K-SHELL- LINK CR.-HORSESHOE RIDGE
77(1)A

GEOLOGICAL
STUDY

1977

OPEN FILE

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 415

GEOLOGICAL STUDY
FOR
THE LINE CREEK PROJECT

BRITISH COLUMBIA, CANADA

CROWS NEST INDUSTRIES LIMITED

MITSUI & CO., LTD.

MINING RECORDER
RECEIVED and RECORDED
JAN 23 1978
M.R. #
VICTORIA, B. C.

March, 1977

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by

Mitsui Mining Co., Ltd.

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INTRODUCTION

This report covers the results of geological study which was made on the coal reserves and the coal quality for the Line Creek Project. The study was made according to "Line Creek Project Technical Service Agreement" concluded in October of 1976 among Crows Nest Industries Ltd., Mitsui & Co., Ltd. and Mitsui Mining Co., Ltd.

The scope of the study is to compile the following exploration works.

(1) Previous works in 1968 through 1973 Topographic & Geologic Mapping ✓

Non-Core Drillings 50 holes (by reverse circulation)

Core Drillings 11 holes (by Consolidation Coal Co.)

Test Pits 8 places

Adit 12 places

Bulk sampling for washability coal/coke testing ✓

" " " plant tests.

(2) Additional works in 1976

Adit Sampling

Nos. 8, 9, 10B, 10A seams ...... Channel & Bulk (by Mitsui)

Nos. 6 and 7 seams ...... Channel (by C.N.I.)

Among these samples, the bulk samples of Nos. 8, 9, 10B and 10A seams and composite samples of the above seams were sent to Japanese steel mills and the other samples were tested by Mitsui Mining Co., Ltd.

I. GEOLOGY

I-1 Stratigraphy

The Kootenay formation is known to occur in the area. The formation is more than 1,600 feet thick and consists mainly of gray to dark gray shale intercalating thin layers of sandy shale and marl. Sandstone beds are found largely in the lower section below No. 7 seam and particularly, the massive, hard medium grained sandstone above No. 9 seam is well developed through the area with the thickness of about 130 feet and attention should be paid in relation to stripping work.

More than ten coal seams are present in the formation which are called Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10B and 10A seams from top to bottom. In this study, the objective coal seams for open pit mining are Nos. 4, 6, 7, 8, 9, 10B and 10A seams, among which the lower four seams give the major reserves in the area.

I-2 Geological Structure

I-2-1 Review of Drill Hole Data

Although the geological interpretation in this study was made based on the previous exploration results, some drill hole data were reviewed as follows.

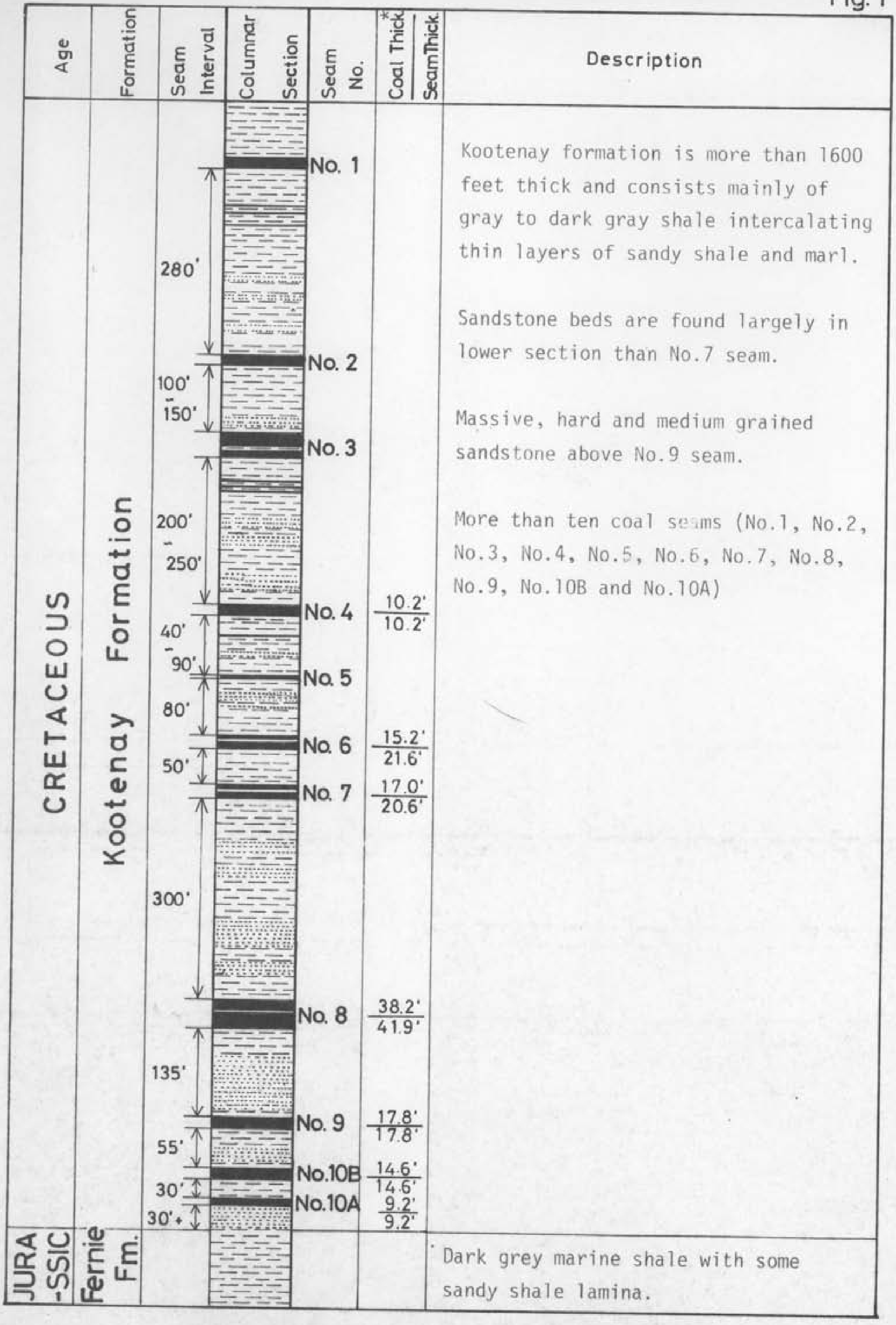
(1) The coal seams intersected in DH-73 at 6,699 feet elevation and in DH-70 at 6,743 elevation were both identified with No. 2 seam. (previously correlated to No. 4 seam.)

(2) The lackings of No. 3 and No. 4 seams in DH-73, and No. 9 seam in DH-60 and DH-49 were assumed to be faulted.

(3) The coal seam which was intersected in DH-8 at 6,327 feet elevation was correlated to No. 7 seam. (Previous correlation is not clear.)

General Stratigraphic Section In The Line Creek Area.

Fig. 1



Kootenay formation is more than 1600 feet thick and consists mainly of gray to dark gray shale intercalating thin layers of sandy shale and marl.

Sandstone beds are found largely in lower section than No.7 seam.

Massive, hard and medium grained sandstone above No.9 seam.

More than ten coal seams (No.1, No.2, No.3, No.4, No.5, No.6, No.7, No.8, No.9, No.10B and No.10A)

Dark grey marine shale with some sandy shale lamina.

* Coal thickness including thin partings.

(4) The thickening interval between No. 9 and No. 10B seams in DH-71 was due to faulting.

I-2-2 Geological Structure

Line Creek Ridge area shows a synclinal structure which is known as Fording River Syncline and its axis runs in the eastern side of the area with NNE trend plunging to the north. The major part of the proposed open pit area is situated on the west limb of the syncline.

The dip is varies up to approximately 45 degrees near the outcrops of the west limb and approximately 30 degrees on the east limb. At the southern outcrops near the synclinal axis, the dip becomes 20 degrees to the north with E-W strike.

The existence of two major faults is anticipated at the eastern limit of the area from the discordance of the drilling results. One is Fording River Fault and the other is a branch of the above fault and the displacements of them are estimated at about 400 feet and 200 feet respectively.

K-SHELL - LINE CR. - HORSESHOE
RIDGE 77(2)A

GEOLOGICAL STUDY
FOR
THE LINE CREEK PROJECT
BRITISH COLUMBIA, CANADA

CROWS NEST INDUSTRIES LIMITED
MITSUI & CO., LTD.

MARCH, 1977

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BY

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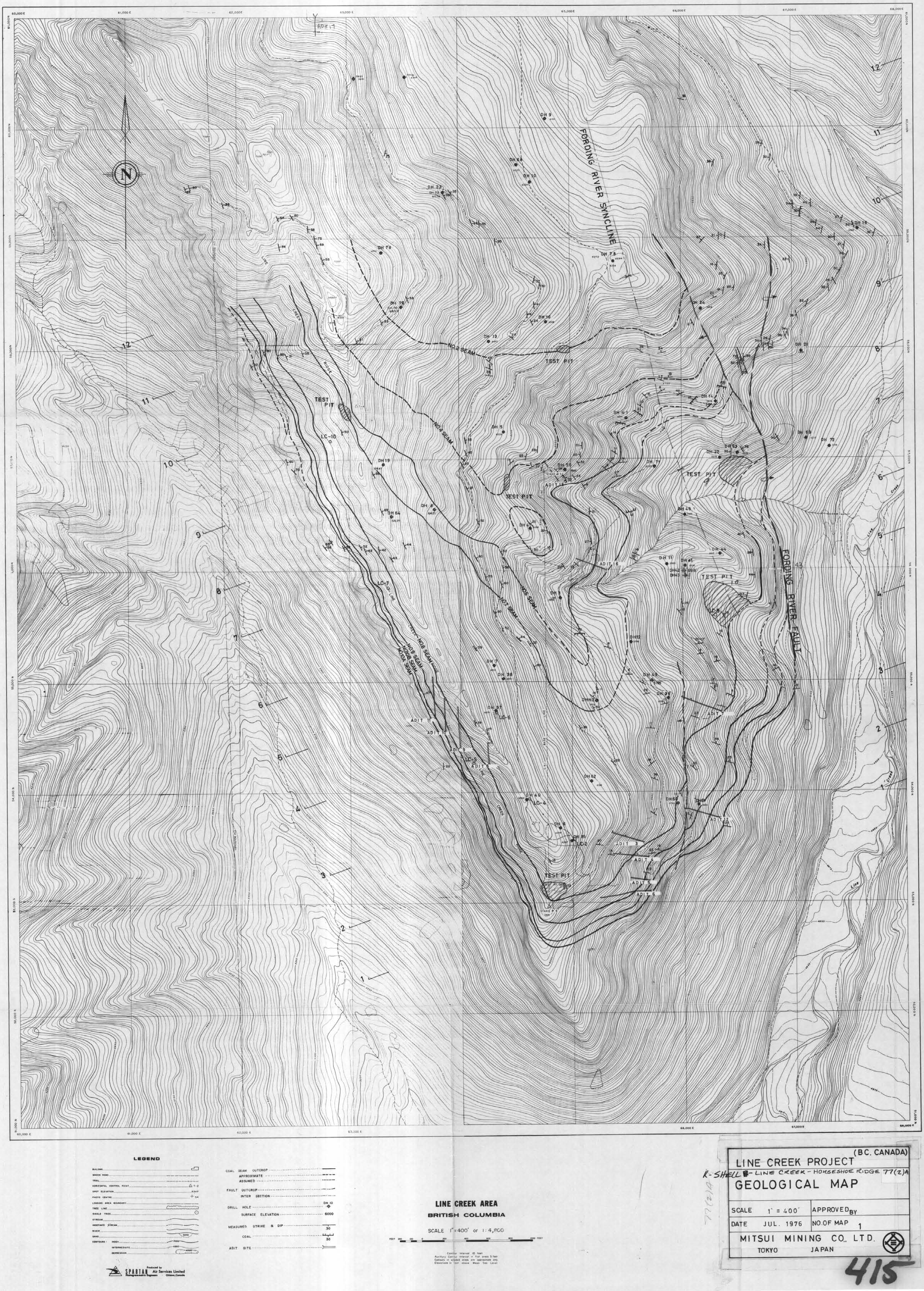

77(2)A

LINE CREEK PROJECT (BC. CANADA)

K-SHELL - LINE CREEK - HORSESHOE RIDGE 77(2)A

GEOLOGICAL MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	1

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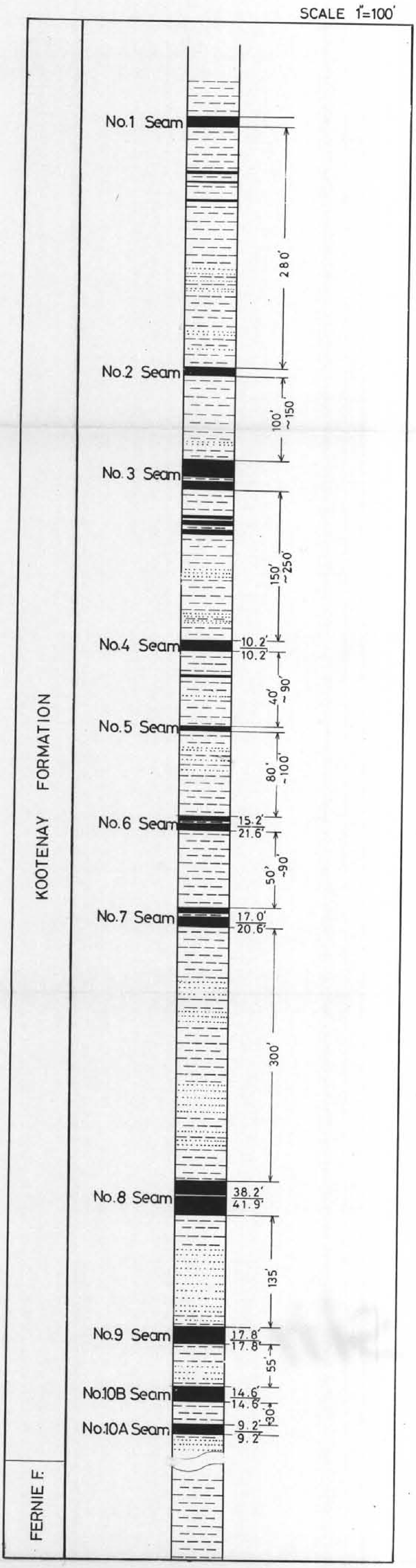
GENERAL STRATIGRAPHIC SECTION

SCALE 1"=100'



LEGEND

■ COAL

░ SANDSTONE

▤ SHALE

THIS SECTION WAS COMPILED
BY LOGGING DATA

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LINE CREEK PROJECT (BC. CANADA)
K-SHELL - LINE CREEK- HORSESHOE RIDGE 77(2)A.
GENERAL STRATIGRPHIC SECTION

SCALE	1" = 100'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	2

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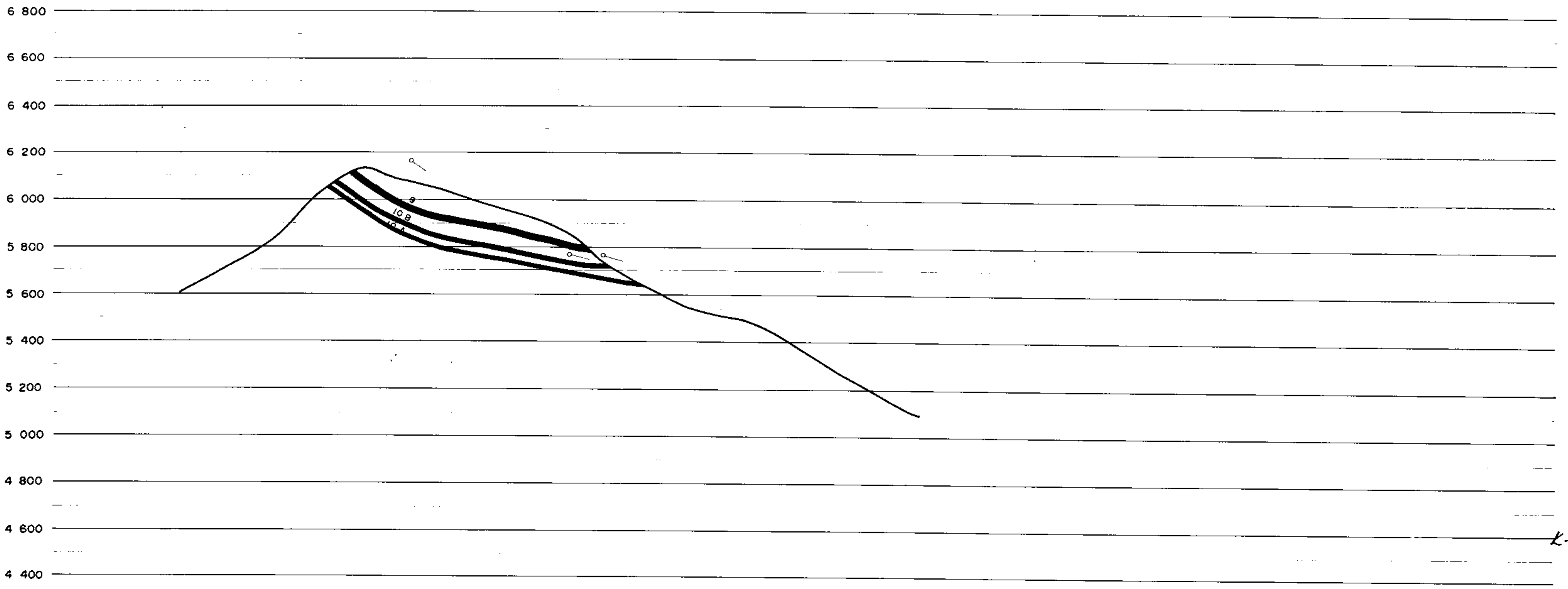
SECTION 1 - 1' SCALE 1" = 400'



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LINE CREEK PROJECT (BC. CANADA)
K-SHELL LINE CREEK-HORSESHOE RIDGE 77(2)4.
CROSS SECTION 1 - 1'

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	3-1

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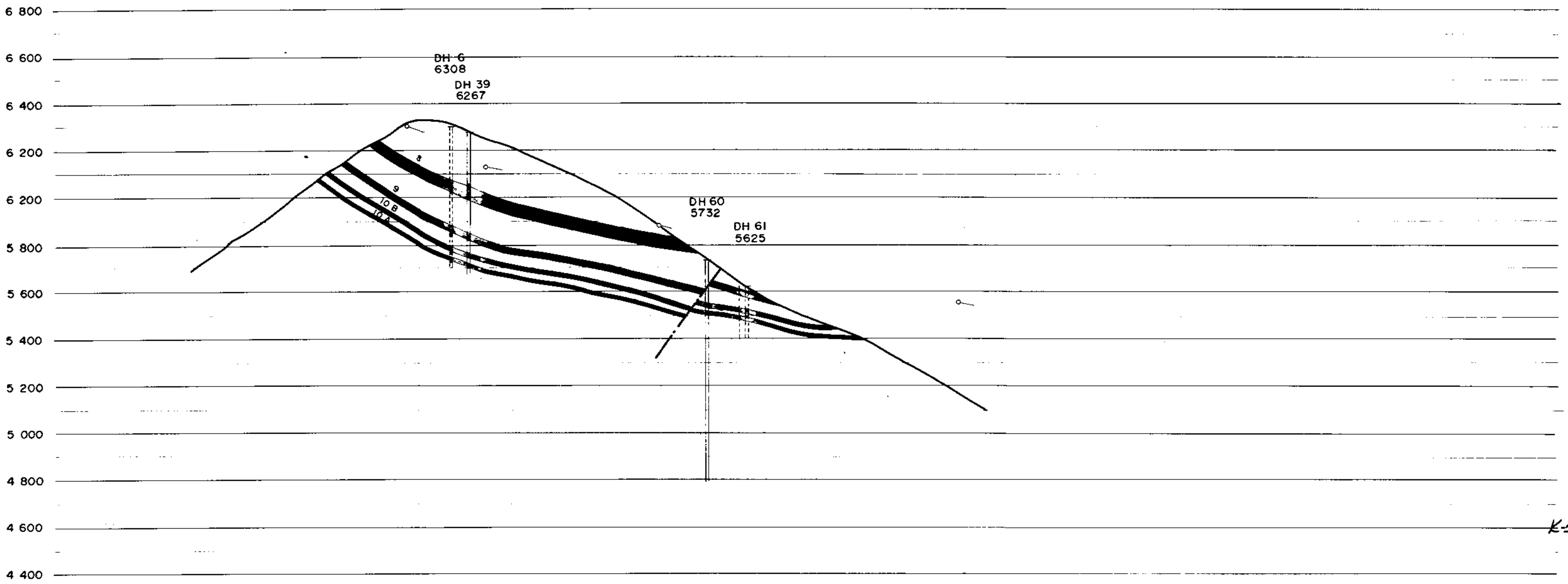
2

SECTION 2-2' SCALE 1"= 400'



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL LINE CREEK- HORSESHOE RIDGE 77(2)A.

CROSS SECTION 2 - 2'

SCALE	1"= 400'	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	3-2

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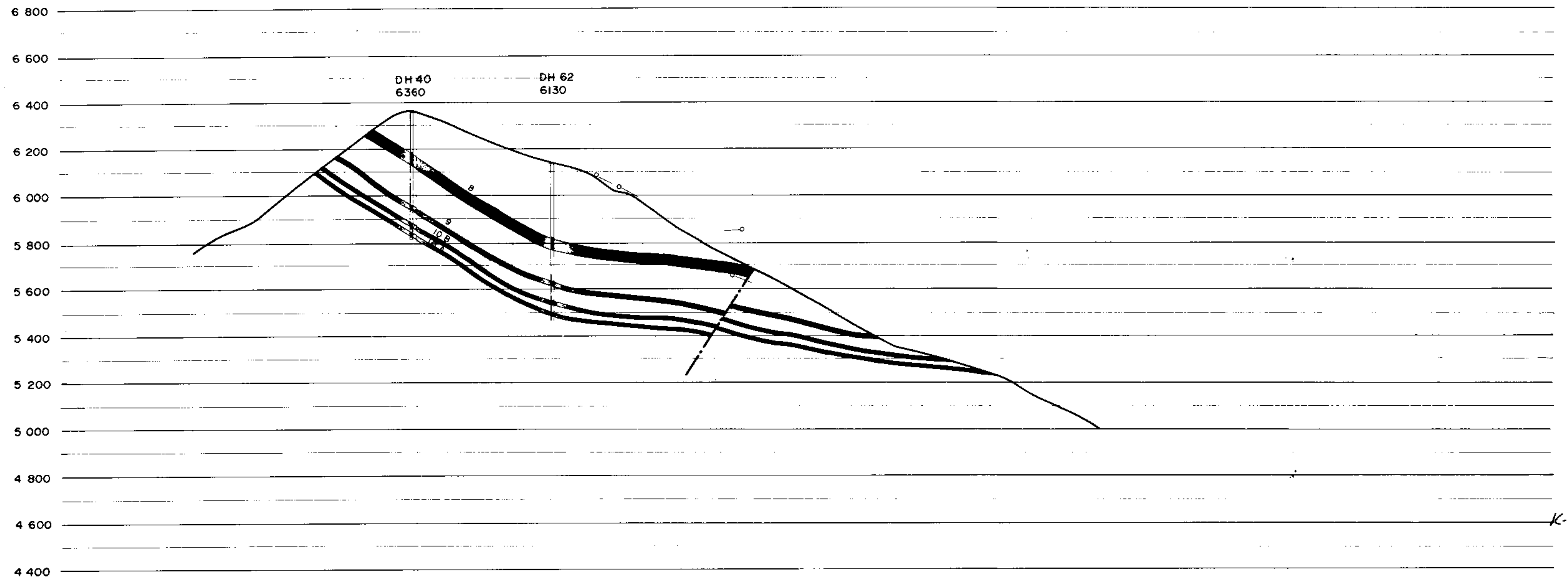
3

SECTION 3 - 3′ SCALE 1″ = 400′



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL -LINE CREEK HORSESHOE RIDGE 77(2)A

CROSS SECTION 3 - 3′

SCALE	1″ = 400′	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	3-3

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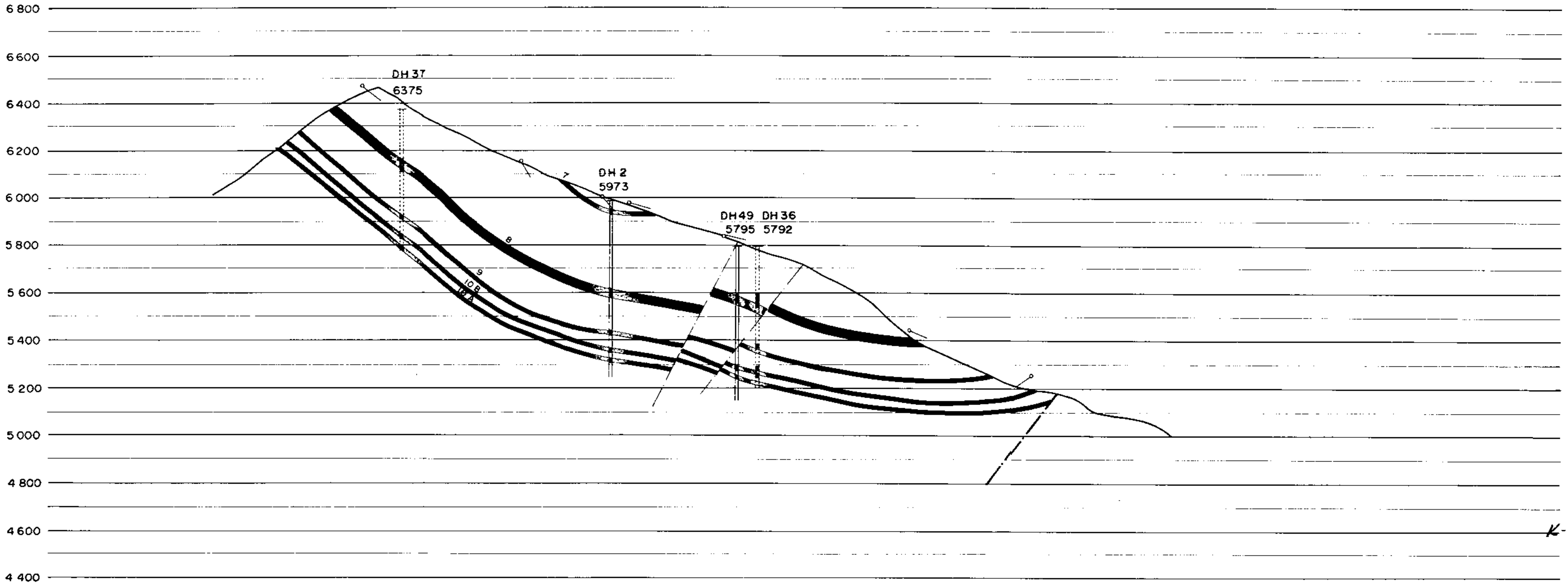
4

SECTION 4-4′ SCALE 1″= 400′



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LINE CREEK PROJECT (BC. CANADA)
K-SHELL [illegible]-LINE CREEK HORSESHOE RIDGE 77(2)4
CROSS SECTION 4 - 4′

SCALE	1″= 400′	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	3-4

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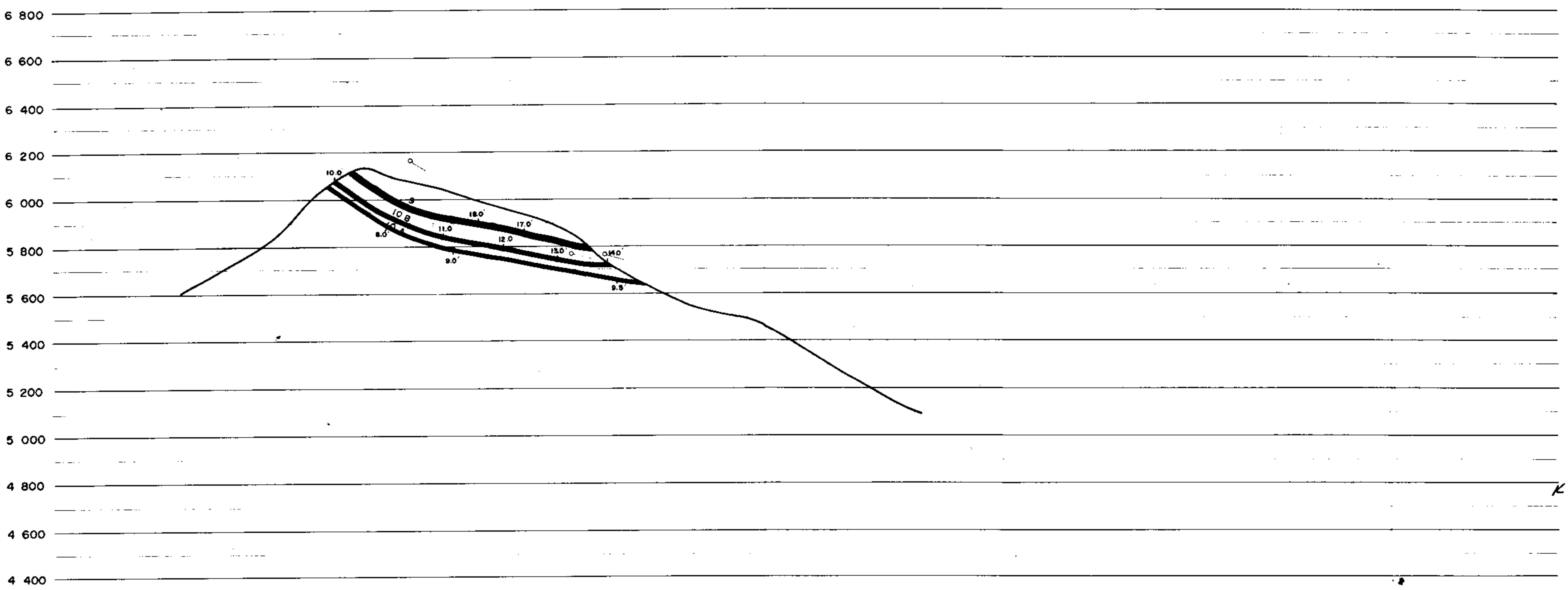
SECTION I - I' SCALE I" = 400'



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77(2)A

K-SHELL LINE CREEK HORSESHOE RIDGE (B.C. CANADA)

LINE CREEK PROJECT

CROSS SECTION I — I'

SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE I" = 400'	APPROVED BY
DATE JUL. 1976	NO.OF MAP 7 — 1

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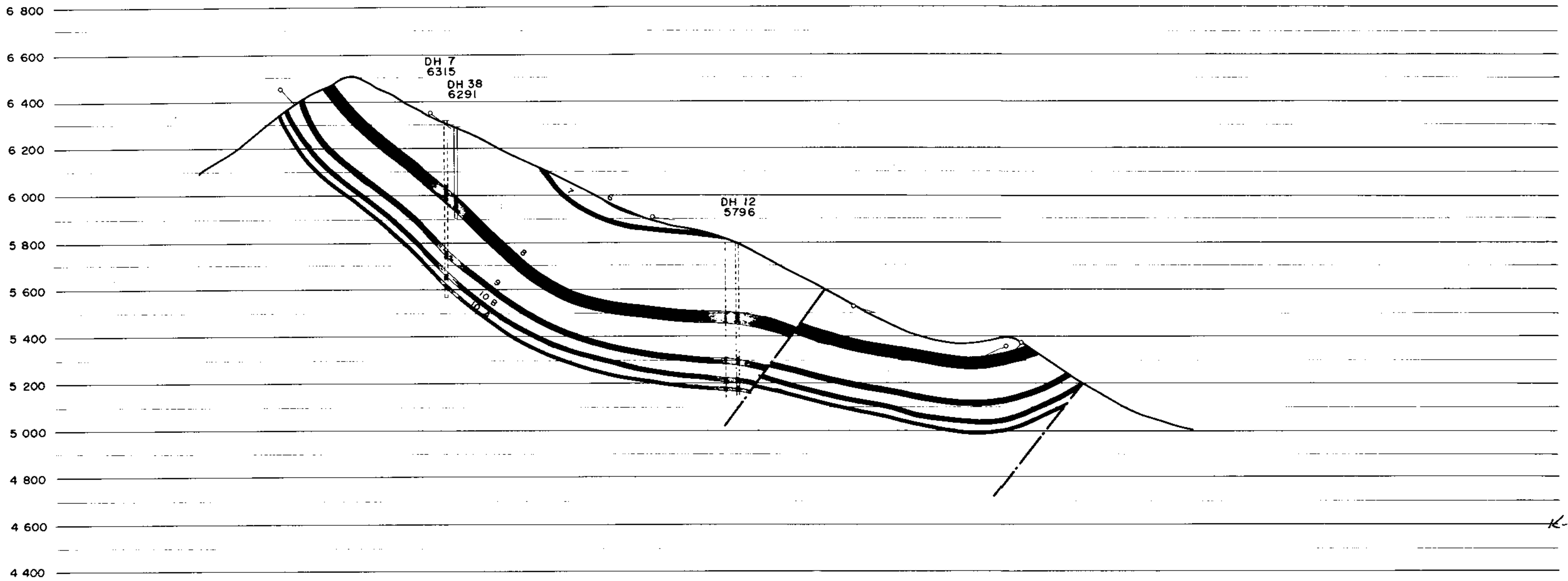
TOKYO JAPAN

5

SECTION 5-5' SCALE 1" = 400'



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL ▨-LINE CREEK HORSE SHOE RIDGE77(7)A.

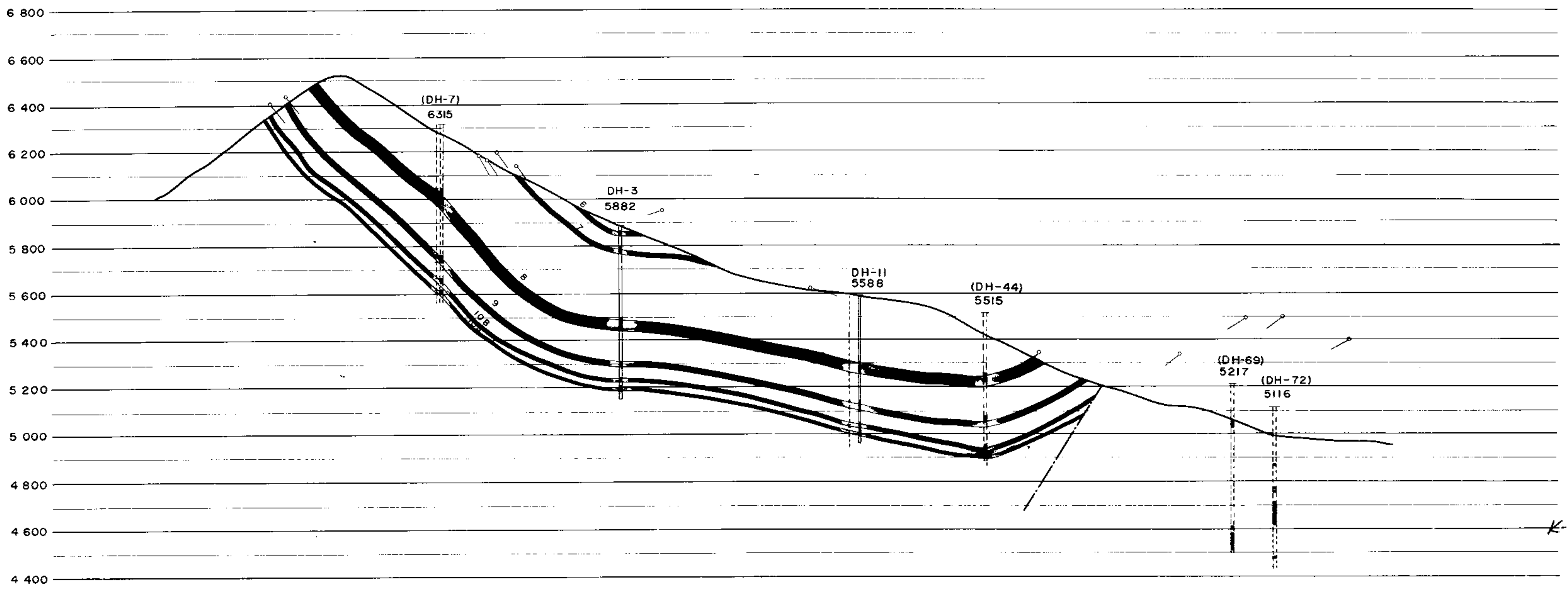
CROSS SECTION 5 - 5'

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 3 - 5

MITSUI MINING CO. LTD.
TOKYO JAPAN

6

SECTION 6-6' SCALE 1"=400'



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(BC. CANADA)
LINE CREEK PROJECT

K-SHELL ■- LINE CREEK HORSESHOE RIDGE 77(2)A

CROSS SECTION 6-6'

SCALE 1"= 400'
APPROVED BY
DATE JUL. 1976
NO OF MAP 3-6

MITSUI MINING CO. LTD.
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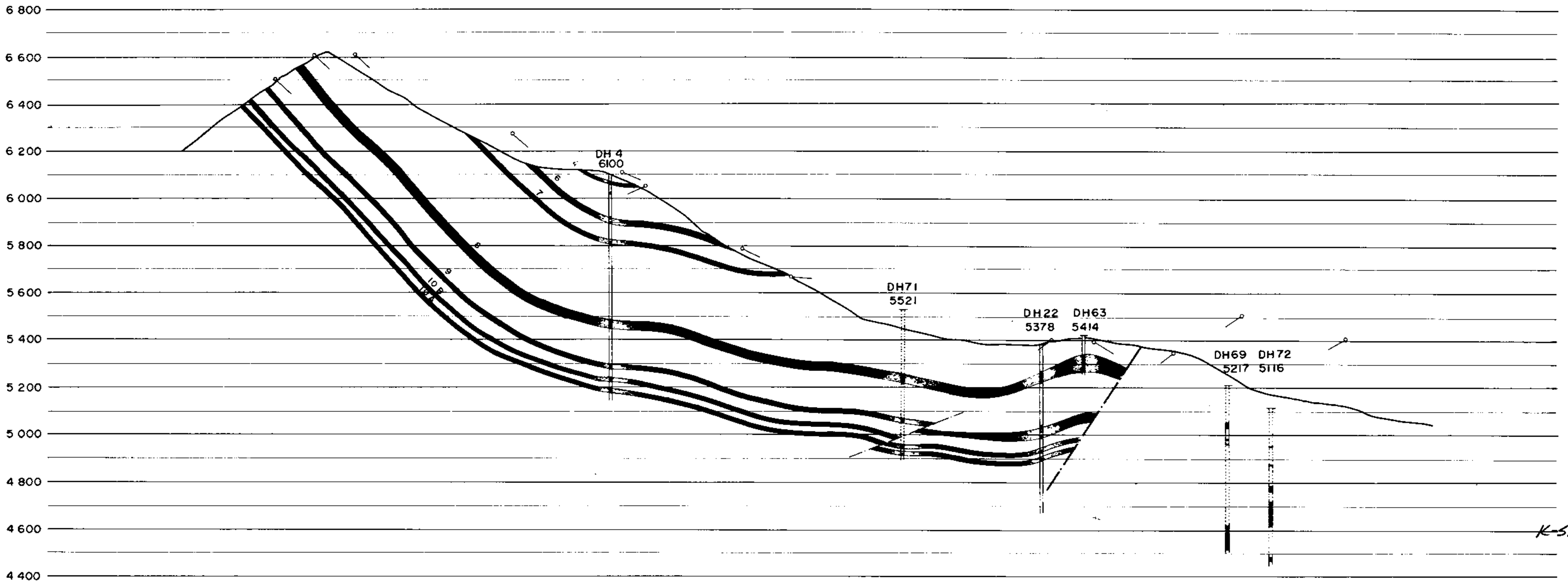
7

SECTION 7-7' SCALE 1"= 400'



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL LINE CREEK HORSESHOE RIDGE 71(7)A

CROSS SECTION 7-7'

SCALE 1"= 400'	APPROVED BY
DATE JUL. 1976	NO.OF MAP 3-7

MITSUI MINING CO. LTD.
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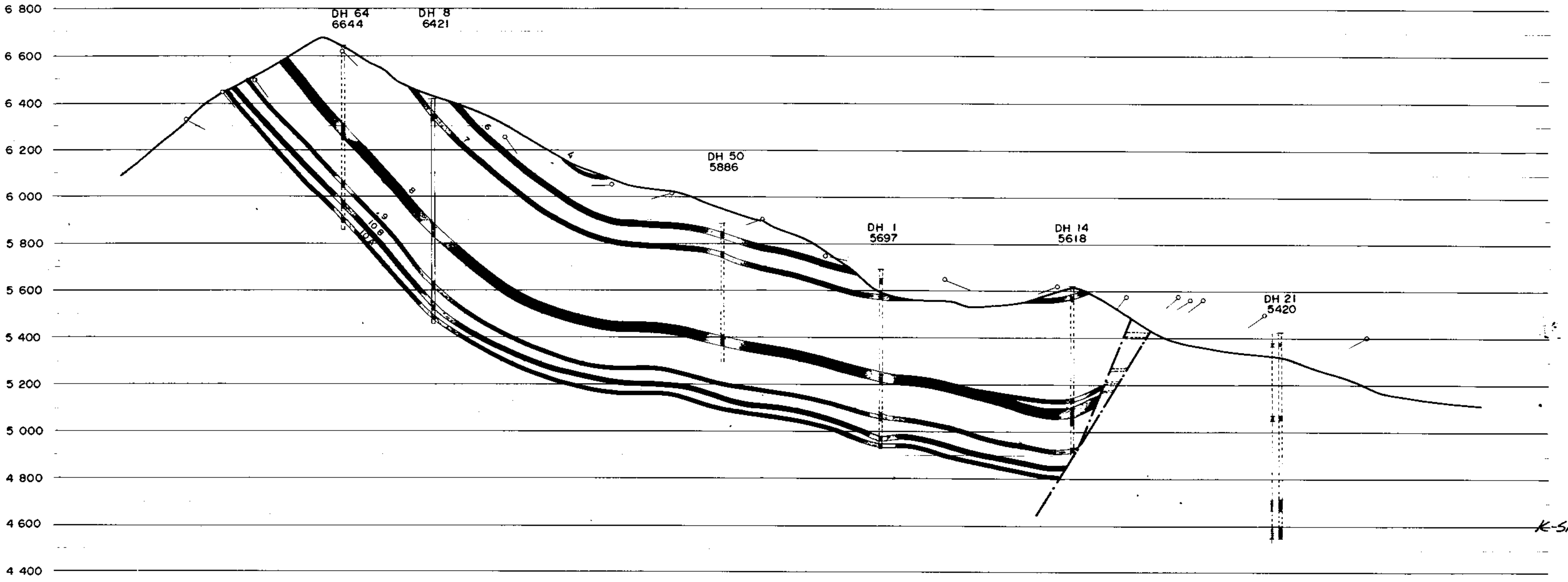
SECTION 8-8′ SCALE 1″= 400′



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL LINE CREEK HORSESHOE RIDGE 7X(2)A.

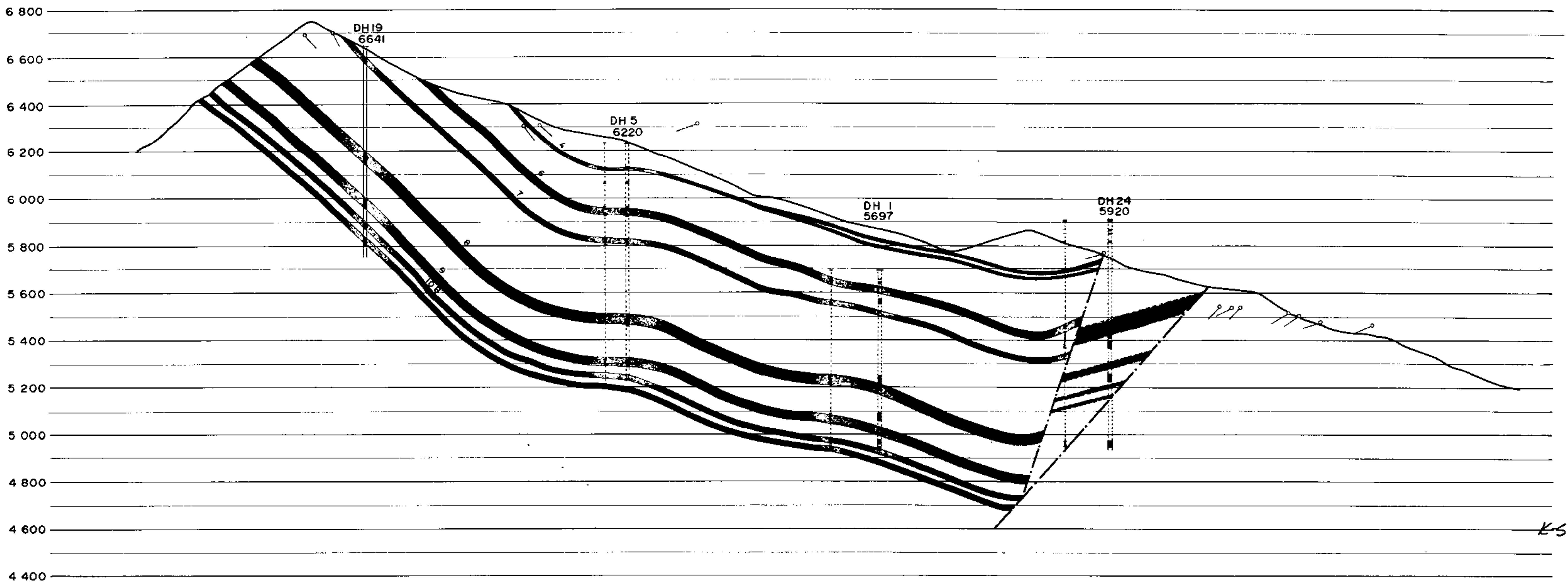
CROSS SECTION 8 - 8′

SCALE	1″ = 400′	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	3 - 8

MITSUI MINING CO. LTD.
TOKYO JAPAN

9

SECTION 9-9′ SCALE 1″ = 400′



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

CROSS SECTION 9 - 9′

SCALE 1″ = 400′	APPROVED BY
DATE JUL. 1976	NO. OF MAP 3-9

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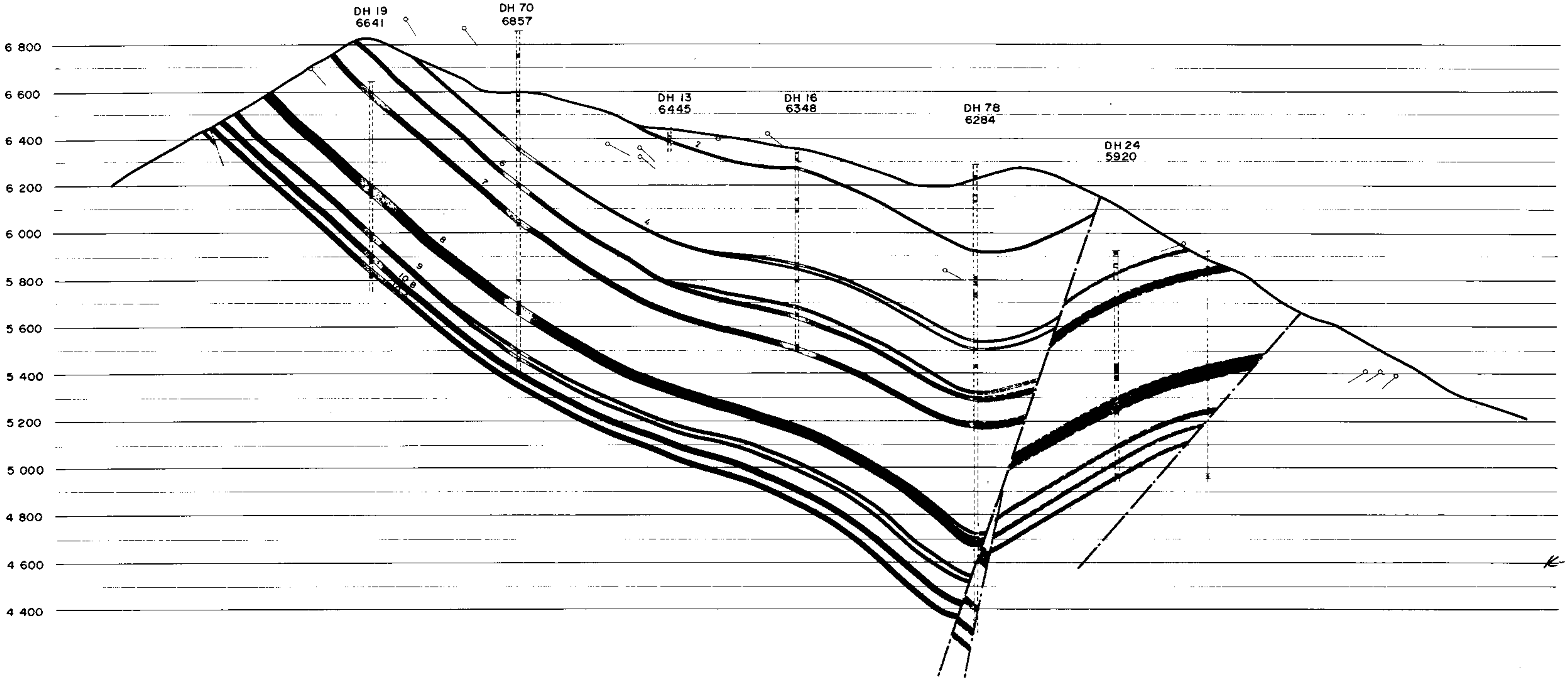
10

SECTION 10-10′ SCALE 1″ = 400′



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL - LINE CREEK HORSESHOE RIDGE 77(2)4

CROSS SECTION 10-10′

SCALE 1″ = 400′	APPROVED BY
DATE JUL. 1976	NO. OF MAP 3-10

MITSUI MINING CO. LTD.
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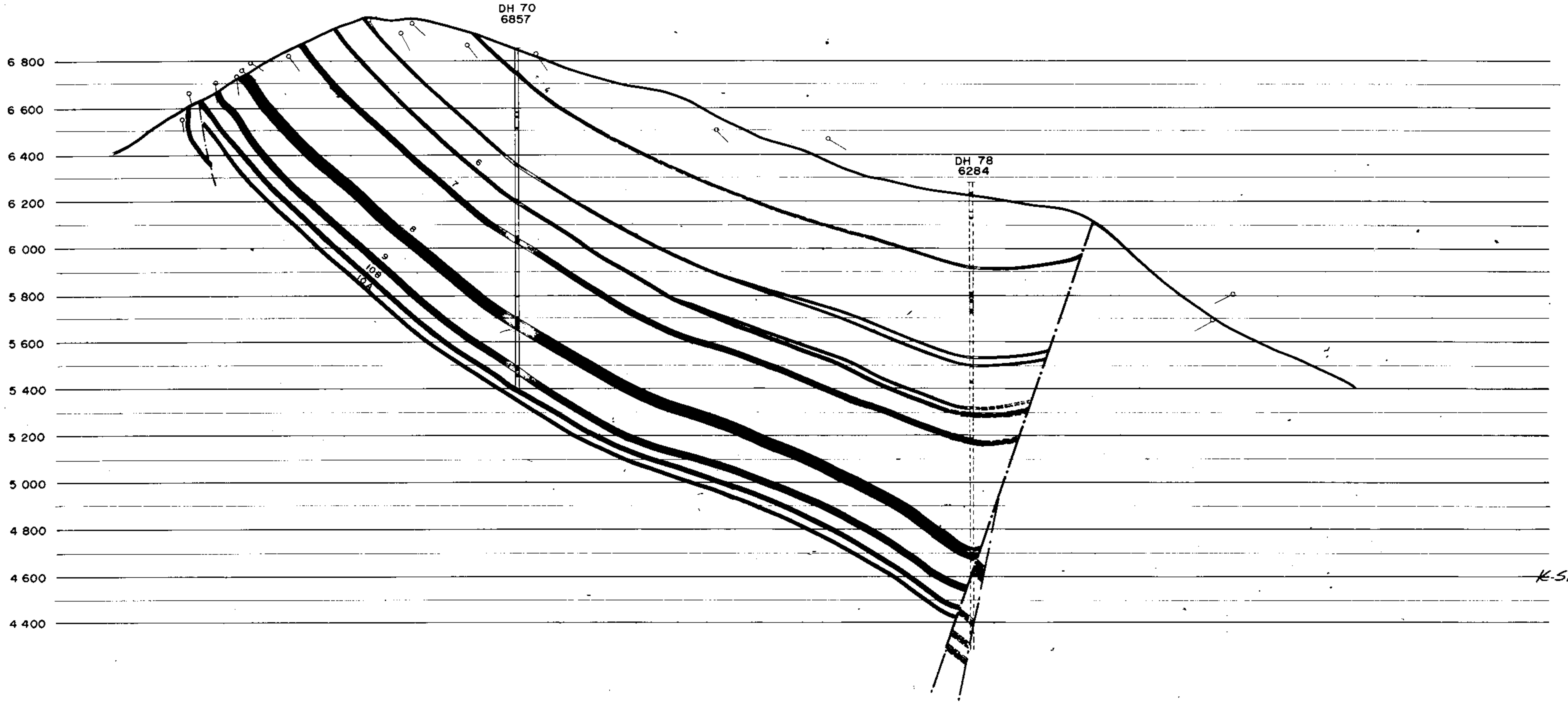
SECTION 11-11′ SCALE 1″= 400′



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(BC. CANADA)

LINE CREEK PROJECT

K-SHELL LINE CREEK HORSESHOE RIDGE 77(7)A

CROSS SECTION 11 – 11′

SCALE 1″ = 400′	APPROVED BY
DATE JUL. 1976	NO. OF MAP 3–11

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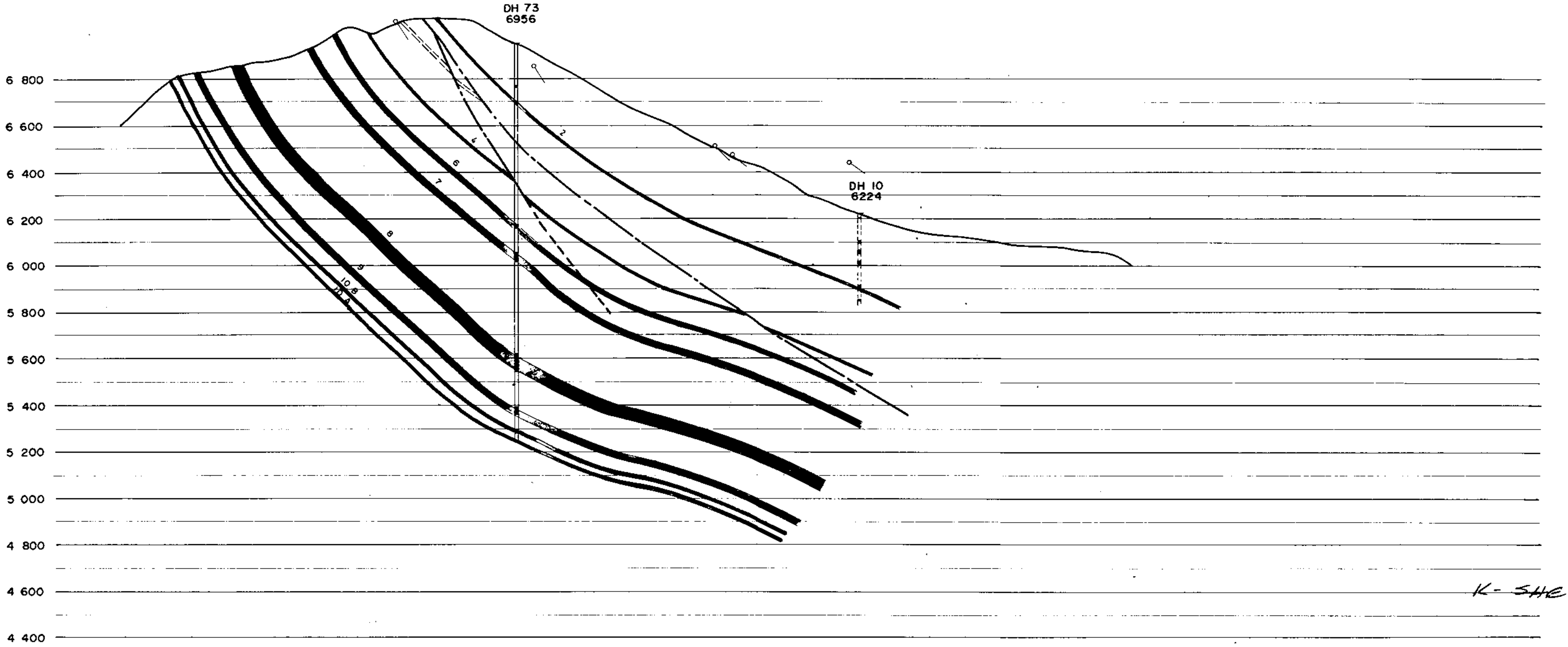
12

SECTION 12-12' SCALE 1"= 400'



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K-SHELL

LINE CREEK PROJECT (BC. CANADA)

~~■ ■~~ LINE CREEK HORSESHOE RIDGE
CROSS SECTION 12 - $\overset{77(2)A}{12'}$

SCALE 1" = 400' APPROVED BY
DATE JUL. 1976 NO.OF MAP 3 - 12

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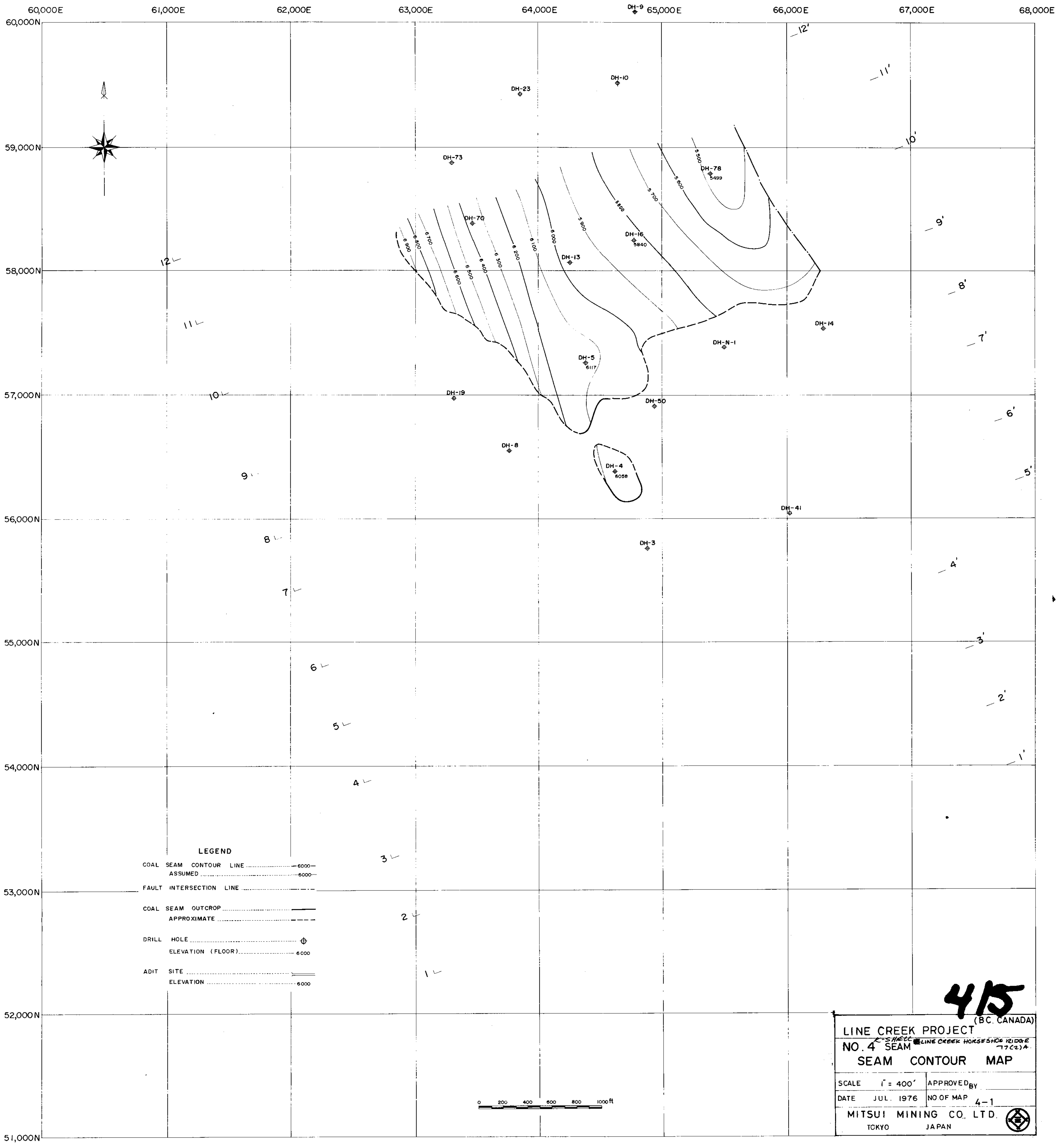

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(BC. CANADA)

LINE CREEK PROJECT

NO. 4 SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO OF MAP 4-1

MITSUI MINING CO. LTD.
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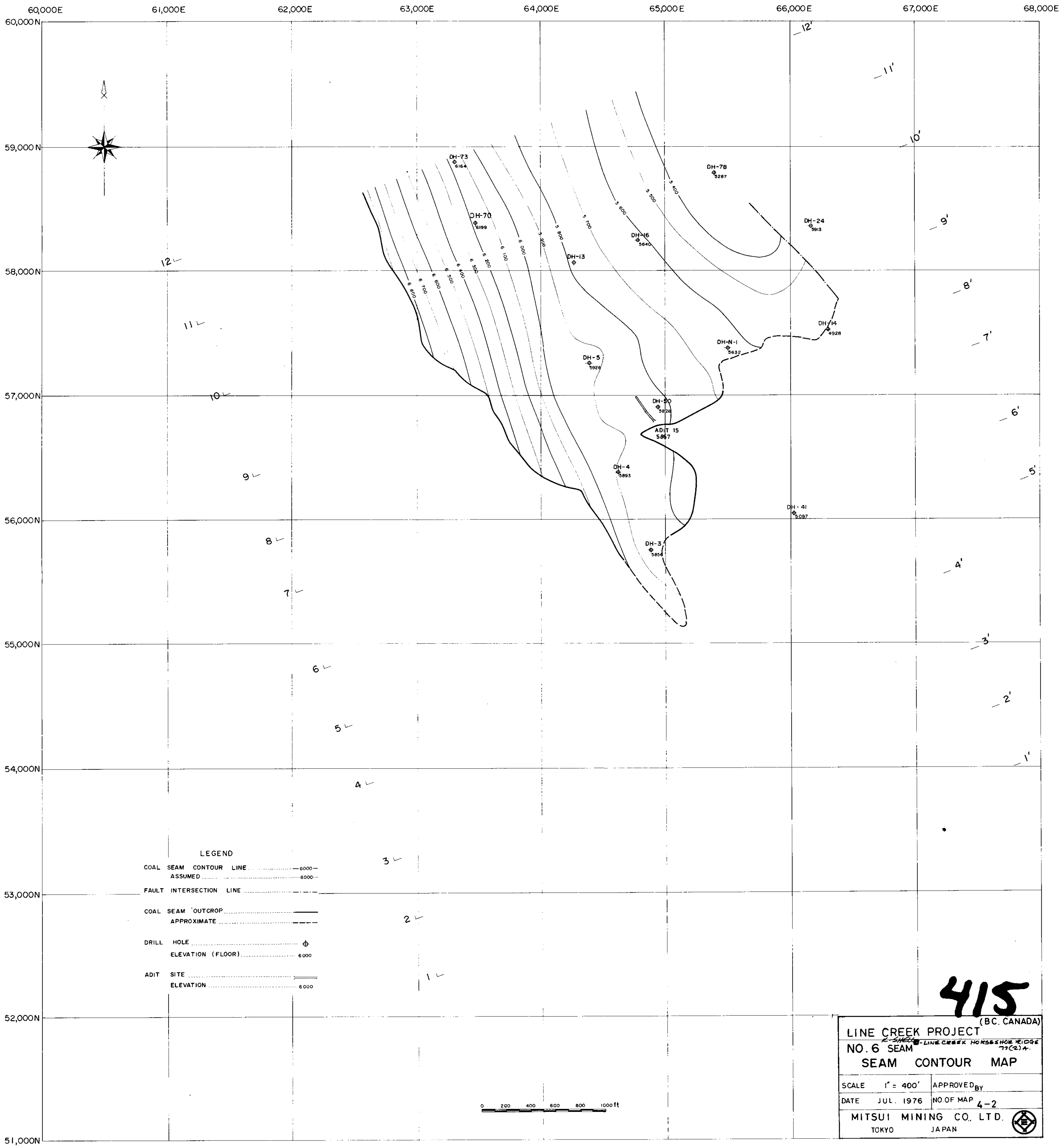

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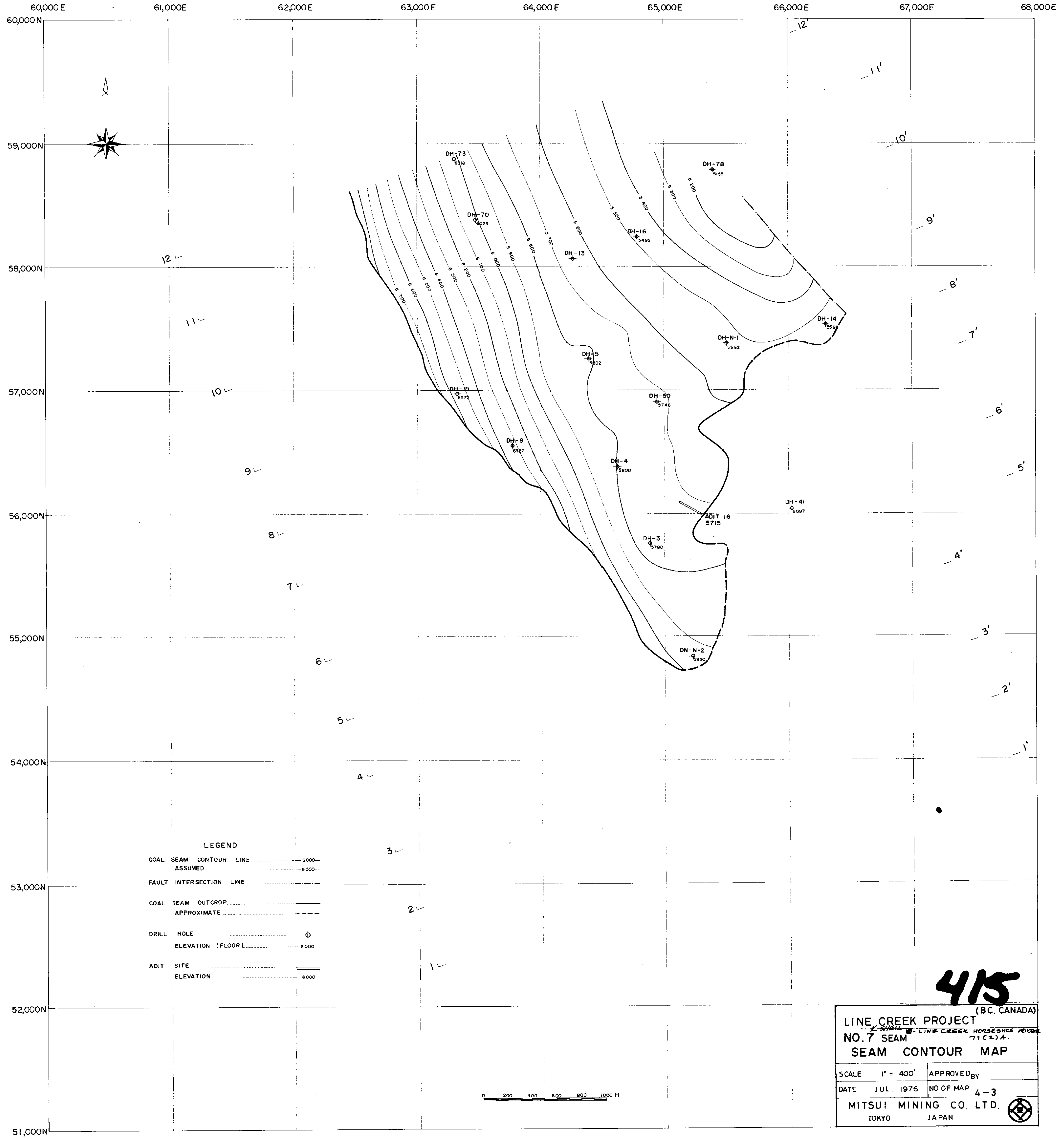
LINE CREEK PROJECT (BC. CANADA)

NO. 6 SEAM K-SHELL -LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 4-2

MITSUI MINING CO. LTD.
TOKYO JAPAN



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(BC. CANADA)

LINE CREEK PROJECT

NO. 7 SEAM K SHELL - LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 4-3

MITSUI MINING CO. LTD.
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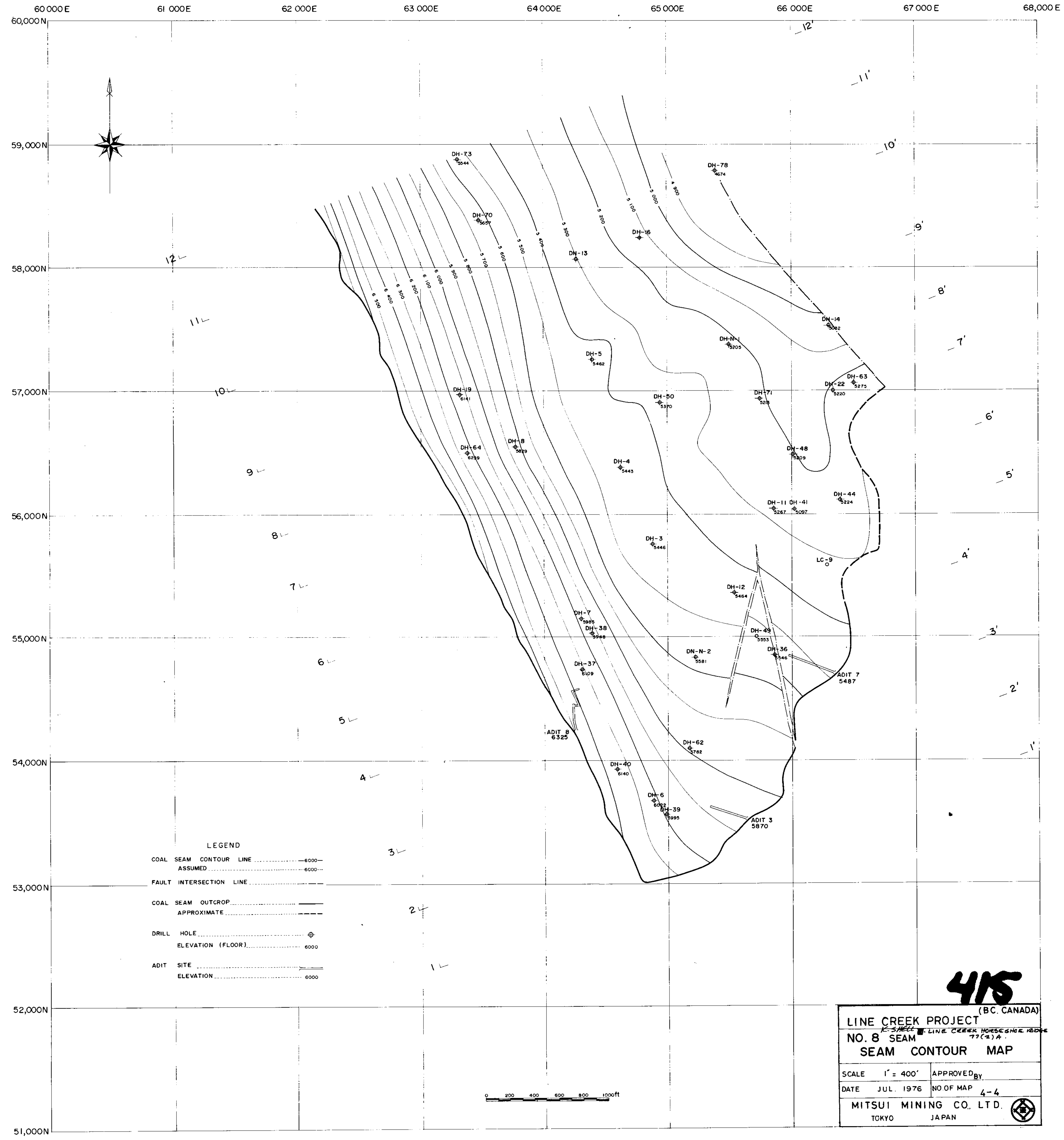

LEGEND

COAL SEAM CONTOUR LINE .... —6000—
ASSUMED .... ···6000···

FAULT INTERSECTION LINE .... —·——

COAL SEAM OUTCROP .... ———
APPROXIMATE .... – – –

DRILL HOLE .... ⊕
ELEVATION (FLOOR) 6000

ADIT SITE .... ═
ELEVATION 6000

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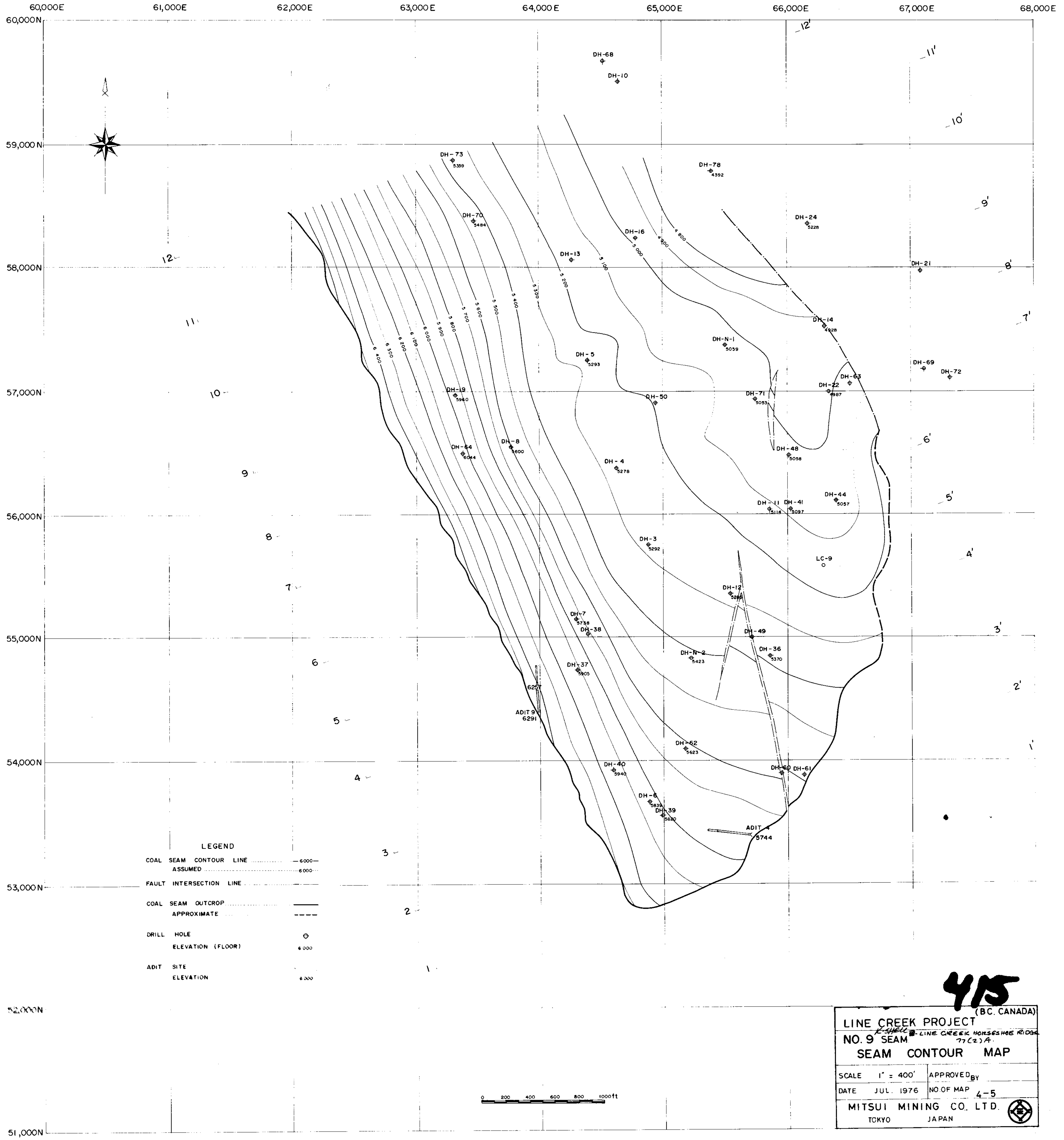
LINE CREEK PROJECT (BC. CANADA)

NO. 8 SEAM K-SHELL [illegible]-LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 4-4

MITSUI MINING CO. LTD.
TOKYO JAPAN



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(BC. CANADA)

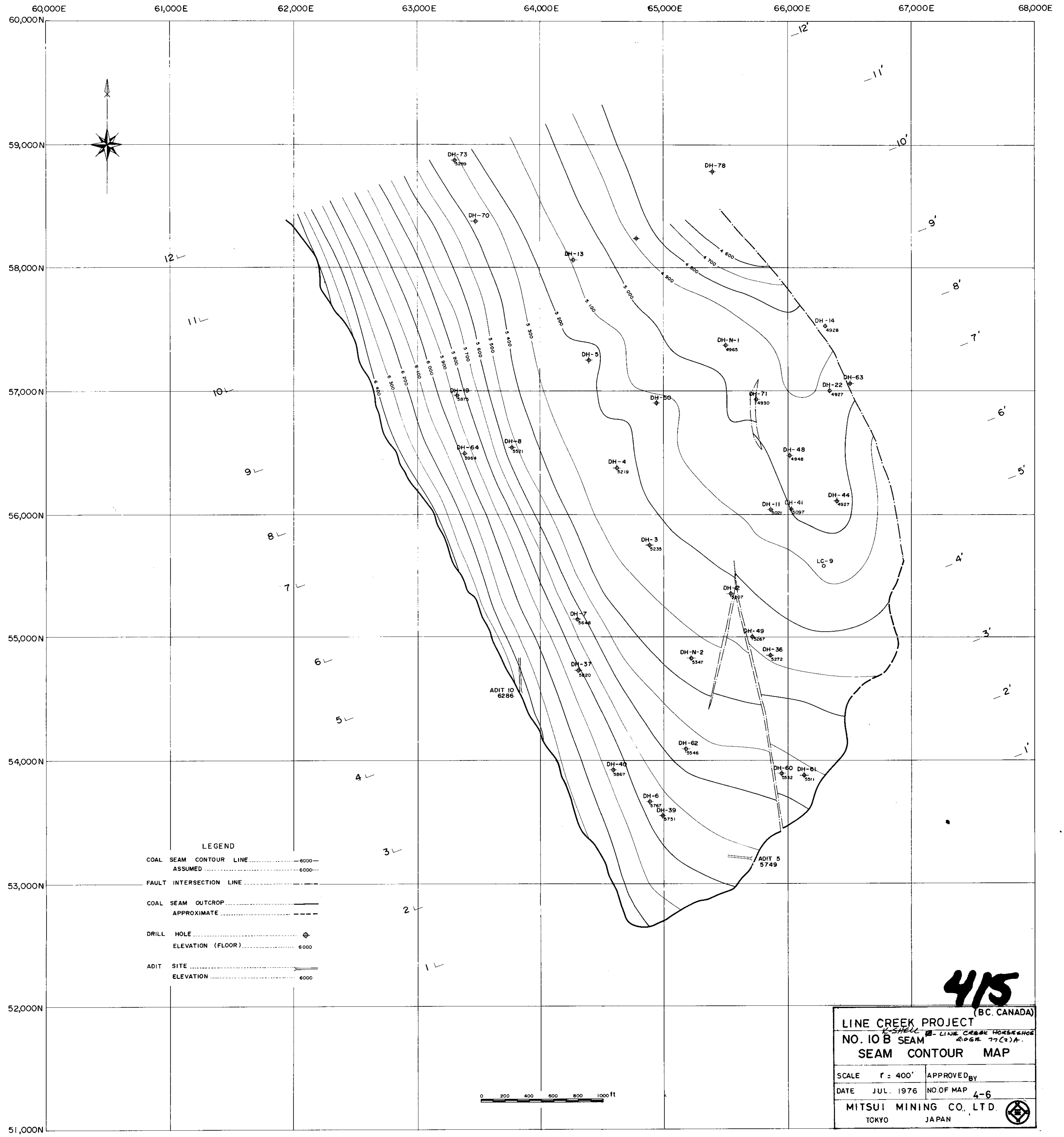
LINE CREEK PROJECT

NO. 9 SEAM K-SHELL - LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	4-5

MITSUI MINING CO. LTD.
TOKYO JAPAN



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(BC. CANADA)

LINE CREEK PROJECT

NO. 10 B SEAM
K-SHELL - LINE CREEK HORSESHOE RIDGE 77(2)A.

SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
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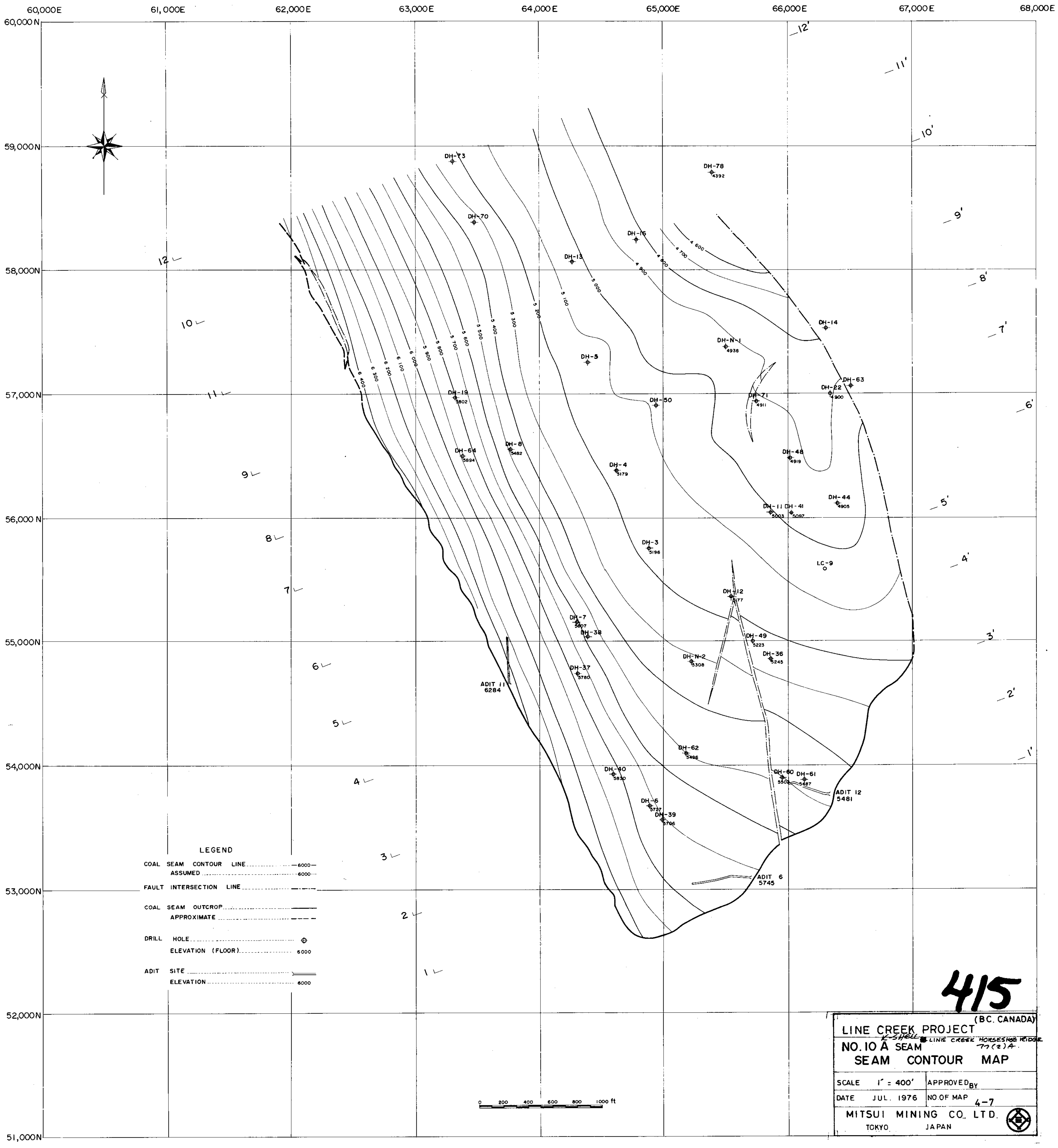


LINE CREEK PROJECT (BC. CANADA)

NO. 10 A SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

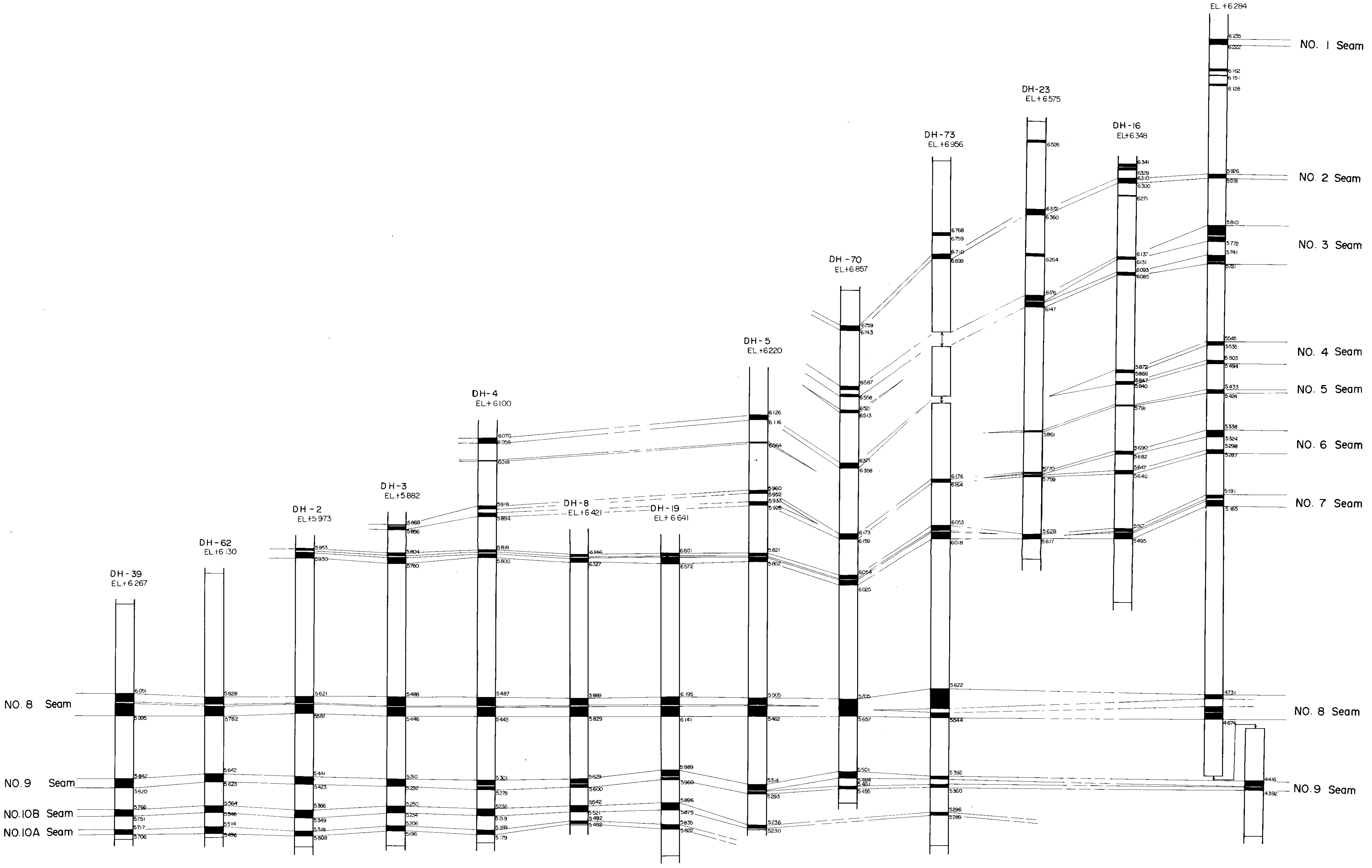
SEAM CONTOUR MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 4-7

MITSUI MINING CO. LTD.
TOKYO JAPAN

STRATIGRAPHIC CORRELATION

Scale 1" = 100'



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LINE CREEK PROJECT (BC. CANADA)

K-SHELL ▇ LINE CREEK HORSESHOE RIDGE 77(2) 4

STRATIGRAPHIC CORRELATION

SCALE	1" = 100'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	5

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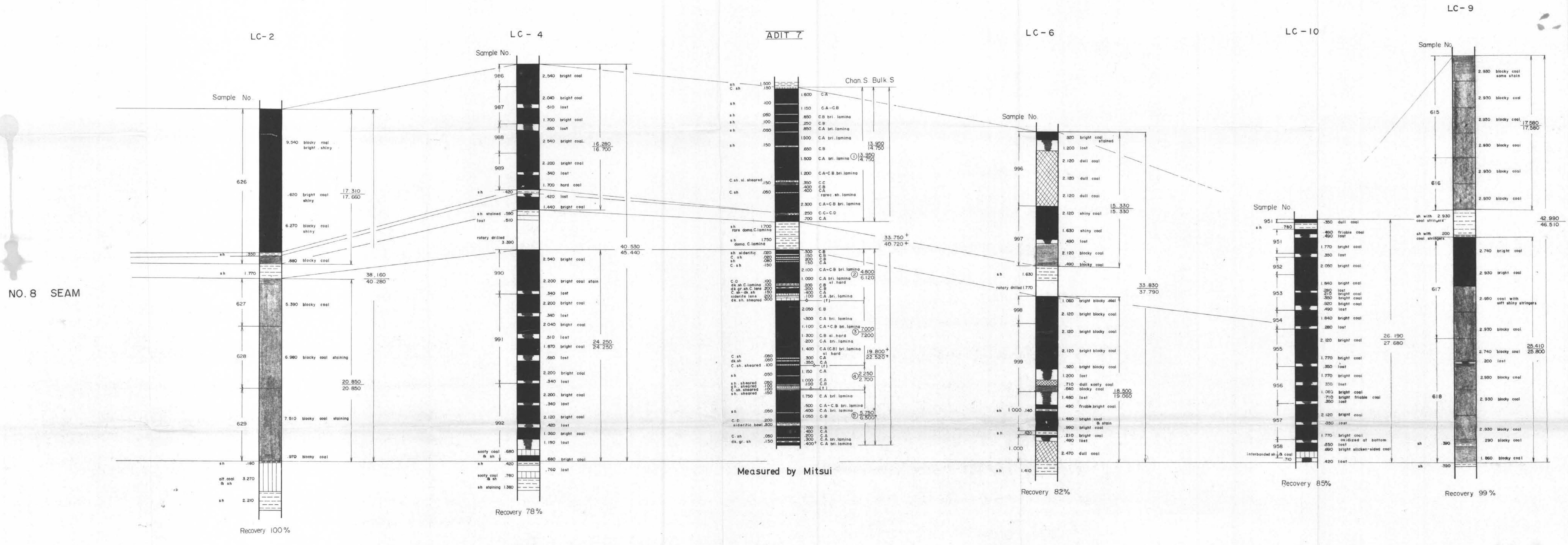
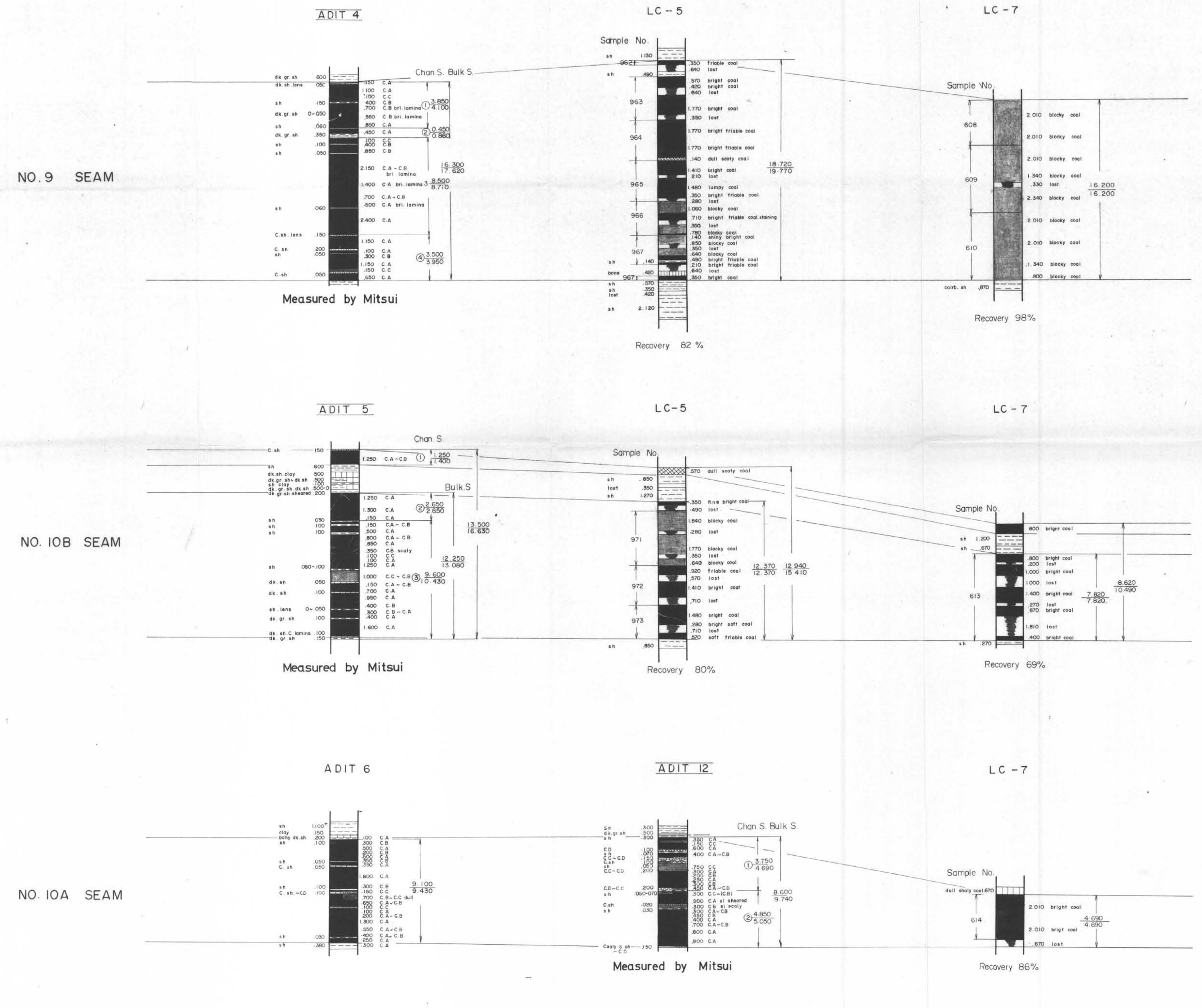
SEAMS CORRELATION & VARIATION

SCALE 1" = 5' No. 1





Legend of seam section measured by MITSUI

■	C.A or C.B	COAL A or COAL B	ash is of less than 20%
▩	C.C	COAL C	ash is between 20~30%
▨	C.D	COAL D	ash is between 30-40% excluded from coal thickness
▥	C.sh	COALY SHALE	
▥	dk.sh	COALY DARK SHALE	
▤	dk.gr.sh sh	DARK GRAY SHALE SHALE	
16.300 17.620		COAL SEAM THICKNESS IN FEET	

Legend of seam section given by C.N.I

■	BRIGHT COAL
▩	BLOCKY COAL
▨	DULL COAL
▥	BONE
▥	SHALY COAL or ALT. COAL & SHALE
▤	SHALE
38.160 40.280	COAL THICKNESS INCLUDING THIN PARTINGS SEAM THICKNESS
▼	LOST : UNRECOVERED CORE

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LINE CREEK PROJECT (BC. CANADA)
K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A
SEAMS CORRELATION & VARIATION
No. 1

SCALE 1" = 5'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 6-1

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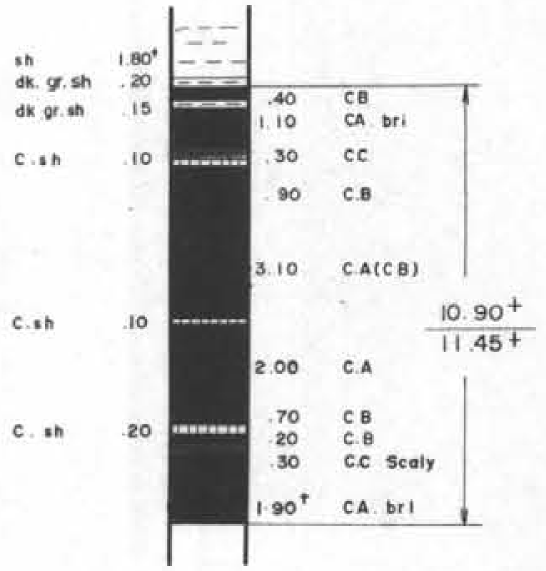
TOKYO JAPAN

SEAMS CORRELATION & VARIATION NO.2

Scale 1" = 5'

NO.4 Seam

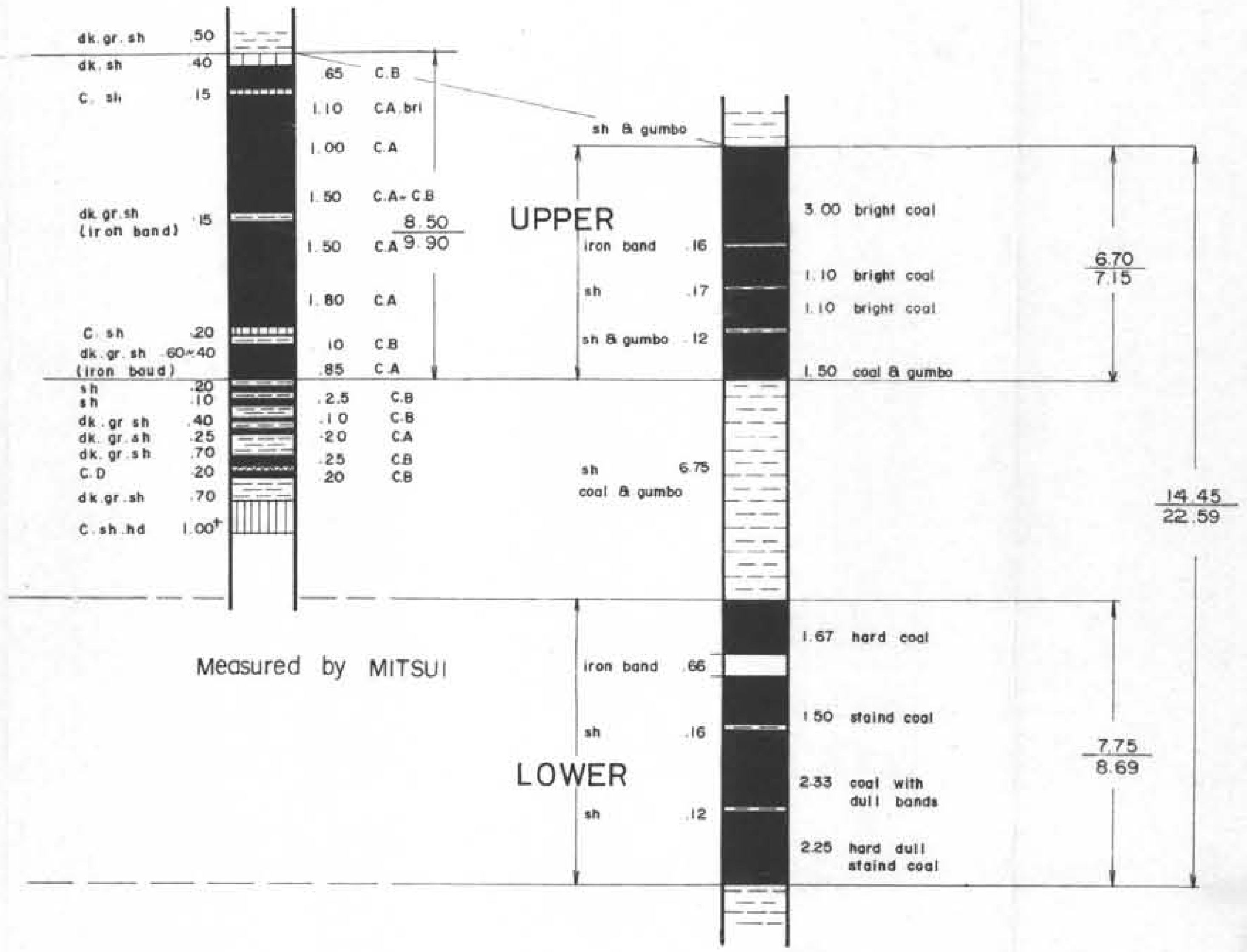
Test Pit



Measured by MITSUI

NO.6 Seam

at Adit portal — Adit 15

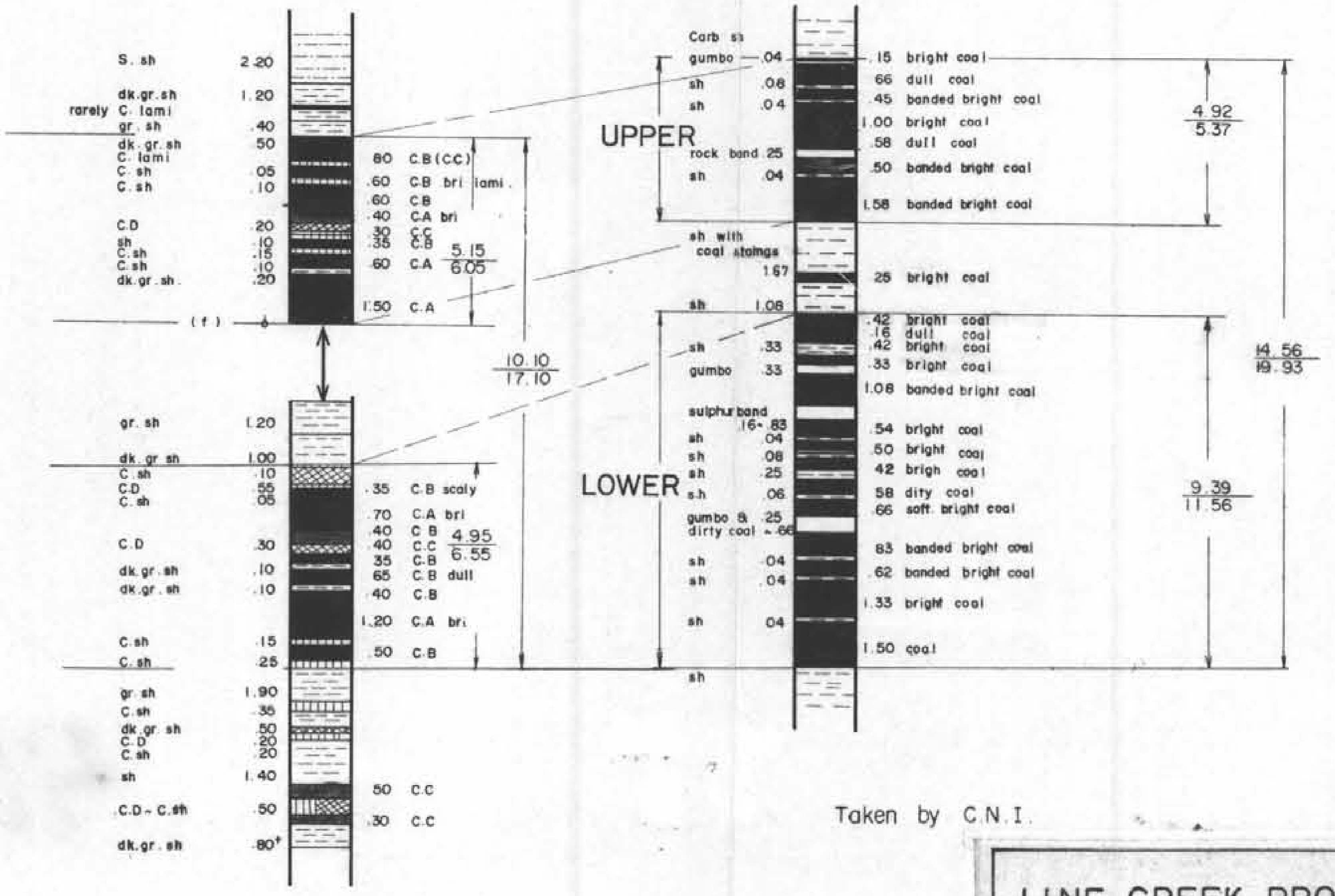


Measured by MITSUI

Taken by C.N.I

NO. 7 Seam

at outcrop near Adit — Adit 16



Measured by MITSUI

Taken by C.N.I.

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(BC. CANADA)

LINE CREEK PROJECT

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)4

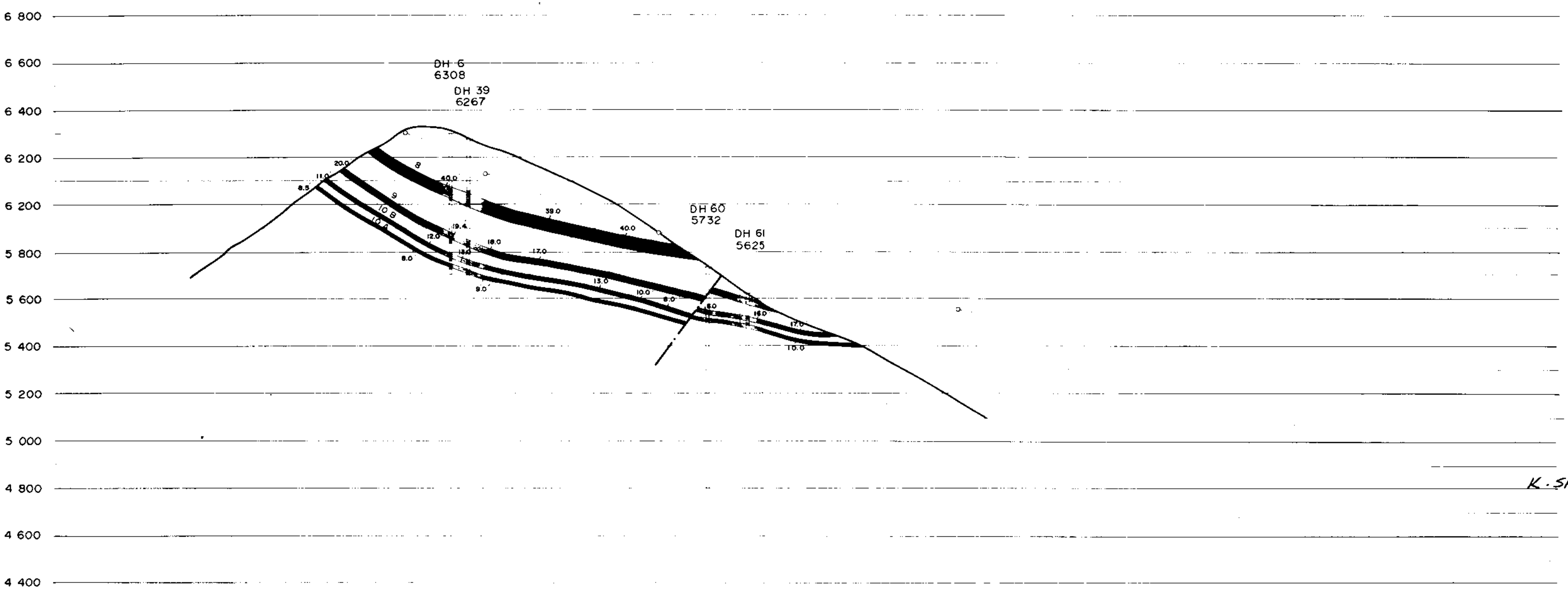
SEAMS CORRELATION & VARIATION No. 2

SCALE	1" = 5'	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	6–2

MITSUI MINING CO. LTD.
TOKYO JAPAN

2

SECTION 2-2' SCALE 1" = 400'



415

K. SHELL LINECREEK HORSESHOE RIDGE 77(2)A. 2.

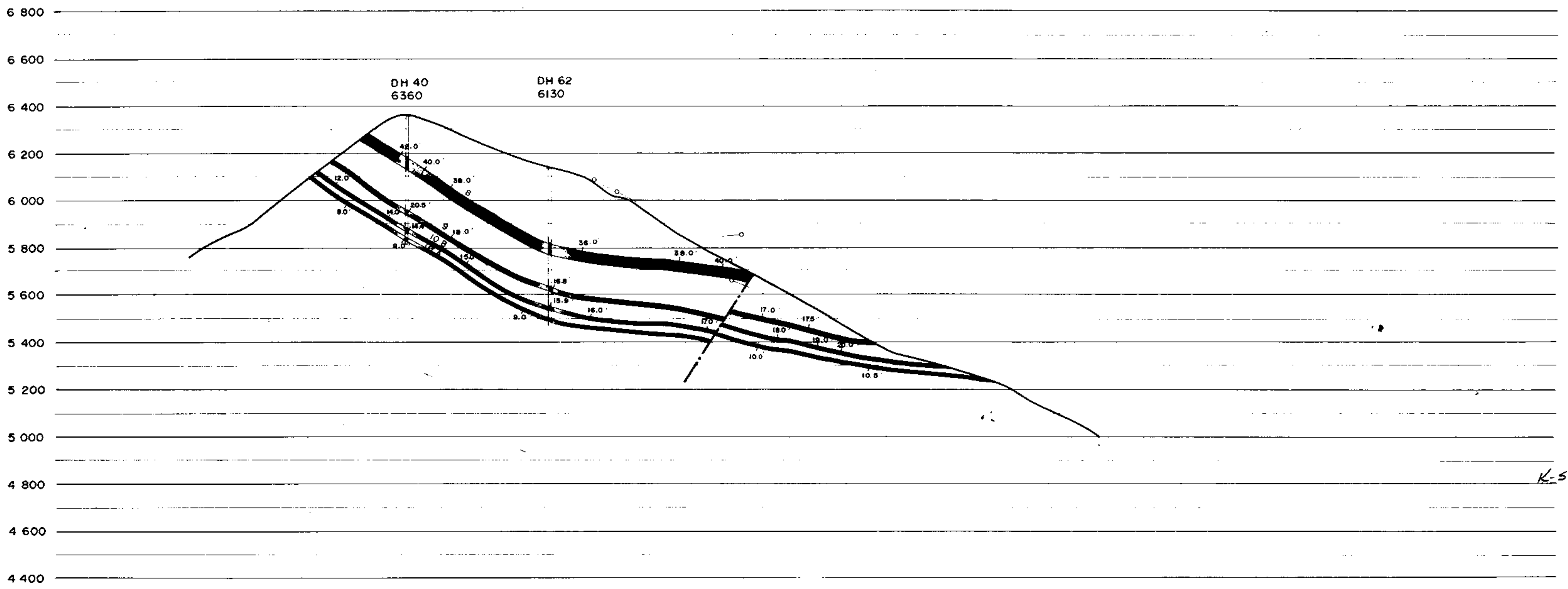
(BC CANADA)
LINE CREEK PROJECT
CROSS SECTION 2 — 2'
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE 1" = 400' APPROVED BY
DATE JUL. 1976 NO OF MAP 7-2

MITSUI MINING CO. LTD.
TOKYO JAPAN

3

SECTION 3 - 3′ SCALE 1″ = 400′



415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)4 3

(BC. CANADA)

LINE CREEK PROJECT

CROSS SECTION 3 – 3′

SHOWING SEAM THICKNESS WHICH IS ESTIMATED FROM ISOPACH MAP

SCALE 1″ = 400′

APPROVED BY

DATE JUL. 1976

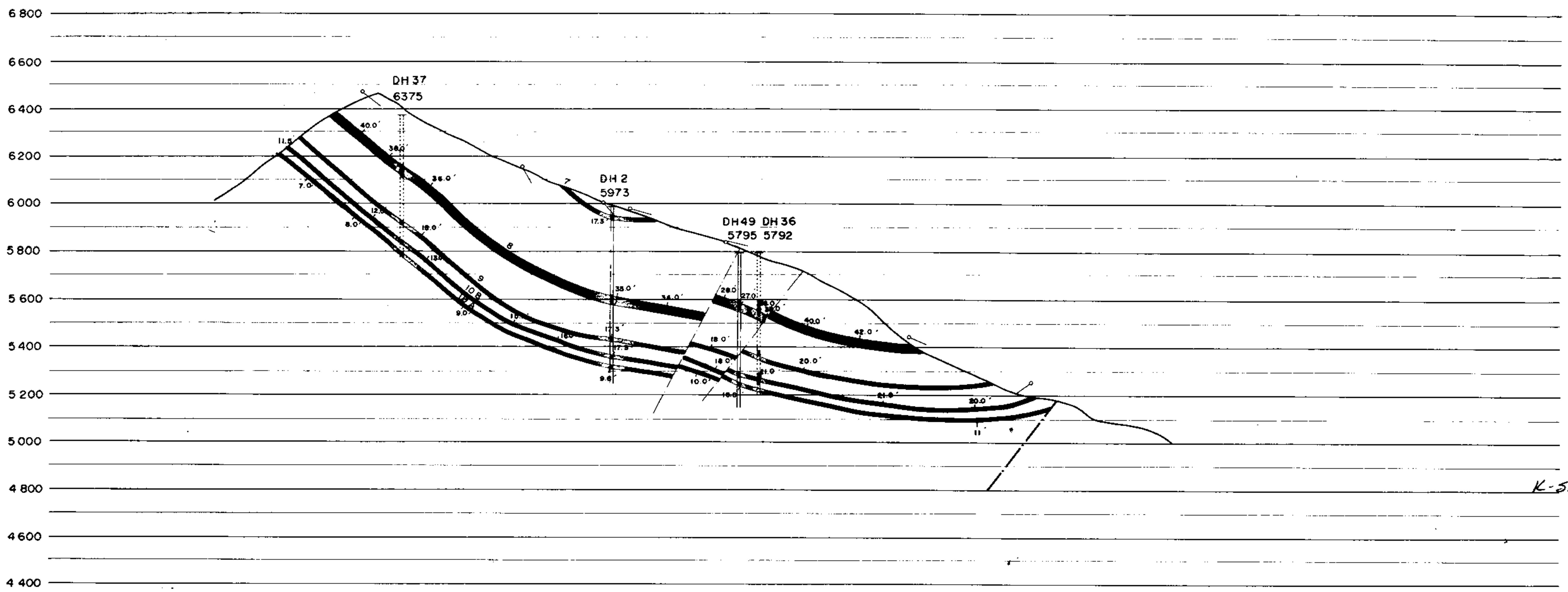
NO. OF MAP 7–3

MITSUI MINING CO. LTD.

TOKYO JAPAN

4

SECTION 4-4' SCALE 1" = 400'



415

K-SHELL -LINE CREEK HORSESHOE RIDGE 77(2)A

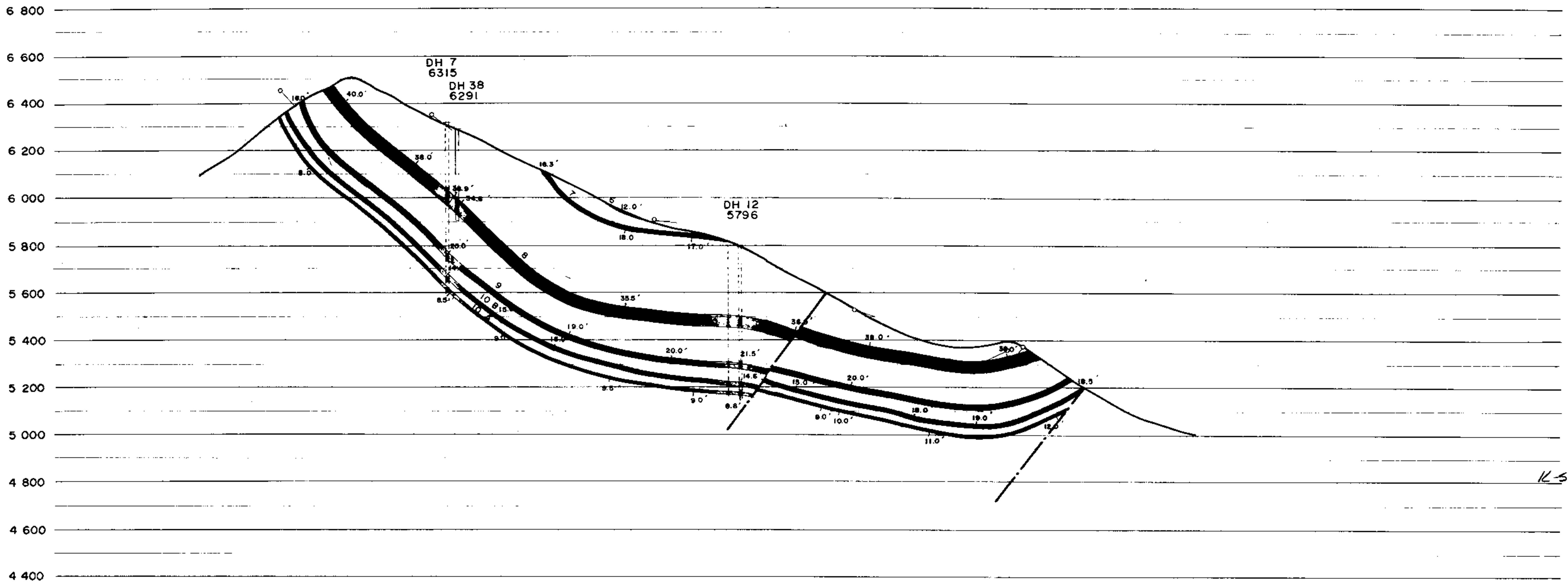
4

(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 4—4'
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	7-4

MITSUI MINING CO. LTD.
TOKYO JAPAN

SECTION 5-5′ SCALE 1″=400′



415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)4 5

(BC. CANADA)

LINE CREEK PROJECT

CROSS SECTION 5—5′

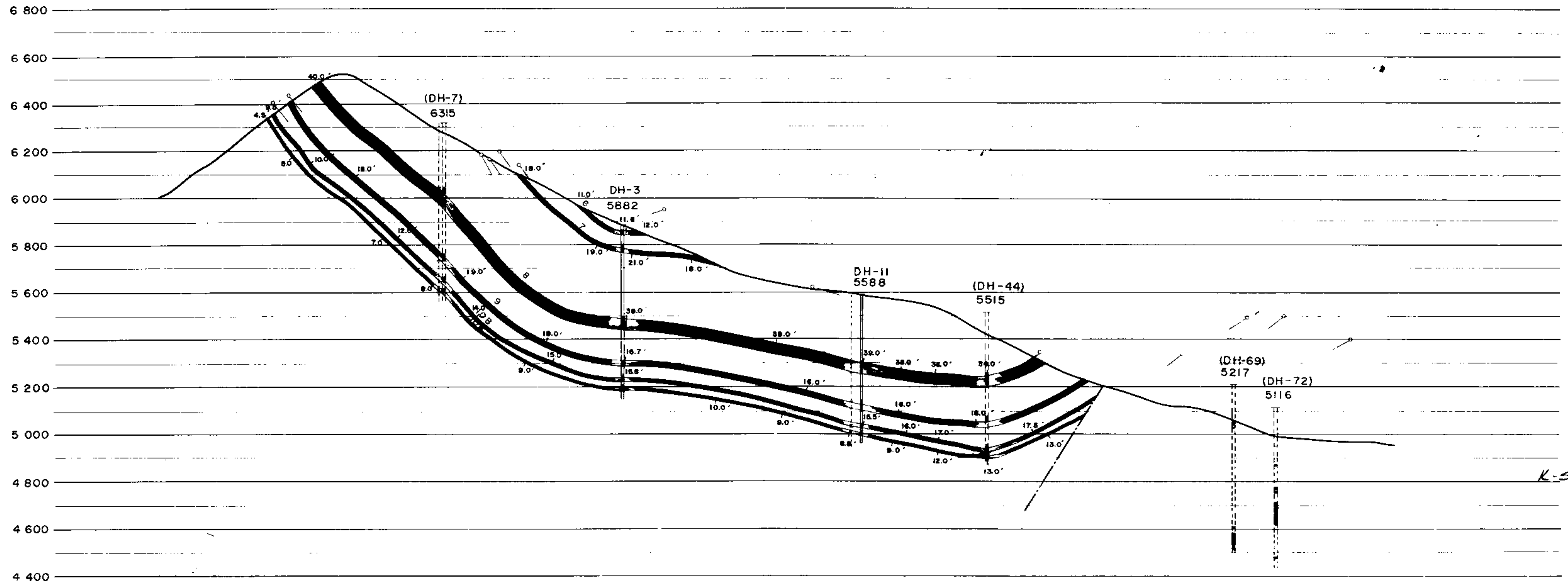
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE	1″ = 400′	APPROVED BY	
DATE	JUL 1976	NO OF MAP	7-5

MITSUI MINING CO. LTD.
TOKYO JAPAN

6

SECTION 6-6' SCALE 1" = 400'



415

K-SHELL [redacted]- LINE CREEK HORSESHOE RIDGE 77(2)A 6

(BC. CANADA)

LINE CREEK PROJECT

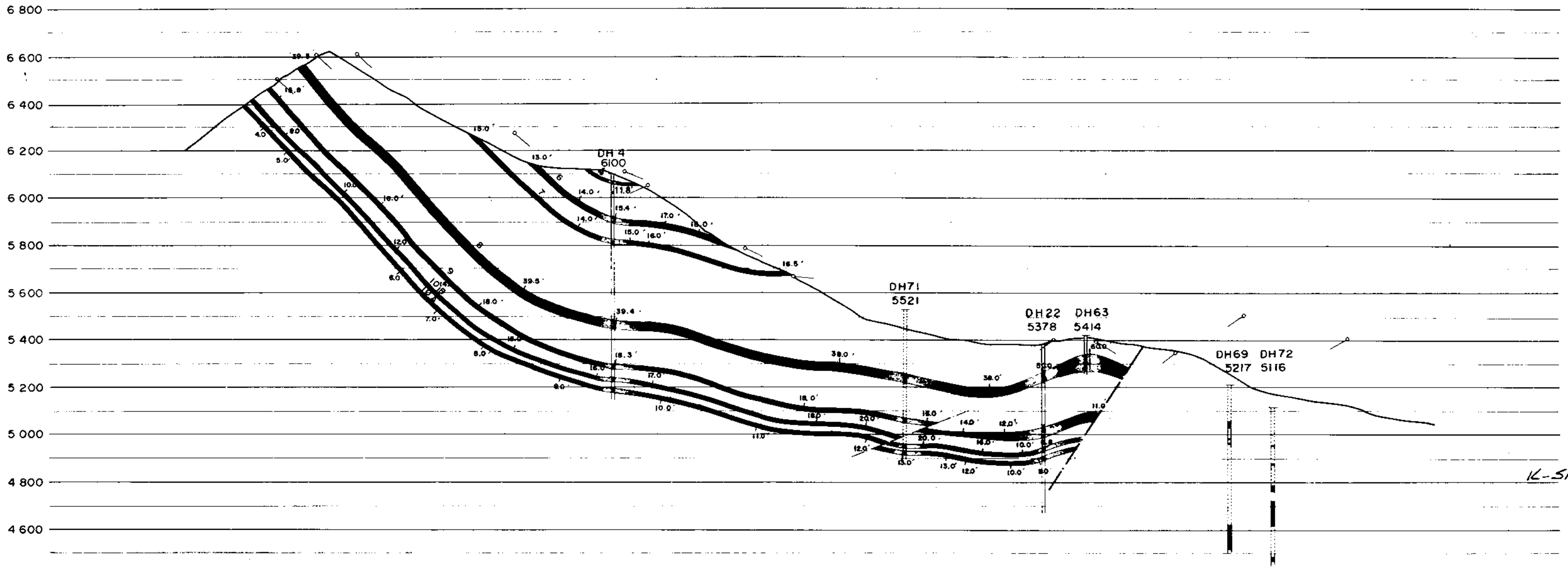
CROSS SECTION 6 – 6'

SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE 1" = 400' APPROVED BY
DATE JUL 1976 NO OF MAP 7-6

MITSUI MINING CO. LTD
TOKYO JAPAN

SECTION 7-7' SCALE 1" = 400'



415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)
LINE CREEK PROJECT

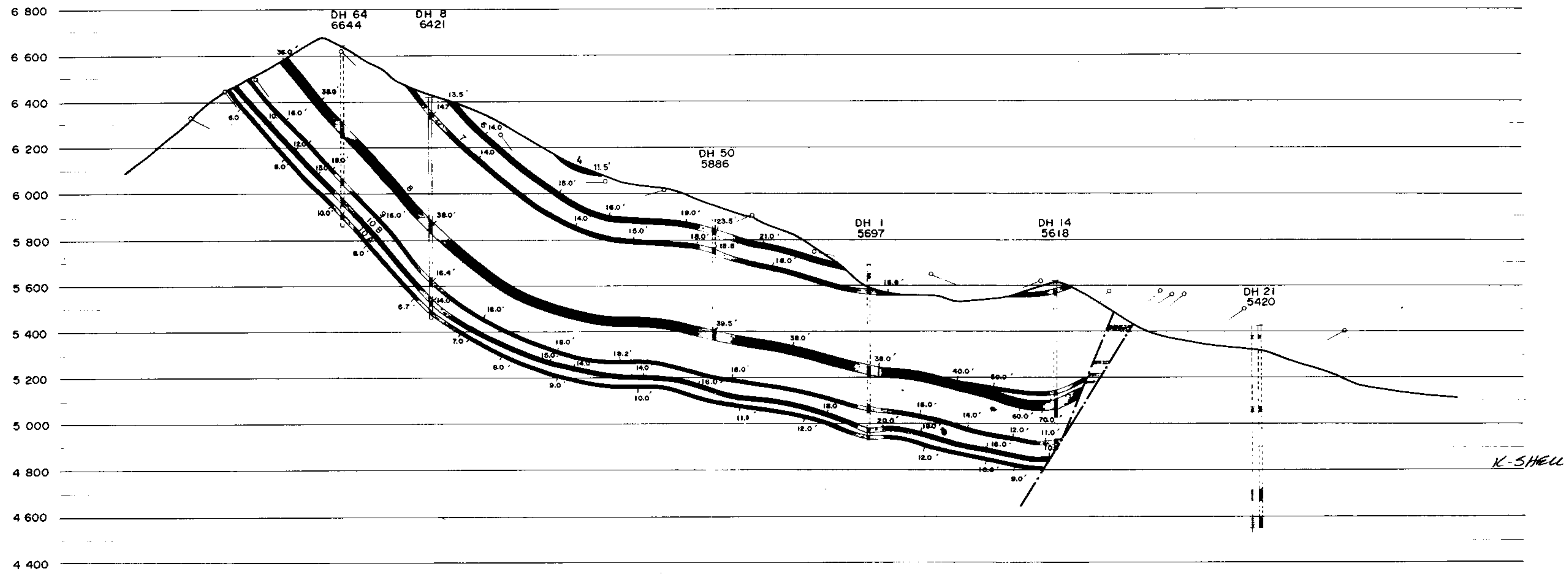
CROSS SECTION 7—7'
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 7-7

MITSUI MINING CO. LTD.
TOKYO JAPAN

8

SECTION 8-8' SCALE 1"= 400'



415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)

LINE CREEK PROJECT

CROSS SECTION 8 — 8'

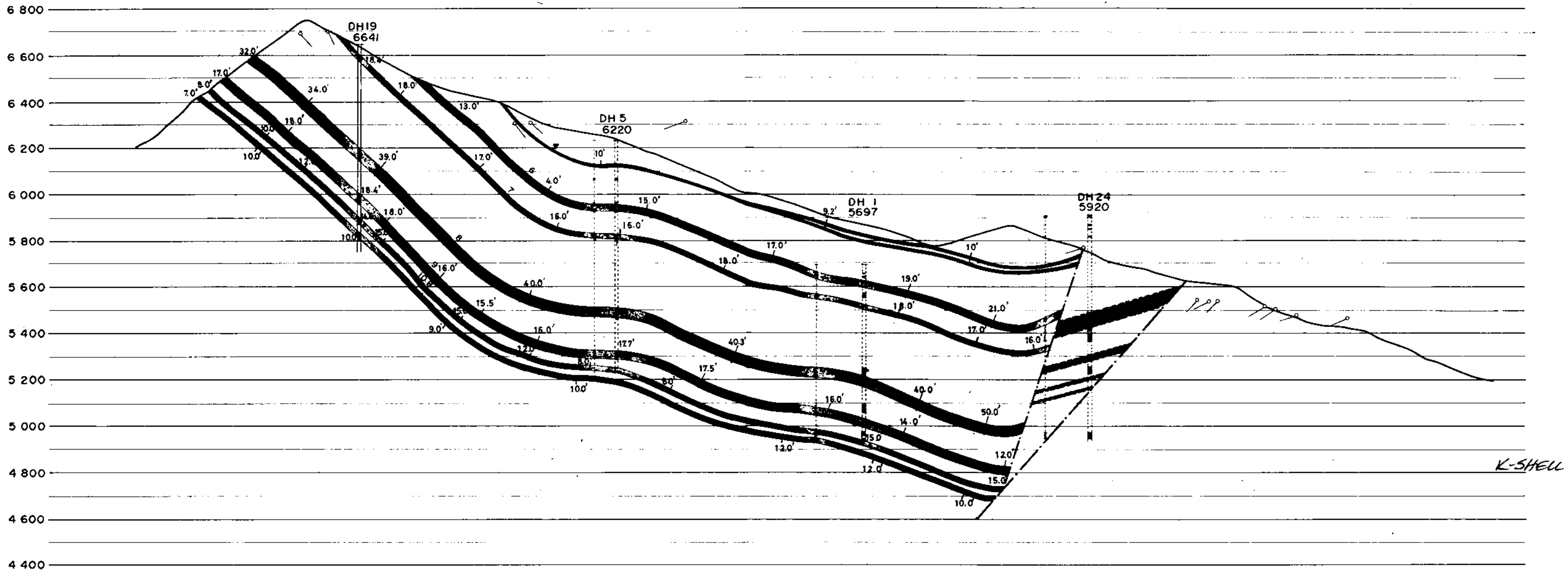
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	7-8

MITSUI MINING CO. LTD.
TOKYO JAPAN

9

SECTION 9-9' SCALE 1" = 400'



415

77(2)A.
K-SHELL LINE CREEK HORSESHOE RIDGE

(BC. CANADA)
LINE CREEK PROJECT

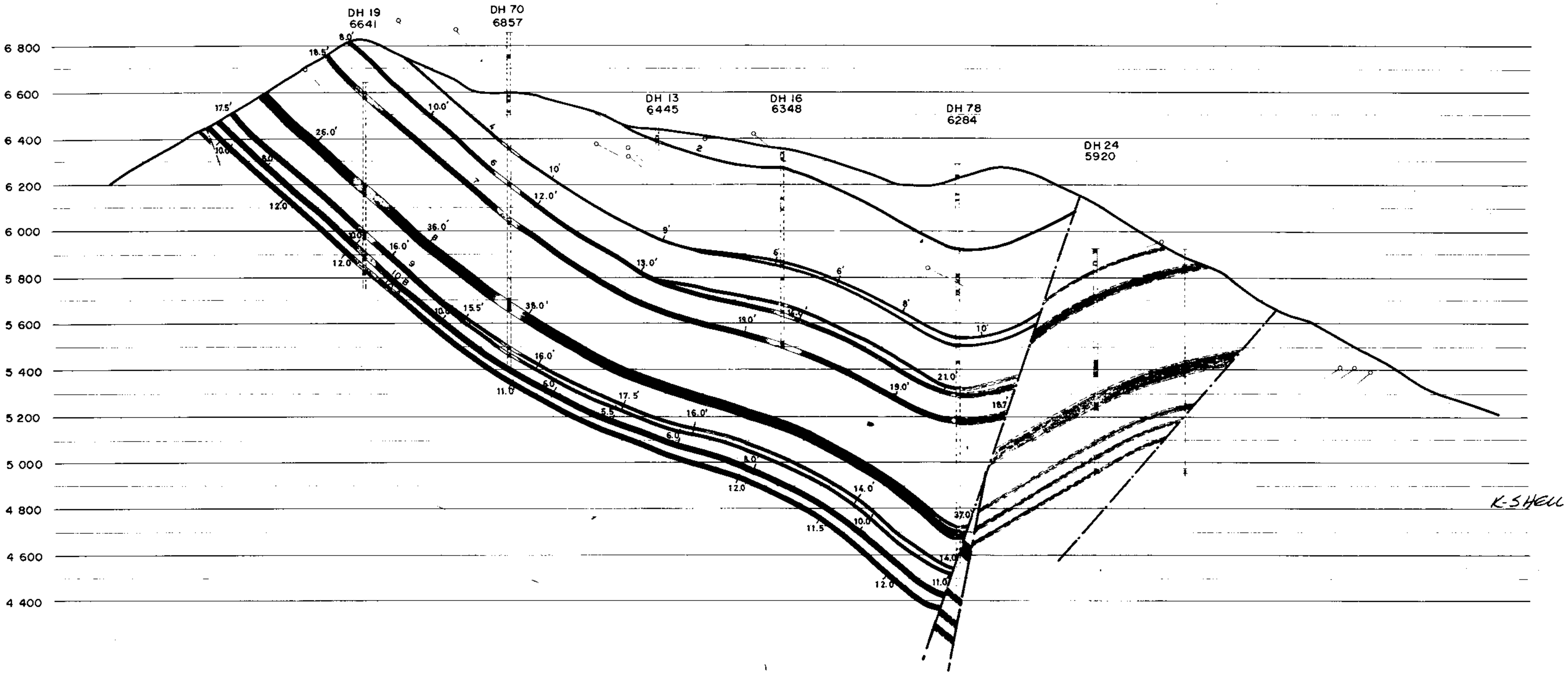
CROSS SECTION 9-9'
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	7-9

MITSUI MINING CO. LTD.
TOKYO JAPAN

10

SECTION 10–10′ SCALE 1″ = 400′



415

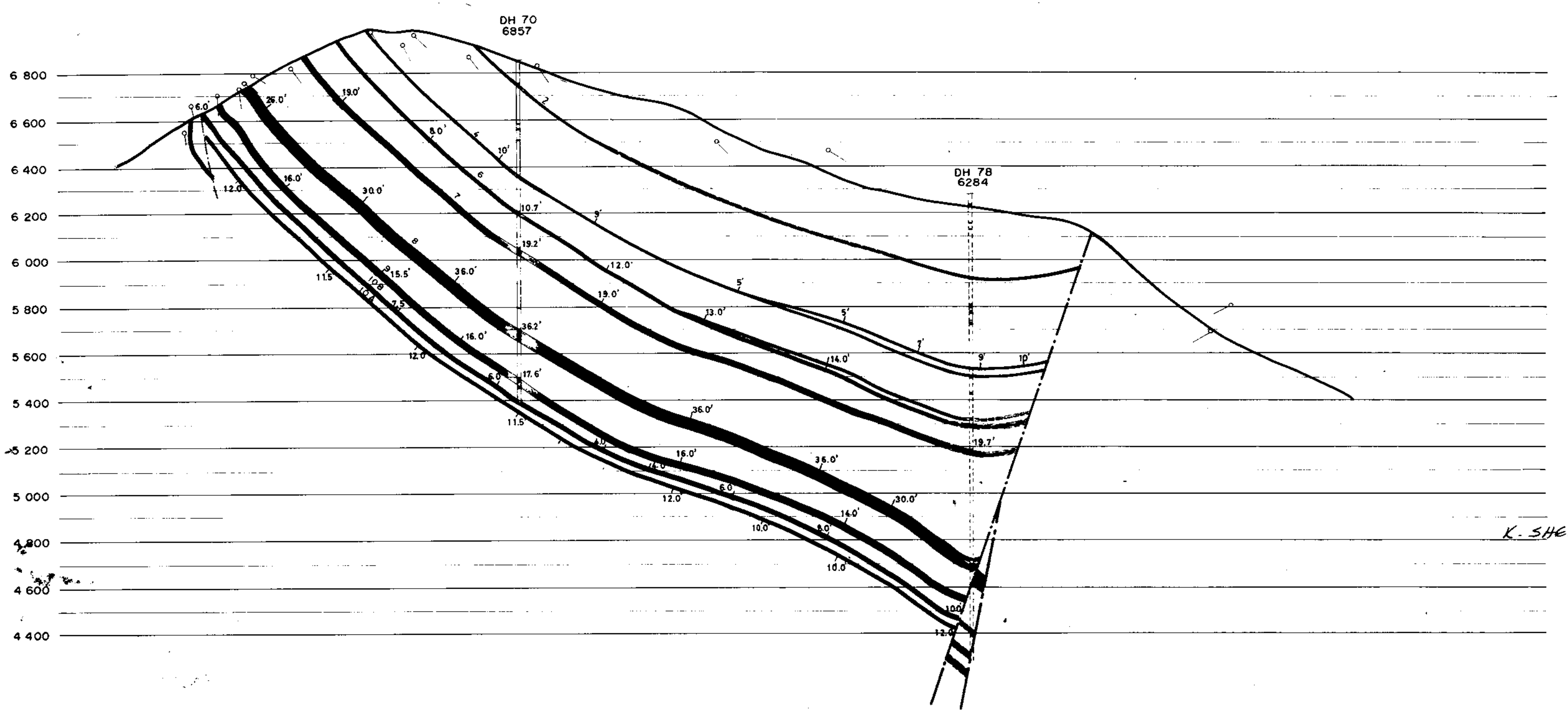
K-SHELL LINECREEK HORSESHOE RIDGE 77(2)4

(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 10–10′
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE	1″ = 400′	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	7–10

MITSUI MINING CO. LTD.
TOKYO JAPAN

SECTION 11-11' SCALE 1"= 400'



415

K. SHELL ■ LINE CREEK HORSESHOE RIDGE 77(2)4

(BC. CANADA)

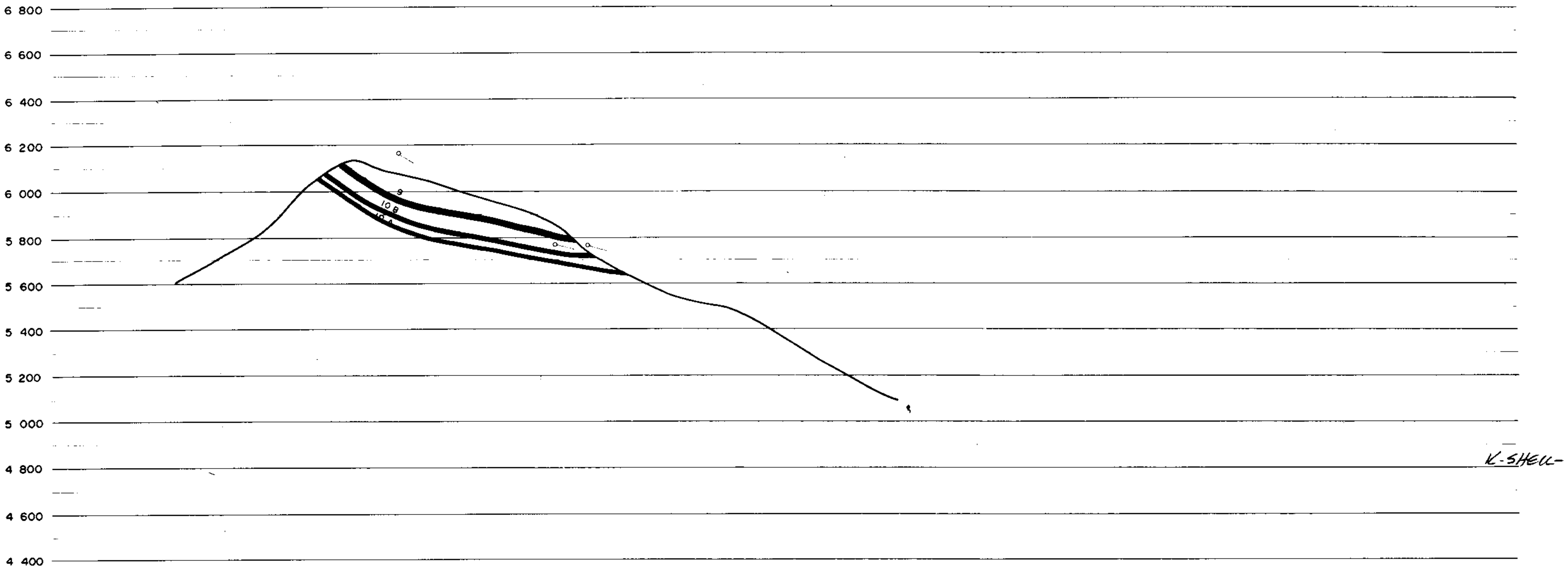
LINE CREEK PROJECT

CROSS SECTION 11-11'
SHOWING SEAM THICKNESS WHICH
IS ESTIMATED FROM ISOPACH MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO OF MAP 7-11

MITSUI MINING CO. LTD.
TOKYO JAPAN

SECTION I - I' SCALE 1" = 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei $\frac{9.0\%}{4\frac{1}{2}}$ ASH / FSI

415

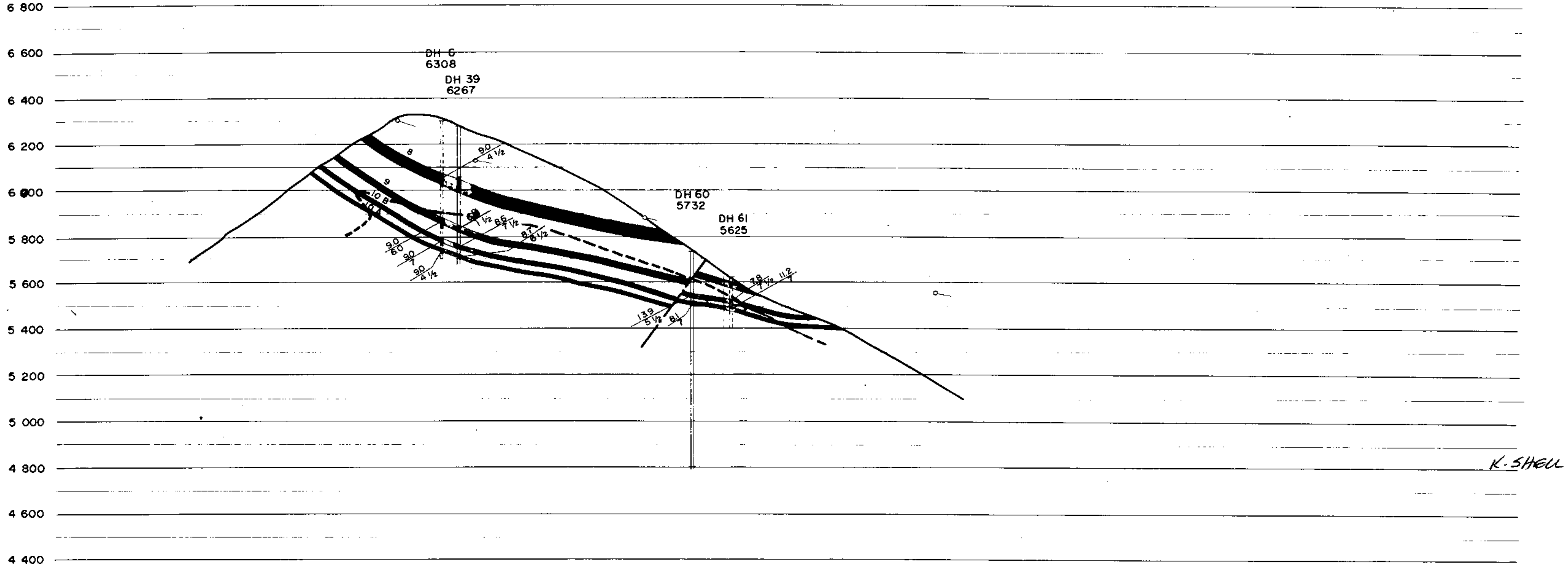
K-SHELL- LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION I - I'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	8-1

MITSUI MINING CO. LTD.
TOKYO JAPAN

SECTION 2-2′ SCALE 1″= 400′



ESTIMATED LIMIT OF OXIDIZED ZONE

el 9.0% ASH / 4 1/2 FSI

415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)

LINE CREEK PROJECT

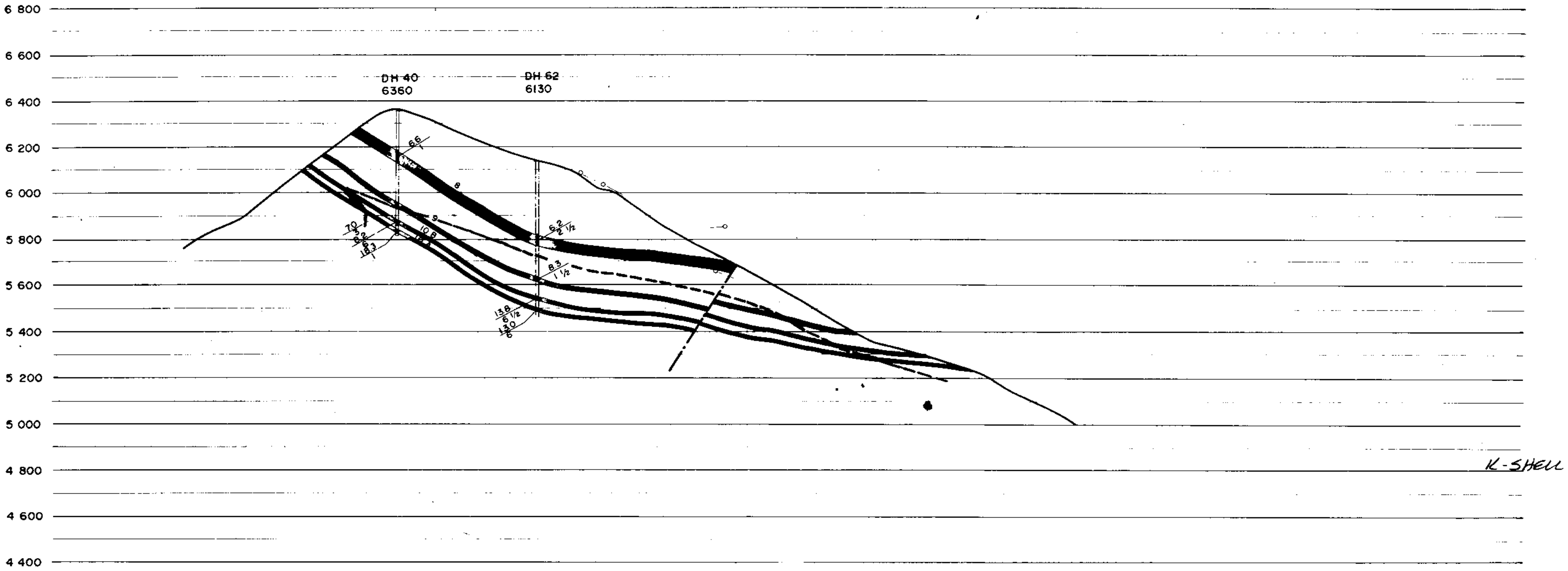
CROSS SECTION 2 – 2′
SHOWING F.S.I. VARIATION

SCALE	1″= 400′	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	8 – 2

MITSUI MINING CO. LTD.
TOKYO JAPAN

3

SECTION 3 - 3′ SCALE 1″ = 400′



ESTIMATED LIMIT OF OXIDIZED ZONE

ei 9.0% ASH
4 1/2 FSI

415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

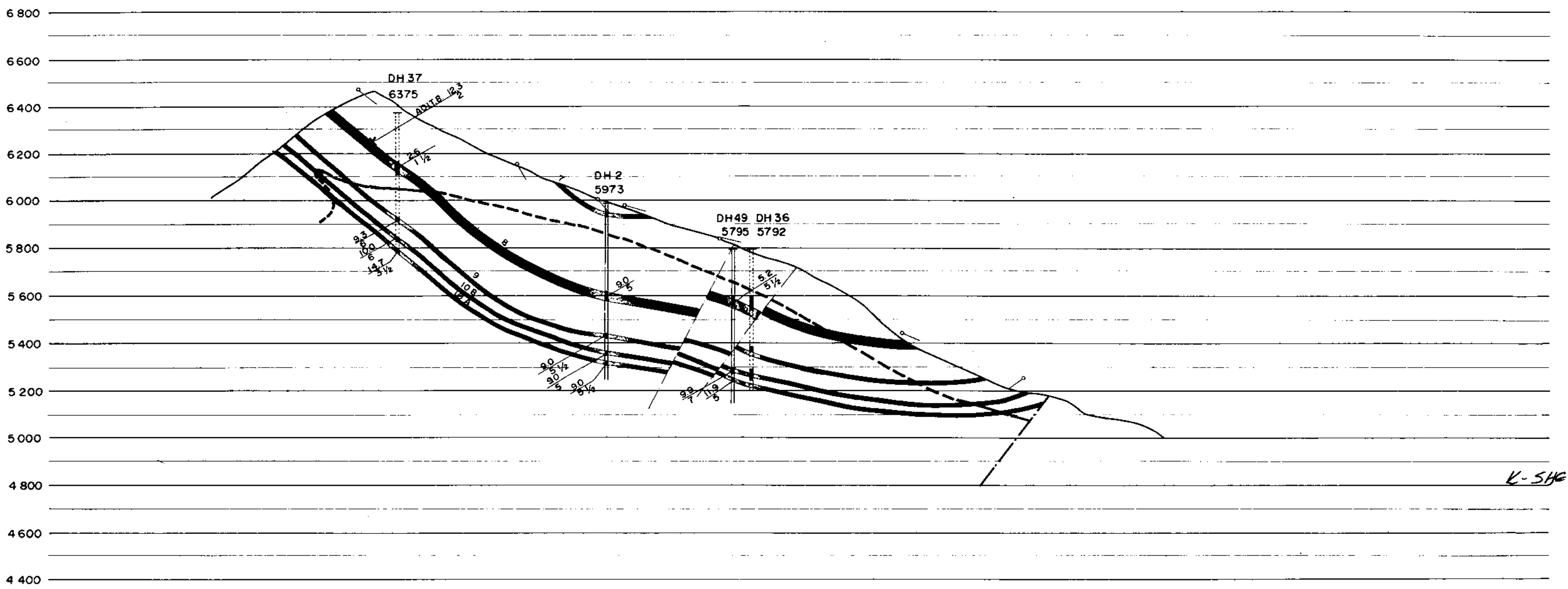
(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 3 – 3′
SHOWING F.S.I. VARIATION

SCALE 1″ = 400′
APPROVED BY
DATE JUL 1976
NO OF MAP 8-3

MITSUI MINING CO. LTD.
TOKYO JAPAN

4

SECTION 4-4' SCALE 1" = 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei 9.0% ASH
4½ FSI

415

K-SHELL ▨ LINE CREEK HORSESHOE RIDGE 77(2)A

(BC. CANADA)
LINE CREEK PROJECT

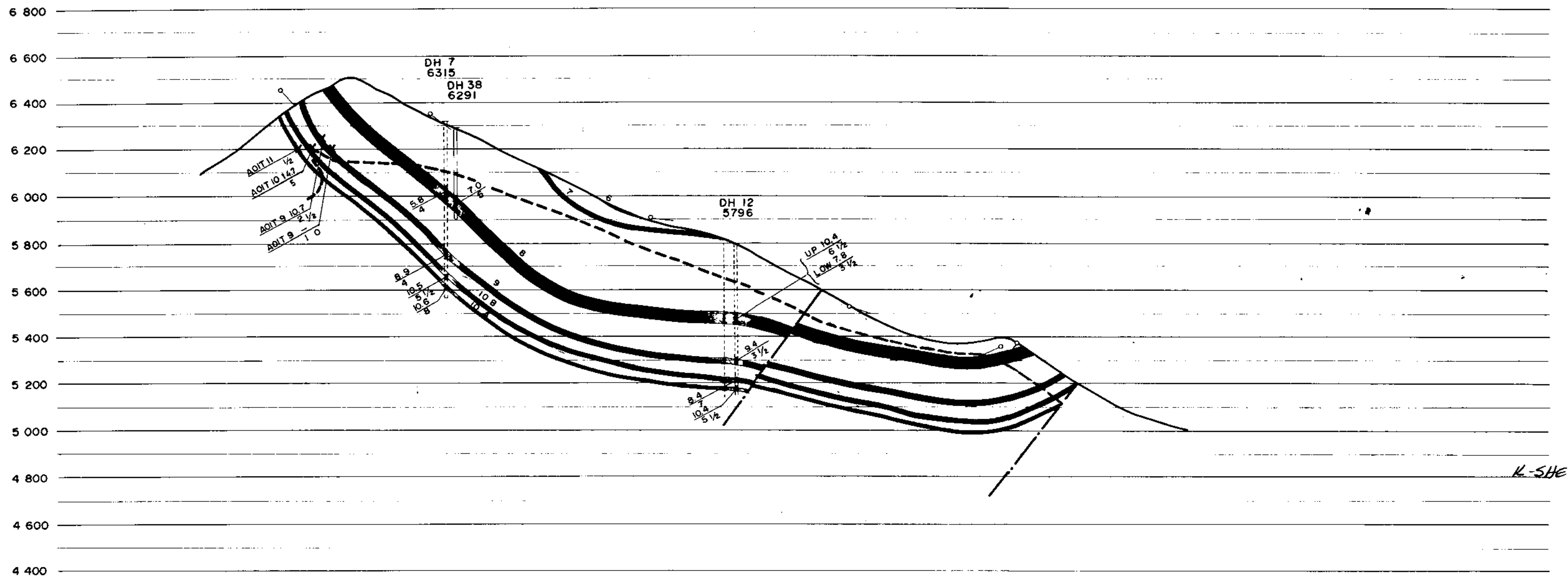
CROSS SECTION 4 — 4'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	8-4

MITSUI MINING CO. LTD.
TOKYO JAPAN

5

SECTION 5-5' SCALE 1" = 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei 9.0% ASH
4 1/2 FSI

415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)
LINE CREEK PROJECT

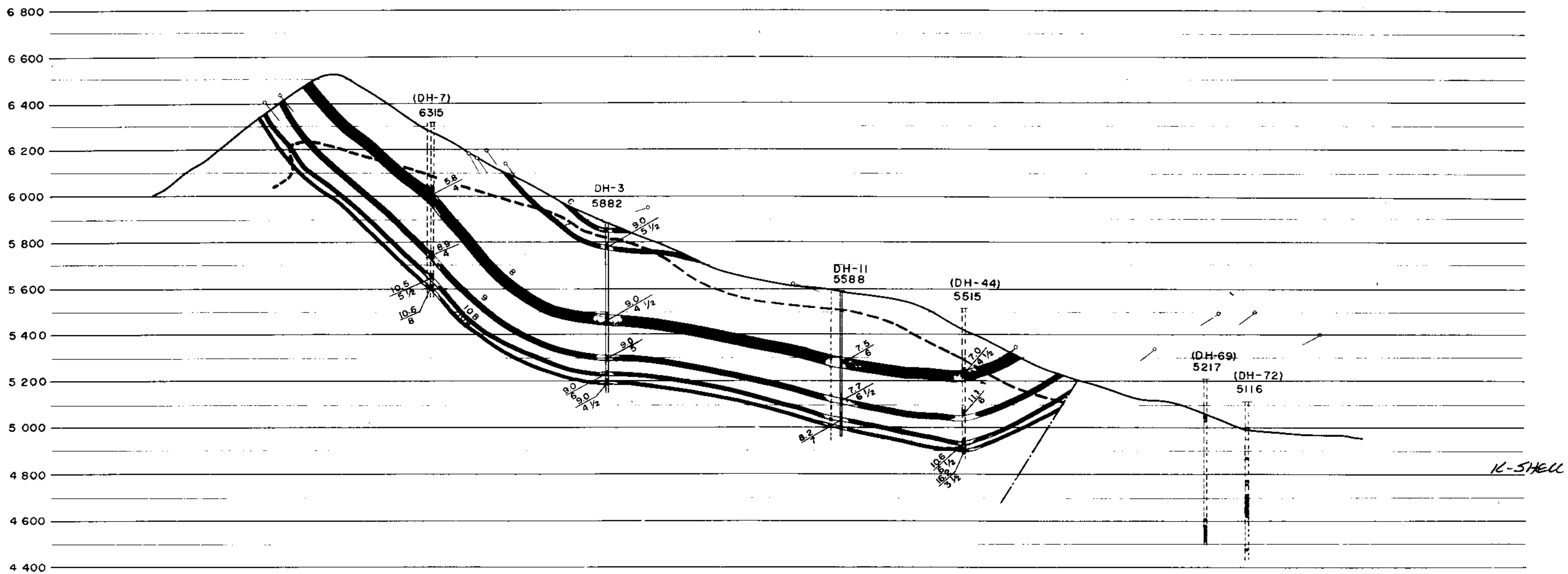
CROSS SECTION 5 — 5'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	8-5

MITSUI MINING CO. LTD.
TOKYO JAPAN

6

SECTION 6-6′ SCALE 1″= 400′



━ ━ ━ ------------ ESTIMATED LIMIT OF OXIDIZED ZONE

ei 9.0% ------------ ASH
4½ ------------ FSI

415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

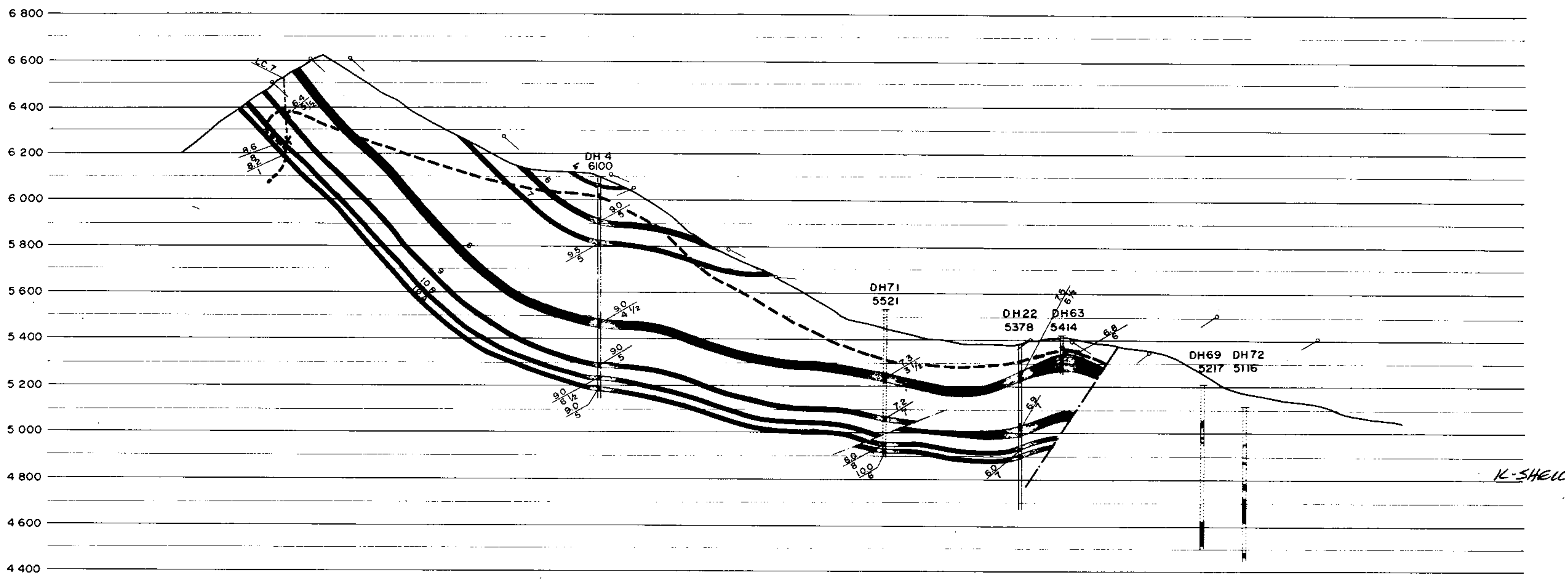
(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 6—6′
SHOWING F.S.I. VARIATION

SCALE	1″= 400′	APPROVED BY	
DATE	JUL 1976	NO OF MAP	8-6

MITSUI MINING CO. LTD
TOKYO JAPAN

7

SECTION 7—7′ SCALE 1″= 400′



ESTIMATED LIMIT OF OXIDIZED ZONE

el 9.0% ASH
4 1/2 FSI

415

K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A

(BC. CANADA)
LINE CREEK PROJECT

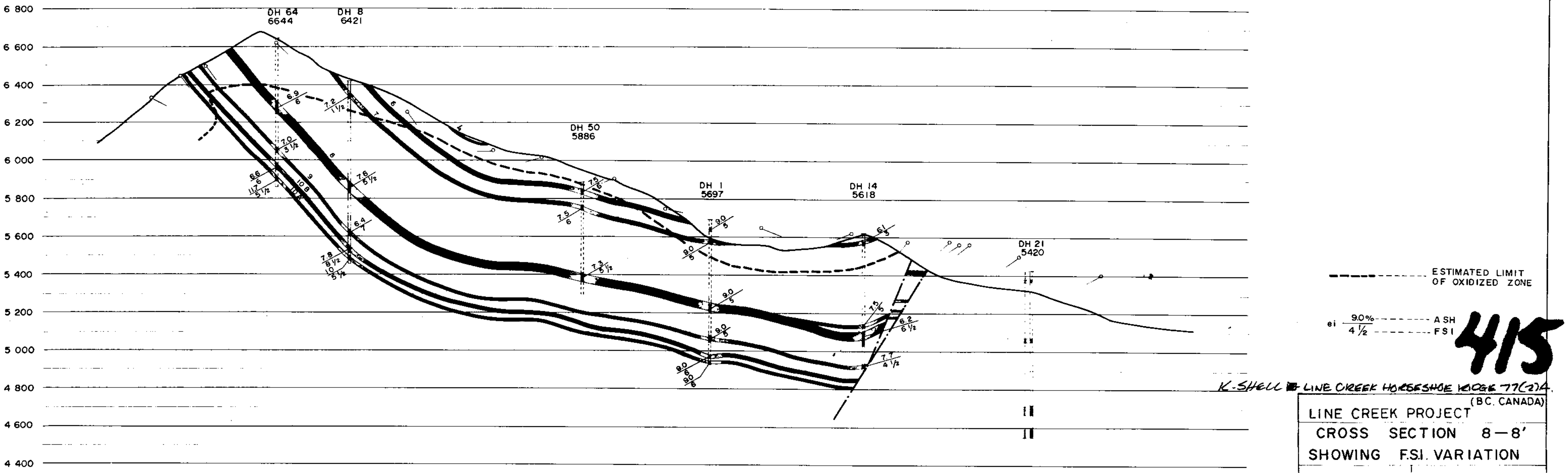
CROSS SECTION 7—7′
SHOWING F.S.I. VARIATION

SCALE	1″= 400′	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	8—7

MITSUI MINING CO. LTD.
TOKYO JAPAN

8

SECTION 8-8′ SCALE 1″= 400′



415

K-SHELL ■ LINE CREEK HORSESHOE RIDGE 77(2)A.

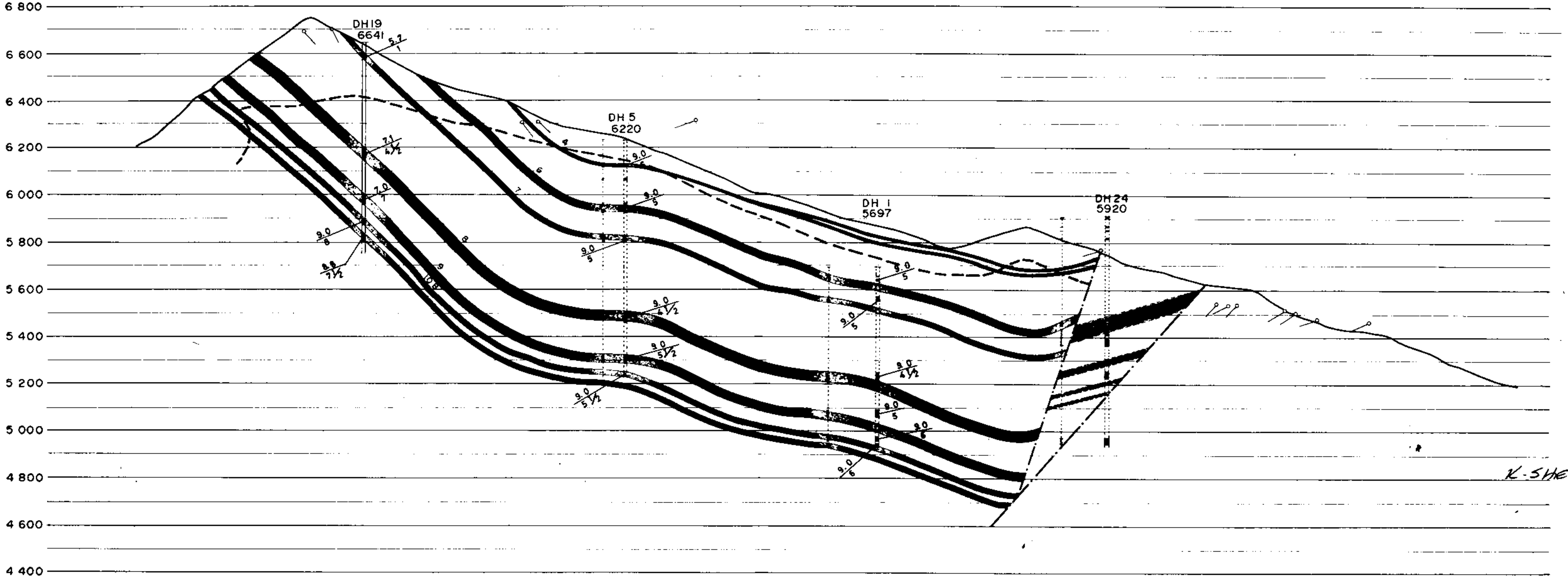
(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 8—8′
SHOWING F.S.I. VARIATION

SCALE 1″= 400′
APPROVED BY
DATE JUL 1976
NO OF MAP 8-8

MITSUI MINING CO. LTD
TOKYO JAPAN

9

SECTION 9-9' SCALE 1" = 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei $\frac{9.0\%}{4\frac{1}{2}}$ — ASH — F.S.I.

415

K-SHELL ~~B~~ LINE CREEK HORSESHOE RIDGE 77(2)4

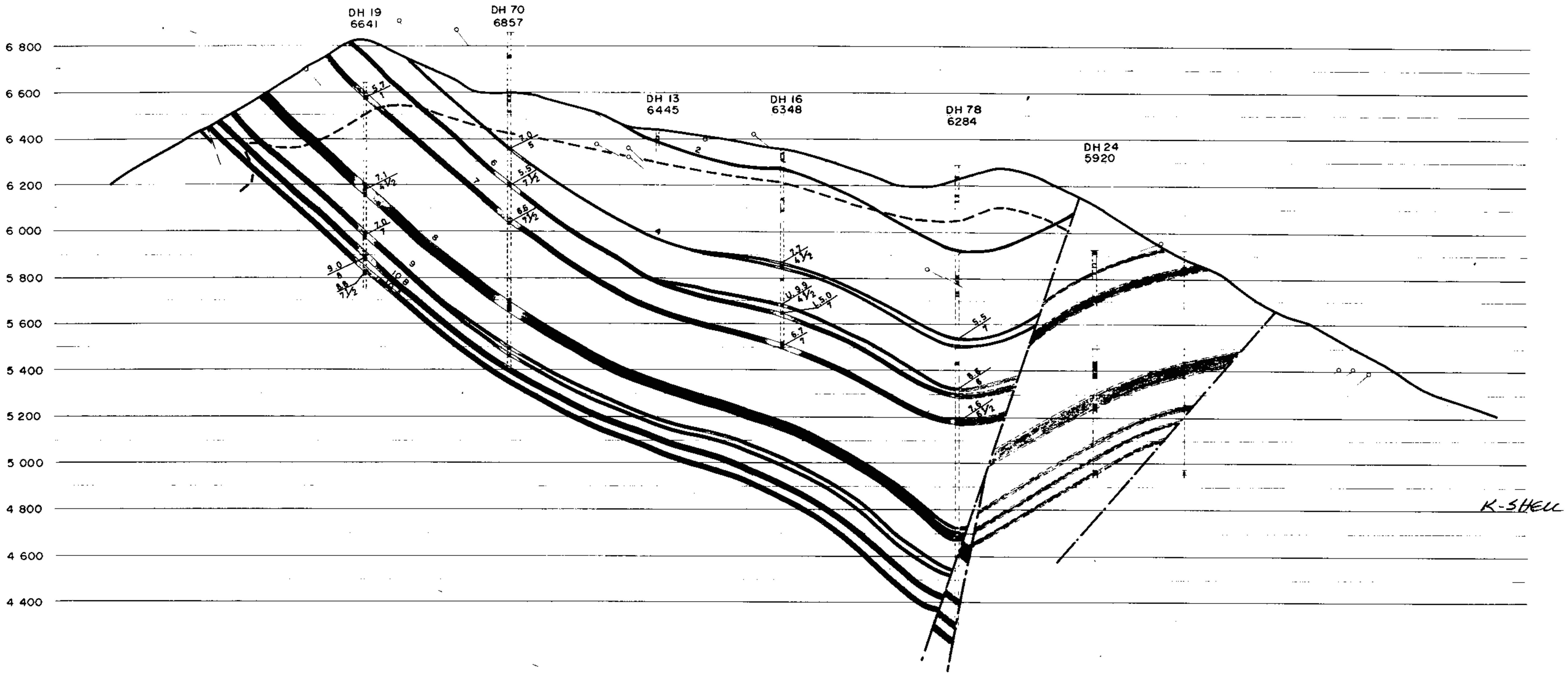
(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 9-9'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	8-9

MITSUI MINING CO. LTD.
TOKYO JAPAN

10

SECTION 10-10' SCALE 1" = 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei 9.0 % ----- ASH
4½ ----- F.S.I.

415

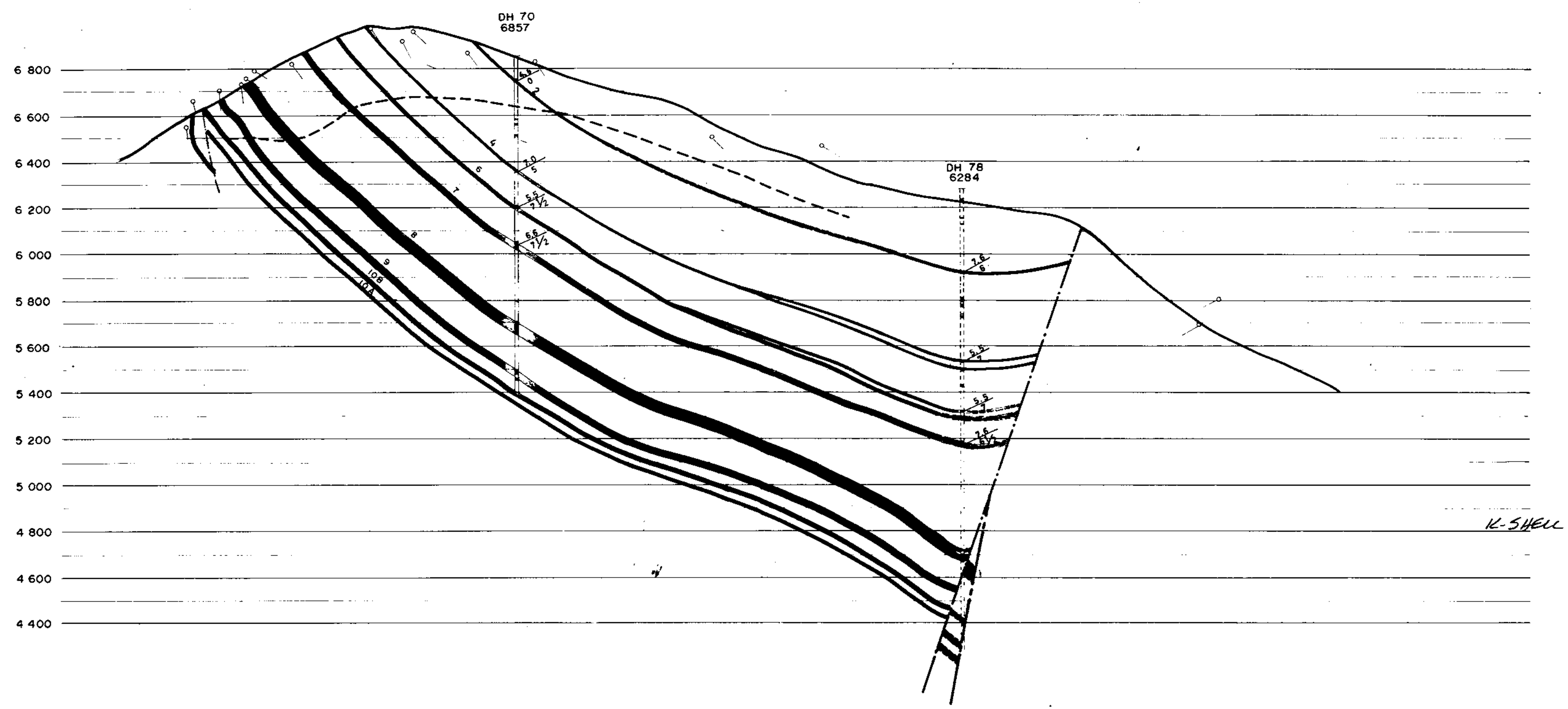
K-SHELL ■ LINE CREEK HORSESHOE RIDGE 71(2)A.

(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 10 - 10'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	8-10

MITSUI MINING CO. LTD.
TOKYO JAPAN

SECTION 11-11' SCALE 1"= 400'



ESTIMATED LIMIT OF OXIDIZED ZONE

ei $\frac{9.0\%}{4\frac{1}{2}}$ ASH F.S.I.

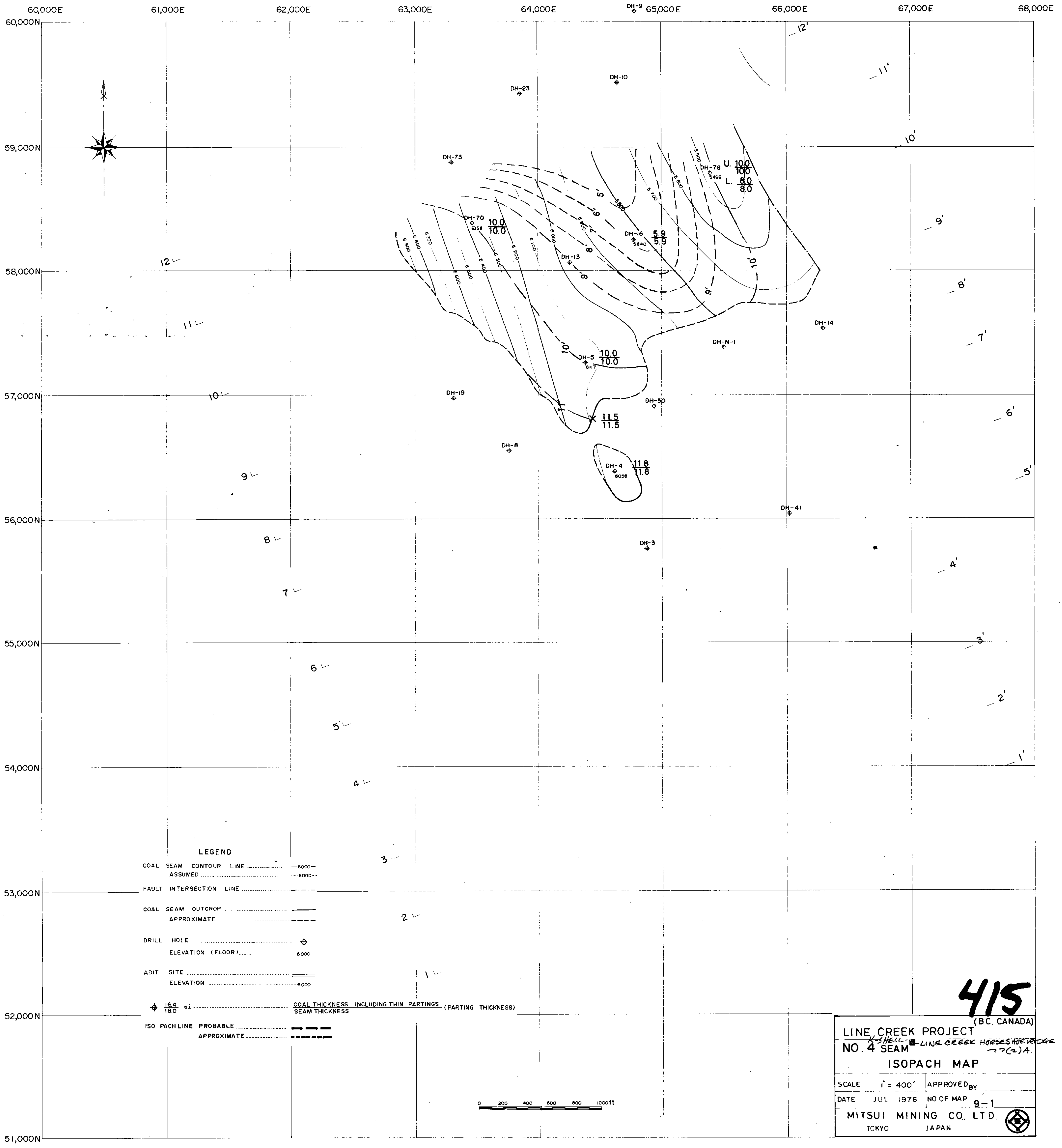
415

K-SHELL ■ LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)
LINE CREEK PROJECT
CROSS SECTION 11-11'
SHOWING F.S.I. VARIATION

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO OF MAP	8-11

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

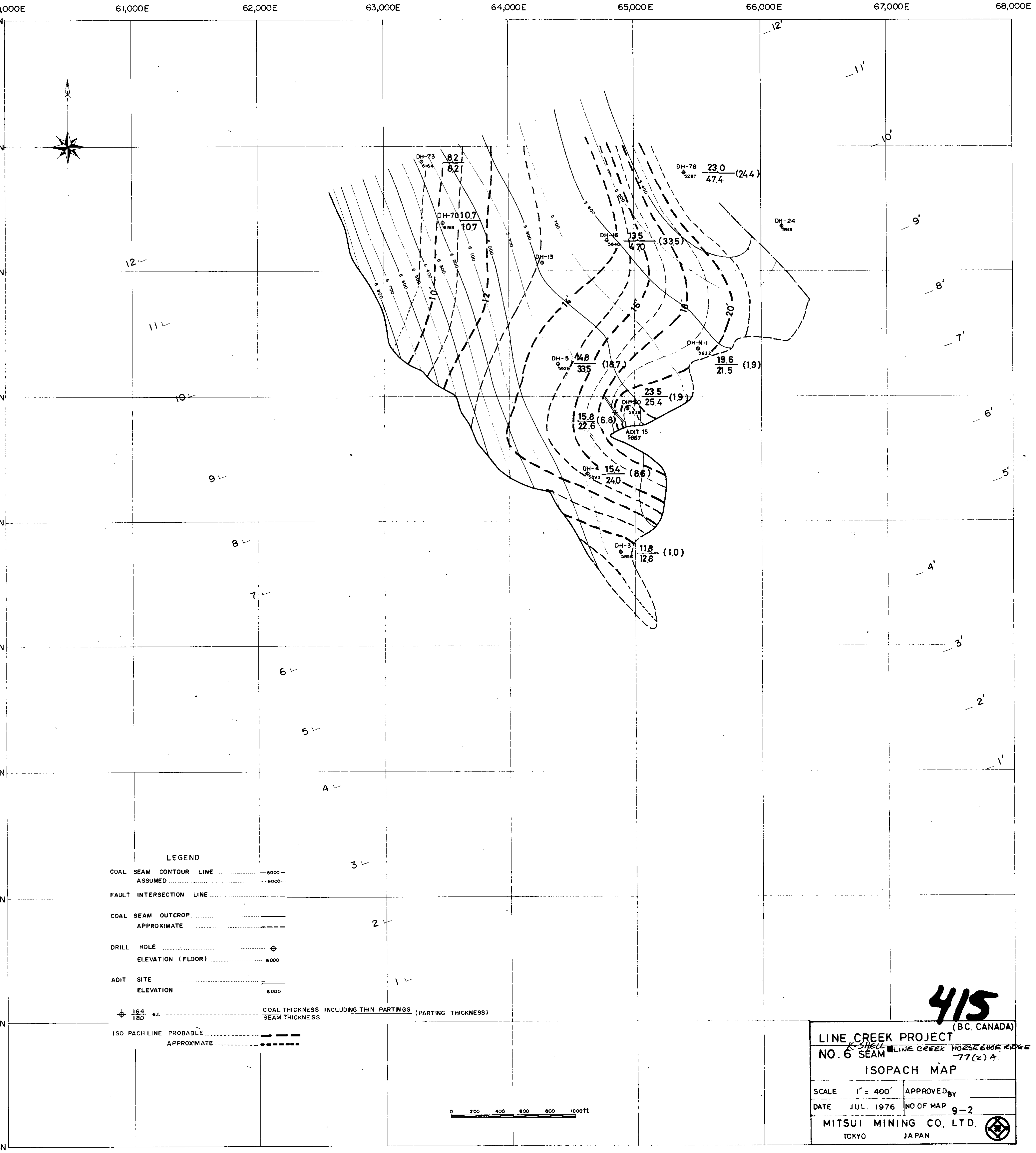
COAL SEAM CONTOUR LINE 6000
ASSUMED 6000
FAULT INTERSECTION LINE ....
COAL SEAM OUTCROP ....
APPROXIMATE ....
DRILL HOLE .... ⊕
ELEVATION (FLOOR) 6000
ADIT SITE ....
ELEVATION 6000
⊕ 16.4/18.0 e.i. .... COAL THICKNESS INCLUDING THIN PARTINGS / SEAM THICKNESS (PARTING THICKNESS)
ISO PACHLINE PROBABLE ....
APPROXIMATE ....

415

(B.C. CANADA)
LINE CREEK PROJECT
NO. 4 SEAM K-SHELL - LINE CREEK HORSESHOE RIDGE 77(2)A.
ISOPACH MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL 1976
NO OF MAP 9-1
MITSUI MINING CO. LTD.
TOKYO JAPAN

415



LINE CREEK PROJECT (BC. CANADA)

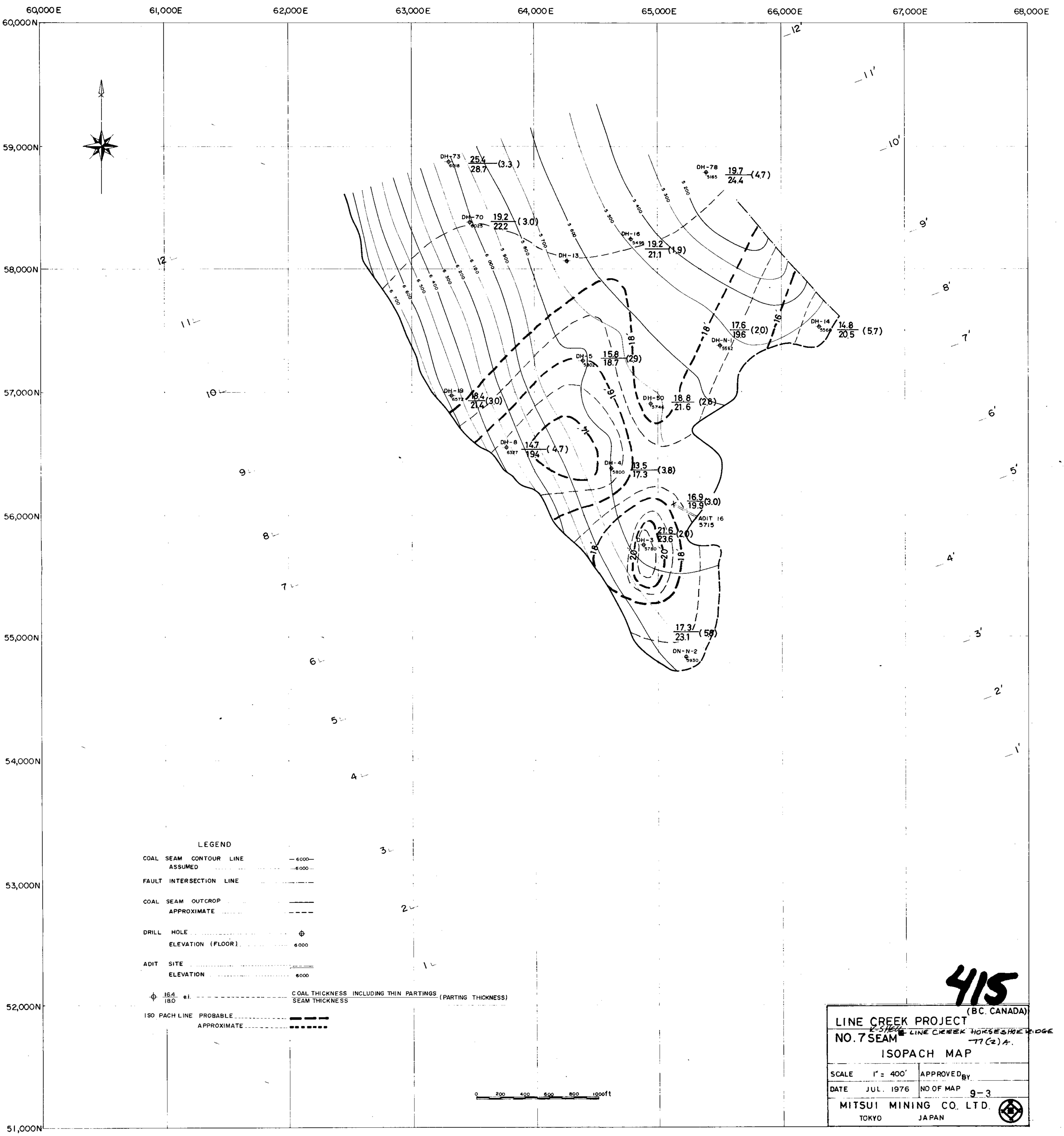
NO. 6 SEAM K-SHELL LINE CREEK HORSESHOE RIDGE
77(2)A.

ISOPACH MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO.OF MAP 9-2

MITSUI MINING CO. LTD.
TOKYO JAPAN

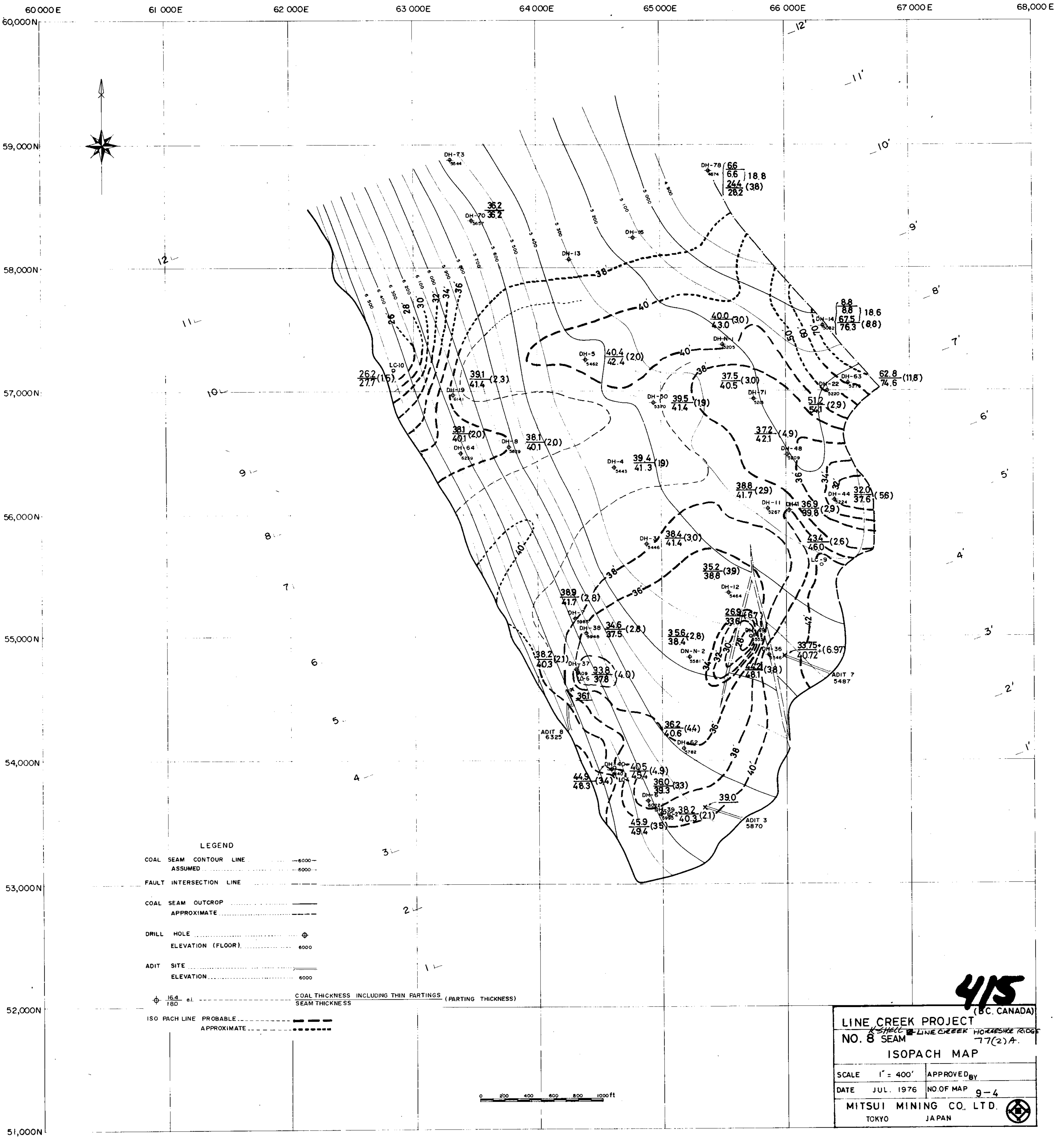
415



(B.C. CANADA)
LINE CREEK PROJECT
NO. 7 SEAM ~~K-SHELL~~ LINE CREEK HORSESHOE RIDGE
77(2)A.
ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	9-3

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(BC. CANADA)

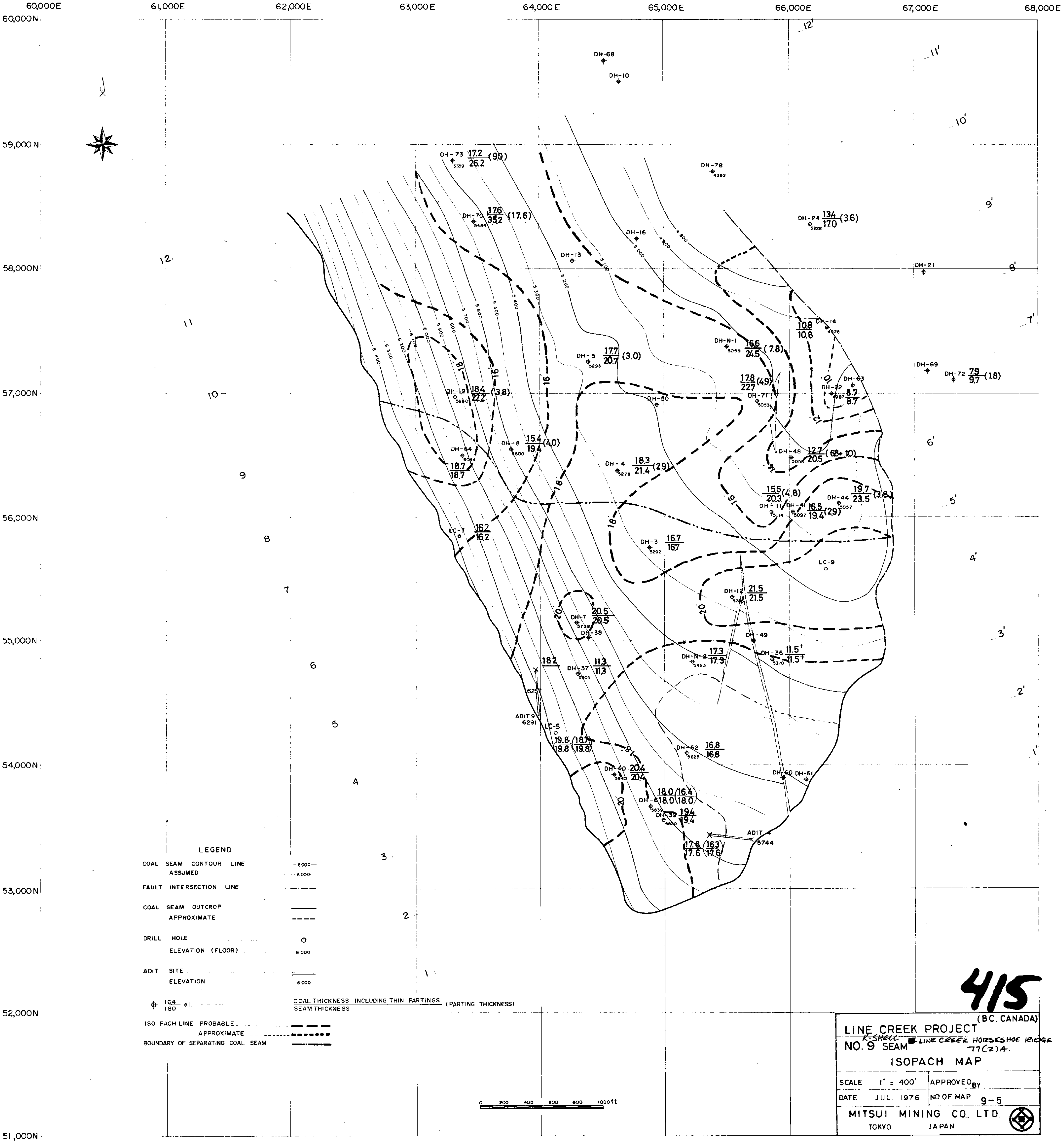
LINE CREEK PROJECT

NO. 8 SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	9-4

MITSUI MINING CO. LTD.
TOKYO JAPAN



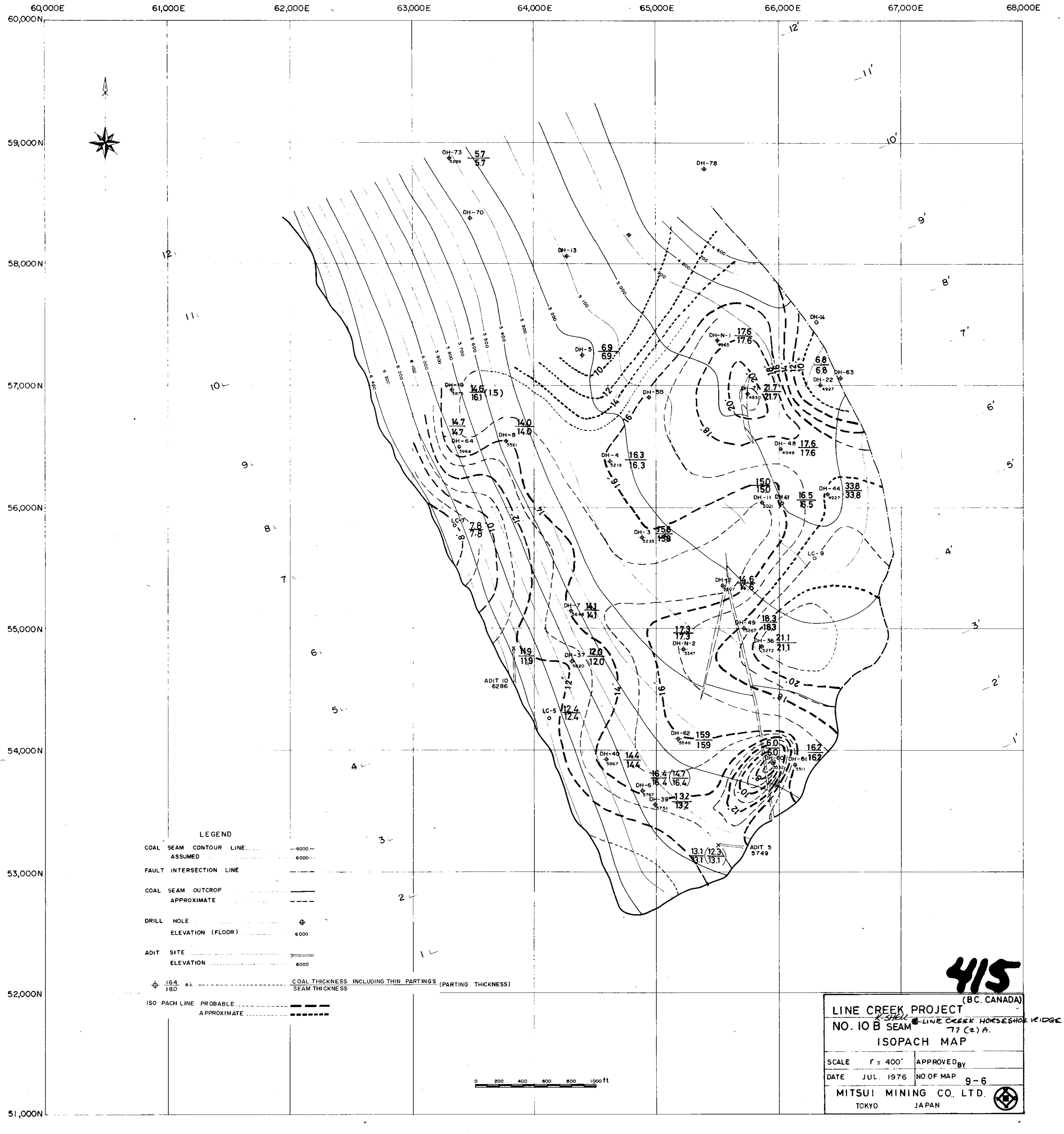
415

(BC. CANADA)
LINE CREEK PROJECT
K-SHELL
NO. 9 SEAM ■LINE CREEK HORSESHOE RIDGE 77(2)A.

ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	9-5

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

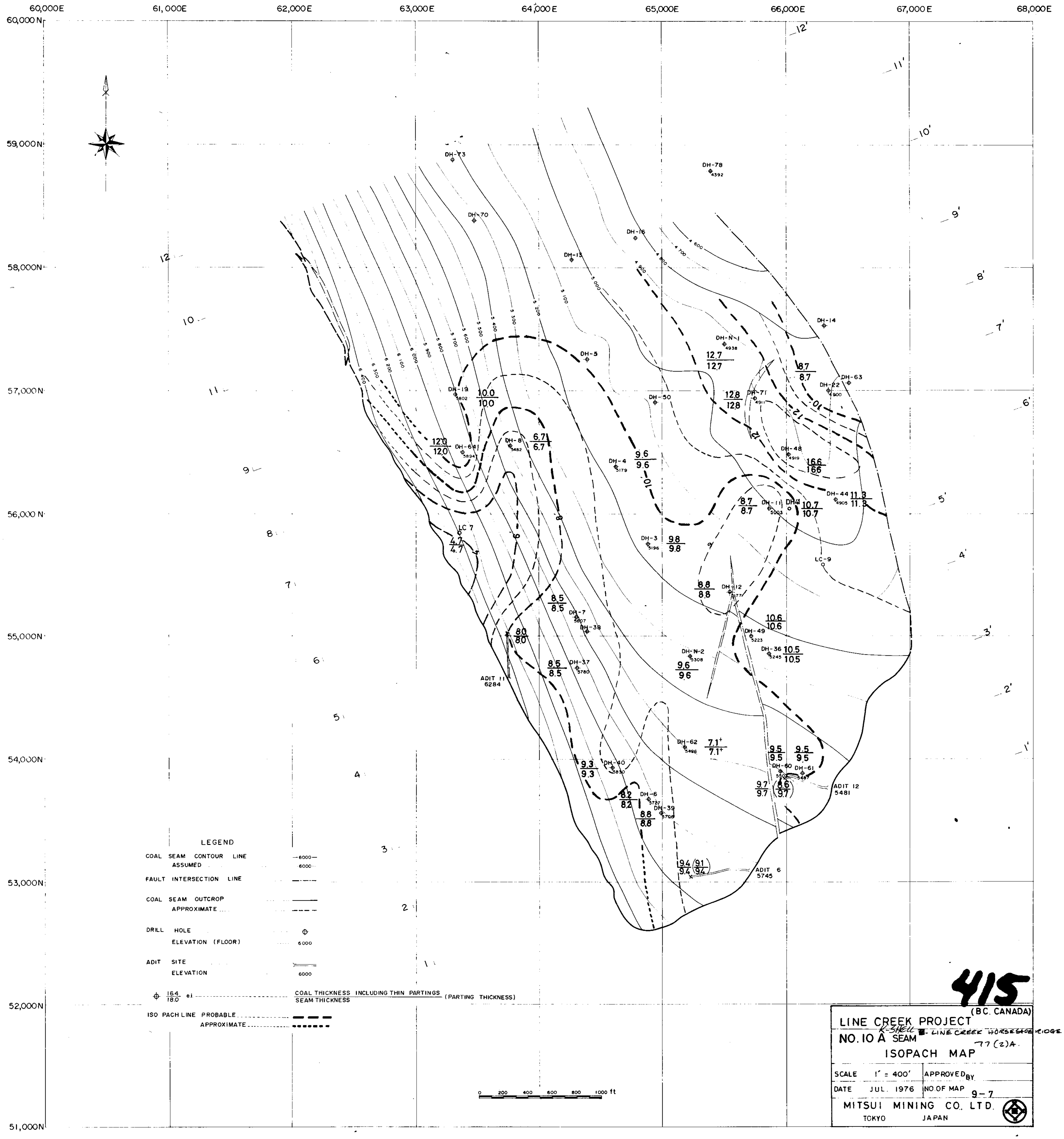
LINE CREEK PROJECT (BC. CANADA)

NO. 10 B SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77 (2) A.

ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	9-6

MITSUI MINING CO. LTD.
TOKYO JAPAN

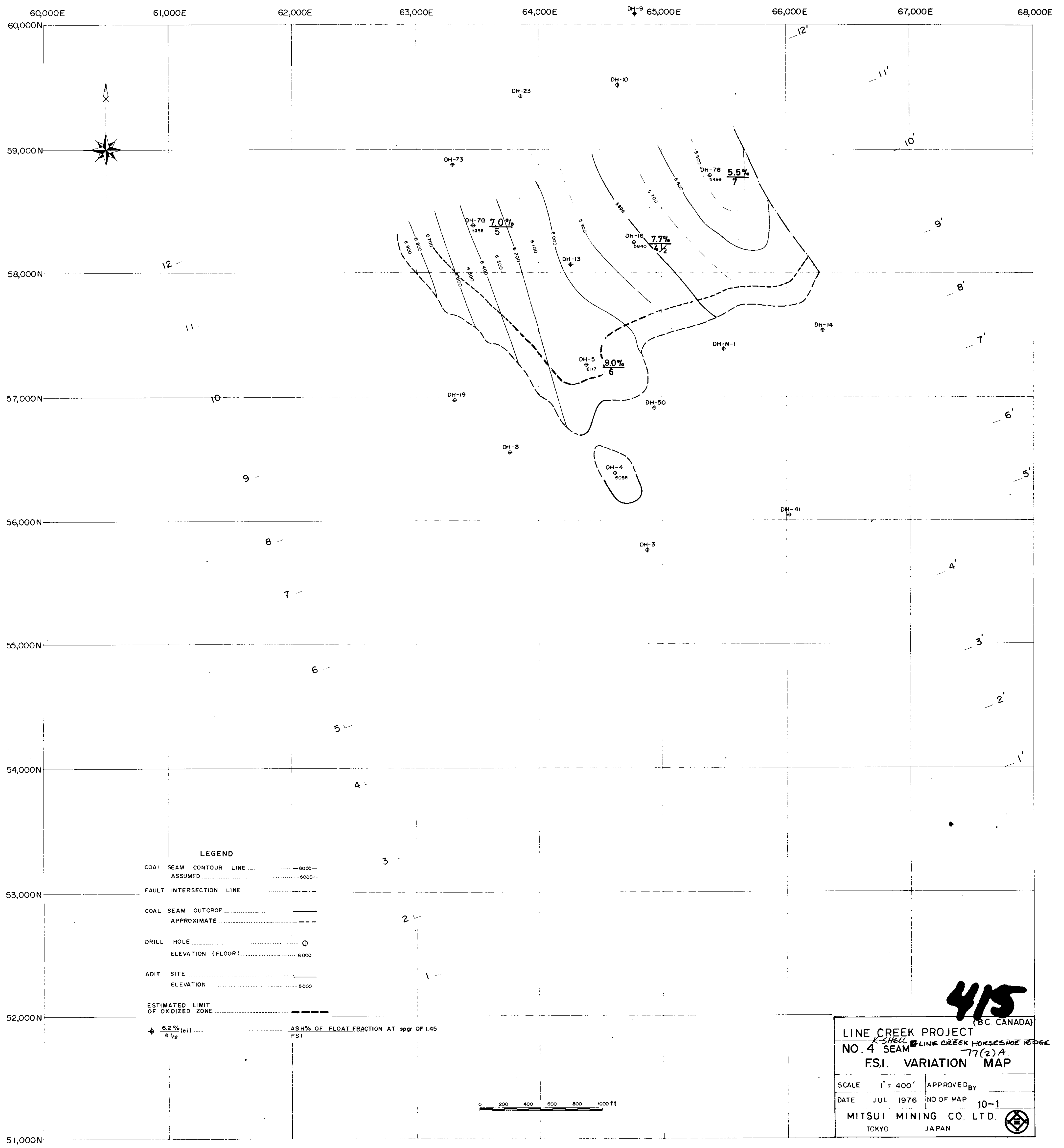


415

(BC. CANADA)
LINE CREEK PROJECT
NO. 10 A SEAM K-SHELL - LINE CREEK HORSESHOE RIDGE
77 (2)A.
ISOPACH MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	9-7

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(B.C. CANADA)

LINE CREEK PROJECT

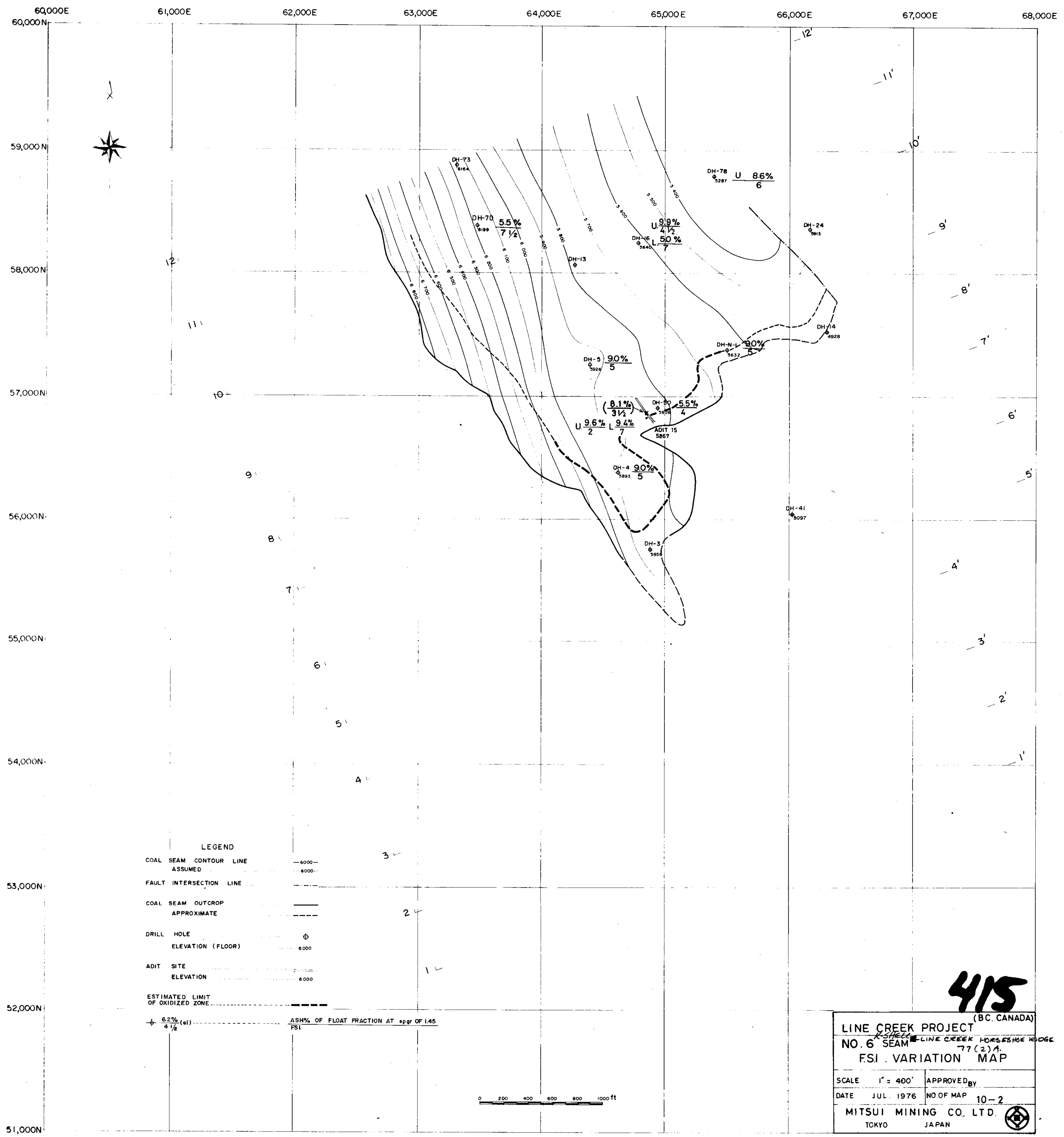
NO. 4 SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)A.

F.S.I. VARIATION MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL 1976	NO OF MAP	10-1

MITSUI MINING CO. LTD.
TOKYO JAPAN

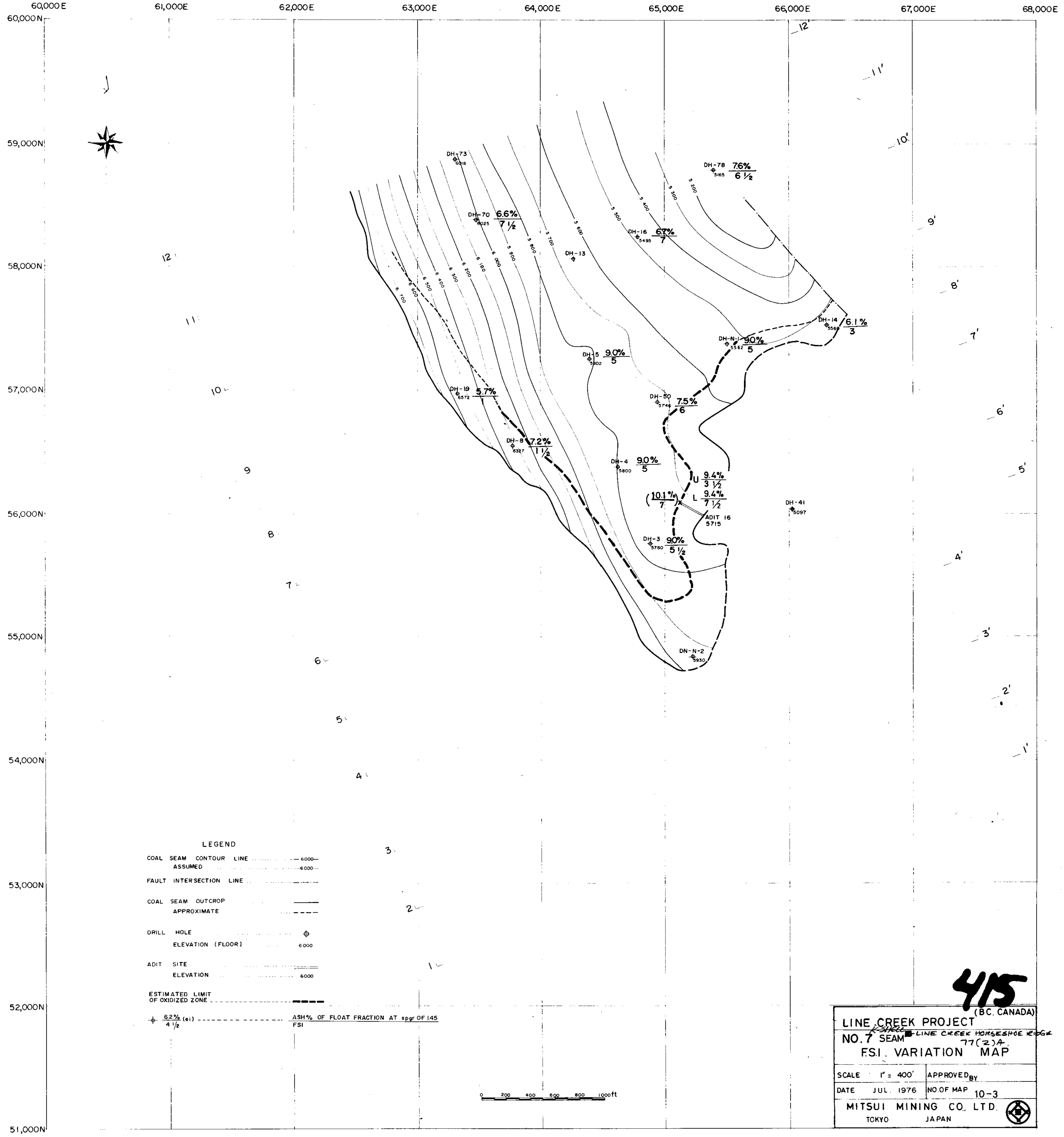
415



(BC. CANADA)
LINE CREEK PROJECT
NO. 6 SEAM K-SHell LINE CREEK HORSESHOE RIDGE 77(2)A.
F.S.I. VARIATION MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	10 – 2

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(BC. CANADA)

LINE CREEK PROJECT

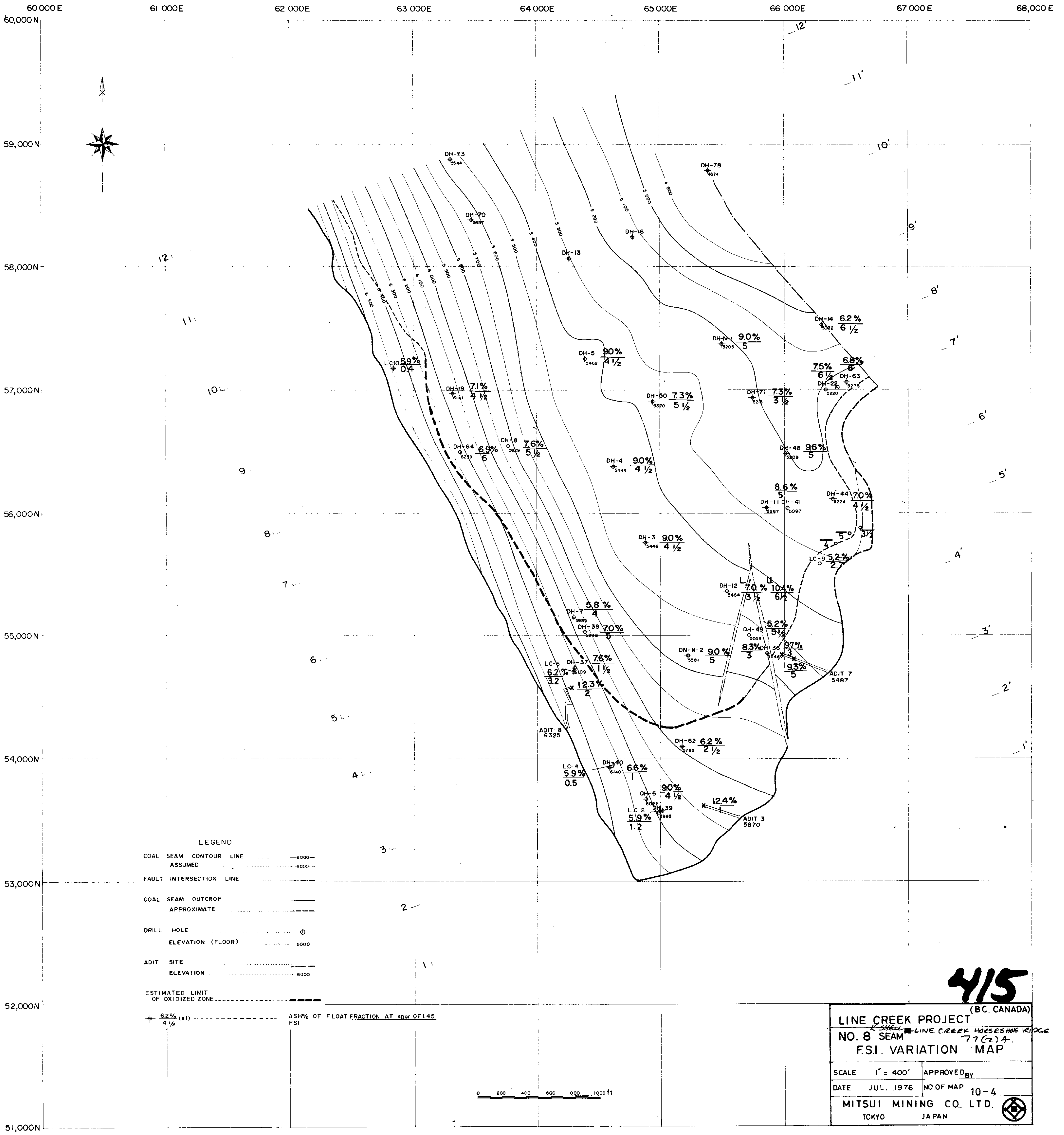
NO. 7 K-SHELL SEAM LINE CREEK HORSESHOE RIDGE 77(2)A.

F.S.I. VARIATION MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 10-3

MITSUI MINING CO. LTD.
TOKYO JAPAN

415



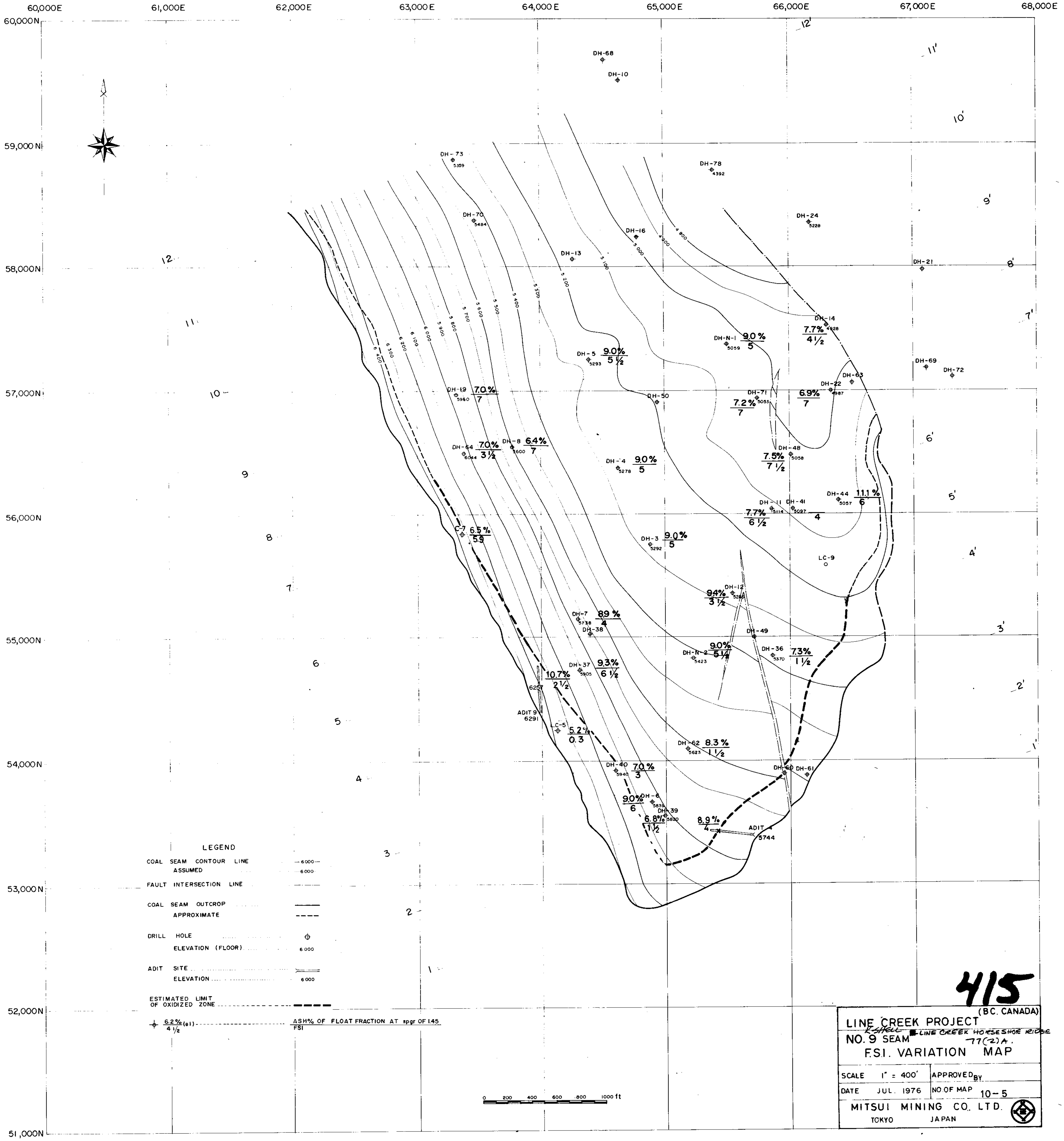
LINE CREEK PROJECT (BC. CANADA)

NO. 8 SEAM K-SHELL LINE CREEK HORSESHOE RIDGE 77(2)4.

F.S.I. VARIATION MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 10-4

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

COAL SEAM CONTOUR LINE —6000—
ASSUMED 6000
FAULT INTERSECTION LINE
COAL SEAM OUTCROP
APPROXIMATE
DRILL HOLE ⊕
ELEVATION (FLOOR) 6000
ADIT SITE
ELEVATION 6000
ESTIMATED LIMIT OF OXIDIZED ZONE

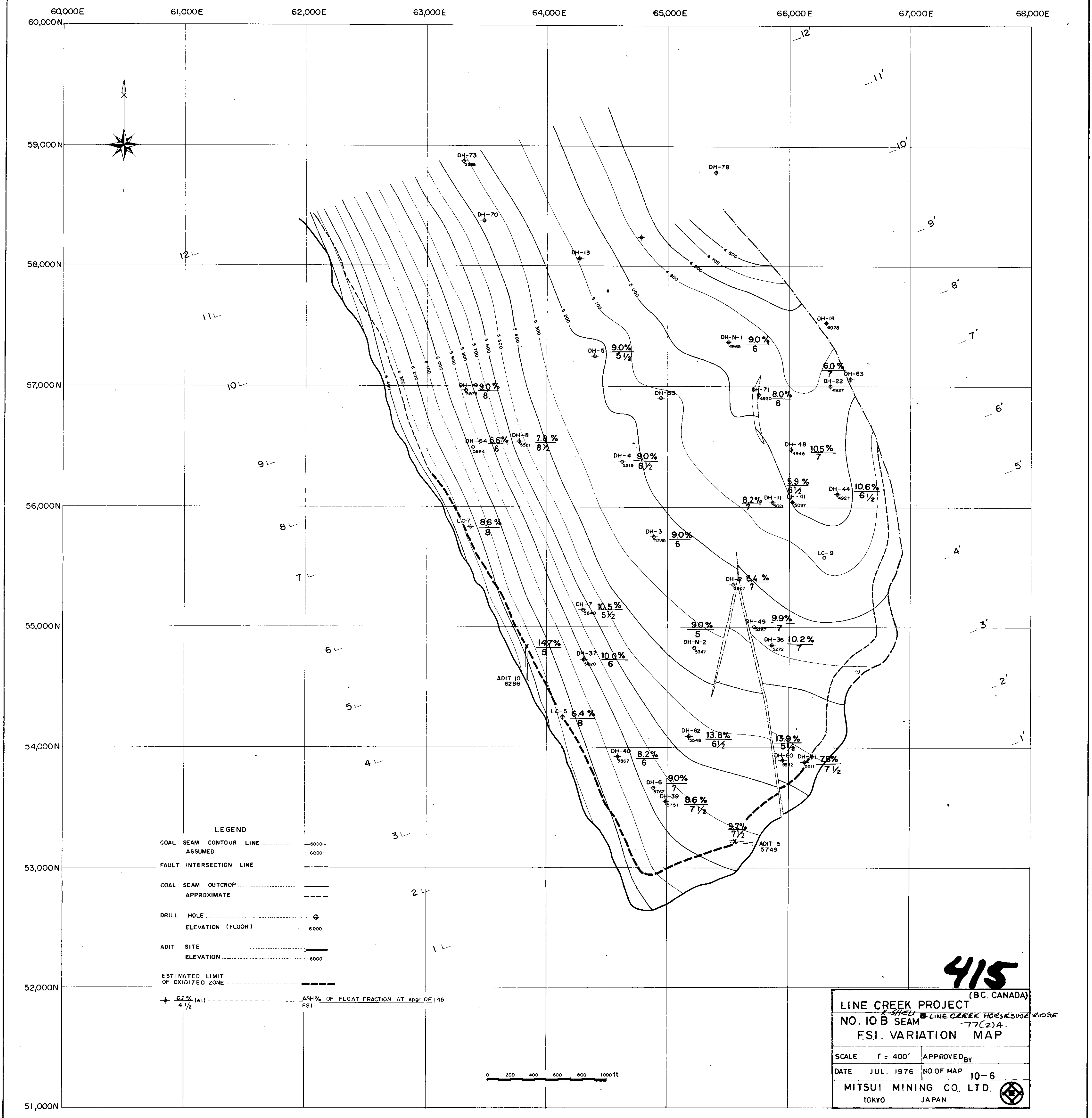
⊕ $\frac{6.2\%}{4\ 1/2}$(el) ASH% OF FLOAT FRACTION AT spgr OF 1.45 / FSI

415

LINE CREEK PROJECT (BC. CANADA)
R-SHELL LINE CREEK HORSESHOE RIDGE
NO. 9 SEAM 77(2)A.
F.S.I. VARIATION MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 10-5

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(B.C. CANADA)

LINE CREEK PROJECT

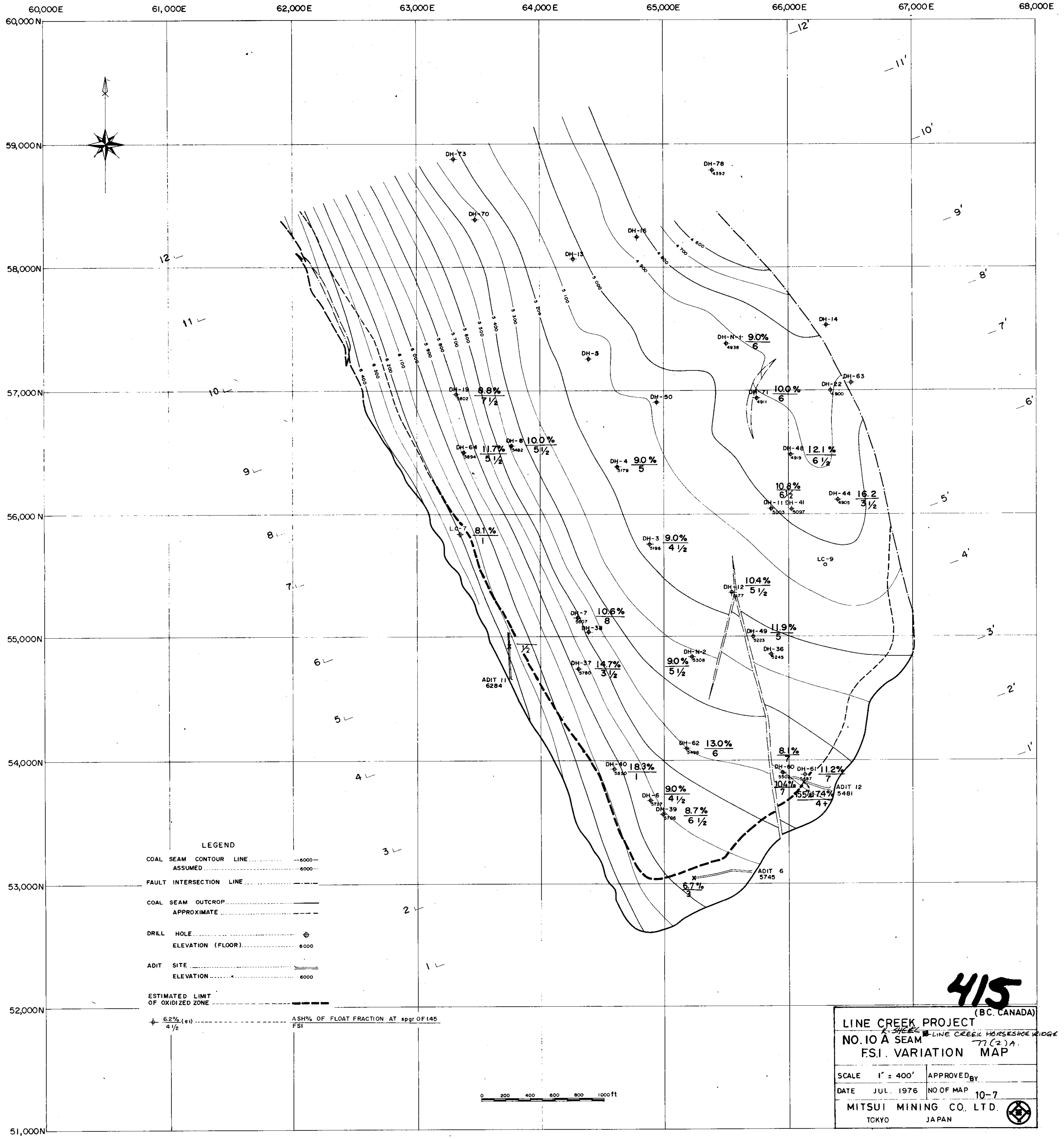
NO. 10 B SEAM R-SHELL & LINE CREEK HORSESHOE RIDGE 77(2)A.

F.S.I. VARIATION MAP

SCALE 1" = 400'
APPROVED BY

DATE JUL. 1976
NO. OF MAP 10-6

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

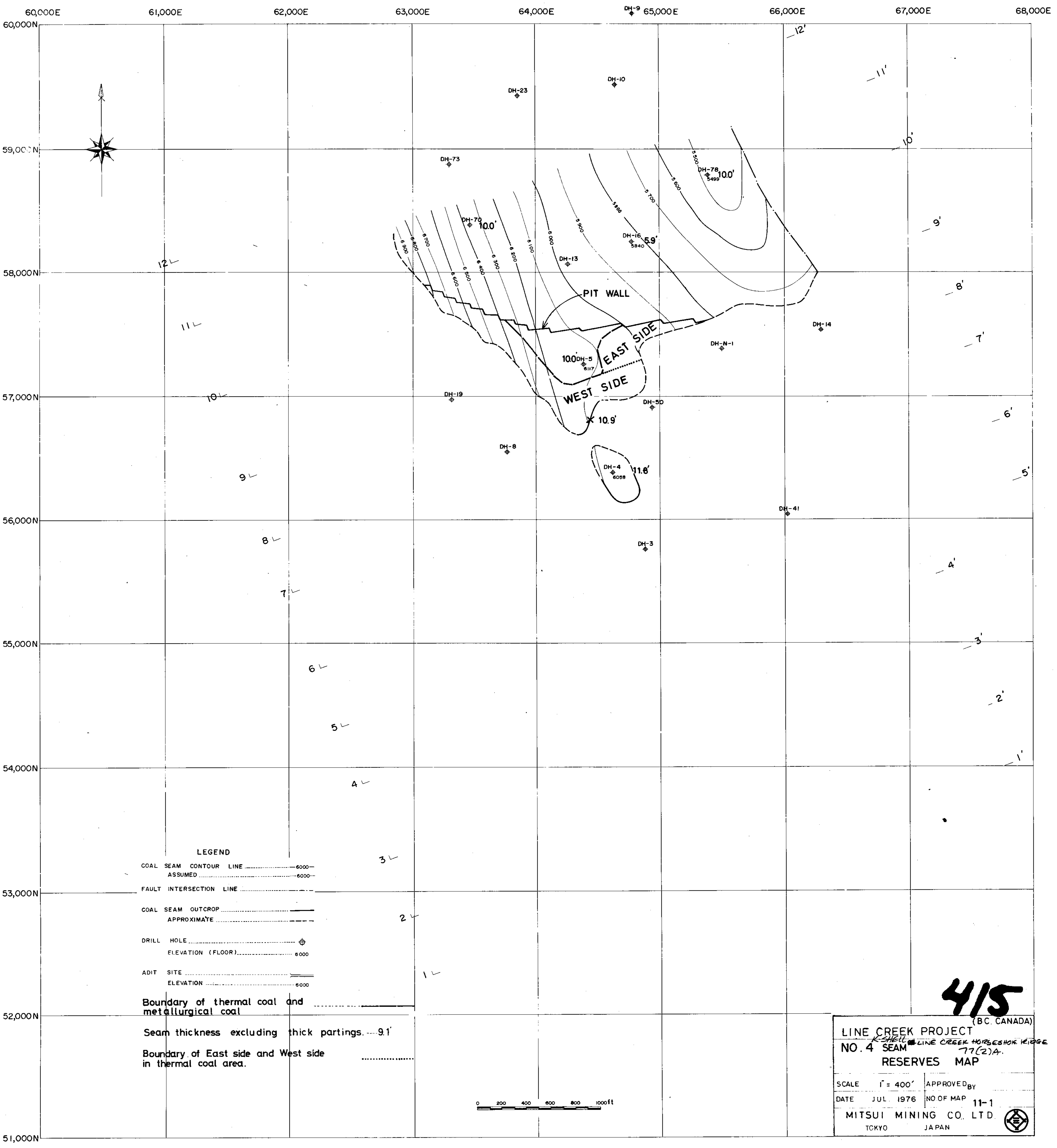
LINE CREEK PROJECT (BC. CANADA)

NO. 10 A SEAM K-SHEEL LINE CREEK HORSESHOE RIDGE 77(2)A.

F.S.I. VARIATION MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO OF MAP 10-7

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(B.C. CANADA)

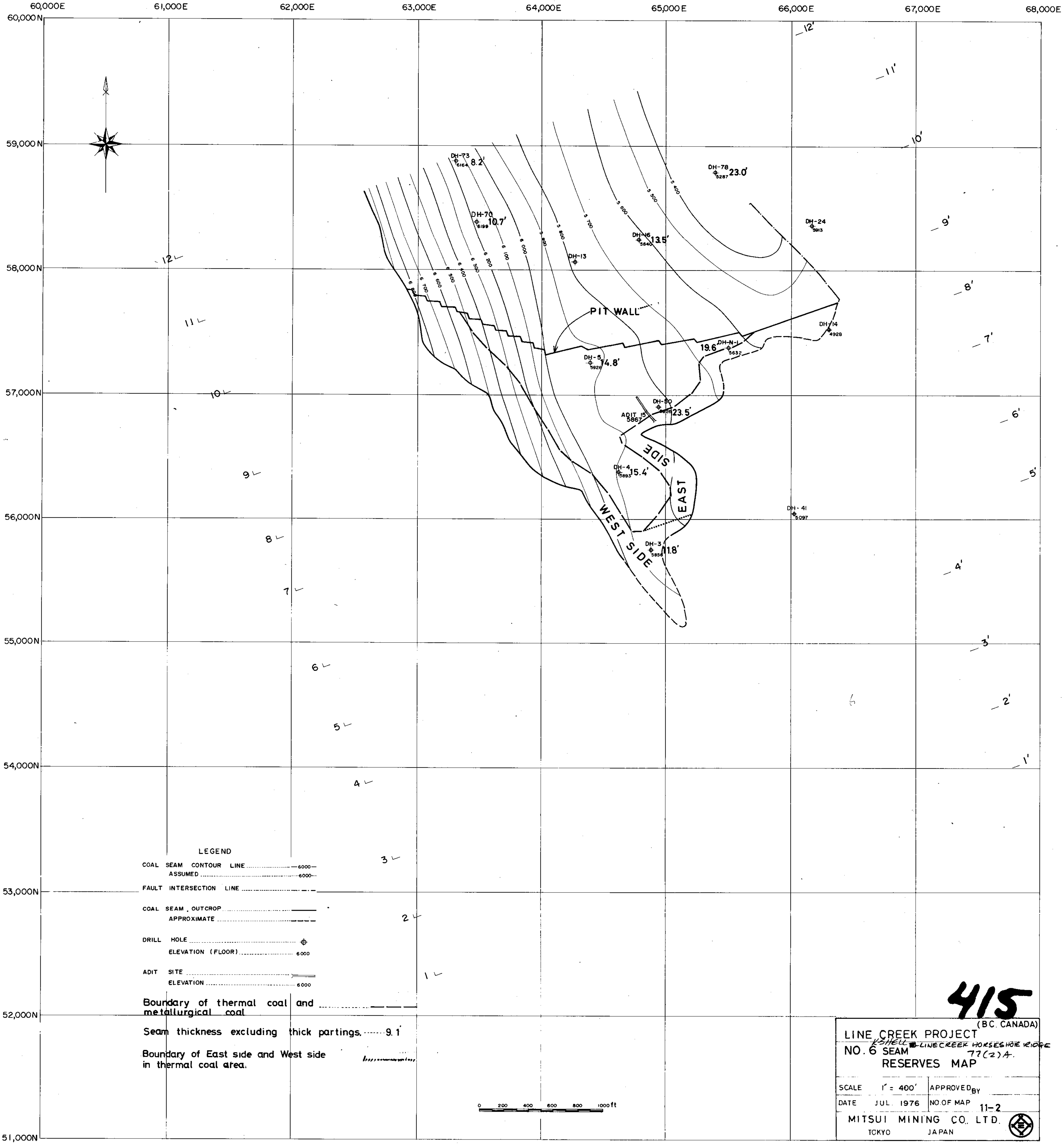
LINE CREEK PROJECT

NO. 4 K-SHELL SEAM LINE CREEK HORSESHOE RIDGE 77(2)A.

RESERVES MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 11-1

MITSUI MINING CO. LTD.
TOKYO JAPAN

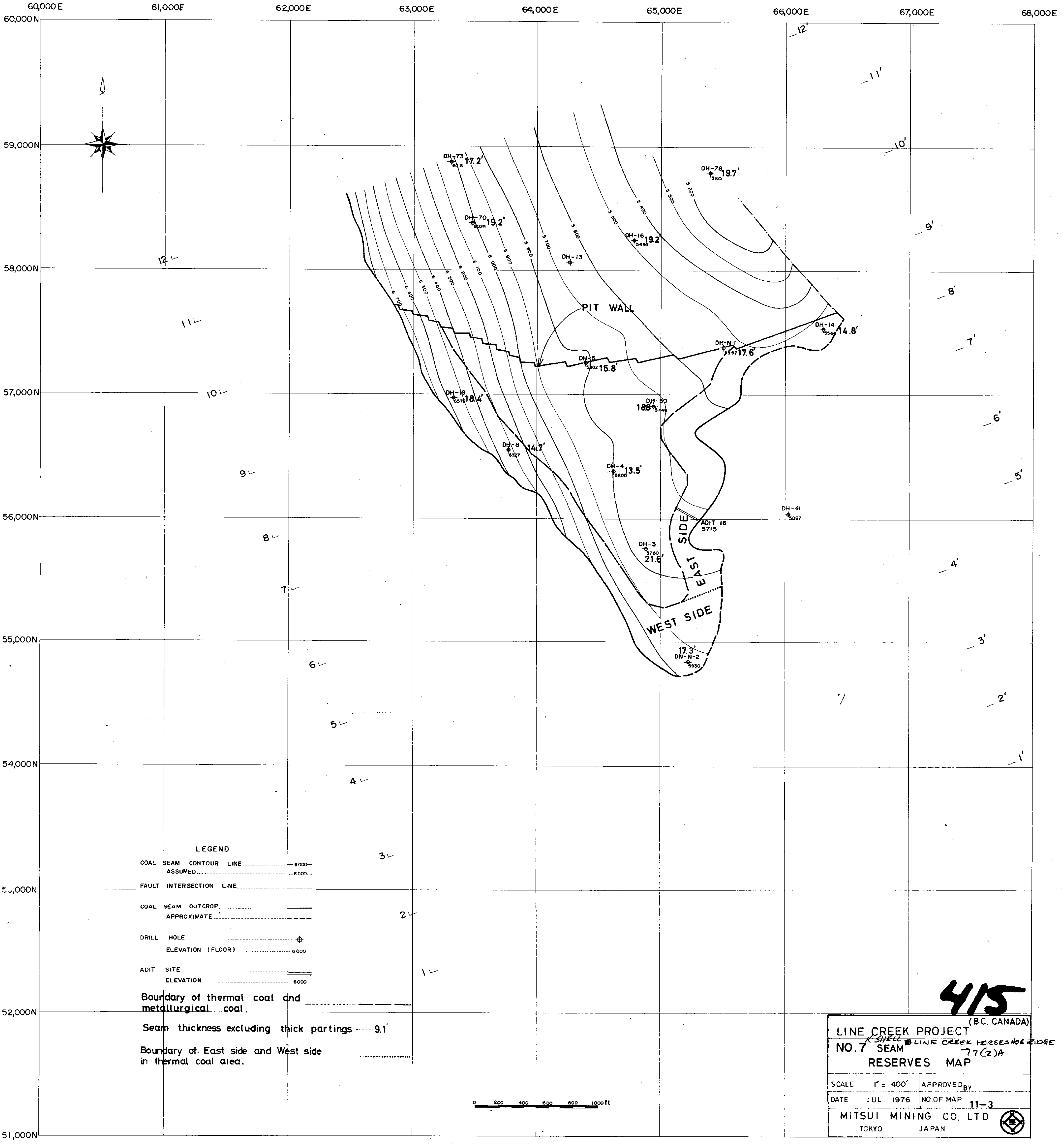


415

LINE CREEK PROJECT (BC. CANADA)
NO. 6 SEAM ~~KSHELL~~ LINECREEK HORSESHOE RIDGE 77(2)A.
RESERVES MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	11-2

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

COAL SEAM CONTOUR LINE ——6000——
ASSUMED ……6000……

FAULT INTERSECTION LINE —·—·—

COAL SEAM OUTCROP ————
APPROXIMATE — — — —

DRILL HOLE ⊕
ELEVATION (FLOOR) 6000

ADIT SITE ═══
ELEVATION 6000

Boundary of thermal coal and metallurgical coal — — —

Seam thickness excluding thick partings -----9.1'

Boundary of East side and West side in thermal coal area. ……………

415

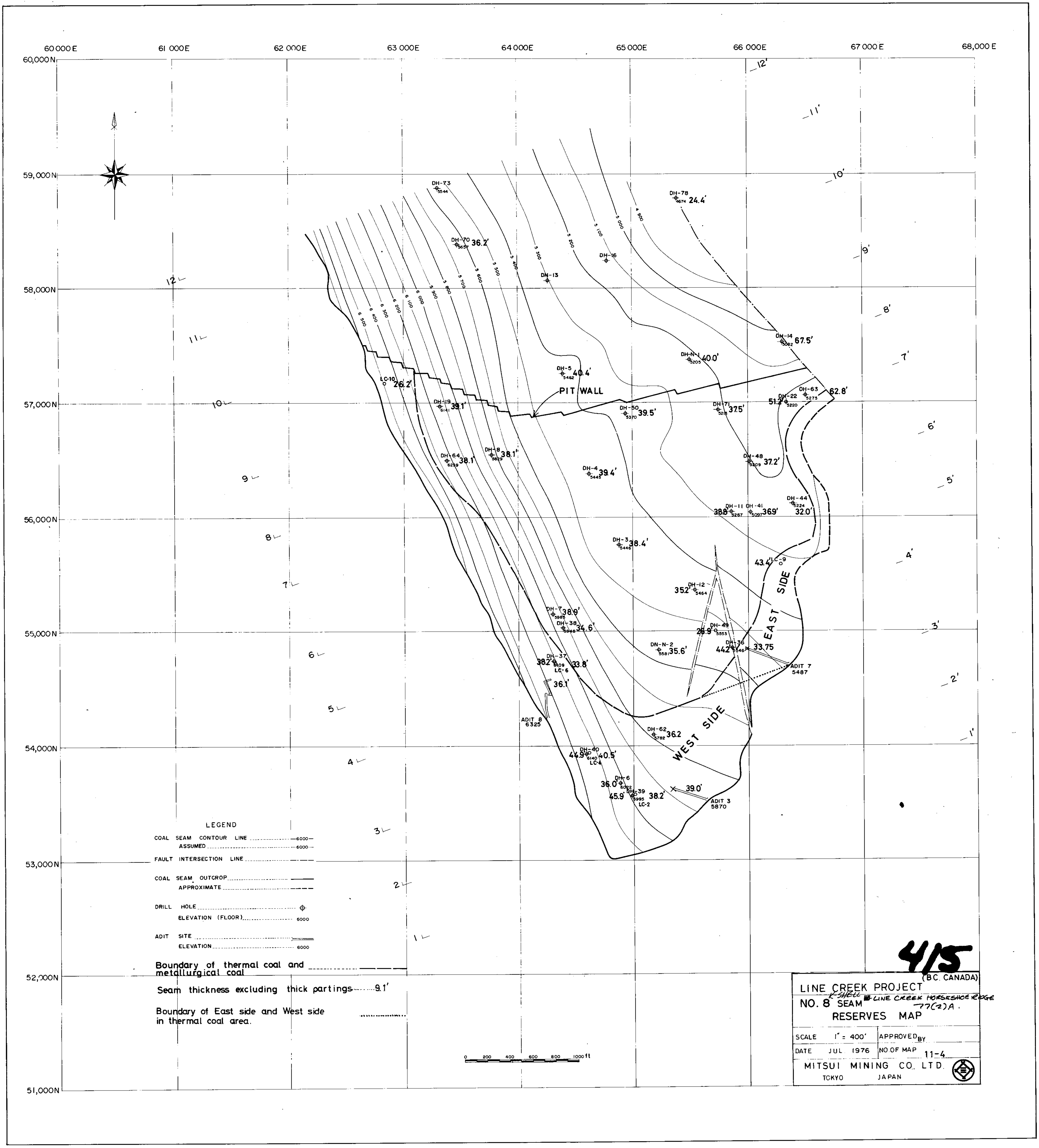
LINE CREEK PROJECT (BC. CANADA)

NO.7 K-SHELL SEAM LINE CREEK HORSESHOE RIDGE 77(2)A.

RESERVES MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 11-3

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

COAL SEAM CONTOUR LINE —6000—
ASSUMED ····6000····

FAULT INTERSECTION LINE —·—

COAL SEAM OUTCROP ———
APPROXIMATE – – –

DRILL HOLE ⊕
ELEVATION (FLOOR) 6000

ADIT SITE ═
ELEVATION 6000

Boundary of thermal coal and metallurgical coal — — —

Seam thickness excluding thick partings 9.1'

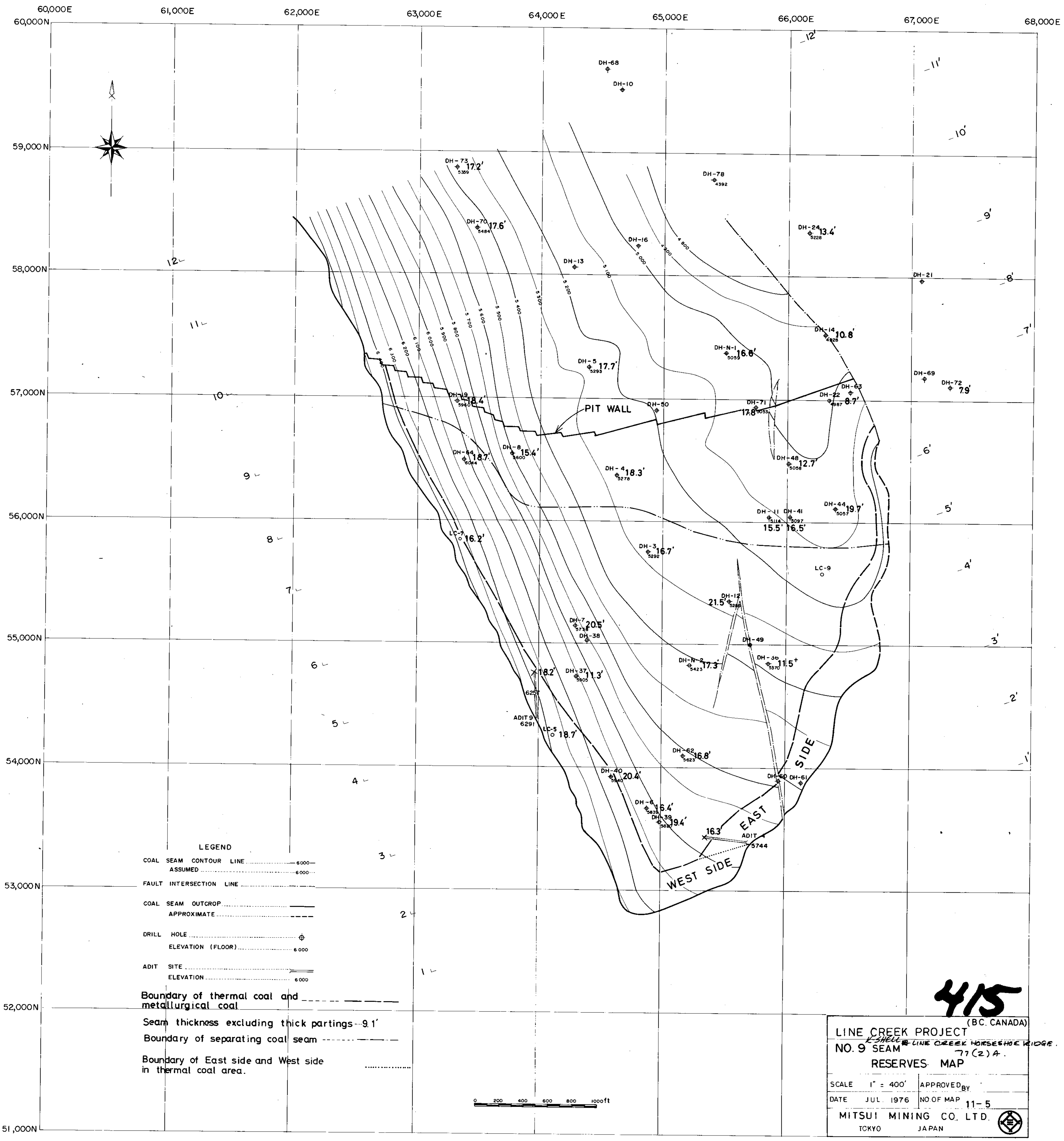
Boundary of East side and West side in thermal coal area. ··········

415

(BC. CANADA)
LINE CREEK PROJECT
NO. 8 K SHELL SEAM LINE CREEK HORSESHOE RIDGE 77(2)A.
RESERVES MAP

SCALE 1" = 400'	APPROVED BY
DATE JUL 1976	NO.OF MAP 11-4

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

COAL SEAM CONTOUR LINE .... —6000—
ASSUMED 6000

FAULT INTERSECTION LINE .... —·—·—

COAL SEAM OUTCROP .... ——
APPROXIMATE .... – – –

DRILL HOLE .... ⊕
ELEVATION (FLOOR) 6 000

ADIT SITE .... ═
ELEVATION 6 000

Boundary of thermal coal and metallurgical coal – – – — — —

Seam thickness excluding thick partings --9.1'

Boundary of separating coal seam ------ —·—·—

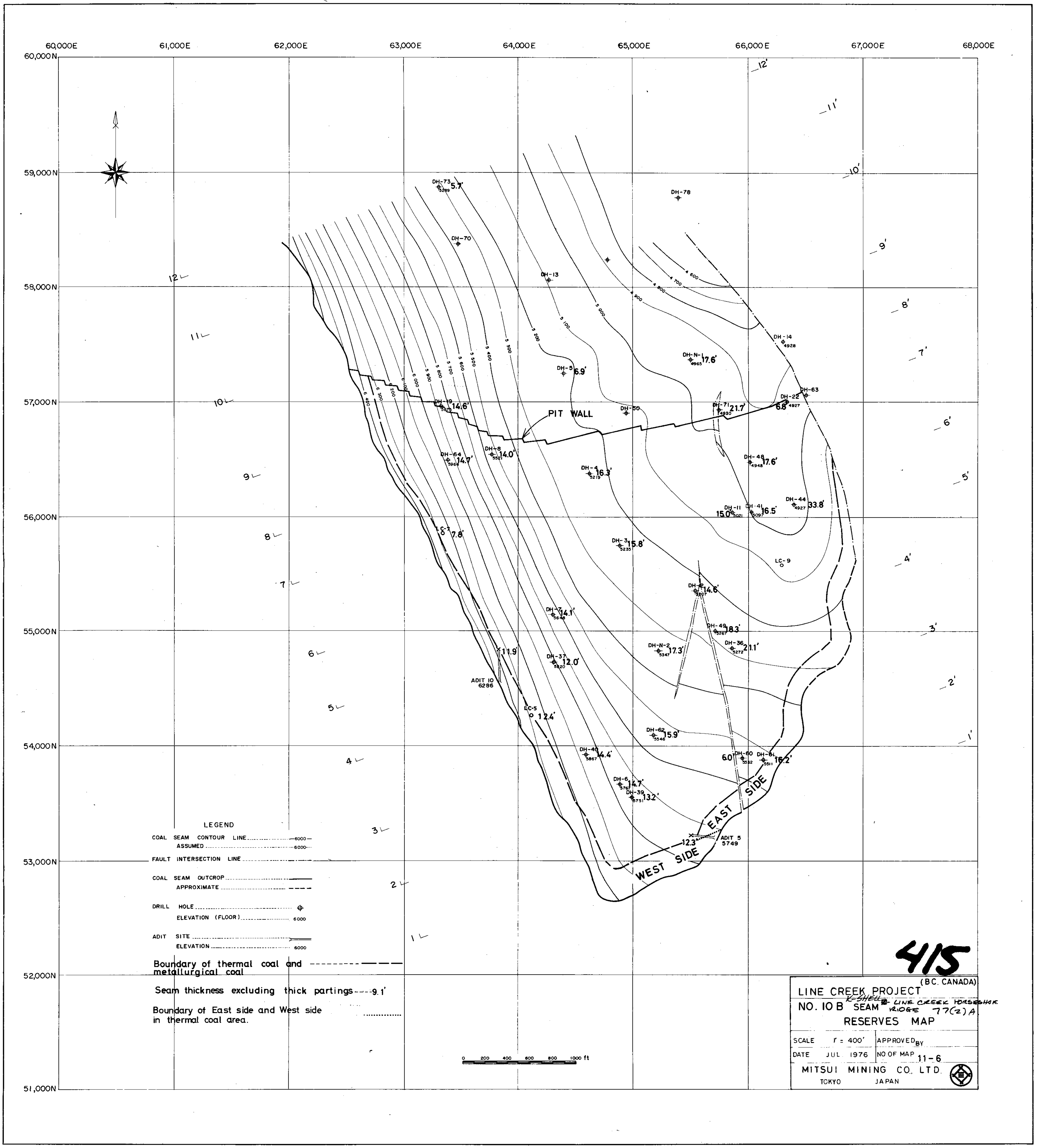
Boundary of East side and West side in thermal coal area. ....

415

LINE CREEK PROJECT (BC. CANADA)
NO. 9 SEAM K-SHELL & LINE CREEK HORSESHOE RIDGE. 77(2)A.
RESERVES MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 11-5

MITSUI MINING CO. LTD.
TOKYO JAPAN



LEGEND

COAL SEAM CONTOUR LINE ....—6000—
ASSUMED 6000

FAULT INTERSECTION LINE ....

COAL SEAM OUTCROP ....
APPROXIMATE ....

DRILL HOLE .... ⊕
ELEVATION (FLOOR) 6000

ADIT SITE ....
ELEVATION 6000

Boundary of thermal coal and metallurgical coal ----------

Seam thickness excluding thick partings----9.1'

Boundary of East side and West side in thermal coal area. ....

415

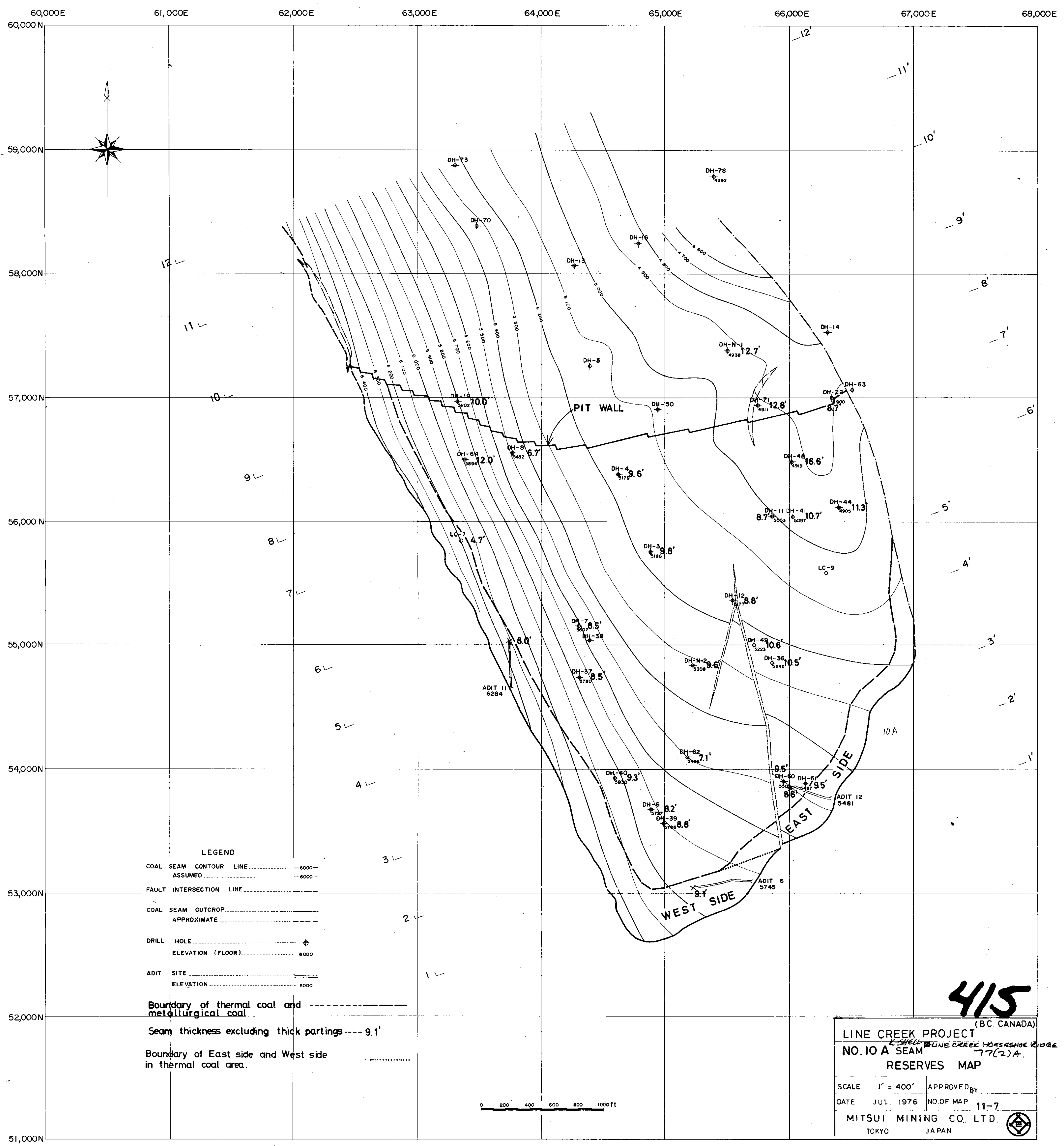
LINE CREEK PROJECT (BC. CANADA)

NO. 10 B K-SHELL SEAM - LINE CREEK HORSESHOE RIDGE 77(2)A

RESERVES MAP

SCALE	1" = 400'	APPROVED BY	
DATE	JUL 1976	NO OF MAP	11-6

MITSUI MINING CO. LTD.
TOKYO JAPAN



415

(B.C. CANADA)
LINE CREEK PROJECT
K-SHELL LINE CREEK HORSESHOE RIDGE
NO. 10 A SEAM
77(2)A.
RESERVES MAP

SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 11-7

MITSUI MINING CO. LTD.
TOKYO JAPAN

CHART SHOWING RESERVE CALCULATION DIMENSIONS No. 1

Seam NO.	Section NO	Section interval	True seam thickness excluding thick partings which are estimated from iso thickness map Distance along the seam from western outcrop --- oxidized coal —— unoxidized coal ⦶ projected point of calculation area	Averaged seam thickness through section	Averaged seam thickness on oxidized zones		Averaged seam thickness on unoxidized area ( ) Averaged seam thickness in calculation area
					western side	eastern side	
# 6	8	450	13.5 140 15.0 16.0 19.0 23.5 21.0 21.0 0 200 340 610 860 1200 1360 15601610 1940 Scale of distance 1"=400'	17.71	14.0	21.0	17.85
	7	650	13.0 14.0 15.4 17.0 18.0 0 150 240 440 660 810 890	15.52	13.3	18.0	15.05
	6	500	11.0 11.8 12.0 0 250 330 280	11.52	11.52		
	5		12.0 0 200	12.0	12.0		
# 7	8	450	14.7 14.0 14.0 15.0 18.0 18.8 18.0 16.8 14.8 0 160 350 440 970 1240 1520 1580 1860 2080 2380 2940 3190	15.0	14.0	17.0	15.99
	7	650	15.0 140 15.0 16.0 16.5 0 270 600 840 920 1180 1570	15.93	14.70	16.30	16.14
	6	500	18.0 19.0 21.0 18.0 0 240 440 600 740 860 920 1010	19.01	18.30	18.0	19.72
	5	500	18.3 18.0 17.0 0 256 430 553 720 850	17.93	17.93		
	4		17.3 0 400	17.30	17.30		
# 8	8	450	pit wall 36.0 38.0 38.0 39.5 38.0 38.0 400 50.0 60.0 70.0 (F) 240 970 2340 2700 2850 3100 3360 3440 3610 3750 3840 4000	41.10	37.0		41.37 (38.50)
	7	650	(F) 39.5 39.5 39.4 38.0 38.0 50.0 60.0 70.0 0 410 1350 1780 2760 3400 3670 3753 3840 3970	40.79	39.5		40.95
	6	500	40.0 38.0 38.0 39.0 38.0 36.0 34.0 500 1700 2350 2730 2900 3050 3280 3400 3560	37.95	39.7	34.0	37.87
	5	500	40.0 38.0 34.6 35.5 36.0 38.0 36.0 0 90 500 720 1620 2370 2630 2980 3240 3400	36.43	39.0	36.0	35.99
	4	650	40.0 38.0 36.0 35.0 340 320 30.0 270 36.0 28.0 38.0 40.0 42.0 0 140 300 510 570 1460 1680 1890 1970 2050 2090 2250 2370 2480 2730	36.56	38.0	42.0	34.51
	3 + 150 3	500	910 1460 2290 420 40.0 38.0 36.0 38.0 40.0(F) 0 170 290 420 1060 1480 1670 1770 2020	38.29	38.29		
	2		40.0 39.0 40.0 0 350 820 1150 1400	39.71	39.71		
# 9	8	450	parting pit wall 16.0 19.0 16.0 16.4 16.0 18.0 18.2 18.0 16.0 14.0 12.0 11.0(F) 0 170 240 540 840 880 1200 1480 1620 1750 1840 2120 2620 3480 3700 3900 4040 4070	16.55	16.0		16.58 (16.78)
	7	650	parting 15.8 16.0 18.0 18.8 18.0 16.0 (F) 14.0 12.0 11.0 (F) 0 60 120 690 1160 1280 1930 2770 3290 3470 3640 4050	16.42	15.8		16.43
	6	500	Parting 17.0 18.0 19.0 18.0 16.0 16.0 18.0 16.0 0 200 440 1070 1530 2300 2670 3080 3410 3730 3890	17.37	17.2	16.5	17.42
	5	500	Parting 18.0 20.0 19.0 200 21.5 200 0 310 920 1560 2020 2300 2780 3380 3620 3750	19.77	18.2	20.0	19.91
	4	650	18.0 17.3 18.0 20.0 0 320 670 1610 2020 2430 3010 3230	18.49	18.0	20.0	18.43
	3	500	20.5 18.0 16.8 17.0 17.5 0 410 610 1100 2000 2080 2200 2490 2750	17.87	20.5	17.5	17.32
	2	500	20.0 19.4 18.0 17.0 16.5 0 380 570 740 950 1540 1910	17.79	19.7	16.7	17.51
	1 + 150' 1		400 770 1260 20.0 18.0 17.0 0 590 790 1050	18.4			
#10 B	8	450	pit wall 10.0 12.0 13.0 14.0 15.0 14.0 14.0 16.0 18.0 20.0 19.0 16.0 10.0 (F) 0 150 220 380 520 1280 1600 1740 1880 1980 2290 2540 3130 3400 3570 3870 4120	14.84	9.5		15.04 (13.13)
	7	650	8.0 10.0 12.0 14.0 15.0 16.0 17.0 18.0 20.0 20.0 16.0 10.0 6.8 (F) 0 120 200 560 880 1130 1530 1920 2170 2870 3120 3370 3620 3780 3860 4050	14.35	8.0		14.55
	6	500	9.5 10.0 12.0 14.0 15.0 15.8 15.5 16.0 17.0 17.5 17.0 0 180 260 750 1220 1600 1910 2970 3160 3300 3730 3940 4010	14.41	9.6	17.0	14.59
	5	500	12.0 14.0 15.0 15.0 14.6 15.0 18.0 19.0 (F) 18.5 0 200 280 980 1250 1530 2330 2550 3070 3330 3710 3830	15.25	11.7	18.5	15.34
	4	650	11.5 12.0 13.0 15.0 16.0 17.3 18.0 21.0 21.0 20.0 0 180 470 760 1220 1420 1670 2100 2290 2820 3200 3220 3450	16.70	11.6	20.0	16.75
	3	500	12.0 14.4 15.0 15.9 16.0 17.0 18.0 19.0 20.0 0 90 200 350 460 750 1160 1340 1840 2130 2290 2390 2430 2670 2850	16.50	12.0	20.0	16.79
	2	500	11.0 12.0 13.0 13.0 10.0 8.0 6.0 16.0 17.0 0 180 520 680 1280 1460 1580 1720 1940 1970 2130 2270	12.38	11.2	17.0	11.73
	1		10.0 11.0 12.0 13.0 14.0 0 200 510 770 1000 1240 1270	12.06	12.06		
#10A	8	450	pit wall 6.0 8.0 10.0 8.0 6.7 7.0 8.0 9.0 10.0 11.0 12.0 12.0 10.0 9.0 (F) 0 100 280 390 680 910 1220 1270 1490 1700 1970 2340 2800 3090 3640 3920 4050 4150	9.36	6.2		9.59 (8.01)
	7	650	4.0 5.0 6.0 7.0 8.0 9.0 100 11.0 12.0 130 130 12.0 10.0 9.0 (F) 0 120 260 280 960 1190 1440 1800 2250 2670 3080 3160 3330 3570 3590 3780 3900 4050	8.88	4.2		9.23 (8.41)
	6	500	4.5 5.0 7.0 8.0 9.0 100 9.0 8.8 9.0 12.0 13.0 13.0 (F) 0 200 250 720 1010 1520 2350 2640 2930 3120 3320 3520 3800 3990	9.20	4.7		9.50
	5	500	8.0 8.5 9.0 9.5 9.0 8.8 (F) 9.0 10.0 11.0 12.0(F) 0 260 310 1070 1360 1850 2220 2410 2470 2760 2840 3240 3790 3830 3860	9.40	8.0	12.0	9.50
	4	650	7.0 8.0 9.0 9.6 10.0 10.6 11.0 0 160 320 420 1020 1710 2040 2250 3260 3370 3550	9.60	7.0	11.0	9.79
	3	500	8.0 9.0 9.0 10.0 10.5 0 320 480 1080 2080 2570 2750 2970 3120	9.46	8.0	10.5	9.53
	2	500	8.5 8 9 10.0 0 290 500 830 2170 2440	9.17	8.3	10.0	9.13
	1 + 50' 1		350 1010 1490 1790 8.0 9.0 9.5 0 300 600 1280 1410	8.87	8.87		

K-SHELL ■-LINE CREEK HORSESHOE RIDGE 71(2)A

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(BC. CANADA)
LINE CREEK PROJECT
CHART SHOWING
RESERVE CALCULATION DIMENSIONS
No. 1
SCALE 1" = 400'
APPROVED BY
DATE JUL. 1976
NO. OF MAP 12-1
MITSUI MINING CO. LTD.
TOKYO JAPAN

CHART SHOWING RESERVE CALCULATION DIMENSIONS No. 2

Seam No	Section No	Section interval	True seam thickness excluding thick partings which are estimated from iso thickness map Distance along the seam from western outcrop --- oxidized coal —— unoxidized coal projected point of calculation area	Averaged seam thickness through section	Averaged seam thickness on oxidized zones		Averaged seam thickness on unoxidized area ( ) Averaged seam thickness in calculation area
					western side	eastern side	
# 4	11	600	10.0 9.0 5.0 5.0 7.0 9.0 10.0 450 790 1270 1970 2 450 2 810 3 080 3280 3 390 Scale of distance 1"=400'	7.99	10.02		7.68
	10	700	pit wall 10.0 9.0 6.0 6.0 8.0 10.0 270 450 820 1 380 1 880 2 170 2 500 2 880 3 140	8.71	10.00		8.49
	9	550	pit wall 10.0 9.2 10.2 280 540 750 950 1460 1 560 2 110 2 450 2600	9.77	10.00	9.55 (9.56)	10.18
	8	450	170 ⊕ 370	11.50			
	7		240	11.80			
# 6	11	600	8.0 10.7 12.0 13.0 14.0 350 590 1 080 1 540 2 010 2 590 3 500	11.72	8.00		12.13
	10	700	8.0 10.0 12.0 13.0 14.0 21.0 450 480 1 080 1 620 2 340 3 040 3 360	13.80	9.00		14.54
	9		pit wall 13.0 14.0 15.0 17.0 19.0 21.0 250 300 750 ⊕ 990 1 190 1340 1 790 2 380 2 780 3 100	16.55	13.00		16.94 (14.02)
# 7	11	600	19.0 19.2 19.0 19.7 280 320 1 310 1 730 3 410 3 620	19.27	19.00		19.30
	10	700	18.5 19.0 19.0 18.7 320 2 200 2 910 3 420	18.86	18.50		18.89
	9		pit wall 18.4 18.0 17.0 16.0 16.0 18.0 18.0 17.0 16.0 140 370 470 820 1 250 1210 1 540 2 000 2 800 3 160 3 420 3 480	17.28	18.20		17.14 (16.94)
# 8	11	600	26.0 30.0 36.0 36.2 36.0 36.0 30.0 160 300 730 1 260 1 600 2 440 3 040 3 400 3 840	33.04	26.00		33.64
	10	700	26.0 36.0 38.0 37.0 270 300 1 000 1 530 3660	35.28	26.00		36.11
	9		pit wall 34.0 39.0 40.0 40.3 40.0 50.0 300 370 750 990 1 610 2 550 3 400 3 700 3 860	39.86	34.00		40.36 (37.16)
# 9	11	600	16.0 15.5 16.0 17.6 16.0 14.0 190 470 1 010 1 470 1 780 2 540 3 300 3 910	15.66	16.00		15.64
	10	700	17.0 16.0 15.5 16.0 17.5 16.0 14.0 14.0 180 940 1 360 1 750 2 160 2 480 3 280 3 780	15.76	16.80		15.68
	9		pit wall 17.0 18.0 18.4 18.0 16.0 15.5 16.0 17.7 17.5 16.0 14.0 12.0 170 380 800 960 930 1 310 1540 1 810 2 180 2 540 3 130 3 480 3 960	16.43	17.30		16.39 (18.10)
# 10B	11	600	6.0 7.5 6.0 4.0 4.0 6.0 8.0 10.0 170 1 200 1 730 2 280 2 490 2 880 3 370 3 970	6.60	6.00		6.63
	10	700	8.0 10.0 10.0 6.0 5.5 6.0 8.0 10.0 11.0 170 310 820 1 310 1 900 2 180 2 480 2 830 3 380 3 820	8.49	8.00		8.70
	9		pit wall 10.0 12.0 14.6 15.0 15.0 12.0 8.0 8.0 15.0 15.0 170 350 560 890 940 1 030 1 420 1 850 2 130 2 400 3 380 3 990	12.27	8.50		12.43 (10.00)
# 10A	11	600	12.0 11.5 12.0 11.5 12.0 10.0 10.0 12.0 450 500 1 040 1 540 2 050 2 800 3 200 3 550 4 140	11.48	12.00		11.42
	10	700	10.0 12.0 12.0 11.0 12.0 11.5 12.0 180 280 560 910 1 820 2 880 3 290 3 670 3 950	11.52	10.00		11.64
	9		Pit wall 7.0 10.0 10.0 9.0 10.0 12.0 12.0 10.0 280 340 830 930 1 470 2 100 3 040 3 450 3 880 4 010	10.27	8.50		10.41 (11.99)

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K-5HEL LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)

LINE CREEK PROJECT

CHART SHOWING
RESERVE CALCULATION DIMENSIONS
No.2

SCALE 1" = 400'	APPROVED BY
DATE JUL. 1976	NO. OF MAP 12-2

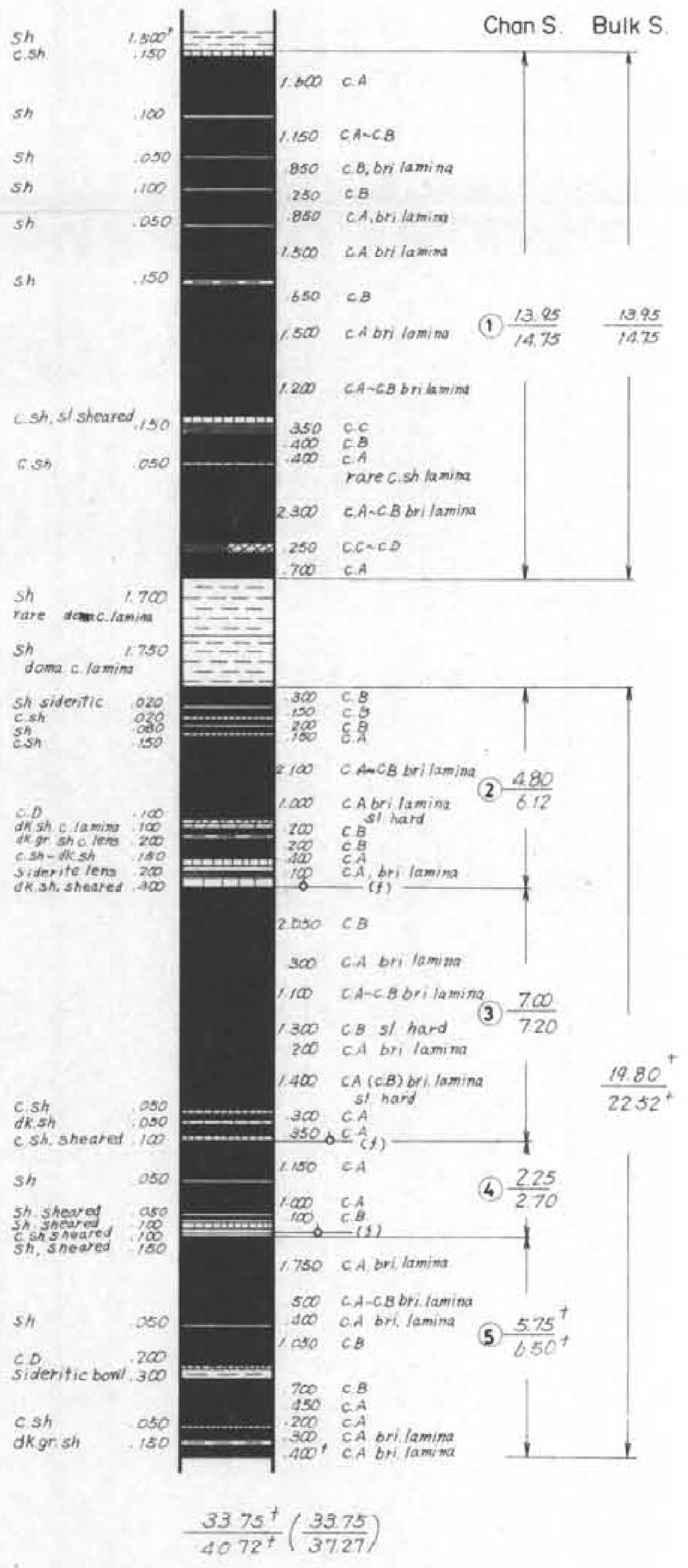
MITSUI MINING CO. LTD.
TOKYO JAPAN

SAMPLING SECTION AT EACH ADIT

Scale 1" = 5'

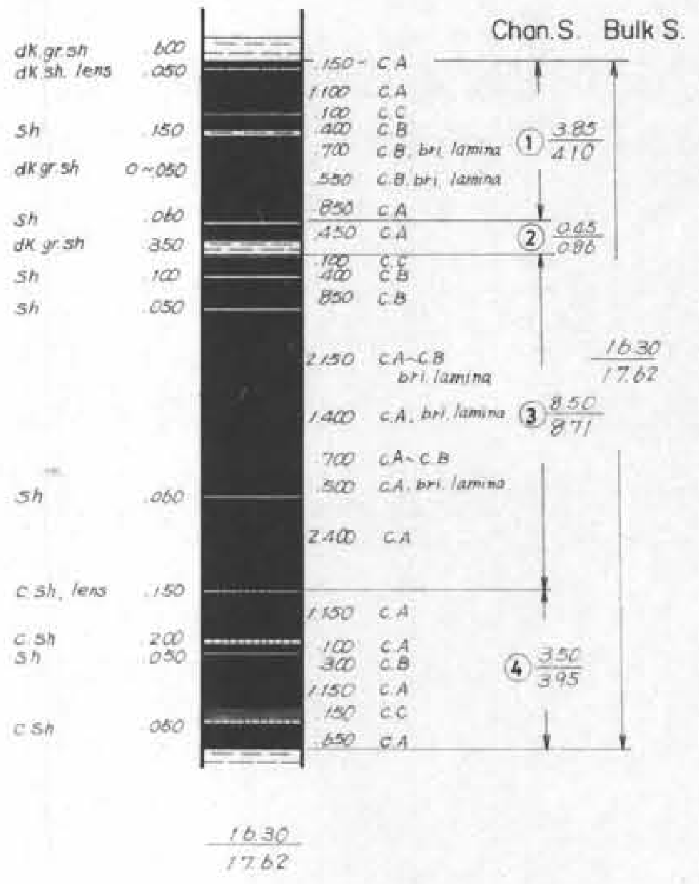
NO.8 SEAM

ADIT 7



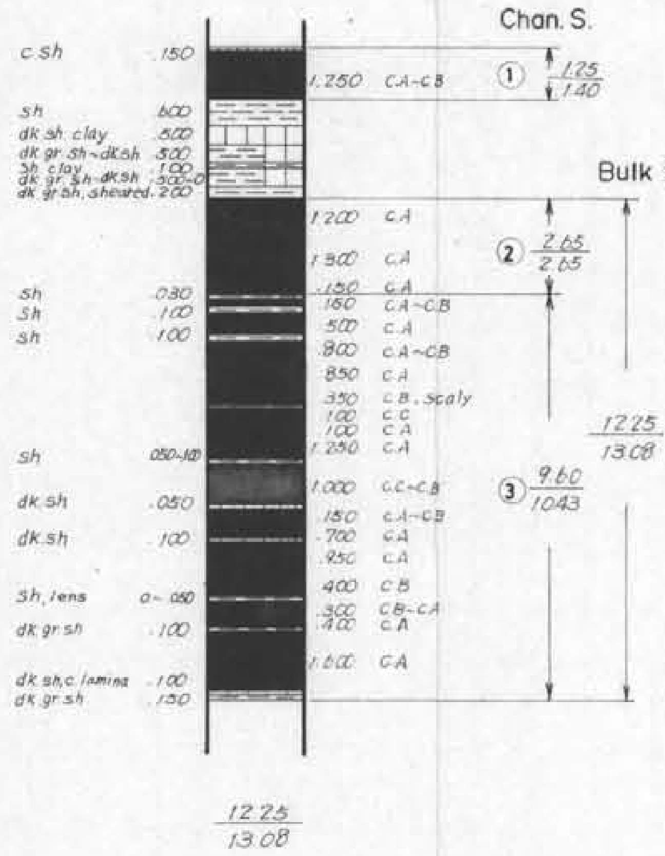
NO.9 SEAM

ADIT 4



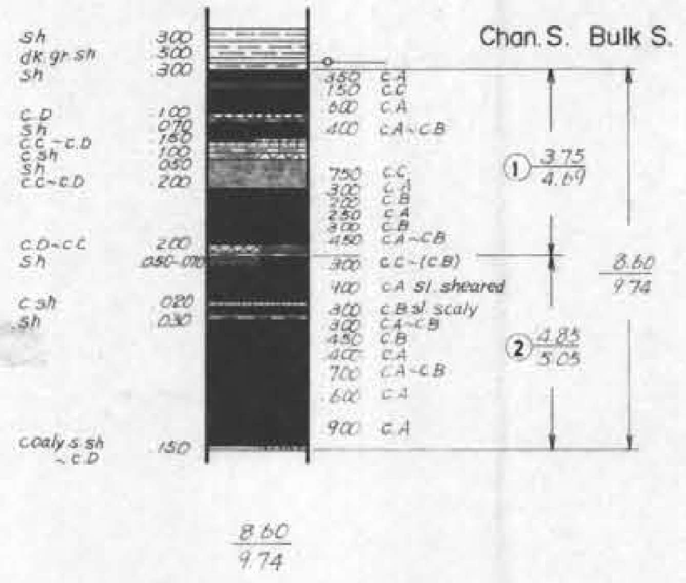
NO.10B SEAM

ADIT 5



NO.10A SEAM

ADIT 12



LEGEND

■	C.A	COAL A
■	C.B	COAL B
▒	C.C	COAL C
▨	C.D	COAL D
▥	C.sh	COALY SHALE
▦	dk.sh	COALY DARK SHALE
▤	dk.gr.sh sh	DARK GRAY SHALE SHALE
—○—		FAULT
8.60 / 9.74	COAL / SEAM	THICKNESS IN FEET

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K-SHELL ▨-LINE CREEK HORSESHOE RIDGE 77(2)A

LINE CREEK PROJECT (BC. CANADA)

SAMPLING SECTION
AT EACH ADIT

SCALE	1" = 5'	APPROVED BY	
DATE	JUL. 1976	NO.OF MAP	13

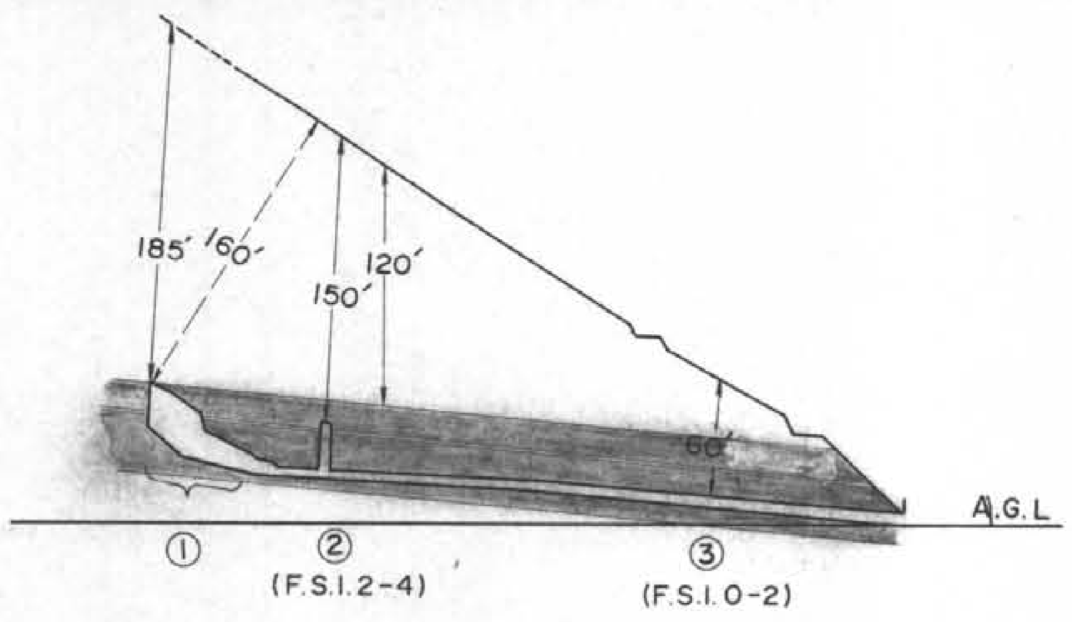
MITSUI MINING CO. LTD.
TOKYO JAPAN

BULK SAMPLING SECTION & PLAN

SCALE 0 100′ 200′

NO. 8 SEAM (ADIT 7)

SECTION



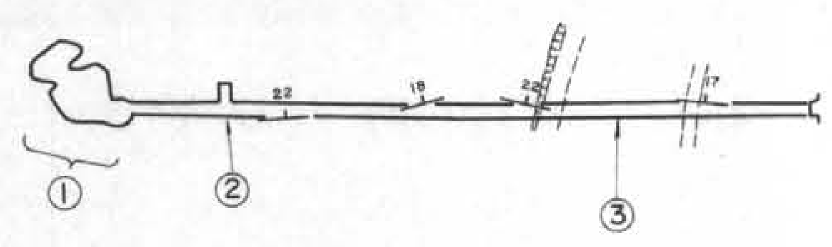
LEGEND

① Bulk and channel sampling location.

② Oxidized coal sampling location

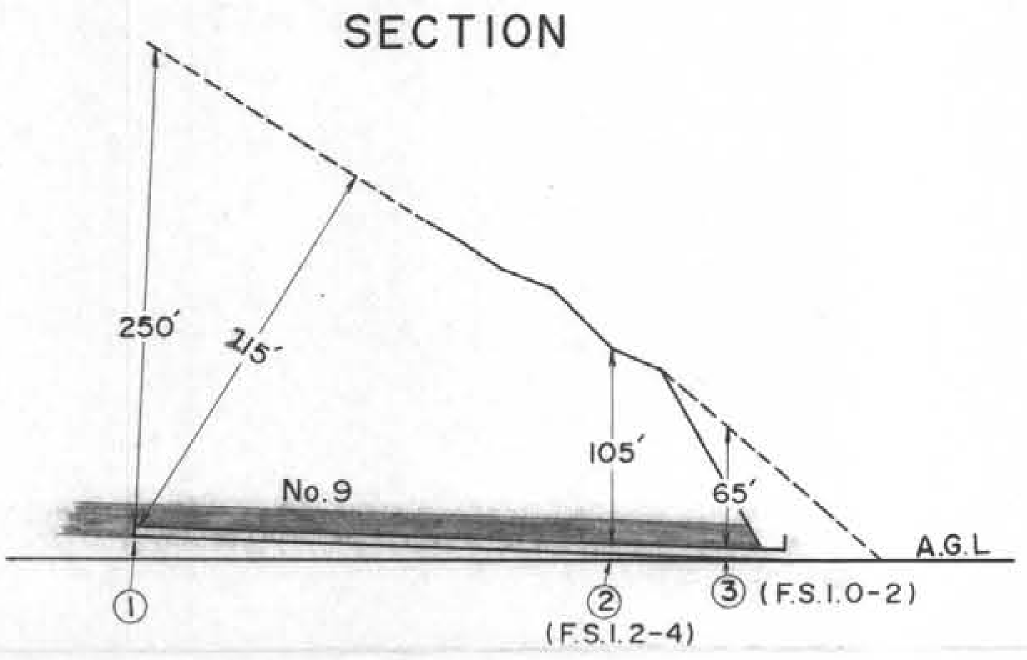
③ Weathered coal sampling location.

PLAN

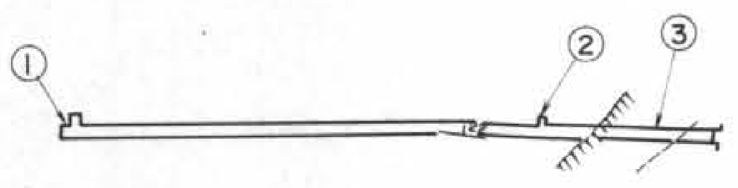


NO. 9 SEAM (ADIT 4)

SECTION

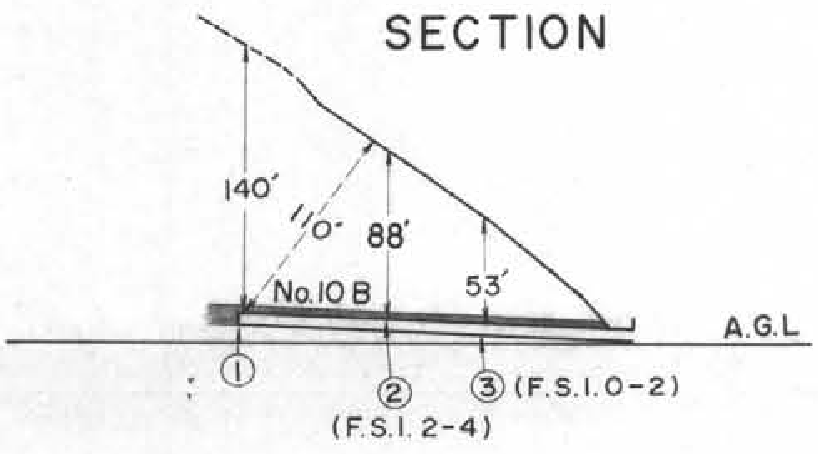


PLAN



NO. 10 B SEAM (ADIT 5)

SECTION



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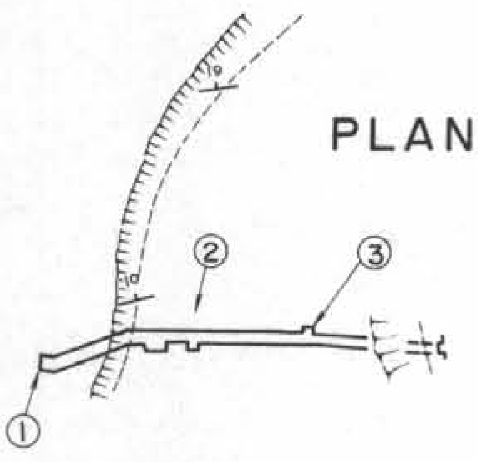
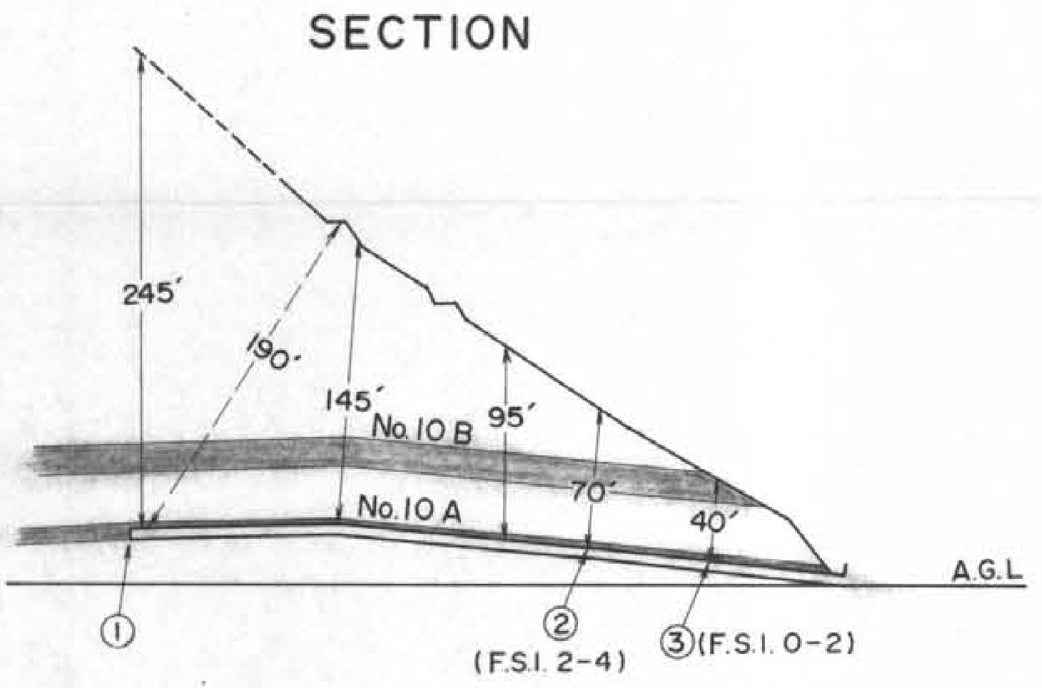


NO. 10 A SEAM (ADIT 12)

SECTION



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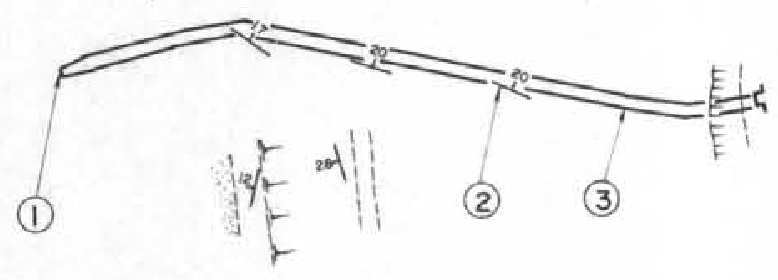


415

K-SHELL-LINE CREEK HORSESHOE RIDGE 77(2)A.

(BC. CANADA)
LINE CREEK PROJECT

BULK SAMPLING SECTION & PLAN

SCALE	1″ = 100′	APPROVED BY	
DATE	JUL. 1976	NO. OF MAP	14

MITSUI MINING CO., LTD.
TOKYO JAPAN

K-SHELL-LINE CR. - HORSESHOE
RIDGE 77(4)A

ANALYTICAL
DATA.

1977.

CONFIDENTIAL

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 415

IV. COAL QUALITY

The bulk and the channel samples taken from each adit were tested according to the test procedure which is shown on Table-9. The previous test results made on adit and drill core samples by C.N.I. were given to us.

The summary of the above tests is given in this section and the detailed report by Japanese Steel MillS are attached at the end of this report.

IV-1 Test Results of Straight Coal Samples

Proximate Analysis (Table- 10)

(1) Raw coal ash content are mostly from 15% to 20% except 27% of No. 7 seam which has many partings.

(2) Some differences of volatile content are recognized between the upper three seams and the lower four seams, namely the upper seams give 21.9% (24.7% on d.a.f basis) and the lower seams give 20.5% (22.5% on d.a.f basis) as average of adit samples. The analyses of non-core drill samples give the approximately 2% higher values than those of adit samples.

Ultimate Analysis (Table- 11)

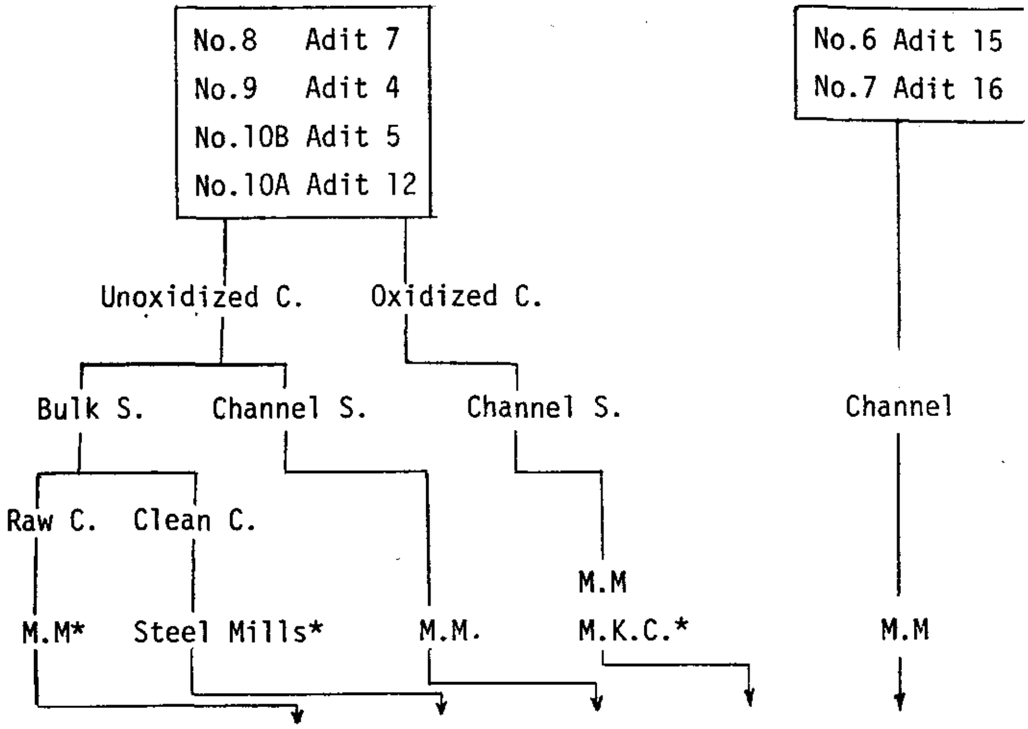
F.S.I., Fluidity, Dilatation (Table-12)

(1) F.S.I. of Nos. 8 and 9 which are obtained at the present test are low, particularly that of No. 8 seam is 3 on the average of the Steel Mills analyses. However, as mentioned in II-2-2 F.S.I. of each seam in the metallurgical coal area is estimated at ranges of 4 to 4-1/2 in No. 8, 5 in No. 9, 5 to 8 in No. 10B and 5 to 8 in No. 10A seam.

(2) The fluidity by Gieseler Plastometer is low in general and it ranges from 2 d.d.p.m. of No. 8 seam to 75 d.d.p.m. of No. 10A seam as shown in the Steel Mill's analyses.

Sampling and Testing Procedure of Adit Samples

Table 9.



Proximate A., F.S.I.	○	○	○	○	○
Ultimate A.	-	○	-	○	-
Size Analysis	○	○	-	○	-
Plasticily	-	○	○	○	○
Dilatation	-	○	-	○	-
Petrographic A.	-	○	○	○	○
Drum Test	-	○	-	-	-
Washability	○	-	○	-	○
H.G.I.	-		-	○	-
Ash Composition	-	-	-	○	-

* M.M Mitsui Mining Co.

Steel Mills Nippon Steel, Nippon Kokan, Kawasaki Steel, Sumitomo Metal Industry, Kobe Steel, Nissin Steel, Mitsui Kozan Coking Ind. (MKC)

Table 10

Proximate Analysis

Adit Samples

Seam	Adit	I.M.	Ash	V.M.(d.a.f.)	F.C.	T.S.	P. in coal	Raw coal Ash
By Steel Mills (average)								
No.8	7	1.3	9.7	20.0 (22.5)	69.0	0.39	0.042	–
No.9	4	1.2	8.9	19.6 (22.0)	70.3	0.35	0.037	–
No.10B	5	1.0	9.7	20.1 (22.5)	69.2	0.47	0.020	–
No.10A	12	0.9	10.4	20.3 (22.9)	68.4	0.54	0.016	–
By Mitsui Mining								
No.6 Upper	15	2.4	9.6	20.7 (23.5)	68.3	0.54	–	11.1
Lower		1.4	9.4	22.8 (25.6)	66.4	0.56	–	13.1
No.7 Upper	16	2.0	9.4	21.1 (24.0)	67.5	0.50	–	26.0
Lower		1.4	9.4	22.9 (25.7)	66.3	0.53	–	27.5
No.8	7	1.6	9.6	20.3 (22.9)	68.5	0.35	0.045	17.2
No.9	4	1.5	9.4	19.7 (22.1)	69.4	0.33	0.027	16.5
No.10B	5	1.3	9.6	20.1 (22.6)	69.0	0.43	0.029	17.5
No.10A	12	1.1	9.6	20.2 (22.6)	69.1	0.49	0.039	19.2

Drill Hole Samples

Seam	Non-Core Drill					Core Drill
	Number of Holes	I.M.	Clean Coal* Ash	Clean Coal* V.M.(d.a.f.)	F.C.	Raw Coal** Ash
No.4	5	1.1	7.3	27.2 (29.8)	64.4	–
No.6	7	1.2	7.7	25.1 (27.5)	66.0	–
No.7	10	1.1	7.8	25.2 (27.6)	65.9	–
No.8	29	1.1	7.9	22.2 (24.4)	68.8	17.3
No.9	25	1.1	8.1	22.3 (24.5)	68.5	15.7
No.10B	26	1.2	9.1	22.1 (24.7)	67.6	17.4
No.10A	22	0.9	11.0	21.8 (24.5)	66.3	19.0

* Clean Coal – Float fraction of s.g. 1.45 of non-core drill chip samples.

** Raw coal – Core samples of L.C. drill holes.

Seam	Number of Holes
No.8	5
No.9	2
No.10B	2
No.10A	1

Ultimate Analysis

Table 11

Seam	Adit	C	H	O	N	S	Ash
By Steel Mills (average)							
No.8	7	88.68	4.68	5.07	1.16	0.41	9.6
No.9	4	89.12	4.65	4.67	1.18	0.38	9.4
No.10B	5	89.32	4.80	4.16	1.22	0.50	9.6
No.10A	12	89.06	4.74	4.49	1.10	0.61	9.6
By Mitsui Mining							
No.6 Upper	15	87.8	4.6	5.8	1.3	0.5	9.6
Lower		88.6	4.9	3.9	2.0	0.6	9.4
No.7 Upper	16	88.6	4.8	4.9	1.2	0.5	9.4
Lower		88.8	5.0	4.2	1.4	0.6	9.4
By C.N.I.							
No.6	15	87.1	4.8	6.0	1.3	0.84	8.1
No.7	16	88.5	4.9	4.7	1.2	0.68	10.1
No.8	7	87.8	4.7	4.8	1.2	0.47	9.7
No.9	4	89.4	4.7	4.2	1.2	0.46	8.8
No.10B	5	89.1	4.8	4.0	1.3	0.67	9.8
No.10A	12	90.2	5.0	3.0	1.1	0.65	9.6

F.S.I., Fluidity, Dilatation

Table 12

Seam	Location	F.S.I. (av.)	Gieseler Max. Fluidity	Dilatometer Max. Contraction	Max. Dilatation
By Steel Mills					
No.8	Adit-7	1-3½ (3)	0-3 (2)	18-27 (21)	-18~-27 (-21)
No.9	" -4	2½-5 (4)	0-4 (3)	20-30 (24)	-20~-30 (-24)
NO.10B	" -5	6½-8½ (7½)	14-26 (18)	18-31 (24)	-2~40 (24)
No.10A	" -12	5½-8 (7)	54-98 (75)	20-30 (24)	12~50 (35)
By Mitsui Mining					
No.6 Upper	Adit-15	2			
Lower		7	21		
No.7 Upper	" -16	3½	1		
Lower		7½	33		
No.8	" -7	4			
No.9	"-4	4			
No.10B	"-5	7½			
No.10A	"-12	8½			
By C.N.I.					
No.8	Adit-7	2	0.9	8.5	-8.5
"	DH-41	4½	5.4	19	-19
No.9	Adit-4	3-4	10-5	27-20	-27--20
No.10B	" -5	8	7.5-36	34-20	7-34
"	" -10	7½	54	29	14
"	DH-36	7½	5.4		
No.10A	Adit-12	8	6.4		
"	DH-41	7½	187	20	43
No.7	Adit-16	7	24	29	11
NO.6	Adit-15	3½	-	-	-

Drum Test (JIS) (Table-13 and 14)

On the average of the analyses by Steel Mills, DI_{15}^{30} of Nos. 8 and 9 seams are lower than 90 and No. 8 seam gives the lowest value of 80.8 while No. 8 seam in DH-41 hole recorded DI_{15}^{30} of 92.

Petrographic Analysis (Table-15)

(1) The averaged total inerts of the upper four seams are approximately 38% which is similar to that of Balmer coal, while those of the lower two seams are 27% and 33%.

(2) Mean reflectance of vitrinoids ($\bar{R}o$) is approximately 1.3 in No. 6 and No. 7 seams, while those of the lower four seams are in a range of 1.40 to 1.51 which indicates high grade coalification.

(3) Among the five separate increments of channel samples of No. 8 seam in adit 7, weathered vitrinoids of 4.5% and 3.8% were observed in Nos. 4 and 5 samples respectively which were taken from the lower part of the seam.

IV-2 Tests for Composite Samples (Table-16 and 17)

The composite samples are prepared in proportion to their reserves and coal thickness of the main four seams. The test results on the samples are summarized on Table 16 and 17 .

Drum Test. (Straight Coal Samples) **Table 13.**

Seam	Location	JIS DI_{15}^{30}	
		By Steel Mills	By C.N.I.
No.8	Adit-7	73.2-95.1 (80.8)	86.7
No.9	-4	85.5-96.0 (89.7)	91.8
No.10B	-5	92.2-96.2 (94.1)	93.7
No.10A	-12	83.2-96.4 (92.5)	93.3
No.6	-15	–	79.8
No.7	-16	–	92.5
No.8	DH-41	–	92.0
No.10B	Adit-10	–	93.3

Drum Test (Blended Samples)

Table 14

Kawasaki Steel

	No.8	No.9	No.10B	No.10A	No.8	No.9	No.10B	No.10A
Line Creek	40	40	40	40	40	40	40	40
Newdell	60	60	60	60	-	-	-	-
Yubari	-	-	-	-	60	60	60	60
DI $^{30}_{15}$	91.2	90.8	93.0	92.0	91.0	91.6	92.6	92.1

Sumitomo Metal Industry

	No.8	NO.9	NO.10B	No.10A	No.8	No.9	No.10B	No.10A
Line Creek	40	40	40	40	55	55	55	55
Akabira	60	60	60	60	20	20	20	20
Cerro	-	-	-	-	25	25	25	25
DI $^{30}_{15}$	92.6	92.4	93.7	93.8	85.6	83.0	94.0	94.6

Nippon Kokan

Line Creek No.8	10	20	-
Keystone	10	10	10
Pittston MV	15	15	15
Balmer	20	-	20
Coal Cliff	10	10	10
Blackwater	-	10	10
Liddel	23	23	23
Oil Coke	2	2	2
Oyusen	10	10	10
DI $^{30}_{15}$	92.3	92.3	93.1

Kobe Steel

	No.8	NO.9	NO.10B	No.10A
Line Creek	30	30	30	30
Takashima	70	70	70	70
DI $^{30}_{15}$	91.5	93.2	93.4	91.3

Petrographic Analysis

Table 15

Seam	Adit	Vitrinoid	Semi Fusinoid	Total Reactives	Total Inerts	$\bar{R}$o
By Steel Mills (average)						
No.8	7	55.9	17.9	62.0	38.0	1.40
No.9	4	57.8	16.1	62.7	37.3	1.47
No.10B	5	69.3	11.5	73.1	26.9	1.51
No.10A	12	62.2	15.1	67.2	32.8	1.47
By Mitsui Mining						
No.6 Upper	15	51.3	26.9	60.3	39.7	1.29
No.6 Lower		59.0	23.4	66.8	33.2	1.30
No.7 Upper	16	48.2	27.7	57.4	42.6	1.30
No.7 Lower		60.1	22.0	67.4	32.6	1.29
By C.N.I.						
No.6	15	47.5	29.4	57.3	42.7	1.24
No.7	16	54.2	27.1	63.2	36.8	1.23
No.8	7	36.4	48.6	52.6	47.4	1.18
No.10B	5	54.2	33.1	63.5	36.5	1.28
No.10A	12	53.7	29.5	63.5	36.5	1.36

Composite Sample

Table 16.

Sample	Composite Ratio	No.8	No.9	No.10B	No.10A	Tested by
A	at reserves ratio	36	30	24	10	Mitsui Kozan Coking
B	at seam thickness ratio	51	25	17	7	– do.
C	at the average of A & B	43	27	21	9	Kobe Steel
D	do.	43	27	21	9	Nippon Kokan

		A	B	C	D
Proximate Analysis	I.M. %	1.27	1.30	(dry basis)	
	Ash. %	9.52	9.50	9.42	9.8
	V.M. %	19.60	19.47	20.16	20.3
	F.C. %	69.61	69.73	70.42	69.9
Total Sulphur	%	0.42	0.40	0.42	0.40
Phosphorus in Coal	%			0.034	
Ultimate Analysis	C %	88.69	89.27		
	H %	4.71	4.76		
	O %	5.01	4.38		
	N %	1.14	1.16		
	S %	0.45	0.43		
F.S.I.		4½	3½	4	4
Gieseler Max. Fluidity	ddpm	1.9	2.2	0	3
Dilatometer Max. Contraction	%	23	24	30	
Max. Dilatation	%	-12	-17	-30	
J.I.S. DI^{30}_{15}		94.0	93.0	86.4	87.9
Petrographic Analysis					
Vitrinoid	%			61.9	60.8
Total Reactives	%			66.0	66.3
Total Inerts	%			34.0	33.7
$\overline{Ro}$	%			1.52	1.40

Blended Sample

Table 17

	Blending Ratio		DI^{30}_{15}
Nippon Kokan	Line Creek	100**	87.9
	Keystone	10	
	Pittston MV.	15	
	Saraji	10	
*	Blackwater	10	91.9
	Lemington	23	
	Oil Coke	2	
	Yubari	10	
	Line Creek	20	
	do. as *	80	91.9
	Wollondilly	20	
	do. as ●	80	91.9
	Balmer	20	
	Wollondilly	100	85.8
	Balmer	100	85.7
Kobe Steel	Line Creek	100	86.4
	Line Creek	30	92.8
	Takashima	70	

	No.8	No.9	No.10B	No.10A
** Mixing Ratio	43	27	21	9

IV-3 Summary of Coal Quality

(1) The lower four seams give the relatively low volatile content of 20.5% (22.5% on d.a.f. basis) on the average, compared with the upper two seams, which give volatile content of 21.9% (24.7% on d.a.f. basis).

(2) Gieseler fluidity is very low.

(3) The mean reflectances of the main four seams are higher than 1.4 which indicates the high grade coalification, but those of the lower two seams are approximately 1.3.

(4) Sulphur and phosphorus content are acceptably low.

(5) Nos. 10A and 10B seams give the DI^{30}_{15} of 92 and 94 respectively, but those of Nos. 8 and 9 seams are below 90 on the average.

(6) Blendability is generally good.

(7) Judging from the inherrent moisture, oxigen content, F.S.I. and fluidity of the adit samples, the upper bed of both Nos. 6 and 7 seams are regarded as oxidized. As the lower beds of the both seams give the high F.S.I. of 7 and 7.1/2 and the calculated strength of 58, it would be possible to produce the metallurgical coal from Nos. 6 and 7 seams in unoxidized area.

IV.4 Quality of Oxidized Coal

In this study, the coal of which F.S.I. is less than 4 is regarded as oxidized. But some test works were carried out on the oxidized coal to know suitability for thermal and/or for metallurgical usages. For that purpose two types of oxidized coals, one type is of F.S.I. below 2 and the other is of F.S.I. between 2 to 4, were taken from the adits as under.

Seam	Adit	Sampling place	
		F.S.I. below 2	F.S.I. 2 - 4
No. 8	7	100 ft.	300
No. 9	4	30	120
No. 10B	5	50	125
No. 10A	12	60	135

Though these samples were taken from sidewall of the adits so that they do not represent total seam thickness, the test results will give reasonable conclusion on coal characteristics as under.

(1) As to thermal usage

a) Ash fusion temperature is higher than 1450°C which is good.

b) Fuel ratio is about 3.4 which is extremely high.

c) Sulphur content is low (0.4% on the average) and nitrogen content is from 1.1% to 1.3%.

d) H.G.I. is approximately 90.

(2) As to metallurgical usage

With reference to the oxidized coal being of F.S.I. 2 to 4, the strength index are calculated according to US steel method as mentioned on the table 21. It could be said that those coals are of marginal quality as metallurgical usage.

Oxidized Coal (Tested by Mitsui Mining Co, Ltd.)

Table 18.

Raw Coal

		High F.S.I. Coal				Low F.S.I. Coal			
		No.8	No.9	No.10B	No.10A	No.8	No.9	No.10B	No.10A
Proximate A.									
I.M.	%	1.6	1.4	1.5	1.2	3.3	1.7	2.4	2.0
Ash	%	15.7	18.7	17.4	16.3	15.9	9.1	18.0	17.7
V.M.	%	18.8	19.1	18.9	19.1	19.7	19.6	19.4	18.5
F.C.	%	63.9	60.8	62.2	63.4	61.1	69.6	60.2	61.8
Cal. V.	Kcal/kg	7,020	6,820	6,910	7,080	6,610	7,600	6,630	6,710
Total S.	%	0.37	0.33	0.39	0.45	0.35	0.32	0.37	0.44
F.S.I.		3	3	4	5-1/2	2	2	1-1/2	1-1/2
H.G.I.		87	85	106	94	89	86	85	86
Melting P.	°C	+1,450	"	"	"	"	"	"	"
Ultimate A.									
C	%	88.9	88.2	88.7	88.7	86.4	89.1	87.1	87.7
H	%	5.0	5.0	5.1	5.0	4.6	4.7	4.8	4.6
O	%	4.6	5.1	4.6	4.7	7.4	4.7	6.6	6.0
N	%	1.1	1.3	1.1	1.1	1.2	1.2	1.2	1.1
S	%	0.4	0.4	0.5	0.5	0.4	0.3	0.4	0.6
Ash Composition									
SiO_2	%	56.4	60.7	64.7	64.8	55.8	58.5	65.4	66.0
Al_2O_3	%	37.20	33.01	30.70	30.44	34.88	33.73	29.30	30.21
Fe_2O_3	%	0.99	0.79	0.99	0.50	0.90	0.62	0.76	0.76
CaO	%	1.38	0.66	0.34	0.36	2.99	3.04	1.11	0.61
MgO	%	0.10	0.27	0.21	0.13	0.42	0.29	0.35	0.24
Na_2O	%	0.48	0.46	0.43	0.95	0.38	0.45	0.38	0.41
K_2O	%	0.47	1.27	0.88	1.24	0.56	0.33	0.68	0.51
SO_3	%	0.34	0.26	0.06	0.08	0.60	0.66	0.17	0.06

Oxidized Coal (Tested by Mitsui Mining Co., Ltd.)   Table 19.

Clean Coal

		No.8	No.9	No.10B	No.10A
Proximate Analysis					
I.M.	%	1.8	1.6	1.7	1.3
Ash.	%	9.2	9.2	9.2	9.5
V.M.	%	20.2	20.7	20.1	20.9
F.C.	%	68.8	68.5	69.0	68.3
Total Sulphur	%	0.44	0.37	0.46	0.54
P. in coal	%	0.071	0.040	0.020	0.012
F.S.I.		3	4	5	8-1/2
Ultimate Analysis					
C	%	89.0	89.1	89.7	89.5
H	%	4.6	4.8	4.9	5.0
O	%	4.8	4.5	3.6	3.7
N	%	1.1	1.2	1.3	1.2
S	%	0.5	0.4	0.5	0.6
Petrographic Analysis					
Vitrinite	%	41.8	58.1	69.7	66.4
Semi-Fus.	%	32.9	23.1	16.0	17.8
Total Reactives	%	53.4	66.6	75.0	72.3
Total Inerts	%	46.6	33.4	25.0	27.7
$\overline{Ro}$		1.34	1.30	1.38	1.31
Weathered Vit.	%	4.7	0.6	0.2	0.5

Oxidized Coal (Tested by Mitsui Kozan Coking Ind.) Table 20.

		No.8	No.9	No.10B	No.10A
Proximate Analysis					
I.M.	%	1.86	1.50	1.58	1.39
Ash	%	8.84	9.10	9.21	8.92
F.S.I.	%	2	3	3-1/2	8
Gieseler Max. Fluidity	ddpm	1.0	3.0	1.3	24.0
Dilatometer					
Max. Contraction		9	18	19	21
Max. Dilatation		-9	-18	-19	31
Petrographic Analysis					
Vitrinite	%	46.9	49.7	66.9	61.1
Semi-Fus.	%	22.5	19.8	13.4	15.8
Total Reaetives	%	54.4	56.4	71.4	66.4
Total Inerts	%	45.6	43.6	28.6	33.6
$\overline{Ro}$		1.41	1.44	1.47	1.46

Table 21.

		F.S.I.	Strength Index	Comp. Balance Index	Calculated Strength
Oxidized Coal					
Mitsui Kozan Coking	No.8	2	6.12	4.31	43
	No.9	3	6.26	4.11	45
	No.10B	3-1/2	6.82	2.29	61
	No.10A	8	6.70	2.84	57
Mitsui Mining	No.8	3	5.59	3.89	42
	No.9	4	5.49	1.91	58
	No.10B	5	6.23	1.47	64
	No.10A	8-1/2	5.70	1.49	62
Unoxidized Coal					
Mitsui Kozan Coking	No.8	2	6.15	4.6	41
	No.9	3-1/2	6.5	4.8	41
	No.10B	7	7.0	2.5	60
	No.10A	7	6.7	3.03	56
Sumitomo Metal	No.8	3-1/2	5.56	2.05	57
	No.9	5	6.18	3.28	52
	No.10B	7-1/2	6.44	2.50	58
	No.10A	7-1/2	6.11	2.40	58
Nippon Kokan	No.8	2-1/2	5.8	2.4	56
	No.9	5	6.17	2.07	60
	No.10B	8	6.56	1.60	64
	No.10A	7	6.30	2.44	58
Kobe Steel	No.8	3-1/2	6.66	3.2	54
	No.9	4	6.74	4.0	49
	No.10B	7	7.2	3.1	56
	No.10A	6	7.1	4.5	45
Nippon Kokan	Composite S.	4	6.08	2.32	58
Kobe Steel	"	4	6.85	3.34	54
Mitsui Mining	No.6U	2	5.29	2.49	52
	No.6L	7	5.53	1.88	58
	No.7U	3-1/2	5.28	2.82	49
	No.7L	7-1/2	5.32	1.75	58

APPENDIX B

Proximate Analysis of D.H. and L.C. Drill Samples.

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No.4	DH-4	7-7'	30	11.8	-	-	-	-	-	-	-
	" 5	9-9'	94	10.0	1.1	32.0	9.0	6	35.6	-	-
	" 16	10-10'	476	5.9	1.6	26.9	7.7	4 1/2	29.8	32.0	2
	" 70	11-11'	486	10.0	1.0	22.6	7.0	5	24.6	29.6	1 1/2
	" 78	"	738	18.0	0.8	27.3	5.5	7	29.1	34.1	5 1/2
	Average				1.1	27.2	7.3		29.8		
No.6	DH-4	7-7'	183	15.4	0.7	24.0	9.0	5	26.6	-	-
	" 50	8-8'	32	23.5	1.2	23.9	5.5	4	25.6	33.3	1 1/2
	" 1	"	44	19.6	1.1	28.0	9.0	5	31.1	-	-
	" 5	9-9'	260	14.8	0.9	27.0	9.0	5	30.0	-	-
	" 16	10-10'	U. 658	7.7	1.7	24.4	9.9	4 1/2	27.6	26.7	3
			L. 702	7.7	1.4	26.0	5.0	7	27.8	27.9	5 1/2
	" 70	11-11'	684	10.7	1.1	23.9	5.5	7 1/2	25.5	22.4	6 1/2
	" 78	"	U. 945	12.2	1.1	23.3	8.6	6	25.8	21.8	4 1/2
	Average				1.2	25.1	7.7		27.5		

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No.7	DH-3	6-6'	79	21.6	0.8	25.3	9.0	5 1/2	28.0	-	-
	" 4	7-7'	283	13.5	0.7	24.0	9.0	5	26.6	-	-
	" 8	8-8'	66	14.7	2.0	25.5	7.2	1 1/2	27.8	36.2	0
	" 50	"	117	18.8	1.5	23.6	7.5	6	25.9	35.9	1 1/2
	" 1	"	115	17.6	0.9	28.5	9.0	5	31.6	-	-
	" 14	"	L. 49	10.7	1.6	24.8	6.1	3	26.9	34.4	1
	" 5	9-9'	399	15.8	0.7	26.5	9.0	5	29.3	-	-
	" 16	10-10'	832	19.2	1.7	24.4	6.7	7	26.6	33.8	2
	" 70	11-11'	803	19.2	0.6	23.8	6.6	7 1/2	25.6	36.6	2 1/2
	" 78	"	1,095	19.7	0.9	25.2	7.6	6 1/2	27.5	36.7	4
	Average				1.1	25.2	7.8		27.6		

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V. M. (%)	ASH (%)	F.S.I.
No. 8	DH-39	2-2'	217	45.9	-	21.6	-	-	-	19.2	0
	" 6	"	238	36.0	1.0	22.5	9.0	4 1/2	25.0	-	-
	" 40	3-3'	164	44.9	1.6	-	6.6	1	-	-	-
	" 62	"	302	36.2	1.7	21.2	6.2	2 1/2	23.0	19.9	1
	" 2	4-4'	353	35.6	0.6	22.3	9.0	5	24.7	-	-
	" 49	"	207	26.9	1.0	21.2	5.2	5 1/2	22.6	21.7	4
	" 36	"	196	44.2	1.6	21.6	8.3	3	24.0	-	-
	" 37	5-5'	210	38.2	1.4	21.3	7.6	1 1/2	23.7	-	-
	" 38	"	290	34.6	0.5	22.4	7.0	5	24.2	-	-
	" 7	"	271	38.9	1.1	23.6	5.8	4	25.2	19.0	2 1/2
	" 12	"	U. 292 L. 311	14.7 20.5	0.8 1.5	23.8 22.0	10.4 7.0	6 1/2 3 1/2	26.8 24.0	29.1 31.5	3 1/2 1
	" 3	6-6'	394	38.4	0.7	22.5	9.0	4 1/2	24.9	-	-
	" 11	"	278	38.8	1.5	22.7	7.5	6	24.9	37.4	2
	" 41	"	226	36.9	1.3	21.6	8.6	5	24.0	22.2	3 1/2
	" 42	"	220	40.7	1.6	22.4	9.8	4 1/2	25.3	-	-
	" 43	"	218	38.8	1.5	21.1	12.0	4 1/2	24.4	-	-
	" 44	"	250	32.0	1.0	21.6	7.0	4 1/2	23.5	26.5	2 1/2
	" 4	7-7'	614	39.4	0.8	22.5	9.0	4 1/2	24.9	-	-
	" 71	"	267	37.5	1.2	21.3	7.3	3 1/2	23.3	18.7	3
	" 48	"	157	37.2	0.7	21.5	9.6	5	24.0	-	-

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No.8	DH-22	7-7'	U. 102	28.0	0.7	23.2	7.5	6 1/2	25.2	17.9	4
			L. 134	23.2	0.8	23.0	6.6	6 1/2	24.8	27.8	5 1/2
	" 63	"	62	62.8	1.6	22.8	6.8	6	24.9	32.9	1 1/2
	" 64	8-8'	325	38.1	0.6	20.5	6.9	6	22.3	19.3	4
	" 8	"	532	38.1	1.0	23.4	7.6	5 1/2	25.6	35.2	2
	" 50	"	471	39.5	1.2	22.5	7.3	5 1/2	24.6	28.2	2 1/2
	" 1	"	448	40.0	0.7	22.5	9.0	5	24.9	-	-
	" 14	"	509	58.7	1.2	23.8	6.2	6 1/2	25.7	24.7	4
	" 19	9-9'	445	39.1	1.0	21.6	7.1	4 1/2	23.5	25.0	3 1/2
	" 5	"	715	40.4	1.0	22.5	9.0	4 1/2	25.1	-	-
Average					1.1	22.2	7.9		24.4		

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 14.5 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No. 9	DH-39	2-2'	425	19.4	1.6	21.0	6.8	1 1/2	22.9	21.3	1
	" 6	"	448	16.4	0.9	22.4	9.0	6	24.9	-	-
	" 40	3-3'	396	20.4	1.4	21.2	7.0	3	23.2	-	-
	" 62	"	490	16.8	1.5	20.7	8.3	1 1/2	22.9	15.4	1
	" 2	4-4'	532	17.3	0.6	22.4	9.0	5 1/2	24.7	-	-
	" 49	"	452	Fault	-	-	-	-	-	44.4	2 1/2
	" 36	"	410	11.5^{+}	1.4	21.4	7.3	1 1/2	23.4	-	-
	" 37	5-5'	454	11.3	1.0	21.9	9.3	6 1/2	24.4	-	-
	" 7	"	548	20.5	1.6	22.7	8.9	4	25.4	36.7	1
	" 12	"	489	21.5	0.7	21.7	9.4	3 1/2	24.1	28.4	2 1/2
	" 3	6-6'	572	16.7	0.6	22.4	9.0	5	24.7	-	-
	" 11	"	452	15.5	0.7	23.7	7.7	6 1/2	25.9	38.1	2 1/2
	" 41	"	401	16.5	0.8	-	-	4	-	-	-
	" 42	"	397	18.4	1.1	22.7	5.9	7 1/2	24.0	33.1	3
	" 44	"	430	19.7	0.9	21.8	11.1	6	24.8	38.9	3
	" 4	7-7'	799	18.3	1.0	22.3	9.0	5	24.8	-	-
	" 71	"	448	17.8	0.4	22.8	7.2	7	24.7	34.2	3 1/2
	" 48	"	331	12.7	0.9	22.3	7.5	7 1/2	24.3	34.0	3
	" 22	"	334	39.1	1.4	22.5	6.9	7	24.5	47.9	1 1/2
	" 64	8-8'	570	18.7	1.2	22.4	7.0	3 1/2	24.4	35.0	1
	" 8	"	792	15.4	1.6	23.5	6.4	7	25.5	32.5	3
	" 1	"	613	16.6	0.8	22.0	9.0	5	24.4	-	-
	" 14	"	684	10.8	1.3	22.7	7.7	4 1/2	24.9	23.2	2 1/2
	" 19	9-9'	652	18.4	1.9	23.8	7.0	7	26.1	23.1	4
	" 5	"	906	17.7	1.0	22.4	9.0	5 1/2	24.9	-	-
	Average				1.1	22.3	8.1		24.5		

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V. M. (%)	ASH (%)	F.S.I.
No. 10A	DH-6	2-2'	571	8.2	1.3	23.2	9.0	4 1/2	24.4	-	-
	" 39	"	550	8.8	1.0	22.1	8.7	6 1/2	24.5	21.6	3 1/2
	" 60	"	218	9.5	0.5	22.3	8.1	7	24.4	12.7	4 1/2
	" 61	"	128	9.5	1.2	21.5	11.2	7	24.5	33.0	1 1/2
	" 40	3-3'	519	9.3	0.7	-	18.3	1	-	-	-
	" 62	"	616	7.1	1.3	21.7	13.0	6	25.3	25.6	3 1/2
	" 2	4-4'	655	9.6	0.6	23.9	9.0	5 1/2	26.4	-	-
	" 49	"	545	10.6	0.9	21.6	11.9	5	24.8	-	1
	" 37	5-5'	582	8.5	0.5	20.4	14.7	3 1/2	24.1	-	-
	" 7	"	695	8.5	0.7	22.1	10.6	8	24.9	32.3	2 1/2
	" 12	"	609	8.8	0.6	23.3	10.4	5 1/2	26.2	32.8	1 1/2
	" 3	6-6'	675	9.8	0.5	23.1	9.0	4 1/2	25.5	-	-
	" 11	"	576	8.7	-	-	-	-	-	-	-
	" 41	"	529	10.7	0.9	21.8	10.8	6 1/2	24.6	-	-
	" 42	"	526	8.7	0.6	-	9.6	6 1/2	-	-	-
	" 44	"	597	11.3	0.8	19.8	16.2	3 1/2	23.9	22.6	2 1/2
	" 4	7-7'	911	9.6	0.9	23.2	9.0	5	25.7	-	-
	" 71	"	595	12.8	0.6	19.5	10.0	6	21.8	22.0	4
	" 48	"	516	23.4	0.7	20.1	12.1	6 1/2	23.1	25.1	3 1/2
	" 22	"	469	8.7	-	-	-	-	-	-	-
	" 64	8-8'	730	12.0	1.0	21.6	11.7	5 1/2	24.7	21.9	3
	" 8	"	929	6.7	1.2	22.6	10.0	5 1/2	25.0	29.5	2
	" 1	"	746	12.7	0.6	21.5	9.0	6	23.8	-	-
	" 19	9-9'	806	10.0	1.8	19.7	8.8	7 1/2	22.0	27.7	4 1/2
	Average				0.9	21.8	11.0		24.5		

ANALYTICAL RESULTS OF D.H. DRILL SAMPLE

SEAM NO.	DRILL HOLE NO.	CROSS SECTION NO.	DEPTH TO SEAM (Feet)	TRUE SEAM THICKNESS EXCLUDING THICK PARTING (Feet)	CLEAN COAL ANALYSIS - 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No. 10B	DH-6	2-2'	520	14.7	0.9	23.3	9.0	7	25.9	-	-
	" 39	"	502	13.2	1.6	21.0	8.6	7 1/2	23.4	20.5	5 1/2
	" 60	"	194	6.0	1.3	21.4	13.9	5 1/2	25.2	44.7	1 1/2
	" 61	"	98	16.2	1.3	22.3	7.8	7 1/2	24.5	24.0	4 1/2
	" 40	3-3'	473	14.4	1.3	21.5	8.2	6	23.8	-	-
	" 62	"	567	15.9	1.0	20.2	13.8	6 1/2	23.7	22.8	5 1/2
	" 2	4-4'	607	17.3	0.6	23.8	9.0	5	26.3	-	-
	" 49	"	511	18.3	1.3	22.0	9.9	7	24.8	24.3	4
	" 36	"	498	21.1	2.0	20.9	10.2	7	23.8	-	-
	" 37	5-5'	537	12.0	1.1	21.3	10.0	6	24.0	-	-
	" 7	"	647	14.1	1.2	22.5	10.5	5 1/2	25.5	38.4	1
	" 12	"	574	14.6	0.7	23.2	8.4	7	25.5	49.5	1
	" 3	6-6'	632	15.8	0.5	23.0	9.0	6	25.4	-	-
	" 11	"	552	15.5	1.2	22.5	8.2	7	24.8	26.1	4
	" 41	"	502	16.5	1.1	-	5.9	6 1/2	-	-	-
	" 42	"	500	15.5	0.9	-	9.4	7	-	-	-
	" 44	"	550	33.8	2.6	20.1	10.6	6 1/2	23.2	16.9	6
	" 4	7-7'	864	16.3	1.0	22.5	9.0	6 1/2	25.0	-	-
	" 71	"	562	21.7	0.9	24.4	8.0	8	26.7	19.4	6 1/2
	" 48	"	443	17.6	0.6	22.4	10.5	7	25.2	36.6	4 1/2
	" 22	"	443	6.8	1.3	22.4	6.0	7	24.2	46.3	1 1/2
	" 64	8-8'	655	14.7	1.6	21.7	6.6	6	23.6	30.5	4 1/2
	" 8	"	880	14.0	1.7	23.9	7.8	8 1/2	26.4	35.1	4 1/2
	" 1	"	719	17.6	0.8	21.5	9.0	6	23.8	-	-
	" 19	9-9'	745	14.6	3.3	20.5	9.0	8	23.4	30.2	4
	" 5	"	984	6.9	0.6	23.0	9.0	5 1/2	25.4	-	-
	Average				1.2	22.1	9.1		24.7		

ANALYTICAL RESULTS OF L.C. DRILL SAMPLES

SEAM NO.	DRILL NO.	SAMPLE NO.	DEPTH TO SEAM (ft)	SEAM THICKNESS (ft)	CLEAN COAL ANALYSIS 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No.8	LC-2	625	250.0	10	1.81	20.84	5.55	1/2	22.50	20.93	1/2
		626	260.0	10	1.30	21.09	6.87	1	22.97	12.50	1
		627	272.0	8	0.78	20.78	6.00	2 1/2	22.29	16.44	1/2
		628	280.0	10	1.15	20.57	5.58	1 1/2	22.05	10.51	1 1/2
		629	290.0	5.6	1.84	21.32	5.48	1/2	23.00	21.15	1/2
		Average			1.36	20.89	5.94	1.2	22.53	16.0	
	LC-4	986	157.0	3	1.58	19.43	6.86	1/2	21.22	16.25	1/2
		987	160.0	5	1.55	21.56	5.73	1	23.25	18.09	1
		988	165.0	5	1.49	21.55	6.00	1 1/2	23.29	8.15	1 1/2
		989	170.0	4	1.31	20.59	6.30	1 1/2	22.29	17.02	1 1/2
		990	182.0	8	1.47	19.99	6.19	1/2	21.65	13.19	1/2
		991	190.0	10	1.69	19.96	6.10	1/2	21.65	11.55	1/2
		992	200.0	10.6	3.19	22.16	5.21	0	24.19	14.17	0
		Average			1.92	20.84	5.93	0.5	22.62	13.6	
	LC-6	996	197.0	13	0.74	21.21	7.00	6 1/2	22.99	16.74	5 1/2
		997	210.0	8.7	0.81	21.73	6.66	7	23.48	21.50	3 1/2
		998	223.5	6.5	1.41	20.55	6.08	1	22.21	20.04	1
		999	230.0	10	2.11	19.38	6.15	0	21.12	18.66	0
		1000	240.0	9.9	3.21	21.75	5.03	0	23.70	24.99	0
		Average			1.63	20.94	6.24	3.2	22.73	20.2	
	LC-9	615	17.0	13	0.90	21.95	6.47	4 1/2	23.70	17.15	2 1/2
		616	30.0	6.8	1.12	20.62	5.38	1 1/2	22.05	13.68	1
		617	40.0	10	0.85	20.36	6.82	3	22.05	26.79	1
		618	50.0	14.6	1.64	21.72	6.02	1 1/2	23.52	17.37	1
		Average			1.17	21.31	5.23	2.7	23.02	19.0	

ANALYTICAL RESULTS OF L.C. DRILL SAMPLES

SEAM NO.	DRILL NO.	SAMPLE NO.	DEPTH TO SEAM (ft)	SEAM THICKNESS (ft)	CLEAN COAL ANALYSIS 1.45 FLOAT BASIS					RAW COAL	
					MOISTURE (%)	VOLATILE MATTER (%)	ASH (%)	F.S.I.	D.A.F. V.M. (%)	ASH (%)	F.S.I.
No. 8	LC-10	951	64.5	3.7	3.17	23.39	5.96	1/2	25.74	29.87	0
		952,953	70.5	9.5	2.24	21.01	6.41	0	23.00	20.93	0
		954,955	80.0	10	2.30	22.71	5.45	1/2	24.62	15.77	1/2
		956,957,958	90.0	12.9	2.34	21.54	5.79	1/2	23.45	12.65	1/2
		Average			2.39	21.91	5.88	0.4	23.89	17.7	
No. 9	LC-5	962,963	61.6	6.8	2.06	21.71	4.73	1/2	23.29	19.92	1/2
		964,965	70.0	10.0	2.13	20.46	5.42	1/2	22.13	11.00	1/2
		966,967	80.0	8.6	2.69	20.64	5.33	0	22.44	13.35	0
		Average			2.30	20.86	5.20	0.3	22.55	14.3	
	LC-7	608	123.0	7.0	0.81	22.25	5.03	8	23.63	17.78	6
		609	130.0	9.5	0.71	22.18	7.16	7	24.07	21.18	4
		610	140.0	7.2	0.84	20.53	6.98	2 1/2	22.27	10.37	2
		Average			0.78	21.70	6.48	5.9	23.39	17.0	
No.10B	LC-5	971,972,973	153.0	16.8	0.86	22.12	6.36	8	23.84	14.1	7 1/2
	LC-7	613	207.0	4.8	0.63	21.20	8.58	8	23.35	20.6	4 1/2
No.10A	LC-7	614	268.0	6.0	1.62	20.12	8.11	1	22.29	19.0	1 1/2

APPENDIX C

Analytical Results by Steel Mills and Mitsui Kozan Coking Ind.

1. Proximate Analysis, Total Sulphur, CSN, Calorific Value and Hard Grove Index
2. Ultimate Analysis
3. Phosphorus Contents
4. Size Distribution and Analysis
5. Gieseler Plastometer
6. Dilatometer
7. Petrographic Analysis
8. Drum Test

9-1 Composite Sample (M.K.C.)

9-2 Composite Sample (N.K.K. and K.S.L.)

10. Oxidized Coal (M.K.C.)

1. Proximate Analysis, Total Sulphur, CSN, Calorific Value and Hard Grove Index.

	Seam No.	T.M.	I.M.	Ash	V.M.	F.C.	T.S.	C S N	Cal	H.G.I
Nippon Steel	No.8		1.3	9.6	20.2	68.9	0.41	2-1/2		
	No.9		1.2	8.9	19.8	70.1	0.36	4		
	No.10B		1.0	9.2	20.4	69.4	0.49	7		
	No.10A		0.9	10.4	20.3	68.4	0.56	6-1/2		
Nippon Kokan	No.8			9.9	20.2	69.9	0.40	2-1/2	7722	
	No.9			8.9	19.9	71.2	0.35	5	7850	
	No.10B			10.0	20.8	69.2	0.48	8	7772	
	No.10A			10.5	20.7	68.8	0.55	7	7734	
Kawasaki	No.8	7.5		9.7	19.4	70.9	0.40	3		
	No.9	6.2		8.4	19.1	72.5	0.35	4-1/2		
	No.10B	6.3		9.8	19.8	70.4	0.48	8-1/2		
	No.10A	7.6		10.4	20.4	69.2	0.55	8		
Sumitomo	No.8		1.2	9.6	20.2	69.0	0.41	3-1/2		
	No.9		1.1	9.2	19.6	70.1	0.34	5		
	No.10B		1.0	9.7	20.0	69.3	0.45	7-1/2		
	No.10A		0.8	10.4	20.3	68.5	0.55	7-1/2		
Kobe	No.8		1.32	9.90	20.22	69.80	0.39	3-1/2		
	No.9		1.18	8.75	19.77	71.48	0.35	4		
	No.10B		0.66	9.74	20.17	70.07	0.46	7		
	No.10A		0.96	11.13	19.98	68.89	0.52	6		
Nisshin	No.8			9.5	20.0		0.39	1		80
	No.9			8.8	19.1		0.35	2-1/2		83
	No.10B			9.9	20.0		0.49	6-1/2		105
	No.10A			10.4	20.0		0.56	5-1/2		98
Mitsui Kozan Coking	No.8		1.26	9.59	19.78	69.37	0.38	2		
	No.9		1.12	8.78	19.58	70.52	0.36	3-1/2		
	No.10B		1.02	9.56	19.90	69.52	0.46	7		
	No.10A		0.96	10.21	20.18	68.65	0.55	7		

C/

2. Ultimate Analysis

		C	H	N	S	O
Mitsui Kozan Coking	No.8	88.68	4.68	1.16	0.41	5.07
	Seam No.9	89.12	4.65	1.18	0.38	4.67
	No.10B	89.32	4.80	1.22	0.50	4.16
	No.10A	89.06	4.74	1.10	0.61	4.49

3. Phosphorus Contents

		In Ash	In Coal
Kobe	No.8	0.429	0.0425
	Seam No.9	0.343	0.0300
	No.10B	—	—
	No.10A	0.141	0.0156
Nisshin	No.8	0.415	0.040
	Seam No.9	0.513	0.045
	No.10B	0.204	0.020
	No.10A	0.153	0.016

C2

4. Size Distribution and Analysis

Kawasaki

Seam No.		+10m/m	6	3	1.5	1.0	0.6	0.3	-0.3	M.S.S.
No.8	Weight	24.8	15.0	14.6	14.9	8.4	7.2	7.7	7.4	6.7
	Ash	11.5	10.4	9.0	7.6	7.3	7.6	10.1	12.6	9.7
	V.M.	18.7	18.7	19.1	20.4	20.2	20.5	20.2	20.0	19.5
	F.S.I.	1	1	2	4-1/2	5	5-1/2	5-1/2	5-1/2	
No.9	Weight	24.8	12.8	17.2	16.0	7.7	7.6	5.1	8.8	6.7
	Ash	9.4	9.9	8.8	7.6	7.0	6.9	7.4	10.7	8.7
	V.M.	18.0	18.0	18.6	19.7	19.6	19.9	20.2	20.0	18.9
	F.S.I.	2	2	4	5-1/2	7	7-1/2	7-1/2	7	
No.10B	Weight	17.3	13.7	17.3	17.7	9.0	7.5	6.5	11.1	5.5
	Ash	10.5	9.2	9.1	9.5	9.8	10.0	10.8	12.0	10.0
	V.M.	19.0	19.5	19.9	19.9	19.5	19.7	19.6	19.6	19.6
	F.S.I.	8	8-1/2	8-1/2	8	8	8	8	8-1/2	
No.10A	Weight	14.8	12.9	14.2	18.2	10.8	8.0	8.3	12.8	4.9
	Ash	11.9	10.3	9.9	9.4	9.8	10.1	11.3	12.2	10.6
	V.M.	19.6	19.6	19.9	20.7	20.1	20.2	19.8	19.9	20.0
	F.S.I.	6-1/2	8	8	8-1/2	8-1/2	8-1/2	8-1/2	8-1/2	

Sumitomo

Seam No.		+10m/m	5	2.88	1.41	0.59	0.297	-0.297
No.8	weight	14.5	23.5	11.7	13.9	15.7	7.4	13.3
No.9	weight	11.9	24.5	13.5	17.2	16.7	6.2	10.0
No.10B	weight	6.2	20.8	14.1	18.4	18.7	8.2	13.6
No.10A	weight	3.8	18.1	13.6	16.2	21.5	9.3	17.5

Kobe

Seam No.		+25m/m	9.52	4.0	3.0	2.0	1.0	0.15	-0.15	Ave.
No.8	Weight	0	21.6	22.8	5.6	7.6	12.5	21.5	8.4	100
	Ash	0	11.00	10.07	8.77	7.94	7.32	9.05	14.52	9.85
	V.M.	0	19.25	19.54	20.07	21.58	21.00	21.22	20.99	20.25
	F.S.I.	0	1-1/2	1-1/2	2-1/2	4	6	6-1/2	4	-
No.9	weight	0	18.6	25.1	7.0	9.4	14.2	18.9	6.8	100
	Ash	0	9.82	9.95	8.39	7.86	7.16	7.28	13.59	8.97
	V.M.	0	18.91	19.04	19.68	20.20	20.46	20.75	20.65	19.79
	F.S.I.	0	2-1/2	2-1/2	4	5	6-1/2	7	5-1/2	-
No.10B	Weight	0	9.8	24.3	8.4	11.0	16.2	22.5	7.8	100
	Ash	0	10.10	9.24	8.75	9.34	9.45	10.04	13.66	9.85
	V.M.	0	19.87	20.76	20.55	20.21	20.46	20.28	20.34	20.44
	F.S.I.	0	6-1/2	7	7	7	7	7-1/2	7	-
No.10A	Weight	0	9.8	19.5	6.6	9.6	17.0	26.8	10.7	100
	Ash	0	11.83	10.46	9.53	9.18	9.28	10.52	13.47	10.57
	V.M.	0	19.73	20.31	20.86	20.84	21.15	20.78	20.50	20.69
	F.S.I.	0	6	7	7-1/2	7-1/2	8	7-1/2	7-1/2	-

CK

Nisshin

Seam No.		+25m/m	15m/m	6m/m	3m/m	16#	42#	100#	-100#
No.8	Weight	0	6.4	27.5	13.1	21.0	16.5	8.1	7.4
	Ash	0	10.9	11.3	9.5	7.7	8.1	10.6	14.2
	V.M.	0	19.4	19.2	19.7	20.7	21.1	20.8	20.4
	F.S.I.	0	1	1	1	2-1/2	3-1/2	3	3-1/2
NO.9	Weight	0	5.9	28.8	13.4	25.3	16.0	5.7	4.9
	Ash	0	9.4	9.6	9.2	7.5	7.2	7.7	13.0
	V.M.	0	19.0	19.8	20.0	18.7	20.7	19.7	19.8
	F.S.I.	0	1	1	1-1/2	2-1/2	3-1/2	3	6-1/2
No.10B	Weight	0	2.2	24.8	13.8	25.1	19.5	8.1	6.5
	Ash	0	10.4	9.4	8.9	9.3	9.9	10.4	12.7
	V.M.	0	19.4	19.9	19.9	21.1	18.9	20.0	19.9
	F.S.I.	0	6-1/2	7	6-1/2	7	6-1/2	5 1/2	6-1/2
No.10A	Weight	0	1.9	18.2	13.4	27.2	20.5	10.1	8.7
	Ash	0	13.5	11.1	10.0	9.3	10.0	10.7	12.7
	V.M.	0	19.1	19.7	20.6	20.6	20.6	20.7	20.3
	F.S.I.	0	3	5	6-1/2	6-1/2	7	7	7

Mitsui Kozan Coking

Seam No.		+25m/m	10	6	2.83	1.19	0.5	0.297	-0.297
No.8	Weight	0	13.2	16.1	16.8	18.3	14.9	6.0	14.7
No.9	Weight	0	14.1	15.1	19.5	21.5	14.5	4.5	10.8
No.10B	Weight	0	7.8	13.5	20.9	22.1	16.1	6.0	13.6
No.10A	Weight	0	5.8	9.5	18.0	23.9	18.2	7.4	17.2

C5

5. Gieseler Plastometer

			Temperature				
			Softening	Max. Fludity	Solidification	Range	Max. Fludity
Nippon Steel	Seam	No.8	-	-	-	-	3
		No.9	-	-	-	-	4
		No.10B	-	-	-	-	26
		No.10A	-	-	-	-	72
Nippon Kokan	Seam	No.8	445	456	472	27	2
		No.9	449	465	478	29	3
		No.10B	441	472	496	55	13
		No.10A	422	466	491	69	92
Kawasaki	Seam	No.8	445	-	474	29	1
		No.9	440	466	477	37	2
		No.10B	432	469	487	55	20
		No.10A	418	466	490	72	98
Sumitomo	Seam	No.8	449	464	484	35	3
		No.9	436	472	491	55	4
		No.10B	441	477	501	60	17
		No.10A	430	472	504	74	66
Kobe	Seam	No.8	-	-	-	-	0
		No.9	-	-	-	-	0
		No.10B	442	478	496	54	15
		No.10A	427	472	498	71	54
Nisshin	Seam	No.8	445	463	490	45	2.2
		No.9	439	466	489	50	2.4
		No.10B	438	469	497	59	13.6
		No.10A	424	469	514	90	53.6
Mitsui Kozan Coking	Seam	No.8	455	471	480	25	2
		No.9	451	472	487	36	3
		No.10B	441	480	498	57	23
		No.10A	436	477	500	64	90

6. Dilatometer

			Temperature			Max. Contraction (%)	Max. Dilatation (%)
			Softening	Max. Contraction	Max. Dila'n		
		No.8	—	—	—	—	—
Nippon Steel	Seam	No.9	—	—	—	—	—
		No.10B	—	—	—	—	—
		No.10A	—	—	—	—	—
		No.8	425	-	532	18	-18
Kawasaki	Seam	No.9	418	-	481	20	-20
		No.10B	408	451	494	18	42
		No.10A	400	442	486	20	53
		No.8	403	-	517	18.0	-18.0
Sumitomo	Seam	No.9	403	-	475	23.0	-23.0
		No.10B	397	439	475	23.3	21.0
		No.10A	391	439	481	21.5	33.3
		No.8	410	487	-	27	-27
Kobe	Seam	No.9	405	478	-	30	-30
		No.10B	395	455	485	31	-2
		No.10A	392	446	483	30	12
		No.8	422	480	-	19	-19
Mitsui Kozan Coking	Seam	No.9	422	480	-	21	-21
		No.10B	409	448	496	23	33
		No.10A	394	438	487	24	42

7. Petrographic Analysis

	Seam No.	Maceral and Reflectance									Vitrinoid Type								
		Vit	Exi	S-F	Fusi	Mic	M-M	T.R.	T.I.	$\overline{Ro}$	6	11	12	13	14	15	16	17	18
Nippon Kokan	No.8	56.8	-	23.1	6.2	8.9	5.0	64.5	35.5	1.33	4		12	72	8		4		
	No.9	62.5	-	17.2	9.3	6.5	4.5	65.6	34.4	1.38			4	60	36				
	No.10B	71.6	-	10.0	10.9	2.5	5.0	74.9	25.1	1.41			4	32	60	4			
	No.10A	60.4	-	16.5	11.8	6.0	5.3	65.9	34.1	1.39			4	44	48	4			
Sumitomo	No.8	59.1	-	18.8	3.3	14.6	4.2	65.4	34.6	1.31		2	35	52	11				
	No.9	52.7	-	21.7	3.6	17.9	4.1	59.9	40.1	1.39			8	38	45	7	2		
	No.10B	61.8	-	16.1	3.7	14.1	4.3	67.2	32.8	1.41		2	4	30	48	15	1		
	No.10A	59.9	-	16.4	2.4	16.7	4.6	65.4	34.6	1.38			10	50	34	6			
Kobe	No.8	62.3	-	4.0	6.1	22.2	4.4	64.0	36.0	1.48			1.4	9.9	56.3	21.1	9.9	1.4	
	No.9	60.3	-	5.8	6.1	23.9	3.9	62.2	37.8	1.53				3.7	30.5	46.3	18.3	1.2	
	No.10B	71.5	-	7.6	5.3	11.3	4.3	74.0	26.0	1.64				1.3	3.8	24.0	48.1	21.5	1.3
	No.10A	63.0	-	11.2	6.2	14.7	4.9	66.7	33.3	1.64					8.5	20.7	45.2	24.4	1.2
Nisshin	No.8	55.0	-	21.6	8.5	10.6	4.3	62.2	37.8	1.47				12	60	24	4		
	No.9	64.5	-	15.3	8.0	8.3	3.9	69.6	30.4	1.54					26	62	12		
	No.10B	73.4	-	10.8	5.4	6.0	4.4	77.0	23.0	1.57					4	66	28	2	
	No.10A	67.8	-	15.2	4.5	7.9	4.6	72.9	27.1	1.49			2	8	42	48			
Mitsui Kozan Coking	No.8	46.2	0.2	22.0	1.4	25.3	4.9	53.7	46.3	1.43			2	29	54	14	1		
	No.9	49.1	0.2	20.3	1.9	24.1	4.4	56.1	43.9	1.49		2	2	5	38	45	8		
	No.10B	68.3	0.1	13.0	0.9	12.9	4.8	72.2	27.8	1.53				3	26	58	9	4	
	No.10A	59.7	0	16.1	1.1	17.9	5.2	65.1	34.9	1.46				15	52	30	3		

8 Drum Test

			Nippon Steel											
			1	2	3	4	5	6	7	8	9	10	11	12
JIS DRUM	30 R	15	78.3	85.5	92.0	92.2								
		25												
		38												
		50												
	150 R	15												
		25												
		38												
		50												
Tumbler		6												
		25												
	Line Creek	No.8	100											
		No.9		100										
		No.10B				100								
		No.10A			100									
	Balmer													

Drum Test

			Kobe								Nisshin							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		15	90.4	96.0	83.2	95.4	91.4	93.2	91.3	93.4	74.3	86.3	93.1	93.4	91.1	91.1		
J	30	25	85.2	92.6	80.2	92.6	81.2	86.7	85.2	86.8								
I	R	38																
S		50	23.0	27.5	26.6	46.1	24.4	35.0	24.2	35.6	21.2	19.2	35.0	23.6	30.6	32.3		
D		15	75.6	87.8	62.2	85.6	76.8	80.5	81.4	81.5	51.8	71.0	82.7	83.1	78.9	77.0		
R	150	25	67.6	83.0	57.0	81.0	60.8	69.5	66.8	70.3								
U	R	38																
M		50	6.1	16.7	5.9	26.8	4.7	9.6	3.6	8.8	5.5	7.3	18.6	6.9	15.5	9.0		
Tumbler		6																
		25																
		Line Creek No.8	100				30				100							
		No.9		100				30				100						
		No.10B				100				30				100				
		No.10A			100				30				100					
		Takasima					70	70	70	70								
		Balmer													100			
		Vicary														100		

Drum Test

			Nippon Kokan											
			1	2	3	4	5	6	7	8	9	10	11	12
JIS DRUM	30 R	15	73.2	88.9	94.6	94.2	93.1	92.3	92.3					
		25	69.8	85.5	91.7	91.8	89.7	88.7	88.7					
		38												
		50	26.1	13.3	31.3	41.5	32.0	28.4	32.7					
	150 R	15	50.4	76.0	85.9	84.0	82.2	81.0	80.4					
		25	45.8	69.5	80.6	79.7	73.6	75.7	74.7					
		38												
		50	5.0	5.3	17.6	20.1	14.7	7.9	15.3					
Tumbler		6												
		25												
		Line Creek No.8	100					20	10					
		No.9		100										
		No.10B				100								
		No.10A			100									
		Keystone					10	10	10					
		Pittston MV					15	15	15					
		Balmer					20		20					
		Coal Cliff					10	10	10					
		Blackwater					10	10						
		Liddell					23	23	23					
		Oil Coke					2	2	2					
		Oyusen					10	10	10					

Drum Test

			Kawasaki												Mitsui Kozan Coking			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
JIS DRUM	30 R	15	80.3	86.7	94.0	96.2	91.2	90.8	92.0	93.0	91.9	91.6	92.1	92.6	95.1	93.6	94.3	92.2
		25	71.8	82.8	89.1	93.8	83.2	84.0	82.8	89.0	83.7	86.2	83.0	88.4	92.6	87.5	90.3	86.4
		38																
		50													17.6	4.9	12.2	6.2
	150 R	15													87.4	84.2	84.8	81.2
		25													83.6	75.4	77.4	70.8
		38																
		50													6.1	0.5	3.4	1.3
Tumbler		25	33.4	45.8	64.1	63.8	53.8	52.7	50.1	58.8	48.6	53.2	43.4	57.1				
		6	48.6	56.0	71.5	68.9	67.8	69.0	63.9	70.4	62.9	60.8	59.1	65.2				
		Line Creek No.8	100				40				40				100			
		No.9		100				40				40				100		
		No.10B				100				40				40				100
		No.10A			100				40				40				100	
		Newdell					60	60	60	60								
		Yubari									60	60	60	60				

c/3

Drum Test

			Sumitomo											
			1	2	3	4	5	6	7	8	9	10	11	12
JIS DRUM	30 R	15	73.9	90.6	96.4	94.8	92.6	92.4	93.8	93.7	85.6	83.0	94.6	94.0
		25	70.2	87.6	95.2	93.2	87.4	87.4	89.4	89.4	83.2	80.0	92.0	91.8
		38	53.6	73.8	85.2	82.2	67.0	66.2	73.4	70.2	68.6	66.1	76.2	79.4
		50	31.9	26.0	52.0	49.8	34.2	31.9	44.4	35.2	41.1	40.8	33.0	48.4
	150 R	15	53.2	76.8	88.4	85.1	80.5	80.4	82.6	83.6	68.6	65.6	85.1	83.6
		25												
		38												
		50												
Tumbler		6	45.4	56.0	74.3		66.6	68.5			57.5	54.9		
		25	42.5	50.9	70.5		55.2	59.4			54.3	51.4		
	Line Creek	No.8	100				40				55			
		No.9		100				40				55		
		No.10B				100				40				55
		No.10A			100				40				55	
	Cerro										25	25	25	25
	Akabira						60	60	60	60	20	20	20	20

9-1 Composite Sample (Analysis by M.K.C.)

Sample	Mixing Ratio	No.8	No.9	No.10B	No.10A
A	at reserves ratio	36	30	10	24
B	at coal thickness ratio	51	25	7	17

Proximate Analysis

	I.M.	Ash	V.M.	F.C.	T.S.	F.S.I.
A	1.27	9.52	19.60	69.61	0.42	4-1/2
B	1.30	9.50	19.47	69.73	0.40	3-1/2

Ultimate Analysis

	C	H	O	N	S
A	88.69	4.71	5.01	1.14	0.45
B	89.27	4.76	4.38	1.16	0.43

Gieseler Plastometor

	Softening Temp.	Max. Temp.	Fludity Log DD/M	Solidification Temp.	Range
A	458	474	0.28	488	30
B	453	474	0.34	487	34

Dilatometer

	Softening	Max.Contraction		Max.Dilatation		Total Dilatation
	Temp.	Temp.	%	Temp.	%	%
A	413	471	23	489	-12	11
B	413	468	24	484	-17	7

C/14

Drum Index

	DI^{30}_{50}	DI^{30}_{25}	DI^{30}_{15}	DI^{150}_{50}	DI^{150}_{25}	DI^{150}_{15}
A	10.2	89.5	94.0	1.6	77.0	84.6
B	11.0	88.2	93.0	3.8	74.2	82.4

Coke Analysis

	Ash	V.M.	F.C.	T.S.
A	11.81	0.60	87.59	0.38
B	11.81	0.57	87.62	0.37

C/5

9-2 Composite Sample (Analysis by N.K.K. and K.S.L.)

	No.8	No.9	No.10B	No.10A
Mixing Ratio	43	27	21	9

Proximate Analysis

	Ash	V.M.	F.C.	T.S.	F.S.I.	Cal.	P in ash	P in coal
N.K.	9.8	20.3	69.9	0.40	4	7,771	0.353	
Kobe	9.42	20.16	70.42	0.42	4		0.363	0.0342

Petrographic Analysis

	Vit.	Exi	S-F.	Fusi.	Mic.	M.M.	T.R.	T.I.	$\overline{Ro}$
N.K.	60.8	0	16.4	13.4	4.5	4.9	66.3	33.7	1.40
Kobe	61.9	0	12.2	8.7	13.0	4.2	66.0	34.0	1.52

Vitrinoid Type

	11	12	13	14	15	16	17
N.K.	4	4	48	36	8		
Kobe			4.7	35.9	45.3	12.5	1.6

Gieseler Plastometer

	Softening Temp.	Max.Fludity Temp.	Solidification Temp.	Max.Fludity d.d.p.m.
N.K.	456	475	491	3
Kobe		no fluidity		

Size Analysis (kobe)

Size	m.m	9.52	4.0	3.0	2.0	1.0	0.15	-0.15	total
Yield	%	17.1	23.5	6.8	9.3	14.4	21.5	7.4	100
Ash	%	9.34	10.14	8.92	8.15	8.31	9.46	13.42	9.52
V.M.	%	19.10	19.24	19.86	20.28	20.49	20.80	20.89	20.04
C.S.N.		1	1-1/2	3-1/2	4-1/2	5	5	4-1/2	

A. A. Dilatometer (Kobe)

Softening Temp.	Max. Contraction Temp.	Max. Contraction %	Max.Dilation Temp.	Max.Dilation %
405	482	30	-	-30

J I S Drum Index

			DI $^{30}_{15}$	DI $^{30}_{25}$	DI $^{30}_{50}$	DI $^{150}_{15}$	DI $^{150}_{25}$	DI $^{150}_{50}$
N.K.	Line Creek	100%	87.9	82.3	13.1	68.8	57.9	4.5
	Keystone Pittston MV Saraji * Blackwater Remington Oil Coke Yubari Line Creek	10% 15% 10% 10% 23% 2% 10% 20%	91.9	85.5	15.4	75.8	65.9	2.7
	do as * Wollondilly	80% 20%	91.9	86.6	15.5	75.6	65.3	2.8
	do as * Balmer	80% 20%	91.9	84.3	10.1	76.2	62.5	2.7
	Wollondilly	100%	85.8	79.9	20.6	64.3	53.7	6.7
	Balmer	100%	85.7	78.0	10.4	65.9	62.3	5.9
Kobe	Line Creek	100%	86.4	83.4	30.4			
	Line Creek Takashima	30% 70%	92.8	85.2	24.8			

10 Oxidized Coal (analysis by M.K.C.)

Proximate Analysis

	I.M.	Ash	V.M.	F.C.	T.S.	F.S.I.
No.8	1.86	8.84	19.58	69.72	0.68	2
No.9	1.50	9.10	20.24	69.16	0.47	3
No.10B	1.58	9.21	20.12	69.09	0.61	3-1/2
No.10A	1.39	8.92	20.40	69.29	0.64	8

Ultimate Analysis

	C	H	O	N	S
No.8	87.35	4.53	6.24	1.14	0.74
No.9	87.50	4.69	6.15	1.15	0.51
No.10B	89.00	4.74	4.36	1.22	0.68
No.10A	88.05	4.76	5.40	1.08	0.71

Gieseler Plastometer

	Softening Temp.	Max.Fludity		Solidification Temp.	Range
		Temp.	Log DD/M		
No.8	-	-	0	-	0
No.9	444	465	0.48	483	39
No.10B	459	471	0.11	477	18
No.10A	432	477	1.38	499	67

Dilatometer

	Softening Temp.	Max.Contraction		Max.Dilatation		Total Dilatation %
		Temp.	%	Temp.	%	
No.8	433	480	9	-	-9	0
No.9	417	480	18	-	-18	0
No.10B	421	480	19	-	-19	0
No.10A	404	439	21	499	31	52

Petrographic Analysis

Maceral and Reflectance

	Vit	Exi.	S-F.	Fusi.	Mic.	M.M.	T.I.	$\overline{Ro}$
No.8	46.9	0	22.5	1.3	24.3	5.0	45.6	1.41
No.9	49.7	0.1	19.8	1.8	23.5	5.1	43.6	1.44
No.10B	66.9	0	13.4	0.8	13.7	5.2	28.6	1.47
No.10A	61.1	0	15.8	1.3	16.7	5.1	33.6	1.46

Vitrinoid Type

	12	13	14	15	16	17
No.8	2.8	14.5	24.4	4.7	0.5	
No.9	1.0	13.9	25.3	7.5	2.0	
No.10B	0.7	8.0	34.1	21.4	2.7	
No.10A		9.2	36.7	14.0	0.6	0.6

K-SHELL - LINE CR. - HORSESHOE RIDGE 77(5)A.

COAL SEAM

DATA

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GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 415

II. COAL SEAMS

The study of this section is based on the information from forty-two non-core drill holes, eight core drill holes and eleven adits.

II-1 Development of Each Coal Seam

No. 4 seam

In the western part of the area, this is more than 10 feet thick with no parting. However, it splits into two seams in the northeastern part of the area.

No. 6 seam

This seam splits into two seams in the proposed pit area and the interval of the two seams varies from 1 to 18 feet. Total seam thickness excluding a thick parting is about 20 feet in the eastern part and it becomes thinner to 10 feet in the western part.

No. 7 seam

This seam shows relatively regular thickness ranging from 15 to 21 feet with a parting of from 2 to 5 feet thick.

No. 8 seam

This is the thickest seam in the area. Its thickness maintains above 35 feet in most part of the area with a parting of from 2 to 4 feet thick. The thinner thickness of about 26 feet was recorded in LC-10 and DH-49 holes. It is not clear whether the thin thickness was caused by fault within the seam. On the other hand, in DH-14 and DH-63 at the northeastern limit of the area, the seam splits into three seams of which composite thickness is more than 60 feet.

No. 9 seam

In the southern half of the area, the seam gives the relatively regular thickness ranging from 17 to 21 feet. In the northern half, it splits into two seams and thins toward east.

No. 10B seam

In the major part of the area, the seam is mostly within a range from 14 to 18 feet thick, while it changes its thickness near the surface. The thinnest 6 feet thickness is recorded in DH-60, and it is interpreted that the section is intraformationally faulted. The thickest 33.8 feet section is recorded in DH-44.

The geophysical logging of the seam in some drilling holes do not show sharp contact lines at roof. Judging from the observation at adits, it is interpreted that the existence of the carbonaceous thin layers give ambiguity. Therefore, consideration is given to reduce the seam thickness for the reserves calculation multipling safety factor.

No. 10A seam

This seam is relatively thin and from 8 to 12 feet thick in the most part of the area.

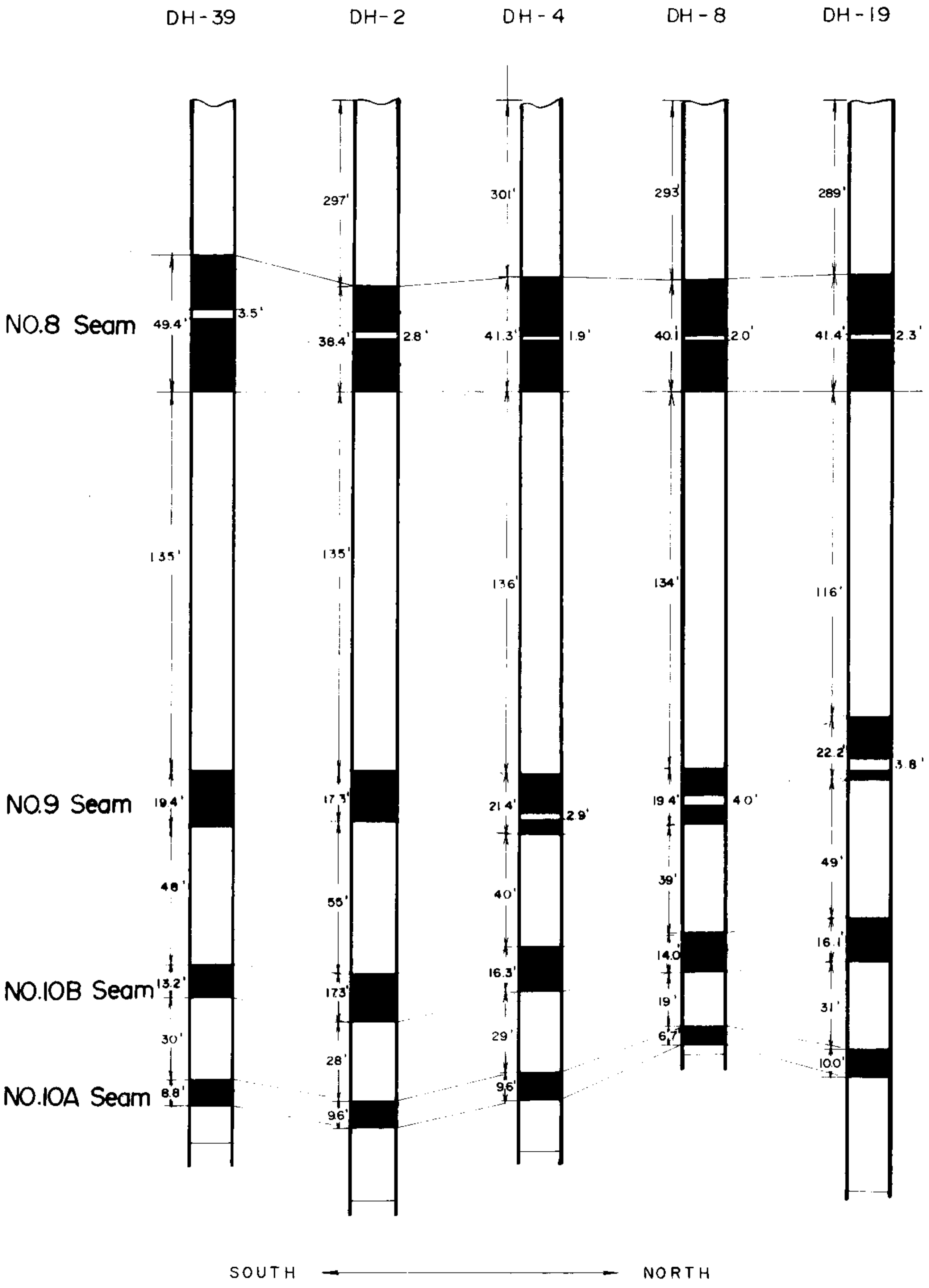
The measured thickness of each seam at the adits is as follows.

Seam	No. 6	No. 7	No. 8	No. 9	No. 10B	No. 10A
Adit	15	16	7	4	5	12
Coal	15.84	16.93	37.27	17.62	13.08	9.74
Parting Thickness	6.75	3.00	3.45	0	0	0
Seam Thickness	22.59	19.93	40.72	17.62	13.08	9.74

COLUMNAR SECTION
(NO. 8 ~ NO. 10A)

Scale 1" = 50'

Fig. 2(2)



COLUMNAR SECTION Scale 1" = 50'
(NO.4 - NO.7)

Fig. 2(1)

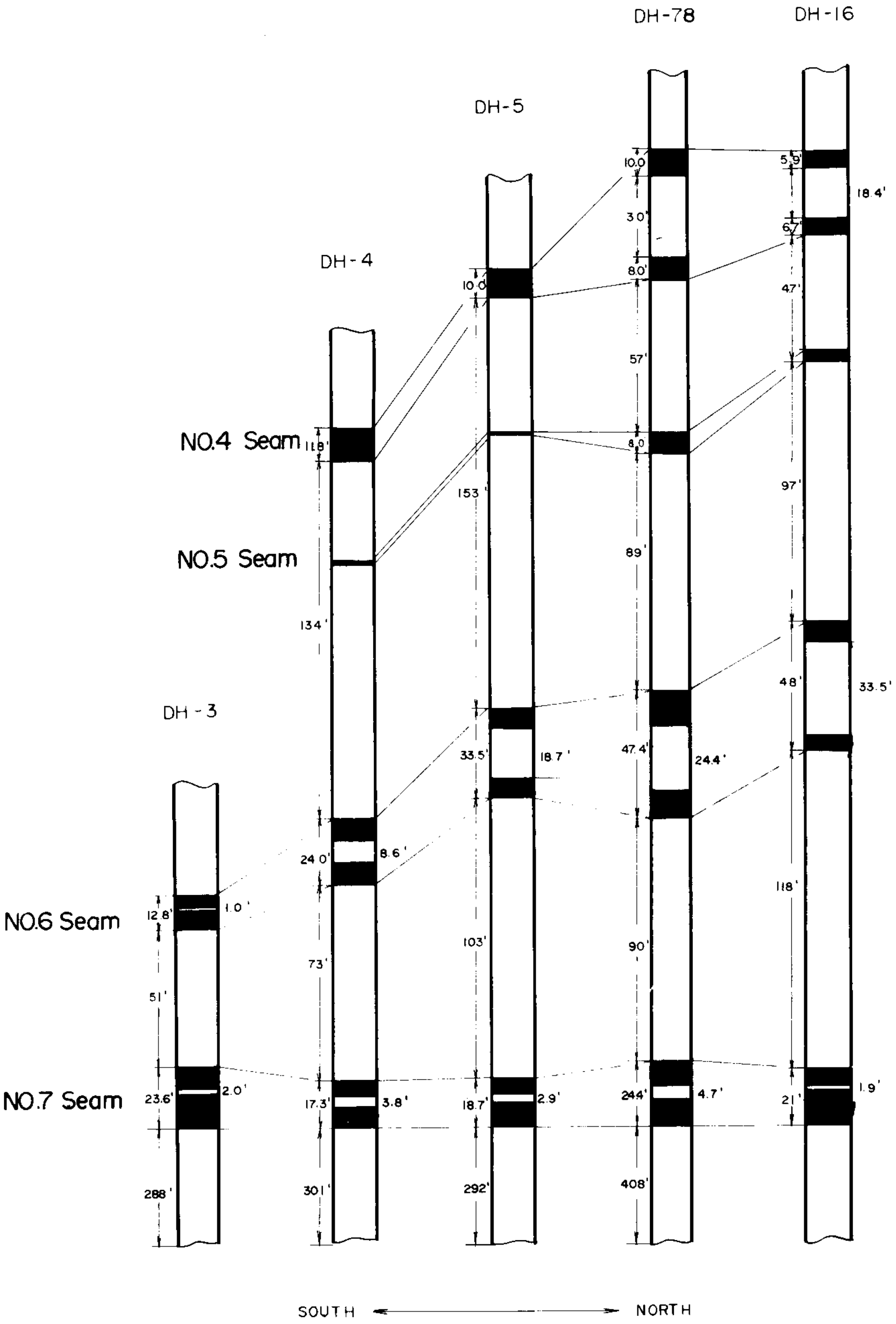


TABLE OF COAL THICKNESS, SEAM THICKNESS BY DRILLHOLES

Table 1.

	Drilling NO	# 4					# 6					# 7					# 8					# 9					# 10 B					# 10 A				
		Drilling		Dip (°)	True		Drilling		Dip (°)	True		Drilling		Dip (°)	True		Drilling		Dip (°)	True		Drilling		Dip (°)	True		Drilling		Dip (°)	True		Drilling		Dip (°)	True	
		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)	※Coal thickness / Seam thickness (ft)	Parting thickness (ft)		※Coal thickness / Seam thickness (ft)	Parting thickness (ft)
non core (REVERSE CIRCULATION DRILL)	OH-1						20.0/22.0	2.0	?	19.6/21.5	1.9	18.0/20.0	2.0	?	17.6/19.6	2.0	41.0/44.0	3.0	12	40.0/43.0	3.0	17.0/25.0	8.0		16.6/24.5	7.8	18.0/18.0	0	?	17.6/17.6	0	13.0/13.0	0	?	12.7/12.7	0
	2											18.0/24.0	6.0		17.3/23.1	5.8	37.0/40.0	3.0	16	35.6/38.4	2.8	18.0/18.0	0	?	17.3/17.3	0	18.0/18.0	0		17.3/17.3	0	10.0/10.0	0		9.6/9.6	0
	3						12.0/13.0	1.0	?	11.8/12.8	1.0	22.0/24.0	2.0	?	21.6/23.6	2.0	39.0/42.0	3.0	10	38.4/41.4	3.0	17.0/17.0	0		16.7/16.7	0	16.0/16.0	0		15.8/15.8	0	10.0/10.0	0		9.8/9.8	0
	4	12.3/12.3	0	16	11.8/11.8	0	16.0/25.0	9.0	?	15.4/24.0	8.6	14.0/18.0	5.0		13.5/17.3	3.8	41.0/43.0	2.0	16	39.4/41.3	1.9	19.0/22.0	3.0		18.3/21.4	2.9	17.0/17.0	0		16.3/16.3	0	10.0/10.0	0		9.6/9.6	0
	5	10.5/10.5	0	10	10.0/10.0	0	15.0/34.0	19.0	?	14.8/33.5	18.7	16.0/19.0	3.0		15.8/18.7	2.9	41.0/43.0	2.0	10	40.4/42.4	2.0	18.0/21.0	3.0		17.7/20.7	3.0	6.0+1.0/6.0+1.0	0		6.9/6.9	0	—	—		—	—
	6																44.0/48.0	4.0	35	36.0/39.3	3.3	20.0/22.0	2.0		16.4/18.0	1.6	18.0/20.0	2.0		14.7/16.4	1.7	10.0/10.0	0		8.2/8.2	0
	7																55.0/59.0	4.0	45	38.9/41.7	2.8	29.0/29.0	0		20.5/20.5	0	20.0/20.0	0		14.1/14.1	0	12.0/12.0	0		8.5/8.5	0
	8											22.0/29.0	7.0		14.7/19.4	4.7	57.0/60.0	3.0	48	38.1/40.1	2.0	23.0/29.0	6.0		15.4/19.4	4.0	21.0/21.0	0		14.0/14.0	0	10.0/10.0	0		6.7/6.7	0
	10																—	—	—	—	—	—	—		—	—	—	—		—	—	—	—		—	—
	11																40.0/43.0	3.0	14	38.8/41.7	2.9	16.0/21.0	5.0		15.5/20.3	4.8	16.0/16.0	0		15.5/15.5	0	9.0/9.0	0		8.7/8.7	0
	12																36.0/40.0	4.0	12	35.2/38.8	3.9	22.0/22.0	0		21.5/21.5	0	15.0/15.0	0		14.6/14.6	0	9.0/9.0	0		8.8/8.8	0
	13																																			
	14											15.0/21.0	6.0		14.8/20.5	5.7	9.0/9.0 69.0/78.0	19.0 9.0	12	8.8/8.8 67.5/76.3	0.0 18.6 8.8	11.0/11.0	0		10.8/10.8	0										
	16	U. 6.1/6.1	0	16	U 5.9/5.9	0	14.0/49.0	35.0		13.5/47.0	33.5	20.0/22.0	2.0		19.2/21.1	1.9																				
	19											24.0/28.0	4.0		18.4/21.4	3.0	51.0/54.0	3.0	40	39.1/41.4	2.3	24.0/29.0	5.0		18.4/22.2	3.8	19.0/21.0	2		14.6/16.1	1.5	13.0/13.0	0		10.0/10.0	0
	21																																			
	22																53.0/56.0	3.0	15	51.2/54.1	2.9	9.0/9.0 (40.5/57.0)	0 16.5		8.7/8.7 (39.1/53.2)	0 15.9	7.0/7.0	0		6.8/6.8	0	9.0/9.0	0		8.7/8.7	0
	24																11.0/11.0 62.0/74.0	0.0 14.0 12.0	45	7.8/7.8 43.8/52.3	0.0 9.9 8.5	19.0/24.0	5.0		13.4/17.0	3.6	—	—	f	—	—	—	—	f	—	—
	36																46.0/50.0	4.0	16	44.2/48.1	3.8	(f)12.0+/12.0+	0		11.5+/11.5+	0	22.0/22.0	0		21.1/21.1	0	11.0/11.0	0		10.5/10.5	0
	37																54.0/57.0	3.0	45	38.2/40.3	2.1	16.0/16.0	0		11.3/11.3	0	17.0/17.0	0		12.0/12.0	0	12.0/12.0	0		8.5/8.5	0
	38																49.0/53.0	4.0	45	34.6/37.5	2.8															
	39																52.0/56.0	4.0	28	45.9/49.4	3.5	22.0/22.0	0		19.4/19.4	0	15.0/15.0	0		13.2/13.2	0	10.0/10.0	0		8.8/8.8	0
	40																53.0/57.0	4.0	32	44.9/48.3	3.4	24.0/24.0	0		20.4/20.4	0	17.0/17.0	0		14.4/14.4	0	11.0/11.0	0		9.3/9.3	0
	41																38.0/41.0	3.0	14	36.9/39.8	2.9	17.0/20.0	3.0		16.5/19.4	2.9	17.0/17.0	0		16.5/16.5	0	11.0/11.0	0		10.7/10.7	0
	42																42.0/45.0	3.0	14	40.7/43.7	2.9	19.0/20.0	1.0		18.4/19.4	1.0	16.0/16.0	0		15.5/15.5	0	9.0/9.0	0		8.7/8.7	0
	44																34.0/40.0	6.0	20	32.0/37.6	5.6	21.0/25.0	4.0		19.7/23.5	3.8	36.0/36.0	0		33.8/33.8	0	12.0/12.0	0		11.3/11.3	0
	46																38.0/43.0	5.0	12	37.2/42.1	4.9	13.0/21.0	8.0		12.7/20.5	7.8	18.0/18.0	0		17.6/17.6	0	24.0/24.0 17.0/17.0	0		23.4/23.4 16.6/16.6	0
	49																28.0/35.0	7.0	16	26.9/33.6	6.7	—	—	f	—	—	19.0/19.0	0		18.3/18.3	0	11.0/11.0	0		10.6/10.6	0
	50						25.0/27.0	2.0		23.5/25.4	1.9	20.0/23.0	3.0		18.8/21.6	2.8	42.0/44.0	2.0	20	39.5/41.4	1.9															
	60																										7.0/7.0	0		6.0/6.0	0	10.0/10.0	0		9.5/9.5	0
	61																										17.0/17.0	0		16.2/16.2	0	10.0/10.0	0		9.5/9.5	0
	62																41.0/46.0	5.0	28	36.2/40.6	4.4	19.0/19.0	0		16.8/16.8	0	18.0/18.0	0		15.9/15.9	0	8.0+/8.0+	0		7.1+/7.1+	0
	63																65.0/77.0	12.0	15	62.8/74.6	11.8															
	64																57.0/60.0	3.0	48	38.1/40.1	2.0	28.0/28.0	0		18.7/18.7	0	22.0/22.0	0		14.7/14.7	0	18.0/18.0	0		12.0/12.0	0
	68																																			
	69						21.0/24.0	3.0		18.5/21.2	2.7	9.0/19.0	10.0		7.9/16.7	8.8	99.0/104.0	5.0	28	87.4/91.8	4.4															
	70	13.1/13.1	0	40	10.0/10.0	0	14.0/14.0	0		10.7/10.7	0	25.0/29.0	4.0		19.2/22.2	3.0	48.0/48.0	0	40	36.2/36.2	0	18.0/18.0 5.0/5.0	0 23.0 0		13.8/13.8 3.8/3.8	0 17.6 0										
	71																38.0/41.0	3.0	9	37.5/40.5	3.0	18.0/23.0	5.0		17.8/22.7	4.9	22.0/22.0	0		21.7/21.7	0	13.0/13.0	0		12.8/12.8	0
	72																19.0/23.0 95.0/95.0	4.0 44.0 0	28	16.9/20.3 83.9/83.9	3.4 38.8 0	9.0/11.0	3.0		7.9/9.7	1.8										
	73						10.0/10.0	0		8.2/8.2	0	31.0/35.0	4.0		25.4/28.7	3.3	65.0/78.0	13.0	35	53.2/63.9	10.6	21.0/32.0	11.0		17.2/26.2	9.0	7.0/7.0	0		5.7/5.7	0					
	78	U10.6/10.6 L8.5/8.5	0	20	U10.0/10.0 L8.0/8.0	0	24.5/50.5	26.0		23.0/47.4	24.4	21.0/26.0	5.0		19.7/24.4	4.7	7.0/7.0 26.0/30.0	0 20.0 4.0	20	6.6/6.6 24.4/28.2	0 18.8 3.8	28.0/34.0	6.0		26.3/22.6	5.6										
core	L.C-2																43.6/45.6	2.0	28	38.2/40.3	2.1															
	4																45.6/53.6	8.0	32	40.5/45.4	4.9															
	5																					25.9/28.5	2.6	45	18.7/19.8	1.1	17.5/17.5	0	45	12.4/12.4	0					
	6																48.1/53.5	5.4	45	34.0/37.8	3.8															
	7																					23.7/24.2	0.5	48	16.2/16.2	0	11.7/11.7	1.8	48	7.8/7.8	0	6.0/6.0	0		4.7/4.7	0
	8																																			
	9																44.4/47.6	3.2	12	43.0/46.5	3.5															
	10																35.6/38.4	2.8	45	26.2/27.7	1.5															

※ Coal thickness including thin partings.

The seam thickness in every drill holes are shown on TABLE-1 and the typical seams correlation and variation are given on Fig.-2. (2) ?

The averaged thickness of each seam in the proposed open pit area is summarized on the following table.

The Averaged Thickness of Each Seam   Table 2

Seam	*Coal Thickness ft			Parting Thickness ft			Average ft
	Max.	Min.	Average	Max.	Min.	Average	*Coal thickness Seam thickness
4 seam	11.5	10.0	10.19	--	--	--	10.19/10.19
6 seam	23.5	11.8	15.21	18.7	1.0	6.42	15.21/21.63
7 seam	21.6	13.5	16.96	5.8	2.0	3.63	16.96/20.59
8 seam	62.8	26.2	38.22	11.8	1.5	3.63	38.22/41.85
9 seam	21.5	8.7	17.80	(7.8)	(2.9)	(4.37)	17.80/17.80-(22.17)
10B seam	21.1	6.0	14.64	--	--	--	14.64/14.64
10A seam	16.6	4.7	9.17	--	--	--	9.17/9.17

* Coal thickness including thin partings.

( ) Parting thickness in northern area

II-2 Oxidized Coal Area (see top p 35) — less than 4 FSI

In the present study, the limits of oxidized area were defined by high and low F.S.I. of 4 and thermal coal was thought ? to be produced from the oxidized area.

II-2-1 *F.S.I. Tests of Drill Hole and Adit Samples*

Analyses of drill hole samples by C.N.I. are summarized on Appendix-B. The seams mentioned below which show the marginal values of F.S.I. were considered unoxidized though there was no technological control. reason ?

No. 6	DH-50
No. 8	DH-36, DH-71
No. 9	DH-7, DH-12, DH-64
No. 10A	DH-37, DH-44

TABLE I

ADIT WORK SUMMARY

ADIT NO.	SEAM NO.	STARTING DATE	FINISHING DATE	ENTRY DISTANCE	CROSS	CUTS	COMPLETED	MAN DAYS
1	8 HSR	May 2, 1968	June 4, 1968	110'	None		No ✓	28
2	7 HSR	June 5/68 Sept. 30/70	June 7, 1968 Nov. 9, 1970	25' 218'		218'	No Yes - Sample to Ottawa	6 68
3	8 LCR	July 16/68 Sept. 9/68	Aug. 16/68 Oct. 21/68	110' 305'	178'	305'	No Yes - Oxidized	61 65
4 ✓	9	Aug. 19/68 Mar. 10/69	Aug. 27/68 May 14/69	45' 360'	100'	345'	No Yes - Sample to Ottawa	21 131
5	10B	Aug. 28/68 Jan. 29/70	Sept. 5/68 Feb. 24/70 ✓	40' 156'		156'	No Yes - Sample to Ottawa	9 51
6	10A	Sept. 6/68 Feb. 25/70	Sept. 6/68 May 27/70	Collared 443'		443'	No Yes - Oxidized	3 175
7	8	Oct. 28/68 Jan. 1/69	Dec. 31/68 Mar. 7/69	380'	300'	375'	Yes - Partially Oxidized Sample To Ottawa	82 103
8	8	May 20/69	Sept. 11/69	340'	200'	335'	Yes - Oxidized	220
9	9	June 20/69	Oct. 20/69	375'		356'	Yes - Oxidized	214

Adit Summary - from report 411
1970.

BLE I

ADIT NO.	SEAM NO.	STARTING DATE	FINISHING DATE	ENTRY DISTANCE	CROSS	CUTS	COMPLETED	MAN DAYS
10	10B	Sept. 25/69	Jan. 27/70	305'		305'	Yes - Sample To Ottawa	139
11	10A	Oct. 27/69	Apr. 22/70	394'		394'	Yes - Oxidized	266.5
12	10A	May 28/70	July 3/70	339'		339'	Yes - Sample To Ottawa	149
13	7 HSR	May 4/70	May 26/70	104'	48'	100'	Yes - Sample To Ottawa	45
14	8 HSR	May 24/70	Sept. 24/70	148'		84'	Yes - Sample To Ottawa	102
15	6 LCR	Aug. 12/70	Sept. 8/70	121'	71'	121'	Yes - Sample To Ottawa	55
16	7 LCR	Sept. 11/70	Dec. 2/70	295'	186'	272'	Yes - Sample To Ottawa	127
17	2 LCR	Nov. 11/70	Jan. 7/71	150'			No	65

F.S.I. tests of adit samples are summarized on the following table.

F.S.I. Tests of Adit Samples　　　Table 3

Adit	Seam	Location (ft)	Ash (%)	F.S.I.	Tested by
15	No.6 Upper Lower	100	9.6 9.4	2 7	Mitsui Mining
16	No.7 Upper Lower	218	9.4 9.4	3.1/2 7.1/2	
7	No.8	380	9.6	4	
4	No.9	326	9.4	4	
5	No.10B	156	9.6	7.1/2	
12	No.10A	330	9.6	8.1/2	
8	No.8	340	12.3	2	C.N.I.
9	No.9	265	10.7	2.1/2	
10	No.10B	322	14.7	5	
11	No.10A	398	?	2.1/2	

No. 6U in adit 15 and No. 7U in adit 16 are regarded as oxidized because of low F.S.I., No. 8 seam in adit 7 gives relatively low F.S.I. and some weathered vitrinoids are observed in the petrographic analysis. It is, therefore, concluded that the sample of No. 8 seam is somewhat oxidized.

II-2-2 Oxidized Area of Each Seam

In general, the oxidized area of each seam is wider in the southern part of the area and narrower in the northeastern part. However, its extent veries in each seam. It is questionable phenomena that Nos. 8 and 9 seams in DH-62 give the low F.S.I. of 2.1/2 and 1.1/2, though they are located at the depth of 348 feet and 507 feet from the surface respectively. The estimated oxidized zone in this area is wide compared with other Canadian coal fields.

No. 8 seam

Generally, this seam gives F.S.I. of 4 to 4.1/2 at 9% ash level and F.S.I. of 5 at 6% ash. The low F.S.I. of 2.1/2 in DH-62 was regarded as the effect of oxidation. The oxidized area of the seam is extensive in the southern part of the area.

No. 9 seam

F.S.I. of No. 9 seam is 5 at 9% ash level and 6 to 7 at 7% ash. No. 9 seam in DH-62 and DH-39 which give low F.S.I. of 1.1/2 were included in the unoxidized area, because the former is located at the depth of 507 feet from the surface and the latter is located close to DH-6 of which No. 9 seam shows high F.S.I. of 6. The crack dominating ? thick sandstone which overlies No. 9 seam may give an effect on oxidation of the coal seam and, it could explain that the oxidized area of the seam is wider than that of No. 10B seam.

No. 10B seam

This seam gives high F.S.I. of 5 to 8 at 9% ash level.

No. 10A seam

This seam also give a high F.S.I. of 5 to 8 at 9% ash level. DH-37 and DH-40, in which No. 10A seam give low F.S.I. of 3.1/2 and 1 respectively, were included in the unoxidized area, because these low F.S.I. were measured at high ash level and No. 10B seam in the same holes were unoxidized. The oxidized area of the seam is wider than that of No. 10B seam.

Nos. 4, 6 and 7 seams

These seams also have some patential of producing metallurgical coal judging from F.S.I. test results. However, the limits of oxidized area along the western outcrops are less accurate than those of the other seams due to less informations.

K-SHELL-LINE CREEK -
HORSESHOE RIDGE 77(4)A

RESERVES

DATA

OPEN FILE 477.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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III. COAL RESERVES

The coal reserves estimated for the proposed open pit operation was made on the following clean coal basis.

Coal thickness x sp. gr. x Area = Theoretical Clean Coal Reserves.
Theor. Cl. C. Resev. x Geological Safety Factor x Mining Recovery F.
= Recoverable Clean Coal Reserves.

In the above formula, the coal thickness is determined by summing up coal sections of which ash content are less than 30%.

On the other hand, the quantity of product coal were estimated corresponding to their proposed ash level, namely, 9.5% of metallurgical coal and 11.0% of thermal coal respectively. The adjust factor which was given from the analysis of adit sample was used for the calculation.

III-1 Clean Coal Reserves

III-1-1 Criteria of Reserves Calculation

Coal thickness

As memtioned before, coal thickness is defined as cumulative coal sections of which ash content are less than 30%. In this sense, it is unreasonable to estimate the coal thickness in non-core drilling. In this report, however, coal thickness of non-core drill holes is determined by the following assumption but more exploration is needed before this determination can be made with any approach to precision. ?

geophysical logging?

Coal thickness in non-core drill holes is expressed by Seam thickness x Coal/Seam thickness ratio.

Coal/Seam thickness ratio applied to the above formula is set up as an average of coal/seam thickness ratio which are obtained in adits and seven core drill holes.

Coal/Seam thickness ratio (C/S ratio) in adit.

C/S. ratio is expressed by

$$\frac{\text{S.g. of raw coal}}{\text{S.g. of clean coal}} \times \text{yield}$$

It is now problem to find sp. gr. of raw coal, sp. gr. of clean coal and yield.

These will be given from washability test. Firstly interrelation curve between ash content and sp. gr. of its coal is drawn on the assumption that the each relative density fraction would show mean value of sp. gr.

Secondly, the cumulative ash and the yield of the clean coal which is defined as the lighter coal fraction than coal being of 30% ash is estimated from washability test, so that sp. gr. of clean coal is obtained from the above ash - sp. gr. relation curve.

C/S ratio in core drill holes

As for the test results of core drill hole samples only raw coal ash content is known so that sp. gr. of the coal is estimated from the ash - sp. gr. relation curve.

The C/S ratio is known from

$$\text{sp. gr. of raw coal} = \text{sp. gr. of clean coal} \times C/S$$
$$+ \text{sp. gr. of parting } (1-C/S).$$

By presuming that sp. gr. of the clean coal and the parting of each seam is more or less same as those which are obtained from adit sample, then C/S of seams in each core drill hole is assigned. The C/S ratio calculated in the adit and core drill holes and the more detailed explanation how to calculation them are shown on table 4 and 5

Geological safety factor

Geological safety factor of 95% was applied in the whole area considering that the quite extensive exploration work were made in the area, namely drillings made in 300 to 500 feet intervals,

Coal/Seam Thickness Ratio & Adjust Factor in Adit

Table 4

Seam	No.6	No.7	No.8			No.9			No.10B			No.10A		
Adit	Adit-15	Adit-16	Adit-7			Adit-4			Adit-5			Adit-12		
Sample	Channel	Channel	Channel	Bulk	Average	Channel	Bulk	Average	Channel	Bulk	Average	Channel	Bulk	Average
Raw Coal														
Ash %	17.9	28.6	17.3	17.1	17.2	17.5	15.6	16.6	16.1	18.9	17.5	20.7	17.6	19.2
(1) Specific Gr.	1.47	1.59	1.47	1.46	1.47	1.46	1.44	1.45	1.44	1.47	1.46	1.49	1.46	1.48
Clean Coal (Ash≦30%)														
Ash %	7.0	10.0	10.5	10.5	10.5	9.3	8.0	8.7	9.5	10.0	9.8	14.5	13.5	14.0
(2) Sp. Gr. of Coal	1.36	1.39	1.39	1.39	1.39	1.37	1.38	1.38	1.38	1.38	1.38	1.43	1.41	1.42
(3) Sp. Gr. of Refuse	2.38	2.09	—	—	2.11	—	—	2.02	—	—	1.98	—	—	1.83
(4) Yield %	82.5	62.5	85.5	82.5	84.0	82.5	87.0	84.8	85.0	79.0	82.0	81.0	83.0	82.0
(5) Coal/seam Thick. Ratio %	89.2	71.5	—	—	88.8	—	—	89.1	—	—	86.8	—	—	85.5
(Measured C/S Ratio) %	91.2	—	—	—	90.5	—	—	92.5	—	—	93.6	—	—	88.3
Met. Coal (9.5% Ash)														
(6) Yield %	89.5	60.0	80.0	79.0	79.5	84.0	92.0	88.0	85.0	77.5	81.3	47.5	58.0	52.8
(7) Adjust Factor	1.085	0.960	—	—	0.964	—	—	1.038	—	—	0.991	—	—	0.644
Therm. Coal (11% Ash)														
(8) Yield %	92.5	64.5	87.0	86.0	86.5	89.0	95.5	92.3	89.5	84.0	86.8	57.5	68.5	63.0
(9) Adjust Factor	1.121	1.032	—	—	1.030	—	—	1.088	—	—	1.059	—	—	0.768

(5) Coal/Seam Thickness Ratio = (1) × (4) / (2)

(3) Sp. Gr. of Refuse = (1) - (2) x (5) / 1 - (5)

(7) Adjust Factor of Met. Coal = (6) / (4)

(9) Adjust Factor of Therm. Coal = (8) / (4)

Coal/Seam Thickness Ratio

Table 5.

Seam	Hole No. Adit No.	Ash. Raw. C. %	S.G. Raw C.	S.G. Clean C.	S.G. Refuse	Coal/Seam Thickness Ratio %	
No.8	LC - 2	16.0	1.45	1.39	2.11	91.7	
	LC - 4	13.6	1.43	"	"	94.4	
	LC - 6	20.2	1.50	"	"	84.7	
	LC - 9	19.0	1.48	"	"	87.5	
	LC - 10	17.7	1.47	"	"	88.8	
	Average					89.4	
	Adit - 7	17.2	1.47	"	"	88.8	89.6 ≑ 90
	"	Measured				90.5	
No.9	LC - 5	14.3	1.43	1.38	2.02	92.2	
	LC - 7	17.0	1.46	"	"	87.5	
	Average					89.9	
	Adit - 4	16.6	1.45	"	"	89.1	90.5 ≑ 90
	"	Measured				92.5	
No.10B	LC - 5	14.1	1.42	1.38	1.98	93.3	
	Adit - 5	17.5	1.46	"	"	86.8	91.2 ≑ 90
	"	Measured				93.6	
No.10A	LC - 7	19.0	1.47	1.42	1.83	87.8	
	Adit - 12	19.2	1.48	"	"	85.5	87.2 ≑ 86
	"	Measured				88.3	
No.7	Adit - 16	28.6	1.59	1.39	2.09	71.5	≑ 70
No.6	Adit - 15	17.9	1.47	1.36	2.38	89.2	
	"	Measured				91.2	90.2 ≑ 90
No.4	Test Pit	Measured				95.2	≑ 90

Specific gravities for clean coal & refuse which are obtained for adit sample are applied to drill hole samples.

Geological safety factor **Table 6 (1)**

Seam	S.F. for Thickness	S.F. for Area	Geol. S.F.
No.4	10.19 - 1/10.19 = 0.90	0.95	0.86
NO.6	21.63 - 1/21.63 x 0.95*= 0.91	0.95	0.86
No.7	20.59 - 1/20.59 = 0.95	0.95	0.90
No.8	41.85 - 2/41.85 = 0.95	0.95	0.90
No.9	17.80 - 1/17.80 = 0.94	0.95	0.90
No.10B	14.64 - 1/14.64 x 0.90*= 0.84	0.95	0.80
No.10A	9.17 - 1/ 9.17 = 0.89	0.95	0.85

- Safety factors for thickness of Nos.6 and 10B Seams were deducted again because of difficulty for identification of the roof or the floor which contain coaly shale and thin coal beds.

Mining Recovery Factor **Table 6 (2)**

No.4	10.19 - 1/10.19 = 0.90
No.6	15.21 - 2/15.21 = 0.87
No.7	16.96 - 2/16.96 = 0.88
No.8	38.22 - 2/38.22 = 0.95
No.9	17.80 - 1/17.80 = 0.94
"	17.25 - 2/17.25 = 0.88
No.10B	14.64 - 1/14.64 = 0.93
No.10A	9.17 - 1/ 9.17 = 0.89

tracing of main four seams along the western outcrop and spot tracing along eastern outcrop.

Besides the above factor, one foot or two feet was deducted from the seam thickness estimated from geophisical loggings to offset vague interpretation of seam thickness in non-core drill holes.

The geological safety factors used for the reserves calculation are shown on Table 6(1).

Mining Recovery Factor

Mining loss at stripping coal was estimated at one foot for a single bed and at two feet for the split coal-seams by a thick parting such as Nos. 6, 7, 8 and 9 seams.

Mining recovery factors for each seam are shown on Table 6(2)

III-1-2 Reserves

Reserves calculation was based on section system. Detailed dimensions were explained on the attached chart (Map No. 11).

The theoretical and the recoverable clean coal reserves are summarized on Table 7

III-2 Product Coal

In this study the product coal is estimated to be of 9.5% ash for metallurgical and 11% for thermal coal. The product coal reserves were derived from the clean coal reserves appling the adjust factor as explained below in unoxidized and oxidized area respectively.

Product Coal = Recoverable Clean Coal Reserves X Adjust Factor X Plant Efficiency.

Adjust Factor

This factor was given as the ratio of the theoretically recoverable clean coal yield and yield of the product of the anticipated ash level.

The adjust factor calculated from adit sample analysis are shown on Table 4. (P 16)

Plant Efficiency

The recovery efficiency in the washing plant were estimated at 93.8% for metallurgical coal and 95.0% for thermal coal from the washability test of adit samples.

The product coal reserves are summarized on Table 8.

CLEAN COAL RESERVES (Ash ≦ 30%) $\frac{\text{THEORETICAL COAL RESERVES}}{\text{RECOVERABLE COAL RESERVES}}$

(x 1,000 S.T.)

Table 7

Section No.	No.4			No.6			No.7			No.8			No.9			No.10B			No.10A			Total		
	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total	Met. Coal	Therm. Coal	Total
0 - 1														68.2	68.2		99.8	99.8		96.9	99.8		264.9	264.9
													—	57.7	57.7	—	74.2	74.2	—	73.3	73.3	—	205.2	205.2
1 - 2											662.2	662.2	181.4	322.2	503.6	296.5	119.7	416.2	198.0	158.5	356.5	675.9	1,262.6	1,938.5
										—	566.2	566.2	147.0	272.5	419.5	220.6	89.0	309.6	149.8	119.9	269.7	517.4	1,047.6	1,565.0
2 - 3											1,203.8	1,203.8	474.9	283.5	758.4	565.4	138.7	704.1	384.2	95.0	479.2	1,424.5	1,721.0	3,145.5
										—	1,029.2	1,029.2	401.8	239.8	641.6	420.6	103.1	523.7	290.6	71.9	362.5	1,113.0	1,444.0	2,557.0
3 - 4								13.9	13.9	802.0	1,469.9	2,271.9	988.8	381.5	1,370.3	1,112.1	159.8	1,271.9	682.7	103.4	786.1	3,585.6	2,128.5	5,714.1
							—	11.0	11.0	685.7	1,256.8	1,942.5	836.5	322.7	1,159.2	827.4	118.9	946.3	516.5	78.2	594.7	2,866.1	1,787.6	4,653.7
4 - 5					10.8	10.8		187.8	187.8	1,477.1	696.7	2,173.8	1,118.8	178.3	1,297.1	1,015.2	109.0	1,124.2	610.2	64.0	674.2	4,221.3	1,246.6	5,467.9
				—	8.1	8.1	—	148.8	148.8	1,262.9	595.6	1,858.5	946.5	150.9	1,097.4	755.3	81.1	836.4	461.6	48.4	510.0	3,426.3	1,032.9	4,459.2
5 - 6					53.7	53.7	115.2	145.5	260.7	2,033.7	493.3	2,527.0	1,234.3	138.8	1,373.1	1,055.4	73.1	1,128.5	664.2	34.8	699.0	5,102.8	939.2	6,042.0
				—	40.2	40.2	91.3	114.2	206.5	1,738.8	421.8	2,160.6	1,022.9	114.6	1,137.5	785.2	54.4	839.6	502.5	26.3	528.8	4,140.7	772.5	4,913.2
6 - 7				111.3	156.3	267.6	268.2	211.4	479.6	3,050.8	671.4	3,722.2	1,587.9	95.5	1,683.4	1,414.2	33.9	1,448.1	871.0	29.1	900.1	7,303.4	1,197.6	8,501.0
				83.2	116.9	200.1	212.5	167.3	379.8	2,608.4	574.0	3,182.4	1,292.8	79.3	1,372.1	1,052.2	25.2	1,077.4	659.0	22.0	681.0	5,908.1	984.7	6,892.8
7 - 8				193.8	193.8	387.6	255.1	179.6	434.7	2,305.4	220.2	2,525.6	885.8	40.8	926.6	664.8	20.8	685.6	309.2	25.0	334.2	4,614.1	680.2	5,294.3
				144.9	145.0	289.9	202.0	142.4	344.4	1,971.2	188.3	2,159.5	713.1	34.5	747.6	494.6	15.4	510.0	233.9	19.0	252.9	3,759.7	544.6	4,304.3
8 - 9	—	215.9	215.9	490.5	229.2	719.7	415.6	202.2	617.8	1,036.5	204.8	1,241.3	405.8	60.3	466.1	301.3	40.5	341.8	164.2	43.1	207.3	2,813.9	996.0	3,809.9
	—	167.1	167.1	366.9	171.4	538.3	329.3	160.2	489.5	886.2	175.1	1,061.3	333.6	51.0	384.6	224.1	30.1	254.2	124.2	32.6	156.8	2,264.3	787.5	3,051.8
9 - 10	—	157.6	157.6	129.0	128.5	257.5	110.5	140.0	250.5	196.6	241.8	438.4	133.4	61.9	195.3	85.9	57.9	143.8	42.0	46.1	88.1	697.4	833.8	1,531.2
	—	121.9	121.9	96.5	96.1	192.6	87.6	110.9	198.5	168.1	206.7	374.8	107.7	50.3	158.0	63.9	43.1	107.0	31.8	34.9	66.7	555.6	663.9	1,219.5
10 - 11	—	14.3	14.3		31.7	31.7		14.1	14.1														60.1	60.1
	—	11.1	11.1	—	23.7	23.7		11.2	11.2														46.0	46.0
Total	—	387.8	387.8	924.6	804.0	1,728.6	1,164.6	1,094.5	2,259.1	10,902.1	5,864.1	16,766.2	7,011.1	1,631.0	8,642.1	6,510.8	853.2	7,364.0	3,925.7	695.9	4,621.6	30,438.9	11,330.5	41,769.4
	—	300.1	300.1	691.5	601.4	1,292.9	922.7	867.0	1,789.7	9,321.3	5,013.7	14,335.0	5,801.9	1,373.3	7,175.2	4,843.9	634.5	5,478.4	2,969.9	526.5	3,496.4	24,551.2	9,316.5	33,867.7

PRODUCT COAL RESERVES

(x 1,000 S.T.) **Table 8.**

Section	No.4			No.6			No.7			No.8			No.9			No.10B			No.10A			Total		
	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total	Met Coal	Therm. Coal	Total
0 - 1														59.6	59.6		74.7	74.7		53.5	53.5		187.8	187.8
1 - 2											554.0	554.0	143.1	281.7	424.8	205.1	89.5	294.6	90.5	87.5	178.0	438.7	1,012.7	1,451.4
2 - 3											1,007.1	1,007.1	391.2	247.9	639.1	391.0	103.7	494.7	175.6	52.4	228.0	957.8	1,411.1	2,368.9
3 - 4								10.8	10.8	608.4	1,229.8	1,838.2	814.4	333.5	1,147.9	769.2	119.6	888.8	312.0	57.1	369.1	2,504.0	1,750.8	4,254.8
4 - 5					8.6	8.6		145.9	145.9	1,120.6	582.8	1,703.4	921.5	156.0	1,077.5	702.1	81.6	783.7	278.9	35.3	314.2	3,023.1	1,010.2	4,033.3
5 - 6					42.8	42.8	82.2	112.9	195.1	1,542.8	412.7	1,955.5	995.9	118.5	1,114.4	730.0	54.7	784.7	303.6	19.2	322.8	3,654.5	760.8	4,415.3
6 - 7				84.7	124.5	209.2	191.4	164.0	355.4	2,314.4	561.7	2,876.1	1,258.7	82.0	1,340.7	978.1	25.4	1,003.5	398.1	16.1	414.2	5,225.4	973.7	6,199.1
7 - 8				147.5	154.4	301.9	181.9	139.6	321.5	1,749.0	184.3	1,933.3	694.3	35.7	730.0	459.8	15.5	475.3	141.3	13.9	155.2	3,373.8	543.4	3,917.2
8 - 9		163.5	163.5	373.4	182.5	555.9	296.5	157.1	453.6	786.3	171.3	957.6	324.8	52.7	377.5	208.3	30.3	238.6	75.0	23.8	98.8	2,064.3	781.2	2,845.5
9 - 10		119.3	119.3	98.2	102.3	200.5	78.9	108.7	187.6	149.2	202.3	351.5	104.9	52.0	156.9	59.4	43.4	102.8	19.2	25.5	44.7	509.8	653.5	1,163.3
10 - 11		10.9	10.9		25.2	25.2		11.0	11.0														47.1	47.1
Total		293.7	293.7	703.8	640.3	1,344.1	830.9	850.0	1,680.9	8,270.7	4,906.0	13,176.7	5,648.8	1,419.6	7,068.4	4,503.0	638.4	5,141.4	1,794.2	384.3	2,178.5	21,751.4	9,132.3	30,883.7

See MM Vol p.3
21,752.

APPENDIX A

Detailed Reserve Calculation Tables.

4# Seam THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.90(ft)	Sp. gr.	Rate of conversion (st/ft3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	8+350'		10.27	9.24			346						
	8+350' ~9	200			1.39	0.0312		4,652	40,300	86	34,700	90	31,200
	9		9.56	8.60			710						
	9~ 9+150'	150			1.39	0.0312		3,057	19,900	86	17,100	90	15,400
	9+150'		9.56	8.60			1						
	TOTAL		9.70	8.73					60,200		51,800		46,600
WEST SIDE	8		11.50	10.35			370						
	8~ 8+350'	350			1.39	0.0312		6,190	94,000	86	80,800	90	72,700
	8+350'		10.55	9.50			900						
	8+350' ~9	200			1.39	0.0312		5,535	48,000	86	41,300	90	37,200
	9		10.00	9.00			280						
	9~10	700			1.39	0.0312		2,475	75,100	86	64,600	90	58,100
	10		10.00	9.00			270						
	10~ 10+270'	270			1.39	0.0312		1,220	14,300	86	12,300	90	11,100
	10+270'		10.00	9.00			1						
	TOTAL		10.34	9.31					231,400		199,000		179,100
GROSS TOTAL			10.17	9.15					291,600		242,900		225,700

4# Seam **MET COAL**

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.90(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
8+350'		10.66	9.59			360						
8+350' ~9	200			1.39	0.0312		3,879	33,600	86	28,900	90	26,000
9		10.18	9.16			470 670						
9~ 9+470'	470			1.39	0.0312		3073	62,600	86	53,800	90	48,400
9+470'		10.18	9.16			1						
TOTAL		10.24	9.22					96,200		82,700		74,400

6# Seam **THERMAL COAL**

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.90(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	6+160'		13.12	11.81			320						
	6+160' ~7	490			1.36	0.0312		3,753	78,000	86	67,100	87	58,300
	7		18.0	16.20			230						
	7~ 7+250'	250			1.36	0.0312		3,456	36,700	86	31,600	87	27,500
	7+250'		19.67	17.70			180 830						
	7+250' ~8	200			1.36	0.0312		10,464	88,800	86	76,400	87	66,400
	8		21.0	18.90			330						
	8~ 8+250'	250			1.36	0.0312		13,041	138,300	86	118,900	87	103,400
	8+250'		21.0	18.90			1,050						
	TOTAL		18.87	16.98					341,800		294,000		255,600

6# Seam **THERMAL COAL**

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.90(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	5-160'		12.0	10.80			94						
	5~160' ~5	160'			1.36	0.0312		1,588	10,800	86	9,300	87	8,100
	5		12.0	10.80			200						
	5~6	500			1.36	0.0312		2,532	53,700	86	46,200	87	40,200
	6		11.52	10.37			280						
	6~ 6+160'	160			1.36	0.0312		5,487	37,300	86	32,100	87	27,900
	6+160'		11.96	10.76			750 200						
	6+160' ~7	490			1.36	0.0312		1,974	41,000	86	35,300	87	30,700
	7		13.3	11.97			150 240						
	7~8	450			1.36	0.0312		3,578	68,300	86	58,700	87	51,100
	8		14.0	12.60			340						
	8~9	550			1.36	0.0312		3,897	90,900	86	78,200	87	68,000
	9		13.0	11.70			300						
	9~10	700			1.36	0.0312		4,327	128,500	86	110,500	87	96,100
	10		9.0	8.10			635						
	10~ 10+290'	290			1.36	0.0312		2,576	31,700	86	27,300	87	23,700
	10+290'		8.5	7.65			1						
	TOTAL		11.67	10.50					462,200		397,600		345,800
GROSS TOTAL			14.73	13.26					804,000		691,600		601,400

6# Seam

MET. COAL

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.90(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thick-ness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
6+160'		12.39	11.15			340						
6+160' ~7	490			1.36	0.0312		5,351	111,300	86	95,700	87	83,200
7		15.05	13.55			510						
7~ 7+250'	250			1.36	0.0312		7,268	77,100	86	66,300	87	57,600
7+250'		16.61	14.95			510 474						
7+250' ~8	200			1.36	0.0312		13,748	116,700	86	100,400	87	87,300
8		17.85	16.07			1,270						
8~ 8+250'	250			1.36	0.0312		22,364	237,200	86	204,000	87	177,400
8+250'		15.76	14.18			1,715 1,881						
8+250' ~9	300			1.36	0.0312		19,899	253,300	86	217,800	87	189,500
9		14.02	12.62			1,040 690						
9~10	700			1.36	0.0312		4,358	129,000	86	110,900	87	96,500
10		10.00	9.00			1						
TOTAL		15.66	14.09					924,600		795,100		691,500

7# Seam

THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.70(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	5		17.93	12.55			297						
	5~6	500			1.39	0.0312		3,565	77,300	90	69,600	88	61,200
	6		18.00	12.60			270						
	6~ 6+400	400			1.39	0.0312		4,069	70,600	90	63,500	88	55,900
	6+400		16.95	11.87			399						
	6+400 ~7	250			1.39	0.0312		4,593	49,800	90	44,800	88	39,400
	7		16.30	11.41			390						
	7~ 7+220	220			1.39	0.0312		5,297	50,500	90	45,500	88	40,000
	7+220		16.65	11.66			527 749						
	7+220 ~8	230			1.39	0.0312		6,152	61,400	90	55,300	88	48,700
	8		17.00	11.90			300 1,050						
	8~ 8+170	170			1.39	0.0312		12,198	89,900	90	80,900	88	71,200
	8+170		17.00	11.90			1,000						
	TOTAL		17.09	11.96					399,500		359,600		316,400
GROSS TOTAL			17.07	11.95					1,094,500		985,200		867,000

7# Seam

THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.70(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	4-90		17.3	12.11			189						
	4-90 ~4	90			1.39	0.0312		3,566	13,900	90	12,500	88	11,000
	4		17.3	12.11			400						
	4~ 4+230	230			1.39	0.0312		7,087	70,700	90	63,600	88	56,000
	4+230		17.59	12.31			758						
	4+230 ~5	270			1.39	0.0312		9,999	117,100	90	105,400	88	92,800
	5		17.93	12.55			850 256						
	5~6	500			1.39	0.0312		3,144	68,200	90	61,400	88	54,000
	6		18.30	12.81			240						
	6~ 6+400	400			1.39	0.0312		3,283	57,000	90	51,300	88	45,100
	6+400		16.08	11.26			310						
	6+400 ~7	250			1.39	0.0312		3,135	34,000	90	30,600	88	26,900
	7		14.70	10.29			270						
	7~ 220	220			1.39	0.0312		3,304	31,500	90	28,400	88	25,000
	7+220		14.35	10.05			381						
	7+220 ~8	230			1.39	0.0312		3,630	36,200	90	32,600	88	28,700
	8		14.00	9.80			350						
	8~9	550			1.39	0.0312		4,709	112,300	90	101,100	88	89,000
	9		18.20	12.74			470						
	9~10	700			1.39	0.0312		4,613	140,000	90	126,000	88	110,900
	10		18.50	12.95			250						
	10~ 10+200	200			1.39	0.0312		1,625	14,100	90	12,700	88	11,200
	10+200		18.67	13.07			1						
	TOTAL		17.07	11.95					695,000		625,600		550,600

7# Seam MET. COAL

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.70(ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thick-ness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
5		17.93	12.55			297						
5~6	500			1.39	0.0312		5,314	115,200	90	103,700	88	91,300
6		19.72	13.80			500						
6~ 6+400	400			1.39	0.0312		8,716	151,200	90	136,100	88	119,800
6+400		17.52	12.26			859 921						
6+400 ~7	250			1.39	0.0312		10,787	117,000	90	105,300	88	92,700
7		16.14	11.30			910						
7~ 7+220	220			1.39	0.0312		10,755	102,600	90	92,300	88	81,200
7+220		16.07	11.25			998						
7+220 ~8	230			1.39	0.0312		15,293	152,500	90	137,300	88	120,800
8		15.99	11.19			1,730						
8~ 8+170	170			1.39	0.0312		21,079	155,400	90	140,000	88	123,200
8+170		16.28	11.40			2,000						
8+170 ~9	380			1.39	0.0312		15,788	260,200	90	234,200	88	206,100
9		16.94	11.86			740						
9~ 9+580	580			1.39	0.0312		4,395	110,500	90	99,500	88	87,600
9+580		18.23	12.76			1						
TOTAL		16.86	11.80					1,164,600		1,048,400		922,700

8# Seam **THERMAL COAL**

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	1+80		40.0	36.00			630						
	1+80~2	420			1.39	0.0312		36,358	662,200	90	596,000	95	566,200
	2		39.71	35.74			1,400						
	2~3	500			1.39	0.0312		55,515	1,203,800	90	1,083,400	95	1,029,200
	3		38.29	34.46			1,770						
	3~3+150	150			1.39	0.0312		69,954	455,100	90	409,600	95	389,100
	3+150		38.29	34.46			2,290 910						
	3+150~4	500			1.39	0.0312		25,427	551,400	90	496,300	95	471,500
	4		38.00	34.20			570						
	4~5	500			1.39	0.0312		18,522	401,600	90	361,400	95	343,300
	5		39.00	35.10			500						
	5~6	500			1.39	0.0312		17,708	384,000	90	345,600	95	328,300
	6		39.70	35.73			500						
	6~7	650			1.39	0.0312		16,221	457,300	90	411,600	95	391,000
	7		39.50	35.55			410						
	7~8	450			1.39	0.0312		11,284	220,200	90	198,200	95	188,300
	8		37.00	33.30			240						
	8~9	550			1.39	0.0312		8,586	204,800	90	184,300	95	175,100
	9		34.00	30.60			300						
	9~370'	370			1.39	0.0312		9,948	159,600	90	143,600	95	136,400
	9+370'		29.77	26.79			400						
	9+370'~10	330			1.39	0.0312		5,744	82,200	90	74,000	95	70,300
	10		26.0	23.40			33						
	TOTAL		38.27	34.44					4,782,200		4,304,000		4,088,700

8# Seam **THERMAL COAL**

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	3+150'		39.0	35.10			830						
	3+150' ~4	500			1.39	0.0312		21,371	463,400	90	417,100	95	396,200
	4		42.0	37.80			360						
	4~5	500			1.39	0.0312		13,608	295,100	90	265,600	95	252,300
	5		36.0	32.40			420 160						
	5~6	500			1.39	0.0312		5,040	109,300	90	98,400	95	93,500
	6		34.0	30.60			160						
	6~ 6+300'	300			1.39	0.0312		5,760	74,900	90	67,400	95	64,000
	6+300'		46.0	41.40			160						
	6+300' ~7	350			1.39	0.0312		9,171	139,200	90	125,300	95	119,000
	7		60.0	54.00			217						
	TOTAL		40.50	36.45					1,081,900		973,800		925,000
GROSS TOTAL			38.71	34.84					5,864,100		5,277,800		5,013,700

8# Seam **MET. COAL**

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
3+150		36.50	32.85			550						
3+150 ~4	500			1.39	0.0312		36,988	802,000	90	721,800	95	685,700
4		34.51	31.06			1,800						
4~5	500			1.39	0.0312		68,118	1,477,100	90	1,329,400	95	1,262,900
5		35.99	32.39			2,480 2,740						
5~6	500			1.39	0.0312		93,790	2,033,700	90	1,830,300	95	1,738,800
6		37.87	34.08			2,900						
6~ 6+300	300			1.39	0.0312		101,660	1,322,600	90	1,190,300	95	1,130,800
6+300		39.29	35.36			2,955						
6+300 ~7	350			1.39	0.0312		113,856	1,728,200	90	1,555,400	95	1,477,600
7		40.95	36.86			3,343 3,560						
7~ 7+200	200			1.39	0.0312		129,459	1,122,900	90	1,010,600	95	960,100
7+200		39.86	35.87			3,560						
7+200 ~8	250			1.39	0.0312		109,067	1,182,500	90	1,064,300	95	1,011,100
8		38.50	34.65			2,610						
8~ 8+200	200			1.39	0.0312		64,889	562,800	90	506,500	95	481,200
8+200		38.01	34.21			1,150						
8+200 ~9	350			1.39	0.0312		31,208	473,700	90	426,300	95	405,000
9		37.16	33.44			690						
9~ 9+370	370			1.39	0.0312		12,254	196,600	90	176,900	95	168,100
9+370		31.26	28.13			51						
TOTAL		37.94	34.15					10,902,100		9,811,800		9,321,300

9# Seam THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	1-100'		18.14	16.33			890						
	1-100' ~1	100			1.38	0.0312		15,841	68,200	90	61,400	94	57,700
	1		18.14	16.33			1,050						
	1~ 1+150'	150			1.38	0.0312		18,780	121,300	90	109,200	94	102,600
	1+150'		18.0 19.0	16.20 17.10			1,260 400						
	1+150' ~2	350			1.38	0.0312		6,789	102,300	90	92,100	94	86,500
	2		19.7	17.73			380						
	2~3	500			1.38	0.0312		7,151	153,900	90	138,500	94	130,200
	3		20.5	18.45			410						
	3~4	650			1.38	0.0312		6,375	178,400	90	160,600	94	150,900
	4		18.0	16.20			320						
	4~5	500			1.38	0.0312		5,131	110,500	90	99,500	94	93,500
	5		18.2	16.38			310						
	5~6	500			1.38	0.0312		4,087	88,000	90	79,200	94	74,400
	6		17.2	15.48			200						
	6~7	650			1.38	0.0312		2,401	67,200	90	60,500	94	56,900
	7		15.8	14.22			120						
	7~8	450			1.38	0.0312		2,104	40,800	90	36,700	94	34,500
	8		16.0	14.40			170						
	8~9	550			1.38	0.0312		2,547	60,300	90	54,300	94	51,000
	9		17.30	15.57			170						
	9~9+550'	550			1.38	0.0312		2,612	61,900	90	55,700	94* 88**	20,900 *40% 29,400 **60%
	9+550'		16.38	15.19			170						
	TOTAL		18.32	16.49					1,052,800		947,700		888,500

9# Seam

THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft3)	Extent of seam (ft)	Coal thick-ness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	1+150'		17.0	15.30			490						
	1+150' ~2	350			1.38	0.0312		6,540	98,600	90	88,700	94	83,400
	2		16.7	15.09			370						
	2~3	500			1.38	0.0312		6,019	129,600	90	116,600	94	109,600
	3		17.5	15.75			410 670						
	3~4	650			1.38	0.0312		7,257	203,100	90	182,800	94	171,800
	4		20.0	18.00			220						
	4~5	500			1.38	0.0312		3,150	67,800	90	61,000	94	57,400
	5		20.0	18.00			130						
	5~6	500			1.38	0.0312		2,358	50,800	90	45,700	88	40,200
	6		16.5	14.85			160						
	6~ 6+300'	300			1.38	0.0312		2,193	28,300	90	25,500	88	22,400
	6+300'		13.96	12.56			160						
	TOTAL		17.70	15.93					578,200		520,300		484,800
GROSS TOTAL			18.10	16.29					1,631,000		1,468,000		1,373,300

9# Seam MET COAL

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
1+150'		18.0	16.2			370						
1+150' ~2	350			1.38	0.0312		12,039	181,400	90	163,300	94	147,000
2		17.51	15.59 15.93			1,160						
2~3	500			1.38	0.0312		22,060	474,900	90	427,400	94	401,800
3		17.32	15.59 15.77			1,670						
3~4	650			1.38	0.0312		35,331	988,800	90	889,900	94	836,500
4		18.43	16.59 16.53			2,690						
4~5	500			1.38	0.0312		51,971	1,118,800	90	1,006,900	94	946,500
5		19.91	17.92			3,310						
5~6	500			1.38	0.0312		57,333	1,234,300	90	1,110,900	68 94 32 88	710,100 312,800
6		17.42	15.68			3,530						
6~7	650			1.38	0.0312		56,738	1,587,900	90	1,429,100	41 94 59 88	550,800 742,000
7		16.43	14.79			3,930						
7~ 7+120'	120			1.38	0.0312		58,282	301,100	90	271,000	17 94 83 88	43,300 197,900
7+120'		16.52	14.87			3,930						
7+120' ~8	330			1.38	0.0312		41,149	584,700	90	526,200	28 94 72 88	138,500 333,400
8		16.78	15.10			1,580 1,450						
8~9	550			1.38	0.0312		17,138	405,800	90	365,200	56 94 44 88	192,200 141,400
9		18.10	16.29			760						
9~9+500'	500			1.38	0.0312		6,197.7	133,400	90	121,100	15 94 85 88	17,100 90,600
9+500'		17.12	15.41			1						
TOTAL		17.73	15.96					7,011,100		6,311,000		5,801,900

10# A Seam THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	1-250'		8.8	7.57			890						
	1-250' ~1	250			1.42	0.0312		8,748	96,900	85	82,400	89	73,300
	1		8.87	7.63			1,410						
	1~ 1+150'	50			1.42	0.0312		11,064	24,500	85	20,800	89	18,500
	1+50'		8.87	7.63			1,490 350						
	1+50' ~2	450			1.42	0.0312		2,371	47,300	85	40,200	89	35,800
	2		8.3	7.14			290						
	2~3	500			1.42	0.0312		2,136	47,300	85	40,200	89	35,800
	3		8.0	6.88			320						
	3~4	650			1.42	0.0312		2,064	59,400	85	50,500	89	44,900
	4		7.0	6.02			320						
	4~5	500			1.42	0.0312		2,030	45,000	85	38,300	89	34,000
	5		8.0	6.88			310						
	5~6	500			1.42	0.0312		1,571	34,800	85	29,600	89	26,300
	6		4.7	4.04			250						
	6~7	650			1.42	0.0312		1,010	29,100	85	24,700	89	22,000
	7		4.2	3.61			280						
	7~8	450			1.42	0.0312		1,252	25,000	85	21,300	89	19,000
	8		6.2	5.33			280						
	8~9	550			1.42	0.0312		1,770	43,100	85	36,600	89	32,600
	9		8.5	7.31			280						
	9~ 9+480'	480			1.42	0.0312		2,167	46,100	85	39,200	89	34,900
	9+480'		9.5	8.17			280						
	TOTAL		7.48	6.43					498,500		423,800		377,100

10# A Seam

THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	**Mining recovery (%)**	**Minable reserves (s.t)**
EAST SIDE	1+50'		9.5	8.17			780						
	1+50' ~2	450			1.42	0.0312		4,347	86,700	85	73,700	89	65,600
	2		10.0	8.60			270						
	2~3	500			1.42	0.0312		2,154	47,700	85	40,500	89	36,100
	3		10.5	9.03			220 150						
	3~4	650			1.42	0.0312		1,529	44,000	85	37,400	89	33,300
	4		11.0	9.46			180						
	4~5	500			1.42	0.0312		857	19,000	85	16,200	89	14,400
	5		12.0	10.32			1						
	TOTAL		10.14	8.72					197,400		167,800		149,400
GROSS TOTAL			8.23	7.08					695,900		591,600		526,500

10# A Seam MET. COAL

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft3)	Extent of seam (ft)	Coal thick-ness x extent of seam (ft2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
1+50'		9.0	7.74			660						
1+50' ~2	450			1.42	0.0312		9,933	198,000	85	168,300	89	149,800
2		9.13	7.85			1,880						
2~3	500			1.42	0.0312		17,342	384,200	85	326,600	89	290,600
3		9.53	8.20			2,430 2,650						
3~4	650			1.42	0.0312		23,706	682,700	85	580,300	89	516,500
4		9.79	8.42			3,050						
4~5	500			1.42	0.0312		27,547	610,200	85	518,700	89	461,600
5		9.50	8.17			3,600						
5~6	500			1.42	0.0312		29,984	664,200	85	564,600	89	502,500
6		9.50	8.17			3,740						
6~7	650			1.42	0.0312		30,245	871,000	85	740,400	89	659,000
7		9.23 8.41	7.94 7.23			3,770 3,080						
7~8	450			1.42	0.0312		15,509	309,200	85	262,800	89	233,900
8		8.01	6.89			1,270						
8~9	550			1.42	0.0312		6,740	164,200	85	139,600	89	124,200
9		10.00	8.60			550						
9~ 9+400'	400			1.42	0.0312		2,369	42,000	85	35,700	89	31,800
9+400'		10.00	8.60			1						
TOTAL		9.34	8.03					3,925,700		3,337,000		2,969,900

10# B Seam **THERMAL COAL**

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
WEST SIDE	1-200'		12.0	10.80			870						
	1-200' ~1	200			1.38	0.0312		11,588	99,800	80	79,800	93	74,200
	1		12.06 10.0	10.85 9.00			1,270 200						
	1~2	500			1.38	0.0312		1,807	38,900	80	31,100	93	28,900
	2		11.2	10.08			180						
	2~3	500			1.38	0.0312		1,987	42,800	80	34,200	93	31,800
	3		12.0	10.80			200						
	3~4	650			1.38	0.0312		2,020	56,500	80	45,200	93	42,000
	4		11.6	10.44			180						
	4~5	500			1.38	0.0312		1,993	42,900	80	34,300	93	31,900
	5		11.7	10.53			200						
	5~6	500			1.38	0.0312		1,861	40,100	80	32,100	93	29,800
	6		9.6	8.64			180						
	6~7	650			1.38	0.0312		1,210	33,900	80	27,100	93	25,200
	7		8.0	7.20			120						
	7~8	450			1.38	0.0312		1,074	20,800	80	16,600	93	15,400
	8		9.5	8.55			150						
	8~9	550			1.38	0.0312		1,712	40,500	80	32,400	93	30,100
	9		8.5	7.65			280						
	9~ 9+520'	520			1.38	0.0312		2,585	57,900	80	46,300	93	43,100
	9+520'		9.61	8.65			350						
	TOTAL		10 57	9.51					474,100		379,100		352,400

10# B Seam THERMAL COAL

Area	Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness 0.9 (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
EAST SIDE	1		13.5	12.15			240						
	1~2	500			1.38	0.0312		3,753	80,800	80	64,600	93	60,100
	2		17.0	15.30			300						
	2~3	500			1.38	0.0312		4,455	95,900	80	76,700	93	71,300
	3		20.0	18.00			240 180						
	3~4	650			1.38	0.0312		3,690	103,300	80	82,600	93	76,900
	4		20.0	18.00			230						
	4~5	500			1.38	0.0312		3,069	66,100	80	52,900	93	49,200
	5		18.5	16.65			120						
	5~6	500			1.38	0.0312		1,535	33,000	80	26,400	93	24,600
	6		17.0	15.30			70						
	TOTAL		18.18	16.36					379,100		303,200		282,100
GROSS TOTAL			13.94	12.55					853,200		682,300		634,500

10# B Seam MET. COAL

Section No.	Interval between sections (ft)	Seam thickness (ft)	Coal thickness (ft)	Sp. gr.	Rate of conversion (st/ft^3)	Extent of seam (ft)	Coal thickness × extent of seam (ft^2)	In situ coal reserves (s.t)	Geological safety factor (%)	Recoverable reserves after safety factor (s.t)	Mining recovery (%)	Minable reserves (s.t)
1		12.0	10.8			800						
1~2	500			1.38	0.0312		13,771	296,500	80	237,200	93	220,600
2		11.73	10.56			1,790						
2~3	500			1.38	0.0312		26,265	565,400	80	452,300	93	420,600
3		16.79	15.08			2,230 2,470						
3~4	650			1.38	0.0312		39,736	1,112,100	80	889,700	93	827,400
4		16.75	15.08			3,040						
4~5	500			1.38	0.0312		47,158	1,015,200	80	812,200	93	755,300
5		15.34	13.81			3,510						
5~6	500			1.38	0.0312		49,026	1,055,400	80	844,300	93	785,200
6		14.59	13.13			3,760						
6~7	650			1.38	0.0312		50,531	1,414,200	80	1,131,400	93	1,052,200
7		14.55	13.10			3,930						
7~8	450			1.38	0.0312		34,311	664,800	80	531,800	93	494,600
8		13.13	11.82			1,450						
8~9	550			1.38	0.0312		12,724	301,300	80	241,000	93	224,100
9		11.99	10.79			770						
9~ 9+480'	480			1.38	0.0312		4,158	85,900	80	68,700	93	63,900
9+480'		9.25	8.33			1						
TOTAL		14.73	13.26					6,510,800		5,208.600		4,843,900

K-SHELL-LINE CREEK-HORSESHOE-RIDGE 77(8)A

SPECIFICATION

OF

COAL PREPARATION FACILITIES

OPEN FILE

APRIL 1977

415

ALLEN & GARCIA COMPANY
Consulting & Constructing Engineers
332 SOUTH MICHIGAN AVENUE
CHICAGO, ILLINOIS 60604

CONFIDENTIAL

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SPECIFICATION

of

COAL PREPARATION FACILITIES

for

LINE CREEK PROJECT

BRITISH COLUMBIA, CANADA

CROWS NEST INDUSTRIES LIMITED

MITSUI & CO., LTD.

* * *

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ALLEN & GARCIA COMPANY - Job No. 1929
March 9, 1977

FROM JULY 1977 REPORT

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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ALLEN & GARCIA COMPANY
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SPECIFICATION

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COAL PREPARATION FACILITIES

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1.0 GENERAL

1.1 Scope

This report includes a general description and cost estimate of coal preparation facilities for your proposed Line Creek Project in British Columbia, Canada. Prices are in Canadian dollars.

1.2 Cost Basis

Quotations were obtained on about 95% of the equipment. An item for material price escalation is not included in the summary. Duties, and Federal and Provincial taxes are included.

Labor costs were based on current union rates, including fringe benefits, transportation and camp costs. These were determined by consultation with erection subcontractors. The cost of six hours of overtime per week is included. An item for labor rate escalation is not included in the summary.

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1.3 Codes

The facilities would comply with the latest applicable specifications and codes of the following:

American Society of Mechanical Engineers
American Society for Testing Materials
Canadian Standards Association
Canadian Institute of Steel Construction
American Institute of Electrical Engineers
Building Code of Canada
American Gear Manufacturers
Canadian Electrical Code
Canadian Concrete Institute
National Fire Protection Association
British Columbia Coal Mining Regulation Act
British Columbia Social Services Act
British Columbia Water Act & Regulations
British Columbia Pollution Control Act

1.4 Engineering

Included is the cost of preparing all necessary design and detail drawings, specifications and bills of material, etc., and of field engineering services required to complete the installation and place it in service.

2.0 DESCRIPTION

2.1 Drawings

Layout of the proposed facilities is shown on the following drawings:

No.	Description
A-1	Flow Sheet - Coal Preparation
A-2	Flow Diagram
A-9	Plot Plan
A-10	Plot Plan
A-11	Truck Dump
A-12	Raw Coal Transfer Tower
A-13	Conveyor Units #4 and #6 -- Elevations
A-14	Raw Coal Storage & Reclaim
A-15	Breaker Building
A-16	Conveyor Units #16 & #19 -- Elevations
A-17	Plant Feed Conveyor & Refuse Conveyor
A-18	Preparation Plant Elevation "A-A" & Section "1-1"
A-19	Preparation Plant Elevation "B-B" & Section "2-2"
A-20	Preparation Plant Elevation "C-C" & Section "3-3"
A-21	Preparation Plant Plan T/S El. 4245'-0 & 4257'-4
A-22	Preparation Plant Plan T/S El. 4278'-0 &4298'-0
A-23	Preparation Plant, Plans & Section 4 - 4
A-24	Refuse Thickener
A-25	50'-0 Dia. Magnetite Clarifier
A-26	Dryer Feed Conv. Clean Coal Sampling Conveyor
A-27	Thermal Dryer
A-28	Sampling Building
A-29	Emergency Clean Coal Stockpile
A-30	Clean Coal Storage & Reclaim
A-31	36" C.C. Tripper Conv. & 72" Load-Out Bin Conv.
A-32	Load-Out Bin
A-33	Emergency Spill Pond & Sample Laboratory
A-34	Wash House
A-35	Single Line Diagram

2.2 Operating Criteria

The proposed plant will produce 1,000,000 long tons of metallurgical coal and 400,000 long tons of thermal coal annually from 2,000,000 short tons of raw coal. The plant will operate three shifts per day, 245 days per year, with a nominal 500 short tons per hour feed.

Clean coal will be loaded into unit train cars at a nominal rate of 2,500 short tons per hour.

2.3 Coal Quality

The character of the raw coal and the clean coal product specifications are described in the "Basic Design Criteria" with supplementary information, submitted with Mitsui Mining Company, Limited letter of September 14, 1976 and Crow's Nest Industries, Limited letter dated September 24, 1976.

2.4 Plant Process (Refer to Drawings A-1 and A-2)

The plant process begins with mine trucks dumping raw coal into a truck bin. An apron feeder moves this coal at 1300 net tons per hour from the truck bin to a conveyor which delivers the coal to a transfer tower. At the transfer tower, the raw coal can be directed to a bin for trucking to emergency raw coal storage, or alternatively, the coal can be conveyed to the raw coal stockpile building.

In the raw coal stockpile building, a tripper conveyor will deposit the coal on a metallurgical coal pile of 24,000 tons capacity (12,000 tons live) or on a steam coal pile of 16,000 tons capacity (8,000 tons live).

A tunnel under the stockpile with multiple feeders permits reclaiming the coal from either the metallurgical coal pile or the steam coal pile at a rate of 500 net tons per hour.

The reclaimed coal is conveyed to a vibrating screen - rotary breaker system for reduction in size to 2" x 0 and removal of oversize trash. The 2" x 0 raw coal then is conveyed to the preparation plant.

(2.4 - Cont'd)

In the preparation plant, the raw coal at 500 net tons per hour is fed to a feed distributor after passing under an electro-magnet for the removal of magnetic trash. The distributor divides the raw feed to six desliming screens for the removal of the minus 28 mesh material.

From the desliming screens the 2" x 28 mesh raw coal is pumped to heavy media cyclones from which the product passes over drain and rinse screens for reclamation of the magnetite and for dewatering. After dewatering, the 2"x28 mesh clean coal is centrifuged in vibratory centrifuges for further dewatering and then is delivered to the dryer feed collecting conveyor.

The 2" x 28 mesh heavy media cyclone refuse is also dewatered on drain and rinse screens, with the dewatered refuse dropping on the plant refuse conveyor.

The magnetite from the heavy media cyclones is recovered in a circuit comprising a dilute media sump, a magnetite clarifier and magnetite separators. The recovered magnetite goes to an overdense media sump from which a controlled amount is automatically returned to the washing circuit as called for by the specific gravity metering system.

Make-up magnetite will be delivered to the plant by trucks or rail and will be dumped into a dump hopper. This magnetite will be pumped to the magnetite clarifier when the magnetite circuit requires replenishment.

(2.4 - Cont'd)

The 28 mesh x 0 desliming screen undersize will be pumped to 24" classifying cyclones for thickening and separation at 100 mesh. The 28 x 100 mesh classifying cyclone underflow will flow through distributors to double deck coal washing tables for cleaning.

The table product will be dewatered in screen-bowl centrifuges and then deposited on the dryer feed collecting conveyor. Table refuse will be dewatered in solid bowl centrifuges before dropping on the plant refuse conveyor.

The 100 mesh x 0 overflow from the 24" classifying cyclones will go to froth flotation normally, that is unless the coal is oxydized. If the coal is oxydized, then instead of going to froth flotation, the 100 mesh x 0 coal will be pumped to 14" classifying cyclones for separation at 200 mesh. The cyclone underflow, 100 mesh x 200 mesh, will join the table product in being dewatered in screen-bowl centrifuges. The minus 200 mesh 14" cyclone overflow will go to the 175 ft. thickener.

When non-oxidized coal is froth floated, the flotation concentrate is dewatered in screen-bowl centrifuges together with the table product and the flotation tailings are directed to the 175 ft. thickener.

The thickener overflow will be sufficiently clarified to be recycled back to the plant for re-use. Thickener underflow will be pumped to solid bowl centrifuges together with the table refuse. The solid bowl centrifuge cake will fall on to the plant refuse conveyor.

(2.4 - Cont'd)

Flocculant will be added to the solid bowl centrifuge feed in order to produce a sufficiently clarified effluent to close the water circuit through the thickener.

When oxydized coal is being handled and the froth flotation cells are being by-passed, if the minus 200 mesh thickener feed is low enough in ash to make it worth reclaiming as thermal coal then the thickener underflow can be diverted to the screen-bowl centrifuges as a product instead of going to the solid bowl centrifuges as a refuse.

The plant refuse conveyor will deliver the plant refuse to a refuse bin from which it will be trucked to the refuse disposal area.

The total plant product will be fed to the thermal dryer by the dryer feed collecting conveyor. Provision will be made to by-pass the thermal dryer with a controlled portion of the dryer feed.

The preparation plant has been designed as two parallel half-plant circuits. Thus, either half plant can be taken out of service without affecting the other half-plant. For example, starting at the raw coal feed distributor, each half-plant will consist of the following equipment: 3 desliming screens, 1 heavy media sump and pump, 3 heavy media cyclones, 3 product drain and rinse screens, 1 refuse drain and rinse screen, 1 coarse coal centrifuge, 1 table cyclone feed sump and pump, 4 - 24" classifying cyclones, 5 double deck coal washing tables, 2 screen-bowl centrifuges, 1 secondary classifying cyclone sump and pump, 9 - 14" classifying cyclones, 1 bank of flotation cells and 1 solid bowl centrifuge.

(2.4 - Cont'd)

Certain items, such as the magnetite thickener and the 175 ft. tailings thickener, are not duplicated, but these units are very reliable and should rarely cause trouble.

After drying, the clean coal is sampled and then is conveyed to the clean coal stockpile building where a tripper will form two piles; one of metallurgical coal and one of steam coal, each pile 24,000 tons capacity (12,000 tons live).

A by-pass conveyor will permit the clean coal to be conveyed to a 10,000 ton emergency clean coal ground stockpile. The ground pile, which will be extendable to 100,000 net tons with the use of scrapers and bulldozers, can be reclaimed to the clean coal stockpile building by means of three ground hoppers and a conveyor.

A series of feeders under the clean coal stockpile building will reclaim the clean coal at a rate of 3000 net tons per hour to be conveyed to a railroad car loading bin for unit train loading.

3.0 MECHANICAL EQUIPMENT

3.1 Equipment Specifications

Unit No. 1 - Truck Dump Bin

One (1) 200 ton capacity concrete and steel bin. For additional details see Structural Specifications.

Unit No. 2 - Apron Feeder

One (1) 60" wide x 55'-0 long heavy duty apron feeder for handling 1300 TPH of 6" x 0 raw coal at an operating speed of 65 FPM.

The apron feeder will be complete with self-contained structural weldment frame, 5/8" double beaded formed steel flights, D-4 tractor type sealed chain, D-4 tractor rollers, impact rails under the deck, cast maganese head sprockets and traction wheels, 6:1 ratio shaft mounted speed reducer, driven through a vari-pitch V-belt drive assembly, and a 125 HP, 1750 RPM motor. The unit will also be provided with a drag scraper conveyor mounted below the apron feeder for dribble removal. The scraper conveyor will be driven by a chain drive and motoreducer and a 2 HP, 1750 RPM motor. The apron feeder unit will be NICO Model FD4265, or equal.

Unit No. 3 - Not Used.

Unit No. 4 - 48" Wide Raw Coal Belt Conveyor

Conveyor will handle 6" x 0" raw coal (50 P. C. F.) at the rate of 1300 TPH. Belt will be driven by a 125 HP, 1750 RPM motor at the speed of 561 FPM.

Unit No. 5 - Raw Coal By-Pass Gate

One (1) two-position diverter gate, actuated by an electric cylinder having 18" stroke, 2500# thrust at 6" per second speed. The cylinder will have explosion proof enclosure. The electric cylinder will be as manufactured by "ANDCO", or equal.

Unit No. 6 - 48" Wide Raw Coal Truck Bin Conveyor

Conveyor will handle 6" x 0" raw coal (50 P. C. F.) at the rate of 1300 TPH. Belt will be driven by a 75 HP, 1750 RPM motor at the speed of 561 FPM.

Unit No. 7 - Truck Bin

One (1) 150 ton capacity steel bin. For additional information see Structural Specifications.

Unit No. 8 - Truck Loading Gate

One (1) undercut gate to control the raw coal flowing into the trucks. The gate will be operated through a linkage assembly by a concentric shaft reducer. The motor will be 7½ HP, 1750 RPM.

Unit No. 9 - 48" Wide Raw Coal Tripper Conveyor

Conveyor will handle 6" x 0" raw coal (50 P. C. F.) at the rate of 1300 TPH. Belt will be driven by a 100 HP, 1750 RPM motor at the speed of 561 FPM.

Unit No. 10 - Raw Coal Tripper

One (1) 48" traveling tripper having the capability of receiving material from 48" belt conveyor, Unit No. 9, handling coal at 1300 TPH. The tripper will discharge the material into a pile and will be equipped with a cable reel to provide control to the machine and will have sufficient capacity for 340' of travel. Tripper will be capable of automatic operation.

Tripper will be fitted with mild steel chutes with AR liners. It will be mounted on two 30 lb. rails. The tripper will be driven by a 3 HP electrical motor with a speed reducer and roller chain.

Unit No. 11 - Not Used.

Unit No. 12 - Not Used.

Unit No. 13 - Not Used.

Unit No. 14 - Reclaim Feeders

Ten (10) 36" wide x 102" long electro-mechanical heavy duty vibrating feeder to feed coal weighing 50#/cu. ft., at a maximum rate of 360 TPH each. Feeders will be furnished complete with variable rate control, explosion proof 3 HP, 1800 RPM motors and 1/4" AR liners. The feeders will be as manufactured by "Rexnord", or equal.

Unit No. 15 - 36" Wide Raw Coal Reclaim Conveyor

Conveyor will handle 6" x 0" raw coal (50#/cu.ft) at the rate of 500 TPH. Belt will be driven by a 25 HP, 1750 RPM motor at the speed of 454 FPM.

Unit No. 16 - 36" Wide Raw Coal Screen Feed Conveyor

Conveyor will handle 6" x 0" raw coal (50 P. C. F.) at the rate of 500 TPH. Belt will be driven by a 75 HP, 1750 RPM motor at the speed of 462 FPM.

Unit No. 17 - R. C. Vibrating Screen

One (1) 6' x 16' single deck vibrating screen to handle 500 TPH of 6" x 0" coal. The screen will size at 2" and the 2" oversize will go to a rotary breaker, 2" undersize will by-pass the breaker.

The screen will be set on a 20° decline and floor mounted on steel springs and friction checks. The screen deck will be 5/8" dia. wire cloth with 2" square openings. A feed box with 3/8" A. R. liners will be provided.

The screen will be driven through V-belts and a 20 HP motor and operated at 858 RPM with a 3/8" stroke. The screen will be manufactured by Tyler Co. Type 990 Ty-Rocket, or equal.

Unit No. 18 - Rotary Breaker

One (1)10' x 20' rotary breaker to reduce 6" x 2" R.O.M. coal at a rate of 200 TPH to 2" x 0 size. The breaker will have interchangeable screen plates 4' long x 1" thick of 1040 steel with 2½" dia. round openings. It will be driven by a roller chain from a gear reducer by a 60 HP, 1800 RPM motor.

The breaker will be as manufactured by "Pennsylvania Crusher Corp.", or equal.

Unit No. 19 - 36" Wide Rock Bin Conveyor

Conveyor will handle 6" x 2" rock (100 P. C. F.) at the rate of 280 TPH. Belt will be driven by a 25 HP, 1750 RPM motor at the speed of 300 FPM.

Unit No. 20 - Rock Bin

One (1) 200 ton capacity steel bin. For additional details, see Structural Specification.

Unit No. 21 - Rock Bin Gate

One (1) undercut gate similar to Unit No. 8.

Unit No. 22 - 36" Wide Plant Feed Conveyor

Conveyor will handle 2" x 0" raw coal (50 P. C. F.) at the rate of 500 TPH. Belt will be driven by a 60 HP, 1750 RPM motor at the speed of 462 FPM.

Unit No. 23 - Plant Feed Belt Scale

One (1) 36" belt scale,. to weigh raw coal. The accuracy will be $\pm\frac{1}{4}\%$ of actual weight of material over 0 - 600 TPH range of capacity at an operating temperature range of -40°F to 90°F. The scale will be complete with: calibration weight, belt speed sensor, and a control enclosure with solid state integrator (totalizer). Remote totalizing counter and recording rate meter at control panel. The belt scale will be as manufactured by "Thayer", or equal.

Unit No. 24 - Electro Magnet

One (1) cross belt self-cleaning electromagnetic separator for suspension above 36" plant feed conveyor handling 500 TPH at a belt speed of 462 FPM.

The magnet is expected to remove tramp iron the size of 3/4" hex nuts (1.5 oz) and larger. All with explosion proof enclosures.

The electro magnet will be as manufactured by "Stearns Magnetics, Inc.", or equal.

Unit No. 25 - Plant Feed Sampler

One (1) electrically operated single stage sampler arranged for manual operation. System will have an in-line spoon-type cutter, driven by an electric motor. Cutter will collect 93#/cut of sample. Drive unit electrically operated, chain driven. All electrical equipment shall be explosion proof.

Sampler will be push-button operated and will be manufactured by "Denver Equipment Co.", or equal.

Unit No. 26 - Not Used.

Unit No. 27 - Not Used.

Unit No. 28 - Raw Coal Distributor

One (1) 6-way distributor to feed 520 TPH of 2" x 0 coal and 6450 GPM of water to sieve bends.

Unit No. 29 - Desliming Sieve Bends

Six (6) 5'-0" wide x 6'-8" radius with 45° included angle sieve bends, with 0.75 mm slot opening stainless steel screen, feed box and screen turning mechanism. Feed to each sieve bend 87 TPH, 2" x 0 coal and 1075 GPM water.

Unit No. 30 - Desliming Screens

Six (6) 6' x 12' single deck vibrating screens to handle 2" x 0 coal at a rate of 87 TPH each. These screens will be set level and be floor mounted on rubber air springs with friction checks. A feed box with A. R. liners will be provided. The deck will be 304 stainless steel profile wire with 0.5 mm openings.

Each screen will be driven through V-belts by two 7½ HP motors and operate at 820 RPM with a ½" stroke.

The screens will be as manufactured by "Tyler", or equal.

Unit No. 31 - Heavy Media Sumps and Pumps

Two (2) sumps and pumps to handle media and 2" x 28 mesh raw coal and feed the heavy media cyclones.

For further details see Platework Specifications and Schedule of Pumps.

Unit No. 32 - Heavy Media Cyclones

Six (6) 24" dia. 20° cone heavy media cyclones. The cyclones will be of Ni-Hard construction. They will be arranged in 2 sets of 3 each per set, and will be fed 175 TPH normally (200 TPH maximum) of 2" x 28 mesh coal.

Unit No. 32 - (Cont'd)

The cyclones will be as manufactured by "Heyl & Patterson, or equal.

Unit No. 33 - Coarse Refuse Sieve Bends

Two (2) 6'-0 wide x 6'-8" radius with 45° included angle sieve bends, with 0.75 mm slot opening, stainless steel screen feed box and screen turning mechanism. Feed to each sieve bend 59 TPH, 2" x 28 mesh refuse and 800 GPM water.

Unit No. 34 - Coarse Refuse Drain & Rinse Screens

Two (2) 7' x 16' single deck vibrating screen each to handle 59 TPH of 2" x 28 mesh refuse. The screens will be set level and be floor mounted on rubber air springs with friction checks. The deck will be 304 stainless steel profile wire with 0.5 mm openings. A feed box with A.R. liners will be provided. The screenwill be driven through V-belts by two 10 HP motors and operate at 820 RPM with 1/2" stroke.

The screens will be as manufactured by "Tyler", or equal.

Unit No. 35 - Coarse Coal Sieve Bends

Six (6) 5'-0 wide x 6'-8" radius with 45° included angle sieve bends, with 0.75 mm slot opening stainless steel screen, feed box and screen turning mechanism. Feed to each sieve bend 39 TPH, 2" x 28 mesh coal and 585 GPM water.

Unit No. 36 - Coarse Coal Drain & Rinse Screens

Six (6) 6' x 16' single deck vibrating screen each to handle 39 TPH of 2" x 28 mesh coal. The screens will be set level and be floor mounted on rubber air springs with friction checks. The deck will be 304 stainless steel profile wire with 0.5 mm openings. A feed box with A.R. liners will be provided. The screen will be driven through V-belts by two 10 HP motors and operate at 820 RPM with $\frac{1}{2}$" stroke.

The screens will be as manufactured by "Tyler", or equal.

Unit No. 37 - Coarse Coal Centrifuges

Two (2) centrifuge coal dryers to handle 2" x 28 mesh coarse coal at 110 TPH with 110 GPM water. Fabricated steel housing and base. The basket to be #304 stainless steel conical wedge bar screen, horizontally mounted. Forced oil lubrication with $\frac{1}{4}$ HP motor. Rotation drive motor to be 50 HP and vibrator motor to be $7\frac{1}{2}$ HP, McNally Wedag #150, or equal.

Unit No. 38 - Magnetite Hopper

One (1) sump to receive and store truck or rail delivered magnetite.

Unit No. 39 - Magnetite Pump

One (1) pump to receive and pump magnetite as needed by the magnetite. thickener.

For further details, see Pump Schedule.

Unit No. 40 - Magnetite Sieve Bend

One (1) 5'-0 wide x 6'-8" radius x 45° sieve bend, with .50 mm opening #304 stainless steel screen, feed box and screen turning mechanism.

Feed 300 GPM magnetite slurry at 1.9 specific gravity. This sieve bend will remove trash from slurried magnetite pumped from magnetite sump to magnetite storage thickener.

Unit No. 41 - Magnetite Thickener

One (1) heavy media thickener for installation in a 50' dia. x 14' center depth tank. Unit will be furnished complete, including the following:

a. Center mechanism will be designed for an operating torque of 60,000 ft. lbs. in a momentary peak load of 121,000 ft. lbs. and operated by a 7½ HP motor.

b. Motorized lift for lifting rakes 24" consisting of right angle totally enclosed 1 HP gearmotor connected to 25 ton worm gear jack through flexible coupling, including limit switch and slip ring assemblies and all necessary controls for semi-automatic operation.

c. The center driving cage to which arms are attached. Rake arms with sufficient blades to scrape the tank bottom. A discharge cone scraper will be bolted to the cage and arms.

d. A steel feedwell 14' dia. x 3' deep supported from the cage and fitted with a trash screen.

e. A steel launder truss (with double pipe handrails) to support the walkway and feed launder.

Unit No. 41 - Cont'd)

f. A thickener tank (see Structural Specification) including a steel effluent launder and sump, steel tank sides and concrete bottom.

g. Overload alarm and shutdown controls. The thickener will be capable of delivering a magnetite slurry at 1.5 specific gravity.

The thickener will be as manufactured by "Dorr-Oliver-Long, Ltd.", or equal.

Unit No. 42 - Magnetite Underflow Pump

One (1) pump to deliver the magnetite thickener underflow to the magnetic separators.

For further details see Pump Schedule.

Unit No. 43 - Clarified Water Pump

One (1) pump to accept the magnetite thickener overflow and pump it to the Coarse Refuse Drain & Rinse Screens.

For further details see Pump Schedule

Unit No. 44 - Overdense Media Sump & Pump

One (1) sump and pump to collect the overdense media from the magnetic separators and pump it to the dense media splitters.

For further details see Platework Specifications and Pump Schedule.

Unit No. 45 - Magnetic Separators

Two (2) 36" x 96" double drum wet magnetic separators to recover magnetite from the approximately 917 GPM total of clarifier underflow. The magnetic separators will be primary concurrent flow and secondary counter-current flow, utilizing permanent magnetic material, non-magnetic support rings, tank and iron frame incorporating feed box, weir type adjustable overflow, pulp level control, water spray, complete with supporting framework. Each drum will be driven through a roller chain drive and gear reducer by a 5 HP motor.

Unit No. 46 - Dense Media Splitter

Two (2) pneumatically operated splitter boxes. These boxes will circulate media from the overdense media sump and will split off a controlled amount to the two dense media circuits to maintain constant media specific gravity.

Unit No. 47 - Density Controllers

For details see Electrical Specifications.

Unit No. 48 - Level Controllers

For details see Electrical Specifications.

Unit No. 49 - Instrumentation

Complete instrumentation will be provided for heavy media controls and proper plant operation. For details see Electrical Specifications.

Unit No. 50 - Not Used.

Unit No. 51 - Table Cyclone Feed Sumps & Pumps

Two (2) sumps and pumps to handle 170 TPH at 28 x 0 mesh coal and 6530 GPM of water and pump to the classifying cyclones.

For further details see Platework Specifications and Pump Schedule.

Unit No. 52 - Classifying Cyclones

Eight (8) 24" dia. cyclones arranged in two banks of four. The cyclones will be of Ni-Hard construction and will have ceramic underflow orifices.

Flanges and gaskets will be provided to permit replacement of parts. Inlet pressure will be 20 psi. Total feed will be solids 170 TPH of 28 mesh x 0 coal and 6530 GPM

A diaphragm pressure gauge will be provided at each bank feed chamber. Each cyclone will have a cut-off valve.

The cyclones will be as manufactured by Heyl & Patterson, or equal.

Unit No. 53 - Table Distributor

Two (2) 39" dia. x 27" deep 10-way, "Deister" stationary distributor, or equal, to feed 93 TPH of 28 mesh x 0 coal and 558 GPM water to coal washing tables.

Unit No. 54 - Coal Washing Tables

Ten (10) Concenco #88 diagonal deck coal washing tables as manufactured by Deister Concentrator Co., arranged in pairs for suspended mounting. Each pair will be driven by a 3 HP motor through V-belts. Total feed to the tables will be 93TPHof 28 x 100 mesh coal and 558 GPM.

Unit No. 55 - Bird Filter By-pass

Two (2) pneumatically operated diverters, to by-pass an individual centrifuge in the event of overtorque on the centrifuge conveyor drive and return feed to the tailing sump.

Unit No. 56 - Solid Bowl Centrifuges

Two (2) Bird Machine Company 44" x 132" solid bowl centrifuges equipped with conveyor blade ceramic face plates, ceramic feed orifices, 304 stainless steel liner throughout solid section, Korfund vibration isolators and torque control monitoring system. The centrifuges will be driven by 150 HP, 1200 RPM, wound rotor motors through V-belts. Total feed will be 496 GPM of 27% solids slurry containing 33 TPH of 28 mesh x 0 refuse.

Unit No. 57 - Not Used.

Unit No. 58 - Dilute Media Sump & Pump

One (1) sump and pump to collect the dilute media from the HM circuits and pump it to the classifier.

For further details, see Specifications of Platework and Schedule of Pumps.

Unit No. 59 - Bird Filtrate Sump & Pump

One (1) sump and pump to pump 2T and 1298 GPM of screen bowl centrifuge filtrate to the 175' dia. refuse thickener.

For further details see Platework Specifications & Schedule of Pumps.

Unit No. 60 - Centrifuge Effluent Sump and Pump

One (1) sump and pump to handle 5 tons and 348 GPH of centrifuge effluent and pump to the raw coal distributor.

Unit No. 61 - Secondary Classifying Cyclone Sumps and Pumps

Two (2) sumps and pumps to handle 77 tons of 100 x 0 mesh coal and 5972 GPM of water and pump the secondary classifying cyclones or flotation cells.

Unit No. 62 - Secondary Classifying Cyclones

Eighteen (18) 14" dia. cyclones arranged in two banks of nine. Cyclones will be of Ni-Hard construction and will have ceramic underflow orifices. Flanges and gaskets will be provided to permit replacement of parts. Inlet pressure will be 20 PSI. A diaphragm pressure gauge will be provided at each bank feed chamber. Each cyclone will have a cut-off valve. Total feed will be 77 TPH of 100 mesh x 0 coal and 5972 GPM.

The cyclones will be manufactured by "Heyl & Patterson", or equal.

Unit No. 63 - Not Used.

Unit No. 64-1 - Flotation Cell Blower

One (1) turbo-compressor to supply air to the flotation cells. The compressor will supply 2500 cfm of air at 2.0 PSI and 4,300 ft. altitude and will be complete with a 50 HP, 3600 RPM motor, coupling, filter, silencer, and cork mountings.

The blower will be manufactured by "Spencer Turbine", Model No. 2550-H, or equal.

Unit No. 64-2 - Flotation Cell Reagent System

Two (2) reagent feeders, as manufactured by "Clarkson Simplex", Model E-1, or equal, to feed reagent to the flotation cells. The feeders are of 18 - 8 stainless steel with 20-BI cups, float valve, gear motors, switch, cord, and mounting bracket.

Unit No. 65 - Flotation Cells

Two (2) banks of five 300 cu. ft. supercharged flotation machines. Each cell will be complete with feed and discharge boxes, double side neoprene tipped motorized skimmers ($\frac{1}{2}$ HP motor), neoprene covered impeller, A. R. plate stabilizer, automatic level controls (both darts motorized) and driven by 30 HP, 1200 RPM motors. Total feed will be 36 TPH of 100 mesh x 0 coal and 2986 GPM water.

The cells will be as manufactured by "Galigher Co.", Model #90Cx300, or equal.

Unit No. 66 - Not Used.

Unit No. 67 - Screen Bowl Centrifuge By-Pass

Four (4) pneumatically operated diverters to by-pass an individual centrifuge in the event of over torque on the centrifuge conveyor drive and return feed to the table cyclone feed sump.

Unit No. 68 - Screen Bowl Centrifuges

Four (4) 44" x 132" Bird Machine Co. screen bowl centrifuges equipped with conveyor blade ceramic face plates, ceramic feed orifices, 304 stainless steel liner throughout solids section. Corfund vibration isolators and torque control monitoring system. The centrifuges will be driven by 250 HP, 1200 RPM wound rotor motors through V-belts. Total feed will be 140 TPH of 28 x 0 mesh coal and 1576 GPM water.

Unit No. 69 - Screen bowl Distributors

Two (2) two-way distributors for collecting flotation cell and table products and distributing to screen bowl centrifuges.

Unit No. 70 - Not Used.

Unit No. 71 - Flocculant Systems

One (1) Calgon Canada M-500 (cationic) system, or equal, for the thickener feed, consisting of a 6000 gallon bulk storage tank, transfer pump, 100 gallon day tank, two metering pumps and eductors for feeding flocculant to the flotation cell tailing discharge boxes.

One (1) Calgon Canada M-580 (anionic) system, or equal, polymer feed system for feeding polymer to two solid bowl centrifuges and refuse thickener. The system will consist of one (1) Model TTS-3000 automatic dry polymer feed assembly with mixing tank, mixer, feeder, transfer pumps, and one (1) Model 2L3 pump (0.3 - 3.0 gpm) for the thickener and two (2) Model 1L4 pumps (1.7 - 17 gpm) for the solid bowl centrifuges.

Unit No. 72 - Refuse Thickener

One (1) 175' dia. refuse thickener with "Dorr-Oliver", or equal, Type 109S2-3 mechanism, designed for operation at 600,000 ft. lbs. continuous operating torque rating and a momentary peak torque rating of 1,375,000 ft. lbs. The thickener will handle a maximum of 40 TPH of refuse and will include the following: (See Structural Specifications for thickener tank details).

Unit No. 72 - (Cont'd)

a. A balanced type drivehead powered by two 5 HP helical gear reducers, each driving a worm gear which then drives the main gear through pinions. All gearing components will be enclosed in dust-tight housings for oil lubrication.

b. The center driving cage to which the rake arms are attached.

c. Two long and two short raking arms.

d. 16 ft. dia. discharge trench scrapers bolted to the cage and arms.

e. A stationary steel feedwell 24 ft. dia. with trash screen supported from the cage and/or arms and provided with a feed dispersion shelf.

f. The thickener bridge will be omitted and the steel roof truss will support the walkway and feed launder.

g. An automatic motorized lifting device to provide 24" lift consisting of an inner steel column, lifting jack with yoke and rods, 3 HP gearmotor with coupling and electrical controls. An access ladder and platform will be furnished for inspection and lubrication of the lifting device.

One (1) alarm horn of non-corrosive type will be furnished.

h. Electrical and mechanical overload protection. The electrical system will monitor amperes on each motor circuit and will activate alarm and cut-out circuits should amperage exceed preset limits. The mechanical system is operated by the

Unit No. 72 - (Cont'd)

thrust of the worm gears against disc spring assemblies and will also activate alarm and cut-out systems.

i. A torque recorder mounted on the main control panel for recording main drive torque.

j. A lift position recording system.

Unit No. 73 - Thickener Underflow Pumps

Two (2) pumps (1 operating, 1 spare) to feed the thickener underflow to the solid bowl centrifuges.

For further details see Schedule of Pumps.

Unit No. 74 - Clear Water Pumps

Two (2) pumps - both operating - to handle the clear water from the refuse thickener for distribution to the preparation facilities. For further details see Schedule of Pumps.

Unit No. 75 - Tailing Sump and Pump

One (1) sump and pump to pump the tailings from the solid bowl centrifuges to the refuse thickener. For further details see Platework Specifications and Schedule of Pumps.

Unit No. 76 - Scrubber Effluent Pump

One (1) pump to return the thermal dryer effluent to the refuse thickener. For further details see Schedule of Pumps.

Unit No. 77 - Gland Water Pump

One (1) pump will be provided to supply gland water. This pump will be a horizontal, cast iron pump. The motor will be 15 HP, 1800 RPM, direct drive. The pump will pump 160 GPM at 155 TDH.

Unit No. 78 - Not Used.

Unit No. 79 - 36" Wide Dryer Feed Collecting Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 352 TPH. Belt will be driven by a 50 HP, 1750 RPM motor at the speed of 371 FPM.

Unit No. 80 - Dryer By-Pass Gate

One (1) electrical cylinder operated diverter gate for by-passing thermal dryer. The cylinder will have a 36" stroke at 2500 lb. and will be driven by a 7½ HP electric motor.

Unit No. 81 - Not Used.

Unit No. 82 - Not Used.

Unit No. 83 - Not Used.

Unit No. 84 - Not Used.

Unit No. 85 - 30" Wide Plant Refuse Conveyor

Conveyor will handle 2" x 0" refuse (100 PCF) at the rate of 180 TPH. Belt will be driven by a 15 HP, 1750 RPM motor at the speed of 300 FPM.

Unit No. 86 - Not Used.

Unit No. 87 - Not Used.

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Unit No. 88 - Thermal Dryer

One (1) McNally No. 5 Flowdryer to evaporate 20 TPH of moisture from 352 TPH of coal. Initial Surface Moisture 10.67%
Final Surface Moisture 6.0%

Feed

Surge bin, 33 dry-ton capacity, fabricated with 1/4" steel vertical sides and 3/8" steel sloping sides. The lower 12 ft. of the sloping sides are lined with 1/8" Type 304 stainless steel and have stainless steel 12" radius curved inserts in the valley angles of the lined portion. Bin is fitted with manual cut-off gate and 3/8" steel unlined feeder skirts with 10 gauge steel cover. A hinged gate between skirts provides manual adjustment of flow.

Three (3) bin level indicators provide indication at high level, cut-off at higher level and low level cut-off. One (1) pivoted paddle type control operates between the above high and low levels to regulate the feeder output rate.

Wet coal electromechanical vibrating feeder, Syntron, or equal, 84" wide x 8'-0" long frame, non-radiused trough fitted with 1/4" thick Type 304 stainless steel liner on bottom and sides, and positioned on a 10° downgrade on base type spring mounts.

Adjustable rate drive, 15 HP, is below deck mounted integral motor. Feed rate is automatically regulated by the volume of material in the bin from pivoted paddle type bin level control acting through rheostat to feeder controller. Manual speed variable voltage control from the operator's panel in the dryer control room.

Combustion and Dryer Chamber

Cylindrical vertical combustion chamber of 1/4" ASTM A-242 (weathering

(Unit No. 88 - Cont'd)

steel) plate lined with refractory brick, sides and bottom, resting on steel base beams and fitted with insulated access door. Transition section of 1/4" A-242 steel with refractory supports and by-pass outlet and carried on A-242 steel girders. Compression air bustle and duct from inlet fan of 1/4" A-242 steel. I.D. refractories - 15'-9½", outside diameter of shell - 18'-0", volume - 5,618 C.F.

Sloping screen and supports, both of Type 410 stainless steel carried by girders and having adequate provision for expansion. Screen size - 9' x 15' rod dia. - 7/8", open area - 10% maximum. Temperatures below screen - max. 1000°F, normal - 900°F.

Stack inlet duct from combustion chamber shell to by-pass stack and by-pass stack fabricated of 3/16" A-242 steel with internal steel mesh for insulation. Stack fitted with motorized damper arranged to open with loss of power. Stack inside diameter - 54".

Drying chamber of 1/4" A-242 steel from screen upward to dust cyclones; fitted with coal inlet and outlet, bed gate, refractory channel 1/2" firebox steel skirts, observation windows, service doors, safety doors and water sprays.

Dried coal rotary valve with stainless steel rotor blades in A-242 steel body, AGMA speed reducer and V-belt drive to 10 HP motor.

Dried coal chutes fabricated of 1/4" A-242 steel are from dryer bed to rotary valve, dust inlet, continued to dried coal conveyor and are fitted with

(Unit No. 88 - Cont'd)

manually operated fire gate, hot coal chute and bin.

Dried coal chute continues as pulverizer fuel hopper with welded in liner of 10 gauge, Type 304, 2-B finish stainless steel extending 18" high in throat directly above pulverizer feeder. A pneumatically operated cut-off gate fabricated of 1/4" Type 304 stainless steel operated by remote control from dryer control panel.

Ducts of 10 gauge A-242 steel extend from safety doors of drying chamber outward through building walls and each has mesh screen at outlet.

Insulating Materials

Furnace door - 9" thick, 3" insulating concrete, 1:6 Lumnite - vermiculite on two courses 9" x 4½" x 3" of SKAGIT x high heat duty firebrick. Wall area of combustion chamber from the floor up to the underside of the arch, 9" of Super Duty C.S. plastic refractory, backed with 4" of 1:6 Lumnite - vermiculite. A band of 70 plus 70% alumina plastic refractory 7 feet wide at the burner level.

Flat arch and bull nose section is 9" thick Super Duty C.S. plastic refractory suspended with refractory anchor assemblies.

The upper walls above the flat arch and bull nose sections to be 8-1/2" of Super Plastic C.S. plastic, backed with 4-1/2" of insulating firebrick.

Breeching to by-pass stack lined with 1:2:4 mix of Lumnite Haydite-Vermiculite and tapering from 9" at furnace to 3" at stack.

(Unit No. 88 - Cont'd)

By-pass stack lined with 2" thick 1:2:4 mix of Lumnite Haydite Vermiculite.

All plastic refractory wall linings anchored to the shell with refractory anchor assemblies.

Abrasion and heat resisting primary cyclone lining, 1" thick Stonhard Hi-Temp 1800, installed over 1½" x 13 expanded metal and troweled smooth. Lower 10 ft. of cyclones is lined with 3/4" thick factory installed high temperature loose insulation packed between the outer shell and inner stainless steel liner.

Primary Cyclone Dust Collecting

Four (4) 11'-0" dia. McNally Cyclone Dust Collectors of 3/16" A-242 steel with steel mesh for field installation of 1" Stonhard 1800 high temperature lining. The lower 10 ft. of cyclone is lined with 1/8" Type 304 stainless steel over factory installed internal insulation.

Top of cyclones are fitted with safety doors in outlet section, or applied to extended ducts.

Four (4) coal dust rotary valves. Steel rotor blades in A-242 steel body, AGMA speed reducer and V-belt drive to 5 HP motor.

Three (3) 16" screw type dust collecting conveyor with A-242 steel 1/4" trough and 10 gauge clamp-on cover, AGMA speed reducer and V-belt drive to 10 HP motor.

Exhaust ducts of 3/16" A-242 steel from cyclone outlets to the exhaust

(Unit No. 88 - Cont'd)

fan inlet and from the exhaust fan outlet to the exhaust gas scrubber. 10'-8" dia. x ± 60' high stack of 3/16" Type 316 stainless steel follows scrubber.

Inlet Fan

The inlet fan supplies ambient air through the furnace and screen deck at a pressure adequate to fluidize the bed.

The fan is Buffalo Forge, or equal, Type L39, Size 1320, single inlet, single width, arrangement 1 with backward curved blade non-overloading wheel, roller bearings, coupling, remotely operated non-automatic variable inlet vanes, inlet screen and 3/8" steel fabricated housing with drain and access door. 120 V linear actuator operates vanes.

The fan supplies 120,000 CFM calculated at 70°F and 4250 ft. elevation against 22" WG static pressure when operating at 1180 RPM and couples to 400 HP motor. Fan rotor has 5,822 WR^2.

Inlet duct of 3/16" A-242 steel extends from fan inlet vanes outward through building wall and contain above inlet screen.

Exhaust Fan

The exhaust fan withdraws drying gasses and water vapor from the drying chamber through the dry dust collectors and delivers to the scrubber.

The fan is Buffalo Forge, or equal, Type 21, Size 1965, single inlet, single width, arrangement 3 with backward curved blade non-overloading wheel, roller bearings, coupling, remotely operated non-automatic variable

(Unit No. 88 - Cont'd)

inlet damper, and 3/8" steel fabricated housing with drain and access door. 120 V linear actuator operates damper. The fan exhausts 155,000 CFM, calculated at 140°F and 4250 ft. elevation against 47" WG static pressure when operating at 1180 RPM and coupled to 1200 HP motor. Fan rotor has 20,000 WR^2.

Exhaust Gas Scrubber

One (1) American Air Filter Kinpactor/Cyclonic Separator, Model S, constructed of Type 316 stainless steel where in contact with the water or air stream and externally stiffened with mild steel. Approximate size will be 7'-3½" long by 7'-7" diameter Kinpactor throat and 19'-7" diameter by 40'-6½" high separator with inlet section and 10'-8" diameter outlet. Kinpactor includes movable center cone and access door for adjusting cone to vary the pressure drop across throat. The fabricated stainless steel will be 10 gauge for Kinpactor and separator inlet and 12 gauge for separator.

Total gas inlet volume calculated at 155,000 CFM at 140°F, and scrubber pressure drop at 30" WG to emit no more than 0.04 grains of dust per SCF of exit dry gases.

Total water circulation requirement is 1240 GPM at 25 PSI.

One (1) scrubber effluent sump constructed by extending the base on the separator 18". Sump contains overflow and drain, and water level is normally maintained by high and low level detectors to operate valve in supply water piping.

Fuel System

One (1) Riley #450 Atrita Pulverizer with integral coal breaker, drying

(Unit No. 88 - Cont'd)

and segregation section, exhauster fan, tungsten carbide pulverizing elements, sub-base and pressure lubrication for bearings. Pulverizer rotor assembly has 9,500 WR^2.

Pulverizer is direct-connected through a Fast FS coupling to a 125 HP, 1200 RPM motor. Grind at 89 HGI - 98.9% through 50 mesh.

One (1) Riley Drum Type Coal Feeder with permanent magnet separator, safety shear pin alarm and revolution counter. Feeder is connected to one variable speed Louis Allis drive, 10:1 output speed range enclosed type with integral gear reducer and 1 HP motor and automatic air/electric operated speed control. Maximum capacity - 9,000 lbs/hr.

Two (2) flare type forced draft burners each including coal head, refractory throat material, observation ports, two flame scanners and windbox. Windbox constructed of A-242 steel plate for welding to the combustion chamber and fitted with dampers for regulating of the supply of combustion air from the air bustle manually.

One (1) two-way coal riffle distributor for dividing coal from mill equally to two burners with standard steel pipe to connect between distributor and burners. Primary air duct system from air bustle and furnace to pulverizer-feeder inlet including automatic damper to mix tempering air with hot gas.

Two (2) propane gas electric ignitors for installation in the burners. Ignitors will be weatherproof with local control boxes, air and purge solenoid valves arranged for each burner.

(Unit No. 88 - Cont'd)

Instrumentation

All necessary instrumentation, relays, alarms, control panels, electric operators and internal panel wiring to terminal boards for McNally design automatic control of the drying system to match the drying requirements.

Temperatures are indicated and recorded from the thermocouples at these locations: Exhaust duct (ED), combustion chamber (CC), pulverizer (P), and drying chamber (DC). These temperatures react through controllers to govern the flowdryer operation or to signal alarm at high temperatures.

Furnace combustion temperature is regulated by adjusting speed of pulverizer feeder according to readings measured in the exhaust duct (ED) and combustion chamber (CC). The "ED" controller normally regulates furnace temperature unless exhaust temperature rises to critical set point which then operates Shut-Down alarm mode.

The "CC" controller has its high temperature set point which operates alarm only but not Shut-Down mode, and takes command of furnace temperature and pulverizer feeder until normal control may resume.

Temperature at pulverizer outlet is regulated by tempering air damper adjusted by controller "P" which also operates alarm at high temperature set point.

Temperature above the screen in drying chamber (DC) operates Shut-Down alarm mode when controller's critical set point is reached.

The Shut-Down mode is activated by critically high temperatures above the screen, in either the exhaust duct (ED) or drying chamber (DC). This mode shuts down drying equipment, sounds alarm, opens water sprays over screen, closes exhaust fan damper and opens by-pass stack damper.

Each burner has two (2) ultra-violet ray detectors, both which must signal a timed flame-out to operate alarm and shut down pulverizer.

Furnace pressure is regulated by inlet fan vanes operated from the dryer control panel.

The control devices are as manufactured or supplied by Honeywell, Inc.

One instrumentation control panel approximately 3' wide x 6' high x 2' deep, NEMA 1A construction with internal wiring, flush mounted instruments and accessories.

One operator's panel having all pushbuttons, indicating lights, interlocking relays, etc., for the proper operation of the dryer.

Instrument panel contains temperature recording controllers having high set point, operating indicator and 24-hour circular chart for thermocouples at:

Exhaust Duct (ED)
Combustion Chamber (CC)
Pulverizer Outlet (P)
Drying Chamber (DC)

Panel also contains alarm silencing relays for flame-out alarm and for high temperature alarms from the above controllers.

Operator's pushbutton panel contains indicating ammeters to monitor loading on inlet fan, exhaust fan and pulverizer.

(Unit No. 88 - Cont'd)

Linear actuators, General Controls 120 volt, or equal, for operation of: Inlet fan damper, exhaust fan damper, and pulverizer tempering air damper.

One (1) water valve with electric actuator for fire spray control.

One (1) tank mounted air compressor having 60 CFM free air rating delivered at 150 PSI, 120 gal. horizontal tank, automatic Stop-Start and dual control, V-belt drive from 20 HP, 1800 RPM motor, intake air filter and pressure gauge. Air is used for pulverizer feeder and its fuel gate, burner cooling, water valve to Kinpactor scrubber and cleaning out water sprays over screen.

Unit No. 89 - Vibrating Feeder
Unit No. 90 - By-Pass Damper
Unit No. 91 - Dried Coal Valve
Unit No. 92 - Dust Valves
Unit No. 93 - Dust Conveyor
Unit No. 94 - Inlet Fan
Unit No. 95 - Inlet Damper
Unit No. 96 - Exhaust Fan
Unit No. 97 - Exhaust Damper
Unit No. 98 - Not Used
Unit No. 99 - Pulverizer Feeder
Unit No. 100 - Pulverizer
Unit No. 101 - Temperature Air Damper
Unit No. 102 - Water Valve

SEE UNIT #88 SPECS.

Unit No. 103 - Not Used.

Unit No. 104 - Not Used.

Unit No. 105 - Not Used.

Unit No. 106 - Scrubber Pump

One (1) pump to supply water to the scrubber. For further details see Pump Schedule.

Unit No. 107 - 36" Wide Sampling Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 352 TPH. Belt will be driven by a 25 HP, 1750 RPM motor at the speed of 374 FPM.

Unit No. 108 - Sampler (Primary and Secondary)

One (1) automatic 2-stage sampling system handling 2" x 0" clean coal at 352 TPH. The primary sampler is designed to make 15 cuts per hour at 9" per second with a 6" cutter opening. Cutter operating range is variable from 4" to 18"/sec. Cutter opening variable from 6" to 9". Cutter will have replaceable 304 stainless liners. Cutter drive will be hydraulic.

The secondary sampler will be similar to the primary sampler, but with 1" opening to make 150 cuts/hr. at 9"/second. Cutter will operate at 4" to 18" per second. Cutter opening variable from $\frac{1}{2}$" to 2$\frac{1}{2}$". Cutter drive is 2$\frac{1}{2}$" diameter hydraulic cylinder.

The hydraulic power unit will be complete with tank, 10 HP explosion-proof motor and drive, pump and controls including flexible coupling and guard.

Unit No. 108 - Cont'd)

The sampler will be a'Denver" automatic sampler system, or equal.

Unit No. 109 - Sample Vibrating Feeder

One (1) 12" x 30" electro-magnetic vibrating feeder to feed the sampled coal to the crusher. The feeder will have stainless steel liners and CS-4 controller in Cema 4 enclosure for 115 volts, single phase, 60 cycle operating.

The feeder will be "FMC" Model F-22, or equal.

Unit No. 110 - Sample Crusher

One (1) coal sample crusher, "American" Model 20 x 12, or equal, to handle 1955#/hr. of 2" x 0 coal. The crusher will be driven by a 20 HP, 1800 RPM motor through V-belts.

Unit No. 111 - Stockout Diverter Gate

One (1) diverter gate similar to Unit No. 5 with a 12" stroke.

Unit No. 112 - 36" Wide Emergency Stockout Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 352 TPH. The belt will be driven by a 40 HP, 1750 RPM motor at the speed of 374 FPM.

Unit No. 113 - Clean Coal Belt Scale

One (1) 36" belt scale to weigh clean coal, similar to Unit No. 23, Range 0 - 500 TPH.

Unit No. 114 - 36" Wide Clean Coal Tripper Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 500 TPH. Belt will be driven by a 50 HP, 1750 RPM motor at the speed of 374 FPM.

Unit No. 115 - 36" Clean Coal Tripper

One (1) 36" traveling tripper having capability to handle coal at 500 TPH. The tripper is similar to Unit No. 10.

Unit No. 116 - 36" Wide Emergency Stockpile Reclaim Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 350 TPH. Belt will be driven by a 40 HP, 1750 RPM motor at the speed of 374 FPM.

Unit No. 117 - Emergency Stockpile Reclaim Feeders

Three (3) 36" wide x 102" long vibrating feeders. For details see Unit No. 14.

Unit No. 118 - Clean Coal Reclaim Feeders

Twelve (12) 72" wide x 114" long vibrating feeders each having a capacity of 720 TPH (max.) and driven by a 5 HP explosion-proof motor. The feeders will be of heavy duty construction with $1\frac{1}{4}$" thick AR liners and variable rate controls.

Unit No. 119 - 72" Wide Clean Coal Reclaim Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 3000 TPH.

(Unit No. 119 - Cont'd)

Belt will be driven by a 100 HP, 1750 RPM motor at the speed of 561 FPM.

Unit No. 120 - 72" Wide Loadout Bin Conveyor

Conveyor will handle 2" x 0" clean coal (50 PCF) at the rate of 3000 TPH. Belt will be driven by a 400 HP, 1750 RPM motor at the speed of 589 FPM.

Unit No. 121 - In-Motion Electronic Track Scale System

The proposed in-motion electronic track scale system is designed for bi-directional, in-motion weighing of rail cars in both automatic and semi-automatic operation. The automatic mode is employed in train service where all cars are to be weighed and the weigh command is issued for a strategically located track switch. In the automatic mode, the system is capable of unattended operation.

For individual rail car weights, the system can be operated in the semi-automatic mode with the weigh command initiated by a pushbutton switch.

The basic system consists of the weighbridge assembly complete with the load cells, the electronic package, and provision for automatic print-out of weights, as described below:

1. Weighbridge Assembly:

One steel deck with support beams. Deck dimensions are 12'-6" long by 6'-1" wide by 3/8" thick.

Two prewired track switches for sequencing the weight/print cycle in both directions.

(Unit No. 121 - Cont'd)

Two (2) track switches for customer mounting on approach rails (for sensing car speed and direction and disabling the automatic zero circuit prior to rail traffic over scale).

Rail clips, bolts, and washers for installation of rail to weighbridge.

Four load cell base plate assemblies.

Four high precision compression strain gauge load cells are provided, each load cell is hermetically sealed with a rated, direct load capacity of 200,000 pounds. Overload protection of 150% is provided and the units are structurally safe to 300% of rated capacity. Each cell is complete with top and bottom wear and retaining plates of hardened steel construction.

2. Electronics:

The major portion of the electronic circuitry associated with the weighing system is housed in a thermal insulated, temperature controlled enclosure located as close to the load cells as practical. Temperature control is achieved by means of a precision electronic on-off controller which operates either an electric heater or an exhaust fan to maintain the temperature inside the enclosure to within plus or minus 0.2 degrees F of set-point. In addition, a high limit control is utilized to provide an alarm and switch the heater power off should the temperature controller malfunction.

The electronic package consists of the following:

(Unit No. 121 - Cont'd)

DC power supply for load cells.
DC amplifier.
Filter.
Voltage to frequency converter.
Pulse amplifier.
"Track and Hold" circuits.

The four load cells are connected in parallel and are supplied with a very stable DC voltage from the power supply.

The milli-volt level output signal from the load cell is amplified to a convenient voltage level by the DC amplifier. This signal then passes a specially designed low frequency filter which attenuates by 200 all frequencies higher than three cps and passes the DC component. The resultant filtered output is then directly proportional to the true, average weight on the scale during the weigh cycle. This filter eliminates the effect of car bounce, flat wheels, etc.

The filter output signal is converted to a frequency signal (V to F) which is, in turn, amplified before transmission to the control console.

System Operation:

The system employs four (4) track switches which provide the weigh signals in automatic operation such as would be utilized on your unitrain application.

Two switches are located on the approach rails to establish train speed and disable the automatic zero circuitry. The other switches control the weigh cycle.

As the train approaches, the engine (maximum of six axles) crosses

(Unit No. 121 - Cont'd)

the scale. This weight is automatically rejected. When the first truck of the car to be weighed reaches the weighbridge, one of its front wheels operates a track switch. This causes the first "track and hold" circuit to switch to its hold mode. The output of the hold circuit is an analog representative of the weight of the first truck just before the truck leaves the weighbridge. The circuit "holds" this signal as the truck leaves the bridge. The signal is digitized and is sent to the console mounted counter which is programmed to count for exactly one second. This digital representation is displayed and stored in the counter.

The second "track and hold" circuit is then energized. The process is repeated. The counter adds the weight of the second truck to the previously stored weight of the first truck.

A print command is then issued automatically and the car weight is entered into the computer and printed in pounds. All timing, sequencing, and switching functions are performed in the control unit.

Individual tare weights will be entered into the computer and printed automatically along with the total train tare weight at the end of the train.

Unitrain Loadout System:

Surge Bin:

Surge bin capacity will be 200 tons or approximately two cars. The bin will be constructed of 3/8" steel reinforced plate with 1/4" stainless steel liner plate on the bifurcated hoppers. The hoppers will be fitted with two

(Unit No. 121 - Cont'd)

3' wide x 4' long clam gates. The gates are hydraulically operated at the cylinders are provided with positioners to provide a reduced feed rate at near balance conditions to achieve a precise cut-off at the desired weight.

Weigh Bin:

The weigh bin capacity will be approximately 120 tons and will be supported on four (4) high precision strain gauge load cell assemblies.

Construction material and liner plates are the same as for the surge bin. A single hydraulically operated 3' x 7' clam gate of the same design as those on the surge bin will be provided for discharge of the weigh bin.

Flood Loading Chute:

A flood loading chute will be provided for discharge of coal into the rail cars. The chute arrangement will be suspended from the overhead rails on trolley type wheels. A hydraulic retracting system will be provided for moving the chute to allow for locomotive passage.

Dust Covers:

Dust covers will be provided for both the surge bin and weigh bin as well as flexible dust containing connections between the surge and weigh bin and between the weigh bin and the flood loading chute. Inspection and maintenance access covers will be provided.

Hydraulics:

A 50 HP hydraulic power pack will be provided with a 100 gal. accumulator for operating the bin gates, chute retraction system, as well as semi-automatic operation of the integral static test weights.

(Unit No. 121 - Cont'd)

Calibration Weights:

Two (2) 10,000 pound calibration weights will be supplied with the system. These weights will be certified by the State Weights & Measures Department or other cognizant approval body as required.

The weights will be integrally mounted in the weigh system and will be activated by hydraulic cylinders from the control room.

By means of these weights, it is possible to run a full build-up test on the weigh bin in 10,000 pound increments without leaving the control room. With this simple means of calibration, it is entirely feasible to consider running a calibration check before each train with the print-out of the test being made a part of the train weight record.

Level Sensors:

Three (3) level sensors will be mounted in the surge bin (two at approximately 1/3 and 2/3 capacity and the third at alarm high level shut down position).

Associated lights on the control panel will allow the operator to instruct the train crew to increase or decrease speed, assuming voice communication; depending on the level in the surge bin. We anticipate utilizing a decrease speed light associated with level sensor at 2/3 capacity and an increase speed light associated with the sensor at 1/3 capacity. As long as the surge bin level is between these limits, a normal or safe speed light will be lit.

(Unit No. 121- Cont'd)

Also, a level sensing device will be provided in the weigh bin located at a point which will provide approximately 100 tons of material on a volumetric basis. This device can be used to provide automatic feed cut-off on a volumetric basis should there be a problem with the weigh electronics.

Load Cells:

Four (4) load cell assemblies are provided for support of the weigh bin. Each assembly includes a high precision compression strain gauge load cell, hermetically sealed with a rated, direct load capacity of 100,000 pounds. Overload protection of 150% is provided and the units are structurally safe to 300% of rated capacity. Each load cell is enclosed in a temperature controlled shroud.

Electronics:

The major portion of the electronic circuitry associated with the weighing system is housed in a thermal insulated, temperature controlled enclosure, except the filter and track and hold circuits are not required for the weigh bin system.

The load cell shrouds and weigh electronics are identical for the track scale and weigh bin except for the load cell capacity, filter, track, and hold circuit.

The output from the pulse amplifier is transmitted to the control console.

(Unit No. 121 - Cont'd)

Control Console:

The control console will be designed to mount in front of a control room window so that the operator will have all pertinent control devices and visual indicators in view while performing car loading operation and will house the following:

Track Scale Controls:

A five-digit counter which provides a digital display of the car weight in ten-pound increments and also converts the weight into binary coded decimal format.

A solid state digit processor circuit providing the interface between the counter and the printer.

A system programmer operates in conjunction with the track switches and "track and hold" circuitry to assure a proper weigh and print sequence.

Operator Controls:

Auto position provides automatic re-cycle for unitrain applications. Track switches provide "weigh signal". Manual position requires operator to initiate weigh signal.

Overspeed Indication and Control:

A light is provided to indicate when a car exceeds the maximum permissible speed. Relay contacts are provided to operate remote "near overspeed" and "overspeed" lights or audible alarm. The printer is programmed to print zero weight in an overspeed condition.

(Unit No. 121 - Cont'd)

Power Switch:

This switch applies 115 volts to the scale system.

Automatic Zero:

The automatic zero provides correction for change in zero tare due to build-up on weighbridge, etc. Maximum correction capability is 2,000 pounds. Track switches operate the logic that de-energizes this circuit at the proper time.

Unitrain Loadout System:

A five-digit counter provides a digital display of the bin weight in ten-pound increments and also converts the weight signal into binary coded decimal format.

A solid state digit process or circuit provides the interface between the counter, computer, and printer.

A Nova 2/10 Computer accepts the tare weights of the rail cars from the track scale. The computer will compare the tare weight and the desired gross weight and automatically provide the set-point for the 100 ton weigh hopper.

EXAMPLE: Desired Gross - Tare Weight - 100 Ton Weigh Bin

263,000 Pounds -47,000 Pounds = 216,000 Pounds

The 100 ton weigh bin comparitor will automatically compare the actual weight of material in the weigh hopper against the desired weight and close the surge bin gates when the weights are equal.

(Unit No. 121 - Cont'd)

Operator Controls:

High-low and intermediate level lights for surge bin.
Auto-off-manual switches for surge bin gates.
Manual control switch for weigh bin gate.
Flood chute position control.
Automatic feed cut-off alarms.
Control switches for integral calibration weights.
Time and date clock (digital).
All necessary lights, switches, relay, etc.

Printer:

A Model ASR-33 Teletype Printer with full typewriter keyboard to manually enter train number. The system will automatically print rail car tare weight, net weight, and date-time.

Unitrain Loadout System:

The weighing of the individual car loads is performed automatically and the discharge of the coal into the cars is performed manually by the operator. The system will operate as follows:

Recommended start conditions are (assuming 100 ton cars) the weigh bin comparitor has received the set-point weight from the computer and the weigh bin is full and approximately 1/3 capacity in surge bin with the train approaching at desired loadout speed.

Operator initiates loading and start of conveyor as the first car reaches start load position. Weigh bin weight is printed prior to opening gates.

Weigh bin gate closes automatically as weigh system reaches zero tare.

Cycle proceeds automatically with print-out of each bin weight. Surge bin gates open and close automatically.

(Unit No. 121 - Cont'd)

Cycle repeats until train is loaded.

Weigh bin may be calibrated before and/or after each train. If the car load is weighed into the weigh bin using the semi-automatic calibration weights, the print-out will show calibration for each train load. Having the scale system calibrated with certified weights before every train load will prove valuable for both supplier and client.

Unit No. 122 - Not Used.

Unit No. 123 - Not Used.

Unit No. 124 - Not Used.

Unit No. 125 - Oil Spray Equipment

One (1) oil spray system consisting of:

1 - Unloading Pump
2 - Spray Pumps
1 - 15,000 gal. Storage Tank

The system will operate automatically and will control coal dust.

Unit No. 126 - R.R. Track Scale

See Unit No. 121 for detailed description.

Unit No. 127 - Not Used.

Unit No. 128 - Not Used.

Unit No. 129 - Not Used.

Unit No. 130 - Not Used.

Unit No. 131 - Sump Pumps

Sump pumps will be provided as needed. For further details see Schedule of Pumps.

Unit No. 132 - Ventilation and Exhaust Fans

The following ventilators will be supplied as manufactured by American Air Filter, or equal:

A&G Job 1929
3/9/77

Unit No.	Description	CFM for "X" air changes per hour	Fan, Size, & Type
132-1	Truck Dump	5870 X = 5	1 - 6000 CFM Design II Centrif. Fan
132-2	R.C. Transfer Tower	2017 X = 5	1 - 2200 CFM Roofmaster LA16E4
132-3	R.C. Tunnel	4775 X = 5	1 - 5000 CFM Design II Centrif. Fan
132-4, 5, 6	Prep. Plant	52,360 X = 5	3 - 16,100 CFM Skymaster EC42J
132-7 & 8	Prep. Plant	6890 X = 5	2 - 4950 CFM Skymaster ECH24F
132-9	Prep. Plant	1730 X = 5	1 - 4950 CFM Skymaster ECH24F
132-10 & 11	Rotary Breaker	6750 X = 5	2 - 3550 CFM Roofmaster LA21E6
132-12	Magnet. Thickener	12,500 X = 5	1 - 13,300 CFM Skymaster EC36J
132-13	Prep. Plant Toilet		1 - 255 CFM Centrimaster PW72
132-14, 15 & 16	Refuse Thickener	12,280 X = 5	3 - 4950 CFM Skymaster ECH24F
132-17	C. C. Tunnel	7580 X = 5	1 - 7600 CFM Design II Centrif. Fan
132-18	Sample Bldg.	2590 X = 5	1 - 2600 CFM Roofmaster LA18D6
132-19	Stockout Drive Tower	850 X = 5	1 - 905 CFM Roofmaster LA12A¢-2
132-20	Loadout	7600 X = 5	1 - 8270 CFM Skymaster EC30G
132-21	Emerg. Stockpile Recl.	1070 X = 5	1 - 1100 CFM Design II Centrif. Fan

A&G Job 1929
3/9/77

Unit No.	Description	CFM for "X" air changes per hour	Fan, Size & Type
132-22, 23 & 24	Therm. Dryer	35,060 X = 5	3 - 13,300 CFM Skymaster EC36J
132-25	Change House	800 X = 8	1 - 905 CFM Centrimaster PW82
132-26, 27	Change House	600 X = 8	2 - 370 CFM Centrimaster PW75
132-28	Change House	100 X = 8	1 - 125 CFM Centrimaster PW71
132-29	Laboratory	300 X = 8	1 - 370 CFM Centrimaster PW75
132-30	Laboratory	210 X = 8	1 - 255 CFM Centrimaster PW72

The following louvers will be used to supply air:

Location	4' x 4' Adjustable	2' x 2' Adjustable
R.C. Transfer Tower	1	-
Preparation Plant	10	-
Breaker Building	2	-
Magnetite Thickener	2	-
Refuse Thickener	2	2
Sample Building	1	-
Stockout Drive Tower	1	-
Loadout	2	-
Thermal Dryer	5	-
Laboratory	-	2

Unit No. 133 - Air Compressors

Plant Air Compressor

One (1) air cooled, screw type air compressor to provide 110 SCFM at 4250 altitude of air at 125 PSIG for general plant use, Sullair Corporation, or equal, continuous heavy duty Model 10-30H, 30 HP motor, vertical ASME 425 gal. receiver, dual controls, filter silencer, air cooled after cooler, condensate trap, separator, safety valve and all safety and control instrumentation for proper performance.

Instrument Air Compressors and Dryers

Two (2) Ingersoll-Rand, or equal, teflon ring piston type air compressors, tank mounted, complete with relief and drain valves, instrumentation to provide 36 SCFM of air at 125 PSI. The unit will be furnished complete with a self-regenerating dehumidifier 20 SCFM capacity with purge flow and moisture indicators and pre-filter assembly, as manufactured by Pall-Trinity Micro Model 25HA2 Heat-Les Dryer, or equal. This compressor will deliver oil-free air.

The air dryer will include: prefilter assembly, purge flow indicator, moisture indicator, chamber gauges, and an after filter assembly.

One compressor will be located in preparation plant; one will be located in the dryer building.

Unit No. 134 - Room Pressurizers and Air Conditioners

Ten (10) 1700 CFM pressurizing units will be provided in the following areas:

(Unit No. 134 - Cont'd)

1 - Raw Coal Transfer Tower - Motor Control Center
1 - Rotary Breaker - Motor Control Center
2 - Preparation Plant - Motor Control Center
1 - Dryer Building - Motor Control Center
1 - Dryer Building Exhaust Fan Motor Enclosure
1 - Dryer Building Pulv. Motor Enclosure
1 - Sample Building - Electrical Room
2 - Loadout - Electrical Room
1 - Elevator - Machinery Room

These units will have vibration isolation and will be located outside the room.

These areas will be cooled and ventilated using wall mounted 15,000 BTUH units as follows:

2 - Plant Control Room
1 - Dryer Control Room
1 - Loadout Control Room Air Conditioner/Heater

Unit No. 135 - Heating Units

A plant heating system will be provided using No. 2 oil as fuel.

The following areas of the plant will be heated, using an outside winter ambient temperature of -40°F as follows:

(Unit No. 135 - Cont'd)

Division	Location	No.	Inside DB Temp.	MBH	CFM
1	Truck Dump	1	40	1,000	12,500 Recirc.
3	Breaker Building	1	40	1,500	18,750 Recirc.
4	Preparation Plant	2	40	2,000	25,000 Recirc.
4	Preparation Plant	1	40	2,500	30,000 Recirc.
4	Magnetite Clarifier	1	40	1,000	12,500 Recirc.
5	Refuse Thickener	2	40	2,500	30,000 Recirc.
6	Dryer Building	1	40	2,000	25,000 Recirc.
7	Sample Building	1	70	500	6,000 Recirc.
9	Railroad Loadout	1	40	500	6,000 Recirc.
11	Laboratory	1	70	90	1,000 Recirc.
11	Change Room	1	80	1,200	15,000 Recirc.

The heaters will include electronic flame safety controls and remote thermostats. An air distribution system will be provided with each heater to accomplish proper distribution in the buildings and to direct heated air to all conveyor galleries from the breaker building to the sample building.

Unit No. 136 - Equipment Hoists

Service Hoist - Preparation Plant

One (1) 6 ton, 100 ft. lift, 33 FPM max. speed electric geared trolley hoist, 15 HP motor, located over preparation plant machinery well with pushbutton controls on each floor.

(Unit No. 136 - Cont'd)

Service Hoist - Truck Dump

One (1) 1-ton, 30 ft. lift, 30 FPM speed electric trolley hoist, 2 HP motor, located over machinery well in the truck dump.

Service Hoists - Bird Centrifuges

Dual tandem, 6-ton, 15 ft. lift, 30 FPM electric hoists with 15 HP motors, and dual 4-wheel trolleys, one powered and one plain, complete with track and switches.

The following hand operated geared trolley hoists are provided:

One (1) raw coal transfer tower - 1-ton cap.
One (1) raw coal truck bin - 1-ton cap.
One (1) raw coal breaker building - conv. - 1-ton cap.
One (1) raw coal breaker building - scalp. screen - 1-ton cap.
One (1) raw coal preparation plant - Flotation cells - 1-ton cap.
One (1) raw coal preparation plant -H.M. Cyclones - 1-ton cap.
One (1) raw coal emerg. stockout drive house - 1-ton cap.
Two (2) thermal dryer - 1-ton cap.

Unit No. 137 - Platework

All chutes, hoppers, sluices, etc. required for coal or slurry handling will be fabricated from 1/4", or heavier, mild steel plate, welded construction with necessary stiffeners and supports.

No. 10 gauge cover plate with spring clip fasteners will be provided where needed. All chutes, hoppers, and sluices will have 1/4" AR steel liners on the bottoms, and 6" minimum at the sides. Primary sampler surge

Unit No. 137 - Cont'd)

hopper will be lined with 10 gauge, 304 stainless steel. All other sampling chutes will be 3/16" thick, 304 stainless steel.

Rock pockets will be used when necessary to reduce impact. Conveyor skirt plates will be 3/16" corten steel with skirtboard rubber attached on bottom of skirts for sealing at belt.

Most sumps will have 60° sides in the cones and will be covered with 1" dia. round hole screen plate about 3 ft. from the top for protection against oversize trash. All sumps will have 1/4" AR liners on the conical sides. Unit No's. 59, 60, 74 and 75 will have flat bottoms and Unit No. 51 will have 45° cones. All sumps will have a 4" plug valve at the bottom for drainage.

Sump unit numbers and capacities are as follows:

Unit No.	Description	Gallons
31	Two (2) Heavy Media Sumps	8,000 gal. each
43	Clarified Water Sump	11,000 gal.
44	Overdense Media Sump	5,000 gal.
51	Two (2) Table Cyclone Feed Sumps	5,000 gal.
58	Dilute Media Sump	6,300 gal.
59	Bird Centrifuge Filtrate Sump	5,400 gal.
60	Bird Centrifuge Effluent Sump	5,400 gal.
61	Two (2) Flotation Feed Sumps	4,000 gal.
74	Clear Water Sump	7,600 gal.
75	Tailings Sump	4,000 gal.

Unit No. 138 - Duct Work

Duct work will be provided at all pressurizer intake and discharge areas. Minimum wall thickness will be 16 gauge. Minimum wall thickness of all fittings will be 10 gauge.

Unit No. 139 - Service Elevator

One (1) Otis, or equal, 4000 lbs. capacity, 100 FPM service elevator. The elevator will be traction type, with accessories and controls for automatic operation. The elevator will stop at 5 landings with 90 ft. lift and will be driven by a 15 HP motor.

Unit No. 140 - Fresh Water Systems

Fresh water piping, including process and potable water piping, will be provided in the preparation plant, change house, and sampling station, a point 5'-0" outside these buildings. Crows Nest Industries will provide the water supply and connecting piping to these points. Crows Nest Industries will provide an adequate supply of water and connecting piping to the 8" fire protection main. (See Unit No. 141)

Unit No. 141 - Fire Protection

An 8" underground fire protection main, of coated and wrapped steel with welded joints, will provide water to seventeen (17) fire hydrants spaced every 250 feet, to three (3) valve houses, and to all buildings with fire protection standpipes. The hydrants will be standard double outlet, with hose and hydrant house, and Factory Mutual recommended equipment per National Fire Protection Association #24.

(Unit No. 141 - Cont'd)

Fresh water to the fire protection main will be supplied by Crows Nest Industries.

The thermal dryer will be protected by a standpipe with four (4) hose racks, each with 100 feet of $1\frac{1}{2}$" hose. A post indicator valve outside the building and a manual drain will be provided.

The sampling station will be protected by a standpipe with three (3) hose racks, each with 100 feet of $1\frac{1}{2}$" hose. A post indicator valve outside the building and a manual drain will be provided.

The clean coal reclaim tunnel and emergency stockpile reclaim tunnel will be protected by two (2) dry pipe valves in valve houses, and automatic sprinkler systems covering the areas. There will also be standpipes with seven (7) hose racks, each with 100 feet of $1\frac{1}{2}$" hose to cover the area.

The railroad loadout facilities will be protected by a standpipe with five (5) hose racks, each with 100 feet of $1\frac{1}{2}$" hose. A post indicator valve outside the building and a manual drain will be provided.

The truck dump will be protected by a standpipe with three (3) hose racks, each with 100 feet of $1\frac{1}{2}$" hose. A post indicator valve outside the building and a manual drain will be provided.

The raw coal reclaim tunnel will be protected ay a dry pipe valve in an adjacent valve house, and an automatic sprinkler system covering the entire area. There will also be a standpipe with eight (8) hose racks, each with 100 feet of $1\frac{1}{2}$" hose to cover the area.

(Unit No. 141 - Cont'd)

The rotary breaker building will be protected by a standpipe with five (5) hose racks, each with 100 feet of 1½" hose. A post indicator valve outside the building and manual drain will be provided.

The preparation plant will be protected by standpipes, with eleven (11) hose racks, each with 100 feet of 1½" hose. A post indicator valve outside the building and a manual drain will be provided.

All exterior conveyors will be protected by standpipes with 1½" hose valves at 250 foot intervals. Manual shut-off and drain valves will be provided for each standpipe.

All valve houses will have heat, light, and a water motor type fire alarm gong. All fire protection equipment will be Underwriters Laboratories-Factory Mutual approved where applicable.

Unit No. 142 - Process Piping

Piping, complete with valves, sprays and special platework will be furnished for the circuits of flow indicated.

Pipe 2½" and larger will be welded with necessary flanged joints or coupled sections. Pipe 2" and smaller will be threaded. Pipe will be standard black steel, Schedule 40 except where abrasive wear is expected in which case Schedule 80 will be used.

All fittings will be of the same class as the pipe with which they are used. Flanged connections will be forged steel weld neck flanges. Screwed fittings will be black malleable iron except for potable water piping which will be galvanized.

(Unit No. 142 - Cont'd)

Valves $2\frac{1}{2}$" and larger will be cast iron bodied, 125# minimum

Valves 2" and smaller will be bronzed bodied, 125# minimum

Roof and floor drain piping will be 4" minimum and sized to avoid plugging.

Unit No. 143 - Plumbing

One (1) wash house will be provided near the plant. It will contain a men's change room with three (3) showers, two (2) water closets, and a three-man lavatory with necessary piping. The wash house will also contain one (1) women's change room and one (1) foreman's change room, each with one (1) shower head and stall, one (1) lavatory, and one (1) water closet. A lunch room, with a 7 GPH water cooler, will be provided. Hot water will be obtained from a 600 gal. phenolic lined storage type hot water heater with 100 GPH recovery.

One (1) toilet room will be provided in the preparation plant. It will contain one (1) urinal, one (1) water closet, one (1) lavatory, a twelve (12) gallon electric hot water heater, and all necessary piping.

Unit No. 144 - Sewage Treatment

Sewage piping (cast iron soil pipe) will be provided in the preparation plant and change house, and to a point 5'-0" outside these buildings. Crows Nest Industries will provide sewage treatment and connecting piping.

Unit No. 145 - Fuel Supply System

Underground storage facilities for No. 2 fuel oil will be located as follows:

Division	Location	Gallons Storage
1	Truck Dump	6,000
4	Preparation Plant	50,000
9	Railroad Load-Out	6,000

Unit No. 146 - Not Used.

Unit No. 147 - Diesel Generator

One (1) 200 KW standby diesel generator set as manufactured by Harper Detroit Diesel Ltd. For details see Electrical Specifications.

Unit No. 148 - Change House Equipment

The following items will be provided in the change house:

Lockers

Thirty-six (36) full length lockers will be provided for the wash-house change room. Twenty-six (26) lockers will be for the male laborers, five (5) lockers for the plant foremen and five (5) lockers for female laborers.

Hanging Baskets

Thirty-one (31) hanging baskets - 26 for men, 5 for women - complete with all chains, pulleys and hooks, to be suspended from the ceiling for work clothes.

Benches will be provided in the change room as required.

Unit No. 149 - Laboratory Equipment

The following basic equipment will be provided in the coal laboratory together with the required auxiliary equipment:

1 ea. - Texas Nuclear Model 9200 Ash Analyzer

1 ea. - Preiser/Minco Air Drying Oven with 3 - 500 Watt Blast Heaters

1 ea. - Pulverizer, Holmes, Model 500, 6 x 2

1 ea. - Crusher, Bucking Board Type, Model A

2 ea. - Sieves, U.S. Standard, ASTM, 8" dia. No. 60, SS Cloth, SS Frame

1 ea. - Balance, Analytical, Satorious, Model 2403 with Built-in Manual Tare to 50 Grams

1 ea. - Furnace, Muffle, Hoskins, Type FD-204, 230 Volt

1 ea. - Oven, Labline, Imperial, 200°C, Small

1 ea. - Temco Meter Controller, Model CP-510T, Complete with Chromel-Alumel Thermo-couple and Indicat. Pyrometer

1 ea. - Calorimeter, Parr, Adiabatic, Oxy. Bomb Calormeter, complete with accessories for calorimetric determination

1 ea. - Preiser/Mineco Model 200 Five Minute Coal and Coke Sulfur Analyzer Assembly, Complete with Accessories

1 ea. - Sole-Heated Oven, Complete with Accessories

Unit No. 150 - Machine Bolts

All machine bolts will be provided for proper assembly and installation of all machinery and platework.

BLANK

BLANK

BLANK

3.2 Belt Conveyors - General Specifications

The following standards will be common to the belt conveyors listed in this report:

a. Shafting will be fabricated from SAE C-1045 steel for shafts up to 6" diameter. Over 6" diameter shafts will be C-4140 hot rolled steel.

b. Shafts will be designed to limit deflection to 0.010" per foot of bearing centers.

c. Bearings will be split housing pillow blocks, high capacity, self-aligning, spherical roller bearings, with labyrinth seals, SKF, or equal.

d. All belt take-ups will be of the automatic gravity type.

e. All pulleys will be of welded steel construction with compression hubs and sized according to belt manufacturer's recommendations. They will be adequately designed for the loads imposed on them and will be manufactured by Van Gorp, or equal.

f. All drive pulleys will be lagged with 3/4" minimum herringbone vulcanized rubber, 60 durometer.

g. All other pulleys will be lagged with 1/2" vulcanized soft rubber (50 durometer) lagging.

h. Belt cleaners will be multiple blade spring loaded type with ceramic blades, Martin Engineering, or equal.

i. All inclined conveyors will have holdbacks installed on the head shaft.

(3.2 - Cont'd)

j. Conveyor carrying idlers will be medium duty Cema IV, 35° - 3-roll, taper roller bearing idlers with 6" dia. steel rolls, except Unit No's. 119 and 120 carrying idlers will be heavy duty Cema V. Transition and impact idlers will be provided where required.

k. Return idlers will have 6" dia. steel rolls.

l. Self-aligning carrying and return idlers will be provided, spaced at approximately 100 ft. centers.

m. Carrying idlers will be spaced at 4 ft. centers and return idlers at 10 ft. centers.

n. All belting will be Goodrich Flexseal Longlife, or equal. Belt covers will be 3/16" top cover and 1/16" bottom cover.

o. All belts will have vulcanized splices in accordance with belt manufacturer's recommendations.

p. All conveyor drives will have motor shaft connected through a Falk Steelflex, or equal, coupling to the high speed shaft of the speed reducer. The low speed reducer shaft also will be connected to the drive pulley shaft with a Falk Steelflex, or equal, coupling.

q. All speed reducers will be Jones, or equal, parallel shaft or concentric shaft. All will be rated with AGMA 1.25 service factor on calculated horsepower.

Thermal rating of reducers shall equal or exceed motor horsepower.

(3.2 - Cont'd)

(q.)

All speed reducers driven by 125 HP or larger motors will be parallel shaft type. Speed reducers with up to 100 HP motors will be concentric type.

r. All drives will be guarded in accordance with OSHA regulations.

s. All conveyors will be equipped with full length safety stop pull cables.

3 Pumps

3.3.1 Pumps - Horizontal Slurry

All solids handling pumps will be Goyne Pump Co., (or equal) with vari-speed V-belt drives.

All pumps will have Ni-Hard impellers and casings.

Unit No. Description	31 Heavy Media	42 Clarified Underflow	43 Clarified Water	44 Overdense Media	51 Table Cyclone Feed	58 Dilute Media
No. Furnished	2	1	1	1	2	1
No. Operating	2	1	1	1	2	1
Capacity-GPM ea.	3033	917	1350	1000	3500	2234
% Solids by weight	50.7				9.4	
Specific Gravity	1.49	1.5	1.0	1.9	1.03	1.02
Max. Size Particle	2	½mm		200mm	1/2mm	-100mm
Total Dynamic Head-Ft.	94	75	114	26	143	40
Inlet/Outlet Size	12"/10"	6"/6"	6"/6"	8"/8"	12"/10"	10"/8"
Type	500-1	478-1	478-1	512-1	550-1	512-1
Speed: RPM	835	925	1180	575	800	700
Motor: HP	250	40	100	40	250	50
Motor Speed	1200	1800	1800	1800	1200	1800

3 Pumps

3.3.1 Pumps - Horizontal Slurry (Cont'd)

All solids handling pumps will be Goyne Pump Co., (or equal) with vari-speed V-belt drives.

All pumps will have Ni-Hard impellers and casings.

Unit No. Description	59 Filtrate	60 Centrifuge Effluent	61 Flotation Feed	73 Thickener Underflow	74 Clear Water	75 Tailings
No. Furnished	1	1	2	2	2	1
No. Operating	1	1	2	1	1	1
Capacity-GPM ea.	1302	363	3092	301	3310	307
% Solids by weight	.5	5.4	4.9	25		
Specific Gravity	1.00	1.01	1.01	1.11	1.0	1.01
Max. Size Particle	28M/100m		-100mm	-200mm	28m	28m
Total Dynamic Head-Ft.	32	82	58	81	101	51
Inlet/Outlet Size	8"/8"	4"/4"	10"/8"	4"/4"	12"/10"	4"/4"
Type	512-1	952-3	512-1	952-3	550-1	952-3
Speed: RPM	630	107	1000	790	700	560
Motor: HP	25	20	100	20	150	10
Motor Speed	1800	1800	1800	1800	1800	1800

3.3.1 Pumps - Horizontal Slurry (Cont'd)

All solids handling pumps will be Goyne Pump Co., (or equal) with vari-speed V-belt drives.

All pumps will have Ni-Hard impellers and casings, except Unit No. 76 which will have acid trim.

Unit No. Description	76 Scrubber Effluent	77 Gland Water	106 Scrubber			
No. Furnished	1	1	1			
No. Operating	1	1	1			
Capacity-GPM ea.	1500	160	1240			
% Solids by weight	-	-	-			
Specific Gravity	1.0	1.0	1.0			
Max. Size Particle	-	-	-			
Total Dynamic Head-Ft.	53	155	70			
Inlet/Outlet Size	8"/8"		8"/8"			
Type	512-1		512-1			
Speed: RPM	630	1750	630			
Motor: HP	30	15	40			
Motor Speed	1800	1800	1800			

3.3.2 Pumps - Vertical Slurry

All sump pumps will be Goyne Pump Co., (or equal) heavy duty pumps with V-belt drives.

All pumps will be vertical and have Ni-Hard impellers and casing.

Unit No.	39	131-1	131-2	131-3	131-4	131-5	131-6
Description	Magnetite Unloading	Truck Dump	R. C. Reclaim	R. C. Reclaim	Refuse Thickener	Cl. C. Reclaim	Cl. C. Reclaim
No. Furnished	1	1	1	1	1	1	1
No. Operating	1	1	1	1	1	1	1
Capacity-GPM ca.	300	150	150	150	150	150	150
% Solids by weight	60	7	7	7	7	7	7
Specific Gravity	1.9	1.01	1.01	1.01	1.01	1.01	1.01
Max. Size Particle	100 mesh	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Total Dynamic Head-Ft.	68	120	50	120	50	103	76
Inlet/Outlet Size	3"	3"	3"	3"	3"	3"	3"
Type	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB
Speed: RPM	1250		1150		1150		1370
Motor: HP	10	20	$7\frac{1}{2}$	20	$7\frac{1}{2}$	15	10
Motor Speed	1800	1800	1800	1800	1800	1800	1800

3.3.2 Pumps - Vertical Slurry (Cont'd)

All sump pumps will be Goyne Pump Co., (or equal) heavy duty pumps with V-belt drives.

All pumps will be vertical and have Ni-Hard impellers and casing.

Unit No. Description	131-7 Emerg. Stock-out Tunnel	131-8 Prep. Plant Clean-Up	131-9 Breaker Bldg.	131-10 Prep. Plant Elevator	131-11 Dryer Bldg.	131-12 Sampler Bldg.	131-13 Transfer Tower
No. Furnished	1	1	1	1	1	1	1
No. Operating	1	1	1	1	1	1	1
Capacity-GPM ea.	150	150	150	150	150	150	150
% Solids by weight	7	7	7	7	7	7	7
Specific Gravity	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Max. Size Particle	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Total Dynamic Head-Ft.	32	76	103	50	76	76	32
Inlet/Outlet Size	3"	3"	3"	3"	3"	3"	3"
Type	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB	3-400 VB
Speed: RPM	950	1370		1150	1370	1370	950
Motor: HP	5	10	15	7½	10	10	5
Motor Speed	1800	1800	1800	1800	1800	1800	1800

4.0 ELECTRICAL

4.1 General

4.1.1 Electrical design and equipment shall conform to the following codes and specifications:

a. Canadian Electrical Code, Part 1 and Part 5.

b. Canadian Electrical Manufacturer's Association.

c. Institute of Electrical and Electronic Engineers.

d. I.P.C.E.A.

e. British Columbia CMRA Regulations.

4.1.2 Area Classification

Electrical equipment and enclosures shall be classified per location in accordance with CMRA and CSA, as listed below:

4.1.2A Class II Div. 2 Group F (Coal Dust)and Class I Div. 2 Group D (Methane Gas).

a. Truck Dump Bottom.

b. Top and Bottom of Raw Coal Storage Building.

c. Reclaim Area of Emergency Clean Coal Stockpile.

d. Top and Bottom of Clean Coal Storage Building.

e. Top of Raw Coal Truck Bin.

4.1.2B Class II Div. 2 Group F (Coal Dust) Only.

a. Rotary Breaker Building.

b. Raw Coal Transfer Tower.

c. Preparation Plant.

(4.1.2B - Cont'd.)

d. Dryer Building.

e. Sample Building.

4.1.2C CEMA Type 4 (Water-tight)

a. Rock Bin Conveyor and Rock Bin

b. Refuse Conveyor.

c. Thickener Building.

d. Emergency Stockout Conveyor.

e. Load-Out Bin

4.1.2D CEMA Type 1A (Gasketed)

a. Pressurized Motor Control Center Rooms (Raw Coal, Preparation Plant, Dryer, Clean Coal and Load-Out).

b. Operator's Rooms (Preparation Plant and Load-Out).

c. Any Pressurized Motor Room.

4.2 Power Distribution

4.2.1 Owner shall supply 4160 volt, 3 phase, 60 hertz power at their main substation and distribute underground feeder cables to:

480 Volt Outdoor Substation at Raw Coal Storage
480 Volt Outdoor Substation at Preparation Plant
480 Volt Outdoor Substation at Clean Coal Storage
4160 Volt Starter in Dryer Building
4160 Volt Starters in Clean Coal Load-Out Area

4.2.2 The three outdoor substations shall be rated 4160-480Y/277 volts, 3 phase, 60 hertz. Each substation shall consist of an air filled 5 KV compartment containing a 3 pole fused, load break switch integrally mounted to an oil cooled outdoor transformer equipped with the following:

a. Provisions for cooling fans.

b. No load tap changers.

c. Solidly grounded neutral.

Mounted integrally with the transformer shall be a secondary compartment containing draw-out type circuit breakers with ground fault protection.

4.3 Motor Control Centers

4.3.1 All 480 volt Motor Control Centers shall be self-supporting, floor-mounted, metal clad sections of NEMA Type 1A gasketed enclosures. They shall be dead front 90'' high, 20'' deep with units mounted back-to-back or front mounted, depending on space limitations. Wiring classification shall be NEMA Class 1, Type B. Each Motor Control Center's horizontal bus shall be sized for the total connected load (600 amp. minimum) and shall be braced to withstand 42,000 R.M.S. amperes symmetrical. The vertical copper bus shall be sized 300 amp. minimum. A horizontal copper ground bus shall also be included.

All starters through Size 4 shall be plug-in connection on vertical bus. Size 5 and 6 starters shall be bolted connection. All control

(4.3.1 - Cont'd.)

connections shall be made with split screw type terminal blocks. Terminal strips and device terminals shall be accessible before and after control center is fully wired. Starter units shall be circuit breaker combination type. Each control center will have at least 20% of spare capacity for future additional starters.

4.3.2 Each Motor Control Center shall contain an ammeter and voltmeter on the incoming line, each with a three phase switch and insulated from primary circuits by means of suitable transformers.

4.3.3 Each full voltage motor starter shall include:

a. Individual 460/115 volt control transformer with one side of secondary fused and the other side grounded.

b. Three ambient compensated inverse time thermal overload elements. Overload relays shall be dual manual automatic reset type, operated from outside of the door.

c. One normally open and one normally closed auxiliary contact per mainline contactor, in addition to any required control circuit interlock shall be provided.

d. Provision for locking circuit breaker open with enclosure door both open or closed with minimum of three padlocks.

e. Name and unit number of each drive on each starter door, using nameplates with black letters on white background.

f. Continuous vertical wireway in each vertical section.

(4.3.3 - Cont'd.)

g. Starter sizes shall be selected as follows:

Motor Horsepower	NEMA Starter Size
1/4 - 10	1
15 - 25	2
30 - 50	3
60 - 100	4
125 - 200	5
250	6

4.3.4 Feeder circuit breakers shall be of the visible break type with external and internal operators. Each breaker shall be provided with means of locking it open with enclosure door both open or closed with three padlocks. Name of device fed by feeder breaker shall appear on enclosure door. Feeder breakers shall be dual mounted.

4.3.5 Wound rotor starter shall consist of CEMA standard Step-Start with acceleration limited to 150%. Resistors shall be corrosion resistant cast grid frame CEMA 135. The resistors shall be enclosed in a vertical section and connected in the starter line-up.

4.3.6 Starters for motors over 150 HP will include Power Factor Correction Capacitors, including protection fuses to be switched with the motor and to be within the maximum rating recommended by IEEE.

4.3.7 Hour meters shall be provided for centrifuges and all solids handling pumps except sump pumps. They shall be mounted with their respective starters.

4.3.8 Current transformers for panel mounted ammeters shall be mounted in starters for all process pumps, major conveyors, and major process equipment.

4.4 Medium Voltage Starters

Starters shall be rated 5000 volt, 3 phase, 60 hertz, for full voltage starting of 4160 volt, squirrel cage, induction motors above 250 HP. Starters shall be CEMA Class E2 fused type, 350,000 KVA IC. Line contactors shall be rated 200 amperes minimum, 5 KV (50,000 KVA IC). Starters shall be indoor type, metal-clad, dead-front, self-supporting steel structures. Maximum two (2) high starter construction shall be provided. Line contactors shall be draw-out type and shall be controlled by D.C. operating coil supplied from a single phase, full wave rectifier. Three (3) thermal overloads and time delay undervoltage protection shall be provided with each motor starter. Each starter shall include a control transformer, 120 volt secondary with one (1) side fused and the other side grounded. One normally open and one normally closed auxiliary contact in addition to any contacts required for control circuit interlocks, shall be provided. Starters shall include power factor correction capacitors including protection fuses to be switched with the motor and to be within the maximum rating recommended by IEEE.

Wound rotor motor starter shall include manufacturer's standard number of points of acceleration for motor horsepower. Resistors shall be corrosion resistant cast grid frame NEMA 135.

Instrumentation for starters shall be one (1) ammeter with 3 phase transfer switch and necessary current transformers. Starters for pumps shall have elapsed time meters also.

4.5 Electrical Rooms

All Motor Control Centers and High Voltage Starters shall be mounted in enclosed rooms, pressurized to maintain 1/2" external W. G. pressure to prevent dust from entering. The room floor shall be elevated 2" above the area floor. Walls and ceiling shall be constructed to prevent the entrance of water.

4.6 Operator's Panels

4.6.1 General

All vertical and desk type control panels shall be self-supporting, NEMA 1A enclosure, primed and finished with grey paint. They shall be mounted in a heated, air-conditioned room with the floor 2" above surrounding floor to prevent water entrance.

Oil tight, illuminated type pushbuttons shall be used for starting and stopping of all equipment controlled from the panels.

Color coding shall be as follows:

Start or running	-	Red
Stop or Ready	-	Green
Reverse or Gate Position	-	White
Forward or Gate Position	-	Blue
Full Bins, etc.	-	Amber

Each pushbutton shall have an oversized legend plate denoting function. Each set of pushbuttons shall include an engraved plastic nameplate 3" x 1" in size, describing unit number and unit description. Letters shall be black with white background.

(4.6.1 - Cont'd.)

Ammeters (Section 4.3.8) and an alarm annunciator warning the operator of equipment failure, shall be mounted on all panels as needed.

115 volts, single phase, 60 hertz, A.C. power shall be supplied to each control panel from a separate instrument panelboard mounted in the operator's room.

All panel mounted equipment shall be completely wired to terminal blocks. Terminal blocks shall be used for all electrical lines leaving a panel except for annunciator cabinets and special cables. Pushbuttons and instruments shall be provided to follow the general flow pattern of the process.

Terminal blocks shall have pressure type connectors. A full compliment of terminals for off-panel wiring shall be provided. There shall be spare stations and terminals supplied with the panel. Terminal blocks shall be mounted on vertical surfaces and shall be identified with corresponding unit number and individual wire number.

4.6.2 Main Operator's Panel

One (1) main control panel, vertical type, 7'-6" high x 2'-0 deep, shall be furnished for the preparation plant. This operator will control all equipment from the truck dump feeder to the clean coal storage tripper conveyor, including the emergency raw coal and clean coal stocking-out systems and the clean coal reclaim system, but excluding the thermal dryer. This panel shall be self-supporting and mounted on shock type absorbers.

(4.6.2 - Cont'd.)

In addition to the equipment mentioned in 4.6.1, this panel shall include:

a. Torque alarm, rake ammeter and rake level indicators for both thickeners.

b Instrumentation necessary for process control. (See Instrumentation)

c. Tonnage indication, recorder and totalizer from the two belt scales (one on the plant feed conveyor and one on the clean coal tripper conveyor).

d. Control of raw coal reclaim feeders.

e. An annunciator panel to warn operator of abnormal plant operation.

4.6.3 Dryer Operator's Panel

One vertical type control panel, mounted in the electrical room of the dryer, shall include all pushbuttons, instrumentation and alarms for the complete control of the dryer.

4.6.4 Load-Out Operator's Panel

One desk-type control panel mounted in a control room, overlooking the coal discharge into railroad cars shall include all pushbuttons, instrumentation and alarms for all equipment from the clean coal reclaim feeders to the loadout equipment. Instrumentation shall include batch loading meters and control, clean coal feeders' variable feed control and rate percentage and alarm indication.

4.7 Motors

4.7.1 General

All motors shall be suitable for continuous duty operation at 4300 feet above sea level and for a temperature range of minus 42°F through plus 104°F ambient without exceeding the insulation temperature set forth by CEMA. Breakdown torque shall conform to CEMA standards. Bearings shall be anti-friction type. All motors rated 460 volt, 3 phase, 60 hertz shall be manufactured per CEMA, T-frame design where possible. All 4160 volt, 3 phase, 60 hertz motors shall also be equipped with a thermal protective device mounted in the motor winding. Motors above 400 HP shall be equipped with a space heater.

All motors shall include the following:

a. Constructed for severe duty.

b Oversize, cast type, conduit box with ground terminal.

c. Eyebolts for lifting.

d. Slide base with double screw adjustment for all V-belt drives.

e. Fans shall be of non-sparking material.

4.7.2 Motor enclosures shall match environment in which they are mounted, as per Section 4.1.2.

a. Under 3 HP, motor enclosures shall be totally enclosed, non-ventilated.

b. Motors mounted in Class I, Group D, Div. 2 and Class II, Group F, Div. 2 environment shall be TEFC enclosed if insulation can be

(4.7.2 b. - Cont'd.)

limited to Type B. Otherwise, they shall be explosion-proof, as per CSA Section 18-260.

4.8 Interlocking

All material handling equipment shall be interlocked to provide proper start-up and shut-down. This will prevent material pile-up and protect equipment.

4.9 Grounding

A complete grounding system shall be furnished so that maximum system ground-to-earth shall be 3 ohms. Underground, bare copper wire shall be installed around the exterior of buildings and attached to building columns with Cadweld, or equal, process. Motors in excess of 75 HP, Motor Control Centers, transformers, switchgear, etc., shall be attached to this system. Motors less than 75 HP shall be grounded to building steel. Ground rods shall be driven at intervals along the ground loop and bonded to the system.

4.10 Miscellaneous Electrical

4.10.1 All conveyors shall be equipped with emergency stop pull cords mounted on either side, where conveyor is accessible. The switches shall be of the manual reset type. In addition, speed switches shall stop a conveyor when its speed falls below 80% of the specified speed. High bin switches shall be mounted on all conveyors feeding bins. Plugged chute switches shall be mounted in chutes where one conveyor dumps onto another conveyor.

4.10.2 All equipment that is controlled from one of the control panels shall be equipped at the motor with a three-position selector switch, hand-off-automatic.

4.10.3 Raw coal and clean coal storage tripper conveyors shall be operated automatically by loading different types of coal in their segregated piles. When the high bin indicator senses full bin and the tripper approaches the end of the pile, an alarm horn shall warn the plant operator. If coal engages the chute plug switch, it shall stop the tripper, feed conveyor and other interlocked equipment.

4.10.4 Sirens shall be provided throughout the area to signal plant start-up or emergency.

4.11 Lighting

4.11.1 Lighting in electrical rooms and operator control rooms shall be maintained at (50) foot-candles using fluorescent fixtures.

General plant lighting inside shall be a minimum of (15) foot-candles at thirty (30) inches above the floor using 150 watt high pressure sodium vapor lamps in approved fixture enclosures. All pendant mounted fixtures shall be supported by conduit and braced per CSA. Three (3) foot-candles shall be maintained in aisle walkway of enclosed conveyor galleries using sodium vapor fixtures. Open galleries shall be lit by sodium vapor floodlights and individual 150 watt staunchion mounted fixtures, controlled by photocells, to maintain (3) foot-candles.

(4.11.1 - Cont'd.)

General plant exterior lighting shall be furnished by the Owner, with the exception of the emergency clean coal stockpile which shall be flood lit from the conveyor.

All sodium vapor lighting shall have high power factor ballasts and all fluorescent lighting shall have rapid start ballasts.

Emergency stair lighting, in all buildings, shall be accomplished by using 300 watt incandescent lamps in vapor-tight explosion-proof fixtures. Incandescent lighting shall be incorporated into the emergency power supplied by the generator.

4.11.2 Lights shall be controlled from lighting panels only. Lighting panelboards shall be two-pole, 3-wire, with individual 20 amperes circuit breakers to provide power for lights and convenience outlets. At least thirty (30) percent spare breakers shall be provided in the panelboard. Total lighting load on a circuit shall not exceed 1600 watts.

Lighting transformers shall be rated 480 - 240/120 volts, 1 phase, 60 hertz, dry type. At least twenty-five (25) percent spare transformer capacity shall be provided.

4.12 Conduit

All conduit and fittings shall be Underwriter's approved, rigid steel, heavy wall, hot-dip galvanized, with screwed condulets, pull boxes, and fittings.

Minimum size of rigid conduit shall be 3/4". Flexible conduit shall be used to make connections to motors and electrical equipment

(4.12 - Cont'd.)

that are required to move or are subject to excessive vibration. Where used, the flexible conduit shall be water-tight, PVC jacketed. Conduit passing from hazardous area to a non-hazardous area shall have stuffing boxes or be installed in accordance with CSA - Section 18-106 and 18-156.

4.13 Wire

All wire and cable shall be installed in conduit and in a manner so as not to damage the insulation.

All power and control cable shall be 600 volt insulated, Type THW or THHN. All control wire shall be minimum No. 14 AWG. Minimum power wire size shall be #12 AWG.

5000 volt insulated cable shall be Type RHH or RHW shielded and grounded. All 5000 volt cable splices and terminations shall be made with cable stress cones.

Circuits of different voltages (480 volt power and 115 volt control) shall be included in one conduit, providing that conduit is for the same unit and wire insulation is 600 volt. (CSA Section 12.1004-2b)

The installation of wires and cables will include the furnishing and installing of all hangers, racks, cable cleats, conduit, fittings, and supports that may be necessary to make a neat, substantial wiring installation. On long conveyors, conduit runs shall include expansion unilets.

In connecting wires and cables to apparatus, solderless connectors, in general, shall be used for terminals, also for taps and splices for all wire and cables. Connectors generally will be of the tapered sleeve

(4. 13 - Cont'd.)

type and will be sufficiently large to enclose all strands of the conductors.

All power wires shall be single conductor. Control wires shall be single conductor, except between Motor Control Centers and the control panels which may be multi-conductor.

All control wires between control devices on individual units, such as between emergency stop switches, shall be brought back to its starter in the Motor Control Center and tagged at the terminal strip with unit number and wire number. This will allow for trouble-shooting at only one location.

4. 14 Emergency Power

A diesel electric unit shall be sized to furnish 480 volts, 3 phase, 60 hertz power in the event of power failure. This unit shall provide power to:

a. Thickener rakes.

b. Heating furnace, or

c. Electric heaters for propane or fuel oil pumps.

d. Incandenscent emergency lighting over stairs and doors in buildings and some outdoor area lighting.

This unit shall be automatically energized through a transfer switch on loss of power or by manual operation.

4.15 Communications

A closed circuit intercom system of the page-party type and consisting of a page, to be broadcast on all loud speakers, and one party line to be heard on all hand sets. Individual units to consist of an amplifier, loud speaker and hand set with page-party control. They shall be mounted:

Truck Dump
R.C. Transfer Tower
R.C. Storage Bottom
Breaker Building
Preparation Plant Top
Preparation Plant Operator's Room
Preparation Plant Electrical Room
Preparation Plant Ground Floor
Preparation Plant Lunch Room
Dryer Control Room
Dryer Ground Floor
Refuse Bin Bottom
Sample Building
Clean Coal Storage Bottom
Load-Out Control Room
Laboratory

4.16 Instrumentation

Pneumatic instruments will be used for control and indication. Differential pressure (D/P) cells will be used on sumps for level indication, on pipes for pressure indication, and on density tubes for density indication. The 3 to 15 psi signal from the D/P cells will be connected to the control and indication instruments on the control panel using polyethylene tubing. The tubing will be in conduit to provide protection from any mechanical damage. All connections from the polyethylene tubing to pipe and to the instruments will be made using fittings to insure no air leaks. All D/P cells will be supplied with adjustable pressure regulator and filter. An instrument air compressor and an air dryer will be used to produce instrument supply air. Instrument air will be dried to -40°F dew point.

The main control panel in the preparation plant will have a supply header which will provide air for all instruments. All instruments on the control panel will be of the vertical scale type except for the density controls which will be 12" circular chart recorder/controllers.

The instruments used for indication only will be as follows:

Level - Overdense Media Sump
Specific Gravity - Overdense Media Sump

The instruments used for indication and recorder/controllers will be as follows:

Level - Heavy Media Sump (2)
Specific Gravity - Heavy Media Sump (2)

(4.16 - Cont'd.)

All the indication and recorder/controller instruments on the control panel will have balanceless-bumpless type control. The operator will be able to transfer from automatic-to-manual and from manual-to-automatic without upsetting the control system. The operator will be able to manually control the system from the control panel. All the controllers will have proportional-plus integral-plus derivative control.

The level control on the overdense and heavia media sumps will consist of a D/P cell mounted in the side of the sumps supplying a 3 to 15 psi signal that is directly proportional to the level of the sump. The level of the heavy media sumps will be controlled by splitting off media from the drain and rinse screen. The level of the overdense media sump will only be indicated on the control panel.

Specific gravity of the overdense media sump will be indicated by an indicating instrument on the operator's panel and controlled manually by the operator. The specific gravity for the overdense media sump will be measured on the pump discharge side. Specific gravity control for the heavy media sumps will use a 12" circular chart recorder/controller. On the heavy media circuits, the specific gravity will be measured on the collection pipe from the drain and rinse screens and the feed from the overdense media sump. Splitter boxes will be used on the overdense media circuit to add the heavy media in the appropriate circuit. On all splitter boxes, an air cylinder and a power positioner will be furnished.

All the vertical scale instruments will be supplied with short shelves and grouped together on the control board in a logical order.

(4.16 - Cont'd.)

All instruments will be labeled so that they may be read from the front of the control panel or from the rear of instruments. All the instruments, except the 12" circular recorder/controllers, will be of the front pull-out type without interrupting indication or control of that instrument.

The instrument air header will have a low pressure switch that will be connected to the alarm panel and which will shut off plant feed on decreasing air pressure. Power for the instruments, 120 volts AC, will be from a separate circuit breaker from the lighting panel board located in the operator's control room.

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MOTOR LIST

Unit No.	Div.	Description	Quantity	HP/RPM
1	1	200 Ton Truck Dump Bin	1	-
2	1	Apron Feeder	1	25/1800
3	1	Dribble Flight Conveyor	1	2/1800
4	10	Raw Coal Conveyor	1	125/1800 W.R.
5	2	Raw Coal Bypass Gate	1	10/W-Unit
6	10	R.C. Truck Bin Conveyor	1	75/1800
7	2	150 Ton Truck Bin	1	-
8	2	Truck Loading Gate	1	7½/1800
9	2	Raw Coal Tripper Conveyor	1	100/1800
10	2	Raw Coal Tripper	1	3/1800
11				
12				
13				
14	2	Reclaim Feeder	10	3/W-Unit
15	2	R.C. Reclaim Conveyor	1	20/1800
16	10	R.C. Screen Feed Conveyor	1	75/1800
17	3	R.C. Vibrating Screen	1	20/1800
18	3	Rotary Breaker		60/1800
19	10	Rock Bin Conveyor	1	25/1800
20	3	150 T. Rock Bin	1	-

(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
21	3	Rock Bin Gate	1	7½/1800
22	10	Plant Feed Conveyor	1	60/1800
23	10	Plant Feed Belt Scale	1	-
24	4	Magnet Cleaning Conveyor Electro-Magnet	1	3 HP/W-Unit 3750 Watts W/Unit
25	4	Plant Feed Sampler	1	1½ W/Unit
26				
27				
28	4	Raw Coal Distributor	1	-
29	4	Desliming Sieve Bend	6	-
30	4	Desliming Screen	6	2 @ 7½/1800
31	4	Heavy Media Pump	2	250/1200
32	4	Heavy Media Cyclone	6	-
33	4	Coarse Refuse Sieve Bend	2	-
34	4	Coarse Refuse D&R Screen	2	2 @ 10/1800
35	4	Coarse Coal Sieve Bend	6	-
36	4	Coarse Coal D&R Screen	6	2 @ 10/1800
37	4	Coarse Coal Centrifuge	2	(50/1200- Drive (7½/1800- Agitator (¼ w/Unit-Oil Pump
38	4	Magnetite Hopper	1	-
39	4	Magnetite Pump	1	10/1800 W-Unit
40	4	Magnetite Sieve Bend	1	-

16

(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
41	4	Clarifier Thickener	1	($7\frac{1}{2}$ W/Unit - Rake (1 W/Unit - Lift
42	4	Clarifier Underflow Pump	1	40/1800
43	4	Clarified Water Pump	1	100/1800
44	4	Overdense Media Pump	1	40/1800
45	4	Magnetic Separator	2	2 @ 5 W/Unit
46	4	Dense Media Splitter)		
47	4	Density Controller)	Instrumentation	
48	4	Level Controller)		
49				
50				
51	4	Table Cyclone Feed Pump	2	250/1200
52	4	Classifying Cyclone	8	-
53	4	Table Distributor	2	-
54	4	Deister Table	10	3/1200 W/Unit
55	4	Bird Filter By-Pass	2	Solenoid
56	4	Bird Filter	2	150/1200 W.R.
57	4	Refuse Centrif. Distributor	1	-
58	4	Dilute Media Pump	1	50/1800
59	4	Bird Filtrate Pump	1	25/1800
60	4	Bird Effluent Pump	1	20/1800
61	4	Flotation Feed Pump	2	100/1800

(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
62	4	Classifying Cyclone	18	-
63				
64	4	Flotation Cell Blower	1	50/3600
64	4	Reagent Feeder	2	1/8 115v. W/Unit
65 - 66	4	Skimmer	4	1/4 115v. W/Unit
65	4	Flotation Cell (Bank of 5)	1	5 @ 30/1200
66	4	Flotation Cell (Bank of 5)	1	5 @ 30/1200
67	4	Bird Polisher By-Pass	4	Solenoid
68	4	Bird Polisher	4	250/1200 W.R.
69	4	Bird Distributor	1	-
70				
71	4	Flocculation System	1	4 @ 5 W/Unit
72	5	Fines Thickener	1	2 @ 5 W/Unit - Rake 3 W/Unit - Lift
73	5	Fines Thickener Underflow Pump	2	20/1800
74	4	Clear Water Pump	2	150/1800
75	4	Tailings Pump (Sump)	1	10/1800
76	6	Scrubber Effluent Pump	1	30/1800
77	4	Gland Water Pump	1	15/1800
78				
79	6	Dryer Feed Conveyor	1	50/1800
80	6	Dryer By-Pass Gate	1	7½/W-Unit

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(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
81				
82				
83				
84				
85	10	Refuse Conveyor	1	15/1800
86				
87				
88	6	Thermal Dryer		
89	6	Dryer Vibrating Feeder	1	15/1800
90				
91	6	Dried Coal Valve	1	10/1800
92	6	Dust Valve	4	5/1800
93	6	Dust Conveyor	3	10/1800
94	6	Inlet Fan	1	600/1200 H. V.
95	6	Inlet Damper	1	Actuator
96	6	Exhaust Fan	1	1500/1200 H. V. -WR
97	6	Exhaust Damper	1	Actuator
98				
99	6	Pulverizer Feeder	1	1 W/Unit
100	6	Pulverizer	1	125/1200
101	6	Air Temperature Damper	1	Actuator

(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
102	6	Water Valve	1	Actuator
103				
104				
105				
106	6	Scrubber Pump	1	40/1800
107	10	Sample Conveyor	1	25/1800
108	7	Sample System	2-Stage Power Pack	10/1800 W/Unit
109	7	Sample Vibrating Feeder	1	W/Unit
110	7	Sample Crusher	1	20/1800
111	8	Stockout Diverter Gate		7½/W-Unit
112	10	Emergency Stockout Conveyor		40/1800
113	10	Clean Coal Belt Scale		-
114	8	Clean Coal Tripper Conveyor		60/1800
115	8	Clean Coal Tripper		1½/1800
116	10	Emerg. Stockpile Reclaim Conv.		40/1800
117	8	Emerg. Stockpile " Feeder	3	3/1800 W-Unit
118	8	Clean Coal Reclaim Feeder	12	7½/1800 W-Unit
119	8	Clean Coal Reclaim Conveyor		100/1800
120	10	Loadout Bin Conveyor		400/1800 W.R.
121	9	Unit Train Loading System		50 W/Unit
122		" " " "		-

(MOTOR LIST - Cont'd.)

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Unit No.	Div.	Description	Quantity	HP/RPM
123				-
124				-
125	9	Oil Spray Equipment		2 @ 3 W/Unit
126	9	R.R. Track Scale		-
127				
128				
129				
130				
131		Sump Pumps:	13	
131-1	1	Truck Dump		20
131-2	2	Raw Coal Reclaim		7½
131-3	2	Raw Coal Reclaim		20
131-4	5	Refuse Thickener		7½
131-5	8	Clean Coal Reclaim Tunnel		10
131-6	8	Clean Coal Reclaim Tunnel		15
131-7	8	Emerg. Stockout Tunnel		5
131-8	4	Preparation Plant		10
131-9	3	Breaker Building		15
131-10	4	Elevator Pit		7½
131-11	6	Dryer		10
131-12	7	Sampler		10
131-13	2	Transfer Tower		5
132		Ventilation & Exhaust Fans:	30	
132-1	1	Truck Dump		2
132-2	2	Transfer Tower		
132-3	2	Raw Coal Reclaim Tunnel		2
132-4	4	Preparation Plant		
132-5	4	Preparation Plant		
132-6	4	Preparation Plant		
132-7	4	Preparation Plant		
132-8	4	Preparation Plant		
132-9	4	Preparation Plant		
132-10	3	Rotary Breaker		

(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
132-11	3	Rotary Breaker		
132-12	4	Magnetic Thickener		
132-13	4	Preparation Plant Toilet		
132-14	5	Refuse Thickener		
132-15	5	Refuse Thickener		
132-16	5	Refuse Thickener		
132-17	8	Clean Coal Storage Reclaim Tunnel		3
132-18	7	Sample Building		
132-19	8	Stockout Drive Tower		
132-20	9	Loadout		½
132-21	8	Emergency Stockpile Reclaim Tunnel		
132-22	6	Dryer		
132-23	6	Dryer		
132-24	6	Dryer		
132-25	11	Change House		
132-26	11	Change House		
132-27	11	Change House		
132-28	11	Change House		
132-29	11	Laboratory		
132-30	11	Laboratory		
133-1	4	Air Compressor - Prep. Plant		30/1800
133-2	4	Air Compressor - Instrument Air		7½/1800
133-3	6	Air Compressor - Dryer Building		20/1800
133-4	6	Air Compressor - Instrum. Air (Dryer)		7½/1800
134		Pressurizers & Air Cond.	11 + 4	
134-1	2	Transfer Tower		
134-2	3	Rotary Breaker		
134-3	4	Preparation Plant		
134-4	4	Preparation Plant		
134-5	6	Dryer Building		
134-6	6	Dryer Exhaust Fan Motor		
134-7	6	Dryer Pulv. Motor		
134-8	7	Sample Building		
134-9	9	Loadout		
134-10	9	Loadout		
134-11, 12	4	Prep. Plant Operating Room A. C.		
134-13	6	Dryer Operating Room A. C.		
134-14	9	Loadout Operating Room A. C.		
134-15	4	Elevator Mach. Room (Press.)		

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(MOTOR LIST - Cont'd.)

Unit No.	Div.	Description	Quantity	HP/RPM
135		Heating Units:		
135-1	1	Truck Dump		7½/1800
135-2	3	Breaker Building		10/1800
135-3	4	Preparation Plant		10/1800
135-4	4	Preparation Plant		15/1800
135-5	5	Refuse Thickener		15/1800
135-6	4	Magnetite Clarifier		7½/1800
135-7	7	Sample Building		7½/1800
135-8	6	Dryer Building		10/1800
135-9	9	Rail Loading		7½/1800
135-10	11	Laboratory		5/1800
135-11	11	Change Room		10/1800
136		Equipment Hoists	5	3 @ 15 W/Unit 2 @ 2 W/Unit
137		Platework		
138		Ductwork		
139	4	Plant Elevator	1	15 W/Unit
140		Fresh Water System		
141		Fire Protection		
142		Process Piping		
143		Plumbing, Incl. Fixtures		
144		Sewage Treatment		
145		Fuel Supply System		1 @ 10/1800 1 @ 5/1800 2 @ 1/1800
146				
147		Diesel Generator		
148		Change House Equipment		

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Unit No.	Div.	Description	Quantity	HP/RPM
149		Laboratory Equipment		
150		Machine Bolts		
151				
152				

5.0 STRUCTURAL

5.1 Truck Dump

The truck dump will consist of 20' x 76' x 28'-6" high, partly elevated reinforced concrete structure. Steel girders, covered with rail grillage will allow trucks to pass over the structure and dump raw coal into 200 ton capacity steel hopper. Hopper will be constructed of 3/8" plate. Sloping sides will be lined with 3/8" AR plates. 60" apron feeder under the hopper will feed coal onto the 48" raw coal conveyor. Concrete tunnel will house this conveyor until it reaches grade.

5.2 Raw Coal Transfer Tower

22' x 22' x 47' high enclosed steel structure will house head end and drive of raw coal conveyor, tail end and drive of tripper conveyor, tail end of truck bin feed conveyor, and electrical room. The structure will have a flat, built-up roof and grating floors and platforms.

5.3 Raw Coal Truck Bin

21' x 21' x 58' high steel structure will house head end and drive of truck bin conveyor and 150 ton raw coal bin. Bin will have $\frac{1}{4}$" sides and 5/16" hopper. Sloping sides will be lined with $\frac{1}{4}$" AR plates. Upper 40 ft. of the structure will be enclosed. The structure will have a flat built-up roof and checkered plate floors. Exterior stairs will provide access to upper floors.

5.4 Raw Coal Storage

434' x 100' wide structure will provide storage for 40,000 tons of coal. Lower part of structure will consist of reinforced concrete box extending 20 ft. below grade and 9'-6" above grade. Bottom slab will slope towards the center, where 11' x 11'-6" high concrete tunnel will support and house hoppers, feeders and reclaim conveyor. Access to this tunnel will be by stairwell at one end and sloping tunnel housing screen feed conveyor at the other end. Centrally located escape tube will provide a third access and ventilation.

Upper portion of raw coal storage structure will consist of steel "A" frames supporting roof framing, and at the top-tripper conveyor. Concrete ramps will provide access to each compartment for heavy equipment.

5.5 Breaker Building

31' x 60' x 45' high, enclosed steel structure will house head end and drive of raw coal screen feed conveyor, vibrating screen, rotary breaker, electrical room and tail ends of rock bin and plant feed conveyors. The structure will have a flat built-up roof and concrete floors.

5.6 Rock Bin

21' x 21' x 58' high steel structure will be identical to raw coal truck bin, except that it will have insulated siding. (See Para. 5.3)

5.7 Preparation Plant

The preparation plant will be an irregularly shaped, insulated building approximately 779,000 cu. ft. in volume, which will house and support

(5.7 - Cont'd)

mechanical equipment, conveyors, control room, motor control centers, etc. A small extension on the north side will house a 50' dia. magnetite clarifier. Access to upper floors will be provided by two stairwells and an elevator. A material well will facilitate equipment repairs or replacement. Plant will have a flat built-up roof and concrete floors.

5.8 Refuse Thickener

The 175 ft. dia. thickener will have a 6" concrete bottom and 9'-6" high 5/16" steel plate sidewalls with 2'-0 x 2'-6" overflow launder of ¼" steel (1 ft. freebord). Thickener will be enclosed with a flat built-up roof, placed about 4 ft. above top of sidewall. At center of the thickener a 12' x 12' enclosed gallery will provide access to machinery and support to built-up roofing. A concrete tunnel beneath the thickener will provide access to underflow pumps and sump pump. Enclosed gallery will connect to the preparation plant.

5.9 Thermal Dryer

The thermal dryer will be an irregularly shaped, insulated building which will house and support mechanical equipment, motor enclosure, operator's and electrical rooms, conveyor drives, etc.

5.10 Sampling Building

The sampling building will be an approximately 21' x 37' x 40' high structural steel insulated building which will house and support sampling equipment, conveyor drives, electrical room and laboratory (dirty room). The structure will have a flat, built-up roof, checkered plate lower floor and concrete upper floor.

5.11 Clean Coal Storage

500' x 100' wide structure will provide storage for 48,000 tons of coal. Except for length and tunnel size (14' x 12'-6 high) this structure will be identical to raw coal storage. (See Para. 5.4)

Additional open storage is provided in emergency clean coal stockpile. 11' x 11'-6 concrete tunnel will support and house hoppers, feeders and reclaim conveyor. 36" dia. corrugated pipe escape tube will also provide ventilation.

5.12 Loadout Bin

30' x 38' x 106' high structural steel, insulated building will house head end and drive of loadout bin conveyor, 210 ton surge bin, 105 ton weigh bin and electrical and operator's rooms. Sloping sides of both bins will have $\frac{1}{4}$" stainless steel liners. Lower part of building will be open to provide 22' clearance for railroad equipment. Building will have a flat built-up roof and concrete floors.

Concrete block structure at grade level will house oil spray pumps.

5.13 Belt Conveyors

All interior conveyors will be supported by steel channel stringers with angle posts as required. Elevated conveyor sections will be supported by trussed conveyor galleries with a 2'-6" walkway on one side. Some galleries will be open with belt protected by corrugated metal hoods, some will be enclosed, some will be enclosed and insulated. Galleries will be supported either by "A" frames or towers.

(5.13 - Cont'd)

Conveyors:

48" Raw Coal Conv. - Open
48" Raw Coal Truck Bin Feed Conv. - Open
48" Raw Coal Tripper Conv. - Enclosed
36" Raw Coal Reclaim Conv. - Interior
36" Raw Coal Screen Feed Conv. - Enclosed
36" Rock Bin Conv. - Enclosed
36" Plant Feed Conv. - Enclosed & Insulated
30" Plant Refuse Conv. - Enclosed
36" Dryer Feed Conv. - Enclosed & Insulated
36" Clean Coal Sampling Conv. - Enclosed & Insulated
36" Emergency Stockout Conv. - Open
36" Emergency Stockpile Reclaim Conv. - Enclosed
36" Clean Coal Tripper Conv. - Enclosed
72" Clean Coal Reclaim Conv. - Interior
72" Loadout Bin Conv. - Enclosed

5.14 Change House

The change house will be approximately 43'-4" x 36' x (12' and 20') high building which will house shower and washrooms, change rooms, lockers, office, machinery and lunch rooms. Walls will consist of concrete block on the inside and insulation and metal siding on the outside. Except for machinery and change rooms, tile floors and suspended ceilings will be provided.

5.15 Laboratory

14'-8" x 32'-8" x 14' high building will house laboratory. Building will have a flat built-up roof and concrete block walls faced with insulation and metal siding on the outside.

5.16 Foundations

A soil investigation and recommendation for foundation design by a qualified consulting engineer will be provided by Owner.

(5.16 - Cont'd)

The Engineer will provide surveying services for all foundations from bench marks and reference points which will be established by Owner.

The Engineer will excavate for all foundations, and back-fill and compact all excavated materials to a 2500 P.S.F. bearing value and dispose of surplus materials in a designated area.

All major structures will be supported on spread footings which will extend a minimum of 7'-0" below finished grade. For estimating purposes the allowable soil bearing pressure of 4000 PSF was used.

Minor foundations, such as for stair posts, conveyor stringer posts, take-up guides and similar structural members will be pier type. A 6" layer of well-compacted crushed stone will be placed under all slabs on grade.

Foundations will be designed using concrete with a minimum compressive strength of 3000 PSI at 28 days. Not less than 5½ bags of Type 1 Portland cement per cubic yard of concrete and proper amount of water per bag of cement to give a 4" maximum slump will be used. All concrete will be designed in accordance with the "Code for the Design of Plain or Reinforced Concrete Structures" - C.S.A. Standard A23.3, (latest revision).

Intermediate grade deformed bars, conforming to C.S.A. Standard G30.1 (latest revision) with a minimum yield strength of 40,000 PSI, and welded wire fabric, conforming to C.S.A. Standard G30.5 (latest revision) will be used.

5.17 Structural Steel

G40.21 or approved equal rolled steel shapes will be furnished for the various structures and equipment supports. All steel will be designed, detailed, fabricated and erected in accordance with the latest C.I.S.C. specifications. All shop connections, unless otherwise noted, will be welded, using E70XX electrodes. All main field connections, unless otherwise noted, will be bolted using high strength bolts (A-325). For secondary connections, such as handrails, girts, stair treads, etc., machine bolts will be used. Limited field welded connections will be made. All steel will receive one shop coat of zinc chromate primer.

5.18 Handrails and Toe Plates

1" dia. bar handrail and $2\frac{1}{2}$" x $\frac{1}{2}$" bar posts will be furnished with field bolted connections to structural steel and field welded hand rail and mid-rail connections. 3/16" toe plates will be furnished in random lengths to be fabricated in the field.

5.19 Field Painting

All structural steel and platework will receive a field coat of metallic aluminum paint. All handrails will be painted visibility yellow; all pipe will be primed and color coded.

Surfaces which will not receive a coat of field paint are: Surfaces in contact with flow of material, non-metallic surfaces, stainless or galvanized steels, shafting, open motors, electrical equipment, conduit, rollers and machinery.

(5.19 - Cont'd)

An alternate paint system could be provided resulting in some savings. Under this system steel would receive No. 6 or better commercial blast and a shop coat of zinc rich #31 paint (min. two mil dry film thickness) which will serve as a finish paint. Only touch-up of scratches and field welds would be done in field.

5.20 Flooring & Treads

All main floors will be 4" to 6" thick concrete placed on 20 gauge "Cofar" galvanized steel deck, or equal. These floors will be sloped to drains, which will be piped to the clean-up sump.

1" bar grating and $\frac{1}{4}$" checkered steel plate will be furnished for some floors and platforms.

All stair treads will be 1" x 3/16" bar grating with checkered plate nosings.

5# expanded metal grating will be furnished for walkways along the open conveyors.

3$\frac{1}{2}$" thick lightweight aggregate concrete placed on 20 gauge "Cofar" galvanized steel deck (or equal) will be provided for walkways along enclosed conveyors.

5.21 Roofing, Paneling, & Insulation

Sloping roofs will be covered with 24 gauge galvanized fluted steel attached to supporting members by cadmium plated fasteners. Flat roofs will have bondable, built-up roofing consisting of 20 gauge roof deck (S15 or equal) 2$\frac{1}{2}$" fibrous glass base cap roof insulation, and an aggregate

(5.21 - Cont'd)

surfaced organic tar pitch, 3-ply built-up roof. Materials and application will be equivalent to "Philip Carey" built-up roof Specification No. 1-BZ and will meet Factory Mutural Acceptable Class I Construction.

Exterior wall paneling shall be Canadian Rolling Mills (or equal) Type S-15-SH, Grade B, 22 gauge galvanized. Interior paneling shall be 22 gauge corrugated galvanized sheets. Flashing will be 22 gauge galvanized steel minimum.

Insulation, when designated, shall be 2½" thick minimum, about 9 lb. density, rigid type, for built-up roofs; 2½" thick minimum, 1.2 lb. density, rigid type for wall paneling; 2½" thick minimum, blanket type, for conveyor gallery metal roofs.

All interior partitions including the enclosure for the service elevator in the Preparation Plant will be ½" flat asbestos-cement panels. Insulation and double walls will be provided for the Operator's & Electrical Rooms.

Concrete block will be used for change house, laboratory, pump and valve houses and for interior partitions in the change house and laboratory.

5.22 Doors and Windows

All personnel doors will be 3'-0 x 7'-0 x 1-3/4" thick, single swing, hollow metal, complete with pressed steel frame, door closer and latch. Doors to conveyor galleries will be the same as above except smaller in size.

(5.22 - Cont'd)

3' x 4' double glass insulated type steel windows will be provided in the Operator's Room, change house and laboratory only as required for outside viewing.

Translucent plastic panels to match the siding panels will be provided for general illumination.

5.23 Safety Guards

3/4" Mesh No. 13 gauge, expanded metal machinery guards will be furnished as follows:

Conveyors:

All exposed conveyor tail pulleys shall be enclosed and the side guards extended at least 12" ahead of the pulley/belt nip-point. Vertical take-ups for belt conveyors are to be enclosed on all sides to a height of at least 7' above floor. The nip-point of all non-driven pulleys shall be side guarded to a point at least 12" either side of the nip-point. Nip-points on conveyor idlers will NOT be guarded. The return run of sloping conveyors accessible from a floor or ground shall be side and bottom guarded to a height of at least 7'. Additional guards are furnished at cranks for feeders, trunnions and chains for rotary breaker.

Drives:

Guards for ASA drive chain are 12 to 14 gauge steel plate with hub seals and lap joints to retain oil splash. V-belt guards are #10 gauge with expanded metal two sides. Couplings guards are plate in the 12 to 16 gauge range. All guards are removable for access to machinery.

(5.23 - Cont'd)

Ladders:

All ladders above 7 ft. high will have safety cages.

6.0 SITE WORK

This section covers roads and site preparation:

6.1 Roads

An access road to the plant site will be constructed and maintained by the Owner.

Plant roads to provide access to various structures and haulage roads to truck dump and plant site refuse pile will be constructed by Engineer.

About 20,000 lin. ft. of 24' wide service roads and 6000 lin. ft. of 50' wide haulage road will be constructed. Roads will follow natural grades and will be surfaced with 12" to 15" of crushed stone (before compaction).

6.2 Site Preparation

The clearing of all vegetation from necessary areas in general plant site; the removal and stockpiling of topsoil as required; general excavation and backfilling of the plant site and roads; and the subsequent replacement of topsoil and seeding thereof on embankments and as required to prevent erosion will be provided by the Engineer.

The Engineer will also construct emergency spill pond and protective berm for plantsite refuse pile.

6.3 Drainage

Necessary plant site grading, together with galvanized, corrugated pipe culverts, as required, to provide unimpeded surface runoff, will be provided.

6.4 Soil Investigation

Prior to design of foundations, or as soon as possible, a proper soil investigation including sufficient soil borings and test data to obtain soil

(6.4 - Cont'd)

classifications and allowable bearing values will be made available by the Owner for the purpose of foundation design.

6.5 Site Survey

A survey of the plant site establishing buildings, conveyor center-lines, service and haulage roads, ponds, and protective berm for refuse pile will be provided by the Engineer. Owner shall provide bench mark, base line and topographic and/or aerial survey maps as required for design.

COST ESTIMATE

	MATERIAL COST CANADIAN	
Structural	$ 6,060,567	
Mechanical	7,542,710	
Electrical	1,177,403	
Sub-Total:	$ 14,780,680	
Duty	402,120	
Taxes (Federal 12% - Provincial 7%)	954,200	
Sub-Total - MATERIAL:		$ 16,137,000
Construction Cost	$ 13,363,000	
A & G Field Supervision Services	500,000	
Sub-Total - CONSTRUCTION:		$ 13,863,000
Sub-Total - MATERIAL & CONSTRUCTION:		$ 30,000,000
Engineering - A & G Company		2,090,000
Sub-Total:		$ 32,090,000
Contingency - 10%		3,210,000
Sub-Total:		$ 35,300,000
A & G Comapny Fee - 6%		2,115,000
GRAND TOTAL......................................		$ 37,415,000

(All monies are in Canadain Dollars)
(Escalation of material price and labor rate are not included)

COST ESTIMATE DIVISION

Division 1	Truck Dump	$ 1,319,000
Division 2	R. C. Storage & Reclaim	5,932,000
Division 3	Rotary Beraker	984,000
Division 4	Preparation Plant	10,436,000
Division 5	Refuse Thickener	1,465,000
Division 6	Thermal Dryer	3,780,000
Division 7	Product Sampling Station	430,000
Division 8	Product Storage & Reclaim	6,138,000
Division 9	R.R. Loading Facilities	1,485,000
Division 10	Exterior Conveyors	2,628,000
Division 11	Wash House & Laboratory	501,000
Division 12	Site Preparation	1,021,000
Division 13	Mobile Equipment	1,296,000

GRAND TOTAL.......................................$37,415,000

CROWS NEST INDUSTRUES LIMITED
CALENDAR OF EXPENDITURES

WEEKS	AMOUNT
0	$ -0-
4	58,000
8	346,000
12	382,000
16	513,000
20	1,047,000
24	1,229,000
28	1,369,000
32	1,735,000
36	2,252,000
40	2,275,000
44	2,786,000
48	3,115,000
52	3,540,000
56	4,807,000
60	3,317,000
64	2,100,000
68	1,292,000
72	1,086,000
76	981,000
80	873,000
84	777,000
88	559,000
92	221,000
96	115,000
100	102,000
104	102,000
108	102,000
112	86,000
116	86,000
120	81,000
124	81,000

TOTAL EXPENDITURES.................$37,415,000

BLANK

OPERATING COST

The preparation plant manpower chart and operating costs are listed in the tabulations in this section of the report entitled, "Operating and Maintenance Manpower Schedule" and "Estimated Operating Costs".

The manpower schedule and the costs begin at the raw coal truck dump and terminate at the loading of clean coal into railroad cars. They include the operation and maintenance of the raw coal and clean coal storage and reclaiming facilities, the washing and drying of the coal and the refuse disposal. The operating and maintenance of bulldozers and refuse trucking, as well as plant heating fuel, are also included.

The costs do not include administrative and office costs, fixed charges and amortization costs. Neither do they include operating nor maintenance costs for the items listed in this report under CNI work Section 9.0.

The costs are given in 1976 dollars per long ton of clean dry coal, that is for an annual production of 1,300,000 long tons per year.

Labor rates were based on the 1976 UMWA contract in the Elk River area. Power costs were based on the 1976 rates given by Crow's Nest Industries in a letter dated December 29, 1976.

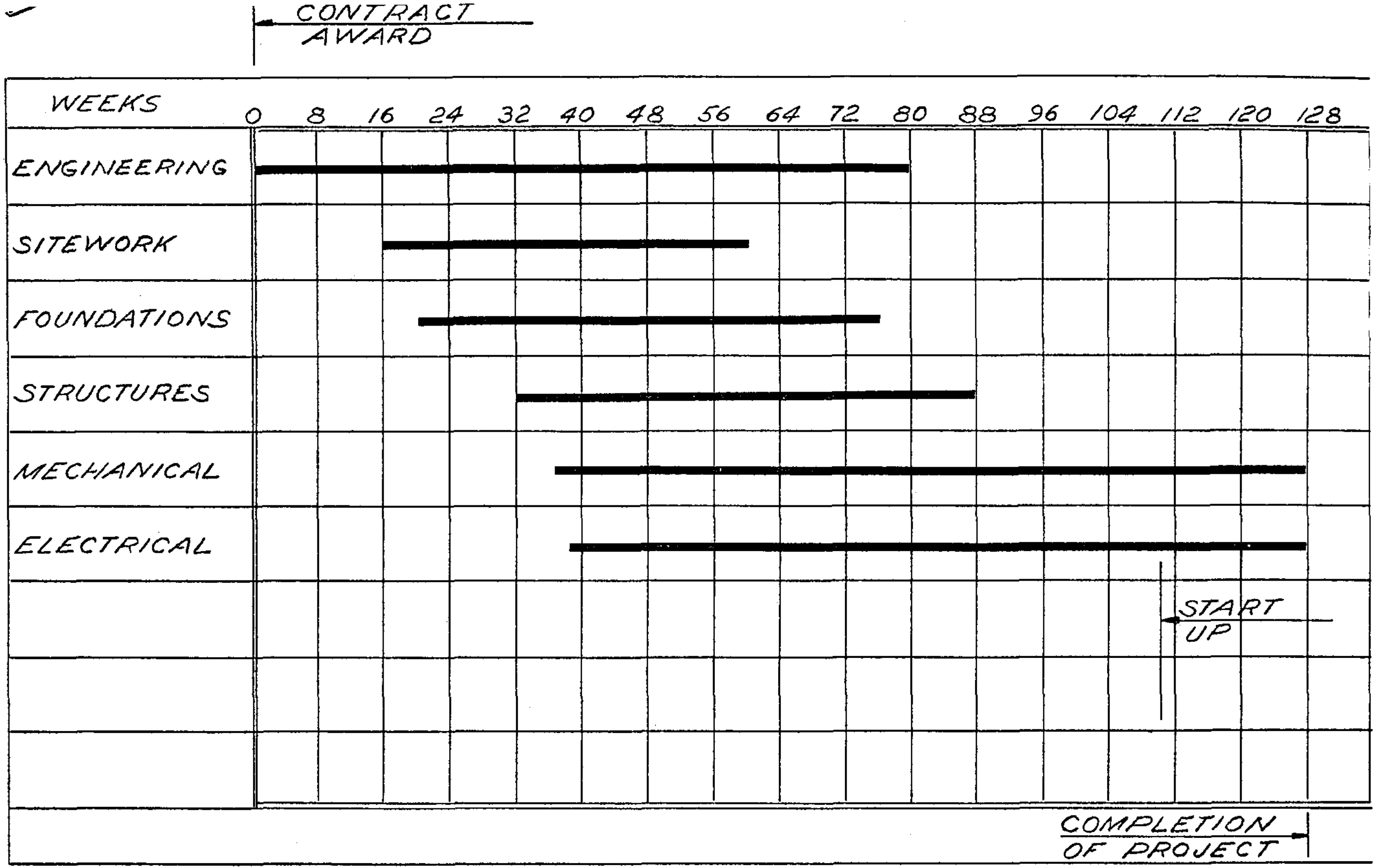
The coal burned in the thermal dryer is not included in the plant operating costs since the value to be placed on this coal was not known, but the consumption rate of this coal is listed in the operating cost tabulation.

OPERATING AND MAINTENANCE MANPOWER SCHEDULE

	8 - 4 Shift	4 - 12 Shift	12 - 8 Shift	Total
Salaried Personnel				
Plant Superintendent	1	-	-	1
Plant Engineer	1	-	-	1
General Foreman	1	-	-	1
Shift Foreman	1	1	1	3
Maintenance Foreman	1	-	-	1
Laboratory	2	-	-	2
Clerk	1	-	-	1
Total Salaried				10
Hourly Personnel				
Raw Coal Operator	1	1	1	3
Raw Coal Dozer Man	1	1	1	3
Control Room	1	1	1	3
Plant Operator	2	2	2	6
Dryer Operator	1	1	1	3
Clean Coal Operator	1	1	1	3
Clean Coal Dozer Man	1	1	1	3
Loan Out Operator	1	1	1	3
Refuse Trucker	2	2	2	6
Refuse Dozer Man	1	1	-	2
Laboratory	1	1	1	3
Labor	1	1	1	3
Maintenance Man	5	2	2	9
Total Hourly				50
GRAND TOTAL				60

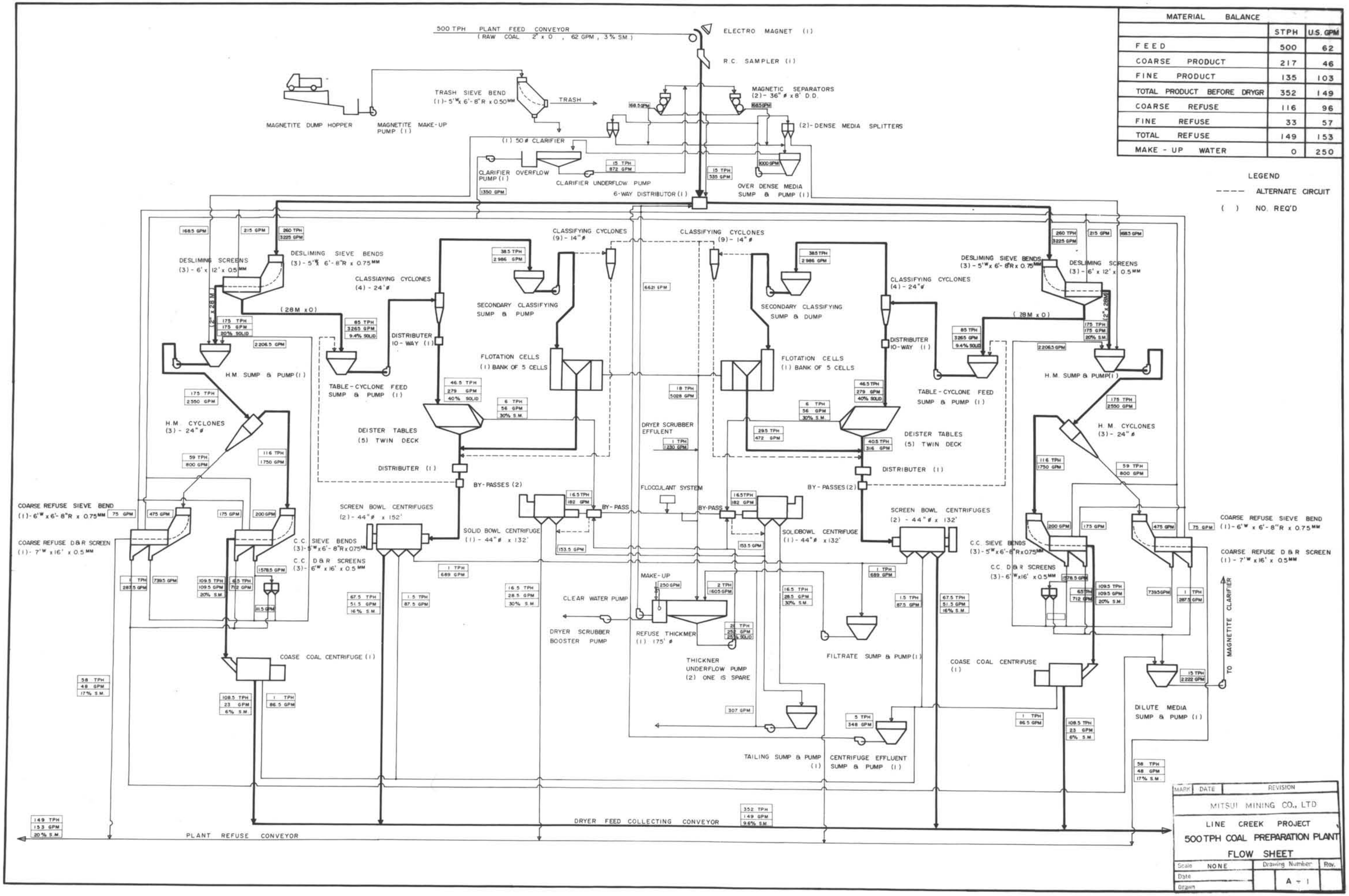
ESTIMATED OPERATING COSTS

	Cost per Long Ton Clean Dry Coal
Operating Labor	$ 0.75
Maintenance Labor	0.29
Maintenance Material	0.44
Supplies	0.22
Magnetite	0.08
Flotation Reagent and Flocculant	0.16
Power	0.37
Dryer Fuel	0.39
Total	$ 2.70



CONSTRUCTION SCHEDULE
CROWS NEST INDUST. LTD.
FERNIE, B.C. CANADA
(EXCLUDING C.N.I. WORK)

Page No. 127
A&G Job 1929
3/9/77



MATERIAL BALANCE

	STPH	U.S. GPM
FEED	500	62
COARSE PRODUCT	217	46
FINE PRODUCT	135	103
TOTAL PRODUCT BEFORE DRYGR	352	149
COARSE REFUSE	116	96
FINE REFUSE	33	57
TOTAL REFUSE	149	153
MAKE - UP WATER	0	250

LEGEND

---- ALTERNATE CIRCUIT

( ) NO. REQ'D

MARK	DATE	REVISION

MITSUI MINING CO., LTD

LINE CREEK PROJECT

500 TPH COAL PREPARATION PLANT

FLOW SHEET

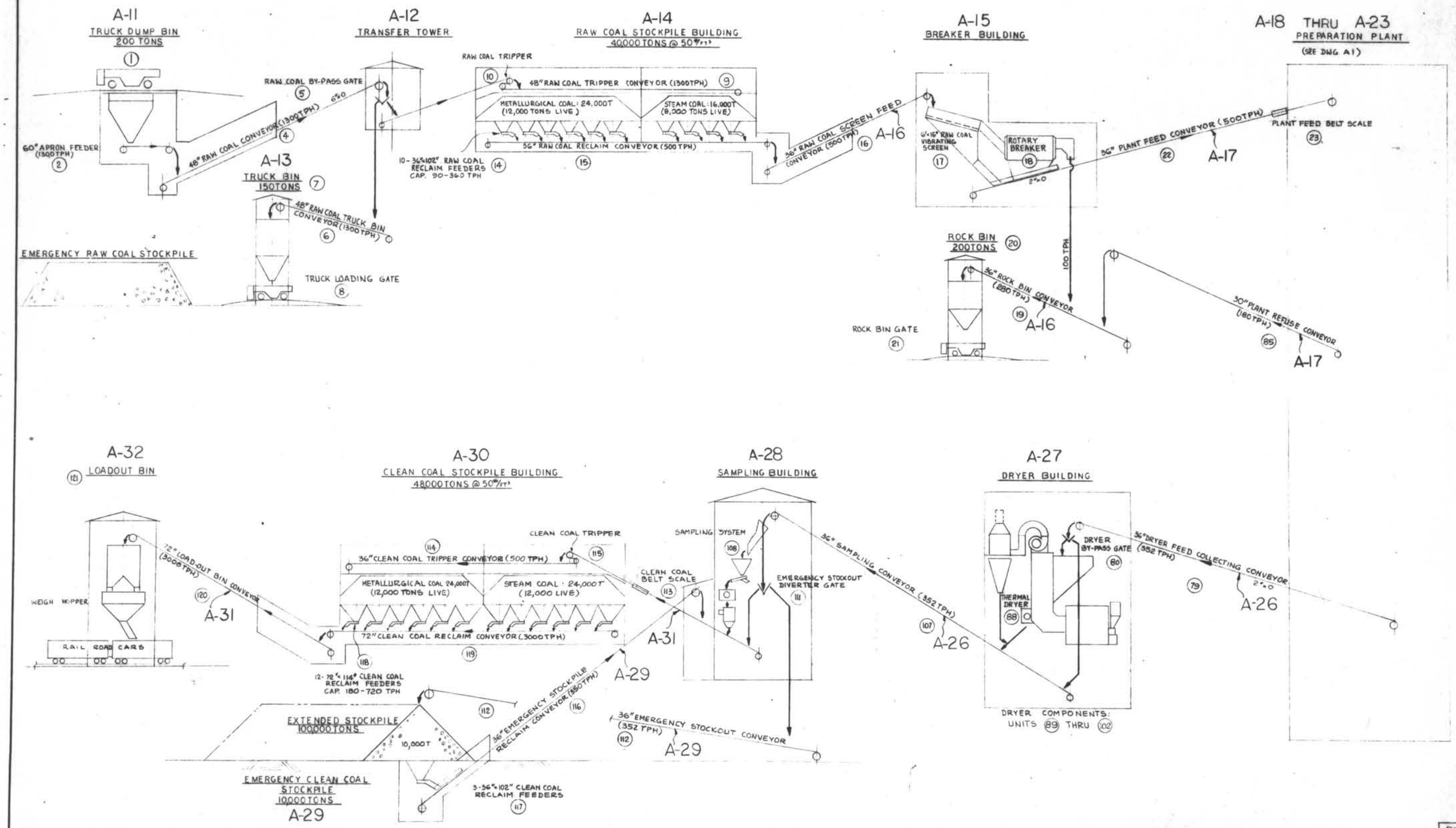
Scale NONE

Date

Drawn

Drawing Number A - 1

Rev.



REVISION:

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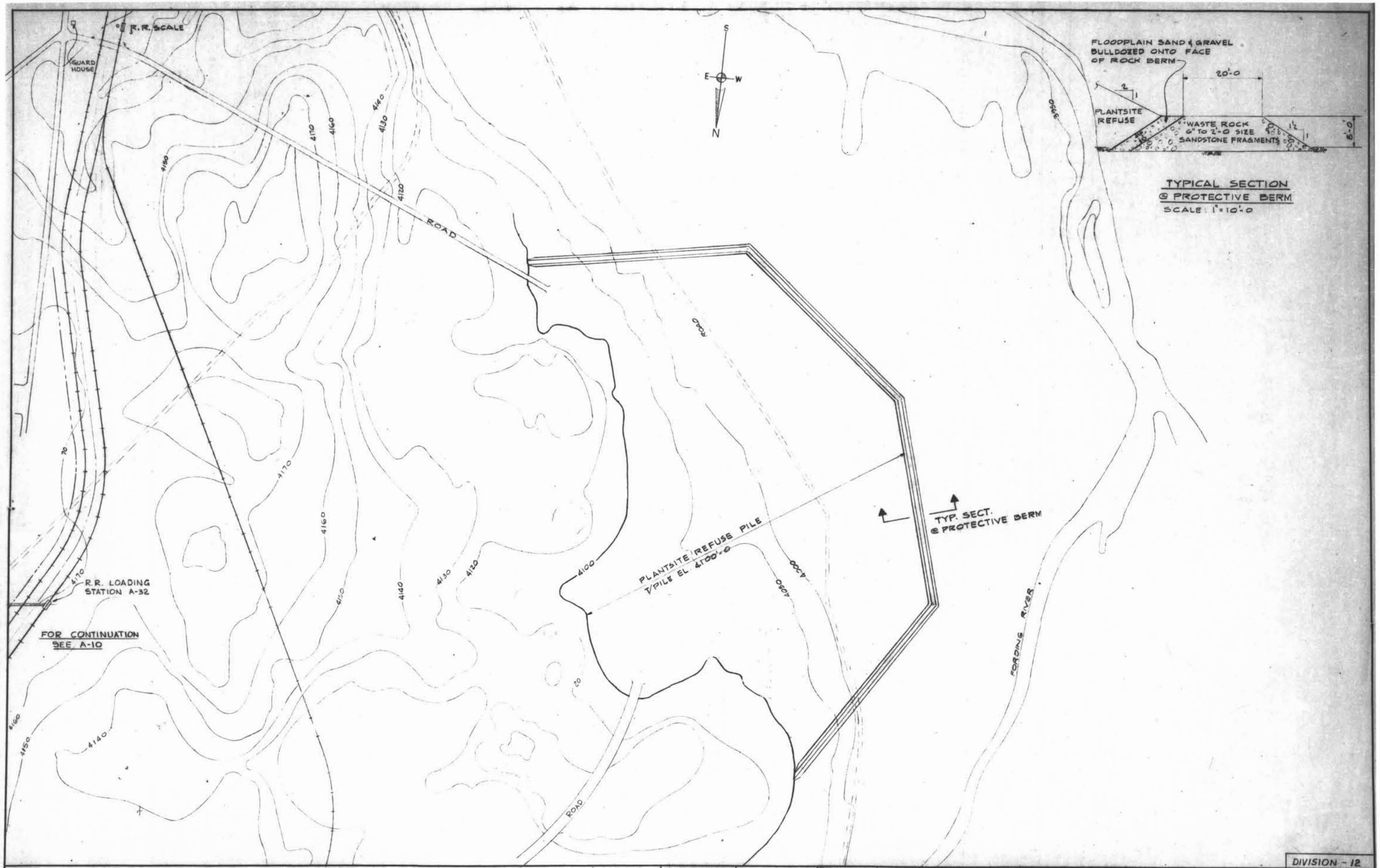
SCALE NONE
DRAWN EDS 12-30-76
CHECKED A.P. 1-26-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

FLOW DIAGRAM
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD. - MITSUI AND CO. LTD.
BRITISH COLUMBIA, CANADA

DIVISION ALL
JOB 1929
DRAWING A-2
REV. 0



REVISION

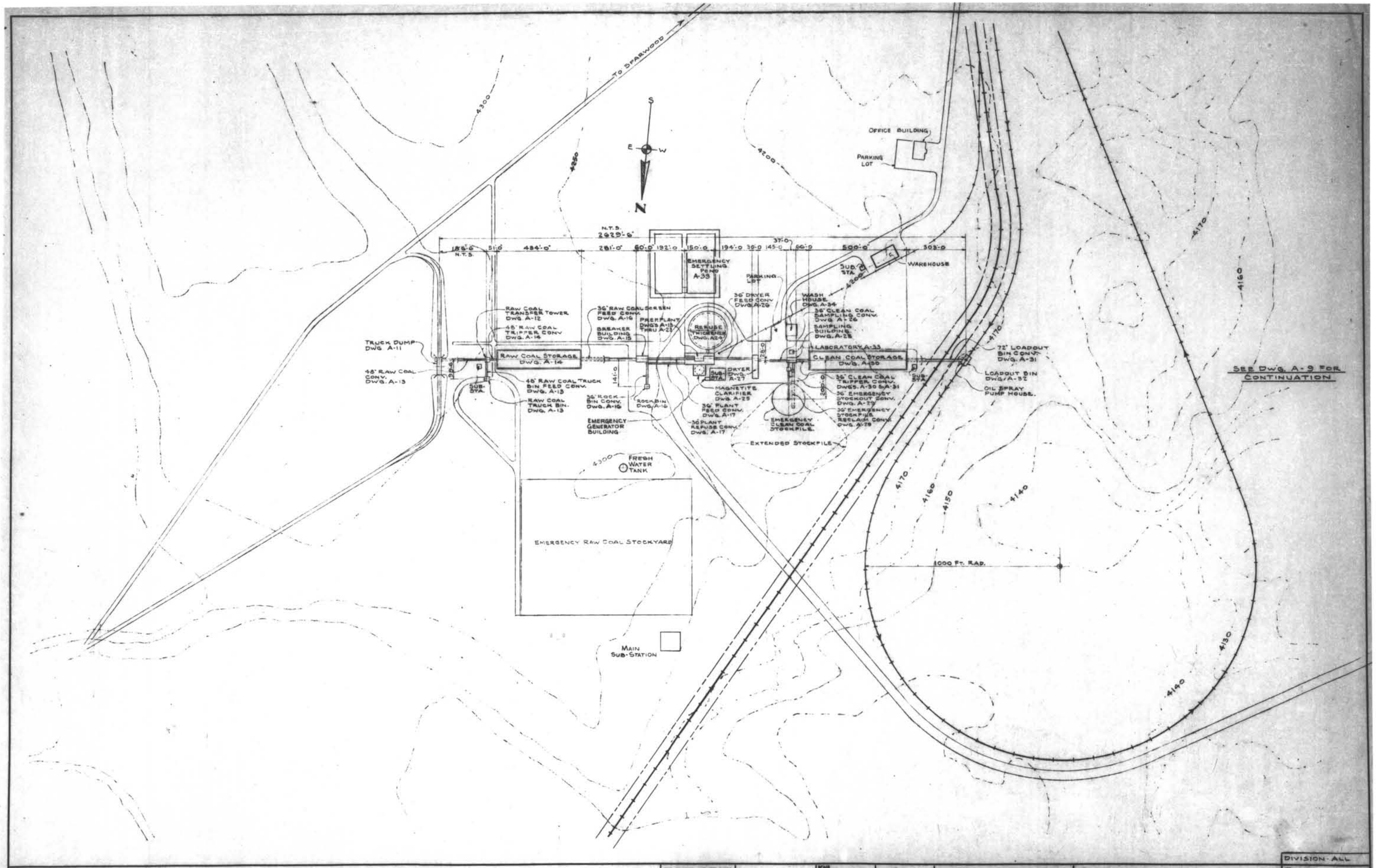
◇

SCALE 1"=200'-0
DRAWN T.A. 1/31/77
CHECKED A.P. 2-18-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PLOT PLAN
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD/MITSUI & CO.LTD.
BRITISH COLUMBIA - CANADA

DIVISION - 12
JOB 1929
DRAWING A-9
REV. 0



REVISION:

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SCALE 1" = 200'-0
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CHECKED A.P. 2-3-77
APPROVED

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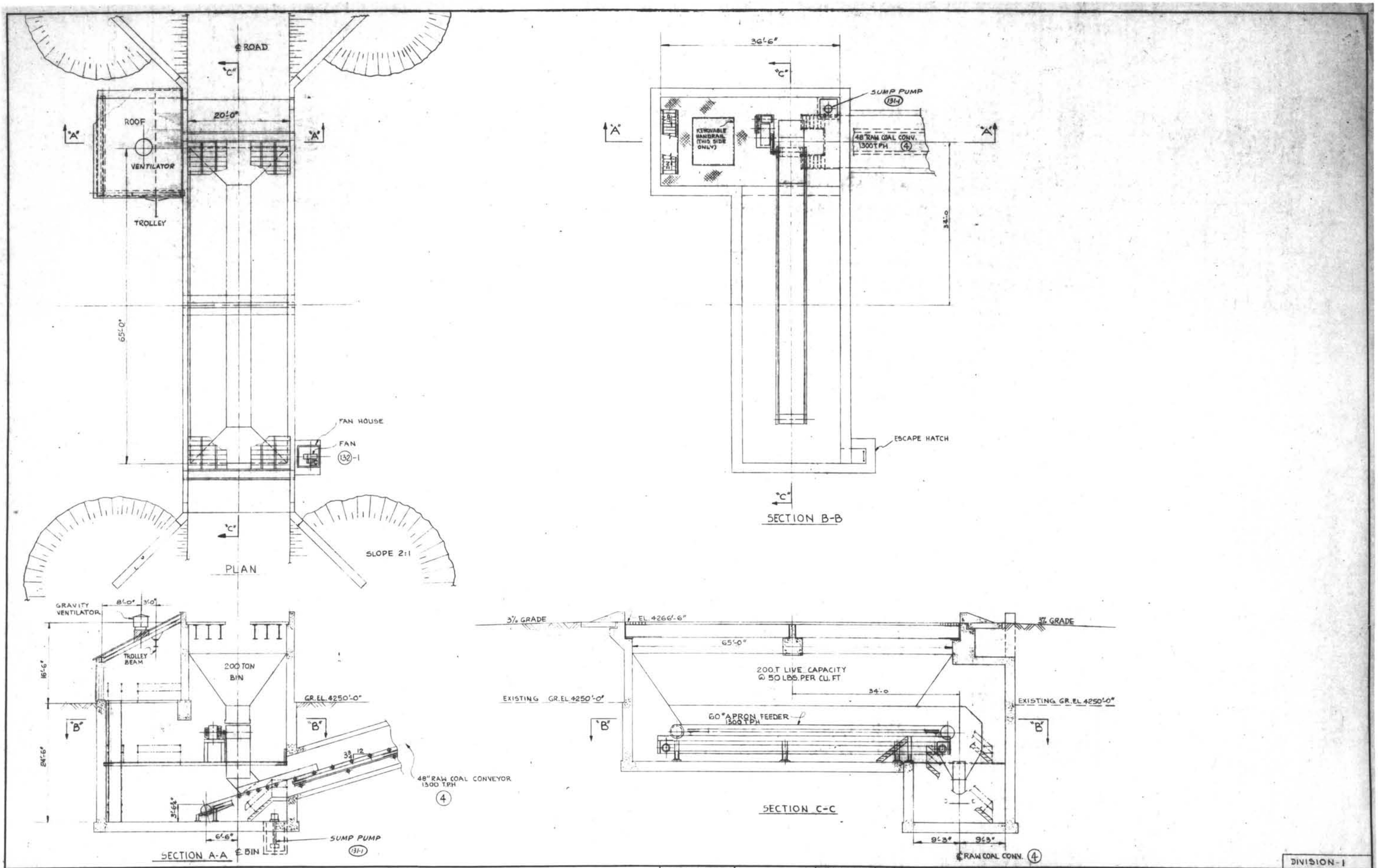
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PLOT PLAN
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD./MITSUI & CO. LTD.
BRITISH COLUMBIA - CANADA

DIVISION - ALL
JOB 1929
DRAWING A-10
REV. 0



REVISION:
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SCALE ⅛"=1'-0"
DRAWN E.D.S. 1-28-77
CHECKED A.P. 2-3-77
APPROVED

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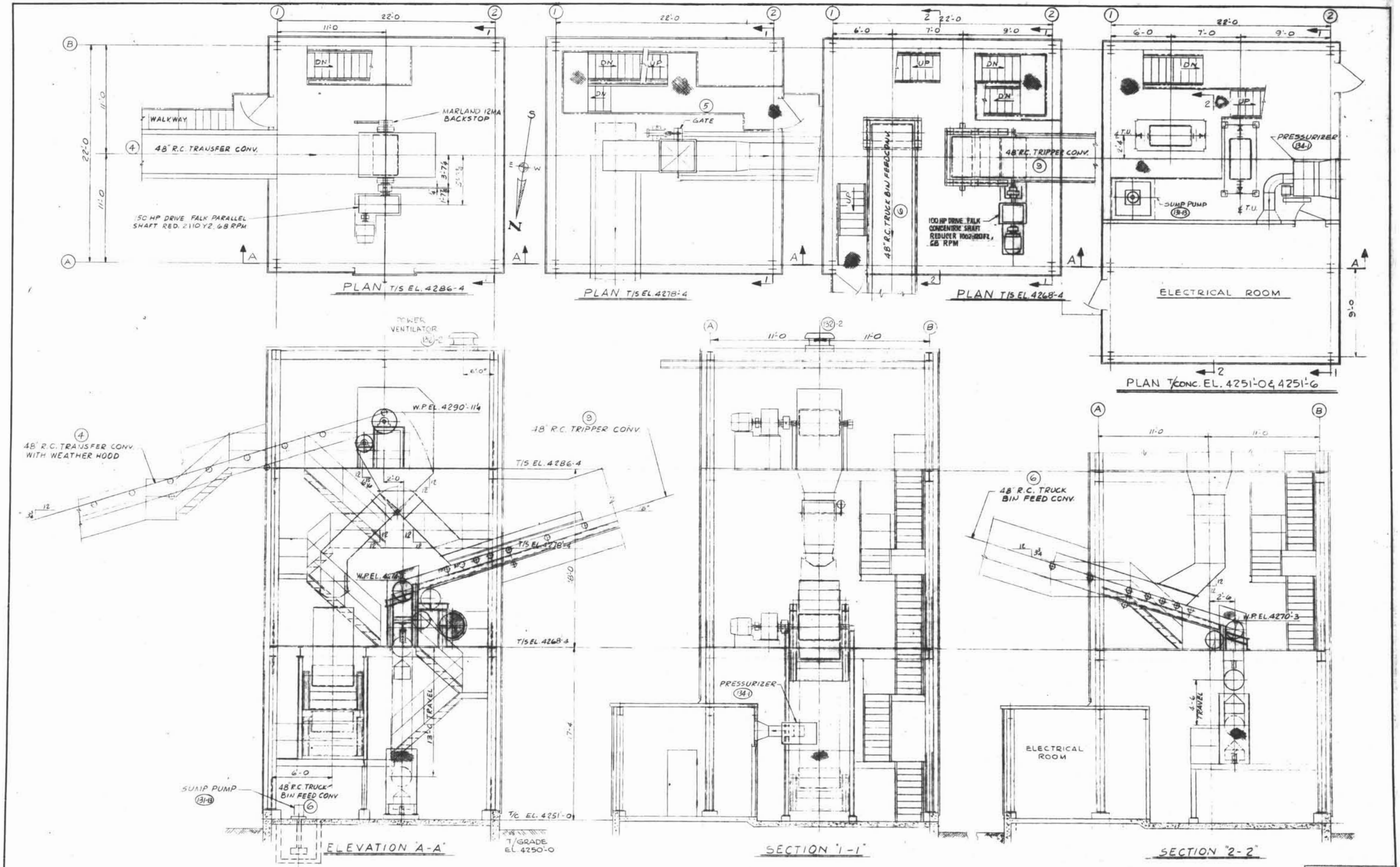
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

TRUCK DUMP
LINE CREEK PROJECT
CROWS NEST INDUSTRIES, LTD.-MITSUI & CO., LTD.
BRITISH COLUMBIA, CANADA

DIVISION-1
JOB 1929
DRAWING A-11
REV. 0



REVISION:

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SCALE ⅛" = 1'-0
DRAWN B.J.D. 12-13-76
CHECKED A.P. 1-17-77
APPROVED

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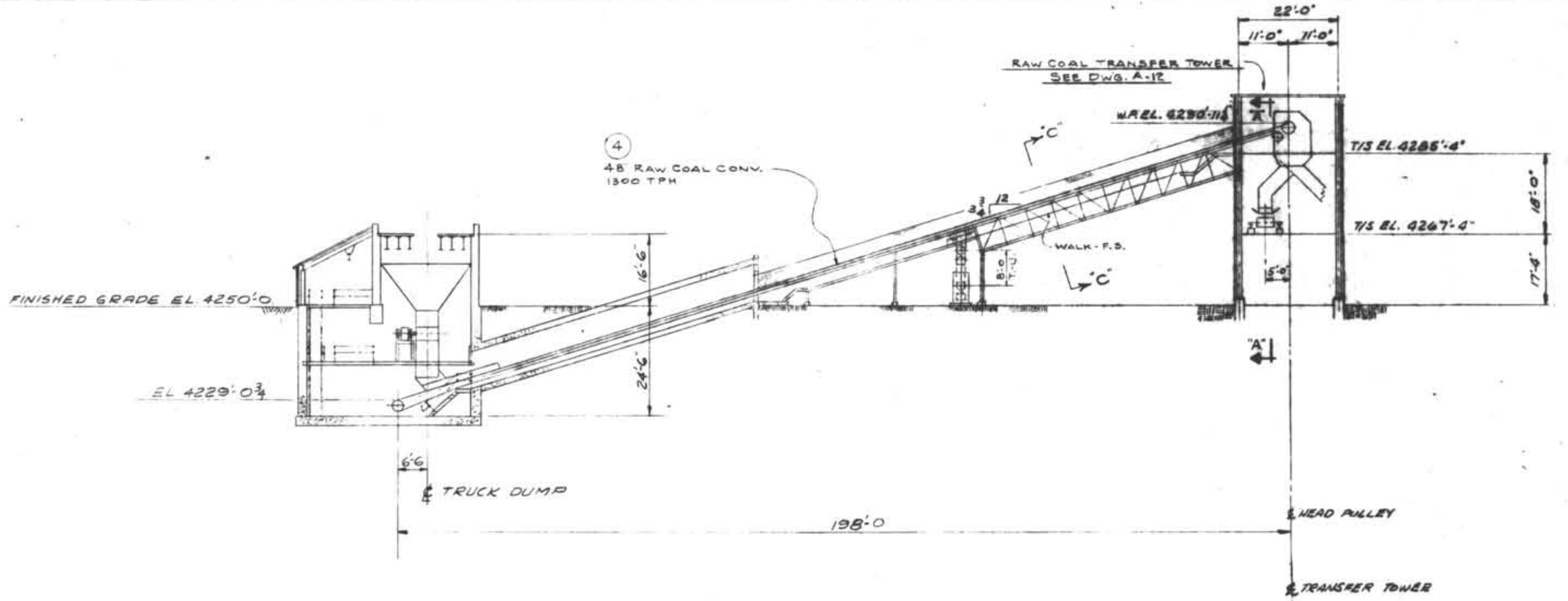
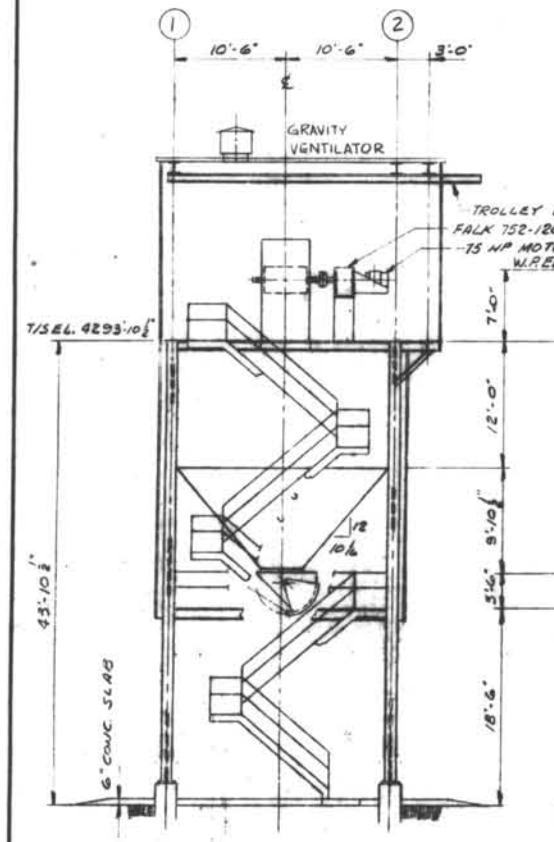
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

RAW COAL TRANSFER TOWER
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD MITSUI & CO. LTD
BRITISH COLUMBIA - CANADA

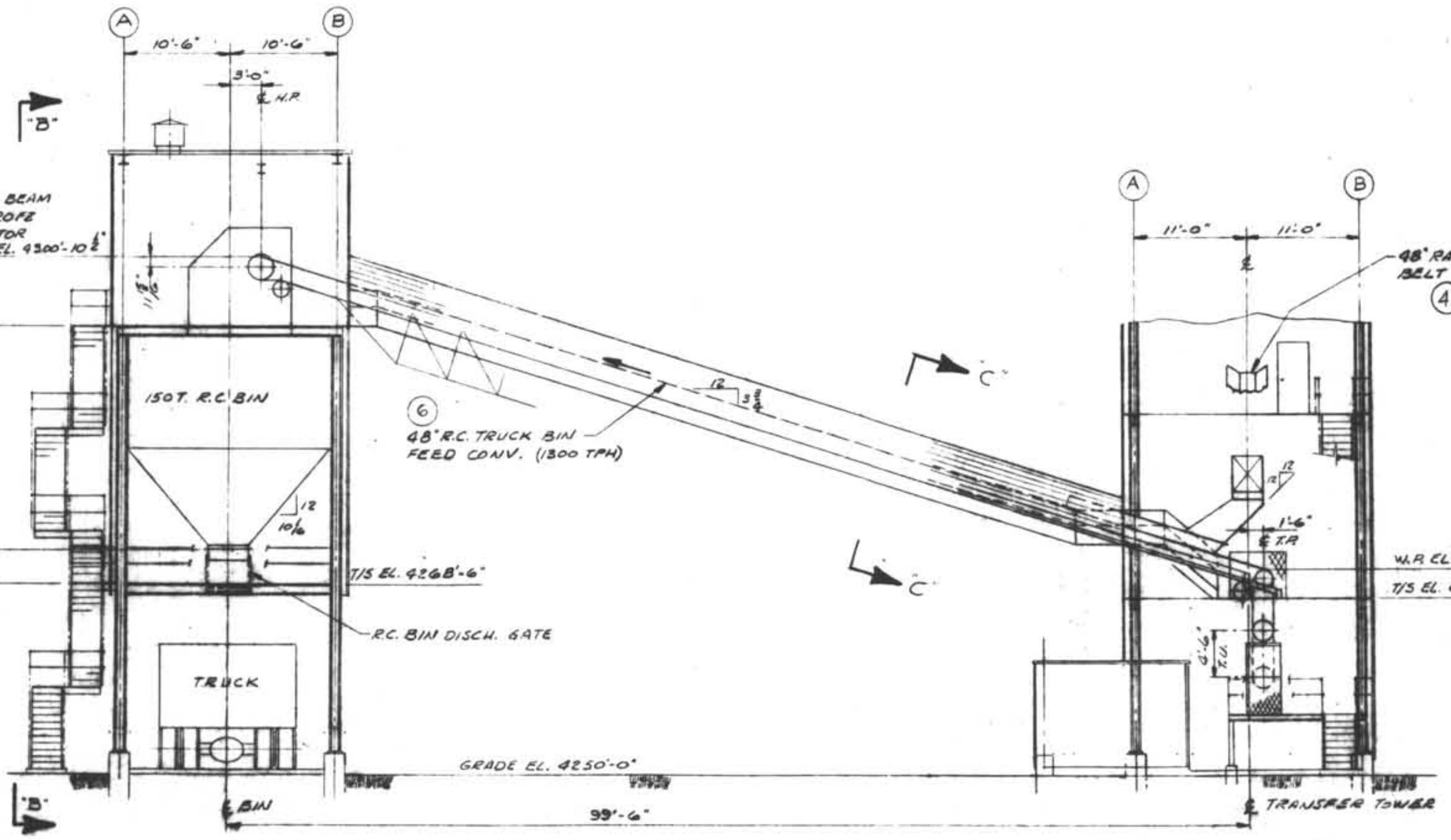
DIVISION-2.
JOB 1929
DRAWING A-12
REV. 0



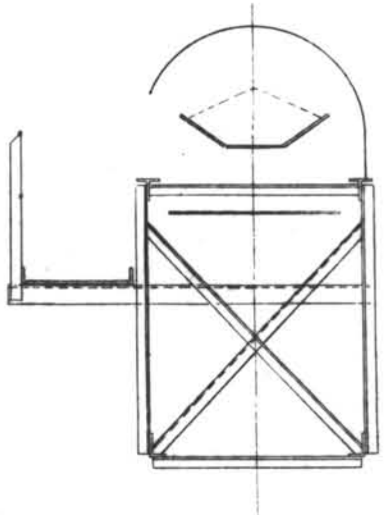
ELEVATION
1/16" = 1'-0"



VIEW "B-B"



SECTION "A-A"
⅛" = 1'-0"



SECTION "C-C"
SCALE ½" = 1'-0

REVISION.
◇

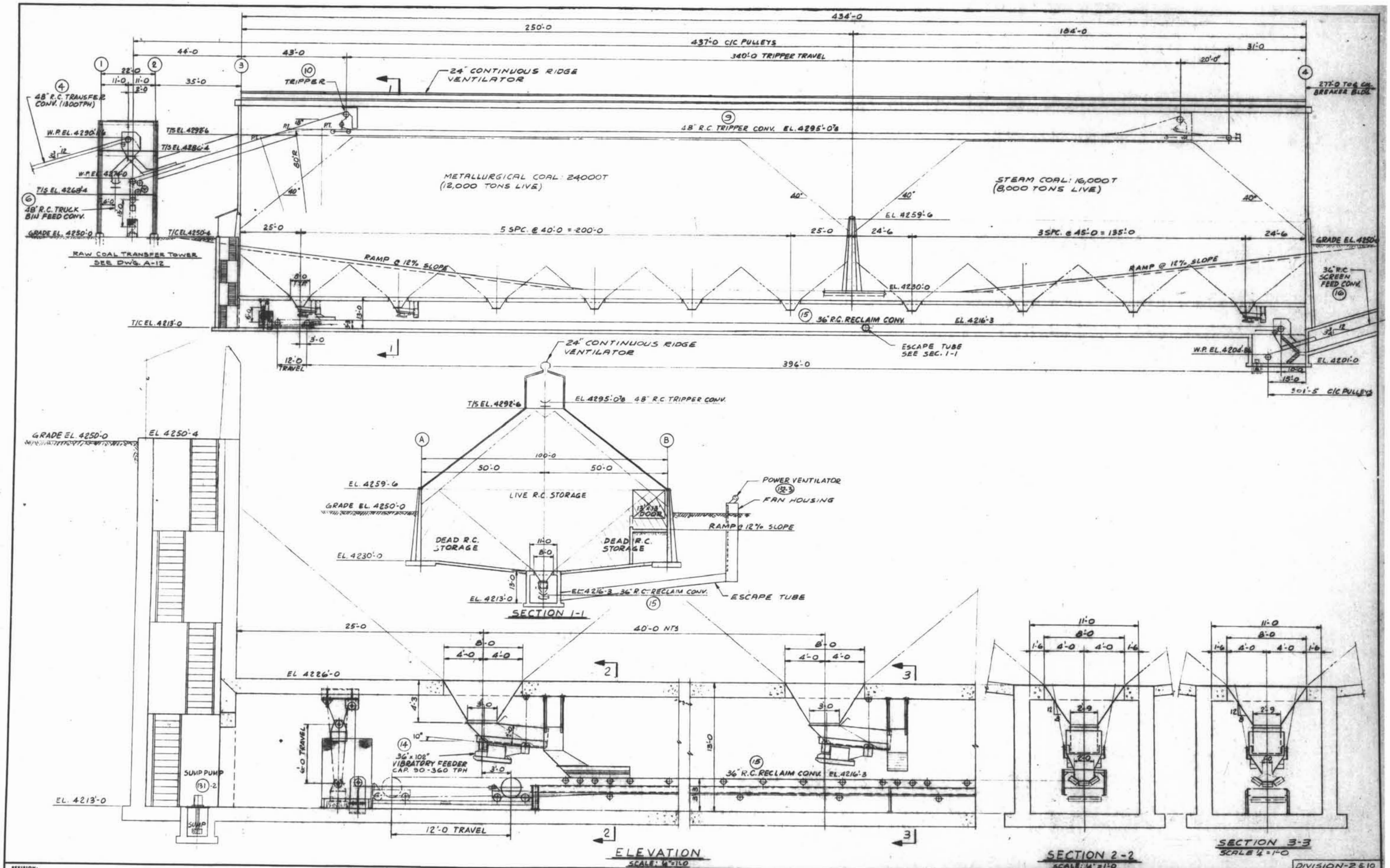
SCALE AS NOTED
DRAWN 12-16-76 D.E. COMSTOCK
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

CONVEYOR UNITS #4 AND #6 ~ ELEVATIONS
LINE CREEK PROJECT
CROWS NEST INDUSTRIES, LTD., MITSUI & Co., LTD.
BRITISH COLUMBIA CANADA

DIVISION-1,2 & 10
JOB 1929
DRAWING A-13
REV. 0

PORT



REVISION:

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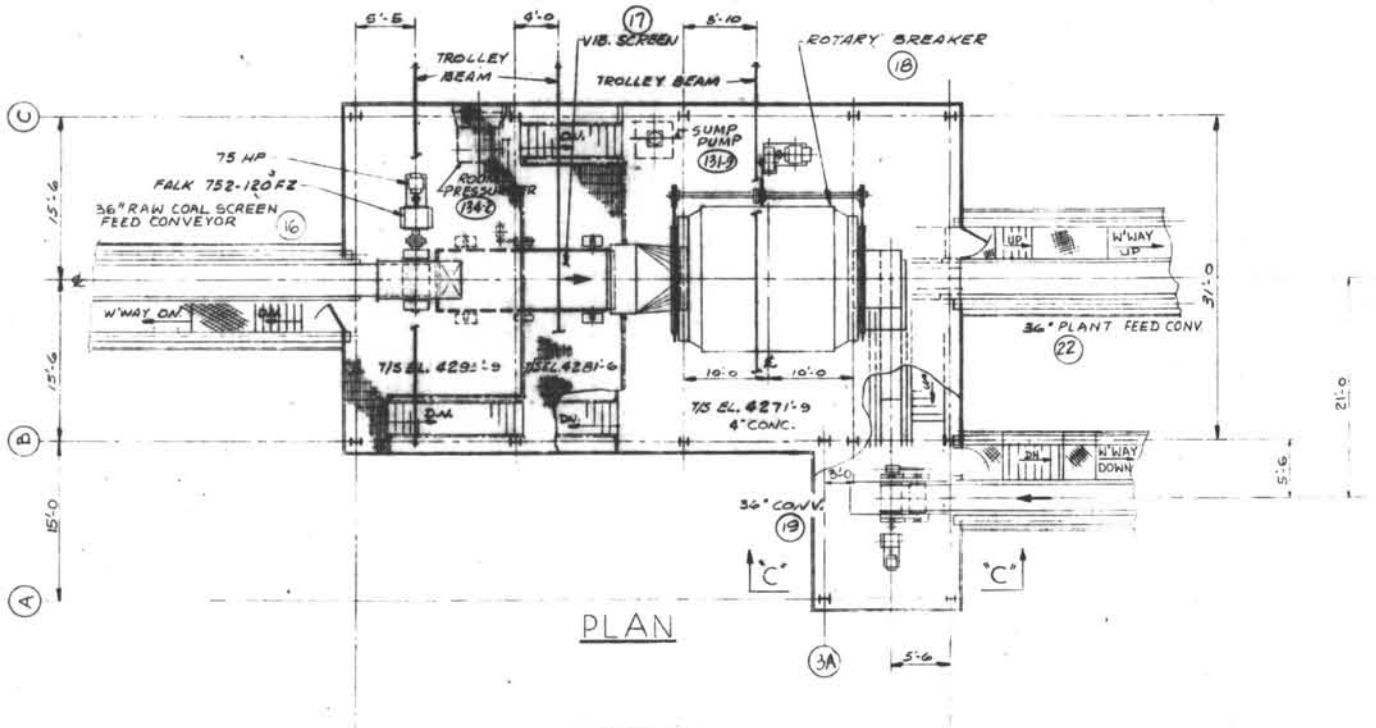
SCALE 1/16"=1'-0 U.N.
DRAWN D.J.O. 12-7-76
CHECKED A.P. 1-26-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604

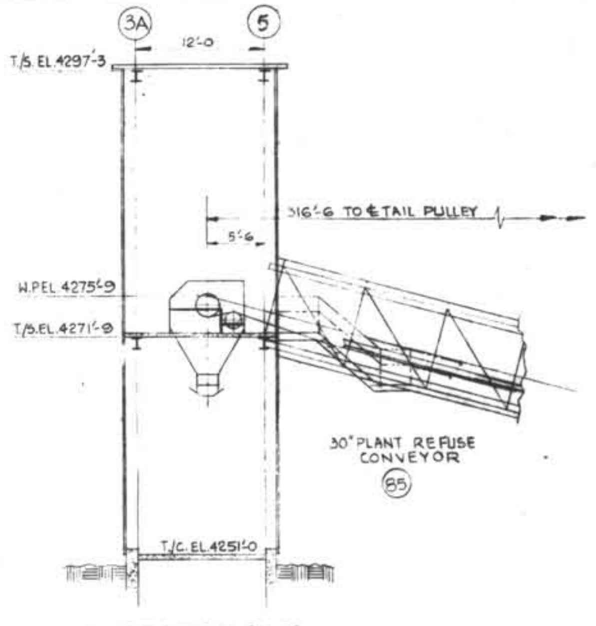
TOP OF THE FIELD

RAW COAL STORAGE AND RECLAIM
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD - MITSUI & CO. LTD.
BRITISH COLUMBIA - CANADA

DIVISION-2 & 10
JOB 1929
DRAWING A-14
REV. 0



PLAN



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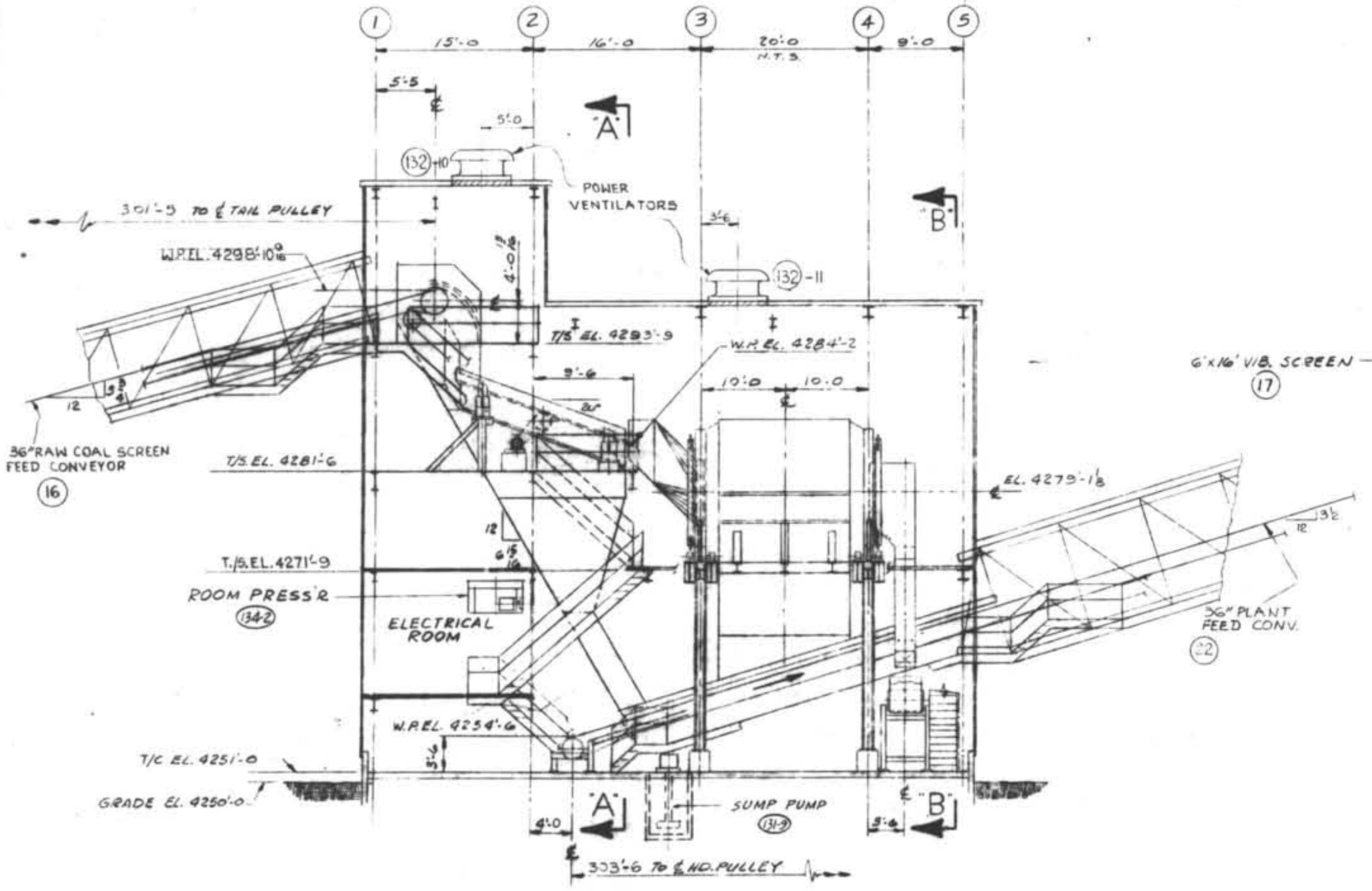
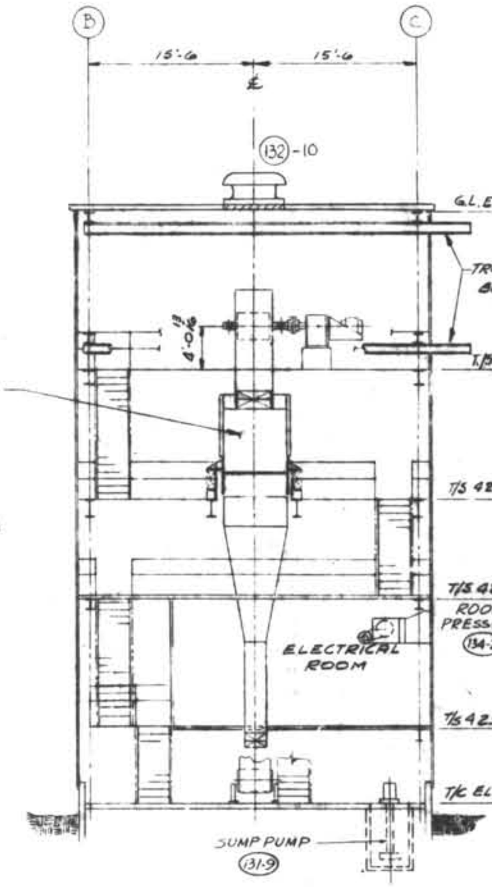
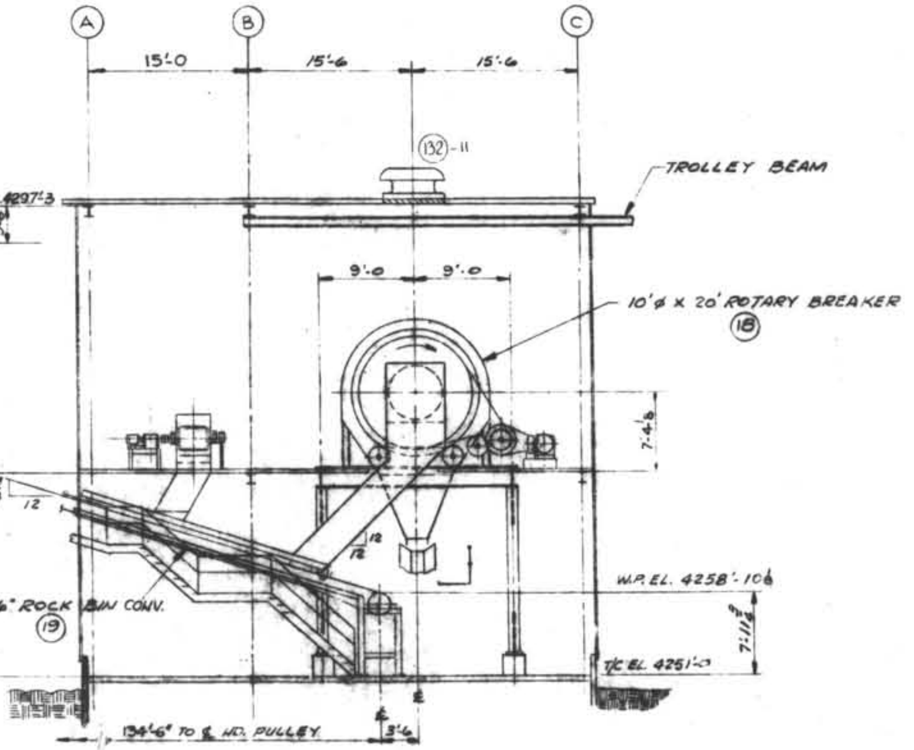


ELEVATION



SECT. "A-A"



SECT. "B-B"

REVISION:

◇

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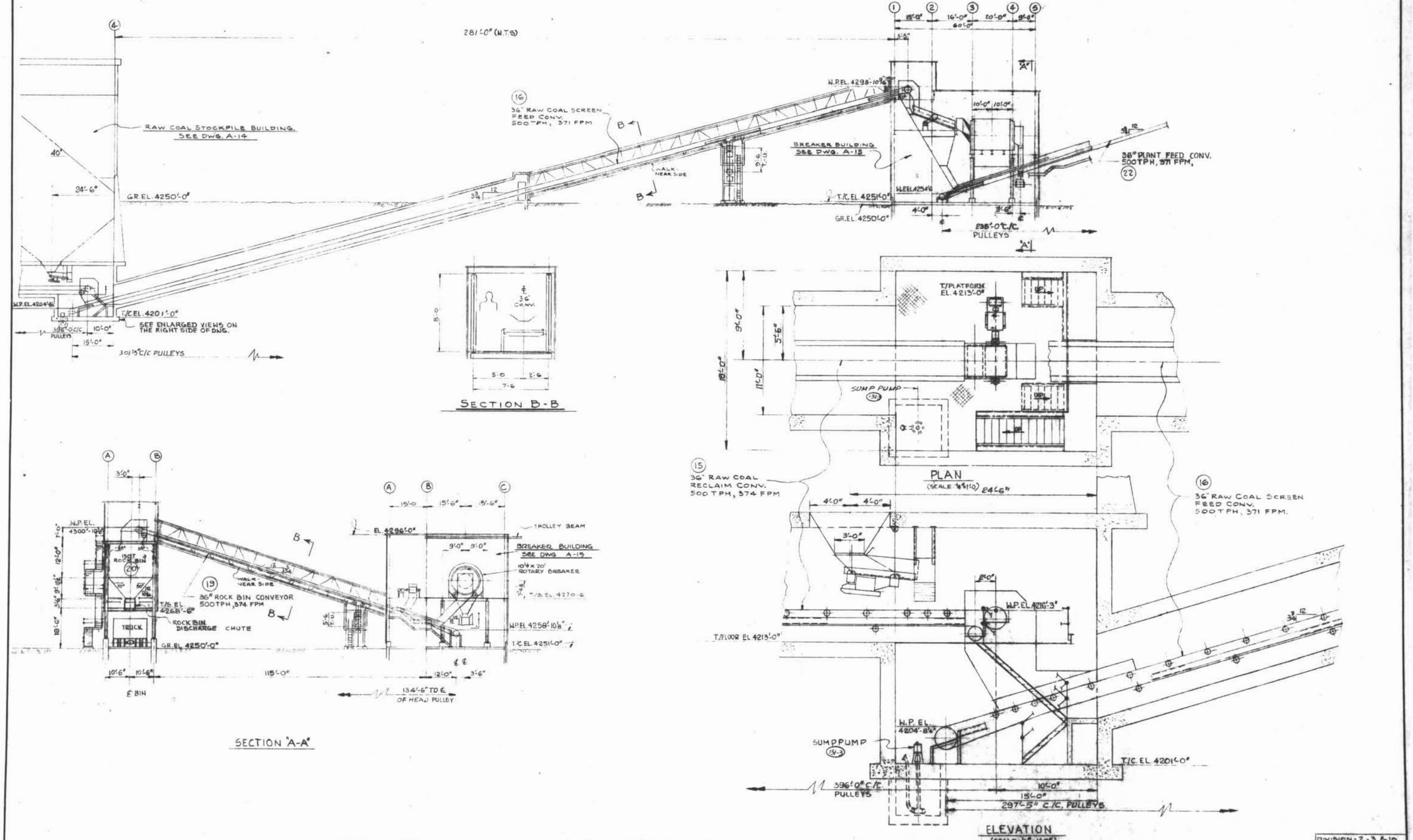
SCALE 1/8" = 1'-0
DRAWN 12-9-76 D.E. COMSTOCK
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604

TOP OF THE FIELD

BREAKER BUILDING
LINE CREEK PROJECT
CROWS NEST INDUSTRIES, LTD., MITSUI & Co., LTD.
BRITISH COLUMBIA CANADA

DIVISION-3
JOB 1929
DRAWING A-15
REV. C



DIVISION - 2 - 3 & 10

REVISION:

◇

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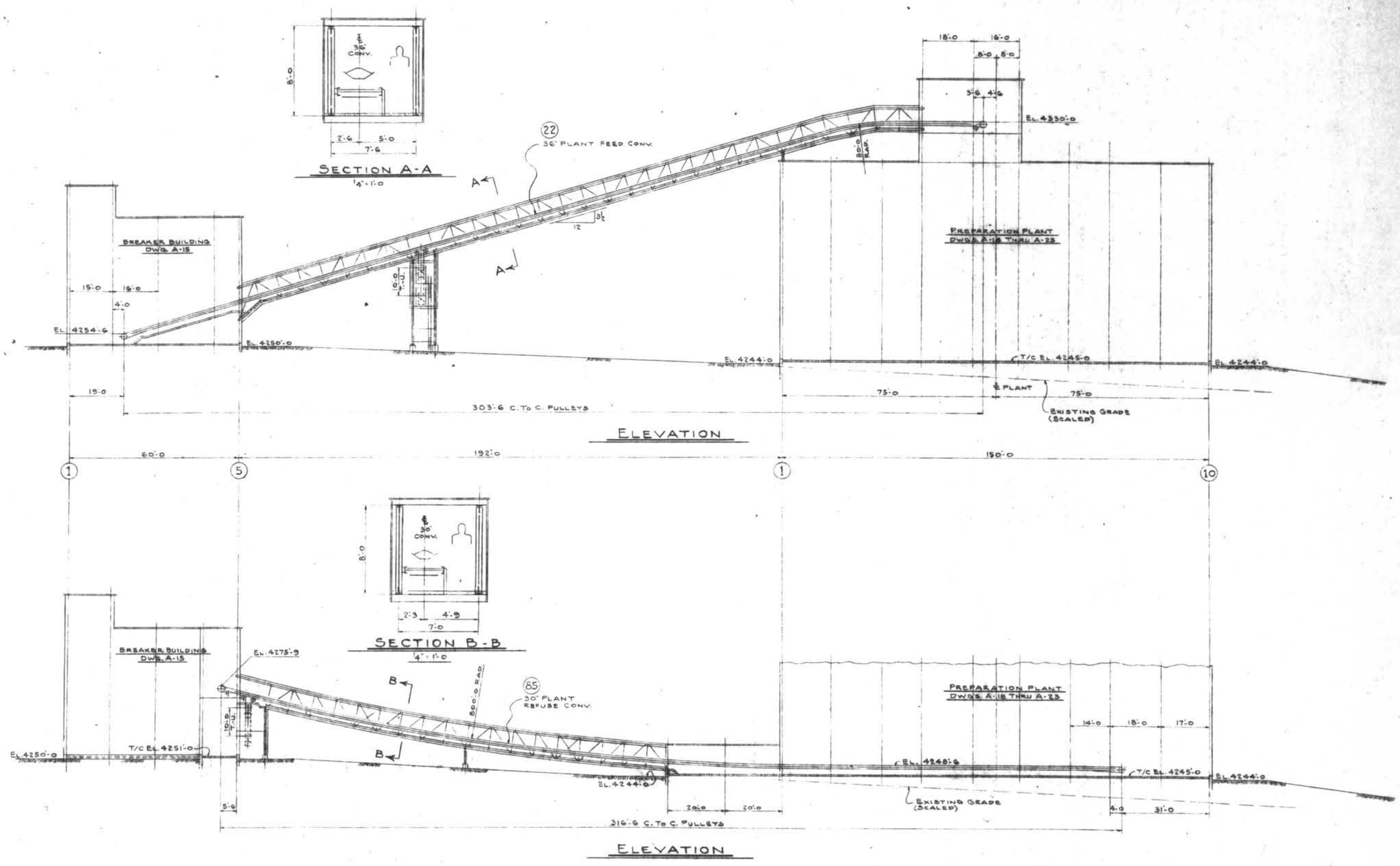
SCALE 1/16"=1'-0" U.N.O.
DRAWN E.D.S. 12-13-76
CHECKED A.B. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS
TOP OF THE FIELD

CONVEYORS UNIT #'S 16 AND 19 - ELEVATIONS
LINE CREEK PROJECT
CROWS NEST INDUSTRIES, LTD - MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA

JOB 1929
DRAWING A-16
REV. 0



REVISION:
◇

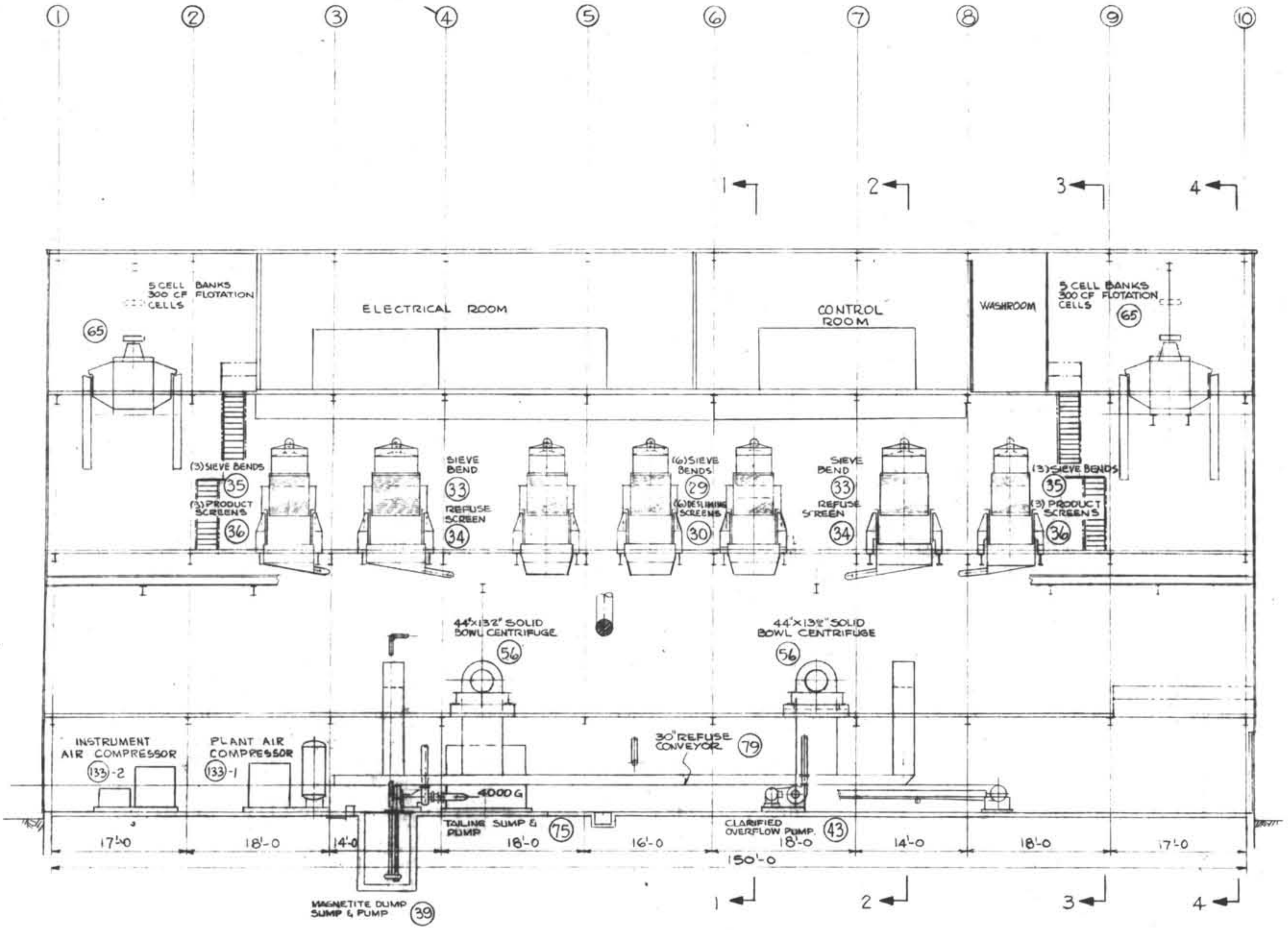
POST

SCALE 1/16" = 1'-0
DRAWN W.J.N. 2-2-77
CHECKED A.P. 2-3-77
APPROVED

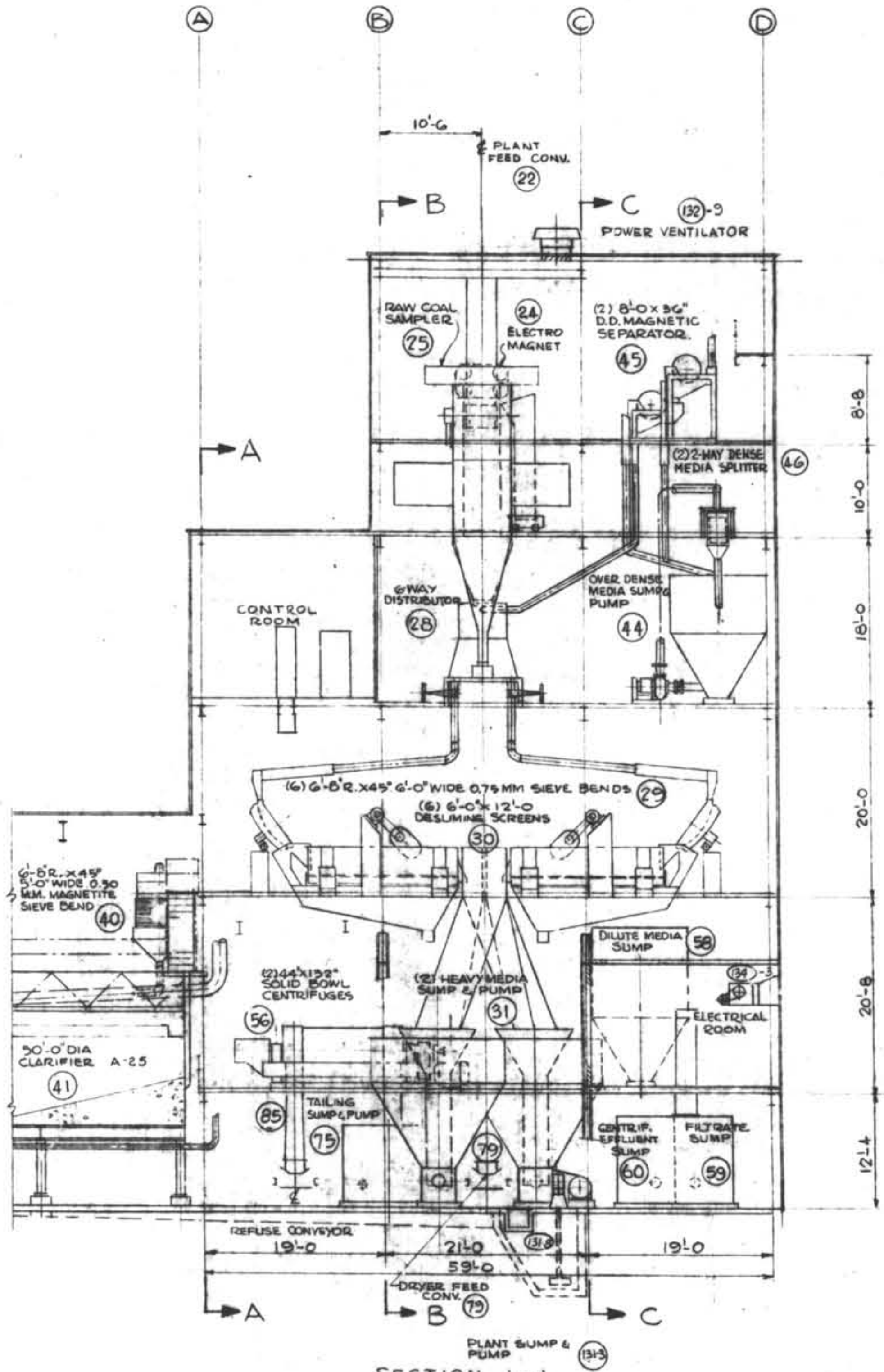
ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PLANT FEED CONV. AND REFUSE CONV.
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD./MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA.

DIVISION-10
JOB 1929
DRAWING A-17
REV. 0



ELEVATION A-A



SECTION 1-1

DIVISION - 4

REVISION:
◇

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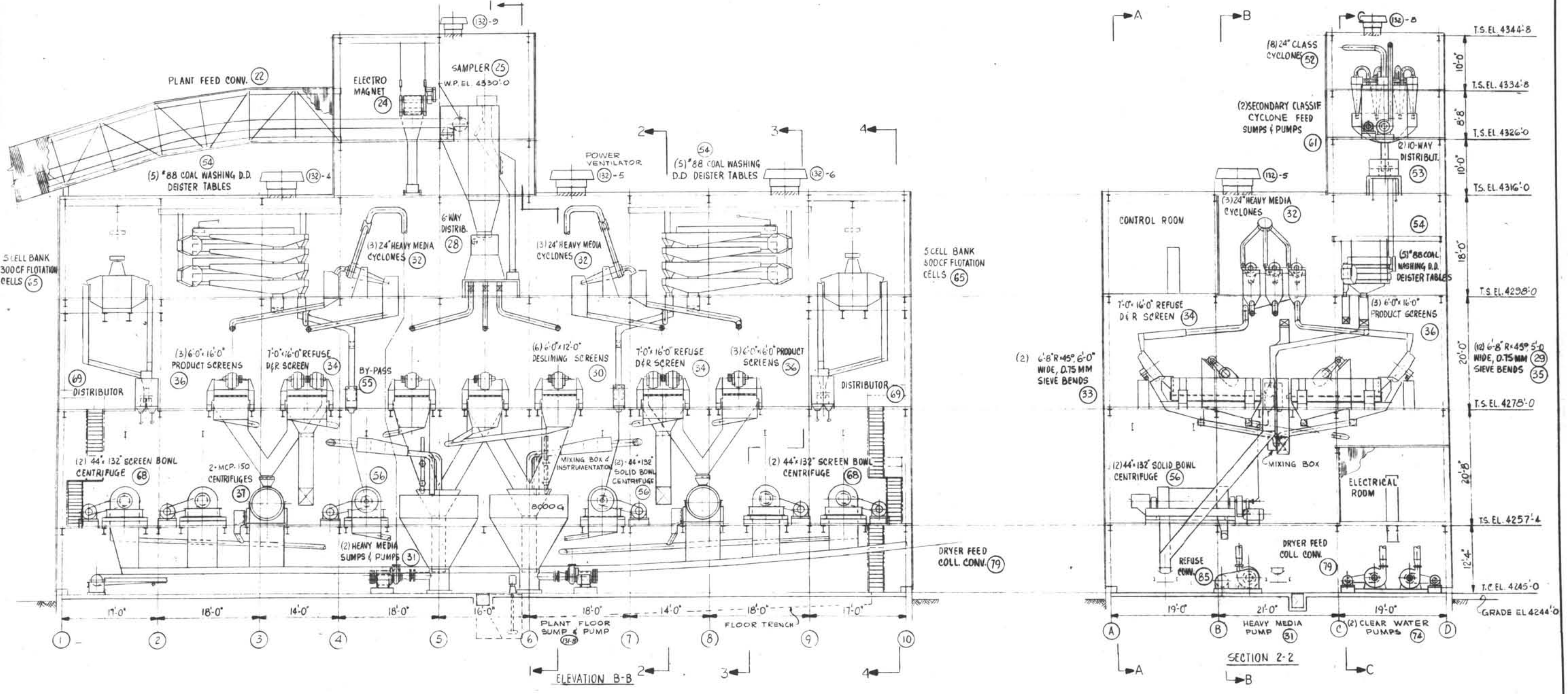
SCALE	1/8" = 1'-0	
DRAWN	J.N.	1-24-77
CHECKED	A.P.	2-2-77
APPROVED		

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PREPARATION PLANT ELEVATION A-A & SECTION 1-1
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD. MITSUI & CO., LTD.
BRITISH COLUMBIA, CANADA

JOB 1929
DRAWING A-18
REV. 0



REVISION:

◇

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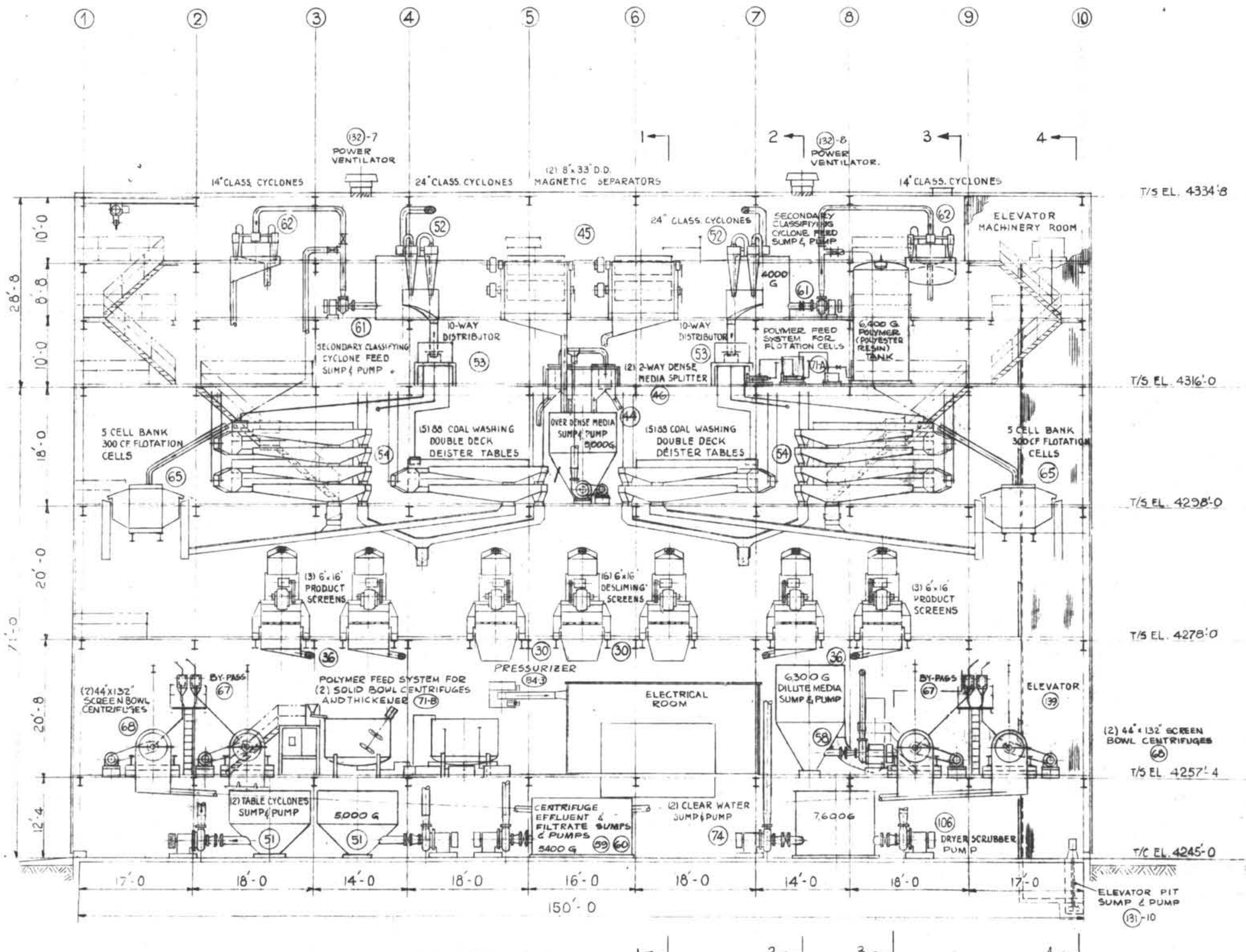
SCALE	1/8" = 1'-0"
DRAWN AP	1-22-77
CHECKED QP	2-2-77
APPROVED	

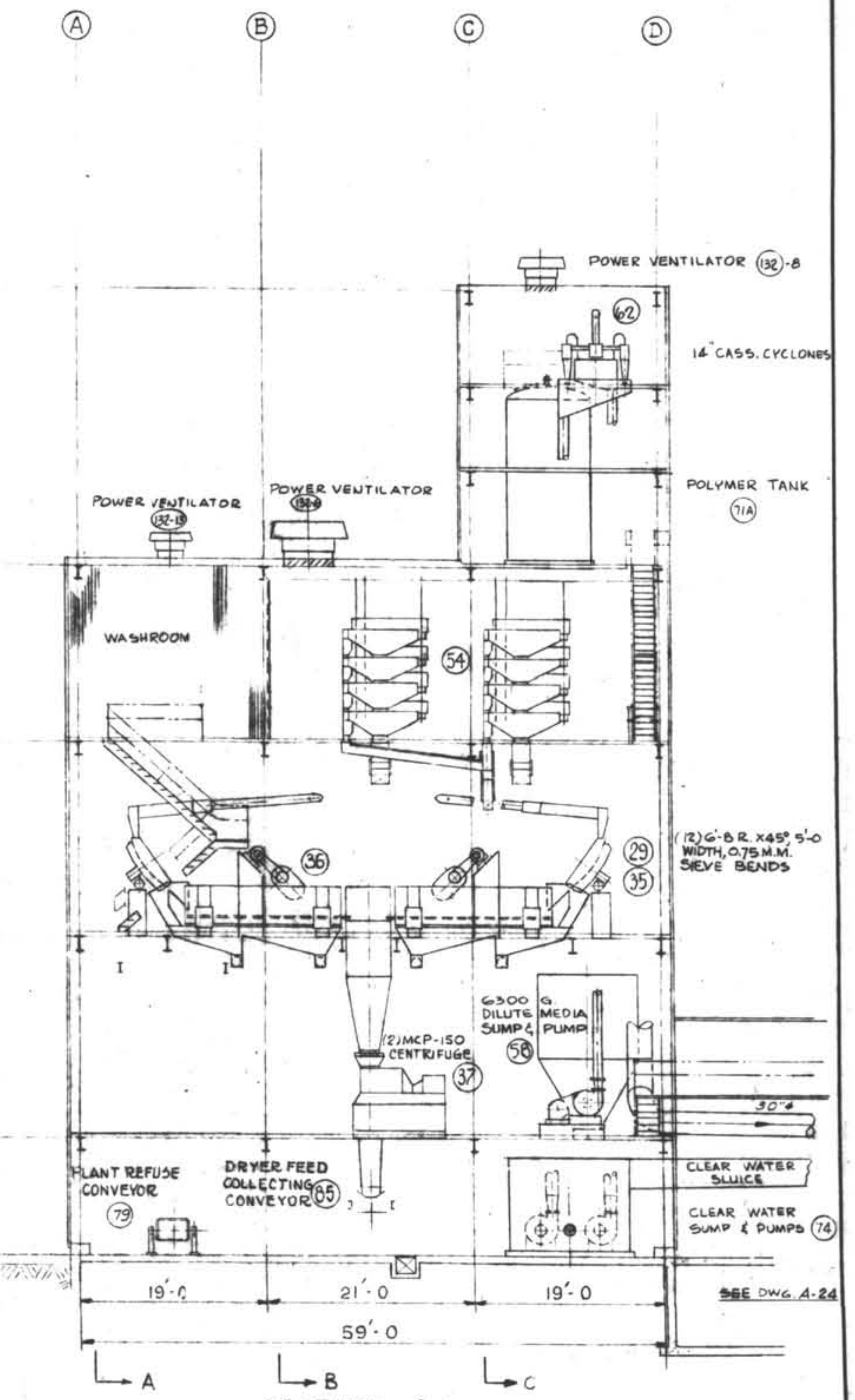
ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PREPARATION PLANT, ELEVATION B-B, SECTION 2-2
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD.- MITSUI & CO., LTD.
BRITISH COLUMBIA, CANADA

DIVISION - 4
JOB 1929
DRAWING A-19
REV. 0



ELEVATION C-C



SECTION 3-3

REVISION:
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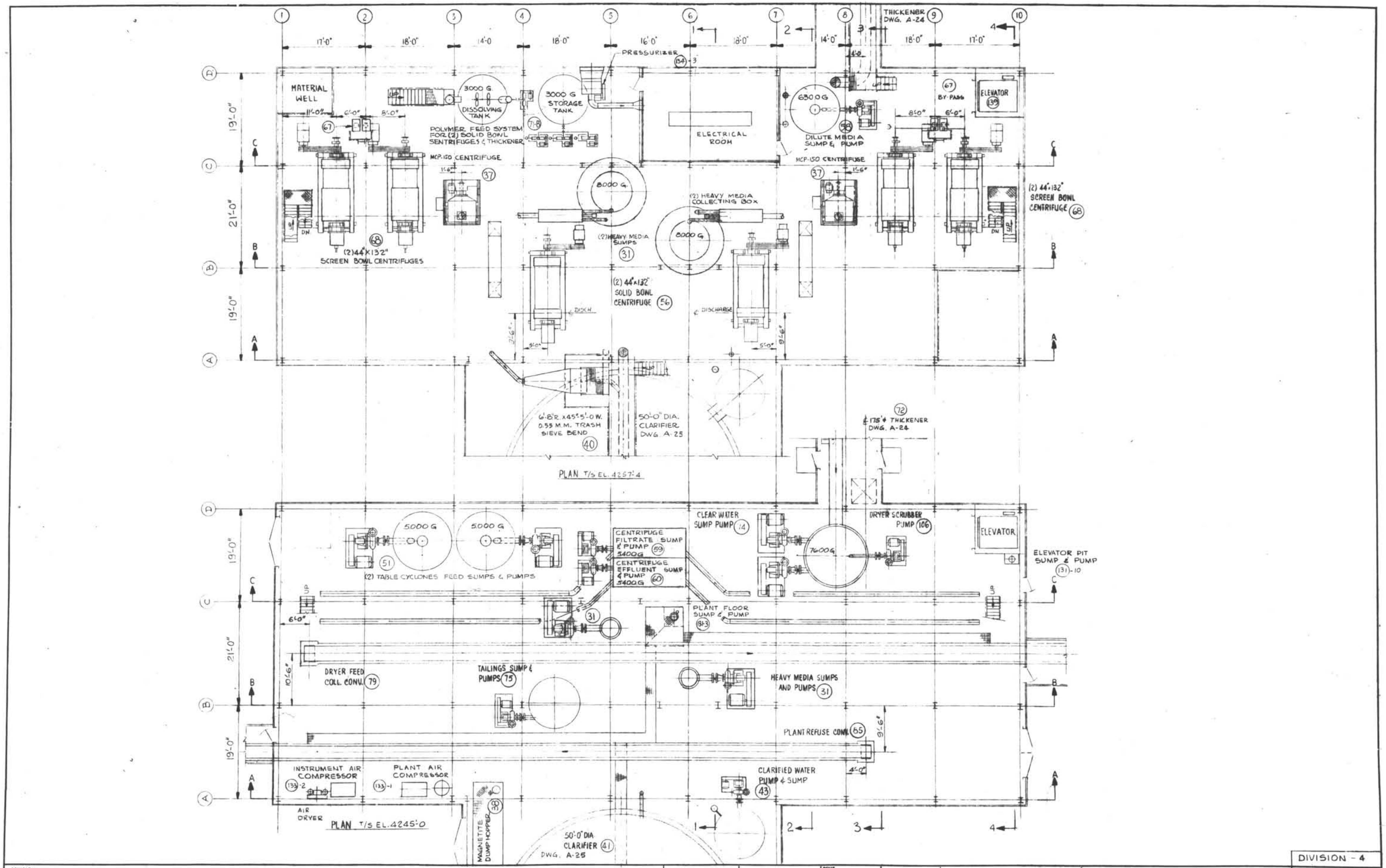
SCALE 1/8" - 1'-0
DRAWN G. S. 1-24-77
CHECKED A. P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PREPARATION PLANT ELEV. C-C & SEC. 3-3
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD. - MITSUI & CO. LTD.
BRITISH COLUMBIA CANADA

DIVISION - 4
JOB 1929
DRAWING A-20
REV. 0



DIVISION - 4

REVISION:

◇

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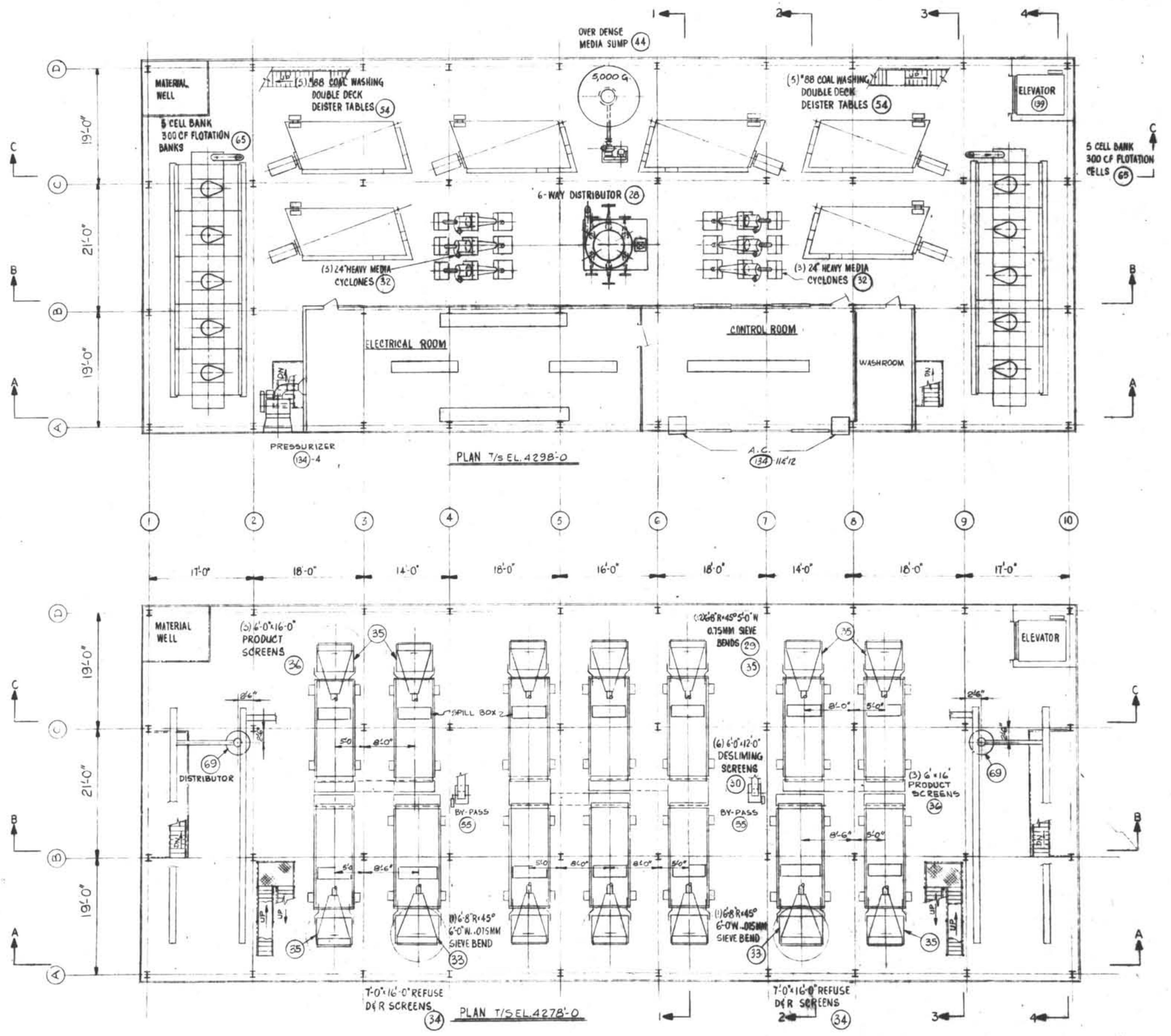
SCALE 1/8"=1'-0"
DRAWN EDS&J.N. 1-24-77
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS, 60604
TOP OF THE FIELD

PREPARATION PLANT, PLAN T/S EL. 4245'-0 & 4257'-4
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD.-MITSUI & CO., LTD
BRITISH COLUMBIA, CANADA

JOB 1929
DRAWING A-21
REV. 0



DIVISION- 4

REVISION:

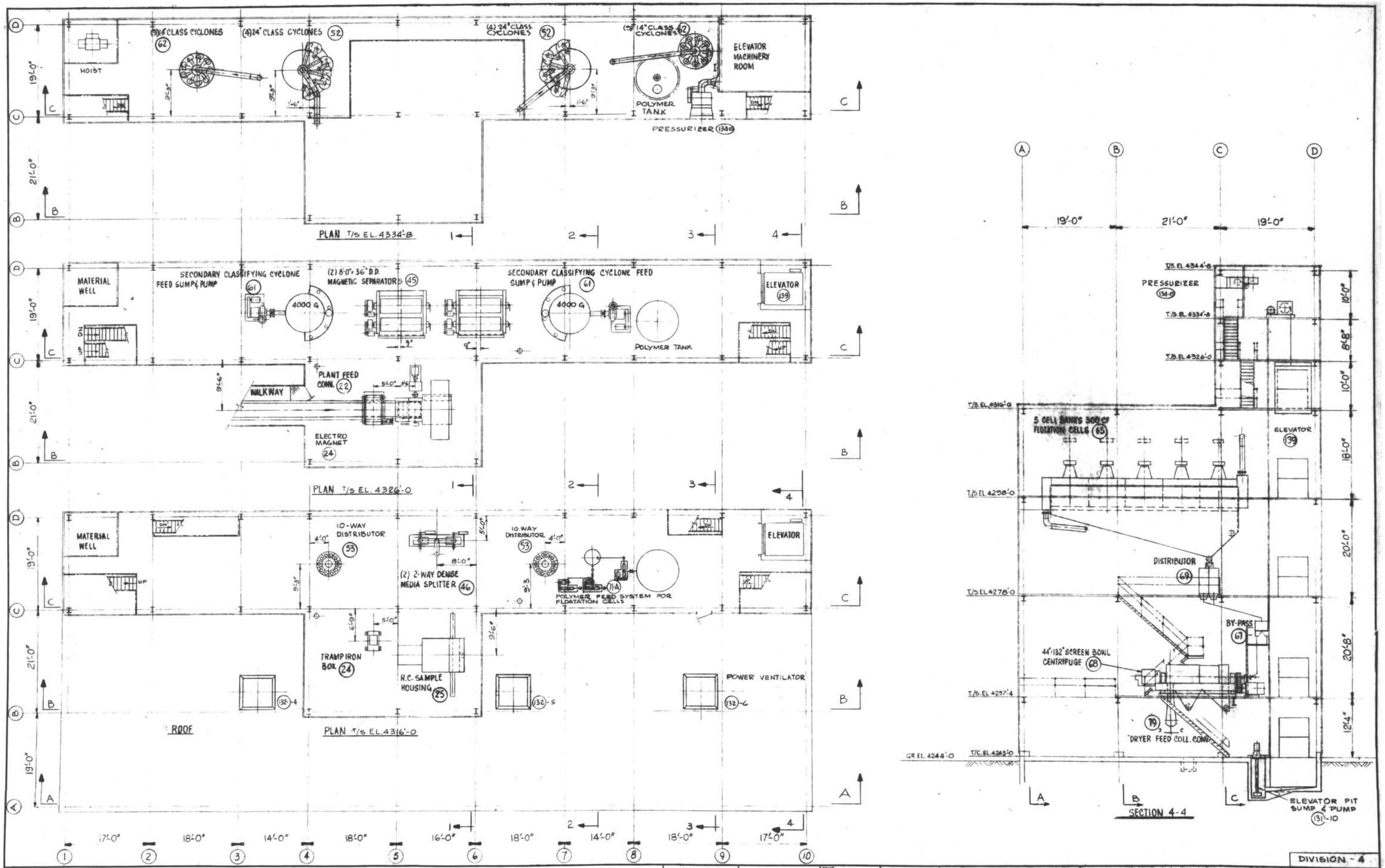
◇

SCALE ⅛"=1'-0"
DRAWN EDS 1-20-77
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

PREPARATION PLANT, PLAN T/S EL. 4278'-0 & 4298'-0
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD.-MITSUI & CO., LTD.
BRITISH COLUMBIA, CANADA

JOB 1929
DRAWING A-22
REV. 0



REVISION:

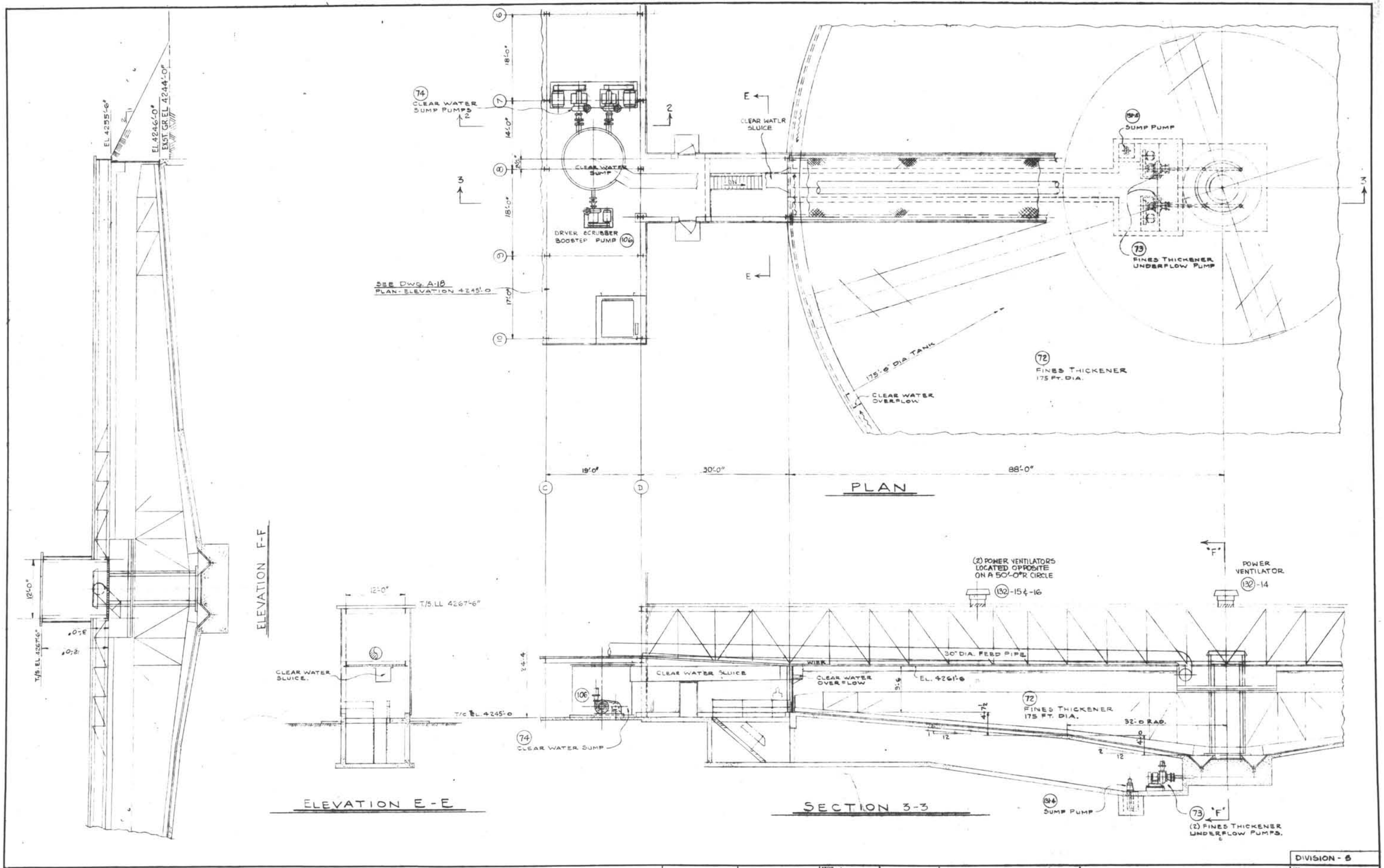
◇

SCALE 1/8" = 1'-0"
DRAWN E.D.S. 1-21-77
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60606
TOP OF THE FIELD

PREPARATION PLANT, PLANS & SECTION 4-4
LINE CREEK PROJECT
CROWS NEST INDUSTRIES, LTD.-MITSUI & CO., LTD.
BRITISH COLUMBIA, CANADA

DIVISION - 4
JOB 1929
DRAWING A-23
REV. 0



DIVISION - 8

REVISION

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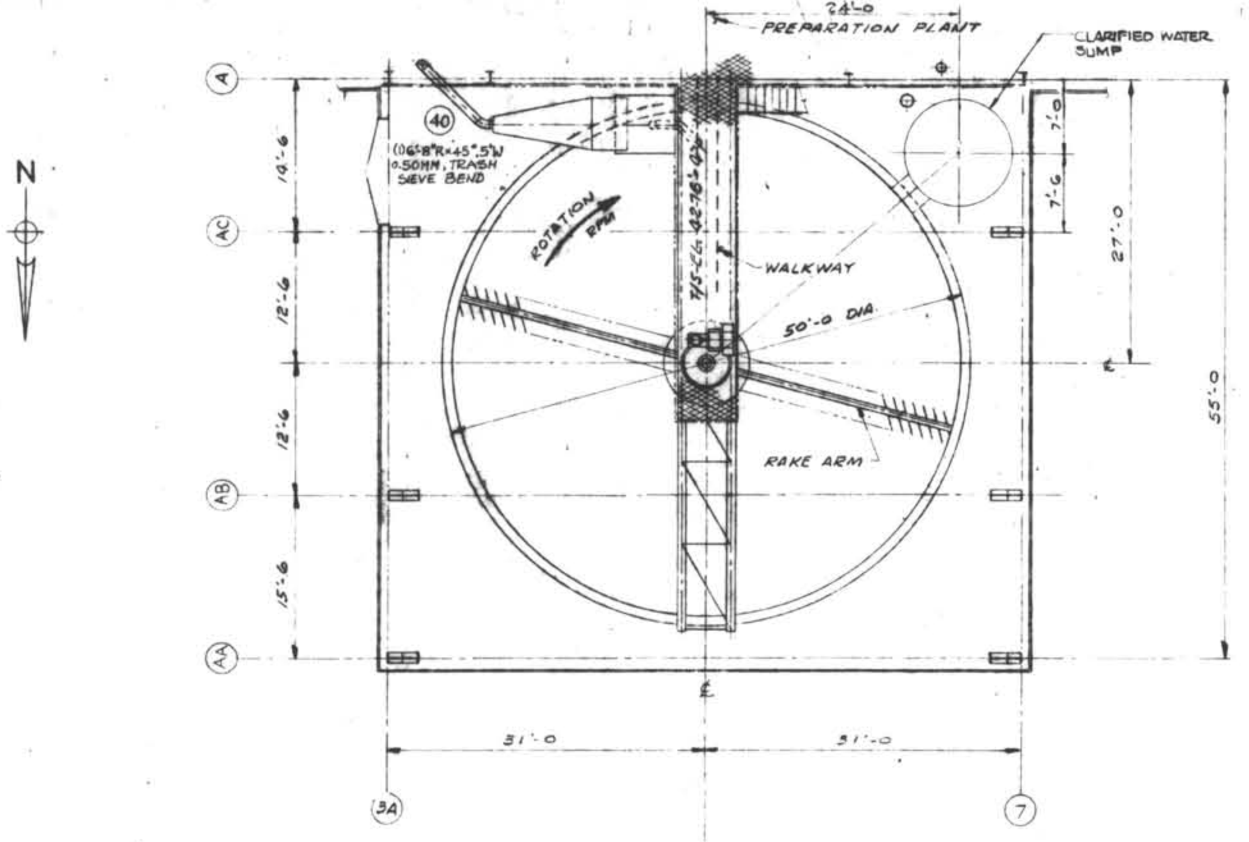
SCALE 1/8" = 1'-0
DRAWN W.J.N. 1-3-77
CHECKED A.P. 2-3-77
APPROVED

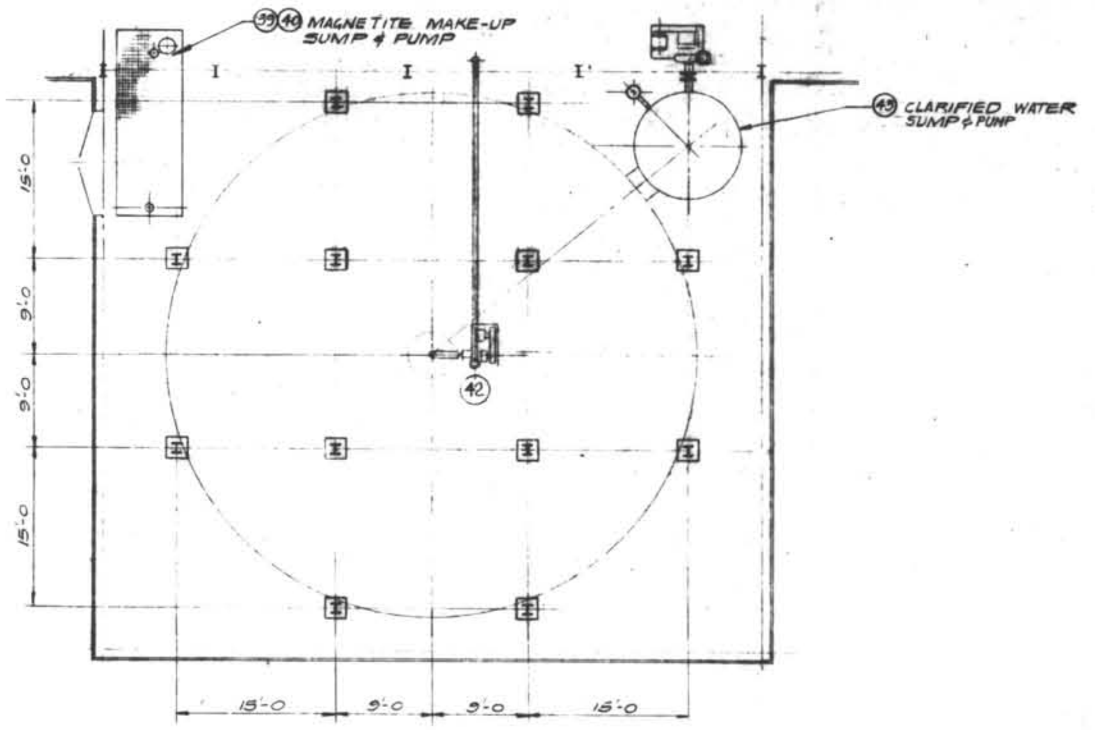
ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

REFUSE THICKENER
LINE CREEK PROJECT
CROWS NEST IND. LTD/MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA.

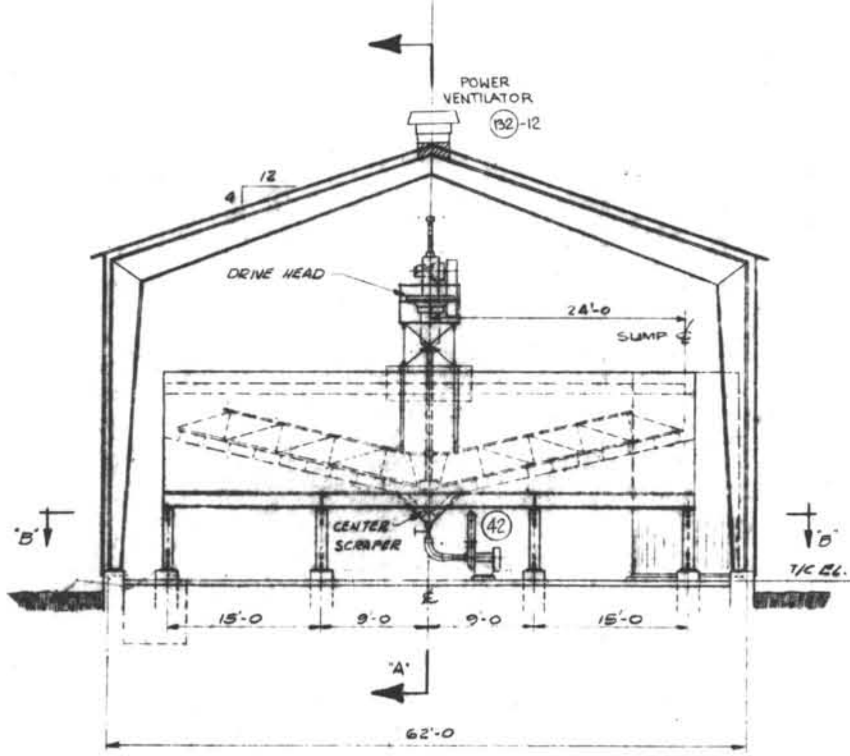
JOB 1929
DRAWING A-24
REV. 0



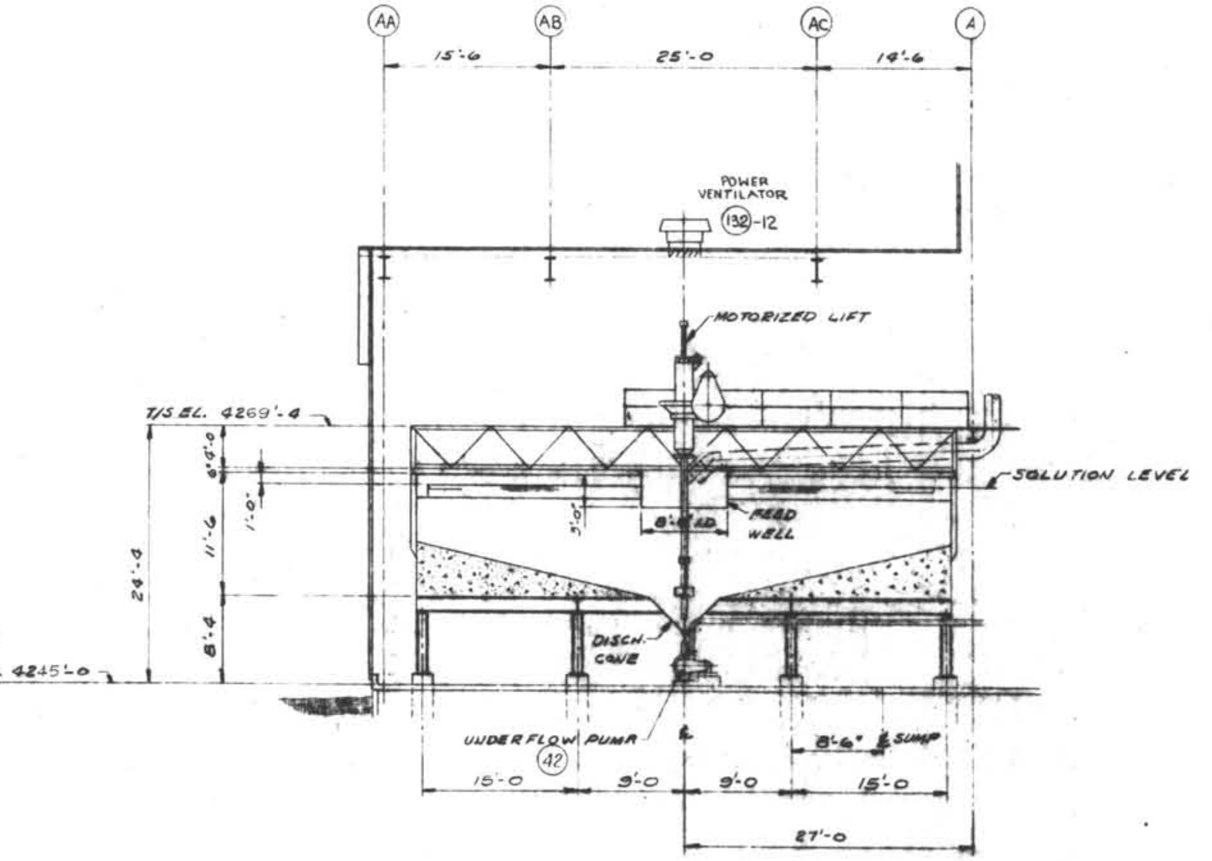
PLAN



SECTION "B-B"



ELEVATION



SECTION "A-A"

REVISION.

◇

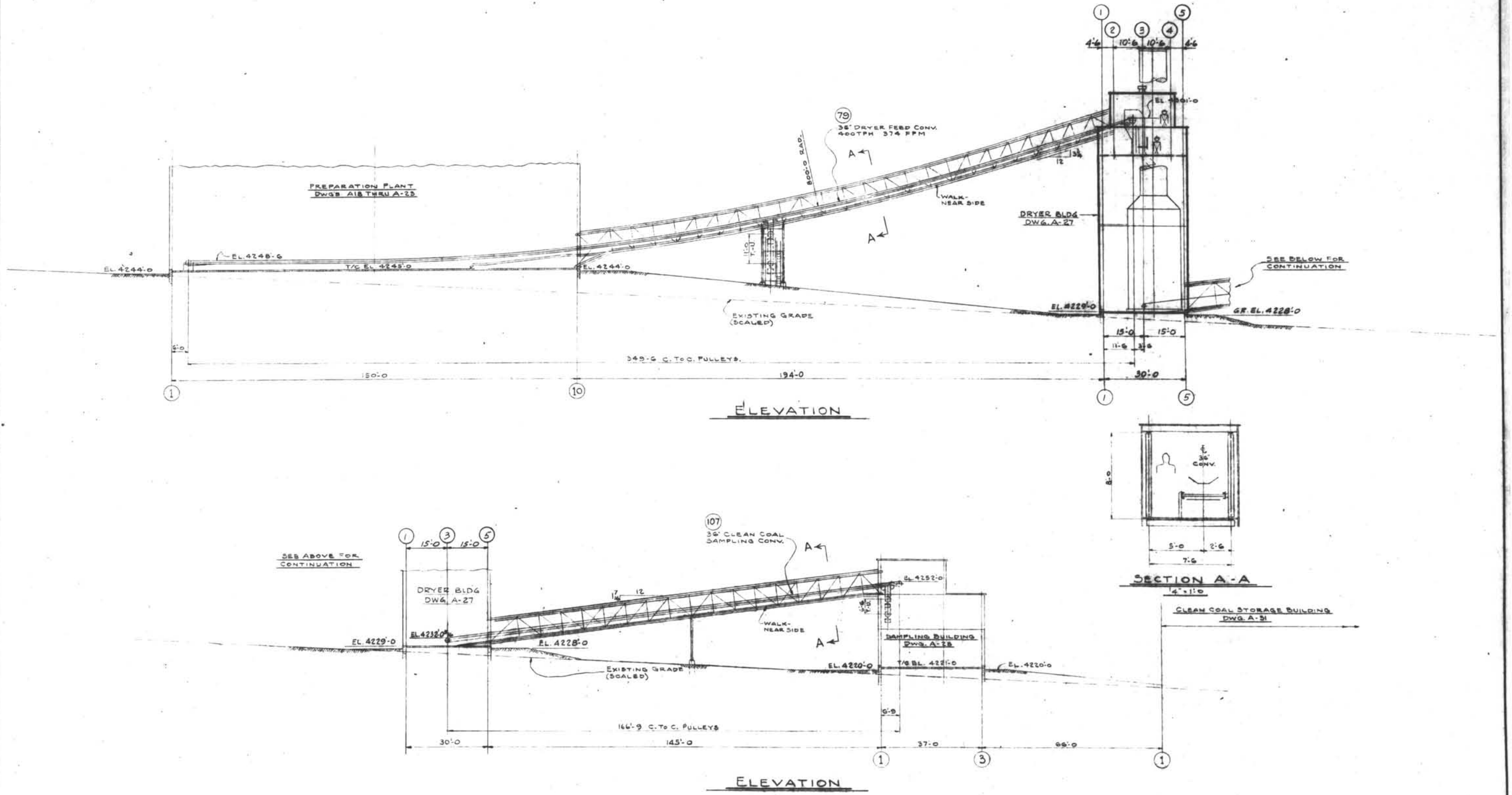
SCALE 1/8" = 1'-0"
DRAWN 12-22-76 D.E. COMSTOCK
CHECKED A.P. 2-3-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60606
TOP OF THE FIELD

50' DIA. MAGNETITE CLARIFIER
LINE CREEK PROJECT
CROWS NESTS INDUSTRIES, LTD., MITSUI & CO., LTD.
BRITISH COLUMBIA CANADA

DIVISION-4
JOB 1929
DRAWING A-25
REV. 0

PORT



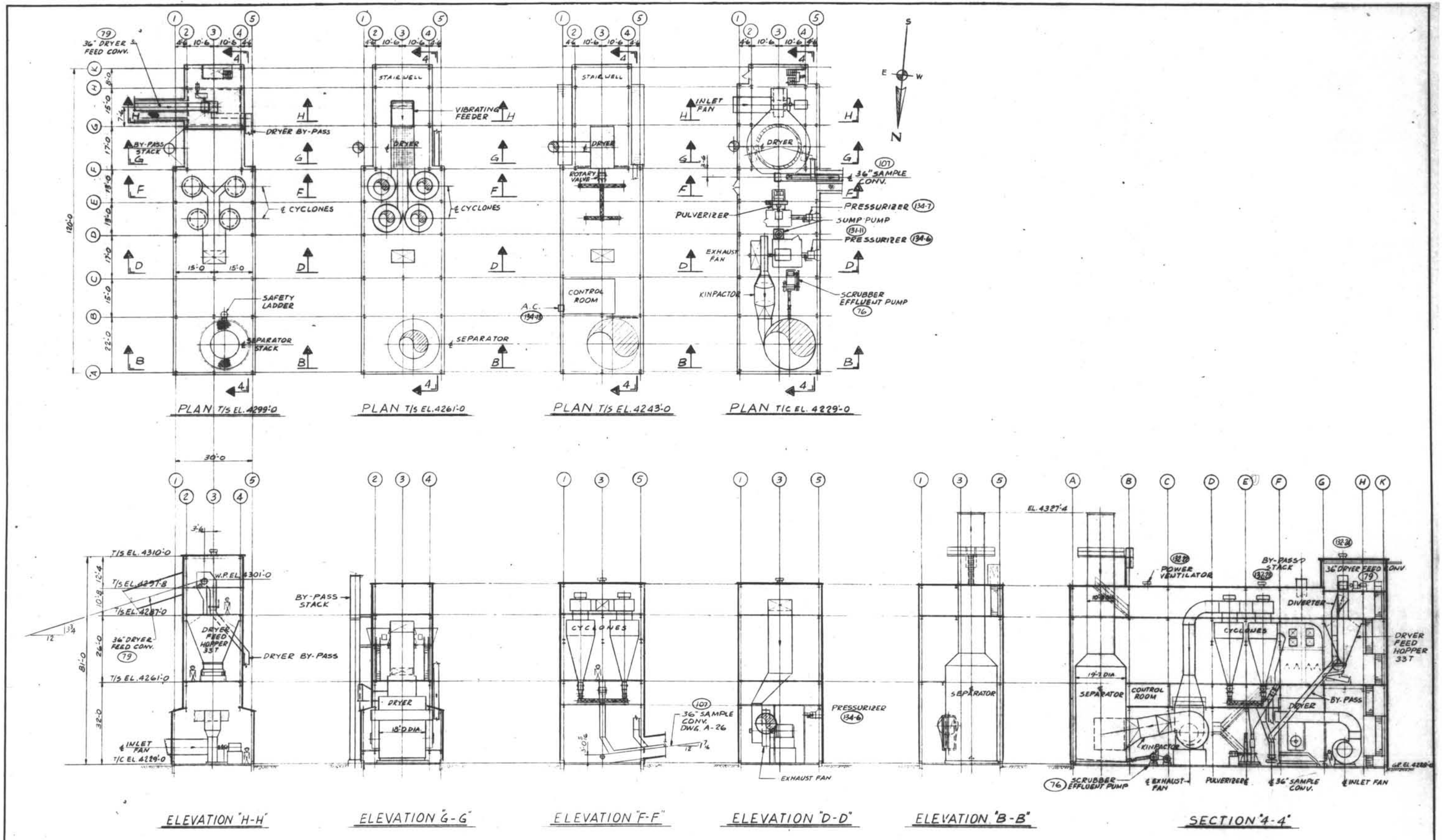
REVISION
◇

SCALE 1/16" = 1'-0
DRAWN W.J.N. 1-31-77
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

DRYER FEED CONV./CLEAN COAL SAMPLING CONV.
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD./MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA.

DIVISION-10
JOB 1929
DRAWING A-26
REV. 0



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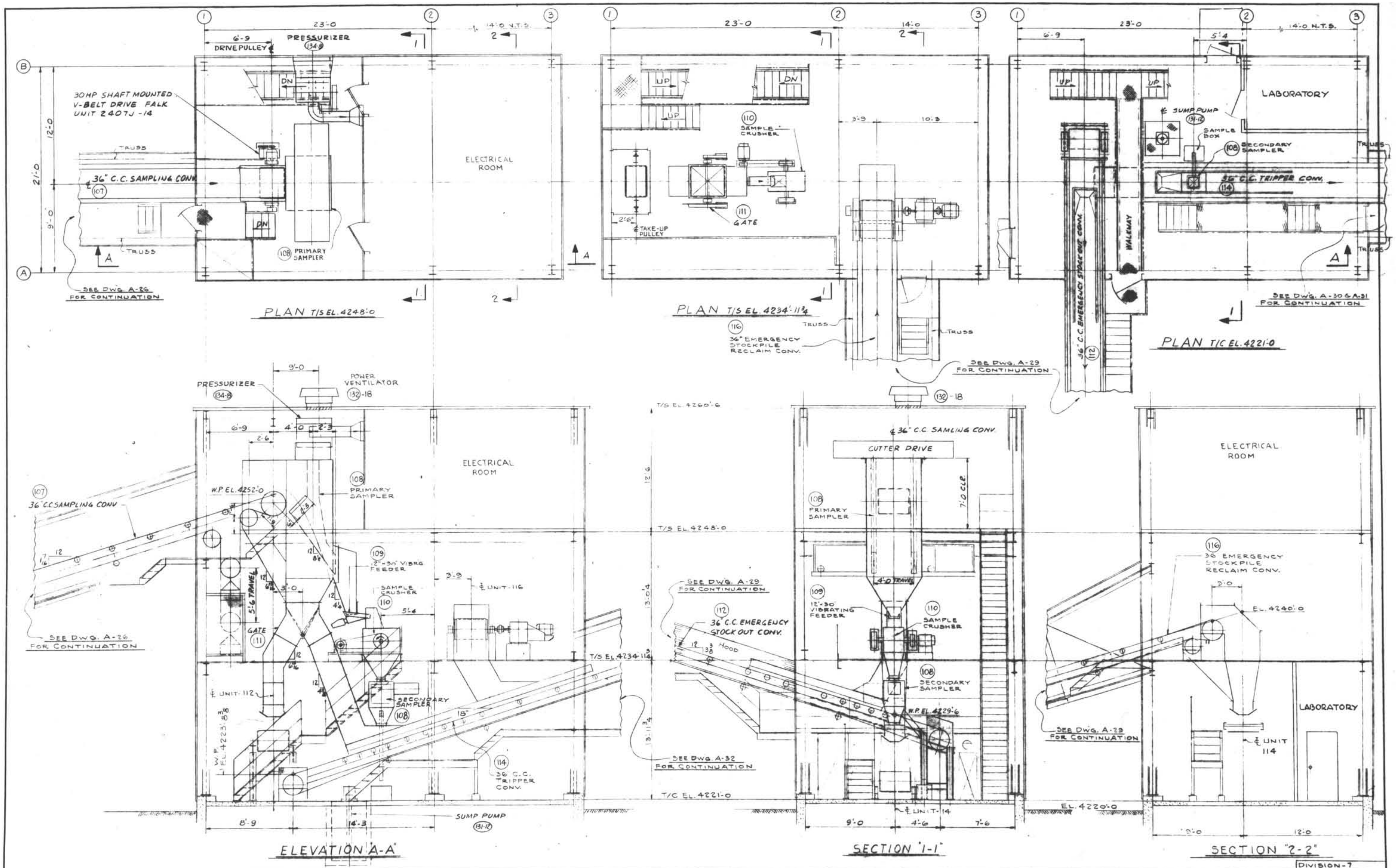
SCALE	1/16" = 1'-0
DRAWN	GPD 3-2-77
CHECKED	OL. 3-8-77
APPROVED	

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

THERMAL DRYER
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD. MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA

DIVISION - 6
JOB 1929
DRAWING A-27
REV.

PORT



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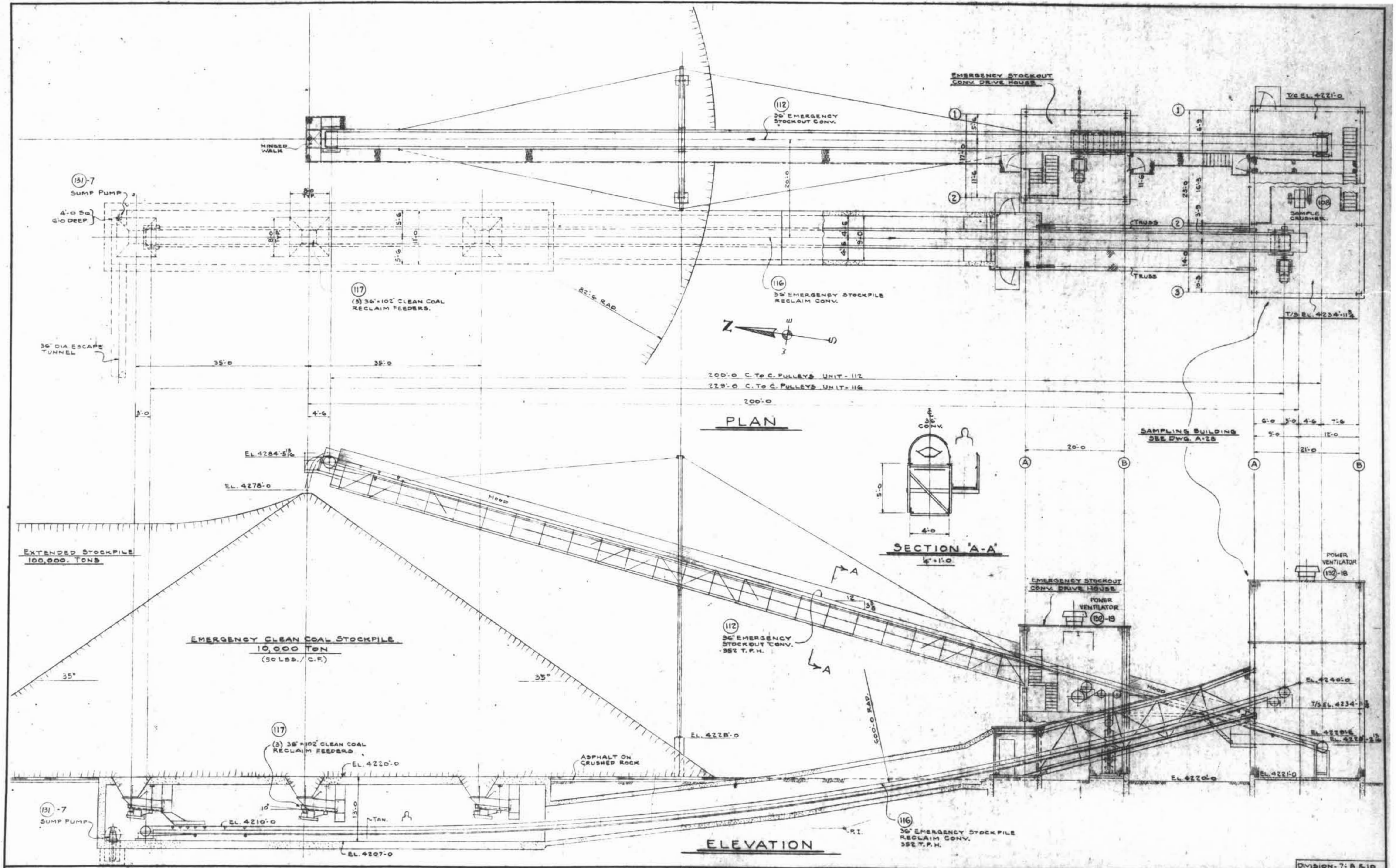
REVISION:
◇



REVISION:
◇

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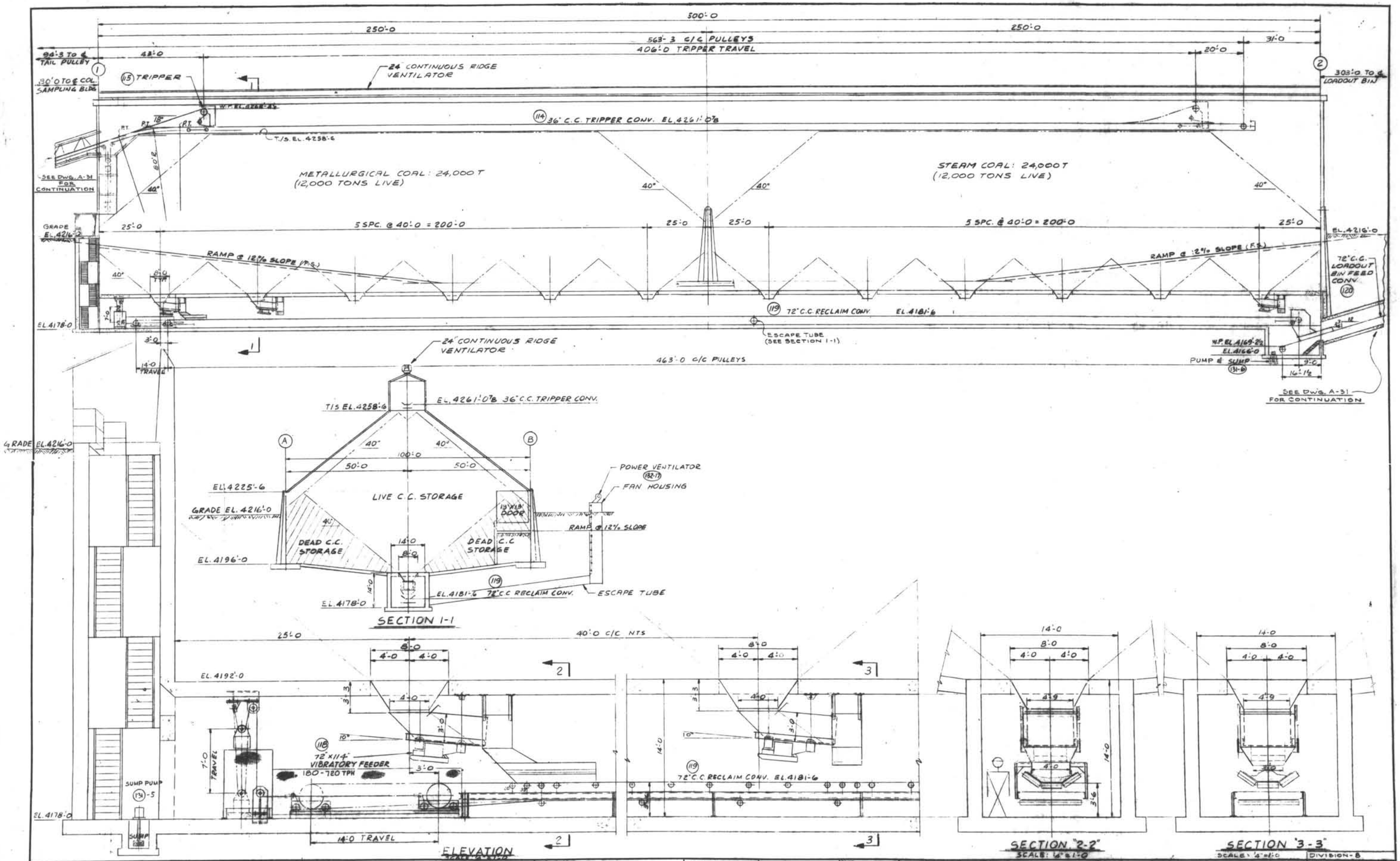
SCALE 1/8"=1'-0
DRAWN W.J.N. 1-6-77
CHECKED A.P. 2-3-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

EMERGENCY CLEAN COAL STOCKPILE
LINE CREEK PROJECT
CROWS NEST IND. LT'D. MITSUI & CO. LT'D.
BRITISH COLUMBIA, CANADA

DIVISION-7: 8 & 10
JOB 1929
DRAWING A-29
REV. 0



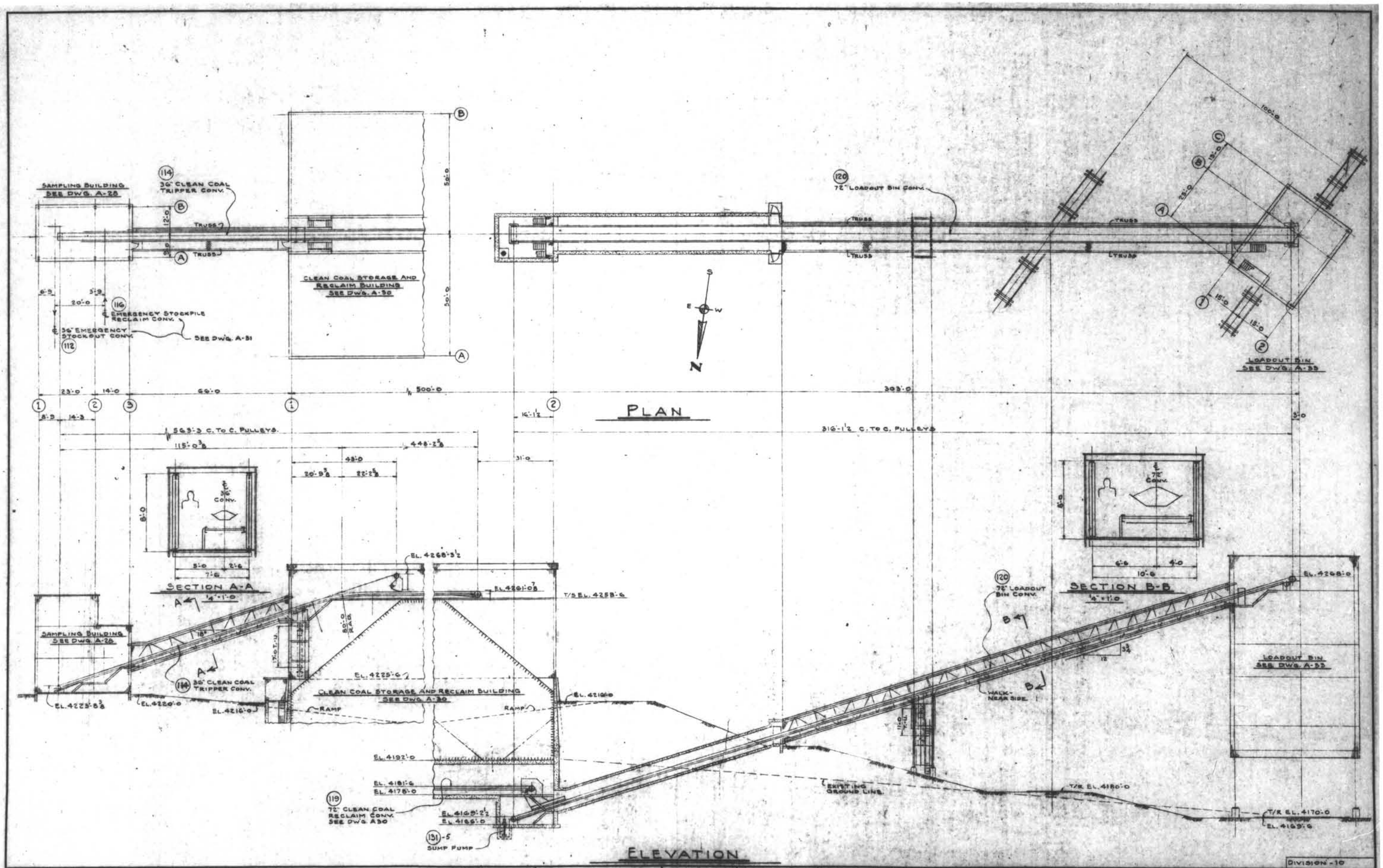
REVISION.
◇

SCALE 1/16" = 1'-0 U.N.
DRAWN BJD 12-16-76
CHECKED A.P. 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

CLEAN COAL STORAGE AND RECLAIM
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD - MITSUI & CO. LTD.
BRITISH COLUMBIA - CANADA

DIVISION - 8
JOB 1929
DRAWING A-30
REV. 0



REVISION:

◇

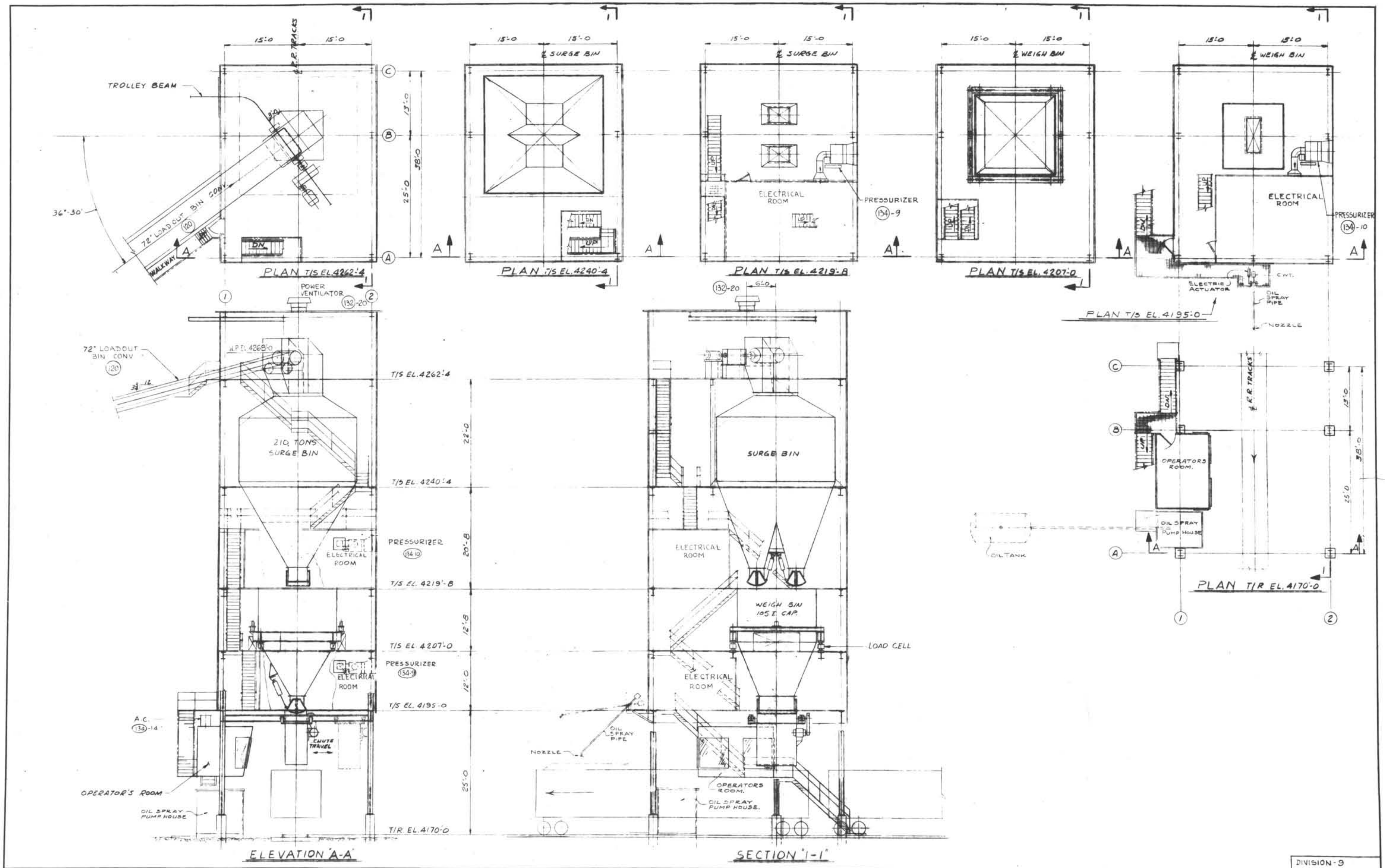
SCALE ⅛"=1'-0
DRAWN W.J.N. 1-13-77
CHECKED A.P 2-2-77
APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604

TOP OF THE FIELD

36" C.C. TRIPPER CONV. & 72" LOADOUT BIN CONV.
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD./MITSUI & CO. LTD.
BRITISH COLUMBIA, CANADA

DIVISION - 10
NO. 1929
DRAWING A-31
REV. 0



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SCALE	1/8" = 1'-0" U.N.
DRAWN	BJD 11-30-76
CHECKED	A.P. 2-3-77
APPROVED	

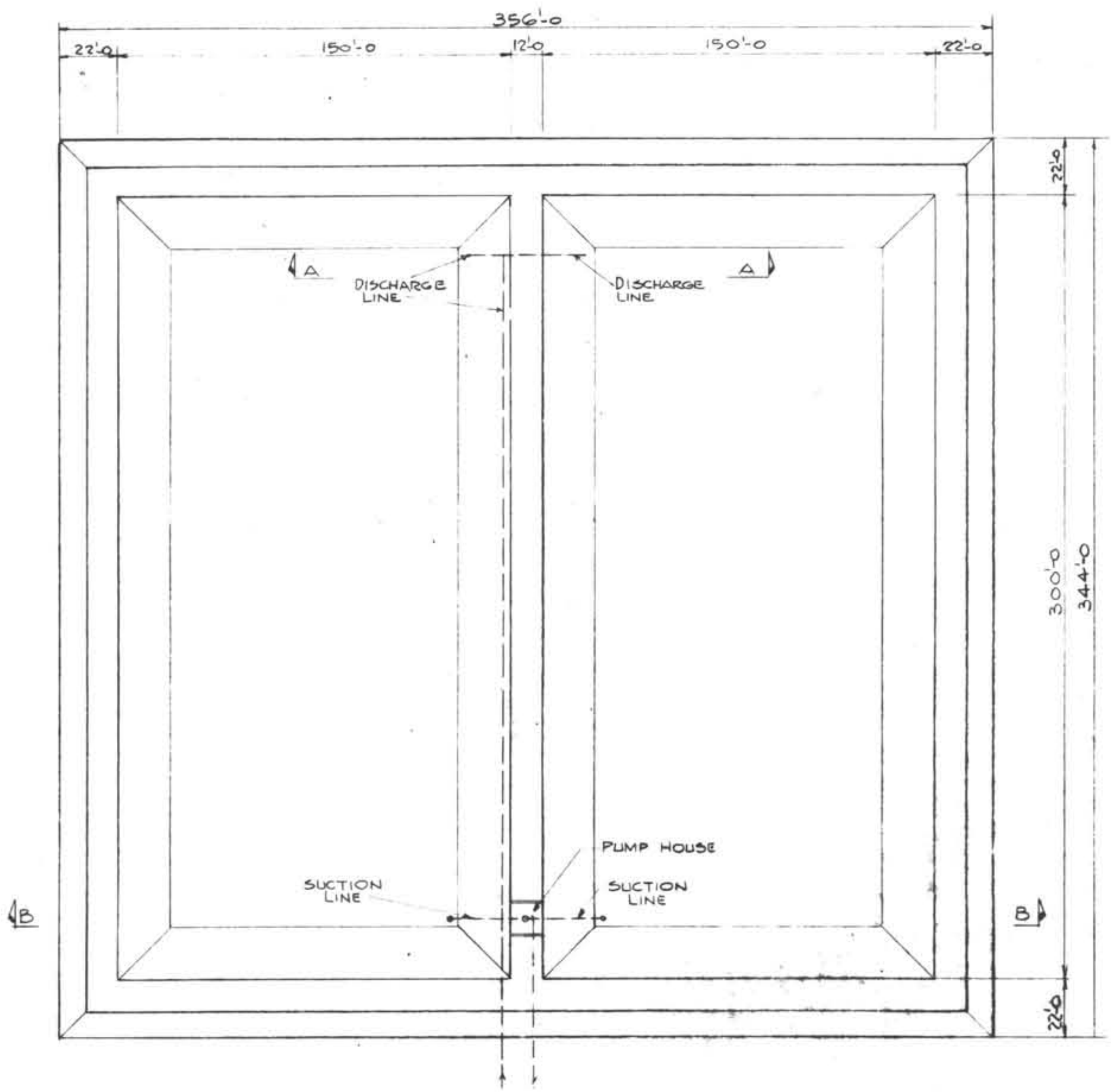
ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

LOADOUT BIN
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD-MITSUI & CO. LTD
BRITISH COLUMBIA - CANADA

DIVISION-9

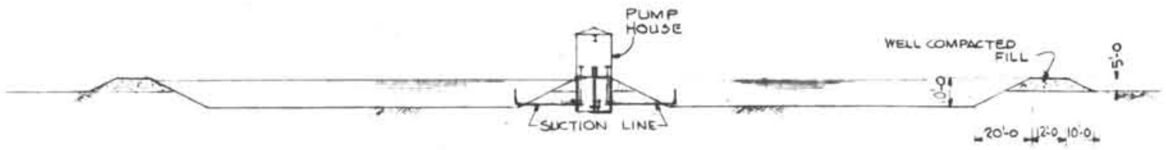
JOB	1929
DRAWING	A-32
REV.	0

REVISION:
◇

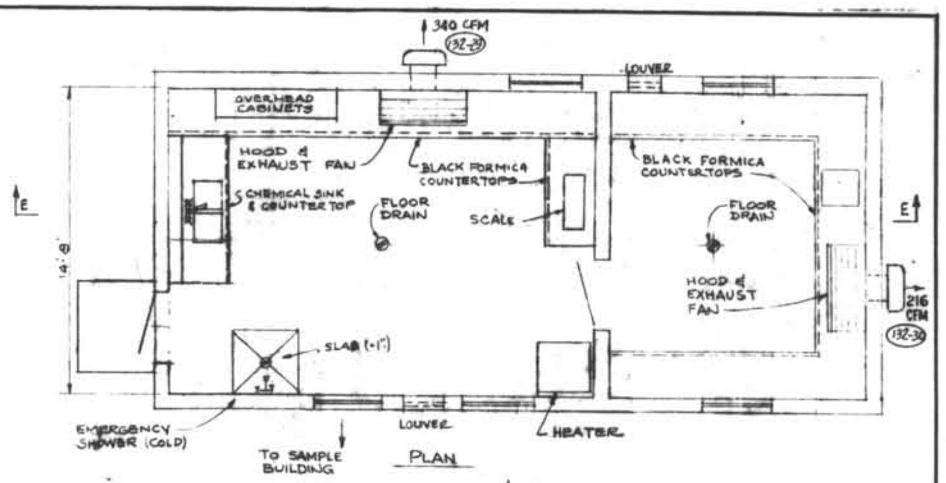


PLAN

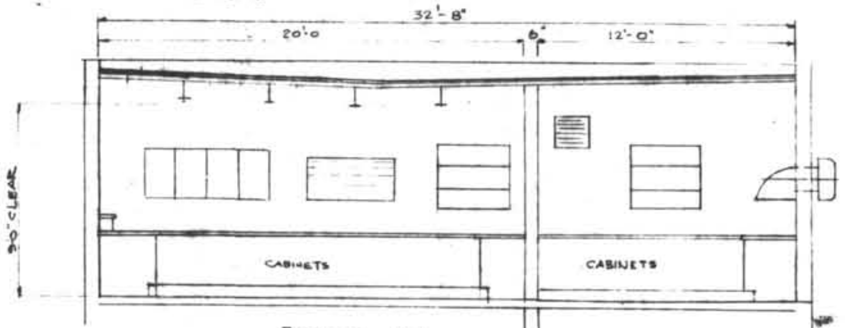
SECTION A-A



SECTION B-B

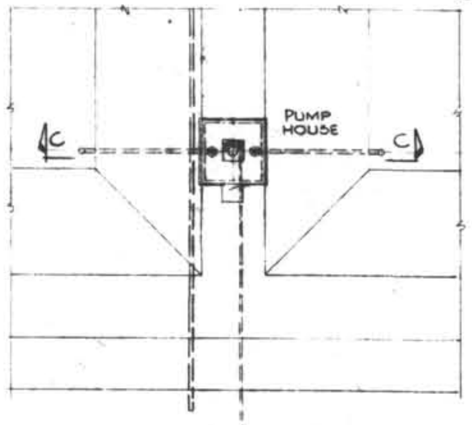


PLAN

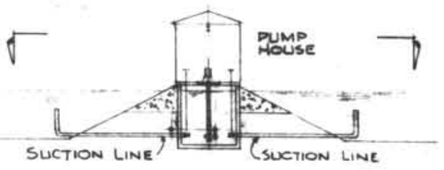


SECTION E-E

SAMPLE LABORATORY
1/4" = 1'-0"



PUMP HOUSE PLAN



PUMP HOUSE SECT. C-C

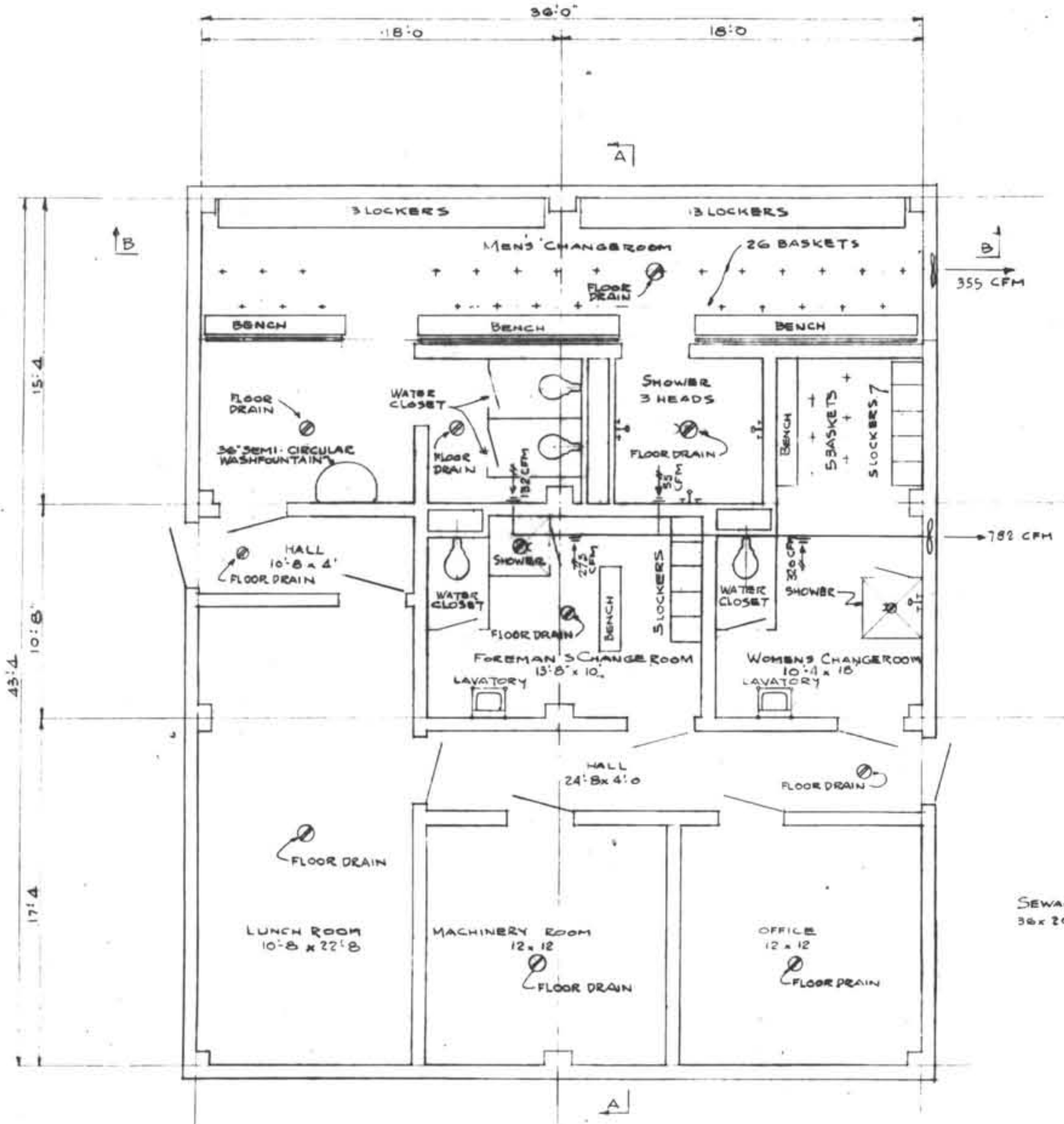
REVISION:
◇

SCALE 1" = 30' & 1/16" = 1'-0"
DRAWN J.N. 2-11-77
CHECKED A.P. 2-14-77
APPROVED

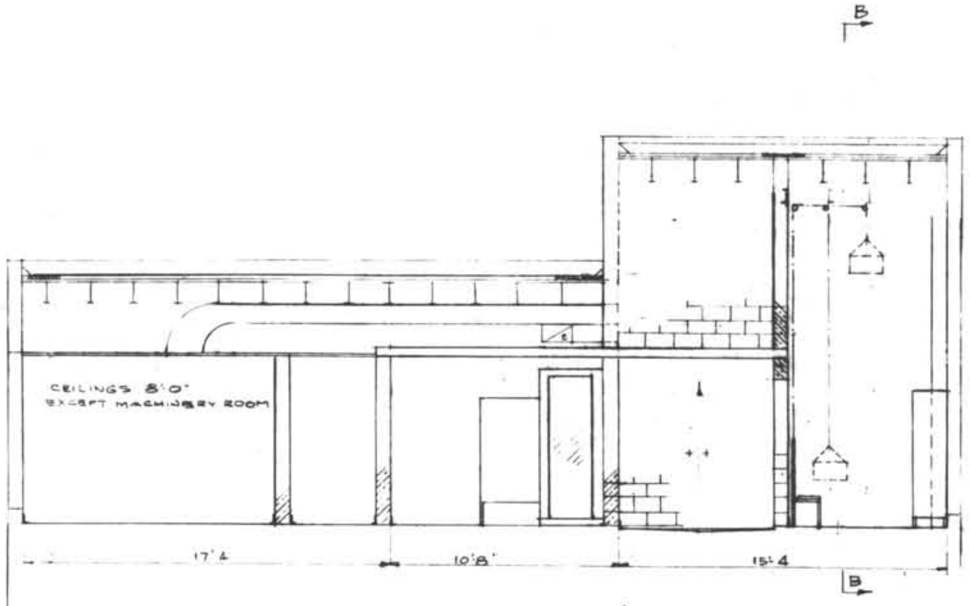
ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604
TOP OF THE FIELD

EMERGENCY SPILL POND & SAMPLE LABORATORY
LINE CREEK PROJECT
CROWS NEST INDUSTRIES LTD, MITSUI & CO. LTD
BRITISH COLUMBIA, CANADA

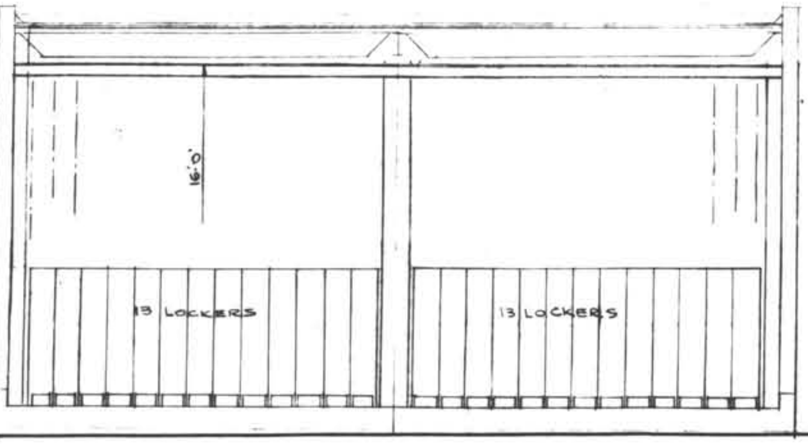
DIVISION - 11 & 12
JOB 1929
DRAWING A-33
REV. 0



SEWAGE DISCHARGE
36 x 20GPD " 720 GPD



SECTION A-A



SECTION B-B

|—→ EXHAUST FAN

—⫽—→|| POSITIVE MECHANICAL EXHAUST

REVISION:

◇

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SCALE 1/4 = 1'-0

DRAWN RJK 2-28-77

CHECKED JGL 2-28-77

APPROVED

ALLEN & GARCIA COMPANY
Consulting & Construction Engineers
CHICAGO, ILLINOIS 60604

TOP OF THE FIELD

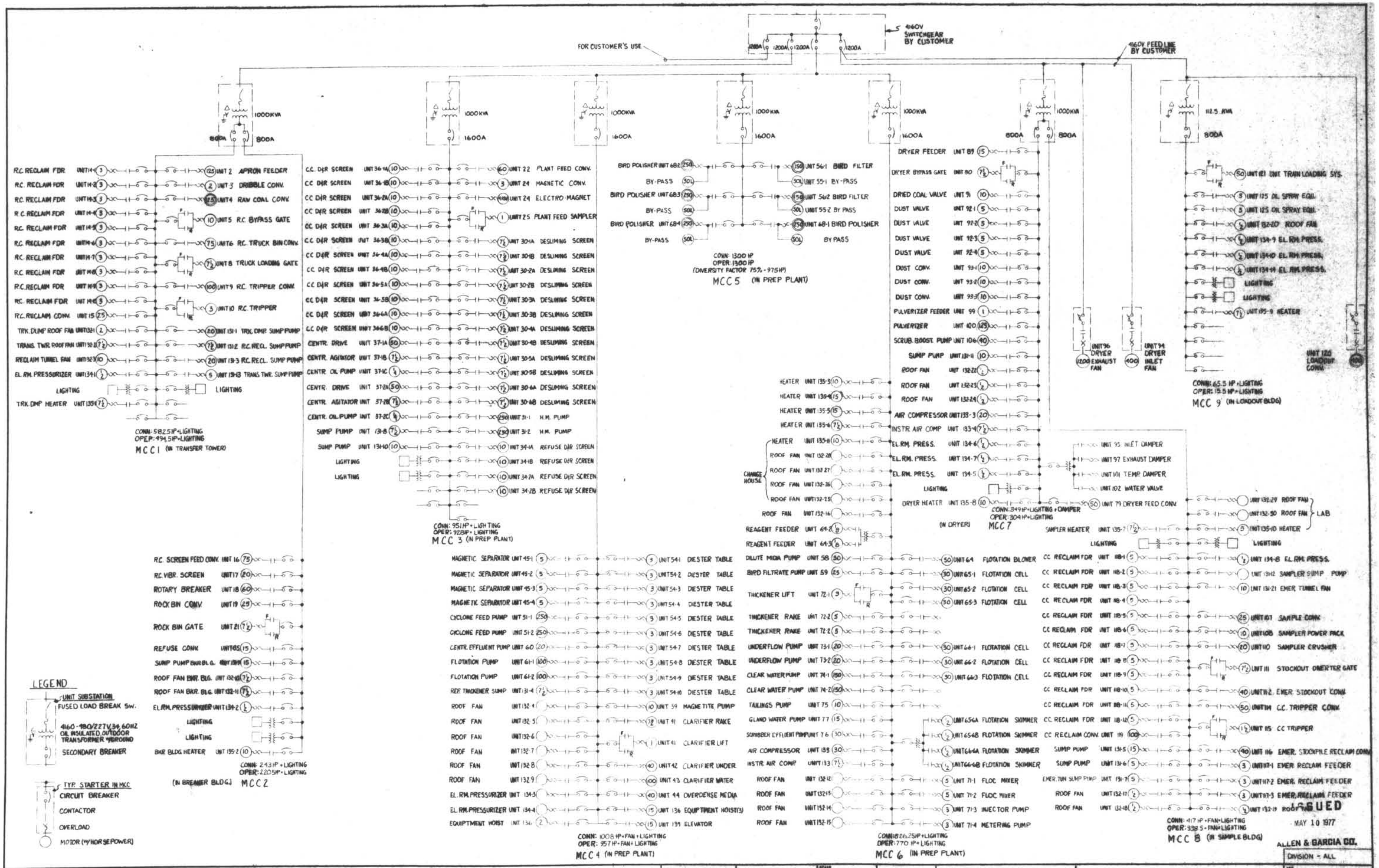
COAL PREPARATION FACILITIES
GENERAL ARRANGEMENT-WASHHOUSE
CROWS NEST INDUSTRIES LTD MITSUI & CO. LTD
FERNIE, BRITISH COLUMBIA, CANADA

DIVISION II

JOB 1929

DRAWING A34

REV. 0



REVISION: CHANGED HP TO MATCH MECHANICAL DESCRIPTION & REV. HP TOTALS
TS 4-15-77

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SCALE	NONE
DRAWN	TS 3-3-77
CHECKED	5-7-77
APPROVED	

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