HAT CREEK PROJECT

MINING FEASIBILITY REPORT

APPENDIX A

STUDY ON THE APPLICATION OF BUCKET WHEEL EXCAVATORS FOR THE EXPLOITATION OF THE HAT CREEK PROJECT

prepared for

British Columbia Hydro and Power Authority

by

Cominco-Monenco Joint Venture

August 1978

HAT CREEK PROJECT

MINING FEASIBILITY REPORT

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Cominco - Monenco Joint Venture

Vancouver / Canada

Study

on the Application

of Bucket Wheel Excavators

for the

Exploitation of the Hat Creek Deposit

Part A

North American Mining Consultants, Inc.

Denver/USA

RHEINBRAUN - Consulting GmbH

Cologne / Federal Republic of Germany

June 1978

PART A

PLANNING

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PART A: PLANNING

0. SUMMARY

Part A of this report refers to the planning of application of bucket wheel excavators and conveyor systems for the exploitation of the Hat Creek Deposit for the supply of a 2 000 MW normal load power plant with a lifetime of 35 years. On the basis of the documents from CMJV, especially the geological and geotechnical documents, an opencast mine was planned providing the combined operation of bucket wheel excavators and shovels/trucks. The opencast mine attains its max. deptn at + 685 m above sea level. The total of masses to be moved are as follows:

- Total Volume approx. 726 mill. m^3
  thereof
  - waste approx. 485 mill. m^3
  - coal approx. 332 mill. t
    with a heating value
    of 7 390 Btu/lb (17.19 MJ/kg)
    corresponding to a waste : coal ratio of
    1.46 : 1 (m^3 : t)
  - low grade coal approx. 10 mill. m^3
    with a cut-off grade
    of 4 000 Btu/lb (9.3 MJ/kg)

The total masses are distributed as follows:

on bucket wheel excavators	approx.	442 mill. m^3
on shovel/truck	approx.	284 mill. m^3

The application of 4 crawler mounted bucket wheel excavators of compact construction is recommended, the capacity of these excavators being 5.5 mill. m^3 per year and unit. They should reach a digging height of 45 m during selective operation, with the ability of 50 m where selective mining is not required. Selective mining describes an operation in which different layers of material are separately

removed. The bucket wheel excavators are intended to be used in conjunction with belt wagons having a length of approx. 80 m.

Further material transport up to the distribution point is intended to be made by steel-cable belt conveyors having a belt width of 1 200 mm, a speed of 5.2 m/s, and a max. length of 16,390 m, the capacity of these conveyors being adapted to the theoretical output rates of the bucket wheel excavators, i. e. 2 600 m^3(loose)/h. The belt conveyor systems will be guided over a central outgoing ramp in SE of the mining area towards a conveyor distribution point, where the materials will be transferred onto the belt conveyor systems planned by CMJV for final discharge onto the outside dump resp. onto the coal stockpile. A total of 6 belt conveyor systems will be situated on the central outgoing ramp, two of which will be envisaged for the onway transport of masses mined by shovel and truck.

The operation of the bucket wheel excavators and belt conveyor systems will be supported by various ancillary equipment. The control and communication systems have been developed and the special requirements towards maintenance facilities indicated.

The electric power supply needs to be designed for a capacity of 30 MVA.

For the opencast mining operations covered by this report the manpower requirement will be at about 220 people incl. 60 maintenance people.

Finally, RC emphasizes that a more favourable presentation of the geological documents might create considerable possibilities for optimisation of the proposed opencast mine planning.

The capital and operating costs are indicated in Part B of this report.

1. INTRODUCTION

1.1 OBJECT OF THE REPORT

The Hat Creek coal deposit is situated some 200 km to the north-east of Vancouver in the province of British Columbia. It is held under license by British Columbia Hydro & Power Authority (BC Hydro).

BC Hydro intends to use the Hat Creek deposit for the supply of a normal-load power plant in vicinity of the mine. The power plant is planned for a capacity of 2 000 MW (net) and a life duration of about 35 years. Initial start-up of the power plant is currently planned to be in 1986. BC Hydro engaged several consultants for the developing of the planning work involved. The planning of the mining facilities is directed by the Joint Venture Cominco-Monenco (CMJV). The geotechnical investigations are carried out by Golder Ass.

It is one of the tasks of CMJV to investigate the application of different mining systems and approaches for developing the Hat Creek deposit, and this from the technical and economical viewpoint. There exists the formal task to investigate the possibility of application of bucket wheel excavators and belt conveyors as one of the possible alternatives. In June 1977 CMJV and RHEINBRAUN-Consulting GmbH, Cologne, (RC) through North American Mining Consultants Inc. (NAMCO) agreed that the study on the application of bucket wheel excavators and belt conveyors will be carried out by RC. This agreement was confirmed by CMJV by their letter OIJ/smg dated July 08, 1977.

1.2 TERMS OF REFERENCE

The services of RC were summarized in the below-mentioned Terms of Reference, as of the date of Febr. 01, 1978:

NAMCO Terms of Reference

(a) Working as a sub-consultant to the Cominco-Monenco Joint Venture, investigate the application of bucket wheel excavators to an integrated system of mining Hat Creek deposit No.1.

(b) Using design criteria and geological interpretations supplied by CMJV, develop mining plans and production schedules on an annual basis for the first 3 years of pre-production and the first 5 years of production. This is then followed by six 5-years increments for a total production period of 35 years. Quantity and quality calculations will be developed jointly by NAMCO and CMJV as agreed.

(c) Recommend primary excavating and conveying equipment requirements to remove coal and waste.

(d) Enumerate any special requirements (such as dewatering) that are peculiar to bucket wheel excavator planning.

(e) Advise CMJV what support facilities are required that are directly related to BWE planning.

(f) Develop capital and operating costs, including manpower requirements.

(g) Prepare a detailed task list and schedule for the study period to aid in monitoring the work as it progresses.

(h) Submit monthly reports on progress and costs of the study.

(i) Prepare specific contributions to the Mining Feasibility Report as requested by CMJV.

(j) Such other work related to the project as may be requested by CMJV from time to time.

According to point(g) of the Terms of Reference the following detailed task list was agreed during the Project-Meeting in Vancouver from 24th to 26th Jan., 1978:

(a) Construction of bench plans and quantity calculation sections

(b) Calculation of the bench plans and calculation sections submitted by RC through CMJV

(c) Developing of the production schedule

(d) Planning of a preliminary mining conception, preliminary selection of equipment and preliminary cost calculation (investments and operating costs)

(e) Realization of a project meeting with CMJV for mutual discussion of the entire planning conception

(f) Based on the results of the meeting as mentioned under (e)above

- Accomplishment of the mine planning and establishment of drawings for approx. 14 mine positions
- Selecting of final equipment and specification
- Determination of ancillary equipment requirement
- Calculation of power supply and indication of the communication and control systems for the mine
- Calculation of the manpower requirement for full output rate
- Establishment of a detailed cost calcualtion

The limits of the RC scope of work can generally be characterized in the manner that RC treats all subjects which are directly related to the bucket wheel excavator system. This scope of work and the above-mentioned task list were subject to some modifications of basic data and supplements. These were covered by verbal agreements or submitted in writing. Special reference is made in this report to these modifications and supplements.

1.3 DOCUMENTATION AVAILABLE

The investigations of RC have been based mainly on the following documents:

- PD-NCB Consultants Ltd., Revised Report on Hat Creek Openpit No. 1, March 1977
- Golder Ass., Hat Creek Geotechnical Study, Final Report, March 1977
- CMJV - Hat Creek Project - Criteria Manual, last edition: 4th Revision, 30.03.1978
- Topographic maps, scaled 1 : 5 000
- Boring maps, scaled 1 : 5 000
- Representation of the geological formations according to "Phase II - Information", see page 2-4 for explanation
- Maps showing the location of the NW slide area and the surficials and cross-sections therof as well as
- Several special memos and documents resp. drawings, to which is made reference in this report, as far as they are of special importance for the investigations carried out.

1.4 DETERMINATION OF PLANNING PHASE

According to the CMJV Terms of Reference the total planning is divided into 2 phases:

- Phase I : preliminary engineering work
- Phase II: final design work

It is stressed here upon the fact that the investigation results submitted by this report are an integrated portion of Phase I, preliminary engineering work, as agreed.

RC is fully convinced that the investigation results submitted through this report provide, in this phase of planning and on the base of the information supplied by BC Hydro resp. CMJV, a sufficiently reliable basis for the evaluation of the application of bucket wheel excavators and belt conveyors for the exploitation of the Hat Creek deposit. At relevant points of this report, and especially under point 5 reference is made to some basic reflections which necessitate according to RC's opinion intensified and additional investigations for the developing of the final design work. These investigations may cause in certain circumstances and for partial fields considerable modifications of the submitted planning conception. They can, however, also create optimizing possibilities since the submitted planning conception is mainly based on conservative estimates.

2. CHARACTERISTICS OF THE DEPOSIT

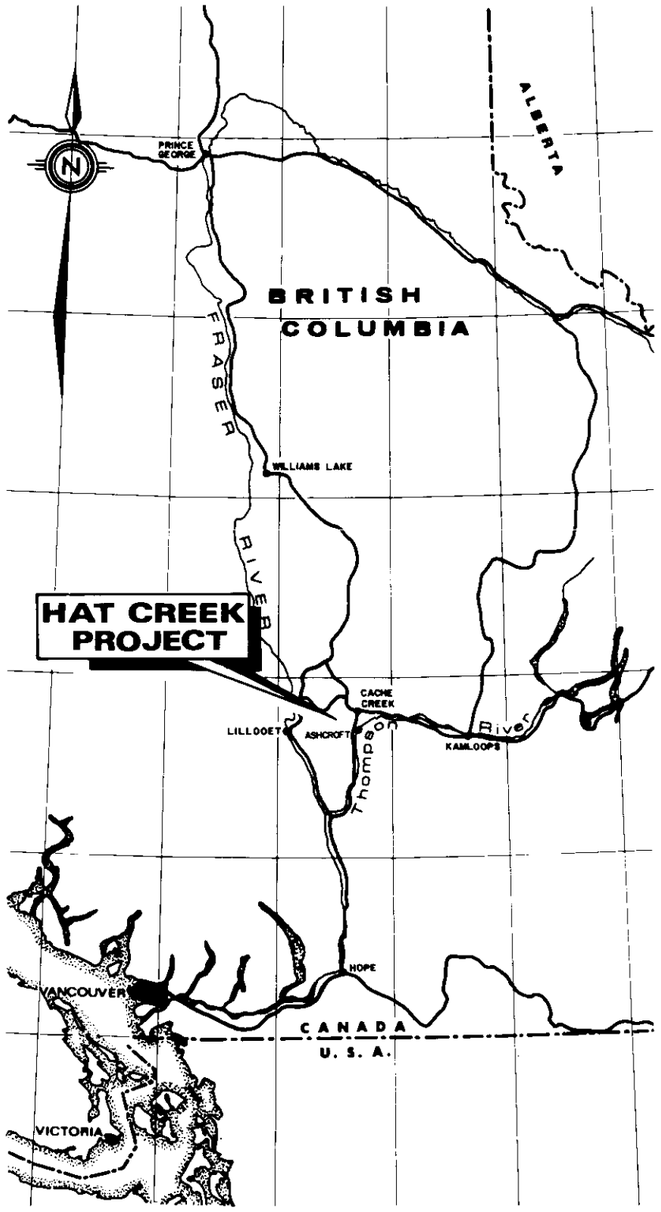
2.1 GENERAL

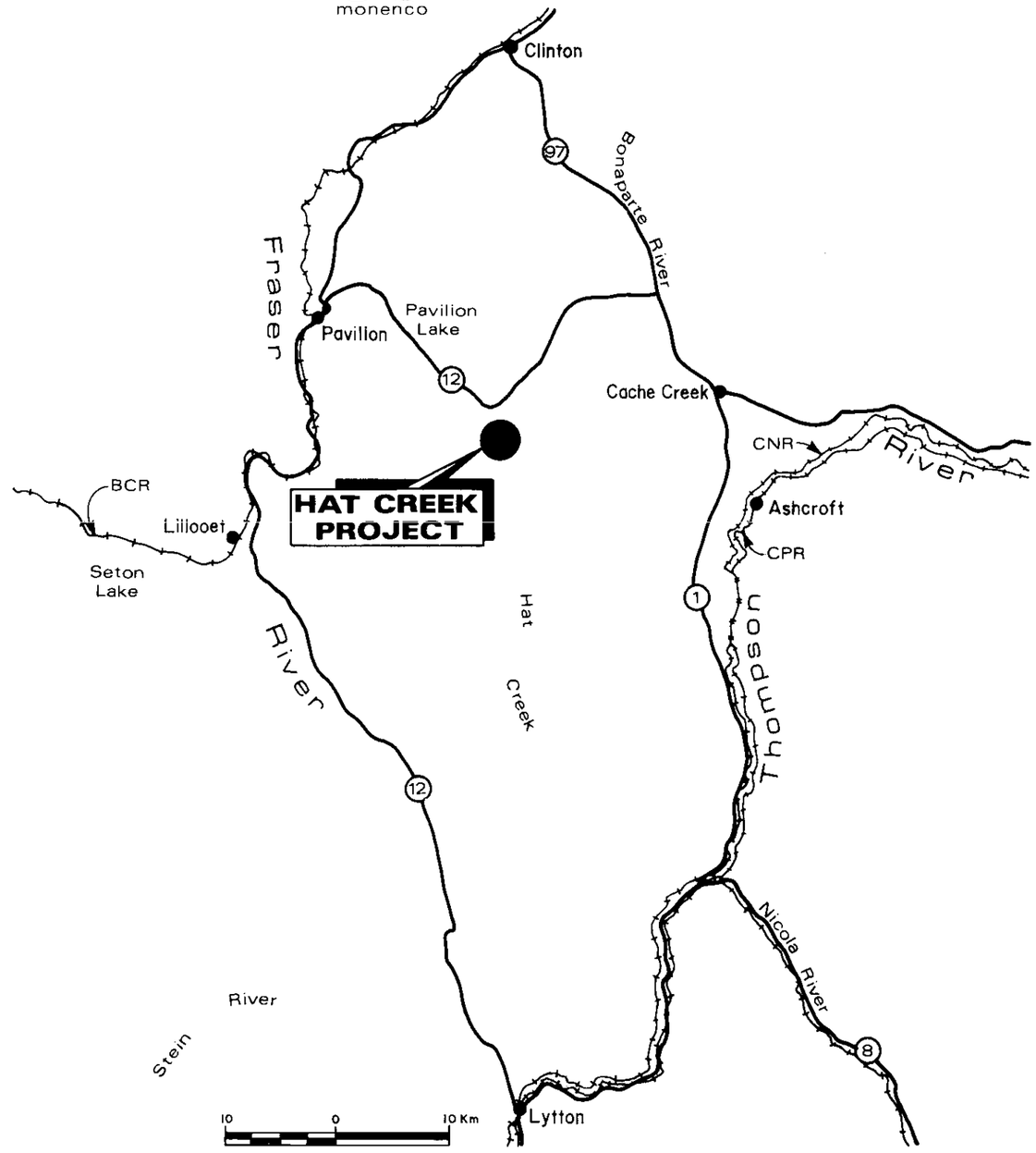
During the treatment of this project RC have had the opportunity to visit together with Messrs. BC Hydro, CMJV and Golder Ass. the deposit on several occasions. The deposit was opened down to a depth of about 30 m through the investigation of two trenches. Besides the information collected during these visits the topographical, geological and geotechnical documents as mentioned under point 1.3 above were available to RC for the evaluation of the deposit.

The following is to repeat briefly the main characteristics of the deposit which are of special importance for the study on the application of bucket wheel excavators.

2.2 SITUATION AND TOPOGRAPHY

The Hat Creek deposit is situated in vicinity of the Harry Lake in the region of the Hat Creek Valley in British Columbia. It is situated in a high valley at an elevation of about + 1 000 to 1 200 m above sea level (see page 2-3). Characteristical for the topography of the mine area are especially the Hat Creek Valley which intersects the deposit from south-east towards north-west at a depth of up to + 860 m, and the upward gradient of the area towards the mine boundaries.





BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
HAT CREEK PROJECT
PROJECT LOCATION

2.3 GEOLOGY

231 COAL

The geology of the Hat Creek deposit, compared to many coal deposits in non-mountaineous areas, is of a rather complex nature. The coal-bearing layers represent trough-shaped beds interspersed with several shearing zones and are reaching a depth of up to about 500 m. The coal is interspersed with various intercalations and waste partings. The volume, the dip and the thickness of these partings vary strongly and influence highly on the heating value of the r.o.m. coal.

Lithologically, the partings are mainly composed of clayey materials. They influence on both the stability of slopes and the handling behaviour of the coal on belt conveyors. The partings are partially distributed in such a fine manner throughout the coal that they cannot be dug selectively to full extent.

This planning report is based on the representation of the geological formations according to the Phase-II-Information. The coal-bearing layers are subdivided into the 4 main zones A, B, C and D with a total of 12 sub zones. Partly the drilling results are combined up to 75 m thickness to average values.

With the exception of the main parting bands A_2 and C_1 the remaining partings are not distinguished. Due to the trough-shaped coal beds and the strongly varying distribution of partings, the coal quality differs highly both in vertical and horizontal distribution of the deposit. The coal of the D-Zone, i. e. the coal of the best quality is found in the North-East and on the Western border of the mining field. These viewpoints are of special importance for the planning of the mining operations. In any case the mining operations need to be very flexible in order to guarantee a somewhat uniform coal quality throughout the entire life duration of the power station.

232 WASTE

From the technical viewpoint, the waste is divided into

- low grade coal with a cut-off grade of 4,300 Btu/lb,
- non-coal material for special uses, consisting of gravels, sands and burnt zone materials, and
- non-coal material with no use

and from the geotechnical viewpoint into

- surficials, consisting of clay and claystone, glacial tills, burnt zone materials and glacial granular materials,
- footwall "rocks", consisting of claystones, sandstone and conglomerate, and
- hanging wall "rocks", mainly composed of shale, claystone, siltstone and sands.

The waste is overlying the trough-shaped coal beds and attains its minimum thickness of about 8 m at the north-eastern edge of the pit area, the waste increases in thickness to about 135 m in the centre of the valley. The characteristics of these "rocks" are discussed in detail in the Golder Report and the Criteria Manual. The geotechnical conditions are treated under point 2.4 of this report. With concern to the planning of mining operations the following features are accentuated:

- highly differing distribution of coal quality
- the slide area in north-west of the deposit
- the surficials for the construction of the embankments for the outside dumps
- the distribution of random boulders
- the existing quantities of low grade coal.

The following statements were made in mutual agreement with CMJV and in relation to the above points:

Re (a) The power station needs to be fed with coal of a fuel specification having minor quality differences throughout its entire operational life.

It should be tried to obtain a grade of coal undiluted of 7,560 Btu/lb. (dry basis). (See File Note MH-st-7 dtd. 10.03.1978).

Re (b) The slide area extends over a length of about 800 m on the north-western edge of the mine. It is here the question of an active slide moving towards the mining area. The main masses of the slide area are situated outside of the mining area. Sections of its basements and branches are reaching into the mining area. All these masses shall be dug by shovels. Stationary conveyor systems need to be avoided throughout the slide area.

Re (c) According to the planning of RC, the main portion of accumulating waste quantities will be spread onto the outside dump Medicine Creek. For building-up of major and eastern embankments of this dump about 70 mill. m^3 of adequate material will be needed according to File Note CMJV 200 dtd. 03.03.1978. Most portion of this material requirement is to be taken from the surficials considering the time sequence for building-up of the embankments.

Re (d) Random boulders of different concentration are found on the surface and in the upper top layers of the mining area, these boulders representing very hard and partially large glacial rock lumps which cannot be dug by bucket wheel excavators and not be handled by the envisaged belt conveyors.

The random boulders are intended to be dug by ancillary equipment. It is, however, not intended to consider their volumes separately in the quantity calculations, since they are not representing a significant portion of the total masses.

Re (e) The accumulating low grade coal masses need to be indicated separately since at present they are considered to be of no use and intended to be dumped on a separate stock pile.

233 PRESENTATION OF GEOLOGICAL DATA AND APPLICATION FOR PLANNING

As indicated above, the investigations made are based on the presentation of the geological formation of the deposit according to the Phase-II-Information subdividing the coal-bearing seams in 12 sub-zones and the two waste-parting-zones in A_2 and C_1. RC is aware that for the developing of the final design work, the Phase-II-Information will be improved by incorporation of the 1977 bores. RC is, however, still of the opinion that the represented complexity of the deposit needs to be subject to basic review. The existence of shearing zones, the highly differing coal quality and the variable distribution of waste partings necessitate in any case a detailed representation of geological formations and an extensive individual representation of all existing coal and waste bands. According to our opinion, this detailed review is absolutely necessary for future control of the running mining operations, and beyond this it would represent a considerable contribution for the final design work, with respect to optimizing of fuel specification, production scheduling, equipment selecting and costing.

The existing number of test bores, the average distance of bores, the quality of the existing bore cores and the various separate investigations of coal and waste samples should permit, in our opinion, to carry out the proposed review of the geology without the necessity of important additional investigations.

2.4 GEOTECHNICS

With respect to the planning of mining operations and equipment selection the geotechnical investigations have especially to treat the following subjects:

(a) Stability of the permanent slopes

(b) Stability of the working faces

(c) Ground pressure, e. g. with regard to the mining equipment, buildings and roads

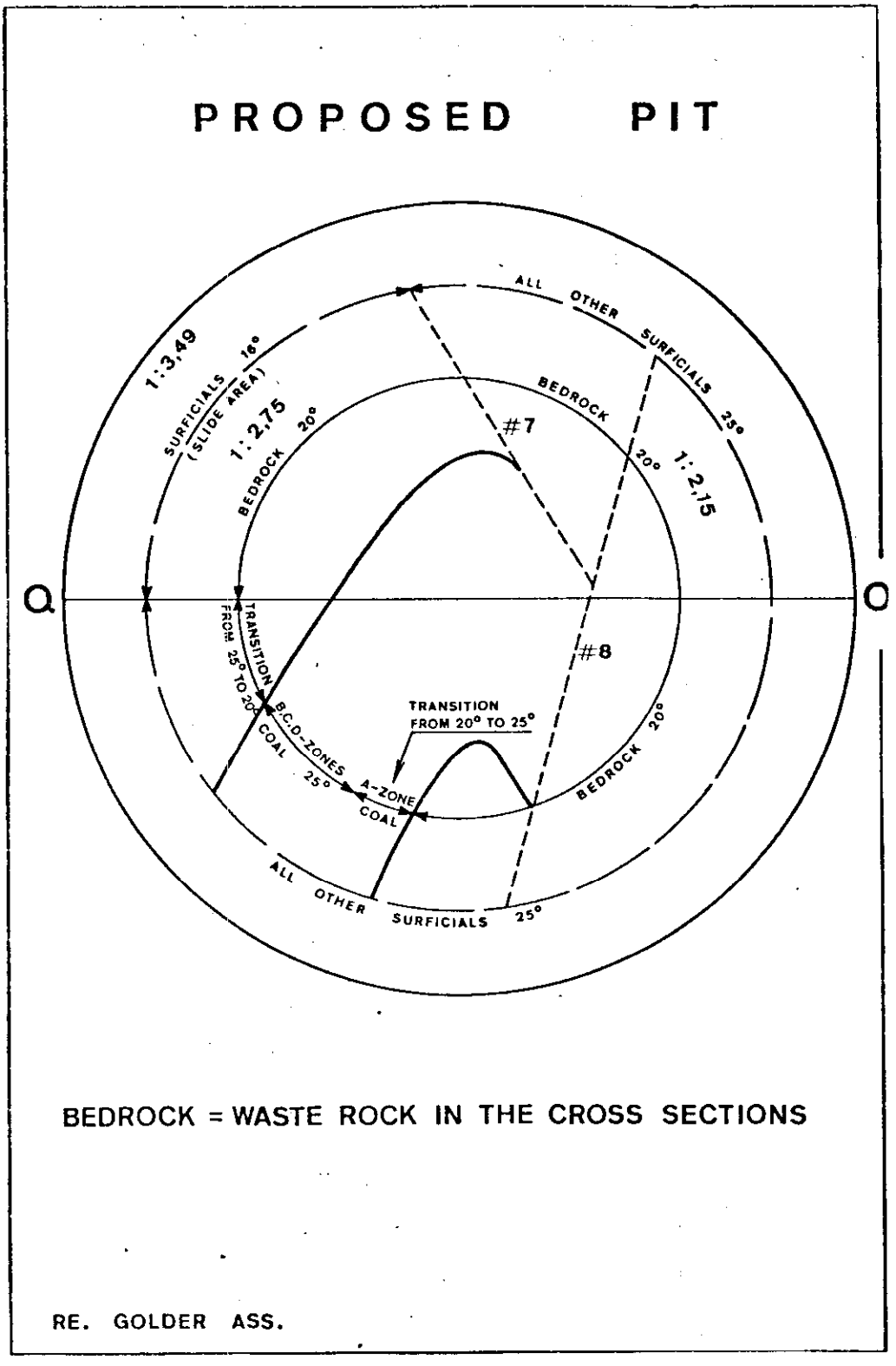
(d) Cutting resistance of the different types of material

(e) The characteristics of the different types of material with respect to handling and wear behaviour.

The geotechnical investigations on which the planning was based were realized by Golder Ass. These investigations permit the following conclusions:

Re (a) The stability of the permanent slopes varies within large limits in the envisaged mining area. Whilst the slopes on the eastern edge of the deposit, where they are built-up to a large extent in granular material and coal, seem to have a relatively high stability, somewhat difficult conditions need to be expected on the western edge of the deposit due to the influence of the slide area. The planning is based on the individual slope angles established by Golder Ass. as 16° to max. 25° (see page 2-9).
These angles are not adverse to bucket wheel excavator application. In individual areas, especially in the slide areas, a more extensive unloading of the slopes could become necessary.

Re (b) With concern to the stability of the working (dynamic) slopes, Golder Ass. have made preliminary statements by their letter


PROPOSED PIT
ALL OTHER SURFICIALS 25°
1:3.49
SURFICIALS (SLIDE AREA) 16°
1:2.75
BEDROCK 20°
BEDROCK
20°
1:2.15
#7
#8
Q
Q
TRANSITION FROM 25° TO 20°
B,C,D-ZONES COAL 25°
A-ZONE COAL
TRANSITION FROM 20° TO 25°
BEDROCK 20°
ALL OTHER SURFICIALS 25°
BEDROCK = WASTE ROCK IN THE CROSS SECTIONS
RE. GOLDER ASS.

E/78/281 dtd. 03.03.1978 as follows: "The steepest slopes that will be operative are likely to be 52° over a 28 m height, or less than 20° over the full dynamic slope of 50m." These conditions are generally adhered to in our planning. Golder Ass. states however that even under consideration of the above slope angles some local instabilities may occur in case of unfavourable geological formations. In a certain range, however, the occurrence of instabilities can also be diminished by certain modes of operation of the bucket wheel excavators especially adapted to the local geotechnical conditions. Thus, a final evaluation can be made only within the final design work, when a final statement of Golder Ass. will be available.

Re (c) The admissible ground pressure for the mining equipment is given over wide ranges of the mining area. Certainly, there will exist some sections, especially in the slide areas, where slick and mudholes need to be removed and be replaced by more stable material. In principal, it can be stated that the ground pressure in case of application of bucket wheel excavators and belt conveyors is normally lower than that of shovels and trucks.

Re (d) a. (e) With respect to cutting resistance and handling and wear behaviour the existing materials are described as to be

- dig easily to slow digging,
- non abrasive to very sharp
- very sticky when wetted.

The letter RC/et dtd. 23.02.1978 explains that the most important geotechnical investigations for design of bucket wheel excavators are as follows:

- uniaxial compression test,
- three-axial shearing test, in case of clayey material with indication of the "Attenberg Consistency Limit",

- point load test and
- a characterization of the detailed tectonic formations.

The following comments are included in the Golder Ass. Report with respect to this point:

Under Volume 3, A 4 - 1, and Volume 4, A 8 the results of various uniaxial compression tests and tri-axial shearing test are indicated. The values of the uni-axial compression tests vary between 300 and 17 000 kN/m^2. It can be taken by this Annexure, especially by Figure 1, Vol. 1 of the Golder Report that most part of the samples does not surpass approx. 6 900 kN/m^2. On the basis of the results indicated for the tri-axial shearing tests, most part of the test samples can clearly be defined as "unconsolidated rock", too.

In Volume 1, Page 88, rocks are indicated having considerably higher hardness, especially the burnt zone materials, hard layers of calcareous siltstone and harder bands in the coal. The cutting resistence of these materials is not only depending on characterization of their hardness. This cutting resistence depends also to a large extend from the thickness of these layers and the detailed tectonic load.

As per letter E/78/265 dtd. Febr. 28, 1978 the point load tests executed by Golder Ass. were only of dubious validity and the investigation of the detailed tectonic formations is not yet completed.

These indications and our own estimation of the deposit - also in comparison to other deposits investigated by RC and where bucket wheel excavators are used - permit for the preliminary engineering work

the conclusion that the Hat Creek deposit is suitable for the application of bucket wheel excavators. This consideration is kept in mind for the specification of mining equipment and costing.

As indicated in the afore-mentioned letter of RC dated Febr. 23, 1978, an upgrading of the information and the execution of several investigations are recommended for the subsequent final design work.

2.5 HYDROLOGY

The investigations with respect to the hydrology of the Hat Creek deposit and the planning for lowering of the ground water are not part of the scope of work of RC. The inspections of the deposit and especially of the opened trenches have shown that ground water is certainly existing in the mine area, this requiring the ground water level to be lowered.

With respect to the planning of exploitation with bucket wheel excavators and belt conveyors it remains to be said that lowering of the ground water level needs to be done in time as to guarantee the stability of the open-pit slopes in connection with the geotechnical investigations. With respect to the considerable portion of clayey material it needs to be observed that dewatering is made in such a manner that no larger quantities of remaining water are retained in individual geological troughs.

Only such materials should be used for casing of pump wells which can be dug by bucket wheel excavators, e. g. asbestos-cement.

2.6 CLIMATE

The following climatical features are important for planning of open-cast mining operations:

- temperature
- rainfall
- wind force and direction

The annual rainfall was indicated as to be about 12". For the other factors no detailed information was made available to RC. However, they were incorporated in the planning as they are generally known.

3. OPENCAST MINE DESIGN

3.1 GENERAL

After extensive discussions with Messrs. CMJV the mine was to be planned for the supply of a power station with a capacity of 2 000 MW and a fuel specification of approx. 7 560 Btu/lb. (dry basis, undiluted) at lowest cost. This was combined with the restriction that the exploitation of the remaining coal reserves for future consumers at a later date should not be excluded.

As agreed, this report covers the investigation of the possibilities for application of bucket wheel excavators and belt conveyor systems. Within the scope of the integrated total project planning the following other parameters were given:

- the position of the power station with its stock piles and blending facilities
- the position of the possible outside dumps
- the position of the major supporting facilities

3.2 DESCRIPTION OF ALTERNATIVES

The first planning draft of RC, designated as conceptual design, proceeded from the idea to make full use of the existing coal reserves. It was based on the representation of geology in 14 geological cross-sections, scaled 1 : 2 500 . The quantity calculations and the determination of coal quality were made by RC as a rough calculation. A central opencast mine exit in the north of the mine and developed by CMJV was taken as a fixed point for planning, since this point represents the shortest possible connection for transport onto the outside dump Houth Meadows. The opencast mine attained a max. depth of approx. 200 m. According to the coal embedding, the eastern border of the opencast mine was shifted relatively far to the east. The mining equipment was composed of 3 or 4 respectively bucket wheel excavators and 1 dragline at the bottom of the pit. The calculation of the opencast mine model has led to the following results:

Total waste masses: approx. 717 mill. m^3

Total coal content: approx. 462 mill. t with an average heating value of 6 475 Btu/lb. (dry basis, undiluted)

thereof - approx. 377 mill. t of coal with an average heating value of 7 360 Btu/lb. (dry basis, undiluted)

and

- approx. 85 mill. t low grade coal with a cut-off grade of 4 000 Btu/lb.,

this being equivalent to an average ratio of waste : overburden of 1.9 : 1 (m^3 : t).

The second planning draft was based on the geological cross-sections H - W made available by CMJV and scaled at 1 : 500. These cross-sections did not combine the coal-bearing layers to subzones but represented the coal and waste parting bands individually.

Thus it was possible to consider - in the scope of the given technical possibilities - a separate mining of coal and waste bands and to investigate the effects with respect to improvement of the fuel specification of run off mine coal. This planning draft intended to mine the coal requested for supply of the power plant at a minimum waste : coal ratio. It proceeded from a central mine outgoing ramp in the north of the deposit, this ramp being however slightly shifted to the west towards the border of the slide area, since this solution ensured a more favorable development of benches and conveyor guidance as compared with the planning draft 1. The calculations have led to the following results:

Total waste masses:	approx. 301 mill. m^3
Total coal content:	approx. 283 mill. t with an average heating value of 7 781 Btu/lb. and a cut-off grade of 4 000 Btu/lb.,
	equivalent to a waste : coal ratio of approx. 1.06 : 1 (m^3 : t).

After detailed discussions of this planning draft during the meeting in Vancouver from 24. - 26.01.78 this opencast mine model was refused, since

- the level of confidence of the geological representation of sections H - W seemed to be not acceptable,
- a shifting of the central outgoing ramp of the mine towards the slide area seemed to be not realizable due to geotechnical reasons

  and

- the inclinations supposed for the permanent slopes were to steep as compared with the values obtained by Golder Ass.

In consideration of the described geotechnical constraints RC had sketched at the same time a further

variant for an opencast mine with the central outgoing ramp being situated nearly in the axis of the Hat Creek Valley at the south-eastern edge of the opencast mine, since this position of the ramp seemed to have the following advantages:

(a) The ramp is situated in an area with stable geotechnical conditions.

(b) It permits - at shorter length - a more rapid access towards high quality coal lying deep in the Hat Creek Valley.

(c) It permits a favorable and simultaneous establishment of mining benches in northern and southern direction, this being of advantage for compensation of the waste : coal ratio and for homogenizing of coal quality.

(d) It permits a favorable transport connection to both the outside dump Medicine Creek and the power station and

(e) allows to avoid the installation of stationary conveyor belts and transfer points in the influencing range of the slide area in the western section of the mine.

With date of Febr. 13, 1978 RC received the documents mentioned under point 1.3 concerning the recent knowledge on the extension and geotechnical structure of the slide area in north-west of the deposit. A review of these documents has led to the clear conclusion that it is impossible to envisage the application of stationary conveyor systems within the influencing range of the slide area.

A detailed check made by RC has shown that under consideration of these new conditions an optimum development of exploitation with bucket wheel excavators and belt conveyor systems is no longer possible when maintaining the northern outgoing ramp for the opencast mine. It was therefore recommended to CMJV to develop the opencast mine with the outgoing ramp in south-east of the deposit and to increase the capacity of the outside dump Medicine Creek, this to suit

the waste-moving operations in the opencast mine. This proposal was accepted and approved by CMJV with their telex 64 dtd. Febr. 14, 1978.

3.3 DESCRIPTION OF SELECTED ALTERNATIVE

331 GENERAL

Based on the executed preliminary investigations and the discussions with CMJV, the essential parameters for the design of selected alternative were fixed. These were:

- optimum feed of the power plant by producing the required tonnage of coal at defined rate, and the minimum cost under application of bucket wheel excavators and belt conveyor systems,
- allowance for continuation of exploitation beyond the lifetime of the power plant,
- simultaneous developing of exploitation beyond the Hat Creek Valley towards northern and southern direction and early mining in greater depth, to meet the fuel specifications as far as possible and to compensate the waste : coal ratio to the greatest possible extent,
- design of the opencast mine with a central outgoing ramp in south-east of the deposit, for the reasons as described under point 3.2,
- no inside dumping in the opencast mine and maximum utilization of the dumping capacity of the Medicine Creek dump,
- separate mining of masses of the north-western slide area with shovels and trucks.

The general layout and the mined-out-position of the selected alternative are represented on Enclosures 1 + 2. The calculation of this mine design results total as follows:

Pre-Production Period:

waste	approx. 22.0 mill. m^3
coal with an average heating value of	

approx. 7 300 Btu/lb. (undiluted, dry basis)	approx. 0.4 mill. t
low grade coal	-

Total quantities over the lifetime of the project:

waste	approx. 485 mill. m^3
coal with an average heating value of 7 390 Btu/lb. (undiluted, dry basis)	approx. 332.0 mill. t
equivalent to a waste : coal ratio of	approx. 1.46 : 1 (m^3:t)
low grade coal	approx. 10.0 mill. m^3
total of masses to be moved	approx. 726.0 mill. m^3

Exploitation is recommended to be done by 4 bucket wheel excavators with belt conveyor systems at an annual capacity of 5.5 mill. m^3. For economical reasons, the mining height of these machines - in relation to their capacity - was limited to a maximum of 50 m. The opencast mine attains maximum depth at approx. + 685 m. Due to this reasons and under consideration of the geological and geotechnical conditions of the Hat Creek deposit, a combination of bucket wheel excavators, shovels and trucks is recommended to be used as an integrated mining system.

As already mentioned under point 1.2 of this report, the Scope of Work of RC is restricted to those subjects which are directly related to the bucket wheel excavator system. Completion of planning with respect to the envisaged application of shovels and trucks is made by CMJV.

Developing of planning of the mine design was made under careful consideration of the mechanical, electrotechnical and economical features, the individual phases being as follows.

332 CONSTRUCTION OF BENCH PLANS AND CALCULATION SECTIONS

The construction of the bench plans and calculation sections needs to be made on the basis of the parameters established during preliminary planning

- probable mine development,
- probable application of equipment,
- probable specification of equipment.

Naturally, even here the topographical, geological and geotechnical conditions of the deposit need to be considered, this to permit establishment of a production schedule which guarantees the required tonnages, fuel specification and a practical and efficient application of the equipment.

The fixation of the bench heights and of position and size of the individual calculation sections is of special importance.

To suit the envisaged combined operation with bucket wheel excavators and shovels as well as the shape of the coal zones, RC expressed the following wishes,

- fixation of bench heights to 15 m,
- construction of the benches with a declination from E towards W,
- subdivision of the mining area in calculation sections with north-southern and east-western sections,

this to have an as much flexible basis as possible for establishment of the production schedule.

Considering the technical capability of the computer envisaged for execution of the mass calculation and the time frame for completion of the study, the following conditions were fixed during a project-meeting

with CMJV on 14.02.1978 with respect to construction of bench plans and calculation sections:

(a) Benches with a height of 30 m will be constructed and calculated. The calculation results will be sub-divided in 15-m-slices.

(b) Construction to cover only benches having horizontal elevations.

(c) The number of calculation sections per bench being restricted to 15 resp. 16 sections.

(d) The masses of the slide area in north-west of the deposit are represented as separate calculation section.

The bench plans and calculation sections constructed on this basis are included as Enclosure 3.

It needs to be stressed here that the conditions indicated for construction of the bench plans and calculation sections are representing a considerable restriction for developing of an optimum production schedule.

- The exclusion of inclined benches delays the access towards high grade coal situated in the west of the deposit at the deepest point of the Hat Creek Valley and permits access to these coal zones only after larger waste-moving operations.

- The restriction in number of calculation sections to 15 per bench did not permit - due to development of main mining operation to N and S - a further sub-division of sections towards E-W-direction.
  Considering the trough-shaped coal beds, this sub-division is of special importance for the development of an optimum production schedule on the basis of calculation sections.
  The results of these restrictions are commented in detail under point 334 Development of Production Schedule.

333 MASS-CALCULATION

The mass-calculation was made by CMJV in Vancouver using ADP-machines, and this on the basis of the bench plans and calculation sections constructed by RC. For this procedure, the MEPS-program* was applied which is fed with the geological data of the Phase II - Information.

The results of the mass-calculation indicate - subdivided by benches and calculation sections -

- the coal content - subdivided in the 12 subzones in tons x 10^3, m^3 x 10^3 and its average heating value in Btu/lb. (undiluted, dry basis) as well as
- the waste in m^3 x 10^3 - subdivided by low grade coal, non seam waste, seam waste, overburden and total waste. Since the region of the slide area in north-west of the deposit was constructed as separate calculation sections, it was possible to find out these masses separately, too. They were indicated to RC on 06.03.1978 (see enclosure 4) and served initially for development of the production schedule.

334 DEVELOPMENT OF PRODUCTION SCHEDULE

334.1 Production Targets

RC established several drafts for a production schedule on the basis of the mass-calculation results as mentioned under point 333. All drafts described herein consider the feed requirements of the power plant according to the annual coal production targets, as they were indicated to RC through CMJV-telex 36 dtd. 16.03.1978. As clearly expressed by CMJV it can be assumed that they include allowance for 2.5 % dilution, 1 % mining loss, 25 % moisture and loss in boiler efficiency.

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*) Name of computer program, used for mine planning by CMJV

They are:

Year	Qty in tonnes
preproduction	400,000
1	2,698,000
2	4,995,000
3	7,240,000
4	9,742,000
5	10,167,000
6 to 15	109,484,000
16 to 25	101,664,000
26 to 35	86,023,000
	332,413,000

The factors of 2.5 % for dilution and 1 % for mining losses have been choosen considering the complicated conditions of the Hat Creek deposit. They consider however also that using the bucket wheel excavator technology in practice a considerable portion of the waste partings in the coal can be excavated separately.

334.2 Preliminary Investigations

One of the drafts of production schedule made up by RC together with a preliminary equipment specification and a cost calculation was submitted for discussion during the project meeting with CMJV on 06. and 07. April 1978 and explained on the basis of graphical representations of several mine positions.

The production schedule for this opencast mine design envisaged the application of 4 bucket wheel excavators and several shovels. It proceeded principally with the intention,

- to make maximum use of the capacity of the bucket wheel excavators installed,
- to operate the bucket wheel excavators on the very same bench over a period as long as possible.

In order to permit a sufficient quantity of coal reserves of adequate quality to be exposed prior to start-up of the power plant, this draft necessitated however the extremely large waste-moving operations of totally 115 mill. m^3 already in the preproduction years and an annual total mass-moving of about 35 - 40 mill. m^3 during the initial years of operation.

Owing to the high charge of the cash flow by the indicated early and considerable mass-moving operations, it was decided to abandon this draft of production schedule on April 7, 1978 by mutual agreement.

This production schedule has clearly shown, that it is only possible to establish an economical production schedule if

- the opencast mine can be developed towards greater depth already in the initial years,
- only such a quantity of waste is removed as absolutely requested to realize the wanted coal production and
- that the problems for establishment of a production schedule are existing during the first years, since later on sufficient access to all the available coal grades is given.

On this basis, two new optimisation drafts were developed since April 8, 1978, called proposal A and proposal B.

Proposal A based again on the mass-calculation results of the bench plans and calculation sections constructed by RC. It was calculated over the total lifetime of the opencast mine and represented for the yearly positions - 1, 1, 2, 5 and 10.

The incremental pits, illustrated by drawings, of this draft were checked with the deposit model stored in the CMJV-computer. The results thereof were submitted to RC with CMJV-telex 138 dtd. April 20, 1978.

Proposal A

incremental pit	required tonnage x 10^6 (7 375 Btu/lb.)	mined coal Btu/lb.	mined coal mill. t	total waste mill. m^3	total volume mill. m^3
year - 1	0.400	8,232	0.030	42.23	42.26
year 1	2.698	7,053	1.502	31.12	32.17
year 2	4.995	7,525	4.118	24.30	27.20
y. 3-5	27.149	7,422	29.690	69.72	90.61
y. 6-10	54.742	7,634	55.302	102.13	141.31
total after year 10	89.984	7,550	90.644	269.50	333.55

It was clear that Proposal A

- represents already a considerable improvement against the above-described production schedule and that the shortages of coal during the years - 1, 1 and 2 could be adapted to the required tonnage by making slight modifications and a more flexible operation of especially the shovels,

  and

- that a further improvement of the production to be only possible if high grade coal is mined in an increased quantity during the initial years, by the application of shovels, which are able to be excavated at minimum waste-moving operations.

RC expressed in their letter et-st-7 dtd. April 27, 1978 and during the project meeting with CMJV on April 28 and 29, 1978 that this further optimisation of the production schedule, due to the limitations mentioned under point 332 with respect to construction of bench plans and calculation sections, can no more be executed in the initial years on the basis of these documents.

Thus, RC commenced since April 8, 1978 to make up incremental pits for the years - 1, 1, 5 and 10, called Proposal B, which were constructed on the basis of a

draft drawing submitted by CMJV during the project meeting on April 6 and 7, 1978.

The incremental pit drafts were also checked by CMJV under application of the MEPS-program. The results thereof were transmitted to RC together with the results of Proposal A on April 20 and 21, 1978. They are:

Proposal B

incremental pit	required tonnage x 10^6 (7 375 Btu/lb.)	mined coal		total waste mill. m^3	total volume mill. m^3
		Btu/lb.	mill. t		
year - 1	0.400	7,431	0.350	21.02	21.27
year 1	2.698	6,540	1,936	30.16	31.46
y. 2-5	32.144	7,385	41.916	113.21	142.69
y. 6-10	54.742	7,674	48.805	103.24	138.16
total after year 10	89.984	7,519	93.008	267.63	333.56

and actually represent a considerable optimisation as compared with Proposal A.

Subsequently, RC decided to use Proposal B as basis for the "final" production schedule. The following comments need however to be made:

(a) The designation "final production schedule" refers only to the actual planning phase I, preliminary engineering work.

(b) The production schedule for the initial years was developed - naturally also in consideration of the knowledge collected in the meantime with respect to distribution of coal in the deposit - on the basis of the incremental pits of the yearly positions - 1, 1, 5 and 10.

(c) A re-calculation of the production schedule is not possible during the initial years on the

basis of the bench plans and calculation sections constructed by RC.

(d) The very slight modifications of the final production schedule in the years - 1, 1 and 5 and the additional interim positions for the years 2, 3 and 4 could thus only be established by interpolation on the basis of the mine positions of the years - 1, 1, 5 and 10 checked by CMJV and not on the basis of calculation sections.

(e) The interim positions during the initial years can thus show a certain discrepancy against the actually existing deposit conditions.

(f) This procedure and the decision to base the final production schedule on the checked drafts of Proposal B was at length described in the mentioned RC-letter of April 27, 1978 and discussed with Messrs. BC Hydro and CMJV during the project meeting on April 28 and 29, 1978.

(g) All participants had the common opinion that the possible discrepancies of the production schedule can in no case be such important that they might cancel appearant and basically secured advantages of Proposal B against Proposal A.

(h) Thus, the procedure of developing the final production schedule selected by RC was accepted by CMJV verbally on April 29, 1978 and in writing by CMJV-File Note 275, dated May 11, 1978.

334.3 Final Production Schedule

The results of the final production schedule are indicated on page 3-16. The individual columns are representing the data as described below:

Column 1 represents the production period.

Column 2 shows the actual calorific feed requirements of the power plant, this resulting from the above stated production targets submitted by CMJV and an assumed heating value needs to be taken at 7 375 Btu/lb., since the indicated tonnages include the reduction of 2.5 % for dilution already.

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Production Schedule

Openast Mine Hat Creek Total — PROPOSAL B — Page: 1

Time Period	P.St. Calorific Requirement BTU/Lb·t·10⁻⁶	BTU	Coal Mined $m^3 \cdot 10^6$	Coal Mined $t \cdot 10^6$	Low Grade $m^3 \cdot 10^6$	Low Grade $t \cdot 10^6$	Total Waste $m^3 \cdot 10^6$	Total Volume $m^3 \cdot 10^6$	Remarks
1	2	3	4	5	6	7	8	9	
- 1	2,950	7,302	0,285	0,404	-	-	21,934	22,219	
	2,950	7,302	0,285	0,404	-	-	21,934	22,219	
1	19,891	6,847	1,980	2,905	0,002	0,004	25,118	27,100	
	22,841	6,903	2,265	3,309	0,002	0,004	47,052	49,319	
2	36,838	7,385	3,497	4,988	0,010	0,018	20,643	24,150	
	59,679	7,193	5,762	8,297	0,012	0,022	67,695	73,469	
3	53,395	7,385	5,070	7,233	0,015	0,026	19,784	24,869	
	113,074	7,281	10,832	15,530	0,027	0,048	87,479	98,338	
4	71,847	7,385	6,819	9,726	0,019	0,036	26,606	33,444	
	184,921	7,322	17,651	25,256	0,046	0,084	114,085	131,782	
5	74,982	7,385	7,119	10,154	0,021	0,037	27,773	34,913	
6 - 10	259,903	7,340	24,770	35,410	0,067	0,121	141,858	166,695	
	403,722	7,629	37,380	52,922	0,391	0,679	118,390	156,161	
11 - 15	663,625	7,513	62,150	88,332	0,458	0,800	260,248	[illegible],856	
	403,722	7,046	39,566	57,297	1,712	2,914	65,539	106,817	
16 - 20	1.067,347	7,329	101,716	145,629	2,170	3,714	325,787	429,673	
	374,886	7,344	35,537	51,047	2,504	4,242	66,068	104,109	
21 - 25	1.442,233	7,333	137,253	196,676	4,674	7,956	391,855	533,782	
	374,886	7,493	34,830	50,034	2,267	3,841	65,257	102,354	
26 - 30	1.817,119	7,365	172,083	246,710	6,941	11,797	457,112	636,136	
	317,210	7,426	29,837	42,716	1,967	3,287	17,590	49,394	
	2.134,329	7,374	201,920	289,426	8,908	15,084	474,702	685,530	

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Köln, May 1978

Production Schedule

Openast Mine Hat Creek Total — PROPOSAL B — Page: 2

Time Period	P.St. Calorific Requirement BTU/Lb·t·10^6	BTU	Coal Mined $m^3 \cdot 10^6$	Coal Mined $t \cdot 10^6$	Low Grade $m^3 \cdot 10^6$	Low Grade $t \cdot 10^6$	Total Waste $m^3 \cdot 10^6$	Total Volume $m^3 \cdot 10^6$	Remarks
1	2	3	4	5	6	7	8	9	
	2,134,329	7,374	201,920	289,426	8,908	15,084	474,702	685,530	
31 - 35	317,210	7,494	29,563	42,326	1,112	1,857	10,045	40,720	
	2,451,539	7,390	231,483	331,752	10,020	16,941	484,747	726,250	

Example for the preproduction period:

tonnage of coal	x cal. value	=	feed requirement of power plant
0.400 mill. t	x 7 375 Btu/lb.	=	2.950 Btu/lb. x mill. t

Column 3 represents the actual quality of the coal in Btu/lb. (undiluted, dry basis), which is scheduled to be mined during the relevant periods and which was taken from the mass calculations in Enclosure 4.

Columns 4 and 5 represent the actual amount of coal in mill. m^3 and mill. t, which has to be delivered to the power plant to meet its feed requirements (1 % mining losses already being accounted for). Example for the preproduction period:

feed requirements of power plant	:	actual coal quality	=	actual tonnage of coal
2.950 Btu/lb. x mill. t	:	7 302 Btu/lb.	=	0.404 mill. t

Columns 6, 7 and 8 represent the actual amounts of low grade coal and waste materials in mill. m^3 resp. mill. t to be mined, in column 9, results from the addition of column 4, 6 and 8.

On page 3-19, the production schedule is illustrated, sub-divided per annual total volume, as well as for bucket wheel excavator and shovel operation respectively.

Page 3-20/21 shows the partition of masses to be mined by bucket wheel excavators or shovels respectively in the northern and southern mine area, page 3-22 shows the masses to be mined on each individual mining bench, whilst page 3-23 illustrates the operation place and the application period of the relevant equipment per benches and years.

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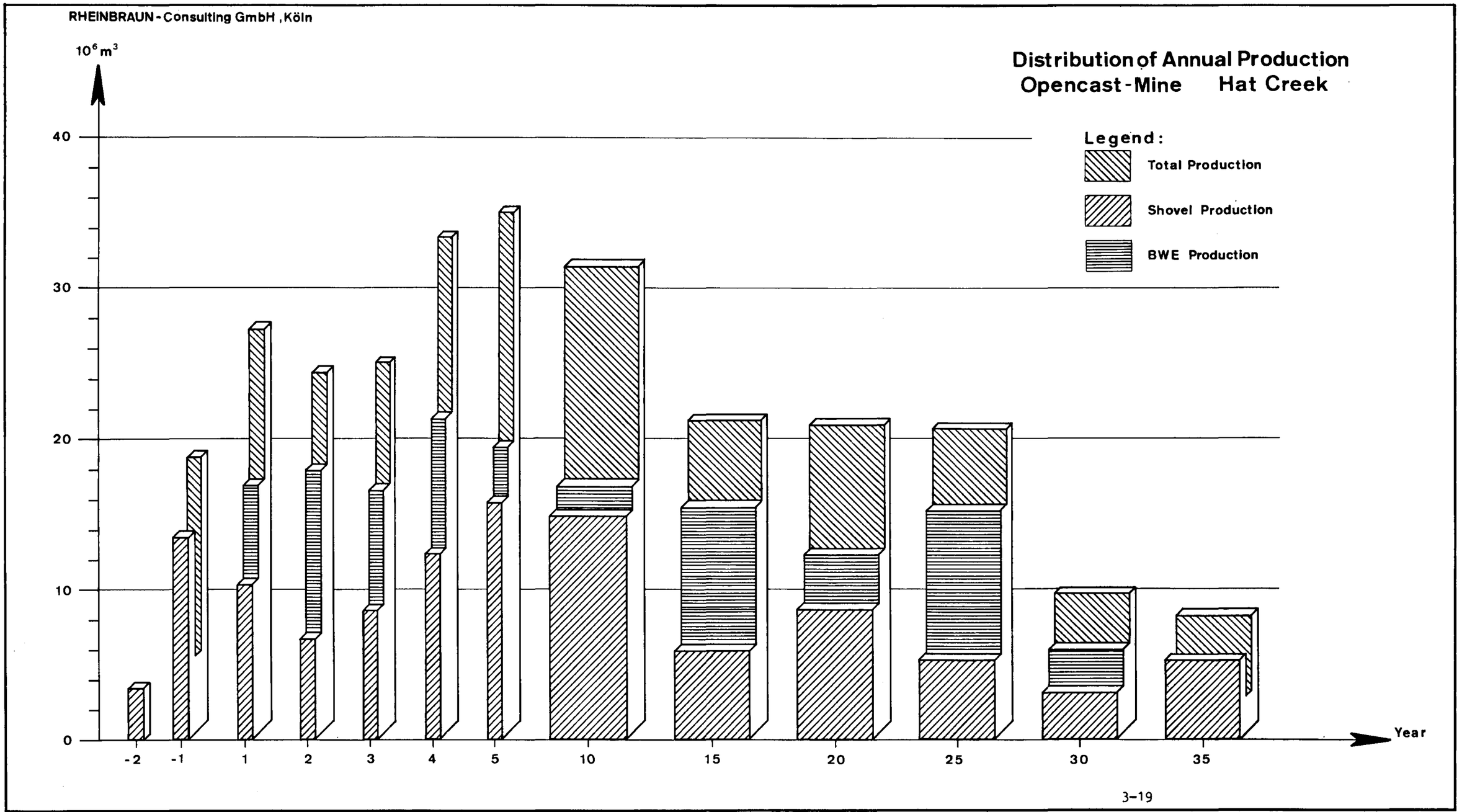

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Köln, May16,78

Distribution of Annual Production

Hat Creek

Period	Shovel North 10^6 m^3	Shovel South 10^6 m^3	Shovel Total 10^6 m^3	BWE North 10^6 m^3	BWE South 10^6 m^3	BWE Total 10^6 m^3	Total Volume 10^6 m^3
- 2	3,5	-	3,5	-	-	-	3,5
	3,5	-	3,5	-	-	-	3,5
- 1	0,2	13,0	13,2	4,2	1,3	5,5	18,7
	3,7	13,0	16,7	4,2	1,3	5,5	22,2
1	-	10,4	10,4	9,3	7,4	16,7	27,1
	3,7	23,4	27,1	13,5	8,7	22,2	49,3
2	-	6,6	6,6	10,9	6,7	17,6	24,2
	3,7	30,0	33,7	24,4	15,4	39,8	73,5
3	-	8,5	8,5	7,9	8,5	16,4	24,9
	3,7	38,5	42,2	32,3	23,9	56,2	98,4
4	0,5	11,7	12,2	10,7	10,5	21,2	33,4
	4,2	50,2	54,4	43,0	34,4	77,4	131,8
5	3,4	12,3	15,7	10,9	8,3	19,2	34,9
	7,6	62,5	70,1	53,9	42,7	96,6	166,7
6 - 10	14,8	58,5	73,3	55,0	27,9	82,9	156,2
	22,4	121,0	143,4	108,9	70,6	179,5	322,9
11 - 15	7,5	22,0	29,5	25,5	51,8	77,3	106,8
	29,9	143,0	172,9	134,4	122,4	256,8	429,7
16 - 20	6,4	36,0	42,4	27,5	34,2	61,7	104,1
	36,3	179,0	215,3	161,9	156,6	318,5	533,8
21 - 25	-	26,7	26,7	27,2	48,4	75,6	102,3
	36,3	205,7	242,0	189,1	205,0	394,1	636,1

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Köln, May 16, 78

Distribution of Annual Production

Hat Creek

Period	Shovel			BWE			Total
	North 10^6 m^3	South 10^6 m^3	Total 10^6 m^3	North 10^6 m^3	South 10^6 m^3	Total 10^6 m^3	Volume 10^6 m^3
	36,3	205,7	242,0	189,1	205,0	394,1	636,1
26 - 30	3,5	12,4	15,9	-	33,5	33,5	49,4
	39,8	218,1	257,9	189,1	238,5	427,6	685,5
31 - 35	12,7	14,0	26,7	-	14,0	14,0	40,7
	52,5	231,1	284,6	189,1	252,5	441,6	726,2

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Distribution of Production
-Hat Creek-

$9,3/5,7$ BWE/Shovels

Köln, May 12, 1978

	Level	Years														
			- 2	- 1	1	2	3	4	5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	Total
		10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3	10^6 m^3
North	925 - Top			0,6	2,8	3,0	2,9	3,9	4,0	25,7						42,9
	880 - 925		3,5	3,6	4,3	3,1	3,1	4,2	4,2	20,0	16,5					62,5
	835 - 880			0,2	2,2	4,8	1,9	2,6	2,7	$9,3/5,7$	9,0	22,8				61,2
	790 - 835							0,5	3,4	9,1	7,5	$4,7/2,0$	13,1	2,6		42,9
	745 - 790											4,4	14,1	0,9	3,8	23,2
	700 - 745														4,5	4,5
	685 - 700														4,4	4,4
	Total		3,5	4,4	9,3	10,9	7,9	11,2	11,3	69,8	33,0	33,9	27,2	3,5	12,7	241,6
South	1015 - Top				2,4	1,8	2,2	4,7	2,0	6,1						19,2
	1000 - 1015			1,9	2,0	0,6	2,2	1,8	2,9	6,5						17,7
	955 - 1000			1,0	$4,1/1,6$	5,5	5,5	5,5	$3,7/1,8$	$8,9/4,1$	6,6					42,3
	910 - 955			$1,3/3,6$	3,3	1,2	3,0	5,0	4,6	19,0	$10,6/2,0$	$7,1/6,9$	11,0			78,6
	865 - 910			6,5	2,6	2,7	2,4	2,6	2,4	19,0	$14,7/5,1$	11,7	21,2			90,9
	820 - 865				1,8	1,5	1,7	2,8	3,2	16,7	19,9	15,4	16,2	7,3		86,5
	775 - 820									6,1	10,3	15,4	14,7	15,8	6,8	69,1
	730 - 775										4,6	13,7	9,8	10,4	7,2	45,7
	685 - 730												2,2	12,4	14,0	28,6
	Total			14,3	17,8	13,3	17,0	22,2	20,6	86,4	73,8	70,2	75,1	45,9	28,0	484,6

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Excavator Operating - Plan
-Hat Creek-

Köln, May 12, 78

	Level	Years: -2	-1	1	2	3	4	5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35
North	925 Top		BWE I	BWE I	BWE I	BWE I	BWE I	BWE I	BWE I					
	880-925	Shovels	BWE I	BWE I partly	BWE I partly	BWE I partly	BWE I partly	BWE I partly	BWE I partly	BWE II				
	835-880		Shovels	BWE II	BWE II	BWE II	BWE II	BWE II	BWE II Shovels	BWE II	BWE II			
	790-835						Shovels	Shovels	Shovels	Shovels	BWE II Shovels	BWE II	Shovels	
	745-790										Shovels	BWE II	Shovels	Shovels
	700-745													Shovels
	685-700													Shovels
South	1015 Top			Shovels	Shovels	Shovels	Shovels	Shovels	Shovels					
	1000-1015		Shovels	Shovels	Shovels	Shovels	Shovels	Shovels	Shovels					
	955-1000		Shovels	BWE IV Shovels	BWE IV	BWE IV	BWE IV	BWE IV	BWE IV					
	910-955		BWE III Shovels	BWE III	BWE III	BWE III	BWE III	BWE III	BWE III	BWE III	BWE III	BWE III		
	865-910		Shovels	Shovels	Shovels	Shovels	Shovels	Shovels	Shovels	BWE IV	BWE IV	BWE IV		
	820-865			Shovels	Shovels	Shovels	Shovels	Shovels	Shovels	BWE IV	BWE IV	BWE IV	BWE IV	
	775-820								Shovels	Shovels	Shovels	Shovels	BWE I	BWE I
	730-775									Shovels	Shovels	Shovels	BWE I	BWE I
	685-730											Shovels	Shovels	Shovels

The development and final design of the mine as well as the specification of the selected equipment are described in the following part of the report. Based on the data of the production schedule it is however possible to make just now the following conclusions:

(a) The total preproduction quantity amounts to about 22.219 mill. m^3. According to the given production targets this includes 404 000 t of coal with a heating value of 7 302 Btu/lb. (undiluted, dry basis).

(b) The following volume will be mined over the total lifetime of the project:

total volume	726 250 mill. m^3
thereof	
waste	484 747 mill. m^3
coal	331 752 mill. t

with a heating value of 7 390 Btu/lb.

equivalent to a waste : coal ratio of 1.46 : 1 (m^3 : t)

low grade coal	10 020 mill. m^3

with a cut off grade of 4 000 Btu/lb.

(c) The heating value of the coal (undiluted, dry basis) has the

minimum value of 6 847 Btu/lb. in the year 1

and the

maximum value of 7 629 Btu/lb. in the years 6 - 10

and thus varies from the indicated

average value of 7 390 Btu/lb. within a range of ./. 7.3 % and + 3.2 %.

As already explained, there exist surely good possibilities of having improved the coal heating value in the year 1.

Since according to the production schedule the next lowest heating value of 7 046 will occur in the years 11 - 15, it can be assumed that the average minimum heating value in any given period of the production schedule will only be max. 4.7 % under the average value.
Also the average of the coal heating value should in total be higher and therefore would meet more closely the presently considered fuel specifications, since a considerable part of the waste partings of coal can surely be excavated separately.

(d) The total masses are distributed on the

Northern area with 241.6 mill. m^3

Southern area with 484.6 mill. m^3

(e) From the total masses will be mined

by bucket wheel excavators 441.6 mill. m^3

by shovels and trucks 284.6 mill. m^3

(f) The masses of the slide area in north-west of the deposit and reaching into the mining area amount to about 20.5 mill. m^3. They will fully be mined by shovels and trucks. It could be required by geotechnical reasons to increase the total masses to be mined in the slide area and to dig them somewhat earlier as indicated in the production schedule, this to realize a further unloading of the slope system as recommended by Golder Ass. with a general inclination of 16°.

(g) The annual mass-moving operations required to be realized by bucket wheel excavators are as follows:

maximum	21.2 mill. m^3
minimum	2.8 mill. m^{3*}

*) during the expiration phase of the operation after the year 30

(h) Listed below is the number of bucket wheel excavators in operation, their average production rate in mill. m^3/a and their actual utilization compared to the specified capacity of 5.5 mill. m^3/a x unit:

year	no. of units	average production mill. m^3/a	average utilization %
- 1	1.5	5.5	66.6
1 - 25	4	15.5	70.6
26 - 30	2	6.7	60.9
31 - 35	1	2.8	50.9
total	-	-	68.9

Especially, this table shows that the production schedule was developed with the intention to cut down the total mass-moving operations during the initial years and to dig later on only such a quantity of waste as required to guarantee the wanted coal tonnage.

RC is convinced that the utilization of the equipment can be improved by reassessing bench elevations, digging heights and equipment dimensioning. This, however, would be part of the final design work, in which additional and more detailed geological information will be available.

(i) The average mass-moving operations to be realized by shovels and trucks are as follows:

year	Mio m^3/a
- 2	3.50
- 1 - 10	12.70
11 - 35	5.65

(j) With respect to the belt conveyor systems leading away from the conveyor distribution point, and for which engineering is carried out by CMJV, it is recommended to lay out two waste handling paths towards the dump. Since 4 excavating units could be mining waste simultaneously, the capacity of each of these conveyors should match the output of 2 excavators.

With respect to simultaneous production of different grades of coal two conveyors are recommended to connect the distribution point with the stockpile. The same reasoning as for the waste conveyors applies for these coal conveyors: each one should be laid out for double the capacity of one excavator.

3.4 FINAL MINE DESIGN

The investigations made led to a layout of the final mine design as described in general below:

341 GENERAL

(see Enclosure 2 - mined-out-position)

The opencast mine is developed by a central outgoing ramp situated in south-east of the mining area, and this nearly in the axis of the Hat Creek Valley. Two mining fronts are dug simultaneously and extended towards northern and southern direction. The limits of the opencast mine are indicated on Enclosure 2. It covers an area of about 5.8 km^2 and attains its maximum depth at about + 685 m above sea level.

The permanent slopes have been chosen according to the individual admissible slope angles of 16 to 25° indicated by Golder Ass.

According to the bucket wheel excavator specification the bench heights have been designed for 45 m and the bench widths for 170 m. The total bench height of 45 m is subdivided by several intermediate levels according to the mode of operation, which is commented in detail under point 411 of this report. Considering the given data and the digging height of 45 m, the dynamical slopes of the bucket wheel excavators will have a general slope angle of about 15°, and the individual slope being 20 m in height will have an inclination of about 55°. The central outgoing ramp of the opencast mine has a general inclination of 1 : 6.4. It is interrupted by horizontal levels having a length of 50 m each and on which are located the stations for material transfer from the bench conveyors onto the ramp conveyors. The individual slopes of the ramp are designed at 1 : 5.

To protect the opencast mine ramp against erosion, it is recommended to sub-divide the ramp by small diagonal channels leading the rainfall quantities towards the outer sides of the ramp into drainage ditches. If requested, the supports of the conveyor structures and the pontoons of the conveyor stations should be protected against erosion by means of a concrete revetment.

The available investigation drillings have shown that coal of good quality is still existing below the deepest envisaged mining bench. This coal can be used for compensation of both short-time peak capacities and coal grade variations. Moreover, the mine is designed in such a manner as to permit a continuation of mining with bucket wheel excavators towards southern direction, and this beyond the intended lifetime of 35 years and without the necessity of major modifications of the final mine design.

342 DESCRIPTION OF CHARACTERISTIC MINE POSITIONS

The description of some characteristical mine positions of the relevant years refers to the drawings of the mine positions at the end of the years - 2, - 1, 1, 2, 3, 4, 5, 10, 15, 20, 25, 30 and 35, attached to this report under Enclosure 2.

The mining operations will be started in the preproduction year - 2. According to the production schedule about 3.5 mill. m^3 of waste will be mined by shovels and trucks. The outgoing ramp of the mine will be opened and the belt conveyor systems and travel faces for the 1st bucket wheel excavator operating on the benches + 935 and + 890 m, above sea level, for the northern mining front will be prepared to such extent as to permit an operation of the BWE I early in the year - 1. The Hat Creek needs to be relocated towards the position as envisaged by CMJV, and this up to the beginning of the year - 2.

During the year - 1 a total of 18.7 mill. m^3 will be mined, this including already 0.404 mill. t of coal for the stock pile. The BWE I has started regular operation on the two upper benches of the northern mining front early in this year. Both benches being equipped with belt conveyor systems. The excavator changes from bench to bench depending on the requested mining advance. The head station of the bench conveyor system on the 2nd bench is equipped with a slewing conveyor transferring the masses of the 2nd bench onto the ramp conveyor R 10. This slewing conveyor can also feed onto the ramp conveyor R 20 which will start operation in the year 1, thus only 2 ramp conveyors will be requested for the 3 benches with belt conveyor systems in the north of the mining area. Around the middle of the year - 1 the BWE III will commence to operate on the bench + 920 m of the southern mining front, and this after preparation of its affiliated bench and of the respective belt conveyor system for shovel/truck operation.

For the initial phase, after commissioning, the bucket wheel excavators are assumed to reach the following efficiency factors:

1st operational quarter	1/3 of capacity
2nd operational quarter	2/3 of capacity

It is assumed that the bucket wheel excavators can work at their full output rates from the 3rd operational quarter and that the operating staff will be well trained in the meantime. According to this assumption BWE I will have an output rate of approx. 4.2 mill. m^3 during its 1st year of operation and BWE III will achieve an output of about 1.3 mill. m^3 during the first 6 months of its operation.

The remaining 13.2 mill. m^3 will be mined by shovels and trucks on the benches + 835 m in the north and 1 000, 955 and 865 m in the south of the mining area. To permit a transport of these masses out of the mine by means of belt conveyors, the two envisaged truck belt conveyors situated in the outgoing ramp and having a length of about 850 m need to be ready for operation early in this year.

In the year 1, i.e. the 1st operating year of the power plant, about 2.9 mill. to of coal and a total of about 27.1 mill. m^3 will be mined according to the production schedule.

The first minor quantities of low grade coal will occur. At the beginning of this year the two last bucket wheel excavators, the BWE II and IV, will commence to operate on the + 845-m-bench in the north resp. on the + 965-m-bench in the south. The mine bottom has attained the elevation of + 820 m. The outgoing ramp will be developed to its final width and equipped with a total of 6 belt conveyor systems.

From the year 2 up to the year 10 all bucket wheel excavators will operate on the same benches and advance mainly by slewing operation, however partly by parallel operation. The capacity of BWE I and II, which will dig proportionally also the masses of the + 890-m-bench, as well as that of BWE IV will be utilized by nearly 100 %. However, the utilization of BWE III needs considerable improvement during the subsequent detail planning. The max. mass-moving of the 4 bucket wheel excavators will be in the year 4, according to the production schedule, and amount to 21.2 mill. m^3. The corresponding max. capacity of the shovels and trucks will occur in the year 5 and total to 15.7 mill. m^3. Beginning with the year 5 the + 965-m-bench in the south of the mining area needs to be shortened, since this bench has extended in the meantime towards the region of the slide area and these masses are intended to be mined by shovel/truck. In the years 4 to 6 shovels will open the 790-m-bench in the north and the 775-m-bench in the south.

Towards the end of the year 10 the 935-m-bench in the north and the 1 015-m-bench, the 1 000-m-bench and the 965-m-bench in the south have already reached the border of the mining area. BWE II will now operate alone on the 890-m- and the 845-m-bench. The affiliated bench conveyors will now be connected to the ramp conveyor R 10. BWE I will be transferred onto the 875-m-bench in the south and BWE IV onto the 830-m-bench in the south.

Even here the bench conveyors will be re-connected to the ramp conveyors, with the + 830-m-bench being connected to the ramp conveyor R 20 by means of an approx. 50 m long bridge conveyor.
The shovels will be advancing towards greater depth and open the 730-m-bench in the south.
Early in the year 16 the 845-m-bench in the north will be completed. The belt conveyor system of this bench will be re-located onto the 800-m-bench which will now be served by BWE II, whilst the shovels start to dig the 745-m-bench. Depending on the increased mining depth, the two truck conveyors T 1 and T 2 will be extended to approx. 1 270 m.
In the year 21 the last mining bench, i.e. the 920-m-bench in the south, has extended beyond the slide area and will now be mined alone by BWE III over its full length. The shovels and trucks will dig the deepest bench in south at + 685 m.
No important modifications will occur up to the end of the year 25.
Early in the year 26, i.e. after 25 years of operation, BWE II and III will stop operation since the remaining quantity which needs to be mined does no longer justify their operation. The remaining mining operations in the north will be realized with shovels and trucks reaching their final depth with + 685 m in the year 31.

After completion of the 875-m-bench in south during the year 25 BWE I will again be transferred onto the benches + 785 m and + 740 m, where it digs the masses of both benches together with 2 belt conveyor systems.

BWE IV and I will stop their regular operation in the years 30 and 35.

4. EQUIPMENT SELECTION AND OTHER REQUIREMENTS

4.1 GENERAL CRITERIA AND LAYOUT OF MACHINERY

411 DIMENSIONS AND WORKING PLAN OF BUCKET WHEEL EXCAVATORS

Because of the relatively congested development of the open pit of Hat Creek with a large number of benches following each other at close distance, it is necessary to have highly mobile equipment that can move from bench to bench. Therefore, it seems essential that the bucket wheel excavators are of compact design with small overall dimensions.

For the same reason, a separate belt wagon was selected to work with the bucket wheel excavator rather than a long extended loading bridge connected with the bucket wheel excavator main unit.

The bucket wheel excavator is designed with a relatively short bucket wheel boom of approx. 21.5 m for a maximum digging height of 20 m and a block width of 25 m. Together with the belt wagon of 80 m length the units can excavate two blocks per conveyor shift.

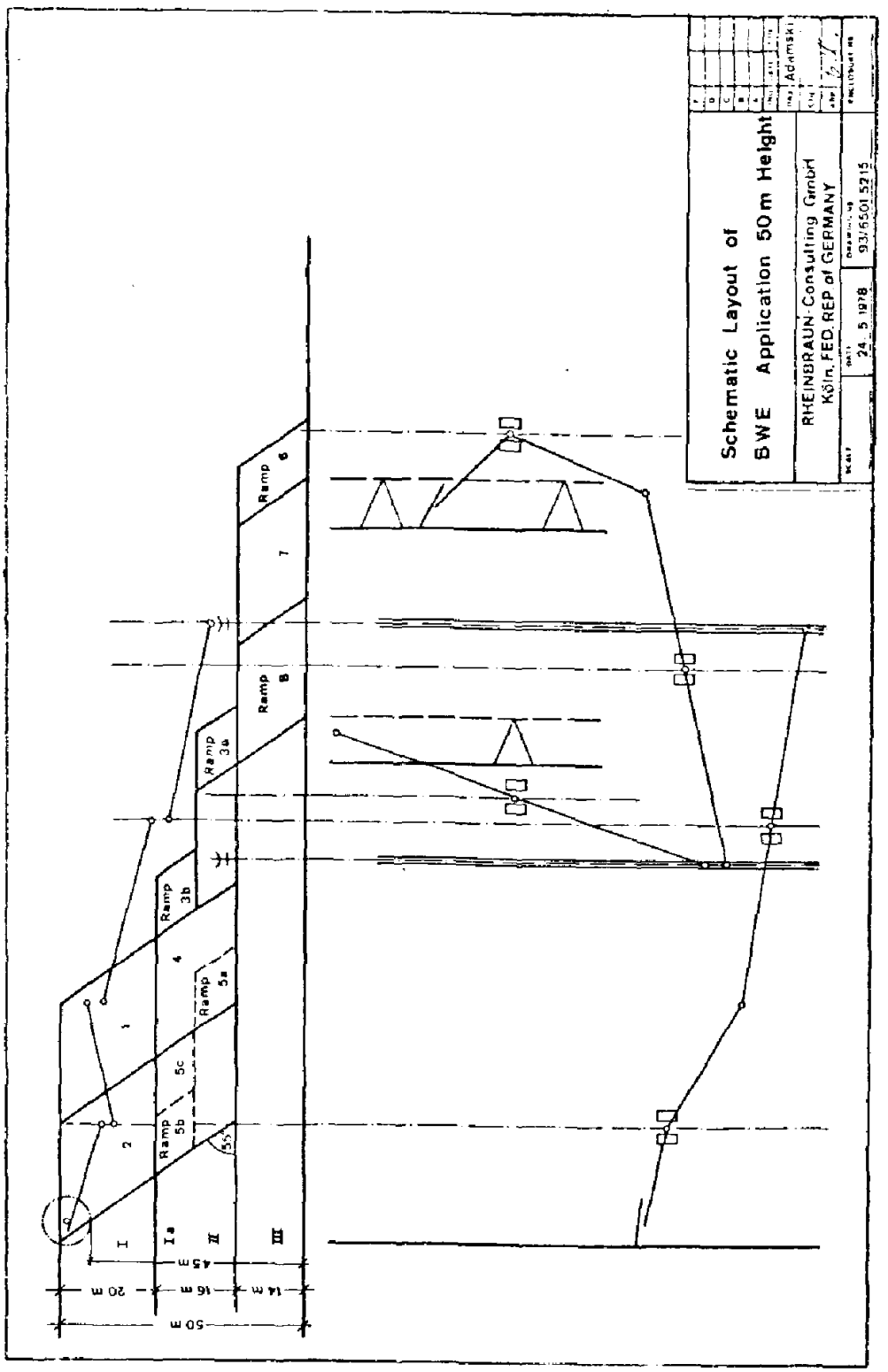
Also, to increase the total excavation height per excavator, a ramping operation is possible with an additional max. of 16 m above, or 14 m below the conveyor level. This provides the possibility of digging a total max. of 50 m with one set of machines and one conveyor.

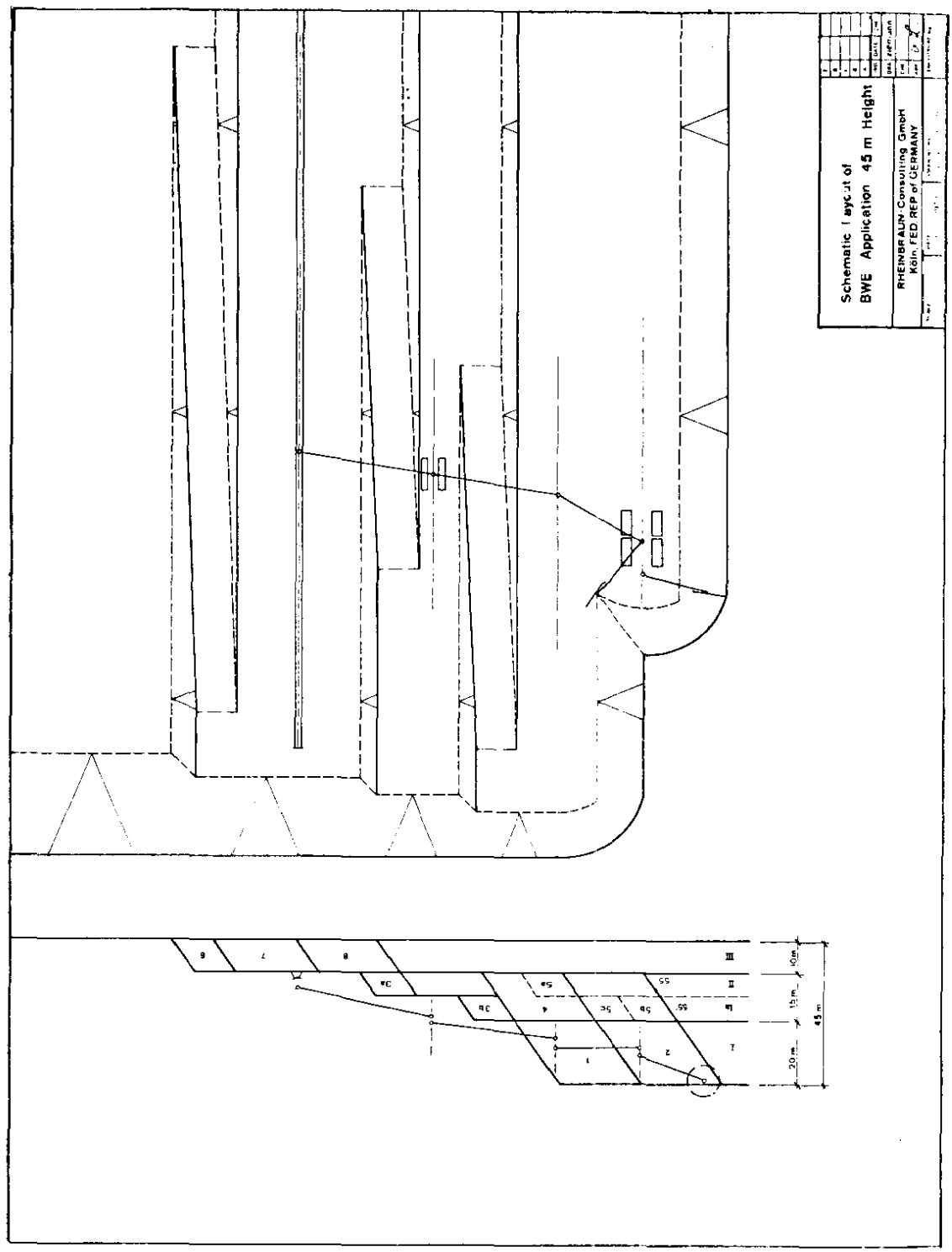
The mode and sequence of excavation of the various blocks is described in the accompanying list and sketch on page 4-3 with a total excavation height of 50 m. For selective mining in the upper parts of the upper block the block height is limited to approximately 15 m instead of 20 m, which results

Mode of Operation

(see page 4-3)

1. BWE travels to Bench I via ramp 3 a and 3 b
2. Belt Wagon travels to level I a via ramp 3 a
3. BWE cuts into block 1
4. BWE excavates block 1, Belt Wagon travels on level I a
5. BWE excavates block 2, Belt Wagon travels on level I a
6. BWE travels to bench II via ramp 3 a and 3 b
7. Belt Wagon travels to bench II via ramp 3 a
8. BWE excavates ramp 3 a
9. BWE cuts into block 3
10. BWE excavates ramp 3 b and block 3
11. BWE excavates block 4 leaving ramp 5 a at end
12. BWE cuts into block 5 c leaving ramp 5 b at end
13. BWE excavates block 5 b/5 c
14. BWE returns to ramp 5 a on level I a
15. BWE travels to bench III via ramp 5 a and 6
16. Belt conveyor is shifted 50 m
17. BWE excavates ramp 6 with belt wagon on bench II
18. BWE cuts into block 7 and excavates that block
19. BWE cuts block 8 and ramp 8 at end
20. BWE travels to bench I via ramp 5 a and 5 b and repeats cycle


Schematic Layout of
BWE Application 50 m Height
RHEINBRAUN-Consulting GmbH
Köln, FED. REP of GERMANY
24. 5. 1978
93/6501 5215
Ramp 6
7
Ramp 8
Ramp 3a
Ramp 3b
4
Ramp 5a
1
5c
Ramp 5b
2
55°
I
Ia
II
III
45 m
20 m
16 m
14 m
50 m


Schematic layout of
BWE Application 45 m Height
RHEINBRAUN Consulting GmbH
Köln, FED REP of GERMANY
10 m
15 m
20 m
45 m

in a total height of 45 m per conveyor. This corresponds to three truck benches of 15 m also being planned for operation in this pit.

Normally, when in overburden with a maximum of 45 m total height without selective mining, the bench below the conveyor level would be reduced to 10 m to facilitate the operation, as shown in the working sketch on page 4-4.

412 FACTORS INFLUENCING THE DESIGN OF BUCKET WHEEL EXCAVATORS

The following is a list of factors influencing the design of bucket wheel excavators and combined equipment:

	Influences:
(a) Type of material to be excavated:	
- Hardness, cuttability, form of breakout	BWE Power, cutting force, cutting speed
- Uniformness, inclusions, layers, lenses	general sturdiness weight
- Abrasiveness	buckets, teeth, chutes, baffle plates, belts
- Stickiness	cleaning devices buckets, fill factor
- Specific weight, swell factor	size of conveyors, buckets
- Size of pieces, size distribution	buckets, conveyors, transfer points
- Dustiness	dust prevention systems

- Softness, wetness	ground pressure
- Ground stability	bench, cutting angles, size of boom, weight

(b) Climate and weather:

- Temperature range	material selection downtime
- Rain- and snowfall	downtime
- Windstrength and -direction	downtime

(c) Pit design

- Number of benches	number of BWE, belt wagons, conveyors, relocation thereof
- Bench height	dimension and size of booms, general size of BWE, belt wagon, number of cuts per bench, low cut, digging losses, weight
- Block width	length of boom, digging losses, downtime, weight
- Number of blocks per conveyor shift	shifting losses, downtime, length of belt wagon

413 CAPACITY CALCULATION

According to the production schedule the capacity calculation for the bucket wheel excavators is based on the maximum yearly required output for each wheel of 5.5 million bank m^3. Since this maximum is not required over the total lifetime of the equipment,

this calculation includes a certain safety factor in additon to the factors used in the attached calculation on page 4-8/11.

The effective working hours per year, estimated at a conservative 4 500 hours per 8 760 hours total calendar time, take into consideration certain losses because of weather conditions, especially during the winter period. Also, some losses are included because of difficult mining conditions, i.e. ramping, and selective mining.

As these factors are already included in the calculation of the operating hours, the capacity loss factor is estimated as under normal conditions at 70 %. In addition, to arrive at the theoretical capacity of the bucket wheel excavator, a bucket fill factor of 1.15 is used resulting in 2 600 loose m^3/h theoretical capacity with a nominal bucket size of 0.85 m^3 at 51 discharges per minute.

Sizing of the belt conveyor system is based on the theoretical capacity of the bucket wheel excavator feeding the conveyors, or 2 600 loose m^3/h.
This results in a belt width of 1 200 mm at a speed of 5.2 m/sec.

For the additional truck operation, two extra conveyors of 1 200 mm width are needed on the ramp leading out of the mine. This is based on the assumption that the truck feed is crushed to size and fed to the conveyors at a steady rate.

Capacity Calculation of Main Mining Equipment

I. Total Loss Factor

(a) Availability, Downtime Estimate

Total scheduled operating hours per year 8 760

With a system of:

1 Bucket wheel excavator
1 Belt wagon
3 Conveyors to distribution point
1 Distribution point
4 Conveyors from distribution point to dump and coal storage

total actual yearly operating hours are estimated

under normal conditions 5 000

under difficult conditions (weather and/or selective mining) 4 500

This represents an availability factor of the system over total calendar time of 51.4 - 57 %

(b) Capacity Loss Factor

When operating with bucket wheel excavators, there are certain losses of digging capacity influenced by:

slewing motion (reversing direction)
travel motion (cut changes)
selective mining
operator ability

For Hat Creek conditions this loss factor between actual capacity and rated capacity is estimated

under normal digging conditions	70 - 75 %
under difficult conditions (selective mining)	50 - 55 %

(c) Total Loss Factor

To arrive at the rated hourly capacity of each bucket wheel excavator from the yearly required capacity, a factor combined from (a) and (b) above is used as follows:

under normal digging conditions	40 %
with selective mining	25 %

II. Machinery Data

(a) Bucket Wheel Excavators

Yearly output: 5.5×10^6 m^3/a (bank)

Swell factor: 1.3 (cf CM 5-5)

Working hours per year: 4 500

Effective output per hour: $\frac{5.5 \times 10^6}{4.5 \times 10^3} \times 1.3 =$

1 589 m^3/h loose

1 600 m^3/h loose

Working factor: 0.7

Bucket fill factor: 1.15

Theoretical output: $\frac{1\,600}{0.7} \times 1.15 =$

2 629 m^3/h loose

Q_{th} = 2 600 m^3/h loose

Number of bucket discharges: 50/min

Bucket capacity: $\frac{2\,600}{50 \times 60}$

= 867 litres

= 850 litres with 51 discharges

(b) Belt Conveyor Systems

Capacity: Q_{th} = 2 600 m^3/h loose

$= \frac{2.2}{1.3} = 1.69$ (23) t/m^3 loose

Q_t = 4 400 t/h

Belt width: 1 200 mm troughing: 35°

Belt speed: 5.2 m/s angle of repose: 7° appr.

The conveyors on the bucket wheel excavators and belt wagons are laid out at a smaller speed of 4 m/sec because of acceleration on the short belts, resulting in 1 400 mm belt width.

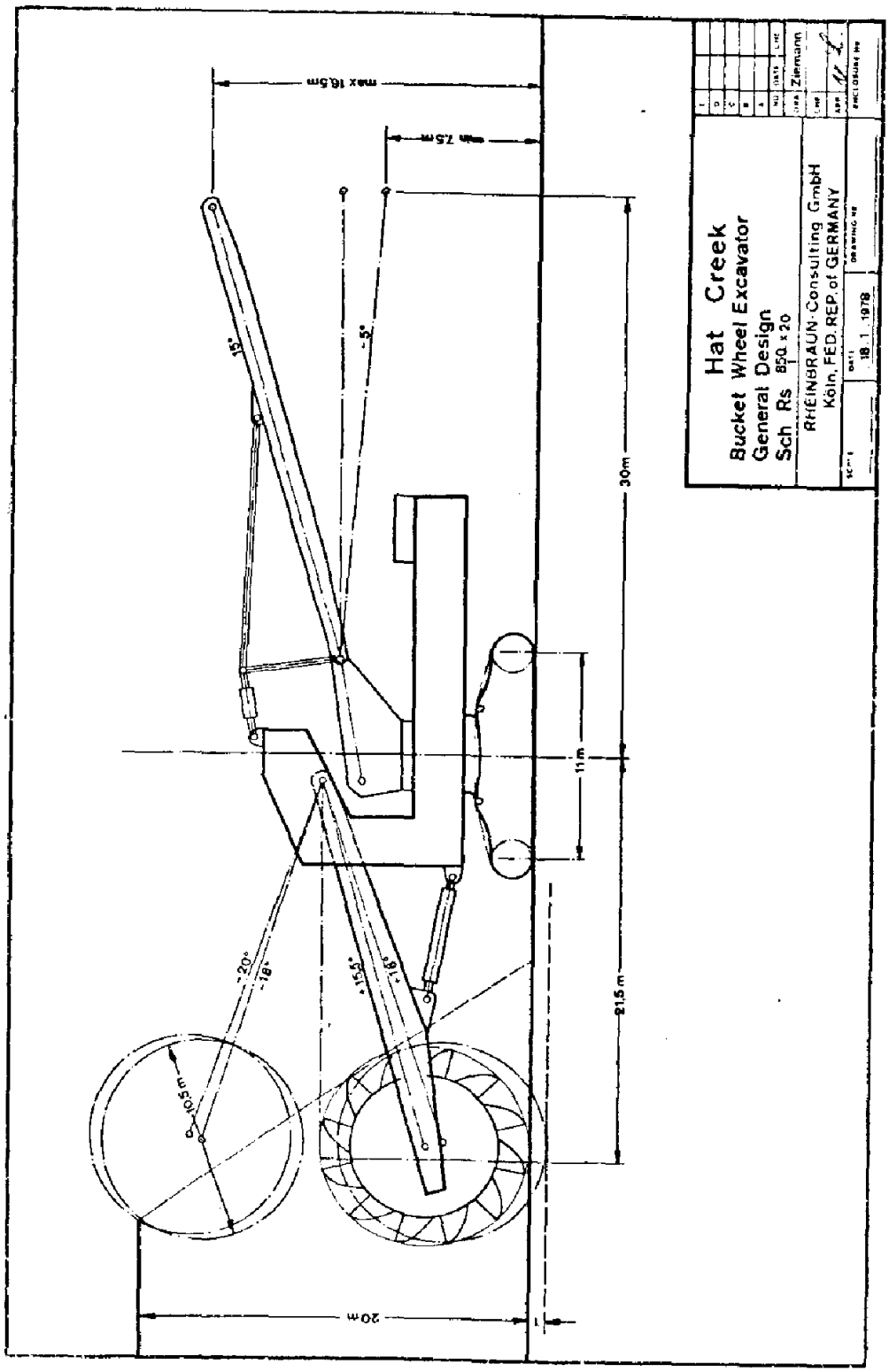
Coal demand by the power station may vary between 60 % and 100 % during any one year. It was agreed that the equipment in the mine should be laid out to recover up to 85 % capacity over several months. It is intended that this variation is reached by organizing the mining operation over the year so that when little coal is needed the bucket wheel excavators will work mainly in overburden and uncover coal reserves to be excavated in periods of high demand. This, together with the general load on the machinery of only about 70 % average, should take care of all variations. Any variations over and on top of the ones described, must be handled by additional shovel and truck equipment.

4.2 SHORT DESCRIPTION AND TECHNICAL MAIN DATA

421 BUCKET WHEEL EXCAVATORS

(See general design and main data list on page 4-13/14)
The bucket wheel excavators are of compact type design with a bucket wheel boom length of only 21.5 m for a maximum digging height of 20 m. The discharge boom of 30 m length is slewing independently of the bucket wheel boom and is adjustable in discharge height to be able to feed the belt wagon in all possible situations with ramp type excavation.
The booms are raised and lowered hydraulically, thereby eliminating rope hoists and a large center and counterweight boom construction. The counterweight for the bucket wheel boom is located at the rear below the discharge boom.
If necessary, at the detail design stage, the discharge boom may also have its own counterweight boom extending to the front of the machine above the bucket wheel boom. Max. inclination of the bucket wheel boom is + 18^{o} or - 20^{o}, of the discharge boom + 15^{o} or - 5^{o}.

The bucket wheel is of rather large diameter of 10.5 m, with 12 buckets of 0.85 m^3 nominal size each. At 51 discharges per minute, a low average for these applications, this results in the necessary 2 600 m^3/h loose theoretical capacity.
The actual cutting force and drive power to be installed should be determined later during the detail design stage after additional testing has been done with respect to the cuttability of the material in situ.
The slewing parts of the bucket wheel and discharge boom are rotating on the base frame of the two-crawler travel gear.
The two crawlers should be moving independent from each other by a three-point suspension, and the support wheels of the crawlers should be mounted two by two in equalizers so that all loads are equalized for each wheel when driving over rough terrain.
Average ground pressure of 16.5 N/cm^2 is believed to be possible for this application.


max 16.5m
max 25m
30m
11m
21.5m
20m
15°
-5°
-20°
-18°
-15.5°
-16°
Hat Creek
Bucket Wheel Excavator
General Design
Sch Rs 850 x 20
RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY
Ziemann
18.1.1978

Bucket wheel excavator, type SchRs $\frac{850}{1}$ x 20, main data

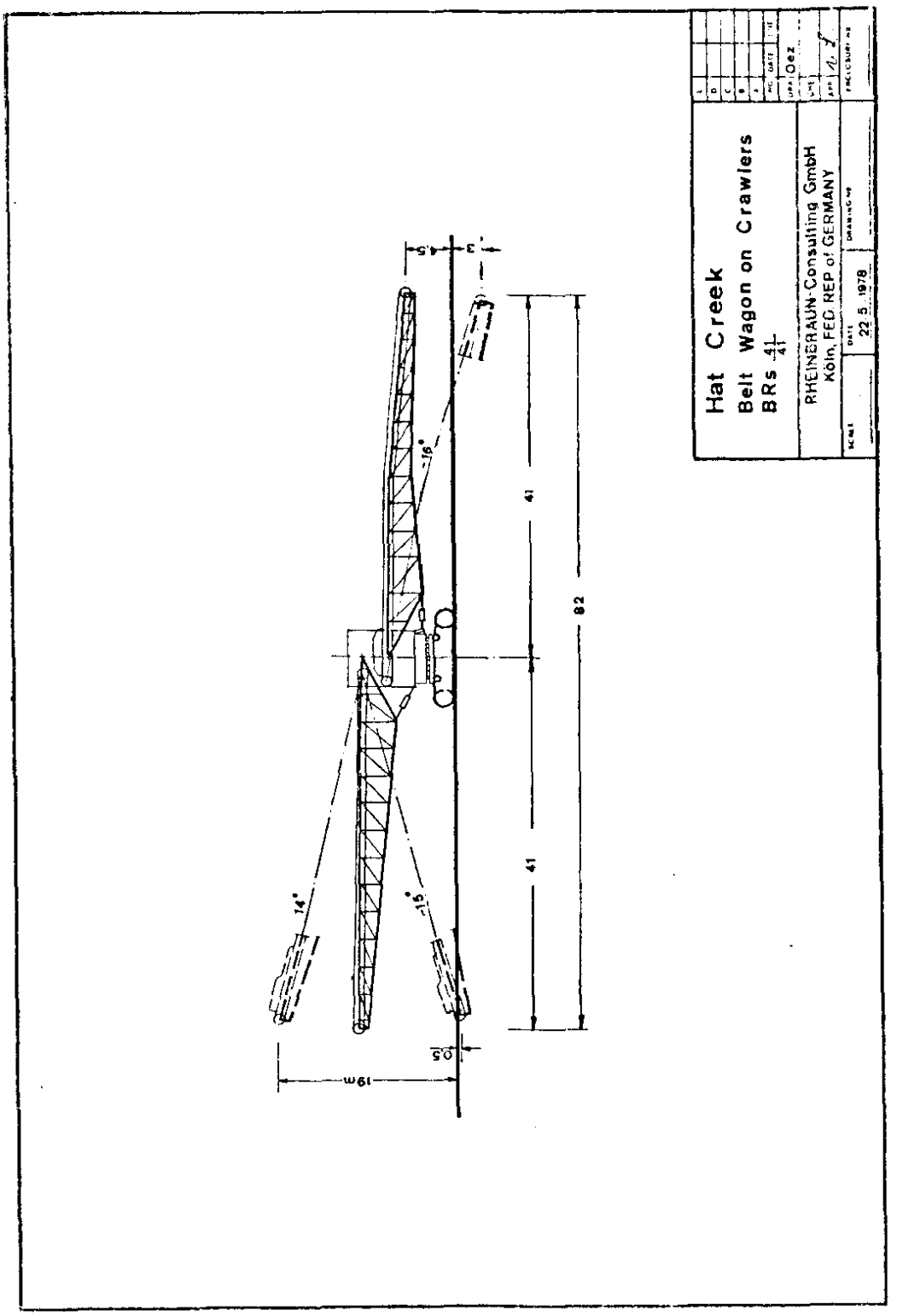
Nominal bucket capacity		0.85 m^3
Bucket wheel diameter across cutting lips		10.5 m^3
Number of buckets		12
Discharges per minute		51
Theoretical output		2 600 m^3/h loose
Cutting speed of cutting lips		2.34 m/s
Bucket wheel driving power		
Cutting height	max.	20 m
Selective digging up to		14.75 m
Cutting depth		1 m
Reach of bucket wheel boom (horizontal, from slew center to center of bucket wheel)		21.5 m
Length of discharge boom (horizontal)		30 m
Height of center discharge pulley above travelling level	min.	+ 7.5 m
	max.	+ 16.5 m
Slewing range of wheel boom		210°
Belt width (troughing 35°)		1 400 mm
Belt speed		4 m/s
Design of travel gear		2 crawlers
Travel speed	max.	9 m/min
Max. permissible inclination	in operation	1 : 20
	transport	1 : 10
Supply weight	approx.	1 100 t
Service weight	approx.	1 200 t
Mean ground pressure	approx.	16,5 N/cm^2
Installed motor capacity	approx.	1 400 kW

422 BELT WAGONS

(See general design and main data list on page 4-16/17).
In order to bridge the distance between the discharge point of the bucket wheel excavator and the loading point of the bench conveyor in all positions of the ramping operation the belt wagon is designed to have two independent belts on the receiving and discharge boom, with a transfer point in the center.
The two booms can be lifted independently by two hydraulic hoists. The receiving boom may be raised to approx. 19 m at 14° when the bucket wheel excavator is operating at a level of 16 m above the bench conveyor. It must be lowered to about 0.5 m below its travel plane, when the bucket wheel excavator is operating 14 m below the conveyor level.
The discharge boom must be lowered to about 3 m below the travel plane when the belt wagon is operating on a ramp 8 m above the bench conveyor level.
The boom is slightly bent to clear the outer edge of the ramp in this position.
The total length of 82 m is designed to bridge a distance of 80 m between bucket wheel discharge and conveyor loading point, to allow the ramping operation and to cut two blocks of 25 m width.
Belt width and speed are chosen the same as for the bucket wheel excavators, with 1 400 mm width and 4 m/sec speed.
Also, the crawler base and parts should correspond as much as possible to those of the bucket wheel excavator.

423 BELT CONVEYOR SYSTEM

The belt layout sketches on page 4-20/29 show in principle the conveyor layout for 5 phases (years).
For each excavator, a series of shiftable bench conveyors are arranged on the horizontal working bench leading to the mine access ramp. From there, the material (coal or overburden) is transported to the surface via four ramp conveyors designed "R" and leading to the distribution station.
As on the North side, the bucket wheel excavator has to change from an upper level to a medium level, a second line of conveyors is arranged there to be fed alternatively. This line can also be


Hat Creek
Belt Wagon on Crawlers
BRs 41/41
RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY
22.5.1978
4.5
3
16°
41
82
41
14°
15°
19m

Belt Wagon on Crawlers, type BRs 1400 $\frac{41}{41}$, main data

Theoretical conveying capacity		2 600 m^3/h loose
Length of loading conveyor		41 m
Length of discharge conveyor		41 m
Height of center of loading belt pulley		
related to travelling level	min.	- 0,5 m
	max.	+ 19 m
Height of center of discharge pulley		
related to ravelling level	min.	- 3 m
	max.	+ 4,5 m
Belt width (troughing 35°)		1 400 mm
Belt speed		4 m/s
Design of travel gear		2 crawlers
Travel speed		approx. 9 m/min
Max. permissible inclination:	in operation	1 : 20
	transport	1 : 10
Supply weight		approx. 250 t
Installed motor capacity		approx. 350 kW

served by the second excavator on the lower level. Therefore, there must be a possibility to change the flow of material from the medium level to either one of the ramp conveyors R 10 or R 20, depending on which conveyor is already used by the first or the second excavator.
To do this, a short slewing conveyor is arranged at the loading point of the intermediate conveyor feeding either R 10 or R 20. The arrangement of this slewing conveyor is shown on the accompanying sketch on page 4-30 with a length of 20 m and a discharge height of 4 m, to cover the gap of 10 m between the two ramp conveyors. Later on, three bucket wheel excavators are supposed to operate on the southern side of the pit. Therefore, one of the conveyor lines on this side must feed ramp conveyor R 20 on the north side. To do this, a conveyor bridge is arranged to bridge the ramp conveyors in the center of the ramp to feed R 20.
In the center of the ramp, two conveyors, T_1 and T_2, are arranged to be fed by the truck operation, transporting either coal or overburden.
They are to be loaded from truck hoppers with a possibility to crush material to a transportable size, and with a feeder regulating the steady flow from the hopper to the conveyor. Determination of location, design and costing rests with CMJV.

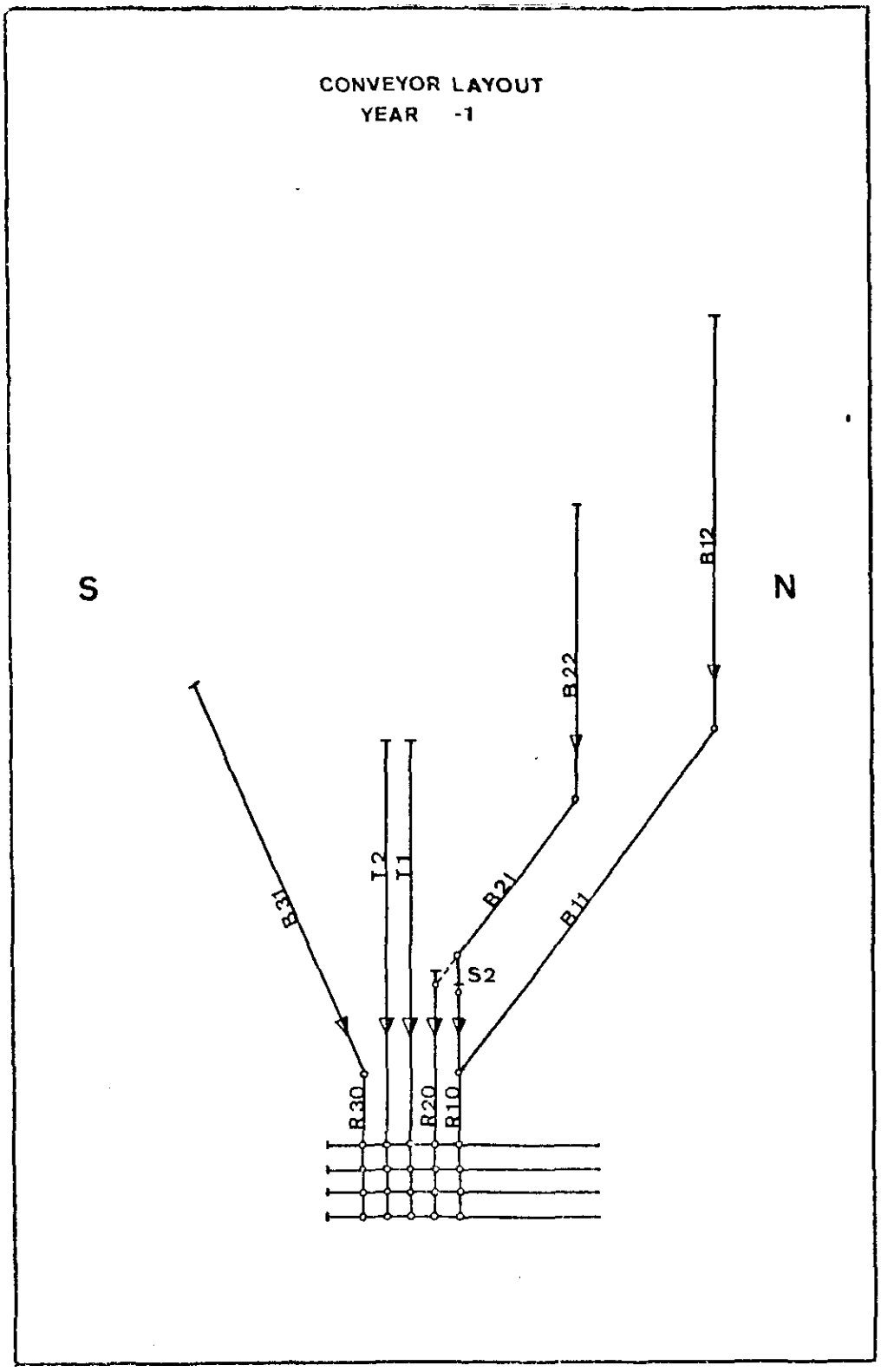
All conveyors being served by the bucket wheel excavators are layed out with the same width of 1 200 mm and a belt speed of 5,2 m/sec. They are able to transport the maximum capacity of one bucket wheel excavator.

The truck conveyors are also chosen with the same design data as the bucket wheel excavator conveyors. At an hourly max. capacity of 2 600 m^3 loose, and being fed fairly constantly from the hopper feeders, the truck conveyors should be able to easily move the required amount of material from the truck operation. At the top of the access ramp of the mine, the conveyor distribution point is arranged, with six conveyors coming out of the mine, and four leading off to coal and waste dumps.
Each of the ramp conveyors has an extendable head section to be able to serve alternatively all four off-going conveyors, of which two are to transport

coal, and two waste.
These extendable heads must be moved each time the feeding bucket wheel excavator (or truck operation) changes from coal to waste, or from high grade coal to low grade coal, or from granular waste material to low grade waste material.

As the length, number and lift of the conveyors change over the course of the mine development, there are several phases being investigated as shown on the belt layout sketches and tables on page 4-20/29 showing length, lift and required drive power for each conveyor, resulting in different totals for each phase.

It should be noted that the tabulation is based on the situations at the beginning of the respective year and correspond with the mine plans of the preceeding year in Enclosure 2, which represent the situation at the end of the respective year.


CONVEYOR LAYOUT
YEAR -1
S
N
B12
B22
B31
T2
T1
B21
B11
S2
B30
B20
B10

Hat Creek

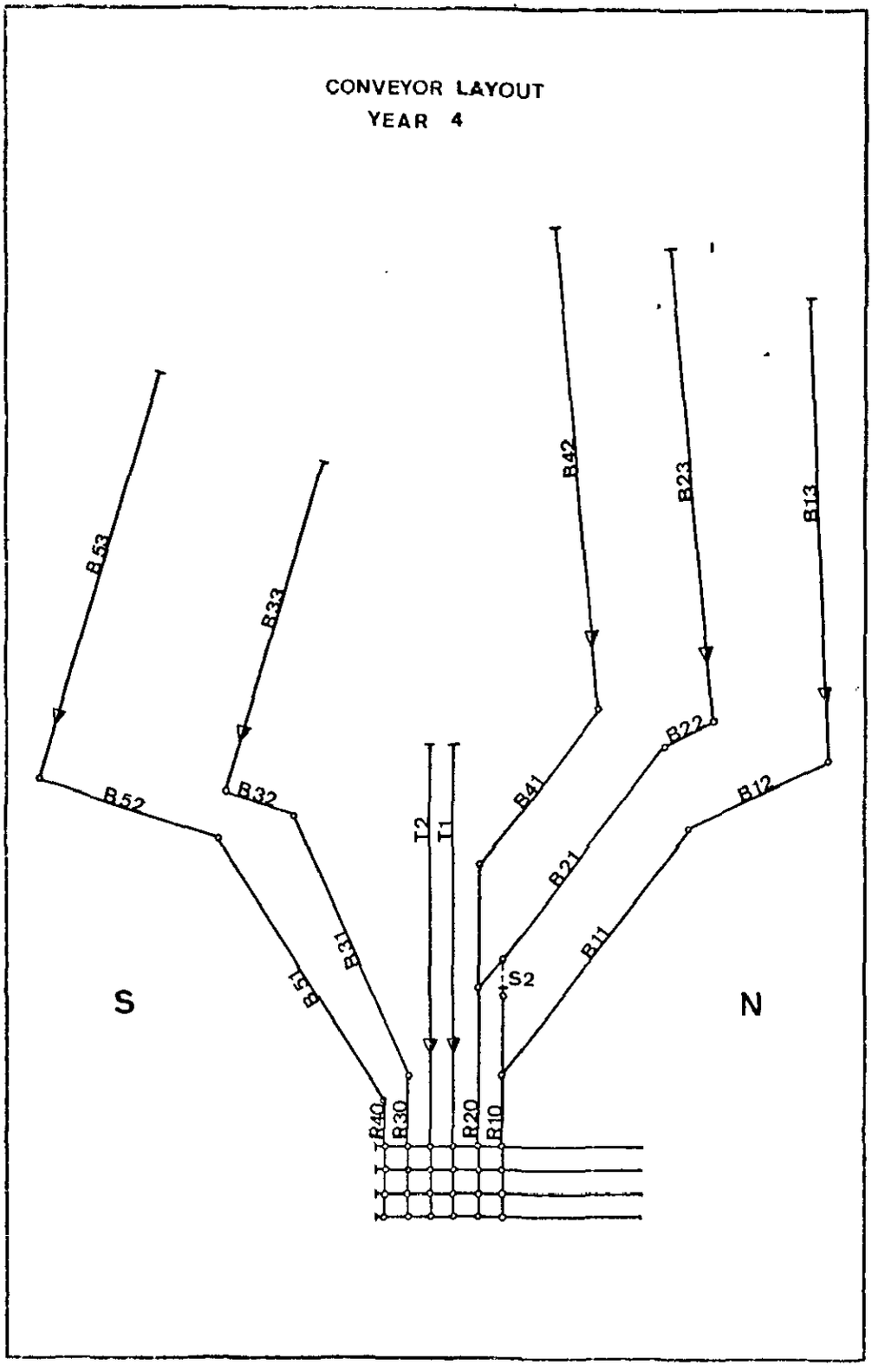
Belt Conveyor System

Position on year -1
(Representative for Phase 1; year - 1)

	BWE operating level	Conveyor no.	Belt length (m)	Lift (m)	Drive power required (kW)
	+ 935 m north	R 10	295	+ 25	514
		B 11	830	- 21	148
		B 12	1 600	+ 4	775
subtotal			2 725		1 437
alterna-tively in ope-ration	+ 890 m north	R 20	305	+ 25	519
		S 2	20	+ 4	113
		B 21	275	+ 4	240
		B 22	720	+ 4	420
subtotal			1 320		(1 292)
	+ 920 to 910 south (July 1)	R 30	150	+ 5	196
		B 31	1 080	- 6	433
subtotal			1 230		629

	Belt con-veyors, loaded by trucks	T 1	850	+ 115	1 872
		T 2	850	+ 115	1 872
subtotal			1 700		3 744

total			6 975		5 810


CONVEYOR LAYOUT
YEAR 4
B53
B33
B42
B23
B13
B52
B32
B41
B22
B12
T2
T1
B51
B31
B21
B11
S2
S
N
B40
B30
B20
B10

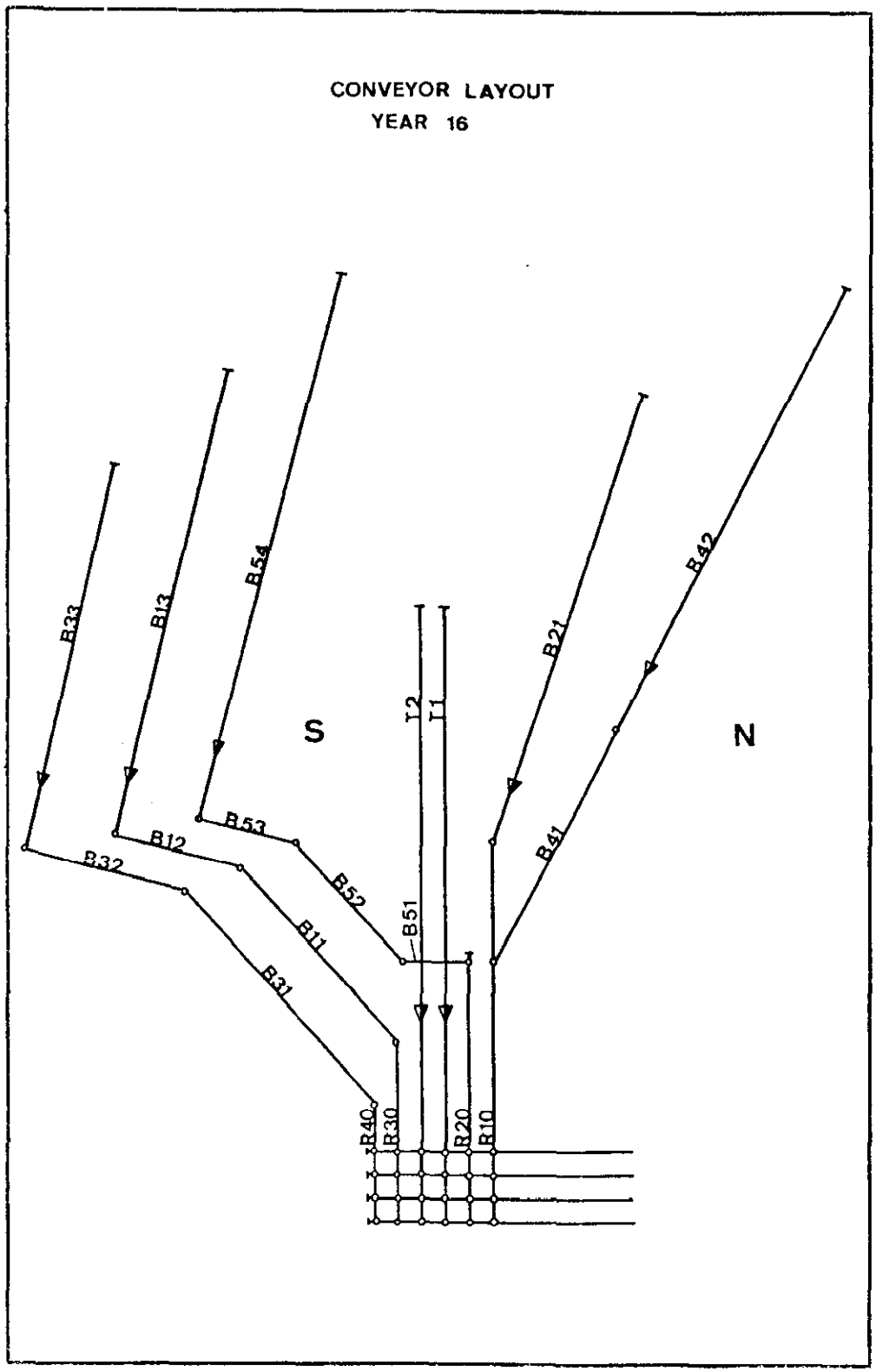
Hat Creek

Belt Conveyor System

Position on year 4

(Representative for Phase 2; year 1 - 10)

	BWE operating level	Conveyor no.	Belt length (m)	Lift (m)	Drive power required (kW)
	+ 935 m north	R 10	295	+ 25	514
		B 11	1 070	- 21	240
		B 12	315	+ 4	258
		B 13	1 570	+ 4	762
subtotal			3 250		1 774
alternatively loading on conv. R 10	+ 890 m north	R 20	550	+ 70	1 185
		S 2	20	+ 4	113
		B 21	940	+ 4	506
		B 22	65	+ 4	139
		B 23	1 690	+ 4	814
subtotal			3 265		2 757
loading on conv. R 20	+ 845 m north	B 41	600	+ 4	371
		B 42	1 730	+ 4	831
subtotal			2 330		(1 202)
	+ 920 m south	R 30	150	+ 5	196
		B 31	990	- 6	398
		B 32	145	+ 4	181
		B 33	900	+ 4	492
subtotal			2 185		1 267
	+ 965 m south	R 40	130	+ 5	186
		B 51	1 040	- 51	582
		B 52	630	+ 4	383
		B 53	1 110	+ 4	573
subtotal			2 910		1 724
	Belt conveyors loaded by trucks	T 1	850	+ 115	1 872
		T 2	850	+ 115	1 872
			1 700		3 744
total			15 640		11 266


CONVEYOR LAYOUT
YEAR 16
S
N
B33
B13
B54
B21
B42
T2
T1
B53
B12
B52
B51
B41
B32
B11
B31
R40
R30
R20
R10

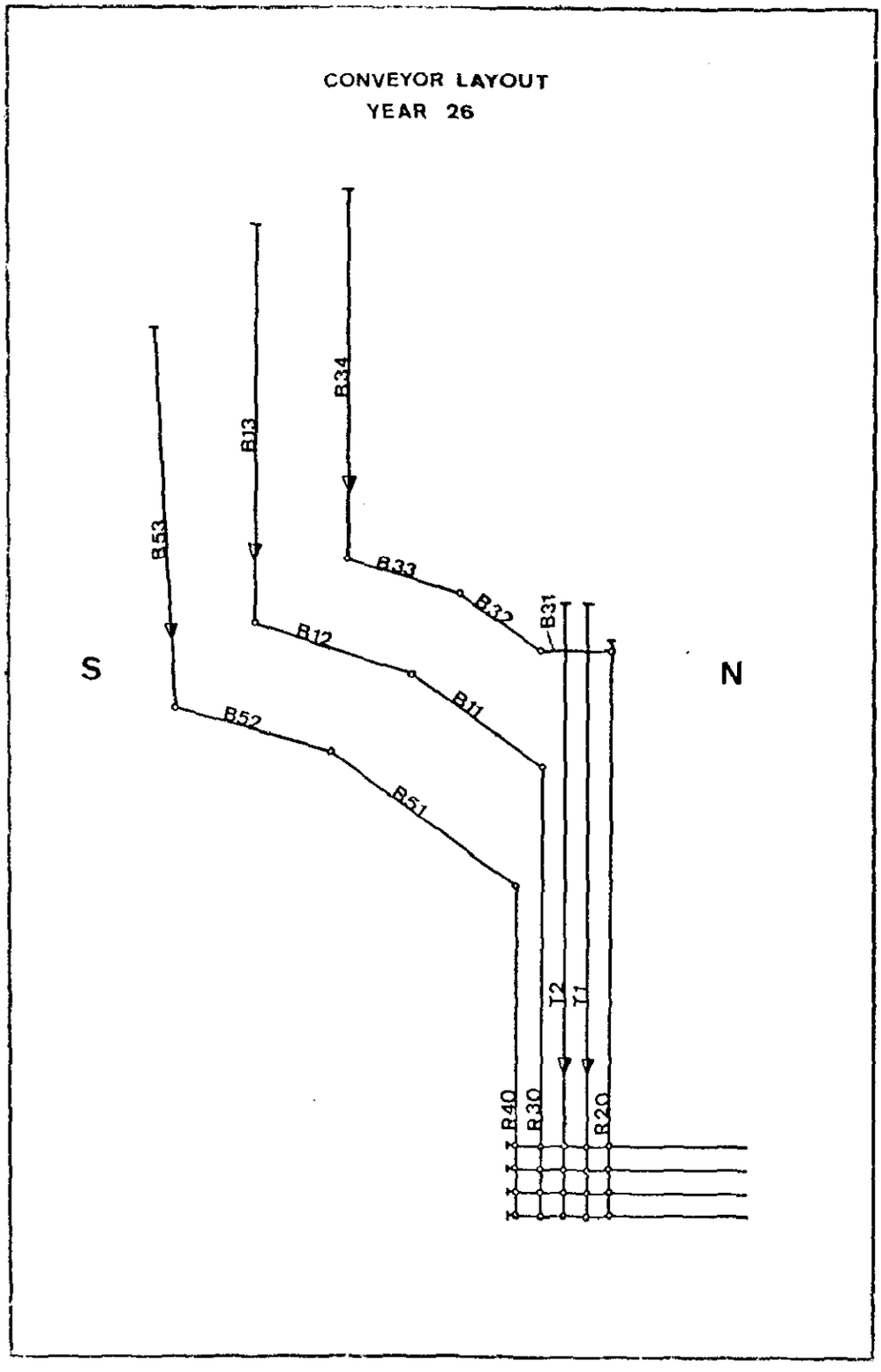
Hat Creek
Belt Conveyor System

Position on year 16
(Representative for Phase 3; year 11 - 25)

	BWE operating level	Conveyor no.	Belt length (m)	Lift (m)	Drive power required (kW)
loading on conv. R 10	+ 800 m north	B 21	1 100	+ 4	574
subtotal			1 100		(574)
	+ 845 m north	R 10	850	+ 115	1 871
		B 41	760	+ 4	435
		B 42	1 450	+ 4	710
subtotal			3 060		3 016
	+ 920 m south	R 40	110	+ 5	176
		B 31	1 030	- 6	416
		B 32	765	+ 4	437
		B 33	1 100	+ 4	568
subtotal			3 005		1 597
	+ 875 m south	R 30	300	+ 25	515
		B 11	870	+ 17	642
		B 12	630	+ 6	408
		B 13	1 230	+ 4	620
subtotal			3 030		2 185
	+ 830 m south	R 20	570	+ 70	1 193
		B 51	50	± 0	80
		B 52	660	+ 19	586
		B 53	420	+ 7	335
		B 54	1 680	+ 4	809
			3 380		3 003

	Belt conveyors loaded by trucks	T 1	1 270	+ 170	2 735
		T 1	1 270	+ 170	2 735
subtotal			2 540		5 470

total			16 115		15 271

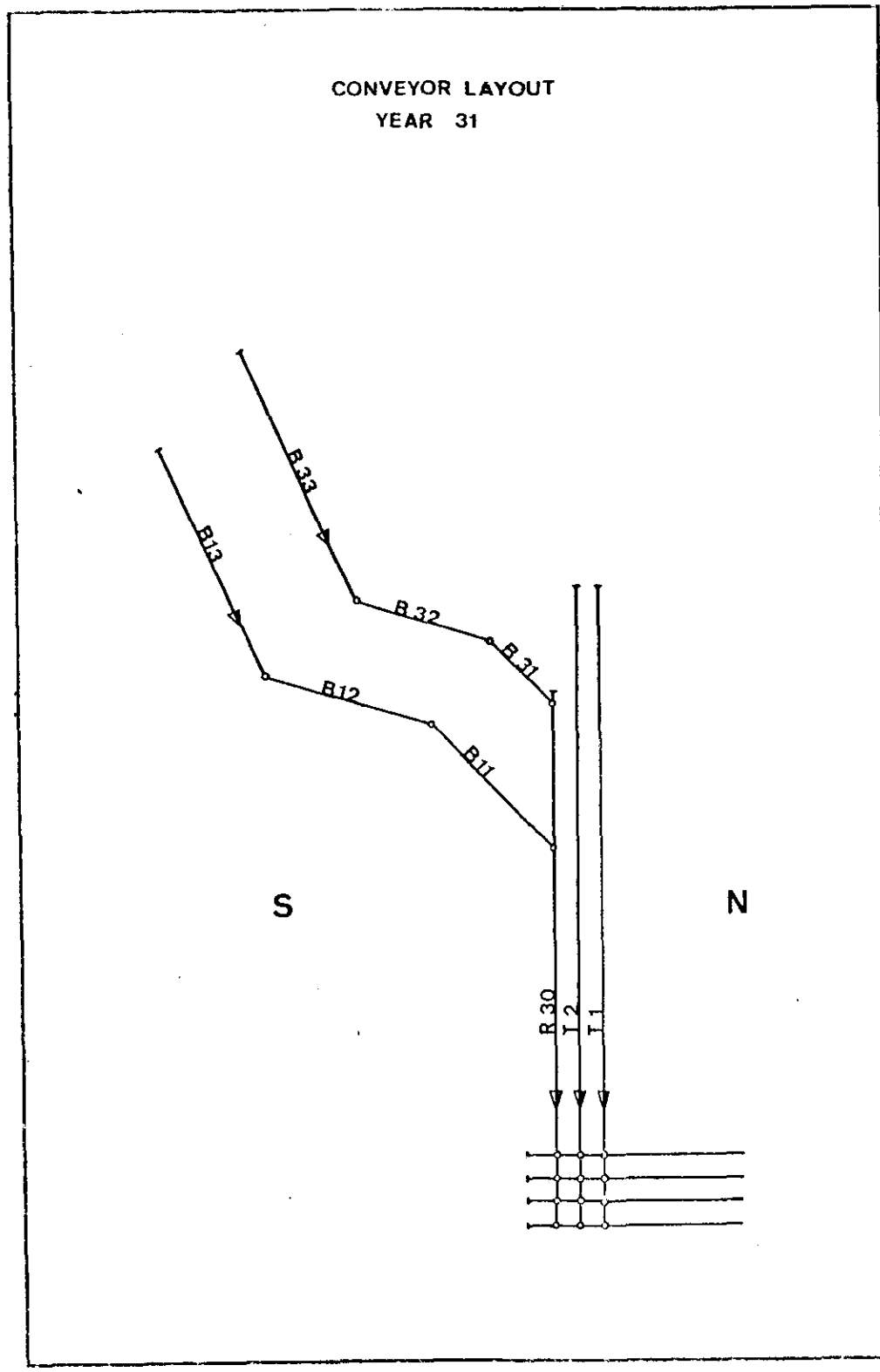

CONVEYOR LAYOUT
YEAR 26
S
N
B53
B13
B34
B33
B32
B31
B12
B11
B52
B51
T2
T1
B40
B30
B20

Hat Creek

Belt Conveyor System

Position on year 26
(Representative for Phase 4; year 26 - 30)

	BWE operating level	Conveyor no.	Belt length (m)	Lift (m)	Drive power required (kW)
	+ 830 south	R 40	580	+ 70	1 197
		B 51	650	+ 14	518
		B 52	515	+ 9	402
		B 53	900	+ 4	492
subtotal			2 645		2 609
alternati-vely in operation	+ 785 m south	R 30	850	+ 115	1 871
		B 11	430	+ 14	429
		B 12	400	+ 9	355
		B 13	1 075	+ 4	557
subtotal			2 755		(3 212)
	+ 740 m south	R 20	1 115	+ 160	2 546
		B 31	30	± 0	69
		B 32	220	+ 15	355
		B 33	310	+ 11	344
		B 34	1 000	+ 4	529
subtotal			2 675		3 843
	Belt con-veyors loaded by trucks	T 1	1 270	+ 170	2 735
		T 2	1 270	+ 170	2 735
subtotal			2 540		5 470
total			10 615		11 922


CONVEYOR LAYOUT
YEAR 31
B33
B13
B32
B31
B12
B11
S
N
B30
T2
T1

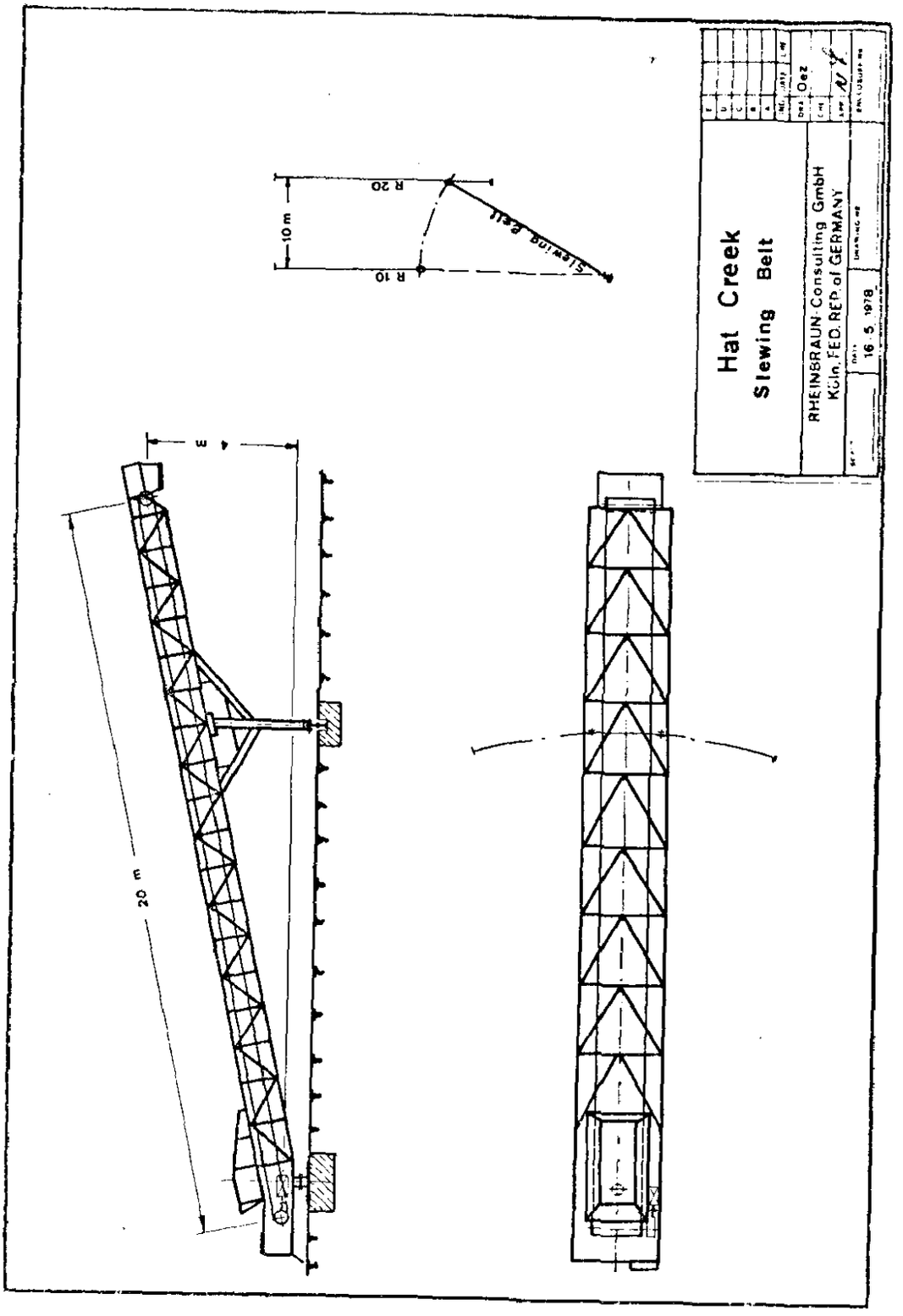
Hat Creek

Belt Conveyor System
Position on year 31
(Representative for Phase 5; year 31 - 35)

	BWE operating level	Conveyor no.	Belt length (m)	Lift (m)	Drive power required (kW)
alternatively in operation, loading on conv. R 30	+ 785 south	B 11	430	+ 14	429
		B 12	450	+ 9	376
		B 13	740	+ 4	426
subtotal			1 620		(1 231)
	+ 740 m south	R 30	1 130	+ 160	2 552
		B 31	215	+ 12	315
		B 32	310	+ 11	344
		B 33	780	+ 4	444
subtotal			2 435		3 655

	Belt conveyors loaded by trucks	T 1	1 270	+ 170	2 735
		T 2	1 270	+ 170	2 735
subtotal			2 540		5 470

total			6 595		10 494


Hat Creek
Slewing Belt
RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY
16. 5. 1978
R 20
10 m
R 10
11,3 Burmeister
20 m

4.3 ANCILLARY EQUIPMENT

The attached list on page 4-32/34 of ancillary equipment for the bucket wheel excavator system under "1. Additionally required" only covers equipment specifically required for the bucket wheel excavator system, and, marked by an asterisk, commonly used equipment that is in full time use for the bucket wheel excavator system.

Other equipment that is only used part time for the bucket wheel excavator system, but regularly for other applications, is listed under "2. Part time application".
The hours per unit and year required for the bucket wheel excavator system alone are listed as well as the number of units and their application for belt shifting under 2.1, for general use under 2.2.

Ancillary Equipment

1. Additionally required

	Equipment	Range of application	Units
*	Bulldozer Cat D 6 C	Levelling for BWE	4
*	FEL Cat 950 with special attachment	Cleaning of belt conv. lines	1
	Pipe laying attachments for Cat D 8 K	Belt shifting	
	a) winch, side boom, adjust. counterweight	ditto	2
	b) shifting head incl. thill	ditto	2
	Cable reel trailer	Cable transport	1
*	Service truck, 2 t	Maintenance and control of belt conveyor lines	2
*	Pick-up 3/4 t	Mine supervision	2

*) Full time operation

2. Part time application

2.1 Equipment for belt shifting

Equipment	Range of application	Units	Hours requ. per unit and year	
Bulldozer Cat D 8 K with shifting attachment	Belt shifting	2	1 100	1*)
Bulldozer Cat D 8 K	Pulling of drive stations	2	1 100	
Backhoe Cat 215	Pit-digging for belt anchors	1	500	
Grader Cat 16 G	Preparing new belt pos.	1	500	
FEL Cat 950	Alignment of belt frames	1	200	
Mobile Crane 15 t	Lifting of belt spools	1	200	2*)
Flat bed trailer 30 t	Transport of heavy equipment	1	400	2*)
Tractor	f. flat bed trailer	1	400	2*)
Truck, flat deck 3 t	Transp. of workshop equipment	1	2 000	
Vulcanizing Equipment	Belt splicing	2	1 100	2*)
Emergency power unit	Vulcanizing	2	500	2*)

Total time for one shifting operation (incl. belt splicing) 3 shifts

1*) altern. Pipelayer Cat 571 G

2*) only applicable for simultaneous belt extension

2.2 Other Equipment

Equipment	Range of application	Units	Hours requ. per unit and year
Bulldozer Cat D 8 K with ripper	Ramp dozing	2	1 100
Grease truck		1	1 100
Personnel bus		2	1 100

4.4 POWER CONSUMPTION

In accordance with the development of the conveyor systems the annual power consumption for the bucket wheel excavator system is calculated for the phases described on page 4-20/29.
They take into account the actual number of units in operation and their utilization as given by the production schedule on page 3-16/17.

(a) BWEs + Belt Wagons + Hopper Cars

Total drive power installed: 1 800 kW = 1.8 MW

Typical load factor: 0.65

Operating hours per year: 4 500

Phase	No. of units in operation	Utiliz. factor	Total actual number of oper. hours/year	Power consumption MWh/a
1	2	0.71	4 793	5 610
2	4	0.71	12 780	14 950
3	4	0.71	12 780	14 950
4	2	0.61	5 490	6 420
5	1	0.51	2 295	2 690

(b) Belt Conveyor System

For the calculation of the power consumption of the belt conveyor system at each phase it is assumed, that the really installed drive power is 15 percent higher than the required drive power (see data sheets on page 4-20/29).

Typical load factor: 0.5

Operating hours per year: 4 500

Phase No.	Max. drive power* kW	Utilization factor		Power consumption MWh/a
		Conv. system for BWEs	Truck conveyors	
1	6 670	0.71	1.15	14 337
2	12 960	0.71	1.15	24 944
3	17 560	0.71	0.51	25 222
4	13 710	0.61	0.51	17 402
5	10 490	0.51	0.51	7 700

*) simultaneously in operation

4.5 MANPOWER REQUIREMENTS

The personnel requirements are listed on page 4-38/40 It shows under "1. Main Mining Equipment" the manpower requirements for operators of the mentioned equipment within the mine up to and including the distribution station.
For each bucket wheel excavator/belt wagon group, a total of 3 operators is listed. Normally, one of them would be on the ground directing the operation, while one each operates the bucket wheel excavator and the belt wagon. The ground man is exchanged with the bucket wheel excavator operator at regular intervals to avoid a constant 8-hour attention required of one man.
Also, the ground man may substitute as bucket wheel excavator or belt wagon operator during lunch breaks.
In addition, each equipment group has one oiler and one helper constantly on the job.
For conveyor control of each conveyor line up to the ramp conveyors, one helper is available for patroling and cleaning. This group of helpers in total also assists in shifting operations, etc. The drive stations are not constantly manned.

On the distribution station, one operator takes care of changing the extendable head sections to the respective off-going conveyor, and a helper is there for patroling and cleaning.
Two operators are stationed at the central control station.

Operators for the full time required ancillary equipment are listed under 2. on page 4-39.
This list does not cover any maintenance personnel.

For maintenance, the following requirements are estimated:

For the BWE/Belt wagons: 36 men
For the belt conveyor system: 24 men
each working 2 200 hours per year.

These include electricians and cover crews for workshop and field.

HAT CREEK

PERSONNEL PROGRAM

1. Main Mining Equipment

Serial No.	Type of Equipment Place of Employment	Range of Application	Category of Personnel No. per unit and shift	Total of units	Man power Total for 4 crews and 3 shifts	Reserve 10 %	Total
1.1	Bucket Wheel Excavator	Operation of BWE and ground control	2 Operators	4	32	3	35
		Lubrication of BWE and belt wagon	1 Oiler	4	16	2	18
1.2	Belt Wagon	Operation of belt wagon incl. hopper car and ground control	1 Operator	4	16	2	18
		Cleaning of BWE and belt wagon	1 Helper	4	16	2	18
1.3	Belt Conveyor System (incl. truck conveyors)	Conveyor line control cleaning, shifting	4 Helpers	6*	16	2	18
1.4	Distribution Point	Operation control and material distribution	1 Operator 1 Helper	1	4 4	1 1	5 5
1.5	Conveyor Control Centre	Operation control	2 Operators	1	8	1	9
					112	14	126

* 4 BWE-systems in operation plus 2 truck conveyors

HAT CREEK
PERSONNEL PROGRAM

2. Ancillary Equipment, full time required

Serial No.	Type of Equipment Place of Employment	Range of Application	Category of Personnel No. per unit and shift	Total of units	Man power Total for 4 crews and 3 shifts	Reserve 10 %	Total
2.1	Dozer Cat. D 8 C	Levelling for BWE	1 Operator	4	16	2	18
2.2	FEL Cat 950	Cleaning of belt conveyor lines	1 Operator	1	2*	1	3
2.3	Pick-up, 3/4 t	Mine supervision	2 Drivers	2	8	1	9
2.4	Service-truck, 2 t	Belt conveyor control	2 Drivers	2	8	1	9
			2 Helpers	2	8	1	9
					42	6	48

* 2-shift operation

HAT CREEK

PERSONNEL PROGRAM

3. Mine Supervision

Serial No.	Type of Equipment Place of Employment	Range of Application	Category of Personnel No. per unit and shift	Total of units	Man power Total for 4 crews and 3 shifts	Reserve 10 %	Total
3.1			Shift Foreman				
3.1.1	BWE and Belt Wagons				4	1	5
3.1.2	Belt Conveyor System				4	1	5
					8	2	10

4.6 SUPPORT FACILITIES

The planning of the mine workshop refers to Enclosure 5.

(a) General

In the following only the necessary maintenance capacity facilities for the bucket wheel excavator operation (workshop floor area, workshop equipment) and the stores capacities (storeroom area, storeroom equipment) are stated. With these facilities, the opencast mine is in a position to carry out the day-to-day maintenance on the proposed mine equipment and plant (servicing, inspection, small maintenance work, some larger maintenance work to eliminate faults and defects) but not, however, to carry out major overhauls, major repairs, conversions, expansions or new works. The following schedules show individually for which conditions the proposed maintenance and stores capacities are primarily designed. According to the available capacity of any outside contractors an extension or, in individual cases, a reduction of the proposed maintenance and stores capacities is then to be undertaken. As the actual available capacities from and through outside firms are difficult to accurately determine during the present planning stage, it is recommended in any case to include in the planning the expansion possibilities for the maintenance workshop areas, stores, buildings and the open air areas and to regard the proposed capacities as an economically necessary basic burden.

It appears important to us to arrange the maintenance workshop and the stores complex in such a flexible manner so that a later change of function of the duties and change of furnishings/ equipment enables work to be given to outside firms according to the actual work concentration.

The maintenance workshop is to be sited to the opencast mine's access road so that tracklaying vehicles and other auxiliary vehicles as well as heavy vehicles can drive up to the workshop via

a special way by their own power. Thereby, they should pass through a washing down area (also with hot water cleaning facilities).

The auxiliary equipment workshop (Bay 2 of the workshop) is only equipped for the necessary auxiliary equipment for the bucket wheel excavator operation. The number and type of auxiliaries are to be seen in the special schedule.

(b) Maintenance Workshop (Bays 1 and 2)

- General

The maintenance workshop consists of 2 Bays in a north-light-roof construction. A low roof extension over both bays will contain:

- Central lubrication supply for the auxiliary equipment workshop with 4 types of lubricating oils (1 motor oil, 1 hydraulic oil, 2 gear oils);
- Tool issue and subsidiary stores for the machine parts department,
- Tool issue and subsidiary stores for the auxiliary equipment workshop.

In each bay 1 travelling crane, 8.5 m hook height.

Bay 1: 1 x 40/10 t load capacity
Bay 2: 1 x 15 t load capacity

The welding shop, forge and steel construction shop situated in bay 1 should be walled up to the roof because of the noise originating here.

- Bay 1

Mechanical Workshop and Fitters Shop

The following machines should be installed:

- Lathes:

335 x 6 000 mm
315 x 3 000 mm
240 x 2 000 mm

- 1 Bedplate miller, horizontal and vertical, 1 600 x 400 mm
- 1 Radial drilling machine, 50 dia x 2 000 mm
- Column drilling machines

  1 x 50 mm dia
  2 x 32 mm dia
  1 x 20 mm dia
- Double grinding wheel stands

  1 piece 400 mm dia
  2 pieces 300 mm dia
- 1 shaping machine 550 mm stroke
- 1 Keyseating machine 600 mm stroke
- 1 Roller and pulley block device (jib crane)
- 1 Marking plate 2 000 x 3 000
- 1 Stand press 300 t

In the region of the workshop thoroughfare there are some working benches, assembly pads and two enclosed machine part cleaning units (chamber-cleaning units) to be installed for the small machine parts.

Welding Shop, Forges and Steel Construction Shop

There are to be accomodated:

Excavator bucket forges with:

- 1 C-Frame press 200 t with forging dies
- 1 Anvil with accessories (tongs, hammers etc.) and 1 forge furnace
- 1 heating brazier 1.2 m x 1.2 m, 4 m long, 275 kV to 1 200° C

- 1 Working surface 3 m x 3 m with clamping grooves

These blacksmiths' works will hardly be taken over by an outside firm in good time.

Welding Shop with:

2 small welding boxes with E-welding devices (400 A/22 kVA)

2 larger welding boxes with protective gas-welding units 600 A/40 kVA

2 Acetylene welding places

1 Acetylene cutter for approx. 2.5 m x 3.5 m

1 Welding turntable 3 000 kg (also for excavator bucket)

1 Sheet shears 6 x 3 000 mm

1 Profile/Form shears 48 mm dia

Surface plate 2 m x 3 m

no drum shell bending machine; no submerged arc welding

- Bay 2

For the auxiliary equipment maintenance (servicing, inspection for maintenance up to a 1 week's stay in the workshop). Maximum of 2 standing places behind the rapid closing doors, of which 1 place for the conveyor belt shifting equipment (Cat D 8 K with fitted side crane), without assembly pits, auxiliary equipment required if being jacked up.

Electrical Workshop

An electro-instrument workshop (radio telecommunication-telephone workshop) is proposed here in addition to the general electrical workshop which is to be fitted out with 2 small welding boxes, drills and grinding wheel stands and the electrical parts' store.

(c) Stores Complex

Consisting of:

Rack-store:

with cellar (with palette shelves), ground floor (with ramps and goods receipt and issue) and a first floor. The ground floor will receive an intermediate floor and the first floor also if the need arises (also if the requirement arises for the special storage of direct-project-material). A 4-t-lift is required here.

This shelf store hall should be designed to enable the use of a forklift truck for the receipt and issue of stocks. The loading and unloading of vehicles can be solved by the installation of rising working platforms and by fitting a 4-t-travelline crane.

Stores Office:

For approx. a staff of 10 persons according to the type of commercial organisation. Moreover, a breakfast/lunch room.

Crane Hall:

with a 40-t-travelling crane, 16.5 m track centres. For dry, lightly tempered storage of heavy parts (drums, shafts, gear drives, transmission parts, E-motors and so on) stored in palette racks and stacks (e.g. for E-motors).

Open Storage area:

with 40-t-gantry crane, 300 m travelling distance (with central power in feed), 36 m track centre measurement and 9 m each practical cantilever length on both sides.

Under the gantry crane on the concrete areas the following is to be installed:

Cable rewinding unit, consisting of two cable rolling-up brackets, conveyor belt rolling-up unit consisting of two rolling-up brackets - all designed also for the use in the opencast mine.

(d) Other Facilities

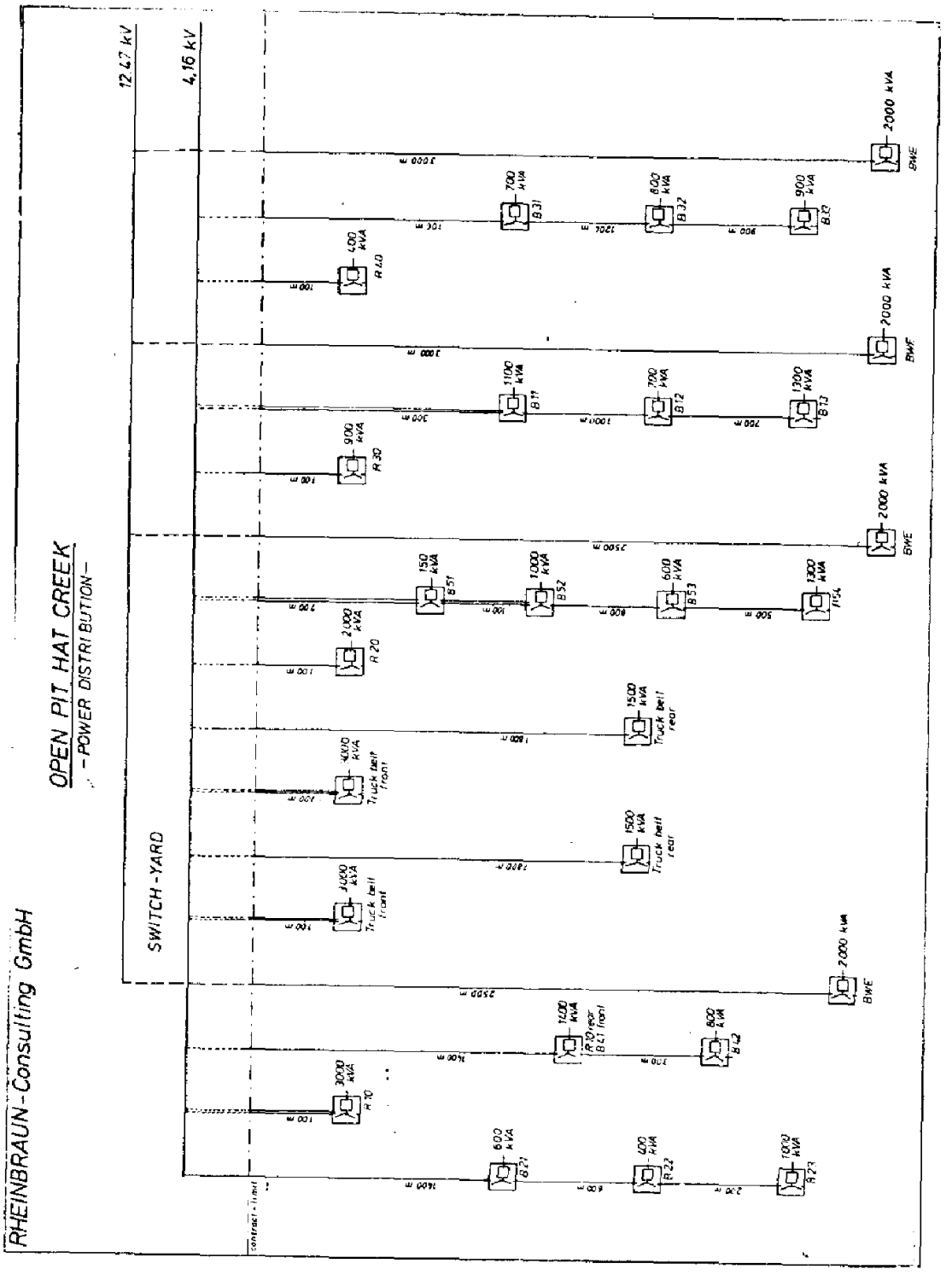
It is assumed that there are general facilities already in existence in the mine which also can be used for the bucket wheel excavator operation. These facilities include: filling station, lubrication store, store for general material and heavy steel as well as scrap metal stores.

4.7 POWER DISTRIBUTION AND ONE-LINE DIAGRAM

According to the one-line-diagram on page 4-48,the power supply is distributed radially and to the benches by means of switchgear located at the conveyor distribution point via insulated cables running alongside the conveyor system. The power requirement for the mine amounts to approx. 30 MVA. The individual conveyor belt stations are supplied by ring-main switchunits which are mounted on pontoons and are easily transportable. The six head-drive stations at the conveyor distribution point must be connected separately via parallel cable for reasons of the great power requirement.

All drive stations are supplied by a voltage of 4.16 kV. The supply voltage for the bucket wheel excavators will be 12.47 kV. When determining the length of cables it was assumed that the bucket wheel excavators will be 12.47 kV. When determining the length of cables it was assumed that the bucket wheel excavators also are to be supplied from the conveyor distribution point. As there is to be an aerial cable network of 12.47 kV erected around the opencast mine, the individual bucket wheel excavators can be connected up direct to this cable via switching units. Thereby, the cable connection lengths for the equipment can be considerably reduced.

For reasons of standardization only one type of cable will be used both for the 4.16 kV and also for the 12.47 kV network. The switchgear itself does not form part of the scope of supply and was not considered in the cost investigation. According to information from CMJV the voltages of 4.16 kV and 12.47 kV and the necessary outlet points are available. The attached switch system chart shall give a survey of the power distribution in the opencast mine.


OPEN PIT HAT CREEK
-POWER DISTRIBUTION-
RHEINBRAUN-Consulting GmbH
12.47 kV
4.16 kV
SWITCH-YARD
2000 kVA
BWE
700 kVA
B31
600 kVA
B32
900 kVA
B22
400 kVA
R40
2000 kVA
BWF
1100 kVA
B11
700 kVA
B12
1200 kVA
B13
900 kVA
R30
2000 kVA
BWE
150 kVA
B51
1000 kVA
B52
600 kVA
B53
1300 kVA
HS4
2000 kVA
R20
1500 kVA
Truck bell rear
4000 kVA
Truck bell front
1500 kVA
Truck bell rear
4000 kVA
Truck bell front
2000 kVA
BWE
1400 kVA
R10 rear
B21 front
800 kVA
B12
3000 kVA
R10
600 kVA
B21
400 kVA
B22
1200 kVA
B23

OPEN PIT HAT CREEK. Estimated Investments for Power Distribution			
Equipment	units / km	price per unit / km (1000 $)	Total (1000 $)
Bench-cable NTSCgEöu 12,47 kV 3x35/3x10 mm^2	11	37	407
Bench-cable NTSCgEöu 4,16 kV 3x120/3x25 mm^2	15	47	705
12,47 kV-switch-units on pontoon	4	36	144
4,16 kV-switch-units on pontoon	23	23	529
12,47 kV-cable-connection boxes	10	7	70
4,16 kV-cable-connection boxes	5	5	25
		TOTAL:	1 880

4.8 CONTROL AND COMMUNICATION SYSTEM

The following is a general description of the control and communication system, recommended for the Hat Creek mine, see page 4-52/53. Details are still to be clarified in mutual discussions at a later date.

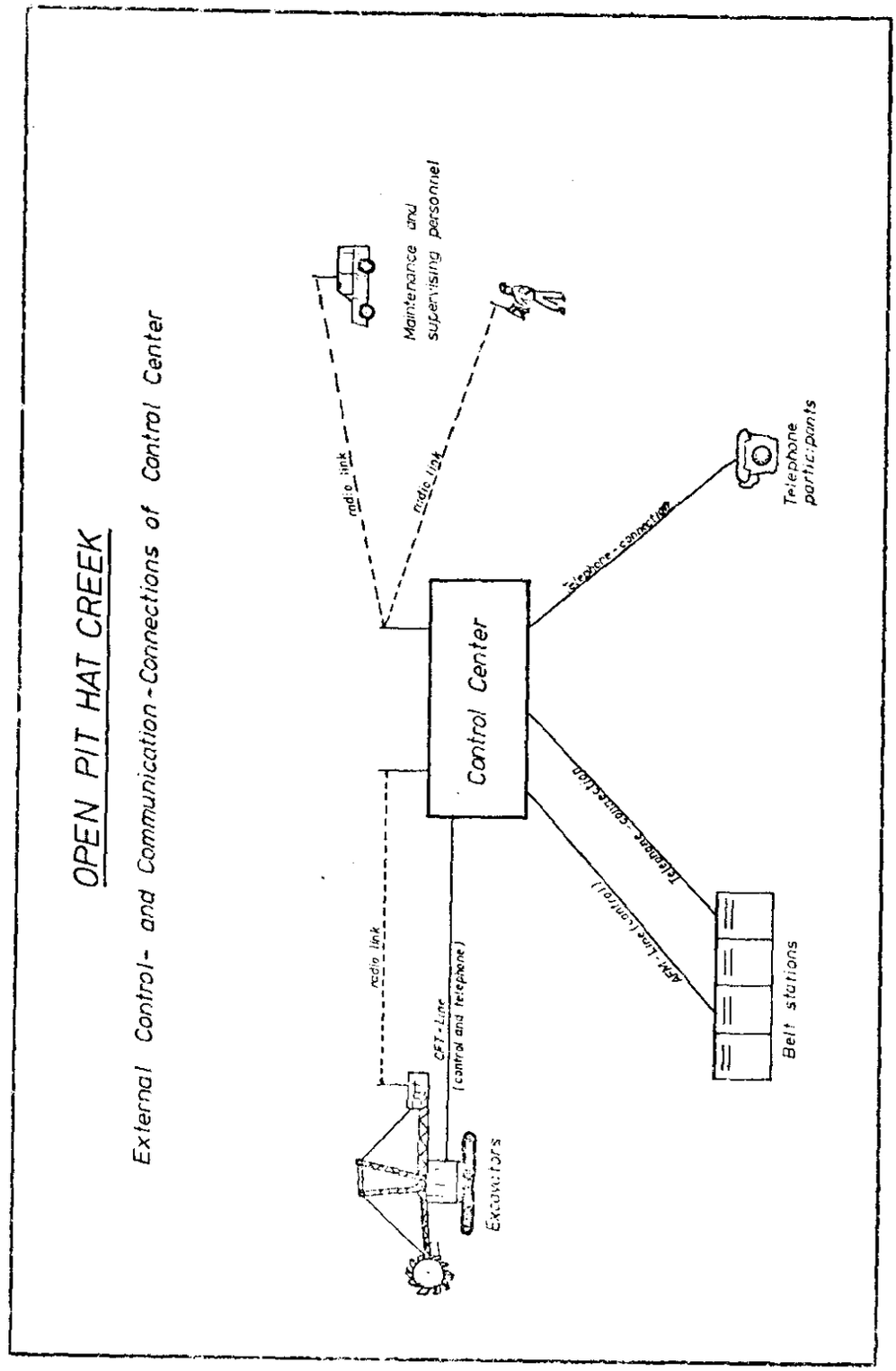
The individual conveyor stations are connected radially to the Central Control Center. All conveyor interlockings are conducted in the Control Center's relay room. Remote control devices (AFM) are used to transmit control commands and messages between the Control Center and the conveyor system. The control connection to the bucket wheel excavators is by carrier frequency telegraphy (CFT) via the high voltage feed cable. The carrier frequency systems serve also to transmit the telephone calls. The control commands transmitted by CFT and AFM are decoupled by interfaces in the Control Center's relay room and interlocked with the assistance of relays or electronic devices to one another. All incoming and outgoing cables are connected via a main distributor.

Apart from the Control Center building and the conveying equipment telephones are installed at the conveyor belt stations and at important/strategic points in the opencast mine. The private telephone exchange (PBX) consists of 50 extensions (participants) and 5 public network (external) connection (lines).

The operations' room in the Control Center is equipped with an operating desk with the provision of two writing desks, various press button fields and an illuminated chart on which the conveyor ways for the mine equipment are schematically shown. By appropriately illuminating the conveyor way symbol the respective operational condition is shown.

In addition to the telephone connection there also exists a radio connection with the excavators which with the help of an accumulator also is readily operative without electrical tension (in a dead

condition) of the bucket wheel excavator. The second stationary radio system in the Control Center serves as a contact with the hand radio transmitters and vehicle radio transceivers resp.


OPEN PIT HAT CREEK
External Control- and Communication-Connections of Control Center
Maintenance and supervising personnel
radio link
radio link
Control Center
telephone-connection
Telephone partic:points
telephone-connection
4Pr.-Line (control)
Belt stations
radio link
CFT-Line (control and telephone)
Excavators

OPEN PIT HAT CREEK — Estimated Investments for Electrical Equipment of Control Center and Communication (without buildings)		
Equipment, Description	units / km	prices 1000 $
1. CFT-lines for telephone and control connection with CC	4	184
2. AFM-lines for control- and signal connection with CC, including shunting-heads	27	994
3. Fixed radio stations CC	2	23
4. Excavator radio equipment	4	10
5. Portable radio equipment	8	14
6. Private telephone exchange, 5o participants, 5 public network connections, including telephon app.	1	40
7. CC operating- and control room equipment: CC-desk, push-button panels, mimic diagram (mosaic type), interlocking equipment relay-room, marshalling distributor, fixed antenna plant etc.		300
8. Telephone and control cables	25	90
9. General building installation, air conditioning etc.		45
	TOTAL:	1 700

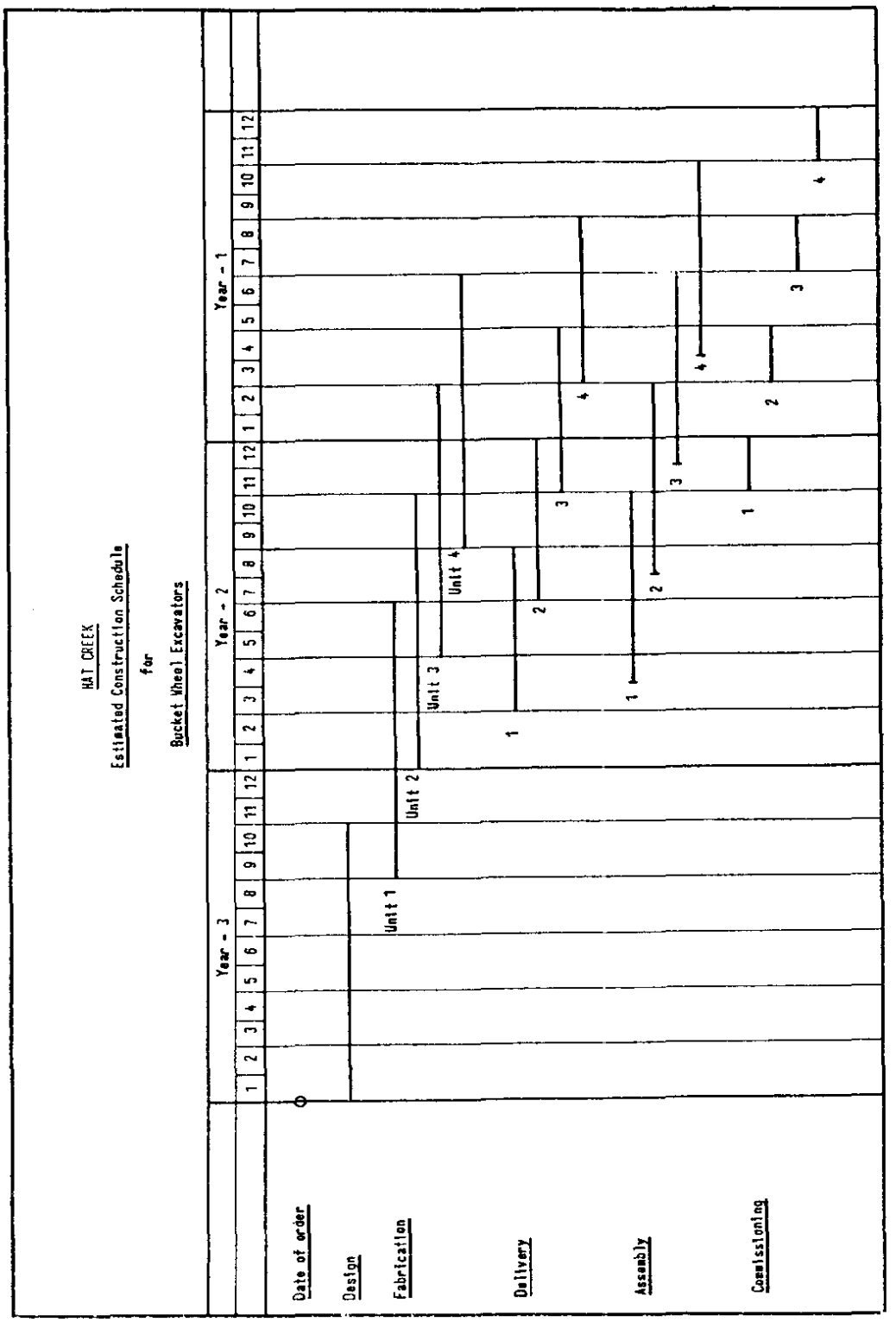
4.9 CONSTRUCTION SCHEDULE

The accompanying schedule on page 4-55 is an estimate of completion of construction from the date of order.

The first unit as shown on the schedule, could be ready for operation after 24 months, with the other 3 units following within the next 12 months.

The bucket wheel excavators are the long lead items. The belt wagons and conveyor system can be constructed simultaneously.

Assembly and commissioning work during months with severe winter weather should be avoided.

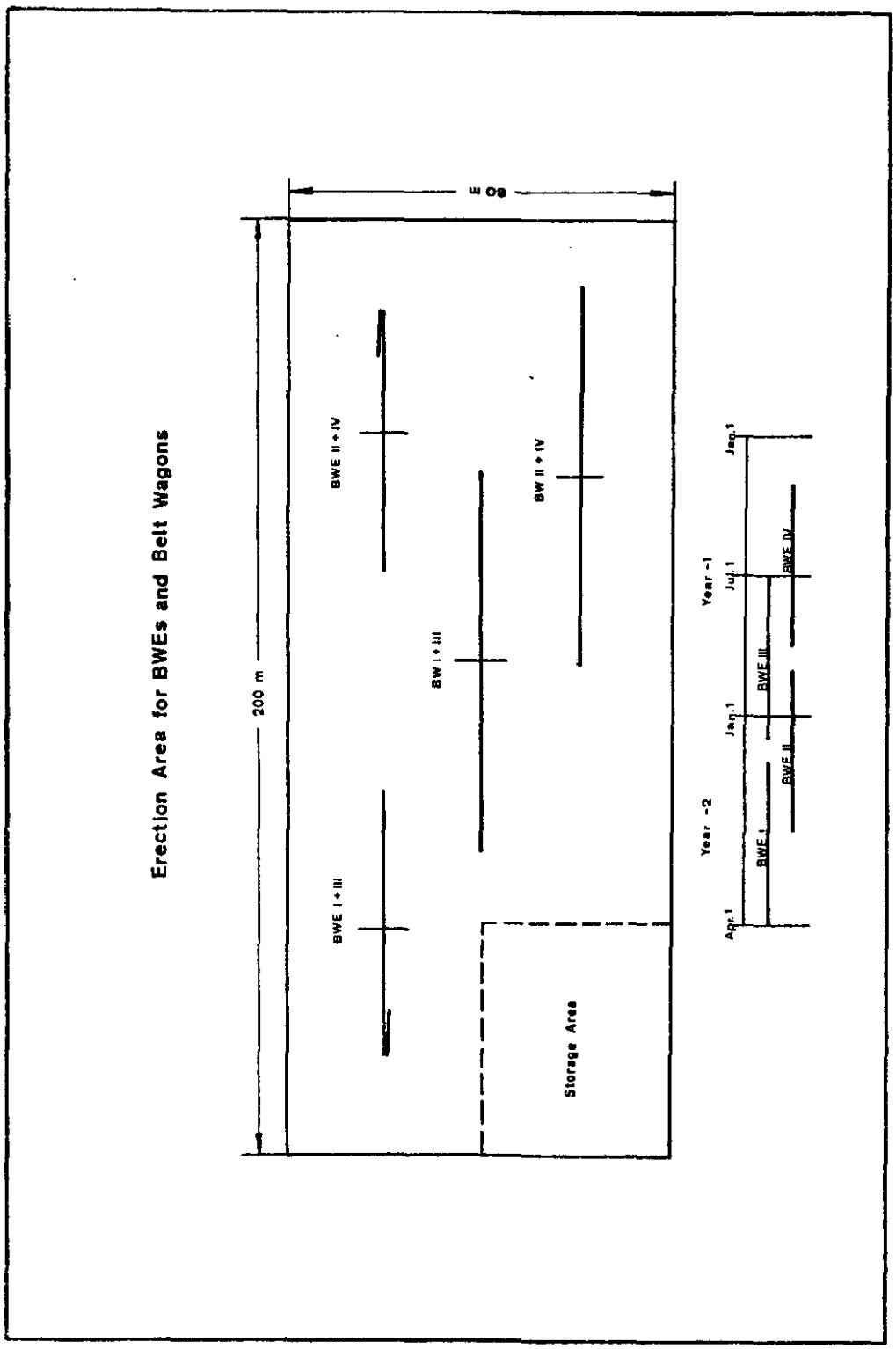

HAT CREEK
Estimated Construction Schedule
for
Bucket Wheel Excavators
Year - 3
Year - 2
Year - 1
1 2 3 4 5 6 7 8 9 10 11 12
Date of order
Design
Fabrication
Delivery
Assembly
Commissioning
Unit 1
Unit 2
Unit 3
Unit 4

4.10 ERECTION REQUIREMENTS

The proposed erection yard for bucket wheel excavators and belt wagons, illustrated on page 5-7 is located in the northern area and adjacent to the maintenance building as shown on Enclosure 1.
The yard is sized for the simultaneous assembly of 2 bucket wheel excavators and 2 belt wagons.
(If the actually required assembly time for one belt wagon is shorter than 5 months, these units could be erected successively, i.e. without time overlapping. The area then could be reduced accordingly.)

Depending on the local conditions a drainage of the whole yard may be necessary.
After levelling, the required light and power cables, the pipes for water supply, fire fighting system and compressed air as well as in case of need the drain pipes and gantry crane tracks must be laid. The final covering with a frost proof layer of gravel with suitable grain size shall allow an accessibility with trucks and mobile cranes.

The erection yard for belt conveyor driving stations (size 50 x 100 mm approx.) is located near the southern mine exit and shall be prepared in a similar way according to requirements.


Erection Area for BWEs and Belt Wagons
80 m
200 m
BWE II + IV
BWE I + III
BW II + IV
BW I + III
Storage Area
Year -1
Year -2
Jan.1
Jul.1
Jan.1
Apr.1
BWE III
BWE IV
BWE II
BWE I

5. CONCLUSIONS

The Hat Creek Deposit represents a difficult and complex deposit from the geotechnical and geological viewpoint. Due to the importance of the project, extensive investigations have been made.

With respect to the geotechnical studies it needs to be stated that the investigations of the detailed tectonic formations - as far as their realization is possible considering the actual position of the exploration - are not yet completed. With respect to the "rocks" designated as to be soft, these investigations could lead to a new consideration of the local instabilities, which cannot be excluded, especially in the local slide areas existing within the mine. The "hard rocks", e.g. the burnt zone materials, hard layers of calcareous siltstone and harder bands in the coal need to be checked once more with respect to their cutting resistence. But with the information at hand the conclusion can be drawn that the Hat Creek deposit is suitable for the application of bucket wheel excavators.

For final design work, however, RC recommends to have the geology represented as exactly as possible and to process the data such as to consider all engineering and technical viewpoints, this means upgrading of the drilling results available and representation of all waste and coal bands separately, and this to the greatest possible extent, at least to 0.5 m thickness each.

Only such an extensive presentation of geological data will permit a reliable investigation of selective mining possibilities of waste partings and of coal in the coal-bearing layers, what might be of considerable influence for

- upgrading the r. o. m. coal quality with respect to the presently considered fuel specification;
- the distribution of masses between bucket wheel excavators and shovels and

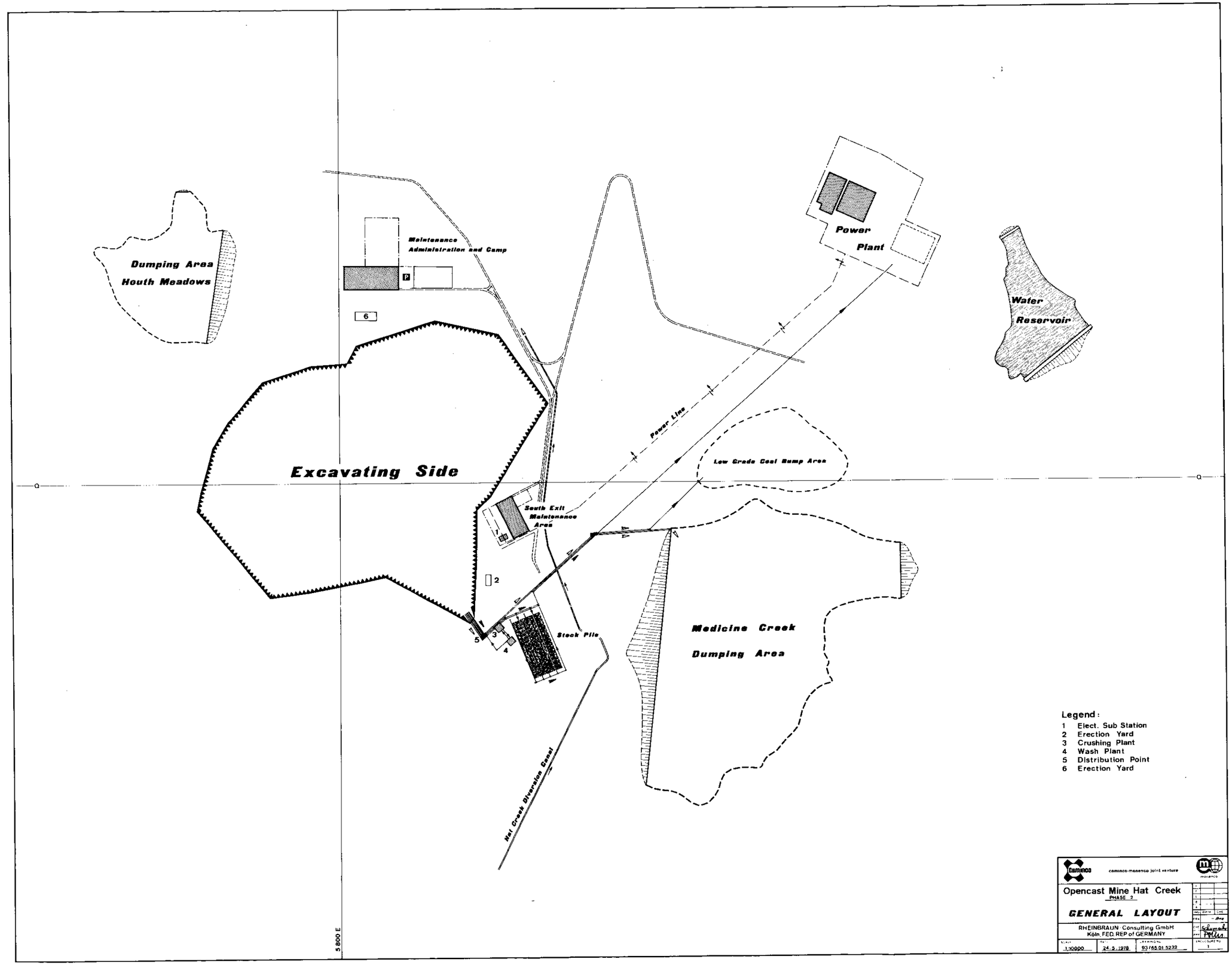
- the possibilities of utilization of the low grade coal.

The investigations to date clearly indicate the potential for the above mentioned improvements, but do not yet permit to quantify them.

The more detailed geological representation will also certainly improve the overall utilization of the proposed mining equipment, since it offers the chance for optimizing bench layouts, for instance by working with inclined benches and by better use of the digging height capabilities, which will reflect in more favourable cost, too.

It is of utmost importance that the mining operation at Hat Creek is as flexible as possible in order to meet a reasonably uniform coal grade throughout the lifetime of the power station. This could be achieved by a prudent combination of shovel/truck operation with the proposed bucket wheel excavator/conveyor system.

On the basis of the investigations made by RC and the proposed additional measures, we would like to express that according to our opinion the application of bucket wheel excavators and belt conveyor systems for the exploitation of the Hat Creek Deposit ensures a practical and efficient operation of the proposed mining equipment.



Legend:

1 Elect. Sub Station
2 Erection Yard
3 Crushing Plant
4 Wash Plant
5 Distribution Point
6 Erection Yard

Opencast Mine Hat Creek	
PHASE 2	
GENERAL LAYOUT	
RHEINBRAUN Consulting GmbH Köln, FED. REP. of GERMANY	
1:10000 — 24.5.1978 — 93/65.01.5232	

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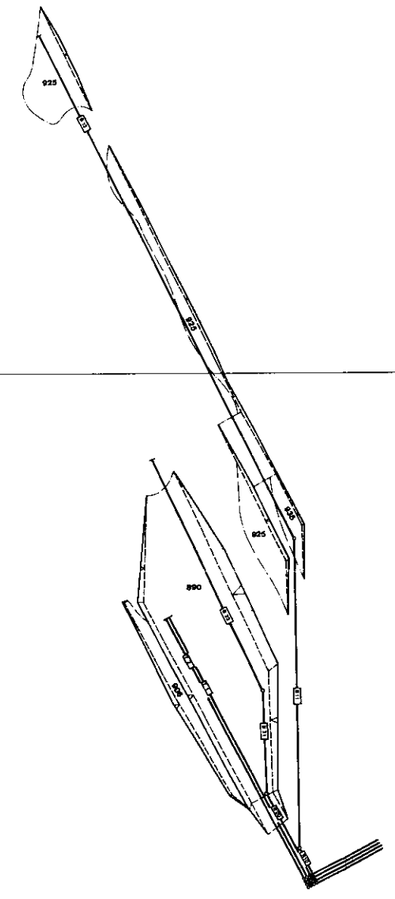

18 5800 E

Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR -2

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
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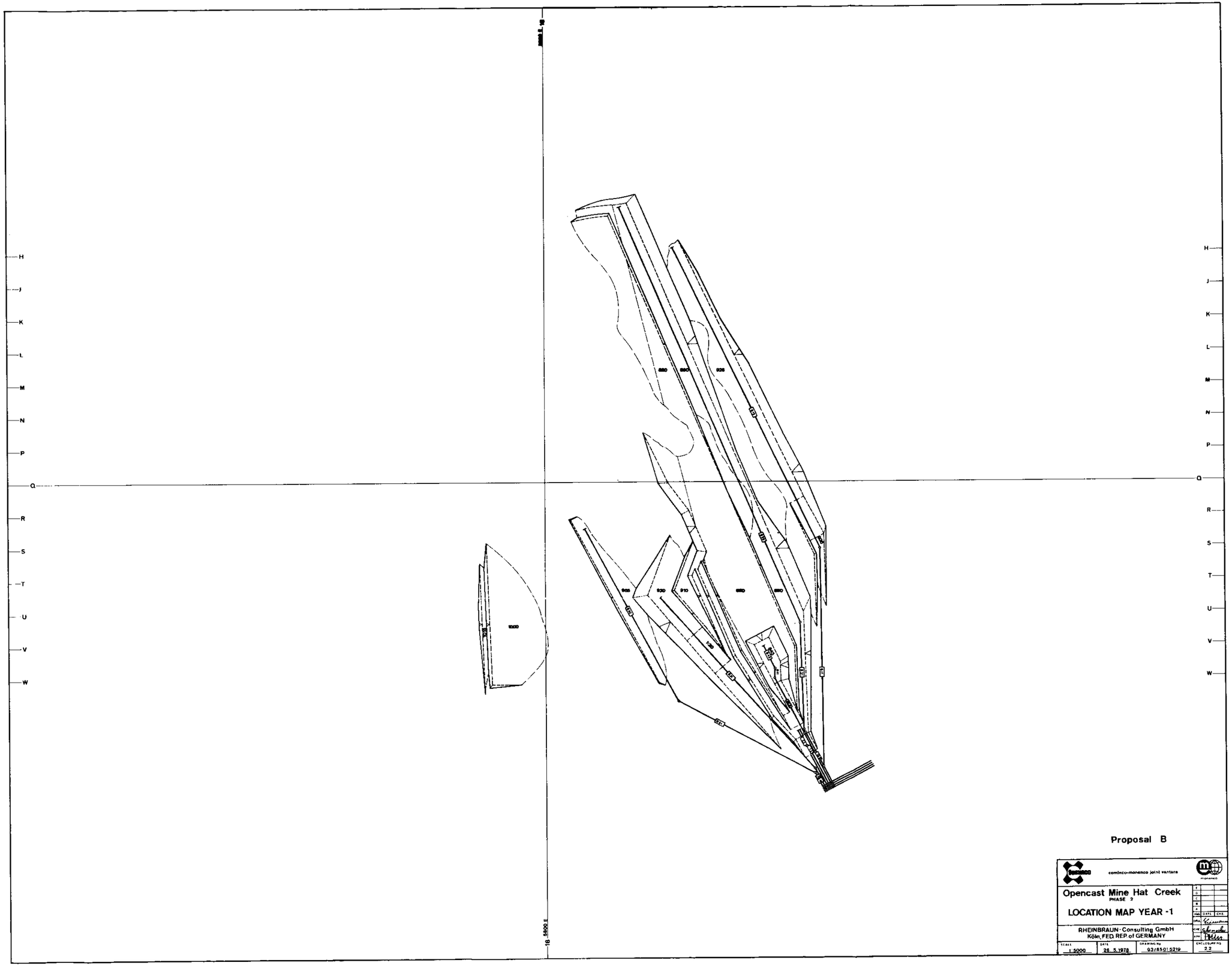

Proposal B

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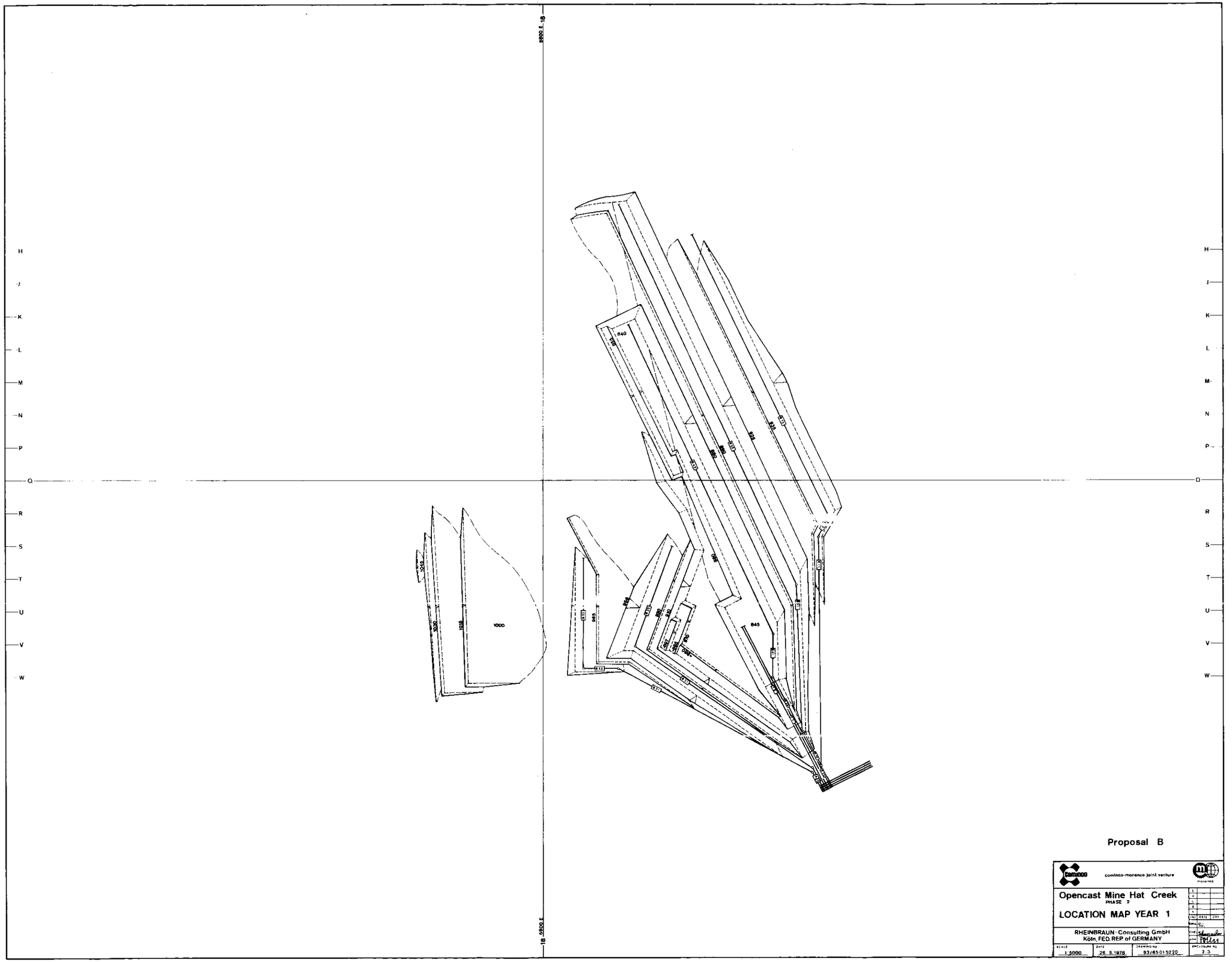
Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR -1

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
1:5000	26.5.1978	93/85015219	2.2

	DWG.	DATE
	DES.	Eisenhauer
	CHK.	Schneider
	APP.	Peters



Proposal B

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Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 1

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

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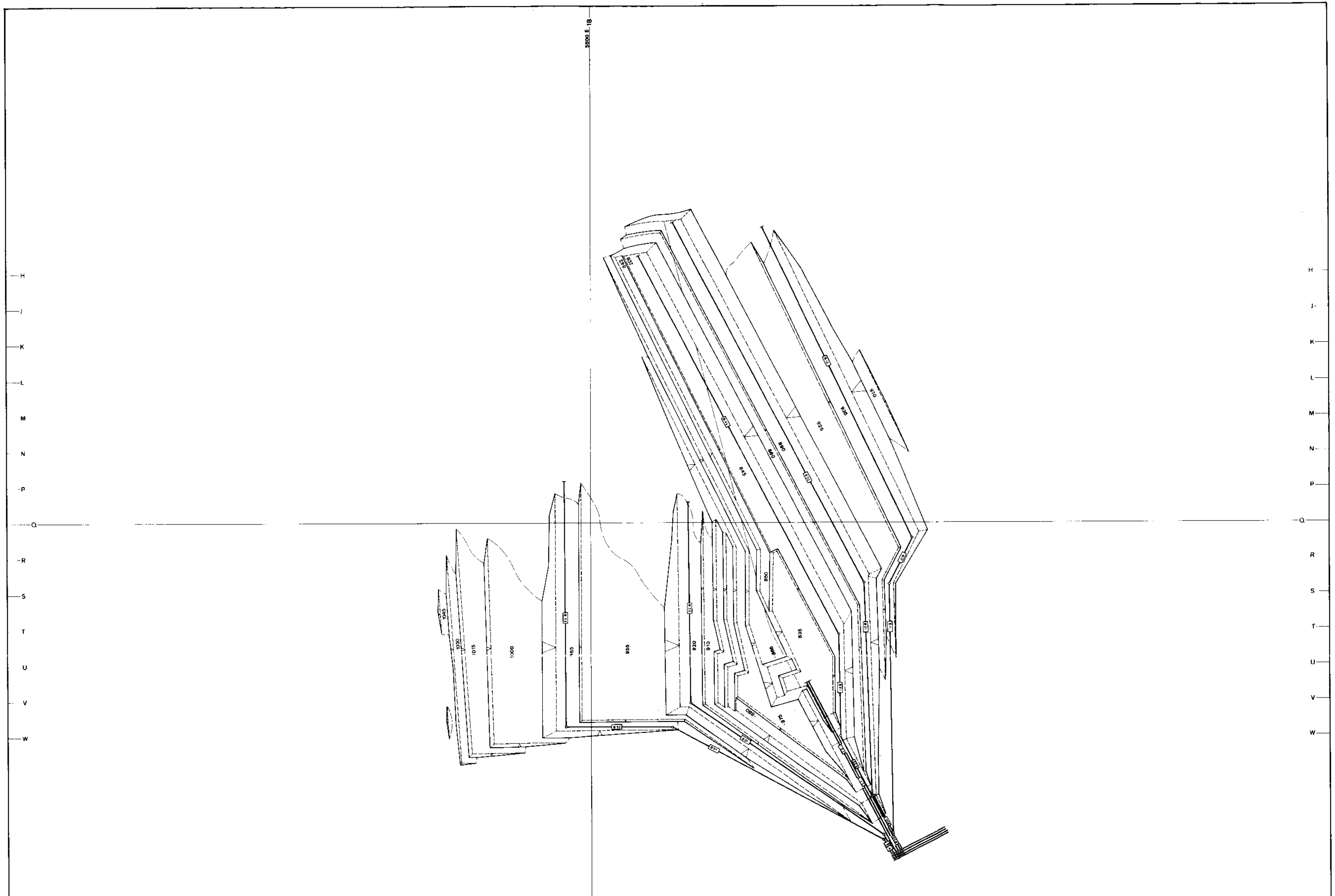

Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 2

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
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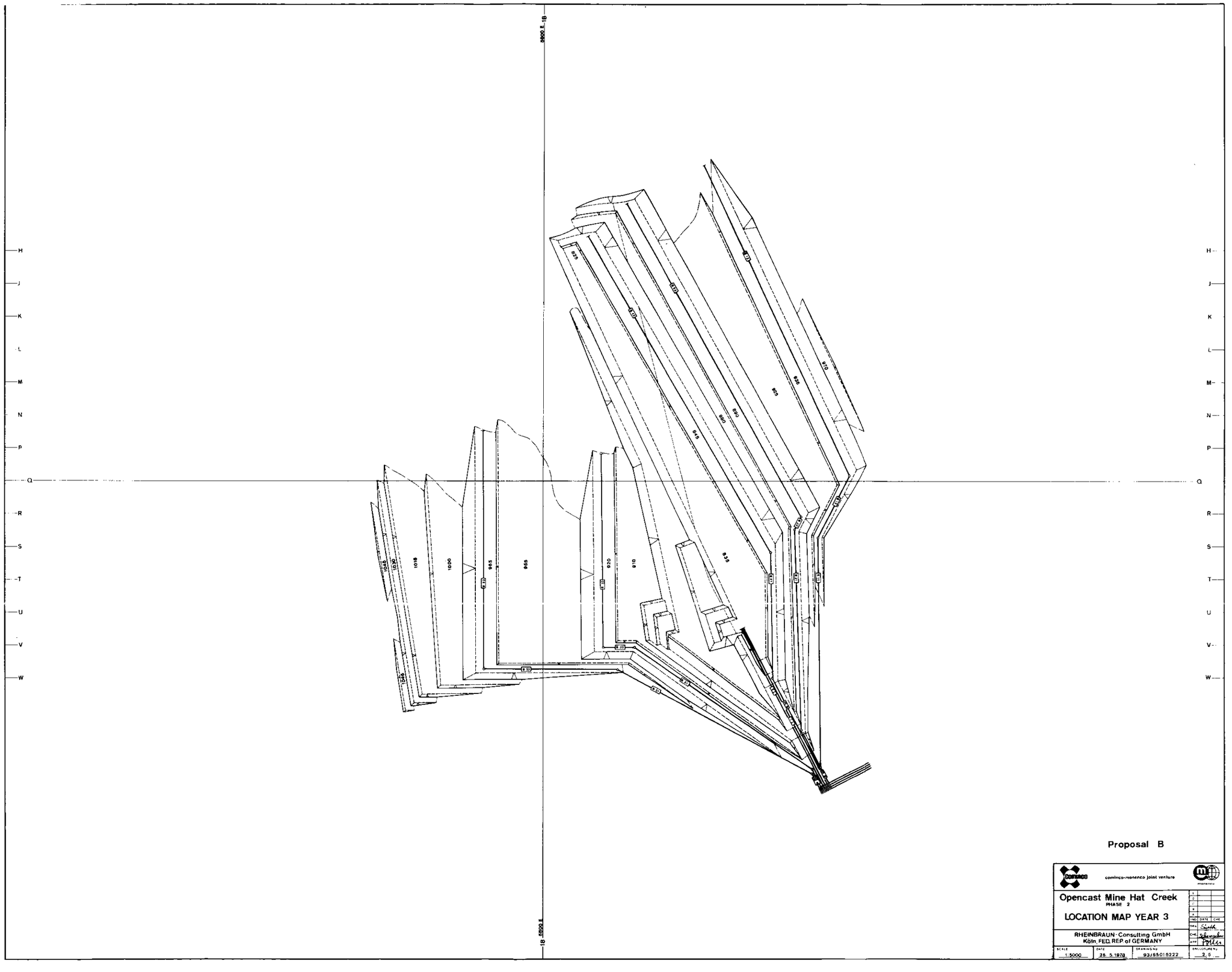

Proposal B

cominco-rasenco joint venture

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 3

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
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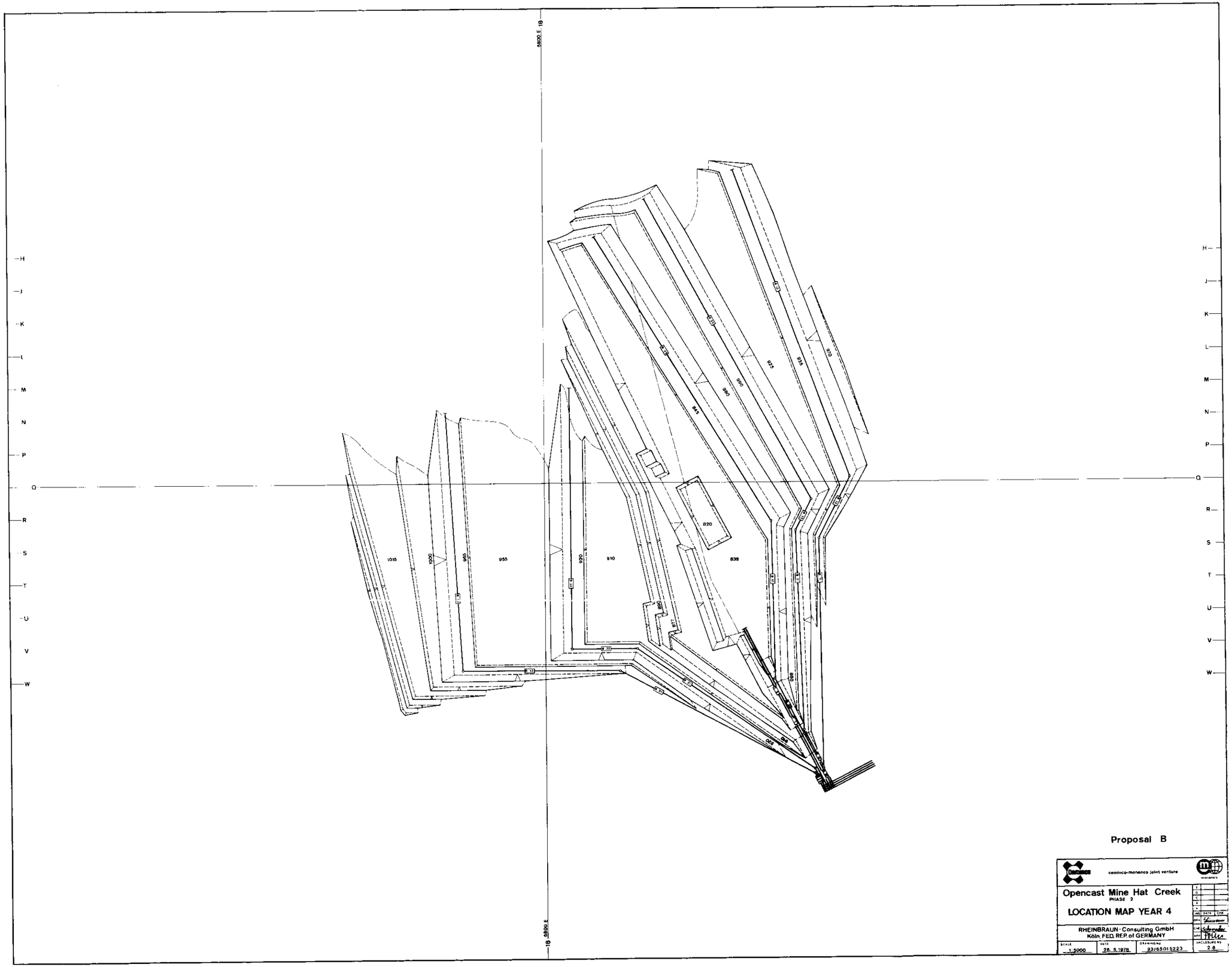
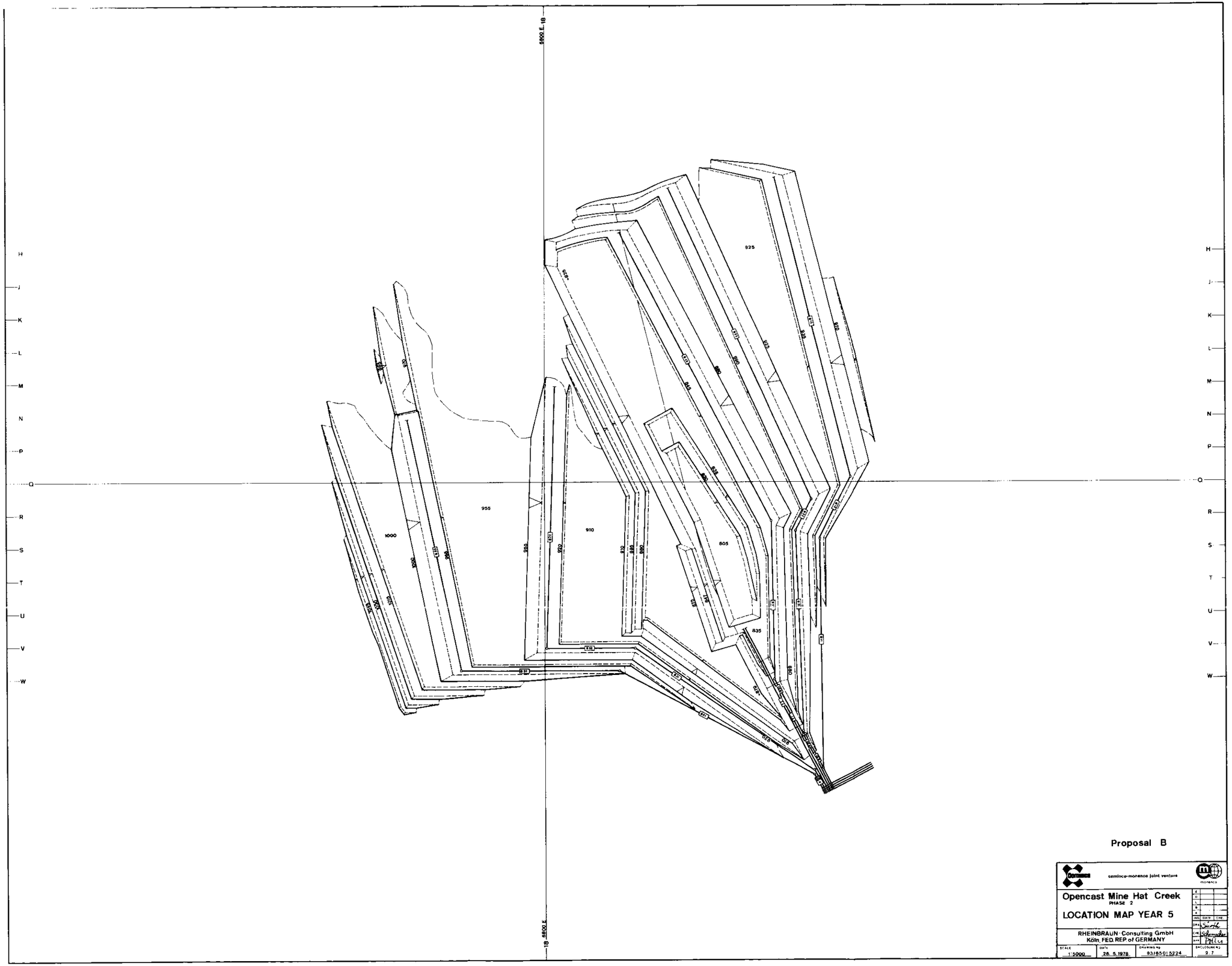


Proposal B

	cominco-monenco joint venture
Opencast Mine Hat Creek	PHASE 2
LOCATION MAP YEAR 4	
RHEINBRAUN-Consulting GmbH	Köln, FED. REP. of GERMANY
SCALE 1:2000	DATE 26. 5. 1978
DRAWING NO 93/65015223	ENCLOSURE NO 2.6
NO. DATE CHK	
DR. Hassmann	
CH. Schroeder	
APP. Miller	



Proposal B

Cominco — cominco-monenco joint venture — monenco

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 5

RHEINBRAUN · Consulting GmbH
Köln, FED REP of GERMANY

SCALE	DATE	DRAWING No
1:5000	26. 5. 1978	93/6501/5224

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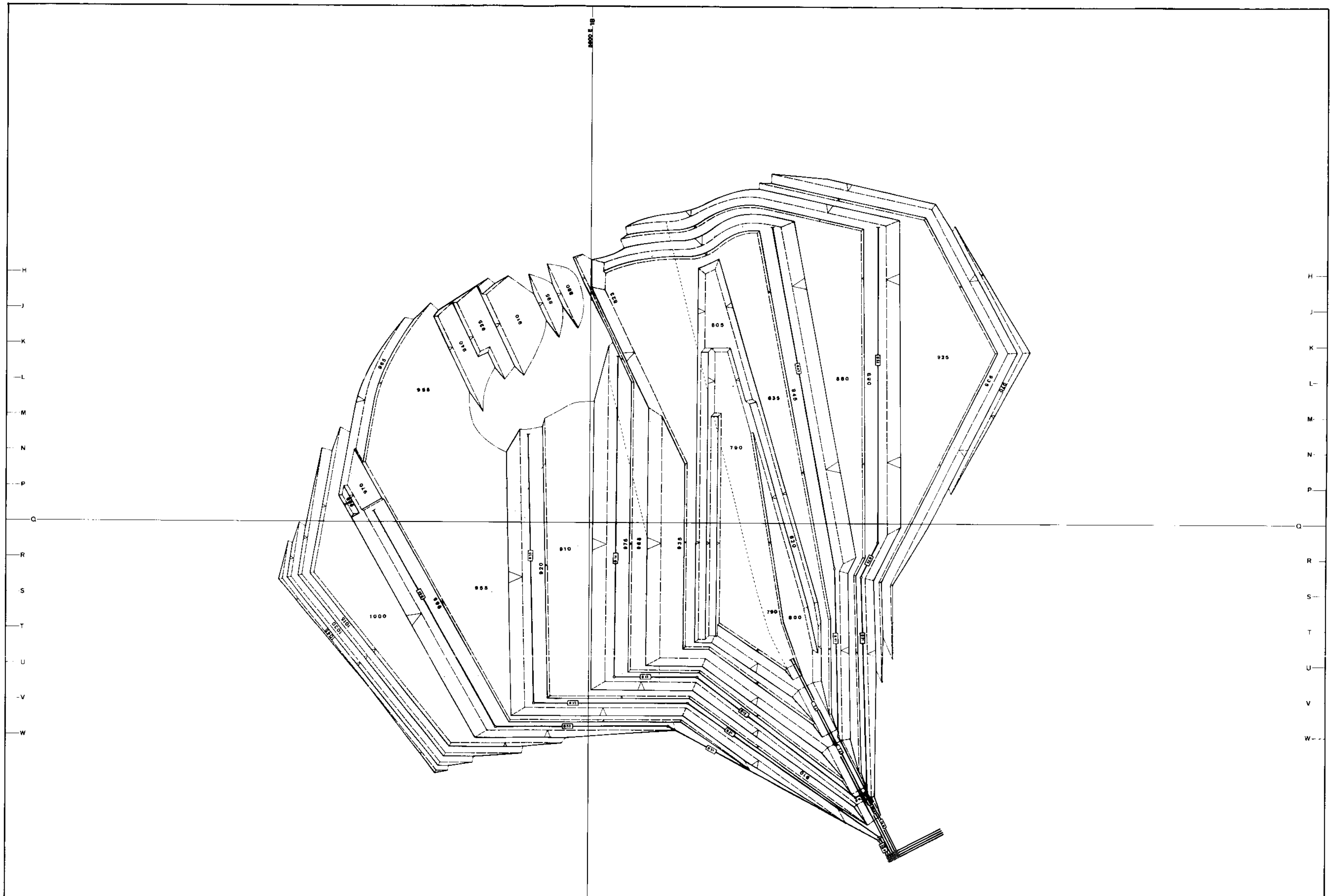
DRN	Smith	
CHK	Schroeder	
APP	Pettit	

ENCLOSURE No. 2.7



Proposal B

cominco-monenco joint venture

monenco

Opencast Mine Hat Creek

PHASE 2

LOCATION MAP YEAR 10

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
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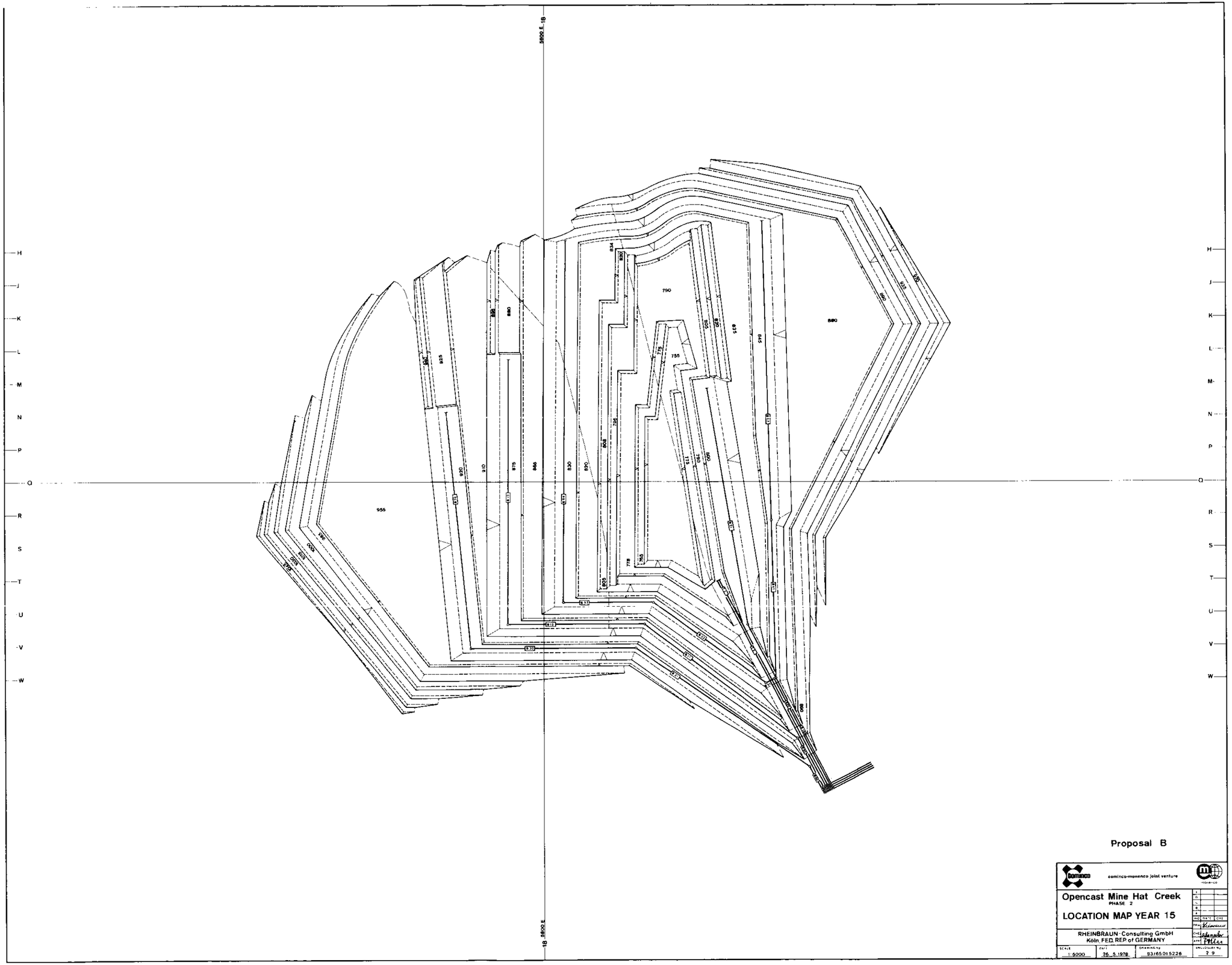


Proposal B

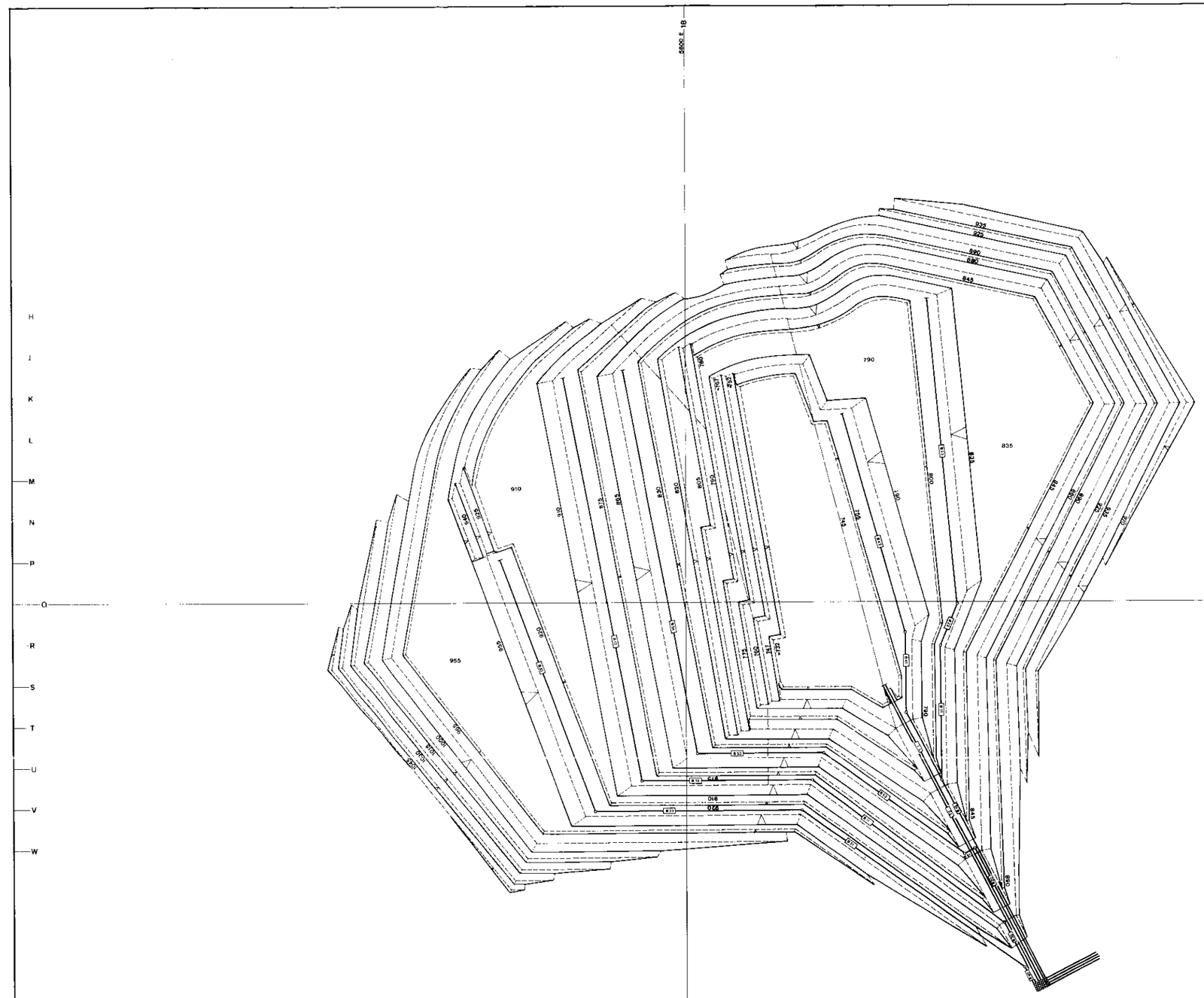
cominco-mpenco joint venture

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 15

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE 1:6000 | DATE 26.5.1978 | DRAWING No. 93/65015226 | ENCLOSURE No. 2.9



Proposal B

Cominco — cominco-menence joint venture — menence

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 20

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

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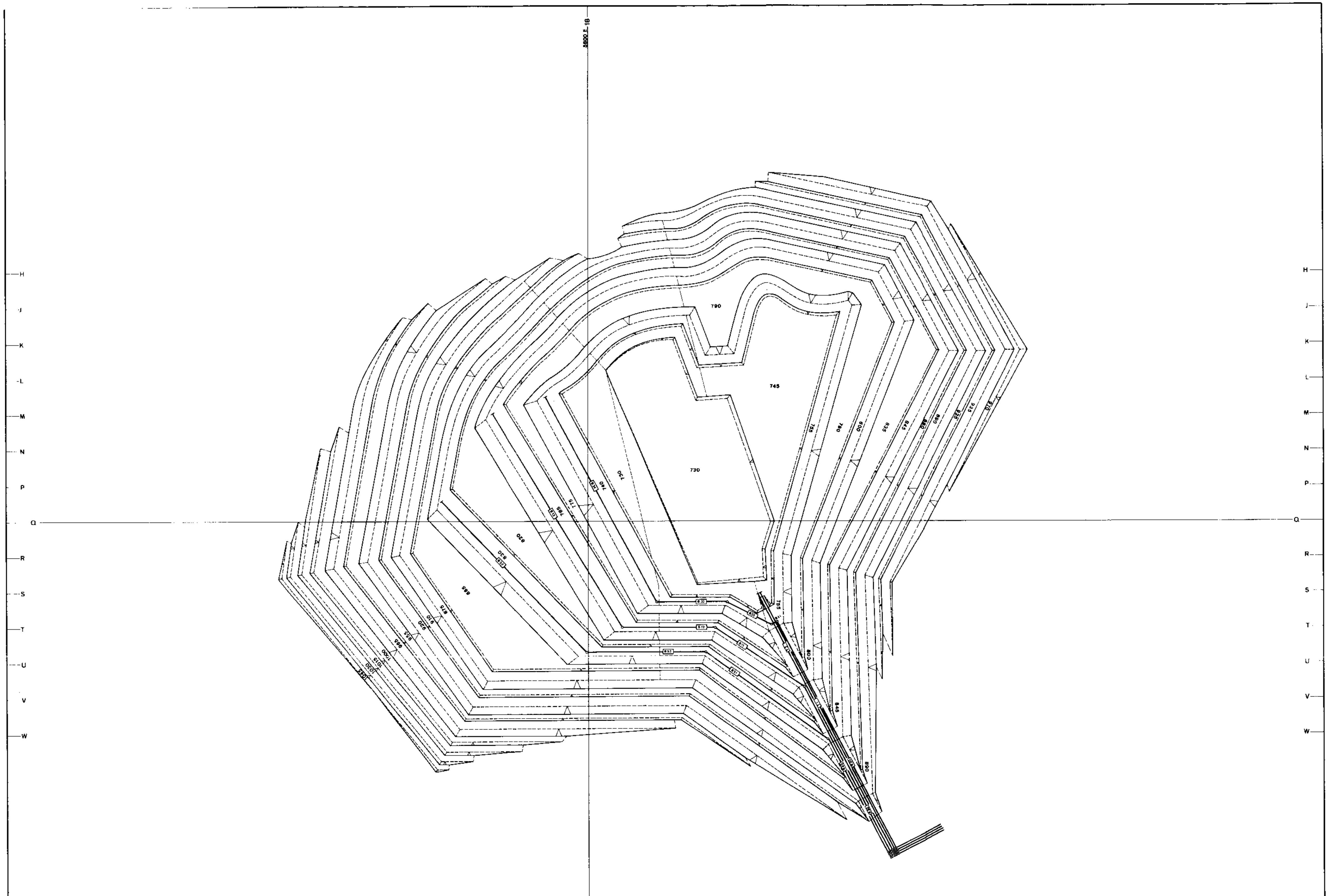

Proposal B

comincc-monenco joint venture

monenco

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 25

RHEINBRAUN - Consulting GmbH
Köln, FED. REP. of GERMANY

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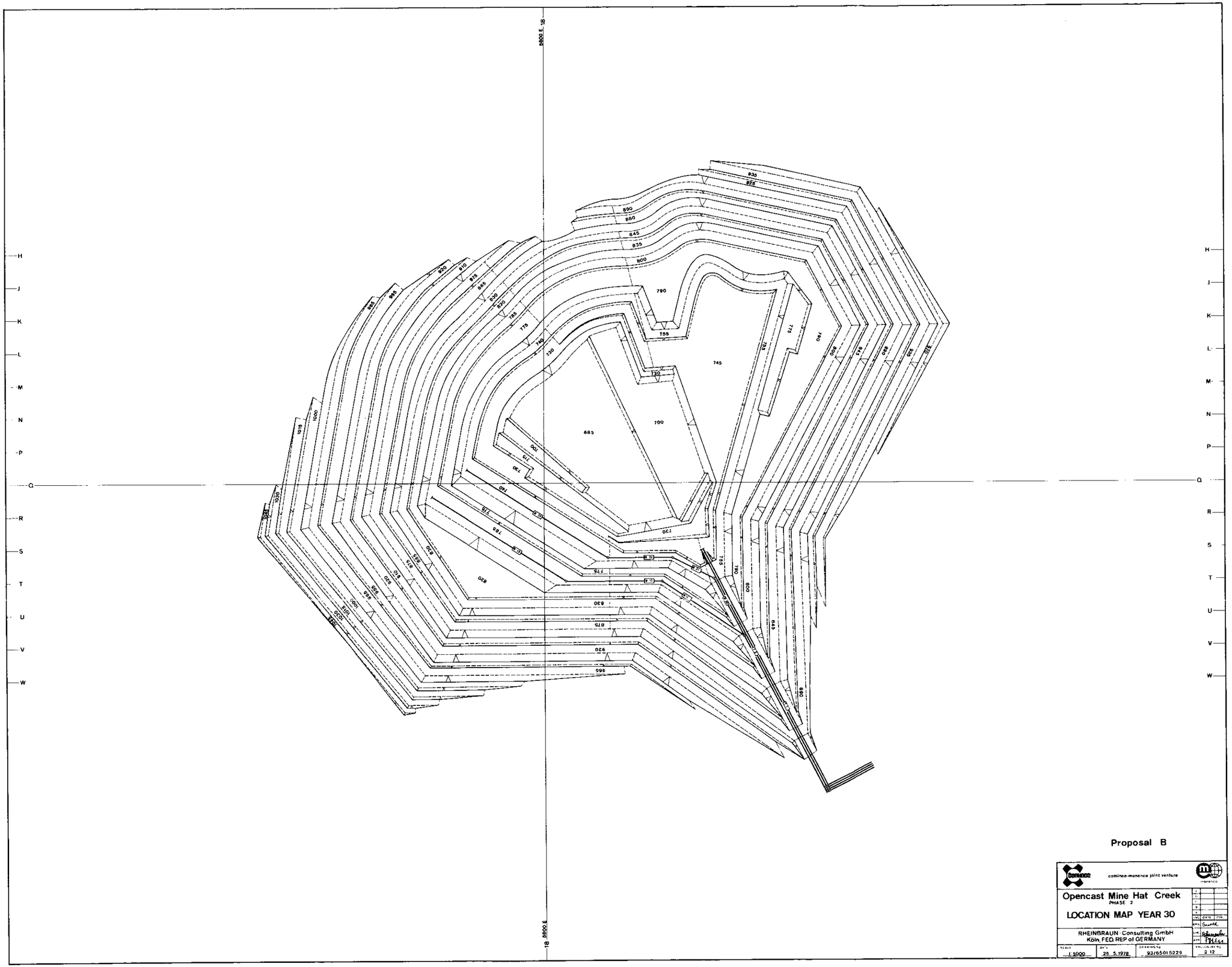

Proposal B

COMINCO — cominco-monenco joint venture — MONENCO

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 30

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

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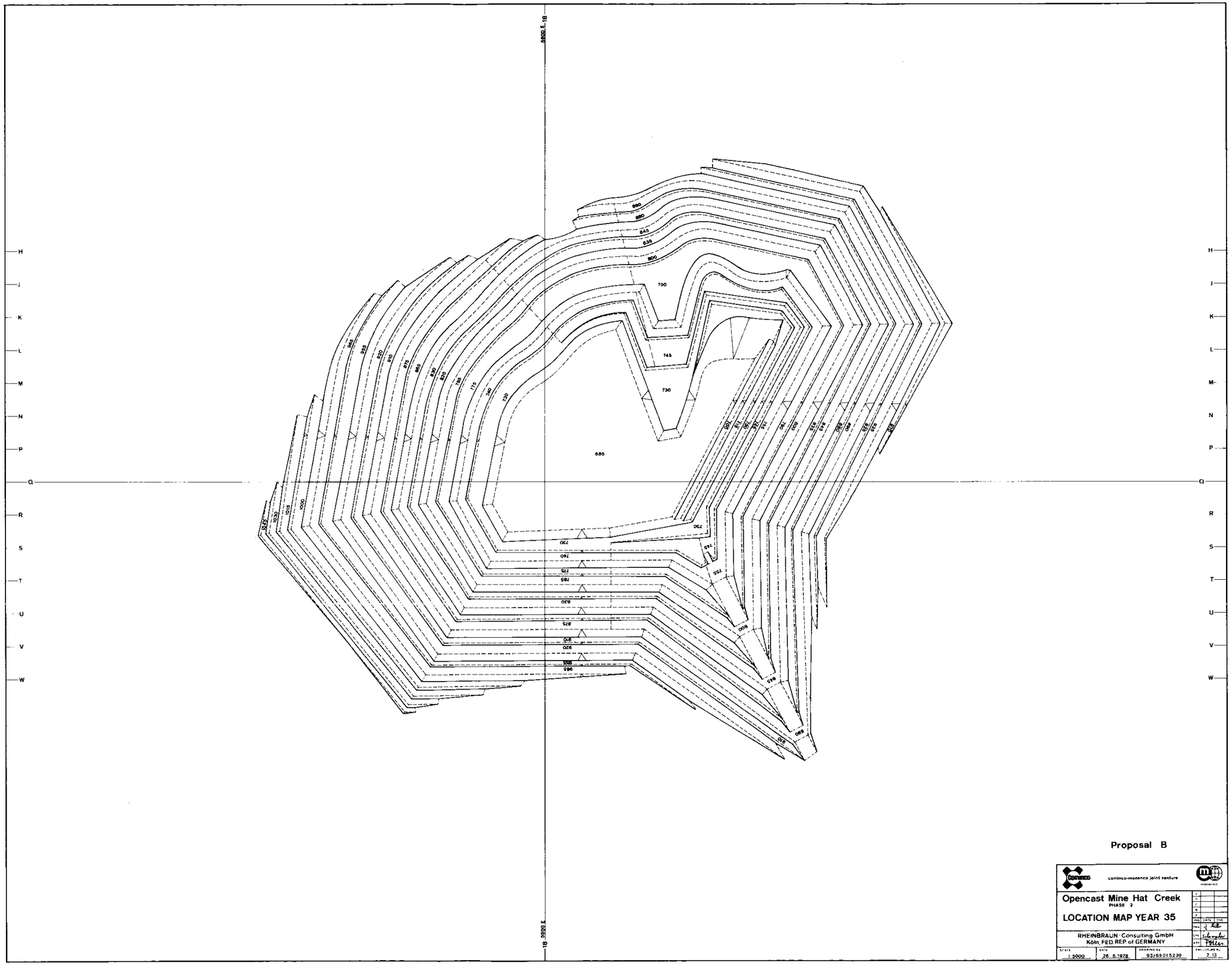

Proposal B

cominco-mannesco joint venture

Opencast Mine Hat Creek
PHASE 2

LOCATION MAP YEAR 35

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

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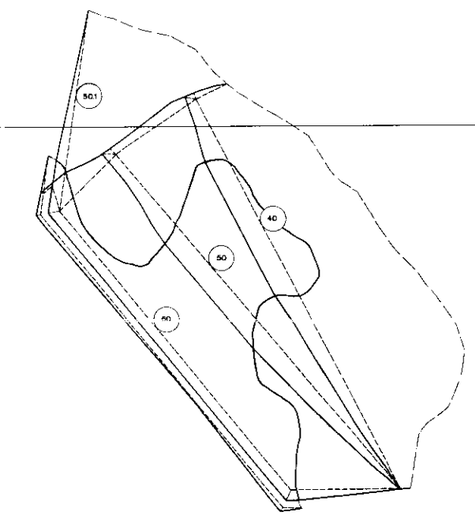

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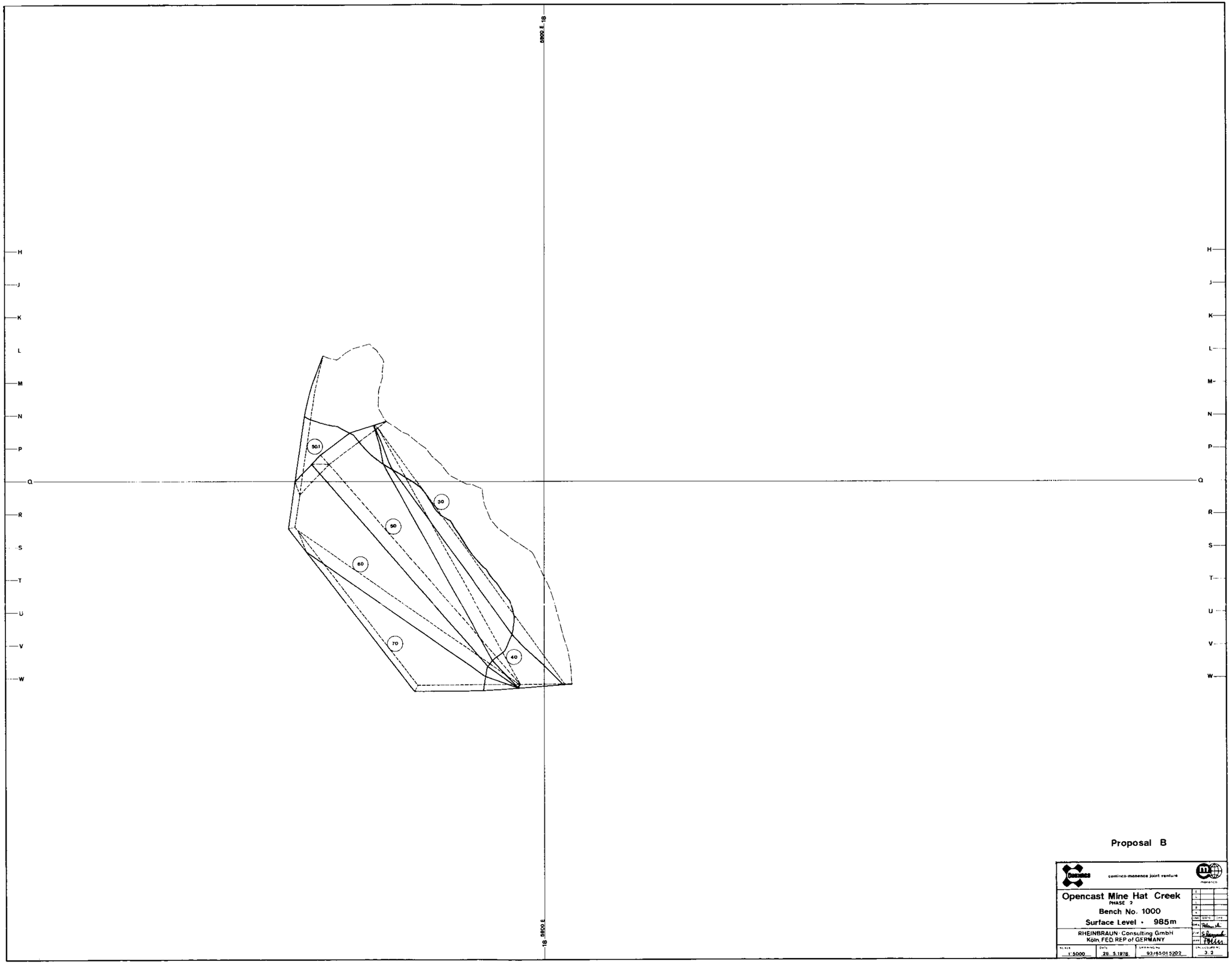
Proposal B

Geminco	gemineo-monence joint venture
Opencast Mine Hat Creek PHASE 2	
Bench No. 1030	
Surface Level · 1015m	
RHEINBRAUN-Consulting GmbH Köln, FED. REP. of GERMANY	
SCALE 1:5000	DATE 26.5.1978
DRAWING No. 93/6501520!	ENCLOSURE No. 31



Proposal B

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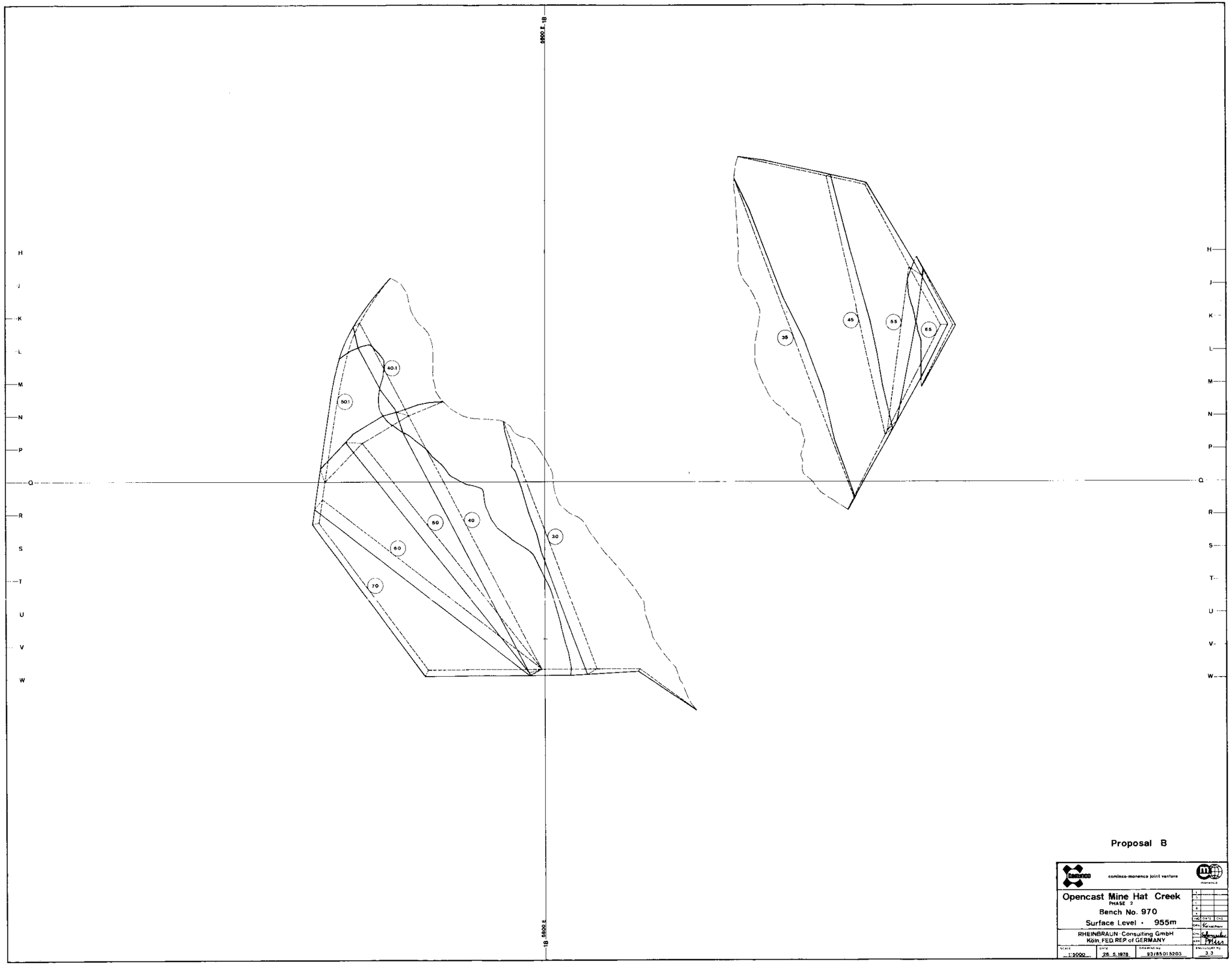
Opencast Mine Hat Creek
PHASE 2
Bench No. 1000
Surface Level · 985m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE 1:5000 | DATE 26.5.1978 | DRAWING No. 93/85015202 | ILLUSTRATION No. 3.2



Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 970
Surface Level · 955m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
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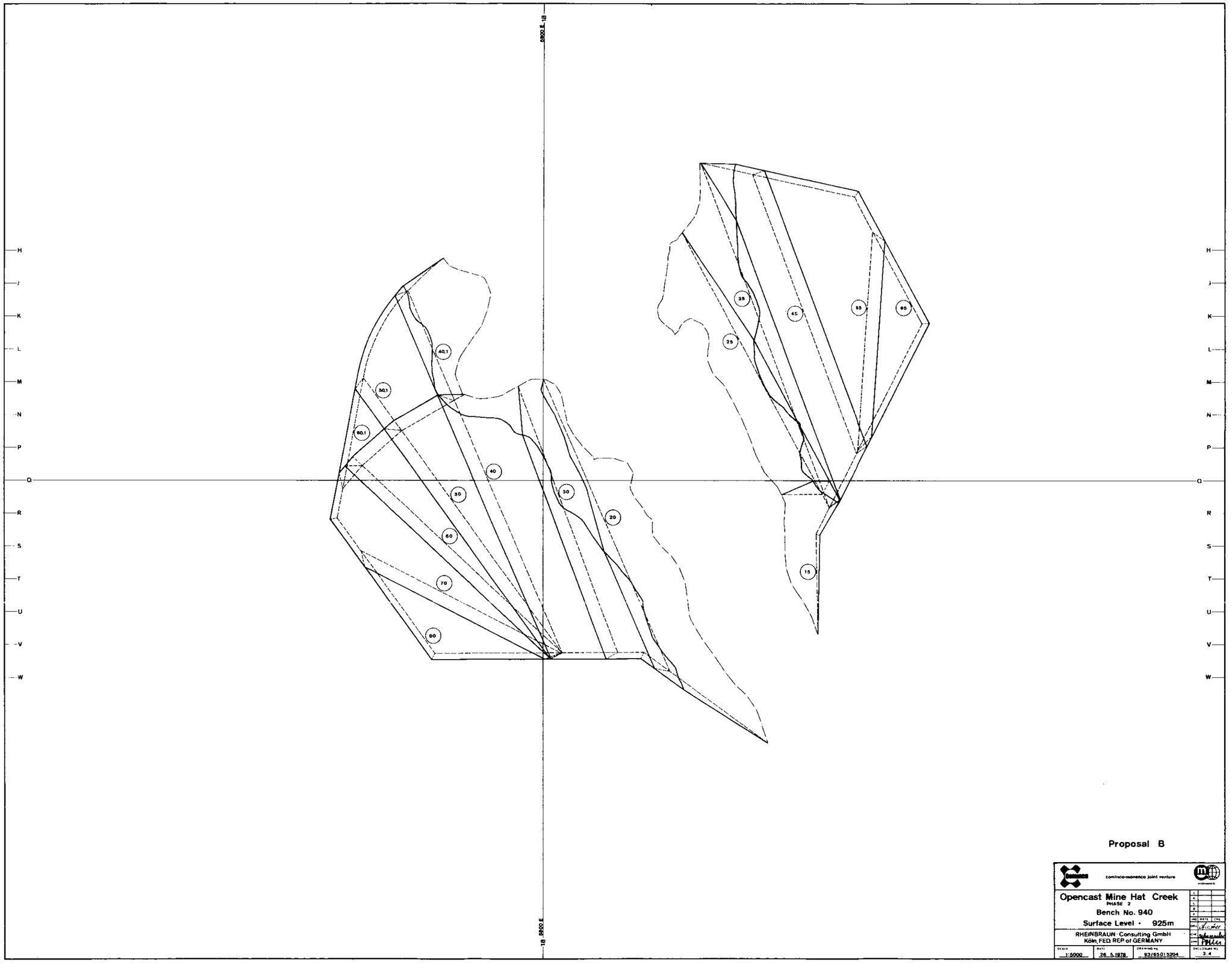

Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 940
Surface Level · 925m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
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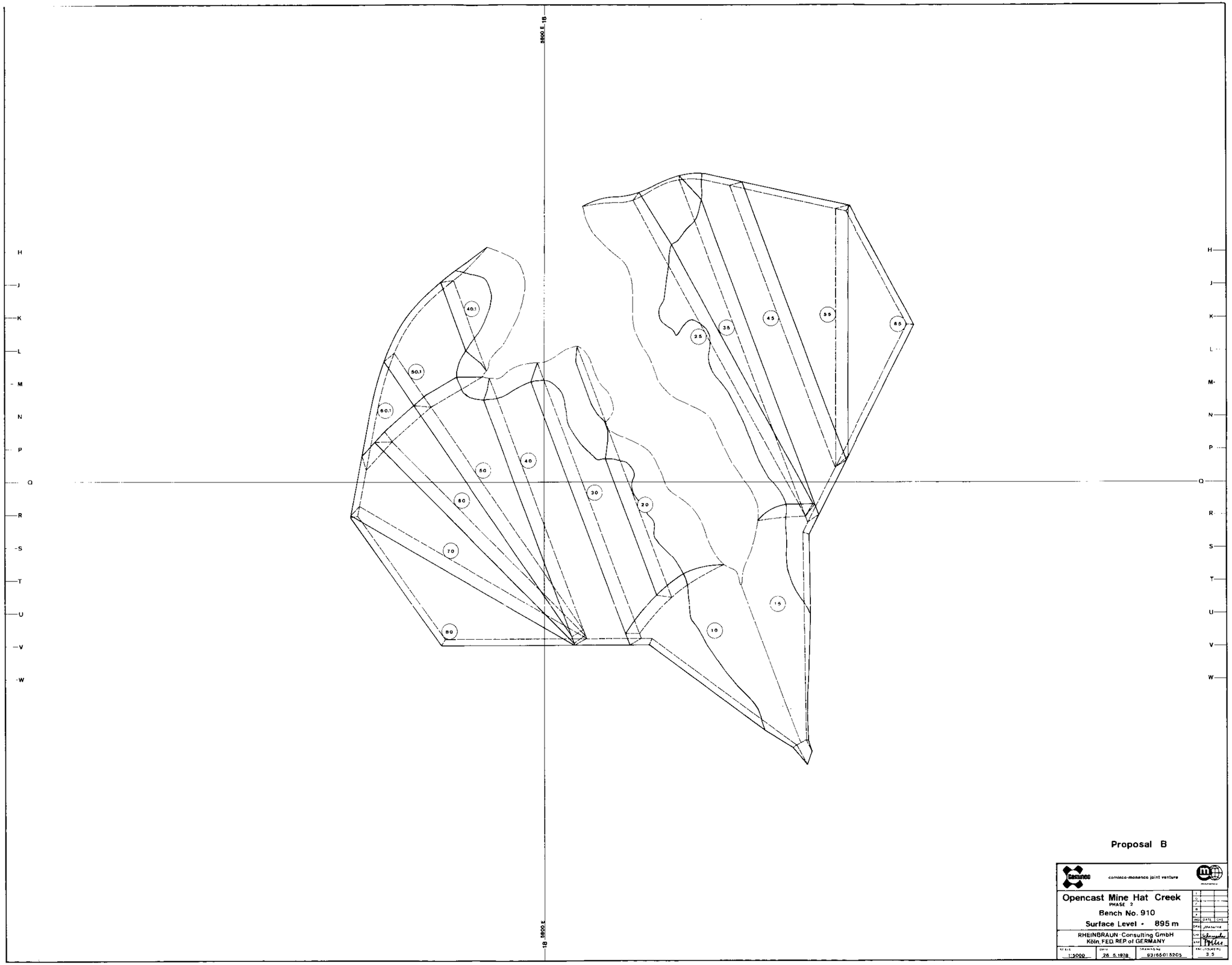

Proposal B

Opencast Mine Hat Creek	comineco-monenco joint venture
PHASE 2	
Bench No. 910	
Surface Level - 895 m	
RHEINBRAUN · Consulting GmbH Köln, FED. REP. of GERMANY	
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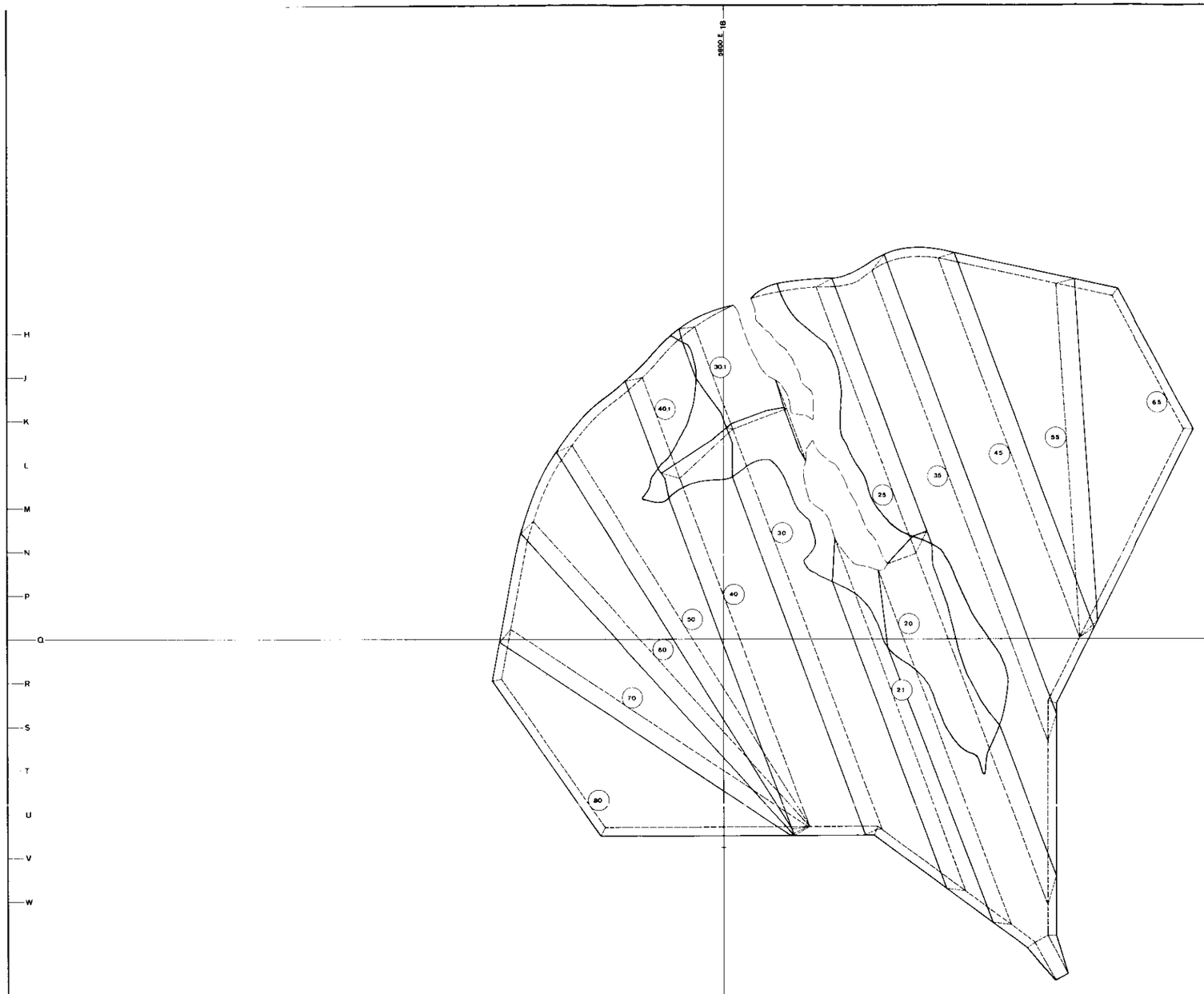

Proposal B

Cominco

cominco-mannesmann joint venture

mannesmann

Opencast Mine Hat Creek
PHASE 2
Bench No. 880
Surface Level · 865m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
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NO. DATE	CHK
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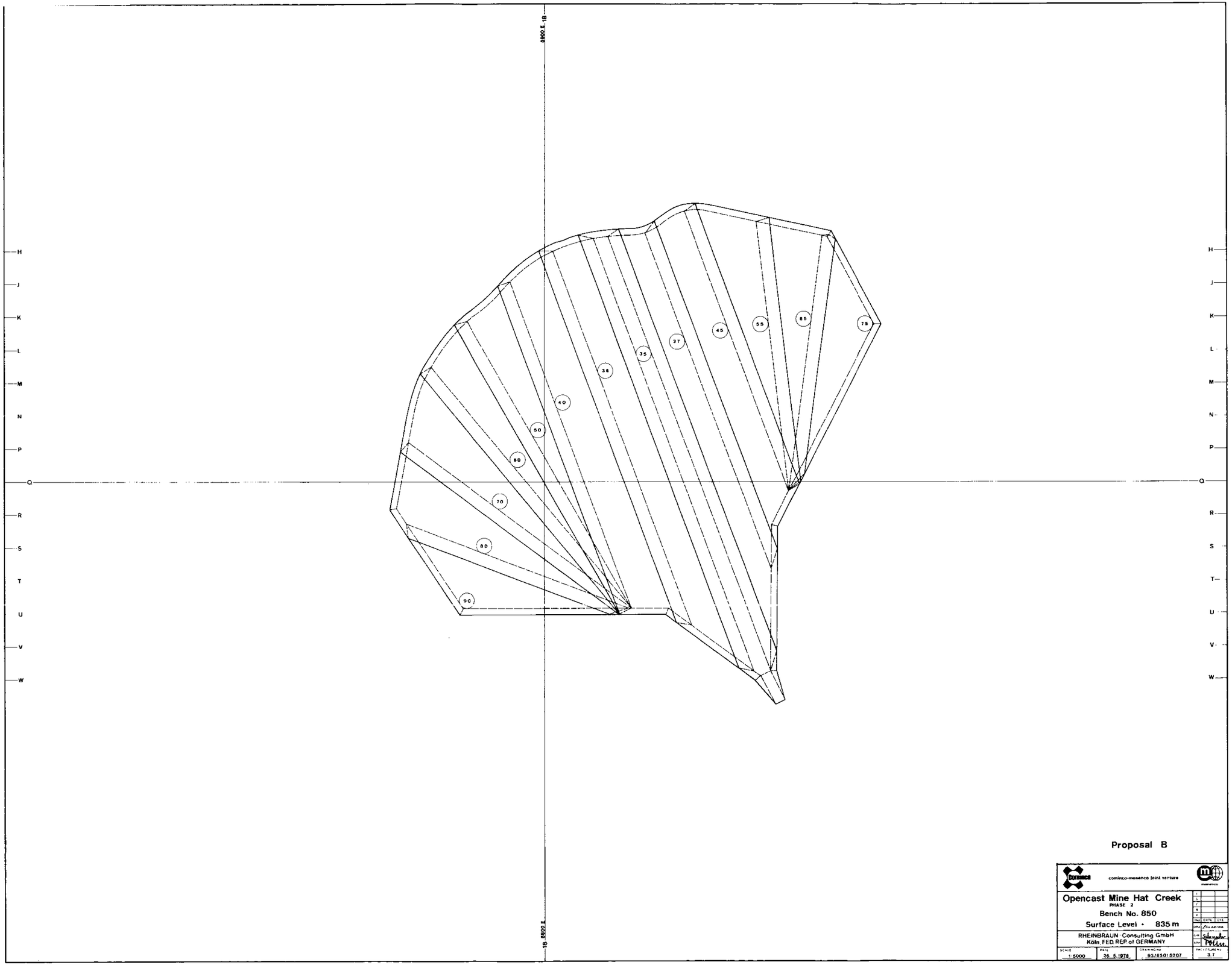
CHK	Schmidt
APP	Peters



Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 850
Surface Level · 835 m

RHEINBRAUN-Consulting GmbH
Köln, FED REP of GERMANY

SCALE	DATE	DRAWING No	REVISIONS
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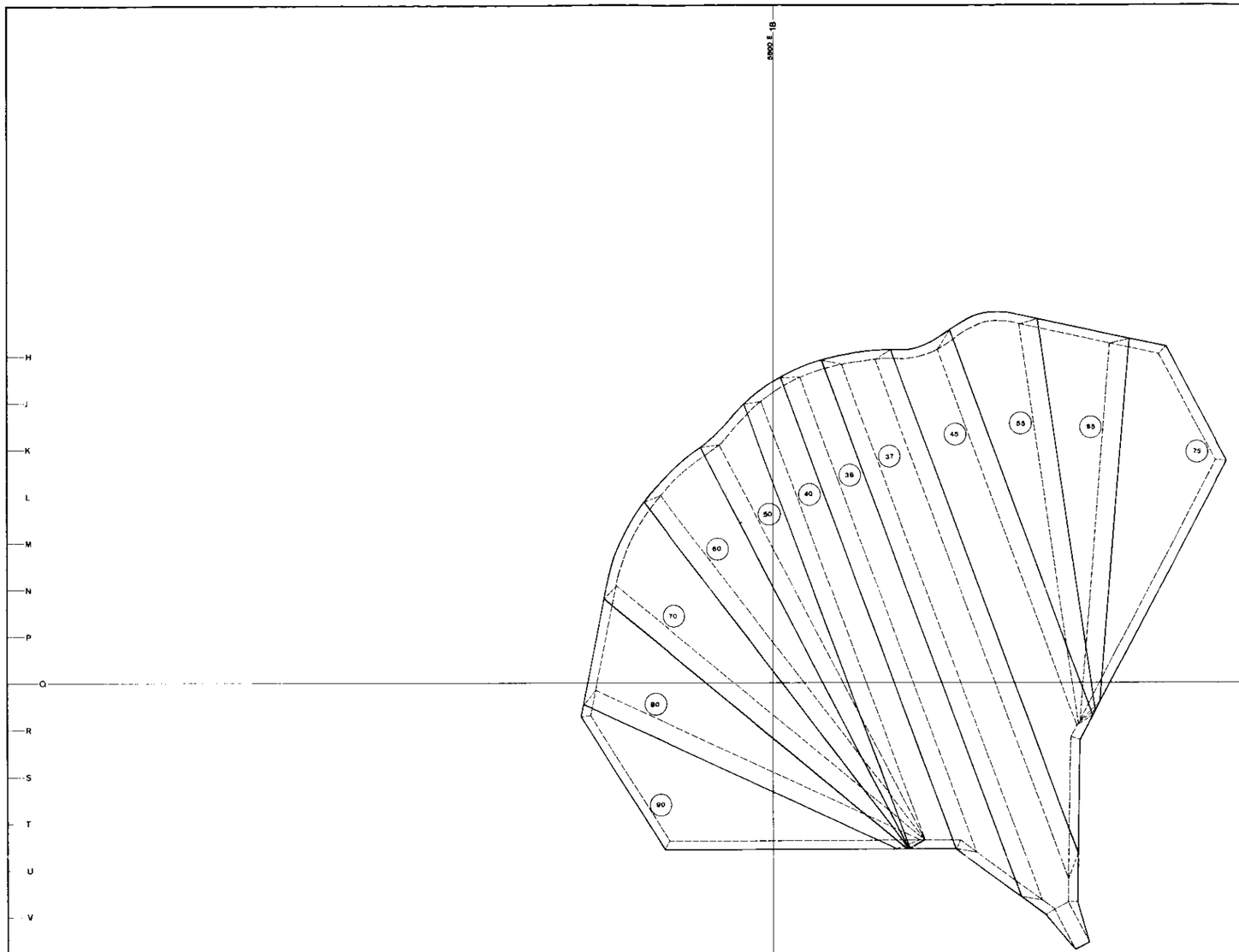

Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 820
Surface Level - 805m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	SHEET No
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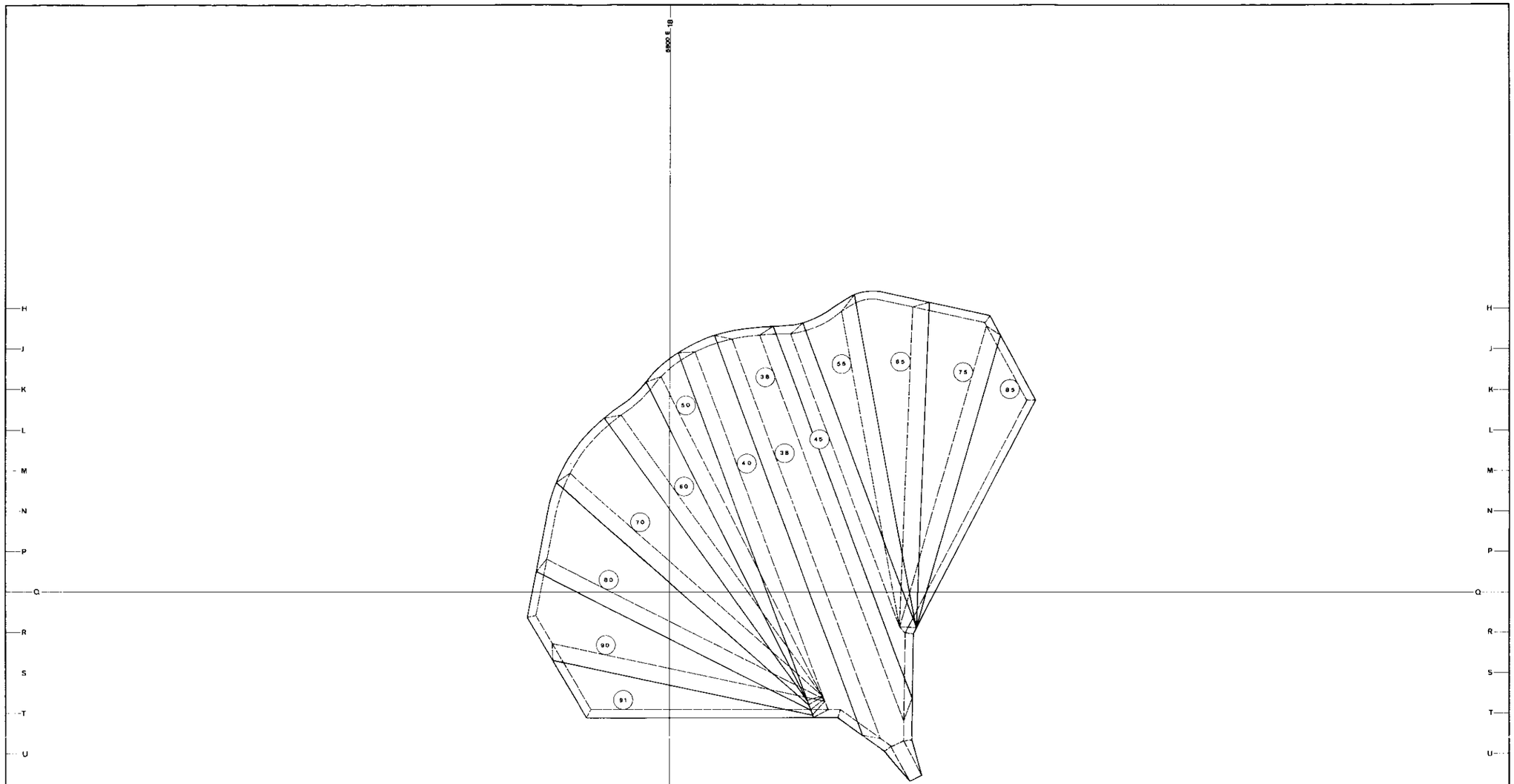

Proposal B

Opencast Mine Hat Creek	
PHASE 2	
Bench No. 790	
Surface Level • 775 m	
RHEINBRAUN · Consulting GmbH Köln, FED. REP. of GERMANY	
SCALE 1:5000	DATE 26 5.1978
DRAWING No. 93/65015209	ENCLOSURE No. 3.9

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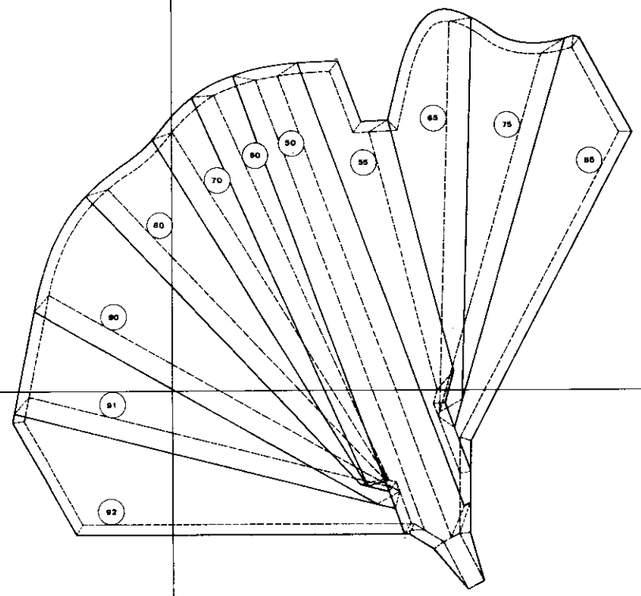


18 5800 E

H J K L M N P Q R S T U V W

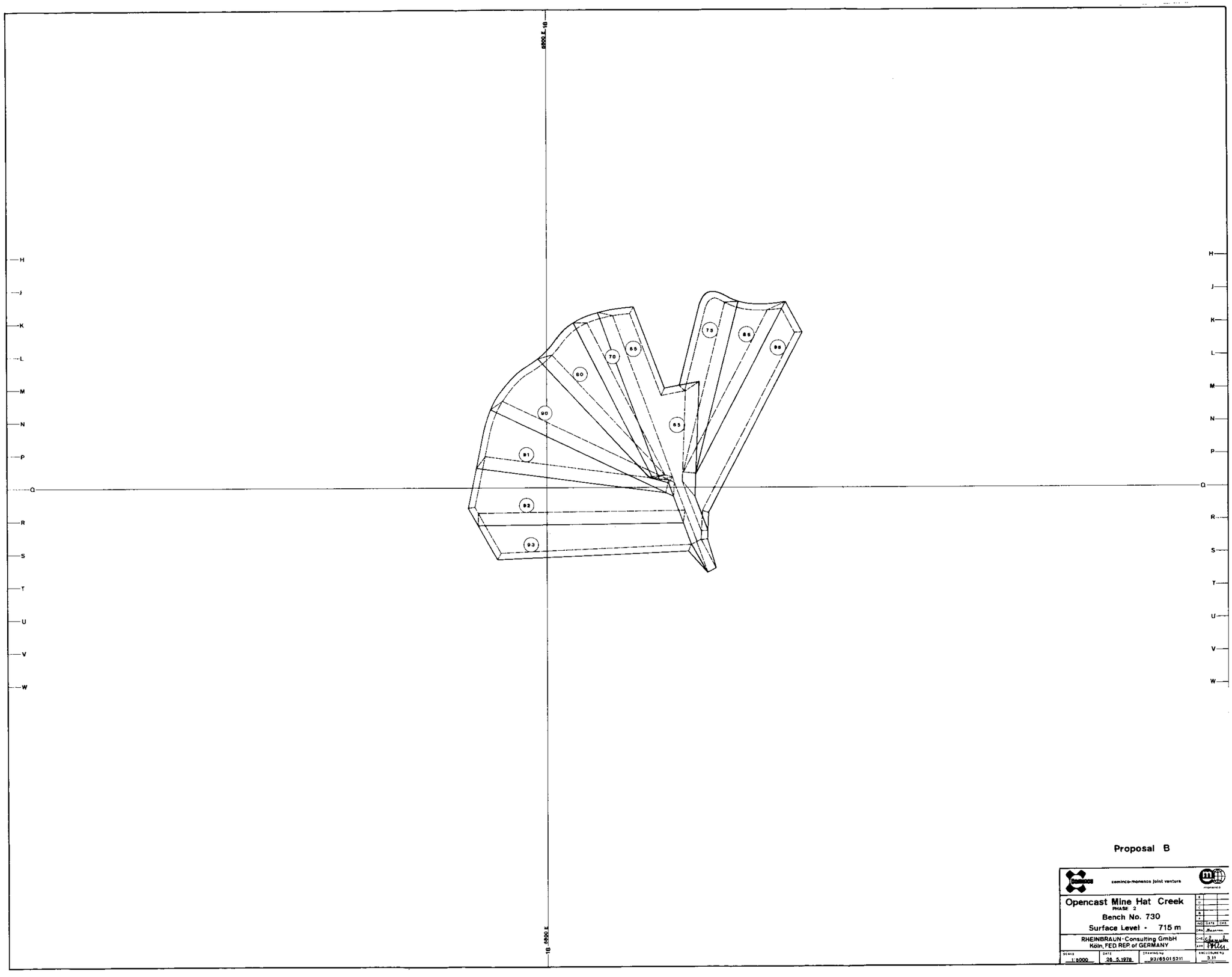
Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 760
Surface Level · 745m

RHEINBRAUN · Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
1:5000	28. 5. 1979	93/65015210	3 10



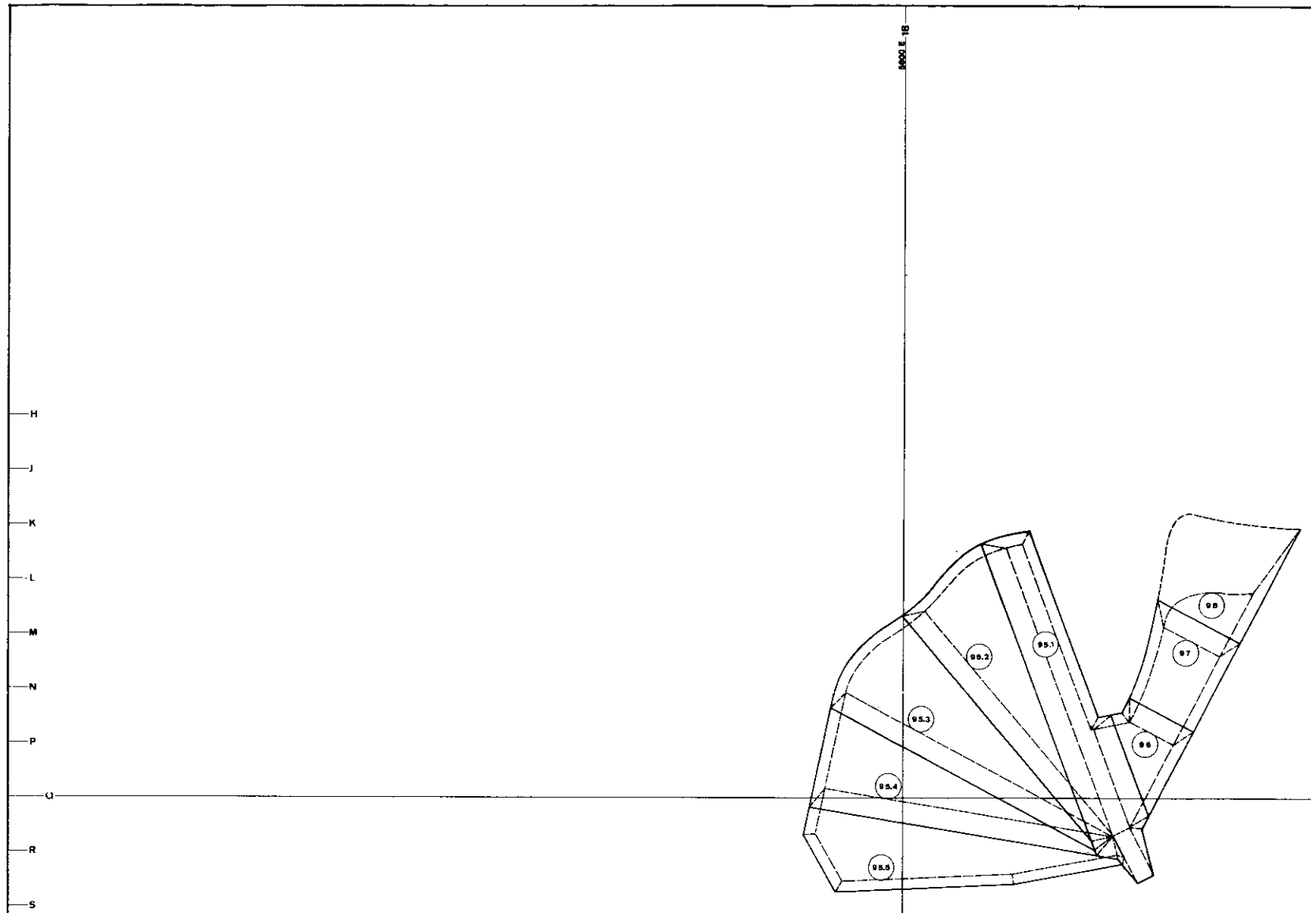
Proposal B

cominco-mannesco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 730
Surface Level - 715 m

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
1:2000	26.5.1978	93/6501 5211	3.11



Proposal B

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 700
Surface Level + 685 m

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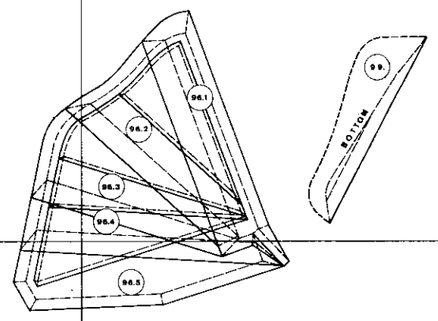
SCALE	DATE	DRAWING No.	DRG. STD. No.
1:5000	28. 5. 1978	93/65.01.5212	3.12



5800 E

18 5800 E

H J K L M N P Q R S T U V W

cominco-monenco joint venture

Opencast Mine Hat Creek
PHASE 2
Bench No. 670
Surface Level - 655 m (645m)

RHEINBRAUN · Consulting GmbH
Köln, FED REP of GERMANY

SCALE	DATE	DRAWING No.	ENCLOSURE No.
1:5000	26.9.1978	93/65015213	3.13

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 10.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 1030-south

page: 1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
40	5,519	0,039	-	5,558	-	-	-	-	-	-	5,558
	5,519	0,039		5,558			-	-		-	5,558
50	4,040	0,129		4,169	-	-	0,011	0,018	8,215	148	4,180
	9,559	0,168		9,727			0,011	0,018		148	9,738
50.1	0,852	-		0,852	-	-	-	-	-	-	0,852
	10,411	0,168		10,579			0,011	0,018		148	10,590
60	8,568	0,051		8,619	-	-	0,022	0,033	5,792	191	8,641
	18,979	0,219	-	19,198	-	-	0,033	0,051	6,647	339	19,231

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 10.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 1000-south

page: 2

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
30	4,299	0,203		4,502	0,016	0,032	0,027	0,043	5,661	243	4,545
	4,299	0,203		4,502	0,016	0,032	0,027	0,043		243	4,545
40	2,870	0,397		3,267	0,069	0,142	0,114	0,206	4,647	957	3,450
	7,169	0,600		7,769	0,085	0,174	0,141	0,249		1,200	7,995
50	5,702	0,450		6,152	0,005	0,010	0,088	0,139	7,731	1,075	6,245
	12,871	1,050		13,921	0,090	0,184	0,229	0,388		2,275	14,240
50.1	2,019	-		2,019	-	-	-	-	-	-	2,019
	14,890	1,050		15,940	0,090	0,184	0,229	0,388		2,275	16,259
60	6,583	0,326		6,909	0,006	0,007	0,064	0,090	7,695	693	6,979
	21,473	1,376		22,849	0,096	0,191	0,293	0,478		2,968	23,238
70	4,388	-		4,388	-	-	0,016	0,024	7,417	178	4,404
	25,861	1,376	-	27,237	0,096	0,191	0,309	0,502	6,267	3,146	27,642

Remarks * Incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 10.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 970-south

page: 3/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
30	3,876			3,876	-	-	0,021	0,035	5,044	176	3,897
	3,876	-		3,876	-	-	0,021	0,035		176	3,897
40	8,979	0,748		9,727	0,016	0,033	0,769	1,216	5,315	6,463	10,512
	12,855	0,748		13,603	0,016	0,033	0,790	1,251		6,639	14,409
40.1	2,421	-		2,421	-	-	-	-	-	-	2,421
	15,276	0,748		16,024	0,016	0,033	0,790	1,251		6,639	16,830
50	3,724	0,897		4,621	0,294	0,546	0,274	0,464	4,951	2,297	5,189
	19,000	1,645		20,645	0,310	0,579	1,064	1,715		8,936	22,019
50.1	3,018	-		3,018	-	-	-	-	-	-	3,018
	22,018	1,645		23,663	0,310	0,579	1,064	1,715		8,936	25,037
60	4,530	1,187		5,717	0,079	0,130	0,654	0,995	7,383	7,346	6,450
	26,548	2,832		29,380	0,389	0,709	1,718	2,710		16,282	31,487
70	5,084	0,708		5,792	0,139	0,226	0,800	1,522	6,009	9,146	6,731
	31,632	3,540	-	35,172	0,528	0,935	2,518	4,232	6,008	25,428	38,218

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 970/north

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000–4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Mined Coal Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
35	0,790	-		0,790	-	-	-	-	-	-	0,790
	0,790			0,790							0,790
45	7,255	-		7,255	-	-	-	-	-	-	7,255
	8,045			8,045							8,045
55	3,370	-		3,370	-	-	-	-	-	-	3,370
	11,415			11,415							11,415
65	1,131	-		1,131	-	-	-	-	-	-	1,131
	12,546	-		12,546	-	-	-	-	-	-	12,546

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 10.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 940/south

page: 4/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
20	4,655	-		4,655	-	-	0,002	0,003	5,917	18	4,657
	4,655			4,655			0,002	0,003		18	4,657
30	5,495	-		5,495	-	-	0,150	0,219	5,850	1,281	5,645
	10,150	-		10,150	-	-	0,152	0,222		1,299	10,302
40	7,207	0,524		7,731	0,101	0,180	1,823	2,809	5,395	15,154	9,655
	17,357	0,524		17,881	0,101	0,180	1,975	3,031		16,453	19,957
40.1	3,083	-		3,083	-	-	-	-	-	-	3,083
	20,440	0,524		20,964	0,101	0,180	1,975	3,031		16,453	23,040
50	2,905	1,387		4,292	0,171	0,305	1,242	1,914	5,861	11,218	5,705
	23,345	1,911		25,256	0,272	0,485	3,217	4,945		27,671	28,745
50.1	4,200	-		4,200	-	-	-	-	-	-	4,200
	27,545	1,911		29,456	0,272	0,485	3,217	4,945		27,671	32,945
60	2,641	1,235		3,876	0,099	0,192	0,742	1,122	6,361	7,137	4,717
	30,186	3,146		33,332	0,371	0,677	3,959	6,067		34,808	37,662
60.1	0,506	-		0,506	-	-	-	-	-	-	0,506
	30,692	3,146		33,838	0,371	0,677	3,959	6,067		34,808	38,168
70	3,502	1,353		4,855	0,057	0,114	1,506	2,200	7,392	16,262	6,418
	34,194	4,499	-	38,693	0,428	0,791	5,465	8,267		51,070	44,586

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 10.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 940/south

page: 4/2

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out	34,194	4,499	-	38,693	0,428	0,791	5,465	8,267		51,070	44,586
80	2,731	1,042		3,773	-	-	1,228	1,824	6,331	11,548	5,001
	36,925	5,541	-	42,466	0,428	0,791	6,693	10,091	6,205	62,618	49,587

Remarks * incl. 1 % mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03 1978

Result of Mass-Calculation

Hat Creek - Bench No. 940/north

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
15	0,702	-		0,702	-	-	-	-	-	-	0,702
	0,702			0,702							0,702
25	1,979	-		1,979	-	-	-	-	-	-	1,979
	2,681			2,681							2,681
35	2,766	-		2,766	-	-	-	-	-	-	2,766
	5,447			5,447							5,447
45	9,171	-		9,171	-	-	-	-	-	-	9,171
	14,618			14,618							14,618
55	8,977	-		8,977	-	-	-	-	-	-	8,977
	23,595			23,595							23,595
65	3,868	-	-	3,868	-	-	-	-	-	-	3,868
	27,463	-	-	27,463	-	-	-	-	-	-	27,463

Remarks * Incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 22.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 910/south

page: 5/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000–4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total
									Average Calorific Content		Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
10	5,295	0,002	–	5,297	–	–	0,171	0,235	6,886	1,618	5,468
	5,295	0,002	–	5,297	–	–	0,171	0,235		1,618	5,468
20	4,053	0,004	–	4,057	–	–	0,391	0,592	5,592	3,310	4,448
	9,348	0,006	–	9,354	–	–	0,562	0,827		4,928	9,916
30	5,049	0,035	–	5,084	–	–	1,763	2,701	5,623	15,188	6,847
	14,397	0,041	–	14,438	–	–	2,325	3,528		20,116	16,763
40/40.1	8,521	0,268	–	8,789	0,036	0,060	2,172	3,276	5,586	18,300	10,997
	22,918	0,309	–	23,227	0,036	0,060	4,497	6,804		38,416	27,760
50/50.1	7,137	1,033	–	8,170	0,488	0,830	1,953	2,920	5,891	17,202	10,611
	30,055	1,342	–	31,397	0,524	0,890	6,450	9,724		55,618	38,371
60/60.1	3,747	1,343	–	5,090	0,083	0,146	1,938	2,804	7,096	19,898	7,111
	33,802	2,685	–	36,487	0,607	1,036	8,388	12,528		75,516	45,482
70	3,001	1,261	–	4,262	0,446	0,818	1,514	2,167	7,453	16,151	6,222
	36,803	3,946	–	40,749	1,053	1,854	9,902	14,695		91,667	51,704
80	2,126	1,611	–	3,737	0,022	0,040	2,505	3,808	6,190	23,572	6,264
	38,929	5,557	–	44,486	1,075	1,894	12,407	18,503		115,239	57,968

Remarks * Incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 910/north

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total
	Waste	*		Total					Average	Calorific Content	Volume
	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
15	2,454	-		2,454	-	-	-	-	-	-	2,454
	2,454			2,454							2,454
25	7,587	-		7,587	-	-	-	-	-	-	7,587
	10,041			10,041							10,041
35	5,370	-		5,370	-	-	-	-	-	-	5,370
	15,411			15,411							15,411
45	9,686	-		9,686	-	-	-	-	-	-	9,686
	25,097			25,097							25,097
55	8,801	-		8,801	-	-	-	-	-	-	8,801
	33,898			33,898							33,898
65	6,287	-		6,287	-	-	-	-	-	-	6,287
	40,185	-	-	40,185	-	-	-	-	-	-	40,185

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 22.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 880/south

page: 6/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
20	6,455	0,028	-	6,483	-	-	0,070	0,097	8,093	785	6,553
	6,455	0,028	-	6,483	-	-	0,070	0,097		785	6,553
21	2,957	0,074	-	3,031	-	-	0,846	1,192	7,321	8,727	3,877
	9,412	0,102	-	9,514	-	-	0,916	1,289		9,512	10,430
30/30.1	5,371	0,132	-	5,503			5,656	8,351	6,222	51,960	11,159
	14,783	0,234	-	15,017	-	-	6,572	9,640		61,472	21,589
40/40.1	6,412	0,053	-	6,465	0,038	0,060	4,809	7,323	5,779	42,322	11,312
	21,195	0,287	-	21,482	0,038	0,060	11,381	16,963		103,794	32,901
50	5,380	0,590	-	5,970	0,568	0,930	1,578	2,340	5,980	13,993	8,116
	26,575	0,877	-	27,452	0,606	0,990	12,959	19,303		117,787	41,017
60	2,752	0,472	-	3,224	0,287	0,484	2,440	3,531	6,744	23,813	5,951
	29,327	1,349	-	30,676	0,893	1,474	15,399	22,834		141,600	46,968
70	3,001	1,085	-	4,086	0,206	0,356	2,313	3,306	7,248	23,962	6,605
	32,328	2,434	-	34,762	1,099	1,830	17,712	26,140		165,562	53,573
80	2,734	1,853	-	4,587	0,508	0,933	3,235	4,777	6,704	32,025	8,330
	35,062	4,287	-	39,349	1,607	2,763	20,947	30,917		197,587	61,903

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 880/north

page: 6/2

Calc. Sector	Waste	Waste C ≤ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≥ 4000 BTU)			Calorific Content	Total Volume
	Waste Mio. m^3	* Mio. m^3	Mio. t	Total Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
25	3,291	-		3,291	-	-	0,009	0,013	8,313	108	3,300
	3,291			3,291			0,009	0,013		108	3,300
35	11,225	-		11,225	-	-	-	-	-	-	11,225
	14,516			14,516			0,009	0,013		108	14,525
45	11,034	-		11,034	-	-	-	-	-	-	11,034
	25,550			25,550			0,009	0,013		108	25,559
55	7,578	-		7,578	-	-	-	-	-	-	7,578
	33,128			33,128			0,009	0,013		108	33,137
65	8,675	-		8,675	-	-	-	-		-	8,675
	41,803	-	-	41,803	-	-	0,009	0,013	8,308	108	41,812

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 11.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 850/south

page: 7/1

Calc. Sector	Waste	Waste C ≤ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≥ 4000 BTU)				Total
									Average	Calorific Content	Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
35	5,522	0,236		5,758	-	-	2,169	2,969	8,658	25,706	7,927
	5,522	0,236		5,758			2,169	2,969		25,706	7,927
36	4,414	0,330		4,744	-	-	6,959	9,862	7,312	72,111	11,703
	9,936	0,566		10,502			9,128	12,831		97,817	19,630
40	3,923	0,142		4,065	-	-	7,958	12,072	5,971	72,082	12,023
	13,859	0,708		14,567	-	-	17,086	24,903		169,899	31,653
50	2,787	0,335		3,122	0,169	0,267	2,956	4,452	6,300	28,048	6,247
	16,646	1,043		17,689	0,169	0,267	20,042	29,355		197,947	37,900
60	2,024	0,158		2,182	0,665	1,067	2,826	4,109	6,999	28,759	5,673
	18,670	1,201		19,871	0,834	1,334	22,868	33,464		226,706	43,573
70	2,872	0,699		3,571	0,435	0,734	2,606	3,697	7,258	26,833	6,612
	21,542	1,900		23,442	1,269	2,068	25,474	37,161		253 539	50,185
80	2,648	0,809		3,457	0,176	0,306	2,583	3,701	7,172	26,544	6,216
	24,190	2,709		26,899	1,445	2,374	28,057	40,862		280,083	56,401
90	1,436	0,642		2,078	0,298	0,553	1,747	2,550	6,830	17,416	4,123
	25,626	3,351	-	28,977	1,743	2,927	29,804	43,412	6,853	297,499	60,524

Remarks * incl. 1% mining losses

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Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 850/north

page: 7/2

Calc. Sector	Waste	Waste (C ≤ 3000 BTU)		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≥ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
37	7,004	0,028		7,032	-	-	2,457	3,414	8,714	29,750	9,489
	7,004	0,028		7,032			2,457	3,414		29,750	9,489
45	7,252	0,024		7,276	-	-	2,051	2,872	8,294	23,820	9,327
	14,256	0,052		14,308			4,508	6,286		53,570	18,816
55	6,086	-		6,086	-	-	0,113	0,158	6,970	1,101	6,199
	20,342	0,052		20,394			4,621	6,444		54,671	25,015
65	5,795	-		5,795	-	-	-	-	-	-	5,795
	26,137	0,052		26,189			4,621	6,444		54,671	30,810
75	5,183	-		5,183	-	-	-	-	-	-	5,183
	31,320	0,052	-	31,372	-	-	4,621	6,444	8,484	54,671	35,993

Remarks * incl. 1% mining losses

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RHEINBRAUN-Consulting GmbH

Köln, 11.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 820/south

page: 8/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
37	4,492	0,060		4,552	-	-	4,848	6,574	8,888	58,430	9,400
	4,492	0,060		4,552			4,848	6,574		58,430	9,400
38	1,812	0,254		2,066	-	-	5,908	8,241	7,753	63,892	7,974
	6,304	0,314		6,618			10,756	14,815		122,322	17,374
40	1,388	0,326		1,714	-	-	5,542	8,213	6,420	52,727	7,256
	7,692	0,640		8,332			16,298	23,028		175,049	24,630
50	1,099	0,074		1,173	-	-	2,709	4,068	6,454	26,255	3,882
	8,791	0,714		9,505	-	-	19,007	27,096		201,304	28,512
60	1,362	0,086		1,448	0,004	0,006	3,848	5,666	6,752	38,257	5,300
	10,153	0,800		10,953	0,004	0,006	22,855	32,762		239,561	33,812
70	1,828	0,337		2,165	0,685	1,108	3,598	5,181	7,089	36,728	6,448
	11,981	1,137		13,118	0,689	1,114	26,453	37,943		276,289	40,260
80	1,978	0,676		2,654	0,391	0,650	2,958	4,304	6,861	29,530	6,003
	13,959	1,813		15,772	1,080	1,764	29,411	42,247		305,819	46,263
90	1,158	0,923		2,081	0,715	1,210	3,191	4,737	6,441	30,511	5,987
	15,117	2,736	-	17,853	1,795	2,974	32,602	46,984	7,158	336,330	52,250

Remarks * incl. 1% mining losses

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Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 820/north

Calc. Sector	Waste	Waste C ≤ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≥ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
45	4,915	0,041		4,956	-	-	4,098	5,605	8,841	49,554	9,054
	4,915	0,041		4,956			4,098	5,605		49,554	9,054
55	1,469	0,054		1,523	-	-	4,286	5,832	8,541	49,811	5,809
	6,384	0,095		6,479			8,384	11,437		99,365	14,863
65	3,054	0,066		3,120	-	-	2,637	3,598	8,477	30,500	5,757
	9,438	0,161		9,599			11,021	15,035		129,865	20,620
75	7,535	0,021		7,556	-	-	0,276	0,404	7,795	3,149	7,832
	16,973	0,182	-	17,155	-	-	11,297	15,439	8,615	133,014	28,452

Remarks * incl. 1 % mining losses

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Köln, 11.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 790/south

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Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	*Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
38	3,558	0,053		3,611	-	-	4,752	6,401	9,190	58,825	8,363
	3,558	0,053		3,611			4,752	6,401		58,825	8,363
40	1,161	0,236		1,397	-	-	5,322	7,391	7,794	57,605	6,719
	4,719	0,289		5,008			10,074	13,792		116,430	15,082
50	1,460	0,164		1,624	-	-	2,046	2,945	7,038	20,727	3,670
	6,179	0,453		6,632			12,120	16,737		137,157	18,752
60	1,262	0,148		1,410	-	-	2,428	3,566	6,796	24,234	3,838
	7,441	0,601		8,042	-	-	14,548	20,303		161,391	22,590
70	1,707	0,077		1,784	0,162	0,258	3,765	5,503	6,787	37,349	5,711
	9,148	0,678		9,826	0,162	0,258	18,313	25,806		198,740	28,301
80	1,936	0,659		2,595	0,321	0,508	3,025	4,401	6,760	29,751	5,941
	11,084	1,337		12,421	0,483	0,766	21,338	30,207		228,491	34,242
90	1,488	0,844		2,332	0,085	0,140	2,614	3,855	6,356	24,502	5,031
	12,572	2,181		14,753	0,568	0,906	23,952	34,062		252,993	39,273
91	0,198	0,475		0,673	0,681	1,152	2,438	3,673	5,945	21,836	3,792
	12,770	2,656	-	15,426	1,249	2,058	26,390	37,735	7,283	274,829	43,065

Remarks * incl. 1% mining losses

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Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 790/north

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total Volume
	Waste Mio. m^3	* Mio. m^3	Mio. t	Total Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average Calorific Content BTU/lb	Calorific Content BTU/lb x Mt	Mio. m^3
C.-out											
45	2,483	0,019		2,502	-	-	1,907	2,576	8,965	23,094	4,409
	2,483	0,019		2,502			1,907	2,576		23,094	4,409
55	1,040	0,024		1,064	-	-	2,408	3,235	9,202	29,768	3,472
	3,523	0,043		3,566			4,315	5,811		52,862	7,881
65	1,004	0,043		1,047	-	-	4,233	5,703	8,802	50,198	5,280
	4,527	0,086		4,613			8,548	11,514		103,060	13,161
75	1,483	0,039		1,522	-	-	3,816	5,379	8,600	46,259	5,338
	6,010	0,125		6,135			12,364	16,893		149,319	18,499
85	4,335	0,003		4,338	-	-	0,254	0,386	8,365	3,229	4,592
	10,345	0,128	-	10,473	-	-	12,618	17,279	8,828	152,548	23,091

Remarks * Incl. 1% mining losses

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Köln, 11.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 760/south

page: 10/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000–4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total
									Average Calorific Content		Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
50	1,830	0,033		1,863	–	–	3,266	4,381	9,357	40,993	5,129
	1,830	0,033		1,863			3,266	4,381		40,993	5,129
60	0,289	0,097		0,386	–	–	2,602	3,576	8,181	29,255	2,988
	2,119	0,130		2,249			5,868	7,957		70,248	8,117
70	0,739	0,167		0,906	–	–	1,845	2,578	7,691	19,827	2,751
	2,858	0,297		3,155			7,713	10,535		90,075	10,868
80	1,395	0,238		1,633	–	–	2,882	4,086	7,417	30,306	4,515
	4,253	0,535		4,788	–	–	10,595	14,621		120,381	15,383
90	1,995	0,067		2,062	0,152	0,244	3,658	5,340	6,621	35,356	5,872
	6,248	0,602		6,850	0,152	0,244	14,253	19,961		155,737	21,255
91	1,350	0,517		1,867	0,254	0,411	2,443	3,548	6,638	23,552	4,564
	7,598	1,119		8,717	0,406	0,655	16,696	23,509		179,289	25,819
92	0,939	0,647		1,586	0,422	0,698	4,269	6,369	6,140	39,106	6,277
	8,537	1,766	–	10,303	0,828	1,353	20,965	29,878	7,310	218,395	32,096

Remarks * Incl. 1% mining losses

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Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 760/north

page: 10/2

Calc. Sector	Waste	Waste C ≤ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≥ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
55	2,384	0,024		2,408	-	-	2,380	3,211	9,150	29,381	4,788
	2,384	0,024		2,408			2,380	3,211		29,381	4,788
65	0,514	0,033		0,547	--	-	3,302	4,405	9,411	41,455	3,849
	2,898	0,057		2,955			5,682	7,616		70,836	8,637
75	0,698	0,034		0,732	-	-	3,350	4,627	8,890	41,134	4,082
	3,596	0,091		3,687			9,032	12,243		111,970	12,719
85	3,733	0,021		3,754	-	-	2,105	3,119	8,552	26,674	5,859
	7,329	0,112	-	7,441	-	-	11,137	15,362	9,025	138,644	18,578

Remarks * incl. 1% mining losses

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Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 11.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 730/south

page: 11/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000–4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total Volume
									Average	Calorific Content	
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
65	2,729	0,019		2,748	–	–	1,852	2,485	9,350	23,235	4,600
	2,729	0,019		2,748			1,852	2,485		23,235	4,600
70	0,243	0,015		0,258	–	–	1,469	1,944	9,570	18,604	1,727
	2,972	0,034		3,006			3,321	4,429		41,839	6,327
80	0,485	0,169		0,654	–	–	1,994	2,749	8,240	22,652	2,648
	3,457	0,203		3,660			5,315	7,178		64,491	8,975
90	0,918	0,239		1,157	–	–	2,807	3,929	7,780	30,568	3,964
	4,375	0,442		4,817			8,122	11,107		95,059	12,939
91	1,146	0,026		1,172	–	–	2,525	3,620	6,841	24,764	3,697
	5,521	0,468		5,989	–	–	10,647	14,727		119,823	16,636
92	1,326	0,376		1,702	0,079	0,131	3,881	5,554	6,982	38,778	5,662
	6,847	0,844		7,691	0,079	0,131	14,528	20,281		158,601	22,298
93	0,474	0,419		0,893	0,393	0,605	3,614	5,337	6,529	34,845	4,900
	7,321	1,263	–	8,584	0,472	0,736	18,142	25,618	7,551	193,446	27,198

Remarks * incl. 1% mining losses

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Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 730/north

Calc. Sector	Waste	Waste (C ≦ 3000 BTU)		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
75	0,083	0,019		0,102	-	-	1,924	2,548	9,721	24,769	2,026
	0,083	0,019		0,102			1,924	2,548		24,769	2,026
85	0,086	0,024		0,110	-	-	2,406	3,293	9,315	30,674	2,516
	0,169	0,043		0,212			4,330	5,841		55,443	4,542
95	1,317	0,032		1,349	-	-	3,189	4,559	8,623	39,312	4,538
	1,486	0,075	-	1,561	-	-	7,519	10,400	9,111	94,755	9,080

Remarks * incl. 1% mining losses

Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 13.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 700/south

page: 12/1

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
95.1	1,633	0,013		1,646	-	-	1,294	1,748	9,145	15,985	2,940
	1,633	0,013		1,646			1,294	1,748		15,985	2,940
95.2	0,302	0,044		0,346	-	-	3,286	4,511	8,394	37,865	3,632
	1,935	0,057		1,992			4,580	6,259		53,850	6,572
95.3	0,780	0,034		0,814	-	-	3,338	4,751	7,265	34,516	4,152
	2,715	0,091		2,806			7,918	11,010		88,366	10,724
95.4	0,636	0,189		0,825	-	-	2,606	3,706	7,287	27,006	3,431
	3,351	0,280		3,631	-	-	10,524	14,716		115,372	14,155
95.5	1,006	0,126		1,132	0,045	0,070	2,997	4,302	6,975	30,006	4,174
	4,357	0,406	-	4,763	0,045	0,070	13,521	19,018	7,644	145,378	18,329

Remarks * Incl. 1% mining losses

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Encl. No.: 4

RHEINBRAUN-Consulting GmbH

Köln, 28.03.1978

Result of Mass-Calculation

Hat Creek - Bench No. 700/north

page: 12/2

Calc. Sector	Waste	Waste C ≦ 3000 BTU		Waste Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)			Calorific Content	Total Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	Average BTU/lb	BTU/lb x Mt	Mio. m^3
C.-out											
96	0,142	0,010		0,152	-	-	0,953	1,284	9,353	12,009	1,105
	0,142	0,010		0,152			0,953	1,284		12,009	1,105
97	0,150	0,015		0,165	-	-	1,515	2,037	9,620	19,596	1,680
	0,292	0,025		0,317			2,468	3,321		31,605	2,785
98	0,117	0,015		0,132	-	-	1,447	2,027	9,130	18,506	1,579
	0,409	0,040	-	0,449	-	-	3,915	5,348	9,370	50,111	4,364

Remarks * Incl. 1 % mining losses

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RHEINBRAUN-Consulting GmbH

Köln, 13.03.78

Result of Mass-Calculation

Hat Creek - Bench No. 670/south

page: 13

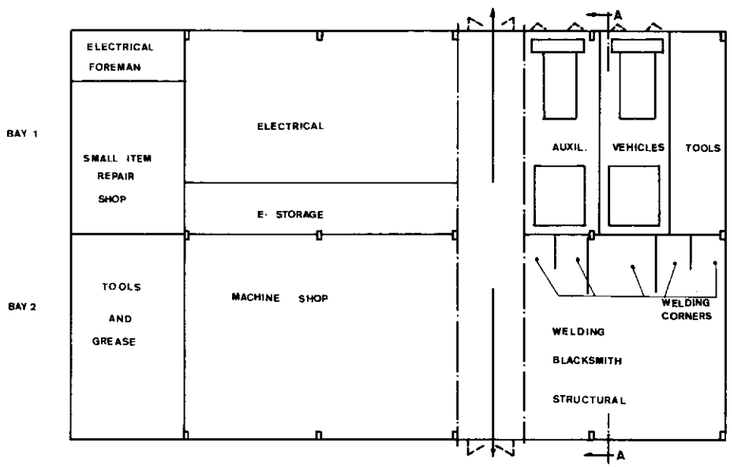
Calc. Sector	Waste	Waste C ≦ 3000 BTU		Total	Low G. Coal (C = 3000-4000 BTU)		Mined Coal (C ≧ 4000 BTU)				Total
									Average	Calorific Content	Volume
	Mio. m^3	* Mio. m^3	Mio. t	Mio. m^3	Mio. m^3	Mio. t	Mio. m^3	Mio. t	BTU/lb	BTU/lb×Mt	Mio. m^3
C.-out											
96.1	0,246	0,023		0,269	-	-	2,254	3,046	8,964	27,304	2,523
	0,246	0,023		0,269			2,254	3,046		27,304	2,523
96.2	0,115	0,044		0,159	-	-	2,269	2,958	7,348	21,735	2,428
	0,361	0,067		0,428			4,523	6,004		49,039	4,951
96.3	0,222	0,096		0,318	-	-	2,070	2,946	7,365	21,697	2,388
	0,583	0,163		0,746			6,593	8,950		70,736	7,339
96.4	0,072	0,042		0,114	-	-	1,040	1,489	7,142	10,634	1,154
	0,655	0,205		0,860			7,633	10,439		81,370	8,493
96.5	0,400	0,076		0,476	-	-	2,453	3,480	7,406	25,773	2,929
	1,055	0,281		1,336	-	-	10,086	13,919	7,698	107,143	11,422
96.2-96.5	0,090	0,165		0,255			2,327	3,307	7,482	24,743	2,582
	0,090	0,165	-	0,255	-	-	2,327	3,307	7,482	24,743	2,582
total											
	1,145	0,446	-	1,591	-	-	12,413	17,226	7,656	131,886	14,004

Remarks * incl. 1% mining losses

RHEINBRAUN-Consulting GmbH

WORKSHOP PLAN

M 1:200



SECTION A-A

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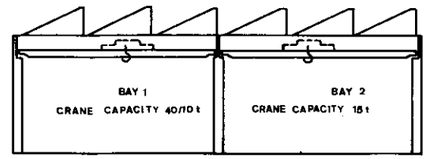
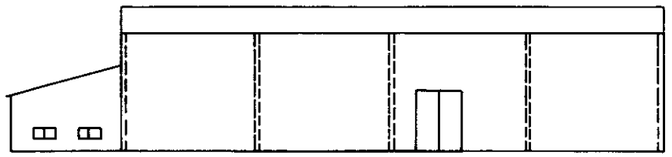
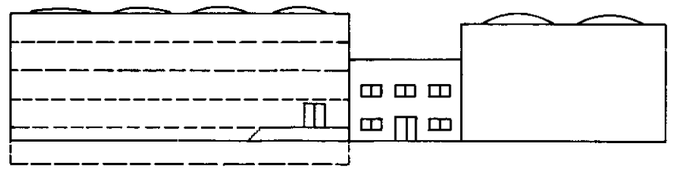


FRONT VIEW OF WORKSHOP



VIEW B



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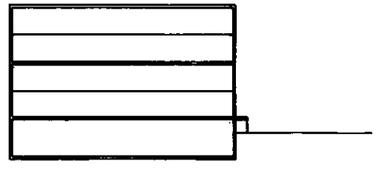
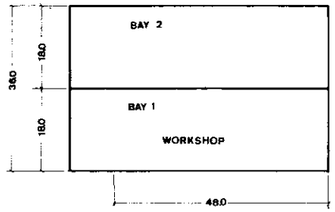
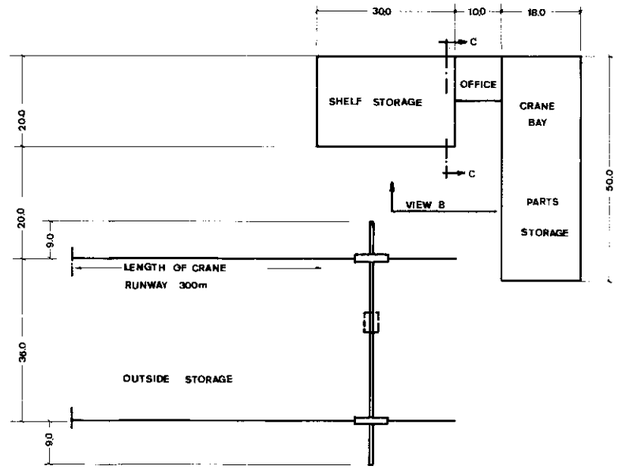


LAYOUT PLAN

M 1: 500





STORAGE AREA

cominco-monenco joint venture

monenco

Opencast Mine Hat Creek

PHASE 2

WORKSHOP

RHEINBRAUN-Consulting GmbH
Köln, FED. REP. of GERMANY

SCALE	DATE	DRAWING No	ENCLOSURE No
1:200, 1:500	12.05.1978	93/65.01.5231	

IND	DATE	CHK.
E		
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C		
B		
A		

DRA öz

CHK

APP

Cominco - Monenco Joint Venture

Vancouver / Canada

Study

on the Application

of Bucket Wheel Excavators

for the

Exploitation of the Hat Creek Deposit

Part B

North American Mining Consultants, Inc.

Denver / USA

RHEINBRAUN - Consulting GmbH

Cologne / Federal Republic of Germany

June 1978

PART B

CALCULATION OF CAPITAL AND OPERATING COSTS

CONTENTS

List of Enclosures, Part B

1. RESULTS OF THE COST CALCULATIONS

The scope of supply of the calculation of capital and operating costs refers to the Terms of Reference, i.e. the investigations and technical data described in Part A of this report.
The total cash flow is shown in Enclosure B 1 and results in the following estimates:

		Million $	$/m³ *)
(a)	Capital Costs	110.7	0.25
(b)	Operating Costs		
	Bucket wheel excavators incl. belt wagons	168.2	0.38
	Belt conveyor systems incl. truck conveyors	98.9	0.22
	Ancillary equipment, add. required	45.7	0.11
	Ancillary equipment, part time required	13.8	0.03
	Supervision of BWE- and conveyor system	13.3	0.03
	Total of Operating Costs	339.9	0.77
(c)	Cash Flow	450.6	1.02

*) Referred to the total volume of 441.6 million m³ which is mined by means of BWE system

2. BASIC DATA

2.1 GENERAL

The enclosed Cost Estimates for the Opencast Mine Hat Creek are based on the following data:

I. Price basis: Sept. 1977
II. Rate of exchange: 1 Canadian $ = 2.15 DM

2.2 CAPITAL COSTS

The summary of the capital costs is shown in Enclosure B 2.1.
The calculation considers that the larger portion of the equipment will be acquired on the home market while others will have to be imported. The separation between home production and import was made on hand of experience and from information from suppliers as follows:

	Import	Inland
Bucket wheel excavators	30 %	70 %
Belt wagons	30 %	70 %
Belt conveyor systems	10 %	90 %
Power supply	20 %	80 %
Central control	20 %	80 %

The above percentages apply for the appropriate initial spare parts inventory for bucket wheel excavators, belt wagons and belt conveyor systems, too. It was calculated with 7 % of the appropriate F.O.B. price.

The following supplements have been calculated:

(a) Freight charges, incl. insurance to Hat Creek

imported equipment	5 %
home production	3.5 %

(b) Import Duty 15 % of F.O.B. price

(c) Provincial Sales Tax: 7 % of the total F.O.B. price + Freight charges + Import Duty
The Erection Costs were not included in the calculation of the Sales Tax.

(d) Erection: 15 % of F.O.B. price

(e) Contingencies: 10 % of total cost erected

The schedule of capital costs is shown in Enclosure B 2.2. The figures indicated refer to the beginning of the relevant years.
The cost schedule of the bucket wheel excavators and belt wagons was calculated under the assumption of start up of operation of

unit I	beginning of year - 1
unit III	mid of year - 1
unit II + IV	beginning of year 1

and that the expenditures are as follows:

1/3	approx. at date of order
1/3	approx. during assembly
1/3	approx. after commissioning.

The cost schedule for the Belt Conveyor Systems is calculated as follows:

total length in

year - 1	5 970 m
year 1	13 810 m
year 4	16 370 m
year 16	17 210 m

commissioning of

shunting heads	year - 1
distribution (slewing) belt	year - 1
conveyor bridge	year 11
hopper cars for BWE-system	year - 1

The costs for Civil Works and Ancillary Equipment, additionally required are indicated as total costs, free Hat Creek.

For the determination of the Ancillary Equipment Reinvestment the following economic lifetimes were used:

Dozer	15 000 hours
Front-end loader	15 000 hours
Cable reel trailer	40 years
Pipe laying attachments	10 years
Trucks 2 t	3 years *)
Pick up truck 3/4 t	1 year *)

*) Driver operation assumed. This accounts for longer lifetime.

2.3 OPERATING COSTS

The total schedule of operating costs is shown in Enclosure B 3.1.
They are sub-divided into the following Cost Centres:

(a) Bucket wheel excavators incl. belt wagons
(b) Belt conveyor system incl. truck conveyors
(c) Ancillary equipment, additionally required
(d) Ancillary equipment, part time required
(e) Supervision (Foreman)

In Enclosure B 3.2 to B 3.5 the above mentioned cost centres are broken down as follows:

- operating labour,
- repair labour,
- material and supply,
- other costs and
- power consumption.

For the cost calculation of repair labour, material and supply, other costs and power consumption specific rates are used which are derived from the experience gained in RHEINBRAUN's mines and bearing in mind the conditions of the Hat Creek deposit as described in Part A of the report. All other rates are derived from CMJV Criteria Manual or indicated below.
For cost centres:

- Bucket wheel excavators incl. belt wagons and
- Belt conveyor system incl. truck conveyors

the calculation is shown on hand of an example for the period of normal operation of 4 bucket wheel excavators. The following additional descriptions are given:

To point (a): Bucket wheel excavators incl. belt wagons

- Operating labour

Example:

32 Operators	x	2 200	h/a	x	14.90 $/h	= 1.049 mill.$
16 Oiler	x	2 200	h/a	x	13.95 $/h	= 0.491 mill.$
16 Operators	x	2 200	h/a	x	13.95 $/h	= 0.491 mill.$
16 Helpers	x	2 200	h/a	x	13.40 $/h	= 0.472 mill.$
						2.503 mill.$

- Repair Labour

Maintenance time per operating hour of BWE 6.2
Rate 20 $/h

Example:

Scheduled operating time according to the specifications x actual utilization x specific rate of maintenance hours per actual operating hour x number of units in operation x hourly labour rate = repair labour cost

4 500 h/a x 0.706 x 6.2 x 4 x 20 $/h
= 1.576 mill.$/a

- Material and supply

Rate 7.37 cts/m^3
plus 1 % p.a. of the investment with the exception of the first 10 years of operation and the last 5 years of operation respectively.

Example:

Total volume (m^3/a) x specific rate + 1 % of the investment (total cost, erected) = cost for material and supply.

15.544 mill. m^3/a x 7.37 cts/m^3 = 1.146 mill. $

0.01 x (40.22 mill. $ (BWE)
+ 8.532 mill. $ (belt wagon) = 0.488 mill. $

1.634 mill. $/a

- Other Costs

Rate 0.535 cts/m^3

Example:

Total volume (m^3/a) x specific rate = other costs

15.544 mill. m^3/a x 0.54 cts/m^3 = 0.083 mill. $/a

- Power Consumption

Rate 2.0 cts/kWh

Example:

14.950 MWh/a x 2.0 cts/kWh = 0.299 mill. $/a

To point (b): Belt conveyor system for BWE- and shovel/truck operation incl. distribution point and central conveyor control centre

- Operating labour

Example:

12 Operators x 2 200 h/a
x 12.40 $/h = 0.327 mill. $

20 Helpers x 2 200 h/a
x 11.00 $/h = 0.484 mill. $

0.811 mill. $

- Repair labour

  Rate: 1.1 to 1.5 maintenance hours per 1 000 m^3 x km of haulage, average transport distance 2 400 m for BWE-operation; 850 m from year - 1 to year 16 and 1 270 m from year 16 up to end for shovel operation

  Example:

  Belt conveyors for BWE-system

  15.544 mill. m^3 x 2.4 km x
  1.10 h/1 000 m^3 x km 20 $/h = 0.820 mill. $

  Belt conveyor for shovel/truck operation

  12.700 mill. m^3 x 0.850 km x
  1.10 h/1 000 m^3 x km 20 $/h = 0.237 mill. $

  1.057 mill. $

- Material and supply

  Rate: 0.612 cts/m^3 x km plus 3 % p.a. of the investment with the exception of the first 5 years of operation and the last 3 years of operation respectively

  Example:

  15.544 mill. m^3/a x 2.4 km x
  0.612 ct/m^3 x km = 0.228 mill. $

  12.700 mill. m^3/a x 0.85 km x
  0.612 ct/m^3 x km = 0.066 mill. $

  36.132 mill. m^3/a x 0.03 x $\frac{4}{5}$ *) = 0.867 mill. $

  1.161 mill. $

- Other costs

  Rate: 10 cts/m^3 x km

*) From the 5 conveyor belt systems installed only 4 are in operation at any one time

Example:

15.544 mill. m^3/a x 2.4 km x 0.10 ct/m^3 x km	= 0.037 mill. $
12.700 mill. m^3/a x 0.850 km x 0.10 cts/m^3 x km	= 0.011 mill. $
	0.048 mill. $

- Power Consumption

  Rate: 2.0 cts/kWh

  Example:

  25,000 MWh/a x 2 cts/kWh — 0.500 mill. $

To point (c): Ancillary equipment, add. required

For easier explanation all data for the cost calculation of the ancillary equipment is given below:

- Operating Labour

  with 3-shift-operation using 4 dozers
  type Cat C 6 c — 16 pers. at 2 200 h each

  According to the number of BWE's in operation the following number of dozers are employed:

year - 1	1.5 dozers
year 1 - 25	4 dozers
year 26 - 30	2 dozers
year 31 - 35	1 dozer

  with a 2-shift-operation using 1 frontend loader
  type Cat 950 — 2 operators at 2 200 h each

  with 3-shift-operation using 2 trucks 2 t
  8 Drivers) at 2 200 h
  8 Helpers) each

with 3-shift-operation using 2 Pick up trucks
8 Drivers at
2 200 h each

Rates:	Dozer, Cat D 6 c	13.40 $/h
	FEL, Cat 950	12.40 $/h
	Truck-driver	12.05 $/h
	Truck-helper	11.00 $/h

- Material and supply incl. repair labour and fuel

Dozer, Cat D 6 c	15.00 $/h
FEL, Cat 950	30.00 $/h
Truck 2 t	12 000 $/year
Pick up truck	10 000 $/year
Cable reel trailer	2 500 $/year
Pipe laying attachments	2 300 $/year

The actual operating hours of the dozers and frontend loader are estimated as follows:

year	dozer, Cat D 6 c	FEL, Cat 950
- 1	2 250	3 000
1 - 25	1 590	3 000
26 - 30	1 370	3 000
31 - 35	1 150	3 000

To point (d): Ancillary equipment - part time required

The cost calculation for the ancillary equipment - part time required - is based on the data given below for the period year 1 - 25 (4 bucket wheel excavators in operation).

	Hours per year	Material + Supply		Operating Labour		Grease Truck + Personnel bus	Total
		$/h	$/year	$/h	$/year	$/year	$/year
	1	2	3=1 x 2	4	5=1x4	6	7=3+5+6
Dozer Cat D 8 K	6 600	26.50	174 900	13.40	88 440		263 340
Backhoe Cat 215	500	10.00	5 000	12.40	6 200		11 200
Grader Cat 16 G	500	25.50	12 750	13.05	6 525		19 275
FEL Cat 950	200	30.00	6 000	12.40	2 480		8 480
Mobile Crane	200	20.00	4 000	13.40	2 680		6 680
Flatbed trailer	400	6.25	2 500	-	-		2 500
Tractor	400	7.50	3 000	12.05	4 820		7 820
Truck	2 000	5.00	10 000	12.05	24 100		34 100
Emergency unit	1 000	5.00	5 000	-	-		5 000
Grease truck						42 000	42 000
Personnel bus						54 000	54 000
			223 150		135 245	96 000	454 395

To point (e): Supervision

8 foremen x 2 200 h/a x 21 $/h = 369 600 $/a

3. CONCLUSION

As described the cost calculations indicated above are based on the investigations and the technical data of Part A of this report. The essential figure for the economical evaluation of the mining system are the specific production costs per m^3 total volume which result in

1.02 $/$m^3$ total volume.

It should be noted that the cost figure given refers to the total volume of 441.6 mill. m^3 mined by the bucket wheel excavators and that they include the respective belt conveyor costs for the operation by shovels and trucks from the mine up to the distribution point.

A final evaluation of the costs cannot be given without the knowledge of the investigations carried out by CMJV. Moreover, it is to be stressed that the costs given in this report are subject to changes and also to the possibilities of optimisation which are stated in Part A of this report.

RHEINBRAUN-Consulting GmbH

Enclosure B1

HAT CREEK PROJECT

Total Cash Flow

IN CANADIAN $ 000's

CODE	COST CENTRE DESCRIPTION	YEAR NUMBER	PRE-PRODUCTION PERIOD						PRODUCTION PERIOD																													RESALE VALUE	TOTAL
			-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	Capital Costs					4,743	27,583	46,372	20,900		2,778	3,097	128	22		33	563	580	368	22			1,053	1,049		22	541	253	22			55	128		22		275			17	22				110,645
	Operating Costs							5,765	10,519	10,519	10,519	10,519	11,081	11,266	11,266	11,266	11,386	11,509	11,738	11,738	11,738	11,738	11,738	11,738	11,841	11,841	11,841	11,841	11,841	11,596	11,596	11,184	11,184	11,184	6,428	6,428	6,210	6,210	6,210	3,785	3,785	3,533	3,533	3,533		339,909
	Cash Flow					4,743	27,583	52,137	31,419	10,519	13,297	13,616	11,209	11,288	11,266	11,299	11,949	12,089	12,106	11,760	11,738	11,738	12,791	12,890	11,841	11,863	12,382	12,094	11,618	11,596	11,184	11,239	11,312	6,428	6,450	6,210	6,485	6,210	3,785	3,802	3,555	3,533	3,533		450,554

RHEINBRAUN-Consulting GmbH

Enclosure B 2.1

SUMMARY OF CAPITAL COSTS

HAT CREEK PROJECT

IN CANADIAN $ 000's

CODE	COST CENTRE DESCRIPTION	EQUIPMENT ITEM OR TYPE OF COST	YEAR OF PUR-CHASE	NO REQ'D	BRIEF NOTE ON COVERAGE (e.g. length, areas, capacity, etc.) & SOURCE OF ESTIMATED COST (i.e. manufacturers quotation, study estimate, etc.)	FOR CAPITAL EQUIPMENT ONLY: APPROX WT (IN TONNES) PER UNIT	COST F.O.B. FACTORY (A) PER UNIT	FREIGHT CHARGES TO SITE (B) PER UNIT	IMPORT-DUTY FED & PROV SALES TAXES (C) PER UNIT	ERECTION COST (D) PER UNIT	TOTAL COST ERECTED (A)+(B)+(C)+(D) PER UNIT	TOTAL COST TO SUMMARY (FORM 1) ALL UNITS
		Bucket wheel excavators		4			7,674	303	927	1,151	10,055	40,220
		Initial spare parts inventory for BWE's		4			537	21	65	- -	623	2,492
		Belt wagons		4			1,628	64	197	244	2,133	8,532
		Initial spare parts inventory for Belt wagons		4			114	5	14	-	133	532
		Belt conveyor system incl. Truck conv.syst.*)		1			30,093	1,098	2,665	4,514	38,370	38,370
		Initial spare parts inventory for Belt conveyor system		1			2,107	77	187	-	2,371	2,371
		Power supply		1			1,880	72	197	282	2,431	2,431
		Central control		1			1,700	65	179	255	2,199	2,199
		Civil works for conveyor distribution station and control building		1							250	250
	Ancillary equipment, additionally required for BWE's	Bulldozer		12							123	1,476
		FEL Cat 950		7							116	812
		Trucks - 2 t		9							15	135
		Pick-up trucks		24							10	240
		Cable reel trailer		1							70	70
		Pipe laying attachments		4							114	456
											698	3,439
		Contingencies										10,059
		Total					45,733	1,705	4,431	6,446	59,013	110,645
		*) Belt conveyors 17 210 m approx. 1,535 $/m					26,415					
		Shuating heads		(6)			2,790					
		Distribution belt		1			163					
		Conveyor bridge		1			465					
		Hopper cars for BWE system		(5)			260					
							30,093					

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Enclosure B 2.2

SCHEDULE OF CAPITAL COSTS

SECTION : _____

HAT CREEK PROJECT

IN CANADIAN $000's

CODE	COST CENTRE DESCRIPTION	YEAR NUMBER	PRE-PRODUCTION PERIOD						PRODUCTION PERIOD																															RESALE VALUE	TOTAL
			-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	Bucket wheel excavators					3,351	13,406	16,759	6,704																																		40,220
	Initial spare parts Inventory for BWE's							1,246	1,246																																		2,492
	Belt wagons					711	2,844	3,555	1,422																																		8,532
	Initial spare parts Inventory for Belt wagons							266	266																																		532
	Belt conveyor system including truck conveyors						7,725	15,725	7,672		2,505	2,505						297	297				821	823																			38,370
	Initial spare parts Inventory for Belt conveyor system							1,499	474			310							37					101																			2,371
	Power supply							1,215	1,216																																		2,431
	Central control						1,099	1,100																																			2,199
	Civil works for conveyor distribution station																																									
	and control building					250																																					250
	Bulldozer							492									492									492																1,476
	FEL Cat 950							116					116					116					116				116					116					116				812
	Trucks - 2 t							30								30								30							30								15			135
	Pick-up trucks							20			20			20			20			20			20			20		20			20			20			20			20		240
	Cable reel trailer							70																																		70
	Pipe laying attachments							114										114									114										114					456
	Contigencies					431	2,506	4,215	1,900		253	282	12	2		3	51	53	34	2			96	95		2	49	23	2			5	12		2			25		2	2		10,059
	Total					4,743	27,580	46,372	20,900		2,778	3,097	128	22		33	563	580	368	22			1,053	1,049		22	541	253	22			55	128		22			275		17	22			110,645

SCHEDULE OF OPERATING COSTS

SECTION : _____

HAT CREEK PROJECT

IN CANADIAN $000's

CODE	COST CENTRE DESCRIPTION	YEAR NUMBER	PRE-PRODUCTION PERIOD						PRODUCTION PERIOD																													RESALE VALUE	TOTAL
			-6	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	Bucket wheel excavators + Belt wagons							2,322	5,607	5,607	5,607	5,607	5,607	5,607	5,607	5,607	5,607	5,607	5,730	6,095	6,095	6,095	6,095	6,095	6,095	6,095	6,095	6,095	6,095	5,850	5,850	5,850	5,850	5,850	2,711	2,711	2,711	2,711	2,711	1,184	1,184	1,184	1,184	1,184		168,190
	Belt conveyor system including truck conveyors							1,804	2,710	2,710	2,710	2,710	3,272	3,457	3,457	3,457	3,457	3,577	3,577	3,441	3,441	3,441	3,441	3,441	3,441	3,544	3,544	3,544	3,544	3,544	3,544	3,544	3,132	3,132	3,132	1,983	1,983	1,765	1,765	1,765	1,099	1,099	847	847	847		98,850
	Ancillary equipment, additionally required							1,038	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,378	1,088	1,088	1,088	1,088	1,088	946	946	946	946	946		45,658
	Ancillary equipment, part time required							231	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	454	276	276	276	276	276	186	186	186	186	186		13,891
	Sub. Total							5,395	10,149	10,149	10,149	10,149	10,711	10,896	10,896	10,896	10,896	11,016	11,139	11,368	11,368	11,368	11,368	11,368	11,471	11,471	11,471	11,471	11,471	11,226	11,226	10,814	10,814	10,814	6,058	6,058	5,840	5,840	5,840	3,415	3,415	3,163	3,163	3,163		326,589
	Supervision							370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370	370		13,320
	Total							5,765	10,519	10,519	10,519	10,519	11,081	11,266	11,266	11,266	11,386	11,509	11,738	11,738	11,738	11,738	11,738	11,738	11,841	11,841	11,841	11,841	11,841	11,596	11,596	11,184	11,184	11,184	6,428	6,428	6,210	6,210	6,210	3,785	3,785	3,533	3,533	3,533		339,909

RHEINBRAUN-Consulting GmbH

Enclosure B 3.2

SUMMARY OF OPERATING COSTS (YEAR BY YEAR)

HAT CREEK PROJECT

IN CANADIAN $ 000's

CODE	COST CENTRE DESCRIPTION		YEAR NO.	OPERATING LABOUR	REPAIR LABOUR	M & S (ie parts, tires, overhaul, etc.)	OTHER COSTS	POWER CONSUMPTION					TOTAL COST TO SUMMARY (FORM 2)
	Bucket wheel excavators + Belt wagons		-1	939	837	405	29	112					2,322
			1	2,503	1,576	1,146	83	299					5,607
			2	2,503	1,576	1,146	83	299					5,607
			3	2,503	1,576	1,146	83	299					5,607
			4	2,503	1,576	1,146	83	299					5,607
			5	2,503	1,576	1,146	83	299					5,607
			6	2,503	1,576	1,146	83	299					5,607
			7	2,503	1,576	1,146	83	299					5,607
			8	2,503	1,576	1,146	83	299					5,607
			9	2,503	1,576	1,146	83	299					5,607
			10	2,503	1,576	1,269	83	299					5,730
			11	2,503	1,576	1,634	83	299					6,095
			12	2,503	1,576	1,634	83	299					6,095
			13	2,053	1,576	1,634	83	299					6,095
			14	2,503	1,576	1,634	83	299					6,095
			15	2,503	1,576	1,634	83	299					6,095
			16	2,503	1,576	1,634	83	299					6,095
			17	2,503	1,576	1,634	83	299					6,095
			18	2,503	1,576	1,634	83	299					6,095
			19	2,503	1,576	1,634	83	299					6,095
			20	2,503	1,576	1,634	83	299					6,095
			21	2,503	1,576	1,389	83	299					5,850
			22	2,503	1,576	1,389	83	299					5,850
			23	2,503	1,576	1,389	83	299					5,850
			24	2,503	1,576	1,389	83	299					5,850
			25	2,503	1,576	1,389	83	299					5,850
			26	1,251	680	616	36	128					2,711
			27	1,251	680	616	36	128					2,711
			28	1,251	680	616	36	128					2,711
			29	1,251	680	616	36	128					2,711
			30	1,251	680	616	36	128					2,711
			31	626	284	206	15	53					1,184
			32	626	284	206	15	53					1,184
			33	626	284	206	15	53					1,184
			34	626	284	206	15	53					1,184
			35	626	284	206	15	53					1,184
				72,899	45,057	39,383	2,359	8,492					168,190

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Enclosure 8.3.5

SUMMARY OF OPERATING COSTS (YEAR BY YEAR)

HAT CREEK PROJECT

CODE	COST CENTRE DESCRIPTION		YEAR NO	IN CANADIAN $ 000's: OPERATING LABOUR	REPAIR LABOUR	M & S (tie parts, log., amortisat., etc.)	OTHER COSTS	POWER CONSUMPTION					TOTAL COST TO SUMMARY (FORM 8)
	Belt conveyor system including truck con. system		-1	811	535	147	24	287					1,804
			1	811	1,057	294	48	500					2,710
			2	811	1,057	294	48	500					2,710
			3	811	1,057	294	48	500					2,710
			4	811	1,057	294	48	500					2,710
			5	811	1,057	856	48	500					3,272
			6	811	1,057	1,041	48	500					3,457
			7	811	1,057	1,041	48	500					3,457
			8	811	1,057	1,041	48	500					3,457
			9	811	1,057	1,161	48	500					3,577
			10	811	1,057	1,161	48	500					3,577
			11	811	964	1,124	42	500					3,441
			12	811	964	1,124	42	500					3,441
			13	811	964	1,124	42	500					3,441
			14	811	964	1,124	42	500					3,441
			15	811	964	1,124	42	500					3,441
			16	811	1,035	1,154	44	500					3,544
			17	811	1,035	1,154	44	500					3,544
			18	811	1,035	1,154	44	500					3,544
			19	811	1,035	1,154	44	500					3,544
			20	811	1,035	1,154	44	500					3,544
			21	811	1,035	1,154	44	500					3,544
			22	811	1,035	1,154	44	500					3,544
			23	811	1,035	742	44	500					3,132
			24	811	1,035	742	44	500					3,132
			25	811	1,035	742	44	500					3,132
			26	406	594	612	23	348					1,983
			27	406	594	612	23	348					1,983
			28	406	594	394	23	348					1,765
			29	406	594	394	23	348					1,765
			30	406	594	394	23	348					1,765
			31	203	391	337	14	154					1,099
			32	203	391	337	14	154					1,099
			33	203	391	85	14	154					847
			34	203	391	85	14	154					847
			35	203	391	85	14	154					847
				24,131	31,200	26,883	1,339	15,297					98,850

RHEINBRAUN-Consulting GmbH

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Enclosure B 3.4

SUMMARY OF OPERATING COSTS (YEAR BY YEAR)

HAT CREEK PROJECT

IN CANADIAN $ 000's

CODE	COST CENTRE DESCRIPTION		YEAR NO.	OPERATING LABOUR	REPAIR LABOUR	M & S (Ins parts, Eq & overhead, etc.)	OTHER COSTS						TOTAL COST TO SUMMARY (FORM 2)
	Ancillary equipment, additionally required		-1	849		189							1,038
			1	1,144		234							1,378
			2	1,144		234							1,378
			3	1,144		234							1,378
			4	1,144		234							1,378
			5	1,144		234							1,378
			6	1,144		234							1,378
			7	1,144		234							1,378
			8	1,144		234							1,378
			9	1,144		234							1,378
			10	1,144		234							1,378
			11	1,144		234							1,378
			12	1,144		234							1,378
			13	1,144		234							1,378
			14	1,144		234							1,378
			15	1,144		234							1,378
			16	1,144		234							1,378
			17	1,144		234							1,378
			18	1,144		234							1,378
			19	1,144		234							1,378
			20	1,144		234							1,378
			21	1,144		234							1,378
			22	1,144		234							1,378
			23	1,144		234							1,378
			24	1,144		234							1,378
			25	1,144		234							1,378
			26	908		180							1,088
			27	908		180							1,088
			28	908		180							1,088
			29	908		180							1,088
			30	908		180							1,088
			31	790		156							946
			32	790		156							946
			33	790		156							946
			34	790		156							946
			35	790		156							946
				37,933		7,719							45,658

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Enclosure 6 3.5

SUMMARY OF OPERATING COSTS (YEAR BY YEAR)

HAT CREEK PROJECT

IN CANADIAN $ 000's

CODE	COST CENTRE DESCRIPTION		YEAR NO.	OPERATING LABOUR	REPAIR LABOUR	M & S (ie parts, fuel, overhaul, etc.)	OTHER COSTS	Total Costs of Grease Truck + Personnel hrs					TOTAL COST TO SUMMARY (FORM 2)
	Ancillary equipment, part time required		- 1	51		84		96					231
			1	135		223							454
			2										
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										
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			19										
			20										
			21										
			22										
			23										
			24										
			25	135		223							454
			26	63		112							276
			27										
			28										
			29										
			30	63		112							276
			31	34		56							186
			32										
			33										
			34										
			35	34		56		96					186
				3,936		6,499		1,456					13,891