.81	60.49	73.15	18.80
1.50 - 1.60	2.03	26.72	76.13	5.38	25.90	63.57	75.12	26.72
1.60 - 1.70	2.67	37.50	78.80	6.46	23.87	66.70	77.47	37.50
1.70 - 1.80	4.01	46.57	82.81	8.41	21.20	70.38	80.81	46.57
+ 1.80	17.19	75.93	100.00	20.01	17.19	75.93	91.41	75.93
Total	100.00	20.01						

FIG. 4 DENISON MINES LTD. - ADIT # 1 - 2

WASHABILITY CURVES FOR 1" x 1/2"



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

OCT. 4 / '71 G.W.L.

K+E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

T A B LE 13 - ADIT #1 - 2

½" x ¼" : 11.96% of Total Sample

Ash, Volatile Matter and Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Wt. %	Cum. F.S.I.
- 1.30	52.38	3.03	25.55	52.38	8½
1.30 - 1.35	19.91	5.08	22.69	72.29	8
1.35 - 1.40	5.05	10.52	20.90	77.34	8
1.40 - 1.45	2.59	14.39	20.77	79.93	7½
1.45 - 1.50	1.74	23.25	19.49	81.67	7½
1.50 - 1.60	2.20	27.24	18.11	83.87	7
1.60 - 1.70	2.72	88.23	16.18	86.59	6½
1.70 - 1.80	2.29	45.62	13.99	88.88	6½
± 1.80	11.12	75.32	8.42	100.00	6½
Total	100.00	14.97	21.93		

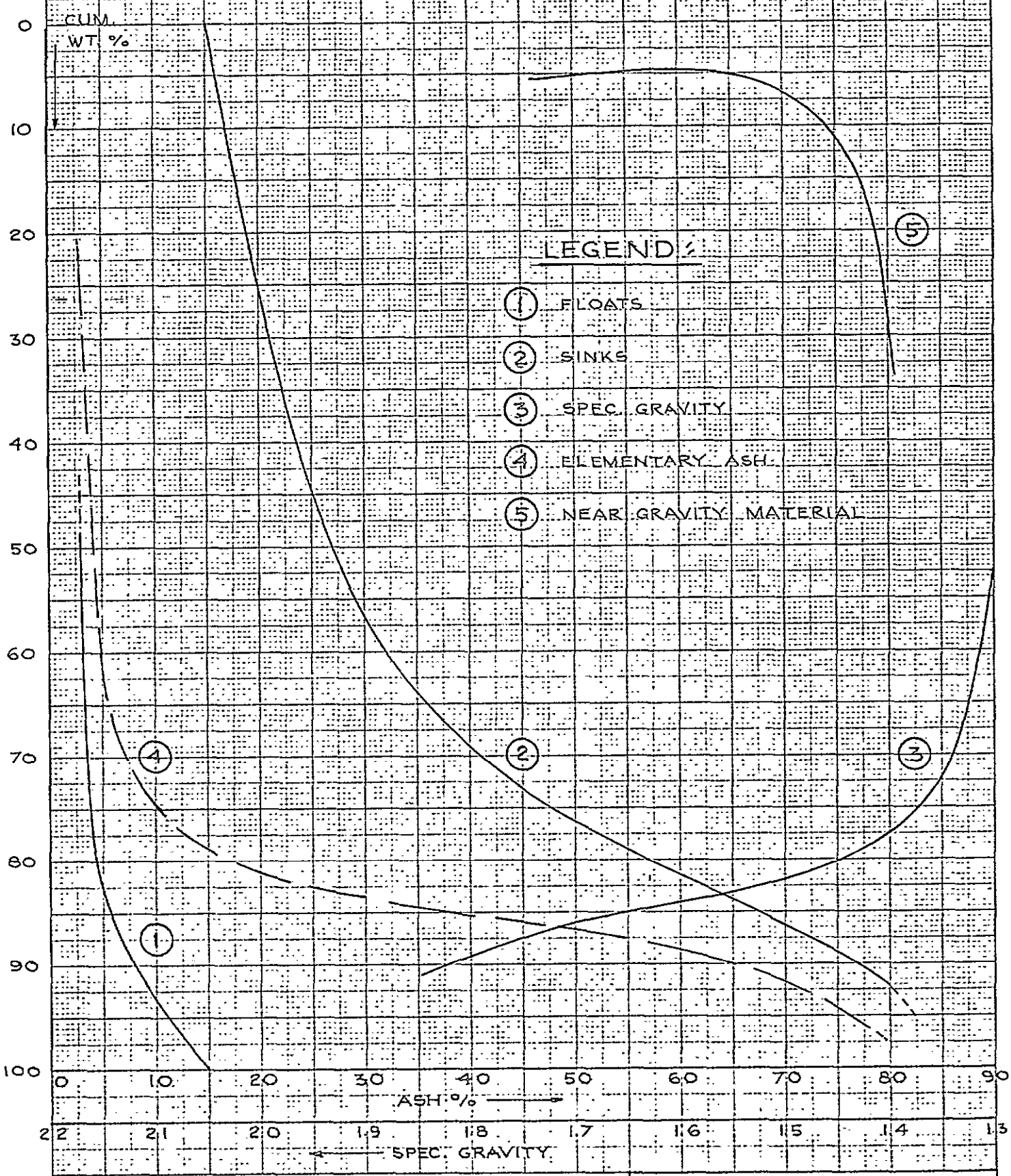
T A B L E 14 - ADIT #1 - 2

Washability Data: ½" x ¼"

Specific Gravity	Fractional		Cummulative				Elementary Ash	
	Wt. %	Ash %	Floats		Sinks		Wt.%	Ash %
			Wt. %	Ash %	Wt. %	Ash %		
- 1.30	52.38	3.03	52.38	3.03	100.00	14.97	26.19	3.03
1.30 - 1.35	19.91	5.08	72.29	3.59	47.62	28.10	62.34	5.08
1.35 - 1.40	5.05	10.52	77.34	4.05	27.71	44.63	74.82	10.52
1.40 - 1.45	2.59	14.39	79.93	4.38	22.60	52.24	78.64	14.39
1.45 - 1.50	1.74	23.25	81.67	4.78	20.07	57.12	80.80	23.25
1.50 - 1.60	2.20	27.24	83.87	5.37	18.33	60.34	82.77	27.24
1.60 - 1.70	2.72	38.23	86.59	6.41	16.13	64.85	85.23	38.23
1.70 - 1.80	2.29	45.62	88.88	7.42	13.41	70.25	87.74	45.62
+ 1.80	11.12	75.32	100.00	14.97	11.12	75.32	94.44	75.32
Total	100.00	14.97						

FIG. 5 — DENISON MINES LTD. - ADIT # 1 - 2

WASHABILITY CURVES FOR 1/2" x 1/4"



OCT. 4 / '71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K+E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

TABLE 15 - ADIT #1 - 2

¼" x 8 m. : 15.65% of Total Sample

Ash, Volatile Matter and Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	63.23	2.61	25.75	63.23	9
1.30 - 1.35	13.97	5.35	22.43	77.20	8½
1.35 - 1.40	4.33	10.46	20.28	81.53	8½
1.40 - 1.45	1.74	14.21	19.97	83.27	8½
1.45 - 1.50	0.95	18.39	19.70	84.22	8
1.50 - 1.60	1.54	26.10	18.33	85.76	8
1.60 - 1.70	1.39	34.55	17.23	87.15	8
1.70 - 1.80	1.87	43.33	15.18	89.02	8
+ 1.80	10.98	78.68	8.94	100.00	6½
Total	100.00	13.60	22.62		

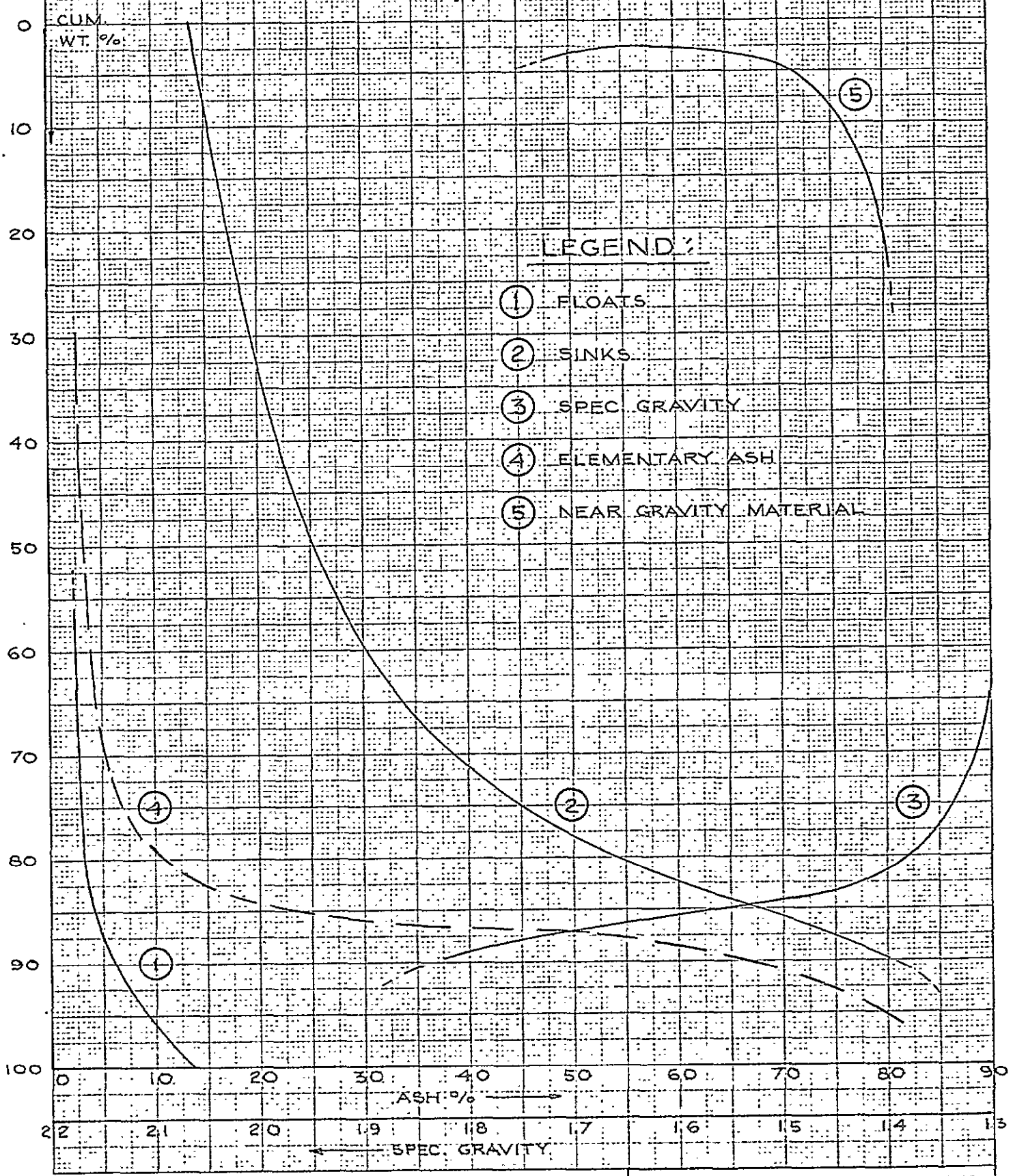
TABLE 16 - ADIT #1 - 2

Washability Data: ¼" x 8 m.

Specific Gravity	Fractional		Cummulative				Elementary Ash	
	Wt. %	Ash %	Floats		Sinks		Wt. %	Ash %
			Wt. %	Ash %	Wt.%	Ash %		
- 1.30	63.23	2.61	63.23	2.61	100.00	13.60	31.61	2.61
1.30 - 1.35	13.97	5.35	77.20	3.11	36.77	32.51	70.21	5.35
1.35 - 1.40	4.33	10.46	81.53	3.50	22.80	49.15	79.36	10.46
1.40 - 1.45	1.74	14.21	83.27	3.72	18.47	58.22	82.31	14.21
1.45 - 1.50	0.95	18.39	84.22	3.89	16.73	62.80	83.74	18.39
1.50 - 1.60	1.54	26.10	85.76	4.28	15.78	65.47	84.99	26.10
1.60 - 1.70	1.39	34.55	87.15	4.77	14.24	69.73	86.46	34.55
1.70 - 1.80	1.87	43.33	89.02	5.58	12.85	73.54	88.09	43.33
+ 1.88	10.98	78.68	100.00	13.60	10.98	78.68	94.51	78.68
Total	100.00	13.60						

FIG. 6 — DENISON MINES LTD. - ADIT # 1-2

WASHABILITY CURVES FOR 1/4" x 8 m.



OCT. 4 /'71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K&E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

TABLE 17 - ADIT #1 - 2

8m. x 28m. : 15.64% of Total Sample

Ash, Volatile Matter and Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	67.73	2.46	26.97	67.73	9
1.30 - 1.35	12.16	5.20	22.50	79.89	8½
1.35 - 1.40	3.88	9.78	20.89	83.77	8½
1.40 - 1.45	1.81	14.32	20.07	85.58	8½
1.45 - 1.50	1.01	22.06	19.50	86.59	8½
1.50 - 1.60	1.62	30.25	19.10	88.21	8½
1.60 - 1.70	1.47	39.15	17.62	89.68	8
1.70 - 1.80	1.16	46.46	16.10	90.84	8
± 1.80	9.16	77.40	10.26	100.00	7½
Total	100.00	11.85	24.07		

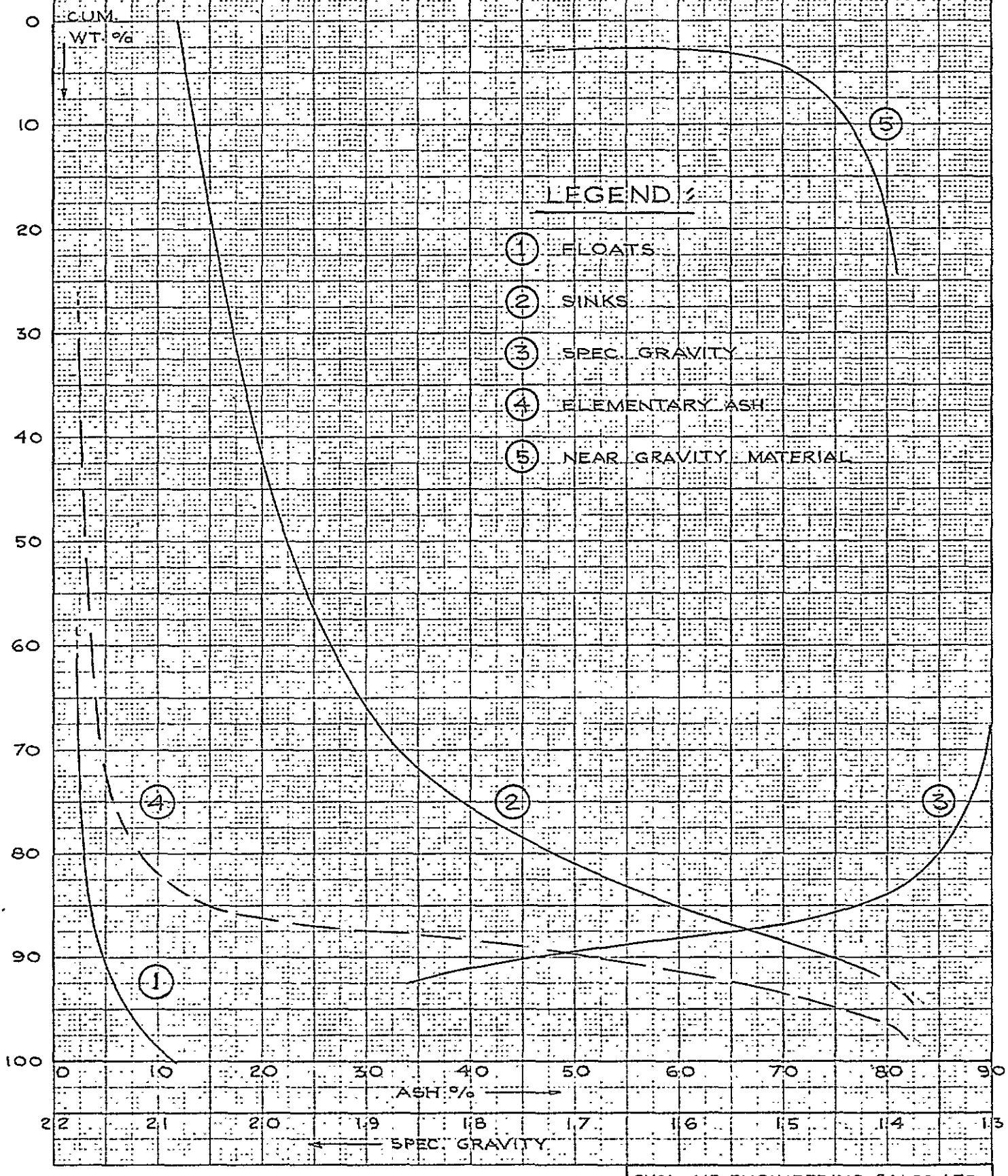
TABLE 18 - ADIT #1 - 2

Washability Data: 8m x 28m.

Specific Gravity	Fractional		Cummulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	67.73	2.46	67.73	2.46	100.00	11.85	33.86	2.46
1.30 - 1.35	12.16	5.20	79.89	2.88	32.27	31.57	73.81	5.20
1.35 - 1.40	3.88	9.78	83.77	3.20	20.11	47.52	81.83	9.78
1.40 - 1.45	1.81	14.32	85.58	3.43	16.23	56.54	84.67	14.32
1.45 - 1.50	1.01	22.06	86.59	3.65	14.42	61.84	86.09	22.06
1.50 - 1.60	1.62	30.25	88.21	4.14	13.41	64.83	87.40	30.25
1.60 - 1.70	1.47	39.15	89.68	4.71	11.79	69.59	88.95	39.15
1.70 - 1.80	1.16	46.46	90.84	5.24	10.32	73.92	90.26	46.46
+ 1.80	9.16	77.40	100.00	11.85	9.16	77.40	95.42	77.40
Total	100.00	11.85						

FIG. 7 DENISON MINES LTD. - ADIT #1-2

WASHABILITY CURVES FOR 8 x 28 m



OCT. 4 / '71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K&E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

TABLE 19 - ADIT #E - 2

28m. x 100m. : 9.73% of Total Sample

Ash, Volatile Matter and Cummulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	62.95	2.10	26.67	62.95	9
1.30 - 1.35	11.57	5.60	23.27	72.52	9
1.35 - 1.40	4.60	10.12	21.38	79.12	9
1.40 - 1.45	2.17	15.73	20.47	81.29	9
1.45 - 1.50	1.45	23.22	20.39	82.74	9
1.50 - 1.60	2.58	30.93	19.66	85.32	8½
1.60 - 1.70	2.17	39.78	17.88	87.49	8½
1.70 - 1.80	1.81	47.14	17.31	89.30	8
+ 1.80	10.70	75.14	12.40	100.00	7½
Total	100.00	13.67	23.74		

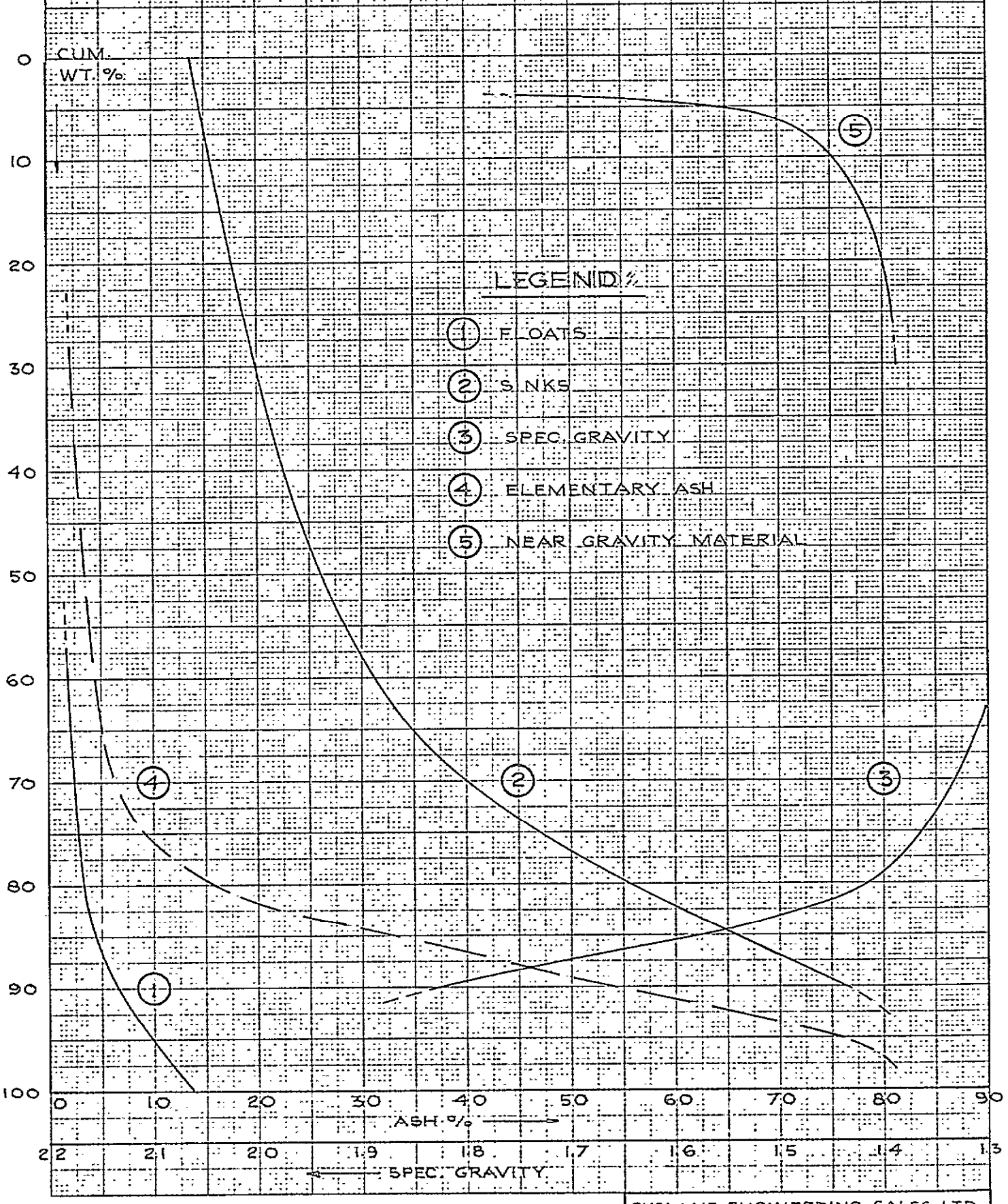
TABLE 20 - ADIT #1 - 2

Washability Data: 28m x 100m

Specific Gravity	Fractional		Cummulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt. %	Ash %
- 1.30	62.95	2.10	62.95	2.10	100.00	13.67	31.47	2.10
1.30 - 1.35	11.57	5.60	72.52	2.64	37.05	33.32	67.73	5.60
1.35 - 1.40	4.60	10.12	79.12	3.08	25.48	45.91	75.82	10.12
1.40 - 1.45	2.17	15.73	81.29	3.42	20.88	53.80	80.20	15.73
1.45 - 1.50	1.45	23.22	82.74	3.76	18.71	58.21	82.02	23.22
1.50 - 1.60	2.58	30.93	85.32	4.58	17.26	61.15	84.03	30.93
1.60 - 1.70	2.17	39.78	87.49	5.46	14.68	66.46	86.41	39.78
1.70 - 1.80	1.81	47.14	89.30	6.30	12.51	71.09	88.40	47.14
+ 1.80	10.70	75.14	100.00	13.67	10.70	75.14	94.65	75.14
Total	100.00	13.67						

FIG. 8 DENISON MINES LTD. - ADIT # 1 - 2

WASHABILITY CURVES FOR 28 m x 100 m



OCT. 4/'71 G.W.L.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

K&E 10 X 10 TO THE CENTIMETER 46 1512
18 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

FROTH FLOTATION TEST

28 Mesh x 100 Mesh: 9.73% of Total Sample

Solids, by weight in Slurry	8.0%
Time of Flotation	1.5 minutes
Flotation Recovery	90.03%
Reagents	MIBC and Kerosene

Analyses of the Products

	Floats	Tailings
Ash %	8.38	65.54
Volatile Matter %	24.26	14.89
Residual Moisture %	0.60	0.53
Fixed Carbon %	66.76	19.04
B.T.U./lb.	13,990	3,650
Sulphur %	0.48	0.55
F.S.I.	8½	N.A.

FROTH FLOTATION TEST

100 Mesh x 0 Mesh: 2.63% of Total Sample

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	92.56%
Reagents	MIBC and Kerosene

Analyses of the Products

	Floats	Tailings
Ash %	10.86	68.34
Volatile Matter %	23.54	22.73
Residual Moisture %	0.58	0.51
Fixed Carbon %	65.02	8.42
B.T.U./lb.	13,430	1,630
Sulphur %	0.51	1.23
F.S.I.	8'	N.A.

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR
DENISON MINES LTD.

QUINTETTE PROJECT

BABCOCK AREA

SEAM F

ADIT NO. F1 LOT 3 (5 TONS)

Submitted by

CYCLONE ENGINEERING SALES LTD.

EDMONTON - ALBERTA - CANADA

Report No.: RI-71.07.b

Job No.: S1-84

Date: November 26, 1971.

REPORT ON
WASHABILITY CHARACTERISTICS AND CLEANING
OF COKING COAL
FOR
DENISON MINES LTD.
QUINTETTE PROJECT
BABCOCK AREA
SEAM F
ADIT NO. F1 LOT 3 (5 TONS)

SUMMARY:

The data presented in this report refer to washability characteristics and the results of washing a 5-ton sample of coal from #F-1 - Lot 3.

The system used for washing this coal was a combination of 2-stage water cyclones with heavy medium cyclone and flotation cells. Basically the middlings fraction from the water cyclones is retreated in the heavy medium cyclone.

A yield in excess of 80% of clean coal was obtained. The bulk of the clean coal (about 67%) was produced in the water cyclones and only about 13% - 15% was produced in the heavy medium cyclone and flotation cells.

The cleaned coal Proximate Analysis is as follows:

	Air Dried Basis	As Received Basis (Coal Product)
Ash	6.74	6.44
Residual Moisture	0.63	5.2
Volatile Matter	24.15	23.04
Fixed Carbon	68.48	65.32
	100.00	100.00
F.S.I.	8	8
B.T.U./lb.	14,360	13,615
Sulphur	0.39	0.37

No attempt has been made to analyze the washing circuit used for washing of the coal as the primary purpose was the production of clean coal for carbonization studies. However, thesystem used appears to have done an adequate job.

A flow diagram of the system has been included in the report.

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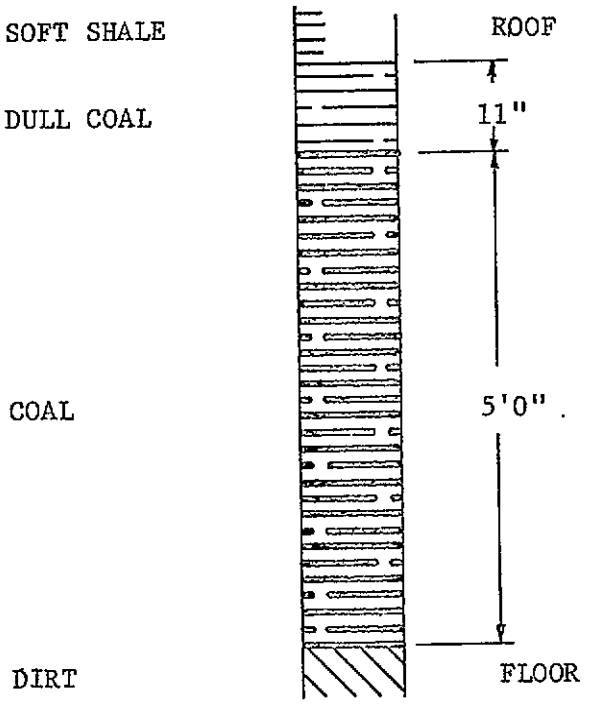
SAMPLE #F1 LOT 3



INTRODUCTION

Approximately a 5-ton sample of Seam F-1 - Lot 3 in 100 lb. bags was received by Cyclone Engineering Sales Ltd. in three shipments, last of which arrived on October 19, 1971.

The coal was air dried, crushed to 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in figure 1, section 2, of this report.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.

SECTION 1

WASHABILITY DATA AND FLOTATION TESTS

ADIT F-1 - LOT 3

TABLE 1

Head Sample Analysis

Ash	14.65%
Volatile Matter	23.08%
Residual Moisture	0.84%
Fixed Carbon	61.43%
F.S.I.	7
B.T.U./lb.	13,020
Sulphur	0.38%

TABLE 2

Size Analysis

3/4" x 28 m.	75.33
28 m. x 0	24.67
Total	100.00

TABLE 3

Incremental Float-Sink Analysis of 3/4" x 28 m.

Sp. Gr.	Wt. %	Ash %	V.M.%.	R.M.%	F.C.%
- 1.30	43.93	2.43	25.29	0.72	71.56
1.30 - 1.35	20.51	4.64	23.23	0.76	71.37
1.35 - 1.40	4.09	9.39	20.77	0.81	69.03
1.40 - 1.45	3.82	13.79	20.22	0.78	65.21
1.45 - 1.50	2.03	20.18	19.43	0.85	59.54
1.50 - 1.60	4.00	26.56	18.59	0.92	53.93
1.60 - 1.70	5.57	38.90	16.17	0.92	44.01
1.70 - 1.80	3.08	45.23	15.13	0.96	38.68
+ 1.80	12.97	68.11	12.82	0.96	18.11
Total	100.00	16.80	21.66	0.79	60.75

TABLE 4

Cumulative Float-Sink Analysis of 3/4" x 28 m.

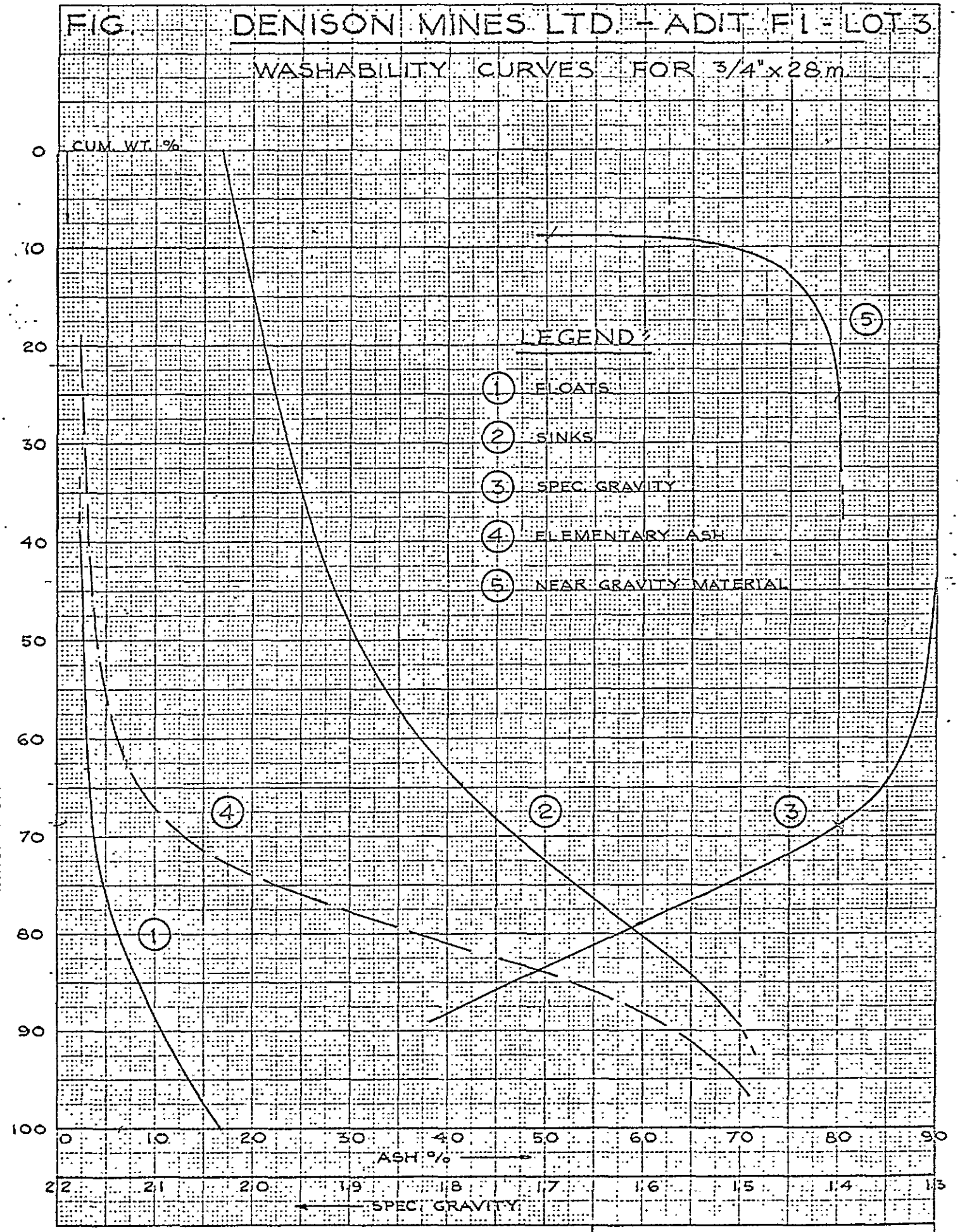
Sp. Gr.	Wt.%	Ash %	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	43.93	2.43	25.29	0.72	71.56	8½
- 1.35	64.44	3.13	24.63	0.73	71.51	8
- 1.40	68.53	3.51	24.40	0.74	71.35	8
- 1.45	72.35	4.05	24.18	0.74	71.03	7½
- 1.50	74.38	4.49	24.05	0.74	70.72	7½
- 1.60	78.38	5.61	23.77	0.75	69.87	7
- 1.70	83.95	7.82	23.27	0.76	68.15	7
- 1.80	87.03	9.15	22.98	0.77	67.10	6
Total	100.00	16.80	21.66	0.79	60.75	5½

* F.S.I. by actual determination.

TABLE 5

Washability Data for 3/4" x 28 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	43.93	2.43	43.93	2.43	100.00	16.80	21.97	2.43
1.30 - 1.35	20.51	4.64	64.44	3.13	56.07	28.05	54.19	4.64
1.35 - 1.40	4.09	9.39	68.53	3.51	35.56	41.55	66.48	9.39
1.40 - 1.45	3.82	13.79	72.35	4.05	31.47	45.73	70.44	13.79
1.45 - 1.50	2.03	20.18	74.38	4.49	27.65	50.15	73.37	20.18
1.50 - 1.60	4.00	26.56	78.38	5.61	25.62	52.52	76.38	26.56
1.60 - 1.70	5.57	38.90	83.95	7.82	21.62	57.33	81.16	38.90
1.70 - 1.80	3.08	45.23	87.03	9.15	16.05	63.72	85.49	45.23
+ 1.80	12.97	68.11	100.00	16.80	12.97	68.11	93.51	68.11
Total	100.00	16.80						



K&E 10 X 10 TO THE CENTIMETER 46 1512
10 X 25 CM. MADE IN U.S.A.
KEUFFEL & ESSER CO.

TABLE 6

Flotation of -28 m.

Solids, by weight in Slurry	8%
Time	1-1/2 minutes
Reagents	MIBC & Kerosene

	Floats	Tailings
Yield	93.71	6.29
Ash	4.94	45.72
Volatile Matter	24.04	21.01
F.S.I.	8½	1½
Sulphur	0.35	0.73

SECTION 2

WASHING TESTS AND ANALYSIS OF PRODUCTS

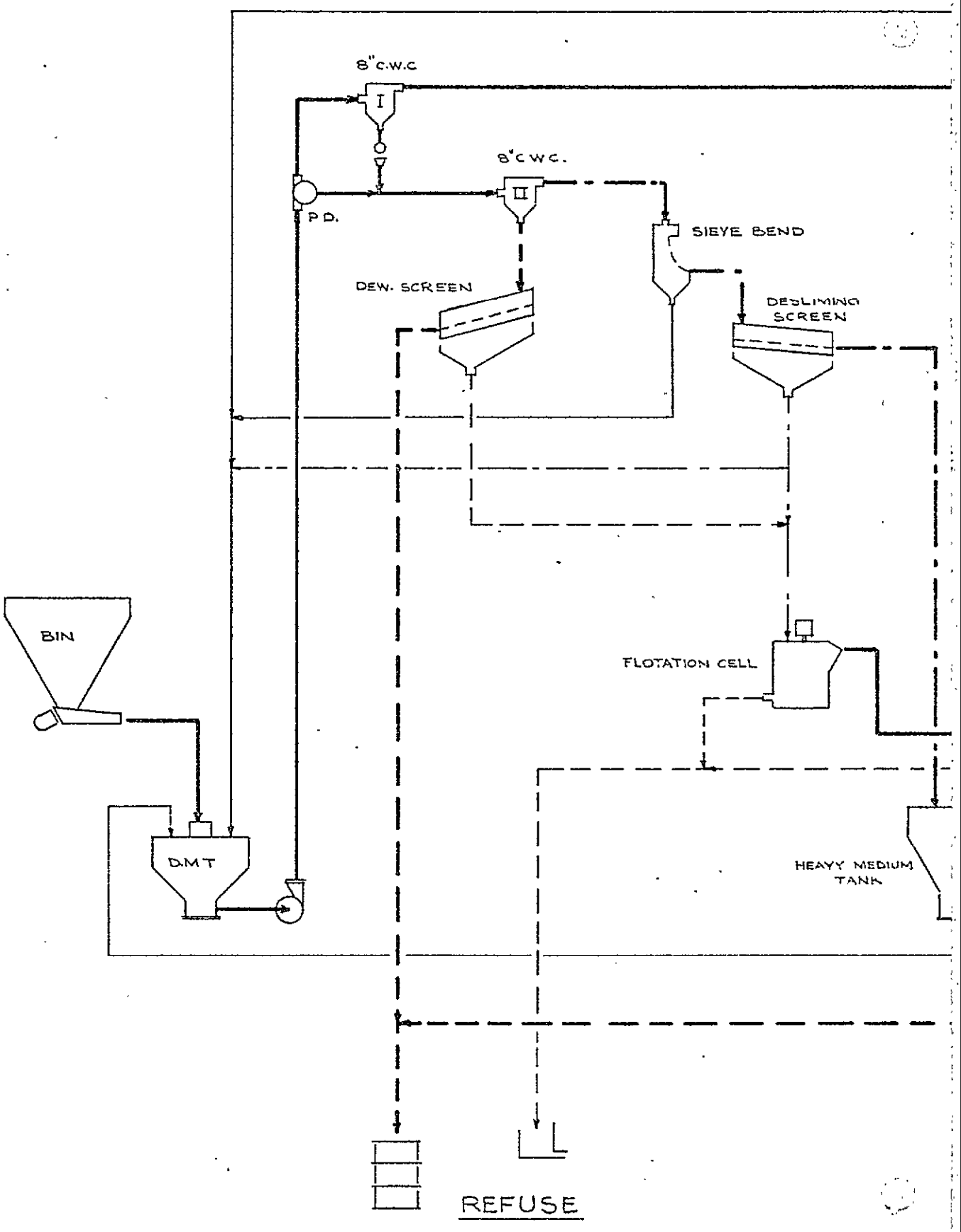
ADIT F-1 - LOT 3

TABLE 1

Approximate Distribution of Products

Product	Wt. %	Ash %
Clean Coal	81.0	6.7
Refuse from water cyclones	11.0	55.0
Refuse from Heavy Media cyclone and floatation cells	8.0	35.0
Total	100.0	14.3

FIG. 1 WASHING CIRCUIT FOR SEAM F1 - LOT 3



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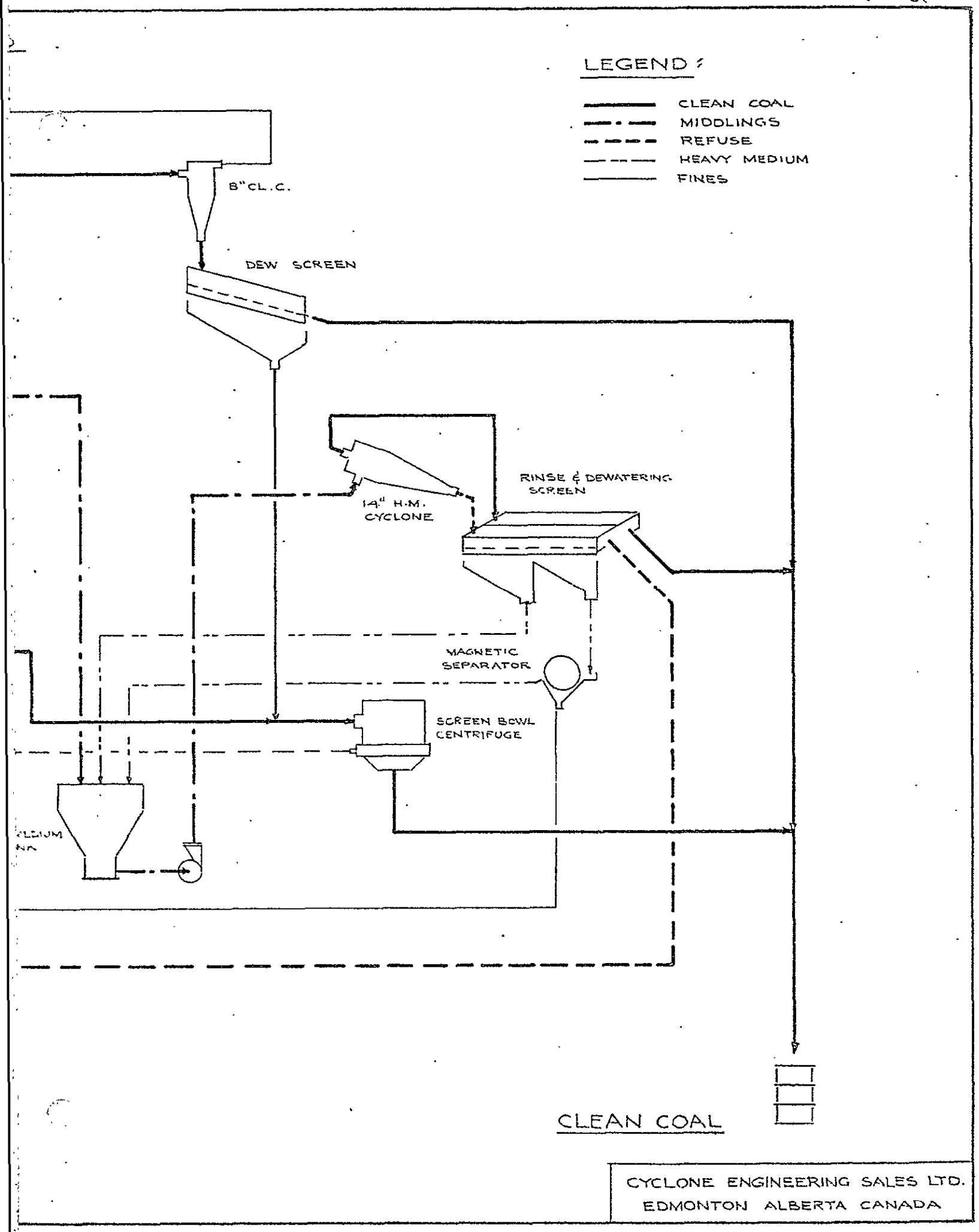

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EDMONTON ALBERTA CANADA

TABLE 2

Proximate Analysis of Clean Coal

Ash	6.74%
Volatile Matter	24.15%
Residual Moisture	0.63%
Fixed Carbon	68.48%
F.S.I.	8 - 7½ - 7½ - 8 - 8
B.T.U./lb.	14,360
Sulphur	0.39%

TABLE 3

Ultimate Analysis

Ash	6.74%
Carbon	82.08%
Hydrogen	4.62%
Nitrogen	1.07%
Oxygen	5.10%
Sulphur	0.39%

TABLE 4

CHARACTERISTICS OF THE ASH

Mineral Analysis of Ash

SiO_2	48.37
Al_2O_3	25.08
Fe_2O_3	10.82
TiO_2	1.42
P_2O_5	2.25
CaO	5.92
MgO	1.43
Na_2O	0.30
K_2O	0.37
SO_3	3.32

Ash Fusibility

	Reducing Atmosphere	Oxidizing Atmosphere
Initial Deformation Temperature	2175°F	2405°F
Spherical Temperature	2315°F	2480°F
Hemispherical Temperature	2410°F	2535°F
Fluid Temperature	2490°F	2625°F

TABLE 5

Analysis of Rejects

Compound water cyclone refuse

Ash	54.93%
Volatile Matter	14.87%
Residual Moisture	0.55%
Fixed Carbon	29.65%
F.S.I.	1
B.T.U./lb.	6,020
Sulphur	0.41%

TABLE 6

Flotation Refuse

Ash	42.37%
Volatile Matter	24.19%
Residual Moisture	0.51%
Fixed Carbon	32.93%
F.S.I.	1/2
B.T.U./lb.	7,240
Sulphur	0.70

TABLE 7

Heavy Medium Cyclone Refuse

Ash	32.44%
Volatile Matter	18.49%
Residual Moisture	0.57%
Fixed Carbon	48.50%
F.S.I.	2
B.T.U./lb.	9,790
Sulphur	0.36%

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT F6

Submitted by

CYCLONE ENGINEERING SALES LTD.
Edmonton, Alberta, Canada

Report No.: RI-72.14

Job No.: S1 - 84

Dated: April 19, 1972

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT F6

SUMMARY:

Data presented in this report refer to the washability characteristics of Denison Mines sample of Adit F6.

The coal is of medium volatile bituminous rank. It has an ash of 22% and an F.S.I. of 5. Bulk of the ash is extraneous and can be easily rejected during cleaning.

The coal will clean to 7% ash at a cut point of 1.71. The amount of near gravity material at this cut point is 9%. The clean coal will have a F.S.I. of 7.

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INTRODUCTION:

A one ton sample of Adit F6 was air dried and the following work was done:

1. A size analysis at 2", 1", 1/2", 1/4", 8 m., 28m. and 100 m.
2. A proximate analysis on all size fractions.
3. A float-sink analysis on all size fractions, except - 100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 1.80.
4. Ash, Volatile Matterand Free Swelling Index determinations on all specific gravity fractions.
5. Washability curves for all size fractions, except - 100 mesh.
6. Washability curves for + 100 mesh fraction of the raw sample by reconstituting the data in 5.
7. Froth flotation tests on 28 m. x 100 m. and - 100 m. fractions.

CONCLUSIONS & RECOMMENDATIONS:

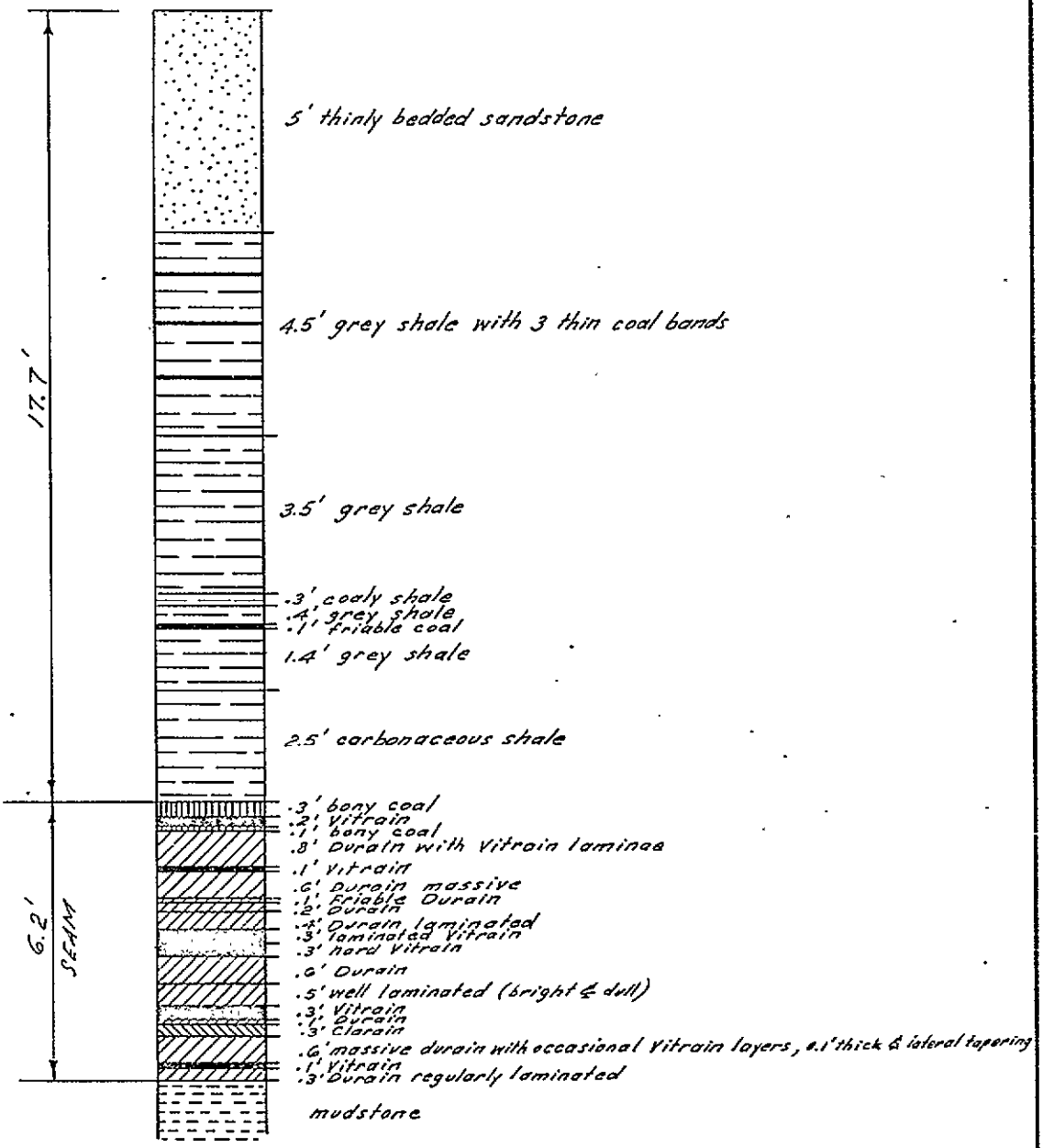
The coal is easy to clean and has good coking properties.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.
Laboratory Manager



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM "F"
ADIT No. 6

DRAWN BY. E.Toth	DATE Dec '71	SCALE 1" = 4'
APPROVED BY	DRAWING NO QNTT 71-0258-R01	

TABLE 1: ADIT F6

Classification by Rank

Ash	21.52%
Volatile Matter	20.65%
Residual Moisture	0.95%
Fixed Carbon	56.88%
F.S.I.	5
B.T.U./lb.	11,830
Sulphur	0.38%
Rank	mvb

TABLE 2: ADIT F6

Analysis of Size Fractions

Size	Wt. %	Ash %	V.M. %	R.M. %	F.C. %	S. %	F.S.I.
+ 2"	10.64	54.26	13.39	1.00	31.35	0.23	1
2" x 1"	7.49	33.92	17.52	0.84	47.72	0.35	1½
1" x 1/2"	14.26	28.70	18.66	0.95	51.69	0.34	2
1/2" x 1/4"	12.03	23.75	19.08	1.01	56.16	0.50	3
1/4" x 8m.	13.78	18.71	21.37	0.91	59.01	0.35	5
8 x 28 m.	24.75	9.17	23.71	0.94	66.18	0.35	8
28 x 100m.	13.17	7.46	24.52	0.96	67.06	0.46	8
- 100m.	3.88	9.87	23.69	0.89	65.55	0.55	8
Total	100.00	21.52	20.65	0.95	56.88	0.38	5

TABLE 3: ADIT F6

Weight % and Ash % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the ash content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+ 2"	0.82 (3.61)	0.93 (5.78)	0.28 (10.35)	0.19 (14.01)	0.08 (22.89)	0.12 (28.68)	0.32 (38.56)	0.41 (45.21)	7.49 (71.26)	10.64 (54.81)
2" x 1"	1.16 (3.50)	1.48 (5.62)	0.44 (10.74)	0.32 (13.62)	0.13 (23.46)	0.19 (27.17)	0.50 (37.97)	0.66 (44.72)	2.61 (69.89)	7.49 (34.82)
1" x 1/2"	2.39 (2.94)	3.13 (4.79)	0.89 (9.28)	0.68 (12.93)	0.26 (23.34)	0.40 (26.36)	1.04 (38.24)	1.42 (44.80)	4.05 (60.96)	14.26 (28.46)
1/2" x 1/4"	4.64 (3.53)	1.36 (5.28)	0.72 (9.71)	0.53 (13.07)	0.30 (22.59)	0.44 (26.17)	0.85 (36.11)	0.93 (43.17)	2.26 (69.36)	12.03 (23.60)
1/4" x 8 m.	6.24 (2.42)	2.25 (5.77)	0.97 (8.89)	0.37 (13.24)	0.24 (21.72)	0.39 (25.98)	0.49 (34.72)	0.66 (42.19)	2.17 (69.77)	13.78 (18.40)
8 x 28 m.	17.45 (2.15)	2.61 (5.32)	1.16 (9.37)	0.50 (13.23)	0.28 (19.26)	0.37 (25.99)	0.37 (35.10)	0.47 (43.63)	1.54 (66.85)	24.75 (8.89)
28 x 100 m.	8.51 (1.65)	2.18 (4.37)	0.81 (8.48)	0.36 (10.21)	0.15 (17.54)	0.20 (23.10)	0.17 (32.90)	0.15 (40.76)	0.64 (68.35)	13.17 (7.37)
Total	41.21 (2.36)	13.94 (5.18)	5.27 (9.34)	2.95 (12.86)	1.44 (21.50)	2.11 (26.08)	3.74 (36.73)	4.70 (43.89)	20.76 (68.30)	96.12 (21.89)
- 100 m.	This fraction forms 3.88% of the total sample and has an ash content of 9.87%, thus giving a total sample ash value of 21.42%.									

TABLE 4: ADIT F6

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the V.M. content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+ 2"	0.82 (24.17)	0.93 (21.66)	0.28 (20.95)	0.19 (20.17)	0.08 (19.63)	0.12 (17.65)	0.32 (15.46)	0.41 (14.51)	7.49 (10.27)	10.64 (13.28)
2" x 1"	1.16 (24.03)	1.48 (21.91)	0.44 (20.85)	0.32 (20.43)	0.13 (19.77)	0.19 (17.86)	0.50 (15.56)	0.66 (13.22)	2.61 (11.31)	7.49 (17.08)
1" x 1/2"	2.39 (24.22)	3.13 (22.08)	0.89 (21.39)	0.68 (21.07)	0.26 (20.06)	0.40 (18.23)	1.04 (15.91)	1.42 (14.62)	4.05 (12.38)	14.26 (18.25)
1/2" x 1/4"	4.64 (24.81)	1.36 (22.67)	0.72 (20.97)	0.53 (20.04)	0.30 (19.85)	0.44 (19.04)	0.85 (15.77)	0.93 (13.94)	2.26 (11.11)	12.03 (19.73)
1/4" x 8 m.	6.24 (25.51)	2.25 (22.42)	0.97 (20.24)	0.37 (19.97)	0.24 (19.63)	0.39 (18.06)	0.49 (15.61)	0.66 (14.16)	2.17 (11.12)	13.78 (21.00)
8 x 28 m.	17.45 (25.76)	2.61 (21.80)	1.16 (19.88)	0.50 (18.97)	0.28 (18.81)	0.37 (17.58)	0.37 (15.78)	0.47 (14.86)	1.54 (11.91)	24.75 (23.51)
28 x 100 m.	8.51 (26.51)	2.18 (23.61)	0.81 (20.22)	0.36 (19.87)	0.15 (18.79)	0.20 (17.89)	0.17 (15.91)	0.15 (15.02)	0.64 (11.12)	13.17 (24.22)
Total	41.21 (25.60)	13.94 (22.33)	5.27 (20.54)	2.95 (20.12)	1.44 (19.52)	2.11 (18.15)	3.74 (15.74)	4.70 (14.25)	20.76 (11.14)	96.12 (20.36)
- 100 m.	This fraction forms 3.88% of the total sample and has a volatile matter content of 23.69%, thus giving a total sample volatile matter value of 20.49%									

TABLE 5: ADIT F6

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity.

(Figures in brackets show the cumulative F.S.I. of cumulative fractions.)

Size \ Sp. Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+ 2"	0.82 (7½)	1.75 (7)	2.03 (7½)	2.22 (6)	2.30 (5)	2.42 (5)	2.74 (4)	3.15 (3)	10.64 (1)
2" x 1"	1.16 (7½)	2.64 (7)	3.08 (6½)	3.40 (6)	3.53 (5½)	3.72 (5)	4.22 (4)	4.88 (3)	7.49 (1½)
1" x 1/2"	2.39 (8)	5.52 (7½)	6.41 (6½)	7.09 (6)	7.35 (5½)	7.75 (5)	8.79 (4)	10.21 (3½)	14.26 (2)
1/2" x 1/4"	4.64 (8)	6.00 (7½)	6.72 (7)	7.25 (7)	7.55 (6½)	7.99 (6)	8.84 (5)	9.77 (4½)	12.03 (3)
1/4" x 8 m.	6.24 (9+)	8.49 (9)	9.46 (9)	9.83 (8½)	10.07 (8½)	10.46 (8)	10.95 (8)	11.61 (8)	13.78 (5)
8 x 28 m.	17.45 (9+)	20.06 (9+)	21.22 (9)	21.72 (9)	22.00 (9)	22.37 (9)	22.74 (8½)	23.21 (8½)	24.75 (8)
28 x 100 m.	8.51 (9+)	10.69 (9+)	11.50 (9)	11.86 (9)	12.01 (9)	12.21 (9)	12.38 (8½)	12.53 (8½)	13.17 (8)
Total	41.21	55.15	60.42	63.37	64.81	66.92	70.66	75.36	96.12
- 100 m.	Weight of this fraction is 3.88% and has a F.S.I. of 8								

TABLE 6: ADIT F6

Washability Data: + 100 m. - 96.12% of Sample

(Reconstituted from Size Fractions.)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	42.87	2.36	42.87	2.36	100.00	21.89	21.43	2.36
1.30 - 1.35	14.50	5.18	57.37	3.07	57.13	36.55	50.12	5.18
1.35 - 1.40	5.48	9.34	62.85	3.62	42.63	47.22	60.11	9.34
1.40 - 1.45	3.07	12.86	65.92	4.05	37.15	52.81	64.38	12.86
1.45 - 1.50	1.50	21.50	67.42	4.44	34.08	56.41	66.67	21.50
1.50 - 1.60	2.20	26.08	69.62	5.12	32.58	58.02	68.52	26.08
1.60 - 1.70	3.89	36.73	73.51	6.79	30.38	60.33	71.56	36.73
1.70 - 1.80	4.89	43.89	78.40	9.11	26.49	63.79	75.95	43.89
+ 1.80	21.60	68.30	100.00	21.89	21.60	68.30	89.20	68.30
Total	100.00	21.89						

FIGURE : 1

COMPANY : DENISON MINES LTD.

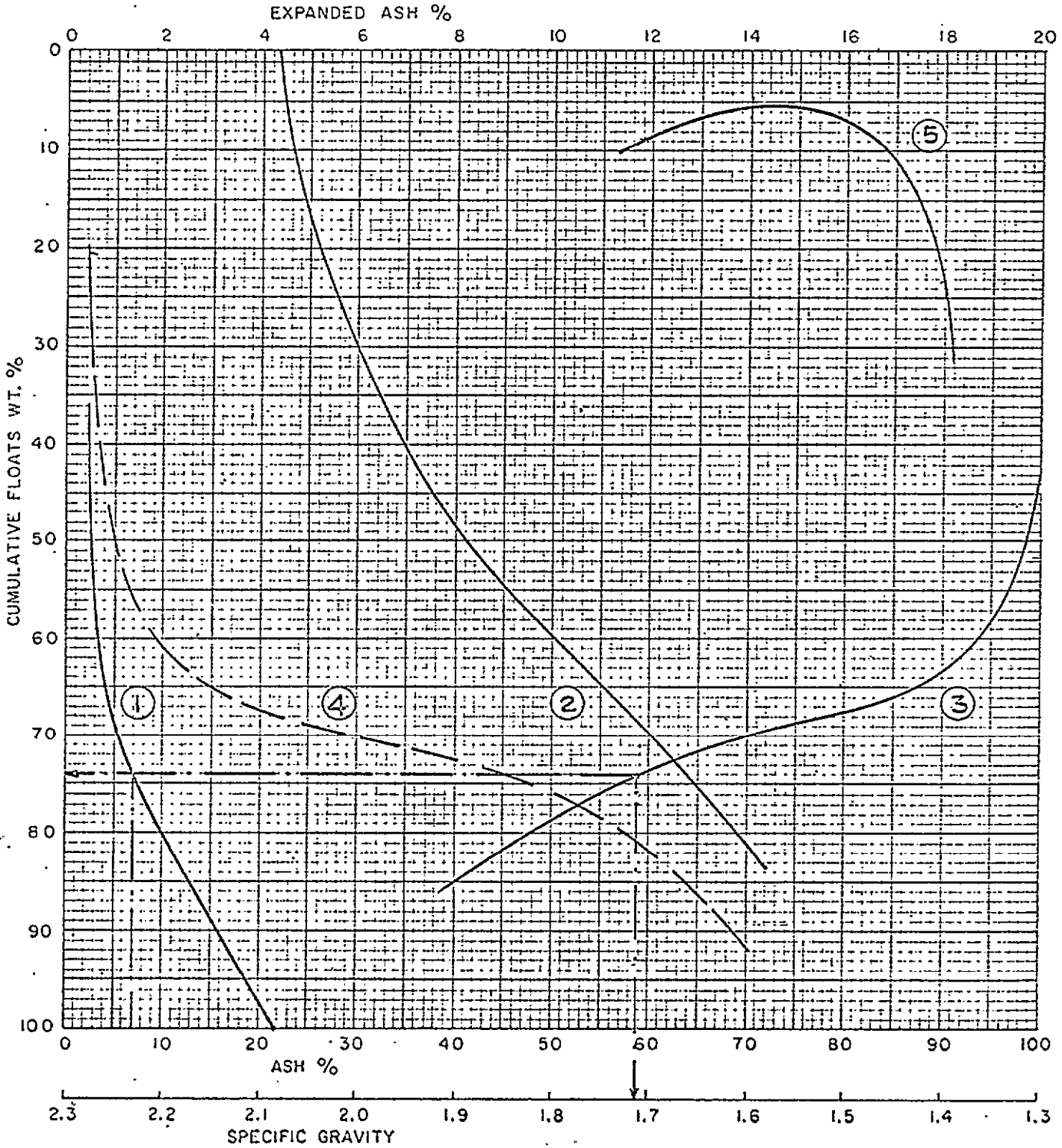
SAMPLE : ADIT F6

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

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EDMONTON ALBERTA CANADA

FIGURE : 1a

COMPANY : DENISON MINES LTD.

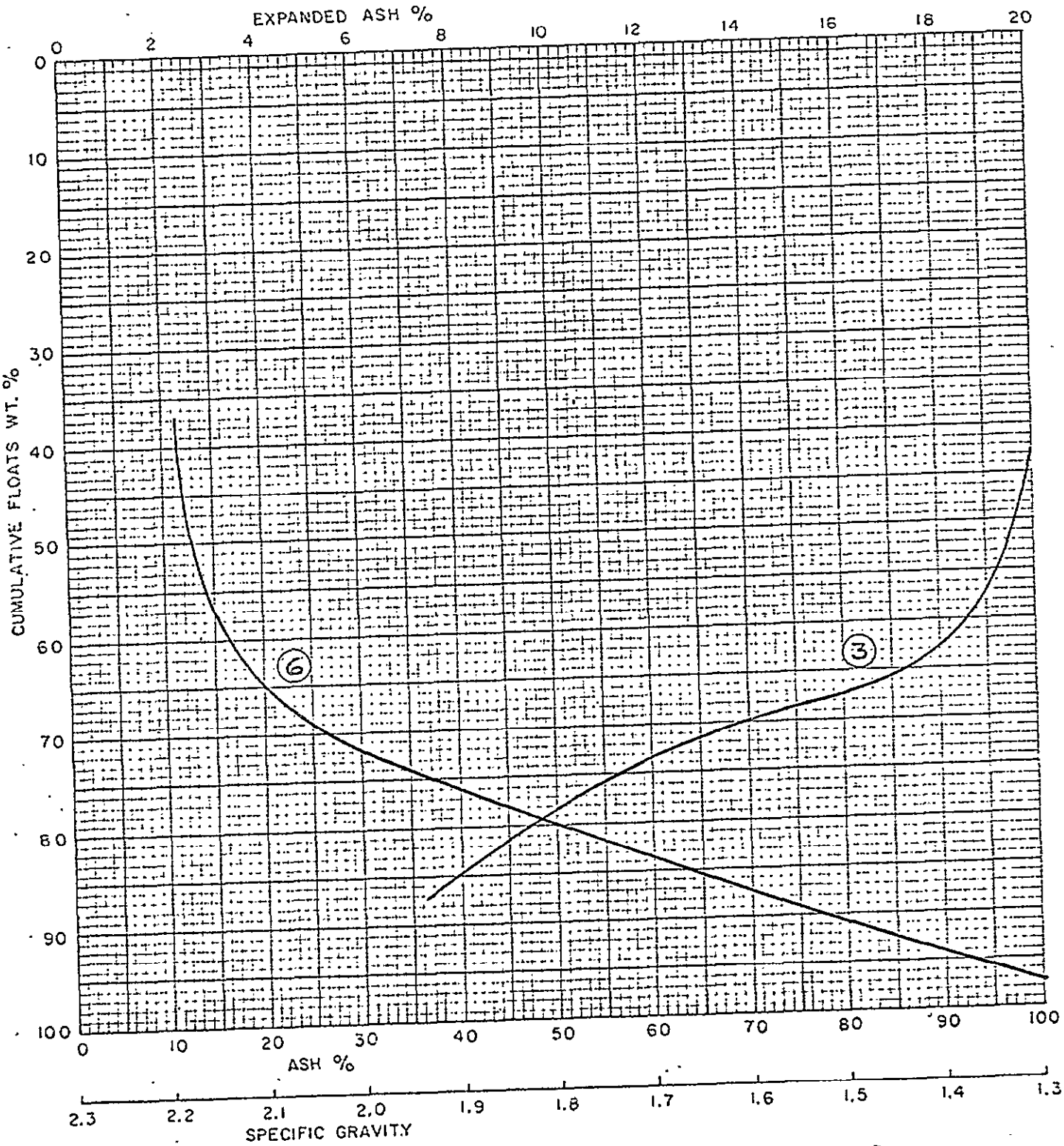
SAMPLE : ADIT F6

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 7: Adit F6

Cumulative Volatile Matter: + 100 m. - 96.12% of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt. %	V.M.%	Wt.%	V.M.%	Wt. %	V.M.%
- 1.30	42.87	25.60	42.87	25.60	100.00	20.36
1.30 - 1.35	14.50	22.33	57.37	24.77	57.13	16.43
1.35 - 1.40	5.48	20.54	62.85	24.40	42.63	14.43
1.40 - 1.45	3.07	20.12	65.92	24.20	37.15	13.53
1.45 - 1.50	1.50	19.52	67.42	24.10	34.08	12.93
1.50 - 1.60	2.20	18.15	69.62	23.91	32.58	12.63
1.60 - 1.70	3.89	15.74	73.51	23.48	30.38	12.23
1.70 - 1.80	4.89	14.25	78.40	22.90	26.49	11.71
+ 1.80	21.60	11.14	100.00	20.36	21.60	11.14
Total	100.00	20.36				

TABLE 8: Adit F6

7% Ash of Clean Coal

Yield	74.00%
Floats Gravity	1.71
Near Gravity Material	9.00%
Ash	7.00%
Volatile Matter	23.40%
Residual Moisture	0.87%
Fixed Carbon	68.73%
F.S.I.	7

TABLE 9. Adit F6

Ash, Volatile Matter & Cumulative F.S.I.

+ 2": 10.64% of Sample

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	7.64	3.61	24.17	7.64	7½
1.30 - 1.35	8.92	5.78	21.66	16.56	7
1.35 - 1.40	2.61	10.35	20.95	19.17	6½
1.40 - 1.45	1.82	14.01	20.17	20.99	6
1.45 - 1.50	0.72	22.89	19.63	21.71	5
1.50 - 1.60	1.13	28.68	17.65	22.84	5
1.60 - 1.70	2.98	38.56	15.46	25.82	4
1.70 - 1.80	3.86	45.21	14.51	29.68	3
+ 1.80	70.32	71.26	10.27	100.00	1
Total	100.00	54.81	13.28		

TABLE 10: Adit F6

Washbility Data: + 2 "

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	7.64	3.61	7.64	3.61	100.00	54.81	3.82	3.61
1.30 - 1.35	8.92	5.78	16.56	4.78	92.36	59.04	12.01	5.78
1.35 - 1.40	2.61	10.35	19.17	5.54	83.44	64.74	17.86	10.35
1.40 - 1.45	1.82	14.01	20.99	6.27	80.83	66.50	20.08	14.01
1.45 - 1.50	0.72	22.89	21.71	6.82	79.01	67.70	21.35	22.89
1.50 - 1.60	1.13	28.68	22.84	7.90	78.29	68.12	22.27	28.68
1.60 - 1.70	2.98	38.56	25.82	11.44	77.16	68.69	24.33	38.56
1.70 - 1.80	3.86	45.21	29.68	15.83	74.18	69.90	27.75	45.21
+ 1.80	70.32	71.26	100.00	54.81	70.32	71.26	64.84	71.26
Total	100.00	54.81						

FIGURE : 2

COMPANY : DENISON MINES LTD.

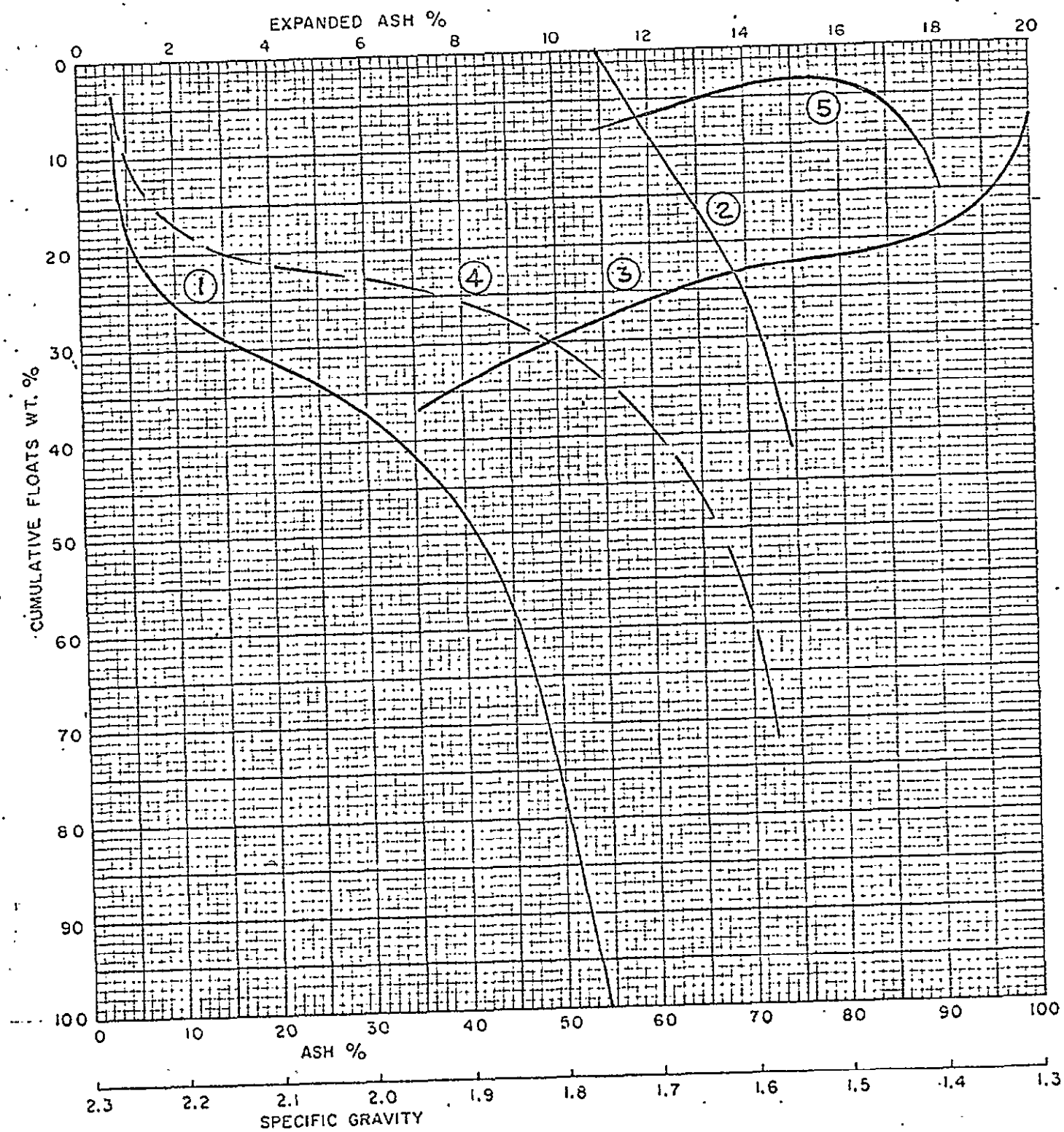
SAMPLE : ADIT F6

SIZE : + 2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 2a

COMPANY : DENISON MINES LTD.

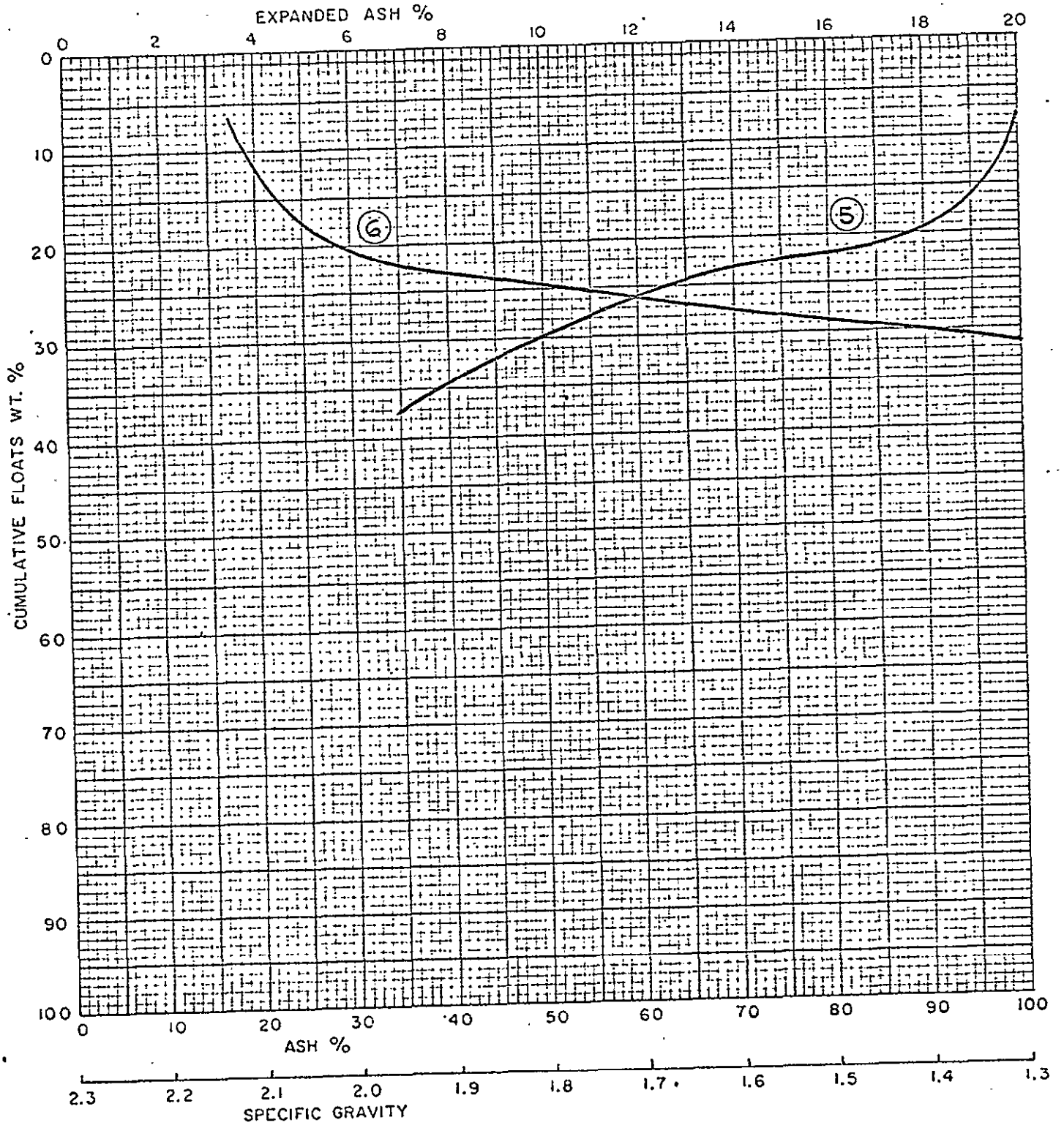
SAMPLE : ADIT F6

SIZE : + 2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 11: Adit F6

2" x 1": 7.49% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	15.44	3.50	24.03	15.44	7½
1.30 - 1.35	19.81	5.62	21.91	35.25	7
1.35 - 1.40	5.82	10.74	20.85	41.07	6½
1.40 - 1.45	4.27	13.62	20.43	45.34	6
1.45 - 1.50	1.72	23.46	19.77	47.06	5½
1.50 - 1.60	2.57	27.17	17.86	49.63	5
1.60 - 1.70	6.64	37.97	15.56	56.27	4
1.70 - 1.80	8.84	44.72	13.22	65.11	3
+ 1.80	34.89	69.89	11.31	100.00	1½
Total	100.00	34.82	17.08		

TABLE 12: Adit F6

Washbility Data: 2" x 1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	15.44	3.50	15.44	3.50	100.00	34.82	7.72	3.50
1.30 - 1.35	19.81	5.62	35.25	4.69	84.56	40.54	24.84	5.62
1.35 - 1.40	5.82	10.74	41.07	5.55	64.75	51.22	38.16	10.74
1.40 -1.45	4.27	13.62	45.34	6.31	58.93	55.22	43.20	13.62
1.45 - 1.50	1.72	23.46	47.06	6.94	54.66	58.47	46.20	23.46
1.50 - 1.60	2.57	27.17	49.63	7.98	52.94	59.61	48.34	27.17
1.60 - 1.70	6.64	37.97	56.27	11.52	50.37	61.26	52.95	37.97
1.70 - 1.80	8.84	44.72	65.11	16.02	43.73	64.81	60.69	44.72
+ 1.80	34.89	69.89	100.00	34.82	34.89	69.89	82.55	69.89
Total	100.00	34.82						

FIGURE : 3

COMPANY : DENISON MINES LTD.

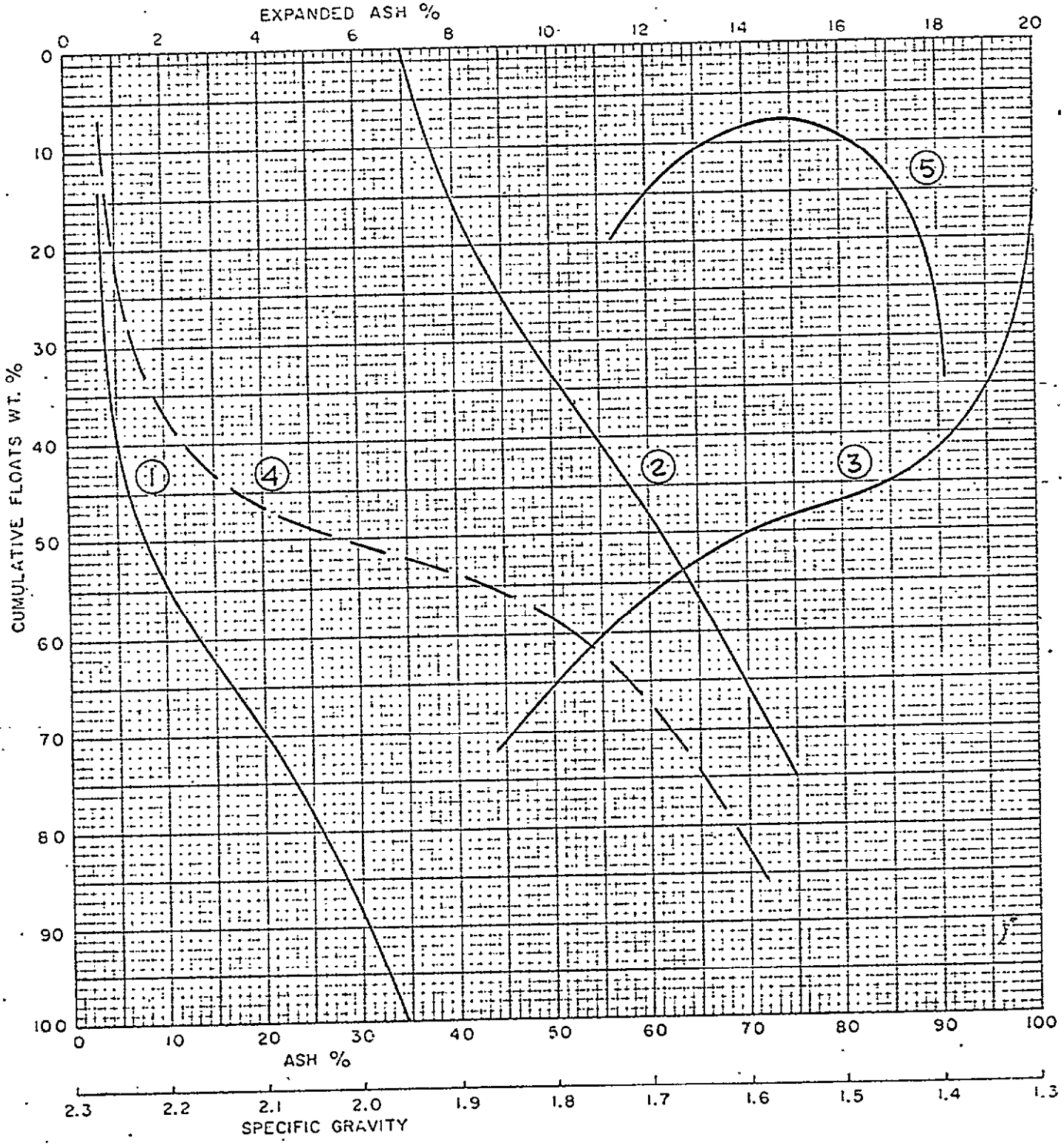
SAMPLE : ADIT F6

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : February 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 3a

COMPANY : DENISON MINES LTD.

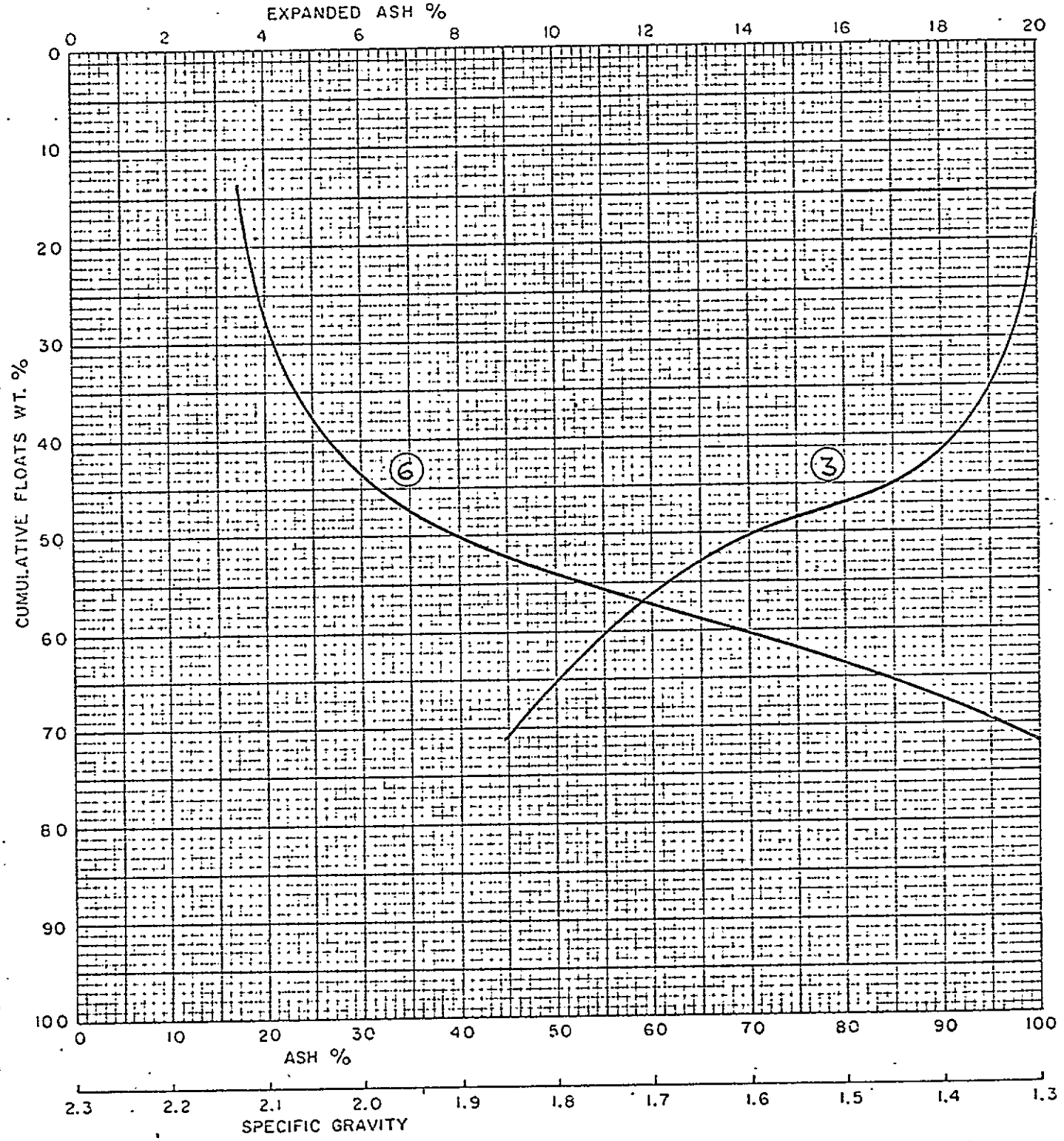
SAMPLE : ADIT F6

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : February 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 13: Adit F6

1" x 1/2": 14.26% of Sample

Ash, Volatile Matter, & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	16.78	2.94	24.22	16.78	8
1.30 - 1.35	21.93	4.79	22.08	38.71	7½
1.35 - 1.40	6.22	9.28	21.39	44.93	6½
1.40 - 1.45	4.80	12.93	21.07	49.73	6
1.45 - 1.50	1.83	23.34	20.06	51.56	5½
1.50 - 1.60	2.83	26.36	18.23	54.39	5
1.60 - 1.70	7.28	38.24	15.91	61.67	4
1.70 - 1.80	9.94	44.80	14.62	71.61	3½
+ 1.80	28.39	60.96	12.38	100.00	2
Total	100.00	28.46	18.25		

TABLE 14: Adit F6

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	16.78	2.94	16.78	2.94	100.00	28.46	8.39	2.94
1.30 - 1.35	21.93	4.79	38.71	3.99	83.22	33.60	27.74	4.79
1.35 - 1.40	6.22	9.28	44.93	4.72	61.29	43.91	41.82	9.28
1.40 - 1.45	4.80	12.93	49.73	5.51	55.07	47.83	47.33	12.93
1.45 - 1.50	1.83	23.34	51.56	6.15	50.27	51.16	50.65	23.34
1.50 - 1.60	2.83	26.36	54.39	7.20	48.44	52.21	52.97	26.36
1.60 - 1.70	7.28	38.24	61.67	10.86	45.61	53.81	58.03	38.24
1.70 - 1.80	9.94	44.80	71.61	15.57	38.33	56.77	66.64	44.80
+ 1.80	28.39	60.96	100.00	28.46	28.39	60.96	85.80	60.96
Total	100.00	28.46						

FIGURE : 4

COMPANY : DENISON MINES LTD.

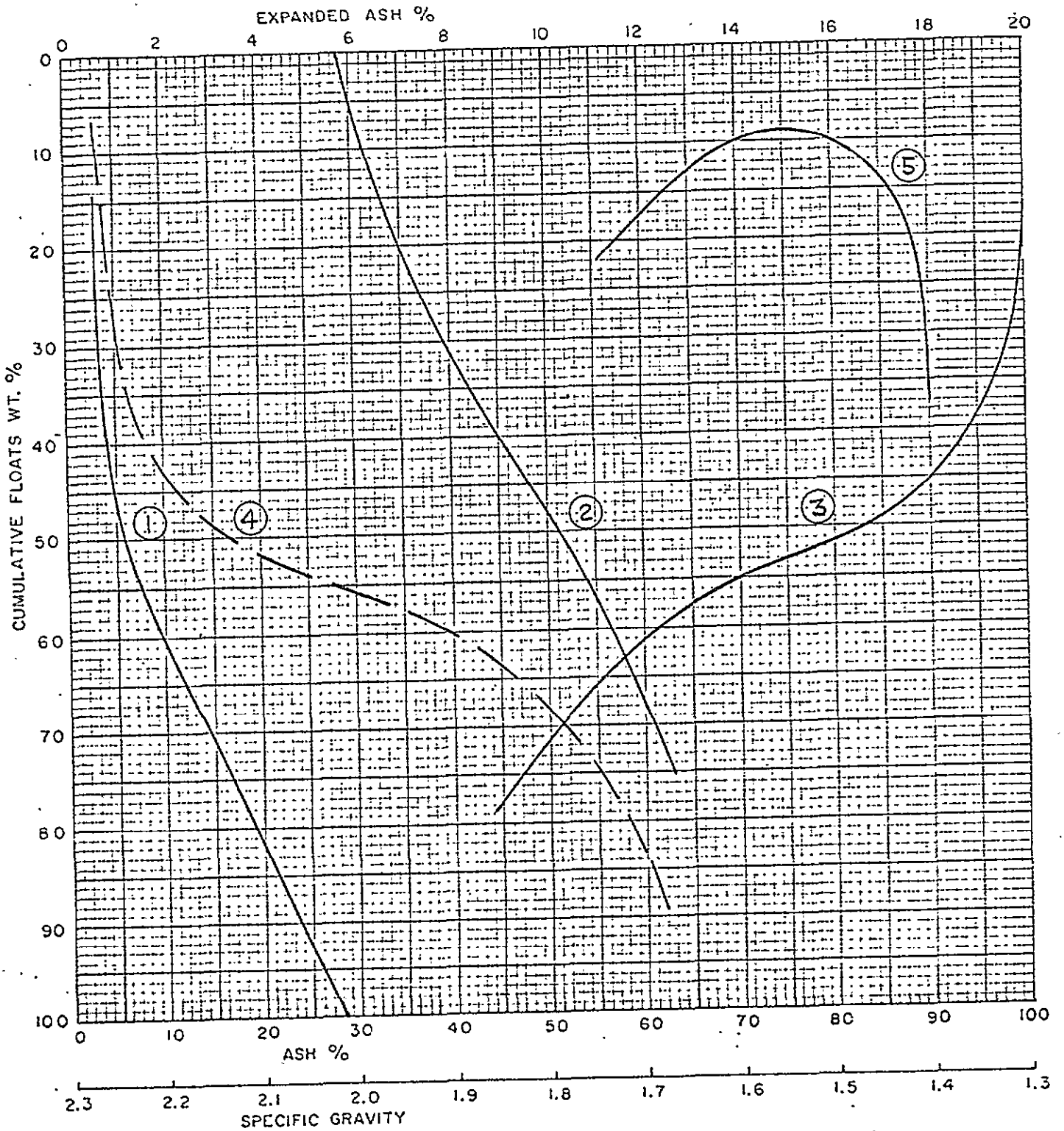
SAMPLE : ADIT F6

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 4a

COMPANY : DENISON MINES LTD.

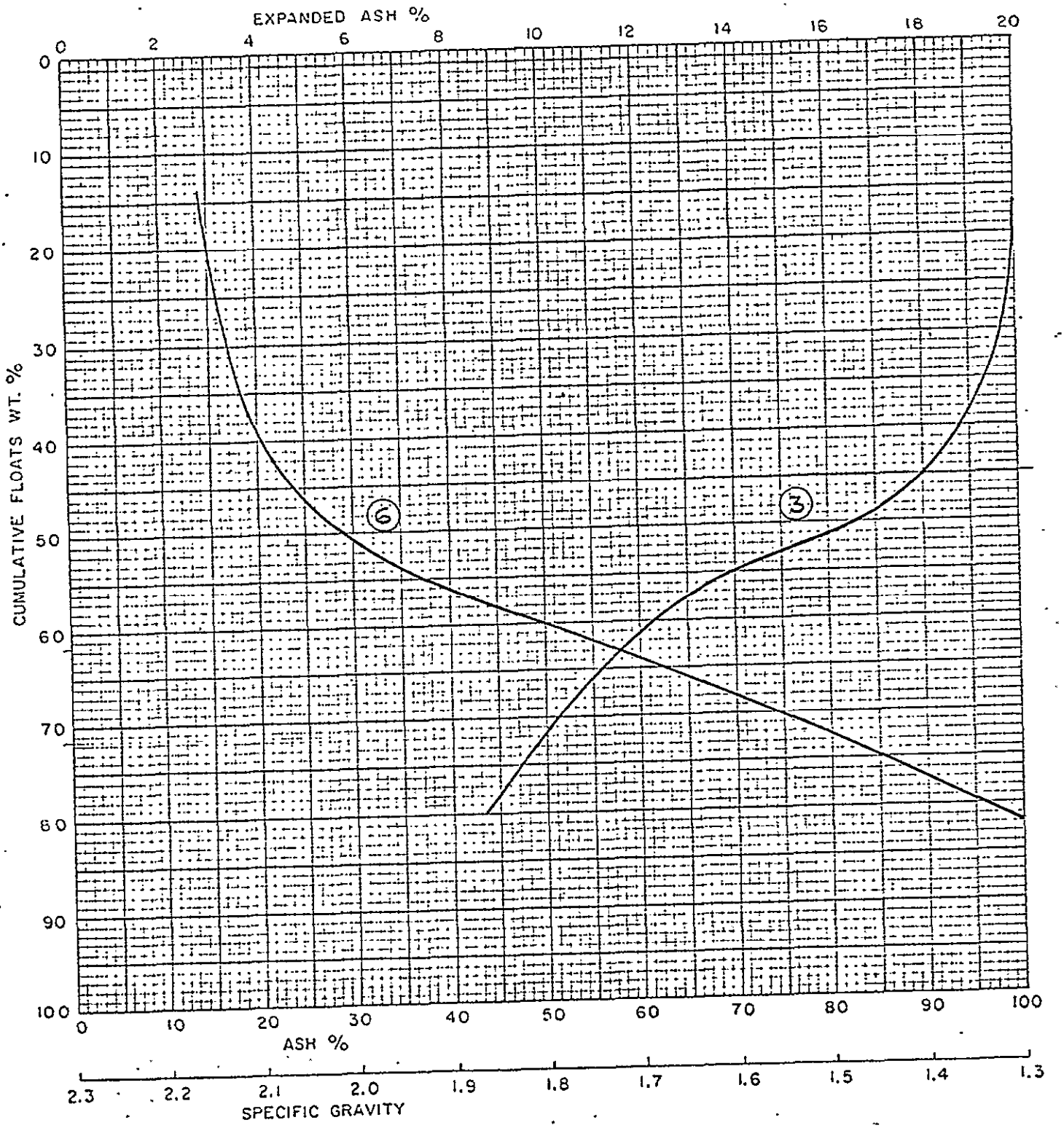
SAMPLE : ADIT F6

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 15: Adit F6

1/2" x 1/4": 12.03% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	38.53	3.53	24.81	38.53	8
1.30 - 1.35	11.29	5.28	22.67	49.82	7½
1.35 - 1.40	5.96	9.71	20.97	55.78	7
1.40 - 1.45	4.43	13.07	20.04	60.21	7
1.45 - 1.50	2.51	22.59	19.85	62.72	6½
1.50 - 1.60	3.62	26.17	19.04	66.34	6
1.60 - 1.70	7.07	36.11	15.77	73.41	5
1.70 - 1.80	7.73	43.17	13.94	81.14	4½
± 1.80	18.86	69.36	11.11	100.00	3
Total	100.00	23.60	19.73		

TABLE 16: Adit F6

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	38.53	3.53	38.53	3.53	100.00	23.60	19.26	3.53
1.30 - 1.35	11.29	5.28	49.82	3.93	61.47	36.18	44.17	5.28
1.35 - 1.40	5.96	9.71	55.78	4.54	50.18	43.13	52.80	9.71
1.40 - 1.45	4.43	13.07	60.21	5.17	44.22	47.64	57.99	13.07
1.45 - 1.50	2.51	22.59	62.72	5.87	39.79	51.48	61.46	22.59
1.50 - 1.60	3.62	26.17	66.34	6.98	37.28	53.43	64.53	26.17
1.60 - 1.70	7.07	36.11	73.41	9.78	33.66	56.36	69.87	36.11
1.70 - 1.80	7.73	43.17	81.14	12.96	26.59	61.75	77.27	43.17
+ 1.80	18.86	69.36	100.00	23.60	18.86	69.36	90.57	69.36
Total	100.00	23.60						

FIGURE: 5

COMPANY : DENISON MINES LTD.

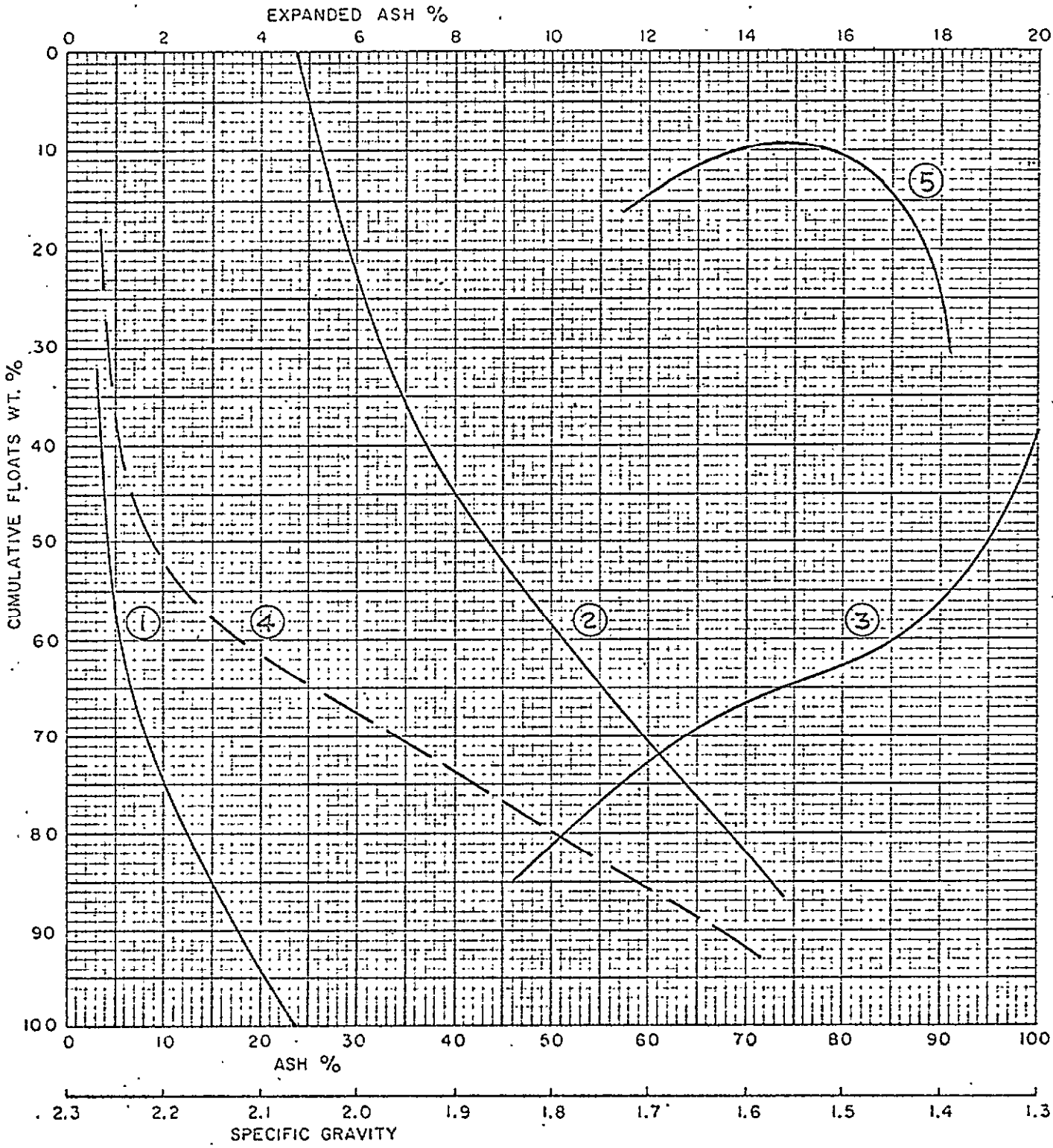
SAMPLE : ADIT F6

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5a

COMPANY : DENISON MINES LTD.

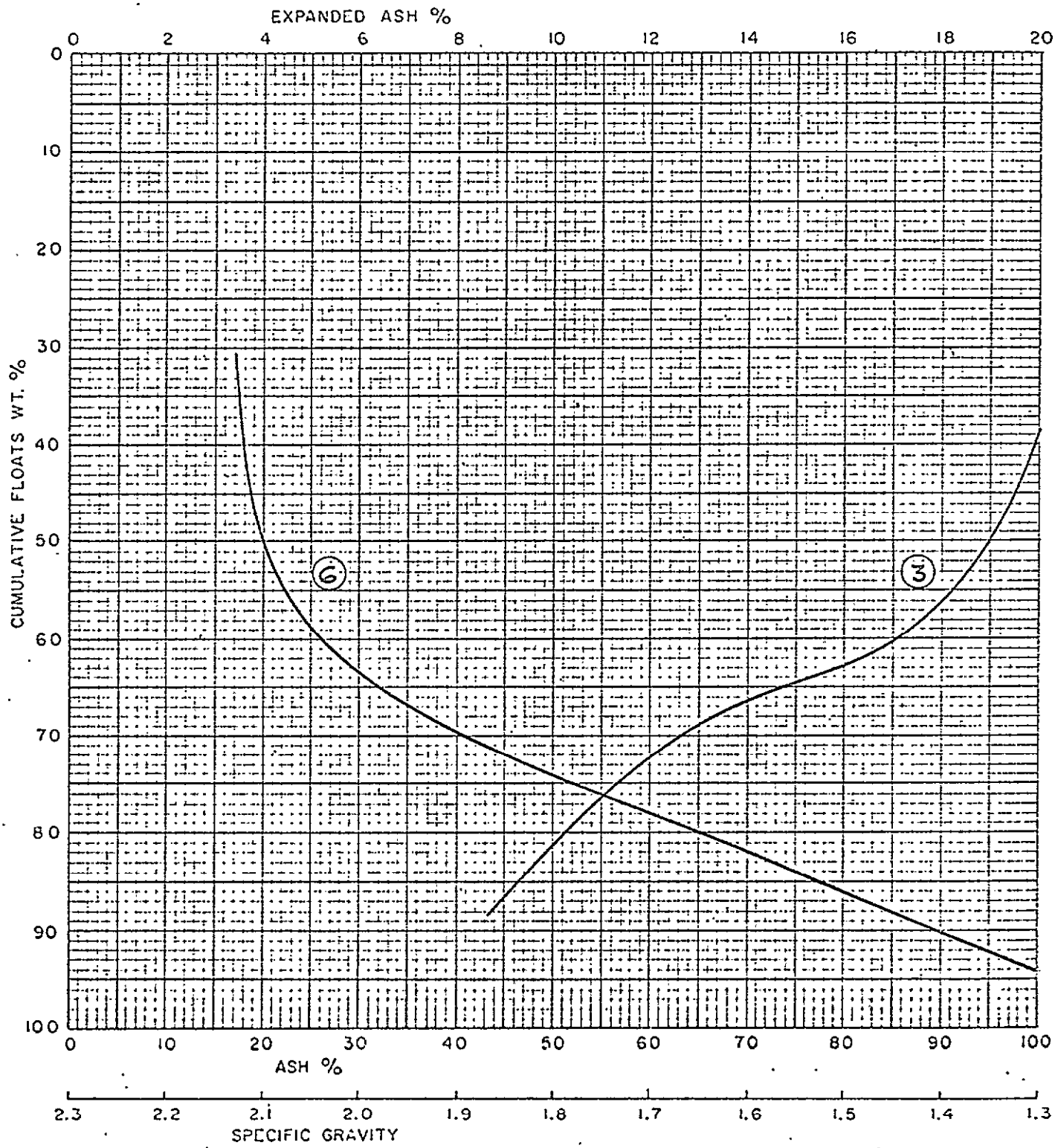
SAMPLE : ADIT F6

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.

TABLE 17: Adit F6

1/4" x 8 m.: 13.78% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	F.S.I. Cum.
- 1.30	45.22	2.42	25.51	45.22	9+
1.30 - 1.35	16.32	5.77	22.42	61.54	9
1.35 - 1.40	7.06	8.89	20.24	68.60	9
1.40 - 1.45	2.68	13.24	19.97	71.28	8½
1.45 - 1.50	1.72	21.72	19.63	73.00	8½
1.50 - 1.60	2.86	25.98	18.06	75.86	8
1.60 - 1.70	3.59	34.72	15.61	79.45	8
1.70 - 1.80	4.78	42.19	14.16	84.23	8
+ 1.80	15.77	69.77	11.12	100.00	5
Total	100.00	18.40	21.00		

TABLE 18: Adit F6

Washability Data: 1/4" x 8 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	45.22	2.42	45.22	2.42	100.00	18.40	22.61	2.42
1.30 - 1.35	16.32	5.77	61.54	3.31	54.78	31.59	53.38	5.77
1.35 - 1.40	7.06	8.89	68.60	3.88	38.46	42.55	65.07	8.89
1.40 - 1.45	2.68	13.24	71.28	4.23	31.40	50.12	69.94	13.24
1.45 - 1.50	1.72	21.72	73.00	4.65	28.72	53.56	72.14	21.72
1.50 - 1.60	2.86	25.98	75.86	5.45	27.00	55.59	74.43	25.98
1.60 - 1.70	3.59	34.72	79.45	6.77	24.14	59.10	77.65	34.72
1.70 - 1.80	4.78	42.19	84.23	8.78	20.55	63.35	81.84	42.19
+ 1.80	15.77	69.77	100.00	18.40	15.77	69.77	92.06	69.77
Total	100.00	18.40						

FIGURE : 6

COMPANY : DENISON MINES LTD.

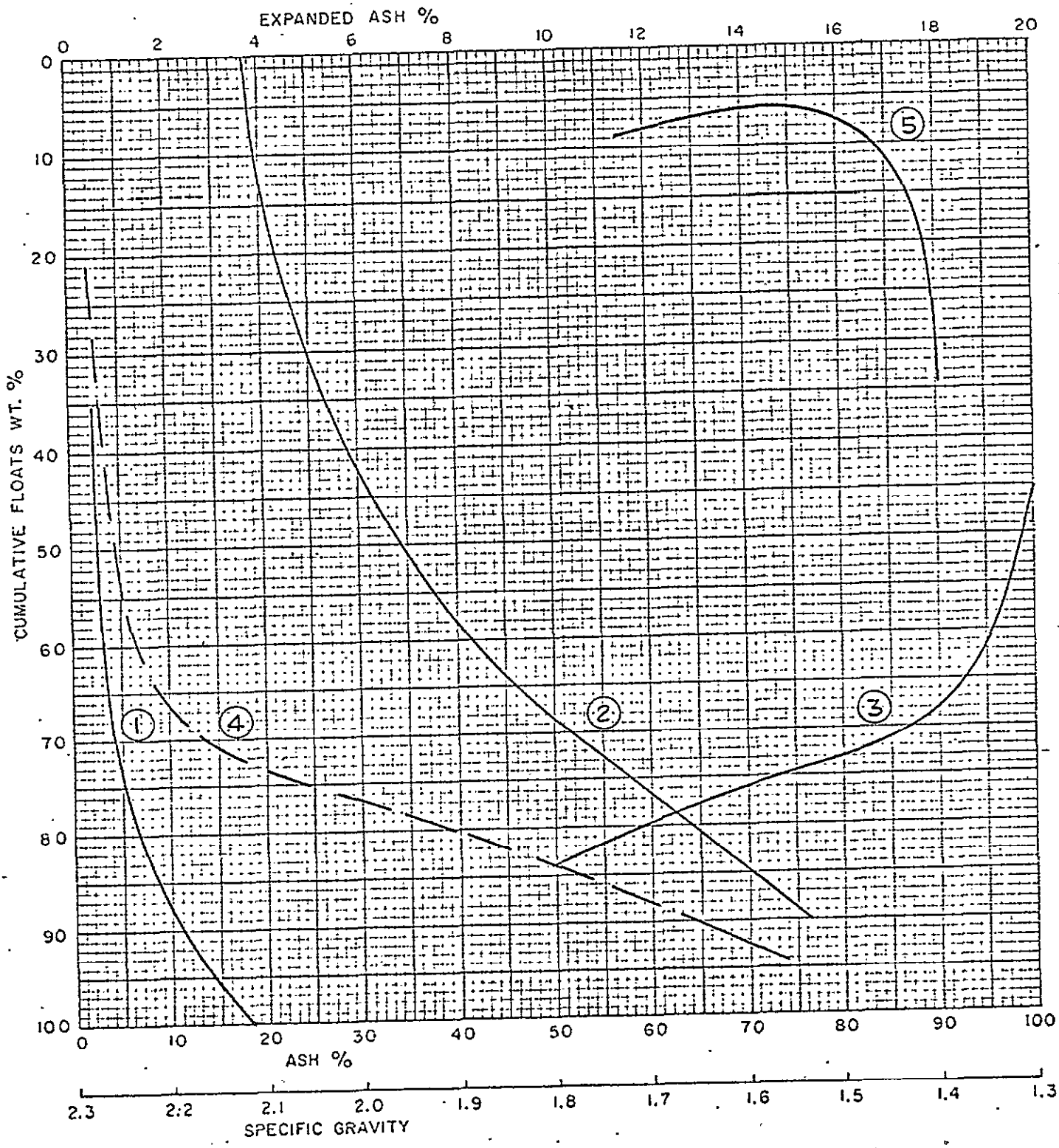
SAMPLE : ADIT F6

SIZE : 1/4" x 8 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 6 a

COMPANY : DENISON MINES LTD.

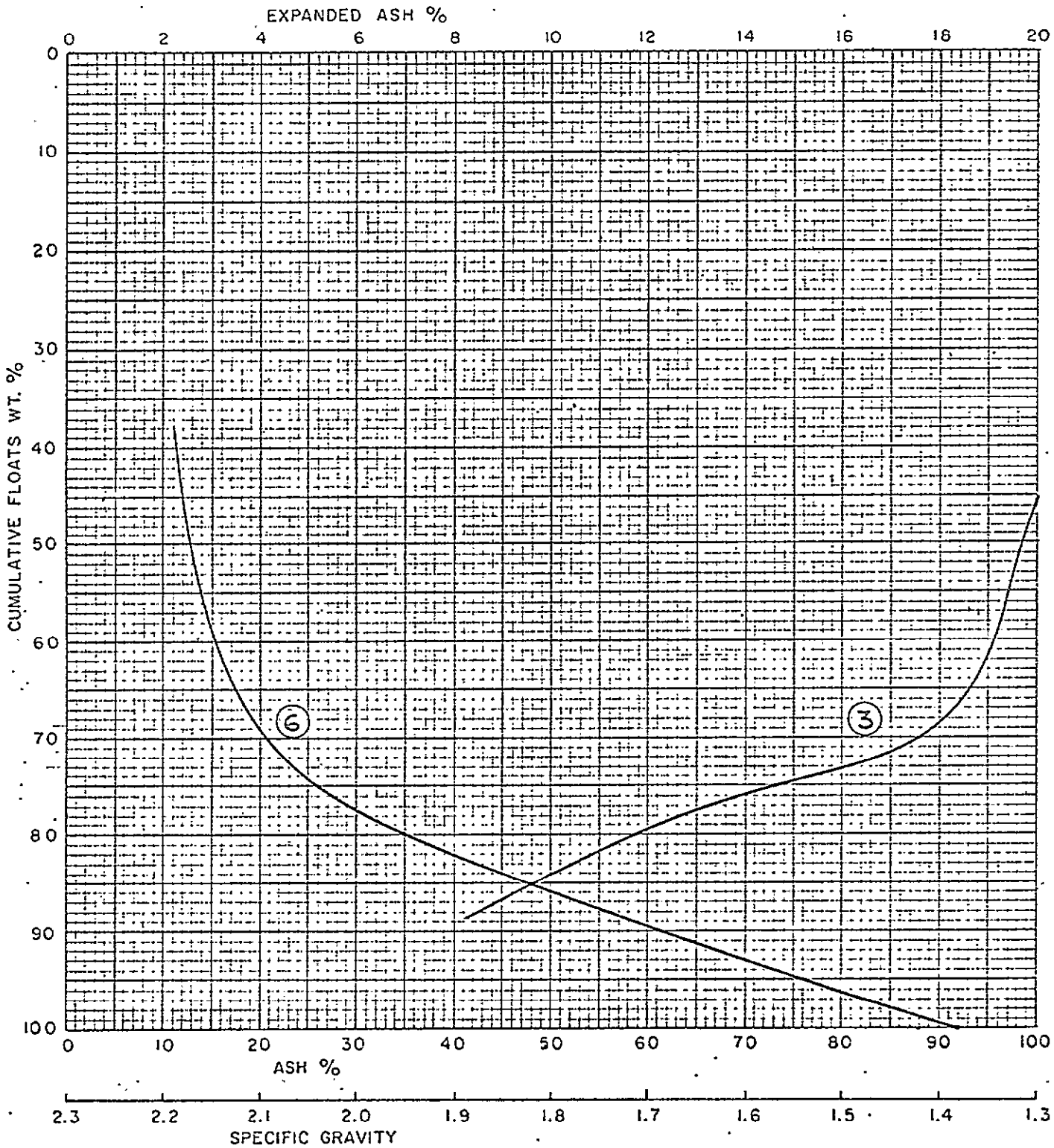
SAMPLE : ADIT F6

SIZE : 1/4" x 8 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

TABLE 19: Adit F6

8 x 28 m.: 24.75% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	70.54	2.15	25.76	70.54	9+
1.30 - 1.35	10.56	5.32	21.80	81.10	9+
1.35 - 1.40	4.68	9.37	19.88	85.78	9
1.40 - 1.45	2.02	13.23	18.97	87.80	9
1.45 - 1.50	1.12	19.26	18.81	88.92	9
1.50 - 1.60	1.48	25.99	17.58	90.40	9
1.60 - 1.70	1.51	35.10	15.78	91.91	8½
1.70 - 1.80	1.88	43.63	14.86	93.79	8½
+ 1.80	6.21	66.85	11.91	100.00	8
Total	100.00	8.89	23.51		

TABLE 20: Adit F6

Washability Data: 8 x 28 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	70.54	2.15	70.54	2.15	100.00	8.89	35.27	2.15
1.30 - 1.35	10.56	5.32	81.10	2.56	29.46	25.02	75.82	5.32
1.35 - 1.40	4.68	9.37	85.78	2.93	18.90	36.02	83.44	9.37
1.40 - 1.45	2.02	13.23	87.80	3.17	14.22	44.79	86.79	13.23
1.45 - 1.50	1.12	19.26	88.92	3.37	12.20	50.02	88.36	19.26
1.50 - 1.60	1.48	25.99	90.40	3.74	11.08	53.13	89.66	25.99
1.60 - 1.70	1.51	35.10	91.91	4.26	9.60	57.31	91.15	35.10
1.70 - 1.80	1.88	43.63	93.79	5.05	8.09	61.45	92.85	43.63
+ 1.80	6.21	66.85	100.00	8.89	6.21	66.85	96.89	66.85
Total	100.00	8.89						

FIGURE : 7

COMPANY : DENISON MINES LTD.

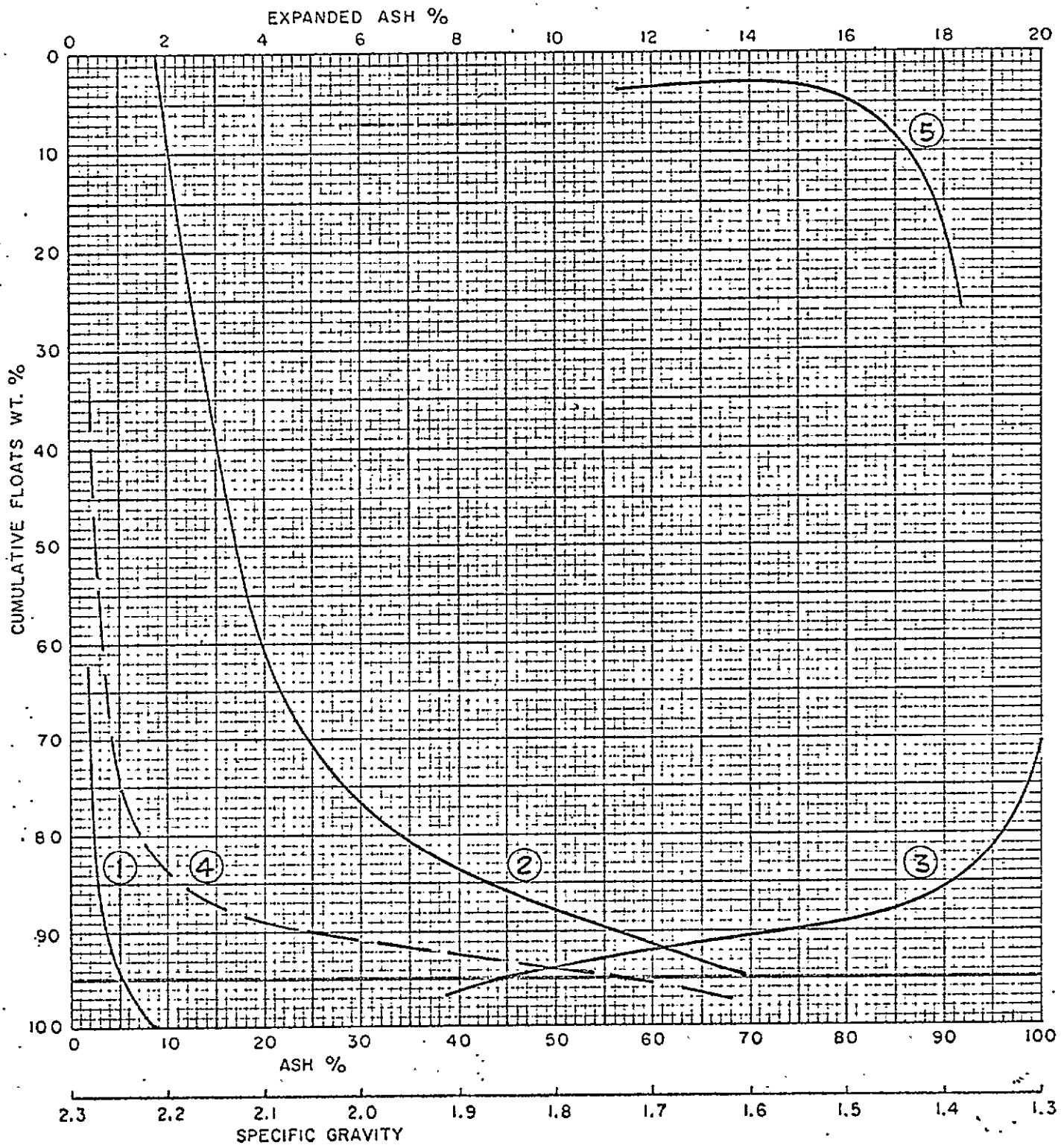
SAMPLE : ADIT F6

SIZE : 8 x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 7a

COMPANY : DENISON MINES LTD.

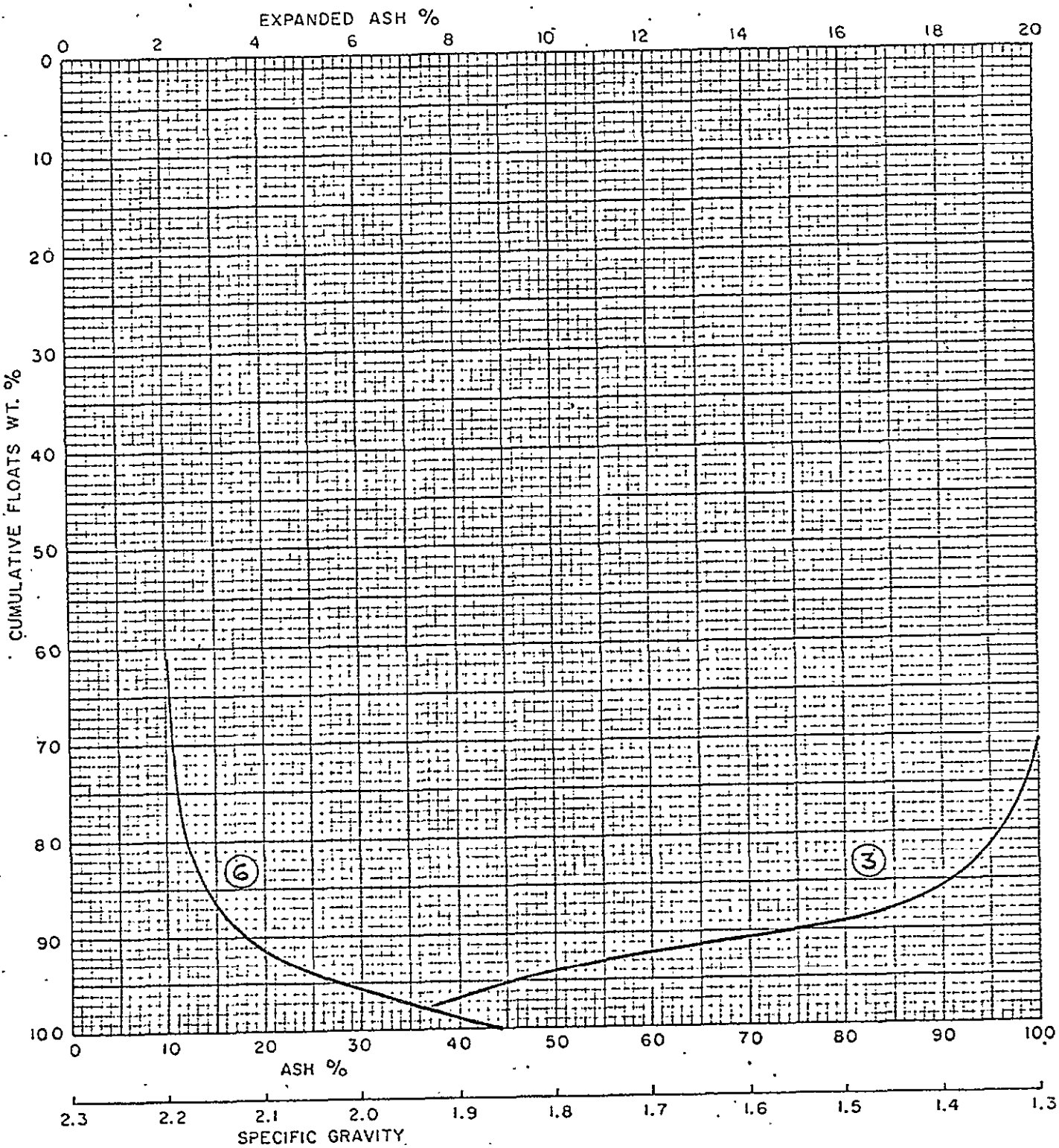
SAMPLE : ADIT F6

SIZE : 8 x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 21: Adit F6

28 x 100 m.: 13.17% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	64.63	1.65	26.51	64.63	9+
1.30 - 1.35	16.58	4.37	23.61	81.21	9+
1.35 - 1.40	6.12	8.47	20.22	87.33	9
1.40 - 1.45	2.73	10.21	19.87	90.06	9
1.45 - 1.50	1.11	17.54	18.79	91.17	9
1.50 - 1.60	1.52	23.10	17.89	92.69	9
1.60 - 1.70	1.27	32.90	15.91	93.96	8½
1.70 - 1.80	1.14	40.76	15.02	95.10	8½
+ 1.80	4.90	68.35	11.12	100.00	8
Total	100.00	7.37	24.22		

TABLE 22: Adit F6

Washability Data: 28 x 100 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	64.63	1.65	64.63	1.65	100.00	7.37	32.31	1.65
1.30 - 1.35	16.58	4.37	81.21	2.21	35.37	17.81	72.92	4.37
1.35 - 1.40	6.12	8.47	87.33	2.64	18.79	29.67	84.27	8.47
1.40 - 1.45	2.73	10.21	90.06	2.87	12.67	39.91	88.69	10.21
1.45 - 1.50	1.11	17.54	91.17	3.05	9.94	48.06	90.61	17.54
1.50 - 1.60	1.52	23.10	92.69	3.38	8.83	51.90	91.93	23.10
1.60 - 1.70	1.27	32.90	93.96	3.78	7.31	57.89	93.32	32.90
1.70 - 1.80	1.14	40.76	95.10	4.22	6.04	63.14	94.53	40.76
+ 1.80	4.90	68.35	100.00	7.37	4.90	68.35	97.55	68.35
Total	100.00	7.37						

FIGURE : 8

COMPANY : DENISON MINES LTD.

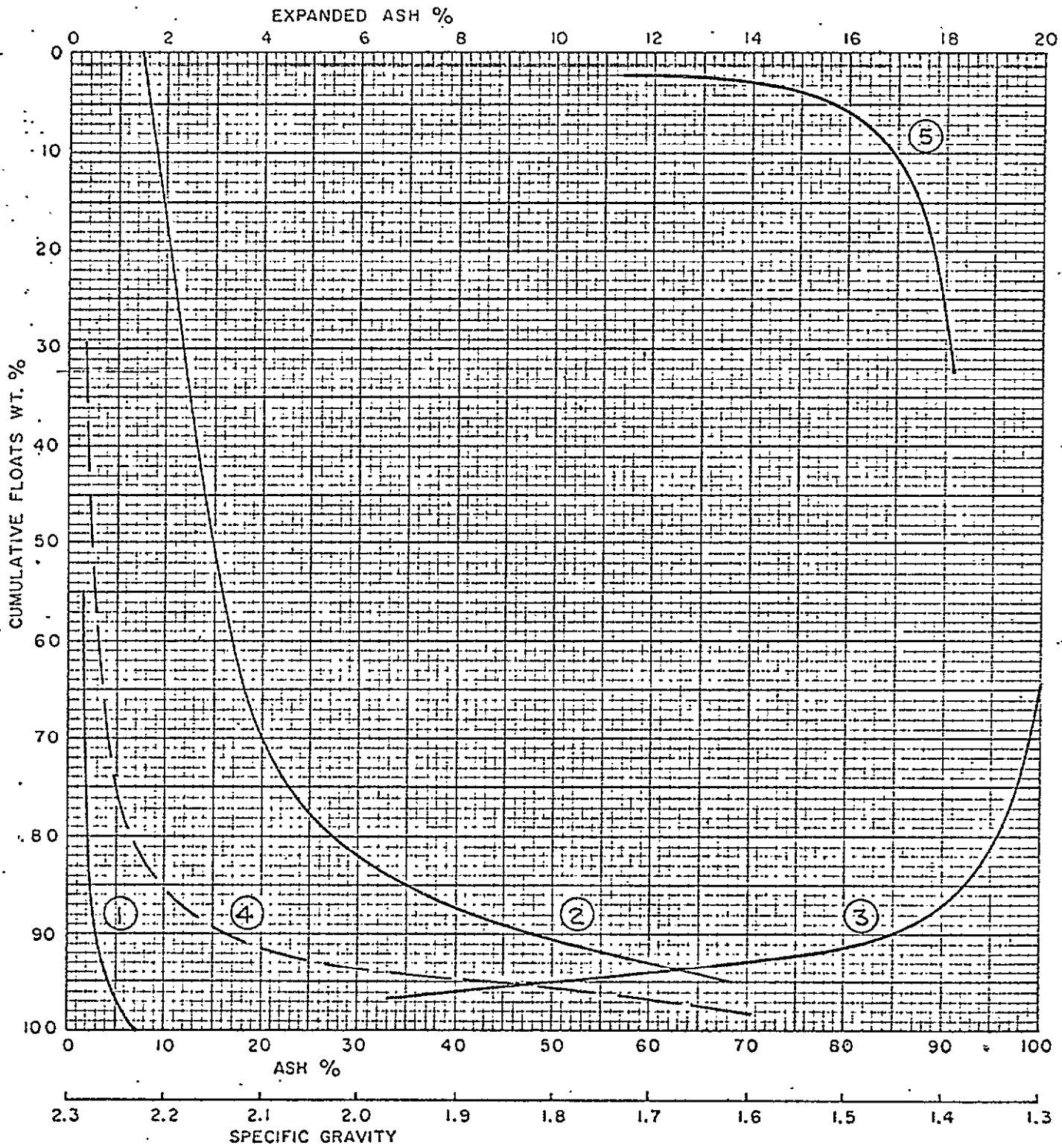
SAMPLE : ADIT F6

SIZE : 28 x 100 mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

FIGURE: 8a

COMPANY : DENISON MINES LTD.

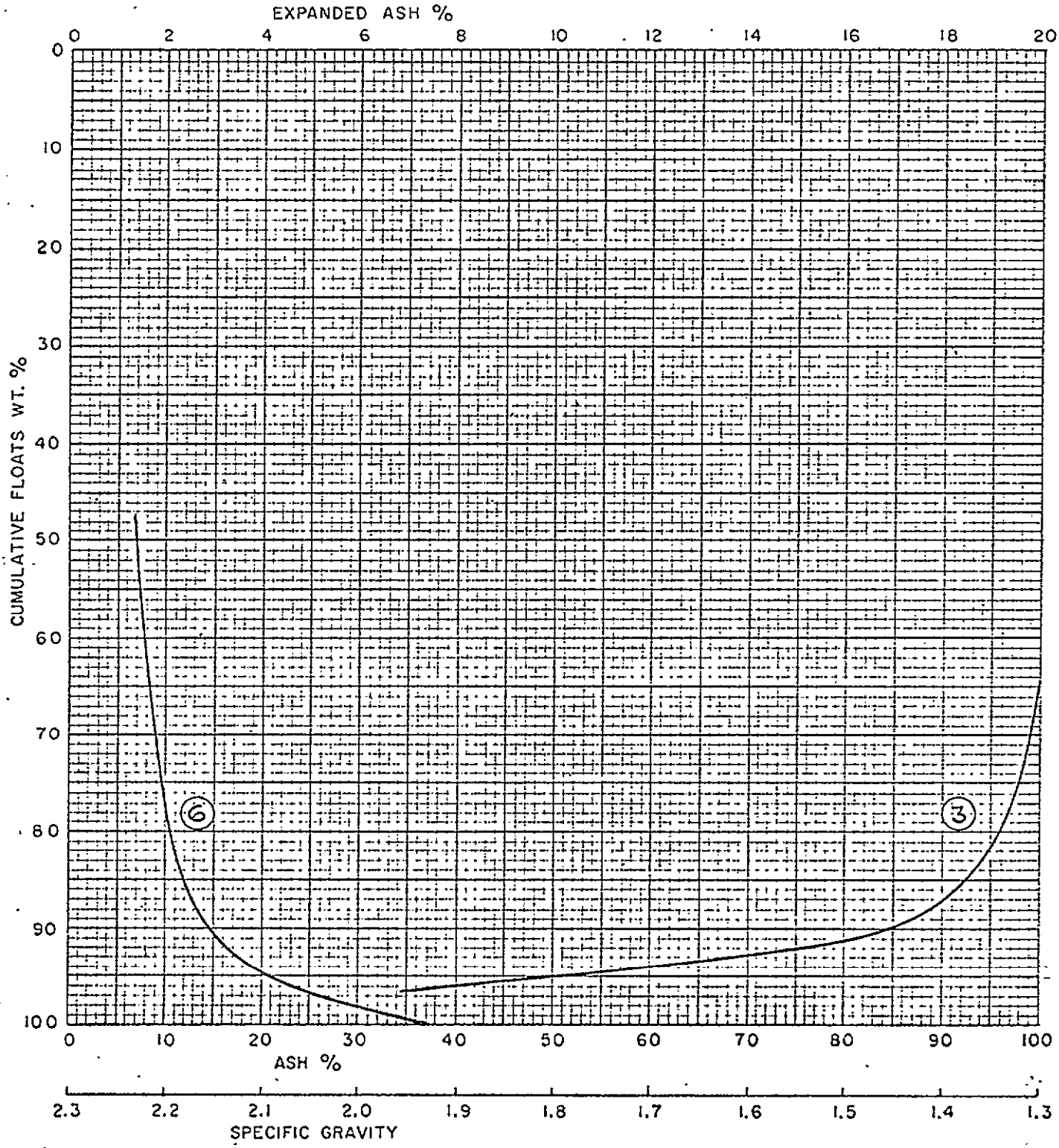
SAMPLE : ADIT F6

SIZE : 28 x 100 mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 19, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

TABLE 23: Adit F6

28 x 100 Mesh: 13.17% of the Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	62.34%
Reagents	MIBC % Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	2.79	16.75
Volatile Matter, %	25.78	20.96
Residual Moisture, %	1.02	0.87
Fixed Carbon, %	70.41	61.42
F.S.I.	9+	4½
Sulphur, %	0.38	0.58

TABLE 24: Adit F6

- 100 Mesh: 3.88% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	86.55%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	4.13	42.80
Volatile Matter, %	24.31	18.37
Residual Moisture, %	0.99	0.57
Fixed Carbon, %	70.57	38.26
F.S.I.	8½	N.A.
Sulphur, %	0.50	1.45

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT #F6

Submitted by,

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.22

Job No.: S1-84

Date: May 18, 1972.

REPORT ON
WASHABILITY CHARACTERISTICS AND CLEANING
OF COKING COAL FOR
DENISON MINES LTD.
ADIT #F6

SUMMARY:

The data presented in this report refer to washability characteristics and the washing of a five ton sample from Adit #F6.

The coal was cleaned in a two-stage compound water cyclone circuit.

A yield of 64% was obtained.

The analysis of Clean Coal is as follows.

	Air Dried Basis.	As Shipped basis.
Surface Moisture, %	-	6.00
Residual Moisture, %	0.89	0.84
Ash, %	5.80	5.45
Volatile Matter, %	25.05	23.55
Fixed Carbon, %	68.26	64.16
F.S.I.	7½	7½
B.T.U./lb.	14,700	13,820
Sulphur, %	0.37	0.35

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studies and production of clean coal.

The coal was sir dried, crushed to - 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in Figure 1, Section 2 of this report.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

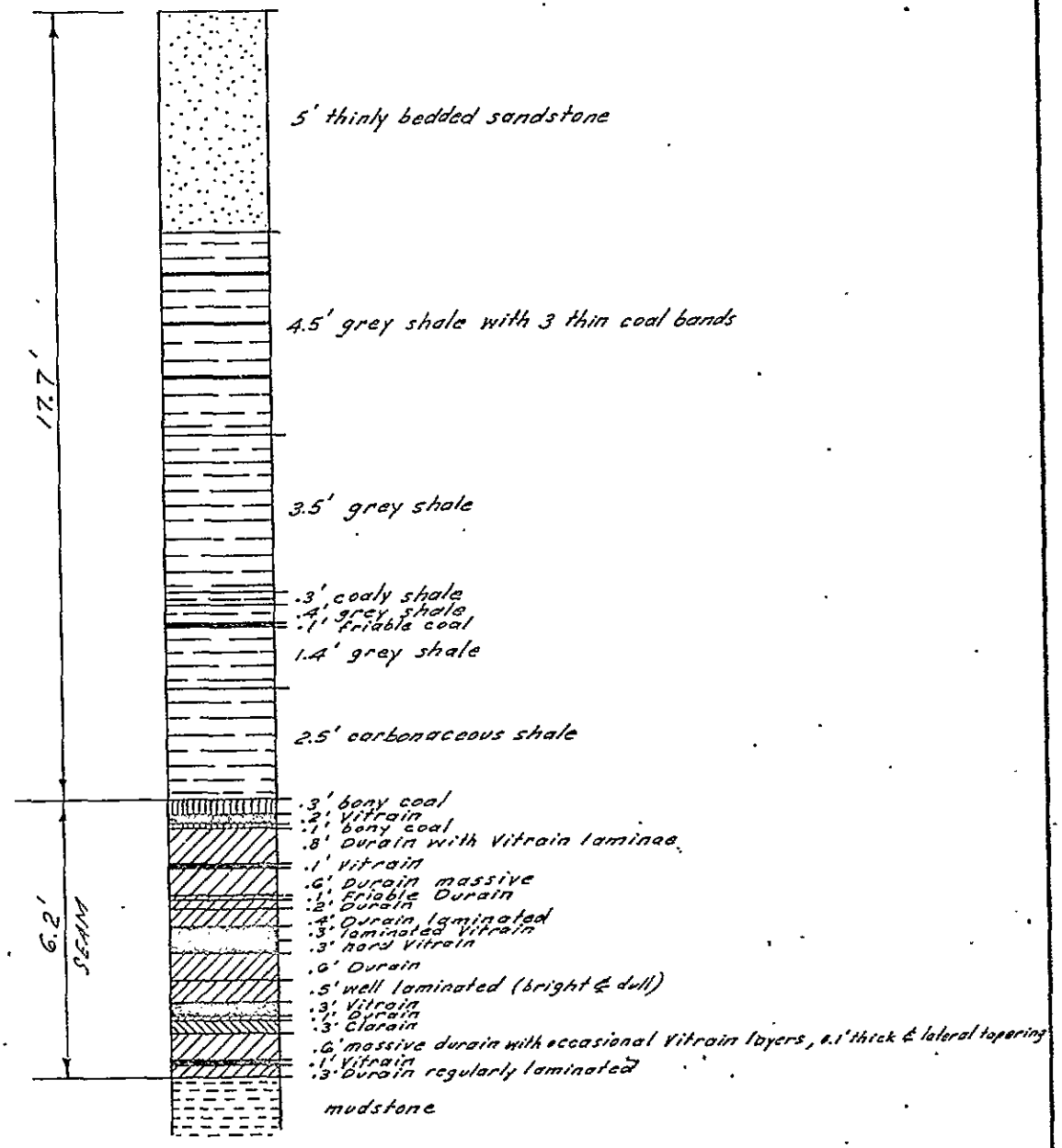
Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.

SECTION 1

WASHABILITY DATA & FLOTATION TESTS

ADIT #F6



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM "F"
ADIT No 6

DRAWN BY E.Toth	DATE Dec '71	SCALE 1" = 4'
APPROVED BY	DRAWING NO QNTT 71-0258-R101	

TABLE 1 - ADIT #F6

Head Sample Analysis

Ash	22.67%
Volatile Matter	20.44%
Residual Moisture	0.88%
Fixed Carbon	56.01%
F.S.I.	5½
B.T.U./lb.	11,760
Sulphur	0.34%

TABLE 2 - ADIT #F6

Size Analysis

	Weight %
3/4" x 28 Mesh	79.93
-28 Mesh	20.07
Total	100.00

TABLE 3: ADIT #F6

Incremental Float-Sink Analysis of 3/4" x 28 Mesh

Specific Gravity	Wt.%	Ash%	V.M.%	R.M.%	F.C.%
- 1.30	33.51	2.33	24.89	0.84	71.94
1.30 - 1.35	18.22	4.77	22.01	0.82	72.40
1.35 - 1.40	6.33	8.98	20.55	0.79	69.68
1.40 - 1.45	3.04	13.45	19.88	0.79	65.88
1.45 - 1.50	1.35	19.95	19.25	0.80	60.00
1.50 - 1.60	2.05	25.93	18.67	0.81	54.59
1.60 - 1.70	4.03	36.86	15.24	0.78	47.12
1.70 - 1.80	7.08	45.92	13.81	0.82	39.45
+ 1.80	24.43	71.20	11.36	0.83	16.61
Total	100.00	25.54	19.26	0.82	54.38

TABLE 4 - ADIT #F6

Cumulative Float-Sink Analysis of 3/4" x 28 M.

Specific Gravity	Wt.%	Ash %	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	33.51	2.33	24.89	0.84	71.94	9+
- 1.35	51.73	3.19	23.88	0.83	72.10	9
- 1.40	58.06	3.82	23.51	0.83	71.84	8½
- 1.45	61.10	4.30	23.33	0.83	71.54	8½
- 1.50	62.45	4.64	23.24	0.83	71.29	8½
- 1.60	64.50	5.31	23.10	0.83	70.76	8
- 1.70	68.53	7.17	22.64	0.82	69.37	7½
- 1.80	75.61	10.80	21.81	0.82	66.57	7
Total	100.00	25.54	19.26	0.82	54.38	5

TABLE 5 - ADIT #F6

Washability Data for 3/4" x 28 Mesh

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %	Wt.%	Ash %
- 1.30	33.51	2.33	33.51	2.33	100.00	25.54	16.75	2.33
1.30 - 1.35	18.22	4.77	51.73	3.19	66.53	37.24	42.62	4.77
1.35 - 1.40	6.33	8.98	58.06	3.82	48.31	49.49	54.90	8.98
1.40 - 1.45	3.04	13.45	61.10	4.30	41.98	55.60	59.58	13.45
1.45 - 1.50	1.35	19.95	62.45	4.64	38.94	58.89	61.77	19.95
1.50 - 1.60	2.05	25.93	64.50	5.31	37.59	60.29	63.48	25.93
1.60 - 1.70	4.03	36.86	68.53	7.17	35.54	62.30	66.51	36.86
1.70 - 1.80	7.08	45.92	75.61	10.80	31.51	65.52	72.07	45.92
+ 1.80	24.43	71.20	100.00	25.54	24.43	71.20	87.82	71.20
Total	100.00	25.54						

FIGURE :

COMPANY : Denison Mines Ltd.

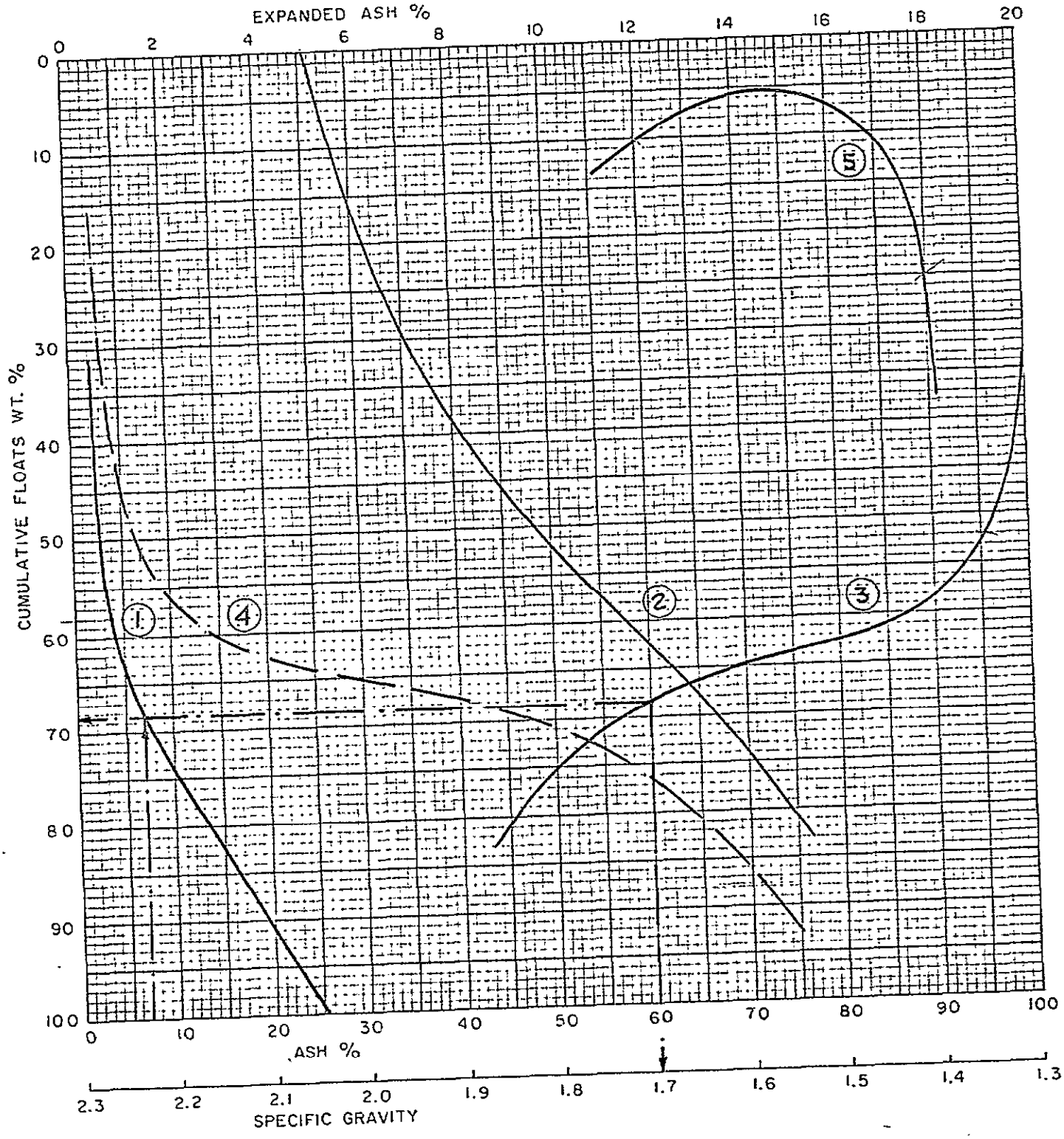
SAMPLE : ADIT #F6

SIZE : 3/4" x 28 m. (500 lb. Split)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 18, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT #F6

Froth Flotation Test of 28 mesh x 0

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Reagents	MIBC & Kerosene

	Concentrate	Tailings
Yield	86.87%	13.13%
Ash	5.43%	44.72%
Volatile Matter	25.86%	16.14%
Residual Moisture	0.95%	0.75%
Fixed Carbon	67.76%	38.39%
F.S.I.	8½	1
Sulphur	0.41%	0.54%

SECTION 2

WASHING TESTS & ANALYSIS OF PRODUCTS

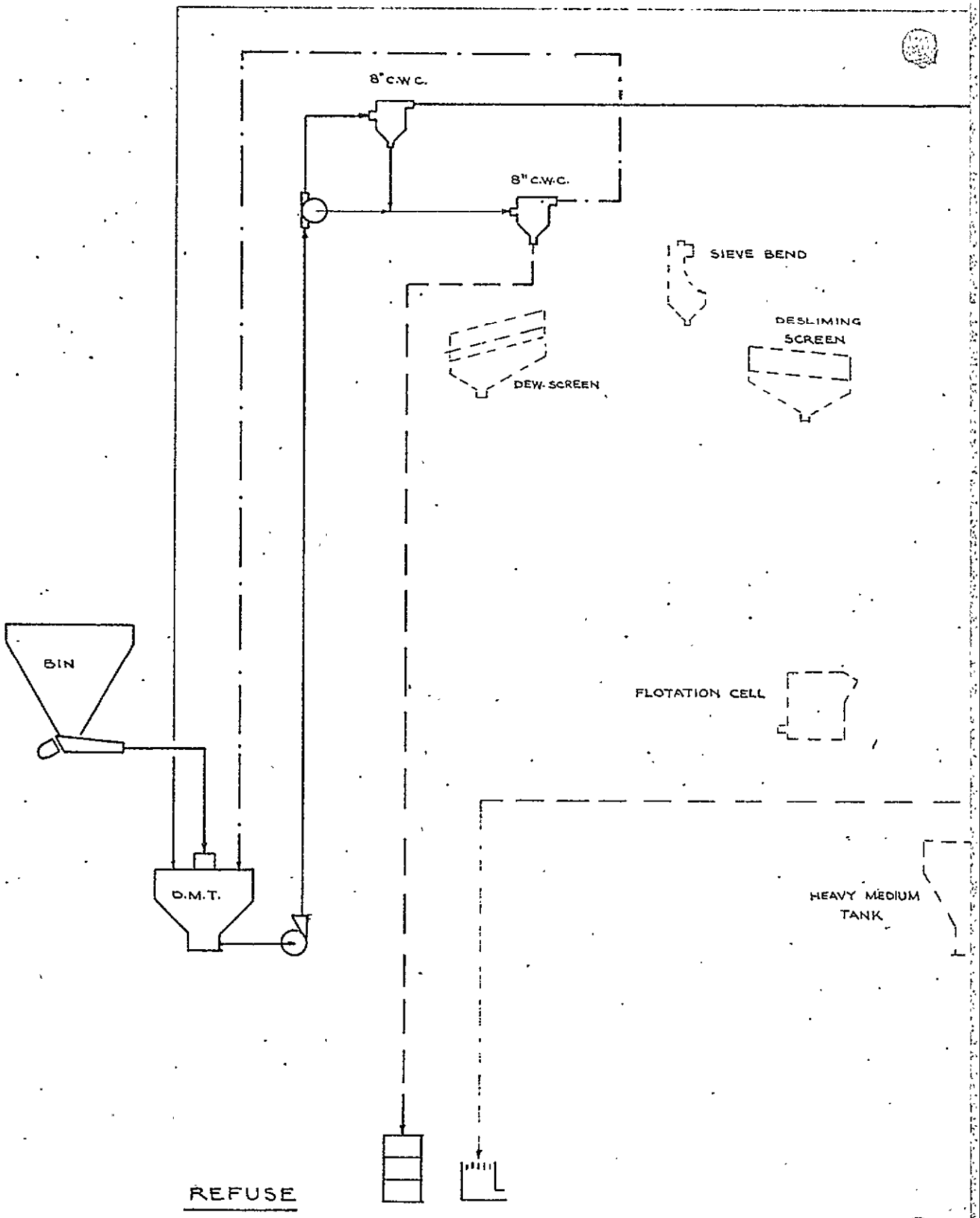
ADIT #F6

TABLE 1 - ADIT #F6

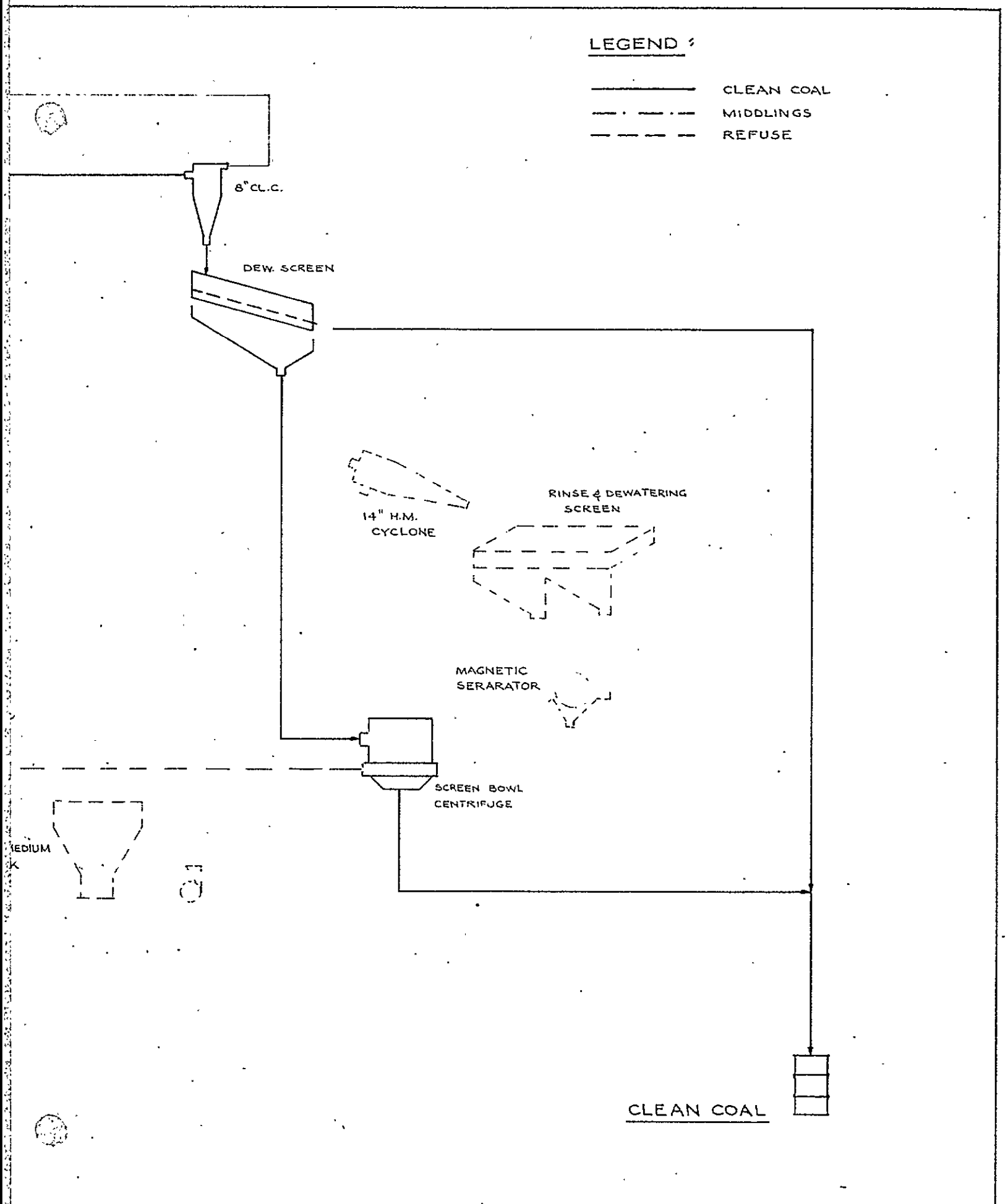
Approximate Distribution of Products

Product	Wt.%	Ash %
Clean Coal	64.00	5.80
Refuse	36.00	53.00
Total	100.00	22.85

FIG. 1 WASHING CIRCUIT FOR ADIT - F 6



MAY 15 ,1972 G.W.L.



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 2 - ADIT #F6

Proximate Analysis of Clean Coal

Ash	5.80%
Volatile Matter	25.05%
Residual Moisture	0.89%
Fixed Carbon	68.26%
F.S.I.	7½
B.T.U./lb.	14,700
Sulphur	0.37%

TABLE 3 - ADIT #F6

Ultimate Analysis

Ash	5.80%
Carbon	83.28%
Hydrogen	4.86%
Nitrogen	1.53%
Oxygen	4.16%
Sulphur	0.37%

TABLE 4 - ADIT #F6

Characteristics of the Ash

Mineral Analysis of Ash

SiO_2	51.51
Al_2O_3	27.40
Fe_2O_3	3.75
TiO_2	1.29
P_2O_5	3.62
CaO	4.60
MgO	0.96
Na_2O	0.24
K_2O	0.39
SO_3	2.31

Ash Fusibility

	Reducing Atmosphere °F.	Oxidizing Atmosphere °F.
Initial Deformation Temperature	2415	2470
Spherical Temperature	2535	2605
Hemispherical Temperature	2640	2640+
Fluid Temperature	2640+	2640+

TABLE 5 - ADIT #F6

Analysis of CWC Reject

Ash	52.88%
Volatile Matter	14.84%
Residual Moisture	0.68%
Fixed Carbon	31.60%
F.S.I.	1
B.T.U./lb.	7,210
Sulphur	0.30%

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT F-11

Submitted by

CYCLONE ENGINEERING SALES LTD.
Edmonton, Alberta, Canada.

Report No: RI-72-19

Job No.: S1-84

Dated: May 8, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT F-11

SUMMARY:

The data presented in this report refer to the washability characteristics of Denison Mills Sample of Adit F-11.

The coal is of medium volatile bituminous rank. It has an Ash of 20% and F.S.I. of 6½.

Cleaning this coal is very simple, as the amount of near gravity material for all cut points above 1.55 is less than 5%.

For cleaning to 7% ash a cutpoint of 1.93 is required. The yield and F.S.I. for such cleaning are 82% and 8 respectively

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6 & 6a	Washability Curves for 1/4" x 8 M.	20 & 20a
7 & 7a	Washability Curves for 8 M. x 28 M.	22 & 22a
8 & 8a	Washbility Curves for 28 M. x 100 M.	24 & 24a

INTRODUCTION:

A one-ton sample of Adit F-11 was air dried and the following work was done:

1. A size analysis at 2", 1", 1/2", 1/4", 8m., 28m. and 100 m.

2. A proximate analysis on all size fractions.

3. A float-sink analysis on all size fractions, except -100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 180.

4. Ash, Volatile Matter and Free Swelling Index determinations on all specific gravity fractions.

5. Washability curves for all size fractions, except -100 mesh.

6. Washability curves for +100 mesh fraction of the raw sample by reconstituting the data in 5.

7. Froth flotation tests on 28m. x 100m. and -100m. fractions.

CONCLUSIONS & RECOMMENDATIONS:

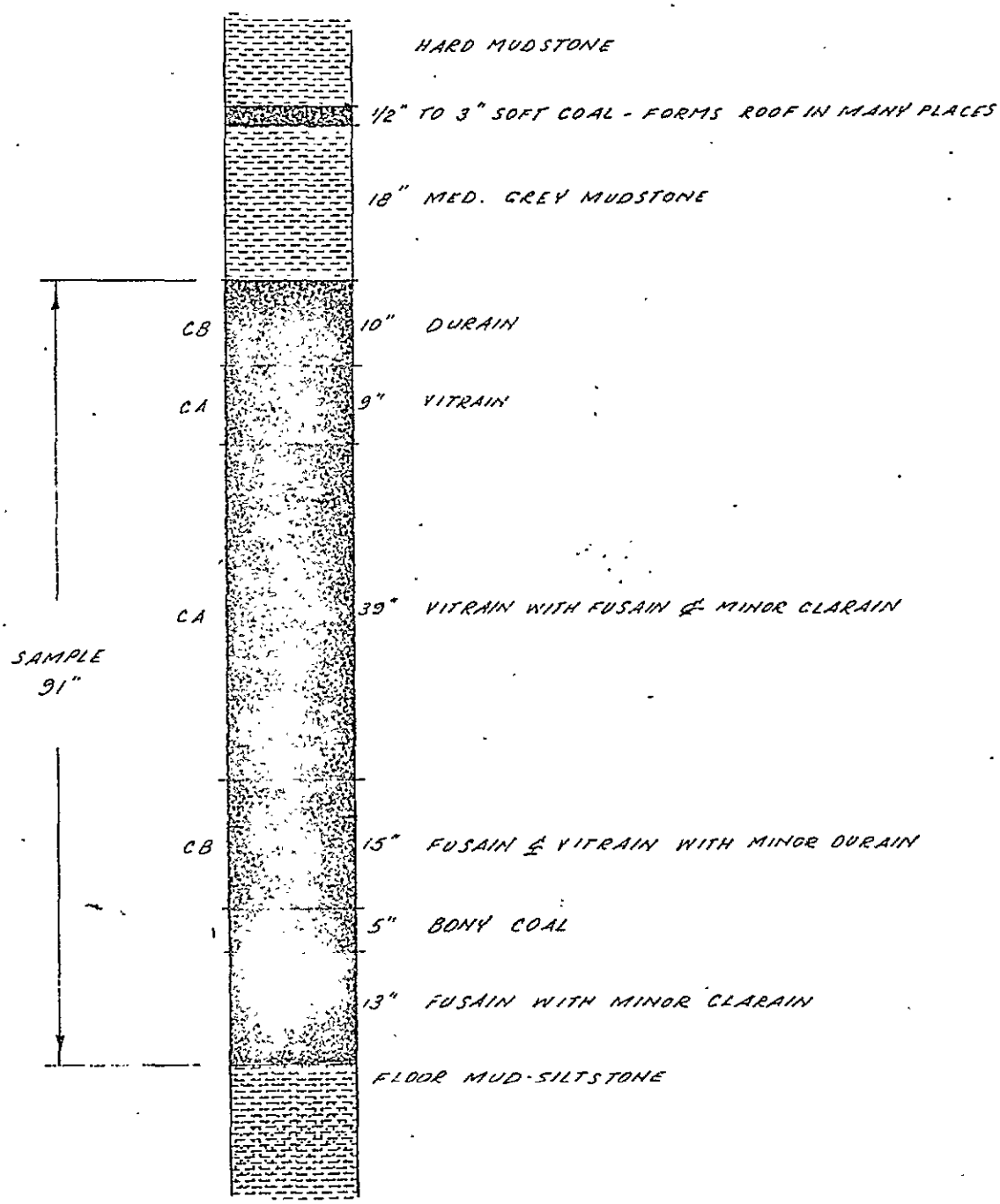
This is an easy coal to clean and has good coking properties.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM SECTION F ADIT 11

DRAWN BY E J T	DATE MAY '72	SCALE 1" = 20"
APPROVED BY.	DRAWING NO.	

TABLE 1: Adit F-11.

Classification by Rank

Ash	19.69%
Volatile Matter	21.03%
Residual Moisture	1.20%
Fixed Carbon	58.08%
F.S.I.	6½
B.T.U./lb.	12,060
Sulphur	0.55%
Rank	mvb

TABLE 2: Adit F-11.

Analysis of Size Fractions.

Size	Wt. %	Ash %	V.M. %	R.M. %	F.C. %	F.S.I.	S. %
+ 2"	12.96	31.45	18.70	1.06	48.79	4	0.36
2" x 1"	5.32	26.48	19.12	1.11	53.29	4½	0.40
1" x 1/2"	11.89	22.70	19.99	1.15	56.16	5	0.44
1/2" x 1/4"	12.79	20.18	20.58	1.21	58.03	5½	0.51
1/4" x 8 m.	15.26	19.50	20.80	1.16	58.54	6	0.63
8 x 28 m.	23.00	15.13	22.46	1.20	61.21	7	0.65
28 x 100 m.	13.48	12.91	22.72	1.37	63.00	8	0.60
- 100 m.	5.30	13.70	22.21	1.44	62.65	8	0.66
Total	100.00	19.69	21.03	1.20	58.08	6½	0.55

TABLE 3: Adit F-11.

Weight % and Ash % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the ash content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80		Total
+ 2"	2.74 (2.77)	4.46 (3.54)	0.48 (7.28)	0.09 (10.39)	0.05 (16.31)	0.05 (30.15)	0.09 (41.52)	0.21 (48.84)	4.79 (74.64)	12.96 (31.00)
2" x 1"	1.30 (2.71)	1.95 (3.65)	0.16 (7.31)	0.03 (10.27)	0.02 (16.54)	0.03 (29.11)	0.04 (39.19)	0.10 (47.17)	1.69 (71.17)	5.32 (26.29)
1" x 1/2"	3.41 (2.47)	4.78 (3.83)	0.29 (7.17)	0.08 (10.17)	0.04 (16.23)	0.05 (29.69)	0.10 (40.19)	0.15 (47.49)	2.99 (79.38)	11.89 (23.53)
1/2" x 1/4"	6.50 (2.59)	3.01 (4.32)	0.23 (7.77)	0.11 (11.40)	0.07 (17.92)	0.08 (27.87)	0.14 (38.51)	0.15 (46.65)	2.50 (81.83)	12.79 (19.83)
1/4" x 8 m.	6.66 (2.36)	4.49 (4.30)	0.47 (7.91)	0.15 (12.89)	0.09 (19.77)	0.14 (26.66)	0.15 (37.51)	0.20 (45.20)	2.91 (79.34)	15.26 (19.12)
8 x 28 m.	13.28 (2.38)	4.07 (5.18)	1.09 (8.58)	0.37 (13.15)	0.22 (19.23)	0.32 (27.28)	0.29 (37.16)	0.28 (44.75)	3.08 (75.39)	23.00 (14.58)
28 x 100 m.	7.12 (2.21)	2.63 (4.44)	0.96 (8.92)	0.38 (12.98)	0.22 (19.34)	0.27 (26.95)	0.21 (36.98)	0.17 (45.01)	1.52 (74.32)	13.48 (13.43)
Total	41.01 (2.42)	25.39 (4.19)	3.68 (8.20)	1.21 (12.43)	0.71 (18.75)	0.94 (27.48)	1.02 (38.12)	1.26 (46.28)	19.48 (76.78)	94.70 (19.88)
- 100 mesh	This fractions forms 5.30% of the total sample and has a ash content of 13.70%, thus giving a total sample ash value of 19.56%.									

TABLE 4: Adit F-11.

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the V.M. content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+ 2"	2.74 (24.72)	4.46 (23.80)	0.48 (20.91)	0.09 (19.97)	0.05 (19.40)	0.05 (17.48)	0.09 (15.15)	0.21 (13.55)	4.79 (9.61)	12.96 (18.35)
2" x 1"	1.30 (24.44)	1.95 (23.63)	0.16 (21.11)	0.03 (20.02)	0.02 (19.67)	0.03 (17.69)	0.04 (15.35)	0.10 (13.73)	1.69 (9.88)	5.32 (19.07)
1" x 1/2"	3.41 (24.86)	4.78 (23.41)	0.29 (21.27)	0.08 (20.18)	0.04 (19.82)	0.05 (17.86)	0.10 (15.51)	0.15 (14.06)	2.99 (7.30)	11.89 (19.49)
1/2" x 1/4"	6.50 (24.48)	3.01 (22.40)	0.23 (20.75)	0.11 (19.98)	0.07 (19.07)	0.08 (17.62)	0.14 (15.88)	0.15 (14.73)	2.50 (7.42)	12.79 (20.26)
1/4" x 8 m.	6.66 (25.77)	4.49 (22.62)	0.47 (20.66)	0.15 (19.51)	0.09 (19.33)	0.14 (18.12)	0.15 (16.59)	0.20 (15.10)	2.91 (8.88)	15.26 (21.07)
8 x 28 m.	13.28 (26.38)	4.07 (22.40)	1.09 (20.54)	0.37 (19.98)	0.22 (19.73)	0.32 (18.63)	0.29 (17.37)	0.28 (15.69)	3.08 (9.65)	23.00 (22.64)
28 x 100 m.	7.12 (26.05)	2.63 (23.91)	0.96 (21.21)	0.38 (20.02)	0.22 (19.55)	0.27 (18.77)	0.21 (17.21)	0.17 (15.81)	1.52 (10.53)	13.48 (22.85)
Total	41.01 (25.62)	25.39 (23.13)	3.68 (20.87)	1.21 (19.95)	0.71 (19.54)	0.94 (18.38)	1.02 (16.56)	1.26 (14.79)	19.48 (8.97)	94.70 (20.91)
- 100 mesh	This fraction forms 5.30% of the total sample and has a volatile matter content of 22.21%, thus giving a total volatile matter value of 20.98%.									

TABLE 5: ADIT F-11

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity

(Figures in brackets show the cumulative F.S.I. of cumulative fractions)

Size \ Sp. Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+2"	2.74 (9)	7.20 (8)	7.68 (7)	7.77 (7)	7.82 (6½)	7.87 (6½)	7.96 (6)	8.17 (6)	12.96 (4)
2" x 1"	1.30 (9)	3.25 (7½)	3.41 (6½)	3.44 (6½)	3.46 (6½)	3.49 (6½)	3.53 (6½)	3.63 (6½)	5.32 (4½)
1" x 1/2"	3.41 (9)	8.19 (7)	8.48 (7)	8.56 (7)	8.60 (7)	8.65 (7)	8.75 (7)	8.90 (7)	11.89 (5)
1/2" x 1/4"	6.50 (9)	9.51 (7½)	9.74 (7½)	9.85 (7½)	9.92 (7½)	10.00 (7½)	10.14 (7)	10.29 (7)	12.79 (5½)
1/4" x .8 m.	6.66 (9+)	11.15 (8½)	11.62 (8)	11.77 (8)	11.86 (8)	12.00 (7½)	12.15 (7½)	12.35 (7)	15.26 (6)
8 m. x 28 m.	13.28 (9+)	17.35 (8½)	18.44 (8½)	18.81 (8)	19.03 (8)	19.35 (8)	19.64 (8)	19.92 (8)	23.00 (7)
28 m. x 100 m.	7.12 (9+)	9.75 (9)	10.71 (8½)	11.09 (8½)	11.31 (8½)	11.58 (8½)	11.79 (8½)	11.96 (8½)	13.48 (8)
Total	41.01	66.40	70.08	71.29	72.00	72.94	73.96	75.22	94.70
-100 Mesh	Weight of this fraction is 5.30% and has a F.S.I. of 8.								

T A B L E 6: ADIT F-11

Washability Data: +100 m.: 94.70% of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Sinks		Floats			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %	Wt.%	Ash%
- 1.30	43.30	2.42	43.30	2.42	100.00	19.88	21.65	2.42
1.30 - 1.35	26.81	4.19	70.11	3.10	56.70	33.22	56.70	4.19
1.35 - 1.40	3.89	8.20	74.00	3.37	29.89	59.26	72.05	8.20
1.40 - 1.45	1.28	12.43	75.28	3.52	26.00	66.89	74.64	12.43
1.45 - 1.50	0.75	18.75	76.03	3.67	24.72	69.71	75.65	18.75
1.50 - 1.60	0.99	27.48	77.02	3.98	23.97	71.31	76.52	27.48
1.60 - 1.70	1.08	38.12	78.10	4.45	22.98	73.20	77.56	38.12
1.70 - 1.80	1.33	46.28	79.43	5.15	21.90	74.93	78.76	46.28
+ 1.80	20.57	76.78	100.00	19.88	20.57	76.78	89.71	76.78
Total	100.00	19.88						

FIGURE : 1

COMPANY : DENISON MINES LTD.

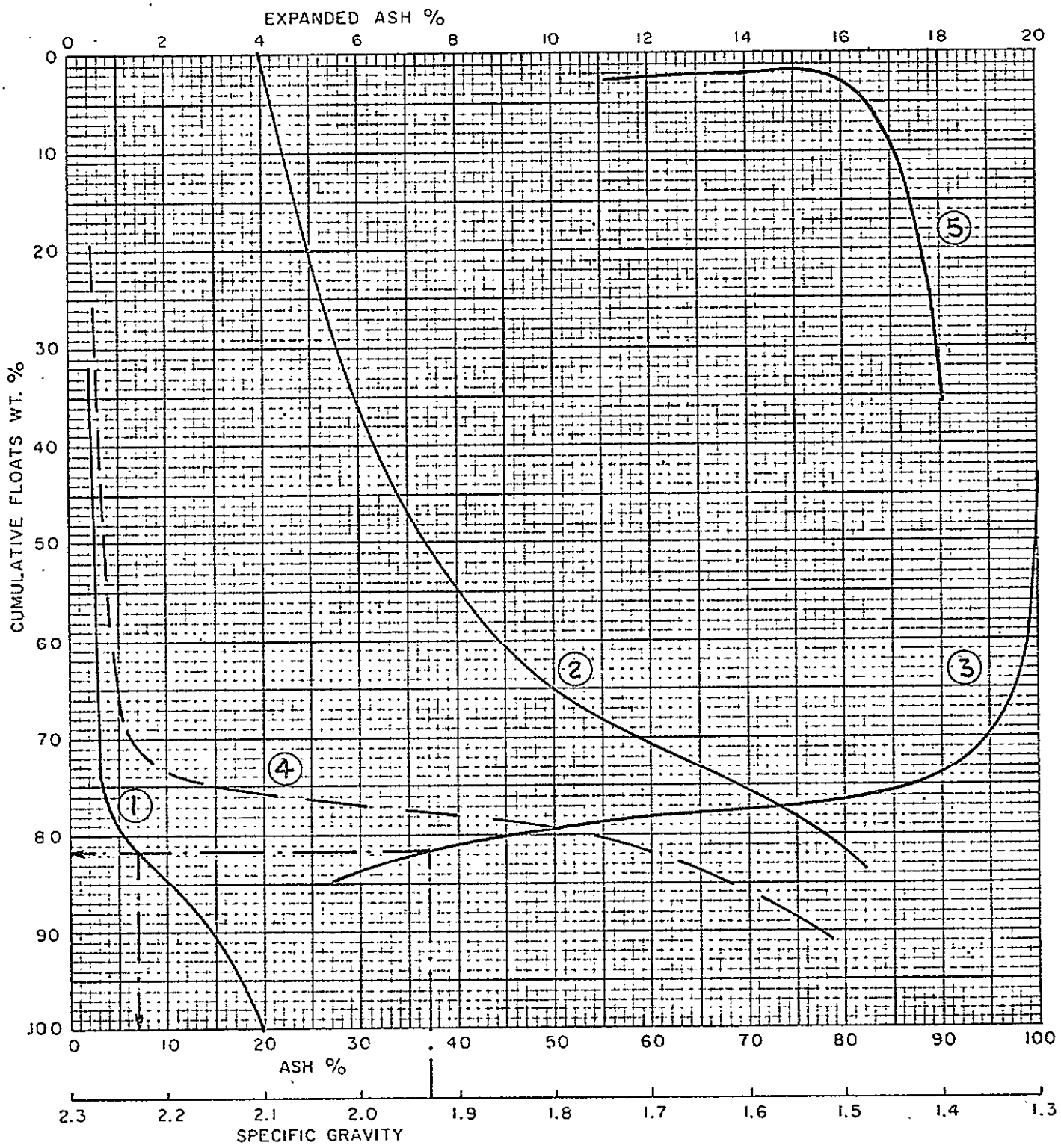
SAMPLE : ADIT F-11

SIZE : + 100 mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 1a

COMPANY : DENISON MINES LTD.

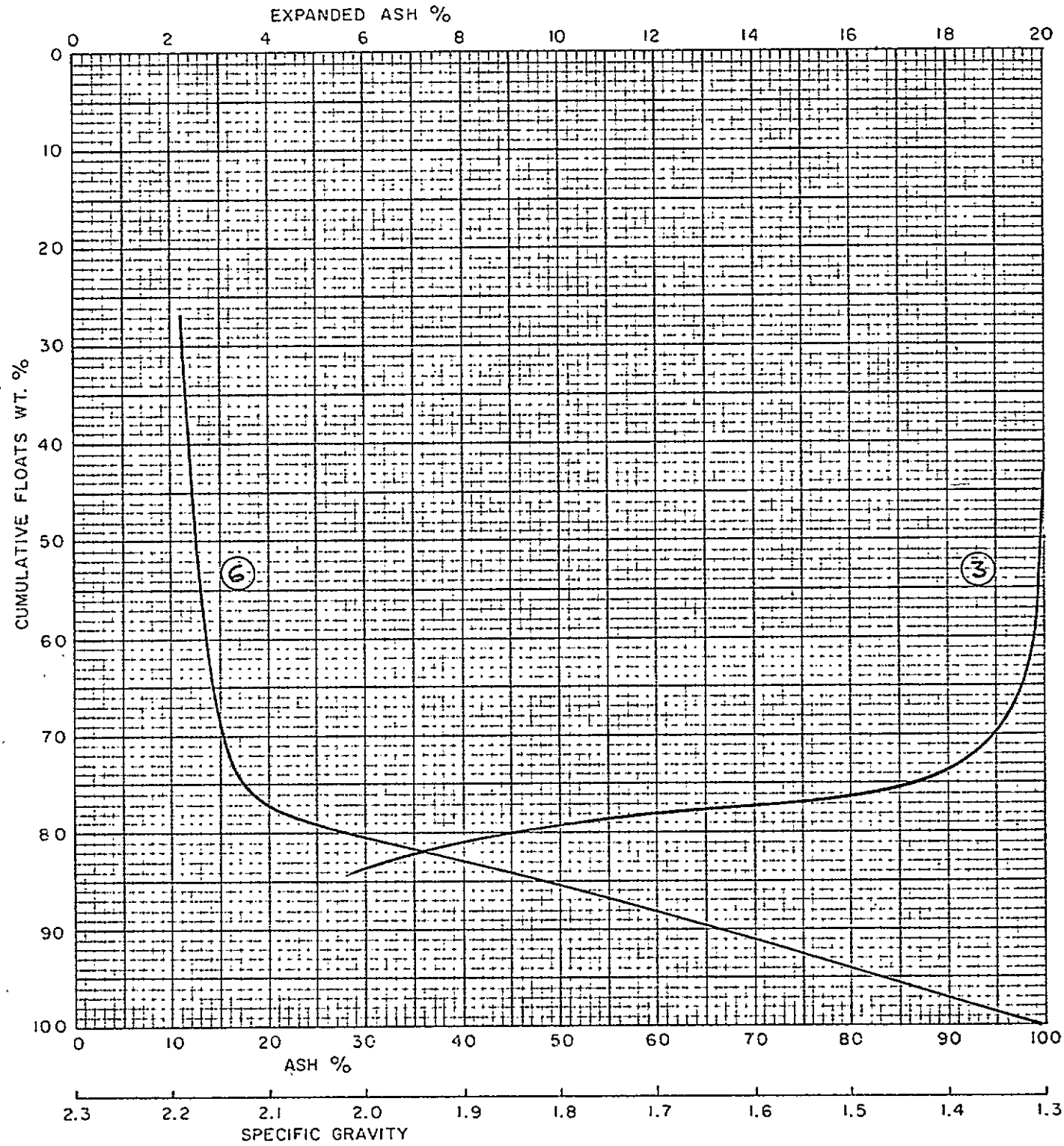
SAMPLE : ADIT F-11

SIZE : + 100 mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 7: ADIT F-11

Cumulative Volatile Matter: +100 M. : 94.70% of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative			
			Sinks		Floats	
	Wt.%	V.M.%	Wt.%	V.M.%	Wt.%	V.M.%
- 1.30	43.30	25.62	43.30	25.62	100.00	20.91
1.30 - 1.35	26.81	23.13	70.11	24.67	56.70	17.31
1.35 - 1.40	3.89	20.87	74.00	24.45	29.89	12.10
1.40 - 1.45	1.28	19.95	75.28	24.39	26.00	10.79
1.45 - 1.50	0.75	19.54	76.03	24.34	24.72	10.31
1.50 - 1.60	0.99	18.38	77.02	24.27	23.97	10.02
1.60 - 1.70	1.08	16.56	78.10	24.16	22.98	9.66
1.70 - 1.80	1.33	14.79	79.43	24.00	21.90	9.32
+ 1.80	20.57	8.97	100.00	20.91	20.57	8.97
Total	100.00	20.91				

TABLE 8: ADIT F-11

7% Ash of Clean Coal

Yield	82.00%
Floats Gravity	1.93
Near Gravity Material	3.00%
Ash	7.00%
Volatile Matter	23.50%
Residual Moisture	1.18%
Fixed Carbon	68.32%
F.S.I.	8

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT G12

Submitted by

CYCLONE ENGINEERING SALES LTD.
Edmonton, Alberta, Canada

Report No.: RL-72.15

Job No.: S1 - 84

Dated: April 22, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT G12

SUMMARY:

The data presented in this report refer to the washability characteristics of Denison Mines Sample of Adit #G12.

The coal is of medium volatile bituminous rank. It has an Ash of 19% and F.S.I. of 4½.

Cleaning characterisitcs of the coal are not easy because of large amount of near gravity material present at all cut points up to about 1.65.

If the coal were to be cleaned to 7% Ash, a yield of only 52% would be obtained. The cut point for such a cleaning is 1.41 and the amount of near gravity material is over 50%.

The F.S.I. of clean coal would be 8½.

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INTRODUCTION:

A one ton sample of Adit G12 was air dried and the following work was done:

1. A size analysis at 2", 1", 1/2",1/4", 8m., 28m. and 100m.

2. A proximate analysis on all size fractions.

3. A float-sink analysis on all size fractions, except -100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.70 and 1.80.

4. Ash, Volatile Matter and Free Swelling Index determinations on all specific gravity fractions.

5. Washability curves for all size fractions, except -100 mesh.

6. Washability curves for +100 mesh fraction of the raw sample by reconstituting the data in 5.

7. Froth flotation tests on 28m. x 100m. and -100m. fractions.

CONCLUSIONS & RECOMMENDATIONS:

A high cut point is almost essential for cleaning of this coal. The increase in Ash is very likely to be compensated for by the increased yield. If, for example, it was cleaned at a cut point of 1.7 where the amount of near gravity material is about 8%, a yield of 89% can be obtained. The ash of clean coal will be 14%.

However, the F.S.I. still will have a value of 5½.

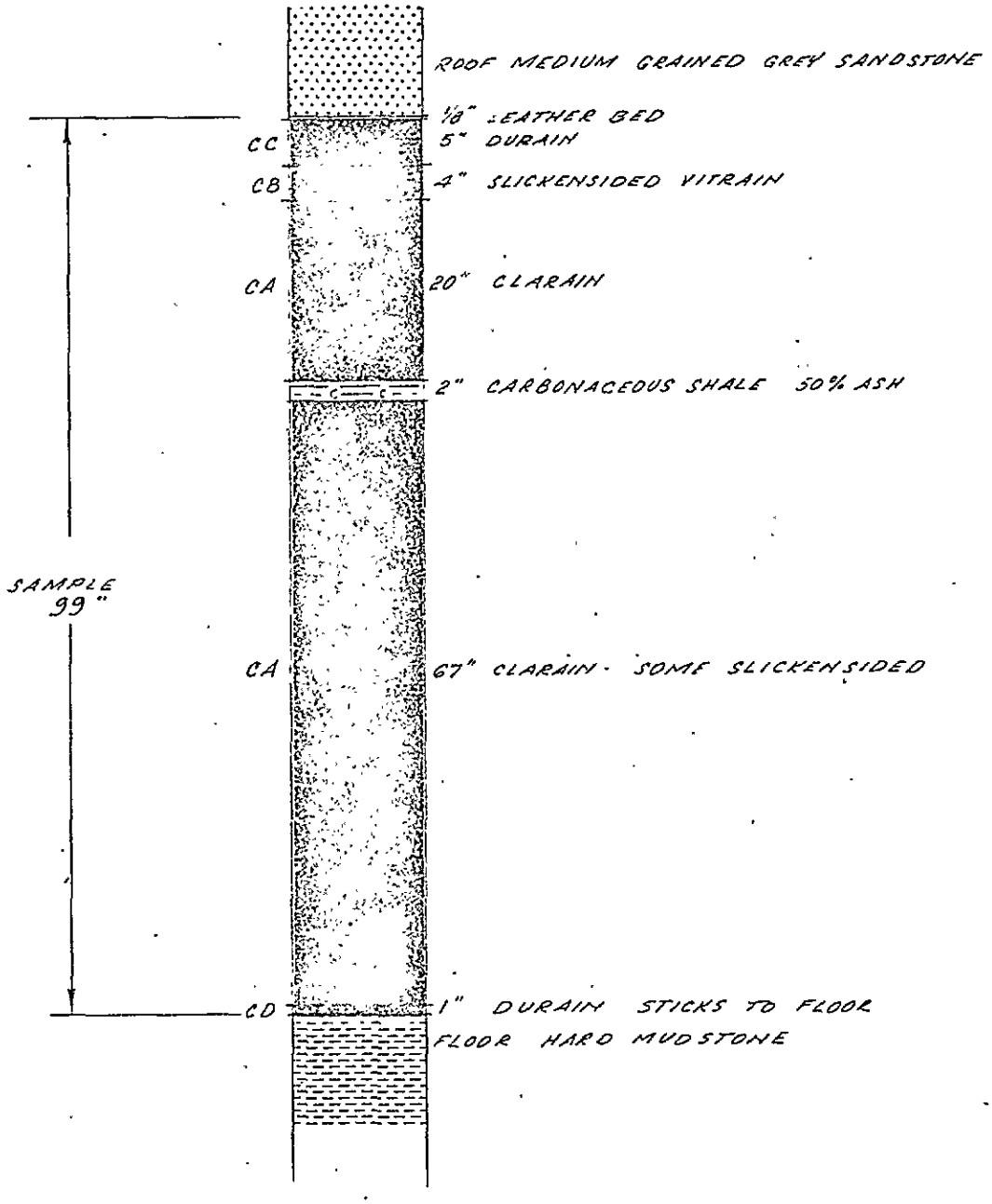
This coal could be ideal for blending with a low ash medium F.S.I. coal.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R. S. Sehgal, P. Eng.
Laboratory Manager



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM SECTION G - ADIT 12

DRAWN BY E.J.T.	DATE. MAY '72	SCALE 1" = 20'
APPROVED BY	DRAWING NO	

TABLE 1: Adit G12

Classification by Rank

Ash	20.23%
Volatile Matter	19.11%
Residual Moisture	0.78%
Fixed Carbon	59.88%
F.S.I.	4½
B.T.U./lb.	12,090
Sulphur	0.62%
Rank	mvb

TABLE 2: Adit G12

Analysis of Size Fractions.

Size	Wt. %	Ash %	V.M. %	R.M. %	F.C. %	S. %	F.S.I.
+ 2"	3.94	14.60	20.16	0.59	64.65	0.58	6
2" x 1"	5.24	22.20	19.23	0.68	57.89	0.59	3½
1" x 1/2"	13.78	22.95	18.91	0.59	57.55	0.56	3
1/2" x 1/4'	15.71	23.24	18.06	0.65	58.05	0.56	2
1/4" x 8m.	17.01	24.24	17.86	0.91	56.99	0.56	2½
8 x 28 m.	23.95	19.19	19.26	0.87	60.68	0.57	4½
28 x 100m.	14.11	14.50	20.74	0.83	63.93	0 .72	6½
- 100 m.	6.26	14.65	20.50	0.89	63.96	1.15	7
Total	100.00	20.23	19.11	0.78	59.88	0.62	4½

TABLE 3: Adit G12

Weight % and Ash % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the ash content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.70	1.80	Total
+ 1"	0.84 (3.16)	1.62 (6.42)	2.00 (10.29)	1.52 (15.40)	0.91 (21.08)	0.47 (25.49)	0.46 (31.67)	0.45 (38.32)	0.33 (50.01)	0.58 (72.90)	9.18 (19.45)
1" x 1/2"	0.56 (2.71)	2.13 (6.47)	3.13 (10.46)	2.53 (15.55)	1.65 (20.18)	0.71 (25.10)	0.45 (31.53)	0.86 (38.40)	0.43 (49.93)	1.33 (76.43)	13.78 (22.42)
1/2" x 1/4"	1.15 (3.07)	2.30 (6.86)	3.45 (10.52)	2.42 (16.01)	1.82 (20.71)	0.96 (25.34)	0.66 (31.20)	0.87 (38.61)	0.36 (47.89)	1.72 (76.49)	15.71 (22.84)
1/4" x 8 m.	1.50 (2.86)	2.51 (6.01)	3.23 (10.22)	2.10 (15.87)	2.13 (20.11)	1.02 (25.27)	1.00 (30.94)	1.03 (38.42)	0.37 (46.56)	2.12 (76.89)	17.01 (23.83)
8 x 28 m.	5.32 (2.13)	3.64 (5.60)	3.70 (10.43)	2.68 (16.60)	2.06 (20.53)	1.42 (24.96)	1.24 (30.91)	1.42 (38.52)	0.41 (46.16)	2.06 (70.48)	23.95 (18.76)
28 x 100 m.	5.48 (2.27)	1.70 (5.12)	1.57 (9.12)	1.29 (14.83)	1.09 (19.76)	0.71 (24.31)	0.43 (30.80)	0.69 (38.72)	0.24 (46.11)	0.91 (70.18)	14.11 (14.76)
Total	14.85 (2.41)	13.90 (6.05)	17.08 (10.28)	12.54 (15.82)	9.66 (20.38)	5.29 (25.07)	4.24 (31.10)	5.32 (38.50)	2.14 (47.87)	8.72 (74.26)	93.74 (20.37)
- 100 m.	This fraction forms 6.26% of the total sample and has an ash content of 14.65%, thus giving a total sample ash value of 20.01%.										

TABLE 4: Adit G12

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the V.M. content of individual fractions.)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.70	1.80	Total
+ 1"	0.84 (23.98)	1.62 (22.76)	2.00 (21.15)	1.52 (19.91)	0.91 (17.34)	0.47 (17.02)	0.46 (16.26)	0.45 (15.03)	0.33 (12.76)	0.58 (10.84)	9.18 (19.40)
1" x 1/2"	0.56 (23.04)	2.13 (21.89)	3.13 (20.55)	2.53 (19.21)	1.65 (17.76)	0.71 (17.41)	0.45 (16.59)	0.86 (15.18)	0.43 (13.58)	1.33 (10.58)	13.78 (18.47)
1/2" x 1/4"	1.15 (23.69)	2.30 (22.34)	3.45 (19.82)	2.42 (19.07)	1.82 (17.64)	0.96 (17.13)	0.66 (16.40)	0.87 (15.72)	0.36 (13.99)	1.72 (10.29)	15.71 (18.39)
1/4" x 8 m.	1.50 (23.30)	2.51 (22.15)	3.23 (19.62)	2.10 (18.72)	2.13 (17.58)	1.02 (17.24)	1.00 (16.51)	1.03 (15.86)	0.37 (14.45)	2.12 (10.31)	17.01 (18.12)
8 x 28 m.	5.32 (24.02)	3.64 (22.33)	3.70 (19.64)	2.68 (18.63)	2.06 (17.80)	1.42 (17.42)	1.24 (16.43)	1.42 (16.09)	0.41 (15.58)	2.06 (11.57)	23.95 (19.48)
28 x 100 m.	5.48 (24.95)	1.70 (22.87)	1.57 (20.84)	1.29 (18.78)	1.09 (17.63)	0.71 (17.31)	0.43 (16.49)	0.69 (16.13)	0.24 (15.17)	0.91 (12.64)	14.11 (21.07)
Total	14.85 (24.23)	13.90 (22.35)	17.08 (20.13)	12.54 (19.02)	9.66 (17.65)	5.29 (17.28)	4.24 (16.45)	5.32 (15.75)	2.14 (14.23)	8.72 (10.92)	93.74 (19.14)
- 100 m.	This fraction forms 6.26% of the total sample and has a volatile matter content of 20.50%, thus giving a total sample vaoltile matter value of 19.24%.										

TABLE 5: Adit G12

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity.

(Figures in brackets show the cumulative F.S.I. of cumulative fractions.)

Size \ Sp. Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.55	- 1.60	- 1.70	- 1.80	Raw
+ 1"	0.84 (8½)	2.46 (8)	4.46 (8)	5.98 (7½)	6.89 (6)	7.36 (5½)	7.82 (5)	8.27 (5)	8.60 (5)	9.18 (4½)
1" x 1/2"	0.56 (8½)	2.69 (8)	5.82 (7)	8.35 (6)	10.00 (4½)	10.71 (4½)	11.16 (4)	12.02 (4)	12.45 (3½)	13.78 (3)
1/2" x 1/4"	1.15 (8½)	3.45 (7½)	6.90 (7)	9.32 (6)	11.14 (5)	12.10 (4½)	12.76 (3½)	13.63 (3)	13.99 (2½)	15.71 (2)
1/4" x 8 m.	1.50 (9)	4.01 (8½)	7.24 (7½)	9.34 (6½)	11.47 (5½)	12.49 (5)	13.49 (5)	14.52 (4½)	14.89 (4½)	17.01 (2½)
8 x 28 m.	5.32 (9+)	8.96 (9)	12.66 (9)	15.34 (8½)	17.40 (8)	18.82 (8)	20.06 (7½)	21.48 (7)	21.89 (6½)	23.95 (4½)
28 x 100 m.	5.48 (9+)	7.18 (9)	8.75 (9)	10.04 (9)	11.13 (9)	11.84 (8½)	12.27 (8½)	12.96 (8½)	13.20 (8)	14.11 (6½)
Total	14.85	28.75	45.83	58.37	68.03	73.32	77.56	82.88	85.02	93.74
- 100 m.	Weight of this fraction is 6.26% and has a F.S.I. of 7.									

TABLE 6: Adit G12

Washability Data: + 100 m. - 93.74% of Sample.

(Reconstituted from Size Fractions.)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	15.84	2.41	15.84	2.41	100.00	20.37	7.92	2.41
1.30 - 1.35	14.83	6.05	30.67	4.17	84.16	23.75	23.25	6.05
1.35 - 1.40	18.22	10.28	48.89	6.45	69.33	27.54	39.78	10.28
1.40 - 1.45	13.38	15.82	62.27	8.46	51.11	33.70	55.08	15.82
1.45 - 1.50	10.31	20.38	72.58	10.15	37.73	40.04	67.42	20.38
1.50 - 1.55	5.64	25.07	78.22	11.23	27.42	47.43	75.40	25.07
1.55 - 1.60	4.52	31.10	82.74	12.32	21.78	53.21	80.48	31.10
1.60 - 1.70	5.68	38.50	88.42	14.00	17.26	59.01	85.58	38.50
1.70 - 1.80	2.28	47.87	90.70	14.85	11.58	69.06	89.56	47.87
+ 1.80	9.30	74.26	100.00	20.37	9.30	74.26	95.35	74.26
Total	100.00	20.37						

FIGURE : 1

COMPANY : DENISON MINES LTD.

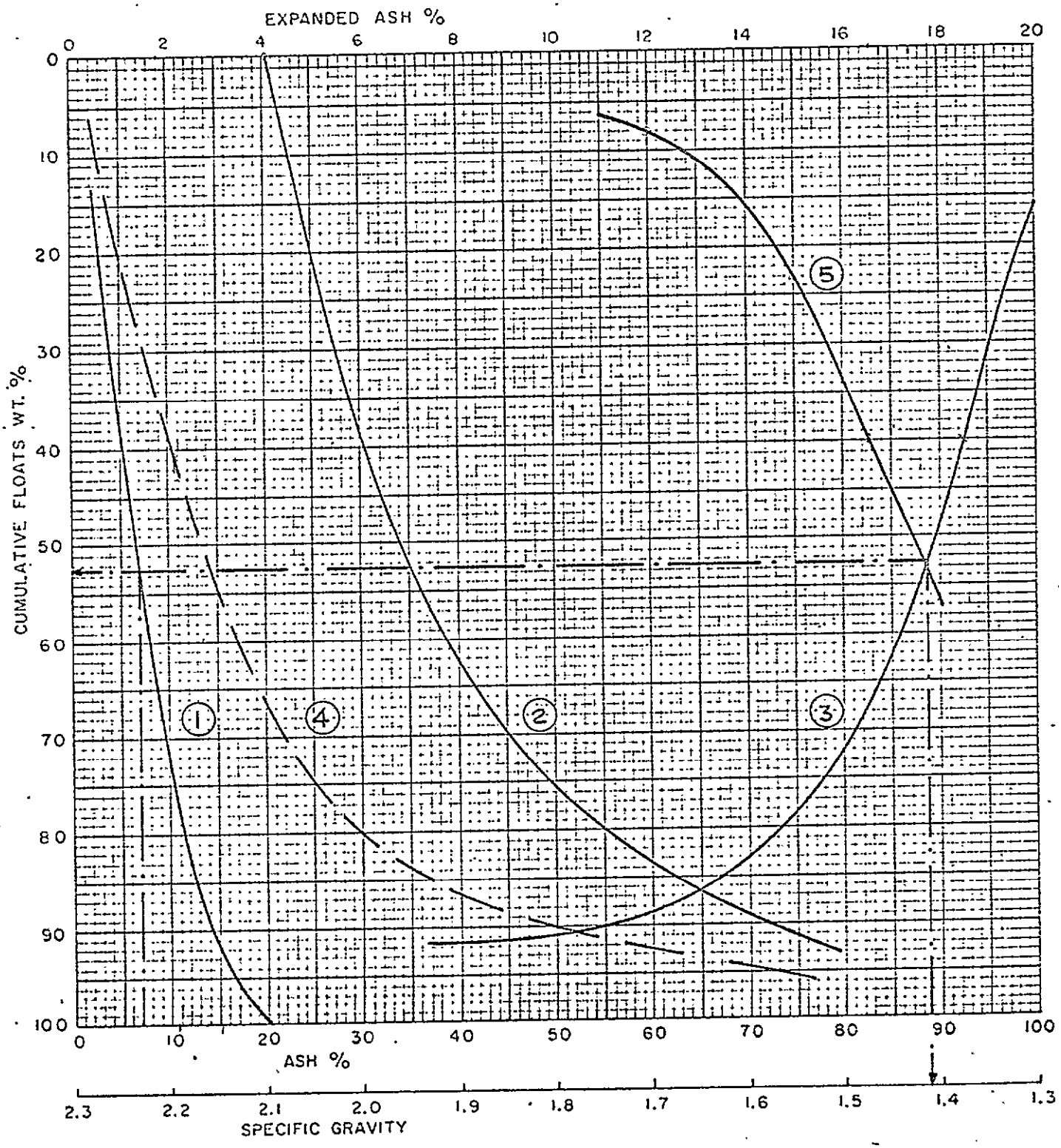
SAMPLE : Adit G12

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 1a

COMPANY : DENISON MINES LTD.

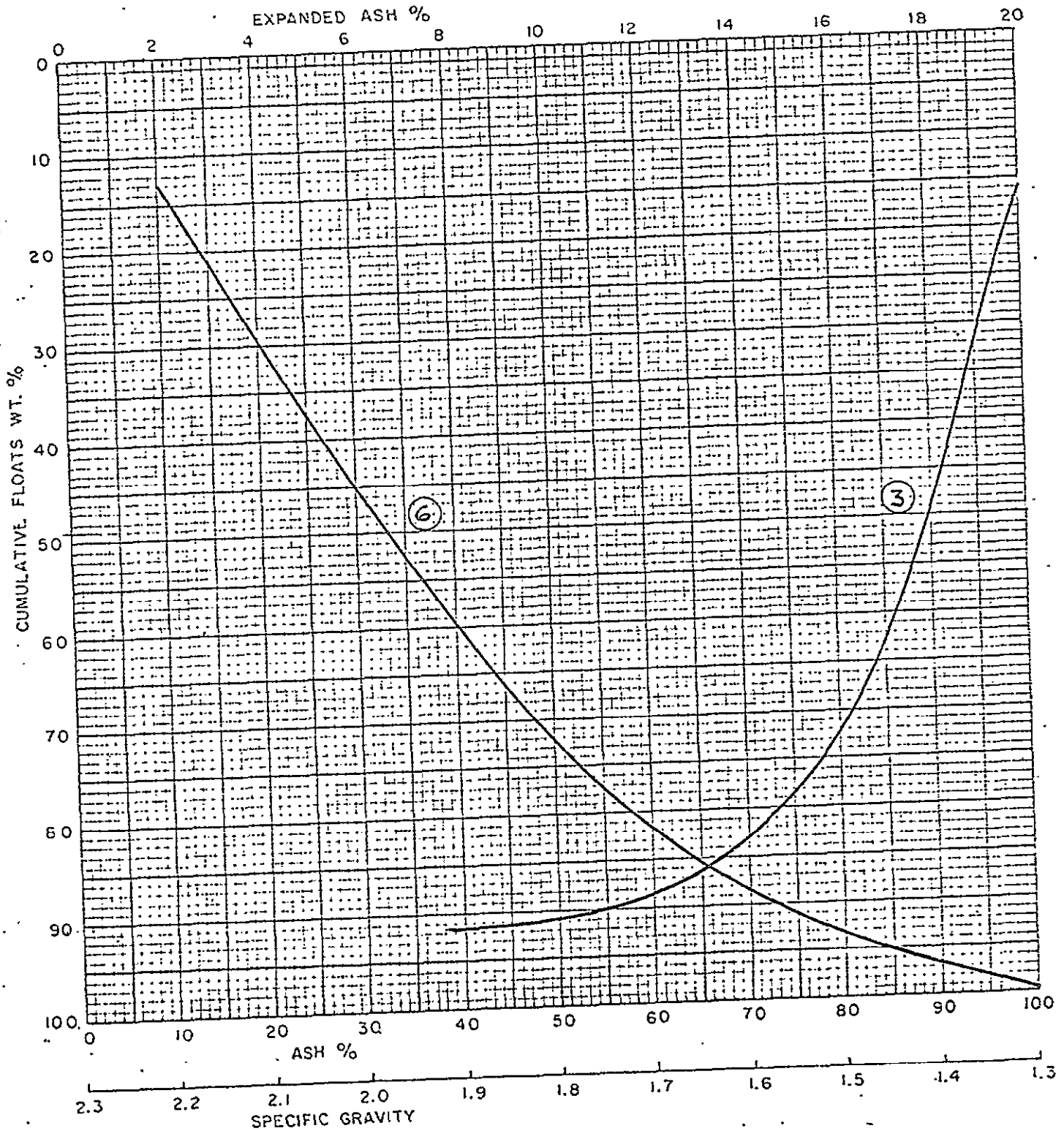
SAMPLE : Adit G12

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 7: Adit G12

Cumulative Volatile Matter: + 100 m. - 93.74% of Sample.

(Reconstituted from Size Fractions.)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt. %	V.M. %	Wt. %	V.M. %	Wt. %	V.M. %
- 1.30	15.84	24.23	15.84	24.23	100.00	19.14
1.30 - 1.35	14.83	22.35	30.67	23.32	84.16	18.18
1.35 - 1.40	18.22	20.13	48.89	22.13	69.33	17.29
1.40 - 1.45	13.38	19.02	62.27	21.46	51.11	16.27
1.45 - 1.50	10.31	17.65	72.58	20.92	37.73	15.30
1.50 - 1.55	5.64	17.28	78.22	20.66	27.42	14.42
1.55 - 1.60	4.52	16.45	82.74	20.43	21.78	13.67
1.60 - 1.70	5.68	15.75	88.42	20.13	17.26	12.95
1.70 - 1.80	2.28	14.23	90.70	19.98	11.58	11.57
+ 1.80	9.30	10.92	100.00	19.14	9.30	10.92
Total	100.00	19.14				

TABLE 8: Adit G12

7% Ash of Clean Coal

Yield	52.00%
Floats Gravity	1.41
Near Gravity Material	51.00%
Ash	7.00%
Volatile Matter	22.00%
Residual Moisture	0.70%
Fixed Carbon	70.30%
F.S.I.	8½

TABLE 9: Adit G12

+ 1": 9.18% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	9.18	3.16	23.98	9.18	8½
1.30 - 1.35	17.62	6.42	22.76	26.80	8
1.35 - 1.40	21.84	10.29	21.15	48.64	8
1.40 - 1.45	16.59	15.40	19.91	65.23	7½
1.45 - 1.50	9.96	21.08	17.34	75.19	6
1.50 - 1.55	5.12	25.49	17.02	80.31	5½
1.55 - 1.60	4.88	31.67	16.26	85.19	5
1.60 - 1.70	4.94	38.32	15.03	90.13	5
1.70 - 1.80	3.56	50.01	12.76	93.69	5
+ 1.80	6.31	72.90	10.84	100.00	4½
Total	100.00	19.45	19.40		

TABLE 10: Adit G12

Washability Data: + 1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	9.18	3.16	9.18	3.16	100.00	19.45	4.59	3.16
1.30 - 1.35	17.62	6.42	26.80	5.30	90.82	21.09	17.99	6.42
1.35 - 1.40	21.84	10.29	48.64	7.54	73.20	24.63	37.72	10.29
1.40 - 1.45	16.59	15.40	65.23	9.54	51.36	30.72	56.93	15.40
1.45 - 1.50	9.96	21.08	75.19	11.07	34.77	38.03	70.11	21.08
1.50 - 1.55	5.12	25.49	80.31	11.99	24.81	44.84	77.75	25.49
1.55 - 1.60	4.88	31.67	85.19	13.12	19.69	49.87	82.75	31.67
1.60 - 1.70	4.94	38.32	90.13	14.50	14.81	55.86	87.66	38.32
1.70 - 1.80	3.56	50.01	93.69	15.85	9.87	64.64	91.91	50.01
+ 1.80	6.31	72.90	100.00	19.45	6.31	72.90	96.84	72.90
Total	100.00	19.45						

FIGURE: 2

COMPANY : DENISON MINES LTD.

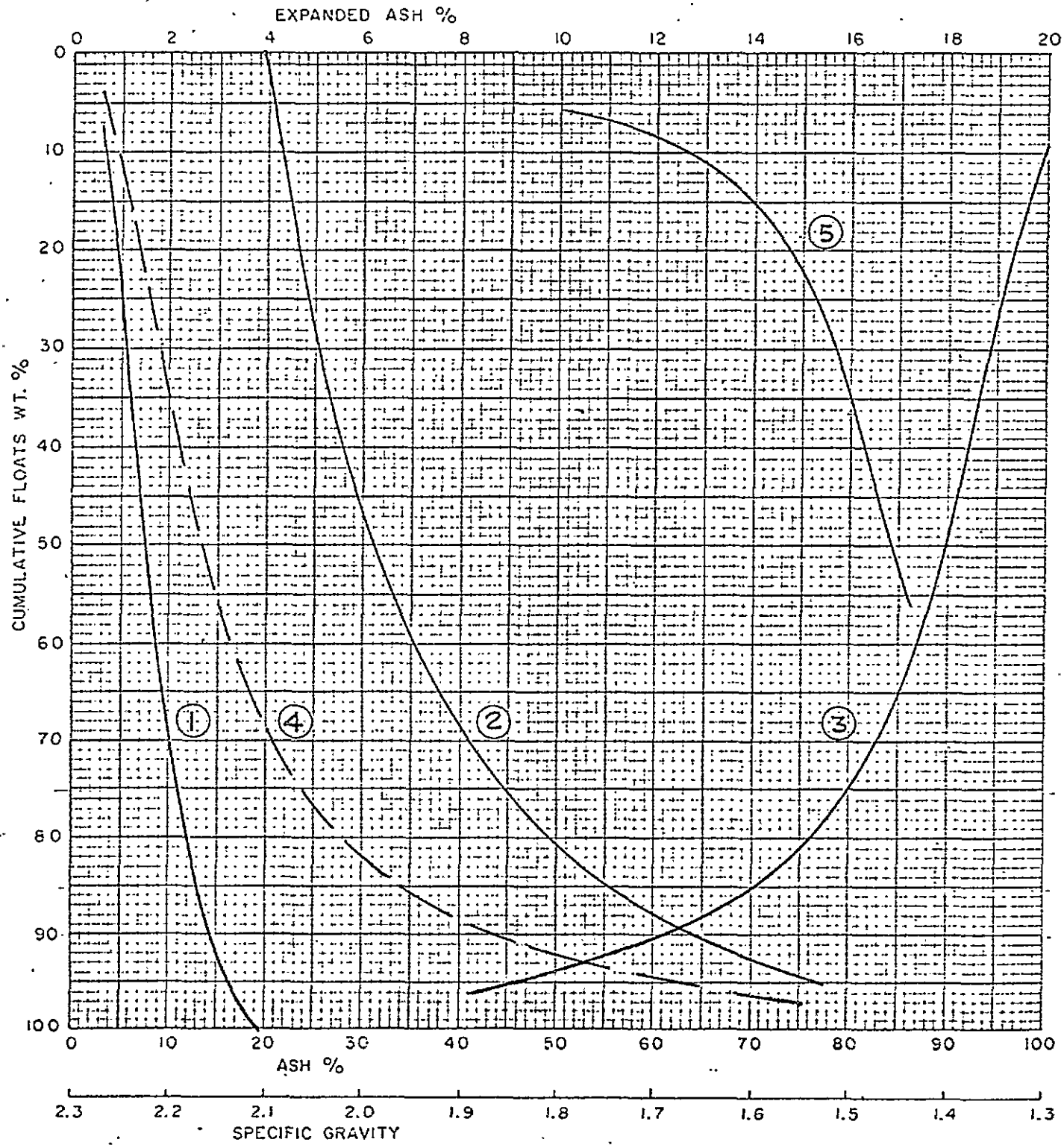
SAMPLE : Adit G12

SIZE : + 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : DENISON MINES LTD.

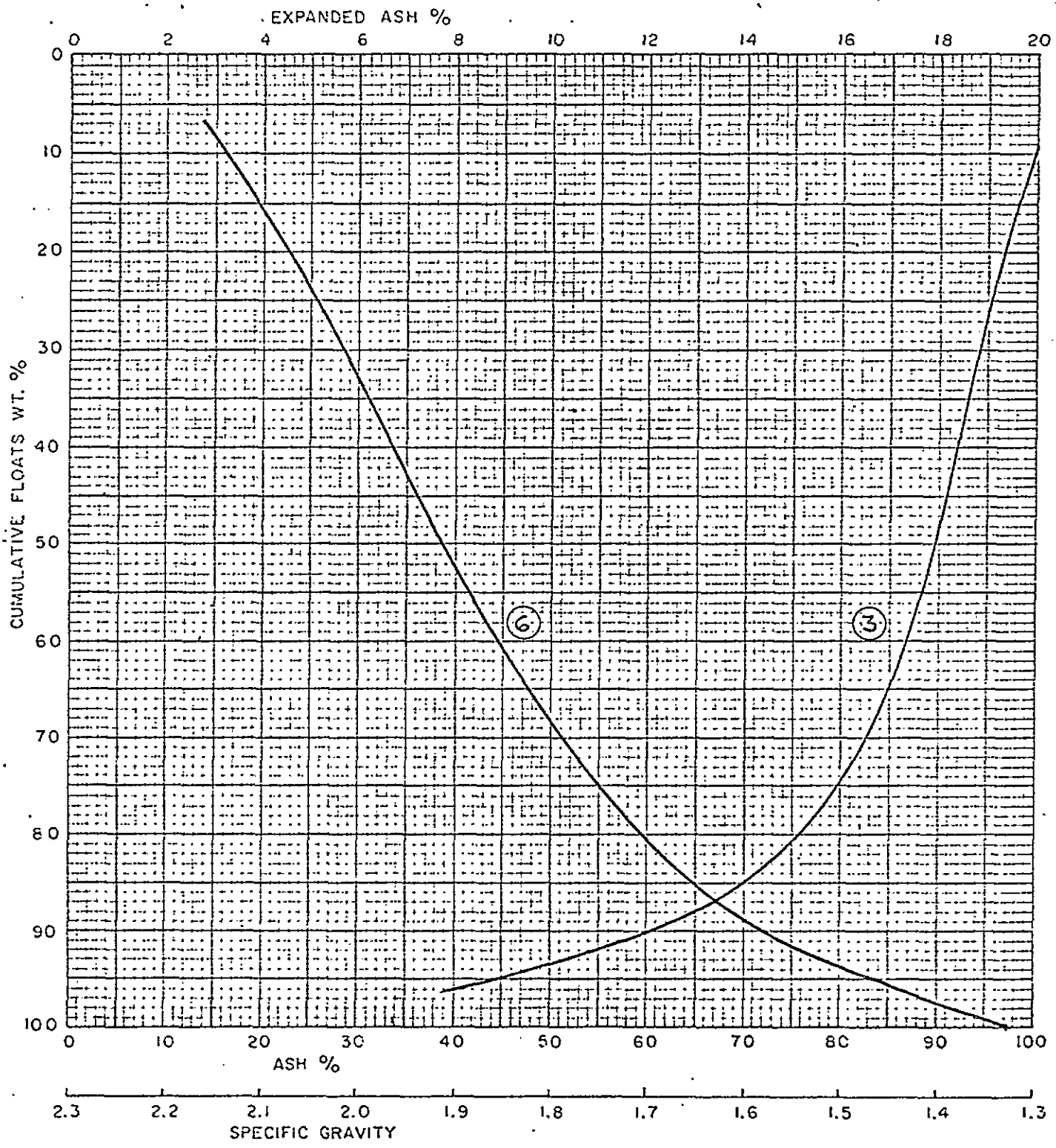
SAMPLE : Adit G12

SIZE : + 1 "

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE :

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 11: Adit G12

1" x 1/2": 13.78% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	4.03	2.71	23.04	4.03	8½
1.30 - 1.35	15.44	6.47	21.89	19.47	8
1.35 - 1.40	22.81	10.46	20.55	42.28	7
1.40 - 1.45	18.36	15.55	19.21	60.64	6
1.45 - 1.50	11.94	20.18	17.76	72.58	4½
1.50 - 1.55	5.12	25.10	17.41	77.70	4½
1.55 - 1.60	3.28	31.53	16.59	80.98	4
1.60 - 1.70	6.23	38.40	15.18	87.21	4
1.70 - 1.80	3.12	49.93	13.58	90.33	3½
+ 1.80	9.67	76.43	10.58	100.00	3
Total	100.00	22.42	18.47		

TABLE 12: Adit G12

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	4.03	2.71	4.03	2.71	100.00	22.42	2.01	2.71
1.30 - 1.35	15.44	6.47	19.47	5.69	95.97	23.25	11.75	6.47
1.35 - 1.40	22.81	10.46	42.28	8.26	80.53	26.46	30.87	10.46
1.40 - 1.45	18.36	15.55	60.64	10.47	57.72	32.79	51.46	15.55
1.45 - 1.50	11.94	20.18	72.58	12.07	39.36	40.83	66.61	20.18
1.50 - 1.55	5.12	25.10	77.70	12.93	27.42	49.82	75.14	25.10
1.55 - 1.60	3.28	31.53	80.98	13.68	22.30	55.49	19.34	31.53
1.60 - 1.70	6.23	38.40	87.21	15.45	19.02	59.63	84.09	38.40
1.70 - 1.80	3.12	49.93	90.33	16.64	12.79	69.97	88.77	49.93
+ 1.80	9.67	76.43	100.00	22.42	9.67	76.43	95.16	76.43
Total	100.00	22.42						

FIGURE : 3

COMPANY : DENISON MINES LTD.

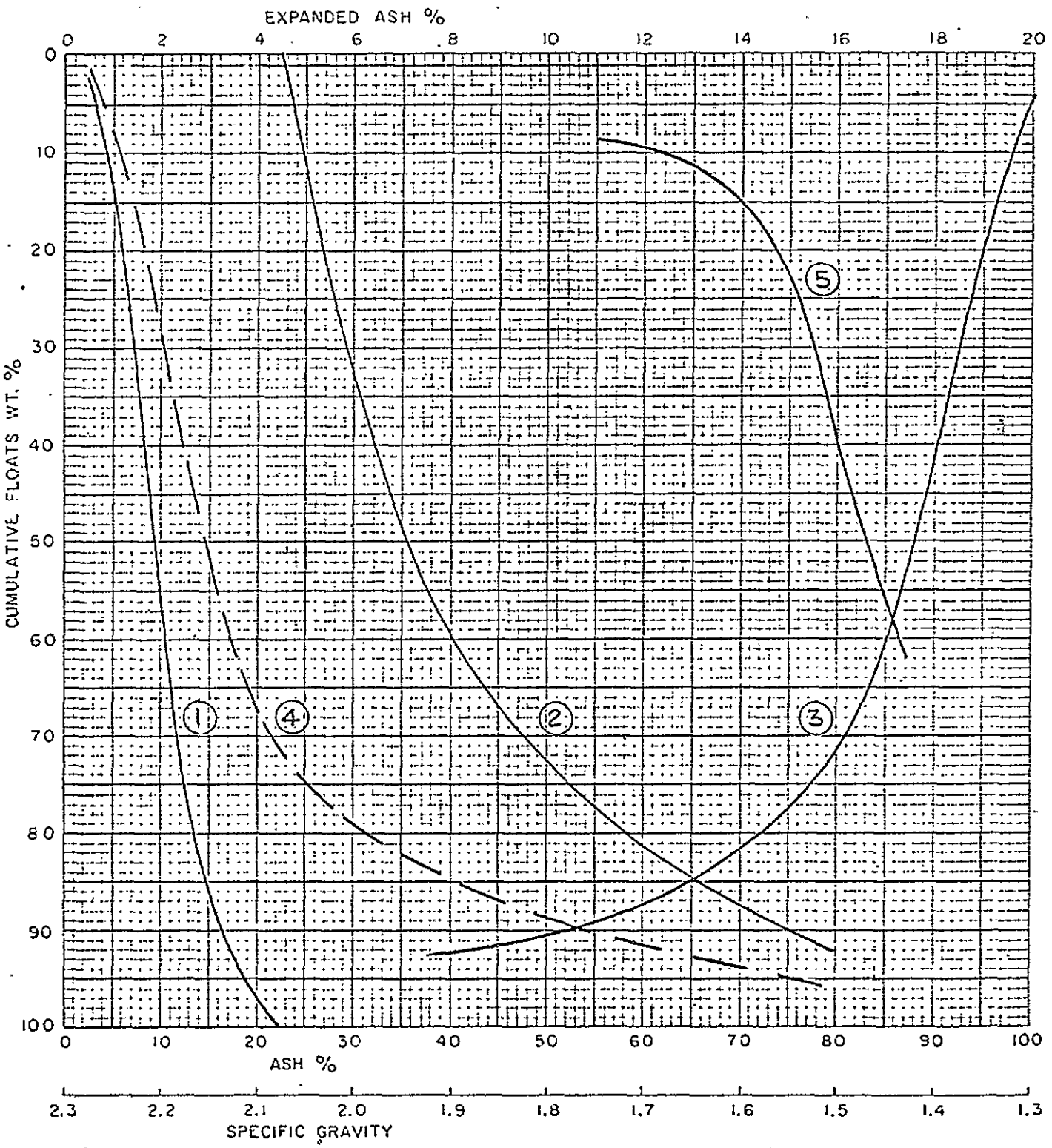
SAMPLE : Adit G12

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 3a

COMPANY : DENISON MINES LTD.

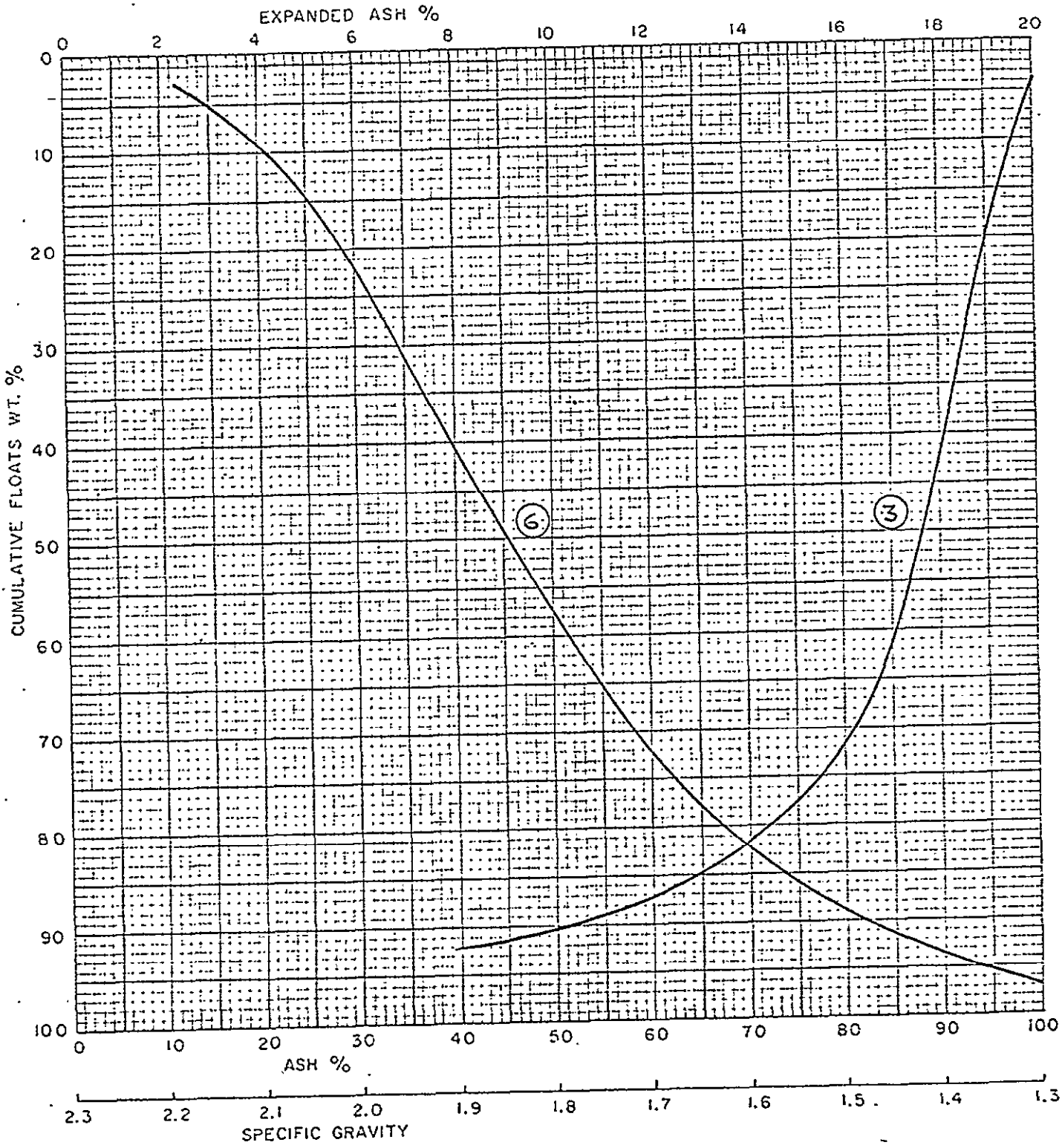
SAMPLE : Adit G12

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 13: Adit G12

1/2" x 1/4": 15.71% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	7.31	3.07	23.69	7.31	8½
1.30 - 1.35	14.63	6.86	22.34	21.94	7½
1.35 - 1.40	22.03	10.52	19.82	43.97	7
1.40 - 1.45	15.40	16.01	19.07	59.37	6
1.45 - 1.50	11.59	20.71	17.64	70.96	5
1.50 - 1.55	6.17	25.34	17.13	77.13	4½
1.55 - 1.60	4.18	31.20	16.40	81.31	3½
1.60 - 1.70	5.53	38.61	15.72	86.84	3
1.70 - 1.80	2.23	47.89	13.99	89.07	2½
+ 1.80	10.93	76.49	10.29	100.00	2
Total	100.00	22.84	18.39		

TABLE 14 Adit G12

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	7.31	3.07	7.31	3.07	100.00	22.84	3.65	3.07
1.30 - 1.35	14.63	6.86	21.94	5.60	92.69	24.40	14.62	6.86
1.35 - 1.40	22.03	10.52	43.97	8.06	78.06	27.69	32.95	10.52
1.40 - 1.45	15.40	16.01	59.37	10.12	56.03	34.44	51.67	16.01
1.45 - 1.50	11.59	20.71	70.96	11.85	40.63	41.43	66.16	20.71
1.50 - 1.55	6.17	25.34	77.13	12.93	29.04	49.69	74.04	25.34
1.55 - 1.60	4.18	31.20	81.31	13.87	22.87	56.26	79.22	31.20
1.60 - 1.70	5.53	38.61	86.84	15.45	18.69	61.87	84.07	38.61
1.70 - 1.80	2.23	47.89	89.07	16.26	13.16	71.64	87.95	47.89
+ 1.80	10.93	76.49	100.00	22.84	10.93	76.49	94.53	76.49
Total	100.00	22.84						

FIGURE : 4

COMPANY : DENISON MINES LTD.

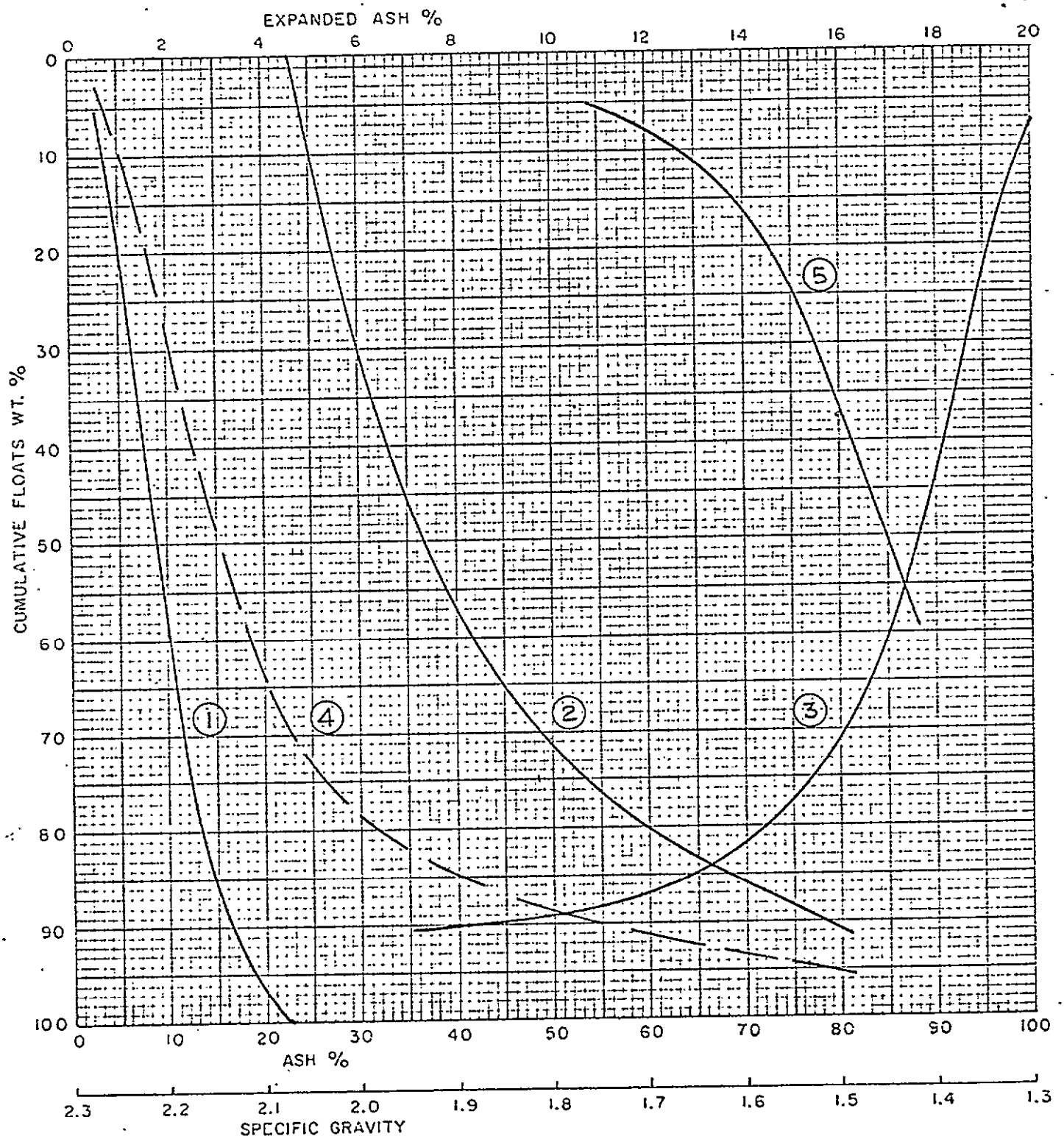
SAMPLE : Adit G12

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 4a

COMPANY : DENISON MINES LTD.

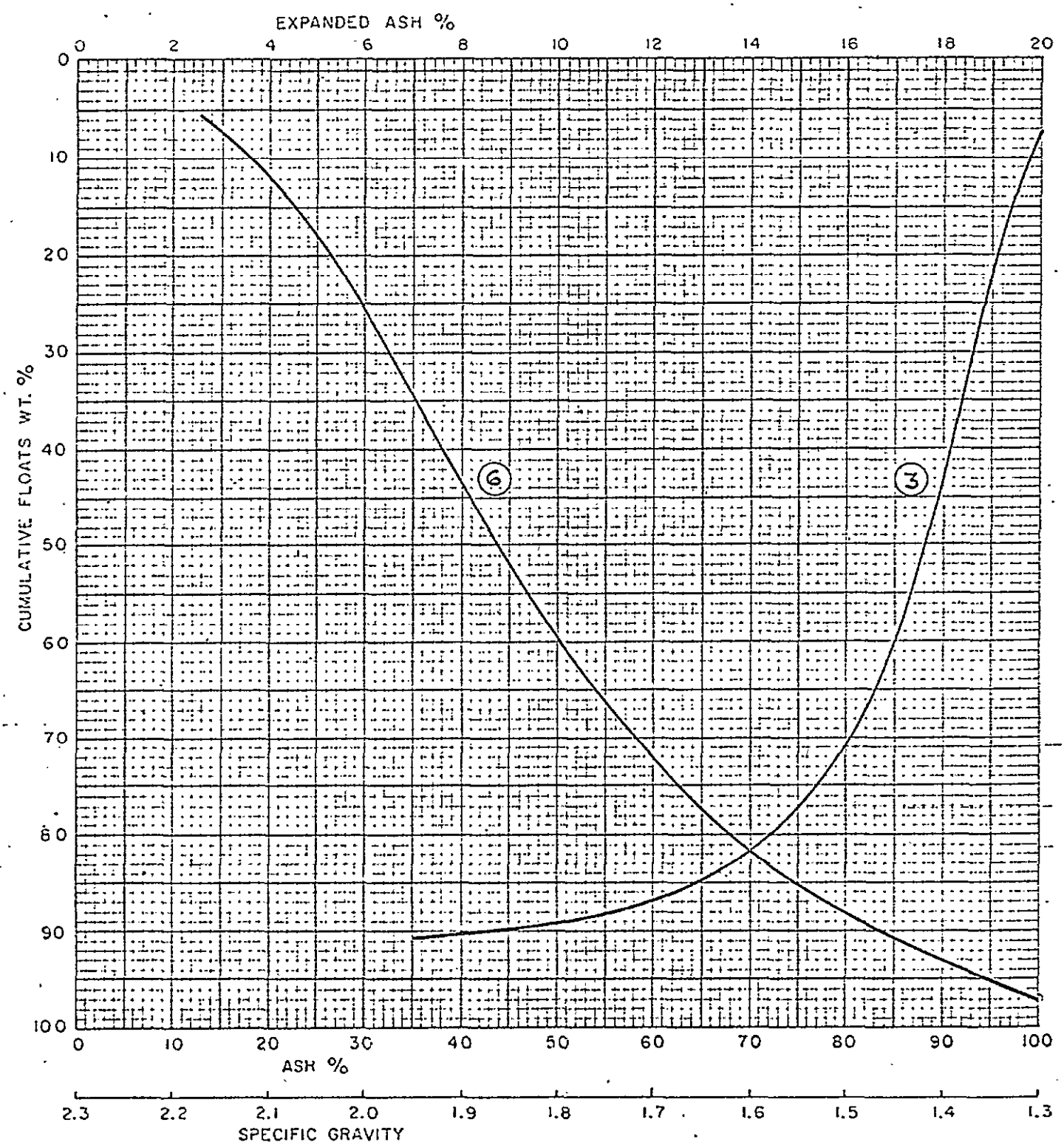
SAMPLE : Adit G12

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 15: Adit G12

1/4" x 8 M.: 17.01% of Sample

Ash, Volatile Matter, & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	8.80	2.86	23.30	8.80	9
1.30 - 1.35	14.74	6.01	22.15	23.54	8½
1.35 - 1.40	19.00	10.22	19.62	42.54	7½
1.40 - 1.45	12.33	15.87	18.72	54.87	6½
1.45 - 1.50	12.51	20.11	17.58	67.38	5½
1.50 - 1.55	6.01	25.27	17.24	73.39	5
1.55 - 1.60	5.90	30.94	16.51	79.29	5
1.60 - 1.70	6.04	38.42	15.86	85.33	4½
1.70 - 1.80	2.19	46.56	14.45	87.52	4½
+ 1.80	12.48	76.89	10.31	100.00	2½
Total	100.00	23.83	18.12		

TABLE 16: Adit G12

Washability Data: 1/4" x 8 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	8.80	2.86	8.80	2.86	100.00	23.83	4.40	2.86
1.30 - 1.35	14.74	6.01	23.54	4.83	91.20	25.86	16.17	6.01
1.35 - 1.40	19.00	10.22	42.54	7.24	76.46	29.68	33.04	10.22
1.40 - 1.45	12.33	15.87	54.87	9.18	57.46	36.12	48.70	15.87
1.45 - 1.50	12.51	20.11	67.38	11.21	45.13	41.65	61.12	20.11
1.50 - 1.55	6.01	25.27	73.39	12.36	32.62	49.91	70.38	25.27
1.55 - 1.60	5.90	30.94	79.29	13.74	26.61	55.47	76.34	30.94
1.60 - 1.70	6.04	38.42	85.33	15.49	20.71	62.46	82.31	38.42
1.70 - 1.80	2.19	46.56	87.52	16.27	14.67	72.36	86.42	46.56
+ 1.80	12.48	76.89	100.00	23.83	12.48	76.89	93.76	76.89
Total	100.00	23.83						

FIGURE : 5

COMPANY : DENISON MINES LTD.

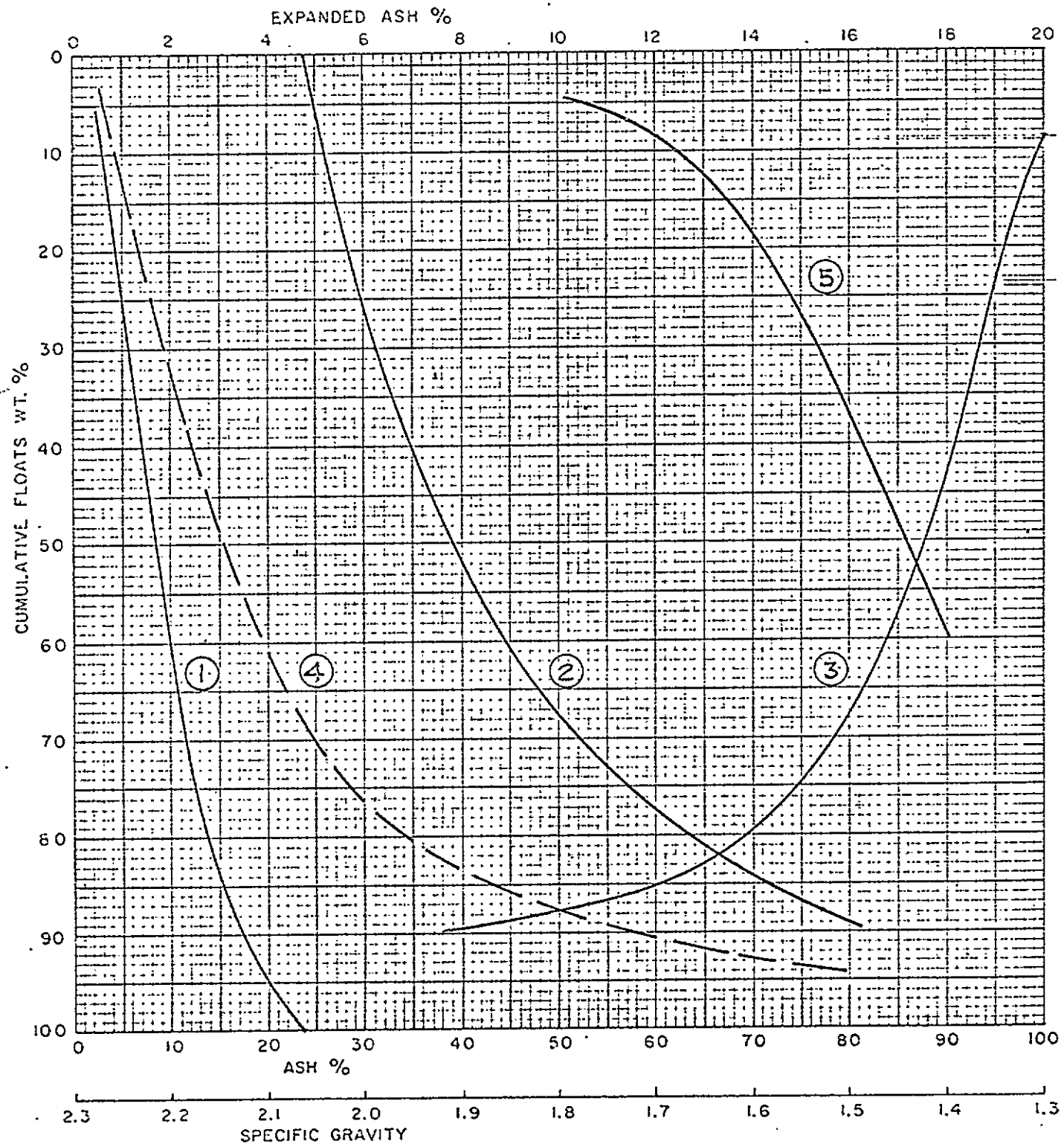
SAMPLE : Adit G12

SIZE : 1/4" x 8 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5 a

COMPANY : DENISON MINES LTD.

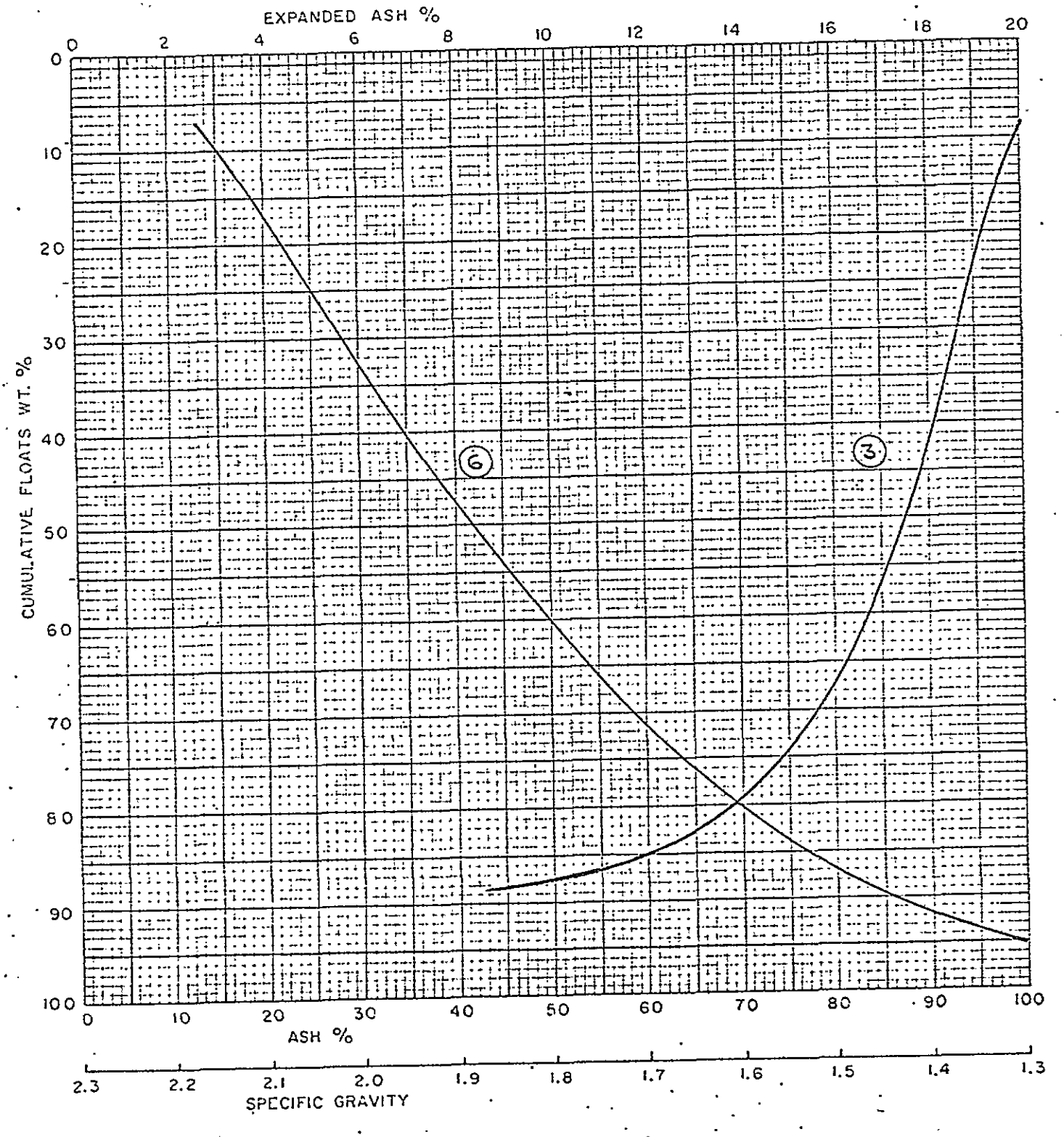
SAMPLE : Adit G12

SIZE : 1/4" x 8 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 17: Adit G12

8 x 28 M.: 23.94% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt.%	F.S.I. Cum.
- 1.30	22.22	2.13	24.02	22.22	9+
1.30 - 1.35	15.21	5.60	22.33	37.43	9
1.35 - 1.40	15.49	10.43	19.64	52.92	9
1.40 - 1.45	11.17	16.60	18.63	64.09	8½
1.45 - 1.50	8.59	20.53	17.80	72.68	8
1.50 - 1.55	5.92	24.96	17.42	78.60	8
1.55 - 1.60	5.16	30.91	16.43	83.76	7½
1.60 - 1.70	5.94	38.52	16.09	89.70	7
1.70 - 1.80	1.70	46.16	15.58	91.40	6½
+ 1.80	8.60	70.48	11.57	100.00	4½
Total	100.00	18.76	19.48		

TABLE 18: Adit G12

Washability Data: 8 x 28 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	22.22	2.13	22.22	2.13	100.00	18.76	11.11	2.13
-1.30- 1.35	15.21	5.60	37.43	3.54	77.78	23.52	29.82	5.60
1.35 - 1.40	15.49	10.43	52.92	5.56	62.57	27.87	45.17	10.43
1.40 - 1.45	11.17	16.60	64.09	7.48	47.08	33.61	58.50	16.60
1.45 - 1.50	8.59	20.53	72.68	9.02	35.91	38.90	68.30	20.53
1.50 - 1.55	5.92	24.96	78.60	10.22	27.32	44.68	75.64	24.96
1.55 - 1.60	5.16	30.91	83.76	11.50	21.40	50.14	81.18	30.91
1.60 - 1.70	5.94	38.52	89.70	13.29	16.24	56.24	86.73	38.52
1.70 - 1.80	1.70	46.16	91.40	13.90	10.30	66.47	90.55	46.16
+ 1.80	8.60	70.48	100.00	18.76	8.60	70.48	95.70	70.48
Total	100.00	18.76						

FIGURE : 6

COMPANY : DENISON MINES LTD.

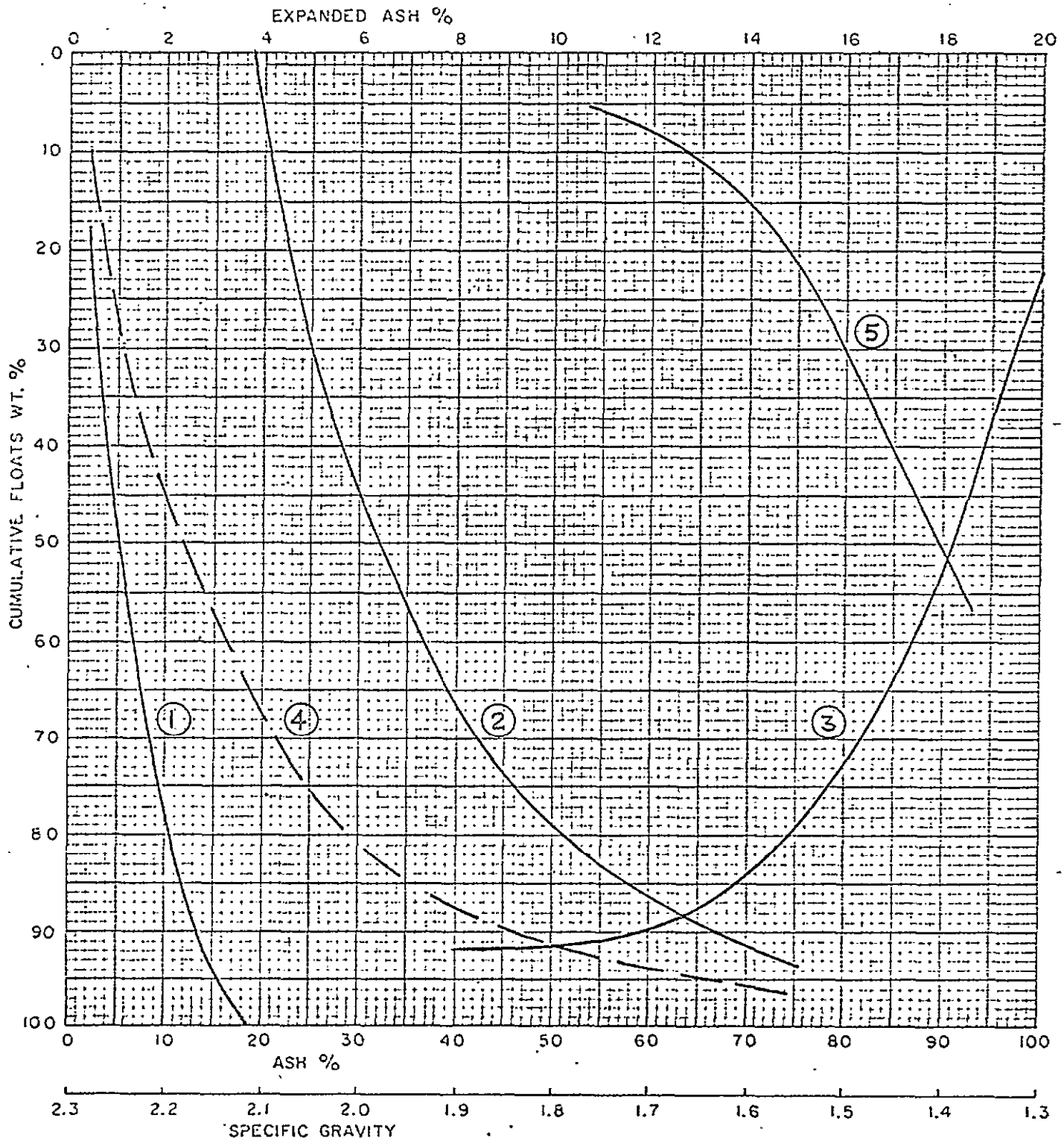
SAMPLE : Adit G12

SIZE : 8 x 28 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 6a

COMPANY : DENISON MINES LTD.

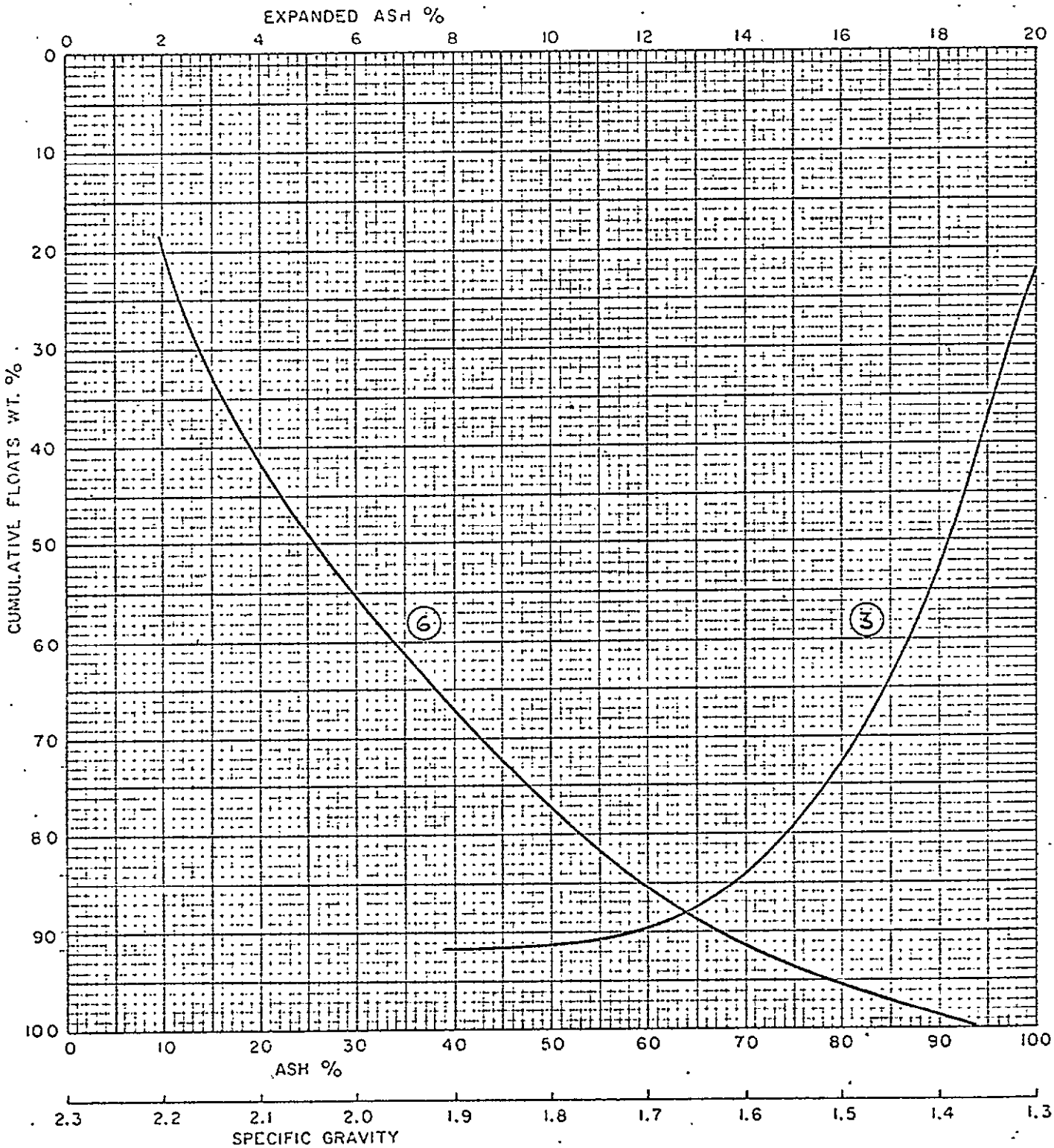
SAMPLE : Adit G12

SIZE : 8 x 28 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 19: Adit G12

28 x 100 M.: 14.11% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific G.	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	38.84	2.27	24.95	38.84	9+
1.30 - 1.35	12.06	5.12	22.87	50.90	9
1.35 - 1.40	11.13	9.12	20.84	62.03	9
1.40 - 1.45	9.13	14.83	18.78	71.16	9
1.45 - 1.50	7.74	19.76	17.63	78.90	9
1.50 - 1.55	5.01	24.31	17.31	83.91	8½
1.55 - 1.60	3.02	30.80	16.49	86.93	8½
1.60 - 1.70	4.91	38.72	16.13	91.84	8½
1.70 - 1.80	1.69	46.11	15.17	93.53	8
+ 1.80	6.47	70.18	12.64	100.00	6½
Total	100.00	14.76	21.07		

TABLE 20: Adit G12

Washability Data: 28 x 100 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	38.84	2.27	38.84	2.27	100.00	14.76	19.42	2.27
1.30 - 1.35	12.06	5.12	50.90	2.95	61.16	22.70	44.87	5.12
1.35 - 1.40	11.13	9.12	62.03	4.05	49.10	27.02	56.46	9.12
1.40 - 1.45	9.13	14.83	71.16	5.44	37.97	32.27	66.59	14.83
1.45 - 1.50	7.74	19.76	78.90	6.84	28.84	37.79	75.03	19.76
1.50 - 1.55	5.01	24.31	83.91	7.88	21.10	44.40	81.40	24.31
1.55 - 1.60	3.02	30.80	86.93	8.68	16.09	50.66	85.42	30.80
1.60 - 1.70	4.91	38.72	91.84	10.29	13.07	55.25	89.38	38.72
1.70 - 1.80	1.69	46.11	93.53	10.93	8.16	65.19	92.68	46.11
+ 1.80	6.47	70.18	100.00	14.76	6.47	70.18	96.76	70.18
Total	100.00	14.76						

FIGURE : 7

COMPANY : DENISON MINES LTD.

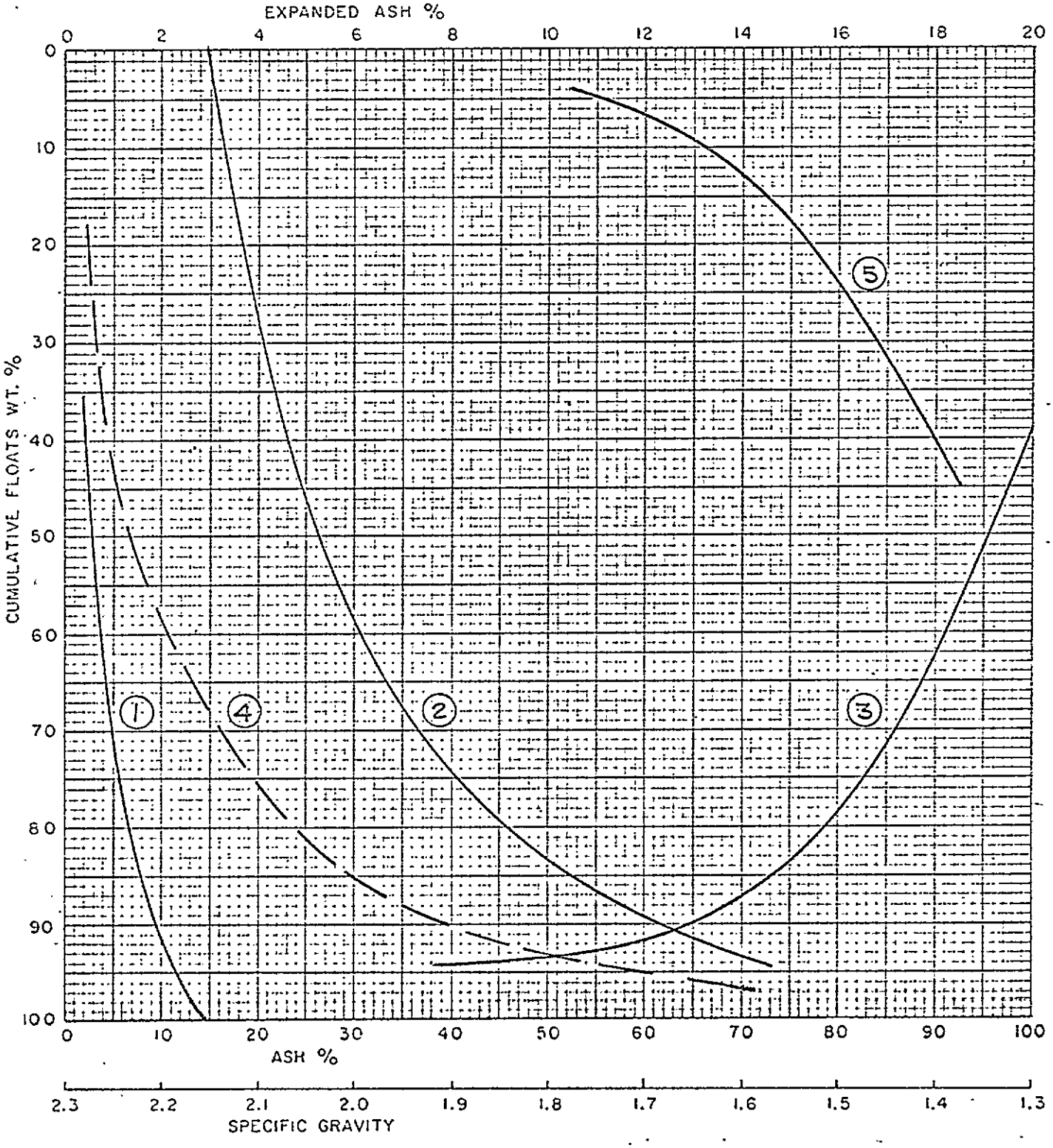
SAMPLE : Adit G12

SIZE : 28 x 100 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 7a

COMPANY : DENISON MINES LTD.

SAMPLE : Adit G12

SIZE : 28 x 100 M.

WASHABILITY CURVES

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
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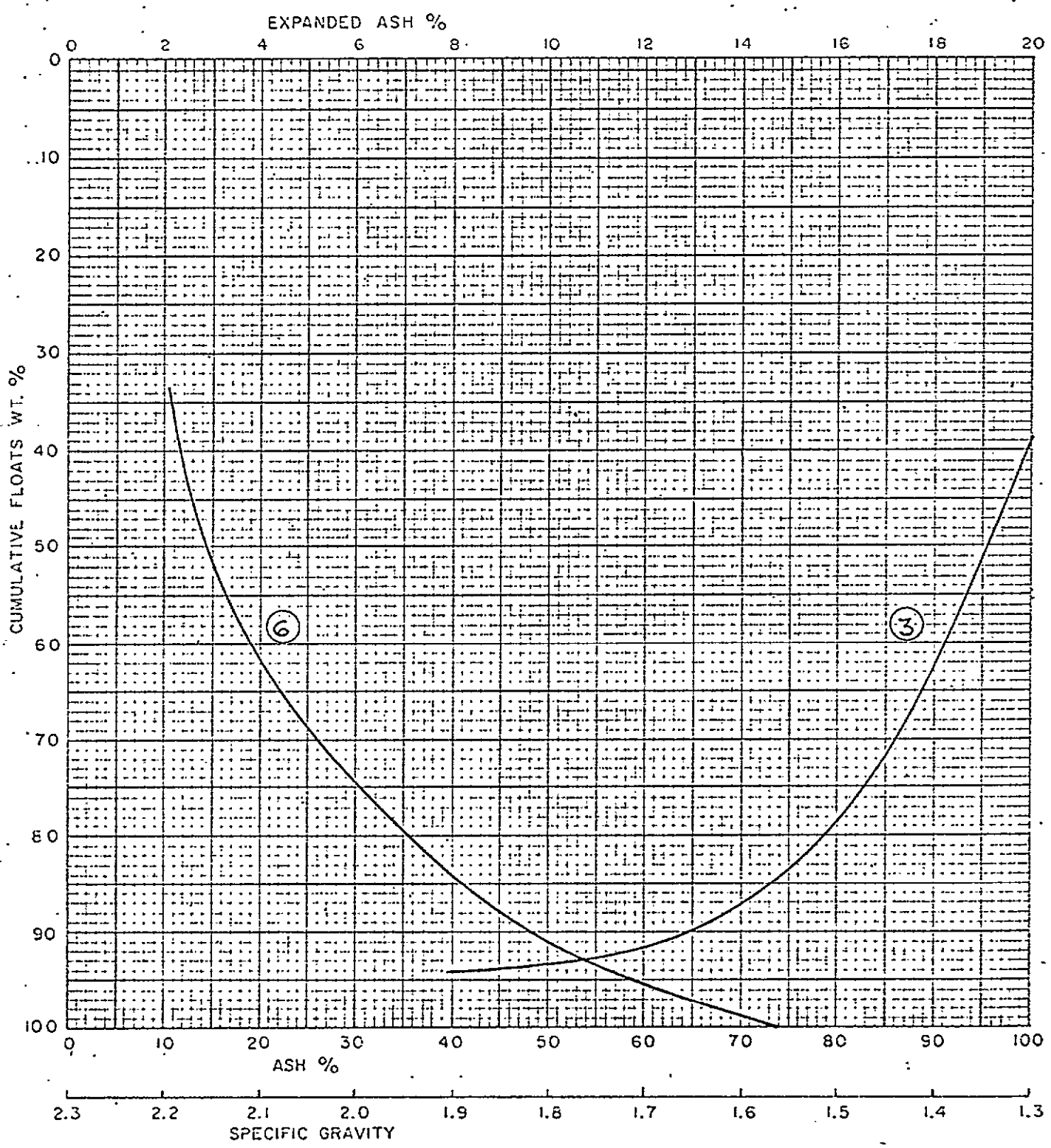
6 - EXPANDED FLOATS



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 21: Adit G12

28 x 100 Mesh: 14.11% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	69.54%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	8.86	25.74
Volatile Matter, %	21.16	19.56
Residual Moisture, %	0.85	0.81
Fixed Carbon, %	69.13%	53.89%
F.S.I.	7½	3
Sulphur, %	0.69	0.82

TABLE 22: Adit G12

- 100 Mesh: 6.26% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	89.10%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	9.76	51.03
Volatile Matter, %	21.25	17.37
Residual Moisture, %	0.87	0.91
Fixed Carbon, %	68.12	30.69
F.S.I.	7½	N.A.
Sulphur	0.95	3.23

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT G12

Submitted by

CYCLONE ENGINEERING SALES LTD.
Edmonton, Alberta, Canada

Report No.: RL-72.15

Job No.: S1 - 84

Dated: April 22, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT G12

SUMMARY:

The data presented in this report refer to the washability characteristics of Denison Mines Sample of Adit #G12.

The coal is of medium volatile bituminous rank. It has an Ash of 19% and F.S.I. of 4½.

Cleaning characterisitcs of the coal are not easy because of large amount of near gravity material present at all cut points up to about 1.65.

If the coal were to be cleaned to 7% Ash, a yield of only 52% would be obtained. The cut point for such a cleaning is 1.41 and the amount of near gravity material is over 50%.

The F.S.I. of clean coal would be 8½.

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INTRODUCTION:

A one ton sample of Adit G12 was air dried and the following work was done:

1. A size analysis at 2", 1", 1/2",1/4", 8m., 28m. and 100m.

2. A proximate analysis on all size fractions.

3. A float-sink analysis on all size fractions, except -100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, 1.60, 1.70 and 1.80.

4. Ash, Volatile Matter and Free Swelling Index determinations on all specific gravity fractions.

5. Washability curves for all size fractions, except -100 mesh.

6. Washability curves for +100 mesh fraction of the raw sample by reconstituting the data in 5.

7. Froth flotation tests on 28m. x 100m. and -100m. fractions.

CONCLUSIONS & RECOMMENDATIONS:

A high cut point is almost essential for cleaning of this coal. The increase in Ash is very likely to be compensated for by the increased yield. If, for example, it was cleaned at a cut point of 1.7 where the amount of near gravity material is about 8%, a yield of 89% can be obtained. The ash of clean coal will be 14%.

However, the F.S.I. still will have a value of 5½.

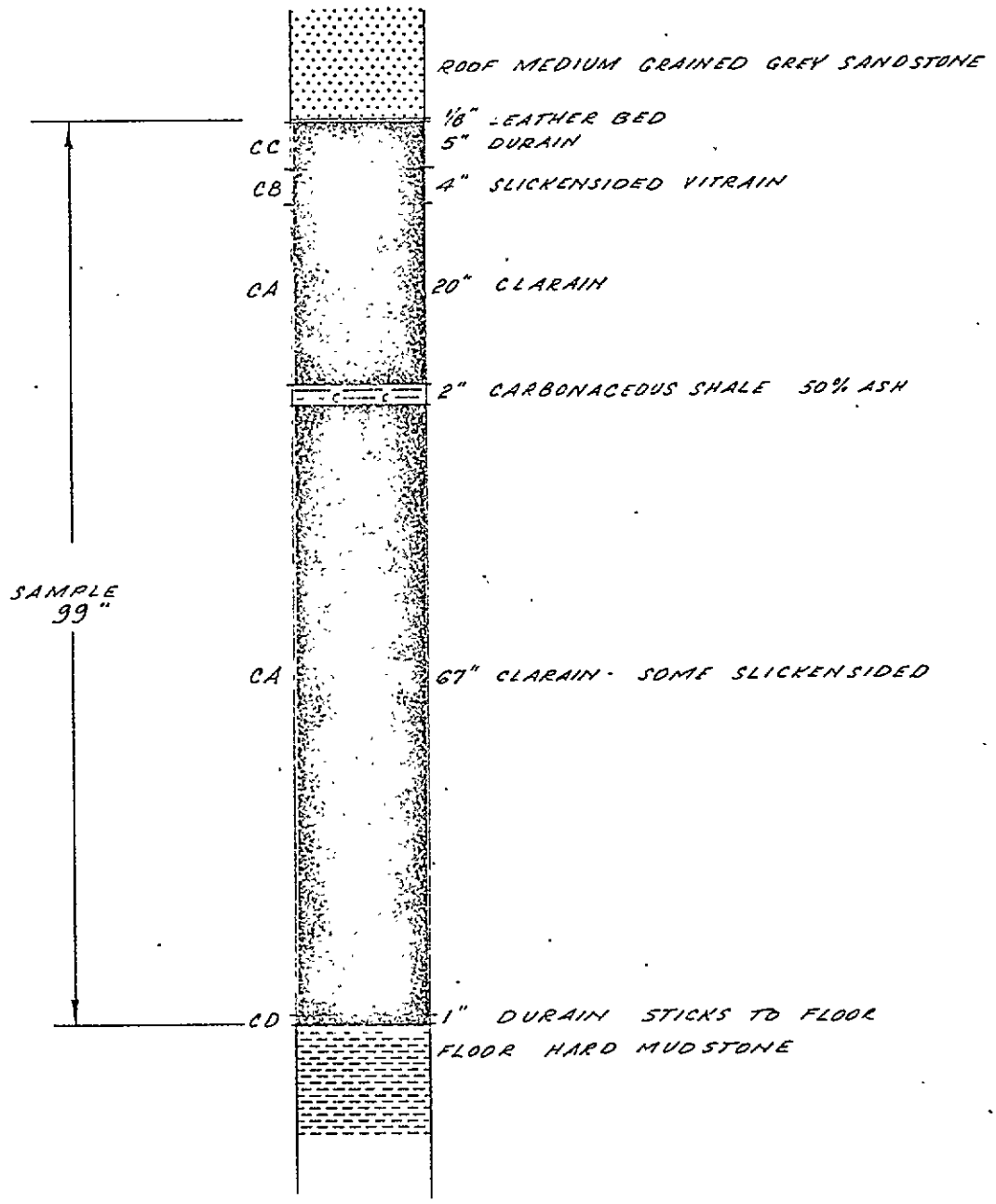
This coal could be ideal for blending with a low ash medium F.S.I. coal.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R. S. Sehgal, P. Eng.
Laboratory Manager



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM SECTION G - ADIT 12

DRAWN BY E J T	DATE MAY '72	SCALE 1" = 20'
APPROVED BY	DRAWING NO	

TABLE 1: Adit G12

Classification by Rank

Ash	20.23%
Volatile Matter	19.11%
Residual Moisture	0.78%
Fixed Carbon	59.88%
F.S.I.	4½
B.T.U./lb.	12,090
Sulphur	0.62%
Rank	mvb

TABLE 2: Adit G12

Analysis of Size Fractions.

Size	Wt. %	Ash %	V.M. %	R.M. %	F.C. %	S. %	F.S.I.
+ 2"	3.94	14.60	20.16	0.59	64.65	0.58	6
2" x 1"	5.24	22.20	19.23	0.68	57.89	0.59	3½
1" x 1/2"	13.78	22.95	18.91	0.59	57.55	0.56	3
1/2" x 1/4"	15.71	23.24	18.06	0.65	58.05	0.56	2
1/4" x 8m.	17.01	24.24	17.86	0.91	56.99	0.56	2½
8 x 28 m.	23.95	19.19	19.26	0.87	60.68	0.57	4½
28 x 100m.	14.11	14.50	20.74	0.83	63.93	0.72	6½
- 100 m.	6.26	14.65	20.50	0.89	63.96	1.15	7
Total	100.00	20.23	19.11	0.78	59.88	0.62	4½

TABLE 3: Adit G12

Weight % and Ash % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the ash content of individual fractions.)

Size \ Sp.Gr.	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.70	1.80	Total
+ 1"	0.84 (3.16)	1.62 (6.42)	2.00 (10.29)	1.52 (15.40)	0.91 (21.08)	0.47 (25.49)	0.46 (31.67)	0.45 (38.32)	0.33 (50.01)	0.58 (72.90)	9.18 (19.45)
1" x 1/2"	0.56 (2.71)	2.13 (6.47)	3.13 (10.46)	2.53 (15.55)	1.65 (20.18)	0.71 (25.10)	0.45 (31.53)	0.86 (38.40)	0.43 (49.93)	1.33 (76.43)	13.78 (22.42)
1/2" x 1/4"	1.15 (3.07)	2.30 (6.86)	3.45 (10.52)	2.42 (16.01)	1.82 (20.71)	0.96 (25.34)	0.66 (31.20)	0.87 (38.61)	0.36 (47.89)	1.72 (76.49)	15.71 (22.84)
1/4" x 8 m.	1.50 (2.86)	2.51 (6.01)	3.23 (10.22)	2.10 (15.87)	2.13 (20.11)	1.02 (25.27)	1.00 (30.94)	1.03 (38.42)	0.37 (46.56)	2.12 (76.89)	17.01 (23.83)
8 x 28 m.	5.32 (2.13)	3.64 (5.60)	3.70 (10.43)	2.68 (16.60)	2.06 (20.53)	1.42 (24.96)	1.24 (30.91)	1.42 (38.52)	0.41 (46.16)	2.06 (70.48)	23.95 (18.76)
28 x 100 m.	5.48 (2.27)	1.70 (5.12)	1.57 (9.12)	1.29 (14.83)	1.09 (19.76)	0.71 (24.31)	0.43 (30.80)	0.69 (38.72)	0.24 (46.11)	0.91 (70.18)	14.11 (14.76)
Total	14.85 (2.41)	13.90 (6.05)	17.08 (10.28)	12.54 (15.82)	9.66 (20.38)	5.29 (25.07)	4.24 (31.10)	5.32 (38.50)	2.14 (47.87)	8.72 (74.26)	93.74 (20.37)
- 100 m.	This fraction forms 6.26% of the total sample and has an ash content of 14.65%, thus giving a total sample ash value of 20.01%.										

TABLE 4: Adit G12

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity.

(Figures in brackets show the V.M. content of individual fractions.)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.70	1.80		Total
+ 1"	0.84 (23.98)	1.62 (22.76)	2.00 (21.15)	1.52 (19.91)	0.91 (17.34)	0.47 (17.02)	0.46 (16.26)	0.45 (15.03)	0.33 (12.76)	0.58 (10.84)	9.18 (19.40)
1" x 1/2"	0.56 (23.04)	2.13 (21.89)	3.13 (20.55)	2.53 (19.21)	1.65 (17.76)	0.71 (17.41)	0.45 (16.59)	0.86 (15.18)	0.43 (13.58)	1.33 (10.58)	13.78 (18.47)
1/2" x 1/4"	1.15 (23.69)	2.30 (22.34)	3.45 (19.82)	2.42 (19.07)	1.82 (17.64)	0.96 (17.13)	0.66 (16.40)	0.87 (15.72)	0.36 (13.99)	1.72 (10.29)	15.71 (18.39)
1/4" x 8 m.	1.50 (23.30)	2.51 (22.15)	3.23 (19.62)	2.10 (18.72)	2.13 (17.58)	1.02 (17.24)	1.00 (16.51)	1.03 (15.86)	0.37 (14.45)	2.12 (10.31)	17.01 (18.12)
8 x 28 m.	5.32 (24.02)	3.64 (22.33)	3.70 (19.64)	2.68 (18.63)	2.06 (17.80)	1.42 (17.42)	1.24 (16.43)	1.42 (16.09)	0.41 (15.58)	2.06 (11.57)	23.95 (19.48)
28 x 100 m.	5.48 (24.95)	1.70 (22.87)	1.57 (20.84)	1.29 (18.78)	1.09 (17.63)	0.71 (17.31)	0.43 (16.49)	0.69 (16.13)	0.24 (15.17)	0.91 (12.64)	14.11 (21.07)
Total	14.85 (24.23)	13.90 (22.35)	17.08 (20.13)	12.54 (19.02)	9.66 (17.65)	5.29 (17.28)	4.24 (16.45)	5.32 (15.75)	2.14 (14.23)	8.72 (10.92)	93.74 (19.14)
- 100 m.	This fraction forms 6.26% of the total sample and has a volatile matter content of 20.50%, thus giving a total sample vaoltile matter value of 19.24%.										

TABLE 5: Adit G12

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity.

(Figures in brackets show the cumulative F.S.I. of cumulative fractions.)

Size \ Sp. Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.55	- 1.60	- 1.70	- 1.80	Raw
+ 1"	0.84 (8½)	2.46 (8)	4.46 (8)	5.98 (7½)	6.89 (6)	7.36 (5½)	7.82 (5)	8.27 (5)	8.60 (5)	9.18 (4½)
1" x 1/2"	0.56 (8½)	2.69 (8)	5.82 (7)	8.35 (6)	10.00 (4½)	10.71 (4½)	11.16 (4)	12.02 (4)	12.45 (3½)	13.78 (3)
1/2" x 1/4"	1.15 (8½)	3.45 (7½)	6.90 (7)	9.32 (6)	11.14 (5)	12.10 (4½)	12.76 (3½)	13.63 (3)	13.99 (2½)	15.71 (2)
1/4" x 8 m.	1.50 (9)	4.01 (8½)	7.24 (7½)	9.34 (6½)	11.47 (5½)	12.49 (5)	13.49 (5)	14.52 (4½)	14.89 (4½)	17.01 (2½)
8 x 28 m.	5.32 (9+)	8.96 (9)	12.66 (9)	15.34 (8½)	17.40 (8)	18.82 (8)	20.06 (7½)	21.48 (7)	21.89 (6½)	23.95 (4½)
28 x 100 m.	5.48 (9+)	7.18 (9)	8.75 (9)	10.04 (9)	11.13 (9)	11.84 (8½)	12.27 (8½)	12.96 (8½)	13.20 (8)	14.11 (6½)
Total	14.85	28.75	45.83	58.37	68.03	73.32	77.56	82.88	85.02	93.74
- 100 m.	Weight of this fraction is 6.26% and has a F.S.I. of 7.									

TABLE 6: Adit G12

Washability Data: + 100 m. - 93.74% of Sample.

(Reconstituted from Size Fractions.)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	15.84	2.41	15.84	2.41	100.00	20.37	7.92	2.41
1.30 - 1.35	14.83	6.05	30.67	4.17	84.16	23.75	23.25	6.05
1.35 - 1.40	18.22	10.28	48.89	6.45	69.33	27.54	39.78	10.28
1.40 - 1.45	13.38	15.82	62.27	8.46	51.11	33.70	55.08	15.82
1.45 - 1.50	10.31	20.38	72.58	10.15	37.73	40.04	67.42	20.38
1.50 - 1.55	5.64	25.07	78.22	11.23	27.42	47.43	75.40	25.07
1.55 - 1.60	4.52	31.10	82.74	12.32	21.78	53.21	80.48	31.10
1.60 - 1.70	5.68	38.50	88.42	14.00	17.26	59.01	85.58	38.50
1.70 - 1.80	2.28	47.87	90.70	14.85	11.58	69.06	89.56	47.87
+ 1.80	9.30	74.26	100.00	20.37	9.30	74.26	95.35	74.26
Total	100.00	20.37						

FIGURE: 1

COMPANY : DENISON MINES LTD.

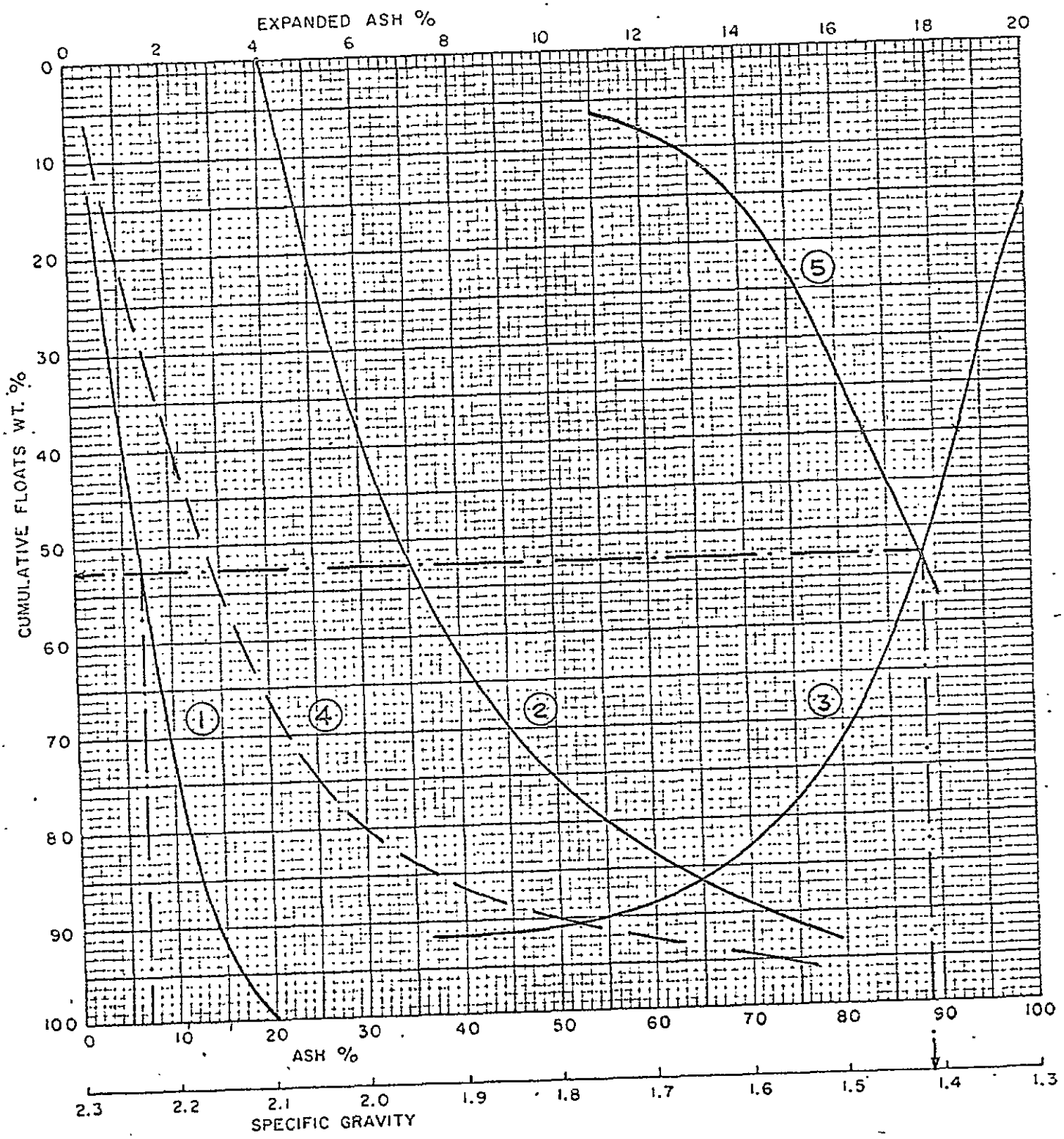
SAMPLE : Adit G12

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 1a

COMPANY : DENISON MINES LTD.

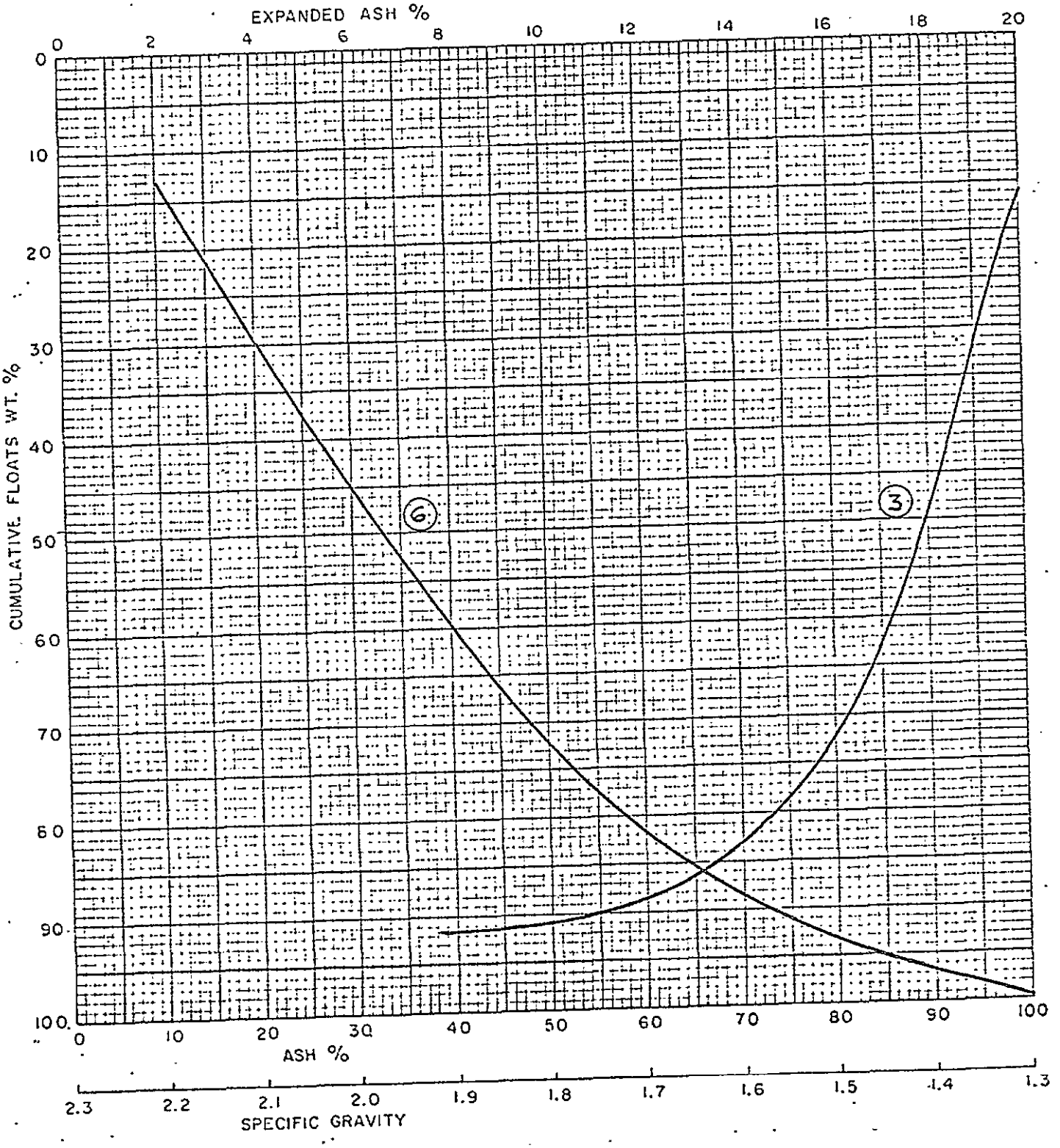
SAMPLE : Adit G12

SIZE : + 100 Mesh (Reconstituted)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 7: Adit G12

Cumulative Volatile Matter: + 100 m. - 93.74% of Sample.

(Reconstituted from Size Fractions.)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt. %	V.M. %	Wt. %	V.M. %	Wt. %	V.M. %
- 1.30	15.84	24.23	15.84	24.23	100.00	19.14
1.30 - 1.35	14.83	22.35	30.67	23.32	84.16	18.18
1.35 - 1.40	18.22	20.13	48.89	22.13	69.33	17.29
1.40 - 1.45	13.38	19.02	62.27	21.46	51.11	16.27
1.45 - 1.50	10.31	17.65	72.58	20.92	37.73	15.30
1.50 - 1.55	5.64	17.28	78.22	20.66	27.42	14.42
1.55 - 1.60	4.52	16.45	82.74	20.43	21.78	13.67
1.60 - 1.70	5.68	15.75	88.42	20.13	17.26	12.95
1.70 - 1.80	2.28	14.23	90.70	19.98	11.58	11.57
+ 1.80	9.30	10.92	100.00	19.14	9.30	10.92
Total	100.00	19.14				

TABLE 8: Adit G12

7% Ash of Clean Coal

Yield	52.00%
Floats Gravity	1.41
Near Gravity Material	51.00%
Ash	7.00%
Volatile Matter	22.00%
Residual Moisture	0.70%
Fixed Carbon	70.30%
F.S.I.	8½

TABLE 9: Adit G12

+ 1": 9.18% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	9.18	3.16	23.98	9.18	8½
1.30 - 1.35	17.62	6.42	22.76	26.80	8
1.35 - 1.40	21.84	10.29	21.15	48.64	8
1.40 - 1.45	16.59	15.40	19.91	65.23	7½
1.45 - 1.50	9.96	21.08	17.34	75.19	6
1.50 - 1.55	5.12	25.49	17.02	80.31	5½
1.55 - 1.60	4.88	31.67	16.26	85.19	5
1.60 - 1.70	4.94	38.32	15.03	90.13	5
1.70 - 1.80	3.56	50.01	12.76	93.69	5
+ 1.80	6.31	72.90	10.84	100.00	4½
Total	100.00	19.45	19.40		

TABLE 10: Adit G12

Washability Data: + 1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	9.18	3.16	9.18	3.16	100.00	19.45	4.59	3.16
1.30 - 1.35	17.62	6.42	26.80	5.30	90.82	21.09	17.99	6.42
1.35 - 1.40	21.84	10.29	48.64	7.54	73.20	24.63	37.72	10.29
1.40 - 1.45	16.59	15.40	65.23	9.54	51.36	30.72	56.93	15.40
1.45 - 1.50	9.96	21.08	75.19	11.07	34.77	38.03	70.11	21.08
1.50 - 1.55	5.12	25.49	80.31	11.99	24.81	44.84	77.75	25.49
1.55 - 1.60	4.88	31.67	85.19	13.12	19.69	49.87	82.75	31.67
1.60 - 1.70	4.94	38.32	90.13	14.50	14.81	55.86	87.66	38.32
1.70 - 1.80	3.56	50.01	93.69	15.85	9.87	64.64	91.91	50.01
+ 1.80	6.31	72.90	100.00	19.45	6.31	72.90	96.84	72.90
Total	100.00	19.45						

FIGURE: 2

COMPANY : DENISON MINES LTD.

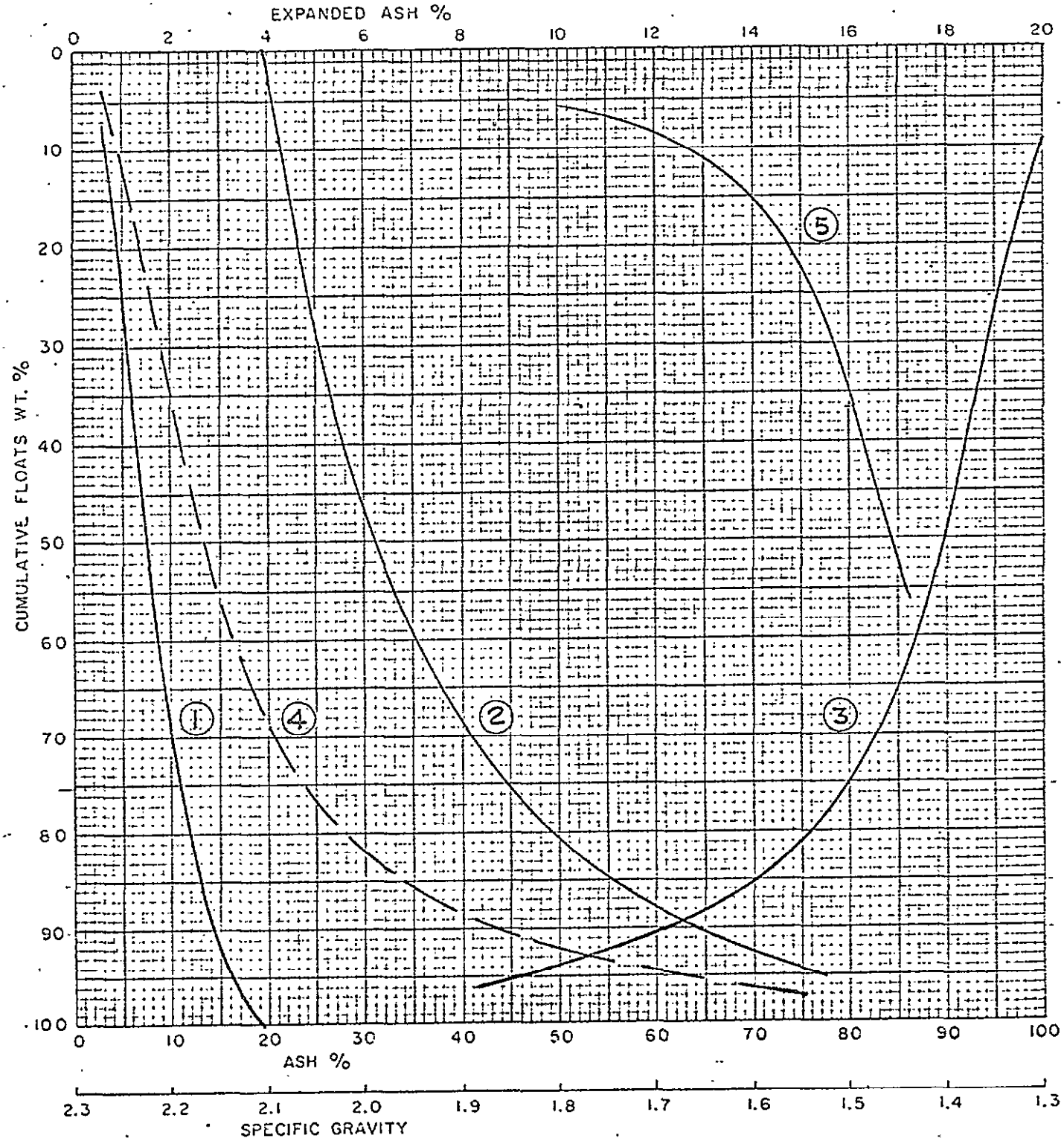
SAMPLE : Adit G12

SIZE : + 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : DENISON MINES LTD.

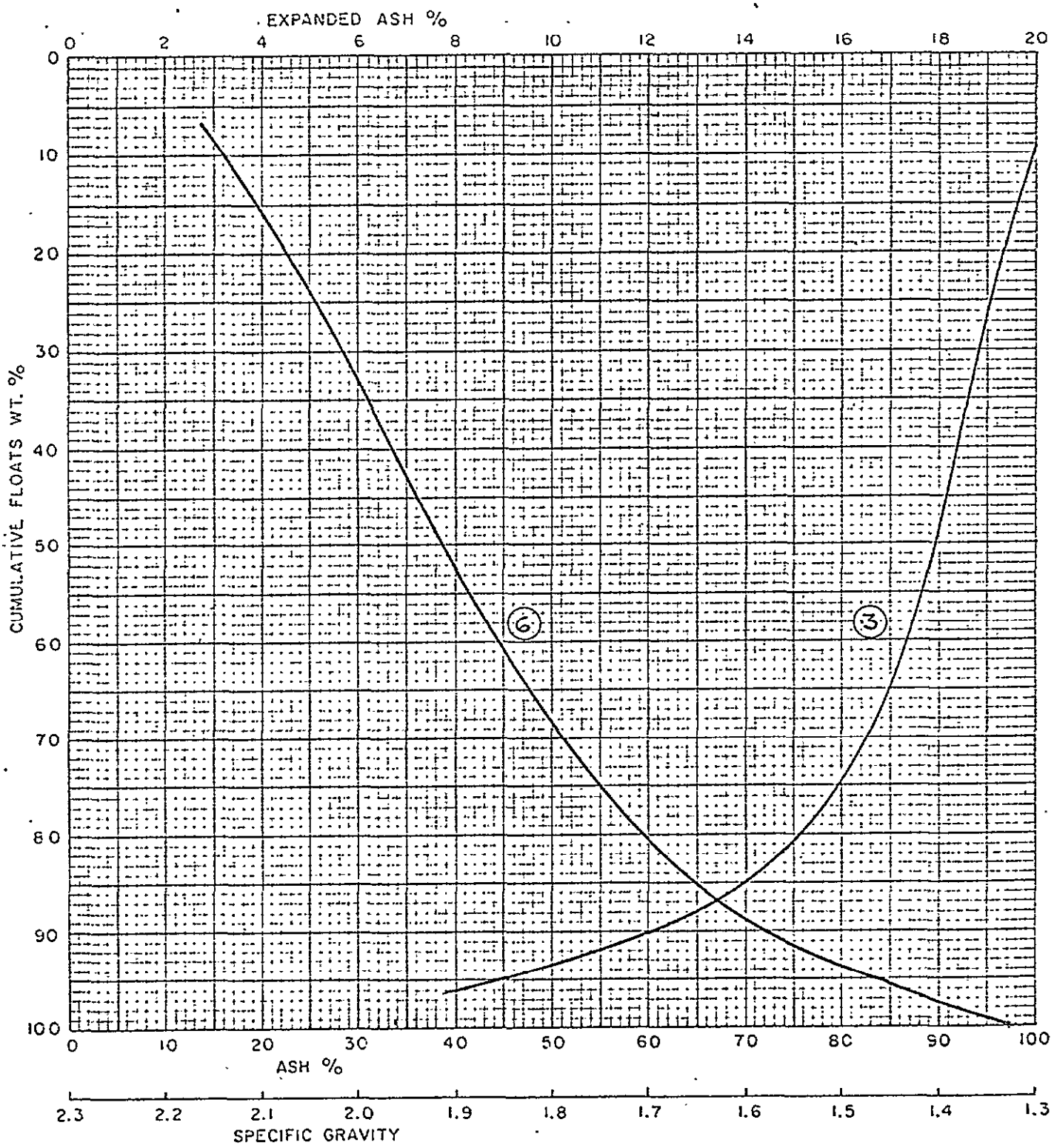
SAMPLE : Adit G12

SIZE : + 1 "

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE :

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 11: Adit G12

1" x 1/2": 13.78% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	4.03	2.71	23.04	4.03	8½
1.30 - 1.35	15.44	6.47	21.89	19.47	8
1.35 - 1.40	22.81	10.46	20.55	42.28	7
1.40 - 1.45	18.36	15.55	19.21	60.64	6
1.45 - 1.50	11.94	20.18	17.76	72.58	4½
1.50 - 1.55	5.12	25.10	17.41	77.70	4½
1.55 - 1.60	3.28	31.53	16.59	80.98	4
1.60 - 1.70	6.23	38.40	15.18	87.21	4
1.70 - 1.80	3.12	49.93	13.58	90.33	3½
+ 1.80	9.67	76.43	10.58	100.00	3
Total	100.00	22.42	18.47		

TABLE 12: Adit G12

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	4.03	2.71	4.03	2.71	100.00	22.42	2.01	2.71
1.30 - 1.35	15.44	6.47	19.47	5.69	95.97	23.25	11.75	6.47
1.35 - 1.40	22.81	10.46	42.28	8.26	80.53	26.46	30.87	10.46
1.40 - 1.45	18.36	15.55	60.64	10.47	57.72	32.79	51.46	15.55
1.45 - 1.50	11.94	20.18	72.58	12.07	39.36	40.83	66.61	20.18
1.50 - 1.55	5.12	25.10	77.70	12.93	27.42	49.82	75.14	25.10
1.55 - 1.60	3.28	31.53	80.98	13.68	22.30	55.49	19.34	31.53
1.60 - 1.70	6.23	38.40	87.21	15.45	19.02	59.63	84.09	38.40
1.70 - 1.80	3.12	49.93	90.33	16.64	12.79	69.97	88.77	49.93
+ 1.80	9.67	76.43	100.00	22.42	9.67	76.43	95.16	76.43
Total	100.00	22.42						

FIGURE : 3

COMPANY : DENISON MINES LTD.

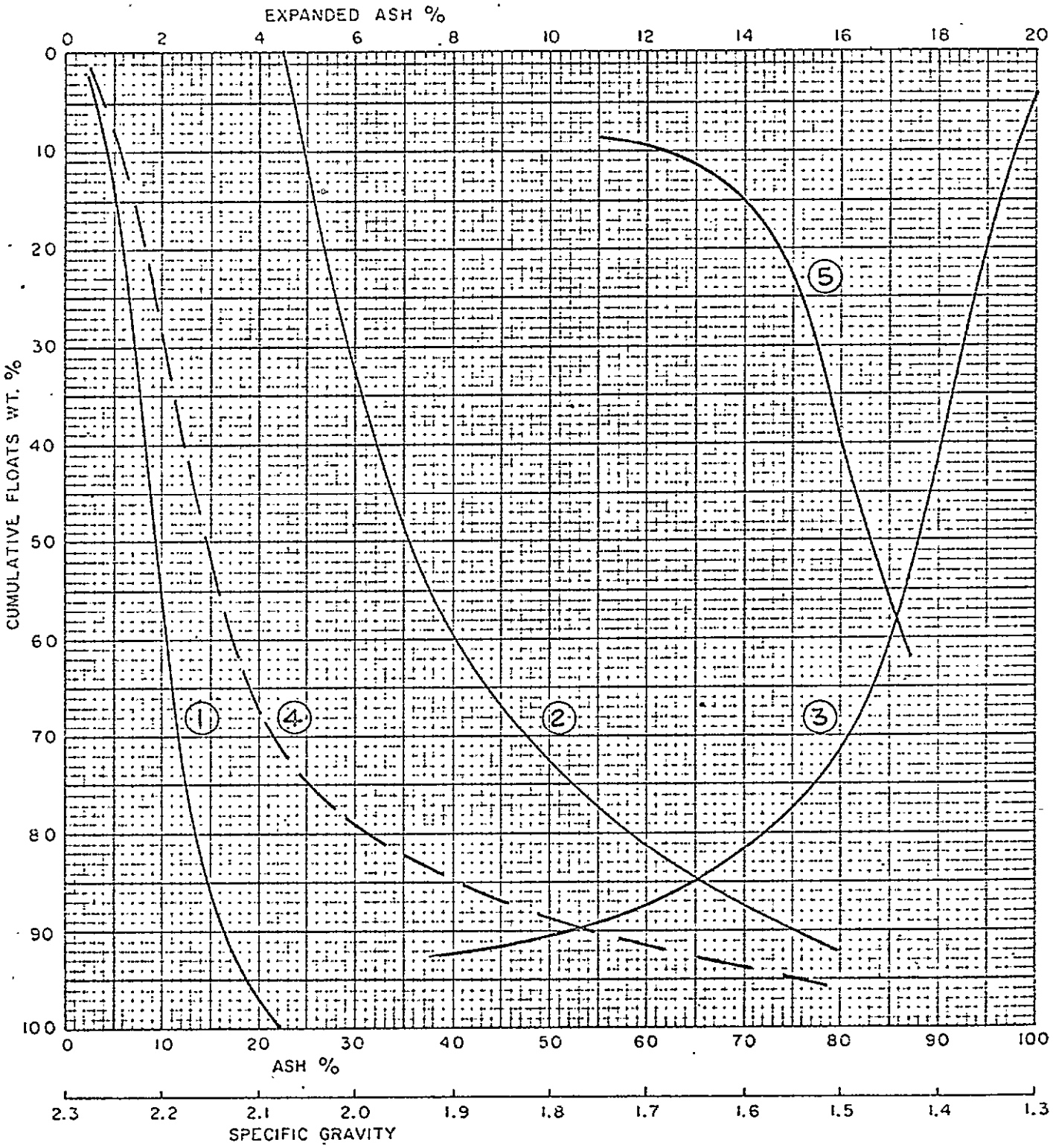
SAMPLE : Adit G12

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 3a

COMPANY : DENISON MINES LTD.

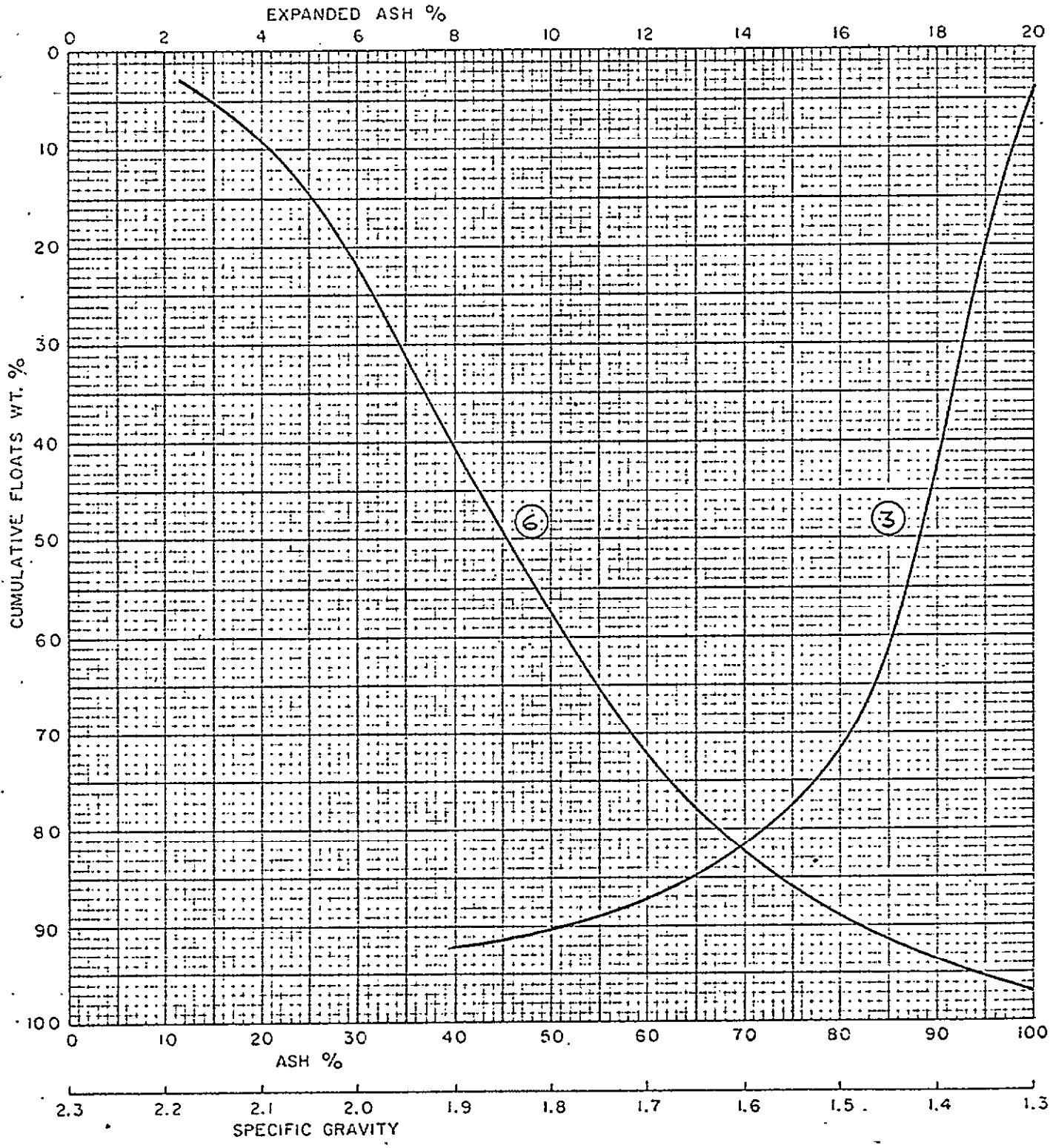
SAMPLE : Adit G12

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

TABLE 13: Adit G12

1/2" x 1/4": 15.71% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	7.31	3.07	23.69	7.31	8½
1.30 - 1.35	14.63	6.86	22.34	21.94	7½
1.35 - 1.40	22.03	10.52	19.82	43.97	7
1.40 - 1.45	15.40	16.01	19.07	59.37	6
1.45 - 1.50	11.59	20.71	17.64	70.96	5
1.50 - 1.55	6.17	25.34	17.13	77.13	4½
1.55 - 1.60	4.18	31.20	16.40	81.31	3½
1.60 - 1.70	5.53	38.61	15.72	86.84	3
1.70 - 1.80	2.23	47.89	13.99	89.07	2½
+ 1.80	10.93	76.49	10.29	100.00	2
Total	100.00	22.84	18.39		

TABLE 14 Adit G12

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	7.31	3.07	7.31	3.07	100.00	22.84	3.65	3.07
1.30 - 1.35	14.63	6.86	21.94	5.60	92.69	24.40	14.62	6.86
1.35 - 1.40	22.03	10.52	43.97	8.06	78.06	27.69	32.95	10.52
1.40 - 1.45	15.40	16.01	59.37	10.12	56.03	34.44	51.67	16.01
1.45 - 1.50	11.59	20.71	70.96	11.85	40.63	41.43	66.16	20.71
1.50 - 1.55	6.17	25.34	77.13	12.93	29.04	49.69	74.04	25.34
1.55 - 1.60	4.18	31.20	81.31	13.87	22.87	56.26	79.22	31.20
1.60 - 1.70	5.53	38.61	86.84	15.45	18.69	61.87	84.07	38.61
1.70 - 1.80	2.23	47.89	89.07	16.26	13.16	71.64	87.95	47.89
+ 1.80	10.93	76.49	100.00	22.84	10.93	76.49	94.53	76.49
Total	100.00	22.84						

FIGURE: 4

COMPANY : DENISON MINES LTD.

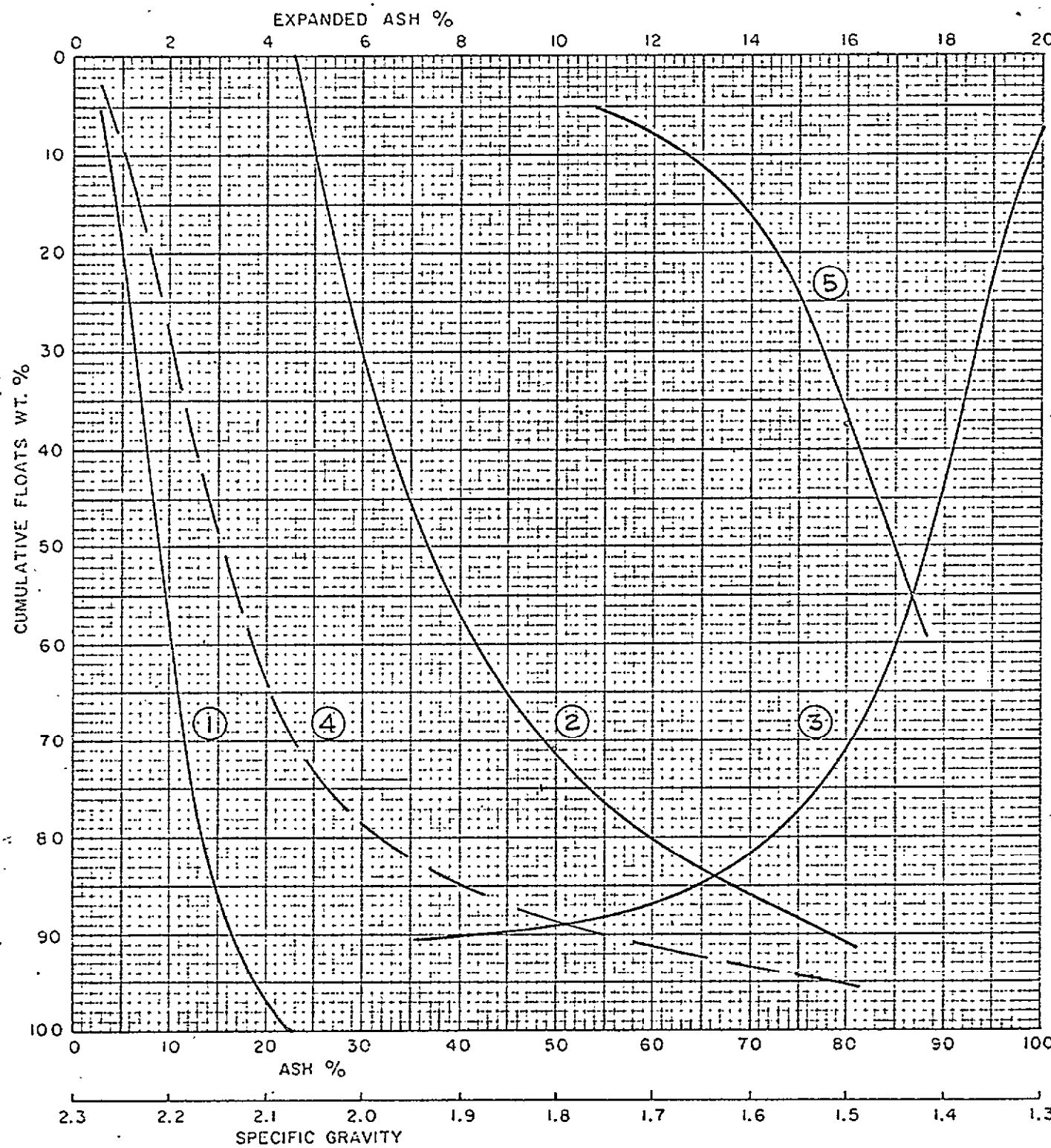
SAMPLE : Adit G12

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 4a

COMPANY : DENISON MINES LTD.

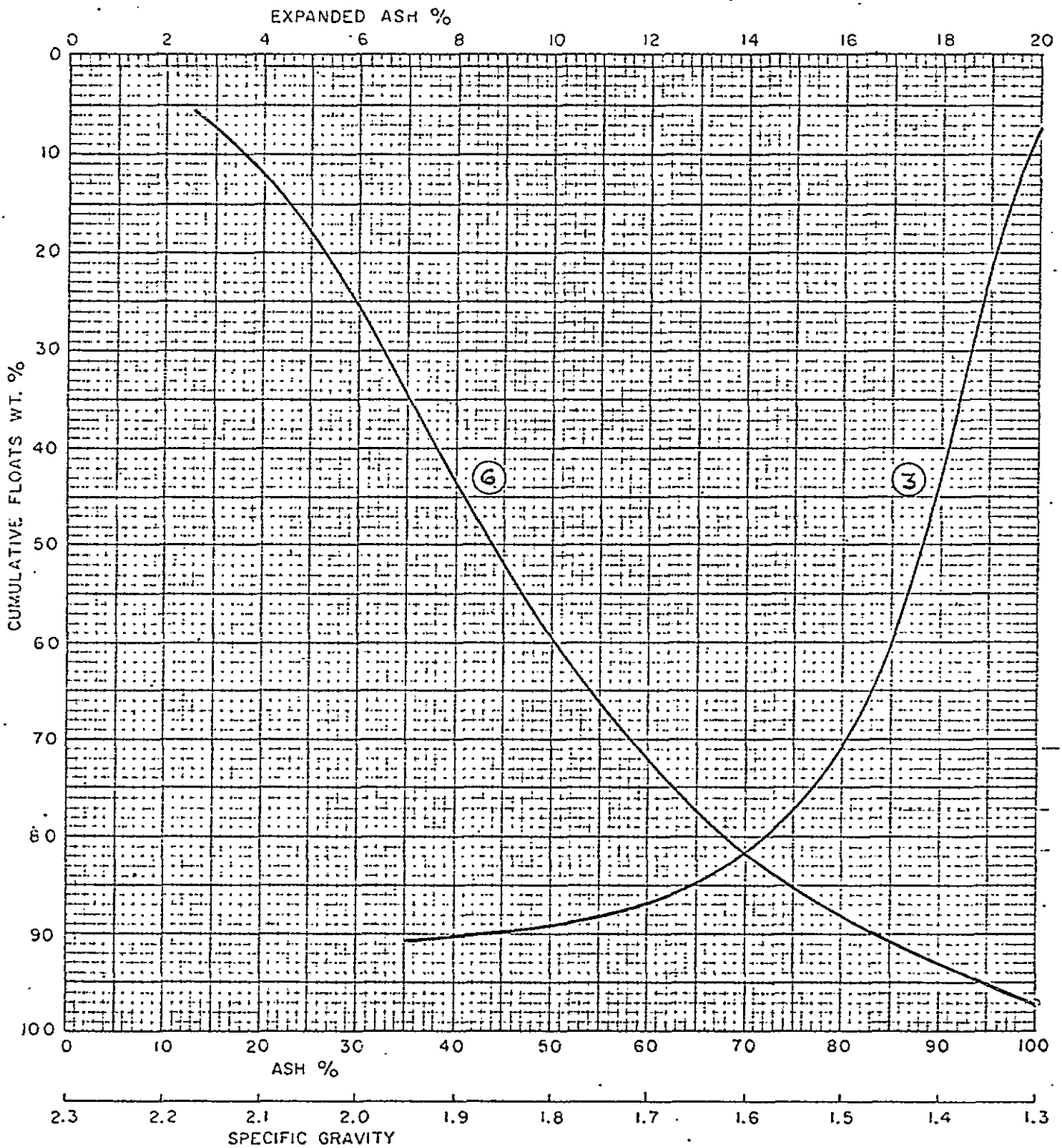
SAMPLE : Adit G12

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 15: Adit G12

1/4" x 8 M.: 17.01% of Sample

Ash, Volatile Matter, & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	8.80	2.86	23.30	8.80	9
1.30 - 1.35	14.74	6.01	22.15	23.54	8½
1.35 - 1.40	19.00	10.22	19.62	42.54	7½
1.40 - 1.45	12.33	15.87	18.72	54.87	6½
1.45 - 1.50	12.51	20.11	17.58	67.38	5½
1.50 - 1.55	6.01	25.27	17.24	73.39	5
1.55 - 1.60	5.90	30.94	16.51	79.29	5
1.60 - 1.70	6.04	38.42	15.86	85.33	4½
1.70 - 1.80	2.19	46.56	14.45	87.52	4½
+ 1.80	12.48	76.89	10.31	100.00	2½
Total	100.00	23.83	18.12		

TABLE 16: Adit G12

Washability Data: 1/4" x 8 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	8.80	2.86	8.80	2.86	100.00	23.83	4.40	2.86
1.30 - 1.35	14.74	6.01	23.54	4.83	91.20	25.86	16.17	6.01
1.35 - 1.40	19.00	10.22	42.54	7.24	76.46	29.68	33.04	10.22
1.40 - 1.45	12.33	15.87	54.87	9.18	57.46	36.12	48.70	15.87
1.45 - 1.50	12.51	20.11	67.38	11.21	45.13	41.65	61.12	20.11
1.50 - 1.55	6.01	25.27	73.39	12.36	32.62	49.91	70.38	25.27
1.55 - 1.60	5.90	30.94	79.29	13.74	26.61	55.47	76.34	30.94
1.60 - 1.70	6.04	38.42	85.33	15.49	20.71	62.46	82.31	38.42
1.70 - 1.80	2.19	46.56	87.52	16.27	14.67	72.36	86.42	46.56
+ 1.80	12.48	76.89	100.00	23.83	12.48	76.89	93.76	76.89
Total	100.00	23.83						

FIGURE : 5

COMPANY : DENISON MINES LTD.

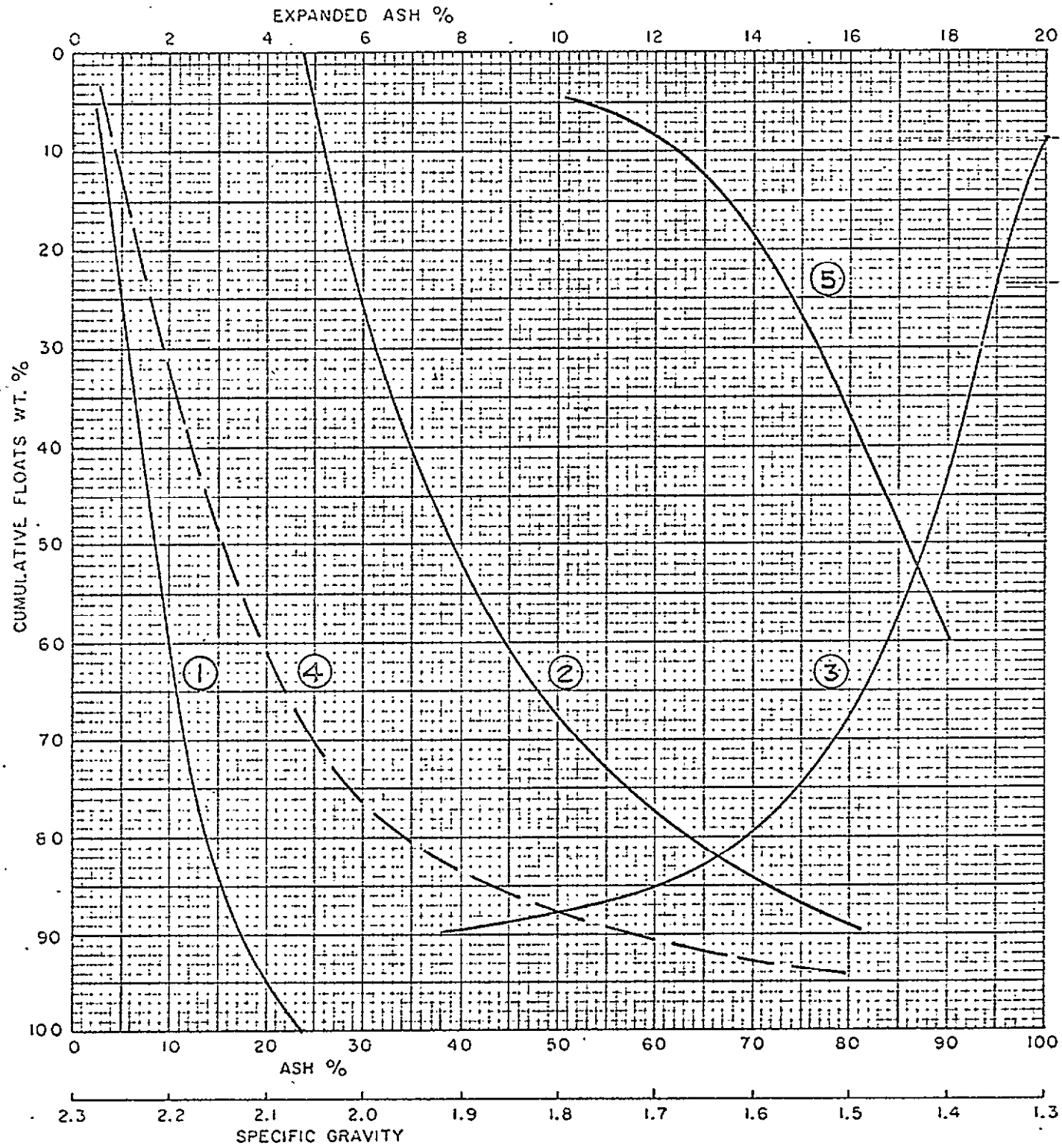
SAMPLE : Adit G12

SIZE : 1/4" x 8 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5 a

COMPANY : DENISON MINES LTD.

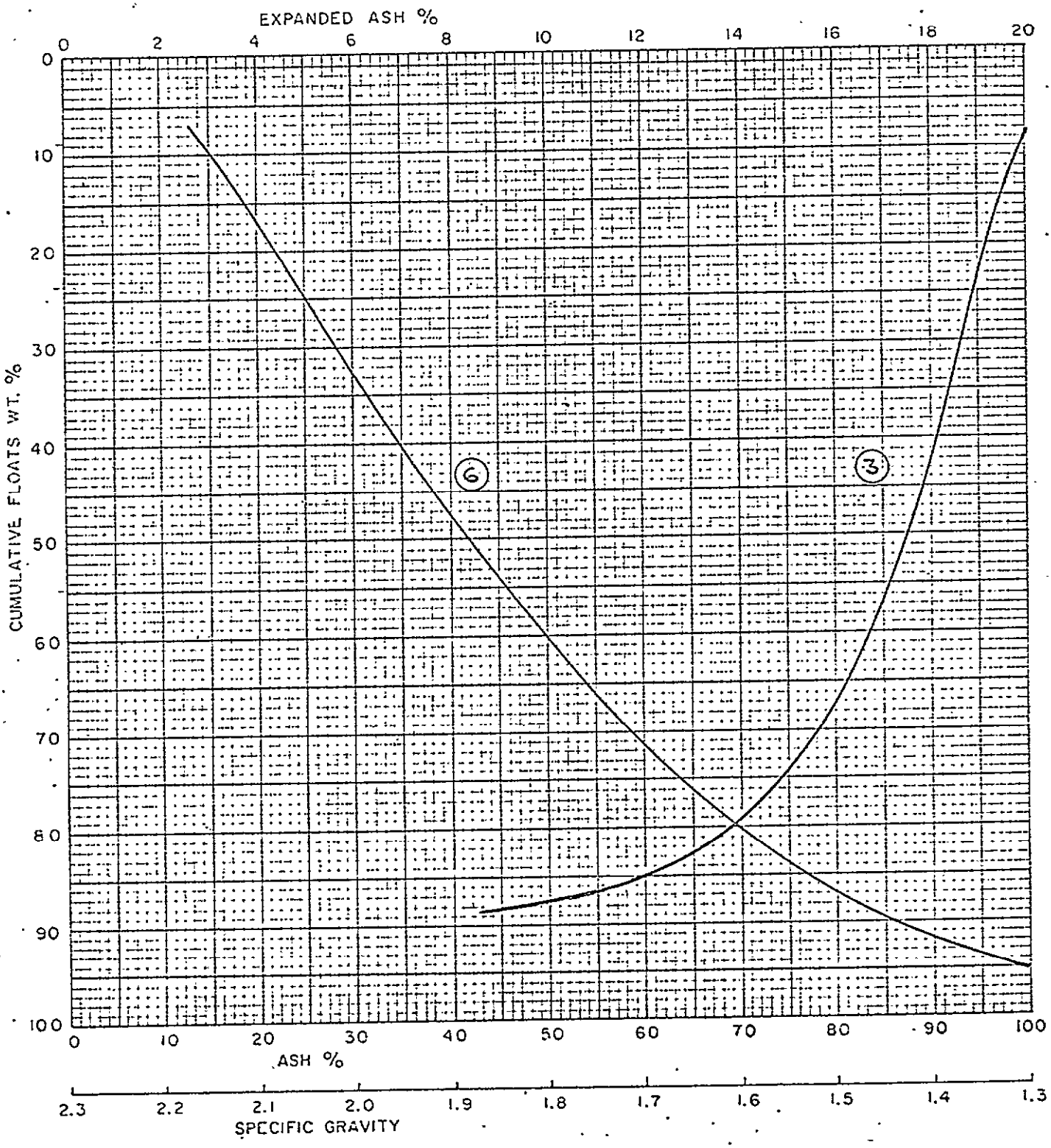
SAMPLE : Adit G12

SIZE : 1/4" x 8 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 17: Adit G12

8 x 28 M.: 23.94% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt.%	F.S.I. Cum.
- 1.30	22.22	2.13	24.02	22.22	9+
1.30 - 1.35	15.21	5.60	22.33	37.43	9
1.35 - 1.40	15.49	10.43	19.64	52.92	9
1.40 - 1.45	11.17	16.60	18.63	64.09	8½
1.45 - 1.50	8.59	20.53	17.80	72.68	8
1.50 - 1.55	5.92	24.96	17.42	78.60	8
1.55 - 1.60	5.16	30.91	16.43	83.76	7½
1.60 - 1.70	5.94	38.52	16.09	89.70	7
1.70 - 1.80	1.70	46.16	15.58	91.40	6½
+ 1.80	8.60	70.48	11.57	100.00	4½
Total	100.00	18.76	19.48		

TABLE 18: Adit G12

Washability Data: 8 x 28 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	22.22	2.13	22.22	2.13	100.00	18.76	11.11	2.13
-1.30- 1.35	15.21	5.60	37.43	3.54	77.78	23.52	29.82	5.60
1.35 - 1.40	15.49	10.43	52.92	5.56	62.57	27.87	45.17	10.43
1.40 - 1.45	11.17	16.60	64.09	7.48	47.08	33.61	58.50	16.60
1.45 - 1.50	8.59	20.53	72.68	9.02	35.91	38.90	68.30	20.53
1.50 - 1.55	5.92	24.96	78.60	10.22	27.32	44.68	75.64	24.96
1.55 - 1.60	5.16	30.91	83.76	11.50	21.40	50.14	81.18	30.91
1.60 - 1.70	5.94	38.52	89.70	13.29	16.24	56.24	86.73	38.52
1.70 - 1.80	1.70	46.16	91.40	13.90	10.30	66.47	90.55	46.16
+ 1.80	8.60	70.48	100.00	18.76	8.60	70.48	95.70	70.48
Total	100.00	18.76						

FIGURE : 6

COMPANY : DENISON MINES LTD.

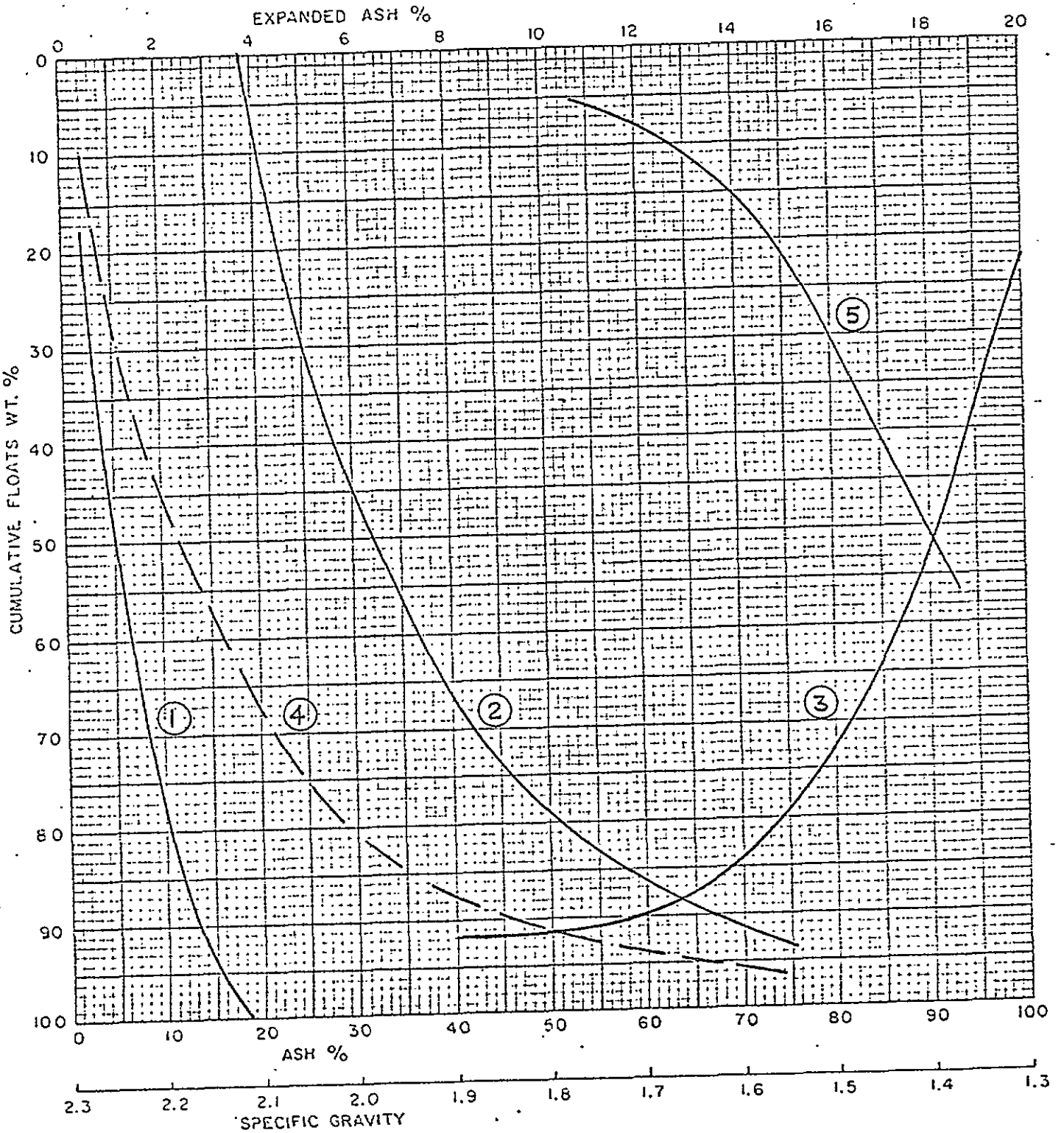
SAMPLE : Adit G12

SIZE : 8 x 28 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 6a

COMPANY : DENISON MINES LTD.

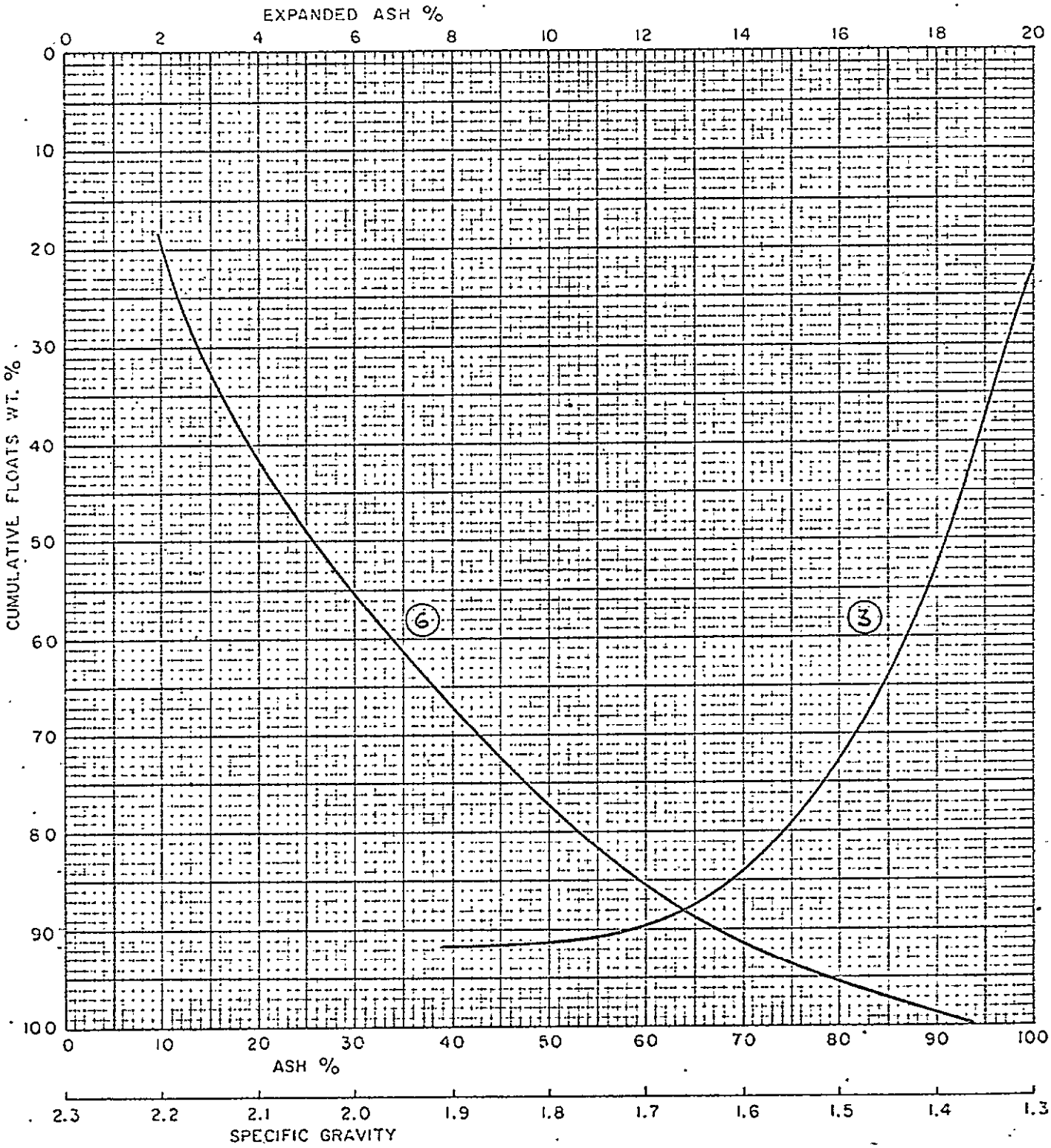
SAMPLE : Adit G12

SIZE : 8 x 28 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.

TABLE 19: Adit G12

28 x 100 M.: 14.11% of Sample

Ash, Volatile Matter & Cumulative F.S.I.

Specific G.	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	38.84	2.27	24.95	38.84	9+
1.30 - 1.35	12.06	5.12	22.87	50.90	9
1.35 - 1.40	11.13	9.12	20.84	62.03	9
1.40 - 1.45	9.13	14.83	18.78	71.16	9
1.45 - 1.50	7.74	19.76	17.63	78.90	9
1.50 - 1.55	5.01	24.31	17.31	83.91	8½
1.55 - 1.60	3.02	30.80	16.49	86.93	8½
1.60 - 1.70	4.91	38.72	16.13	91.84	8½
1.70 - 1.80	1.69	46.11	15.17	93.53	8
+ 1.80	6.47	70.18	12.64	100.00	6½
Total	100.00	14.76	21.07		

TABLE 20: Adit G12

Washability Data: 28 x 100 M.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	38.84	2.27	38.84	2.27	100.00	14.76	19.42	2.27
1.30 - 1.35	12.06	5.12	50.90	2.95	61.16	22.70	44.87	5.12
1.35 - 1.40	11.13	9.12	62.03	4.05	49.10	27.02	56.46	9.12
1.40 - 1.45	9.13	14.83	71.16	5.44	37.97	32.27	66.59	14.83
1.45 - 1.50	7.74	19.76	78.90	6.84	28.84	37.79	75.03	19.76
1.50 - 1.55	5.01	24.31	83.91	7.88	21.10	44.40	81.40	24.31
1.55 - 1.60	3.02	30.80	86.93	8.68	16.09	50.66	85.42	30.80
1.60 - 1.70	4.91	38.72	91.84	10.29	13.07	55.25	89.38	38.72
1.70 - 1.80	1.69	46.11	93.53	10.93	8.16	65.19	92.68	46.11
+ 1.80	6.47	70.18	100.00	14.76	6.47	70.18	96.76	70.18
Total	100.00	14.76						

FIGURE: 7

COMPANY : DENISON MINES LTD.

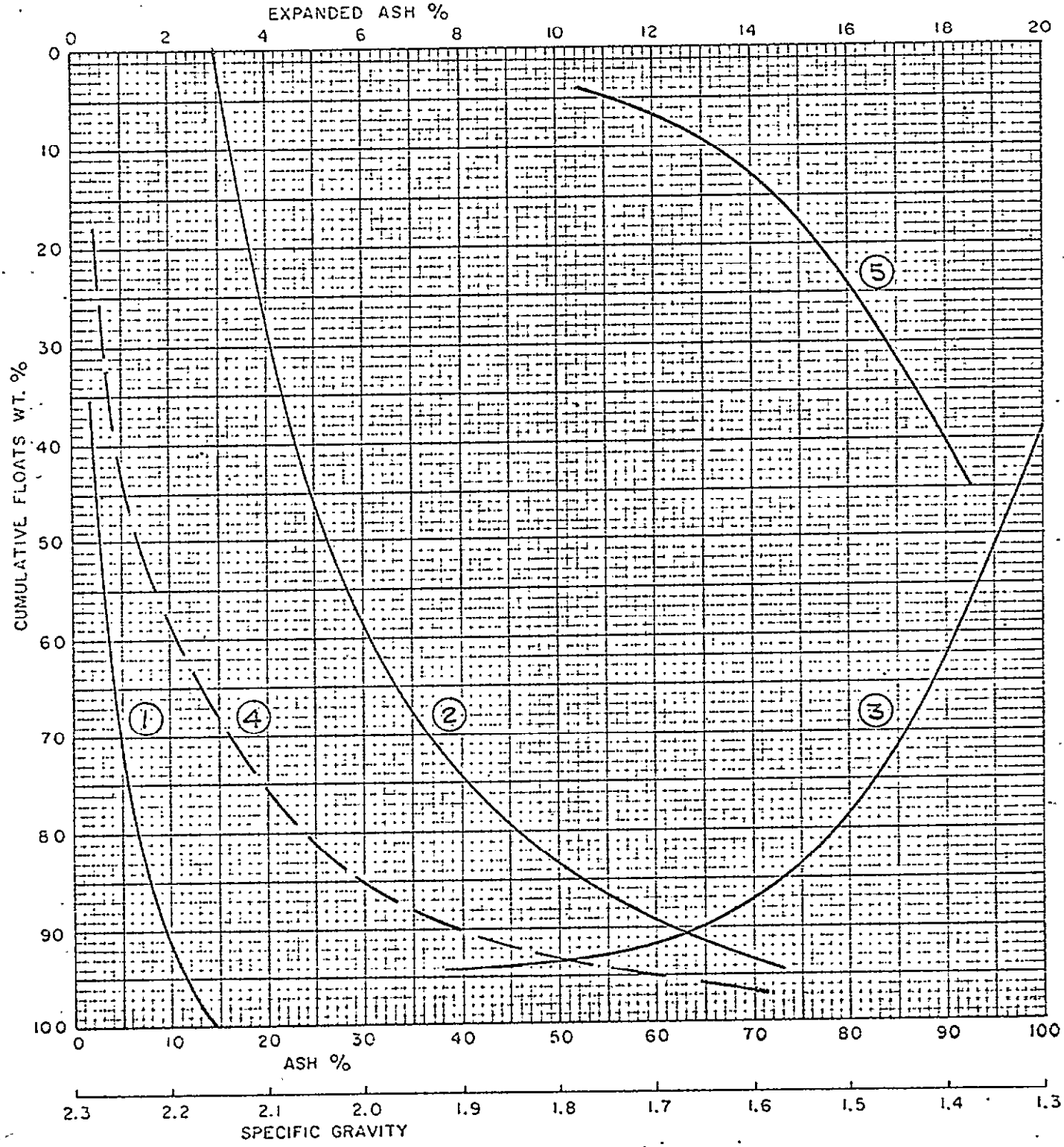
SAMPLE : Adit G12

SIZE : 28 x 100 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : April 22, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 7a

COMPANY : DENISON MINES LTD.

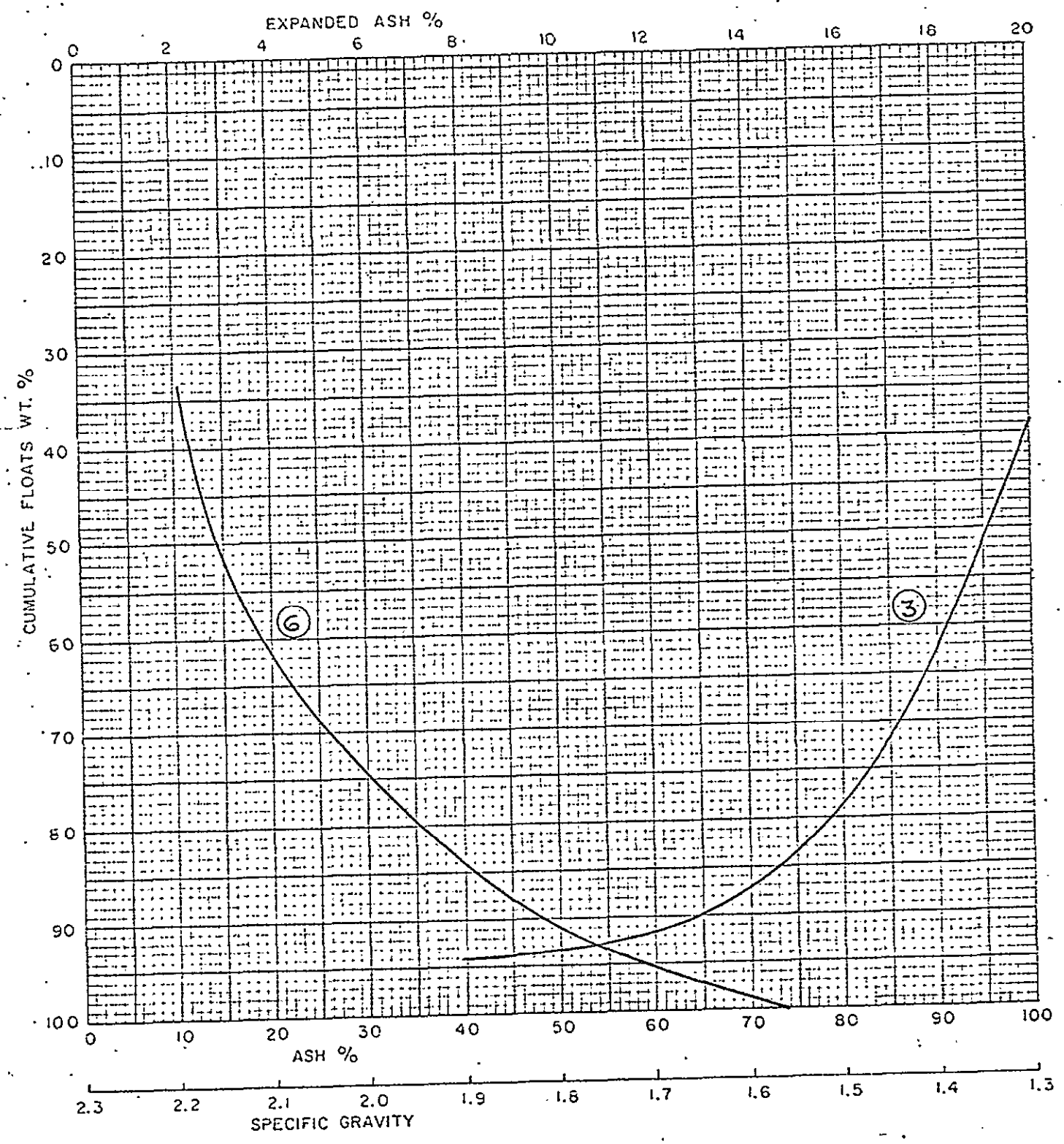
SAMPLE : Adit G12

SIZE : 28 x 100 M.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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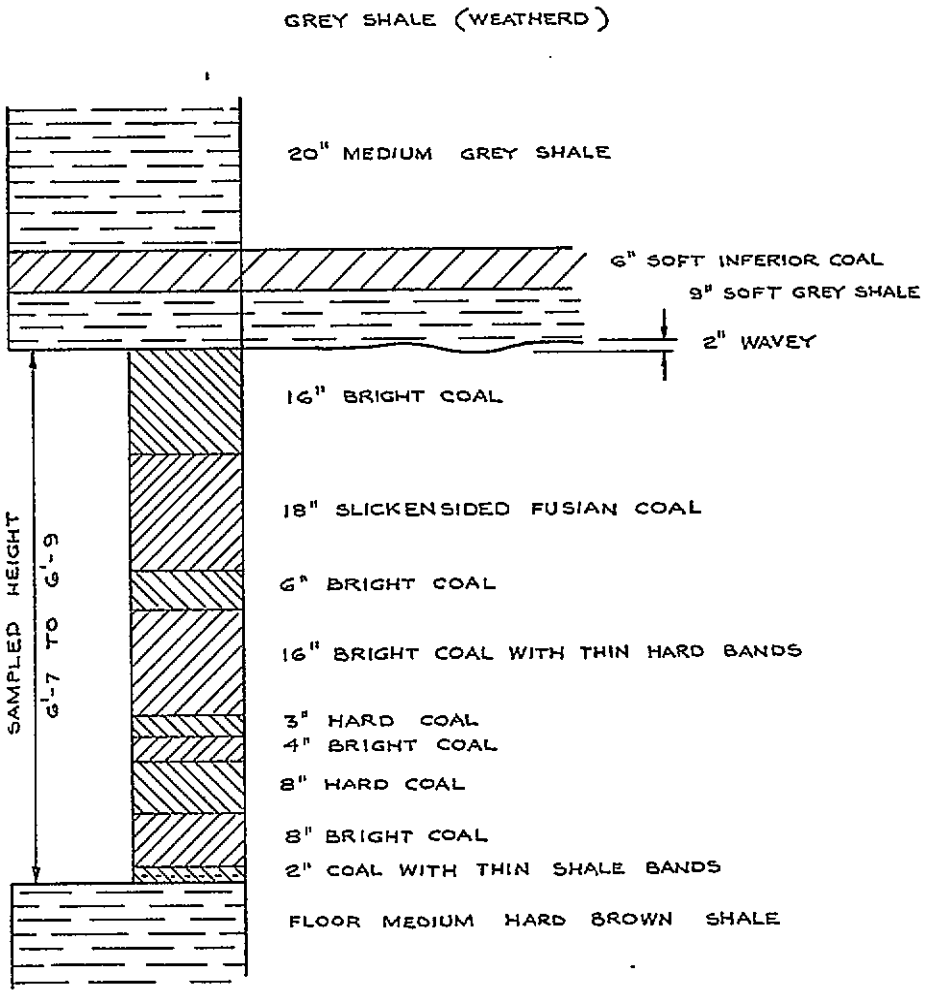
CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

QUINTETTE ADIT # G5

DENISON MINES LTD.



T A B L E 1. ADIT # G5

Classification by Rank

Ash:	15.13%
Volatile Matter:	21.95%
Residual Moisture	0.75%
Fixed Carbon	62.17%
F.S.I.	4
B.T.U./lb.	12,500
Sulphur:	0.39%
Rank	mvb

T A B L E 2. ADIT # G5

Analysis of Size Fractions

Size	Wt.%	Ash %	V.M.%	R.M.%	F.C.%	S.%	F.S.I.
+2"	6.06	15.45	22.41	0.53	61.61	0.49	5
2" x 1"	11.19	20.85	19.63	0.58	58.94	0.40	1½
1" x 1/2"	13.27	19.28	20.29	0.60	59.83	0.34	1½
1/2" x 1/4"	12.90	18.98	20.48	0.62	59.92	0.33	2½
1/4" x 8m.	16.47	16.14	21.49	0.86	61.51	0.35	4½
8m. x 28m.	23.20	10.89	23.37	0.84	64.90	0.40	7
28m. x 100m.	10.54	9.40	24.73	0.95	64.92	0.43	7½
- 100 m.	6.37	10.68	23.43	0.91	64.98	0.55	7
Total	100.00	15.13	21.95	0.75	62.17	0.39	4

TABLE 3 - ADIT # G5

Ash % and Weight % Distribution vs. Size and Specific Gravity

(Figures in brackets show the Ash Content of Individual Fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+2"	0.90 (2.97)	0.94 (5.11)	0.99 (8.05)	0.94 (13.06)	0.72 (18.71)	0.46 (25.80)	0.51 (34.21)	0.21 (42.91)	0.39 (62.82)	6.06 (17.16)
2" x 1"	0.53 (3.15)	1.75 (5.87)	1.46 (9.01)	2.16 (15.10)	1.60 (17.67)	1.25 (28.67)	1.14 (35.08)	0.26 (42.56)	1.04 (64.11)	11.19 (21.39)
1" x 1/2"	1.37 (2.82)	1.91 (5.27)	1.79 (7.55)	2.17 (12.71)	1.78 (18.13)	1.30 (27.35)	1.46 (34.16)	0.34 (43.86)	1.15 (65.37)	13.27 (19.78)
1/2" x 1/4"	2.04 (2.94)	1.94 (4.99)	1.86 (7.30)	1.77 (12.24)	1.45 (18.09)	1.04 (26.19)	1.34 (34.41)	0.33 (42.32)	1.13 (65.63)	12.90 (18.52)
1/4" x 8 m.	4.54 (2.78)	3.44 (5.31)	2.15 (8.60)	1.52 (14.32)	1.04 (18.94)	1.19 (27.52)	1.05 (36.52)	0.36 (44.63)	1.18 (64.05)	16.47 (15.42)
8 m. x 28 m.	9.00 (2.42)	5.67 (4.76)	2.76 (9.06)	1.33 (14.15)	0.74 (18.63)	1.21 (25.53)	0.89 (34.71)	0.38 (41.63)	1.22 (59.94)	23.20 (11.08)
28m x 100 m.	4.70 (2.47)	2.51 (4.35)	1.31 (8.54)	0.47 (13.98)	0.40 (18.56)	0.36 (25.74)	0.27 (34.15)	0.13 (41.81)	0.39 (64.33)	10.54 (9.18)
Total	23.08 (2.61)	18.16 (5.01)	12.32 (8.35)	10.36 (13.64)	7.73 (18.26)	6.81 (26.93)	6.66 (34.82)	2.01 (42.92)	6.50 (63.74)	93.63 (15.51)
- 100 Mesh	This fraction forms 6.37% of the total sample and has an ash content of 10.68%, thus giving a total sample ash value of 15.20%.									

T A B L E 4. ADIT # G5

Volatile Matter % and Weight % Distribution vs. Size and Specific Gravity

(Figures in brackets show the V.M. Content of Individual Fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80		Total
+2"	0.90 (26.45)	0.94 (23.98)	0.99 (21.24)	0.94 (19.89)	0.72 (18.88)	0.46 (17.48)	0.51 (15.42)	0.21 (14.68)	0.39 (10.94)	6.06 (20.28)
2" x 1"	0.53 (26.83)	1.75 (24.70)	1.46 (21.24)	2.16 (19.97)	1.60 (18.59)	1.25 (17.69)	1.14 (15.98)	0.26 (15.09)	1.04 (11.05)	11.19 (19.40)
1" x 1/2"	1.37 (27.00)	1.91 (24.45)	1.79 (20.99)	2.17 (19.97)	1.78 (18.70)	1.30 (17.72)	1.46 (16.12)	0.34 (15.59)	1.15 (10.85)	13.27 (19.77)
1/2" x 1/4"	2.04 (26.79)	1.94 (24.22)	1.86 (21.58)	1.77 (19.85)	1.45 (18.70)	1.04 (16.96)	1.34 (15.61)	0.33 (14.98)	1.13 (10.95)	12.90 (20.15)
1/4" x 8 m.	4.54 (27.53)	3.44 (23.52)	2.15 (20.47)	1.52 (19.72)	1.04 (18.36)	1.19 (17.03)	1.05 (15.94)	0.36 (15.15)	1.18 (11.30)	16.47 (21.54)
8m x 28m.	9.00 (26.46)	5.67 (23.85)	2.76 (21.31)	1.33 (19.93)	0.74 (18.72)	1.21 (16.95)	0.89 (15.81)	0.38 (15.05)	1.22 (12.69)	23.20 (22.77)
28m x 100m.	4.70 (26.08)	2.51 (23.64)	1.31 (21.29)	0.47 (20.05)	0.40 (19.19)	0.36 (17.15)	0.27 (15.96)	0.13 (15.08)	0.39 (13.12)	10.54 (23.19)
Total	23.08 (26.66)	18.16 (23.95)	12.32 (21.14)	10.36 (19.90)	7.73 (18.68)	6.81 (17.29)	6.66 (15.86)	2.01 (15.12)	6.50 (11.47)	93.63 (21.25)
- 100 Mesh	This fraction forms 6.37% of the total sample and has a volatile matter content of 23.43% Thus giving a total sample volatile matter value of 21.39%.									

TABLE 5. ADIT #G5

Cumulative F.S.I. and Cumulative Weight % vs. Size and Specific Gravity

(Figures in brackets show the Cumulative F.S.I. of Cumulative Fractions)

Size \ Sp. Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+2"	0.90 (9)	1.84 (7½)	2.83 (6½)	3.77 (6½)	4.49 (6½)	4.95 (6)	5.46 (5½)	5.67 (5½)	6.06 (5)
2" x 1"	0.53 (9)	2.28 (7½)	3.74 (5)	5.90 (4)	7.50 (2½)	8.75 (2½)	9.89 (2½)	±0.15 (2)	11.19 (1½)
1" x 1/2"	1.37 (9)	3.28 (8)	5.07 (5½)	7.24 (4½)	9.02 (3½)	10.32 (3½)	11.78 (3)	12.12 (2½)	13.27 (1½)
1/2" x 1/4"	2.04 (9)	3.98 (8½)	5.84 (7½)	7.61 (5)	9.06 (3½)	10.10 (3½)	11.44 (3)	11.77 (3)	12.90 (2½)
1/4" x 8 m.	4.54 (9+)	7.98 (9)	10.13 (8½)	11.65 (8)	12.69 (7½)	13.88 (6)	14.93 (5½)	15.29 (5½)	16.47 (4½)
8m. x 28m.	9.00 (9+)	14.67 (9)	17.43 (8½)	18.76 (8½)	19.50 (8)	20.71 (8)	21.60 (7½)	21.98 (7½)	23.20 (7)
28m. x 100m.	4.70 (9+)	7.21 (9)	8.52 (8½)	8.99 (8½)	9.39 (8½)	9.75 (8½)	±0.02 (8½)	10.15 (8)	10.54 (7½)
Total	23.08	41.24	53.56	63.92	71.65	78.46	85.12	87.13	93.63
- 100 mesh	Weight % of this fraction is 6.36 and has a F.S.I. of 7.								

TABLE 6. ADIT # G5

Washability Data

+100 m. 93.63% of total sample
(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt. %	Ash %
- 1.30	24.65	2.61	24.65	2.61	100.00	15.51	12.32	2.61
1.30 - 1.35	19.40	5.01	44.05	3.67	75.35	19.73	34.35	5.01
1.35 - 1.40	13.16	8.35	57.21	4.74	55.95	24.84	50.63	8.35
1.40 - 1.45	11.06	13.64	68.27	6.18	42.79	29.90	62.74	13.64
1.45 - 1.50	8.26	18.26	76.53	7.49	31.73	35.58	72.40	18.26
1.50 - 1.60	7.27	26.93	83.80	9.18	23.47	41.67	80.17	26.93
1.60 - 1.70	7.11	34.82	90.91	11.18	16.20	48.28	87.35	34.82
1.70 - 1.80	2.15	42.92	93.06	11.91	9.09	58.82	91.99	42.92
+ 1.80	6.94	63.74	100.00	15.51	6.94	63.74	96.53	63.74
Total	100.00	15.51						

FIGURE : 1

COMPANY : Denison Mines Ltd.

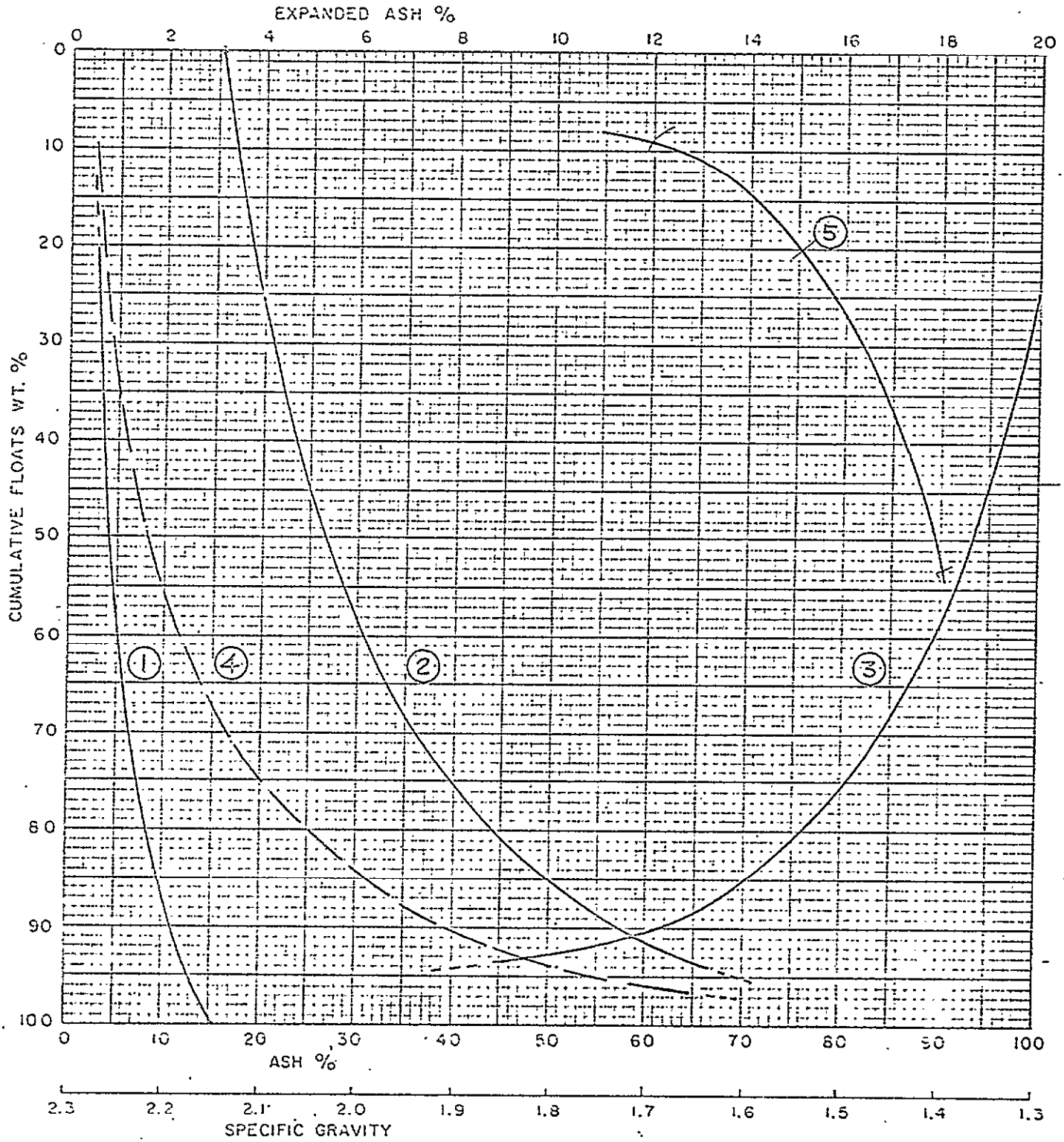
SAMPLE : Adit # G5

SIZE : +100 Mesh (Reconstituted from Size Fractions)

WASHABILITY CURVES

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 1a

COMPANY : Denison Mines Ltd.

SAMPLE : Adit # G5

SIZE : +100 Mesh (Reconstituted from Size Fractions)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES

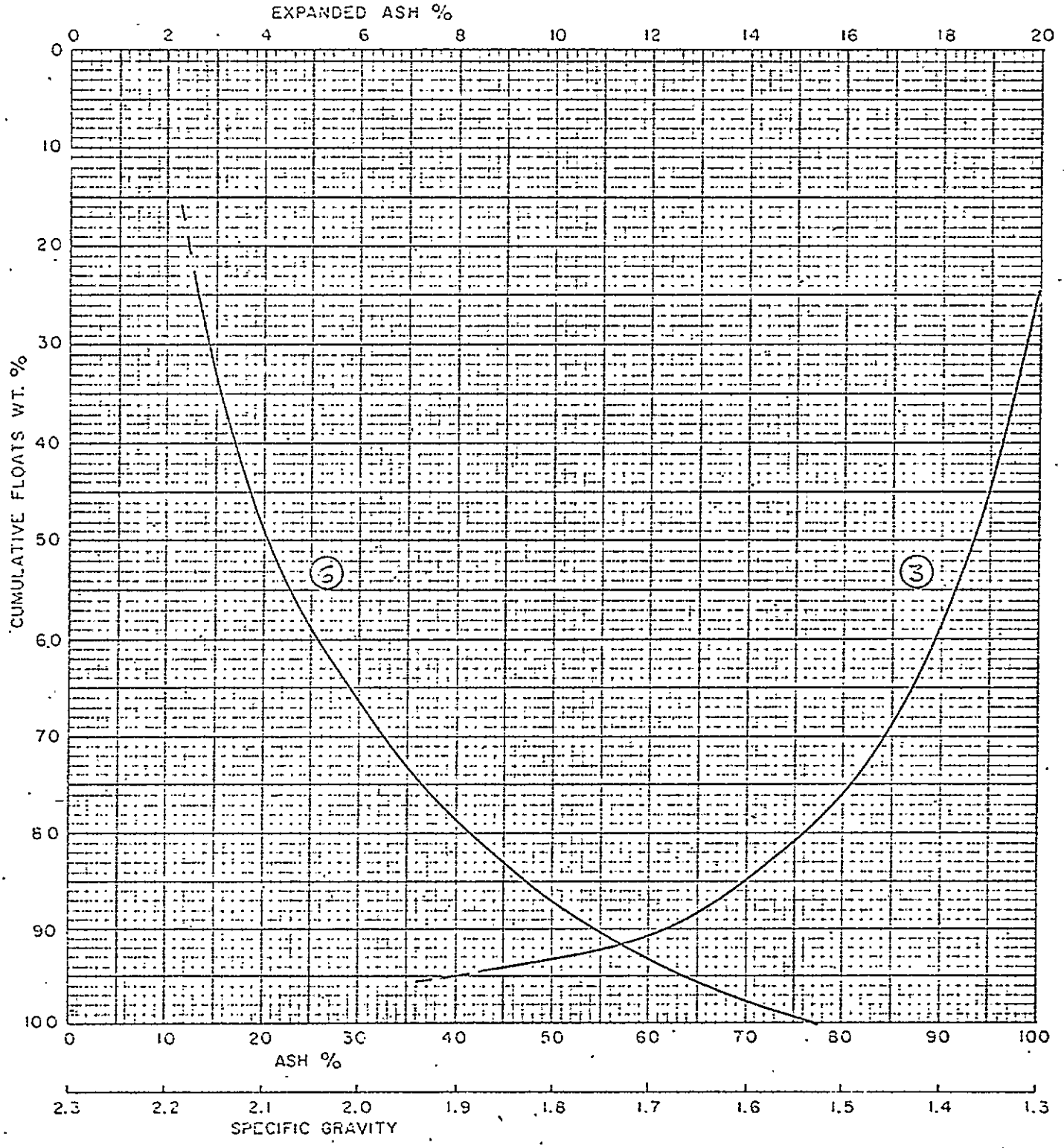

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TABLE 7. ADIT # G5

Cumulative Volatile Matter for + 100 Mesh:

93.63% of the Total Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt.%	V.M.%	Wt.%	V.M.%	Wt.%	V.M.%
- 1.30	24.65	26.66	24.65	26.66	100.00	21.25
1.30 - 1.35	19.40	23.95	44.05	25.47	75.35	19.48
1.35 - 1.40	13.16	21.14	57.21	24.47	55.95	17.93
1.40 - 1.45	11.06	19.90	68.27	23.73	42.79	16.94
1.45 - 1.50	8.26	18.68	76.53	23.19	31.73	15.91
1.50 - 1.60	7.27	17.29	83.80	22.67	23.47	14.94
1.60 - 1.70	7.11	15.86	90.91	22.14	16.20	13.88
1.70 - 1.80	2.15	15.12	93.06	21.98	9.09	12.33
+ 1.80	6.94	11.47	100.00	21.25	6.94	11.47
Total	100.00	21.25				

TABLE 8. ADIT #G5

7% Ash of Clean Coal

Yield	73.00%
Floats Gravity	1.49
Near Gravity Material	27.00%
Ash:	7.00%
Volatile Matter	23.51%
Residual Moisture	0.77%
Fixed Carbon	68.72%
F.S.I.	7

TABLE 9. ADIT # G5

+2" : 6.06% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	14.92	2.97	26.45	14.92	9
1.30 - 1.35	15.51	5.11	23.98	30.43	7½
1.35 - 1.40	16.31	8.05	21.24	46.74	6½
1.40 - 1.45	15.51	13.06	19.89	62.25	6½
1.45 - 1.50	11.87	18.71	18.88	74.12	6½
1.50 - 1.60	7.63	25.80	17.48	81.75	6
1.60 - 1.70	8.30	34.21	15.42	90.05	5½
1.70 - 1.80	3.47	42.91	14.68	93.52	5½
+ 1.80	6.48	62.82	10.94	100.00	5
TOTAL	100.00	17.16	20.28		

TABLE 10. ADIT # G5

Washability Data: +2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	14.92	2.97	14.92	2.97	100.00	17.16	7.46	2.97
1.30 - 1.35	15.51	5.11	30.43	4.06	85.08	19.65	22.68	5.11
1.35 - 1.40	16.31	8.05	46.74	5.45	69.57	22.89	38.58	8.05
1.40 - 1.45	15.51	13.06	62.25	7.35	53.26	27.44	54.50	13.06
1.45 - 1.50	11.87	18.71	74.12	9.17	37.75	33.35	68.18	18.71
1.50 - 1.60	7.63	25.80	81.75	10.72	25.88	40.06	77.94	25.80
1.60 - 1.70	8.30	34.21	90.05	12.89	18.25	46.02	85.90	34.21
1.70 - 1.80	3.47	42.91	93.52	13.99	9.95	55.88	91.78	42.91
+ 1.80	6.48	62.82	100.00	17.16	6.48	62.82	96.76	62.82
Total	100.00	17.16						

FIGURE : 2

COMPANY : Denison Mines Ltd.

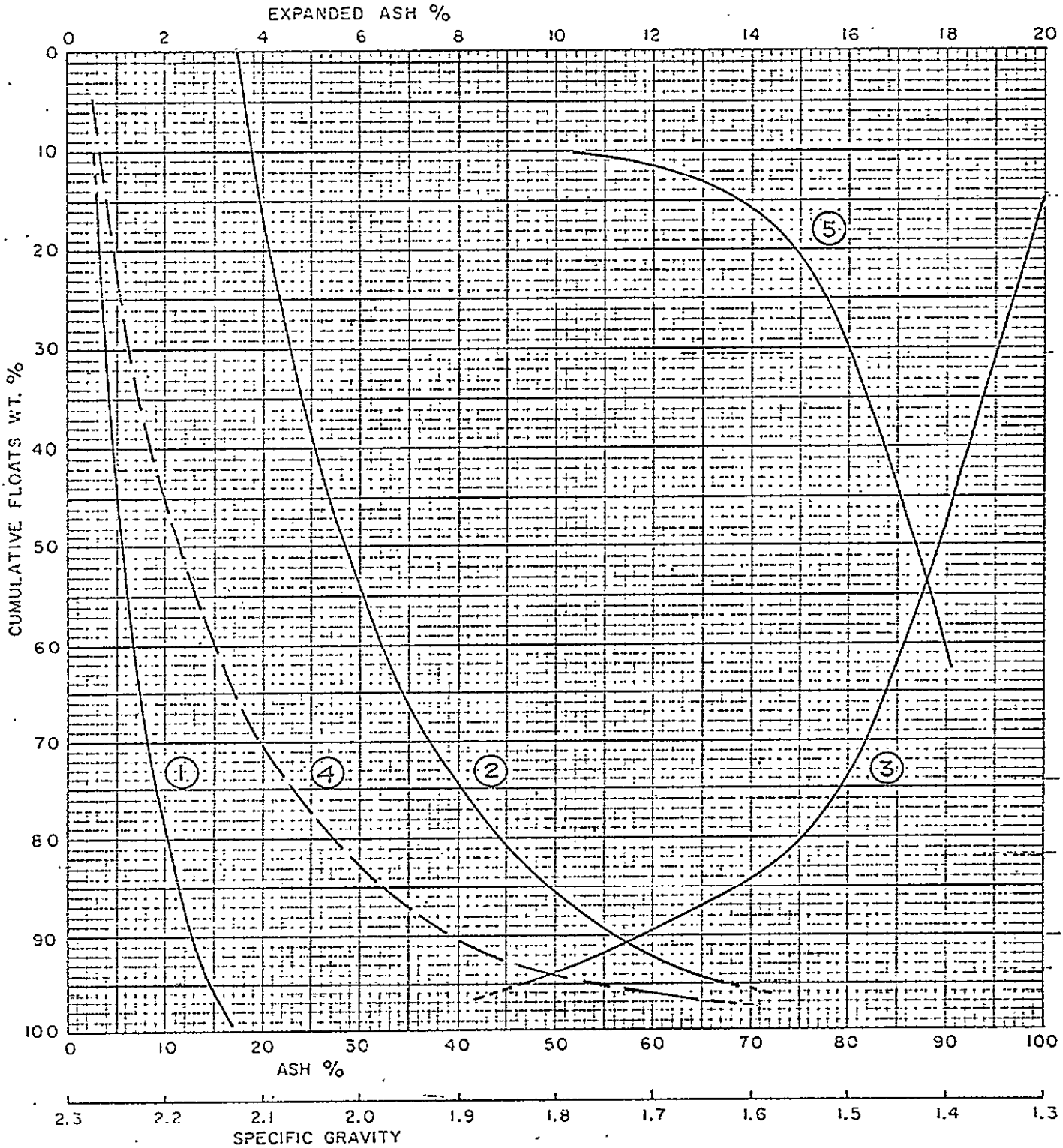
SAMPLE : Adit # G5

SIZE : +2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : Denison Mines Ltd.

SAMPLE : Adit #G5

SIZE : +2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES.

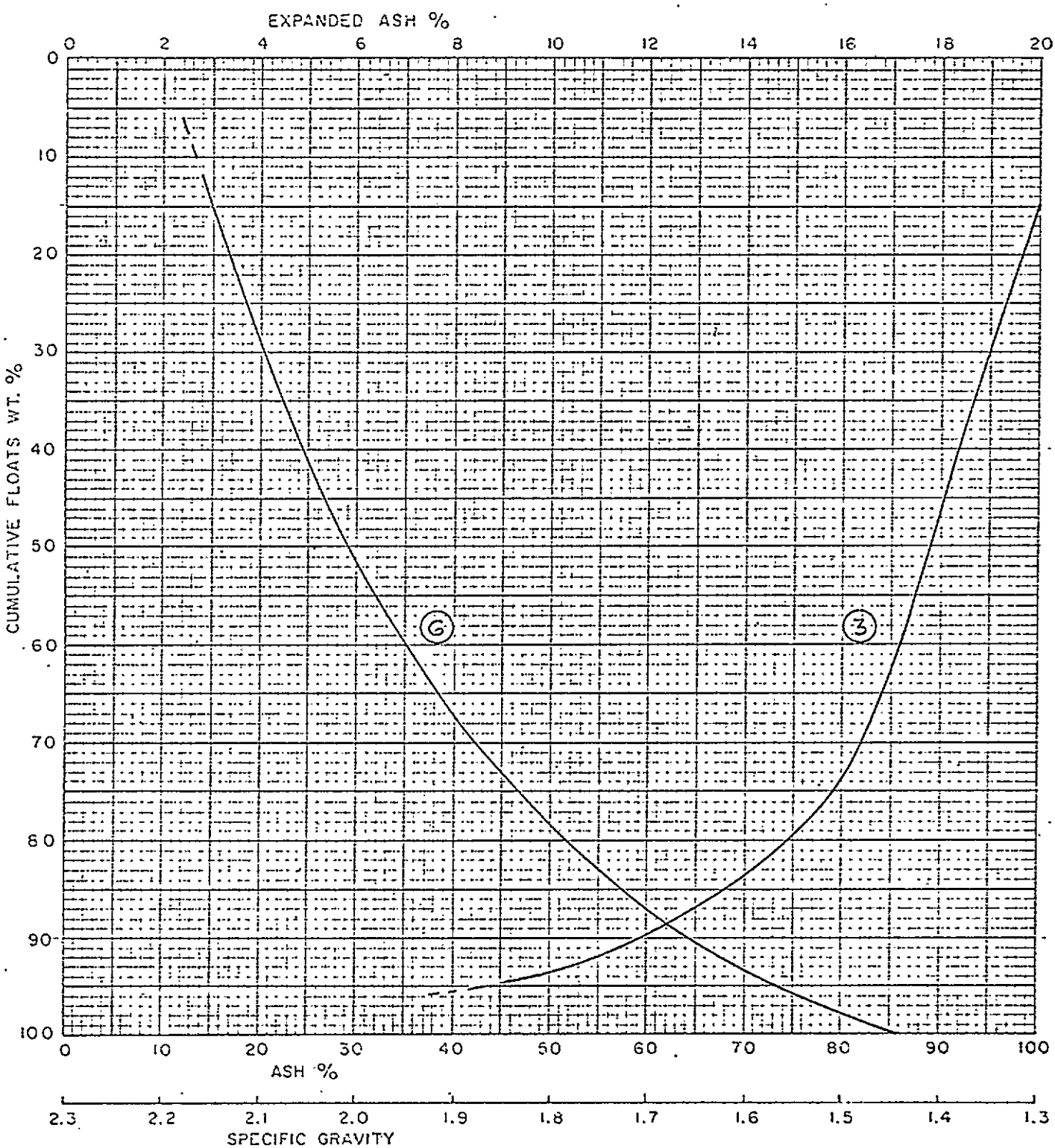

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TABLE 11. ADIT # G5

2"x 1" : 11.19% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	4.73	3.15	26.83	4.73	9
1.30 - 1.35	15.62	5.87	24.70	20.35	7½
1.35 - 1.40	13.04	9.01	21.24	33.39	5
1.40 - 1.45	19.33	15.10	19.97	52.72	4
1.45 - 1.50	14.33	17.67	18.59	67.05	2½
1.50 - 1.60	11.17	28.67	17.69	78.22	2½
1.60 - 1.70	10.18	35.08	15.98	88.40	2½
1.70 - 1.80	2.36	42.56	15.09	90.76	2
+ 1.80	9.24	64.11	11.05	100.00	1½
Total	100.00	21.39	19.40		

TABLE 12. ADIT # G5

Washability Data: 2" x 1"

Specific Gravity	fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	4.73	3.15	4.73	3.15	100.00	21.39	2.37	3.15
1.30 - 1.35	15.62	5.87	20.35	5.24	95.27	22.30	12.54	5.87
1.35 - 1.40	13.04	9.01	33.39	6.71	79.65	25.52	26.87	9.01
1.40 - 1.45	19.33	15.10	52.72	9.79	66.61	28.75	43.05	15.10
1.45 - 1.50	14.33	17.67	67.05	11.47	47.28	34.34	59.88	17.67
1.50 - 1.60	11.17	28.67	78.22	13.93	32.95	41.58	72.64	28.67
1.60 - 1.70	10.18	35.08	88.40	16.36	21.78	48.21	83.31	35.08
1.70 - 1.80	2.36	42.56	90.76	17.04	11.60	59.73	89.58	42.56
+ 1.80	9.24	64.11	100.00	21.39	9.24	64.11	95.38	64.11
Total	100.00	21.39						

FIGURE : 3

COMPANY : Denison Mines Ltd.

SAMPLE : Adit # G5

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES

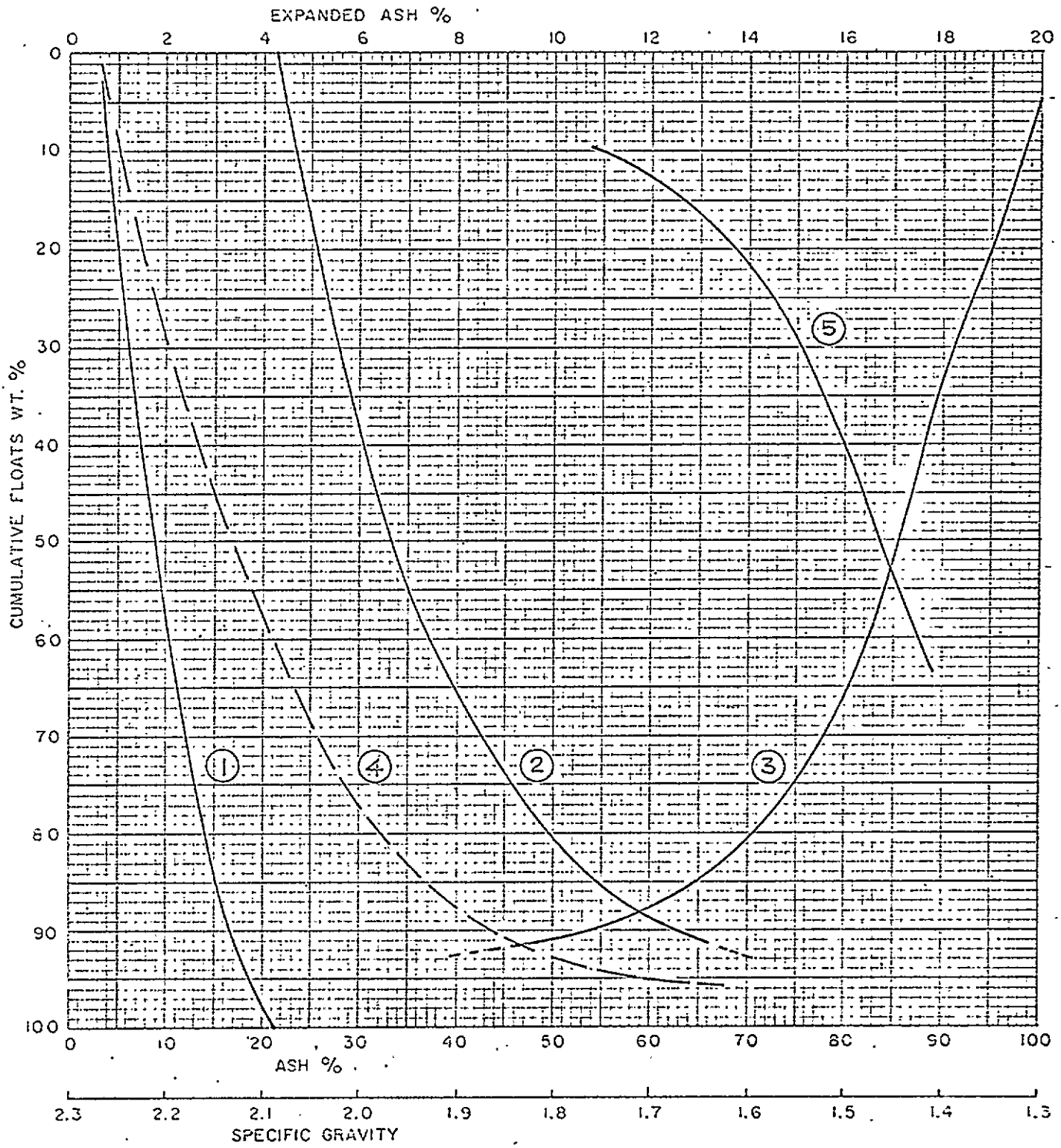

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FIGURE : 3A

COMPANY : Denison Mines Ltd.

SAMPLE : Adit #JG5

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES

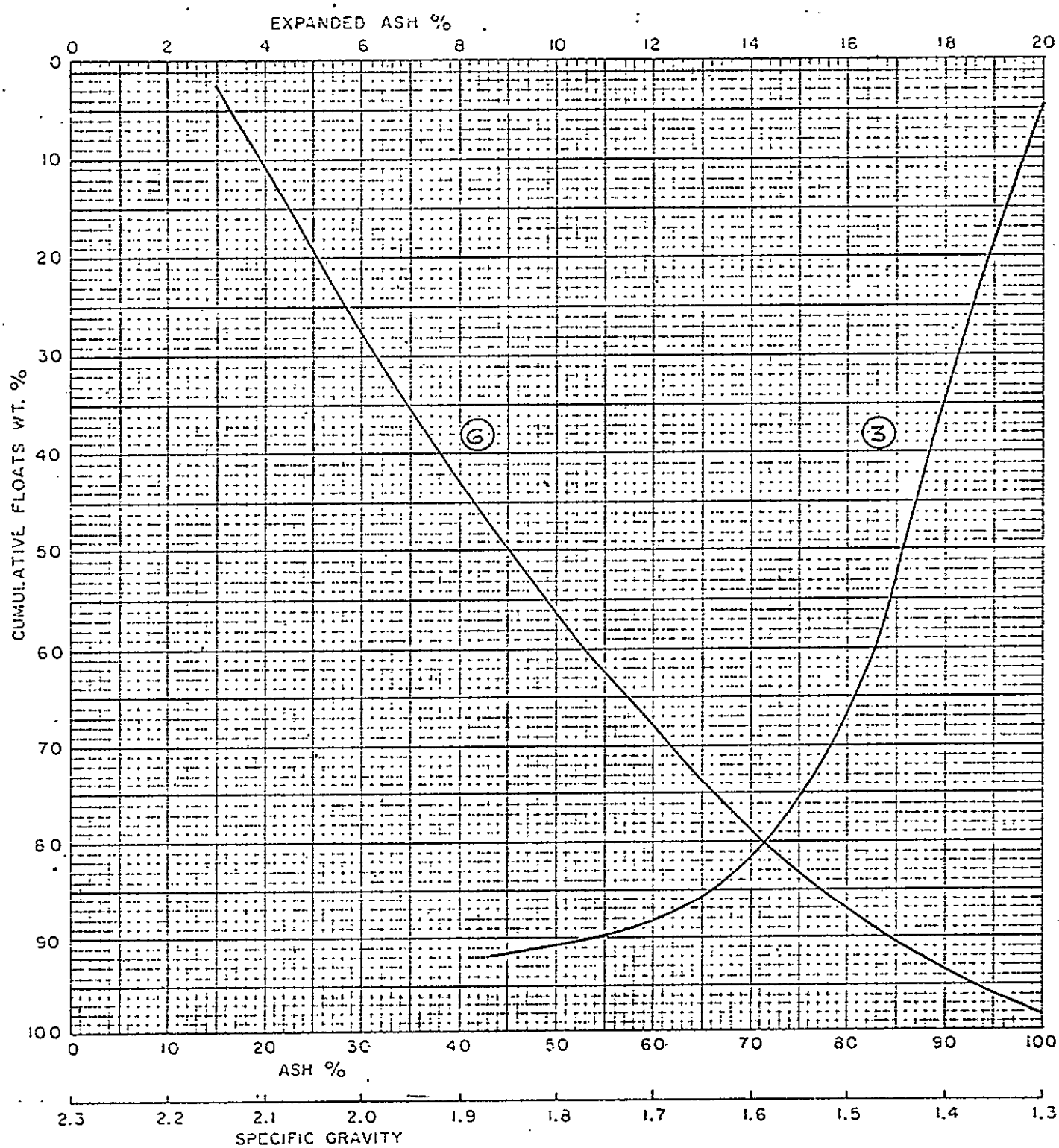

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TABLE 13. ADIT # G5

1" x 1/2": 13.27% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	10.36	2.82	27.00	10.36	9
1.30 - 1.35	14.40	5.27	24.45	24.76	8
1.35 - 1.40	13.48	7.55	20.99	38.24	5½
1.40 - 1.45	16.32	12.71	19.97	54.56	4½
1.45 - 1.50	13.46	18.13	18.70	68.02	3½
1.50 - 1.60	9.77	27.35	17.72	77.79	3½
1.60 - 1.70	11.03	34.16	16.12	88.82	3
1.70 - 1.80	2.55	43.86	15.59	91.37	2½
+ 1.80	8.63	65.37	10.85	100.00	1½
Total	100.00	19.78	19.77		

TABLE 14. ADIT # G5

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	10.36	2.82	10.36	2.82	100.00	19.78	5.18	2.82
1.30 - 1.35	14.40	5.27	24.76	4.24	89.64	21.74	17.56	5.27
1.35 - 1.40	13.48	7.55	38.24	5.41	75.24	24.90	31.50	7.55
1.40 - 1.45	16.32	12.71	54.56	7.59	61.76	28.68	46.40	12.71
1.45 - 1.50	13.46	18.13	68.02	9.68	45.44	34.42	61.29	18.13
1.50 - 1.60	9.77	27.35	77.79	11.90	31.98	41.28	72.90	27.35
1.60 - 1.70	11.03	34.16	88.82	14.66	22.21	47.40	83.31	34.16
1.70 - 1.80	2.55	43.86	91.37	15.48	11.18	60.46	90.10	43.86
+ 1.80	8.63	65.37	100.00	19.78	8.63	65.37	95.68	65.37
Total	100.00	19.78						

FIGURE : 4

COMPANY : Denison Mines Ltd.

SAMPLE : Adit #G5

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES

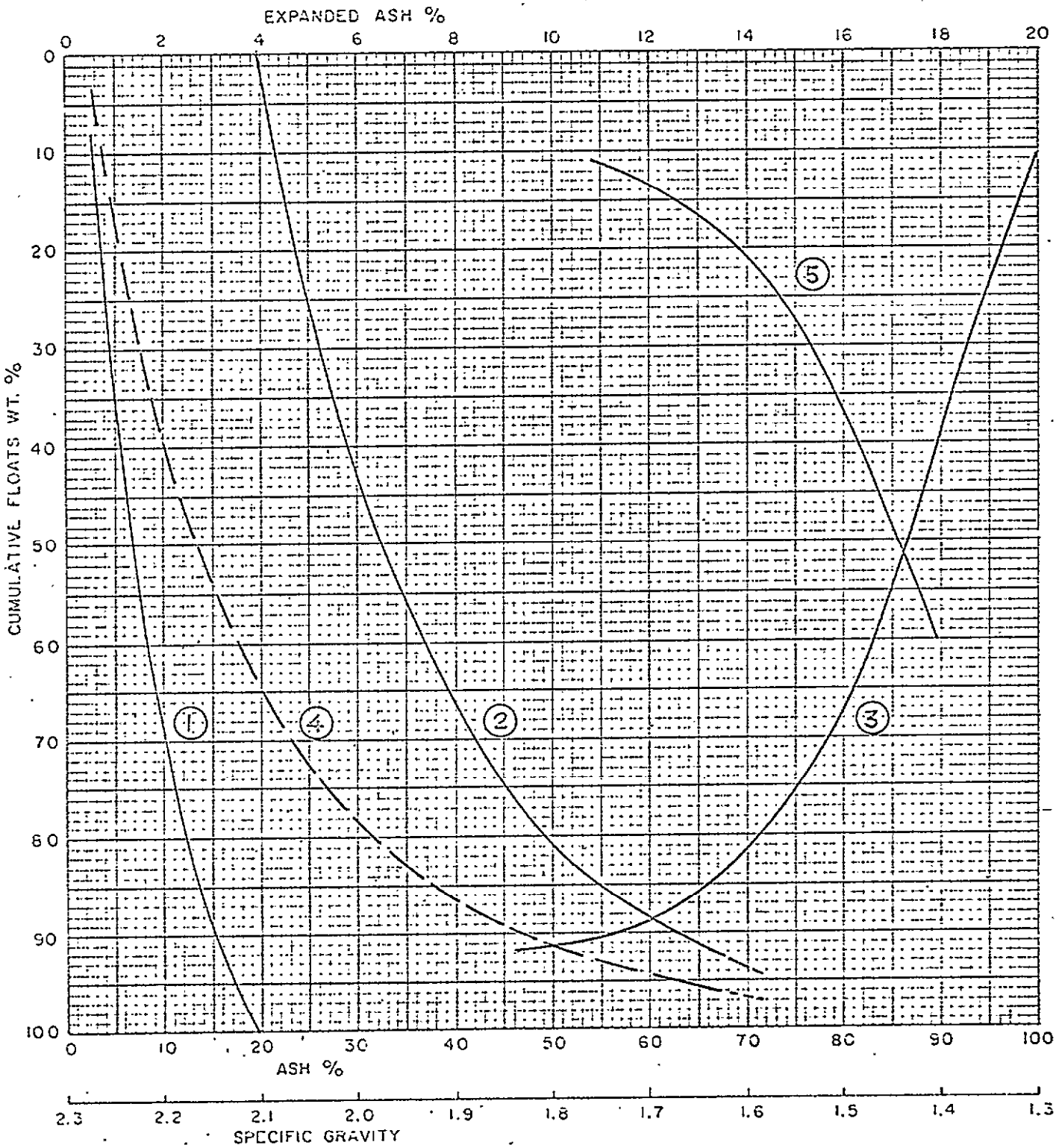

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FIGURE : 4A

COMPANY : Denison Mines Ltd.

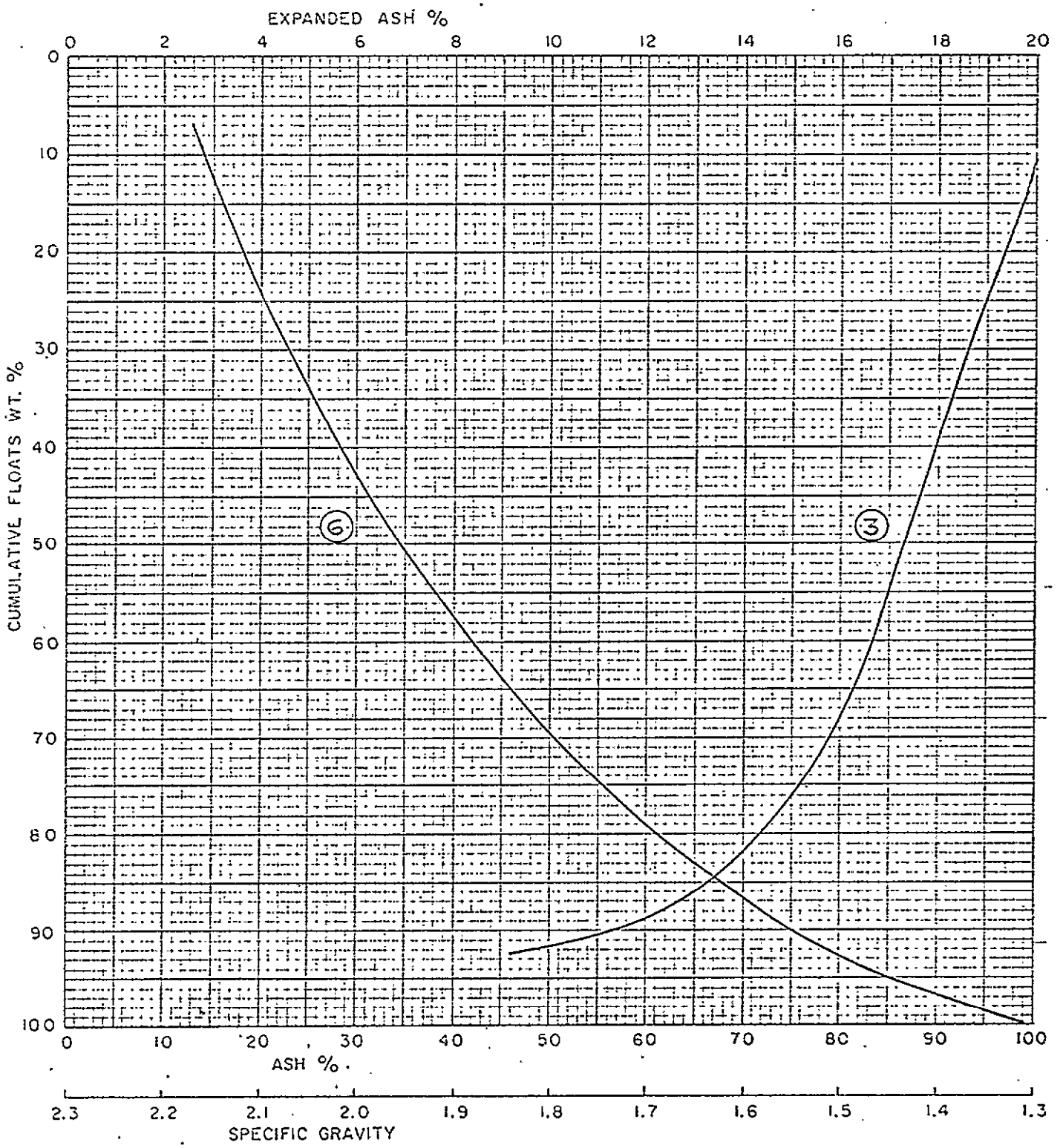
SAMPLE : Adit #G5

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 15. ADIT # G5

1/2" x 1/4": 12.90% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	15.83	2.94	26.79	15.83	9
1.30 - 1.35	15.06	4.99	24.22	30.89	8½
1.35 - 1.40	14.38	7.30	21.58	45.27	7½
1.40 - 1.45	13.71	12.24	19.85	58.98	5
1.45 - 1.50	11.24	18.09	18.70	70.22	3½
1.50 - 1.60	8.06	26.19	16.96	78.28	3½
1.60 - 1.70	10.35	34.41	15.61	88.63	3
1.70 - 1.80	2.55	42.32	14.98	91.18	3
+ 1.80	8.82	65.63	10.95	100.00	2½
Total	100.00	18.52	20.15		

T A B L E 16. ADIT # G5

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	15.83	2.94	15.83	2.94	100.00	18.52	7.92	2.94
1.30 - 1.35	15.06	4.99	30.89	3.94	84.17	21.45	23.36	4.99
1.35 - 1.40	14.38	7.30	45.27	5.01	69.11	25.03	38.08	7.30
1.40 - 1.45	13.71	12.24	58.98	6.69	54.73	29.69	52.12	12.24
1.45 - 1.50	11.24	18.09	70.22	8.51	41.02	35.53	64.60	18.09
1.50 - 1.60	8.06	26.19	78.28	10.33	29.78	42.11	74.25	26.19
1.60 - 1.70	10.35	34.41	88.63	13.15	21.72	48.02	83.45	34.41
1.70 - 1.80	2.55	42.32	91.18	13.96	11.37	60.40	89.91	42.32
+ 1.80	8.82	65.63	100.00	18.52	8.82	65.63	95.59	65.63
Total	100.00	18.52						

FIGURE : 5

COMPANY : Denison Mines Ltd.

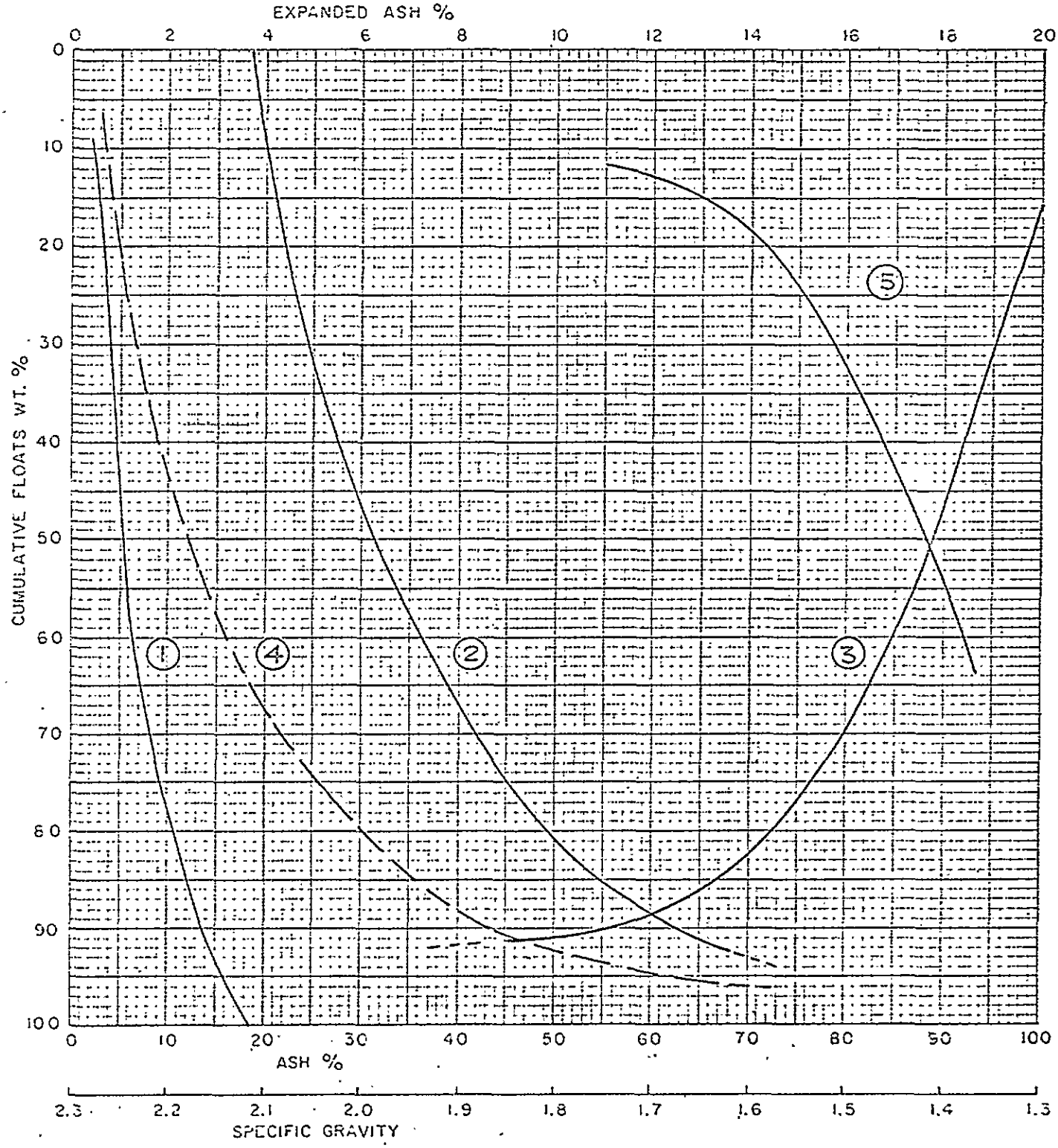
SAMPLE : Adit # G5

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5A

COMPANY : Denison Mines Ltd.

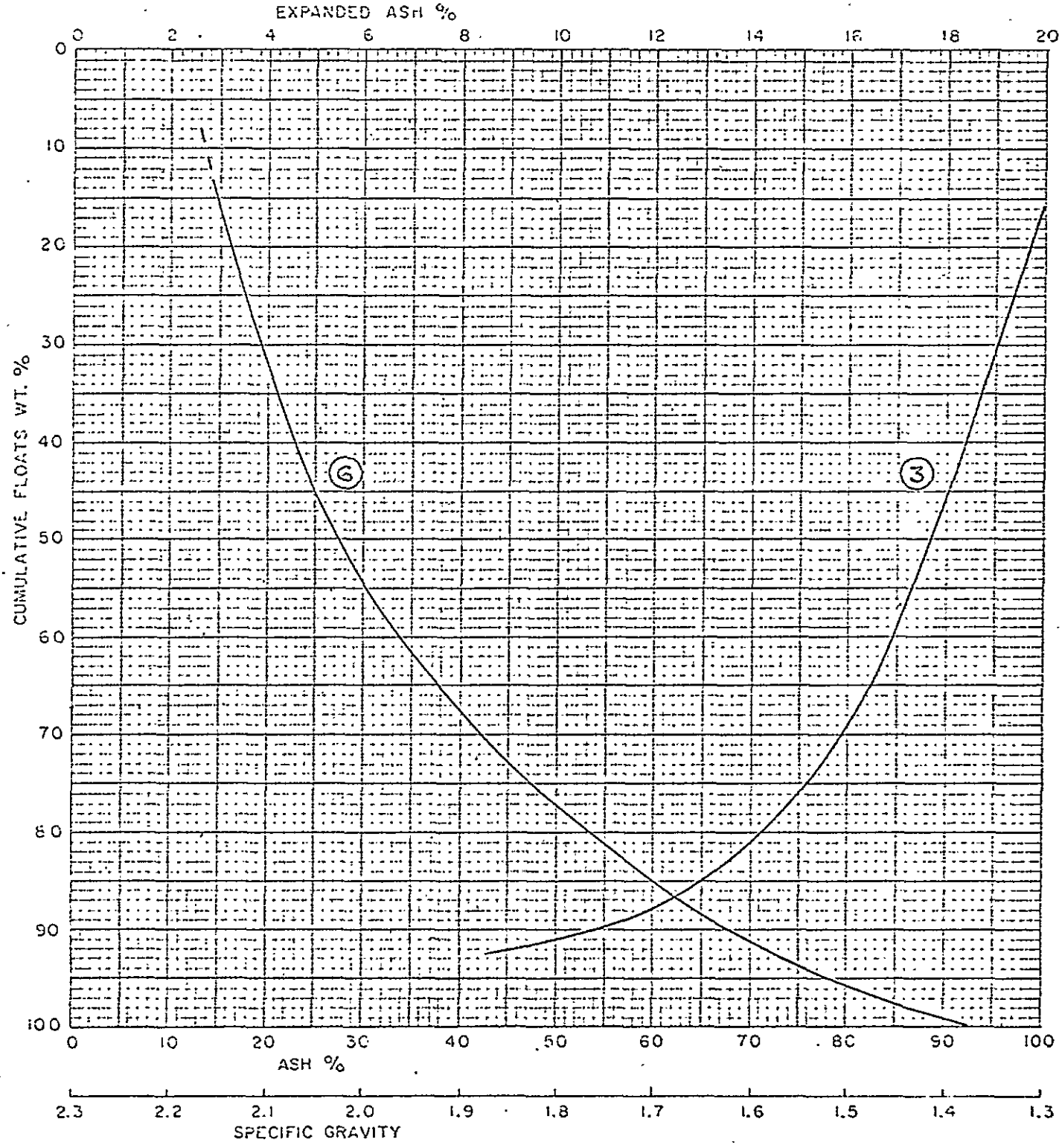
SAMPLE : Adit #G5

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 17. ADIT # G5

1/4" x 8 m.: 16.47% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	27.57	2.78	27.53	27.57	9+
1.30 - 1.35	20.87	5.31	23.52	48.44	9
1.35 - 1.40	13.05	8.60	20.47	61.49	8½
1.40 - 1.45	9.19	14.32	19.72	70.68	8
1.45 - 1.50	6.33	18.94	18.36	77.01	7½
1.50 - 1.60	7.21	27.52	17.03	84.22	6
1.60 - 1.70	6.37	36.52	15.94	90.59	5½
1.70 - 1.80	2.20	44.63	15.15	92.79	5½
+ 1.80	7.21	64.05	11.30	100.00	4½
Total	100.00	15.42	21.54		

TABLE 18. ADIT # G5

Washability Data: 1/4" x 8 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	27.57	2.78	27.57	2.78	100.00	15.42	13.78	2.78
1.30 - 1.35	20.87	5.31	48.44	3.87	72.43	20.23	38.01	5.31
1.35 - 1.40	13.05	8.60	61.49	4.87	51.56	26.27	54.96	8.60
1.40 - 1.45	9.19	14.32	70.68	6.10	38.51	32.26	66.08	14.32
1.45 - 1.50	6.33	18.94	77.01	7.16	29.32	37.89	73.85	18.94
1.50 - 1.60	7.21	27.52	84.22	8.90	19.26	46.47	82.48	29.44
1.60 - 1.70	6.37	36.52	90.59	10.84	15.78	50.23	87.40	36.52
1.70 - 1.80	2.20	44.63	92.79	11.64	9.41	59.51	91.69	44.63
+ 1.80	7.21	64.05	100.00	15.42	7.21	64.05	96.39	64.05
Total	100.00	15.42						

FIGURE : 6

COMPANY : Denison Mines Ltd.

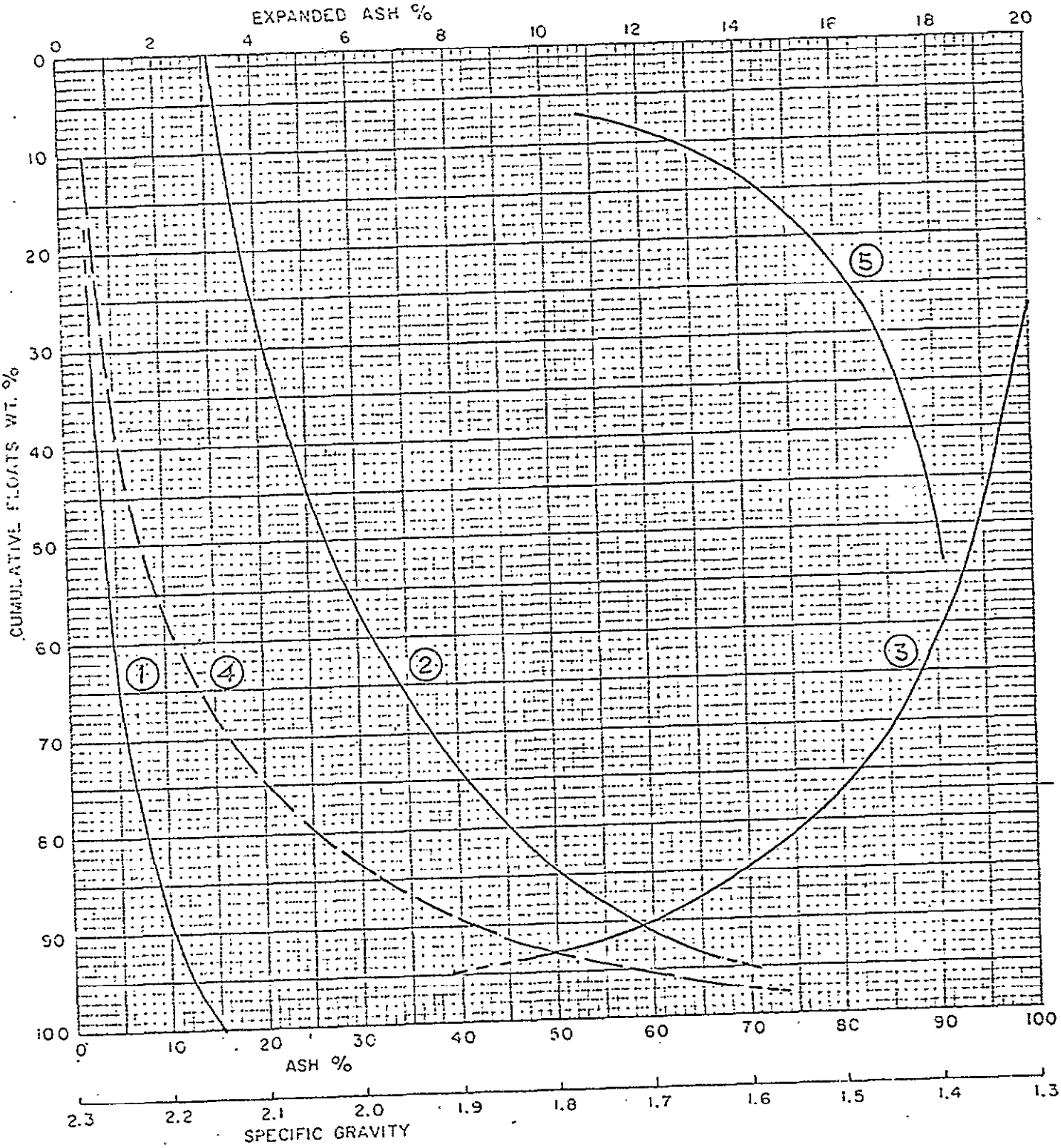
SAMPLE : Adit # G5

SIZE : 1/4" x 8 mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 6A

COMPANY : Denison Mines Ltd.

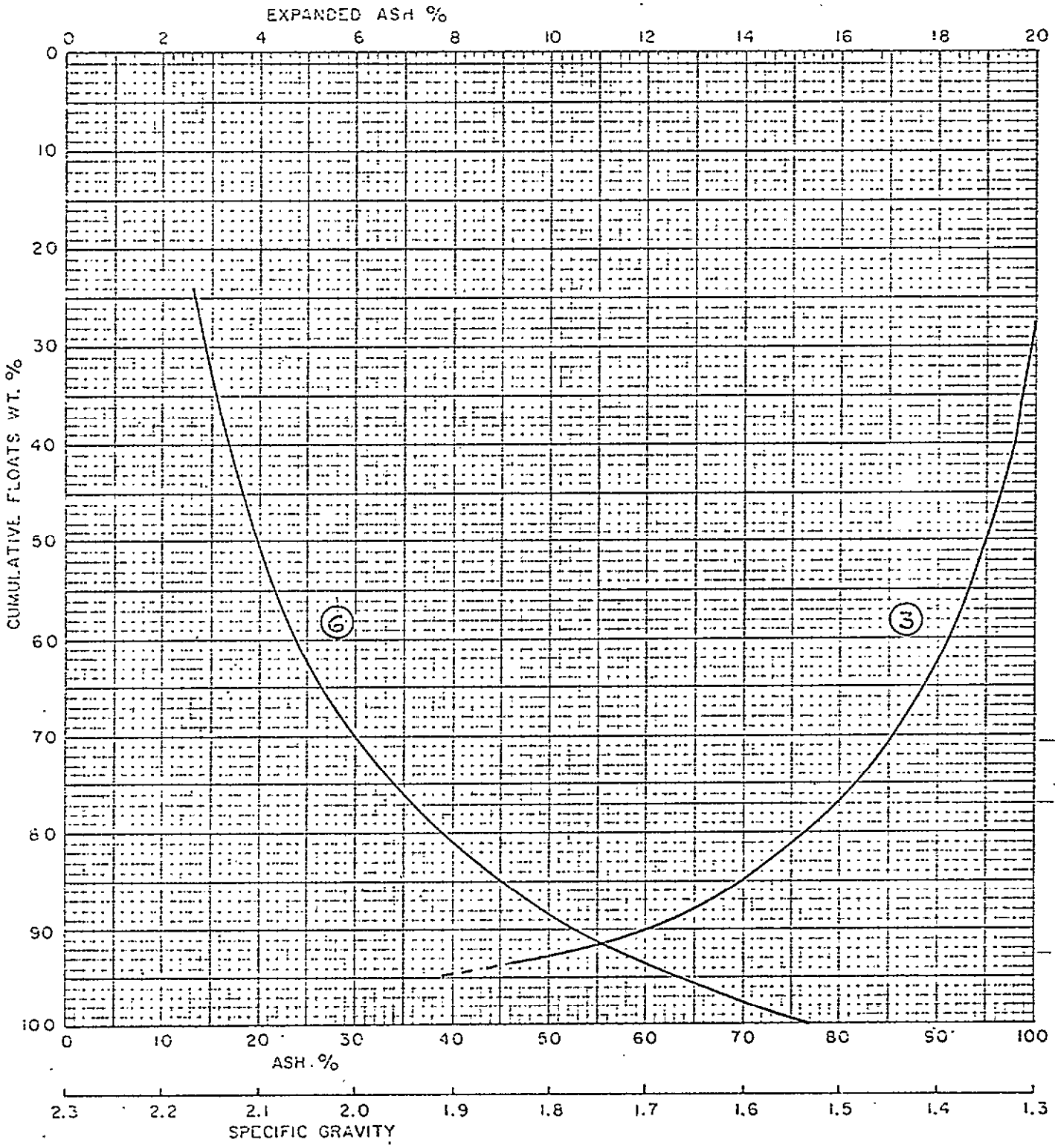
SAMPLE : Adit # G5

SIZE : 1/4" x 8 mesh.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 19. ADIT # G5

8m. x 28m.: 23.20% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	38.81	2.42	26.46	38.81	9+
1.30 - 1.35	24.43	4.76	23.85	63.24	9
1.35 - 1.40	11.91	9.06	21.31	75.15	8½
1.40 - 1.45	5.72	14.15	19.93	80.87	8½
1.45 - 1.50	3.21	18.63	18.72	84.08	8
1.50 - 1.60	5.21	25.53	16.95	89.29	8
1.60 - 1.70	3.82	34.71	15.81	93.11	7½
1.70 - 1.80	1.62	41.63	15.05	94.73	7½
+ 1.80	5.27	59.94	12.69	100.00	7
Total	100.00	11.08	22.77		

TABLE 20. ADIT # G5

Washability Data: 8m. x 28m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	38.81	2.42	38.81	2.42	100.00	11.08	19.40	2.42
1.30 - 1.35	24.43	4.76	63.24	3.32	61.19	16.57	51.03	4.76
1.35 - 1.40	11.91	9.06	75.15	4.23	36.76	24.42	69.19	9.06
1.40 - 1.45	5.72	14.15	80.87	4.93	24.85	31.78	78.01	14.15
1.45 - 1.50	3.21	18.63	84.08	5.46	19.13	37.05	82.48	18.63
1.50 - 1.60	5.21	25.53	89.29	6.63	15.92	40.76	86.68	25.53
1.60 - 1.70	3.82	34.71	93.11	7.78	10.71	48.17	91.20	34.71
1.70 - 1.80	1.62	41.63	94.73	8.36	6.89	55.63	93.92	41.63
+ 1.80	5.27	59.94	100.00	11.08	5.27	59.94	97.37	59.94
Total	100.00	11.08						

FIGURE : 7

COMPANY : Denison Mines Ltd.,

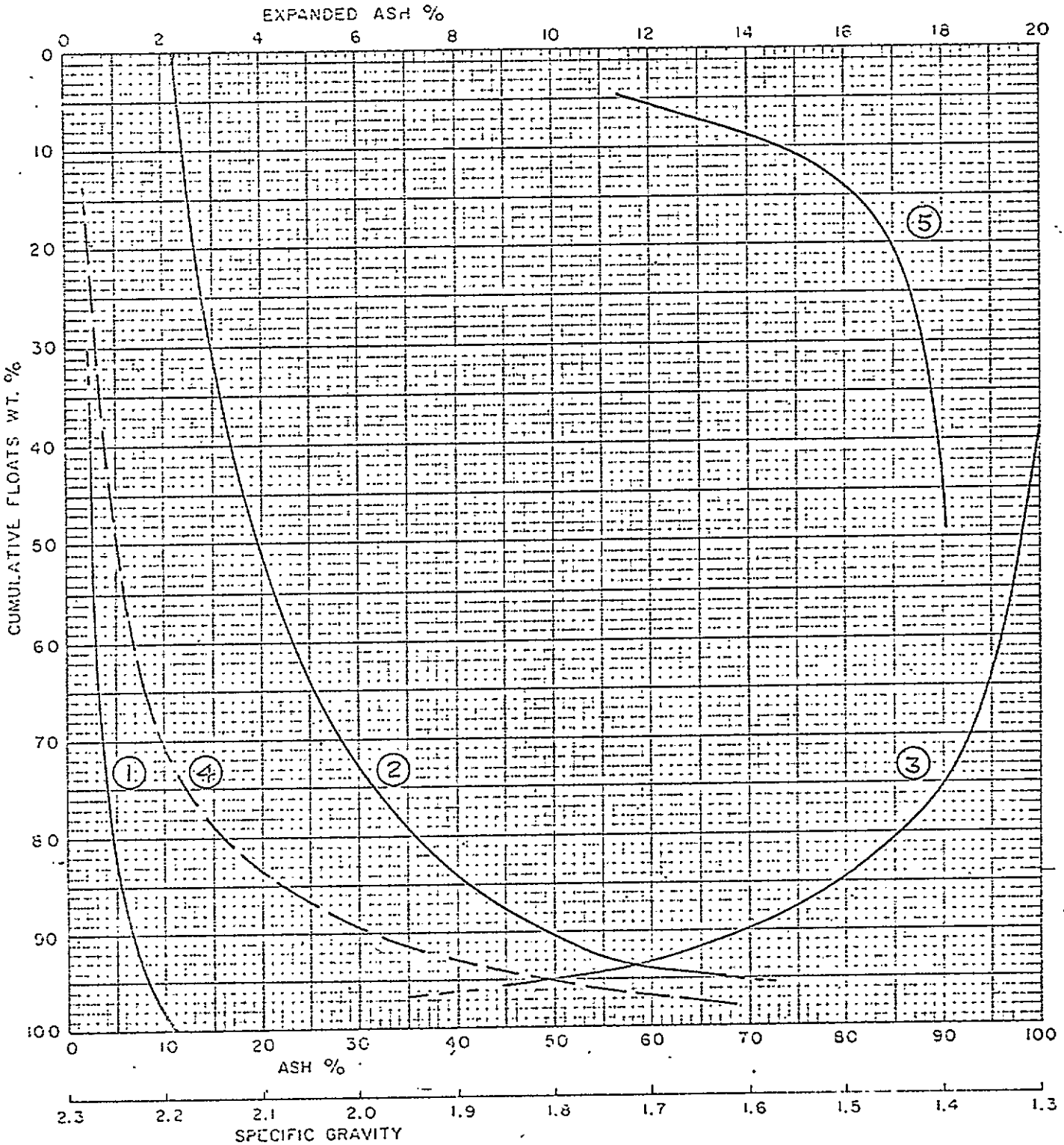
SAMPLE : Adit # G5

SIZE : 8 m. x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : February 18, 1982.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 7a

COMPANY : Denison Mines Ltd.

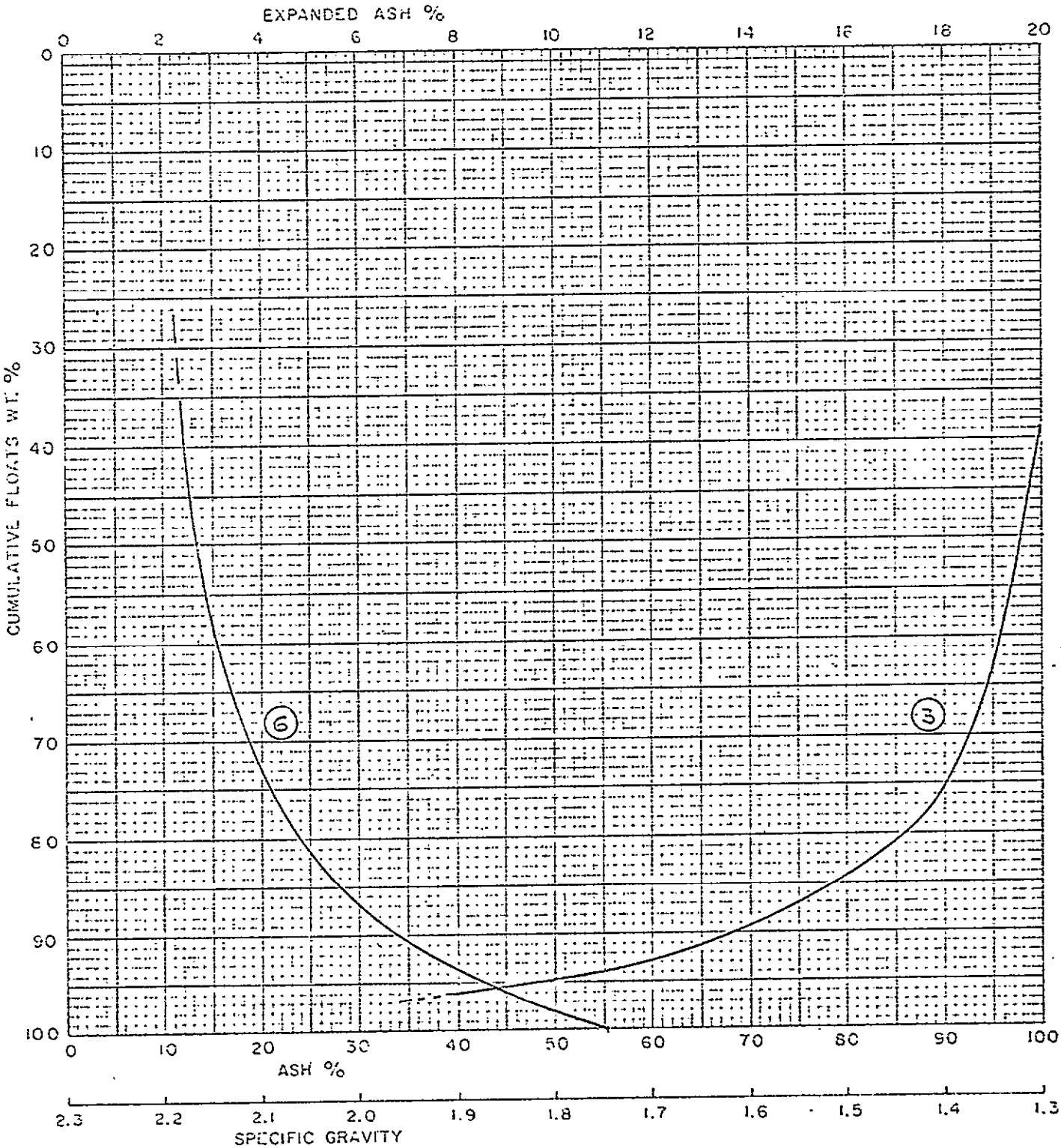
SAMPLE : Adit # G 5

SIZE : 8m. x 28m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES.



DATE : February 18, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 21. ADIT # G 5

28m x 100m.L 10.54% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Weight %	Ash %	V.M.%	Cum. Weight %	Cum. F.S.I.
- 1.30	44.57	2.47	26.08	44.57	9+
1.30 - 1.35	23.84	4.35	23.64	68.41	9
1.35 - 1.40	12.42	8.54	21.29	80.83	8½
1.40 - 1.45	4.42	13.98	20.05	85.25	8½
1.45 - 1.50	3.79	18.56	19.19	89.04	8½
1.50 - 1.60	3.46	25.74	17.15	92.50	8½
1.60 - 1.70	2.58	34.15	15.96	95.08	8½
1.70 - 1.80	1.25	41.81	15.08	96.33	8
+ 1.80	3.67	64.33	13.12	100.00	7½
Total	100.00	9.18	23.19		

TABLE 22. ADIT # G 5

Washability Data: 28m x 100m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	44.57	2.47	44.57	2.47	100.00	9.18	22.28	2.47
1.30 - 1.35	23.84	4.35	68.41	3.13	55.43	14.57	56.49	4.35
1.35 - 1.40	12.42	8.54	80.83	3.96	31.59	22.28	74.62	8.54
1.40 - 1.45	4.42	13.98	85.25	4.48	19.17	31.18	83.04	13.98
1.45 - 1.50	3.79	18.56	89.04	5.08	14.75	36.33	87.15	18.56
1.50 - 1.60	3.46	25.74	92.50	5.85	10.96	42.47	90.77	25.74
1.60 - 1.70	2.58	34.15	95.08	6.62	7.50	50.19	93.79	34.15
1.70 - 1.80	1.25	41.81	96.33	7.07	4.92	58.61	95.71	41.81
+ 1.80	3.67	64.33	100.00	9.18	3.67	64.33	98.16	64.33
Total	100.00	9.18						

FIGURE : 8

COMPANY : Denison Mines Ltd.

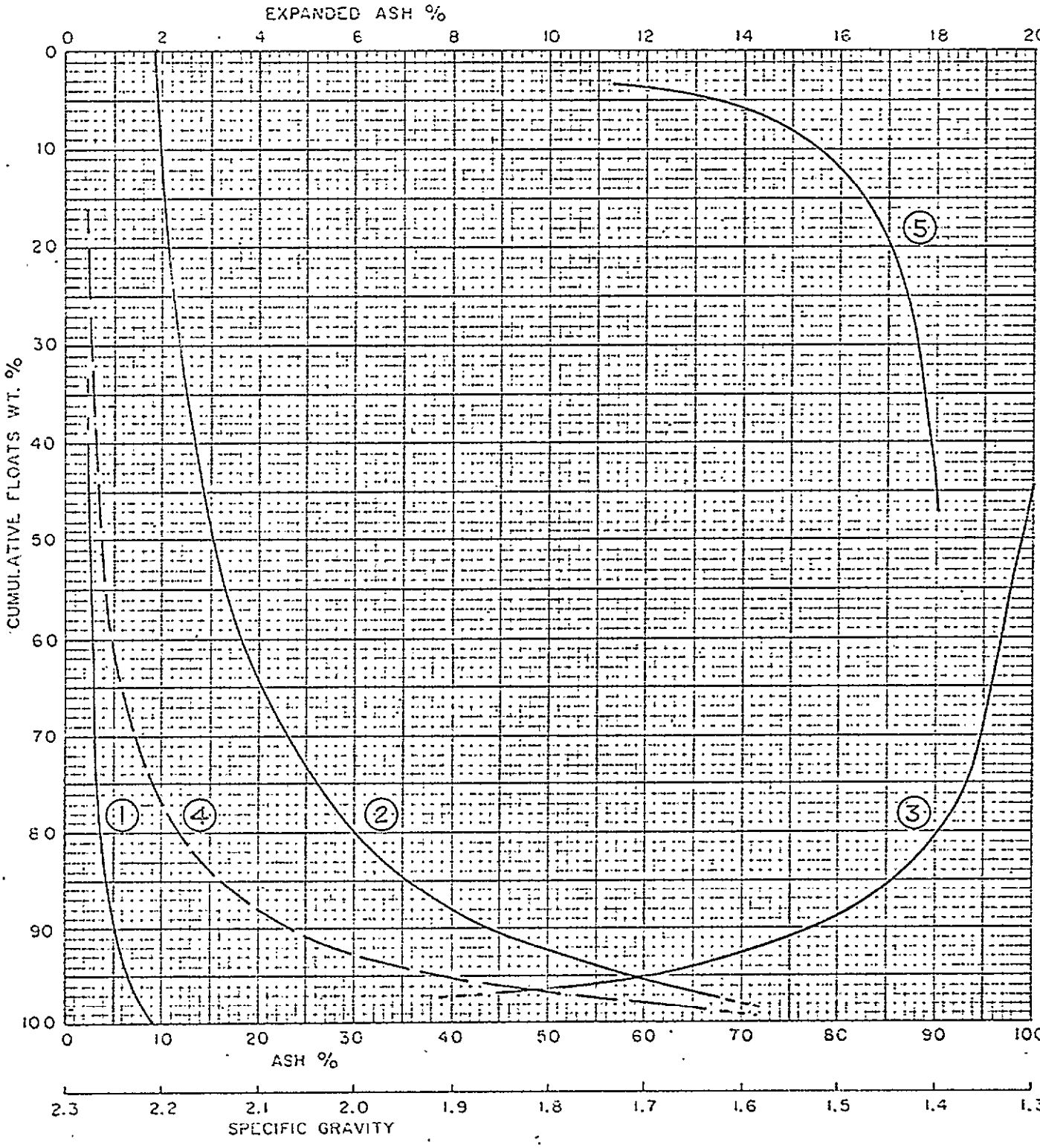
SAMPLE : Adit # G 5

SIZE : 28m x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : February 17, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 8a

COMPANY : Denison Mines Ltd.

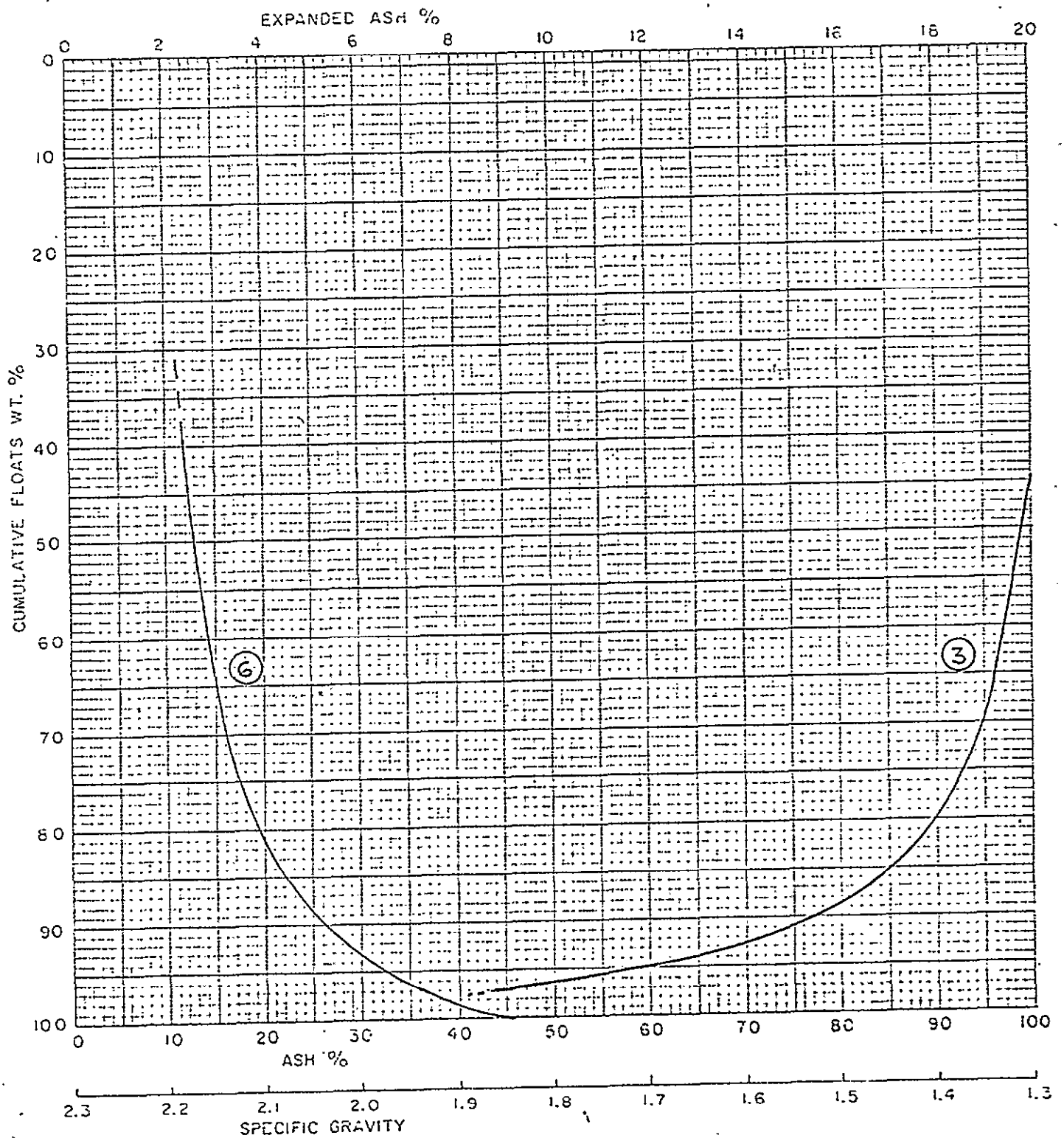
SAMPLE : Adit # G 5

SIZE : 28m. x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : February 17, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 23 - ADIT # G 5

FROTH FLOTATION TEST

28 Mesh x 100 Mesh: 10.54% of the Total Sample

Solids, by weight in Slurry	8.0%
Time of Flotation	1.5 minutes
Flotation Recovery	57.03%
Reagents	MIBC and Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	5.84%	13.93%
Volatile Matter, %	24.47%	22.57%
Residual Moisture, %	0.95%	0.91%
Fixed Carbon, %	68.74%	62.59%
F.S.I.	8	4½
Sulphur, %	0.37%	0.59%

TABLE 24. ADIT # G5

FROTH FLOTATION TEST

- 100 Mesh: 6.37% of Total Sample

Solids, by weight in Slurry	8.0%
Time of Flotation	1.5 minutes
Flotation Recovery	77.67%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	7.24%	19.15%
Volatile Matter, %	24.02%	21.40%
Residual Moisture, %	0.89%	0.84%
Fixed Carbon, %	67.85%	58.61%
F.S.I.	8	2½
Sulphur, %	0.47%	0.57%

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT #G-5

Submitted by,

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.12

Job No.: S1-84

Date: March 30, 1972.

REPORT ON WASHABILITY CHARACTERISTICS AND CLEANING OF COKING COAL FOR DENISON MINES LTD. ADIT #G-5

SUMMARY:

The data presented in this report refer to washability characteristics and the washing of a 5-ton sample from Adit #G-5.

The sample was washed in the two-stage water cyclone system followed by after cleaning of fines by froth flotation cells. Both the middlings and the refuse from the water cyclones were cleaned in heavy medium cyclone circuit. A yield of 66% was obtained. The bulk of the clean coal (50%) was produced in the water cyclone. The remaining 16% was obtained by washing the middlings from the water cyclone system in the heavy medium circuit. Fines were cleaned by flotation.

The analysis of the clean coal is as follows:

	Air Dried Basis	As Shipped Basis
Surface Moisture, %	-	6.00
Residual Moisture, %	0.65	0.61
Ash, %	7.28	6.84
Volatile Matter, %	24.02	22.58
Fixed Carbon	68.05	63.97
F.S.I.	6	6
B.T.U./lb.	14,110	13,263
Sulphur, %	0.33	0.31

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studies and production of clean coal.

The coal was air dried, crushed to - 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in Figure 1, Section 2, of this report.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager

SECTION 1

WASHABILITY DATA & FLOTATION TESTS

ADIT #G-5

TABLE 1 - ADIT #G-5

Head Sample Analysis

Ash	16.26%
Volatile Matter	21.05%
Residual Moisture	0.63%
Fixed Carbon	62.06%
F.S.I.	4
B.T.U./lb.	12,500
Sulphur	0.37%

TABLE 2 - ADIT #G-5

Size Analysis

	Weight %
3/4" x 28 Mesh	81.29
-28 Mesh	18.71
Total	100.00

TABLE 3 - ADIT #G-5

Incremental Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash %	V.M.%	R.M.%	F.C.%
- 1.30	25.06	2.60	26.55	0.67	70.18
1.30 - 1.35	18.32	5.50	23.62	0.66	70.22
1.35 - 1.40	12.99	8.10	20.75	0.67	70.48
1.40 - 1.45	11.21	13.93	19.96	0.65	65.46
1.45 - 1.50	9.24	18.66	18.48	0.65	62.21
1.50 - 1.60	7.75	26.98	17.78	0.65	54.59
1.60 - 1.70	7.08	34.92	15.92	0.63	48.53
1.70 - 1.80	1.81	44.64	15.28	0.60	39.48
+ 1.80	6.54	64.34	11.79	0.61	23.26
Total	100.00	15.58	21.17	0.65	62.60

TABLE 4 - ADIT #G-5

Cumulative Float-Sink Analysis of 3/4" x 28 M.

Sp. Gr.	Wt.%	Ash %	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	25.06	2.60	26.55	0.67	70.18	9+
- 1.35	43.38	3.82	25.31	0.67	70.20	8½
- 1.40	56.37	4.81	24.26	0.67	70.26	7½
- 1.45	67.58	6.32	23.55	0.66	69.47	5
- 1.50	76.82	7.81	22.94	0.66	68.59	4½
- 1.60	84.57	9.56	22.47	0.66	67.31	4
- 1.70	91.65	11.52	21.96	0.66	65.86	4
- 1.80	93.46	12.16	21.83	0.66	65.35	3½
Total	100.00	15.58	21.17	0.65	62.60	3

*F.S.I. by actual determination.

TABLE 5 - ADIT #G-5

Washability Data for 3/4" x 28 Mesh

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	25.06	2.60	25.06	2.60	100.00	15.58	12.53	2.60
1.30 - 1.35	18.32	5.50	43.38	3.82	74.94	19.92	34.22	5.50
1.35 - 1.40	12.99	8.10	56.37	4.81	56.62	24.58	49.87	8.10
1.40 - 1.45	11.21	13.93	67.58	6.32	43.63	29.49	61.97	13.93
1.45 - 1.50	9.24	18.66	76.82	7.81	32.42	34.87	72.20	18.66
1.50 - 1.60	7.75	26.98	84.57	9.56	23.18	41.32	80.69	26.98
1.60 - 1.70	7.08	34.92	91.65	11.52	15.43	48.53	88.11	34.92
1.70 - 1.80	1.81	44.64	93.46	12.16	8.35	60.07	92.61	44.64
+ 1.80	6.54	64.34	100.00	15.58	6.54	64.34	96.73	64.34
Total	100.00	15.58						

FIGURE :

COMPANY : Denison MinesLimited

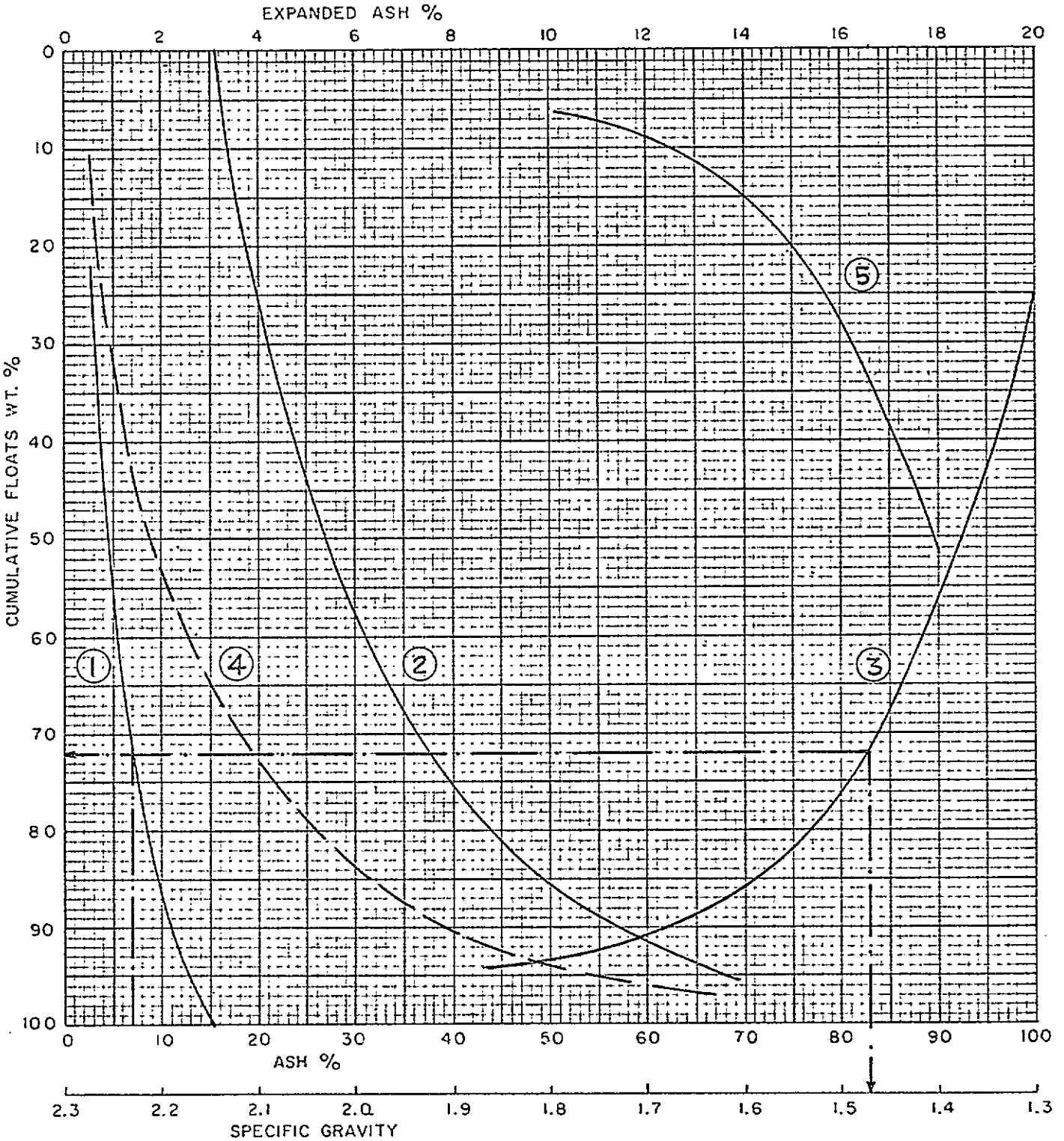
SAMPLE : Adit #G-5

SIZE : 3/4" x 28 Mesh - 500 lb. Split

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : March 29, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT #G-5

Froth Flotation Test of 28m. x 0

Solids, by weight in Slurry	8%
Flotation Time	1.5 minutes
Reagents	MIBC & Kerosene

	Concentrate	Tailings
Yield	88.78%	11.22%
Ash	7.27%	25.10%
Volatile Matter	23.98%	18.82%
Residual Moisture	1.13%	1.37%
Fixed Carbon	67.62%	54.71%
F.S.I.	7	2
Sulphur	0.57%	0.46%

SECTION 2

Washing Tests and Analysis of Products

ADIT #G-5

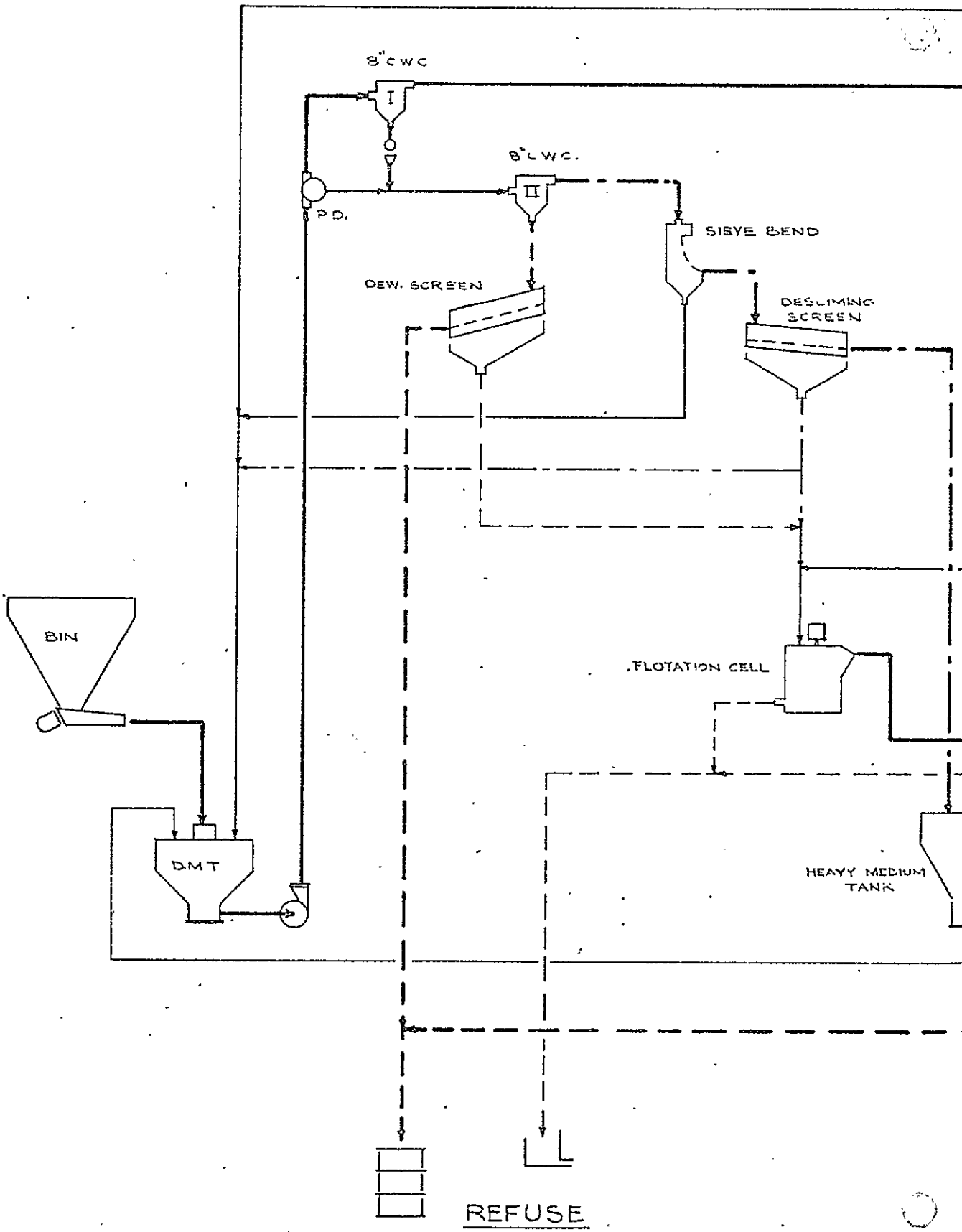
TABLE 1 - ADIT #G-5

Distribution of Products

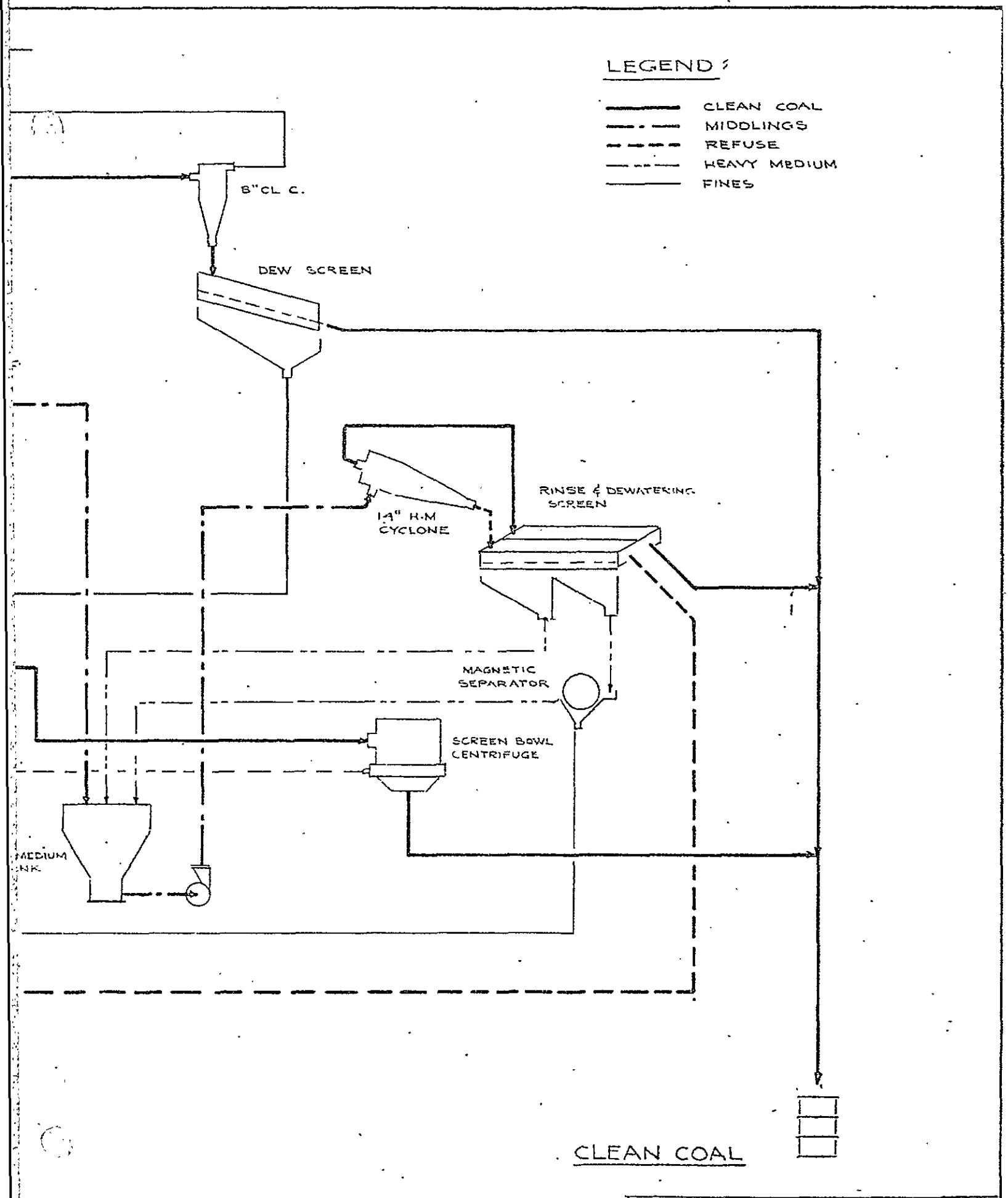
Product	Wt.%	Ash %
Clean Coal	66.00	7.30
CWC Refuse	20.00	40.00
H M Reject	12.00	28.00
Flotation Refuse	2.00	24.00
Total	100.00	16.70

FIG. 1

WASHING CIRCUIT FOR ADIT # G-5



MARCH 30, 1972 G.W.L.



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 2 - ADIT #G-5

Proximate Analysis of Clean Coal

Ash	7.28%
Volatile Matter	24.02%
Residual Moisture	0.65%
Fixed Carbon	68.05%
F.S.I.	6
B.T.U./lb.	14,110
Sulphur	0.33%

TABLE 3 - ADIT #G-5

Ultimate Analysis

Ash	7.28%
Carbon	81.10%
Hydrogen	4.58%
Nitrogen	0.90%
Oxygen	5.81%
Sulphur	0.33%

TABLE 4 - ADIT #G-5

Characteristics of the Ash

Mineral Analysis of Ash

SiO_2	57.26
Al_2O_3	31.47
Fe_2O_3	2.84
TiO_2	1.51
P_2O_5	1.57
CaO	2.85
MgO	0.43
Na_2O	0.19
K_2O	0.45
SO_3	0.74

Ash Fusibility

	Reducing Atmosphere	Oxidizing Atmosphere
Initial Deformation Temperature	2640+	2640+
Spherical Temperature	2640+	2640+
Hemispherical Temperature	2640+	2640+
Fluid Temperature	2640+	2640+

TABLE 5 - ADIT #G-5

Analysis of CWC Reject

Ash	39.57%
Volatile Matter	15.21%
Residual Moisture	0.41%
Fixed Carbon	44.81%
F.S.I.	N.A.
B.T.U./lb.	8,640
Sulphur	0.46%

TABLE 6 - ADIT #G-5

Analysis of H M Reject

Ash	29.64%
Volatile Matter	17.02%
Residual Moisture	0.32%
Fixed Carbon	53.02%
F.S.I.	1
B.T.U./lb.	9,230
Sulphur	0.40%

TABLE 7 - ADIT #G-5

Analysis of Flotation Refuse

Ash	23.86%
Volatile Matter	18.72%
Residual Moisture	0.46%
Fixed Carbon	56.96%
F.S.I.	1
B.T.U./lb.	11,270
Sulphur	0.47%

TABLE 9: Adit F-11.

+ 2": 12.96% of the Sample.

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	21.10	2.77	24.72	21.10	9
1.30 - 1.35	34.45	3.54	23.80	55.55	8
1.35 - 1.40	3.71	7.28	20.91	59.26	7
1.40 - 1.45	0.67	10.39	19.97	54.93	7
1.45 - 1.50	0.39	16.31	19.40	60.32	6½
1.50 - 1.60	0.41	30.15	17.48	60.73	6½
1.60 - 1.70	0.68	41.52	15.15	61.41	6
1.70 - 1.80	1.62	48.84	13.55	63.03	6
+ 1.80	36.97	74.64	9.61	100.00	4
Total	100.00	31.00	18.35		

TABLE 10: Adit F11.

Washability Data: + 2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	21.10	2.77	21.10	2.77	100.00	31.00	10.55	2.77
1.30 - 1.35	34.45	3.54	55.55	3.25	78.90	38.55	38.32	3.54
1.35 - 1.40	3.71	7.28	59.26	3.50	44.45	65.68	57.40	7.28
1.40 - 1.45	0.67	10.39	59.93	3.58	40.74	71.00	59.59	10.39
1.45 - 1.50	0.39	16.31	60.32	3.66	40.07	72.01	60.12	16.31
1.50 - 1.60	0.41	30.15	60.73	3.84	39.68	72.56	60.52	30.15
1.60 - 1.70	0.68	41.52	61.41	4.26	39.27	73.00	61.07	41.52
1.70 - 1.80	1.62	48.84	63.03	5.40	38.59	73.56	62.22	48.84
+ 1.80	36.97	74.64	100.00	31.00	36.97	74.64	81.51	74.64
Total	100.00	31.00						

FIGURE : 2

COMPANY : DENISON MINES LTD.

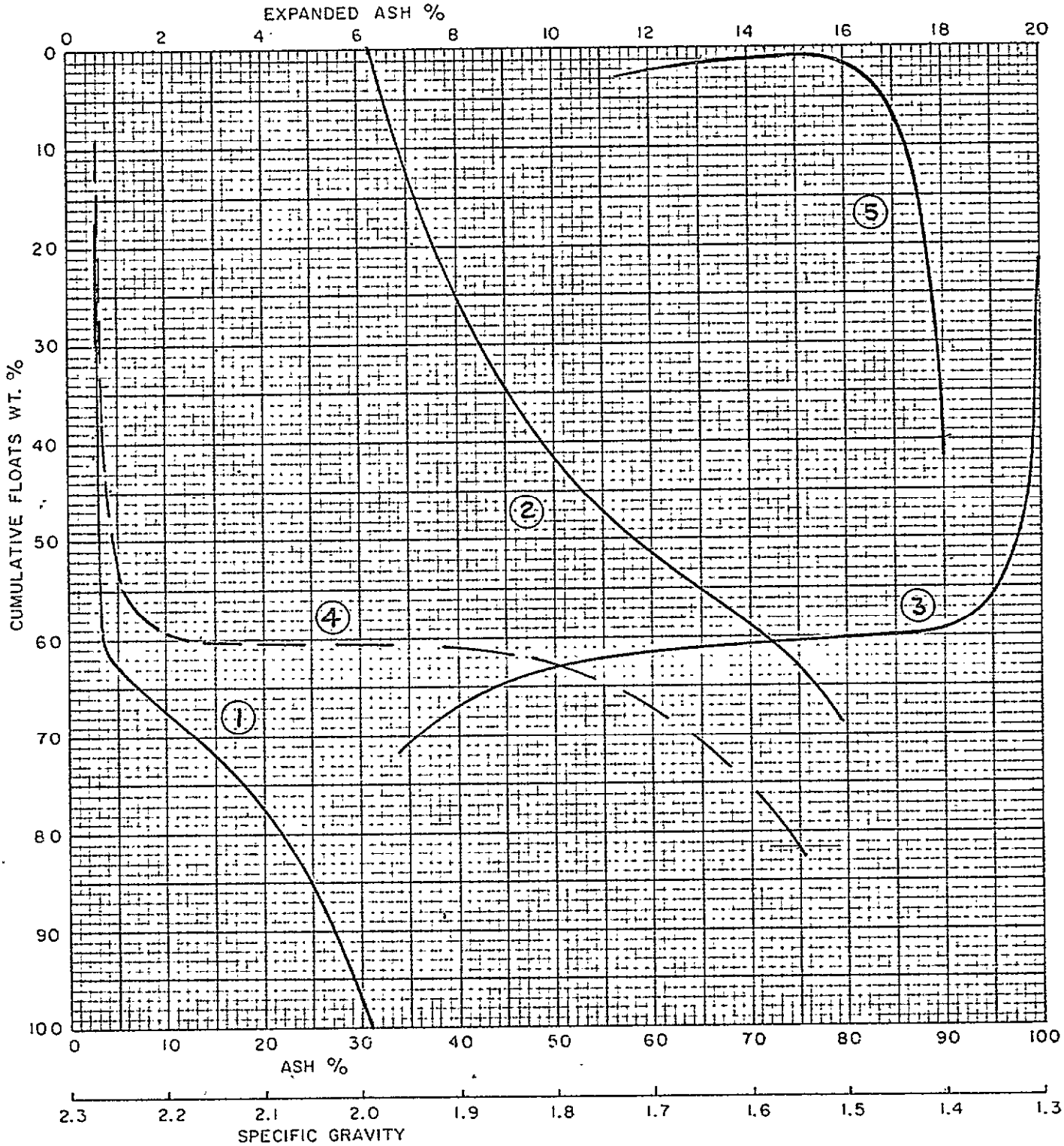
SAMPLE : ADIT F-11

SIZE : + 2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : DENISON MINES LTD.

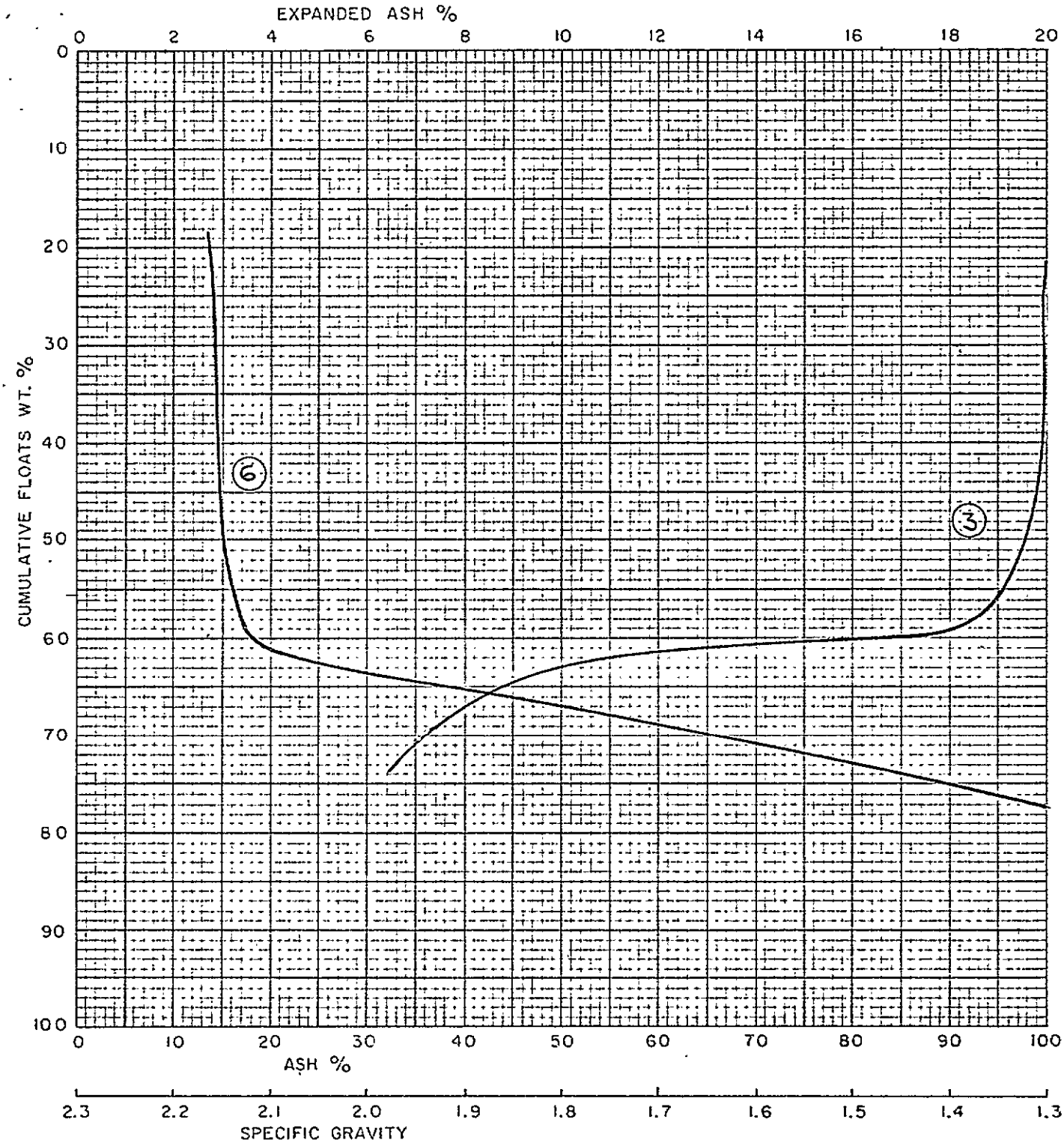
SAMPLE : ADIT F-11

SIZE : + 2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 11: Adit F-11

2" x 1": 5.32% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	24.54	2.71	24.44	24.54	9
1.30 - 1.35	36.61	3.65	23.63	61.15	7½
1.35 - 1.40	2.97	7.31	21.11	64.12	6½
1.40 - 1.45	0.64	10.27	20.02	64.76	6½
1.45 - 1.50	0.41	16.54	19.67	65.17	6½
1.50 - 1.60	0.49	29.11	17.69	65.66	6½
1.60 - 1.70	0.67	39.19	15.35	66.33	6½
1.70 - 1.80	1.81	47.17	13.73	68.14	6½
+ 1.80	31.86	71.17	9.88	100.00	4½
Total	100.00	26.29	19.07		

TABLE 12: Adit F-11

Washability Data: 2" x 1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt.%	Ash %
- 1.30	24.54	2.71	24.52	2.71	100.00	26.29	12.27	2.71
1.30 - 1.35	36.61	3.65	61.15	3.27	75.46	33.95	42.84	3.65
1.35 - 1.40	2.97	7.31	64.12	3.46	38.85	62.51	62.63	7.31
1.40 - 1.45	0.64	10.27	64.76	3.53	35.88	67.08	64.44	10.27
1.45 - 1.50	0.41	16.54	65.17	3.61	35.24	68.11	64.96	16.54
1.50 - 1.60	0.49	29.11	65.66	3.80	34.83	68.72	65.41	29.11
1.60 - 1.70	0.67	39.19	66.33	4.16	34.34	69.28	65.99	39.19
1.70 - 1.80	1.81	47.17	68.14	5.30	33.67	69.88	67.23	47.17
+ 1.80	31.86	71.17	100.00	26.29	31.86	71.17	84.07	71.17
Total	100.00	26.29						

FIGURE: 3

COMPANY : DENISON MINES LTD.

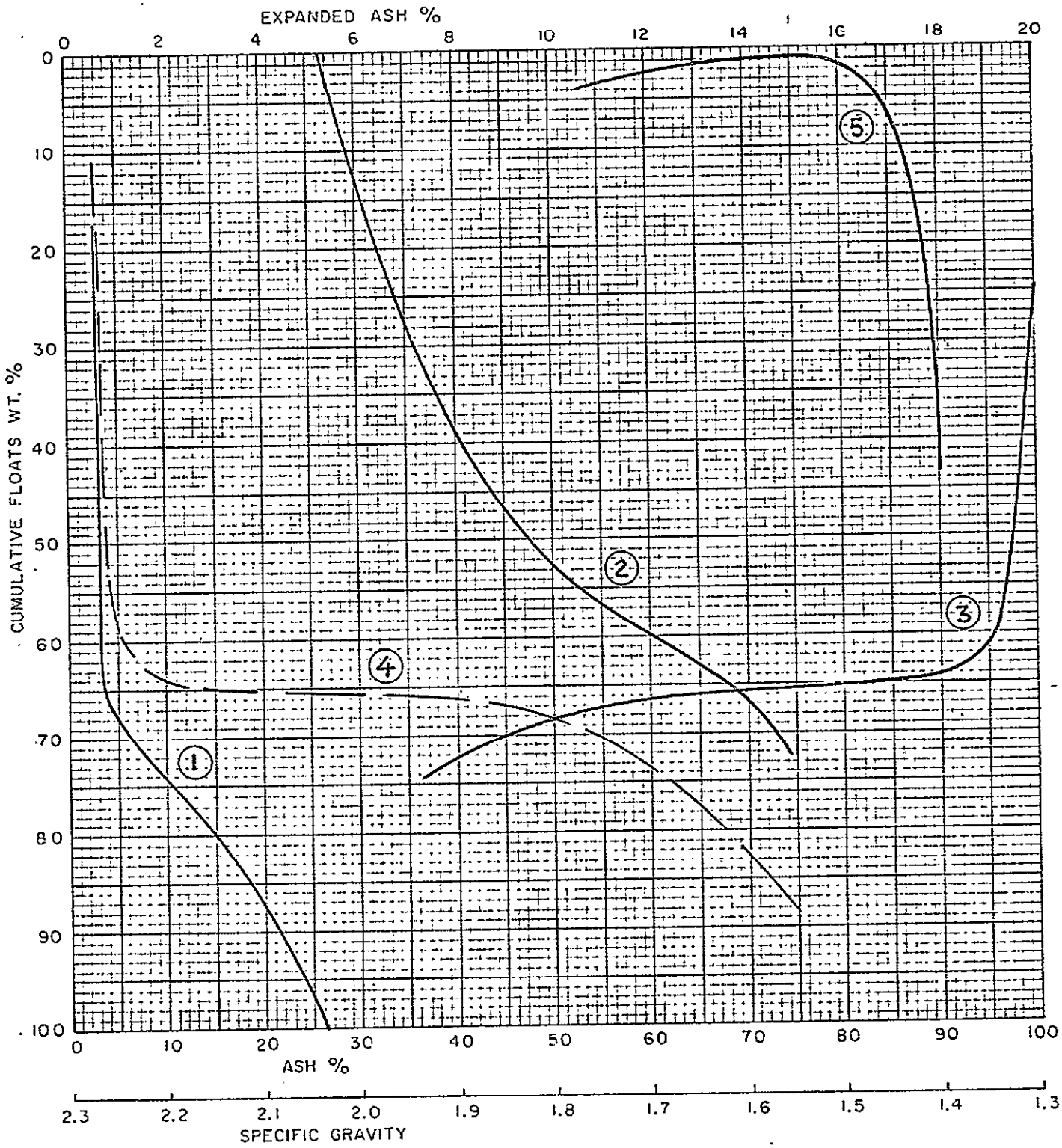
SAMPLE : ADIT F-11

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON : ALBERTA CANADA

FIGURE : 3a

COMPANY : DENISON MINES LTD.

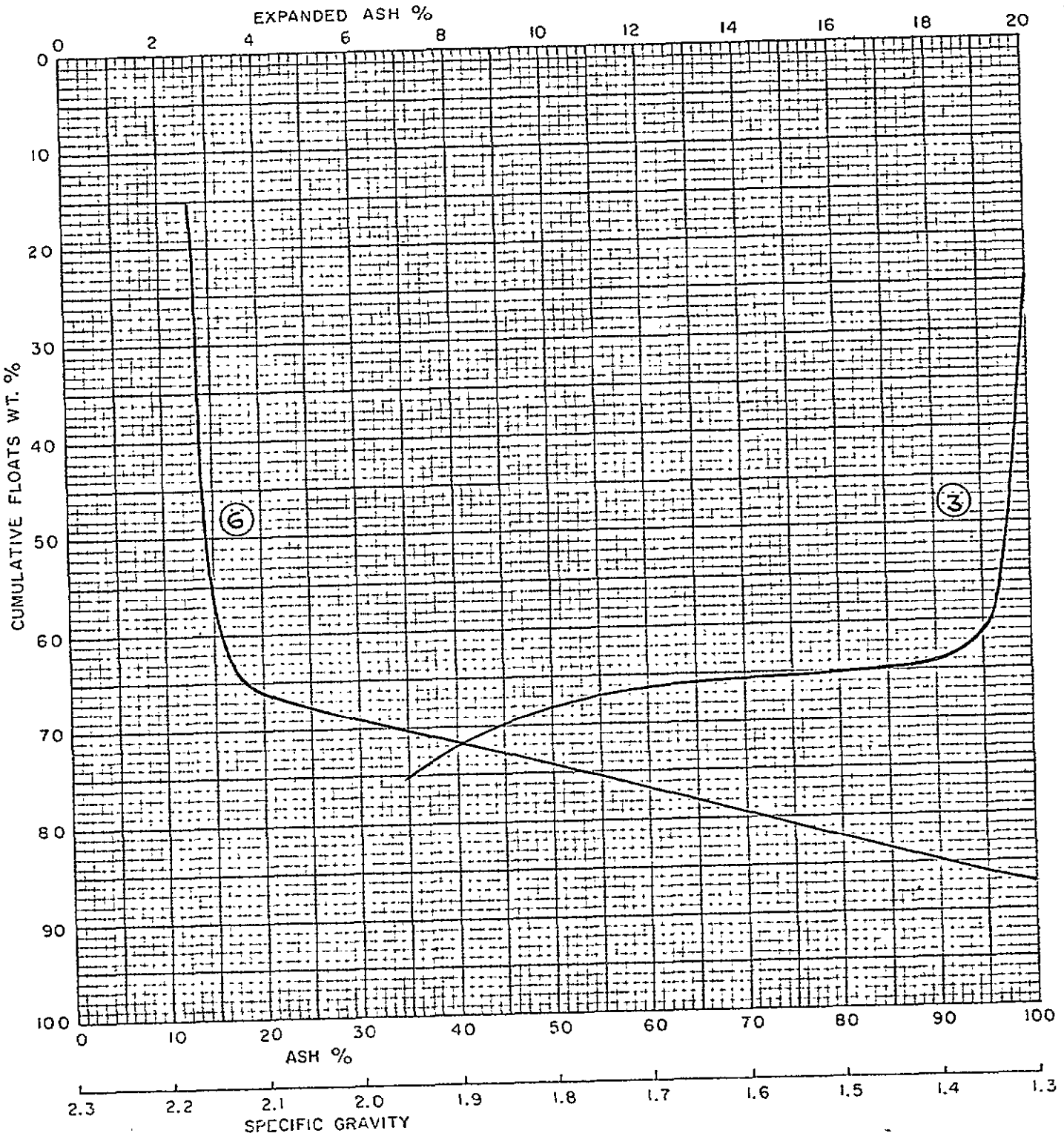
SAMPLE : ADIT F-11

SIZE : 2" x 1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD
EDMONTON ALBERTA CANADA

TABLE 13: Adit F-11.

1" x 1/2": 11.89% of Sample.

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	28.69	2.47	24.86	28.69	9
1.30 - 1.35	40.17	3.83	23.41	68.86	7
1.35 - 1.40	2.46	7.17	21.27	71.32	7
1.40 - 1.45	0.69	10.17	20.18	72.01	7
1.45 - 1.50	0.37	16.23	19.82	72.38	7
1.50 - 1.60	0.43	29.69	17.86	72.81	7
1.60 - 1.70	0.84	40.19	15.51	73.65	7
1.70 - 1.80	1.26	47.49	14.06	74.91	7
+ 1.80	25.09	79.38	7.30	100.00	5
Total	100.00	23.53	19.49		

TABLE 14: Adit F-11.

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	28.69	2.47	28.69	2.47	100.00	23.53	14.34	2.47
1.30 - 1.35	40.17	3.83	68.86	3.26	71.31	32.01	48.77	3.83
1.35 - 1.40	2.46	7.17	71.32	3.40	31.14	68.36	70.09	7.17
1.40 - 1.45	0.69	10.17	72.01	3.46	28.68	73.61	71.66	10.17
1.45 - 1.50	0.37	16.23	72.38	3.53	27.99	75.17	72.19	16.23
1.50 - 1.60	0.43	29.69	72.81	3.68	27.62	75.96	72.59	29.69
1.60 - 1.70	0.84	40.19	73.65	4.10	27.19	76.69	73.23	40.19
1.70 - 1.80	1.26	47.49	74.91	4.83	26.35	77.86	74.28	47.49
+ 1.80	25.09	79.38	100.00	23.53	25.09	79.38	87.45	79.38
Total	100.00	23.53						

FIGURE : 4

COMPANY : DENISON MINES LTD.

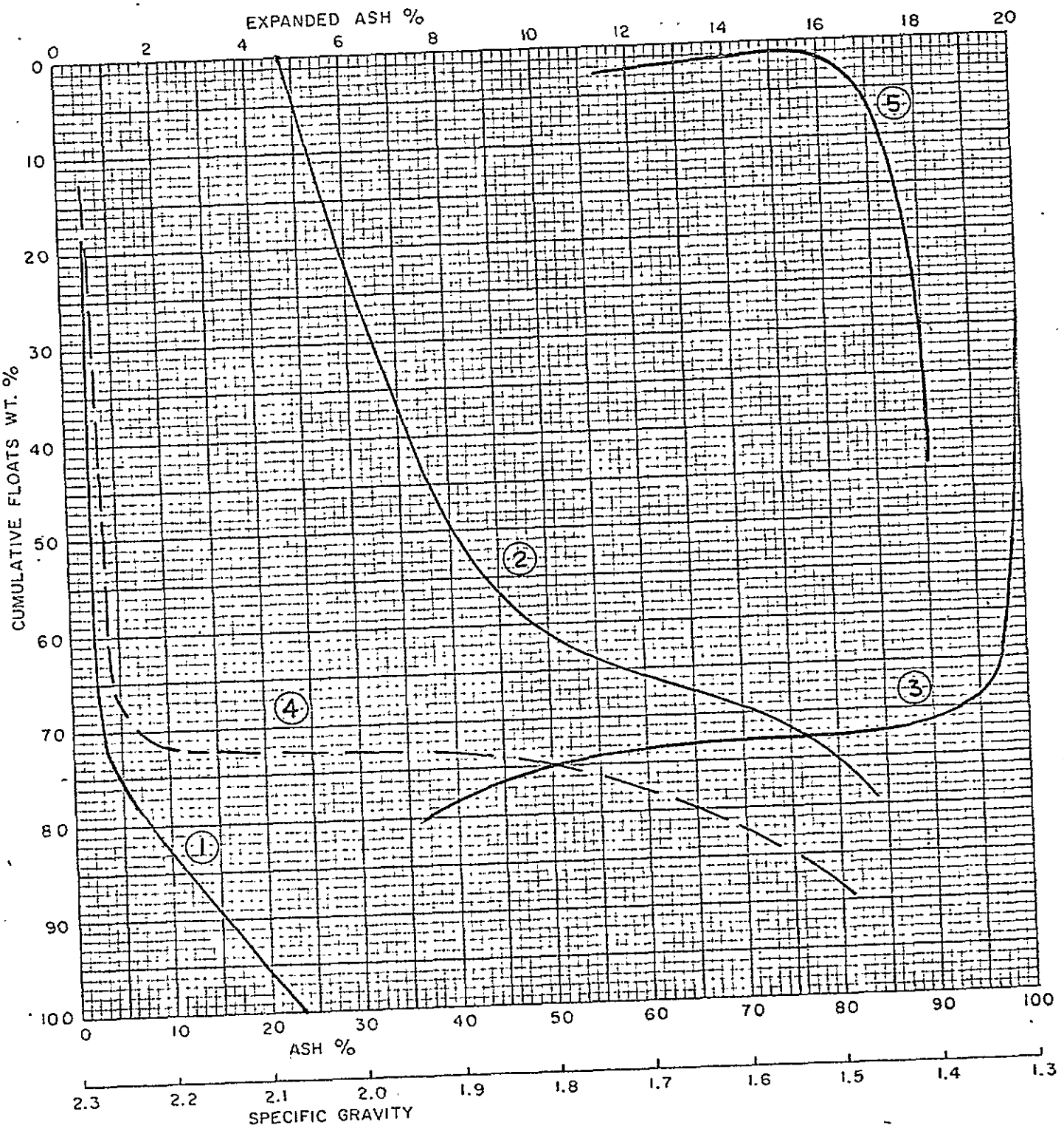
SAMPLE : ADIT F-11

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 4a

COMPANY : DENISON MINES LTD.

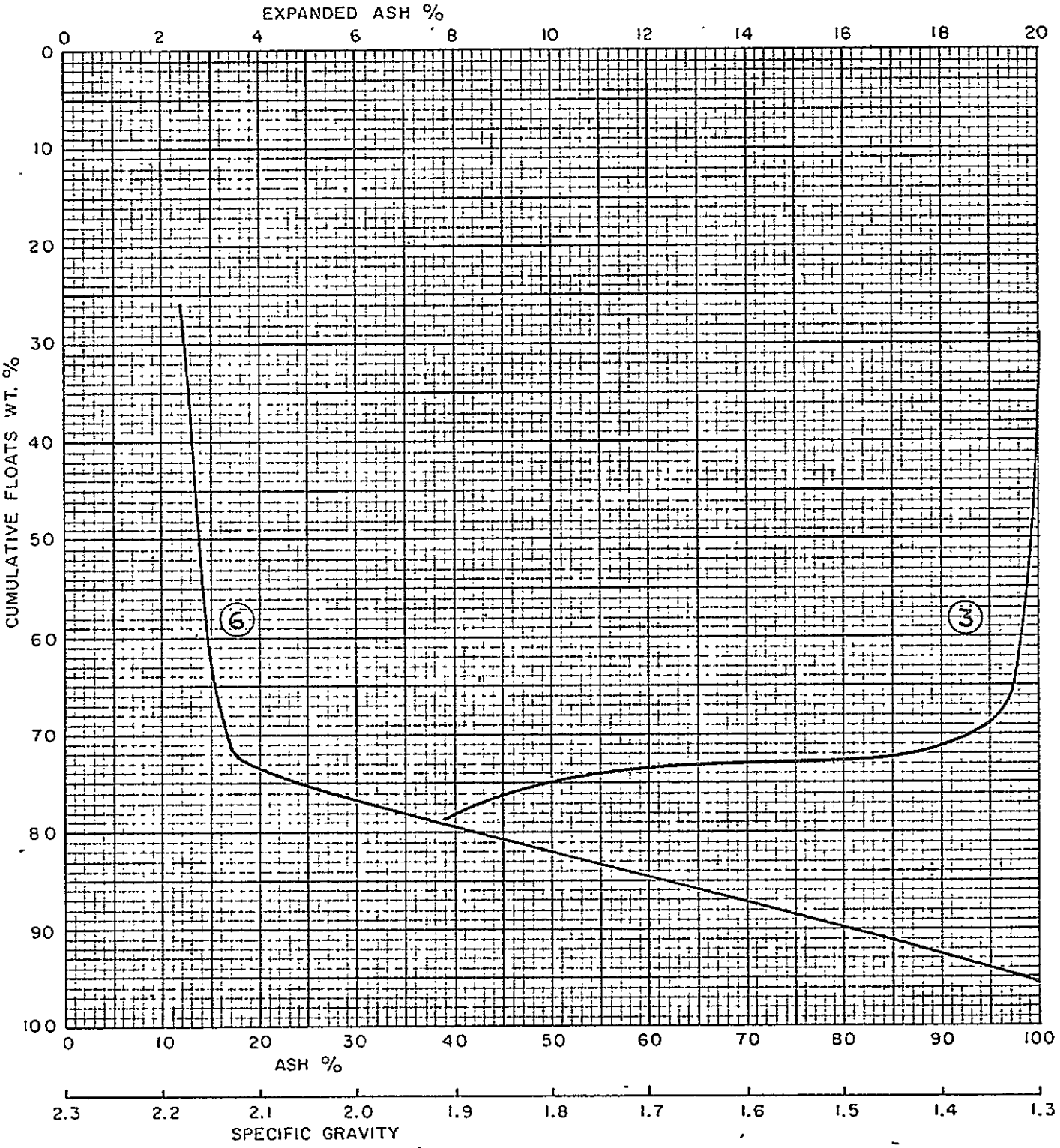
SAMPLE : ADIT F-11

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



CYCLONE ENGINEERING SALES LTD.

DATE : May 7, 1972

TABLE 15: Adit F-11.

1/2" x 1/4": 12.79% of Sample.

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	50.79	2.59	24.48	50.79	9
1.30 - 1.35	23.53	4.32	22.40	74.32	7½
1.35 - 1.40	1.77	7.77	20.75	76.09	7½
1.40 - 1.45	0.88	11.40	19.98	76.97	7½
1.45 - 1.50	0.51	17.92	19.07	77.48	7½
1.50 - 1.60	0.64	27.87	17.62	78.12	7½
1.60 - 1.70	1.13	38.51	15.88	79.25	7
1.70 - 1.80	1.20	46.65	14.73	80.45	7
+ 1.80	19.55	81.83	7.42	100.00	5½
Total	100.00	19.83	20.26		

TABLE 16: Adit F-11.

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	50.79	2.59	50.79	2.59	100.00	19.83	25.39	2.59
1.30 - 1.35	23.53	4.32	74.32	3.14	49.21	37.63	62.55	4.32
1.35 - 1.40	1.77	7.77	76.09	3.25	25.68	68.15	75.20	7.77
1.40 - 1.45	0.88	11.40	76.97	3.34	23.91	72.62	76.53	11.40
1.45 - 1.50	0.51	17.92	77.48	3.43	23.03	74.96	77.22	17.92
1.50 - 1.60	0.64	27.87	78.12	3.63	22.52	76.25	77.80	27.87
1.60 - 1.70	1.13	38.51	79.25	4.13	21.88	77.66	78.68	38.51
1.70 - 1.80	1.20	46.65	80.45	4.77	20.75	79.80	79.85	46.65
+ 1.80	19.55	81.83	100.00	19.83	19.55	81.83	90.22	81.83
Total	100.00	19.83						

FIGURE: 5

COMPANY : DENISON MINES LTD.

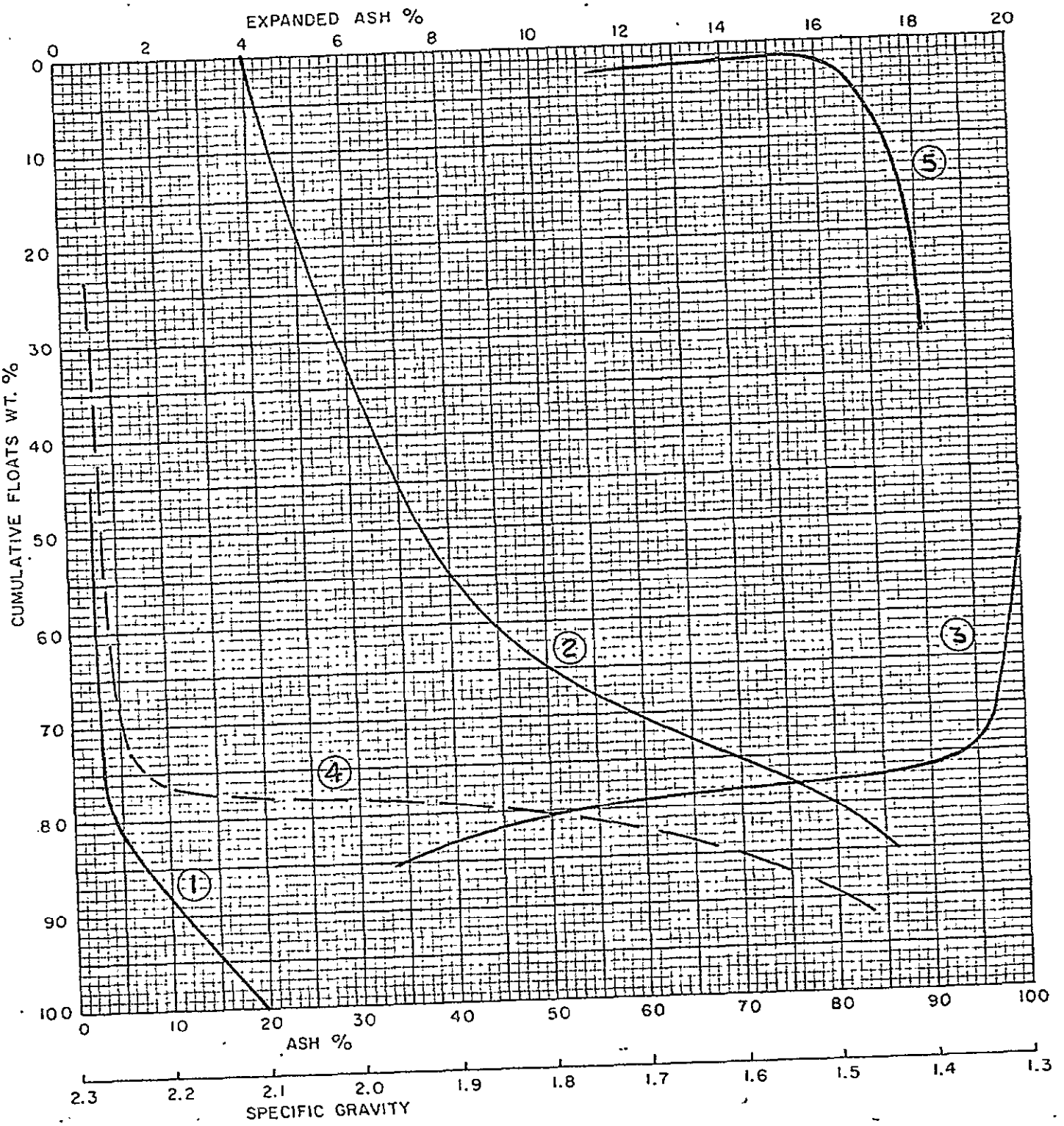
SAMPLE : ADIT F-11

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5a

COMPANY : DENISON MINES LTD.

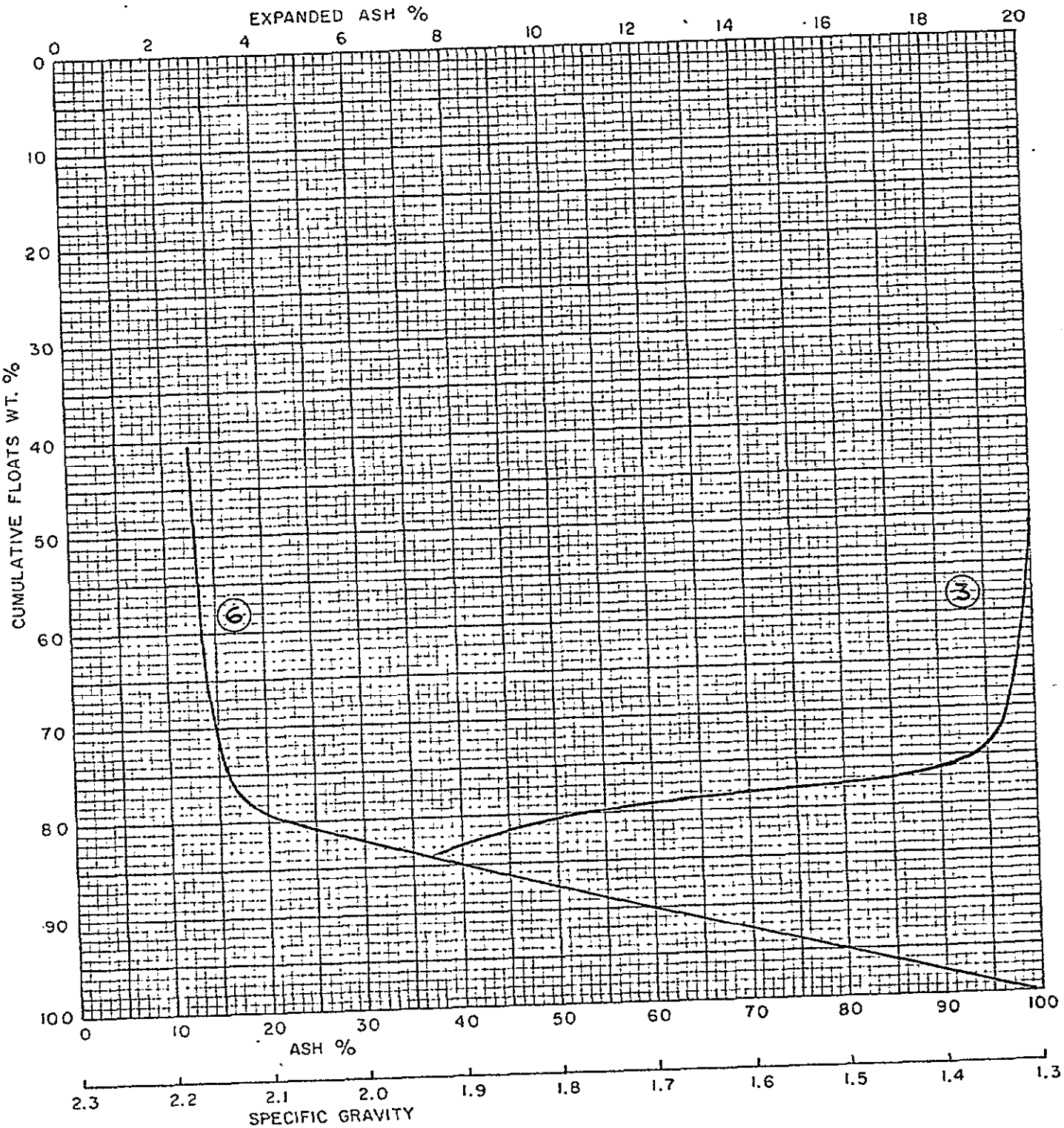
SAMPLE : ADIT F-11

SIZE : 1/2" x1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 17: Adit F-11.

1/4" x 8 m.: 15.26% of Sample.

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	43.68	2.36	25.77	43.68	9+
1.30 - 1.35	29.43	4.30	22.62	73.11	8½
1.35 - 1.40	3.05	7.91	20.66	76.16	8
1.40 --1.45	0.98	12.89	19.51	77.14	8
1.45 - 1.50	0.57	19.77	19.33	77.71	8
1.50 - 1.60	0.92	26.66	18.12	78.63	7½
1.60 - 1.70	0.98	37.51	16.59	79.61	7½
1.70 - 1.80	1.30	45.20	15.10	80.91	7
+ 1.80	19.09	79.34	8.88	100.00	6
Total	100.00	19.12	21.07		

TABLE 18: Adit F-11.

Washability Data: 1/4" x 8 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	43.68	2.36	43.68	2.36	100.00	19.12	22.84	2.36
1.30 - 1.35	29.43	4.30	73.11	3.14	56.32	32.12	58.39	4.30
1.35 - 1.40	3.05	7.91	76.16	3.33	26.89	62.58	74.63	7.91
1.40 - 1.45	0.98	12.89	77.14	3.45	23.84	69.57	76.65	12.89
1.45 - 1.50	0.57	19.77	77.71	3.57	22.86	72.00	77.42	19.77
1.50 - 1.60	0.92	26.66	78.63	3.84	22.29	73.34	78.17	26.66
1.60 - 1.70	0.98	37.51	79.61	4.26	21.37	75.34	79.12	37.51
1.70 - 1.80	1.30	45.20	80.91	4.92	20.39	77.16	80.26	45.20
+ 1.80	19.09	79.34	100.00	19.12	19.09	79.34	90.45	79.34
Total	100.00	19.12						

FIGURE : 6

COMPANY : DENISON MINES LTD.

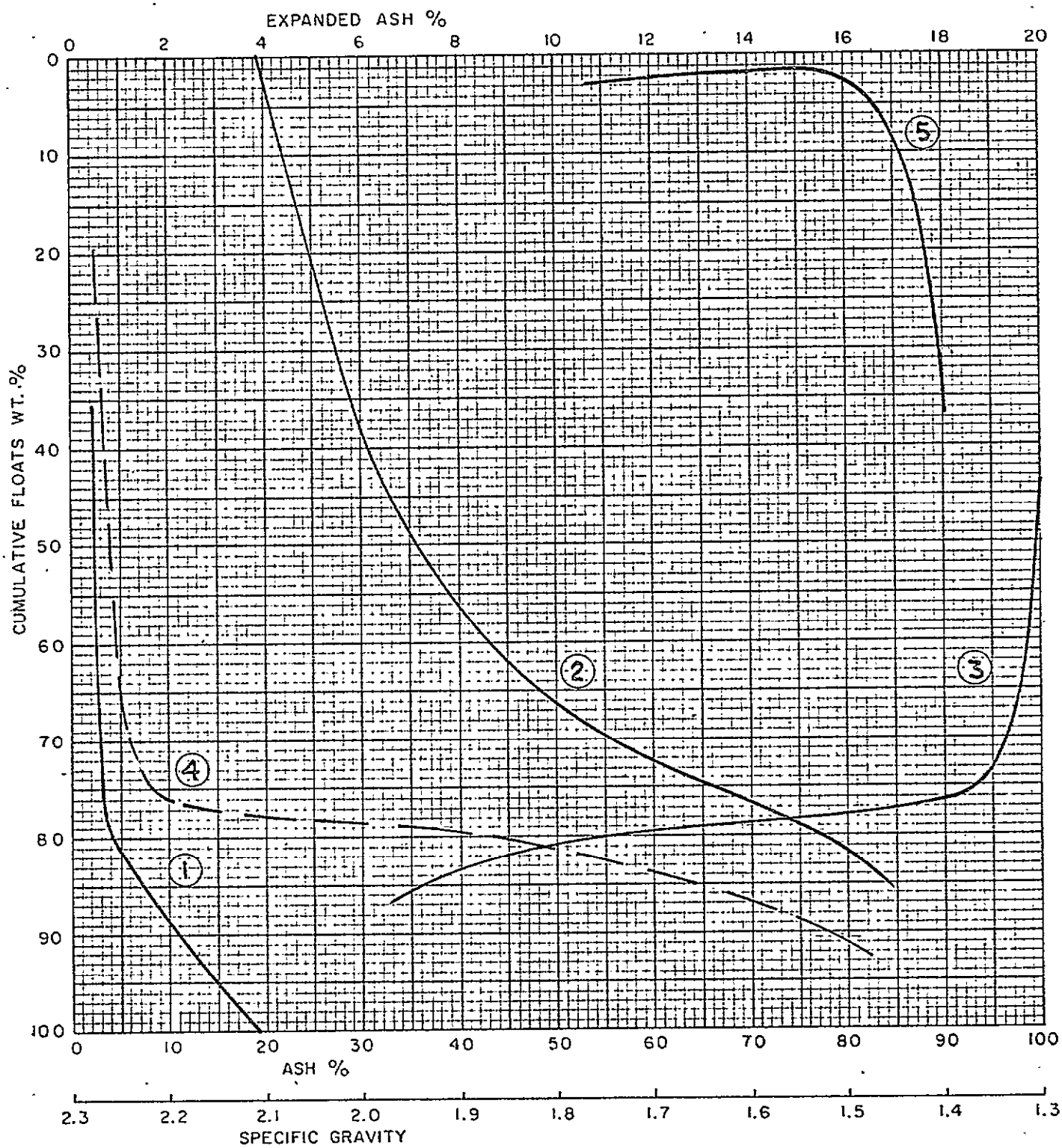
SAMPLE : ADIT F-11

SIZE : 1/4" x 8 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 6a

COMPANY : DENISON MINES LTD.

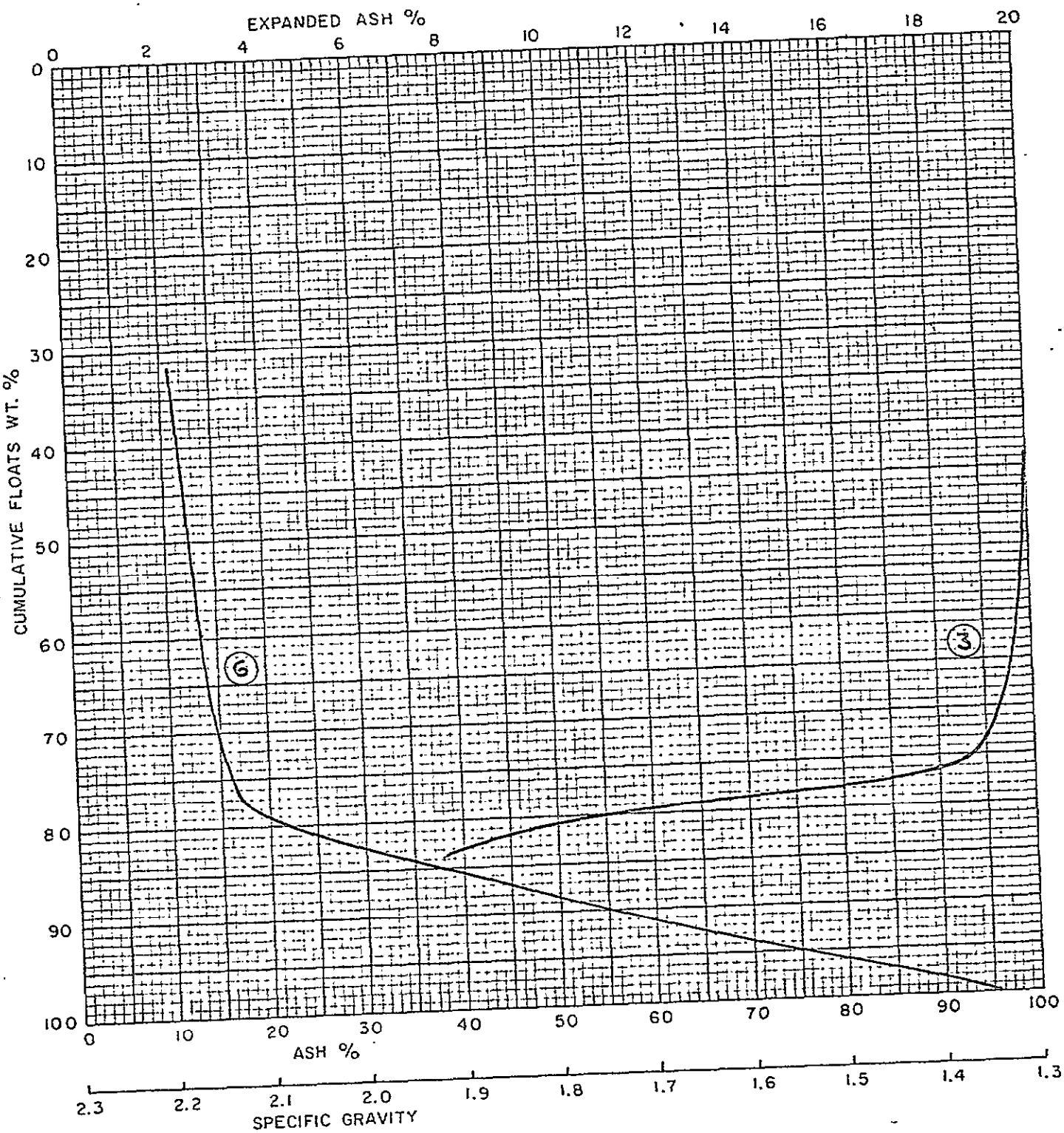
SAMPLE : ADIT F-11

SIZE : 1/4" x 8 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

DATE :

TABLE 19: Adit F-11

8 x 28 m.: 23.00% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. FSI
- 1.30	57.76	2.38	26.38	57.76	9+
1.30 - 1.35	17.69	5.18	22.40	75.45	8½
1.35 - 1.40	4.74	8.58	20.54	80.19	8½
1.40 - 1.45	1.59	13.15	19.98	81.78	8
1.45 - 1.50	0.96	19.23	19.73	82.74	8
1.50 - 1.60	1.37	27.28	18.63	84.11	8
1.60 - 1.70	1.28	37.16	17.37	85.39	8
1.70 - 1.80	1.21	44.75	15.69	86.60	8
+ 1.80	13.40	75.39	9.65	100.00	7
Total	100.00	14.58	22.64		

TABLE 20: Adit F-11.

Washability Data: 8 x 28 m.

Specific Gravity	Fractional		Cumulavitve				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	57.76	2.38	57.76	2.38	100.00	14.58	28.88	2.38
1.30 - 1.35	17.69	5.18	75.45	3.04	42.24	31.27	66.60	5.18
1.35 - 1.40	4.74	8.58	80.19	3.36	24.55	50.08	77.82	8.58
1.40 - 1.45	1.59	13.15	81.78	3.55	19.81	60.00	80.98	13.15
1.45 - 1.50	0.96	19.23	82.74	3.74	18.22	64.09	82.26	19.23
1.50 - 1.60	1.37	27.28	84.11	4.12	17.26	66.59	83.42	27.28
1.60 - 1.70	1.28	37.16	85.39	4.62	15.89	69.98	84.75	37.16
1.70 - 1.80	1.21	44.75	86.60	5.18	14.61	72.85	85.99	44.75
+ 1.80	13.40	75.39	100.00	14.58	13.40	75.39	93.30	75.39
Total	100.00	14.58						

FIGURE : 7

COMPANY : DENISON MINES LTD.

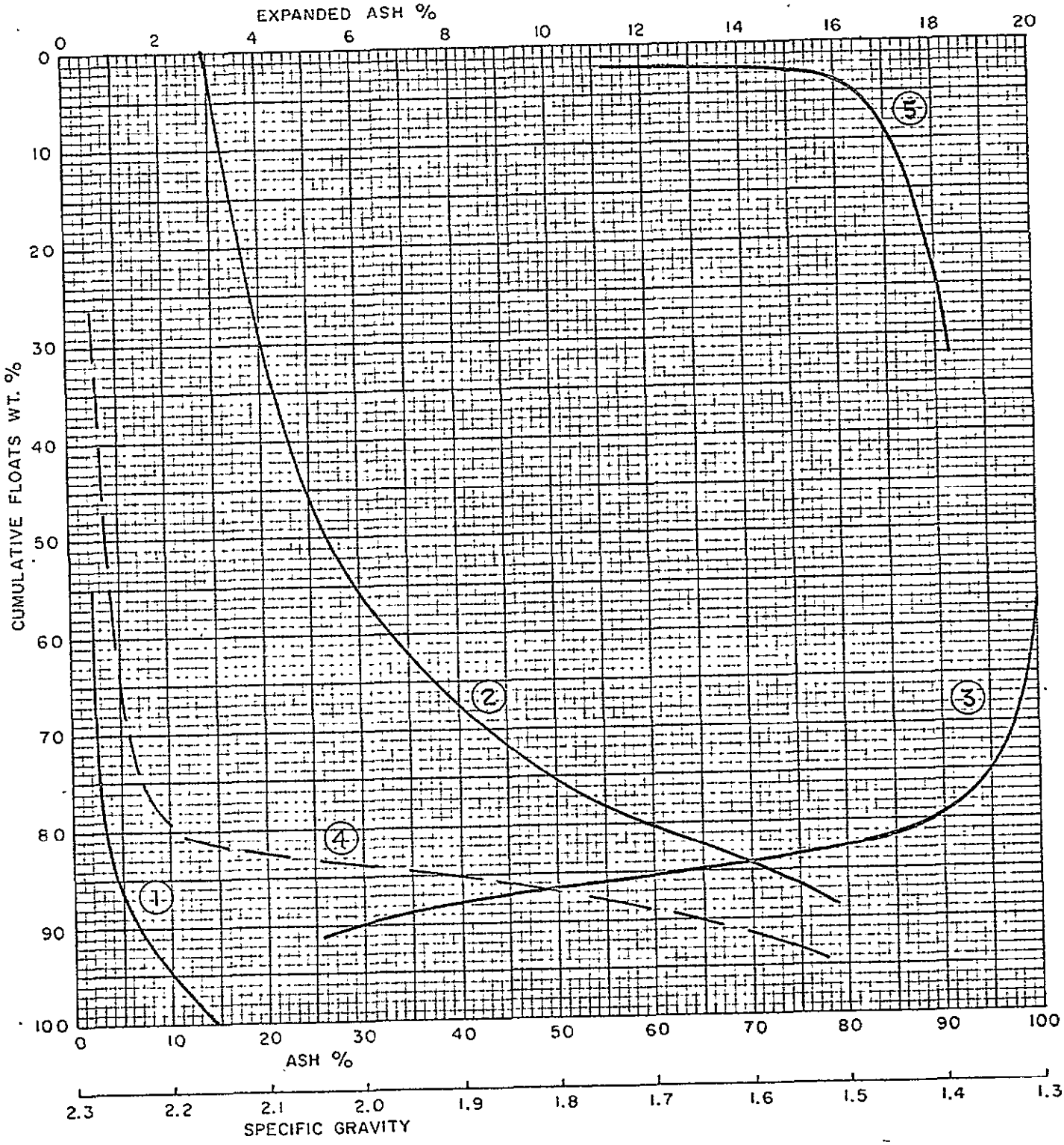
SAMPLE : ADIT F-11

SIZE : 8 x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 7a

COMPANY : DENISON MINES LTD.

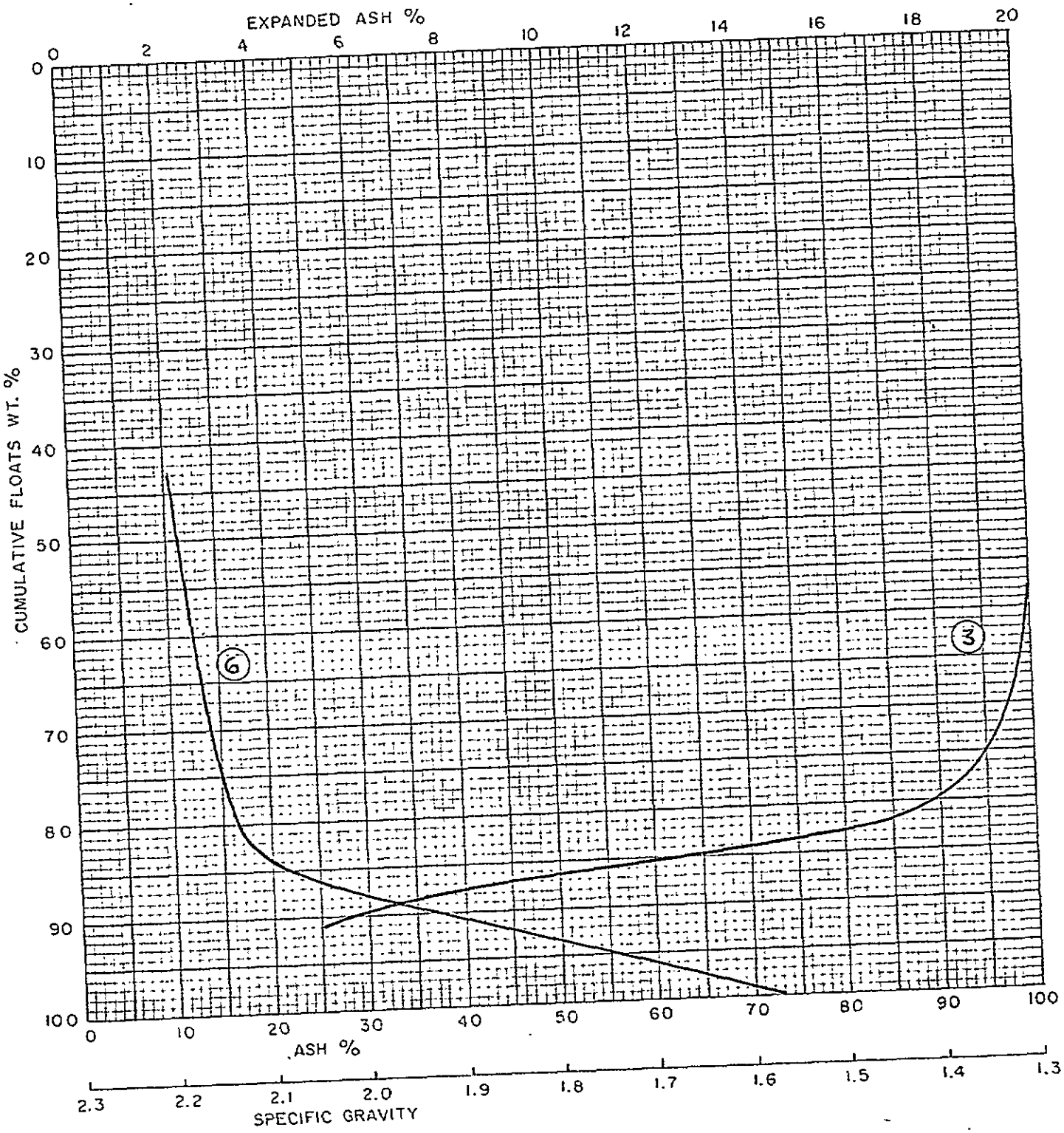
SAMPLE : ADIT F-11

SIZE : 8 x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

DATE : May 7, 1972

TABLE 21: Adit F-11.

28 x 100 m.: 13.48% of the Sample.

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt. %	Ash %	V.M. %	Cum. Wt. %	Cum. F.S.I.
- 1.30	52.80	2.21	26.05	52.80	9+
1.30 - 1.35	19.50	4.44	23.91	72.30	9
1.35 - 1.40	7.14	8.92	21.21	79.44	8½
1.40 - 1.45	2.82	12.98	20.02	82.26	8½
1.45 - 1.50	1.60	19.34	19.55	83.86	8½
1.50 - 1.60	2.02	26.95	18.77	85.88	8½
1.60 - 1.70	1.56	36.98	17.21	87.44	8½
1.70 - 1.80	1.28	45.01	15.81	88.72	8½
+ 1.80	11.28	74.32	10.53	100.00	8
Total	100.00	13.43	22.85		

TABLE 22: Adit F-11.

Washability Data: 28 x 100 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %	Wt. %	Ash %
- 1.30	52.80	2.21	52.80	2.21	100.00	13.43	26.40	2.21
1.30 - 1.35	19.50	4.44	72.30	2.81	47.20	25.97	62.55	4.44
1.35 - 1.40	7.14	8.92	79.44	3.36	27.70	41.13	75.87	8.92
1.40 - 1.45	2.82	12.98	82.26	3.69	20.56	52.32	80.85	12.98
1.45 - 1.50	1.60	19.34	83.86	3.99	17.74	58.57	83.06	19.34
1.50 - 1.60	2.02	26.95	85.88	4.53	16.14	62.46	84.87	26.95
1.60 - 1.70	1.56	36.98	87.44	5.11	14.12	67.54	86.66	36.98
1.70 - 1.80	1.28	45.01	88.72	5.68	12.56	71.33	88.08	45.01
+ 1.80	11.28	74.32	100.00	13.43	11.28	74.32	94.36	74.32
Total	100.00	13.43						

FIGURE: 8

COMPANY : DENISON MINES LTD.

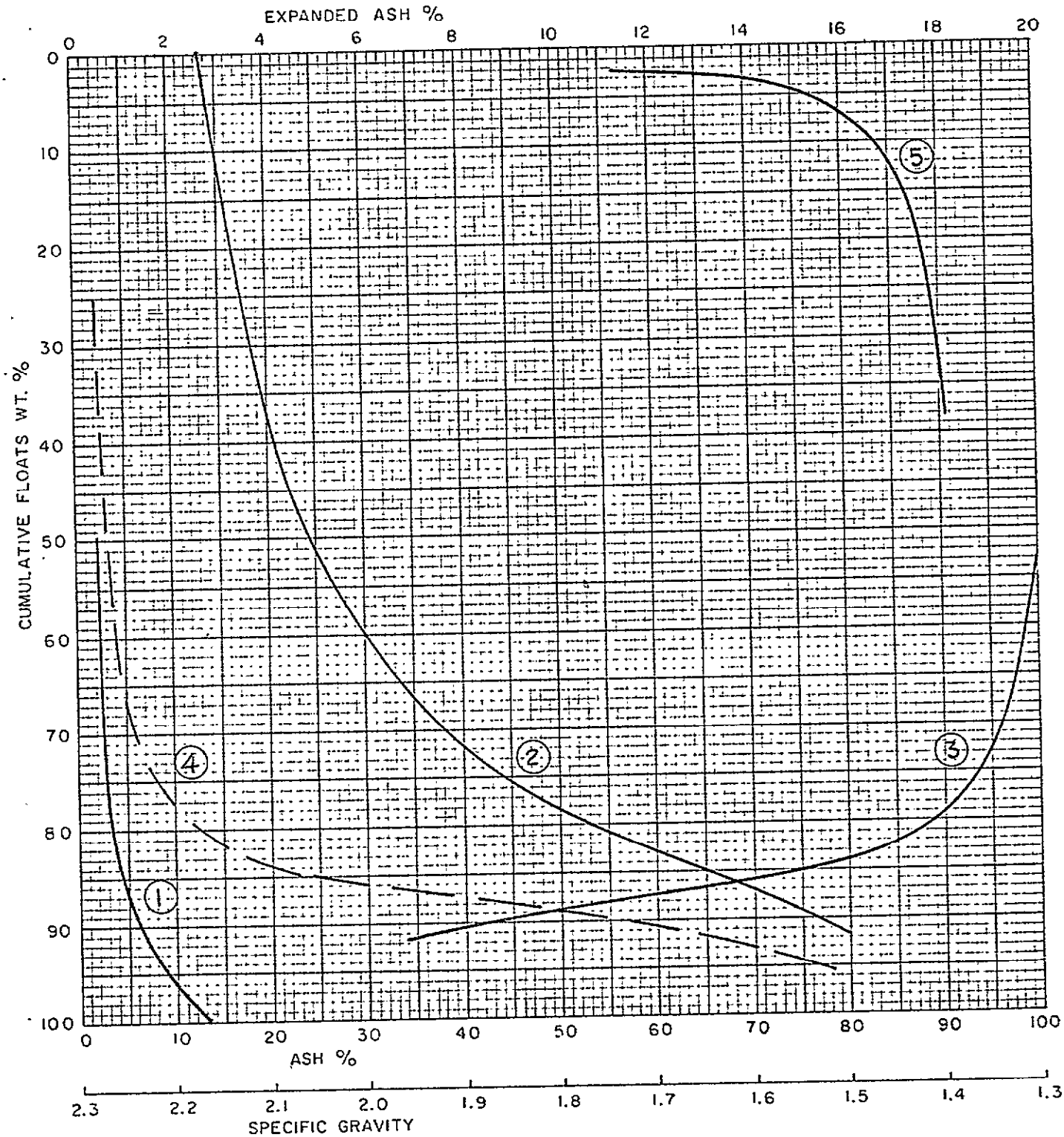
SAMPLE : ADIT F-11

SIZE : 28 x 100 mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1927

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 8a

COMPANY : DENISON MINES LTD.

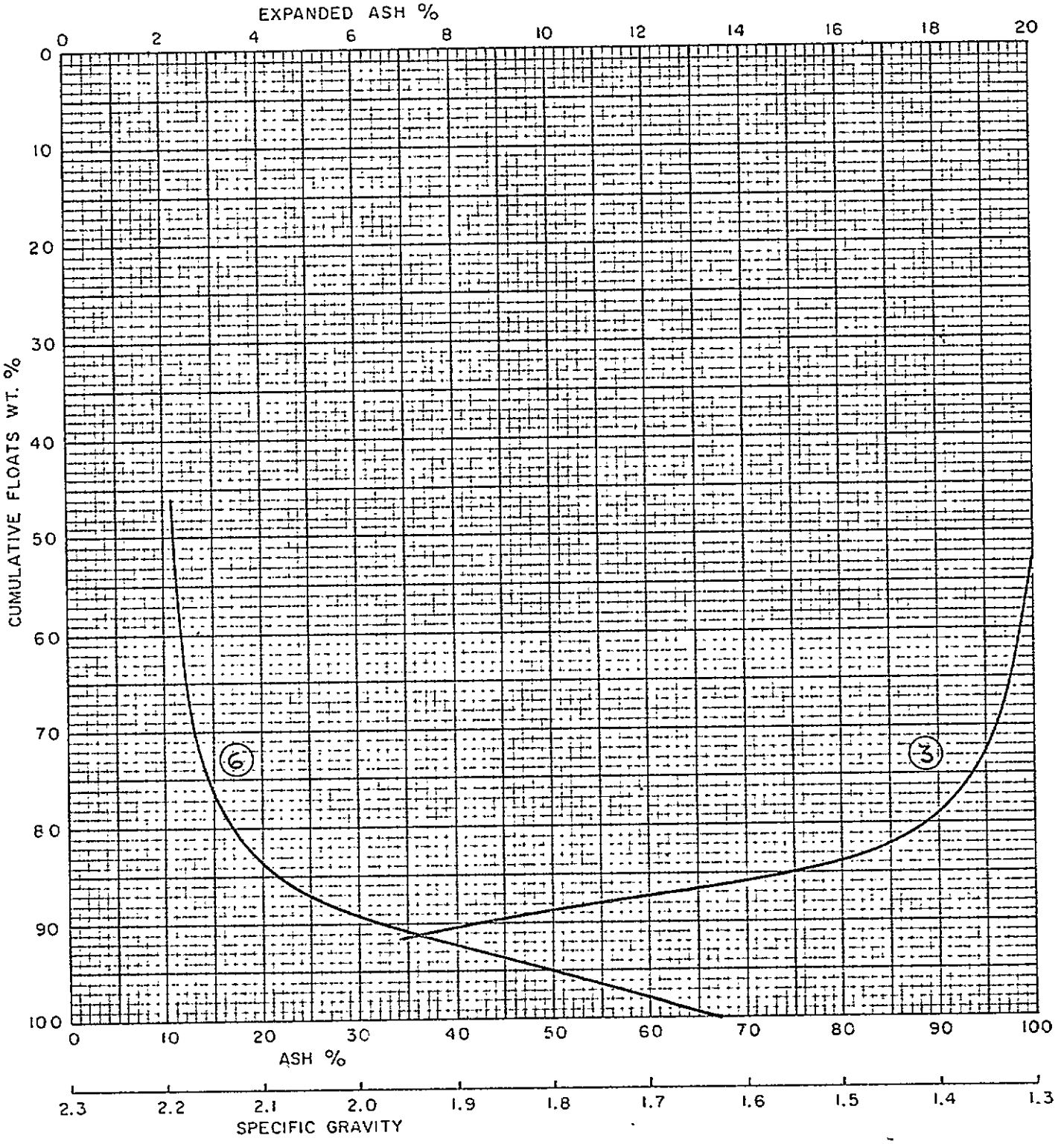
SAMPLE : ADIT F-11

SIZE : 28 x 100 mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 7, 1972

CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

TABLE 23: Adit F-11.

28 x 100 Mesh: 13.48% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	78.11%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	6.84	37.60
Volatile Matter, %	24.06	17.59
Residual Moisture, %	1.41	1.29
Fixed Carbon, %	67.69	43.52
F.S.I.	8½	5
Sulphur, %	0.53	0.76

TABLE 24: Adit F-11.

- 100 Mesh: 5.30% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	88.93%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	7.73	61.68
Volatile Matter, %	22.26	14.91
Residual Moisture, %	1.48	1.11
Fixed Carbon, %	68.53	22.30
F.S.I.	8½	N.A.
Sulphur, %	0.60	1.31

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT #F-11

Submitted by

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada

Report No. RI-72.23

Job No.: S1-84

Date: June 3, 1972.

REPORT ON
WASHABILITY CHARACTERISTICS AND CLEANING
OF COKING COAL
FOR
DENISON MINES LTD.
ADIT #F-11

SUMMARY:

The data presented in this report refer to washability characteristics and the washing of a 5-ton sample from Adit F-11.

The coal was cleaned using a two-stage water cyclone system, followed by after cleaning of fines in the clean coal in flotation cells. This was done to remove the remaining mineral matter from the fines.

A clean coal yield of about 75% was obtained.

The analysis of clean coal is as follows.

	Air Dried Basis	As Shipped Basis
Surface Moisture	--	6.00%
Residual Moisture	0.98%	0.92%
Ash	5.88%	5.53%
Volatile Matter	23.57%	22.16%
Fixed Carbon	69.57%	65.39%
F.S.I.	7½	7½
B.T.U./lb.	14,620	13,745
Sulphur	0.43%	0.40%

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studies and production of clean coal.

The coal was air dried, crushed to minut 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in Figure 1, Section 2 of this report.

Respectfully, submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.

SECTION 1

WASHABILITY DATA & FLOTATION TESTS

ADIT #F-11

TABLE 1 - ADIT #F-11

Head Sample Analysis

Ash	20.82%
Volatile Matter	20.36%
Residual Moisture	1.14%
Fixed Carbon	57.68%
F.S.I.	6½
B.T.U./lb.	11,910
Sulphur	0.54%

TABLE 2 - ADIT #F-11

Size Analysis

	Weight %
3/4" x 28 mesh	80.35
-28 Mesh	19.65
Total	100.00

TABLE 3 - ADIT #F-11

Incremental Float-Sink Analysis of 3/4" x 28 m.

Sp. Gr.	Wt.%	Ash%	V.M.%	R.N.%	F.C.%
- 1.30	50.21	2.59	25.06	1.18	71.17
1.30 - 1.35	18.04	4.37	21.97	1.20	72.46
1.35 - 1.40	3.67	7.38	19.94	1.09	71.59
1.40 - 1.45	1.38	12.63	19.21	1.11	67.05
1.45 - 1.50	0.57	18.99	19.03	1.11	60.87
1.50 - 1.60	0.79	26.77	18.20	1.14	53.89
1.60 - 1.70	0.83	38.30	16.32	1.09	44.29
1.70 - 1.80	1.19	45.98	14.80	1.10	38.12
+ 1.80	23.32	77.46	8.66	1.15	12.73
Total	100.00	21.78	20.13	1.17	56.92

TABLE 4 - ADIT #F-11

Cumulative Float-Sink Analysis of 3/4" x 28 m.

Sp. Gr.	Wt.%	Ash%	V.M.%	R.M.%	F.C. %	F.S.I.
- 1.30	50.21	2.59	25.06	1.18	71.17	9
- 1.35	68.25	3.06	24.24	1.18	71.52	8½
- 1.40	71.92	3.28	24.02	1.18	71.52	8
- 1.45	73.30	3.46	23.93	1.18	71.43	8
- 1.50	73.87	3.58	23.90	1.18	71.34	8
- 1.60	74.66	3.82	23.83	1.18	71.17	8
- 1.70	75.49	4.20	23.75	1.18	70.87	8
- 1.80	76.68	4.85	23.61	1.18	70.36	8
Total	100.00	21.78	20.13	1.17	56.92	6½

TABLE 5 - ADIT #F-11

Washability Data for 3/4" x 28m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	50.21	2.59	50.21	2.59	100.00	21.78	25.10	2.59
1.30 - 1.35	18.04	4.37	68.25	3.06	49.79	41.14	59.23	4.37
1.35 - 1.40	3.67	7.38	71.92	3.28	31.75	62.03	70.09	7.38
1.40 - 1.45	1.38	12.63	73.30	3.46	28.08	69.17	72.61	12.63
1.45 - 1.50	0.57	18.99	73.87	3.58	26.70	72.09	73.58	18.99
1.50 - 1.60	0.79	26.77	74.66	3.82	26.13	73.25	74.27	26.77
1.60 - 1.70	0.83	38.30	75.49	4.20	25.34	74.70	75.07	38.30
1.70 - 1.80	1.19	45.98	76.68	4.85	24.51	75.93	76.09	45.98
+ 1.80	23.32	77.46	100.00	21.78	23.32	77.46	88.34	77.46
Total	100.00	21.78						

TABLE 6: ADIT F-11

Washability Data: +100m.: 94.70% of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	43.30	2.42	43.30	2.42	100.00	19.88	21.65	2.42
1.30 - 1.35	26.81	4.19	70.11	3.10	56.70	33.22	56.70	4.19
1.35 - 1.40	3.89	8.20	74.00	3.37	29.89	59.26	72.05	8.20
1.40 - 1.45	1.28	12.43	75.28	3.52	26.00	66.89	74.64	12.43
1.45 - 1.50	0.75	18.75	76.03	3.67	24.72	69.71	75.65	18.75
1.50 - 1.60	0.99	27.48	77.02	3.98	23.97	71.31	76.52	27.48
1.60 - 1.70	1.08	38.12	78.10	4.45	22.98	73.20	77.56	38.12
1.70 - 1.80	1.33	46.28	79.43	5.15	21.90	74.93	78.76	46.28
+ 1.80	20.57	76.78	100.00	19.88	20.57	76.78	89.71	76.78
Total	100.00	19.88						

FIGURE :

COMPANY : Denison Mines Ltd.

SAMPLE : Adit #F-11 (500 lb. Split)

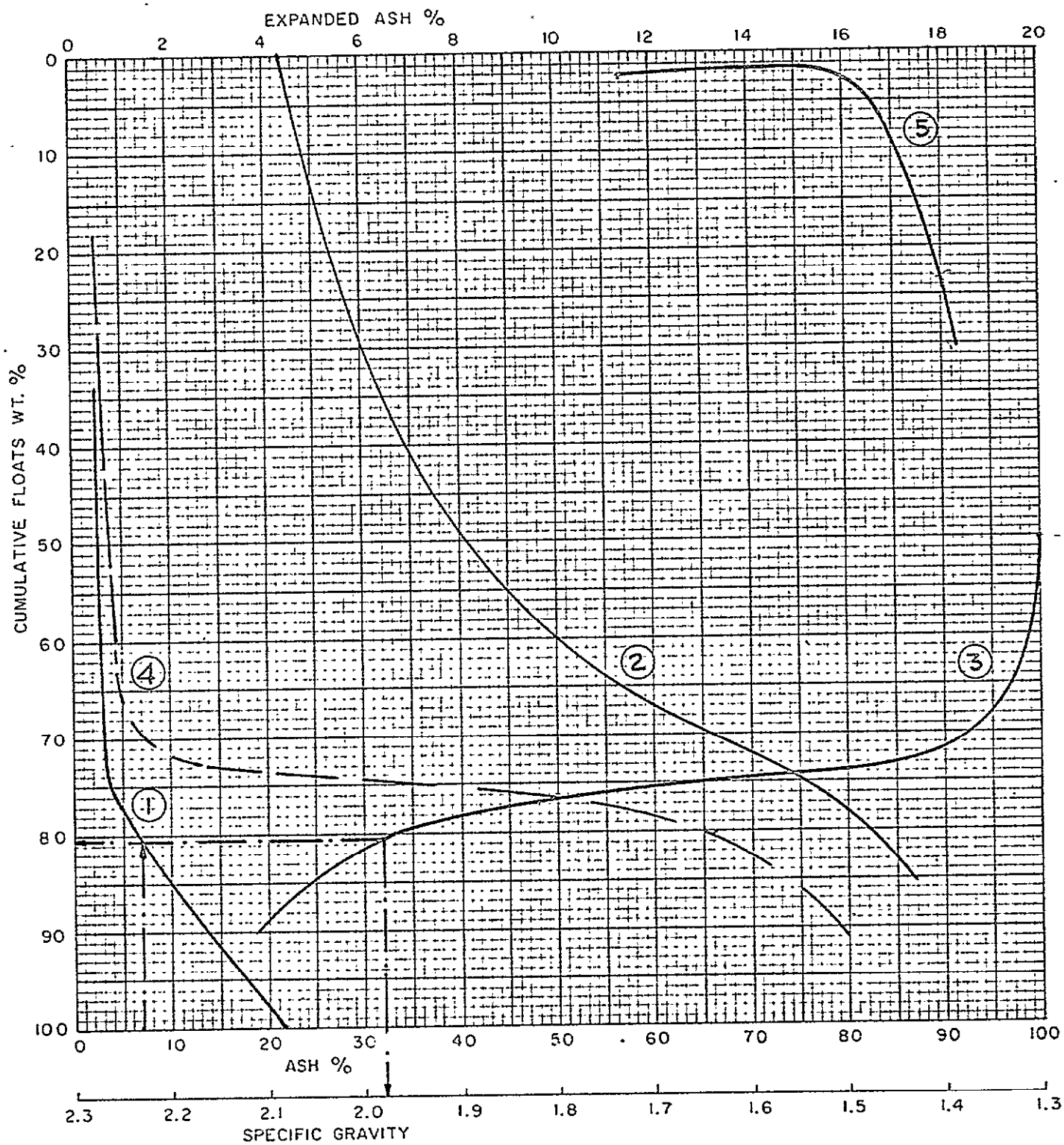
SIZE : 3/4" x 28 Mesh

(

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT #F-11

Froth Flotation Test of 28m. x 0

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Yield	89.37%	10.63%
Ash	9.22%	66.97%
Volatile Matter	22.50%	13.01%
Residual Moisture	0.94%	0.89%
Fixed Carbon	67.34%	19.13%
F.S.I.	7½	1/2
Sulphur	0.61%	0.89%

SECTION 2

WASHING TESTS AND ANALYSIS OF PRODUCTS

ADIT #F-11

TABLE 1. Adit F-11.

Approximate Distribution of Products

Product	Wt. %	Ash %
Clean Coal	73.00	5.90
Coarse Reject	22.00	61.60
Flotation Refuse	5.00	54.00
Total	100.00	20.60

TABLE 2. Adit F-11.

Proximate Analysis of Clean Coal

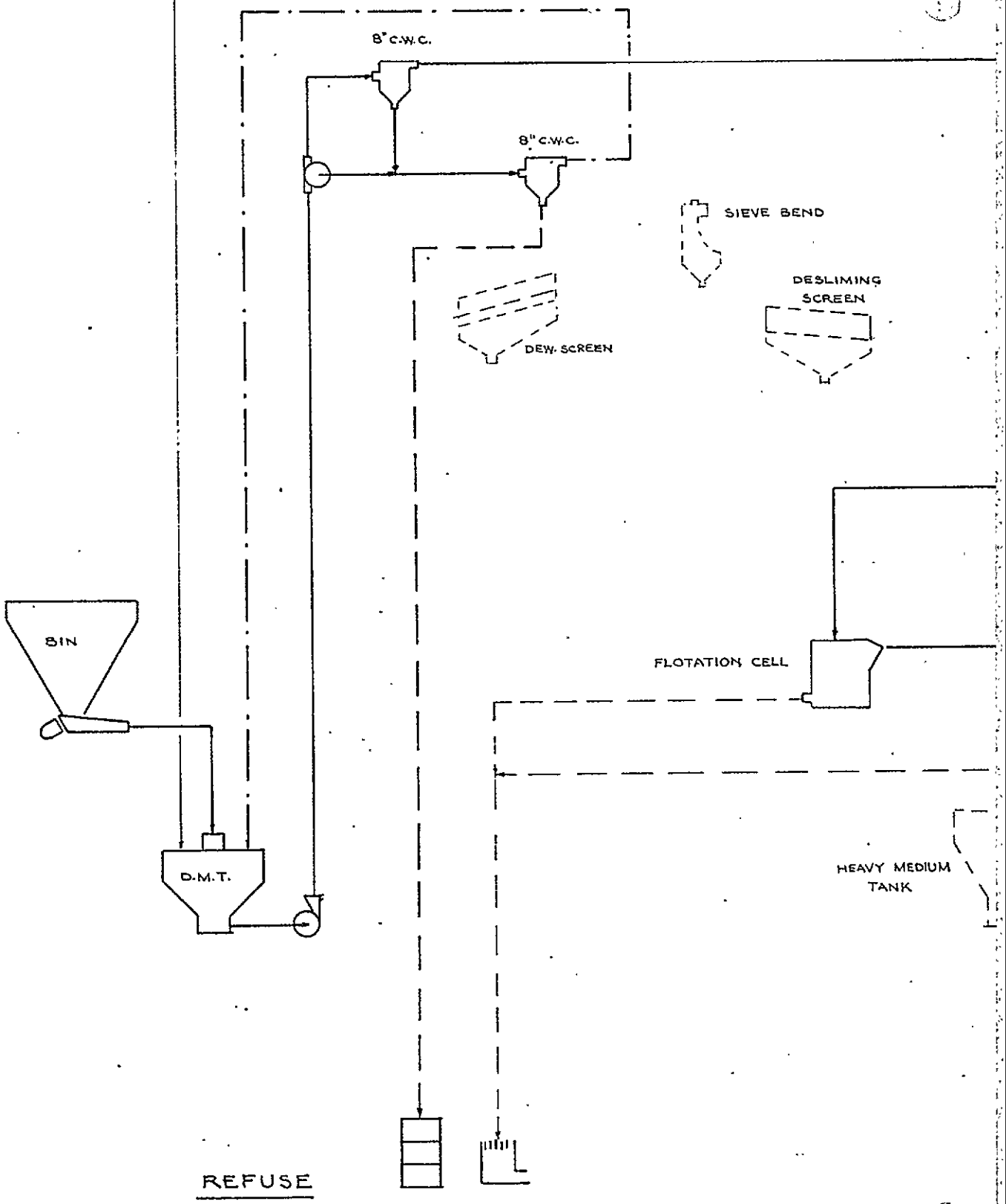
Ash	5.88%
Volatile Matter	23.57%
Residual Moisture	0.98%
Fixed Carbon	69.57%
F.S.I.	7½
B.T.U./lb.	14,620
Sulphur	0.43%

TABLE 3. Adit F-11.

Ultimate Analysis

Ash	5.88%
Carbon	83.40%
Hydrogen	4.75%
Nitrogen	1.01%
Oxygen	4.53%
Sulphur	0.43%

FIG. 1 WASHING CIRCUIT FOR ADIT # F-11



G.W.L.

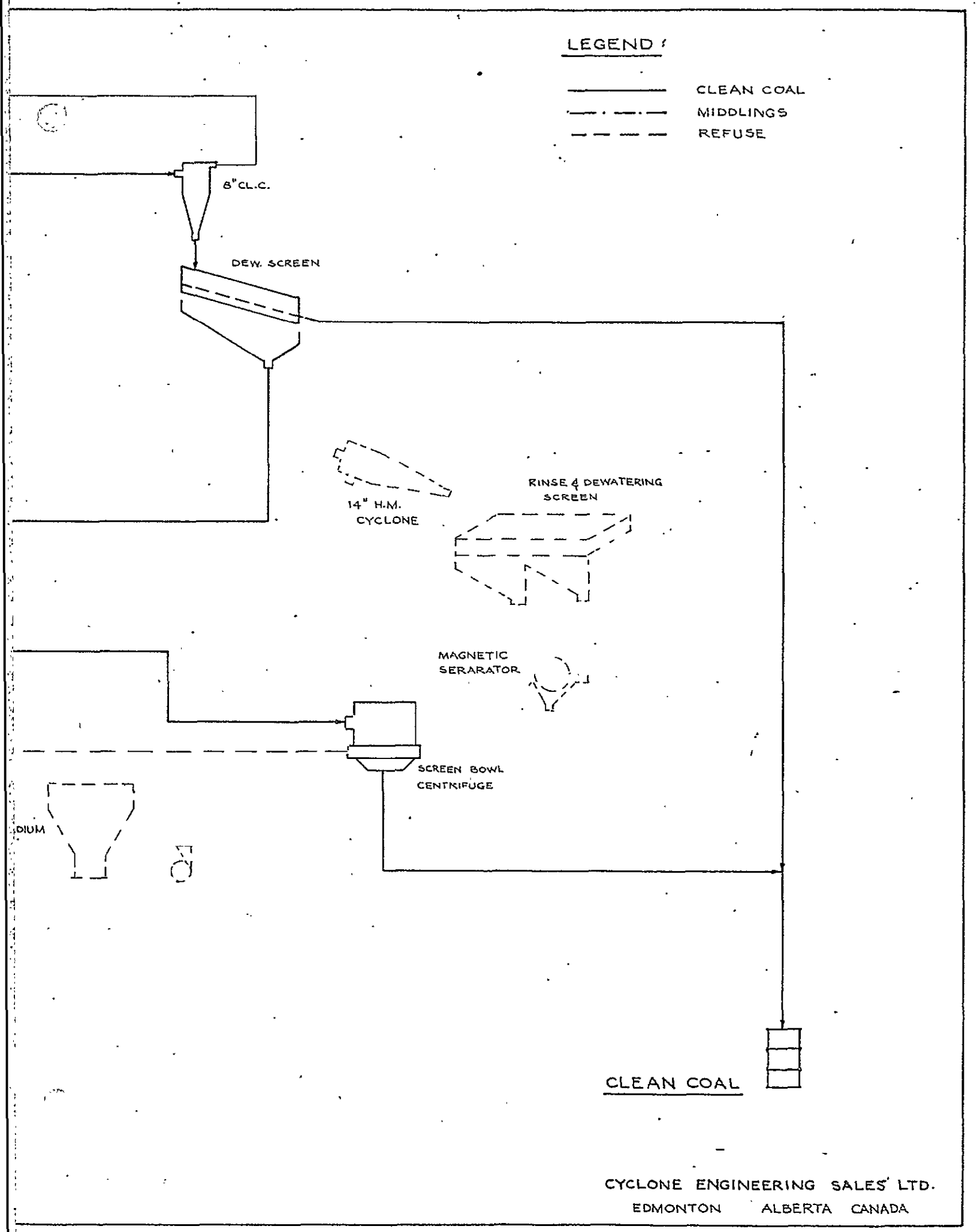

LEGEND :
CLEAN COAL
MIDDLINGS
REFUSE
8" CL.C.
DEW. SCREEN
14" H.M. CYCLONE
RINSE & DEWATERING SCREEN
MAGNETIC SERARATOR
SCREEN BOWL CENTRIFUGE
DIUM
CLEAN COAL
CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 4. Adit F-11.

Characteristics of the Ash

Mineral Analysis of Ash

SiO_2	58.14%
Al_2O_3	26.63%
Fe_2O_3	4.17%
TiO_2	1.12%
P_2O_5	1.63%
CaO	3.02%
MgO	0.82%
Na_2O	0.24%
K_2O	1.56%
SO_3	1.17%

Ash Fusibility

	Reducing Atmosphere °F	Oxidizing Atmosphere °F
Initial Deformation Temperature	2535	2640+
Spherical Temperature	2640+	2640+
Hemispherical Temperature	2640+	2640+
Fluid Temperature	2640+	2640+

TABLE 5. Adit F-11.

Analysis of Rejects

Coarse Refuse: + 28 Mesh.

Ash	61.63%
Volatile Matter	12.74%
Residual Moisture	1.02%
Fixed Carbon	24.61%
F.S.I.	1
B.T.U./lb.	5,460
Sulphur	0.97%

Flotation Refuse

Ash	53.15%
Volatile Matter	14.88%
Residual Moisture	0.96%
Fixed Carbon	31.01%
F.S.I.	½
B.T.U./lb.	6,490
Sulphur	0.84%

REPORT ON

WASHABILITY CHARACTERISTICS

OF

COKING COAL

FOR

DENISON MINES LTD.

ADIT # G 5

Submitted by

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.05

Job No.: S1-84

Date: February 17, 1972.

REPORT ON
WASHABILITY CHARACTERISTICS
OF
COKING COAL
FOR
DENISON MINES LTD.
ADIT # G 5

SUMMARY:

The data presented in this report refer to washability characteristics of Denison Mines Sample Adit #G5.

The coal is of medium volatile bituminous rank.

The F.S.I. of the sample is 4, and the ash is 15%. The cleaning at 7% ash is rather difficult as the amount of near gravity material is large (about 27%). The F.S.I. of a 7% ash product is 7, at a yield of about 70%.

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I. INTRODUCTION:

A one ton sampleof Adit #G5 was air dried and the following work was done:

1. A size analysis at 2", 1", 1/2", 1/4", 8m., 28m. and 100m.
2. A proximate analysis on all size fractions.
3. A float-sink analysis on all size fractions, except - 100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 1.80.
4. Ash, volatile matter and free swelling index determinations on all specific gravity fractions.
5. Washability curves for all size fractions, except -100 mesh.
6. Washability curves for + 100 mesh fraction of the raw sample by re-constituting the data in 5.
7. Froth flotation tests on 28m x 100m. and -100 mesh fractions.

II. CONCLUSIONS AND RECOMMENDATIONS:

The ash and F.S.I. show a marked relationship to particle size. As the size goes down, both the ash and F.S.I. improve.

The cleaning process used for this coal should take into account 1) the possibility of some beneficiation by screening and 2) the large amounts of near gravity material.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per

R.S. Sehgal, P. Eng.,
Laboratory Manager.

TABLE 21: Adit G12

28 x 100 Mesh: 14.11% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	69.54%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	8.86	25.74
Volatile Matter, %	21.16	19.56
Residual Moisture, %	0.85	0.81
Fixed Carbon, %	69.13%	53.89%
F.S.I.	7½	3
Sulphur, %	0.69	0.82

TABLE 22: Adit G12

- 100 Mesh: 6.26% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	89.10%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	9.76	51.03
Volatile Matter, %	21.25	17.37
Residual Moisture, %	0.87	0.91
Fixed Carbon, %	68.12	30.69
F.S.I.	7½	N.A.
Sulphur	0.95	3.23

REPORT ON

WASHABILITY CHARACTERISTICS & CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT G-12

Submitted by,

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.31

Job No.: S1-84

Date: June 13, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT G-12

SUMMARY:

The data presented in this report refer to the washability characteristics and washing of a 5-ton sample of Adit G-12.

The coal was cleaned in a single stage water compound cyclone followed by after cleaning of refuse in heavy medium cyclone and froth flotation cells. Due to a very high amount of near gravity material present, the coal was found to be difficult to wash. A yield of 63% was obtained at a rather high ash of 10.3%.

The analysis of Clean Coal is as follows:

	Air Dried Basis	As Shipped Basis
Surface Moisture	--	6.00%
Residual Moisture	0.89%	0.84%
Ash	10.31%	9.69%
Volatile Matter	21.08%	19.82%
Fixed Carbon	67.72%	63.65%
F.S.I.	6½	6½
B.T.U./lb.	13,860	13,020
Sulphur	0.60%	0.56%

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studies and production of clean coal.

The coal was air dried, crushed to minus 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

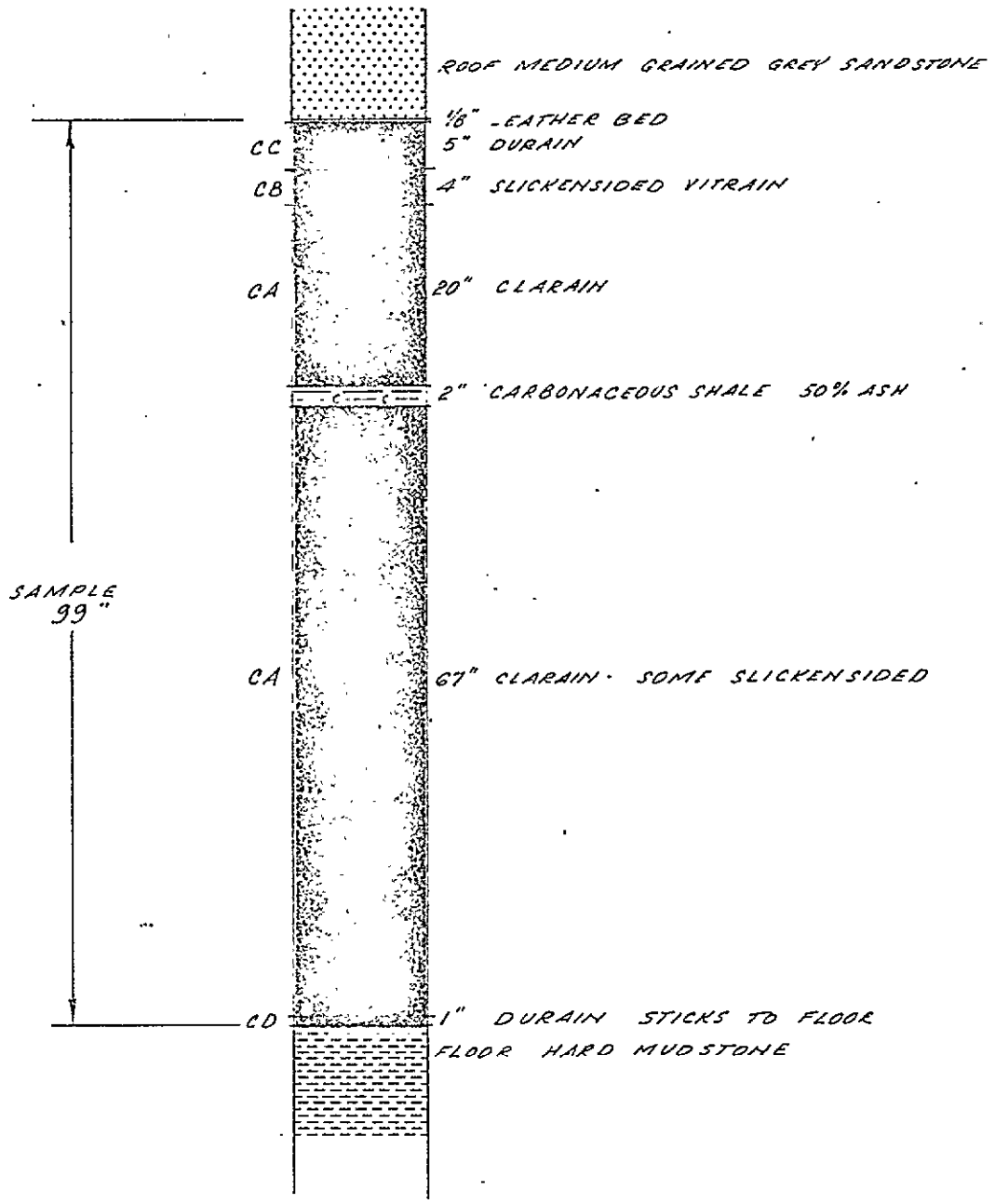
The washing circuit employed is shown in Figure 1, Section 2 of this report.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,,
Laboratory Manager.



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

SEAM SECTION G · ADIT 12

DRAWN BY. E J T.	DATE MAY '72	SCALE 1" = 20
APPROVED BY	DRAWING NO	

SECTION 1

WASHABILITY DATA & FLOTATION TESTS

ADIT G-12

TABLE 1 - ADIT G-12

Head Sample Analysis

Ash	19.80%
Volatile Matter	19.48%
Residual Moisture	0.80%
Fixed Carbon	59.92%
F.S.I.	4½
B.T.U./lb.	12,160
Sulphur	0.64%

TABLE 2 - ADIT G-12

Size Analysis

	Weight %
3/4" x 28 Mesh	74.77
-28 Mesh	25.23
Total	100.00

TABLE 3 - ADIT G-12

Incremental Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash%	V.M.%	R.M.%	F.C.%
- 1.30	12.92	2.58	24.93	0.89	71.60
1.30 - 1.35	14.72	6.05	21.72	0.91	71.32
1.35 - 1.40	17.82	10.39	19.93	0.92	68.76
1.40 - 1.45	12.68	14.85	19.06	0.89	65.20
1.45 - 1.50	11.06	19.53	17.87	0.86	61.74
1.50 - 1.60	10.86	26.49	17.37	0.88	55.26
1.60 - 1.70	5.75	34.96	16.27	0.83	47.94
1.70 - 1.80	2.70	44.97	14.70	0.82	39.51
+ 1.80	11.49	71.24	11.76	0.86	16.14
Total	100.00	21.41	18.93	0.89	58.77

TABLE 4 - ADIT G-12

Cumulative Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash%	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	12.92	2.58	24.93	0.89	71.60	9+
- 1.35	27.64	4.43	23.22	0.90	71.45	9
- 1.40	45.46	6.77	21.93	0.91	70.39	8½
- 1.45	58.14	8.53	21.30	0.90	69.27	8
- 1.50	69.20	10.29	20.76	0.90	68.05	6½
- 1.60	80.06	12.48	20.30	0.89	66.33	5½
- 1.70	85.81	13.99	20.03	0.89	65.09	4½
- 1.80	88.51	14.94	19.86	0.89	64.31	4½
Total	100.00	21.41	18.93	0.89	58.77	3½

*F.S.I. by actual determination.

TABLE 5 - ADIT G-12

Washability Data for 3/4" x 28 Mesh

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %	Wt.%	Ash%
- 1.30	12.92	2.58	12.92	2.58	100.00	21.41	6.46	2.58
1.30 - 1.35	14.72	6.05	27.64	4.43	87.08	24.20	20.28	6.05
1.35 - 1.40	17.82	10.39	45.46	6.77	72.36	27.89	36.55	10.39
1.40 - 1.45	12.68	14.85	58.14	8.53	54.54	33.61	51.80	14.85
1.45 - 1.50	11.06	19.53	69.20	10.29	41.86	39.29	63.67	19.53
1.50 - 1.60	10.86	26.49	80.06	12.48	30.80	46.39	74.63	26.49
1.60 - 1.70	5.75	34.96	85.81	13.99	19.94	57.22	82.94	34.96
1.70 - 1.80	2.70	44.97	88.51	14.94	14.19	66.24	87.16	44.97
+ 1.80	11.49	71.24	100.00	21.41	11.49	71.24	94.25	71.24
Total	100.00	21.41						

FIGURE :

COMPANY : Denison Mines Ltd.,

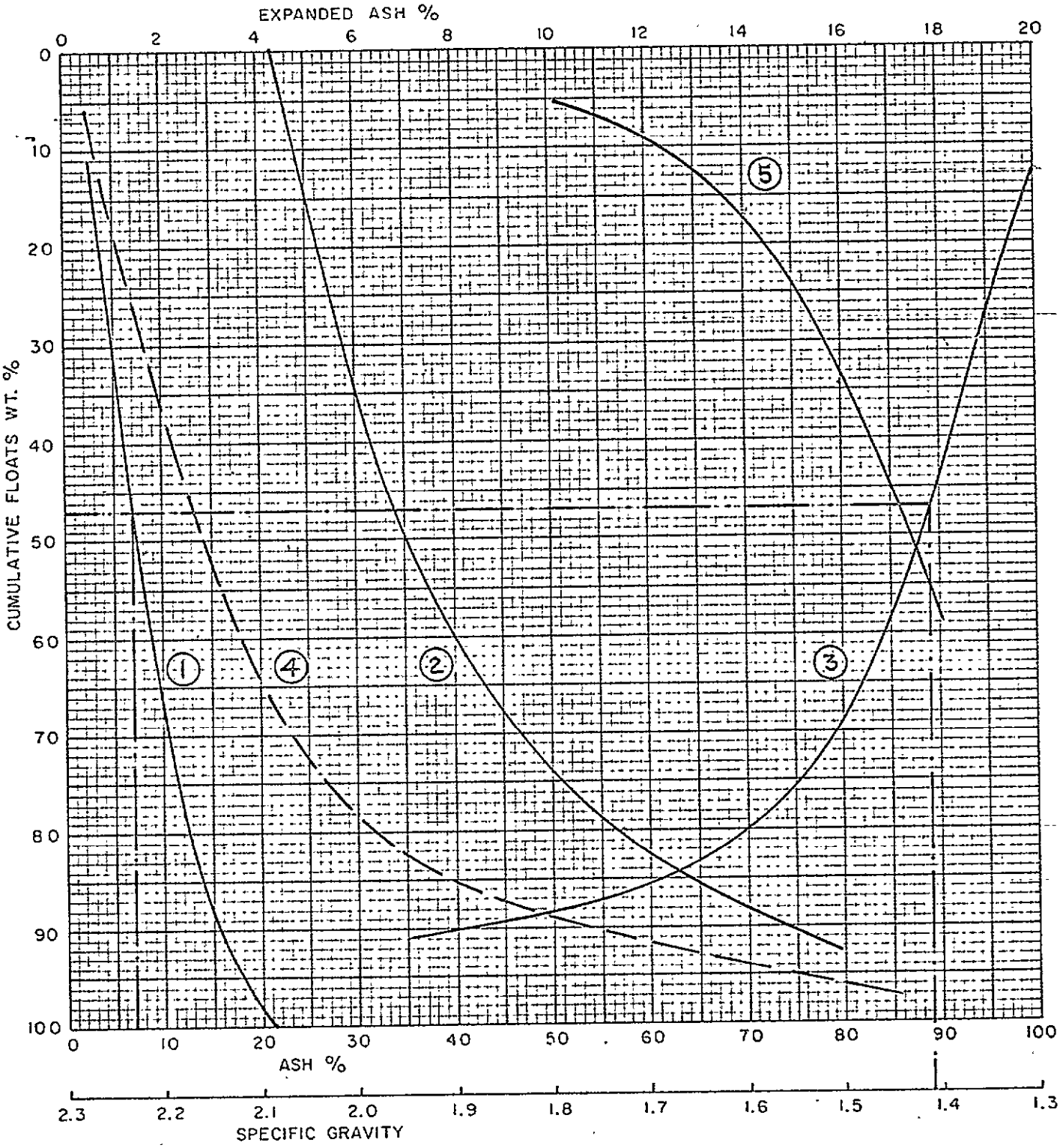
SAMPLE : Adit G-12 (500 lb. Split)

SIZE : 3/4" x 28 Mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : June 12, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT G-12

Froth Flotation of 28 Mesh x 0

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Yield	75.35%	24.65%
Ash	9.18%	31.58%
Volatile Matter	21.22%	17.35%
Residual Moisture	0.84%	0.78%
Fixed Carbon	68.76%	50.29%
F.S.I.	7	2
Sulphur	0.75%	1.06%

SECTION 2

WASHING TESTS AND ANALYSIS OF PRODUCTS

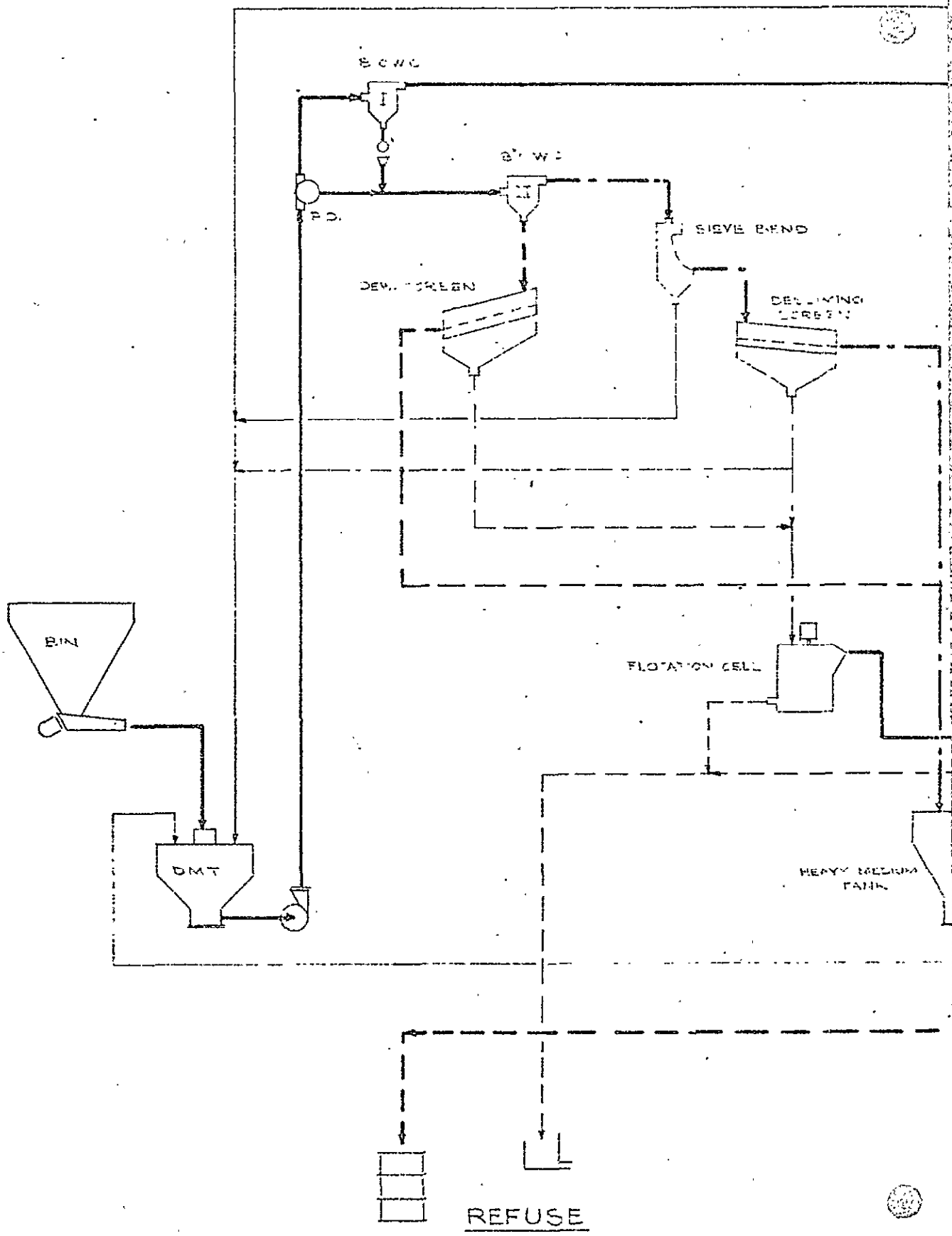
ADIT G-12

TABLE 1. ADIT G-12

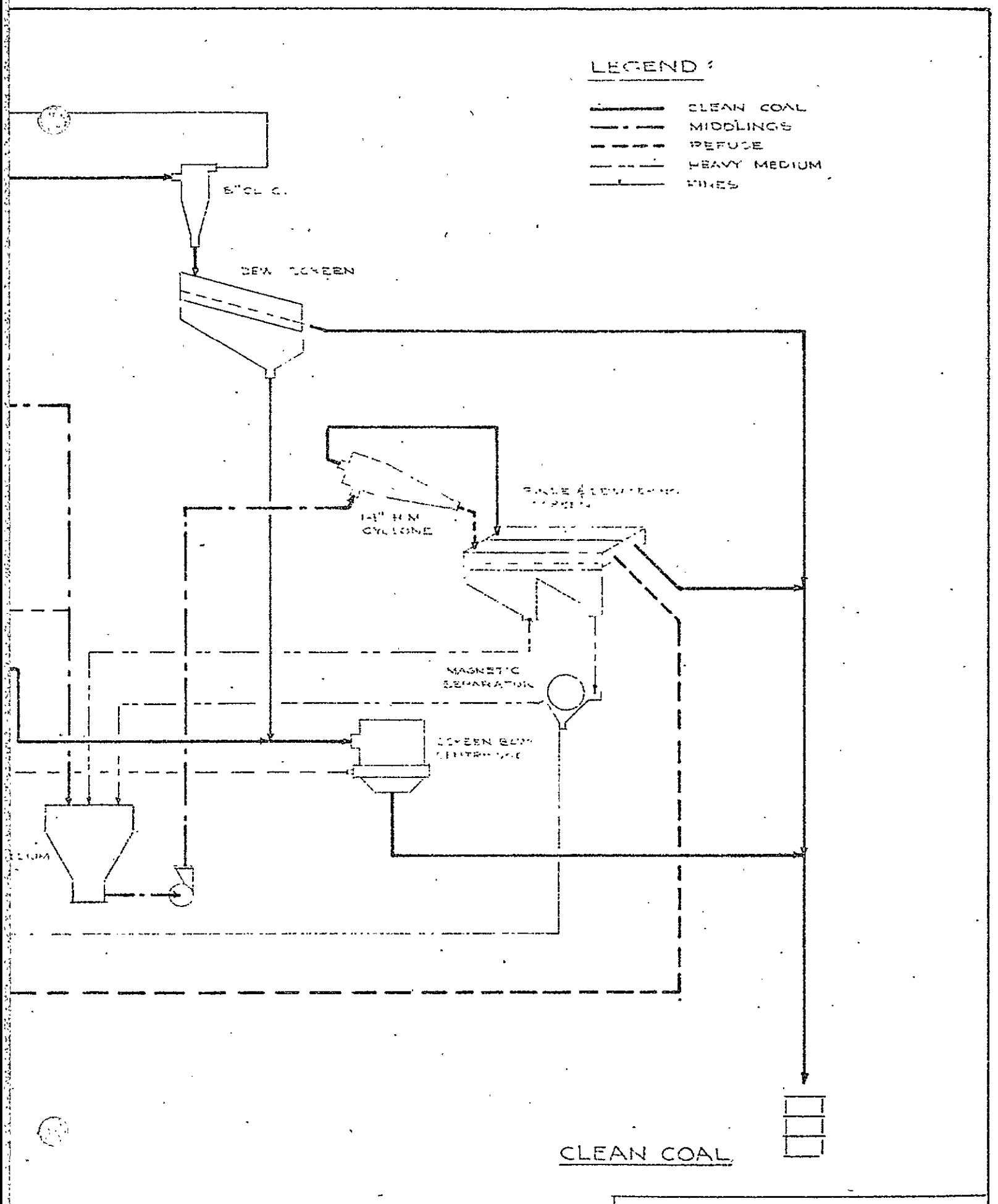
Approximate Distribution of Products

Product	Weight %	Ash %
Clean Coal	63.00	10.30
Coarse Refuse	30.00	38.00
Flotation Refuse	7.00	32.80
Total	100.00	20.20

FIG. 1 WASHING CIRCUIT FOR ADIT G-12



G.W.L.



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 2. ADIT G-12

Proximate Analysis of Clean Coal

Ash	10.31%
Volatile Matter	21.08%
Residual Moisture	0.89%
Fixed Carbon	67.72%
F.S.I.	6½
B.T.U./lb.	13,860
Sulphur	0.60%

TABLE 3. ADIT G-12

Ultimate Analysis

Ash	10.31%
Carbon	79.22%
Hydrogen	4.37%
Nitrogen	1.04%
Oxygen	4.46%
Sulphur	0.60%

TABLE 4 - ADIT G-12

CHARACTERISTICS OF THE ASH

Mineral Analysis of Ash

SiO^2	58.46%
Al_2O_3	32.96%
Fe_2O_3	2.66%
TiO_2	1.19%
P_2O_5	0.71%
CaO	1.92%
MgO	0.61%
Na_2O	0.06%
K_2O	0.55%
SO_3	1.21%

Ash Fusibility

	Reducing Atmosphere °F	Oxidizing Atmosphere °F.
Initial Deformation Temperature	2640+	2640+
Spherical Temperature	2640+	2640+
Hemispherical Temperature	2640+	2640+
Fluid Temperature	2640+	2640+

T A BL E 5. ADIT G-12

ANALYSIS OF REJECTS

Coarse Reject: + 28 Mesh

Ash	38.04%
Volatile Matter	14.88%
Residual Moisture	0.90%
Fixed Carbon	46.18%
F.S.I.	1
B.T.U./lb.	8,340
Sulphur	0.69%

Flotation Reject

Ash	32.83%
Volatile Matter	17.02%
Residual Moisture	1.00%
Fixed Carbon	49.15%
F.S.I.	1½
B.T.U./lb.	9,880
Sulphur	1.09%

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT J14 - UPPER, LOT 1

Submitted by,

CYCLONE ENGINEERING SALES LTD.
Edmonton, Alberta, Canada.

Report No.: RI-72-20

Job No.: S1-84

Date: May 16, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS

of

COKING COAL

for

DENISON MINES LTD.

ADIT J14 - UPPER, LOT 1

SUMMARY:

The data in this report refer to the washability characteristics of Denison Mines Sample of Adit J14 - Upper, Lot 1.

The coal is of medium volatile bituminous rank. It has an ash of 16% and F.S.I. of 5.

The coal can be cleaned to 7% ash at a cut point of 1.44 at yield of 72% and an F.S.I. of 6. This cleaning however, is not easy as there is a very large amount, i.e. 45% of near gravity material present at 1.44. It may be better to clean this coal at an ash of 8% - 9%, where the amount of near gravity material is less than 20% and the yields considerably higher

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17 & 18	Analysis & Washability Data: 8 m. x 28m.	19
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2 & 2a	Washability curves for +1"	12 & 12a

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5 & 5a	Washability Curves for 1/4" x 8m.	18 & 18a
6 & 6a	Washability Curves for 8m. x 28m.	20 & 20a
7 & 7a	Washability Curves for 28m. x 100 m.	22 & 22a

INTRODUCTION:

A one ton sample of Adit J4 - Upper, Lot 1 was air dired and the following work was done:

1. A size analysis at 2", 1", 1/2", 1/4", 8m., 28m. and 100m.

2. A proximate analysis on all size fractions.

3. A fbat-sink analysis on all size fractions, except -100 mesh at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 1.80.

4. Ash, Volatile Matter and Free Swelling Index determinations on all specific gravity fractions.

5. Washability curves for all size fractions, except -100 mesh.

6. Washability curves for +100 Mesh fraction of the raw sample by reconstituting the data in 5.

7. Froth flotation tests on 28m. x 100m. and -100m. fractions.

CONCLUSIONS & RECOMMENDATIONS:

The coal has good coking properties, but is rather difficult to clean at 7% ash due to large amounts of near gravity material.

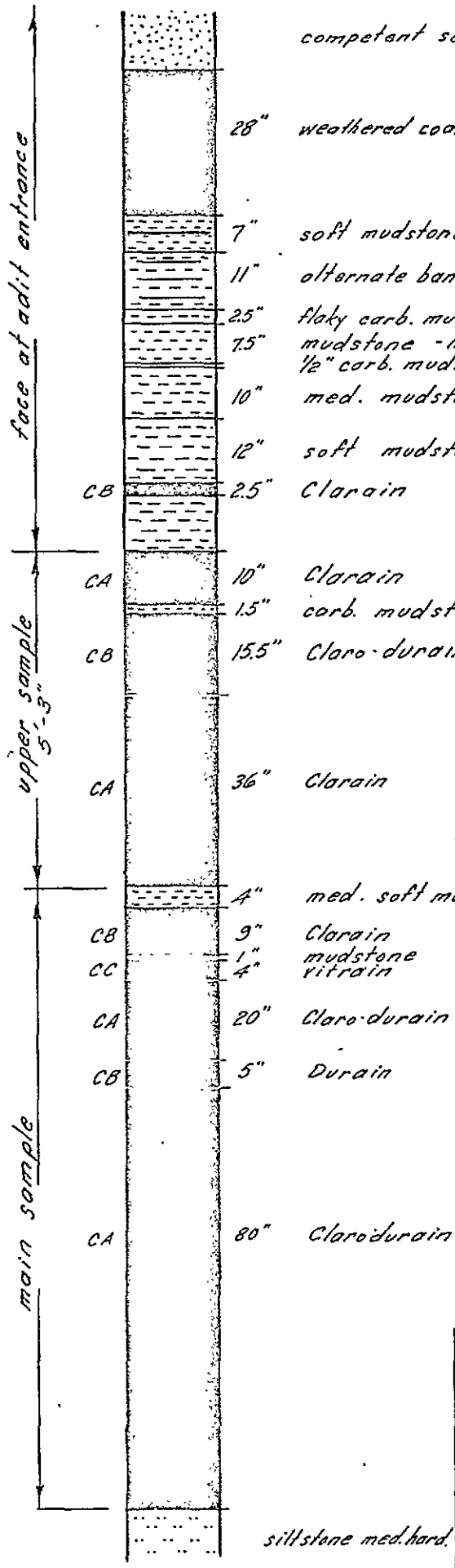
Consideration should be given to cleaning it at a higher ash content.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.



DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA

J14 ADIT SECTION

DRAWN BY. E.J.T.	DATE APR 72	SCALE 1" = 30"
APPROVED BY	DRAWING NO QNTT 72-0315-R01	

T A B L E 1 - ADIT J14 - UPPER, LOT 1

Classification by Rank

Ash	15.80%
Volatile Matter	20.82%
Residual Moisture	1.02%
Fixed Carbon	62.36%
F.S.I.	5
B.T.U./lb.	12,800
Sulphur	0.32%
Rank	mvb

T A B L E 2 - ADIT J14 - UPPER, LOT 1

Analysis of Size Fractions

Size	Wt.%	Ash%	V.M.%	R.M.%	F.C.%	S.%	F.S.I.
+1"	15.98	23.11	19.50	1.94	55.45	0.26	3
1" x 1/2"	12.68	18.77	20.05	0.90	60.28	0.31	2½
1/2" x 1/4"	12.96	18.41	19.56	1.07	60.96	0.24	2½
1/4" x 8m.	14.86	15.83	19.34	0.85	63.98	0.31	3
8 m. x 28m.	23.15	11.96	21.80	0.76	65.48	0.33	6½
28 x 100m.	13.33	9.94	22.80	0.83	66.43	0.44	8
-100 m.	7.04	12.77	23.66	0.63	62.94	0.45	8½
Total	100.00	15.80	20.82	1.02	62.36	0.32	5

T A B L E 3: ADIT J14 - UPPER , LOT 1

Weight % and Ash % Distribution vs. Size and Specific Gravity
(Figures in brackets show the ash content of individual fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	Total
+1"	0.16 (4.59)	4.01 (6.01)	2.92 (10.34)	2.48 (15.84)	1.40 (20.39)	1.68 (26.52)	0.94 (34.82)	0.59 (44.47)	1.80 (74.96)	15.98 (22.60)
1" x 1/2"	0.13 (4.34)	3.73 (5.88)	2.92 (10.13)	1.64 (14.63)	1.05 (19.40)	1.20 (25.11)	0.60 (35.09)	0.27 (44.31)	1.14 (73.49)	12.68 (19.19)
1/2" x 1/4"	0.26 (3.76)	4.33 (5.74)	3.00 (10.01)	1.62 (14.41)	0.81 (19.64)	0.96 (25.84)	0.58 (34.78)	0.24 (43.91)	1.16 (73.47)	12.96 (18.21)
1/4" x 8m.	1.75 (3.34)	4.88 (5.93)	3.28 (10.06)	1.48 (15.46)	0.75 (20.83)	0.85 (28.06)	0.42 (34.47)	0.27 (42.08)	1.18 (72.18)	14.86 (16.26)
8m. x 28m.	8.09 (2.74)	6.05 (5.73)	3.82 (10.00)	1.45 (15.74)	0.80 (21.81)	0.78 (27.32)	0.48 (35.26)	0.30 (42.90)	1.38 (69.72)	23.15 (12.22)
28m. x 100m.	6.44 (2.26)	2.95 (5.36)	1.60 (9.37)	0.66 (15.15)	0.32 (20.98)	0.33 (27.41)	0.18 (34.95)	0.12 (41.72)	0.73 (65.62)	13.33 (9.77)
Total	16.83 (2.66)	25.95 (5.79)	17.54 (10.03)	9.33 (15.25)	5.13 (20.39)	5.80 (26.50)	3.20 (34.89)	1.79 (43.56)	7.39 (72.15)	92.96 (16.08)
-100 Mesh	This fraction forms 7.04% of the total sample and has an ash content of 12.77%, thus giving a total sample ash value of 15.85%.									

T A B L E 3: ADIT J14 - UPPER, LOT 1

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity

(Figures in brackets show the V.M. content of individual fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80		Total
+1"	0.16 (24.37)	4.01 (21.38)	2.92 (20.21)	2.48 (19.44)	1.40 (20.48)	1.68 (20.87)	0.94 (19.62)	0.59 (18.55)	1.80 (10.98)	15.98 (19.38)
1" x 1/2"	0.13 (24.06)	3.73 (21.33)	2.92 (20.11)	1.64 (19.76)	1.05 (21.17)	1.20 (21.33)	0.60 (20.80)	0.27 (18.48)	1.14 (11.65)	12.68 (19.90)
1/2" x 1/4"	0.26 (24.14)	4.33 (20.93)	3.00 (19.87)	1.62 (19.46)	0.81 (20.07)	0.96 (20.78)	0.58 (20.68)	0.24 (19.39)	1.16 (11.82)	12.96 (19.65)
1/4" x 8m.	1.75 (24.01)	4.88 (21.18)	3.28 (18.65)	1.48 (18.75)	0.75 (19.52)	0.85 (19.30)	0.42 (19.47)	0.27 (19.63)	1.18 (13.23)	14.86 (19.81)
8m. x 28m.	8.09 (25.15)	6.05 (21.00)	3.82 (19.12)	1.45 (18.13)	0.80 (19.24)	0.78 (19.13)	0.48 (19.62)	0.30 (19.01)	1.38 (15.44)	23.15 (21.45)
28m. x 100m.	6.44 (24.78)	2.95 (21.60)	1.60 (20.04)	0.66 (19.36)	0.32 (19.10)	0.33 (19.32)	0.18 (19.74)	0.12 (19.21)	0.73 (17.50)	13.33 (22.45)
Total	16.83 (24.86)	25.95 (21.20)	17.54 (19.59)	9.33 (19.18)	5.13 (20.14)	5.80 (20.40)	3.20 (20.02)	1.79 (18.94)	7.39 (13.05)	92.96 (20.51)
-100 mesh	This fraction forms 7.04% of the total sample and has a volatile matter content of 23.66%, thus giving a total sample volatile matter content of 20.73%.									

TABLE 5: ADIT J14 - Upper, Lot 1

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity.

(Figures in brackets show the cumulative F.S.I. of cumulative fractions.)

Size \ Sp.Gr.	- 1.30	- 1.35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+ 1"	0.16 (9+)	4.17 (7½)	7.09 (6½)	9.57 (5½)	10.97 (4½)	12.65 (4)	13.59 (4)	14.18 (4)	15.98 (3)
1" x 1/2"	0.13 (9+)	3.86 (6)	6.78 (4½)	8.42 (3½)	9.47 (3)	10.67 (2½)	11.27 (2½)	11.54 (2½)	12.68 (2½)
1/2" x 1/4"	0.26 (9)	4.59 (6)	7.59 (4½)	9.21 (3½)	10.02 (3)	10.98 (2½)	11.56 (2½)	11.80 (2½)	12.96 (2½)
1/4" x 8 m.	1.75 (9+)	6.63 (6½)	9.91 (6)	11.39 (5½)	12.14 (5)	12.99 (4½)	13.41 (4½)	13.68 (4)	14.86 (3)
8m. x 28 m.	8.09 (9+)	14.14 (9)	17.96 (8½)	19.41 (8)	20.21 (8)	20.99 (7½)	21.47 (7½)	21.77 (7½)	23.15 (6½)
28 x 100 m.	6.44 (9+)	9.39 (9+)	10.99 (9)	11.65 (8½)	11.97 (8½)	12.30 (8)	12.48 (8)	12.60 (8)	13.33 (8)
Total	16.83	42.78	60.32	69.65	74.78	80.58	83.78	85.57	92.92
- 100 m.	This fraction weighs 7.04% of the total sample and has a F.S.I. of 8½.								

T A B L E 6: ADIT J14 - UPPER, LOT 1

Washability Data: +100 Mesh: - 92.96 % of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash %	Wt.%	Ash %	Wt.%	Ash %
- 1.30	18.10	2.66	18.10	2.66	100.00	16.08	9.05	2.66
1.30 - 1.35	27.92	5.79	46.02	4.56	81.90	19.03	32.06	5.79
1.35 - 1.40	18.87	10.03	64.89	6.15	53.98	25.88	55.45	10.03
1.40 - 1.45	10.04	15.25	74.93	7.37	35.11	34.41	69.91	15.25
1.45 - 1.50	5.52	20.39	80.45	8.26	25.07	42.08	77.69	20.39
1.50 - 1.60	6.24	26.50	86.69	9.58	19.55	48.20	83.57	26.50
1.60 - 1.70	3.44	34.89	90.13	10.54	13.31	58.37	88.41	34.89
1.70 - 1.80	1.93	43.56	92.06	11.23	9.87	66.56	91.10	43.56
+ 1.80	7.94	72.15	100.00	16.08	7.94	72.15	96.03	72.15
Ttoal	100.00	16.08						

FIGURE : 1

COMPANY : Denison Mines Ltd.

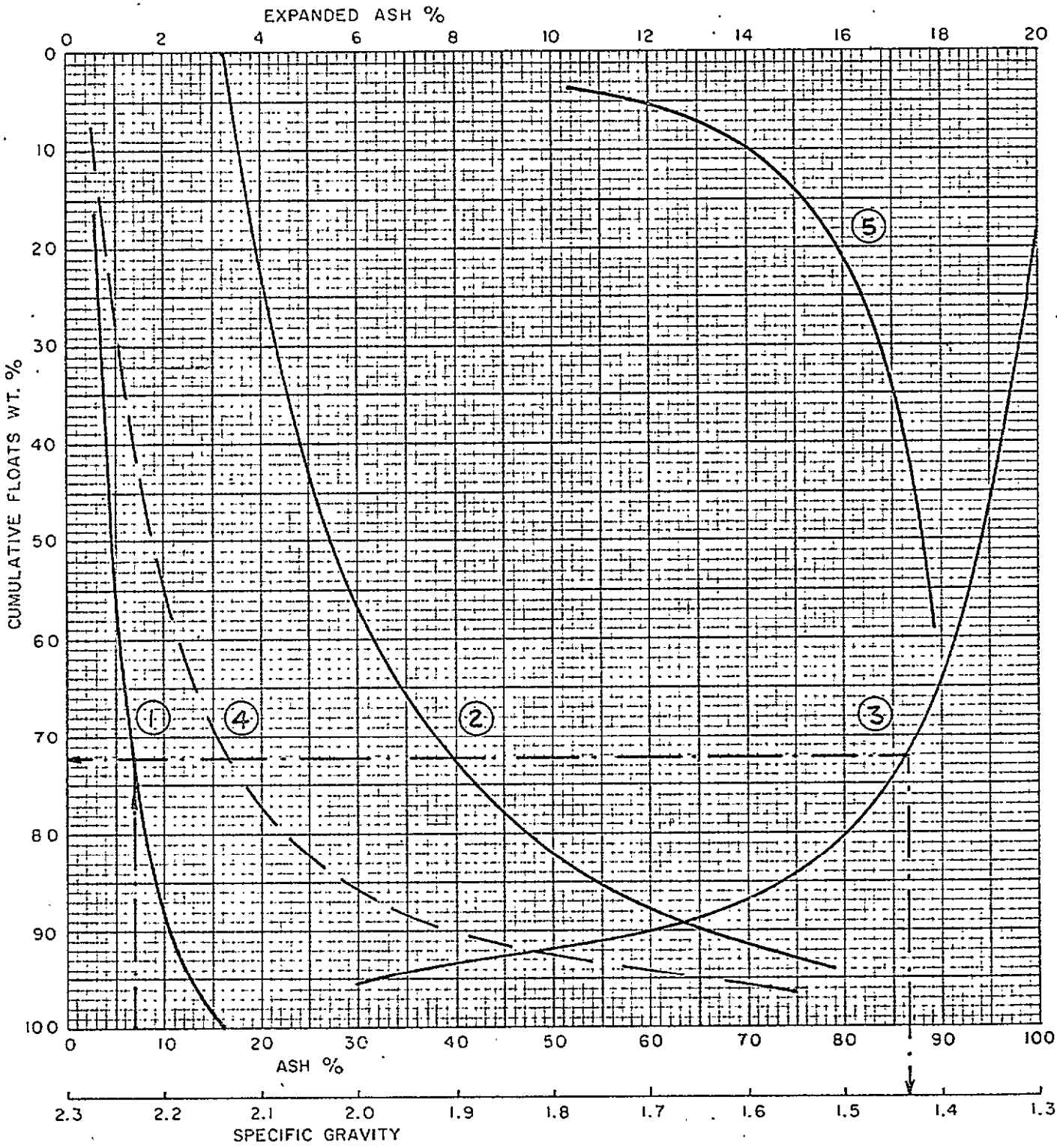
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : +100 M. (reconstituted from size fractions)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 1a

COMPANY : Denison Mines Ltd.

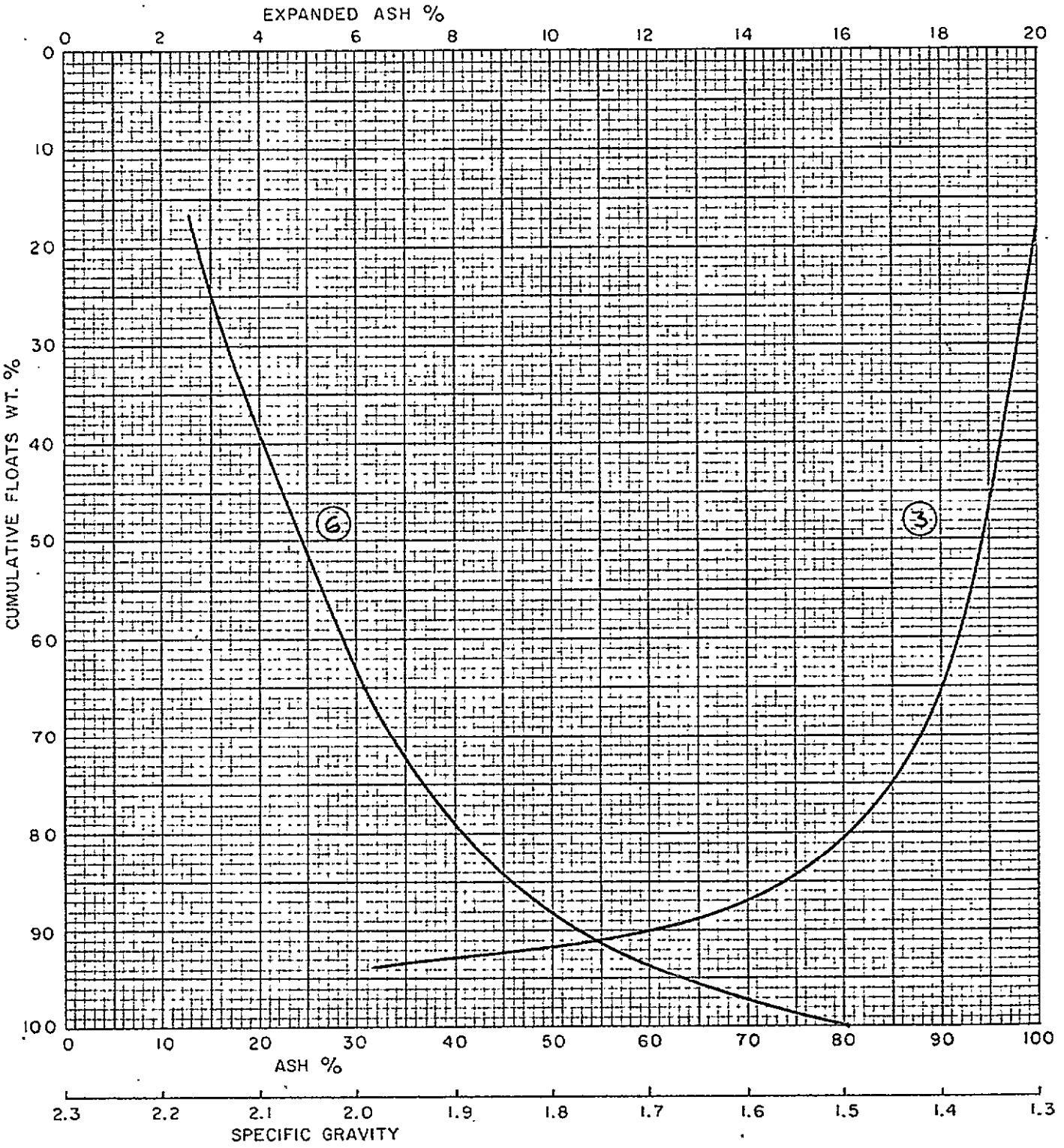
SAMPLE : ADIT J14, UPPER, LOT 1

SIZE : +100m. (Reconstituted from size fractions)

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 7: ADIT J14 - UPPER, LOT II

Cumulative Volatile Matter: +100 M. - 92.96 % of Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt.%	V.M.%	Wt.%	V.M.%	Wt.%	V.M.%
- 1.30	18.10	24.86	18.10	24.86	100.00	20.51
1.30 - 1.35	27.92	21.20	46.02	22.64	81.90	19.56
1.35 - 1.40	18.87	19.59	64.89	21.75	53.98	18.71
1.40 - 1.45	10.04	19.18	74.93	21.41	35.11	18.23
1.45 - 1.50	5.52	20.14	80.45	21.32	25.07	17.85
1.50 - 1.60	6.24	20.40	86.69	21.25	19.55	17.20
1.60 - 1.70	3.44	20.02	90.13	21.21	13.31	15.71
1.70 - 1.80	1.93	18.94	92.06	21.16	9.87	14.20
+ 1.80	7.94	13.05	100.00	20.51	7.94	13.05
Total	100.00	20.51				

T A B L E 8: ADIT J14 - UPPER, LOT 1

7% Ash of Clean Coal

Yield	72.00%
Floats Gravity	1.44
Near Gravity Material	45.00%
Ash	7.00%
Volatile Matter	21.50%
Residual Moisture	1.05%
Fixed Carbon	70.45%
F.S.I.	6

TABLE 9: ADIT J14 - UPPER, LOT 1

Ash, Volatile Matter and Cumulative F.S.I.

+1": 15.98 % of Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	0.98	4.59	24.37	0.98	9+
1.30 - 1.35	25.11	6.01	21.38	26.09	7½
1.35 - 1.40	18.25	10.34	20.21	44.34	6½
1.40 - 1.45	15.51	15.84	19.44	59.85	5½
1.45 - 1.50	8.79	20.39	20.48	68.64	4½
1.50 - 1.60	10.54	26.52	20.87	79.18	4
1.60 - 1.70	5.89	34.82	19.62	85.07	4
1.70 - 1.80	3.70	44.47	18.55	88.77	4
+ 1.80	11.23	74.96	10.98	100.00	3
Total	100.00	22.60	19.38		

TABLE 10: ADIT J14 - UPPER, LOT 1

Washability Data: +1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	0.98	4.59	0.98	4.59	100.00	22.60	0.49	4.59
1.30 - 1.35	25.11	6.01	26.09	5.96	99.02	22.78	13.53	6.01
1.35 - 1.40	18.25	10.34	44.34	7.76	73.91	28.47	35.32	10.34
1.40 - 1.45	15.51	15.84	59.85	9.85	55.66	34.42	52.09	15.84
1.45 - 1.50	8.79	20.39	68.64	11.20	40.15	41.60	64.25	20.39
1.50 - 1.60	10.54	26.52	79.18	13.24	31.36	47.54	73.91	26.52
1.60 - 1.70	5.89	34.82	85.07	14.74	20.82	58.19	82.12	34.82
1.70 - 1.80	3.70	44.47	88.77	15.98	14.93	67.40	86.92	44.47
+ 1.80	11.23	74.96	100.00	22.60	11.23	74.96	94.39	74.96
Ttoal	100.00	22.60						

FIGURE : 2

COMPANY : Denison Mines Ltd.

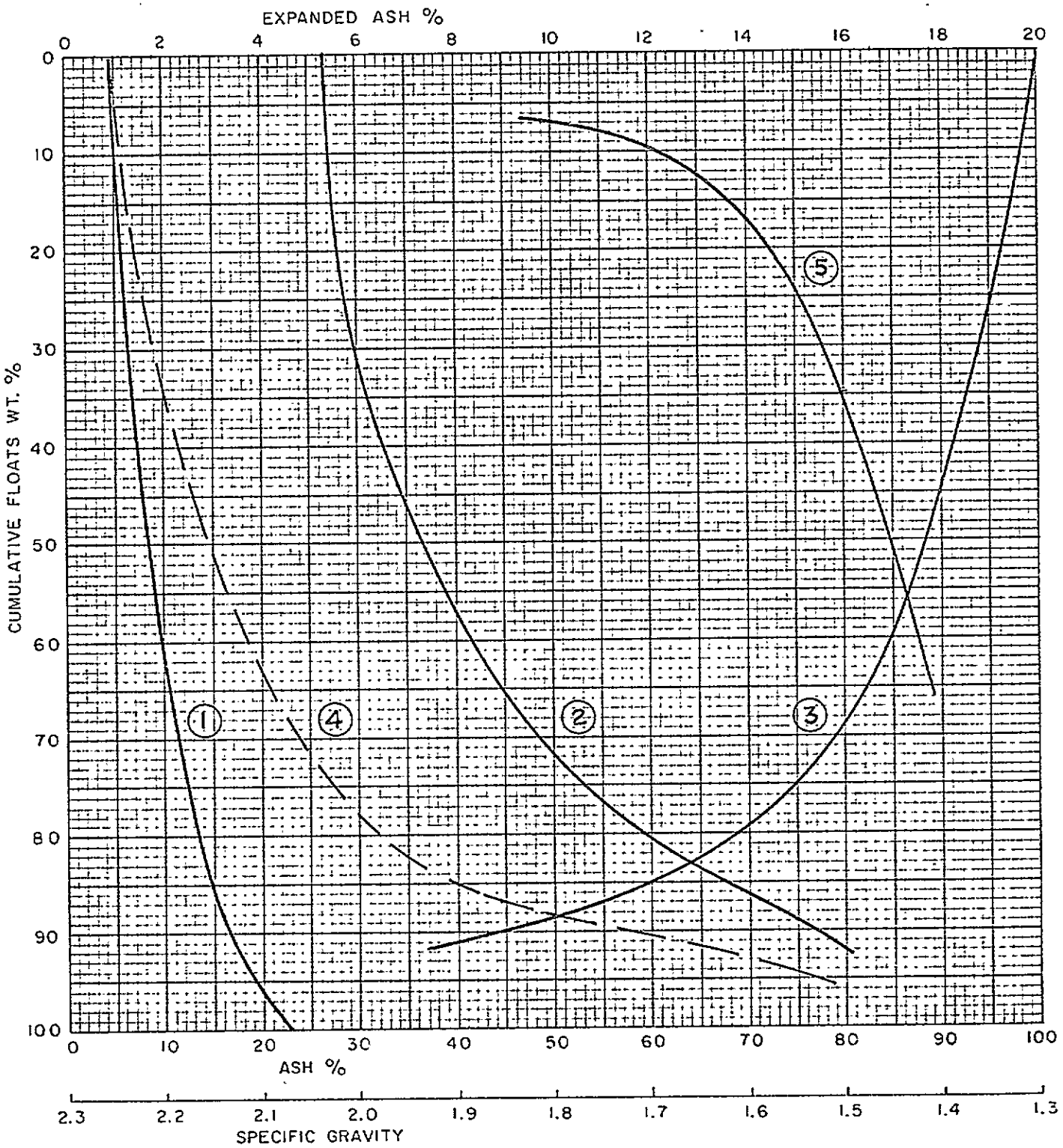
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : +1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : Denison Mines Ltd.

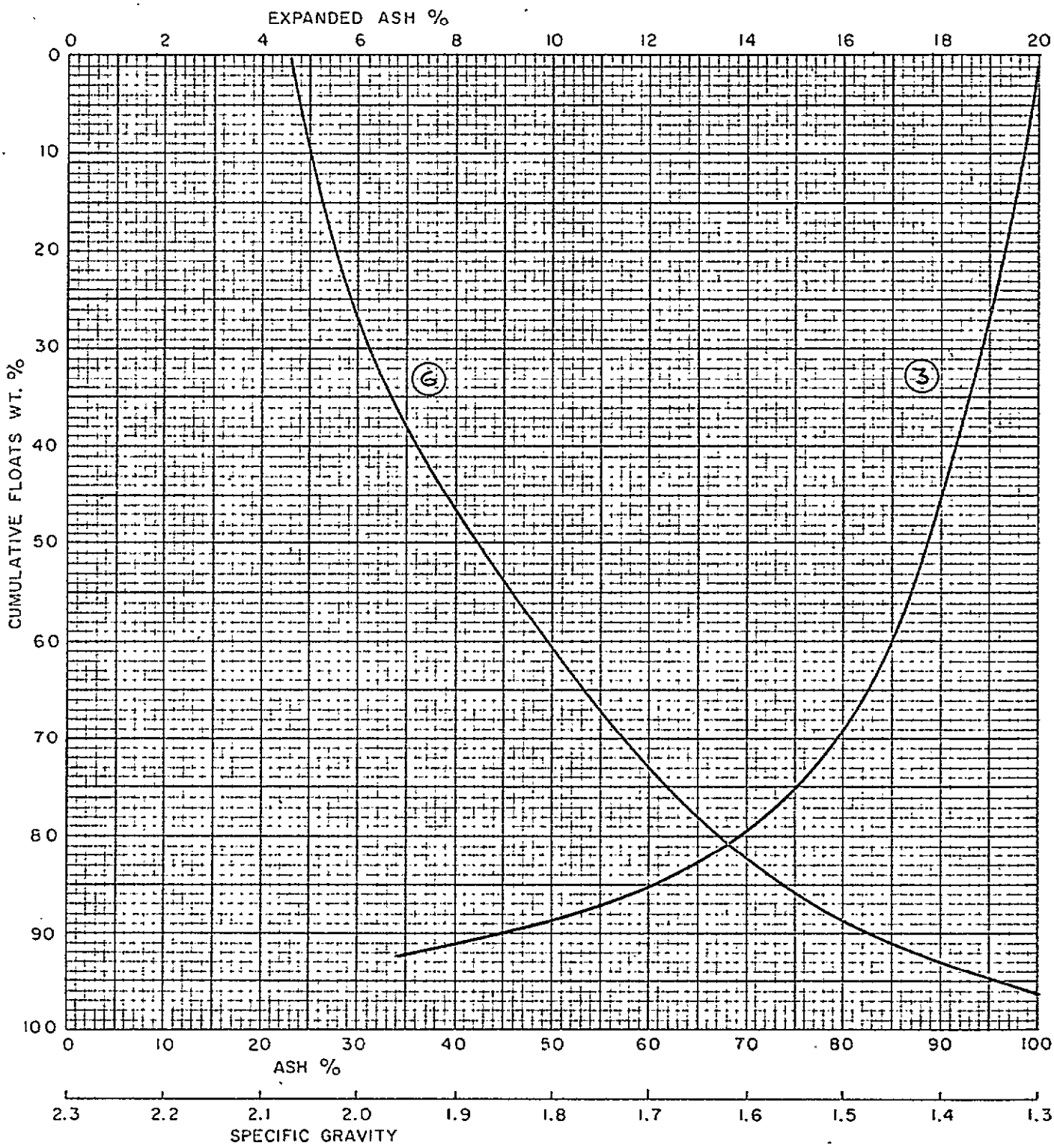
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : +1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON, ALBERTA, CANADA

TABLE 11: ADIT J14 - UPPER, LOT 1

Ash, Volatile Matter and Cumulative F.S.I.

1" x 1/2": 12.68% of Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	1.03	4.34	24.06	1.03	9+
1.30 - 1.35	29.43	5.88	21.33	30.46	6
1.35 - 1.40	23.06	10.13	20.11	53.52	4½
1.40 - 1.45	12.90	14.63	19.76	66.42	3½
1.45 - 1.50	8.27	19.40	21.17	74.69	3
1.50 - 1.60	9.45	25.11	21.33	84.14	2½
1.60 - 1.70	4.75	35.09	20.80	88.89	2½
1.70 - 1.80	2.13	44.31	18.48	91.02	2½
+ 1.80	8.98	73.49	11.65	100.00	2½
Ttoal	100.00	19.19	19.90		

TABLE 12: ADIT J14 - UPPER, LOT 1

Washability Data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	1.03	4.34	1.03	4.34	100.00	19.19	0.51	4.34
1.30 - 1.35	29.43	5.88	30.46	5.83	98.97	19.34	15.75	5.88
1.35 - 1.40	23.06	10.13	53.52	7.68	69.54	25.04	41.99	10.13
1.40 - 1.45	12.90	14.63	66.42	9.03	46.48	32.43	59.97	14.63
1.45 - 1.50	8.27	19.40	74.69	10.18	33.58	39.27	70.65	19.40
1.50 - 1.60	9.45	25.11	84.14	11.86	25.31	45.76	79.42	25.11
1.60 - 1.70	4.75	35.09	88.89	13.10	15.86	58.07	86.51	35.09
1.70 - 1.80	2.13	44.31	91.02	13.83	11.11	67.90	89.96	44.31
+ 1.80	8.98	73.49	100.00	19.19	8.98	73.49	95.51	73.49
Total	100.00	19.19						

FIGURE: 3

COMPANY : Denison Mines Ltd.

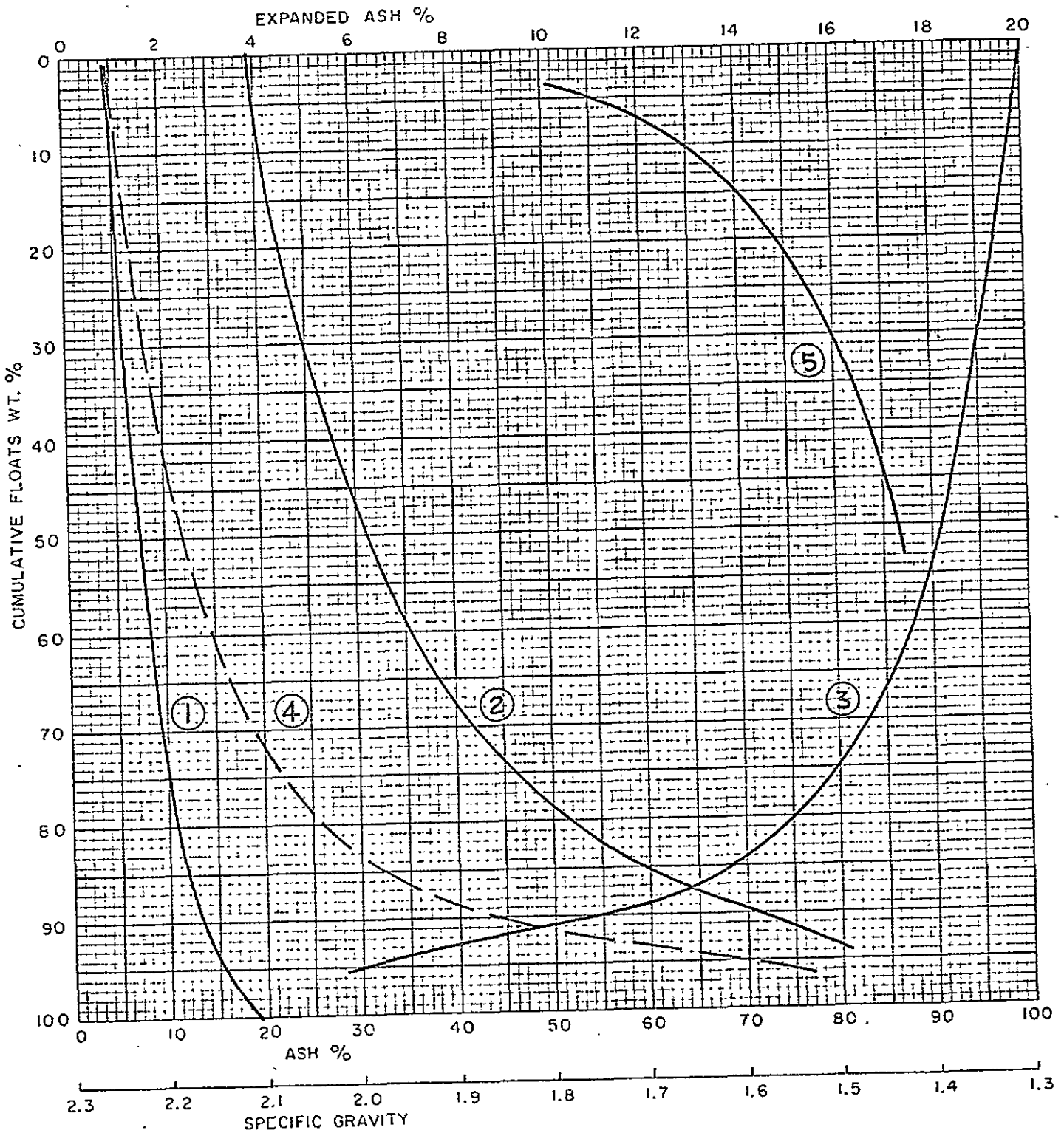
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 3a

COMPANY : Denison Mines Ltd.

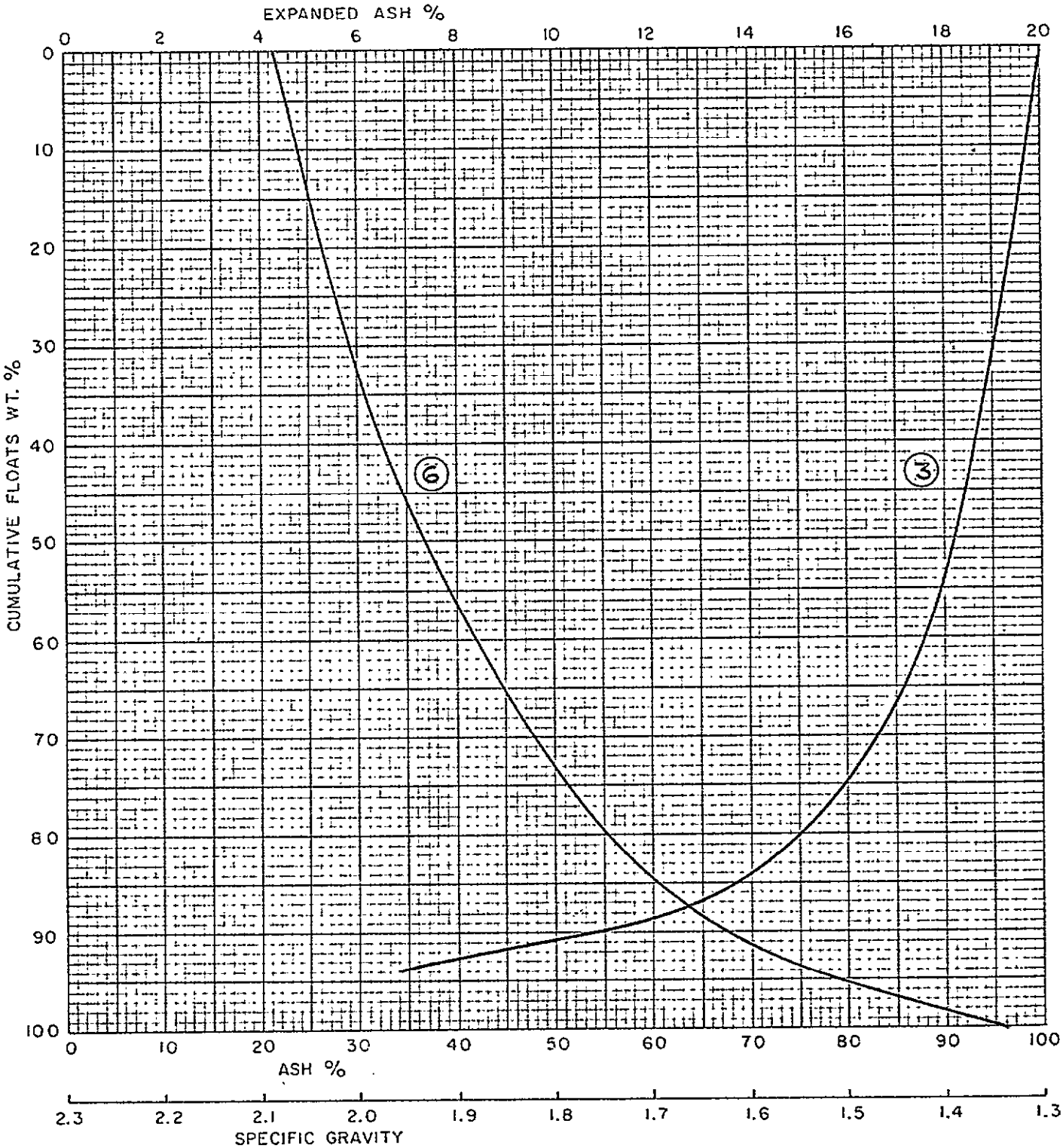
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
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TABLE 13: ADIT J14 - UPPER, LOT 1

1/2" x 1/4": 12.96 % of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	2.00	3.76	24.14	2.00	9
1.30 - 1.35	33.41	5.74	20.93	35.41	6
1.35 - 1.40	23.14	10.01	19.87	58.55	4½
1.40 - 1.45	12.50	14.41	19.46	71.05	3½
1.45 - 1.50	6.26	19.64	20.07	77.31	3
1.50 - 1.60	7.43	25.84	20.78	84.74	2½
1.60 - 1.70	4.45	34.78	20.68	89.19	2½
1.70 - 1.80	1.84	43.91	19.39	91.03	2½
+ 1.80	8.97	73.47	11.82	100.00	2½
Total	100.00	18.21	19.65		

TABLE 14: ADIT J14 - UPPER, LOT 1

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	2.00	3.76	2.00	3.76	100.00	18.21	1.00	3.76
1.30 - 1.35	33.41	5.74	35.41	5.63	98.00	18.50	17.70	5.74
1.35 - 1.40	23.14	10.01	58.55	7.36	64.59	25.10	46.98	10.01
1.40 - 1.45	12.50	14.41	71.05	8.60	41.45	33.53	64.80	14.41
1.45 - 1.50	6.26	19.64	77.31	9.49	28.95	41.78	74.18	19.64
1.50 - 1.60	7.43	25.84	84.74	10.93	22.69	47.89	81.03	25.84
1.60 - 1.70	4.45	34.78	89.19	12.12	15.26	58.62	86.96	34.78
1.70 - 1.80	1.84	43.91	91.03	12.76	10.81	68.44	90.11	43.91
+ 1.80	8.97	73.47	100.00	18.21	8.97	73.47	95.52	73.47
Total	100.00	18.21						

FIGURE : 4

COMPANY : Denison Mines Ltd.

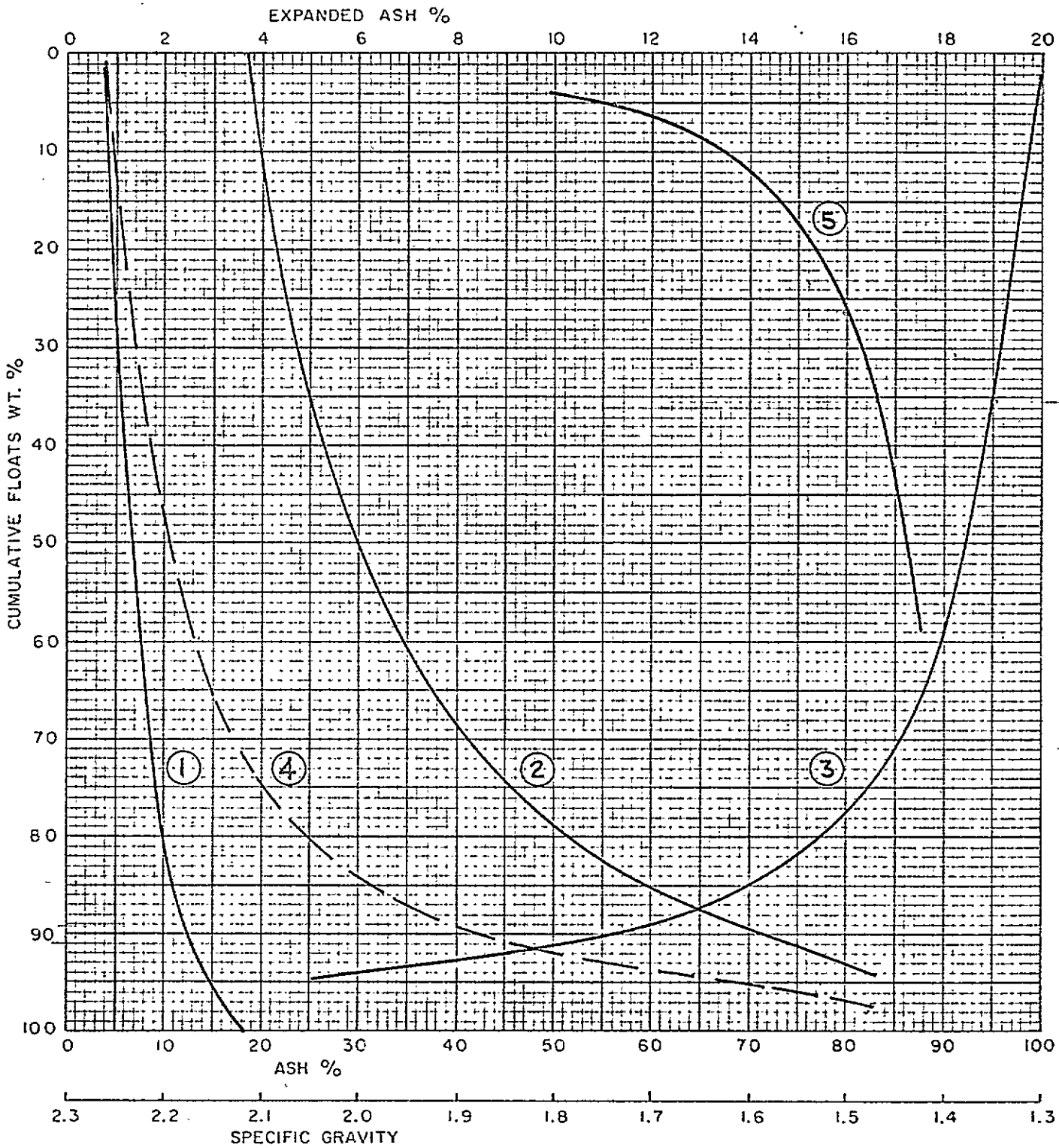
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 4 a

COMPANY : Denison Mines Ltd.

SAMPLE : ADIT J14 - UPPER , LOT 1

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES

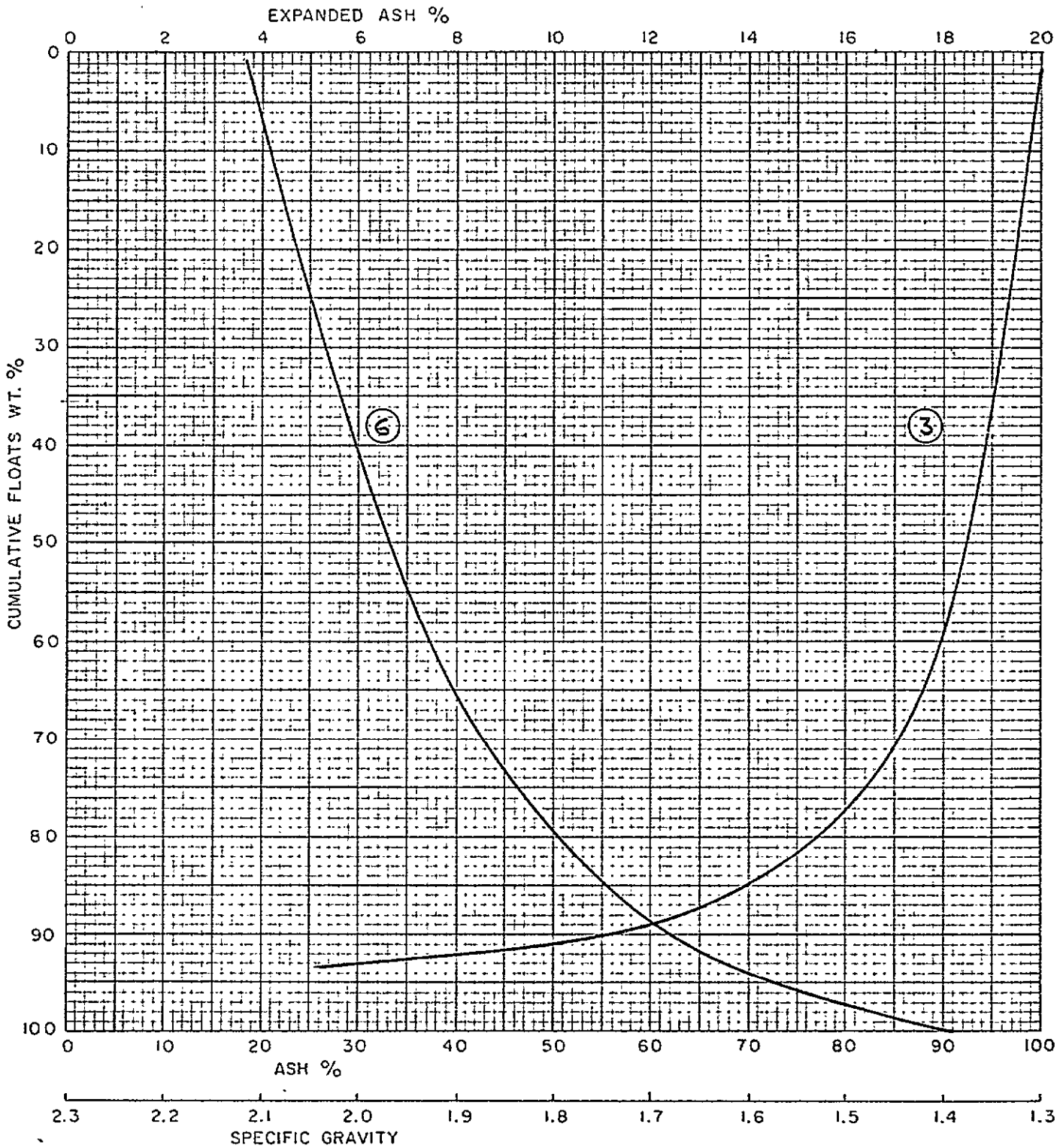

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TABLE 15: ADIT J14, UPPER - LOT 1

1/4" x 8m. : 14.86 % of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt.%	Ash %	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	11.76	3.34	24.01	11.76	9+
1.30 - 1.35	32.80	5.93	21.18	44.56	6½
1.35 - 1.40	22.06	10.06	18.65	66.62	6
1.40 - 1.45	9.93	15.46	18.75	76.55	5½
1.45 - 1.50	5.08	20.83	19.52	81.63	5
1.50 - 1.60	5.74	28.06	19.30	87.37	4½
1.60 - 1.70	2.83	34.47	19.47	90.20	4½
1.70 - 1.80	1.84	42.08	19.63	92.04	4
+ 1.80	7.96	72.18	13.23	100.00	3
Total	100.00	16.26	19.81		

TABLE 16: ADIT J14 - UPPER, LOT 1

Washability Data: 1/4" x 8m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	11.76	3.34	11.76	3.34	100.00	16.26	5.88	3.34
1.30 - 1.35	32.80	5.93	44.56	5.25	88.24	17.98	28.16	5.93
1.35 - 1.40	22.06	10.06	66.62	6.84	55.44	25.11	55.59	10.06
1.40 - 1.45	9.93	15.46	76.55	7.96	33.38	35.05	71.58	15.46
1.45 - 1.50	5.08	20.83	81.63	8.76	23.45	43.34	79.09	20.83
1.50 - 1.60	5.74	28.06	87.37	10.03	18.37	49.57	84.50	28.06
1.60 - 1.70	2.83	34.47	90.20	10.79	12.63	59.35	88.79	34.47
1.70 - 1.80	1.84	42.08	92.04	11.42	9.80	66.53	91.12	42.08
+ 1.80	7.96	72.18	100.00	16.26	7.96	72.18	96.02	72.18
Total	100.00	16.26						

FIGURE : 5

COMPANY : Denison Mines Ltd.

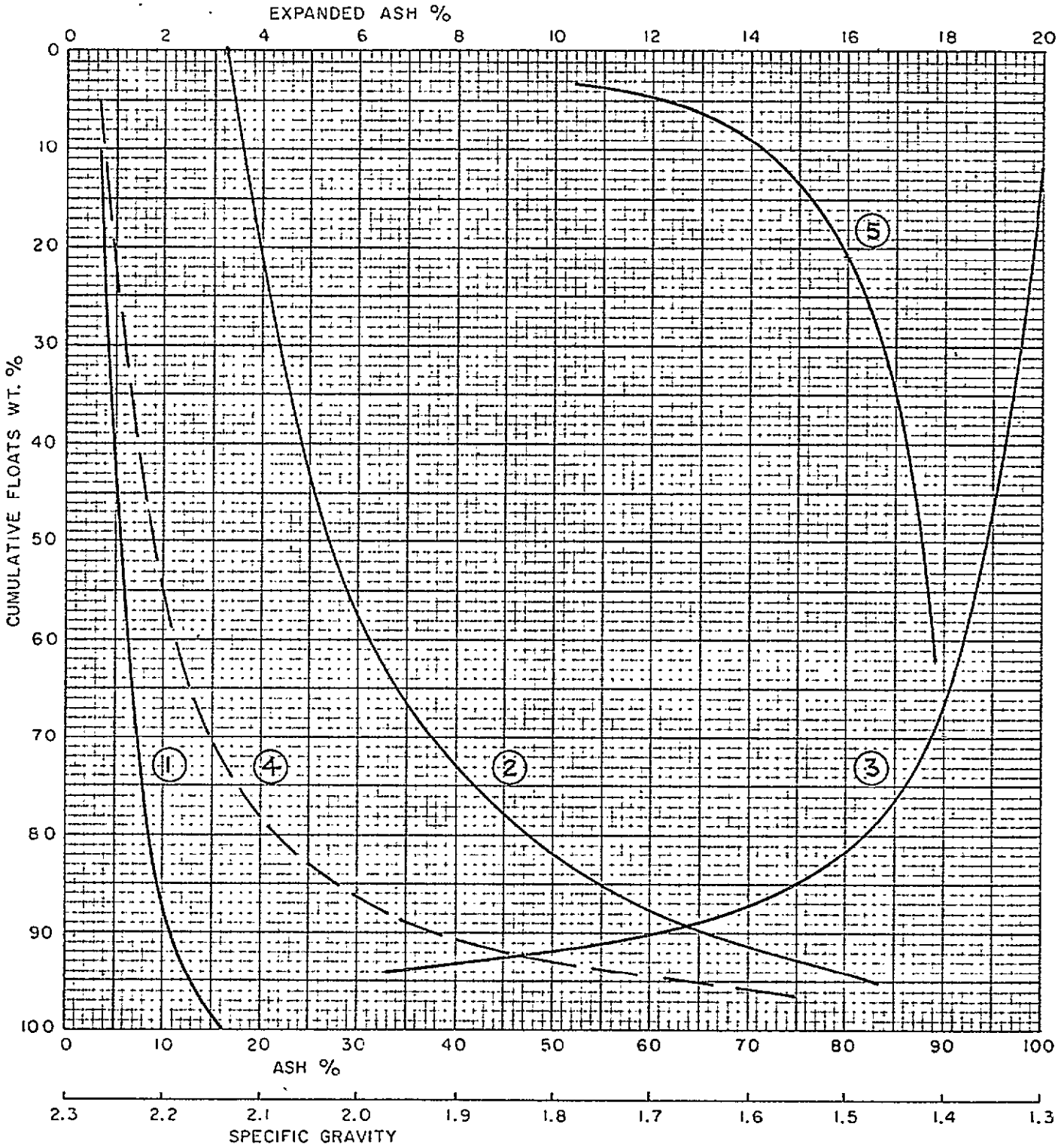
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 1/4" x 8m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5a

COMPANY : Denison Mines Ltd.

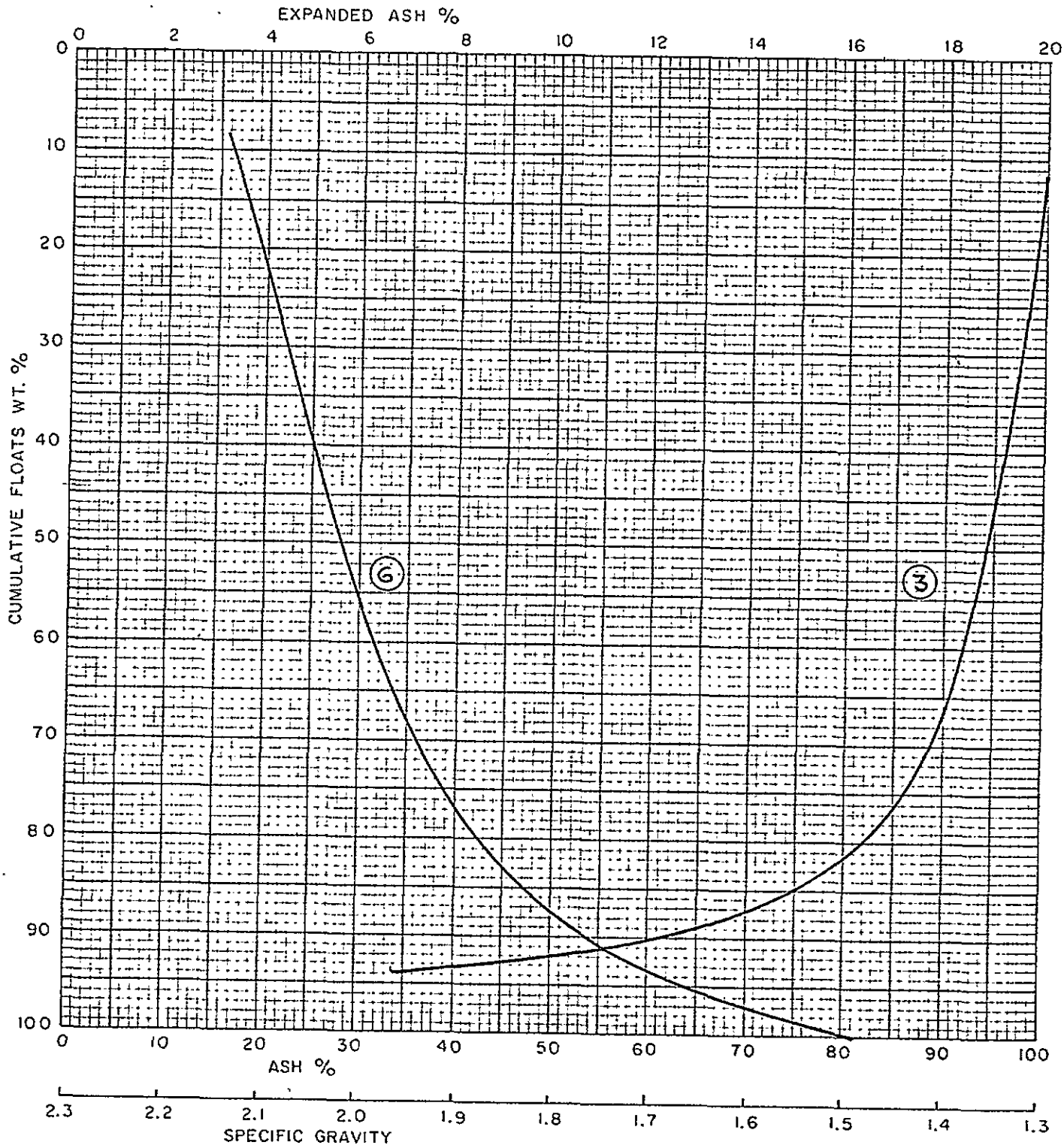
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 1/4" x 8m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 17: ADIT J14 - UPPER, LOT 1

8m. x 28m.: 23.15% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt.%	Ash %	V.M.%	Cum. Wt. %	Cum. F.S.I.
- 1.30	34.93	2.74	25.15	34.93	9+
1.30 - 1.35	26.12	5.73	21.00	61.05	9
1.35 - 1.40	16.52	10.00	19.12	77.57	8½
1.40 - 1.45	6.28	15.74	18.13	83.85	8
1.45 - 1.50	3.44	21.81	19.24	87.29	8
1.50 - 1.60	3.39	27.32	19.13	90.68	7½
1.60 - 1.70	2.06	35.26	19.62	92.74	7½
1.70 - 1.80	1.28	42.90	19.01	94.02	7½
+ 1.80	5.98	69.72	15.44	100.00	6½
Total	100.00	12.22	21.45		

T A B L E 18: ADIT J14 - UPPER, LOT 1

Washability Data: 8m. x 28m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	34.93	2.74	34.93	2.74	100.00	12.22	17.46	2.74
1.30 - 1.35	26.12	5.73	61.05	4.02	65.07	17.30	47.99	5.73
1.35 - 1.40	16.52	10.00	77.57	5.30	38.95	25.06	69.31	10.00
1.40 - 1.45	6.28	15.74	83.85	6.08	22.43	36.16	80.71	15.74
1.45 - 1.50	3.44	21.81	87.29	6.70	16.15	44.09	85.57	21.81
1.50 - 1.60	3.39	27.32	90.68	7.47	12.71	50.12	88.99	27.32
1.60 - 1.70	2.06	35.26	92.74	8.08	9.32	58.42	91.71	35.26
1.70 - 1.80	1.28	42.90	94.02	8.56	7.26	64.99	93.38	42.90
+ 1.80	5.98	69.72	100.00	12.22	5.98	69.72	97.01	69.72
Total	100.00	12.22						

FIGURE: 6

COMPANY : Denison Mines Ltd.

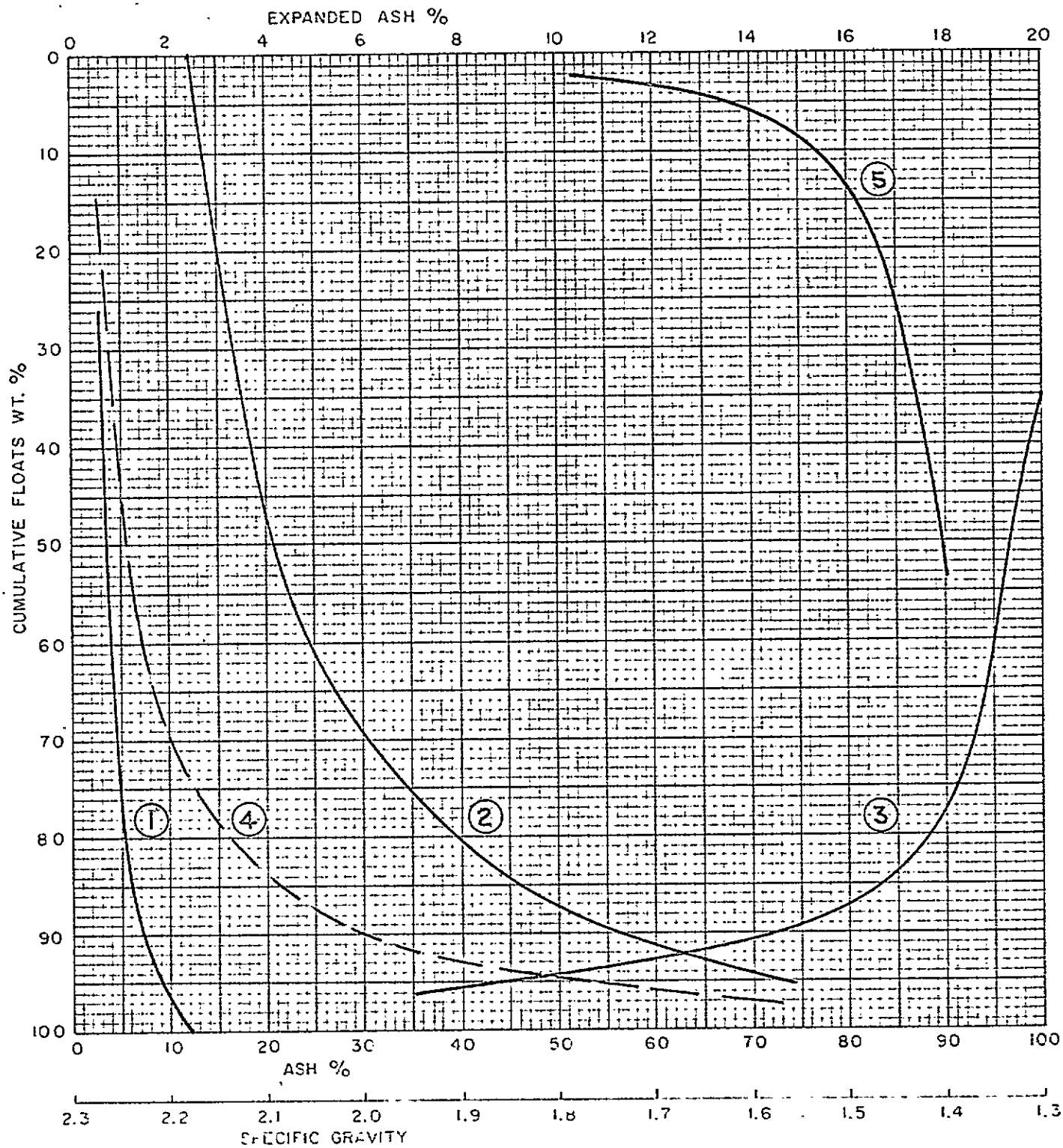
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 8m. x 28m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



May 12, 1972.

FIGURE: 6 a

COMPANY : Denison Mines Ltd.

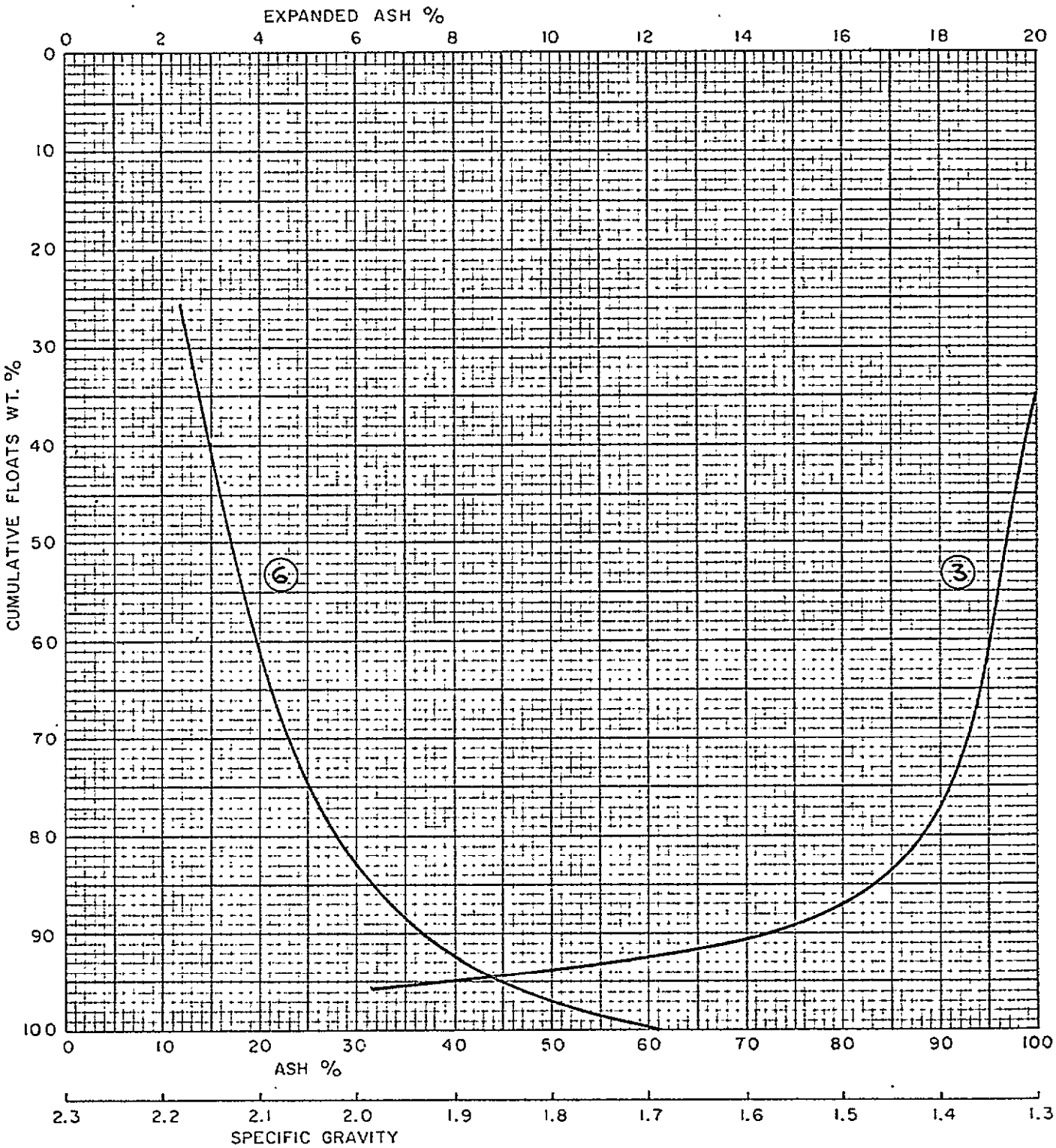
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 8m. x 28m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 12, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 19: ADIT J14 - UPPER, LOT 1

28m. x 100m.: 13.33% of Sample

Ash, Volatile Matter and Cumulative F.S.I.

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	48.28	2.26	24.78	48.28	9+
1.30 - 1.35	22.14	5.36	21.60	70.42	9+
1.35 - 1.40	11.97	9.37	20.04	82.39	9
1.40 - 1.45	4.98	15.15	19.36	87.37	8½
1.45 - 1.50	2.43	20.98	19.10	89.80	8½
1.50 - 1.60	2.50	27.41	19.32	92.30	8
1.60 - 1.70	1.37	34.95	19.74	93.67	8
1.70 - 1.80	0.88	41.72	19.21	94.55	8
+ 1.80	5.45	65.62	17.50	100.00	8
Total	100.00	9.77	22.45		

TABLE 20: ADIT J14 - UPPER, LOT 1

Washability Data: 28m. x 100m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	48.28	2.26	48.28	2.26	100.00	9.77	24.14	2.26
1.30 - 1.35	22.14	5.36	70.42	3.23	51.72	16.78	59.35	5.36
1.35 - 1.40	11.97	9.37	82.39	4.13	29.58	25.33	76.40	9.37
1.40 - 1.45	4.98	15.15	87.37	4.75	17.61	36.18	84.88	15.15
1.45 - 1.50	2.43	20.98	89.80	5.19	12.63	44.48	88.59	20.98
1.50 - 1.60	2.50	27.41	92.30	5.80	10.20	50.07	91.05	27.41
1.60 - 1.70	1.37	34.95	93.67	6.22	7.70	57.43	92.98	34.95
1.70 - 1.80	0.88	41.72	94.55	6.55	6.33	62.30	94.11	41.72
+ 1.80	5.45	65.62	100.00	9.77	5.45	65.62	97.28	65.62
Total	100.00	9.77						

FIGURE : 7

COMPANY : Denison Mines Ltd.

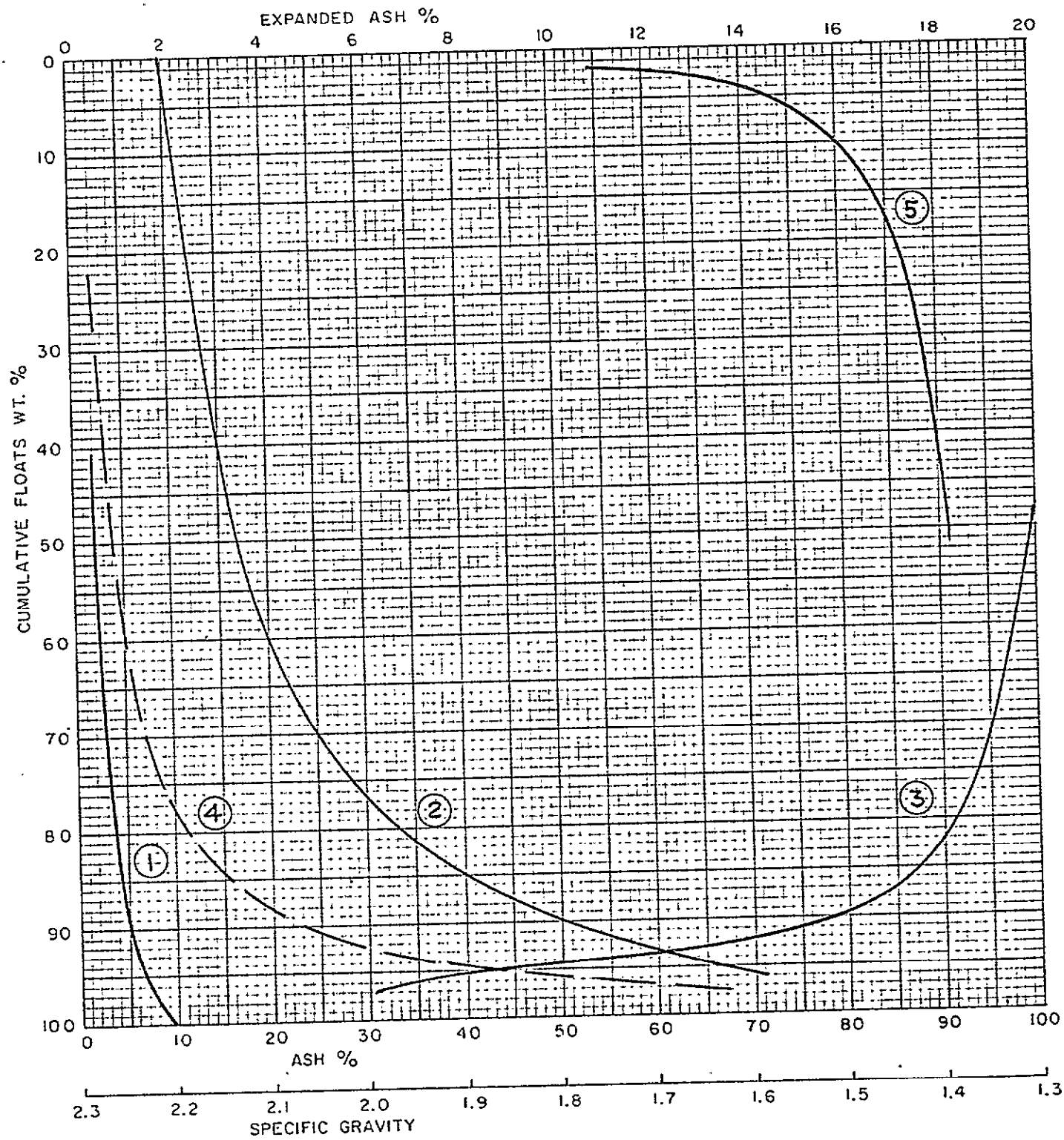
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 28m. x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 12, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 7a

COMPANY : Denison Mines Ltd.

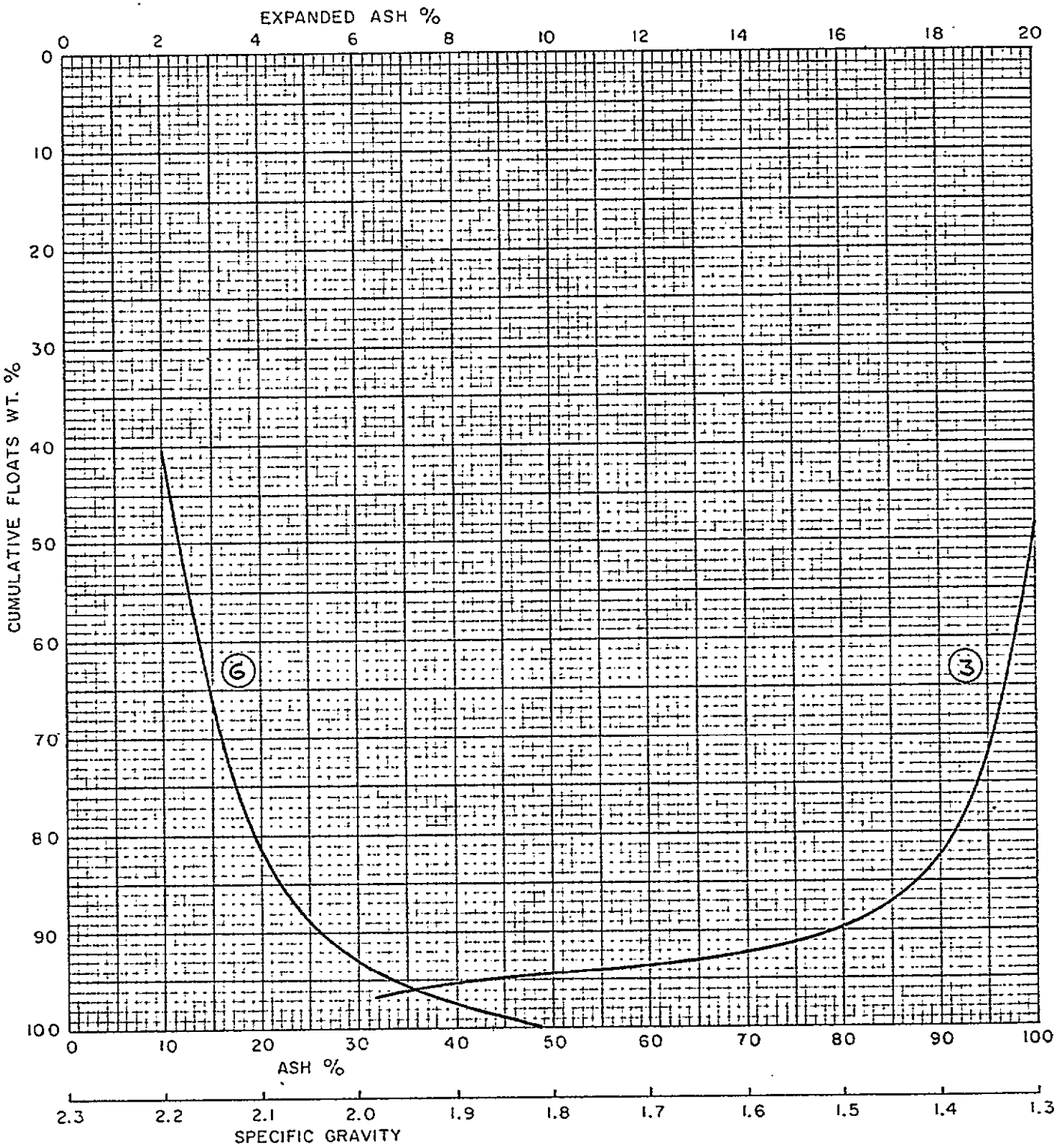
SAMPLE : ADIT J14 - UPPER, LOT 1

SIZE : 28m. x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 12, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 21 - ADIT J14 - UPPER, LOT 1

28m. x 100m.: 13.33% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	88.80%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	6.77	34.37
Volatile Matter, %	23.51	20.68
Residual Moisture, %	0.87	0.80
Fixed Carbon, %	68.85	44.15
F.S.I.	9	1
Sulphur, %	0.34	1.02

T A B L E 22: ADIT J14 - UPPER, LOT 1

-100 Mesh: 7.04% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	92.70%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	8.61	64.86
Volatile Matter, %	23.22	30.95
Residual Moisture, %	0.61	0.74
Fixed Carbon, %	67.56	3.45
F.S.I.	9	N.A.
Sulphur, %	0.40	1.24

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT J14 - UPPER

Submitted by

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.28

Job No.: S1-84

Date: June 3, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT J14 - UPPER

SUMMARY:

The data presented in this report refer to washability characteristics and the washing of a 5-ton sample from Adit J14, Upper.

The coal was cleaned using a two-stage water cyclone system, followed by after cleaning of fines in the clean coal in flotation cells. This was done to remove the remaining mineral matter from the fines.

A clean coal yield of about 70% was obtained.

The analysis of clean coal is as follows.

	Air Dried Basis	As Shipped Basis
Surface Moisture	--	6.00%
Residual Moisture	1.34%	1.26%
Ash	7.58%	7.13%
Volatile Matter	21.43%	20.14%
Fixed Carbon	69.65%	65.47%
F.S.I.	7½	7½
B.T.U./lb.	14,310	13.450
Sulphur	0.33%	0.31%

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studies and production of clean coal.

The coal was air dried, crushed to minus 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in Figure 1, Section 2 of this report.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per

R.S. Sehgal, P. Eng.
Laboratory Manager

SECTION 1

WASHABILITY DATA & FLOTATION TESTS

ADIT J14 - UPPER

T A B L E 1 - ADIT J14 - UPPER

Head Sample Analysis

Ash	16.23%
Volatile Matter	20.56%
Residual Moisture	1.15%
Fixed Carbon	62.06%
F.S.I.	5½
B.T.U./lb.	12,450
Sulphur	0.31%

T A B L E 2 - ADIT J14 - UPPER

Size Analysis

	Weight %
3/4" x 28 m.	80.85
-28 Mesh	19.15
Total	100.00

TABLE 3 - ADIT J14 - UPPER

Incremental Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash%	V.M.%	R.M.%	F.C.%
-1.30	12.28	2.86	24.18	1.08	71.88
1.30 - 1.35	25.94	5.66	20.89	1.11	72.34
1.35 - 1.40	22.18	9.33	18.75	1.09	70.83
1.40 - 1.45	11.52	15.22	18.87	1.07	64.84
1.45 - 1.50	6.66	20.87	19.97	0.99	58.17
1.50 - 1.60	7.58	27.36	20.55	0.98	51.11
1.60 - 1.70	4.25	36.11	20.34	1.01	42.54
1.70 - 1.80	2.14	43.09	19.70	0.98	36.23
+ 1.80	8.45	74.40	12.76	1.06	11.78
Total	100.00	17.64	19.77	1.07	61.52

TABLE 4 - ADIT J14 - UPPER

Cumulative Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash%	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	12.28	2.86	24.18	1.08	71.88	9+
- 1.35	38.22	4.76	21.95	1.10	72.19	8½
- 1.40	60.40	6.44	20.77	1.10	71.69	7
- 1.45	71.92	7.85	20.47	1.09	70.59	5½
- 1.50	77.58	8.80	20.43	1.08	69.69	5½
- 1.60	85.16	10.45	20.44	1.08	68.03	5
- 1.70	89.41	11.67	20.44	1.07	66.82	4½
- 1.80	91.55	12.40	20.42	1.07	66.11	4
Total	100.00	17.64	19.77	1.07	61.52	3½

*F.S.I. by actual determination.

T A B L E 5 - ADIT J14 - UPPER

Washability Data for 3/4" x 28 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	12.28	2.86	12.28	2.86	100.00	17.64	6.14	2.86
1.30 - 1.35	25.94	5.66	38.22	4.76	87.72	19.71	25.25	5.66
1.35 - 1.40	22.18	9.33	60.40	6.44	61.78	25.61	49.31	9.33
1.40 - 1.45	11.52	15.22	71.92	7.85	39.60	34.73	66.16	15.22
1.45 - 1.50	5.66	20.87	77.58	8.80	28.08	42.73	74.75	20.87
1.50 - 1.60	7.58	27.36	85.16	10.45	22.42	48.25	81.37	27.36
1.60 - 1.70	4.25	36.11	89.41	11.67	14.84	58.92	87.29	36.11
1.70 - 1.80	2.14	43.09	91.55	12.40	10.59	68.07	90.48	43.09
+ 1.80	8.45	74.40	100.00	17.64	8.45	74.40	95.77	74.40
Total	100.00	17.64						

FIGURE :

COMPANY : Denison Mines Ltd.

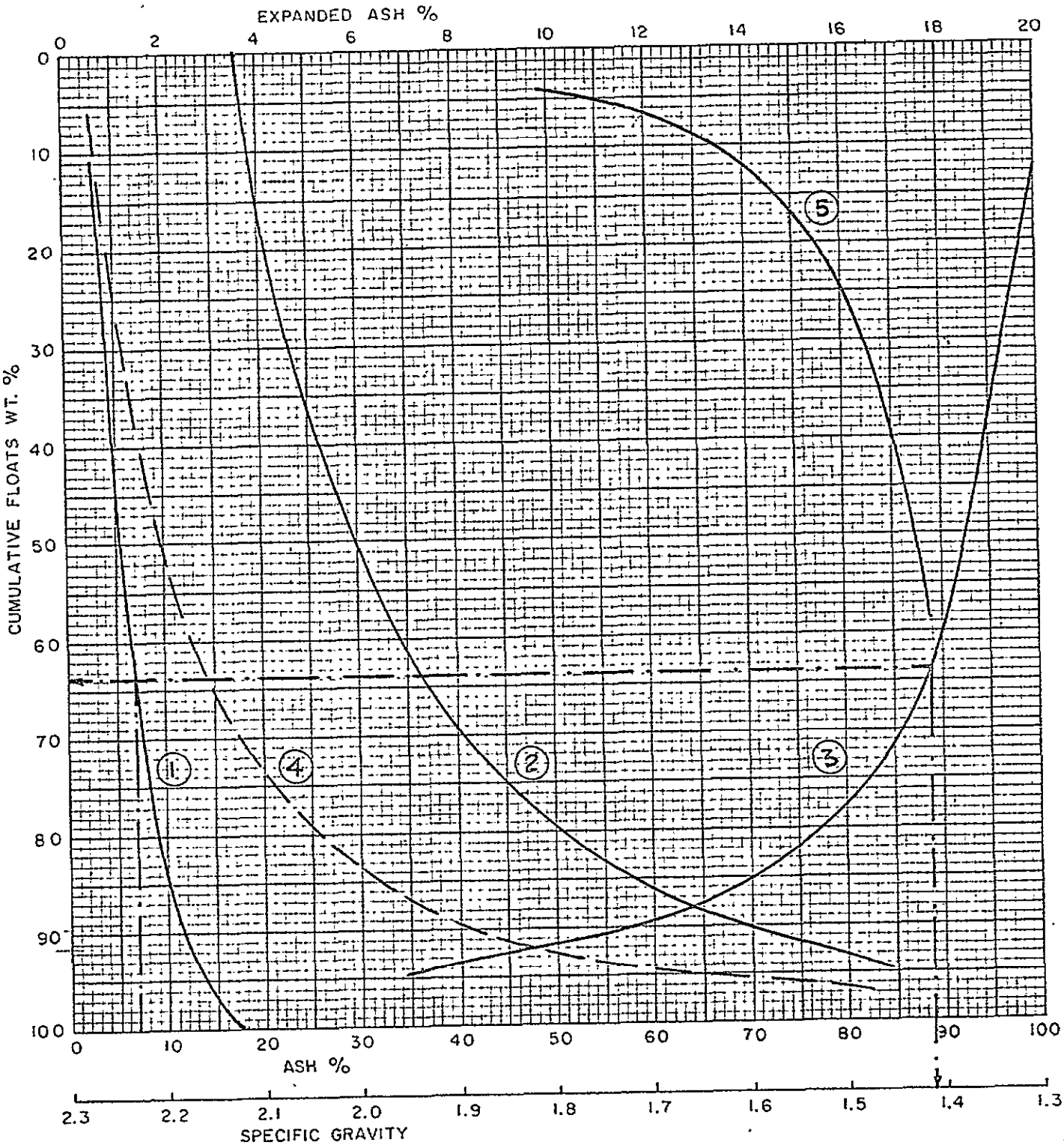
SAMPLE : Adit J14 - Upper (500 lb. Split)

SIZE : 3/4" x 28 m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : June 2, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT J14 - UPPER

Froth FlotationTest of 28 Mesh x 0

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Yield	92.64%	7.36%
Ash	7.92%	53.75%
Volatile Matter	22.25%	24.70%
Residual Moisture	0.98%	1.06%
Fixed Carbon	68.85%	20.49%
F.S.I.	7½	N.A.
Sulphur	0.35%	0.85%

SECTION 2

WASHING TESTS AND ANALYSIS OF PRODUCTS

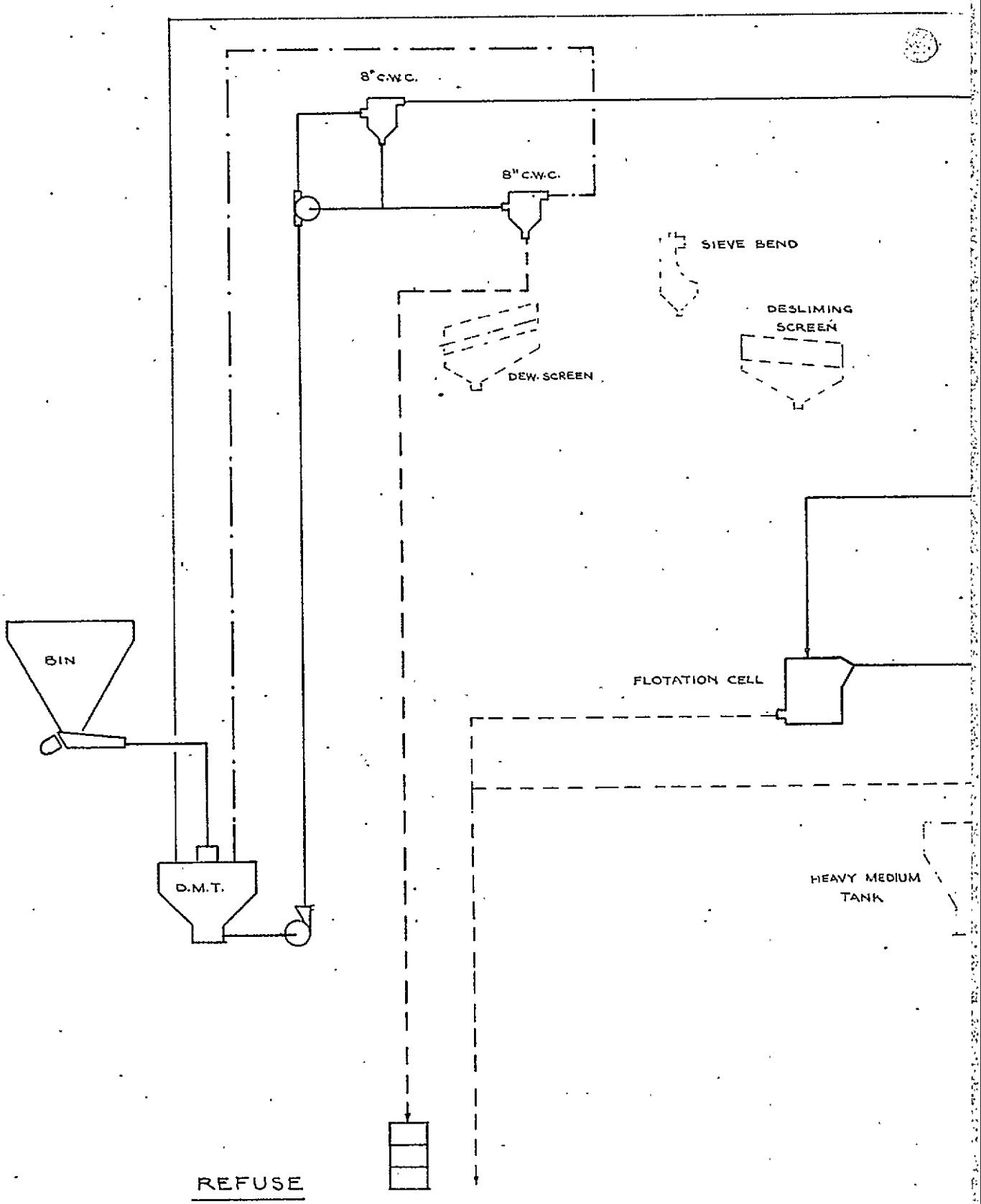
ADIT J14 - UPPER

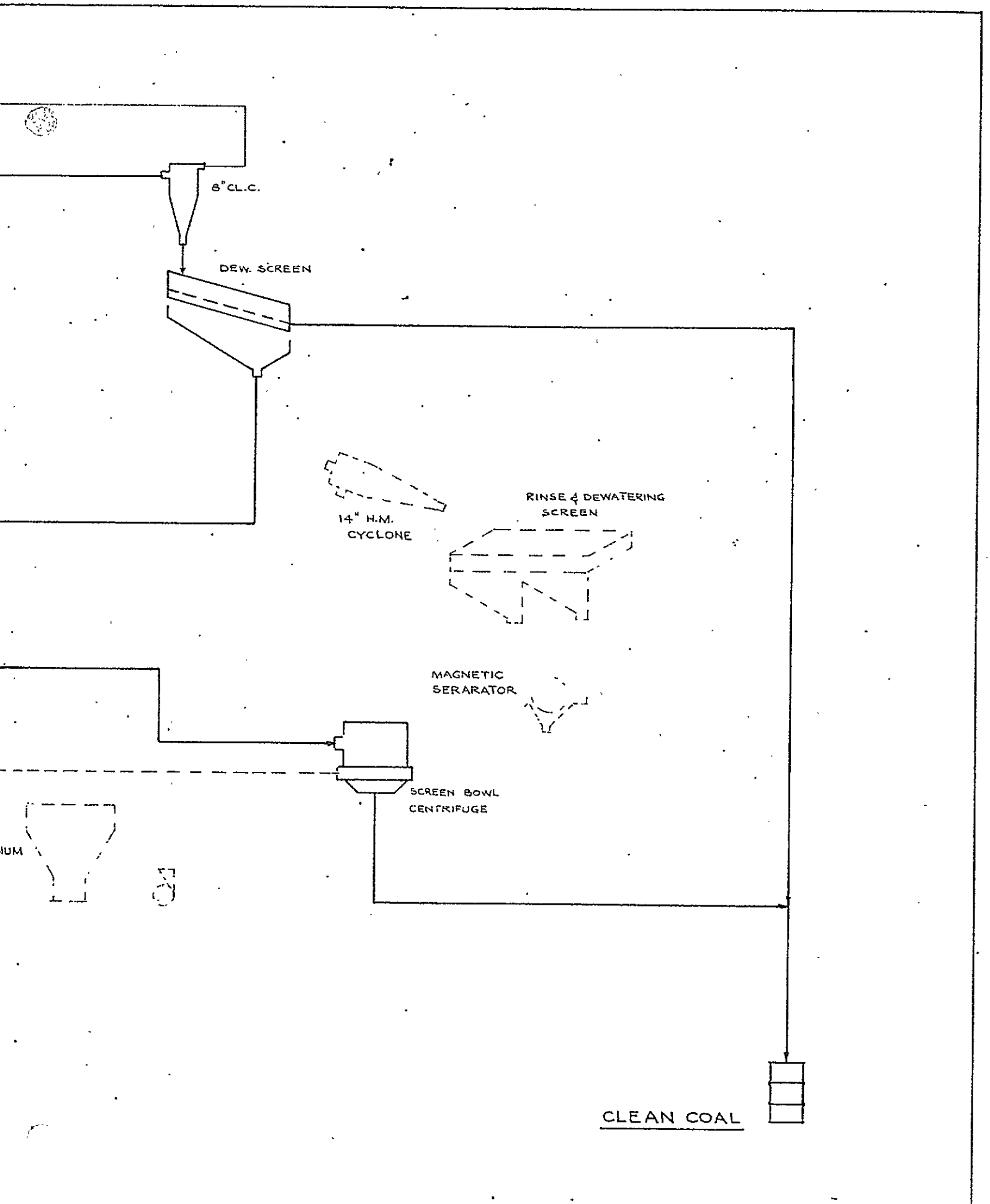
TABLE 1. Adit J14 - Upper

Approximate Distribution of Products

Product	Wt. %	Ash %
Clean Coal	71.00	7.60
Coarse Refuse	26.00	41.00
Flotation Refuse	3.00	30.20
Total	100.00	16.90

FIG. 1 WASHING CIRCUIT FOR ADIT J 14 - UPPER





CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 2. Adit J14 - Upper

Proximate Analysis of Clean Coal

Ash	7.58%
Volatile Matter	21.43%
Residual Moisture	1.34%
Fixed Carbon	69.65%
F.S.I.	7½
B.T.U./lb.	14,310
Sulphur	0.33%

TABLE 3. Adit J14 - Upper

Ultimate Analysis

Ash	7.58%
Carbon	80.82%
Hydrogen	0.86%
Oxygen	10.41%
Sulphur	0.33%

TABLE 4 - ADIT J14 - Upper

Characteristics of the Ash

Mineral Analysis of Ash

SiO_2	53.14%
Al_2O_3	23.66%
Fe_2O_3	3.58%
TiO_2	1.22%
P_2O_5	1.86%
CaO	6.54%
MgO	1.66%
Na_2O	0.34%
K_2O	0.36%
SO_3	4.92%

Ash Fusibility

	Reducing Atmosphere °F	Oxidizing Atmosphere °F.
Initial Deformation Temperature	2325	2370
Spherical Temperature	2410	2460
Hemispherical Temparature	2495	2525
Fluid Temperature	2590	2635

TABLE 5. Adit J14 - Upper

Analysis of Rejects

Coarse Refuse: + 28 Mesh

Ash	41.38%
Volatile Matter	16.92%
Residual Moisture	1.20%
Fixed Carbon	40.50%
F.S.I.	1
B.T.U./lb.	7,990
Sulphur	0.30%

Flotation Refuse

Ash	30.27%
Volatile Matter	19.86%
Residual Moisture	1.12%
Fixed Carbon	48.75%
F.S.I.	2½
B.T.U./lb.	9,850
Sulphur	0.59%

REPORT ON

WASHABILITY CHARACTERISTICS

OF

COKING COAL

FOR

DENISON MINES LTD.

ADIT J14 - MAIN

Submitted by,

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

Report No.: RI-72.25

Job No.: S1=84

Date: May 23, 1972.

REPORT ON

WASHABILITY CHARACTERISTICS

OF

COKING COAL

FOR

DENISON MINES LTD.

ADIT J14 - MAIN

SUMMARY:

The data presentedin this report refer to Denison Mines Sample of Adit J14 - Main.

The coal is of medium volatile bituminous rank.

It has an ash of 10.5% and F.S.I. of 8.

This coal can be cleaned to 7% ash at a cut point of 1.63 with a yield of 93%. The amount of near gravity material at this cut point is 6%. The F.S.I. of the clean coal is 9.

Froth flotation of fines indicates high recoveries and low ashes for the flotation concentration.

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6 & 6a	Washability Curves for 8m. x 28m.	20 & 20a
7 & 7a	Washability Curves for 28m. x 100m.	22 & 22a

INTRODUCTION:

A one ton sample of Adit J14 - Main, was air dried and the following work was done:

1. A size analysis at 1", 1/2", 1/4", 8m., 28m. and 100m.

2. A proximate Analysis on all Size Fractions.

3. A float-sink analysis on all size fractions, except -100 mesh, at 1.30, 1.35, 1.40, 1.45, 1.50, 1.60, 1.70 and 1.80.

4. Ash, Volatile Matter and Free Swelling Index determinations on all specific gravity fractions.

5. Washability curves for all size fractions, except -100 mesh.

6. Washability curves for +100 mesh fraction of the raw sample by reconstituting the data in 5.

7. Froth Flotation tests on 28m. x 100m. and =100 m. fractions.

CONCLUSIONS AND RECOMMENDATIONS:

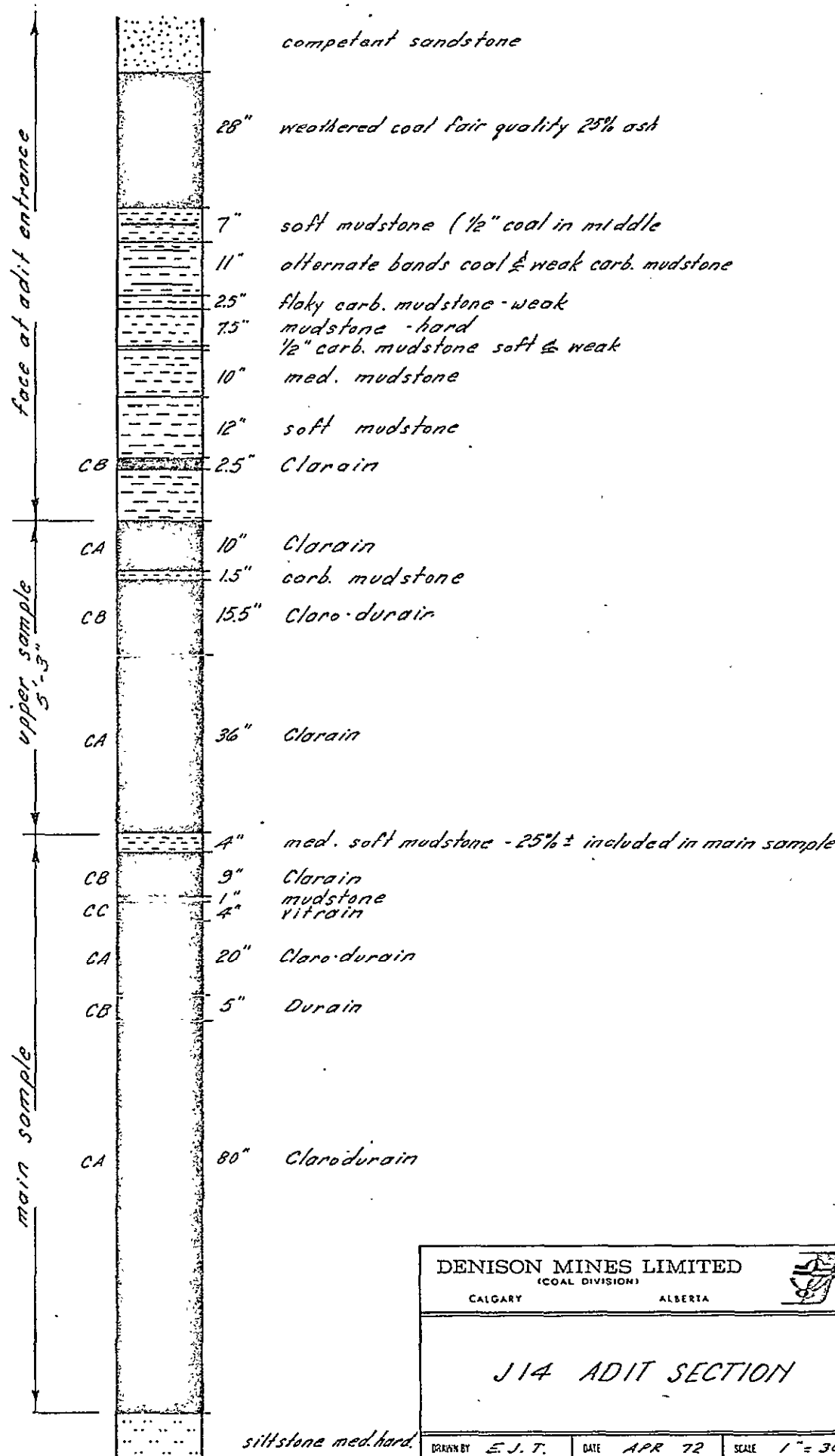
This coal is very easy to clean and has a high F.S.I. It should be considered for blending with some low ash and low F.S.I. coals.

Respectfully submitted,

CYCLONE ENGINEERING SALES LTD.

Per: _____

R.S. Sehgal, P. Eng.,
Laboratory Manager.


competent sandstone
28" weathered coal fair quality 25% ash
7" soft mudstone (½" coal in middle
11" alternate bands coal & weak carb. mudstone
2.5" flaky carb. mudstone - weak
7.5" mudstone - hard
½" carb. mudstone soft & weak
10" med. mudstone
12" soft mudstone
CB 2.5" Clarain
face of adit entrance
CA 10" Clarain
1.5" carb. mudstone
CB 15.5" Claro-durain
upper sample 5'-3"
CA 36" Clarain
4" med. soft mudstone - 25%± included in main sample
CB 9" Clarain
1" mudstone
CC 4" vitrain
CA 20" Claro-durain
CB 5" Durain
main sample
CA 80" Claro durain
siltstone med. hard
DENISON MINES LIMITED
(COAL DIVISION)
CALGARY ALBERTA
J14 ADIT SECTION
DRAWN BY E.J.T.
DATE APR 72
SCALE 1" = 30"
APPROVED BY
DRAWING NO ONTT 72-0315-R01

T A B L E 1 - ADIT J14 - MAIN

Classification by Rank

Ash	10.42%
Volatile Matter	21.91%
Residual Moisture	1.15%
Fixed Carbon	68.06%
F.S.I.	8
B.T.U./lb.	13,830
Sulphur	0.42%
Rank	mvb

T A B L E 2 - ADIT J14 -MAIN

Analysis of Size Fractions

Size Fraction	Wt.%	Ash%	V.M.%	R.M.%	F.C.%	S.%	F.S.I.
+1"	15.38	16.33	20.59	0.97	72.11	0.39	6
1" x 1/2"	11.02	13.88	20.70	1.06	64.36	0.41	6
1/2" x 1/4"	11.72	11.75	20.99	1.08	66.18	0.41	6½
1/4" x 8m.	14.24	10.00	21.83	1.18	66.99	0.39	8½
8m. x 28m.	26.06	6.58	22.98	1.28	69.16	0.40	9
28m. x 100m.	14.34	7.18	22.88	1.15	68.79	0.40	9
-100 mesh	7.24	11.47	22.42	1.24	64.87	0.62	8½
Total	100.00	10.42	21.91	1.15	68.06	0.42	8

TABLE 3 - ADIT J4 - MAIN

Weight % and Ash % Disbribution vs. Size and Specific Gravity
(Figures in brackets show the ash content of individual fractions).

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80		Total
+1"	3.05 (4.28)	3.91 (6.31)	1.96 (11.24)	1.52 (15.23)	1.40 (19.36)	1.22 (23.62)	0.80 (33.61)	0.67 (41.41)	0.85 (72.55)	15.38 (16.63)
1" x 1/2"	2.99 (3.67)	2.99 (5.57)	1.56 (10.71)	0.79 (14.96)	0.77 (19.47)	0.76 (22.95)	0.43 (33.70)	0.25 (40.67)	0.48 (71.49)	11.02 (13.34)
1/2" x 1/4"	3.91 (3.43)	3.25 (5.47)	1.89 (10.64)	0.68 (14.87)	0.62 (19.54)	0.51 (24.72)	0.30 (34.01)	0.19 (42.53)	0.37 (75.60)	11.72 (11.26)
1/4" x 8m.	6.70 (2.84)	3.53 (4.96)	1.39 (10.68)	0.82 (15.23)	0.45 (20.41)	0.42 (26.61)	0.26 (34.54)	0.20 (43.78)	0.47 (71.96)	14.24 (9.51)
8m. x 28m.	17.81 (2.41)	3.59 (6.26)	1.59 (10.66)	0.87 (15.54)	0.51 (20.89)	0.53 (28.64)	0.32 (36.78)	0.19 (45.02)	0.65 (68.83)	26.06 (7.17)
28m. x 100m.	9.16 (2.12)	2.37 (5.05)	0.97 (9.98)	0.49 (16.64)	0.25 (20.98)	0.30 (29.10)	0.21 (37.52)	0.10 (44.76)	0.49 (67.42)	14.34 (7.60)
Total	43.62 (2.72)	19.64 (5.65)	9.36 (10.72)	5.17 (15.33)	4.00 (19.82)	3.74 (25.12)	2.32 (34.57)	1.60 (42.36)	3.31 (71.16)	92.76 (10.41)
- 100 mesh	This fraction forms 7.24% of the total sample and has an ash content of 11.47%, thus giving a total sample ash value of 10.49%.									

T A B L E 4 - ADIT J14 - MAIN

Weight % and Volatile Matter % Distribution vs. Size and Specific Gravity

(Figures in brackets show the V.M. Content of individual fractions)

Size \ Sp. Gr.	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80		Total
+1"	3.05 (22.54)	3.91 (20.87)	1.96 (20.04)	1.52 (20.64)	1.40 (22.29)	1.22 (22.91)	0.80 (19.15)	0.67 (16.31)	0.85 (10.25)	15.38 (20.51)
1" x 1/2"	2.99 (22.90)	2.99 (21.10)	1.56 (20.25)	0.79 (20.16)	0.77 (21.32)	0.76 (22.68)	0.43 (19.39)	0.25 (17.33)	0.48 (10.81)	11.02 (20.93)
1/2" x 1/4"	3.91 (23.32)	3.25 (20.76)	1.89 (19.75)	0.68 (19.54)	0.62 (18.63)	0.51 (18.95)	0.30 (17.88)	0.19 (16.11)	0.37 (10.02)	11.72 (20.71)
1/4" x 8m.	6.70 (23.63)	3.53 (21.43)	1.39 (20.43)	0.82 (19.76)	0.45 (19.07)	0.42 (18.68)	0.26 (17.24)	0.20 (16.33)	0.47 (12.68)	14.24 (21.68)
8m. x 28m.	17.81 (23.81)	3.59 (20.49)	1.59 (18.95)	0.87 (18.35)	0.51 (18.31)	0.53 (17.93)	0.32 (16.71)	0.19 (16.60)	0.65 (14.90)	26.06 (22.28)
28m. x 100m.	9.16 (23.99)	2.37 (21.31)	0.97 (20.57)	0.49 (19.82)	0.25 (19.02)	0.30 (18.58)	0.21 (17.77)	0.10 (17.92)	0.49 (19.89)	14.34 (22.70)
Total	43.62 (23.62)	19.64 (20.97)	9.36 (19.94)	5.17 (19.82)	4.00 (20.46)	3.74 (20.80)	2.32 (18.35)	1.60 (16.58)	3.31 (12.99)	92.76 (21.60)
- 100 mesh	This fraction forms 7.24% of the total sample and has a volatile matter content of 22.42%, thus giving a total sample volatile matter content of 21.66%.									

TABLE 5 - ADIT J14 - MAIN

Cumulative Weight % and Cumulative F.S.I. vs. Size and Specific Gravity

(Figures in brackets show the cumulative F.S.I. of cumulative fractions)

Size \ Sp. Gr.	- 1.30	-1. 35	- 1.40	- 1.45	- 1.50	- 1.60	- 1.70	- 1.80	Raw
+1"	3.05 (8½)	6.96 (8)	8.92 (8)	10.44 (7½)	11.84 (7)	13.06 (7)	13.86 (6½)	14.53 (6½)	15.38 (6)
1" x 1/2"	2.99 (8½)	5.98 (7½)	7.54 (7½)	8.33 (7)	9.10 (7)	9.86 (6½)	10.29 (6½)	10.54 (6½)	11.02 (6)
1/2" x 1/4"	3.91 (9)	7.16 (8½)	9.05 (8)	9.73 (8)	10.35 (7½)	10.86 (7½)	11.16 (7)	11.35 (7)	11.72 (6½)
1/4" x 8m.	6.70 (9+)	10.23 (9+)	11.62 (9+)	12.44 (9+)	12.89 (9)	13.31 (9)	13.57 (9)	13.77 (9)	14.24 (8½)
8m. x 28m.	17.81 (9+)	21.40 (9+)	22.99 (9+)	23.86 (9+)	24.37 (9+)	24.90 (9+)	25.22 (9+)	25.41 (9+)	26.06 (9)
28m. x 100m.	9.16 (9+)	11.53 (9+)	12.50 (9+)	12.99 (9+)	13.24 (9+)	13.54 (9+)	13.75 (9+)	13.85 (9+)	14.34 (9)
Total	43.62	63.26	72.62	77.79	81.79	85.53	87.85	89.45	92.76
-100 m.	This fraction weighs 7.24% of the total sample and has a F.S.I. of 8½								

T A B L E 6 - ADIT J14 - MAIN

Washability Data: +100 Mesh: 92.76% of the Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	47.03	2.72	47.03	2.72	100.00	10.41	23.51	2.72
1.30 - 1.35	21.17	5.65	68.20	3.63	52.97	17.24	57.62	5.65
1.35 - 1.40	10.09	10.72	78.29	4.54	31.80	24.96	73.24	10.72
1.40 - 1.45	5.57	15.33	83.86	5.26	21.71	31.58	81.08	15.33
1.45 - 1.50	4.32	19.82	88.18	5.97	16.14	37.19	86.02	19.82
1.50 - 1.60	4.03	25.12	92.21	6.81	11.82	43.53	90.19	25.12
1.60 - 1.70	2.50	34.57	94.71	7.54	7.79	53.06	93.46	34.57
1.70 - 1.80	1.72	42.36	96.43	8.16	5.29	61.80	95.57	42.36
+ 1.80	3.57	71.16	100.00	10.41	3.57	71.16	98.22	71.16
Ttoal	100.00	10.41						

FIGURE: 1

COMPANY : Denison Mines Ltd.

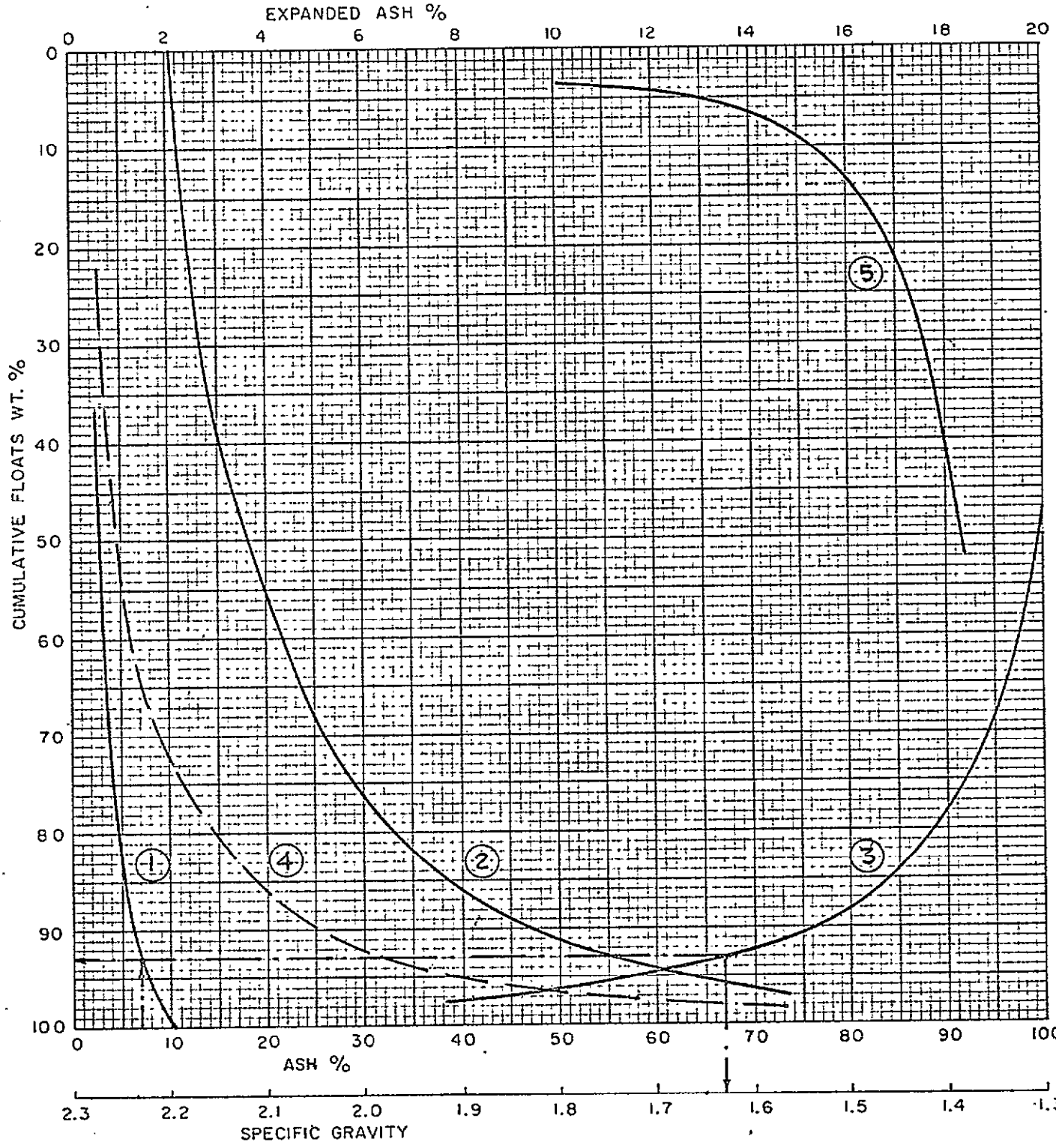
SAMPLE : ADIT J14 - MAIN

SIZE : +100 Mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 1a

COMPANY : Denison Mines Ltd.

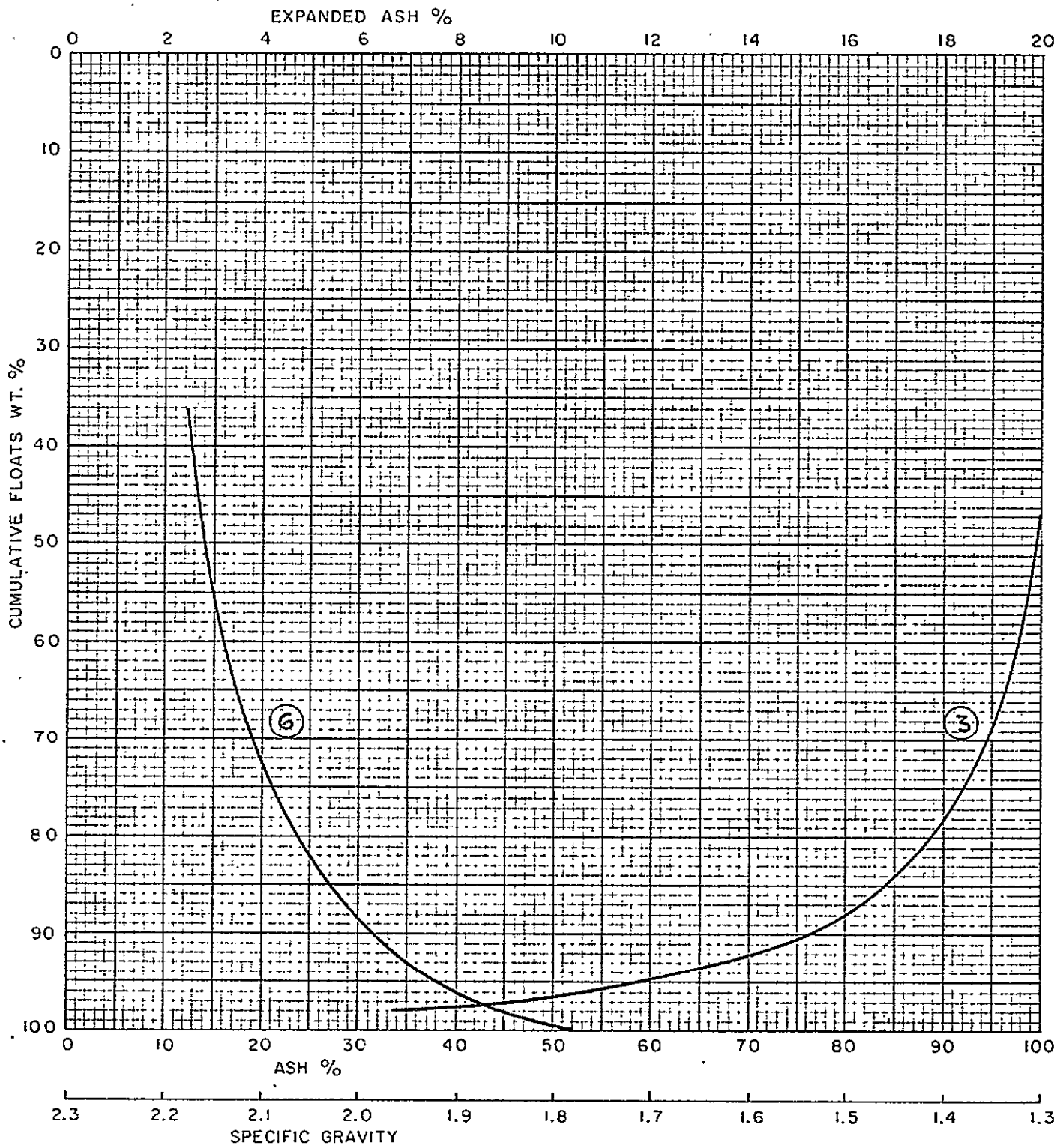
SAMPLE : ADIT J14 - MAIN

SIZE : +100 Mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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EDMONTON, ALBERTA, CANADA

TABLE 7 - ADIT J14 - MAIN

Cumulative Volatile Matter: +100M.: 92.76% of the Sample

(Reconstituted from Size Fractions)

Specific Gravity	Fractional		Cumulative			
			Floats		Sinks	
	Wt.%	V.M.%	Wt.%	V.M.%	Wt.%	V.M.%
- 1.30	47.03	23.62	47.03	23.62	100.00	21.60
1.30 - 1.35	21.17	20.97	68.20	22.80	52.97	19.79
1.35 - 1.40	10.09	19.94	78.29	22.43	31.80	19.01
1.40 - 1.45	5.57	19.82	83.86	22.26	21.71	18.58
1.45 - 1.50	4.32	20.46	88.18	22.17	16.14	18.15
1.50 - 1.60	4.03	20.80	92.21	22.11	11.82	17.31
1.60 - 1.70	2.50	18.35	94.71	22.00	7.79	15.50
1.70 - 1.80	1.72	16.58	96.43	21.91	5.29	14.16
+ 1.80	3.57	12.99	100.00	21.60	3.57	12.99
Total	100.00	12.60				

TABLE 8 - ADIT J14 - MAIN

7% Ash of Clean Coal

Yield	93.00%
Floats Gravity	1.63
Near Gravity Material	6.00%
Ash	7.00%
Volatile Matter	22.05%
Residual Moisture	1.02%
Fixed Carbon	69.93%
F.S.I.	9

TABLE 9 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

+1" : 15.38% of the Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	19.83	4.28	22.54	19.83	8½
1.30 - 1.35	25.42	6.31	20.87	45.25	8
1.35 - 1.40	12.73	11.24	20.04	57.98	8
1.40 - 1.45	9.89	15.23	20.64	67.87	7½
1.45 - 1.50	9.09	19.36	22.29	76.96	7
1.50 - 1.60	7.91	23.62	22.91	84.87	7
1.60 - 1.70	5.18	33.61	19.15	90.05	6½
1.70 - 1.80	4.34	41.41	16.31	94.39	6½
+ 1.80	5.61	72.55	10.25	100.00	6
Total	100.00	16.63	20.51		

TABLE 10 - ADIT J14 - MAIN

Washability Data: +1"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	19.83	4.28	19.83	4.28	100.00	16.63	9.91	4.28
1.30 - 1.35	25.42	6.31	45.25	5.42	80.17	19.68	32.54	6.31
1.35 - 1.40	12.73	11.24	57.98	6.70	54.75	25.89	51.62	11.24
1.40 - 1.45	9.89	15.23	67.87	7.94	42.02	30.33	62.92	15.23
1.45 - 1.50	9.09	19.36	76.96	9.29	32.13	34.97	72.42	19.36
1.50 - 1.60	7.91	23.62	84.87	10.63	23.04	41.13	80.91	23.62
1.60 - 1.70	5.18	33.61	90.05	11.95	15.13	50.29	87.46	33.61
1.70 - 1.80	4.34	41.41	94.39	13.30	9.95	58.97	92.22	41.41
+ 1.80	5.61	72.55	100.00	16.63	5.61	72.55	97.20	72.55
Total	100.00	16.63						

FIGURE : 2

COMPANY : Denison Mines Ltd.

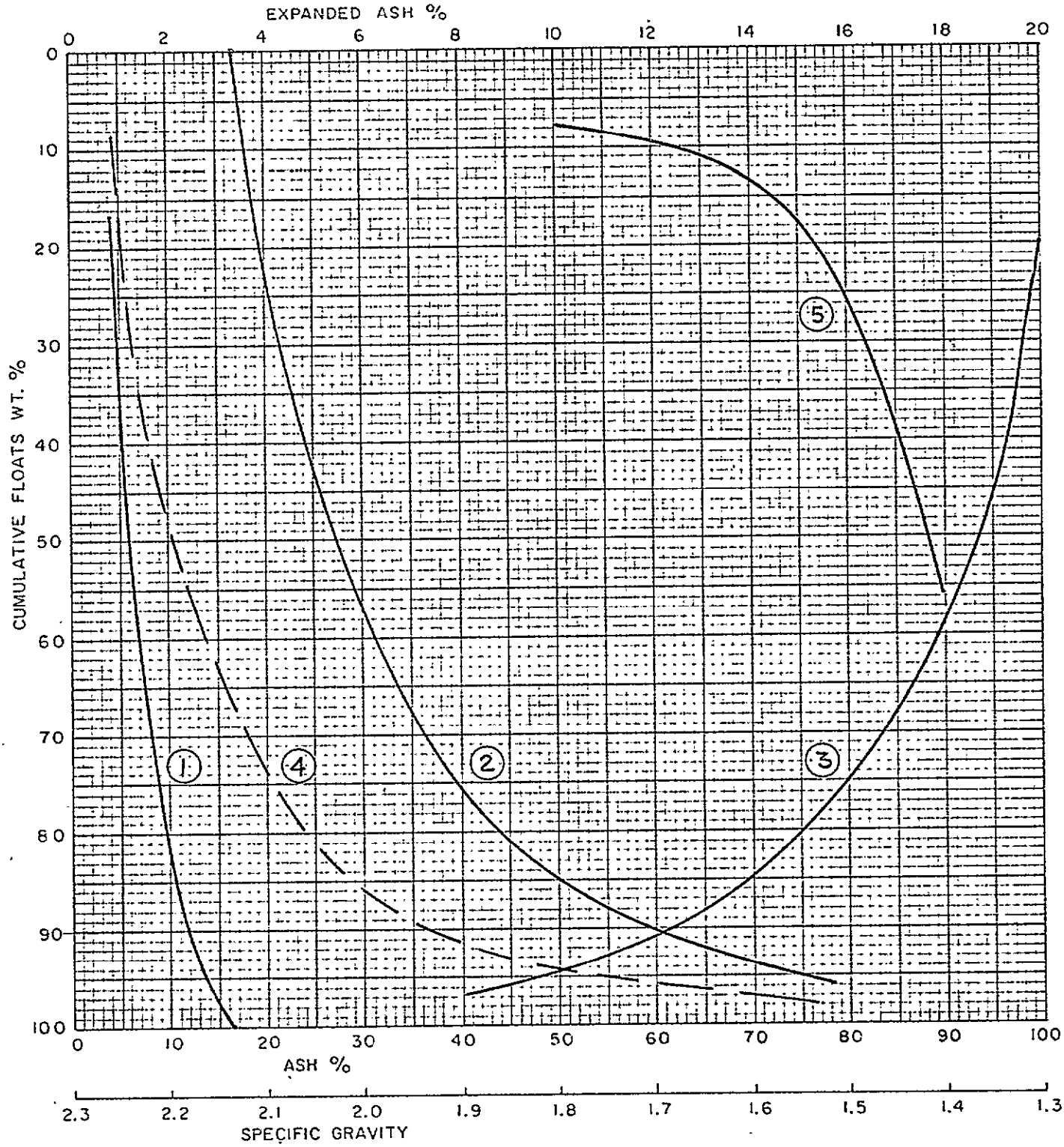
SAMPLE : ADIT J14 - MAIN

SIZE : +¼"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 2a

COMPANY : Denison Mines Ltd.

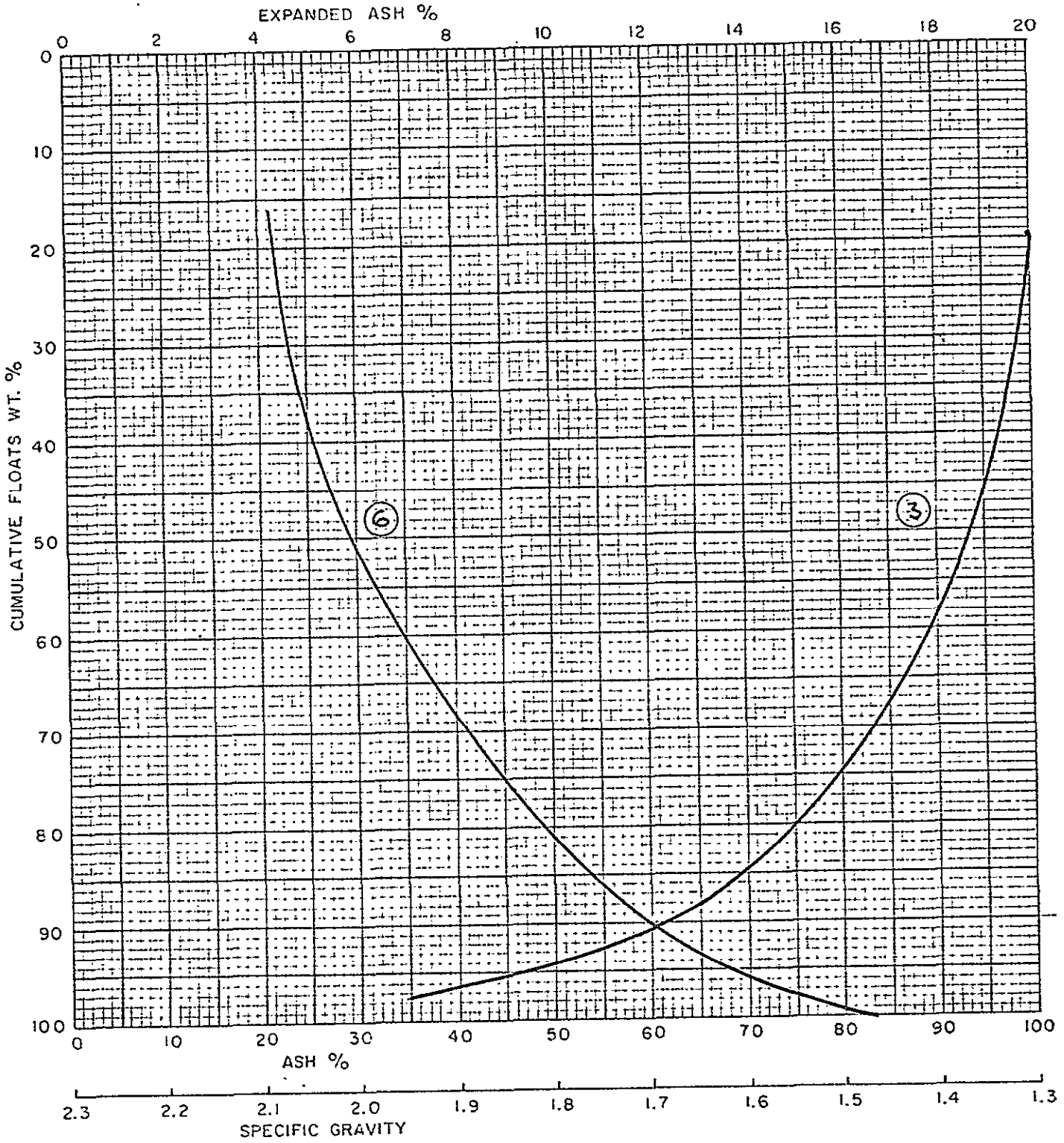
SAMPLE : ADIT J14 - MAIN

SIZE : +1"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



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CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 11 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

1" x 1/2" : 11.02% of the Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	27.19	3.67	22.90	27.19	8½
1.30 - 1.35	27.17	5.57	21.10	54.36	7½
1.35 - 1.40	14.19	10.71	20.25	68.55	7½
1.40 - 1.45	7.15	14.96	20.16	75.70	7
1.45 - 1.50	6.99	19.47	21.32	82.69	7
1.50 - 1.60	6.89	22.95	22.68	89.58	6½
1.60 - 1.70	3.87	33.70	19.39	93.45	6½
1.70 - 1.80	2.23	40.67	17.33	95.68	6½
+ 1.80	4.32	71.49	10.81	100.00	6
Total	100.00	13.34	20.93		

T A B L E 12 - ADIT J14 - MAIN

Washability data: 1" x 1/2"

Specific Gravity	Fractional		Cumulative					
			Floats		Sinks		Elementary Ash	
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	27.19	3.67	27.19	3.67	100.00	13.34	13.59	3.67
1.30 - 1.35	27.17	5.57	54.36	4.62	72.81	16.95	40.78	5.57
1.35 - 1.40	14.19	10.71	68.55	5.88	45.64	23.73	61.45	10.71
1.40 - 1.45	7.15	14.96	75.70	6.74	31.45	29.61	72.13	14.96
1.45 - 1.50	6.99	19.47	82.69	7.81	24.30	33.92	79.20	19.47
1.50 - 1.60	6.89	22.95	89.58	8.98	17.31	39.75	86.13	22.95
1.60 - 1.70	3.87	33.70	93.45	10.00	10.42	50.86	91.52	33.70
1.70 - 1.80	2.23	40.67	95.68	10.72	6.55	60.99	94.56	40.67
+ 1.80	4.32	71.49	100.00	13.34	4.32	71.49	97.84	71.49
Total	100.00	13.34						

FIGURE : 3

COMPANY : Denison Mines Ltd.

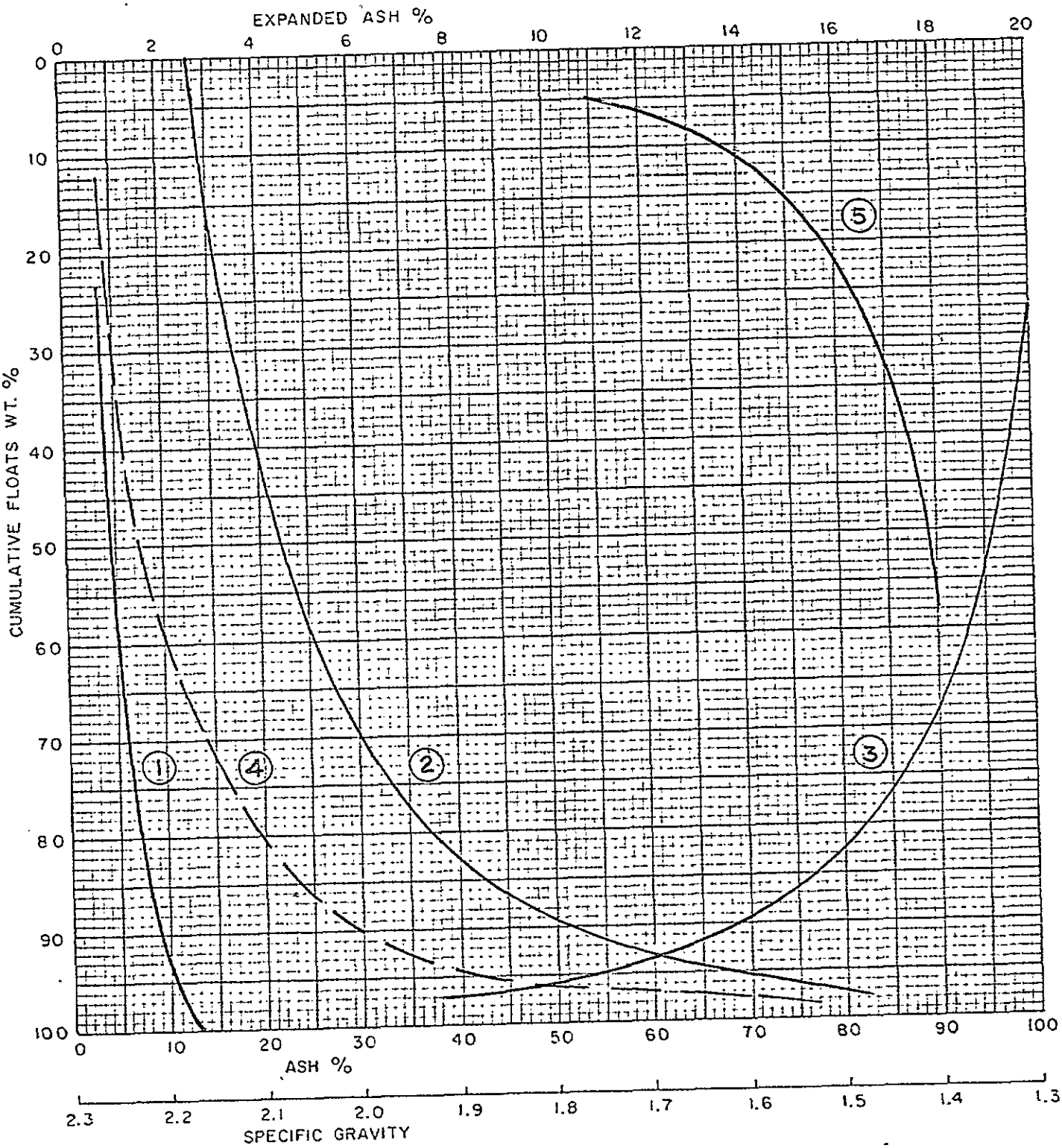
SAMPLE : ADIT J14 - MAIN

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 3a

COMPANY : Denison Mines Ltd.,

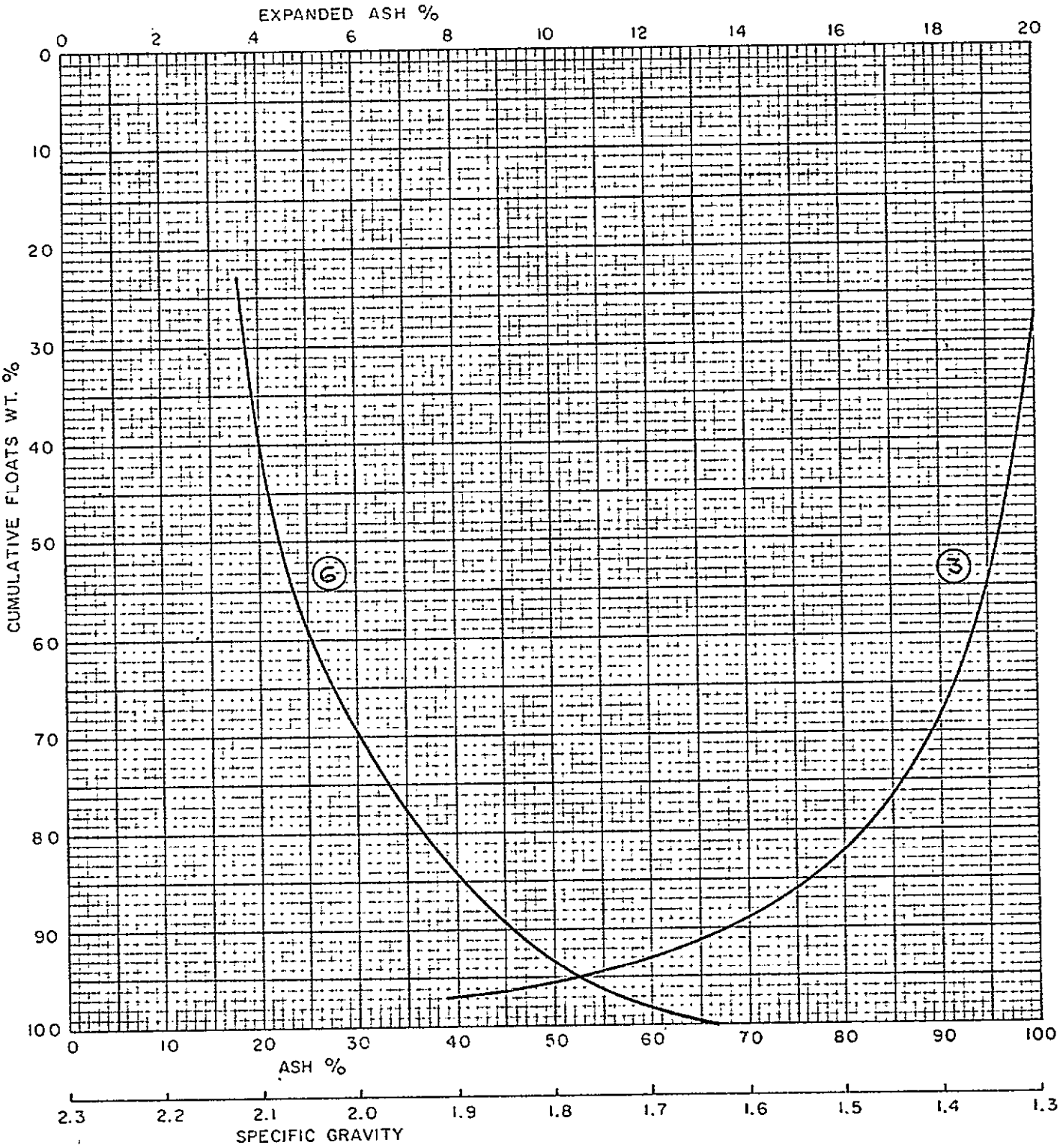
SAMPLE : ADIT J14 - MAIN

SIZE : 1" x 1/2"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 13 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

1/2" x 1/4" : 11.72% of Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	33.39	3.43	23.32	33.39	9
1.30 - 1.35	27.75	5.47	20.76	61.14	8½
1.35 - 1.40	16.13	10.64	19.75	77.27	8
1.40 - 1.45	5.81	14.87	19.54	83.08	8
1.45 - 1.50	5.31	19.54	18.63	88.39	7½
1.50 - 1.60	4.31	24.72	18.95	92.70	7½
1.60 - 1.70	2.53	34.01	17.88	95.23	7
1.70 - 1.80	1.66	42.53	16.11	96.89	7
+ 1.80	3.11	75.60	10.02	100.00	6½
Total	100.00	11.26	20.71		

T A B L E 14 - ADIT J14 - MAIN

Washability Data: 1/2" x 1/4"

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	33.39	3.43	33.39	3.43	100.00	11.26	16.69	3.43
1.30 - 1.35	27.75	5.47	61.14	4.36	66.61	15.19	47.27	5.47
1.35 - 1.40	16.13	10.64	77.27	5.68	38.86	22.13	69.20	10.64
1.40 - 1.45	5.81	14.87	83.08	6.31	22.73	30.29	80.18	14.87
1.45 - 1.50	5.31	19.54	88.39	7.11	16.92	35.58	85.73	19.54
1.50 - 1.60	4.31	24.72	92.70	7.92	11.61	42.92	90.55	24.72
1.60 - 1.70	2.53	34.01	95.23	8.62	7.30	53.67	93.96	34.01
1.70 - 1.80	1.66	42.53	96.89	9.20	4.77	64.09	96.06	42.53
+ 1.80	3.11	75.60	100.00	11.26	3.11	75.60	98.45	75.60
Total	100.00	11.26						

FIGURE: 4A

COMPANY : Denison Mines Ltd.

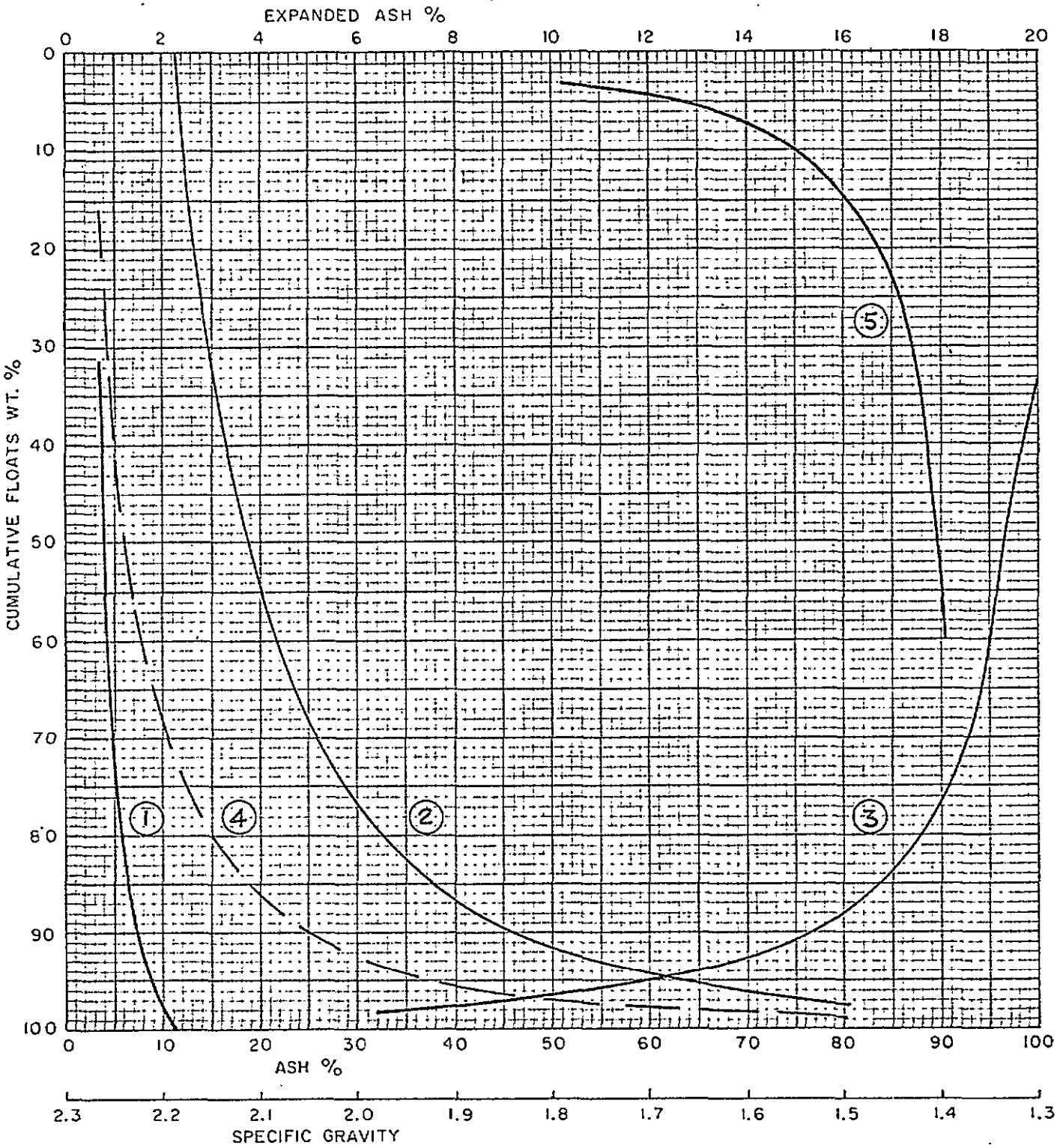
SAMPLE : ADIT J14 - MAIN

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 4a

COMPANY : Denison Mines Ltd.

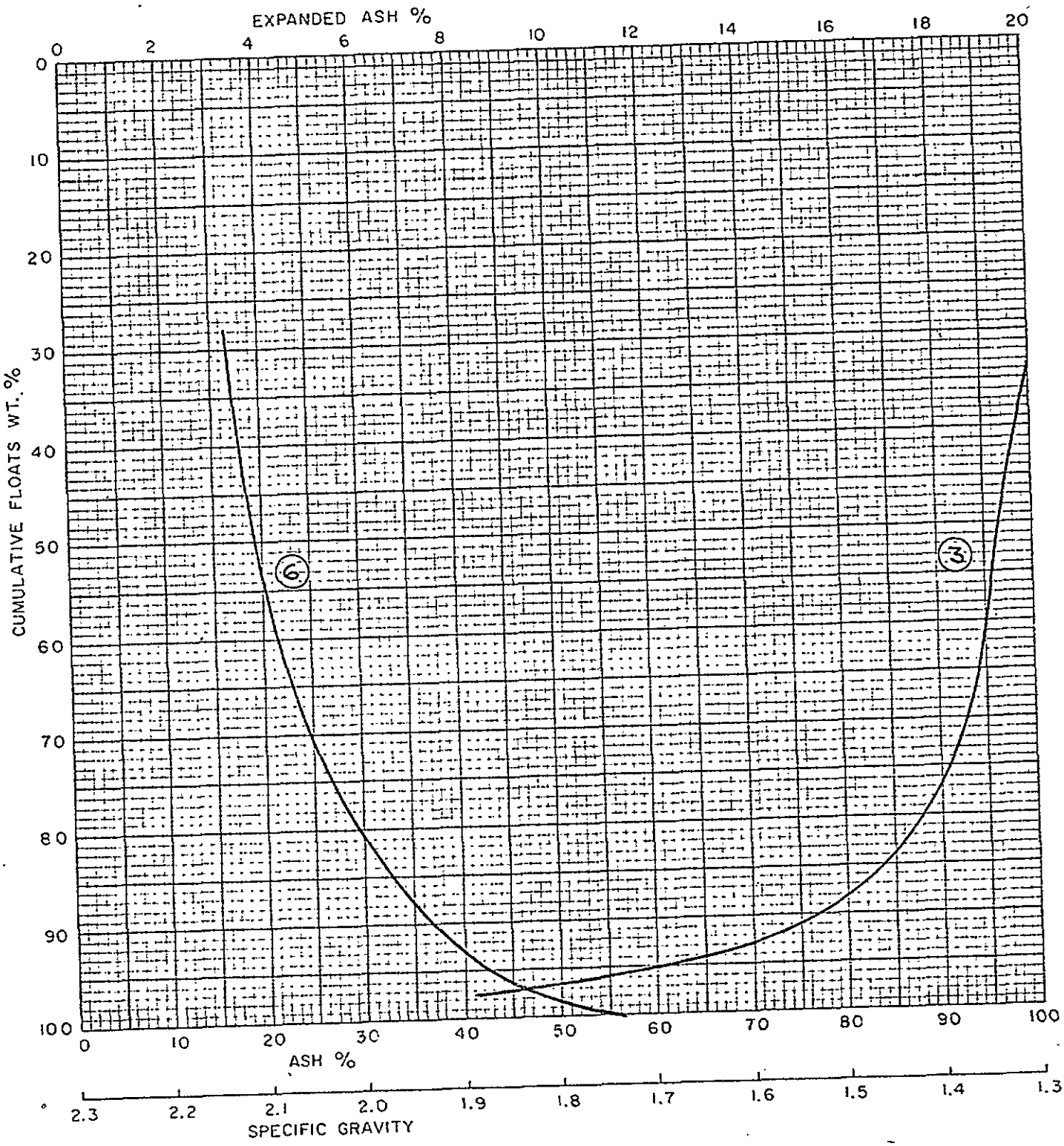
SAMPLE : ADIT J14- MAIN

SIZE : 1/2" x 1/4"

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 15 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

1/4" x 8m: 14.24% of the Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	47.07	2.84	23.63	47.07	9+
1.30 - 1.35	24.82	4.96	21.43	71.89	9+
1.35 - 1.40	9.79	10.68	20.43	81.68	9+
1.40 - 1.45	5.74	15.23	19.76	87.42	9+
1.45 - 1.50	3.19	20.41	19.07	90.61	9
1.50 - 1.60	2.96	26.61	18.68	93.57	9
1.60 - 1.70	1.73	34.54	17.24	95.30	9
1.70 - 1.80	1.40	43.78	16.33	96.70	9
+ 1.80	3.30	71.96	12.68	100.00	8½
Total	100.00	9.51	21.68		

T A B L E 16 - ADIT J14 - MAIN

Washability Data: 1/4" x 8 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	47.07	2.84	47.07	2.84	100.00	9.51	23.53	2.84
1.30 - 1.35	24.82	4.96	71.89	3.57	52.93	15.44	59.48	4.96
1.35 - 1.40	9.79	10.68	81.68	4.42	28.11	24.70	76.79	10.68
1.40 - 1.45	5.74	15.23	87.42	5.13	18.32	32.19	84.55	15.23
1.45 - 1.50	3.19	20.41	90.61	5.67	12.58	39.94	89.01	20.41
1.50 - 1.60	2.96	26.61	93.57	6.33	9.39	46.57	92.09	26.61
1.60 - 1.70	1.73	34.54	95.30	6.85	6.43	55.76	94.44	34.54
1.70 - 1.80	1.40	43.78	96.70	7.38	4.70	63.57	96.00	43.78
+ 1.80	3.30	71.96	100.00	9.51	3.30	71.96	98.35	71.96
Total	100.00	9.51						

FIGURE: 5

COMPANY : Denison Mines Ltd.

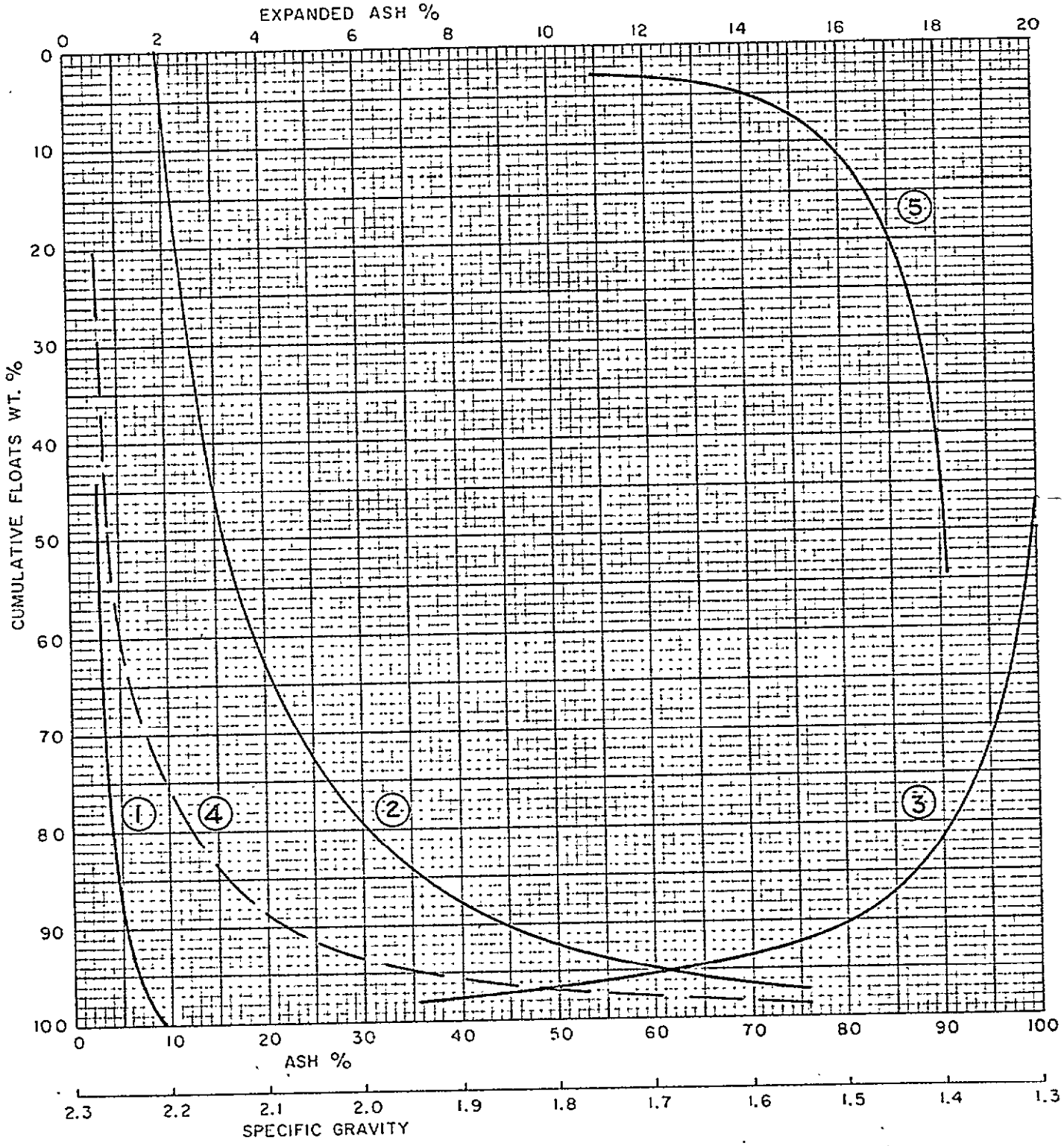
SAMPLE : ADIT J14 - MAIN

SIZE : 1/4" x 8m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 5a

COMPANY : Denison Mines Ltd.

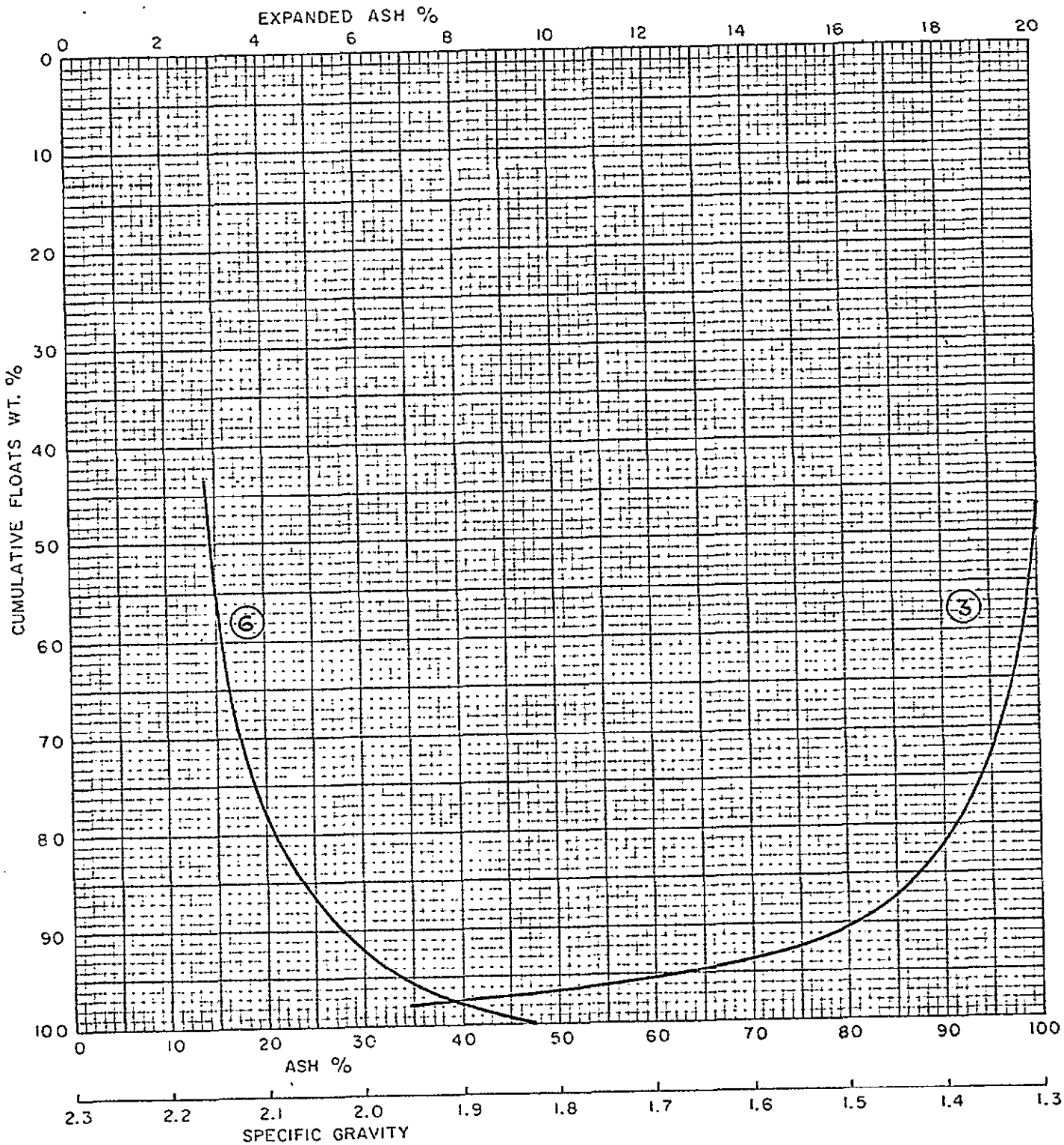
SAMPLE : ADIT J14 - MAIN

SIZE : 1/4" x 8m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 17 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

8m. x 28m.: 26.06% of the Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	68.34	2.41	23.81	68.34	9+
1.30 - 1.35	13.77	6.26	20.49	82.11	9+
1.35 - 1.40	6.11	10.66	18.95	88.22	9+
1.40 - 1.45	3.33	15.54	18.35	91.55	9+
1.45 - 1.50	1.96	20.89	18.31	93.51	9+
1.50 - 1.60	2.03	28.64	17.93	95.54	9+
1.60 - 1.70	1.24	36.78	16.71	96.78	9+
1.70 - 1.80	0.72	45.02	16.60	97.50	9+
+ 1.80	2.50	68.83	14.90	100.00	9
Total	100.00	7.17	22.28		

T A B L E 18 - ADIT J14 - MAIN

Washability Data: 8m. x 28 m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	68.34	2.41	68.34	2.41	100.00	7.17	34.17	2.41
1.30 - 1.35	13.77	6.26	82.11	3.06	31.66	17.44	75.23	6.26
1.35 - 1.40	6.11	10.66	88.22	3.58	17.89	26.05	85.16	10.66
1.40 - 1.45	3.33	15.54	91.35	4.02	11.78	34.03	89.89	15.54
1.45 - 1.50	1.96	20.89	93.51	4.37	8.45	41.32	92.53	20.89
1.50 - 1.60	2.03	28.64	95.54	4.89	6.49	47.49	94.52	28.64
1.60 - 1.70	1.24	36.78	96.78	5.30	4.46	56.08	96.16	36.78
1.70 - 1.80	0.72	45.02	97.50	5.59	3.22	63.51	97.14	45.02
+ 1.80	2.50	68.83	100.00	7.17	2.50	68.83	98.75	68.83
Total	100.00	7.17						

FIGURE : 6

COMPANY : Denison Mines Ltd.

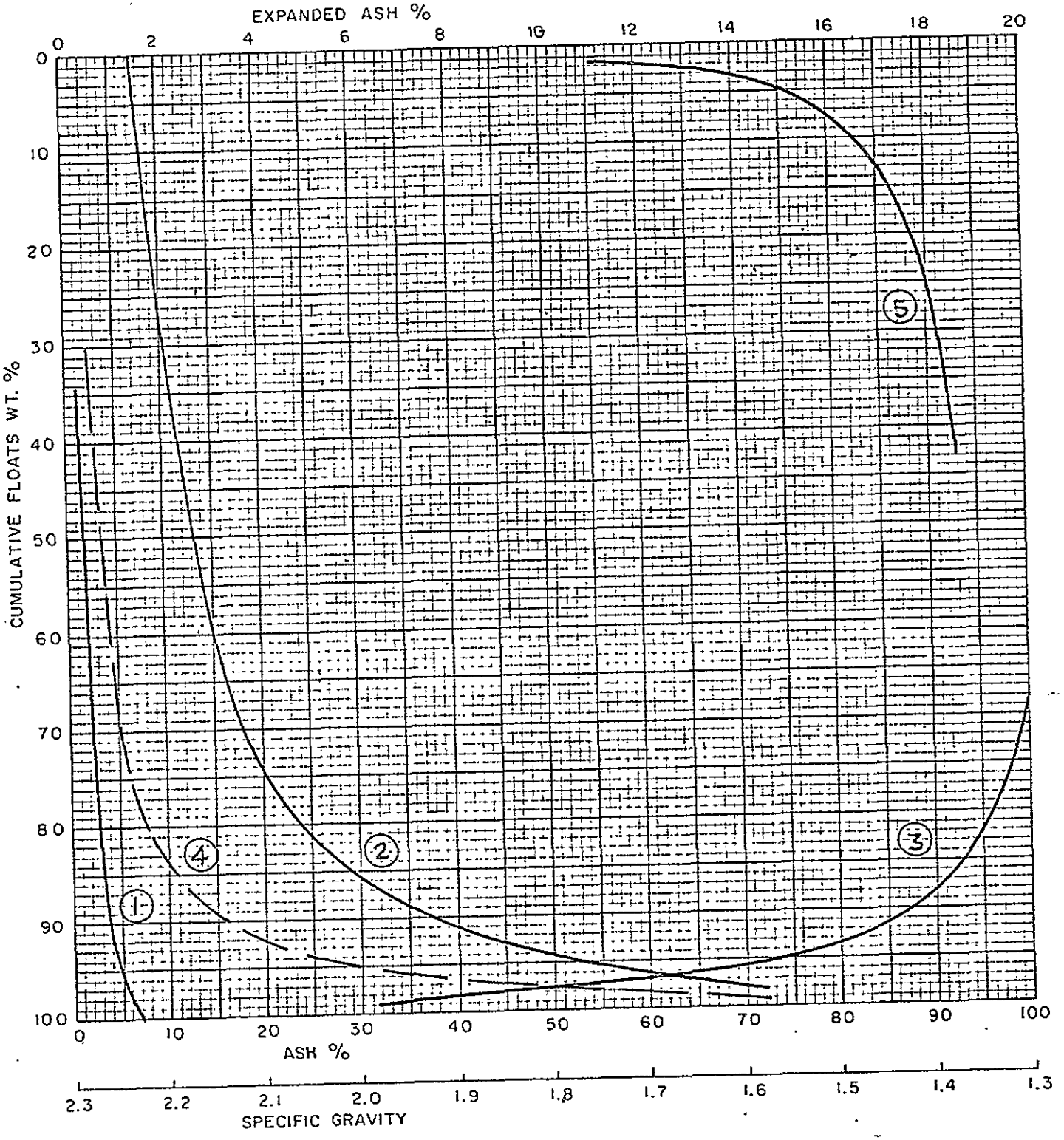
SAMPLE : ADIT J14 - MAIN

SIZE : 8m. x 28m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE: 6a

COMPANY : Denison Mines Ltd.

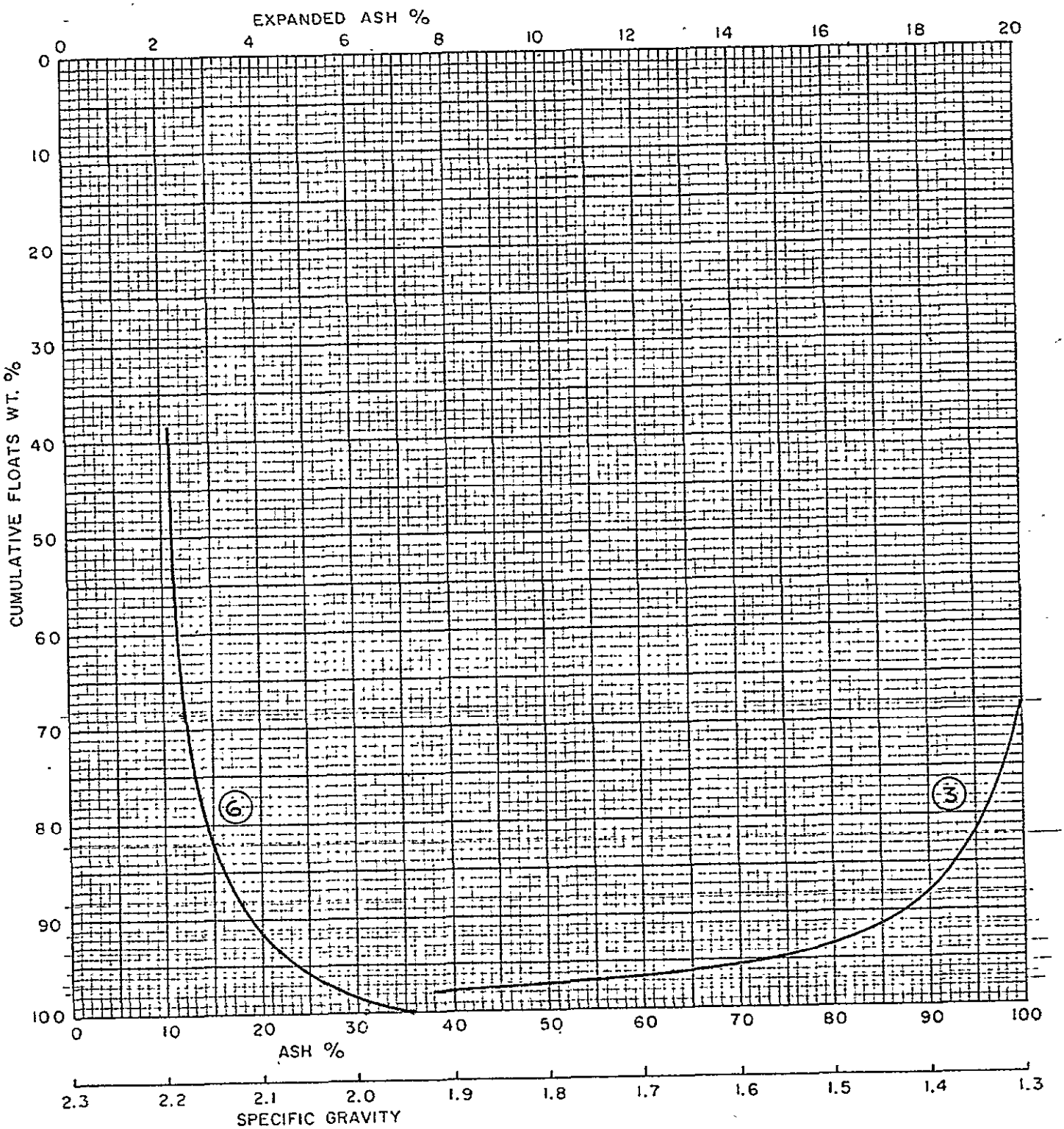
SAMPLE : ADIT J14 - MAIN

SIZE : 8m. x 28m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

T A B L E 19 - ADIT J14 - MAIN

Ash, Volatile Matter and Cumulative F.S.I.

28 x 100 m.: 14.34% of Sample

Specific Gravity	Wt.%	Ash%	V.M.%	Cum. Wt.%	Cum. F.S.I.
- 1.30	63.85	2.12	23.99	63.85	9+
1.30 - 1.35	16.56	5.05	21.31	80.41	9+
1.35 - 1.40	6.74	9.98	20.57	87.15	9+
1.40 - 1.45	3.41	16.64	19.82	90.56	9+
1.45 - 1.50	1.73	20.98	19.02	92.29	9+
1.50 - 1.60	2.11	29.10	18.58	94.40	9+
1.60 - 1.70	1.44	37.52	17.77	95.84	9+
1.70 - 1.80	0.68	44.76	17.92	96.52	9+
+ 1.80	3.48	67.42	19.89	100.00	9
Total	100.00	7.60	22.70		

T A B L E 20: ADIT J14 - MAIN

Washability Data: 28m. x 100m.

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%
- 1.30	63.85	2.12	63.85	2.12	100.00	7.60	31.92	2.12
1.30 - 1.35	16.56	5.05	80.41	2.72	36.15	17.27	72.13	5.05
1.35 - 1.40	6.74	9.98	87.15	3.28	19.59	27.61	83.78	9.98
1.40 - 1.45	3.41	16.64	90.56	3.79	12.85	36.85	88.86	16.64
1.45 - 1.50	1.73	20.98	92.29	4.11	9.44	44.15	91.42	20.98
1.60 - 1.60	2.11	29.10	94.40	4.67	7.71	49.35	93.35	29.10
1.60 - 1.70	1.44	37.52	95.84	5.17	5.60	56.98	95.12	37.52
1.70 - 1.80	0.68	44.76	96.52	5.44	4.16	63.72	96.18	44.76
+ 1.80	3.48	67.42	100.00	7.60	3.48	67.42	98.26	67.42
Total	100.00	7.60						

FIGURE : 7

COMPANY : Denison Mines Ltd.

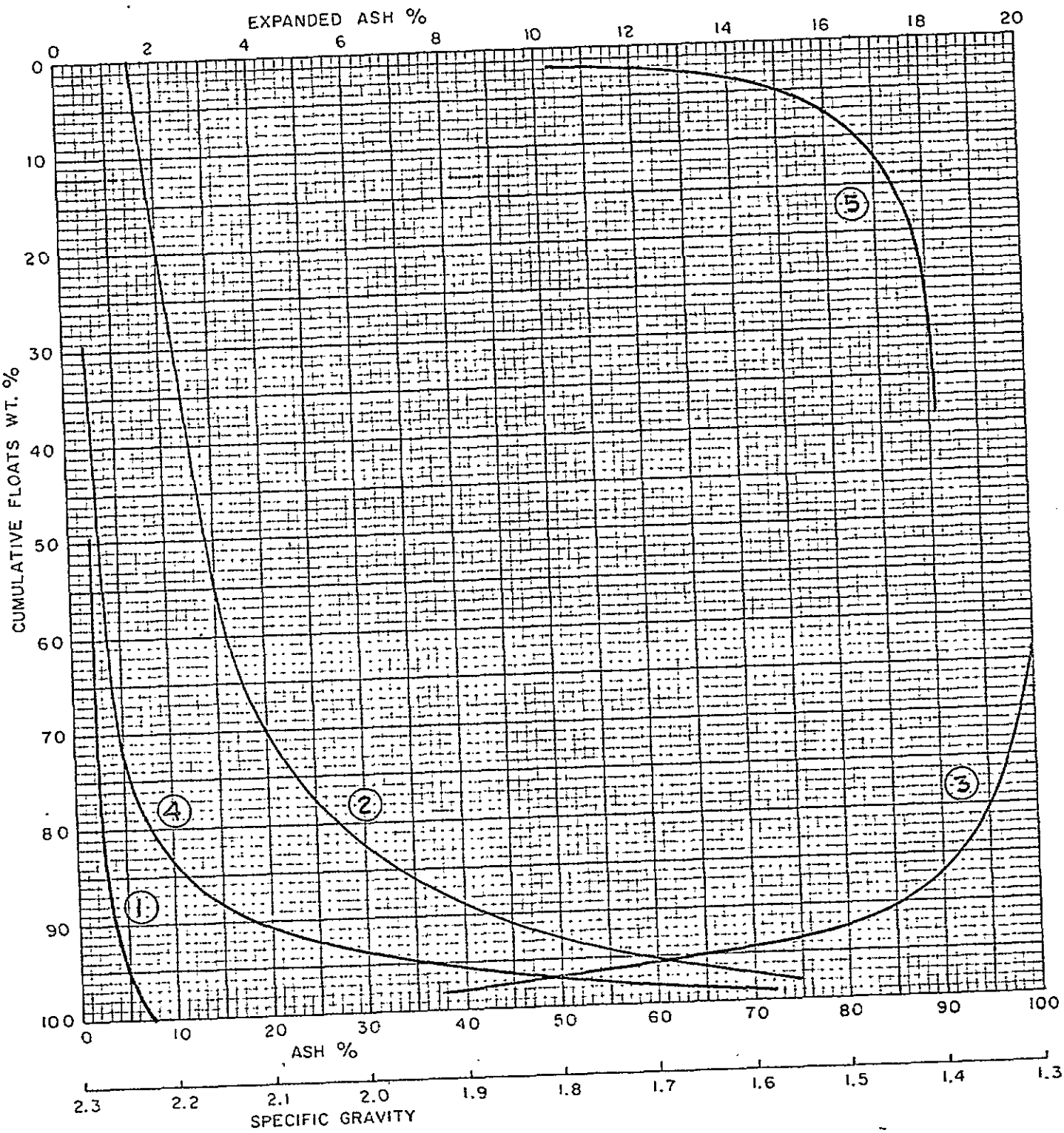
SAMPLE : ADIT J14 - MAIN

SIZE : 28m. x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : May 19, 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

FIGURE : 7a

COMPANY : Denison Mines Ltd.

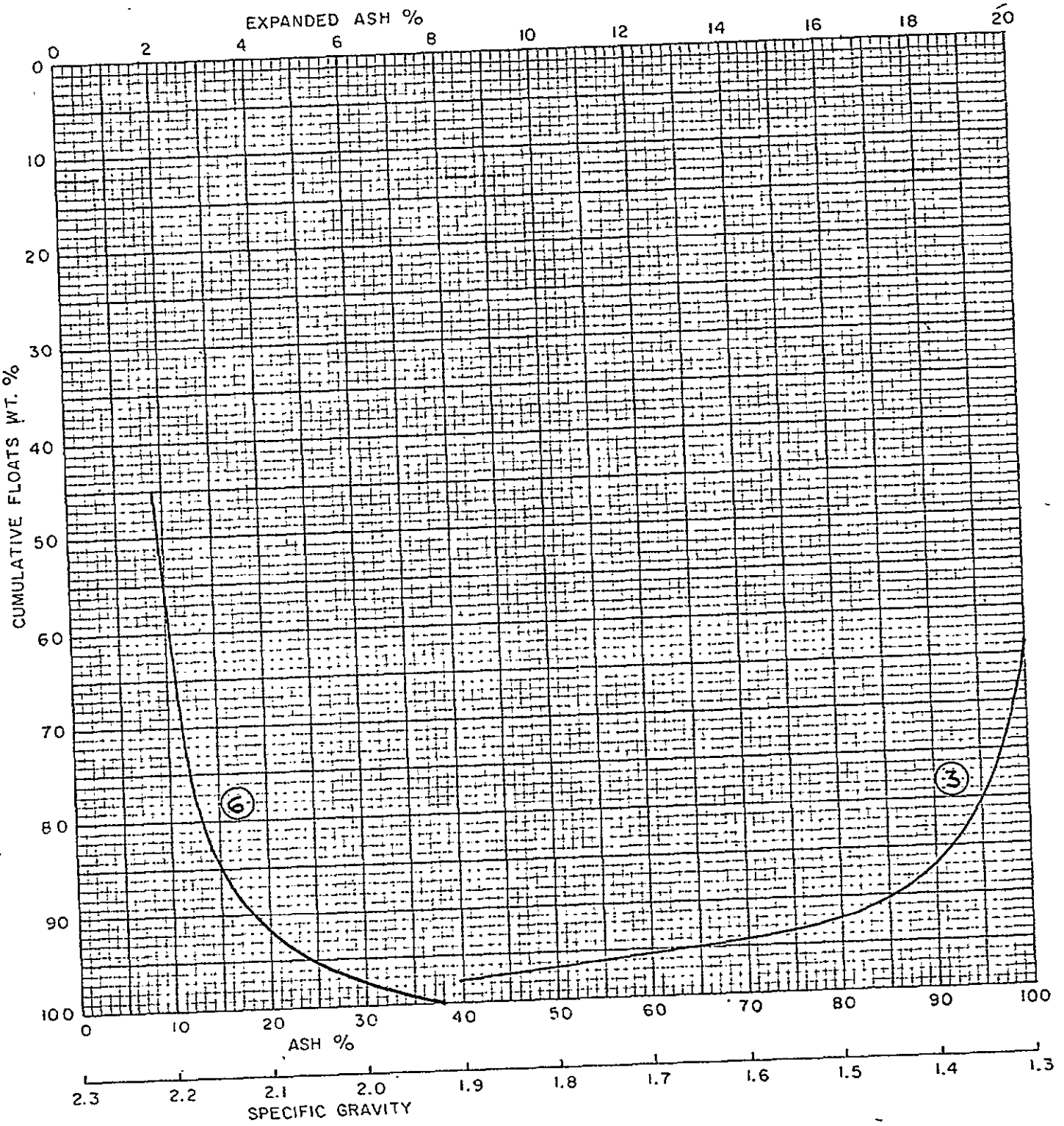
SAMPLE : ADIT J14 - MAIN

SIZE : 28m. x 100m.

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

DATE : May 19, 1972.

TABLE 21 - ADIT J14 - MAIN

28m. x 100m.: 14.34% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	93.62%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	5.49	43.90
Volatile Matter, %	22.43	20.02
Residual Moisture, %	0.98	1.21
Fixed Carbon, %	71.10	34.87
F.S.I.	9+	1½
Sulphur, %	0.37	1.28

TABLE 22 - ADIT J14 - MAIN

-100M.: 7.24% of Sample

Froth Flotation Test

Solids, by weight in Slurry	8%
Time of Flotation	1.5 minutes
Flotation Recovery	92.68%
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Ash, %	6.63	65.57
Volatile Matter, %	22.88	23.69
Residual Moisture, %	1.20	1.26
Fixed Carbon, %	69.29	9.48
F.S.I.	9	N.A.
Sulphur, %	0.53	2.74

REPORT ON

WASHABILITY CHARACTERISTICS AND CLEANING

OF COKING COAL

FOR

DENISON MINES LTD.

ADIT J14 MAIN

Submitted by

CYCLONE ENGINEERING SALES LTD.

Edmonton, Alberta, Canada.

ReportNo: RI-72.27

Job No.: S1-84

Date: June 3, 1972.

REPORT ON
WASHABILITY CHARACTERISTICS AND CLEANING
OF COKING COAL
FOR
DENISON MINES LTD.
ADIT J14 - MAIN

SUMMARY:

The data presented in this report refer to washability characteristics and the washing of a 5-ton sample from Adit J14, Main.

The system used for cleaning of this coal was a two-stage water cyclone circuit.

A yield of about 90% was obtained.

The analysis of clean coal is as follows.

	Air Dried Basis	As Shipped Basis
Surface Moisture	--	6.00%
Residual Moisture	0.99%	0.93%
Ash	7.67%	7.21%
Volatile Matter	22.98%	21.60%
Fixed Carbon	68.36%	64.26%
F.S.I.	8	8
B.T.U./lb.	14,310	13,450
Sulphur	0.38%	0.36%

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INTRODUCTION:

Approximately a 5-ton sample of the coal was used for washability studied and production of clean coal.

The coal was air dried, crushed to minus 3/4" and homogenized. A representative sample of about 500 lb. was taken for washability and flotation tests and the remaining portion was used for preliminary testing and production of the clean coal.

The washing circuit employed is shown in Figure 1, Section 2 of this report.

Respectfully submitted,
CYCLONE ENGINEERING SALES LTD.

Per: _____
R.S. Sehgal, P. Eng.,
Laboratory Manager.

SECTION 1

WASHABILITY DATA AND FLOTATION TESTS

ADIT J14 - MAIN

TABLE 1 - ADIT J14- MAIN

Head Sample Analysis

Ash	9.85%
Volatile Matter	22.21%
Residual Moisture	0.88%
Fixed Carbon	67.06%
F.S.I.	8
B.T.U./lb.	13,960
Sulphur	0.41%

TABLE 2 - ADIT J14 - MAIN

Size Analysis

	Weight %
3/4" x 28 Mesh	79.64
- 28 Mesh	20.36
Total	100.00

TABLE 3 - ADIT J14 - MAIN

Incremental Float-Sink Analysis of 3/4" x 28 Mesh

Sp. Gr.	Wt.%	Ash %	V.M.%	R.M.%	F.C.%
- 1.30	47.51	2.37	23.64	0.97	73.02
1.30 - 1.35	22.59	5.31	20.37	0.95	73.37
1.35 - 1.40	8.34	10.40	18.98	0.89	69.73
1.40 - 1.45	5.28	15.31	18.97	0.90	64.82
1.45 - 1.50	3.78	18.95	20.20	0.89	59.96
1.50 - 1.60	3.91	25.72	20.93	0.86	52.49
1.60 - 1.70	3.24	33.90	19.46	0.90	45.74
1.70 - 1.80	1.80	41.08	18.68	0.84	39.40
+ 1.80	3.55	67.20	14.10	0.83	17.87
Total	100.00	9.95	21.47	0.94	67.64

TABLE 4 - ADIT J14 - MAIN

Cumulative Float-Sink Analysis of 3/4" x 28m.

Sp. Gr.	Wt.%	Ash %	V.M.%	R.M.%	F.C.%	F.S.I.*
- 1.30	47.51	2.37	23.64	0.97	73.02	9+
- 1.35	70.10	3.32	22.59	0.96	73.13	9
- 1.40	78.44	4.07	22.20	0.96	72.77	8½
- 1.45	83.72	4.78	21.99	0.95	72.28	8½
- 1.50	87.50	5.39	21.92	0.95	71.74	8½
- 1.60	91.41	6.26	21.89	0.95	70.90	8½
- 1.70	94.65	7.21	21.80	0.94	70.05	8
- 1.80	96.45	7.84	21.74	0.94	69.48	8
Total	100.00	9.95	21.47	0.94	67.64	7½

* F.S.I. by actual determination.

T A B L E 5 - ADIT j14 - MAIN

Washability Data for 3/4" x 28 Mesh

Specific Gravity	Fractional		Cumulative				Elementary Ash	
			Floats		Sinks			
	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash%	Wt.%	Ash %
- 1.30	47.51	2.37	47.51	2.37	100.00	9.95	23.75	2.37
1.30 - 1.35	22.59	5.31	70.10	3.32	52.49	16.80	58.81	5.31
1.35 - 1.40	8.34	10.40	78.44	4.07	29.90	25.49	74.27	10.40
1.40 - 1.45	5.28	15.31	83.72	4.78	21.56	31.33	81.08	15.31
1.45 - 1.50	3.78	18.95	87.50	5.39	16.28	36.52	85.61	18.95
1.50 - 1.60	3.91	25.72	91.41	6.26	12.50	41.83	89.46	25.72
1.60 - 1.70	3.24	33.90	94.65	7.21	8.59	49.17	93.03	33.90
1.70 - 1.80	1.80	41.08	96.45	7.84	5.35	58.41	95.55	41.08
+ 1.80	3.55	67.20	100.00	9.95	3.55	67.20	98.23	67.20
Total	100.00	9.95						

FIGURE :

COMPANY : Denison Mines Ltd.

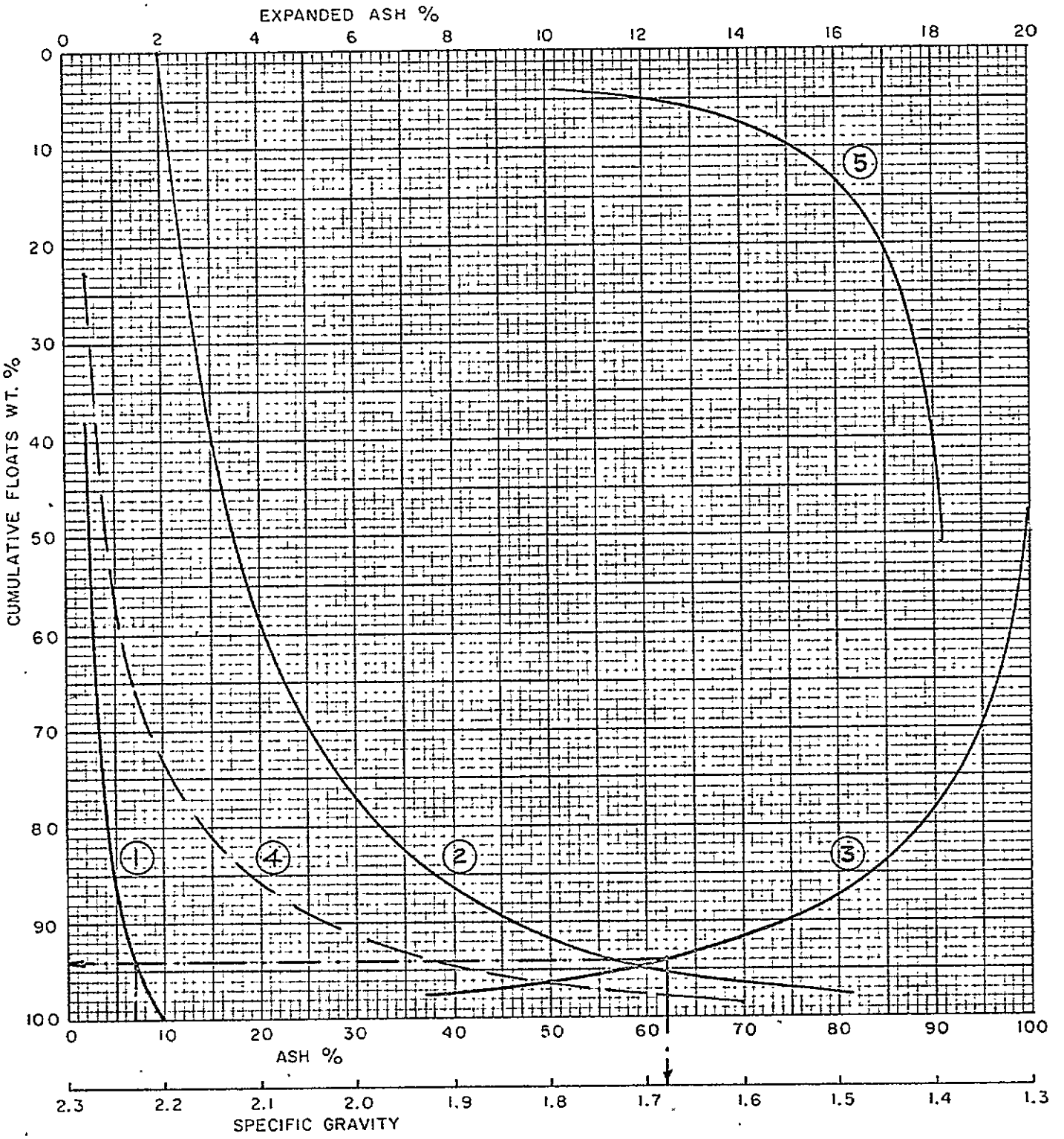
SAMPLE : Adit J14 - Main (500 lb. Split)

SIZE : 3/4" x 28 Mesh

CURVE LEGEND

1 - FLOATS
2 - SINKS
3 - SPECIFIC GRAVITY
4 - ELEMENTARY ASH
5 - NEAR GRAVITY MATERIAL
6 - EXPANDED FLOATS

WASHABILITY CURVES



DATE : June 1972.

CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 6 - ADIT J14 - MAIN

Froth Flotation Test of 28 x 0 m.

Solids, by weight in Slurry	8%
Time	1.5 minutes
Reagents	MIBC & Kerosene

Analyses of the Products

	Concentrate	Tailings
Yield	90.53%	9.47%
Ash	5.76%	37.27%
Volatile Matter	23.02%	20.31%
Residual Moisture	1.16%	1.01%
Fixed Carbon	70.06%	41.41%
F.S.I.	9	1
Sulphur	0.44%	1.14%

SECTION 2

WASHING TESTS AND ANALYSIS OF PRODUCTS

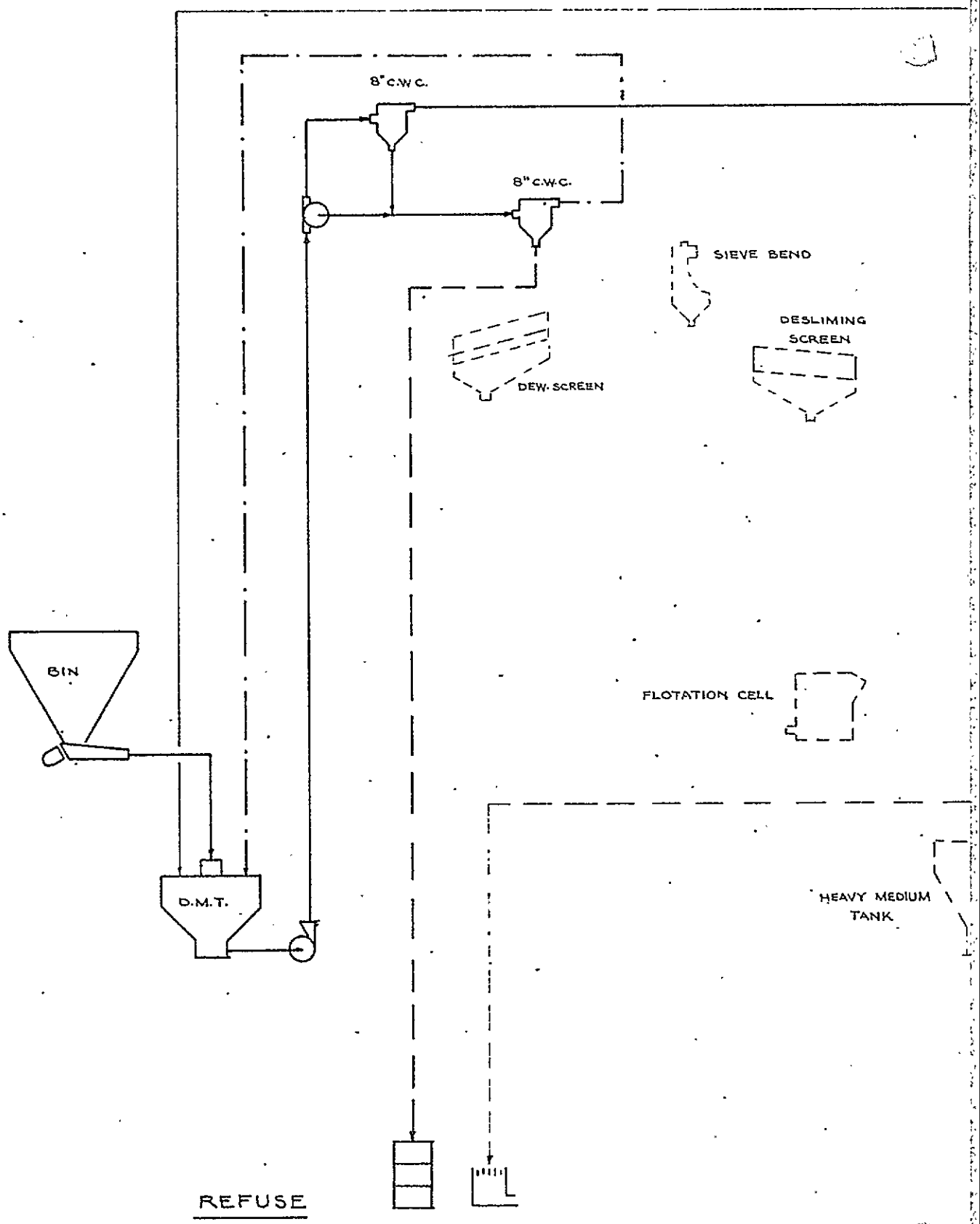
ADIT J14 - MAIN

TABLE I. Adit J14 - Main

Approximate Distribution of Products

Product	Wt. %	Ash %
Clean Coal	92.00	7.60
Refuse	8.00	35.00
Total	100.00	9.80

FIG. 1 WASHING CIRCUIT FOR ADIT - J 14 MAIN



G.W.L.

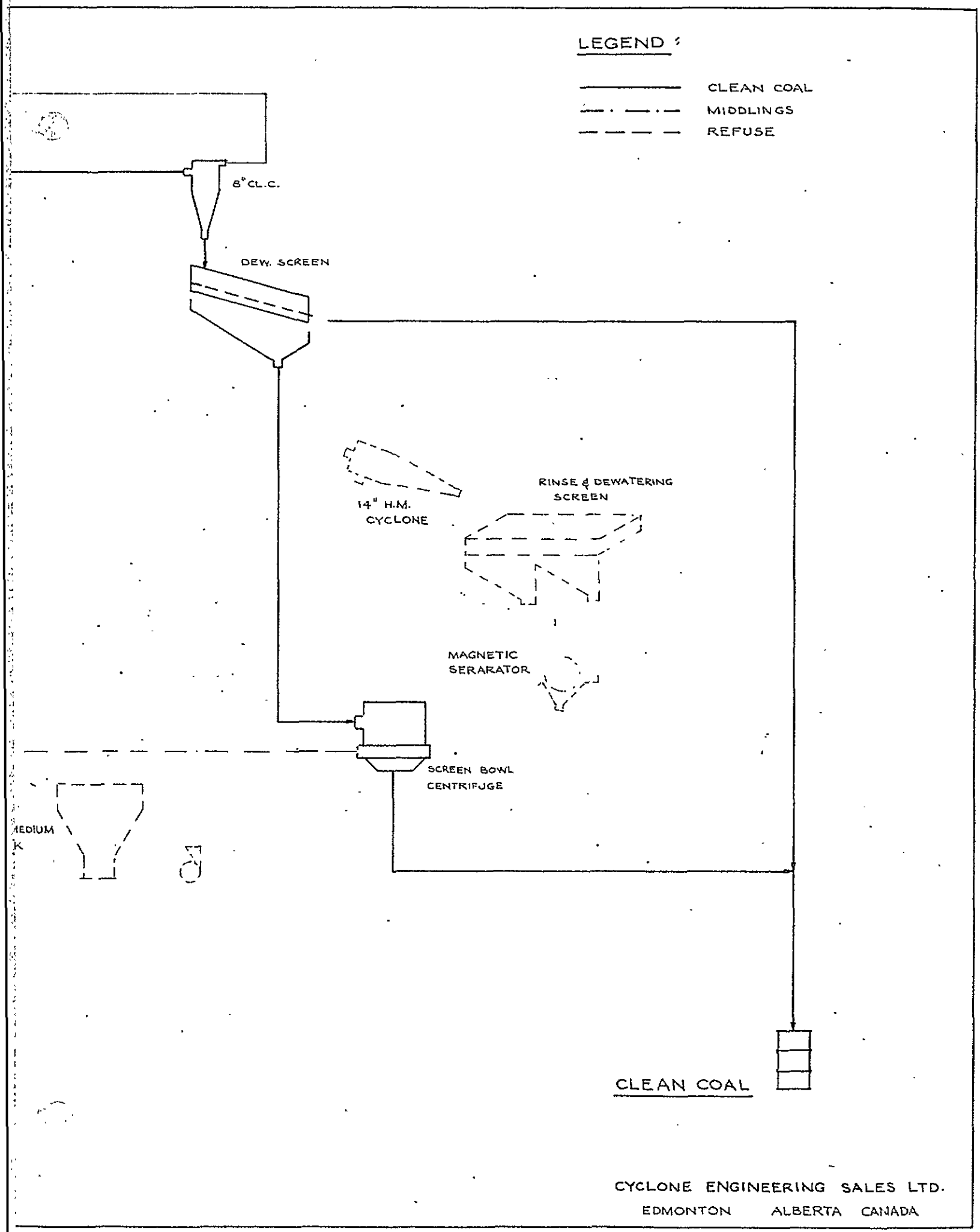

LEGEND :
CLEAN COAL
MIDDLINGS
REFUSE
8" CL.C.
DEW. SCREEN
14" H.M.
CYCLONE
RINSE & DEWATERING
SCREEN
MAGNETIC
SERARATOR
SCREEN BOWL
CENTRIFUGE
MEDIUM
CLEAN COAL
CYCLONE ENGINEERING SALES LTD.
EDMONTON ALBERTA CANADA

TABLE 2. Adit J14 - Main

Proximate Analysis of Clean Coal

Ash	7.67%
Volatile Matter	22.98%
Residual Moisture	0.99%
Fixed Carbon	68.36%
F.S.I.	8
B.T.U./lb.	14,310
Sulphur	0.38%

TABLE 3. Adit J14 - Main

Ultimate Analysis

Ash	7.67%
Carbon	78.68%
Hydrogen	5.16%
Nitrogen	1.15%
Oxygen	6.96%
Sulphur	0.38%

TABLE 4 - ADIT J14 - MAIN

Characteristics of the Ash

Mineral Analysis of Ash

SiO_2	50.98%
Al_2O_3	21.68%
Fe_2O_3	4.82%
TiO_2	0.97%
P_2O_5	0.61%
CaO	9.18%
MgO	2.14%
Na_2O	0.60
K_2O	0.61
SO_3	6.35%

Ash Fusibility

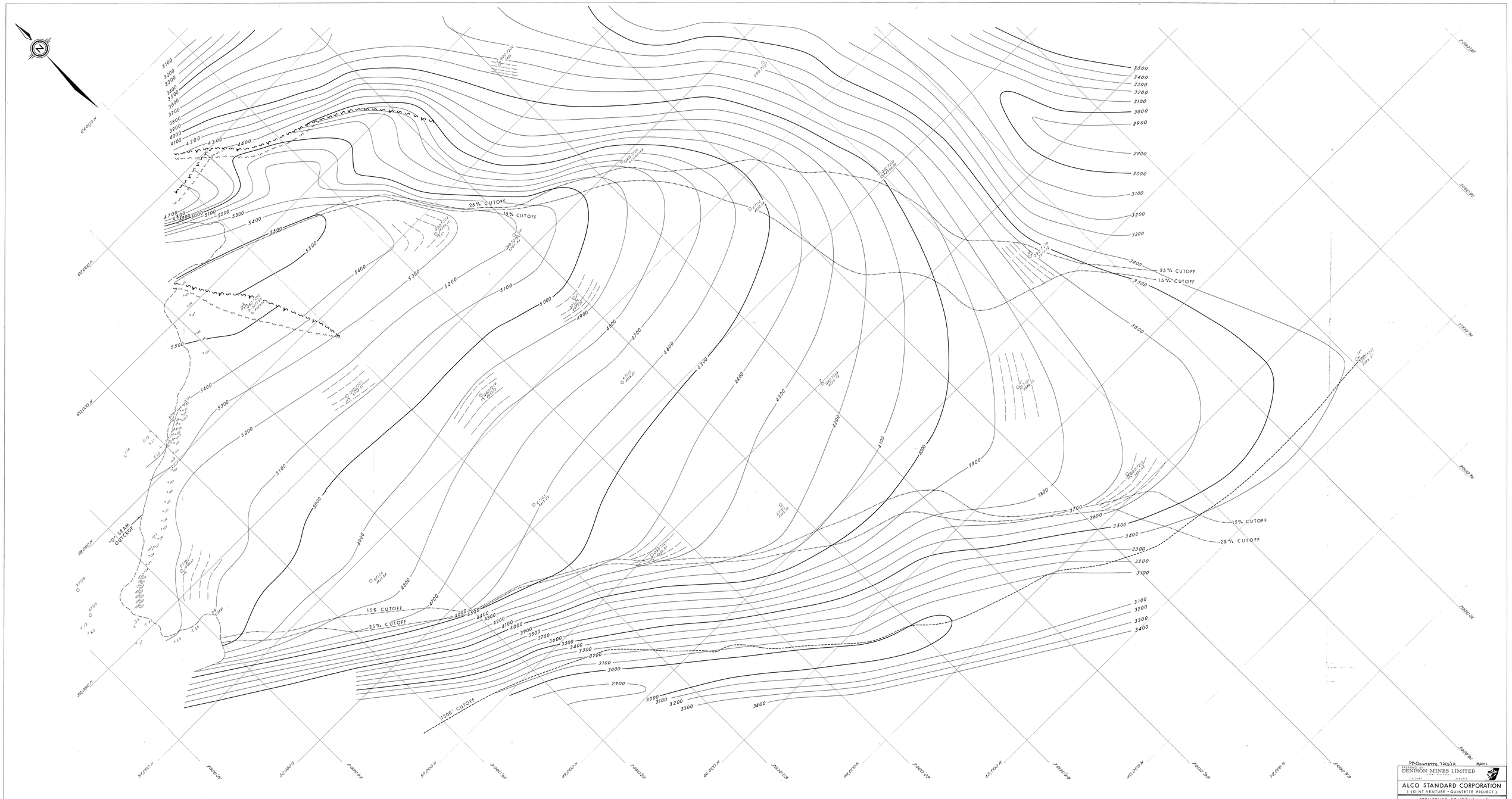
	Reducing Atmosphere °F.	Oxidizing Atmosphere °F.
Initial Deformation Temperature	2300	2345
Spherical Temperature	2355	2415
Hemispherical Temperature	2435	2480
Fluid Temperature	2515	2580

TABLE 5. Adit J14 - Main

Analysis of the Rejects

CWC Refuse

Ash	35.41%
Volatile Matter	18.21%
Residual Moisture	0.78%
Fixed Carbon	45.60%
F.S.I.	3
B.T.U./lb.	9,410
Sulphur	0.58%



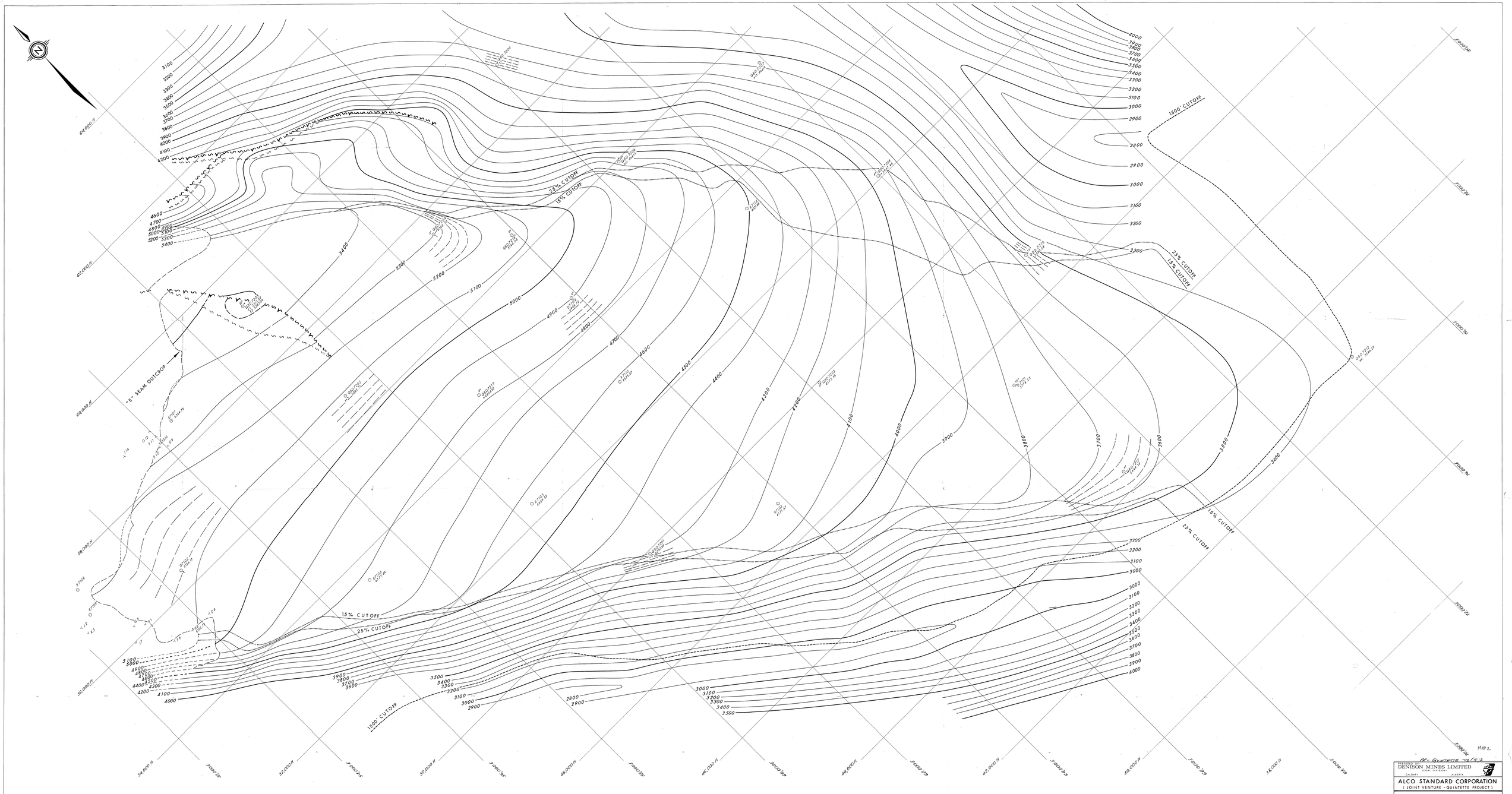
PE-QUINTETTE 72(G)A MAP 1

PREPARED BY
DENISON MINES LIMITED
CORE DIVISION
CALGARY

ALCO STANDARD CORPORATION
(JOINT VENTURE - QUINTETTE PROJECT)

STRUCTURE CONTOUR MAP
"D" SEAM

DRAWN BY	E.T.T.S.T.	DATE	Sept. '72
SCALE	1" = 400'		
APPROVED BY		DRAWING NO	GNTT 72 - 0337 - R02



PREPARED FOR: Re: Quintette 72(5)A

DENISON MINES LIMITED

CALGARY ALBERTA

COAL DIVISION

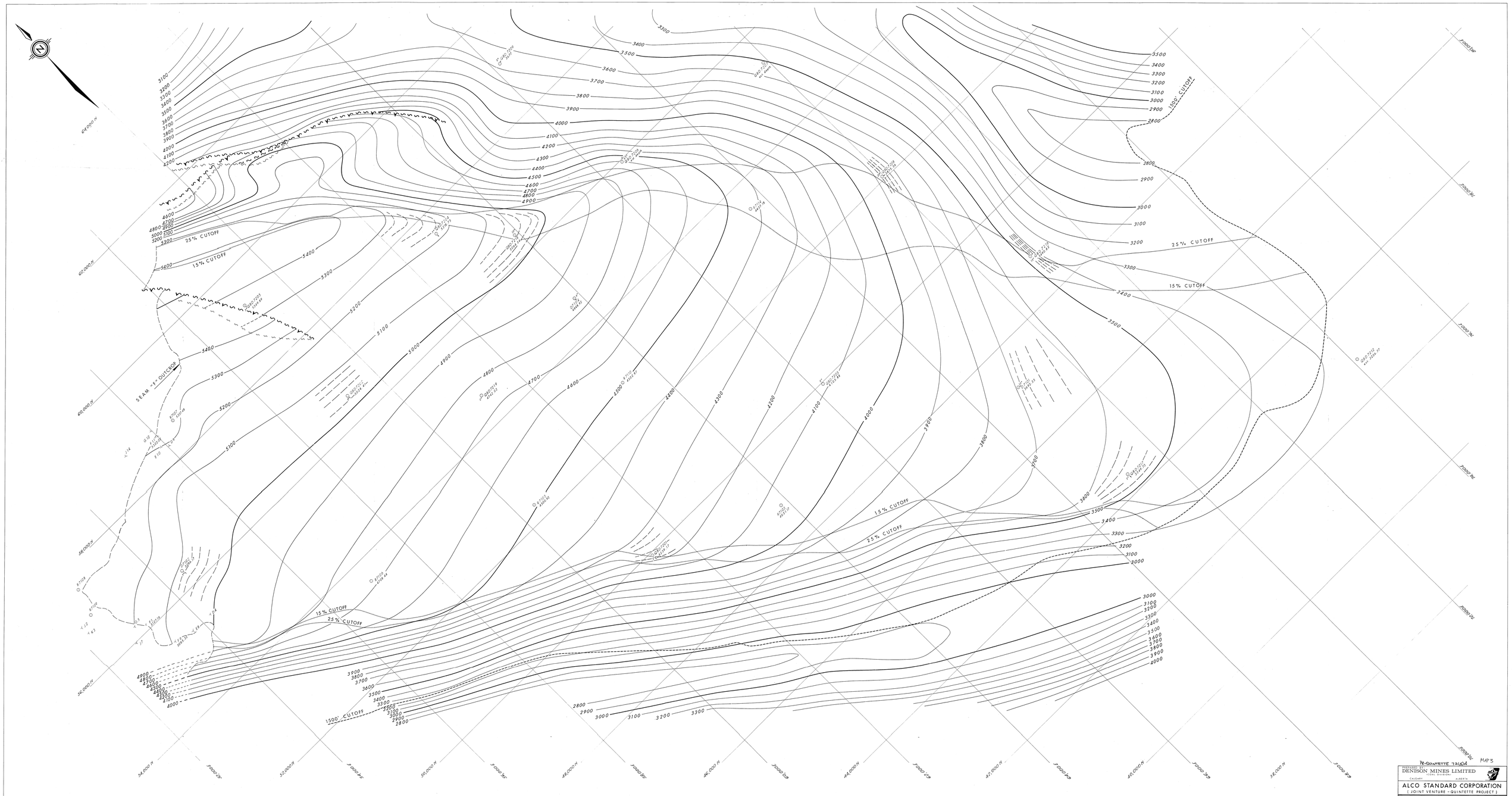
ALCO STANDARD CORPORATION

(JOINT VENTURE - QUINTETTE PROJECT)

STRUCTURE CONTOUR MAP

"E" SEAM

DRAWN BY: E.T.T.T.S.	DATE: Sept. '72	SCALE: 1" = 400'	
APPROVED BY:	DRAWING NO: G.N.T.T. 72 / 0339 - R02		



RE-QUINTETTE 72(6)4 MAP 5

PREPARED FOR:
DENISON MINES LIMITED
COAL DIVISION

CALGARY ALBERTA

ALCO STANDARD CORPORATION
(JOINT VENTURE - QUINTETTE PROJECT)

STRUCTURE CONTOUR MAP
"F" SEAM

DRAWN BY: E.T.T.S.	DATE: Sept. '72	SCALE: 1" = 400'	
APPROVED BY:	DRAWING NO:	QNTT 72 - 0334 - R02	

0907 Quintette

CONFIDENTIAL

Babcock Drill Holes
1971/72 Series
Seam D

72-Quintette 72 (4) A

File to Accompany report
Exploration Results
Quintette Coal Limited Licence Numbers
1303 to 1427 incl. and 2607 to 2644 Incl.
January 31, 1972 to August 31, 1972

1 of 6

72 (4) A 1

600

The 1487 pages of this report following this page contain coal quality data, and remain confidential under the terms of the *Coal Act Regulation*, Section 2(1). They have been removed from the public version.

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