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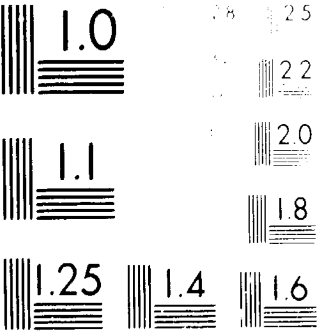
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P. 4651A
February, 1980

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UNIDO

PREFEASIBILITY STUDY FOR KOREA

FINAL REPORT

UNBLEACHED KRAFT PULP MILL

PROJECT NO. UF/ROK/78/210

UNIDO CONTRACT NO. 79/84

simons
H.A. SIMONS (INTERNATIONAL) LTD.

P.4651A February, 1980

UNBLEACHED KRAFT PULPMILL

PREFEASIBILITY STUDY FOR KOREA

A. Glossary

B. Acknowledgements

C. Summary

1.0 Background and Justification for the Study

2.0 Objectives of the Prefeasibility Study

3.0 The International Pulp Market

3.1 World Production and Demand, Short Term
3.2 World Production and Demand, Long Term
3.3 The Korean Pulp Market.

4.0 Raw Materials for UKP Production

4.1 Technical Reasons for Utilization of Coniferous Woods

5.0 General Description of the Sulfate (Kraft) Pulping Process

6.0 General Description of Woodyard and Chipping Operations

7.0 General Description of Shipping Operations for Chips

8.0 Chip Purchase Possibilities

9.0 Description of Alternative Cases for Comparison in the Prefeasibility Study

9.1 Case 1 UKP Expansion of the Dong Hae Pulpmill
9.2 Case 2 Construction of a UKP Pulpmill in Australia
9.3 Case 3 Construction of a UKP Pulpmill at Eureka, California
9.4 Case 4 Construction of a UKP Pulpmill at Ocean Falls, B.C.

10.0 Description of Layouts and Process for Alternative Cases

10.1 Case 1 Expansion of Dong Hae Pulpmill
10.2 Case 2 Beerburrum Pulpmill, Queensland, Australia
10.3 Case 3 Eureka California, U.S.A.
10.4 Case 4 Ocean Falls, British Columbia, Canada

UNBLEACHED KRAFT PULPMILL

PREFEASIBILITY STUDY FOR KOREA

Contd.

11.0 Manufacturing Cost Estimates

12.0 Capital Cost Estimates

13.0 Investment Requirements

14.0 Depreciation and Income Taxes

15.0 Financial Analysis

16.0 Sensitivity Analysis

17.0 Socio-Economic Benefits

18.0 Financial Summary of Sections 15, 16, 17

19.0 Conclusions and Recommendations

Appendix

1 Training Program for UKP Expansion of the Dong Hae Mill

2 Heat Balances

3 Flowsheets and Layouts

4 Proposed Construction Schedule - Onsan Mill

5 Financial Statements

A. GLOSSARY OF TERMS

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a	Annum
AD	Air dry (10% moisture content)
ADt	Air dry metric tonnes
ADt/d	Air dry metric tonnes per day
ADt/a	Air dry metric tonnes per year
BD	Bone dry (0% moisture)
BD Kg	Bone dry kilograms
BDt	Bone dry metric tonnes
BDU	Bone dry units of chips (2400 pounds bone dry)
BTU	British Thermal unit
BKP	Bleached kraft pulp
cm	Centimeter
Cunit	100 cubic feet of wood, solid measure
CIF	Cost, insurance and freight
C & F	Cost and freight
d	day
DDB	Double declining balance depreciation
FOB	Free on board
GP	Groundwood pulp
h	hour
IRR	Internal rate of return

kg	Kilograms
kg/a	Kilograms per year
Kg/ADt	Kilograms per air dry metric tonne
Kg/cm^2	Kilograms per square centimeter
Kg/m^3	Kilograms per cubic meter of wood (bone dry green volume solid measure)
Kg/h	Kilograms per hour
kwh	Kilowatt hour
kwh/ADt	Kilowatt hour per air dry metric tonne
l	Liter
l/h	Liters per hour
m	Meter
m^3	Cubic meters
m^3/a	Cubic meters per year
m^3/ADt	Cubic meters per air dry metric tonne
M cal/kg	Mega calories per kilogram
min	Minute
MW	Megawatt
MWh	Megawatt hour
MWh/a	Megawatt hours per year
OCC	Old corrugated containers
ONP	Old newsprint
ROI	Return on investment
SBK	Semi-bleached kraft
SL	Straight line depreciation
t	Metric tonne of 1000 kg

U	Unbleached
UKP	Unbleached kraft pulp
Unit	
%	Percent
$	U.S. dollar

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B. ACKNOWLEDGEMENTS

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C. SUMMARY

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The Government of the Republic of Korea requested assistance from UNIDO in executing a prefeasibility study to evaulate several options for the supply of unbleached kraft pulp to Korea. The three options were as follows:

OPTION A
Expansion of the Dong Hae bleached kraft pulp mill in Korea by adding an unbleached kraft softwood pulpmill using imported wood chips.

OPTION B
Establish an unbleached kraft softwood pulpmill in an overseas country as a joint venture with Korean equity for export to Korea of all or a major portion of the production.

OPTION C
Acquisition of equity in an existing unbleached kraft softwood pulpmill for export to Korea of all or a major portion of its production.

It was not possible to locate a facility of the Option C category that was available for equity acquisition. Three alternative candidates were found for the Option B category:

- A mill at Beerburrum, Queensland, Australia
- A mill at Eureka, California, United States
- A mill at Ocean Falls, British Columbia, Canada

Projections for pulp consumption in Korea indicate that by 1981 Korea will require at least 210,000 tonnes of unbleached kraft pulp per year. For this reason it was decided to evaluate all of the alternatives on the basis of a mill of 600 ADt/d capacity. Although different wood species would be used, each alternative should be able to produce a satisfactory unbleached kraft pulp.

Each of the alternatives has unique advantages and disadvantages. Expansion of the Dong Hae mill would provide the maximum socio-economic benefits to Korea, but would be dependent on high cost raw materials and energy. The Australian alternative would have low operating costs and an uncontested supply of raw materials, but has high capital costs and depends on extensive infrastructure to be supplied by others. The California mill would have an excellent location and would be able to use facilities already in place, but would be in a competitive situation in obtaining raw materials. The British Columbia alternative would be able to use existing facilities and would have strong government backing, but the supply and cost of raw materials is not yet well-defined.

Manufacturing cost estimates using costs prevailing at January 31, 1980, were prepared for each of the alternatives under consideration. These are summarized below for operation at full capacity:

	Korea	Australia	California	British Columbia
Variable Costs ($ U.S.)	365.37	161.39	199.06	157.70
Total Costs	385.87	201.98	253.56	210.25

The wide variation in estimated variable costs is mainly a reflection of the cost of wood and energy for each alternative.

Estimates were prepared for plant capital costs and these are shown below:

	Korea	Australia	California	British Columbia
Plant Capital Cost ($ 000)	146,000	212,000	157,200	173,800

The considerable variation in plant capital costs is due to site related factors, shared use of existing facilities in some alternatives, and high cost of effluent disposal in the Australian alternative.

Estimates were also made for Working Capital, Startup and Pre-operating Costs, and Interest during Construction. The Total Capital Investment estimate for each alternative is given below:

	Korea	Australia	California	British Columbia
Total Capital Investment ($ 000)	182,724	238,685	178,057	195,997

A C & F selling price to Korea of $430 per ADt was used for the study. From this, mill net selling prices were developed as given below:

	Korea	Australia	California	British Columbia
Mill Net Price per ADt ($ U.S.)	497.00	346.50	355.50	355.50

The high mill net selling price for the Korean alternative is due to duties, taxes, ocean freight, and selling expenses that are charged against imported pulp. Mill net prices were set so that the end user would pay the same price for pulp regardless of its origin.

Gross profit estimates (before depreciation and interest) at full production capacity and gross return on total investment were as follows:

	Korea	Australia	California	British Columbia
Gross Profit ($ 000)	23,337	30,349	21,407	30,503
Gross Return on Total Investment, %	12.8	12.7	12.0	15.6

The above gross returns on total investment are too low to be considered viable. Estimates were made of the effects on gross return on investment due to increased selling prices and increased pulp mill capacity:

	Korea	Australia	California	British Columbia
Selling price increased $50/ADt	18.5	17.1	17.9	20.9
Selling price increased $100/ADt	24.3	21.5	23.8	26.3
Capacity increased to 800 ADt/d	15.0	14.9	15.1	18.9
800 ADt/d + $50/t price increase	21.6	19.9	21.7	25.0
Capital cost reduced by $20,000,000	-	14 0	-	-

Statements of Earnings, Source and Application of Funds, and Balance Sheets were prepared for the four alternative cases under base conditions, base conditions plus a $50 per tonne price increase, and an increase in plant capacity to 800 ADt/d.

Computer calculations were made for the internal rate of return on equity for several alternatives as listed below. The internal rate of return is the discount rate required to equate the surplus cash generated each year up to year 15 to the equity investment. This should be at least 12% for a viable operation.

	Korea	Australia	California	British Columbia
Base Case (600 ADt/d)	-2.37	-4.84	-3.37	-0.11
Base Case plus $50 price increase	4.46	7.84	7.29	12.76
Capacity increase to 800 ADt/d	-1.67	3.24	2.38	9.06
Capital cost reduction to base case of $20,000,000		-0.57		

The internal rate of return rankings were relatively the same as those obtained by Gross ROI Calculations. The strong influence of a selling price increase on viability was again apparent.

The FOB price of softwood imported wood chips for export has increased by more than 60% over the price before December, 1979. The best hope for a viable wood pulp operation in Korea is to develop a procurement plan for domestic pulpwood on a self-sustaining basis. The Korean Government, the Dong Hae Pulp Company and the Ssangyong Paper Company should give this their top priority. If sufficient pulpwood can be generated domestically it is probable that an expansion as envisioned in this study would be economically viable, and the socio-economic benefits would be considerable.

The British Columbia alternative showed the strongest viability under all conditions of comparisons. A mill in British Columbia, possibly including some manufacture of bleached kraft pulp, should continue to receive joint venture consideration by Korean investors. The Government of British Columbia is taking steps to resolve the wood supply situation for this site.

The Australian alternative indicated attractive operating costs and an effort should be made to reduce capital costs pertaining to effluent disposal.

The California site has many good features. Communication should be continued with the principals in the event that the export chip market weakens in price or demand.

The large equity investments required for any of the offshore alternatives would probably require attracting foreign investors to participate in the project.

1.0 BACKGROUND AND JUSTIFICATION FOR THE STUDY

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1.0 BACKGROUND AND JUSTIFICATION FOR THE STUDY

The Republic of Korea has shown an outstanding growth in its economy; since 1962 its Gross National Product has grown at an average of 9.7 percent per year. Most of this achievement has been predicated upon the creation of a large manufacturing and export oriented industry, complemented by Korea's well-educated and industrious labor force. The present world-wide energy crisis and emerging economic slowdown will no doubt be reflected in a reduced growth rate for the Korean economy. Korea weathered the first "oil shock" in the mid 1970's extremely well compared to other countries, which gives one confidence in the resilience of their economy.

The growth of the paper industry in Korea has even exceeded that of the GNP, having increased 19.3 percent per year in the last ten years. In 1978 the total output of paper and paper products was 1,365,000 tonnes. Since 1970 the Korean paper industry has supplied the domestic needs for newsprint, printing paper, kraft paper, paper board and tissue paper. By 1981 the Korean Paper Manufacturers' Association projects that total paper output capacity will reach 2,440,000 metric tonnes per year, but they also point out that the problem of raw materials for the paper industry will also increase.

As of 1979, groundwood is the only pulp which Korea can produce domestically to meet its needs. All of the chemical pulp requirements are imported. The Dong Hae Pulp Company Ltd., a 300 metric tonne per day pulp mill, will commence operation in 1980 and even at full capacity will supply about one-third of the bleached chemical pulp requirements for that year, but present projections show that by 1983 this capacity will supply only a fifth of the needs for bleached chemical pulps.

Because Korea is an exporting nation, a relatively high percentage of its paper production consists of kraft paper and paper board for packaging. Much of the pulp requirements for paperboard can be furnished from waste paper, of which about 56 percent overall is collected in Korea. However, the end uses for kraft paper require high strength, and most of the pulp for kraft paper grades at the present time is imported softwood unbleached kraft pulp (UKP).

The exposed situation with regard to the supply of UKP for Korea is considered undesirable by the kraft paper manufacturers and the government. For this reason the government of the Republic of Korea requested UNIDO assistance in executing a pre-feasibility study to evaluate which of three options is better for the creation of a mostly nationally-owned UKP supply facility. The Government of the Republic of Korea designated the Dong Hae Pulp Company Ltd. and the Ssangyong Paper Company (chief user of UKP) to act together as the "Implementors" of this project. H. A. Simons (International) Ltd., were designated by UNIDO to be the Contractor providing the services and facilities necessary to conduct the study in accordance with the UNIDO Terms of Reference dated December 5th, 1978.

The three options named in the UNIDO Terms of Reference are given below:

Option A
Erection in Korea, either with entirely Korean equity capital or as a joint venture with Korean majority ownership, alongside the Dong Hae bleached kraft hardwood pulp mill, an unbleached kraft softwood pulp mill operating and using imported wood chips procured under long-term contracts from abroad.

Option B
Establishment in an overseas country with softwood resources of a new integrated timber production, wood extraction and pulp mill complex as a joint venture with Korean majority ownership which would export all or the major part of its production to Korea.

Option C
Acquisition in an overseas country with softwood resources of an integrated timber production, wood extraction and pulp mill complex as a joint venture with Korean majority ownership which would export all or the major part of its production to Korea.

2.0 OBJECTIVE OF THE PRE-FEASIBILITY STUDY

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2.0 OBJECTIVE OF THE PRE-FEASIBILITY STUDY

The objective of the pre-feasibility study is to furnish the Government and Paper Industry of the Republic of Korea with comparative financial information regarding several realistic alternatives which could be pursued to secure an adequate economic supply of unbleached kraft pulp. This comparative information should assist the Government and private industry to reach a decision for implementation.

3.0 THE INTERNATIONAL PULP MARKET

3.0 THE INTERNATIONAL PULP MARKET

3.1 World Production and Demand, Short Term

The state of the world pulp market in the 1970's has been strongly influenced by the world economy. The early years were influenced by a large pulp inventory held by the North American and Scandinavian pulp producers, reaching a total of about 2,700,000 metric tonnes in 1971 and 1972. This inventory started to dissipate in late 1972 and reached a level of about 500,000 tonnes in 1974. Pulp prices increased dramatically beginning in 1973 and peaked in 1975, generally over double the price of the 1950 - 1972 period, which had been characterized by very little fluctuation in prices. A world-wide recession commenced at about the time that pulp prices reached their peak. Paper markets reflected the recession, and the demand for market pulps decreased. Unfortunately some of the Norscan pulp producers did not react to the weakening market by reducing production, and again allowed a huge inventory of market pulp to accumulate. The total inventory this time reached close to 3,000,000 metric tonnes. Pulp prices held for 1975 and 1976, but disintegrated by as much as 30% in 1977. As pulp prices declined the market again strengthened, commencing early in 1978. The current market is strong, and pulp prices in the first quarter of 1980 have increased beyond former peaks. Canadian bleached softwood kraft pulps are now listed at $490 per air dry metric tonne, and pulp inventories are at the lowest level since 1974.

3.2 World Production and Demand, Long Term

The preceding section indicated the volatile nature of the world pulp market in the 1970's. Of course there is much more order to the pulp market when the longer term is considered.

There are many factors, including demographic and cultural, that influence the paper and board markets. The pulp market is inextricably linked to the paper and board markets, and the changing technologies and external forces that influence these markets. Factors that are becoming much stronger in recent years are those related to energy, availability and cost of raw materials and the environment. The emergence of hardwood kraft pulps as an important component of the market is an example of a combination of factors such as improved papermaking technology and widely available raw material. In North America the decline of sulphite pulp from 40% of the pulp market in 1950 to 5% in 1978, while sulphate grades increased from 25% to 64%, was due to emergence of new technology, a practically unlimited selection of raw materials and environmental factors. The recent rapid increase in themo-mechanical pulping (TMP) can be explained by technological and raw material factors, but the relatively high energy requirements for this type of pulp may eventually limit its usefulness.

3.2 Continued

The FAO World Pulp and Paper Consumption Outlook, Phase IV - World Outlook for Fiber Products (1979) in its Table 2.0.0.2 shows the World Outlook for Wood Pulps for the years 1960, 1970, 1980, 1990 and 2000. This table is reproduced on the following page (Table 3.2.1). From this table the following have been derived:

Percentage of Total Pulps	1960	1970	1980	1990	2000
- Softwood	82	75	72	70	69
- Hardwood	18	25	28	30	31
- Softwood unbleached kraft	24	24	24	23	22
- Softwood white pulp	26	25	23	22	20

From the above it can be seen that while softwood pulps are projected to decline from 82% of all pulps produced in 1960 to 69% by the year 2000, the percentage of softwood unbleached kraft produced will hold relatively constant. The percentage of softwood bleached krafts related to total pulps will decrease from 26% to 20% during this period. It would appear from the above that the end use requirements of products made from unbleached softwood krafts will continue to require the physical properties that only this pulp grade can offer, whereas bleached paper products can tolerate some substitution of hardwood pulps.

Table 3.2.1 WORLD OUTLOOK FOR WOOD PULPS

(Millions of Metric Tons)

	1960		1970		1980		1990		2000	
Softwoods	Cons.	Prod.	Cons.	Prod.	Cons.	Prod.	Cons.	Prod.	Cons.	Prod.
Mechanical/Semi-Chemical	16.9	16.9	24.8	24.8	30.0	30.0	42.0	42.0	62.1	62.1
Unbleached Kraft	13.8	13.8	24.6	24.6	32.3	32.3	40.8	40.8	53.1	53.1
White Pulp	15.3	15.3	26.0	26.0	31.2	31.2	38.6	38.6	49.3	49.3
Dissolving Pulp	1.9	1.9	2.7	2.7	2.7	2.7	2.8	2.8	3.0	3.0
TOTAL SOFTWOODS	48.0	48.0	78.1	78.1	96.1	96.1	124.1	124.1	167.5	167.5
Hardwoods										
Mechanical/Semi-Chemical	3.6	3.6	9.3	9.3	12.8	12.8	17.8	17.8	24.9	24.9
Unbleached Kraft	0.1	0.1	1.3	1.3	3.3	3.3	6.4	6.4	9.5	9.5
White Pulp	5.6	5.6	13.7	13.7	20.3	20.3	28.5	28.5	40.4	40.4
Dissolving Pulp	1.3	1.3	2.1	2.1	1.7	1.7	1.6	1.6	1.6	1.6
TOTAL HARDWOODS	10.5	10.5	26.4	26.4	38.1	38.1	54.3	54.3	76.4	76.4
Total Pulps										
Mechanical/Semi-Chemical	20.5	20.5	34.1	34.1	42.6	42.6	59.8	59.8	86.9	86.9
Unbleached Kraft	13.9	13.9	25.9	25.9	35.6	35.6	47.1	47.1	62.6	62.6
White Pulp	20.9	20.9	39.7	39.7	51.5	51.5	67.1	67.1	89.8	89.8
Dissolving Pulp	3.2	3.2	4.8	4.8	4.4	4.4	4.4	4.4	4.6	4.6
TOTAL PULPS	58.5	58.5	104.5	104.5	134.1	134.1	178.3	178.3	243.9	243.9

3.3 The Korean Pulp Market

The Korea Paper Manufacturers' Association maintains and publishes excellent records and forecasts for both production capacity, and the demand and supply of all the various papers and paperboard grades produced and used in the Republic of Korea. They also record and forecast pulp statistics. All of the information in this section of this report has been taken from KPMA published information.

At present about 70% of Korea's total paper consumption is for industrial papers (paperboards, kraft wrapping paper, sack kraft, etc.), the remaining 30% being cultural (printing, writing, tissue). Prior to 1974 more than half of Korea's consumption was in cultural papers. The rate of per capita consumption in 1978 was 33.5 kg versus 2.3 kg in 1960 and 13.9 kg in 1972. These should be compared with Japan at 134.3 kg and Canada at 191.4 kg. Paper demand projections for 1985 are 4,371,000 tonnes, of which 5% would be exported. This is a 3.3 - fold projected increase over the 1,339,000 tonnes consumption of 1978, which production was a 4.4 - fold increase over the 278,000 tonnes consumption of 1968.

From the above very brief statistics several facts emerge:

- Total paper consumption has increased at an impressive rate.
- Industrial paper consumption has shown the greatest growth rate.
- At 33.5 kg per capita consumption there is still plenty of opportunity for increased consumption of paper.

3.3 (Continued)

All of the above statistics relate to paper consumption. Until 1970 the quantity of imported papers was about 10% of consumption, this had decreased to 2% by 1978.

With such dynamic growth in the paper section the demands for all types of pulp and waste paper have also increased dramatically. The Korean government and the paper industry recognize that the paper industry is becoming too large and too important to the Korean economy to be vulnerable to shortages and instability of the world pulp market. They therefore have put top priority on increasing the self-sufficiency level of pulp. The Dong Hae bleached kraft pulp mill will begin operation in 1980. Even if it should reach its rated capacity of 105,000 tonnes in the first year it should be capable of meeting only 20% of Korea's demand for chemical pulps. Dong Hae will satisfy none of the UKP demand of 192,000 tonnes for 1980 and forecasted to increase to 263,000 tonnes by 1983.

The following tables have been taken from the Korea Paper Manufacturer's Association Report entitled "Pulp and Paper Industry in Korea 1979".

3.3.1 Paper Production Capacity

Table 1 Unit: M/T

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1962	174,100	47,000	26,600	25,000	27,500	48,000
1966	193,200	52,000	29,500	27,500	30,600	53,600
1968	344,600	80,000	50,400	45,500	108,700	60,000
1970	520,200	117,000	113,500	96,500	133,200	60,000
1972	592,100	117,000	153,000	105,000	157,100	60,000
1973	720,000	160,000	190,000	110,000	160,000	100,000
1974	840,000	160,000	190,000	110,000	280,000	100,000
1975	847,000	167,000	190,000	110,000	280,000	100,000
1976	904,000	167,000	164,000	168,000	336,000	69,000
1977	1,444,000	266,000	209,000	168,000	578,000	219,000
1978	1,543,000	266,000	218,000	168,000	672,000	219,000
1979	1,934,000	266,000	372,000	207,000	835,000	254,000

3.3.2 Paper Production

Table 2 Unit: M/T

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1962	82,360	37,647	20,492	8,053	7,136	9,032
1964	108,051	42,955	27,409	16,165	13,735	7,787
1966	164,059	54,700	40,560	20,125	30,261	18,413
1968	236,903	62,181	57,781	37,140	56,505	23,296
1970	329,530	101,647	74,344	47,928	83,585	22,026
1972	416,968	108,418	101,742	70,556	105,259	30,993
1973	511,187	119,573	137,220	83,524	133,024	37,846
1974	604,101	151,998	139,933	99,511	169,133	43,526
1975	661,722	155,181	131,932	87,228	236,116	51,265
1976	906,692	164,662	158,479	119,003	401,269	63,279
1977	1,124,746	198,254	187,151	148,835	508,348	82,158
1978	1,365,173	182,899	247,120	150,472	655,336	129,346

P. 4651A

3.3.3 Paper Exports

Table 3 — Unit: M/T

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1964	229	--	61	--	110	58
1965	496	--	81	--	101	314
1968	371	--	58	--	250	63
1971	317	5	3	--	259	50
1972	3,711	248	2,982	--	270	211
1973	36,657	--	18,278	7,085	3,499	7,795
1974	30,548	97	11,576	5,098	5,797	8,090
1975	36,167	4,403	10,882	--	8,655	12,227
1976	65,439	8,399	28,175	--	15,195	13,670
1977	52,834	4,230	27,815	1,164	13,995	5,630
1978	59,869	3,750	35,693	336	13,599	6,491

P. 4651A

3.3.4 Paper Imports

Table 4

Unit: M/T

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1964	12,490	10,294	410	1,101	132	553
1965	4,382	2,129	142	1,351	60	700
1968	33,335	21,186	5,396	2,010	3,037	1,706
1971	42,417	12,782	792	2,027	18,798	8,018
1972	37,449	5,330	797	14,491	10,877	5,954
1973	34,817	5,276	122	2,486	16,245	10,688
1974	25,225	--	144	285	16,950	7,846
1975	18,011	5	121	327	8,986	8,572
1976	23,926	--	787	412	5,388	17,339
1977	21,760	--	41	148	1,063	20,508
1978	24,728	--	1,073	53	6,699	16,903

P. 4651A

Table 5 Unit: %

3.3.5 Paper Exports Trend by Country

Year	Total	Japan	China	Philip-pines	Hong Kong	Mala-sia	Singa-pore	Indo-nesia	Burma	Iran	U.S.A.	Thai-land	Paki-stan	Saudi Arabia	Others
1972	100	3.5	0.3	9.1	67.8	1.2	0.6	9.3	--	--	--	8.2	--	--	--
1973	100	2.9	--	0.3	25.5	4.5	2.7	4.6	4.9	24.6	14.6	0.7	1.9	0.2	12.6
1974	100	63.9	--	--	--	0.2	--	--	--	--	30.2	--	--	--	5.7
1975	100	6.6	--	3.1	25.9	4.6	2.7	5.9	5.0	24.9	14.8	0.7	1.5	0.3	4.0
1976	100	3.5	1.8	7.5	32.3	4.3	12.4	8.4	6.7	7.9	9.7	1.7	0.5	0.3	2.9
1977	100	8.7	--	10.6	26.8	4.1	8.6	9.1	10.0	8.9	--	--	--	--	13.2
1978	100	2.0	0.4	14.2	33.8	3.9	7.5	7.6	--	10.3	0.2	1.3	3.0	0.5	15.3

3.3.6 Paper Consumption

Table 6

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1962	125,264	43,192	19,985	9,020	8,108	44,959
1964	137,655	48,140	27,080	17,267	13,860	31,308
1966	207,858	63,729	41,849	26,537	23,719	52,024
1968	278,532	83,367	60,005	44,903	60,124	30,133
1970	358,011	108,284	74,762	55,356	97,553	22,056
1972	445,666	111,916	101,608	83,756	117,259	31,127
1973	521,486	124,849	119,064	78,925	157,909	40,739
1974	572,820	148,254	113,786	90,381	179,963	40,436
1975	646,573	137,969	126,030	88,823	245,835	47,916
1976	884,572	168,270	139,295	119,740	388,051	69,216
1977	1,094,706	195,314	161,835	144,935	495,486	97,136
1978	1,339,205	179,028	213,100	156,193	651,276	139,608

3.3.7 Paper Demand Forecast

Table 7 Unit/1,000 M/T

Year	Total	Newsprint	Printing Paper	Kraft Paper	Paper Board	Others
1979	1,597	217	279	175	776	150
1980	1,887	261	321	191	934	180
1981	2,229	313	369	209	1,121	217
1982	2,650	376	424	228	1,361	261
1983	3,157	451	491	250	1,652	313

P. 4651A

3.3.8 **Pulp Supply & Demand Trend**

Table 8

Unit: M/T

	TOTAL			PRODUCTION			IMPORTS		
Year	Total	Groundwood Pulp	Chemical Pulp	Total	Groundwood Pulp	Chemical Pulp	Total	Groundwood Pulp	Chemical Pulp
1969	221,553	74,002	147,551	65,598	61,081	4,517	155,955	12,921	143,034
1970	239,695	89,854	149,941	80,204	75,391	4,813	159,491	14,463	145,028
1971	293,857	87,548	206,309	84,458	79,391	5,067	209,399	8,157	201,242
1972	313,793	83,349	230,444	84,284	79,143	5,141	229,509	4,206	225,303
1973	383,238	83,310	299,928	81,551	76,801	4,750	301,687	6,509	295,178
1974	373,453	112,069	261,384	96,774	92,161	4,613	276,679	19,908	256,771
1975	325,250	102,026	223,224	93,802	87,109	6,693	231,448	14,917	216,531
1976	368,381	95,603	272,778	105,793	89,696	16,097	262,588	5,907	256,681
1977	447,812	115,039	332,773	128,993	110,401	18,592	318,819	4,638	314,181
1978	509,169	100,190	408,979	98,925	93,805	5,120	410,244	6,385	403,859

P. 4651A

Table 9

Unit: %

3.3.9

Pulp Import Trend by Country

	Total	Japan	Canada	U.S.A.	W. Germany	Sweden	China	Finland	New Zealand	Thailand	Pakistan	Swaziland	Chile	Others
1964	100	0.8	1.1	85.0	0.8	5.2	5.9	1.1	--	--	--	--	--	1.2
1968	100	2.5	2.2	86.2	1.8	2.2	2.0	0.2	0.2	0.1	--	--	--	2.8
1970	100	8.6	7.3	70.1	0.6	4.6	4.6	--	0.3	--	0.2	0.4	--	3.3
1972	100	20.2	27.0	21.1	0.1	7.4	11.6	--	1.3	--	--	10.0	--	1.3
1973	100	14.9	31.4	15.9	--	14.6	4.9	--	1.1	1.1	--	6.7	--	9.4
1974	100	13.4	32.2	21.6	--	16.8	3.1	--	1.2	--	3.1	--	8.6	
1975	100	13.6	24.7	35.9	--	1.4	8.4	--	6.1	0.3	1.0	8.1	--	0.5
1976	100	22.6	10.0	30.6	--	0.1	5.5	--	7.2	0.2	--	15.2	6.5	2.1
1977	100	23.9	21.9	23.2	--	0.4	3.9	1.1	2.8	--	0.3	6.0	16.1	0.5
1978	100	15.9	26.1	18.0	0.3	12.1	4.6	1.1	3.7	--	0.1	5.5	10.7	1.9

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3.3.10 Pulp Demand Forecast

Table 10

Unit: 1,000 M/T

SPEC	1979	1980	1981	1982	1983
GP	168	201	241	289	346
SKP	23	28	33	40	48
BKP	251	294	343	401	472
UKP	173	192	212	237	264
Total	615	715	829	967	1,130

3.3.11 Rate of Waste Paper Used in Paper Production

Table 11

Unit: %

1971	1972	1973	1974	1975	1976	1977	1978
29.8	3[illegible].0	36.9	45.7	54.5	61.2	62.5	64.8

P. 4651A

3.3.12 Waste Paper Supply & Demand Trend

Table 12

Unit: M/T

	Supply Source	1975	1976	1977	1978
	Domestic	17,352 (14.8)	31,088 (16.1)	34,595 (16.0)	42,079 (16.6)
ONP	Import	99,768 (85.2)	161,213 (83.9)	180,537 (34.0)	210,823 (83.4)
	Total	117,130 (100.0)	192,301 (100.0)	215,132 (100.0)	252,902 (100.0)
	Domestic	5,152 (10.6)	89,059 (44.8)	115,312 (49.2)	195,465 (59.5)
OCC	Import	43,583 (89.4)	109,661 (55.2)	119,081 (50.8)	133,001 (40.5)
	Total	48,735 (100.0)	198,720 (100.0)	234,393 (100.0)	328,466 (100.0)
	Domestic	186,252 (83.6)	161,036 (75.0)	253,969 (79.4)	285,642 (80.7)
Others	Import	36,435 (16.4)	53,663 (25.0)	65,964 (20.6)	68,509 (19.3)
	Total	222,687 (100.0)	214,699 (100.0)	319,933 (100.0)	354,151 (100.0)
	Domestic	208,756 (53.7)	281,183 (46.4)	403,786 (52.5)	523,186 (55.9)
Total	Import	179.786 (46.3)	324,537 (53.6)	365,582 (47.5)	412,333 (44.1)
	Total	388,542 (100.0)	605,720 (100.0)	769,458 (100.0)	935,519 (100.0)

3.3.13 Waste Paper Import Trend by Country in 1978

Table 13 Unit: %

U.S.A.	Japan	Hong Kong	Canada	New Zealand	Others	Total
81.1	11.3	4.1	0.7	0.02	2.8	100

3.3.14 Waste Paper Recovery Rate

Table 14 Unit: %

Year	Paper Consumption	Waste Paper Collected	Recovery Rate
1971	411	96	23.3
1972	446	117	26.2
1973	521	86	16.5
1974	612	158	25.8
1975	648	209	32.2
1976	824	281	34.1
1977	1,094	404	36.9
1978	1,339	523	39.1

4.0 RAW MATERIALS FOR UKP PRODUCTION

4.0 RAW MATERIALS FOR UKP PRODUCTION

Unbleached kraft pulps prepared for market are used in a number of paper and board grades. Generally speaking these paper grades are used for packaging where high strength and utility are much more important than appearance and printing qualities.

Unbleached kraft pulps used for the manufacture of board grades are used primarily for liner board manufacture. Liner boards are used for the manufacture of corrugated boxes, in which strength and brightness of the containers are achieved by glueing a fluted or corrugated sheet of high "rigidity" between two board sheets or "liners" made from UKP. Both high bursting strength and tearing properties are required from liner boards. Since shipping is concerned with weight of packaging, the lightest practical board sheets meeting the strength criteria are used.

UKP pulps used for manufacture of multi-wall bags for shipment of heavy bulk commodities also require high strength. Paper made from these grades sometimes is given a special treatment on the paper machine that results in a micro-creping of the sheet. This improves the energy absorbing properties of the paper, which is particularly important when a bag loaded with dense material is dropped on a hard surface. An indication of the intrinsic energy absorbing properties of a pulp is sometimes obtained by multiplying the breaking length by the stretch, which produces a number known as T E A (tensile energy absorption).

4.1 Technical Reasons for Utilization of Coniferous Species for UKP

Since strength and utility are the primary requisites for unbleached market pulp grades, it is necessary to use raw materials and pulping processes that produce these properties. For any given pulping process the strength of the pulp that is produced reflects the morphology (dimensions) of the typical fibers of the wood species. If these fibers are short (1.0 to 1.5 mm) and thin-walled as they are for most hardwood species, the pulp will form into a sheet that is pleasing and uniform in appearance with a smooth surface but inadequate in strength. On the other hand pulps produced from coniferous or softwood species have much longer fibers with thicker fiber walls. Sheets produced from coniferous pulps have a less uniform appearance and surface but are much stronger. Grades requiring high strength properties must be made from coniferous pulps.

Even in coniferous pulps there is a wide range in fiber dimensions and strength properties related to species. Pulps made from species such as the pines and Douglas fir have long fiber length (4.0 mm) and thick fiber walls, which promote high tearing strength. Redwood fibers are unusually long (7.0 mm). Spruce, balsam fir and cedars tend to shorter fiber length (3.5 mm), but thinner fiber walls which give better bursting and tensile strengths. However, for practically all paper and board grades it is necessary to "refine" the pulps to improve the formation, tensile and bursting strength properties. The degree of refining given to a pulp furnish is controlled to give an optimum compromise in drainage properties, bursting strength, tensile strength and tearing strength. Tearing

4.1 (Continued)

strength usually decreases with increased refining because the refining cuts the fiber and reduces average fiber length.

It is felt that species used in any of the alternatives in this study would make good quality UKP, but admittedly there would be differences in the pulp properties. In the stock preparation and papermaking operation it should be possible to select the right type and degree of treatment so that the end product produced would be very similar in all cases.

5.0 GENERAL DESCRIPTION OF THE SULFATE (KRAFT) PULPING PROCESS

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5.0 GENERAL DESCRIPTION OF THE SULFATE (KRAFT) PULPING PROCESS

The sulfate pulping process is a greatly improved version of the soda process for cooking wood chips. The soda process (sodium hydroxide) was invented in 1851 by Burgess and Watt of England. In 1889 Dahl of Germany modified the soda process by the introduction of sodium sulfide into the cooking liquor. The sodium sulfide in the process resulted from the use of Glauber's salt (sodium sulfate) as a make-up for chemicals lost in the cooking process. The sodium sulfate was reduced to sodium sulfide during the chemical recovery process. The sodium sulfide modifies the action of the alkaline cooking liquor so that it is less degrading to the cellulosic constituents of the wood. This milder cooking action results in a higher yield of pulp and a stronger pulp. The increase in strength brought about by the sulfate process is responsible for the more popular name for this process - "kraft", the German word for strong.

Since the inception of kraft pulping it has steadily become the preferred process for producing chemical pulps. The sulfite process was the chief competing process, and is still used preferably for some specialty grades such as certain dissolving pulp, but for the manufacture of paper pulps the kraft process has virtually dominated the field. The universal appeal of the kraft process is due to the following reasons:

- the kraft process can pulp all species of hardwoods and softwoods
- the kraft process is tolerant of high bark and organic dirt contents
- the kraft process allows an efficient recovery of cooking chemicals and heat
- the kraft process minimizes water pollution
- the kraft process produces the strongest pulps

The chief problem of kraft pulping is the disagreeable odor of organic mercaptans and sulfides produced in cooking, and hydrogen sulfide produced during recovery processes. Modern technology has now eliminated most of this problem, and a properly designed and operated kraft pulp mill can now be built in practically any setting.

The kraft process for pulp production begins with the preparation of chips, either in sawmills from waste wood or in chippers from logs. The chips are screened to remove excessive quantities of sawdust which interferes with liquor circulation in the digester. The oversized chips are rechipped and returned to the flow to the digester.

Chips are admitted to a cylindrical pressure vessel called a digester, which can be either batch type or continuous. Cooking liquor containing sodium hydroxide and sodium sulfide is added to the digester, and the mass is heated to cooking temperature of about 170°C by circulating the cooking liquor through external heat exchangers. After sufficient cooking time at temperature the contents of the digester are blown under cooking pressure to a blow tank. The chips have now been reduced to a pulp, and the less desirable chemical components of the wood (lignin, resins and other extractive material) have been dissolved by the cooking liquor which is now called black liquor because of its color. The chemicals in the cooking liquor have been altered by their reaction with the dissolved material, and these chemicals must be returned to their original state before they can again be used for pulping.

The pulp in the blowtank is washed free of spent cooking chemicals, which are added to the black liquor. Washing is accomplished counter-currently, either on external drum washers or by diffusion washers on top the blow tank.

The washed pulp is screened to remove uncooked fiber bundles, and is then ready for centrifugal cleaning in the case of UKP. The cleaned pulp is formed into a continuous sheet on a continuous wire mesh belt loop, and the sheet is dried by hot air or by contact with steam heated cylinders.

The dried pulp sheet is cut into rectangular sheets. These sheets are stacked in piles of about 500 kg each, and the pulp stacks are pressed, wrapped in a pulp wrapper, and tied with baling wire. The baled pulp is either stored in a warehouse or moved directly to a railway car or an ocean vessel.

The black liquor resulting from separation of spent cooking liquor from the pulp is evaporated in multi-effect evaporators and concentrators to a concentration of about 65% solids.

This concentrated black liquor is burned, as one would burn fuel oil, in a chemical recovery boiler. The organic part of the black liquor is combusted to carbon dioxide and the inorganic residue is converted to sodium carbonate and sodium sulfide. The inorganic residue flows from the bottom of the furnace as a chemical smelt. The smelt is dissolved in water to produce "green" liquor.

Green liquor is reacted with calcium hydroxide to produce a calcium carbonate "mud" and white liquor, which consists of sodium hydroxide and sodium sulfide. The white liquor can now be used for cooking a fresh supply of chips. The calcium carbonate mud is thickened and burned in a kiln to drive off the carbon dioxide so that the mud is converted to calcium oxide. The calcium oxide is reacted with water in the slaker to form calcium hydroxide, which reacts with the sodium carbonate in the green liquor to form the calcium carbonate.

To make up for chemicals lost in the process fresh sodium sulfate (salt cake) is added to the chemical recovery process.

6.0 GENERAL DESCRIPTION OF WOODYARD AND CHIPPING OPERATIONS

6.0 GENERAL DESCRIPTION OF WOODYARD AND CHIPPING OPERATIONS

In modern kraft pulp mills the chief raw material is received as waste wood chips from sawmills and plywood mills, or as pulp logs with the bark intact.

In the case of waste wood chips, the chips are usually screened at the source to remove excessive sawdust and oversized material. The screened chips are loaded into railway cars or road transport trailers, and are transported to the pulp mill or to an export terminal for loading bulk carriers for ocean transport.

Chips received at a pulp mill by rail or trailer are weighed. The chip cars or trailers are emptied, usually by elevating one end of the car so that the chips can flow by gravity into a pit fitted with a drag conveyor. The drag conveyor elevates the chips onto a belt conveyor which transports the chips to an outdoor storage chip pile. Alternatively the chips can be transported to a screen room for further screening, or in some cases the chips can be transported directly to the digester.

In the case of a pulpmill receiving pulp logs, in modern mills these logs are transported in tree lengths of about 10 meters, or in some cases long logs of about 6 meters. These long logs are carried to the pulpmill in a bundle by a tractor or prime mover. The load is weighed at the pulpmill, and the log bundle is unloaded by a stacker or similar machine which removes the entire bundle in one load. The logs can be unloaded to a log storage area or directly onto a log deck feeding a barking drum. There is usually a slasher positioned between the log deck and barking drum for cutting the logs into two or three meter lengths.

The logs are fed dry into a barking drum which is a cylinder of heavy steel construction. The logs are fed to the drum parallel to the axis of the drum. The drum is slotted and also had ribs around the inner circumference. Rotation of the drum elevates the logs and causes them to tumble and abrade upon each other and the inner surface of the drum. This action causes the bark to fracture and separate from the wood. The bark drops through the drum slots and is fed to a "hog" which reduces the particles to suitable size for feeding a hog fuel power boiler. A significant part of the boiler heat can be obtained from this hog fuel.

In the case of coastal operations the procedure is somewhat different in that the pulp logs are usually transported in rafts or booms pulled by a tug, or more recently in log barges. Since these logs are wet, the bark from the drum barker must be pressed before it can be used to fuel a boiler.

After barking the logs are chipped by a multi-knife disc chipper. Chips may be transported from the chipper to outside storage, to a screen room, or directly to the digester.

Chips in modern mills are screened first in a disc screen which removes the oversized material, and frozen chunks of chips during winter. The next operation is some form of screening which allows the fines to be separated from the desirable sized chips. Fines may be collected and stored for feeding back into the screened chips at an acceptable percentage. Oversized material is treated in a rechipper and the reduced chips returned to the chip feed.

Chips transported to outside storage are built into conical piles. Chips are reclaimed from storage by pushing by bull-dozer or front end loader over a pit with a drag conveyor. This conveyor elevates the chips onto a belt conveyor feeding the screen room or directly to the digester.

7.0 GENERAL DESCRIPTION OF OVERSEAS SHIPPING OPERATIONS FOR CHIPS

7.0 GENERAL DESCRIPTION OF OVERSEAS SHIPPING OPERATIONS FOR CHIPS

The overseas shipment of chips commenced in a regular way in 1964 in Oregon at Coos Bay. The overseas shipment of chips was brought about because of the rapidly expanding Japanese pulp and paper industry accompanying Japan's postwar industrial growth. The Japanese paper industry had outgrown its domestic fiber source, and begun importing logs from the Pacific Northwest. At that time the Pacific Northwest had excessive quantities of unused sawmill and plywood wastes which were being burned. It was inevitable that the shipment of these wastes to Japan should be tried. Since that time chip loading installations have been constructed in such places as Alaska, British Columbia, Australia, New Zealand, Malaysia, New Brunswick, Washington State, New Guinea and California. Chips are even being shipped to Scandinavia from the southern United States.

Chips are transported to the export facility and unloaded. They are usually disc screened to remove oversized material. After screening the chips are sent to outdoor storage piles.

The chips are reclaimed from outdoor storage as they would be for a pulpmill. They then are carried by belt conveyor to the dock, where they are transferred to a shiploader which travels the length of the dock. From the shiploader the chips are blown into the ships hatch at rates up to 1000 tonnes per hour. The ship loader moves between hatches so that the vessel can remain in one spot. A large vessel can be loaded in a 24 hour period. Normally a ship will hold up to 14,000 BDUs and will make about ten voyages per year. A brochure describing the Fibreco chip handling and loading facility in Vancouver can be found in the flap inside the front cover.

Unloading of the chips at the pulpmill depends on the type of chip vessel being used. Some are equipped for self-unloading, others have to be unloaded by cranes on the dock.

8.0 CHIP PURCHASE POSSIBILITIES

8.0 CHIP PURCHASE POSSIBILITIES

In practical terms, at this time the possibilities for purchases of chips for UKP manufacture in Korea are very limited. Softwood chips from the traditional suppliers are in great demand, barring a worldwide economic recession there cannot be an optimistic prediction for the future. There are many factors at work in today's world that have strong influences on the supply and cost of softwood chips for export.

About 40% of the world's forests are said to be softwood, of this about 60% are in the U.S.S.R. North America has 25% of the softwood resources and Europe less than 10%. Asia, South America, Africa, Australia and New Zealand have the remainder of the softwood resources.

At this time the U.S.S.R. cannot be looked to for resources, in spite of the tremendous potential this area offers. There are many reasons for this, but an in-depth analysis of this situation is beyond the scope of this study. The Japanese paper industry has received some pulpwood and chips from this source, but overall the amount has been disappointing and the supply has not been reliable.

Some softwood chips are being exported from New Zealand to Japan, but there is no surplus for export to Korea. Long term it is expected that all of the softwood chips will be used in the domestic industry for pulp or newsprint. Australia has been shipping hardwood chips to Japan and will continue to do so. Softwood plantations coming to maturity will undoubtedly be used domestically for production of market pulp and newsprint.

South America and Central America are potential sources of softwood chips but the shipping distances to Korea would make the landed cost of such chips in Korea unattractive.

At this time it would appear that the only practical source of softwood chips to Korea would be the Pacific Northwest of the United States and Canada. The Pacific Northwest from northern California to Washington has been the leading supplier of softwood chips to Japan, which has been the only customer of note. At the time this report is being written the suppliers are having great difficulty fulfilling their contractual obligations for chips to Japan. However, the volume of these chip shipments are so great that should Japan's industry suffer a decline, as it did in the 1975 - 1978 period, chips could become in surplus again. For the purposes of this study it has been assumed that chips will be available from the Pacific Northwest, but it must be emphasised that this is only an academic assumption. The suppliers of the Pacific Northwest since the first of the year have been in new negotiations with their Japanese customers and are asking for substantially higher prices FOB their shipping points. These prices have not yet been accepted by the Japanese.

Canada (British Columbia) has only recently become a factor in the supply of softwood chips to Japan. A modern export facility for chips has been in operation in Vancouver since October, 1979. About 400,000 BDU per year are contracted to Japanese pulp mills for the next 10 years, and the facility can ship 750,000 BDUs per year. For the purposes of this study it has been assumed that at least part of Korea's demand for a UKP mill could be filled from this source.

9.0 DESCRIPTION OF ALTERNATIVE CASES FOR COMPARISON IN THE PRE-FEASIBILITY STUDY

9.0 DESCRIPTION OF ALTERNATIVE CASES FOR COMPARISON IN THE PRE-FEASIBILITY STUDY

The objective of this study is to present financial comparisons of realistic alternatives for supplying UKP to the Korean Paper Industry. For this reason the study was limited to only those alternatives that appeared to be possible to implement if they showed favourable financial indications.

The expansion of the Dong Hae pulpmill by the addition of a UKP pulpmill would have considerable appeal if proven viable, which to a great extent would depend on obtaining an economical source of raw materials. The other alternatives in this study are all "Option B" cases described below. It was not possible to locate an "Option C" case, probably because the present world-wide pulp market is booming, and even normally marginal operations are presently profitable.

It will be noted that in all cases the pulp mill is sized for 210,000 air dry tonnes per annum, or a nominal average production of 600 air dry tonnes per day capacity. The Option B alternatives would have difficulty in obtaining sufficient raw materials for larger capacity mills. On the other hand, smaller capacity mills producing market pulp are considerably less profitable because of higher fixed costs per tonne. The entire production of 210,000 ADt/a of UKP could easily be used for papermaking in Korea.

9.1 CASE 1:

Construction of a UKP Pulpmill at Onsan, Korea by expansion of the Dong Hae Pulpmill

The Dong Hae bleached kraft pulpmill, rated at 105,000 tonnes per year production, is scheduled to begin operation in late January of 1981. It is the only chemical pulpmill in the Republic of Korea and will supply less than 20% of Korea's chemical pulp requirements when it reaches its rated production capacity. By standards of the modern pulp industry this mill is small. However, the Dong Hae mill was purposely made small so that the wood resource could be supplied entirely by the residues from Korea's plywood and sawmill industries. Both of these industries depend on imported logs as their primary resource. Ultimately, the extensive reforestation efforts of Korea will begin to pay dividends and domestic wood resources should become available on a self-sustaining basis.

The Dong Hae pulpmill is located on the south-eastern coast within the Onsan Industrial Complex in Kyongsan-namdo. The mill site contains approximately 660,000 square meters, most of which consists of a peninsula jutting into the sea. The site is 450 Km from Seoul and about 6 Km from the Ulsan Industrial area and is serviced with an industrial water supply and an excellent highway. A rail connection is not provided at present but can easily be added when required. The Northeast corner of the site is used for chip receiving and storage. All of the process lines of the mill were laid out for expansion by mirror image. The mill is fully supplied with non-process facilities such as a

9.1 CASE 1 (Continued)

head office building, a canteen, a workshop and stores. A raw water storage pond is also supplied. There is ample room for expansion on the site, and the site has already been graded to accept a duplication of the original mill. Soil conditions for foundations are quite acceptable, particularly in the areas of greatest cut removal. Some piling (286 piles ranging between 4 m and 9 m) was used in preparing foundations for the mill, most of these were in the chip silo area.

9.2 CASE 2

Construction of a UKP Pulpmill at Beerburrum, Queensland, Australia

Australian Paper Manufacturers Limited (APM) is the largest Australian producer of woodpulp, paper and paperboard. APM supplies about 75% of the total Australian requirement for paper and paperboard, with a total installed capacity of 850,000 tonnes per year. APM has also expanded into production of related forest products such as lumber, plywood, housing frames, tissue products, and molded pulp products. They are also active in plastics, packaging equipment and industrial commercial waste collection.

APM has established pulpwood plantations covering over 70,000 hectares in three Australian states, and are pursuing a progressive forest management policy. They have planted over 150 million pine and eucalypt seedlings, four seedlings for each tree that is harvested.

9.2 CASE 2 (Continued)

Extensive pine (pinus elliottii) plantations (20,000 hectare) have been established by APM in the south-east of Queensland, specifically for the purpose of establishing a kraft pulp mill in that area. These APM plantations will yield 500,000 m^3 per year on a sustained basis. The holdings of APM would be supplemented by pulp wood from the 100,000 hectares of State Forests of Queensland and sawmill waste of the area. APM has established that the combined wood resources of the area can easily support a 210,000 tonnes per year unbleached kraft pulp mill.

APM has studied the feasibility of construction of a pulp mill in Queensland since 1973 and are proceeding with planning to implement this project at an early date. The Australian market has a limited growth rate, therefore APM is looking to the export market for the utilization of these resources.

Although APM can implement a pulp project without outside equity participation, they have not ruled out the possibility of a joint venture. The Ssangyong Paper Company has explored the possibility of participating with APM in an unbleached kraft pulp joint venture for this project.

Research by APM has shown their pinus elliottii to be an excellent raw material for kraft pulp manufacture. They have compared the properties of UKP from their resource with several market pulps and are satisfied that their product would have good market acceptance.

9.2 CASE 2 (Continued)

APM has already secured a site just south of Beerburrum for their kraft pulp project. This site is serviced by both the Bruce Highway and the North Coast Railway for delivering raw materials to the mill and transporting the export pulp to the Port of Brisbane. The water supply for the project would be supplied by pipeline from an impoundment of the Caboolture River at a distance of about 15 km from the mill site. The assistance of the Government of the State of Queensland would be sought for the supply of the necessary infrastructure, which is required for the development of this area by other industries also. Electrical power would also be available with assistance from the Queensland Government, although the pulp mill would generate most of its own needs. APM would provide the best in economically achievable modern practice to control odorous gases and particulate emissions. They would also insure that the plant would incorporate the most applicable internal and external treatment processes to minimize the contaminating effects of the treated waste waters. APM expect to pipe the treated water overland to a diffuser outfall extending about 1 km into the sea.

Other requirements such as labor availability are also met in the Beerburrum site. Queensland is Australia's most stable state for freedom from labor unrest. APM's Petrie paper mill, which is near to the Beerburrum site, has not lost production time since its startup in 1957.

9.3 CASE 3

Construction of a UKP Pulpmill at Eureka, California

The Samoa Peninsula at Eureka, California, is recognized as a prime area for siting a pulp mill. This is partially attributed to the unique hook-shaped curvature of the peninsula which creates Humboldt bay on its eastward shore, creating an excellent deepwater sheltered harbor with direct access to the Pacific Ocean.

Two bleached kraft pulp mills are presently located on the Samoa Peninsula in the Fairhaven Industrial Zone. These are the 600 ton per day mill of Crown - Simpson and the 590 ton per day Louisiana Pacific mill. The wood furnishes for these two mills are supplied as waste wood chips from the extensive redwood and Douglas fir sawmill industry in the Northern California - Southern Oregon area.

The North Coast Export Cooperative, Inc. was founded in 1969 and incorporated in 1971. The members of this cooperative unit are independent sawmill companies in the area who up until that time had difficulty in marketing their wastewood chips, or if they could sell their chips locally they were inadequately compensated. The Japanese pulp industry had become an eager buyer for waste wood softwood chips, and the North Coast Export Cooperative was formed to take advantage of this attractive market. A chip exporting facility was constructed at the Fairhaven site, in between the two existing pulpmills. The terminal was completed in 1975 and the first shipment made at that time. Since then the N.C.E.C. has been steadily shipping; in 1979 they shipped approximately 280,000 BDUs to Japan.

9.3 CASE 3 (Continued)

The North Coast Export Cooperative, Inc. is owned by six sawmill companies, three of which together own over 75% in total. The member companies are listed below:

1. Arcata National Corporation, a public company listed on the New York Stock Exchange. They hold about 20% ownership in N.C.E.C., Arcata is also engaged in the printing business and are second largest in the United States.

2. Miller Redwood Corporation. This is a wholly-owned subsidiary of the Stinson Lumber Co. Miller owns about 30% of N.C.E.C.

3. Eel River Sawmills Inc., who hold 26% of N.C.E.C.

4. Reservation Ranch, manufacturing plywood and green veneer. An 8% owner of N.C.E.C.

5. Alexander Timber Products. Alexander does not manufacture lumber or plywood, they are engaged in chipping of whole pulp logs. They own 8% of N.C.E.C.

6. Halversen Industries. A large timberland owner, Halversen recently sold its sawmill to N.C.E.C. who will convert it to whole log chipping. Halversen owns 8% of N.C.E.C.

The last three companies named above own in total about 200,000 acres of timberland (80,000 hectares).

9.3 CASE 3 (Continued)

The N.C.E.C. site consists of about 130 acres of which 10 acres front the Pacific Ocean and cannot be used industrially. The balance of the site is zoned for heavy industrial application. The water frontage on Humboldt bay amounts to 1,800 feet, and another 400 feet of shoreline are controlled by N.C.E.C. The site is serviced by an excellent highway, over which all of the chips for export are brought in by truck. The Northwest Pacific rail line (a Southern Pacific subsidiary) passes through their property.

An industrial water supply pipeline passes through the N.C.E.C. site, this line currently supplies the water for the two existing pulp mills. N.C.E.C. have water rights to about 8 million gallons per day (30,280 cubic meters) and claim that they could obtain rights to more water if needed. This water is supplied by the Ruth Dam on the Mad River, and currently amounts to a supply of 60 million gallons per day (227,000 cubic meters). A natural gas pipeline also runs through the site and can be tapped for industrial purposes.

The N.C.E.C. is currently shipping all of its chips to Japan on 10 year contracts which expire in 1985 and 1986. The wood species mix currently is approximately 60% Douglas fir, 20% redwood and 20% California tan oak and alder. All chips are currently being obtained within a 100 mile (160 km) radius from the shipping point, but N.C.E.C. believes that a further supply of chips is available at higher cost by extending the radius. N.C.E.C. would have to obtain approximately 110,000 additional BDUs to support a 210,000 ADt/a UKP mill.

9.3 CASE 3 (Continued)

In 1977 the North Coast Export Company incorporated the Humboldt Bay Power Corporation. The purpose of this company is to generate electrical power (40 MW) from steam produced in a boiler fueled by sawdust, hog fuel and domestic refuse. The electrical energy generated will be fed into the Pacific Gas and Electric grid. Since there will be no use for the low pressure steam exhausted from the generator, this steam will be condensed. The current capital cost of this project is estimated to be $80 million dollars. The wood waste for this venture will be trucked in from a radius of 65 miles. At this time no specific part of the site has been designated for the power plant construction.

N.C.E.C. have negotiated in principal a contract with the State of California for a $400,000 grant to enable trials to be made to determine whether Refuse Derived Fuel from the Humboldt County area can be used for this project. This material would furnish 10% of the fuel requirements, the balance would be bark and sawdust. N.C.E.C. expect to complete this contract in 1980, commence work on financing in mid-1980, and begin construction in 1981.

North Coast Export Cooperative feel that in the long run they will be better served by converting their chips to market pulp at their site than by shipping them overseas for conversion to pulp. They had considered the manufacture of TMP at their site, but now realise that their chip species are not the best raw material for TMP manufacture. The TMP process is a large consumer of electrical energy but uses very little steam. It was pointed out to them that their site is well-suited to the manufacture of UKP for the following reasons:

9.3 CASE 3 (Continued)

1. The species available would make a good quality UKP for market.
2. UKP could use some of the low pressure steam for process that will otherwise be wasted.
3. UKP manufacture also produces a high pressure steam in the recovery boiler, this could be integrated with the power project.
4. The water requirements for UKP are the least for any chemical market pulp, and the available water supply to the site is minimal.
5. Water pollution for UKP would be the least of all chemical pulp processes.

It must be emphasised that the environmental treatment requirements for a mill located in California would possibly be the most stringent of any location in the world, and a few of the local population can be expected to resist such a venture on environmental grounds. The two existing pulp mills produce bleached kraft pulp and were constructed prior to the adoption of technology now available for internal and external treatment, and thus any new proposal for kraft pulping may suffer somewhat because of prior local experience. However, on the positive side, Humboldt County is said to be very eager for new industry, and there would probably be a large majority of the population in favor of construction of a kraft pulp mill if it were properly designed and operated from environmental considerations.

9.4 CASE 4

Construction of a UKP Pulpmill at Ocean Falls, B.C.

Canada is the major producer of market pulp in the world, and British Columbia accounts for half of Canada's exports of market pulp. British Columbia, on the west coast of Canada, is ideally located for trading with the countries of the Far East. There are actually two distinctly different areas in British Columbia, the coastal region and the interior region. The coastal region was developed first because of its virgin stands of high quality saw timber, and its access to tidewater shipping. Since about 1960 the greatest development in British Columbia has been in the interior (Prince George, Kamloops, Quesnel), and the pulpmills in that area are furnished almost entirely with waste wood chips from the interior sawmills, which are designed for wood of smaller diameter.

At the present time the forest industry in British Columbia is undergoing a reappraisal of its resources and their allocation, both by the Government agencies of British Columbia and the private industry. Several pulp mill expansions have been announced, and one 720 ADt/d expansion is actually underway at Prince George. Of course the pulpmills compete with newsprint mills for raw materials,, and this industry is also undergoing several major expansions in British Columbia.

The Ocean Falls site midway up the coast was one of the earliest to be developed in British Columbia, and is now producing ground-wood pulp and about 100,000 tons per year of newsprint in two paper machines. The present operation was purchased by the

9.4 CASE 4 (Continued)

Government of British Columbia from the Crown Zellerbach Company in 1973 after that company announced that they were going to shut down the operation because of its obsolescence and poor profitability. The Government still operates the mill through its Crown Corporation, B.C. Cellulose Ltd., but the mill has remained unprofitable even in a strong newsprint market. The Government of British Columbia would like to keep the community of Ocean Falls alive, but they realize that a stronger industry is required long term. The plant could be modernized for newsprint production from TMP, but there is no connection with an outside electrical utility, and electrical energy produced from fossil fuels is not an attractive prospect.

In this study it has been assumed that the newsprint operation at Ocean Falls would be shut down and the site redeveloped for UKP production. Wood for the pulpmill would be obtained from a largely undeveloped mid-coast forest area. In this study the services of a B.C. forestry consultant, T & S Consultants, were utilized for developing a procurement plan for resources and estimating their cost. There is no assurance that this plan could be implemented since it would require the Forest Ministry to allocate a supply of logs to this project. Part of these logs would be processed through sawmills with their waste chips directed to the pulpmill, but about 75% of the logs would be converted to chips at the pulpmill. The Government of British Columbia is very anxious to improve the economic position of Ocean Falls, and there are indications that the Minister of Economic Development would give strong support to a viable project.

9.4 CASE 4 (Continued)

There would be benefits to a kraft mill locating on the Ocean Falls site. The site is on tidewater, and ocean vessels can be loaded directly. There is a work force and community in place to supply experienced workers and mechanical tradesmen. The mill has its own water supply created by a dam, and there is in place a hydro-electric generating facility that could be used to supply at least half of the power requirements at very low cost. The wood species supplied to the pulpmill should make a competitive UKP market pulp, similar species are currently being used at the Eurocan UKP mill at Kitimat.

10.0 DESCRIPTION OF PROCESS AND LAYOUTS FOR ALTERNATIVE CASES

10.0 DESCRIPTION OF PROCESS AND LAYOUTS FOR ALTERNATIVE CASES

10.1 CASE 1
Expansion of the Dong Hae Pulp Mill

The mill site is illustrated in Drawing D-4651-250-001 Principal mill departments are arranged on a linear axis parallel to the existing Dong Hae mill, as this site has already been cleared and levelled. This arrangement also facilitates a convenient flow of materials from the input of chips at the eastern end to the pulp warehouse at the western end.

10.1.1 Wood Storage and Preparation

Annual imported pulpwood chip requirements of the 600 air dry metric tonnes per day unbleached kraft mill would be in the order of 400,000 BDU (1,008,000 m^3). For this study it has been assumed that all wood requirements would be imported. As shown on drawing D-4651-864-001, chips would be delivered to the mill site by chip carriers discharging at a specially-constructed wharf to the north and immediately adjacent to the site. The chips would be unloaded from the ship by a bucket unloader, passed over a rotary disc screen and the accepts fed to a rubber belt conveyor. Any dunnage or rejects would be stored in a pile to be dealt with later.

The accepted chips on the conveyor would be transferred to another conveyor at right angles and the chips distributed

10.1.1 Wood Storage and Preparation (Continued)

in two separate storage piles by chip flingers. The individual chip piles would facilitate segregation by species or age.

Chips would be reclaimed from the piles by bulldozer into·a reclaim hopper and then on to another conveyor leading to the screen roon. The use of two variable speed reclaims would allow the metered blending of chips from the two storage piles if desired. The chips would pass over a rotary disc screen, the accepts going to a vibrating screen, and the oversize rejects to a rechipper. The accepts from the vibrating screen would pass directly to the digester conveyor, while fines would be blown to a bin. The fines would be metered on to the digester conveyor at an acceptable rate. The coarse oversized material from the ship unloading area would be hand-sorted and transported to the re-chipper.

10.1.2 Pulp Mill

Chips would be fed by belt tripper to one of eight batch digesters fitted with steam packers to compact the chips. Digesters would be equipped with capping valves and would be fully instrumented to permit control of liquor and steam flows at the correct intervals and to indicate the correct blow time. The cooked stock would be blown to a blow tank having four hours storage at full capacity. Blow heat recovery equipment would be installed to produce hot water for pulp washing and other uses. A turpentine recovery system would be provided. In keeping with the practice at the existing Dong Hae pulp mill, non-condensible vapours from the blow would not be collected.

10.1.2 Pulp Mill (Continued)

Stock from the blow tank would pass through a junk trap to remove metal and would then flow to primary pressure knotters. Rejects from the primary knotters would be passed to a secondary knotter, the accepts returning to the main stock flow, while the rejected knots would pass to a knot tank for subsequent recooking. Provision would also be made to dewater rejected knots for emergency disposal elsewhere.

Accepted stock from the knotters would pass through a conventional four stage brown stock counter-current washing system and would discharge to a 200 t unscreened high density storage chest. The four-stage counter-current washers would minimize soda losses while conserving wash water.

The pulp would be pressure screened over primary, secondary and tertiary screens; the rejects from the tertiary screen would be thickened and refined, passing back into the tertiary screen. The main stock flow would be cleaned in a four-stage centrifugal cleaning system, thickened on a rewasher decker and pumped to a 200 t high density storage tank.

From the high density storage, the pulp would be pumped to the machine chest and then to a flowbox feeding the fan pump of the pulp machine. The pulp drying machine would consist of an open headbox and fourdrinier wet end, one suction and two grooved presses, a cylinder dryer section followed by an automatic cutter and layboy. The machine would be driven by a sectional electric drive.

10.1.2 Pulp Machine (Continued)

Stacked pulp sheets from the layboy would be conveyed to a finishing system consisting of a hydraulic press, automatic wrapping and tying equipment and an automatic stacker and weighing scale. The finished bales would be conveyed to the pulp warehouse where lift trucks would be used for handling, storage and loading of trucks for transport elsewhere.

10.1.3 Chemical Recovery System

The flow diagram of the chemical recovery system is illustrated by drawing D-4651-864-002 and sited as shown in drawing D-4651-250-001. Weak black liquor from No.1 seal tank would be filtered and concentrated up to 52% solids in a six effect evaporator plant. The strong black liquor would be further concentrated up to 64% solids in two concentrators, passing to a saltcake mix tank for the addition of saltcake make-up as required. Relatively clean condensate from No.1 surface condenser would be used in process, while foul condensate from No.2 condenser and the concentrator surface condenser would pass to the evaporator seal tank for eventual stripping.

The heavy black liquor from the saltcake mix tank would be burned in a low odor type recovery boiler fitted with supplementary oil burners, sized to generate full boiler steam output, if required. A dry bottom, two-chamber electrostatic precipitator would recover saltcake from the flue gases and would be designed to maintain particulate emissions at less than 0.25 grams per standard m^3 dry.

10.1.3 Chemical Recovery System (Continued)

The recausticizing plant and lime kiln would be located as on drawing D-4651-250-001 and would be of conventional design. Green liquor from the smelt dissolving tank would be pumped to the green liquor clarifier, from which the underflow would be filtered on the green dregs filter, and the dregs stored with slaker grits for landfill disposal. The overflow green liquor would be causticized in the slaker and causticizers, then passing to the white liquor clarifiers. The clarified white liquor would be pumped to digester storage tanks for re-use in cooking. The mud underflow would pass to the lime mud washer, the recovered weak wash white liquor would be re-used for smelt dissolving and scrubbing the vent stack of the dissolving tank. The washed lime mud would be dewatered on a lime mud filter and burned in a rotary lime kiln fueled with Bunker 'C' oil. Odorous gases from the stripper column and other sources would be burnt in the lime kiln as shown on drawing D-4651-864-003. Make-up limestone would be added to the kiln feed as required. The lime kiln stack gases would discharge through a venturi scrubber and the induced fan to a stack. The precipitator would be designed to remove particulate emissions below 0.25 grams per standard m^3 dry.

10.1.4 Steam and Power Generation

The recovery boiler, power boiler and turbine generator would be located as shown on drawing D-4651-250-001. Provision would be made for the installation of a 16 megawatt turbo-generator

10.1.4 Steam and Power Generation (Continued)

which would supply all of the electrical power requirements. The electrical system for the UKP mill would be integrated with the existing mill, which has a connection with the outside electrical utility.

Steam at 64 kg/cm^2 and 450°C would be supplied from the recovery boiler rated at 150 tonnes per hour and a power boiler rated at 95 tonnes per hour. Steam would be distributed to the turbo-generator with an extraction pressure of 12.5 kg/cm^2 and a back pressure of 4.5 kg/cm^2. A dump condenser cooled by sea water would be provided for unbalanced conditions. Conventional ion exchange equipment would be provided for feedwater treatment.

The power boiler would burn fuel oil, and additional storage and unloading facilities would be provided to augment the existing system in the Dong Hae mill.

10.1.5 Water Supply and Distribution

Water would be supplied from the existing Dong Hae raw water storage pond. The supply to this pond is through a 900 mm diameter line capable of delivering up to 120,000 m^3/day; this supply is deemed adequate for both pulp mills.

Water consumption for the new 600 air dry metric tonnes per day mill is estimated at 34,000 m^3/day and additional clarifier and filtration capacity would be provided to satisfy this criterion.

10.1.6 Effluent Treatment

As in the existing Dong Hae mill, primary clarification treatment and sludge thickening would be provided. Solids would be disposed of by landfill, and the aqeous effluent would be passed to the ocean through an underwater diffusion system.

10.1.7 Fire Protection

The mill would be protected by a fire system designed in accordance with established standards and requirements. The fire protection system would include ring mains, hydrants and hoses at necessary locations. The dry end of the machine room, chip feed to the digester, the extended pulp warehouse and the turbine generator would be covered by a sprinkler system. The generator would also be provided with a carbon dioxide smothering system. Two fire pumps, one driven by an electric motor and the other by a diesel engine would be provided. These pumps would draw water from the existing raw water storage pond and deliver to the ring main.

10.1.8 Shops, Stores and Offices

The existing workshop and stores buildings are deemed adequate for both pulp mills. Later more detailed examination might indicate a need for more machine tools and storage bin capacity; provision for these additions have been made in the capital cost estimates. The existing administration offices and canteen would be used for the combined pulp mills. Provision would be made in the new pulp mill building for the necessary test laboratories and office space to run the mill on a 24 hour basis.

10.2 CASE 2

A Pulpmill at Beerburrum, Queensland, Australia

10.2.1 Wood Storage and Preparation

Annual pulpwood requirements of the 600 ADMT/d unbleached kraft mill would be approximately 400,000 BDU (890,000 m^3), to be supplied in the form of pinus elliottii logs from nearby plantations, supplemented by a small quantity of chips produced from sawmill waste in the area. Logs which would arrive by road or rail in 6m lengths, would be handled on two decks by cherry pickers, or diverted to adjacent log storage. After being slashed to 3m lengths the logs would be drum barked and chipped. The chips would be conveyed to a storage pile, or directly to a screening operation and then further conveyed to the continuous digester. Bark would be hogged and conveyed to a separate storage pile, from which it would be reclaimed for conveyance to the power boiler.

10.2.2 Pulp Mill

Chips would be fed from the chip bin through a chip meter, low pressure feeder, steaming vessel and high pressure feeder to a continuous digester equipped for high heat diffusion washing. Cooked stock would be blown through a power-operated blow device to the first stage of a two stage diffusion washer. After the second stage diffusion washing, the pulp would pass into a 100 t unbleached high density storage tank. Heat recovery equipment would be installed to produce hot water from steam vented from the digester steaming vessel and black

10.2.2 Pulp Mill (Continued)

liquor flash tanks. Non-condensible vapours and turpentine would be burnt in the lime kiln. Crude tall oil would be recovered.

Stock from the blow tank would pass through a junk trap to remove metal and then to primary pressure knotters. Rejects from the primaries would be passed to a secondary knotter, the accepts returning to the main stock flow, while the rejected knots would pass to a knot tank for subsequent re-cooking. Provision has also been made to dewater rejected knots for disposal elsewhere.

Accepted stock from the knotters would pass to pressure screening and cleaning. The pulp would be screened over primary, secondary and tertiary screens; the rejects from the tertiary screen would be thickened and refined, passing back into the tertiary screen. The main stock flow would be cleaned in a four-stage centrifugal cleaning system. thickened on a decker and pumped to a high density storage tank with eight hours capacity.

From the high density storage, the pulp would pass to the machine chest and flowbox to the fan pump of the pulp machine. The pulp drying machine would consist of a headbox and four-drinier wet end, three presses and an airborne dryer section followed by an automatic cutter and layboy. The machine would be driven by a sectional electric drive.

10.2.2 (Continued)

Stacked pulp sheets from the layboy would be conveyed to a finishing system consisting of a hydraulic press, automatic wrapping and tying equipment, an automatic stacker and weighing scale. The finished bales would be conveyed to the pulp warehouse where lift trucks would be used for handling and storage. The pulp would be transported to the Port of Brisbane for loading onto ocean-going freighters.

10.2.3 Chemical Recovery System

The flow diagram of the chemical recovery system is illustrated on drawing D-4651-864-002. Weak black liquor from No.1 seal tank would be filtered and concentrated to 52% solids in a six effect evaporator plant. The strong black liquor would be further concentrated to 65% solids in two concentrators, passing to a saltcake mix tank for the addition of saltcake make-up as required. Relatively clean condensate from No.1 surface condenser would be used in process, while foul condensate from No.2 condenser would pass to the evaporator seal tank for eventual stripping.

The heavy black liquor from the saltcake mix tank would be burned in a low odor type recovery boiler fitted with supplementary gas burners. A dry bottom, two-chamber electrostatic precipitator would recover saltcake from the flue gases and would be designed to maintain particulate emissions of less than 0.25 grams per m^3 dry.

10.2.3 Chemical Recovery System (Continued)

The recausticizing plant and lime kiln would be of conventional design. Green liquor from the smelt dissolving tank would pass to the green liquor clarifier, from which the underflow would be filtered on the green dregs filter, and the dregs disposed of elsewhere. The overflow green liquor would be causticized in the slaker and causticizers, then passing to the white liquor clarifiers. The clarified white liquor would be pumped to storage tanks for re-use in cooking. The underflow would pass to the lime mud washer from which the recovered weak wash would be re-used in process. The lime mud would be dewatered on a lime mud filter and burned in a rotary lime kiln using producer gas. A fixed-bed atmospheric type gas producer operating on coal would be provided. The plant would consist of a continuous, automatic gravity feeding system for the fuel, with a revolving grate and an elevated ash pit. The equipment would be self-contained and the steam required for gas making would be generated within the plant. Instrumentation and modern labor saving features would reduce labor costs to a minimum.

Odorous gases from the stripper column and other sources plus turpentine would also be burnt in the lime kiln as shown on drawing D-4651-864-003. Make-up limestone would be added to the lime kiln feed as required. The lime kiln stack gases would discharge through an electrostatic precipitator and the induced draft fan to a stack. The precipitator would be designed to maintain particulate emissions below 0.25 grams per m^3 dry.

10.2.4 Steam and Power Generation

A recovery boiler of the low-odor type capable of burning 1,000,000 kg/D black liquor solids would be provided. Provision would be made for a power boiler and also for the installation of a 16.25 MW turbo-generator which would supply almost all of the electrical power requirements. About 1.25 MW would be supplied by the public utility company.

Steam at 64 kg/cm^2 and 450°C would be supplied from the recovery boiler. Steam would be distributed to the turbo-generator with an extraction pressure of 12.5 kg/cm^2g and a back pressure of 4.5 kg/cm^2g. A dump condenser would be provided for unbalanced conditions. Equipment would be provided for feed water treatment.

The power boiler rated at 57 t/hr would burn hog fuel supplemented by coal, and the necessary coal and ash handling facilities would be provided. Mill air would be supplied by motor-driven air compressors.

10.2.5 Water Supply and Distribution

As mentioned above, water would be supplied by a public utility to a water storage tank within the mill limits. Filtration and a pump station would be provided for an estimated consumption of 35,000 m^3/D for the proposed pulp mill.

10.2.6 Effluent Treatment

In order to meet the anticipated stringent requirements of the regulatory agency for BOD and suspended solids, effluent treatment would be of a high order. It would consist of primary clarification, high rate BOD treatment, and secondary clarification. Effluent would be discharged to the sea through an overland pipe approximately 20 km long and a diffuser extending about 1 km from shore. An emergency spill tank would be provided to handle spills which might upset the biological system. A sludge dewatering and thickening system would be provided, and the resultant solids would be incinerated in the power boiler.

10.2.7 Fire Protection

The mill would be protected by a fire system designed in accordance with established standards and requirements. The fire protection system would include ring mains, hydrants and hoses at necessary locations. The dry end of the machine room, chip feed to the digester, the pulp warehouse and the turbine generator would be covered by a sprinkler system. The generator would also be provided with a carbon dioxide smothering system. Two fire pumps, one driven by an electric motor and the other by diesel engine would be provided. These pumps would draw water from the raw water storage pond and deliver to the ring main.

10.2.8 Shops, Stores and Offices

In addition to the facilities described above, the mill services would include a centrally-located shop equipped with machine tools and electrical, piping, welding, instrument, sheet metal and painting shop equipment. The shop area would be serviced by an overhead travelling crane.

Mill stores would have material-handling equipment and storage facilities for economic plant operation. A separate administrative office building would include personnel facilities; car parking would be provided nearby. The necessary superintendent offices would be provided within the mill, as well as a central control laboratory.

10.3 CASE 3
A Pulpmill at Eureka, California

10.3.1 Wood Storage and Preparation

Annual pulpwood requirements for the 600 ADt/d unbleached kraft mill would be approximately 390,000 BDU, to be supplied in the form of chips from what is now the N.C.E.C. chip export terminal. Chips would be reclaimed from the chip piles by bulldozer, conveyed to the screening room and after screening to the chip bin for the continuous digester. The wood species mix would be approximately 60% douglas fir, 20% redwood, 10% California tan oak and alder, and 10% spruce - pine - fir.

10.3.2 Pulp Mill

Chips would be fed from the chip bin through a chip meter, lower pressure feeder, steaming vessel and high pressure feeder to a continuous digester equipped for high heat diffusion washing. Cooked stock would be blown through a power-operated blow device to the first stage of a two-stage diffusion washer. After the second stage diffusion washing, the pulp would pass into a 100 t unbleached high density storage tank. Heat recovery equipment would be installed to produce hot water from steam vented from the digester steaming vessel and black liquor flash tanks. Non-condensible vapours would be burnt in the lime kiln.

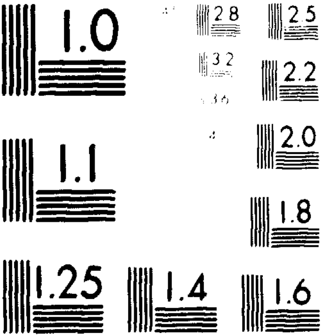
10.3.2 Pulp Mill (Continued)

Stock from the blow tank would pass through a junk trap to remove metal and then to primary pressure knotters. Rejects from the primaries would be passed to a secondary knotter, the accepts returning to the main stock flow, while the rejected knots would pass to a knot tank for subsequent re-cooking. Provision has also been made to dewater rejected knots for disposal elsewhere.

Accepted stock from the knotters would pass to screening and cleaning. The pulp would be pressure screened over primary, secondary and tertiary screens; the rejects from the tertiary screen would be thickened and refined, passing back into the tertiary screen. The main stock flow would be cleaned in a four-stage centrifugal cleaning system, thickened on a decker and pumped to a 100 t high density storage tank.

From the high density storage, the pulp would pass to the machine chest and flowbox to the fan pump of the pulp machine. The pulp drying machine would consist of a headbox and fourdrinier wet end, three presses and an airborne dryer section followed by an automatic cutter and layboy. The machine would be driven by a sectional electric drive.

Stacked pulp sheets from the layboy would be conveyed to a finishing system consisting of a hydraulic press, automatic wrapping and tying equipment, an automatic stacker and weighing scale. The finished bales would be conveyed to the pulp warehouse where lift trucks would be used for handling and storage. The pulp would be transferred by crane in 12 ton loads to flat deck barge lighters for transport and loading on to ocean going freighters moored at the present chip loading terminal.



MICROCOPY RESOLUTION TEST CHART

10.3.3 Chemical Recovery System

The flow diagram of the chemical recovery system would be as illustrated on drawing D-4651-864-002. Weak black liquor from No.1 seal tank would be filtered and concentrated to 52% solids in a five effect evaporator plant. The strong black liquor would be further concentrated to 65% solids in two concentrators, passing to a saltcake mix tank for the addition of saltcake make-up as required. Relatively clean condensate from No.1 surface condenser would be used in process, while foul condensate from No.2 condenser would pass to the evaporator seal tank for eventual stripping.

The heavy black liquor from the saltcake mix tank would be burned in a low odor type recovery boiler fitted with supplementary oil burners. A dry bottom, two-chamber electrostatic precipitator would recover saltcake from the flue gases and would be designed to maintain particulate emissions of less than 0.25 grams per m^3 dry.

The recausticizing plant and lime kiln would be of conventional design. Green liquor from the smelt dissolving tank would pass to the green liquor clarifier, from which the underflow would be filtered on the green dregs filter, and the dregs disposed of elsewhere. The overflow green liquor would be causticized in the slaker and causticizers, then passing to the white liquor clarifiers. The clarified white liquor would be pumped to storage tanks for re-use in cooking. The underflow mud would pass to the lime mud washer from where recovered weak wash would be re-used in process. The lime mud would be

10.3.3 Chemical Recovery System (Continued)

dewatered on a lime mud filter and burned in a rotary lime kiln using natural gas as fuel. Fuel oil would be used as a stand-by for the lime kiln when natural gas supplies are interrupted.

Odorous gases from the stripper column and other sources would also be burnt in the lime kiln as shown on drawing D-4651-864-003. Make-up limestone would be added to the lime kiln feed as required. The lime kiln stack gases would discharge through an electrostatic precipitator and the induced draft fan to a stack. The precipitator would be designed to maintain particulate emissions well below 0.25 grams per dry, and the use of a precipitator would eliminate the unsightly water vapor plume characteristics of a lime kiln scrubber.

10.3.4 Steam and Power Generation

A recovery boiler of the low-odor type capable of burning 1,100,000 kg/D black liquor solids would be provided. Steam generated by this boiler would augment the steam supplied by The Humboldt Bay Power Company's hog and refuse boiler as described in Section 9.3. The integrated steam supply would drive a 55 MW turbo-generator, with extraction pressures of 12.5 kg/cm^2 and 4.5 kg/cm^2 for process steam supplied to the pulp mill. Necessary electrical power for the operation of the pulpmill (approximately 16 MW) would be supplied by the above generator; the remainder of the power would be sold to the public utility. Mill air would be supplied by motor driven air compressors.

10.3.5 Water Supply and Distribution

As mentioned in Section 9.3, water would be supplied by a public utility, and no clarification or filtration would be required. Storage capacity and a pump station would be provided for an estimated consumption of 35,000 m^3/D, for the proposed pulp mill.

10.3.6 Effluent Treatment

In order to meet the anticipated excessive environmental demands of the area, effluent treatment would be of a high order. It would consist of primary clarification, high rate BOD treatment, and secondary clarification. Effluent would be discharged to the Pacific Ocean through an underwater diffusion pipe. An emergency spill tank would be provided to handle spills which might upset the biological treatment system. A sludge dewatering and thickening system would be provided, and the resultant solids would be incinerated in the power boiler on the adjacent N.C.E.C. site.

10.3.7 Fire Protection

The mill would be protected by a fire system designed in accordance with established standards and requirements. The fire protection system would include ring mains, hydrants and hoses at necessary locations. The dry end of the machine room, chip feed to the digester, the pulp warehouse and the turbine generator would be covered by a sprinkler system.

10.3.7 Fire Protection (Continued)

The generator would also be provided with a carbon dioxide smothering system. Two fire pumps, one driven by an electric motor and the other by diesel engine would be provided. These pumps would draw water from the existing raw water storage pond and deliver to the ring main.

10.3.8 Shops, Stores and Offices

In addition to the facilities described above, the mill services would include a centrally located shop equipped with machine tools and electrical, piping, welding, instrument, sheet metal and painting shop equipment. The shop area would be serviced by an overhead travelling crane.

Mill stores would have material-handling equipment and storage facilities for economic plant operation. A separate administrative office building would include personnel facilities; car parking would be provided nearby. The necessary superintendent offices would be provided within the mill, as well as a central control laboratory.

10.4 CASE 4
A Pulp Mill at Ocean Falls, British Columbia

10.4.1 Mill Site

The mill site is illustrated on drawing D-4651-250-004. The construction of the proposed 600 ADt/d unbleached kraft mill on a site which has been used as a pulp and paper mill for many years would necessarily involve extensive changes to existing facilities. These are denoted on the drawing. Some facilities would be retained, while others, not now used, would be razed to make way for the new construction. After construction of the proposed unbleached kraft mill, the existing newsprint operation would be phased out.

10.4.2 Wood Storage and Preparation

Annual pulpwood requirements of the 600 ADMT/D unbleached kraft mill would be approximately 400,000 BDU. Some 76.5% (306,000 BDU) would be provided as pulpwood logs, and the remaining 23.5% (94,000 BDU) as chips from sawmills.

The logs would arrive at the mill site waterborne in rafts or in bundles and would be handled in the booming grounds. The logs would be fed to the woodroom by log haul or by bundle crane to two barker and chipper lines. On one line large and medium sized logs would be hydraulically barked, sawn down to size if necessary, and then chipped. On the other line smaller

10.4.2 Wood Storage and Preparation (Continued)

logs would be mechanically barked and then chipped. Provision would be made to transfer the logs from one line to the other or alternatively rejected to ground storage. The chips would be conveyed to surge bins and then to separate chip piles depending on species.

Bark from the debarkers would be hogged and then separately conveyed to a hog fuel storage pile. From there the hog fuel would be reclaimed, pressed to remove excess moisture and then pneumatically conveyed to the hog fuel boiler.

The sawmill chips would be unloaded from barges to a floating platform and conveyed by belt conveyor to species segregated chip piles as described above.

Chips would be reclaimed from the chip piles by bulldozer, conveyed to the screening room and after screening to the live bottom chip silos. From the silos the chips would pass by belt conveyor to the feed hopper on the continuous digester.

10.4.3 Pulp Mill

Chips would be fed from the feed hopper through a chip meter, low pressure feeder, steaming vessel and high pressure feeder to a continuous digester equipped for high heat diffusion washing. Cooked stock would be blown through a power-operated blow device to a two-stage diffusion washer system above a 100 t blow tank. Heat recovery equipment would be installed to produce

:0.4.3 Pulp Mill (Continued)

hot water from steam vented from the digester steaming vessel and black liquor flash tanks. No provision would be made for turpentine recovery, but non-condensible vapors would be burned in the lime kiln.

Stock from the blow tank would pass through a junk trap to remove metal and then to primary pressure knotters. Rejects from the primaries would be passed to a secondary knotter, the accepts returning to the main stock flow, while the rejected knots would pass to a knot tank for subsequent re-cooking. Provision would be made to dewater rejected knots for disposal elsewhere.

Accepted stock from the knotters would discharge to an unscreened storage chest.

The pulp would be screened over primary, secondary and tertiary screens; the rejects from the tertiary screen would be thickened and refined, passing back into the tertiary screen. The main stock flow would be cleaned in a four-stage centrifugal cleaning system, thickened on a decker and pumped to a 100 t high density storage tank.

From the high density storage, the pulp would pass to the machine chest and flowbox to the fan pump of the pulp machine. The pulp drying machine would consist of a headbox and four-drinier wet end, three presses and an airborne dryer section followed by an automatic cutter and layboy. The machine would be driven by a sectional electric drive.

10.4.3 Pulp Mill (Continued)

Stacked pulp sheets from the layboy would be conveyed to a finishing system consisting of a hydraulic press, automatic wrapping and tying equipment, an automatic stacker and weighing scale. The finished bales would be conveyed to the pulp warehouse where lift trucks would be used for handling and storage. The pulp would be shipped directly by ocean freighter to its destination in Korea from the wharf at Ocean Falls.

10.4.4 Chemical Recovery System

The recausticizing plant and lime kiln would be of conventional design. Green liquor from the smelt dissolving tank would pass to the green liquor clarifier, from which the underflow would be filtered on the green dregs filter, and the dregs disposed of elsewhere. The overflow green liquor would be causticized in the slaker and causticizers, then passing to the white liquor clarifiers. The clarified white liquor would be pumped to storage tanks for re-use in cooking. The underflow would pass to the lime mud washer from where recovered weak wash would be re-used in process. The lime mud would be dewatered on a lime mud filter and burned in a rotary lime kiln using fuel oil. Odorous gases from the stripper column and other sources would also be burnt in the lime kiln as shown on drawing D-4651-864-003. Make-up limestone would be added to the lime kiln feed as required. The lime kiln stack gases would discharge through a venturi scrubber and the induced draft fan to a stack. The scrubber would be designed to maintain particulate emissions below 0.25 grams per m^3 dry.

10.4.4 Chemical Recovery System (Continued)

The flow diagram of the chemical recovery system is illustrated on drawing D-4651-864-002. Weak black liquor from No.1 seal tank would be filtered and concentrated to [illegible]2% solids in a six effect evaporator plant. The strong black liquor would be further concentrated to 65% solids in two concentrators, passing to a saltcake mix tank for the addition of saltcake make-up as required. Relatively clean condensate from No.1 surface condenser would be used in process, while foul codensate from No.2 condenser would pass to the evaporator seal tank for eventual stripping.

The heavy black liquor from the saltcake mix tank would be burned in a low odor type recovery boiler fitted with supplementary oil burners. A dry bottom, two-chamber electrostatic precipitator would recover saltcake from the flue gases and would be designed to maintain particulate emissions of less than 0.25 grams per M^3 dry.

10.4.5 Steam and Power Generation

A new recovery boiler, of the low-odor type capable of burning 960,000 kg/D black liquor solids would be provided. Provision would also be made for the installation of a 7 megawatt turbogenerator to augment the already existing hydro power capacity from Link Lake. The hydro plant contains four Pelton turbines driving electric generators for a total capacity of 14.8 MW depending on lake level.

10.4.5 Steam and Power Generation

Steam at 64 kg/cm^2g and 450°C would be supplied from the recovery boiler. An existing power boiler rated at 100 t/hr on fuel oil or 63 t/hr on hog fuel would be used to supplement the total steam requirements. The existing oil storage and unloading facilities would be used. Mill air would be supplied from the existing system.

10.4.6 Water Supply and Distribution

Water supply for the mill and townsite is obtained from Link Lake, connected to Martin Lake by a tunnel. The watershed supporting these two lakes covers an area of approximately 260 square kilometers, The dam was inspected in 1973 by personnel of the B.C. Hydro and Power Authority who reported it to be in basically sound condition. Minor repairs to the face have been undertaken since that date.

Two 3.66 m diameter steel penstocks lead from the bottom of the dam. No.1 penstock supplies the water to drive three hydraulic turbines in the existing groundwood mill, and for mill process use. No.2 penstock supplies the water to the hydro-generating plant. Water for process use is screened in one Zurn and two Elliot filters. Water quality is excellent. The flow of water into each penstock can be shut off by separate 4.6 x 4.6m vertical steel gates with electrically-operated twin-screw stems. The 1973 B.C. Hydro report indicated they

10.4.6 Water Supply and Distribution (Continued)

were in good condition and should give good service for many years. On the other hand a 1968 report contained recommendations for remedial work including installation of two intake gates designed to close automatically in case of penstock rupture, and other improvements. Some of these improvements are presently in hand.

10.4.7 Effluent Treatment

Primary clarification treatment and sludge thickening would be provided. Solids would be dewatered in a sludge press and burnt together with the hog fuel in the power boiler. Aqueous effluent would be passed to the ocean through an underwater diffusion pipe located in the tail race from the power house.

10.4.8 Fire Protection

Fire protection facilities are good but need upgrading. The major service is comprised of a 46 cm steel fire main running from the dam, parallel to the main penstocks, with branches leading to all existing mill buildings, and servicing strategically located hydrants and hose stations. Two fire pumps, each with a capacity of 6000 l/min., one electrical and one turbine driven are located in the steam plant. There is significant deterioration in the fire mains and substantial investment is

10.4.8 Fire Protection (Continued)

required to upgrade. For new construction, the dry end of the machine room, chip feed to the digester, the rebuilt pulp warehouse and the turbine generator would be covered by a sprinkler system. The generator would also be provided with a carbon dioxide smothering system.

10.4.9 Shops, Stores and Offices

The existing offices, laboratories and personnel facilities are deemed adequate for the new pulp mill. The total area of the various shops including the electric, millwright, machine, welding, tin, pipe, carpentry and instrument shops, and the garage approximates 3,500 square meters. All are well-equipped although more detailed examination might indicate a need for specific items required for the new pulp mill. The mill store facilities are also deemed adequate.

11.0 MANUFACTURING COST ESTIMATE

11.0 MANUFACTURING COST ESTIMATE

The costs used in this study, as well as the selling price for pulp, are those that prevailed on January 31, 1980. The Korean won was devalued on January 12th, and interest rates were increased also. Fuel oil prices in Korea were increased 59.4% on January 29th. The price of chips from the Pacific Northwest was increased in January 1980 by 21% over the price announced in December 1979 for the first half of 1980. The December increase had been 34% over the 1979 price for chips.

11.1 Pulpwood and Chips

11.1.1 Wood Consumption

Wood consumption was calculated for each alternative taking into account the nature of the pulpwood and/or chip supply. Thus for Korea the chip supply would be imported softwood chips. The additional handling given these chips and added storage time would result in a higher wood loss before the digester than if these chips could be used without ocean shipping. In the case of Australia the primary source of fiber would be pulp logs of modest diameter. The loss in slashing and barking results in a higher wood consumption than for a mill receiving screened chips from a sawmill. At Ocean Falls part of the wood supply would be larger diameter pulp logs and part would be screened sawmill chips. The fiber losses prior to the digester would be intermediate in this case.

11.1.1 Wood Consumption (Continued)

	Unit	Amount			
		Korea	Australia	California	B.C.
Unbleached Kraft Pulp	ADt	1.0	1.0	1.0	1.0
Unbleached Kraft Pulp	BD kg/ADt	900	900	900	900
Pulp Mill Losses	%	3	3	3	3
Unscreened Pulp	BD kg/ADt	928	928	928	928
Digester Yield	%	46	48	46	46.3
Wood to Digester	BD kg/ADt	2017	1934	2017	2004
Wood Losses in Chip Shipping	%	2.7	1.5	1	1
Wood Chips to Plant	BD kg/ADt	2070	1965	2037	2024
Pulpwood Handling and Barking Losses	%	-	5	-	2
Wood Consumption	BD kg/ADt	2070	2070	2037	2065
Wood Density	Kg/m^3	432	487	434	383
Wood Consumption	m^3/ADt	4.79	4.25	4.69	5.39
Wood Consumption	BDU	1.90	1.90	1.86	1.90

11.1.2 Cost of Ocean Freight for Chips

It has not been possible to ascertain the current cost of shipping wood chips from the Pacific Northwest to Japan, since all of these chips are carried by Japanese vessels or ships leased to the Japanese. The shipment of chips to Japan is the only major seaborne movement of chips in the world, and cost information on this would be very useful to this study. There are numerous "guess-timates" on this cost, but none that can be considered authentic have been found.

It is known that most of the chips are being shipped in bulk carriers of about 40,000 dead weight tonnes capacity. These vessels have a storage capacity of about 88,000 cubic meters. Usually ships of this type can transport from 14,000 to 15,000 BDU of chips from the Pacific Northwest. In cubic meters this would be approximately 37,500 cubic meters per ship load, depending upon the bulk density of the chips.

The cost of shipping chips would be considerably decreased if use could be made of the vessel on its return trip. However, such considerations are beyond the scope of this study, and it will be assumed that the ships will return under ballast.

In current costs it is estimated by knowledgeable persons that a round trip for a chip carrier to Korea would cost about U.S. $725,000. This cost would cover everything except loading and unloading of the vessel. On this basis it is estimated that the cost for transporting a BDU of chips would be between U.S. $48 and $51, and for the purposes of this study a cost of $50 will be used.

11.1.3 KOREA

A cost of U.S.$141 per BDU was used, based on the new average FOB prices of Weyerhaeuser wood chips to Japan for the first half of 1980 plus an ocean freight charge of $50 per BDU. Chips from Northern California or British Columbia could theoretically be obtained at the same price. At the present time there is no assurance that chips from any of these sources are available for Korea, since there is a scarcity of chips worldwide and practically all chips for export are under long term contracts to Japanese companies. However, for the purpose of this study, it has been assumed that a serious effort to acquire softwood chips for Korea on a long term contract would be rewarded with sufficient chips to supply a 600 ADt/d unbleached kraft pulp mill at the same price being paid by the Japanese companies. Chips from Siberia have not been considered since they have not yet become a factor in the world chip market.

In the event chips were furnished from Northern California the composition would probably be as given below:

Species	%	Density kg/m^3	Weighted Density kg/m^3	Yield UKP %	Weighted Yield %
Douglas fir	60	449	270	48	28.9
Redwood	20	384	77	38	7.6
Spruce, Pine, Fir	10	359	35	47	4.7
Oak	5	593	30	46	2.3
Alder	5	400	20	50	2.5
Weighted Average:			432		46.0

11.1.3 KOREA (Continued)

In the event chips were supplied from British Columbia the composition could be as given below:

Species	%	Density	Weighted Density kg/m3	Yield UKP	Weighted Yield %
White Spruce	36.6	359	132	50	18.3
Lodgepole Pine	23.4	408	95	48	11.2
Balsam Fir	6.7	390	23	50	3.2
Cedar	33.3	328	109	40	13.3
			359		46.0

The mixture being shipped by Weyerhaeuser would be similar to the California chip mixture in density and yield. For this study it was assumed that the California density and yield would apply for imported chips used in Korea. The weighted average price of these chips is $36.20 per cubic meter ($91.00 per BDU) FOB Eureka, California. A loading charge of $6.50 per BDU is included in the FOB price.

11.1.4 AUSTRALIA

The cost of pulpwood delivered to the Beerburrum site in Queensland was given as A$ 23.0/m^3 which at current conversion rates would be U.S. $25.53. This pulpwood would be plantation grown pinus elliottii and would be delivered in 6 meter lengths. This wood is not committed to other projects and is available.

11.1.5 CALIFORNIA

The wood in Northern California would be trucked to the pulpmill in chip form as wastewood chips from sawmills. The average composition of species, weighted average densities and yields would be as stated previously for chips shipped to Korea. It should be noted that these chips are presently being sold to a Japanese company. The loading charge of $6.50 per BDU can be subtracted from the FOB price charged to overseas customers.

11.1.6 BRITISH COLUMBIA

Since there is presently no allocation of pulpwood and chips for a 600 ADt UKP mill at Ocean Falls, a forestry consultant was employed to estimate the probable composition and cost of pulpwood and chips for such a venture. The results of his study are summarized below:

Weighted average pulpwood costs:
U.S. $ 62.00 per BDU ($21.93 per m^3)

Average species make-up:

Hemlock, balsam, spruce	65%
Douglas fir	10%
Red and yellow cedar	25%

Weighted average density	383 kg/m^3
Weighted average pulp yield	46.3%

About 67% of this wood would arrive at the pulp mill in log form and 33% as wastewood chips from sawmills.

11.2 Saltcake

Since pulpmills for all alternatives would be of modern design with good pulp washing and efficient recovery boiler precipitators, it has been assumed that the make-up salt-cake required would be the same for all at 55 kg.ADt. The cost per kilogram of saltcake delivered to the pulpmill site varied considerably as shown in Table 11.12.3.

11.3 Limestone

Each alternative was assumed to require a make-up of 35 kilo-grams per ADt, but unit costs for limestone varied over a wide range.

11.4 Fuel Costs

11.4.1 KOREA

Fuel costs for Korea were based on fuel oil at $217.54 per tonne and a total consumption of 280 kg/ADt, of which 60 kg/ADt would be used for the lime kiln and recovery boiler control and 220 kg/ADt in the power boiler. The power boiler fuel oil requirements were based on the heat balance shown in the Appendix.

11.4.2 AUSTRALIA

Fuel costs for the Australian alternative were based on the use of producer gas manufactured from coal for the lime kiln and recovery boiler control, at the heat equivalent of 60 kg of fuel oil per ADt. The power boiler would burn all the hog fuel generated in the woodroom, the balance of the fuel requirement would be furnished by coal.

11.4.3 CALIFORNIA

The California alternative would be integrated with the steam and power plant of the Humboldt Bay Power Company, which would be fueled with hog fuel. The heat balance in the Appendix indicates the interconnection of the pulp mill with the Power Company. The pulp mill would be charged for the incremental hog fuel required to produce the electrical power for the pulp mill, and for the heat increment in the process steam not supplied by the recovery boiler. Heat for the lime kiln and recovery boiler burner control would be supplied with natural gas.

11.4.4 BRITISH COLUMBIA

The mill at Ocean Falls would be able to use an existing hog fuel power boiler, and also would be able to utilize an existing hydro-electric power generating facility for about half its power requirement. Fuel oil would be used for the lime kiln and to make up heat for the power boiler that would not be supplied from self-generated hog fuel.

11.5 Electrical Power

11.5.1 KOREA

The electrical power consumption was estimated at 640 KWh/ADt. All of this would be self-generated in the mill's turbo-generator as shown on the heat balance. The UKP mill would be inter-connected with the existing mill and would not require a new tie with an outside utility.

11.5.2 AUSTRALIA

The mill would be capable of generating all its own power requirements but would be connected to the utility for start-up purposes etc.

11.5.3 CALIFORNIA

The mill would be interconnected with the Humboldt Bay Power Company

11.5.4 BRITISH COLUMBIA

One half the mill's power requirements would be supplied by the existing hydro-electric plant at a very favorable cost.

11.6 Water

11.6.1 KOREA

Water would be supplied by the Industrial Water Supply of the Onsan Industrial Area. The present treatment system at the mill would be augmented.

11.6.2 AUSTRALIA

It has been assumed that the Government of Queensland would furnish the necessary infrastructure to bring water to the mill site. The cost of this infrastructure would be amortized by the water charge to the mill. No treatment would be required.

11.6.3 CALIFORNIA

Water would be supplied by the Industrial Water Supply at a fixed cost of $1,000,000 per year. No treatment would be required.

11.6.4 BRITISH COLUMBIA

The water supply system is already in place and no treatment would be required.

11.7 Materials and Supplies

The costs of miscellaneous materials and supplies are based on actual costs in several modern pulpmills producing kraft pulp. They cover such items as:

- Maintenance materials
- Defoamers
- Pitch control
- Boiler feedwater treatment
- Water treatment
- Effluent treatment chemicals
- Wires and felts
- Baling wire
- Miscellaneous operating materials

The alternatives with woodrooms were assumed to require higher costs for materials and supplies.

11.8 Labor Costs

	AUSTRALIA			CALIFORNIA			BRITISH COLUMBIA		
	Salaried	Hourly	Total	Salaried	Hourly	Total	Salaried	Hourly	Total
Wood Preparation	5	35	43	5	25	33	5	35	40
Pulping	4	20	24	4	20	24	4	20	24
Recausticizing and Kiln		9	9		9	9		9	9
Recovery & Power Boilers	4	24	28	4	20	24	4	24	28
Pulp Machine		24	24		24	24		24	24
Services		9	9		9	9		9	9
Maintenance & Engineering	7	80	87	7	80	87	7	80	87
Technical & Control	8		8	8		8	8		8
Mill Control	4		4	4		4	4		4
Management	9		9	9		9	9		9
Mill Office	14		14	14		14	14		14
Sales and Shipping	4		4		4	4	4		4
Personnel	4		4	4		4	4		4
TOTAL	63	201	264	63	190	253	63	201	264

Current labor rates and salaries for the respective geographic areas were used to calculate the labor costs for each mill. Allowances were made for shift differentials, premium time and fringe benefits.

In the case of the 600 ADt/d expansion in Korea, it was felt that the 300 ADt/d mill was already generously staffed. Since the new mill would be laid out so that new operations would be in the same area as the old operations, it was felt that many of the supervisors and engineers could oversee operations in both pulp lines. An allowance was made for150 new hourly paid employees and 25 new salaried employees.

11.9 Local Taxes

Local taxes for Korea were estimated based on tax schedules supplied. The local taxes for Australia are quite low in keeping with local policy to amortize infrastructure through utility charges rather than by taxation. Local taxes for California and British Columbia were based on experience of other similar mills in North America.

11.10 Insurance

Insurance costs were based on experience of others for similar plants.

11.11 Overhead

Costs for overhead were based on actual costs for similar operations. Overhead costs would include the following items:

Operating services and supplies
Rental and lease
Travel
Research
Permits and Licences

Head office costs at other locations
Donations
Miscellaneous

TABLE 11.12.1 MANUFACTURING COSTS

210,000 Air Dry Metric Tonnes
per Year Unbleached Kraft Pulp

UNIT CONSUMPTIONS

		Korea	Australia	United States	Canada
Pulpwood and chips	BDU/ADt	1.90	1.90	1.86	1.90
	M^3/ADt	4.79	4.25	4.69	5.39
Saltcake	kg/ADt	55	55	55	55
Limestone	kg/ADt	35	35	35	35
Fuel Oil					
Kiln & recovery	kg/ADt	60			60
Power boiler		220			60
Natural Gas					
Kiln and recovery	M^3/ADt			57	
Coal					
Kiln and recovery	kg/ADt		122		
Power boiler			144		
Hog Fuel					
Power boiler	BDt/ADt		0.18	0.5	0.18
Electric Power					
Total	kWh/ADt	640	650	650	600
Purchased	kWh/ADt	-	50	-	320
Water	M^3/ADt	56.8	56.8	56.8	56.8
Labor Force					
Hourly	Men	150	201	190	201
Salaried	Men	25	63	63	63

P.4651A February, 1980

TABLE 11.12.2 MANUFACTURING COSTS

210,000 Air Dry Metric Tonnes
per Year Unbleached Kraft Pulp

UNIT COSTS FOR MATERIALS & UTILITIES, $ U.S

		Korea	Australia	United States	Canada
Pulpwood and chips	$/BDU	141	57	84.50	62
	$/M3	55.92	25.50	33.51	21.90
Saltcake	$/kg	0.258	0.18	0.09	0.071
Limestone	$/kg	0.0257	0.056	0.024	0.008
Fuel Oil	$/t	217.54	198.00	-	92.43
Natural Gas	$/M3	-	-	0.116	-
Coal	$/t	-	27.75	-	-
Hog Fuel (Purchased)	$/BDt	-	-	10.00	-
Electricity "	$/kWh	-	0.0311	-	0.005
Water	$/M3	0.0258	0.182	$1 Million per year	-

P.4651A February, 1980

TABLE 11.12.3 MANUFACTURING COSTS

210,000 Air Dry Metric Tonnes
per Year Unbleached Kraft Pulp

COST PER AIR DRY METRIC TONNE, U.S.$

	Korea	Australia	United States	Canada
Variable Costs				
Pulpwood and Chips	267.90	108.30	157.17	117.80
Saltcake	14.19	9.90	4.95	3.90
Limestone	0.90	1.96	0.84	0.30
Fuel Oil	60.91	-	-	11.10
Natural gas	-	-	6.60	-
Coal	-	7.38	-	-
Hog Fuel (Purchased)	-	-	4.50	-
Purchased electricity	-	1.55	-	1.60
Water	1.47	9.30	5.00	-
Materials and Supplies	20.00	23.00	20.00	23.00
	365.37	161.39	199.06	157.70
Fixed Costs (Annual, $ 000)				
Labor (Hourly and salaried including benefits)	1,000	5,318	6,600	5,810
Local taxes	1,000	100	2,000	2,000
Insurance	300	300	300	300
Overhead	2,005	2,806	2,545	2,925
	4,305	8,524	11,445	11,035
Total:	385.87	201.98	253.56	210.25

12.0 CAPITAL COST ESTIMATE

12.0 CAPITAL COST ESTIMATE

Capital Cost Estimates were prepared in U.S. dollars on the basis of construction and equipment costs as at January, 1980. The major mechanical equipment costs and structural costs are based on H. A. Simons' experience in recent similar projects, including vendors' and contractors' quotations for comparable equipment and work.

The direct costs are shown for major plant areas broken down into structural and mechanical costs. The indirect costs are common costs for the plant. Applicable taxes are included with the direct costs. No allowances were made for escalation and no allowances were included for site purchases.

Other costs to be capitalized such as interest during construction, working capital, pre-operating and start-up costs are discussed in Section 13.

Special notes pertaining to Capital Costs for the four alternatives follow.

12.1 Korea

The major site work would be in the chip handling and storage area. No allowances were included for harbor development and dock facilities, as it was assumed that these would be supplied by the Government. If these items were part of the plant capital they would cause a significant increase in the costs.

12.1 Korea (Continued)

The plant capital cost estimate for the 600 ADt mill at Onsan was significantly benefitted by the proposed use of Korean materials of construction (structural steel, steel tanks, reinforcing bars, iron and reinforced fiberglass piping, electrical cable, cement, bricks, etc.) and Korean construction companies, which follows the construction practices used for the 300 ADt Dong Hae mill. The maximum use of Korean produced equipment was also factored into the plant capital cost estimate. This equipment includes major equipment such as the lime kiln, electrostatic precipitator, dryer cylinders, power boiler, evaporators, condensers, conveyors for chip and lime handling, bridge cranes, heat exchangers, electrical switchgear, transformers, pumps, electrical motors, valves, elevators, and some vehicles. Detailed engineering for the proposed expansion was assumed to be done by a Korean engineering company.

12.2 Australia

Simons' experience in a current major Australian project was utilized in preparing this estimate. The Australian alternative is the only "greenfield" alternative, and for this reason it cannot take advantage in cost savings related to existing facilities, which was the case for all other alternatives.

The Australian cost estimate is significantly higher in the area of effluent treatment and disposal because of the assumed need to give the effluent complete treatment, and particularly because of the long pipeline and ocean diffuser required for this site.

Contingencies for this site are high also because Simons has less knowledge about this site than for the other alternatives.

12.2 Australia (Continued)

It is possible that another site could be located that would decrease the cost of effluent disposal, and also the contingency allowance would be correspondingly decreased. The estimated costs in this area would warrant careful studies of alternative sites and effluent disposal plans.

12.3 California

The capital cost estimate for this site was benefitted by the existing chip handling facility and the proposed Humboldt Bay Power Company steam and power generating facility.

Rather than estimate construction of a new dock it was assumed that the pulp would be transported by barge to freighters moored at the present chip export dolphins. Long range the North Coast Export Cooperative has plans for a marine cargo dock that would probably be integrated with the pulp mill needs.

12.4 British Columbia

The capital cost estimate for this site took into account the existence of a water supply system, hog fuel burning power boiler and hydro electric power generating facilities. Existing infrastructure such as a pulp warehouse and dock were also factors in decreasing capital costs.

P. 4651A
Onsan, Korea
600 ADMT/Day Unbleached Kraft Mill

February, 1980

	Structural	Mechanical	US$ 1000 Total
Site & Services	1,000	3,705	4,705
Millwater Treatment	480	1,965	2,445
Effluent Treatment & Disposal	170	2,240	2,410
Power Distribution	-	1,820	1,820
Chip Handling Facilities	1,615	6,730	8,345
Digesting	2,900	10,650	13,550
Pulp Washing, Screening & Cleaning	2,225	12,975	15,200
Pulp Machine, Dryer & Bale Handling	3,025	16,445	19,470
Recovery Boiler & Precipitator	3,830	11,545	15,375
Turbo-Generator	480	2,510	2,990
Evaporators	615	6,245	6,860
Power Boiler - Package	105	2,985	3,090
Recausticizing	1,370	6,800	8,170
Warehouse	415	-	415
Repair Shop	135	100	235
Non-Process Buildings	345	135	480
TOTAL DIRECT COST:	18,710	86,850	105,560

Spare Parts	2,180
Temporary Construction Facilities	2,190
Field Administration	2,190
Vendor's Erection Supervision	625
Engineering & Procurement	8,760
Export Packing, Ocean Freight & Import Duty	9,975
Contingencies	14,520
PLANT CAPITAL COST AS AT JANUARY, 1980	$146,000 U.S.

P. 4651A

February, 1980

Beerburrum, Queensland, Australia
600 ADMT/Day Unlbeached Kraft Mill

	Structural	Mechanical	$US 1000 Total
Site & Services	345	10,025	10,370
Millwater Storage	250	210	460
Effluent Treatment & Disposal	1,985	23,395	25,380
Power Distribution	-	1,700	1,700
Woodroom & Chip Handling Facilities	1,910	8,430	10,340
Hog Fuel Handling	390	2,005	2,395
Digesting	810	13,555	14,365
Pulp Washing, Screening & Cleaning	3,570	12,310	15,880
Pulp Machine Dryer & Bale Handling	3,765	17,280	21,045
Recovery Boiler & Precipitator	5,240	13,695	18,935
Turbo-Generator	730	2,840	3,570
Evaporators	675	6,450	7,125
Power Boiler	2,605	6,005	8,610
Coal Handling & Gas Producer	680	2,565	3,245
Recausticizing	1,835	7,805	9,640
Warehouse & Mobile Equipment	1,150	435	1,585
Repair Shops & Stores	1,740	740	2,480
Non-Process Buildings	1,065	545	1,610
TOTAL DIRECT COST:	28,745	130,490	159,235

Spare Parts	2,195
Temporary Construction Facilities	3,200
Field Administration	3,200
Vendor's Erection Supervision	730
Engineering & Procurement	12,770
Export Packing, Ocean Freight, Import Duty, Local Freight	10,250
Contingencies	21,320
PLANT CAPITAL COST AS AT JANUARY, 1980	$212,900 U.S.

P. 4651A
Fairhaven, Eureka, California, U.S.A.
600 ADMT/Day Unbleached Kraft Mill

February, 1980

	Structural	Mechanical	$US 1000 Total
Site & Services	305	7,510	7,815
Millwater Storage	260	220	480
Effluent Treatment & Disposal	2,050	8,800	10,850
Power Distribution	-	1,010	1,010
Chip Handling Facilities	1,110	4,310	5,420
Digesting	830	14,240	15,070
Pulp Washing, Screening & Cleaning	3,510	12,780	16,290
Pulp Machine, Dryer & Bale Handling	3,615	18,140	21,755
Power Boiler (Incremental)	200	1,090	1,290
Recovery Boiler & Precipitator	5,330	14,050	19,380
Turbo-Generator (Incremental)	200	935	1,135
Evaporators	725	6,270	6,995
Recausticizing	2,115	8,770	10,885
Warehouse	1,605	285	1,890
Repair Shop & Stores	1,205	740	1,945
Non-Process Buildings	420	385	805
Ship Loading & Dock	760	1,865	2,625
TOTAL DIRECT COST:	24,240	101,400	125,640

Spare Parts	1,260
Temporary Construction Facilities	2,360
Field Administration	2,360
Vendor's Erection Supervision	375
Engineering & Procurement	9,430
Contingencies	15,775

PLANT CAPITAL COST AS AT JANUARY, 1980 $157,200 U.S.

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P. 4651A
Ocean Falls, B.C.
600 ADMT/Day Unbleached Kraft Mill

February, 1980

	Structural	Mechanical	$US 1000 Total
Site & Services	815	8,345	9,160
Millwater Supply	- No Allowance in Estimate -		
Effluent Treatment & Disposal	250	3,570	3,820
Power Distribution	-	2,030	2,030
Woodroom & Chip Handling Facilities	5,470	21,760	27,230
Hog Fuel Handling	495	1,830	2,325
Digesting	795	13,720	14,515
Pulp Washing, Screening & Cleaning	3,480	12,640	16,120
Pulp Machine, Drying & Bale Handling	3,780	17,430	21,210
Recovery Boiler & Precipitator	5,570	14,020	19,590
Turbo-Generator	640	1,830	2,470
Evaporators	890	6,630	7,520
Recausticizing	1,890	7,910	9,800
Warehouse	695	60	755
Repair Shop & Laboratory	695	500	1,195
Non-Process Buildings	100	-	100
Ship Loading Dock	500	-	500
TOTAL DIRECT COST:	26,065	112,275	138,340

Spare Parts	1,350
Temporary Construction Facilities	2,610
Field Administration	2,[illegible]10
Vendor's Erection Supervision	430
Engineering & Procurement	10,430
Local Freight	650
Contingencies	17,380
PLANT CAPITAL COST AS AT JANUARY, 1980	$173,800 U.S.

13.0 INVESTMENT REQUIREMENTS

13.0 INVESTMENT REQUIREMENTS

13.1 Equity Investment

Equity investment was assumed to be 30% in all cases. During drawdown of funds the equity investment was assumed to be used first.

13.2 Interest Rates

In the case of Korea, 55% of the long term loans were assumed to be local loans at 21% interest. The balance of the loans were assumed to be foreign loans at 12% interest. These loans would be guaranteed by the Korean Exchange Bank.

In all other cases the long term loans were assumed to be at 12% interest rate.

All long term loans were assumed to have a grace period of one year and an eleven year repayment schedule.

Short term loan requirements were assumed to be at 15% interest except for Korea which were at 21%.

Short term loans were assumed to be repaid from surplus funds as soon as possible.

13.3 Interest during Construction

A construction period of 36 months was assumed in all cases. It was also assumed that 15% of total expenditures would be spent in the first year of construction, 50% in the second year, and 35% in the third year. Interest during construction was calculated as below, and takes into account the use of equity funds before borrowed funds.

KOREA	-	$18,924,000
AUSTRALIA	-	$18,485,000
CALIFORNIA	-	$13,657,000
BRITISH COLUMBIA	-	$15,097,000

13.4 Working Capital

This has been calculated at full operation for each case as shown below:

13.4.1 KOREA

	$
12 weeks wood chip supply	13,500,000
1 months chemical supply	270,000
2 weeks fuel oil supply	500,000
Maintenance material & miscellaneous	1,000,000
Finished product for 1 month	6,800,000
Cash	500,000
	22,670,000
At startup working capital was assumed to be	12,000,000

13.4.2 AUSTRALIA

	$
4 weeks wood supply	2,000,000
2 months chemicals	500,000
2 months coal	650,000
Maintenance material & miscellaneous	1,000,000
Finished product - 8 weeks	7,250,000
Cash	500,000
	11,500,000
At startup working capital was assumed to be	3,300,000

13.4.3 CALIFORNIA

	$
4 weeks wood supply	2,200,000
2 months chemicals	250,000
Maintenance material & miscellaneous	1,000,000
Finished product - 8 weeks	8,050,000
Cash	500,000
	12,000,000
At startup working capital was assumed to be	3,200,000

13.4.4 BRITISH COLUMBIA

	$
6 weeks wood supply	2,000,000
2 months chemicals	150,000
Fuel oil - 1 month	200,000
Maintenance material & miscellaneous	1,000,000
Finished product - 8 weeks	7,500,000
Cash	500,000
	11,350,000
At startup working capital was assumed to be	3,100,000

13.5 Pre-operating and Start-up Costs

13.5.1 KOREA

	$
Pre-operating	3,600,000
Start-up	2,200,000
	5,800,000

13.5.2 AUSTRALIA

Pre-operating	3,000,000
Start-up	1,000,000
	4,000,000

13.5.3 CALIFORNIA

Pre-operating	3,000,000
Start-up	1,000,000
	4,000,000

13.5.4 BRITISH COLUMBIA

Pre-operating	3,000,000
Start-up	1,000,000
	4,000,000

The cost of a training program was included in the pre-operating costs. Appendix 1 describes the training program suggested for Korea.

13.6 Ongoing Capital Expenditures

No allowances were made in any of the cases for ongoing capital expenditures.

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14.0 DEPRECIATION AND INCOME TAXES

14.0 DEPRECIATION AND INCOME TAXES

14.1 Tax Rates

The following income tax rates were applied to taxable incomes:

Korea	-	53%
Australia	-	46%
California	-	46% Federal, plus 9% State = 55%
British Columbia	-	45% combined Federal & Provincial

14.2 Depreciation and Capital Cost Allowances

Case 1 Mill in KOREA

Asset Class	Value ($000)	Straight Line Depreciation (%/a)	Salvage Value ($000)
Buildings	24,880	2.5%	2,488
Vehicles	1,000	25 %	100
Machinery	120,120	8.33%	12,012
Total	146,000		14,600

Period Expenditures

Year	%	$ Millions	Buildings	Vehicles	Machinery
1	15	21.9	3.7	0.1	18.10
2	50	73.0	12.48	0.5	60.02
3	35	51.1	8.70	0.4	42.0
	100	146.0	24.88	1.0	120.12

14.2 (Continued)

Case 2 Mill in AUSTRALIA

Asset Class	Value ($000)	Straight Line Depreciation Rate (%/a)	Straight Line Tax Depreciation Rate (%/a)
Structures	38,440	7½	10%
Mechanical	174,460	7½	10%
	212,900		

Period Expenditures

Year	%	$ Millions	Structures	Mechanical
1	15	31.8	5.7	26.1
2	50	106.6	19.3	87.3
3	35	74.5	13.44	61.06
	100	212.9	38.44	174.46

Case 3 Mill in CALIFORNIA

Asset Class	Value ($000)	Depreciation Rate (%/a)	Year Life
Structures	30,300	150 D.D.B	45.0
Mechanical	126,900	200 D.D.B	10.5
	157,200		

Period Expenditures

Year	%	$ Millions	Structures	Mechanical
1	15	23.6	4.6	19.0
2	50	78.6	15.1	63.5
3	35	55.0	10.6	44.4
	100	157.2	30.3	126.9

There is an investment tax credit in the United States of 10% applicable to the equipment portion only, including sales tax.

14.2 (Continued)

Case 4 Mill in BRITISH COLUMBIA

Assets	Value ($000)	Depreciation Rate	Federal CCA	Provincial CCA
Structures	31,300	5% S.L.	5% D.B.	5% D.B
Vehicles	1,000	20% S.L.	50% S.L.	30% D.B.
Machinery	138,900	10% S.L.	50% S.L.	20% D.B.
Temporary Buildings	2,600	10% S.L.	20% S.L.	10% D.B.
	173,800			

Period Expenditure

Year	%	$ Millions	Buildings	Vehicles	Machinery	Temporary Buildings
1	15	26.1	4.7	0.1	20.8	0.5
2	50	86.9	15.6	0.5	69.5	1.3
3	35	60.8	11.0	0.4	48.6	0.8
	100	173.8	31.3	1.0	138.9	2.6

15.0 FINANCIAL ANALYSIS

15.0 FINANCIAL ANALYSIS

All costs and selling prices used in this study are current for January 31, 1980. It is impossible to predict the actual capital costs, manufacturing costs and selling prices that would exist at the time of startup and for each year of operation should any of these alternatives proceed. In January there were substantial increases for imported softwood chips and fuel costs for Korea.

All costs and prices are stated in U.S. dollars. The following conversion rates were used:

1 U.S. dollar	=	580 Korean Won
1 U.S. dollar	=	0.90 Australian dollars
1 U.S. dollar	=	1.17 Canadian dollars

Inflation beyond January, 1980 has been ignored in all cost and price estimates.

It was assumed that in all cases the pulp mills would produce at 75% of nominal rated capacity in the first year of operation, 90% in the second year and 100% in the third year and thereafter. It was also assumed that all production would bring the full market price, and that there would be no quality factor in pricing of the product.

15.1 Pulp Selling Price

In order to arrive at a selling price for unbleached kraft pulp in Korea, a review was made of the three year price trend of unbleached softwood kraft pulps purchased by a large Korean user of this grade. This has been shown in graph form in Figure 15.2. The prices shown on this graph are not for a single pulp but are the average of the C & F prices of the following:

Springwood	(Swaziland)
Celco	(Chile)
Hyogo	(Japan)
Billerud	(Sweden)
Vaggeryd	(Sweden)

It can be seen that beginning in the second quarter of 1978 the C & F price of pulp to Korea has increased rapidly, so that the price paid at the end of 1979 was double that of March, 1978. A C & F price of U.S. $430.00 per air dry metric tonne will be used in this study, which is the January, 1980 price for imported UKP.

The C & F price is not the actual cost of the pulp delivered to the Korean customer. The exercise following shows the additional costs which must be borne by the customer, assuming pulp is purchased for $430.00 per air dry metric tonne on the C & F basis.

15.1 Pulp Selling Price (Continued)

	$
Customs Duty: (5% of CIF price, CIF price is 1.008 x C & F price)	21.67
Defence Tax (2.5% of CIF price)	10.84
Warehouse storage, insurance (0.24% of C & F price)	1.03
Warehouse storage, bonded transportation fee (5 won per tonne)	0.01
Customs clearance fee (0.125% of CIF price)	0.54
Customs wharfage charge (122 won per tonne)	0.21
Letter of Credit opening commission (0.17% of C & F price)	0.73
Letter of credit interest (16.5% per year for 6 months on C & F price)	35.48
Letter of credit cable charge (40 won per tonne)	0.07
Letter of credit term charge (0.17% of C & F price x 2)	1.46
Letter of credit reimbursement charge (4.85 won per tonne)	0.01
Loading and unloading charge (2,700 won per tonne)	4.66
Korea Trade Association fee (0.55% of CIF price)	2.38
Inland transportation costs from Inchon to Osan (2900 won)	5.00
Total Additional Costs:	84.09

Under present circumstances, a domestically located pulp mill at Onsan would be able to competitively sell unbleached kraft pulp of market quality at a price of $497.00 per air dry metric tonne FOB the pulp mill, as developed on the following page.

In the case of an overseas pulp mill, it has been assumed for this study that the total production would be shipped to Korea. During the first half of 1980 the cost for shipping 500 to 2,000 tonne lots of pulp to Korea from the Pacific Northwest (British Columbia, Washington and Oregon) is U.S.$55.00 per gross metric

15.1 Pulp Selling Price (Continued)

tonne, which is equivalent to U.S. $57.75 per air dry metric tonne. It is assumed that this cost would also apply for pulp shipments from Eureka, California. This cost is all-inclusive of shipping costs but does not include loading and unloading costs. In the case of a pulpmill on tidewater, it is estimated that the loading cost would be about $4.50 per air dry metric tonne. Since the above shipping cost applies on parcels of 500 tonnes and greater, a lesser rate would be obtained for loads of 10 to 15,000 tonnes. 10,000 tonnes represents only 16 days at full production capacity, and it will be assumed for this study that the shipping cost from the Pacific Northwest will be $50.00 per air dry metric tonne, and loading costs will be $4.50 per tonne. The same shipping and loading costs will be assumed for Australia, and an inland cartage cost of U.S. $9.00 will also apply in the case of Australia. The inland transportation cost from the Onsan area is estimated to be 9,860 won per tonne ($17.00).

The table below shows the estimated mill net sales prices for UKP per ADt for the various cases:

	Korea	Australia	U.S.	Canada
Delivered cost to customer	$ 514	514	514	514
Inland transportation	17	5	5	5
Customs duty & charges, taxes, letter of credit, etc.	-	79	79	79
C & F price	-	430	430	430
Overseas freight		50	50	50
Loading charge		4.50	4.50	4.50
Insurance & selling charge		20	20	20
Freight from mill to port		9	0	0
Mill net sales price, ADt	497	346.50	355.50	355.50

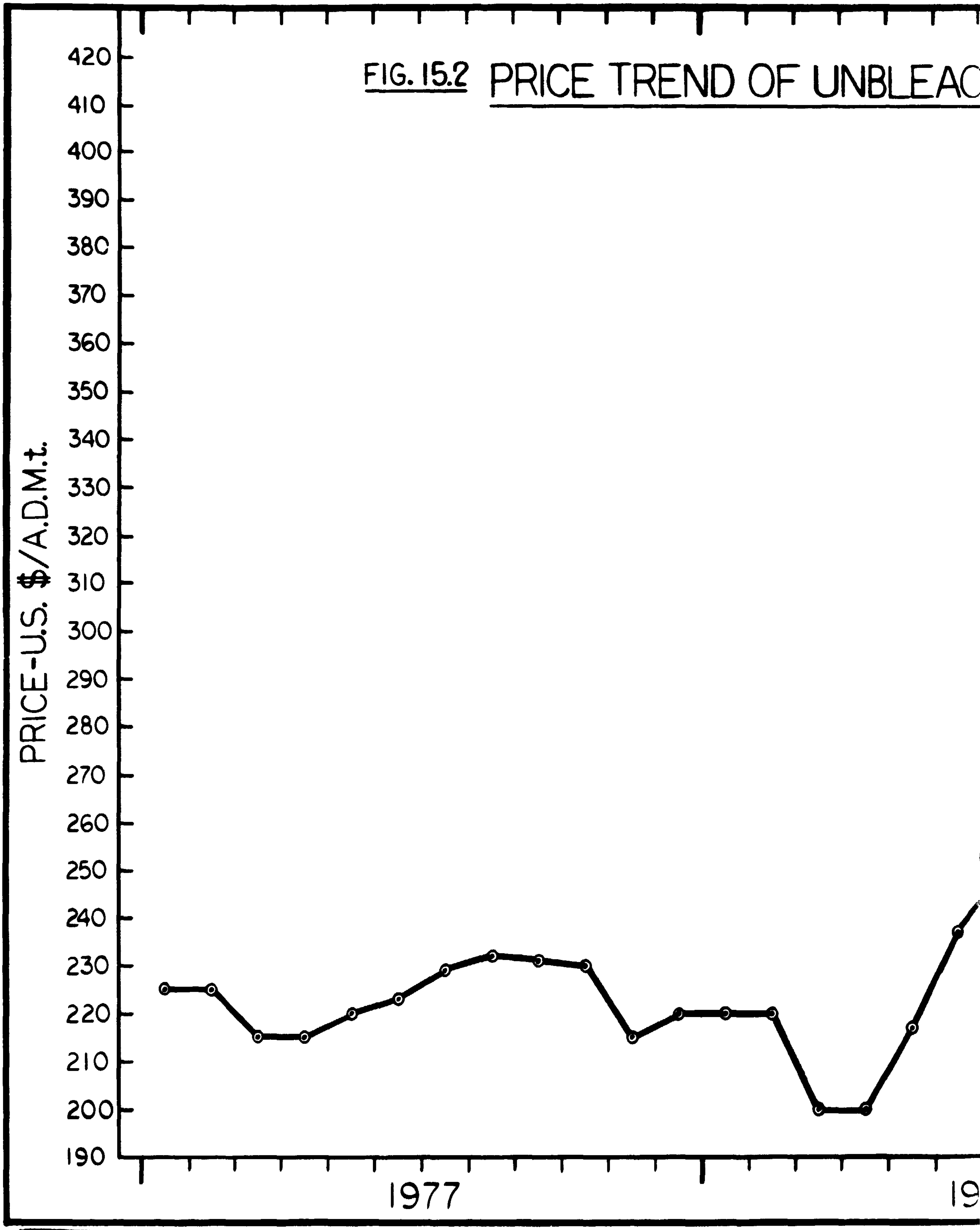
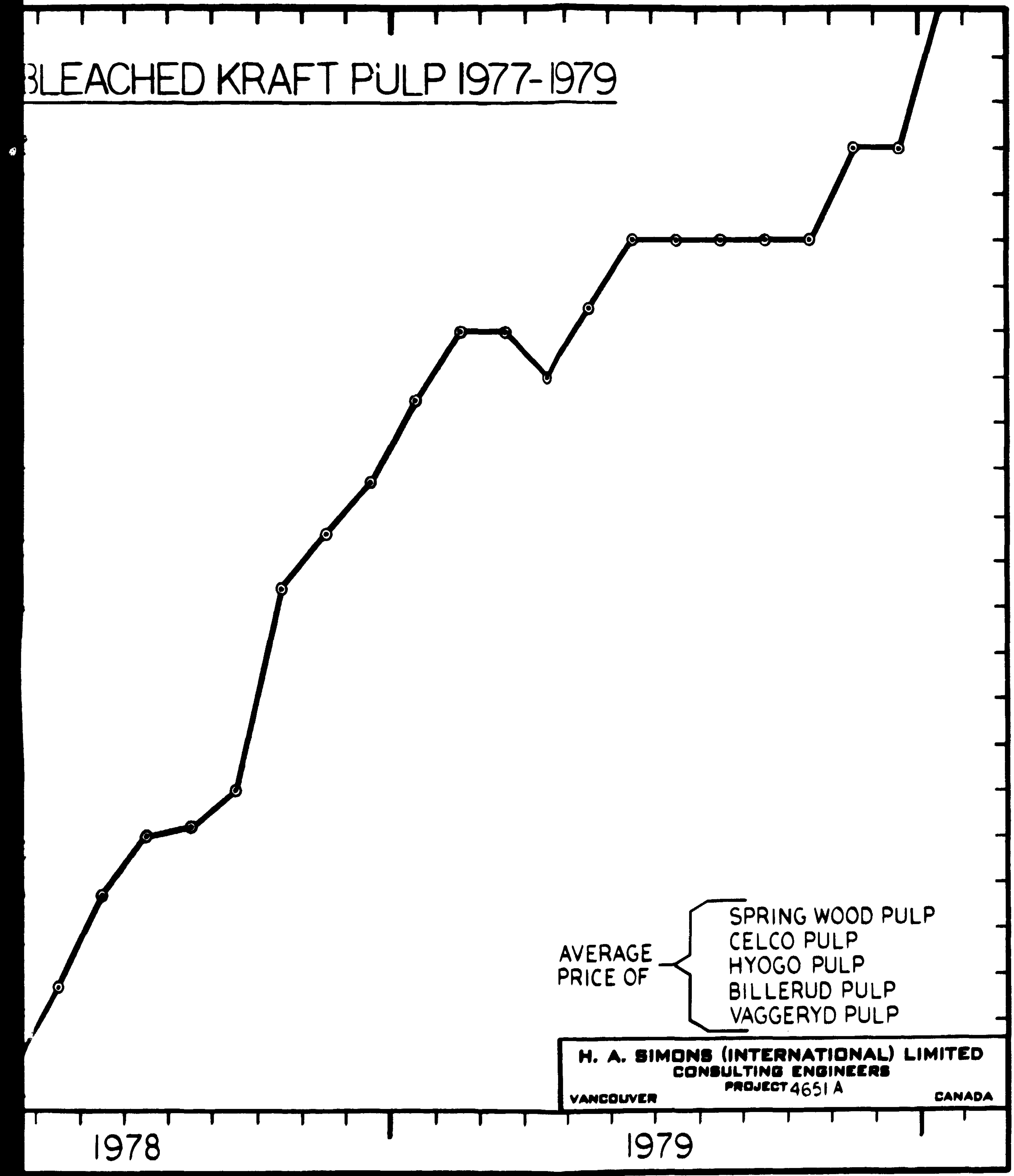


FIG. 15.2 PRICE TREND OF UNBLEAC
PRICE-U.S. $/A.D.M.t.
420
410
400
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
1977
19


BLEACHED KRAFT PULP 1977-1979
AVERAGE PRICE OF
SPRING WOOD PULP
CELCO PULP
HYOGO PULP
BILLERUD PULP
VAGGERYD PULP
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
PROJECT 4651 A
VANCOUVER
CANADA
1978
1979

SECTION 2

15.3 Gross Return on Investment

Based upon the mill net sales price in Section 15.1 and the manufacturing costs developed in Section 11.0, gross profit calculations were calculated for operation at full capacity as shown below:

	Korea	Australia	California	British Columbia
Mill net sales, $	497.00	346.50	355.50	355.50
ADt/a	210,000	210,000	210,000	210,000
Sales/a ($000)	104,370	72,765	74,655	74,655
Manufacturing Cost, $	385.87	201.98	253.56	210.25
Manufacturing Cost/a ($000)	81,033	42,416	53,248	44,152
Gross Profit/a	23,337	30,349	21,407	30,503

Total investments and returns on investment were calculated as below:

	Korea	Australia	California	British Columbia
Plant capital cost ($000)	146,000	212,900	157,200	173,800
Working capital before startup ($000)	12,000	3,300	3,200	3,100
Startup & Pre-operating costs ($000)	5,800	4,000	4,000	4,000
Interest during construction	18,924	18,485	13,657	15,097
Total Investment	182,724	238,685	178,057	195,997
Gross Return on Investment, %	12.8	12.7	12.0	15.6

The gross return on investment is not an accurate indicator of profitability since it ignores depreciation and interest charges. However, it should give a preliminary indication before more

15.3 Gross Return on Investment (Continued)

sophisticated analyses are attempted. None of the above ROIs indicate a viable enterprise, since the gross ROI should be in the order of 24% in order for a project to be considered an attractive investment.

Since the preliminary gross ROIs were unfavorable, a calculation was made to determine the effect of a $50/tonne price increase on ROIs.

	Korea	Australia	California	British Columbia
Gross profit/a ($000)	33,837	40,849	31,907	41,003
Gross ROI, %	18.5	17.1	17.9	20.9

These ROIs are still in an unsatisfactory range, although considerably improved over the base case. A calculation was then made for the effect of a $100/tonne price increase over the base case:

	Korea	Australia	California	British Columbia
Gross profit/a ($000)	44,337	51,349	42,407	51,503
Gross ROI, %	24.3	21.5	23.8	26.3

The above ROIs indicate that a product price increase of about $100 per tonne would probably be required to bring the projects into a favorable range.

15.3 Gross Return on Investment (Continued)

Evaluations were also made to determine the gross ROIs if the mill capacities were increased to 800 ADt/d. These are shown below:

	Korea	Australia	California	British Columbia
Plant Capital Cost	172, 95	251,170	185,380	205,180
Total Investment ($ 000)	213,012	280,773	209,481	230,085
Gross Profit/a ($ 000)	32,051	41,807	31,558	43,549
Gross ROI, %	15.0	14.9	15.2	18.9

The effect of a $50/tonne price increase at 800 ADt/d was also calculated:

	Korea	Australia	California	British Columbia
Gross Profit/a ($ 000)	46,051	55,807	45,558	57,549
Gross ROI, %	21.6	19.9	21.7	25.0

The Australian case is burdened with high investment costs because of the need to pipe effluent to the ocean for dispersal. If the investment cost is arbitrarily reduced by $20 million the ROI for the base case increases to 14%, and a $50/tonne price increase improves the ROI to 18.7%.

The high costs of imported raw material and fuel oil for the Korean pulp mill destroy the profitability for this alternative. If it were assumed that domestic pulpwood could be obtained at a cost of $35 per cubic meter delivered to the pulpmill, and 4.8 cubic meters of wood were required per ADt of pulp, the raw material costs would be reduced by $100 per tonne of pulp. Domestic pulpwood would also furnish the mill with hog fuel, which would save at least $30 per ADt in fuel oil costs. Total costs per ADt would reduce to $256 per ADt. This would greatly enhance the profitability of this alternative as shown below:

Gross Profit/a	$50,610,000
Gross ROI	27.7%

15.4 Financial Statements

Financial Statements (Statement of Earnings, Source and Application of Funds, Balance Sheet) are given in Appendix 4 for the following cases:

- Base Case, 210,000 ADt/a, for each location
- Base Case, plus $50 price increase for each location.
- Capacity Increase to 280,000 ADt/a for each location.
- $20 million capital reduction, Australia only.

15.5 Internal Rate of Return

Private investors and bankers are interested in the internal rate of return of a project. For this study the equity return at the end of 15 years has been selected as the index of internal rate of return. The computer calculates the discount percentage required to equate all of the increases in surplus cash to the original equity investment. For a viable operation this percentage or IRR should be at least 12%. Listed below are the equity returns for several alternatives considered:

	Korea	Australia	California	British Columbia
Base Case (210,000 ADt/a)	-2.37	-4.84	-3.37	-0.11
Base Case plus $50 price increase	4.46	7.84	7.29	12.76
Capacity Increase to 280,000 ADt/a	-1.67	3.24	2.38	9.06
$20 million Capital reduction to Base Case		-0.57		

16.0 SENSITIVITY ANALYSIS

16.0 SENSITIVITY ANALYSIS

None of the base cases was viable under the conditions existing at the time of the study, therefore an extensive sensitivity analysis was not indicated. However, the effects of increasing the selling price by $50 per tonne and increasing the mill capacity by one third were investigated, as reported in the previous section. Increasing the selling price was much more effective in improving profitability than higher capacity. The combination of higher capacity and higher selling price, as indicated by gross ROI, would bring all of the alternatives close to the viable range. Of course, none of the adverse factors such as increased raw material costs or increased capital cost were investigated. The Korean alternative would become viable if supplied completely with domestic pulpwood at $35 per cubic meter.

17.0 SOCIO-ECONOMIC BENEFITS

17.0 SOCIO-ECONOMIC BENEFITS

Only the Korean alternative would appear to produce benefits of a socio-economic nature. The chief savings in foreign exchange would be the net difference in annual cost for imported pulp and the cost of imported wood chips.

Annual cost of pulp @ $430 per ADt	-	$90,300,000
Annual cost of chips @ $268 per ADt	-	$56,280,000
		$34,020,000

However, this apparent savings would be offset by other costs of imported materials such as fuel oil, and by interest and principal payments on foreign debt:

Fuel oil costs @ $61 per ADt	-	$12,810,000
Foreign loan repayment	-	$ 5,091,000
Interest on foreign loan	-	$ 3,500,000
		$21,401,000

The net savings in foreign exchange would be about $12,500,000 per year.

The construction phase of a pulp mill in Korea would produce several benefits of a socio-economic nature. A considerable portion of the detailed engineering would be done by Korean engineering companies, this would give employment to almost 75 engineers and technicians for two years, and would enrich their knowledge and expertise in this field. The mill would be built by Korean construction companies, giving employment to as many as 1,500 construction workers at one time, and an average number of about 750 for a two year period. Valuable experience would be gained in the practices used in pulp mill construction.

Korean labor would be used to produce the structural steel and the other construction materials, including such items as sand and gravel. Korean industry would produce a high percentage of the major process equipment, including such items as the power boiler, chip conveyors, dryer cylinders, evaporators, electrostatic precipitator, lime kiln, and most of the pumps, motors and electrical equipment. The experience gained in producing the process equipment could be used to advantage in making these items for export.

The number of new employees for the expanded mill would be about 175. In addition to the multiplier effect these new jobs would add to the Korean economy, the pool of pulp mill workers experienced in startup and operation would be increased.

If the mill could be completely supplied with domestic pulpwood, this would increase the savings in foreign exchange to about $69,000,000 per year.

The bark from domestic pulpwood would supply hog fuel to the mill, this could result in a substantial reduction in the use of fuel for power generation and an annual savings in foreign exchange estimated at $6,000,000. The harvesting of domestic pulpwood would require several thousand full time forestry, transportation and pulpwood workers, a very valuable socio-economic benefit to Korea.

18.0 FINANCIAL SUMMARY

simons

18.0 FINANCIAL SUMMARY

The preceding information in Sections 15, 16, and 17 indicate that under current conditions none of the base case alternatives is economically viable. In recent months the costs of raw materials and energy have been rapidly escalating. Capital costs have also been increasing at about 10% per year. Interest rates in North America are 3 points higher than a short time before. UKP pulp prices have also advanced, but obviously they have not yet increased sufficiently to overcome these rapidly escalating cost factors.

The Korean pulp mill alternative is particularly unprofitable under the conditions of this study. The capital costs for this alternative are the lowest, but the operating costs are the highest. The cost of imported chips FOB the shipping point has increased more than 60% in the last two months, and constitutes 70% of the manufacturing costs.

The cost of fuel oil in Korea increased 59.4% in January. Korean interest rates also increased about 25% in January. The mill net price of domestic pulp in Korea enjoys some substantial advantage because of duties and taxes charged to imported pulps. This artificially high mill net price gives the illusion of a better profit and return on investment than is actually the case. The equity return on investment shown in 15.4 gives a truer picture of the lack of profitability.

If sufficient domestic pulpwood could be supplied to the proposed Korean pulp mill, it is probable that this operation would become economically viable. It seems reasonable that as much as $130 per tonne of pulp could be saved in wood and fuel costs through the use of domestic wood. The existing Dong Hae pulpmill should also be furnished with domestic pulpwood, both hardwood and softwood. The Korean Government should give the Dong Hae operation their strong assistance in developing a supply plan for domestic pulpwoods on a sustained basis. A brief survey of Korea's forest resources in 1975* indicated that self-sufficiency in pulpwood supply (including waste wood chips) for an 800 tonne pulpmill could be attained earlier than the 1991 date then considered possible by the forestry authorities.

* Pulpwood Availability Study for Korea Chemical Pulp Company Limited, April, 1975: Reid Collins and Associates Limited, Consulting Foresters and Engineers, Vancouver, British Columbia.

The Australian alternative has the lowest operating costs but the highest capital costs. This is actually the only alternative that has an uncommitted wood supply that is in place. The high capital costs could possibly be reduced, but a substantial reduction is needed to bring this project into a profitable range.

The California case suffers from the high cost of raw materials. The price of these materials is set by the FOB export chip prices, and these have increased by more than 60% in the last two months. As long as the North Coast Export Cooperative can sell all their chips at today's high export prices FOB Eureka there is no incentive for them to consider sales to their own joint venture pulpmill at a lower chip price. Eventually this site might come back into the picture, but not until the bullish chip market subsides.

The British Columbia alternative appears to be the best of the four, although it also is not viable under today's conditions. A larger mill should be considered for this site, perhaps combined with bleached kraft production.

In all cases an equity funding of 30% was used. This requires that the owners invest between 50 to 60 million dollars at the initiation of an offshore project. This would seem to be a large burden for most Korean companies to undertake, and it would probably be necessary to consider attracting foreign partners to help finance the project.

19.0 CONCLUSIONS AND RECOMMENDATIONS

19.0 CONCLUSIONS AND RECOMMENDATIONS

1. Four alternatives were evaluated for the production of kraft pulp for Korea:

   Option A - Expansion of the Dong Hae pulpmill at Onsan, Korea
   Option B - A new pulpmill at Beerburrum, Queensland, Australia
   Option B - A pulpmill at Eureka, California, United States
   Option B - A pulpmill at Ocean Falls, British Columbia, Canada

   No suitable Option C opportunity (purchase of equity in an existing UKP mill) could be located for this study.

2. The Australian alternative has an uncommitted supply of pulpwood available. All other alternatives are in a competititive wood supply situation.

3. Satisfactory unbleached kraft pulps for sack kraft and linerboard could be produced at any of the alternative locations.

4. A nominal mill size of 600 ADt/d (210,000 ADt/a) was selected for comparision of alternatives. The Korean domestic market can support an unbleached kraft pulp mill of this capacity.

5. Costs of raw materials and fuel oil have escalated rapidly in the last two months, particularly with respect to the Korean and Californian alternatives. Interest rates for domestic loans in Korea are very high. All costs and prices used for this study were at the January 31, 1980 levels.

6. The indicated manufacturing costs in U.S. dollars for the four alternatives range from $202 per ADt for Australia to $386 per ADt for Korea. About 70% of the Korean manufacturing cost is accounted for by the cost of imported chips.

7. The indicated plant capital costs for the 600 ADt/d unbleached kraft pulpmills range from U.S. $146,000,000 for Korea to $213,000,000 for Australia. The shared use of existing facilities for the alternatives in Korea, California, and Canada reduced their capital cost requirements. The Australian alternative was an entirely new mill and also required an expensive effluent pipeline.

8. Because of duties, taxes, ocean freight and other costs for imported pulps, the indicated mill net selling price for UKP produced in Korea is about $145 per tonne higher than the mill net selling price for UKP produced offshore.

9. The gross return on investments for all alternatives under base case conditions are in a low range and would indicate non-viability under those conditions.

10. Viability of all alternatives is improved most by an increase in selling price. Increasing the capacity of each alternative to 800 ADt/d also improves viability. A combination of increased selling price by $50 per ADt and increased capacity to 800 ADt moves each alternative close to the viable range.

11. The Korean pulpmill alternative would become economically viable if it were possible to be supplied with domestic pulpwood at $35 per cubic meter instead of imported chips at $56 per cubic meter. Fuel cost savings of about $6,000,000 per year are indicated if the hog fuel produced in bark removal were used for steam generation. There are considerable socio-economic benefits to Korea in the event that a pulp mill could be built there.

12. Under the conditions that prevailed at January 31, 1980, and within the constraints of this study, none of the four alternative cases for manufacture of UKP should be considered for implementation.

13. With the approval, assistance and financial support of the Government of the Republic of Korea, a concerted effort should be made by the Dong Hae Pulp Company and the Ssangyong Paper Company to develop a long range program for the procurement and sustained supply of domestic softwood and hardwood pulpwood. When the economics and schedule of domestic wood procurement are available, the economics of the Dong Hae pulpmill expansion should be reconsidered.

14. Further contacts and investigations are warranted with the B.C. Cellulose Company, owners of the Ocean Falls Paper Company. If the wood supply and wood costs for this mill can be firmed, it appears that this site would have interesting development opportunities for bleached and unbleached kraft pulps. The Ocean Falls Company is presently engaged in a program to define their wood supply potential.

15. Further studies should be made for the reduction of capital costs at the Australian mill. The low operating costs indicated for this mill and the uncontested wood supply make this an attractive possibility for a joint venture providing the capital costs can be reduced. Specifically an alternative to the effluent pipeline should be studied.

16. Communications with the North Coast Export Company (California) should be maintained. In the event that chip export prices become too expensive for the Japanese market, there could be a decision to manufacture kraft pulp at the Eureka site and there would be an opportunity for a joint venture.

APPENDIX 1

TRAINING PROGRAM FOR UKP
EXPANSION OF THE DONG HAE MILL

simons

APPENDIX 1: Training Program for UKP Expansion of the Dong Hae Mill

In the event that Option A (erection of an unbleached kraft softwood pulp mill alongside the Dong Hae bleached kraft pulpmill) should be selected for implementation, a training program should be carried out for the personnel involved.

The present Dong Hae bleached kraft operation will have been in operation for several years at the time of startup of the unbleached kraft operation. The management, supervisors and operators of the Dong Hae mill should have gained considerable experience in operating a kraft mill by the time the UKP operation starts up, and the extent of the required training program would take this into consideration. For this reason the training program would be designed primarily to benefit the 150 new operators and the 25 new salaried employees.

The existence of the operating bleached kraft pulp mill at Onsan would provide an excellent opportunity for "hands-on" training of the new operators and supervisors. The equipment in the UKP expansion would be very similar to that in the present mill, except no bleaching equipment would be involved.

Training should be conducted in the Korean language by selected members of the Dong Hae staff. However, it is recommended that the services of a professional trainer be engaged to insure that the most effective training methods are used, and that the content and scheduling of the training program are appropriate to the needs of the expanded mill. Professional training services are available from engineering consultants and from individuals who specialize in this activity.

It is envisioned that the training program would follow a schedule such as that suggested below:

Phase 1 - 24 Months Before Startup

1. Engage services of professional trainer
2. Complete organization chart and job descriptions.
3. Identify training needs and organize training plan.
4. Draw up schedule for hiring new employees based on training needs prior to startup.
5. Commence training manual planning and preparation.

Phase 2 - 18 Months Before Startup

1. Commence course in training methods for selected Dong Hae personnel who will conduct the training program.
2. Commence preparation of operating manuals for mill departments. Preparation to be done by Dong Hae staff under guidance of the professional trainer.

Phase 3 - 12 Months Before Startup

1. Commence safety manuals
2. Set up maintenance systems and record keeping.
3. Commence to set up departmental data sheets and records system.

Phase 4 - 9 Months Before Startup

1. Commence new operator and supervisor classroom training sessions in process, operating techniques and safety.
2. Commence new operator mill visits to plant under construction for familiarization with equipment, pipeline, etc.
3. Commence accounting procedures and record keeping systems for purchasing, inventory, cost control, stores and accounting.

Phase 5 - 0 to 6 Months Before Startup

1. Conduct "hands-on" training of new operators in existing mill.
2. Complete all manuals, records systems, etc.
3. Complete the setup of all laboratory facilities and testing procedures. Train testers, set specifications for raw materials, materials in process, and finished products.
4. Organize operating and maintenance crews.

Training in all cases would be conducted by mill supervisors and operators under the guidance of the professional trainer. All facets of mill operations would be covered in the training program, and the inter-departmental relationships explained. In depth departmental training would be conducted for operators of the various departments. All operators would be trained in elementary aspects of instrumentation, fluid and gas flow in pipelines, pumps, motors, electric circuits, electrical starters, and circuit breakers, simple chemistry pertaining to the process and operations and maintenance of departmental equipment.

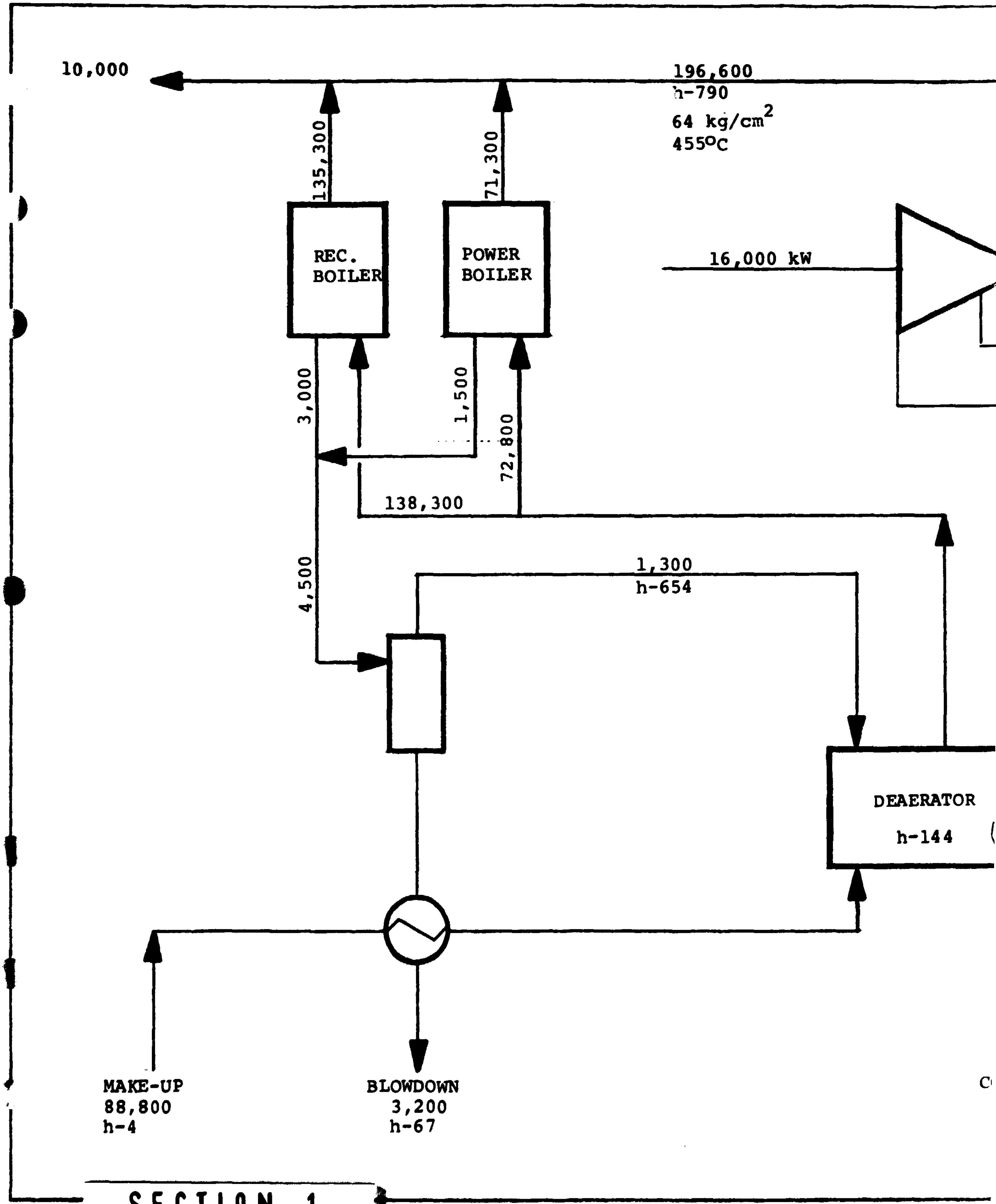
Although the above training program is suggested for the expanded Dong Hae mill, the remarks are equally applicable to the cases under Option B. In these cases arrangements would be made to conduct the mill operating training at other mills.

APPENDIX 2

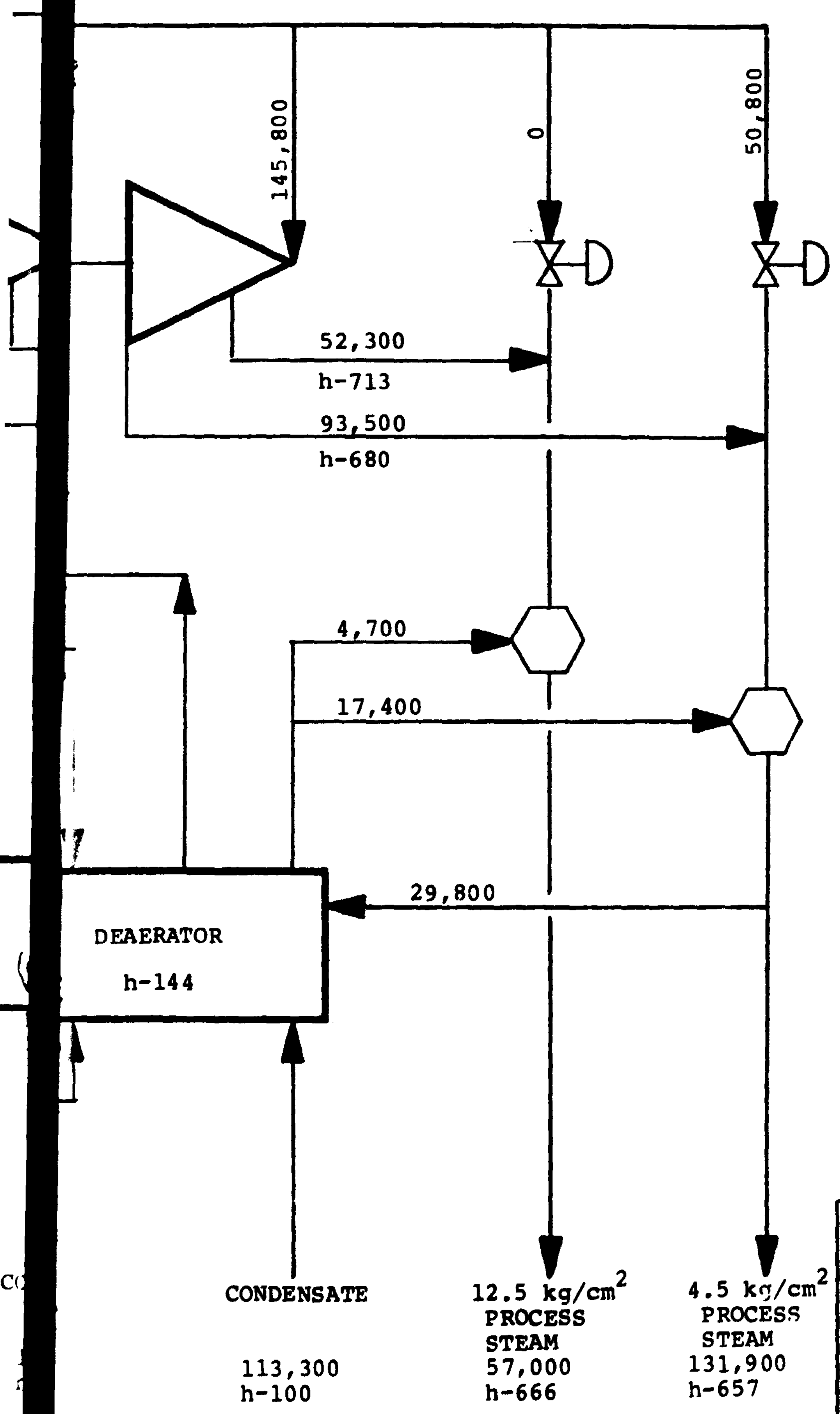
HEAT BALANCES

2.1 Process Steam Requirements - Yearly Averages for 600 ADt/d Production

Location:	KOREA		AUSTRALIA		CALIFORNIA		BRITISH COLUMBIA	
Digester type:	Batch		Continuous		Continuous		Continuous	
Dryer type:	Cylinder		Airborne		Airborne		Airborne	
No. of Evaporator effects:	6		6		5		6	
Black Liquor solids kg/d:	967,000		903,600		967,000		957,100	
Power Boiler fuel	Oil		Hog Fuel-Coal		Hog Fuel		Hog Fuel-Oil	
	kg/t	kg/h	kg/t	kg/h	kg/t	kg/h	kg/t	kg/h
4.5 kg/cm^2								
Digesters	300	7,500	-	-	-	-		-
Brown Stock Washing	100	2,500	100	2,500	100	2,500	100	2,500
Evaporators	1,720	46,900	1,330	37,000	1,820	50,600	1,410	39,200
Machine Room	2,150	53,750	250	6,250	250	6,250	250	6,250
Recovery Air Heater	400	10,000	400	10,000	400	10,000	400	10,000
Stripper	110	2,750	110	2,750	110	2,750	110	2,750
Heating & Ventilating	300	7,500	200	5,000	250	6,250	500	12,500
Miscellaneous		1,000		750		750		750
		131,900		64,250		79,100		73,950
12.5 Kg/cm^2								
Digesters	1,950	48,750	1,460	36,500	1,565	39,125	1,550	38,750
Evaporator Ejectors	15	375	15	375	15	375	15	375
Recovery Air Heater	240	6,250	240	6,250	240	6,250	240	6,250
Shatter Nozzles	40	1,000	40	1,000	40	1,000	40	1,000
Machine	-	-	1,700	42,500	1,700	42,500	1,700	42,500
Miscellaneous		625		375		750		125
		57,000		87,000		90,000		89,000
60% Condensate return:		113,300		90,750		101,500		97,800


10,000
196,600
h-790
64 kg/cm2
455°C
135,300
71,300
REC. BOILER
POWER BOILER
16,000 kW
3,000
1,500
72,800
138,300
4,500
1,300
h-654
DEAERATOR
h-144
MAKE-UP
88,800
h-4
BLOWDOWN
3,200
h-67

SECTION 1



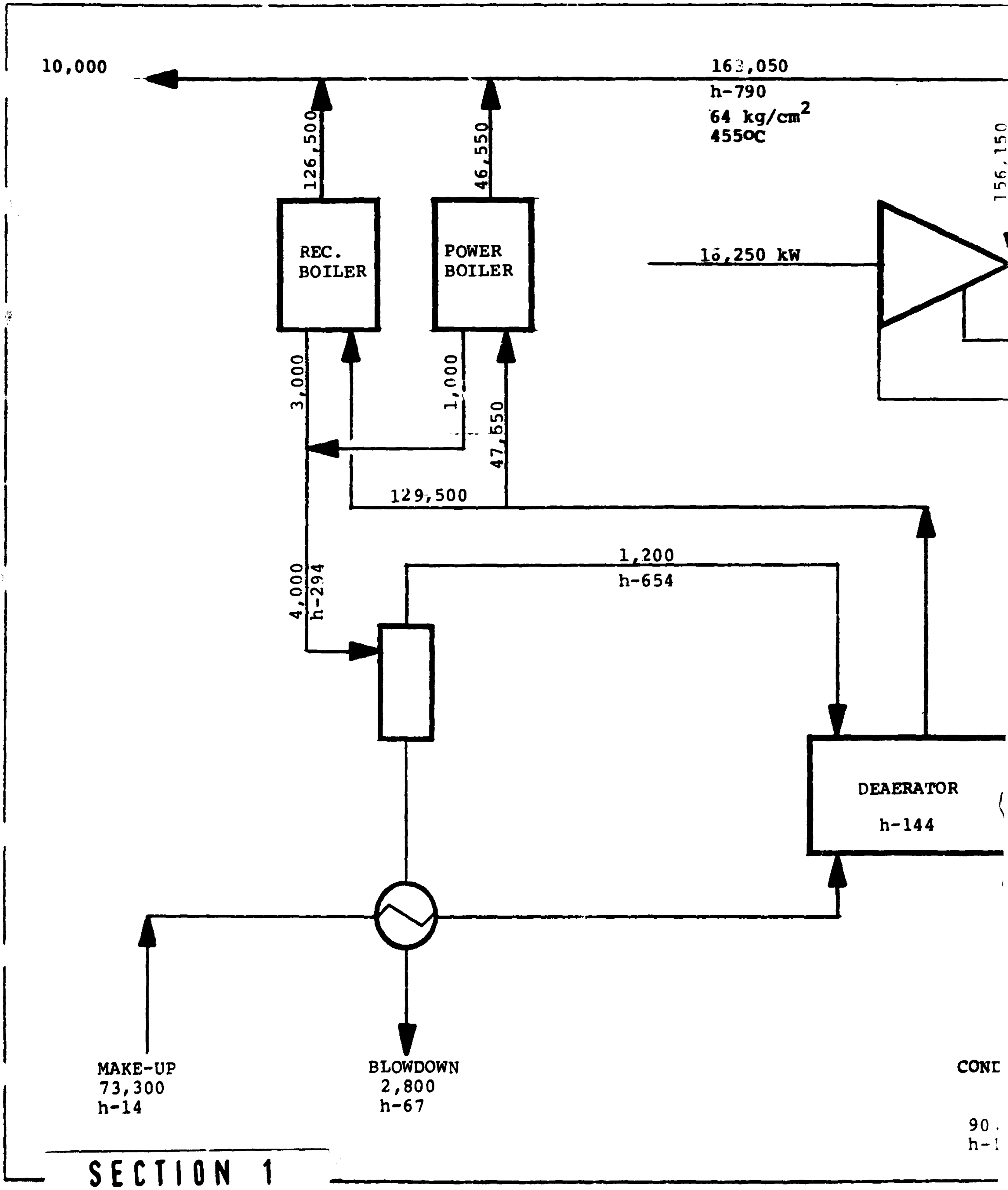
ALL FLOWS IN kg/hr

P.4651A - UNIDO - KOREA

SITE - KOREA
YFARLY AVERAGE

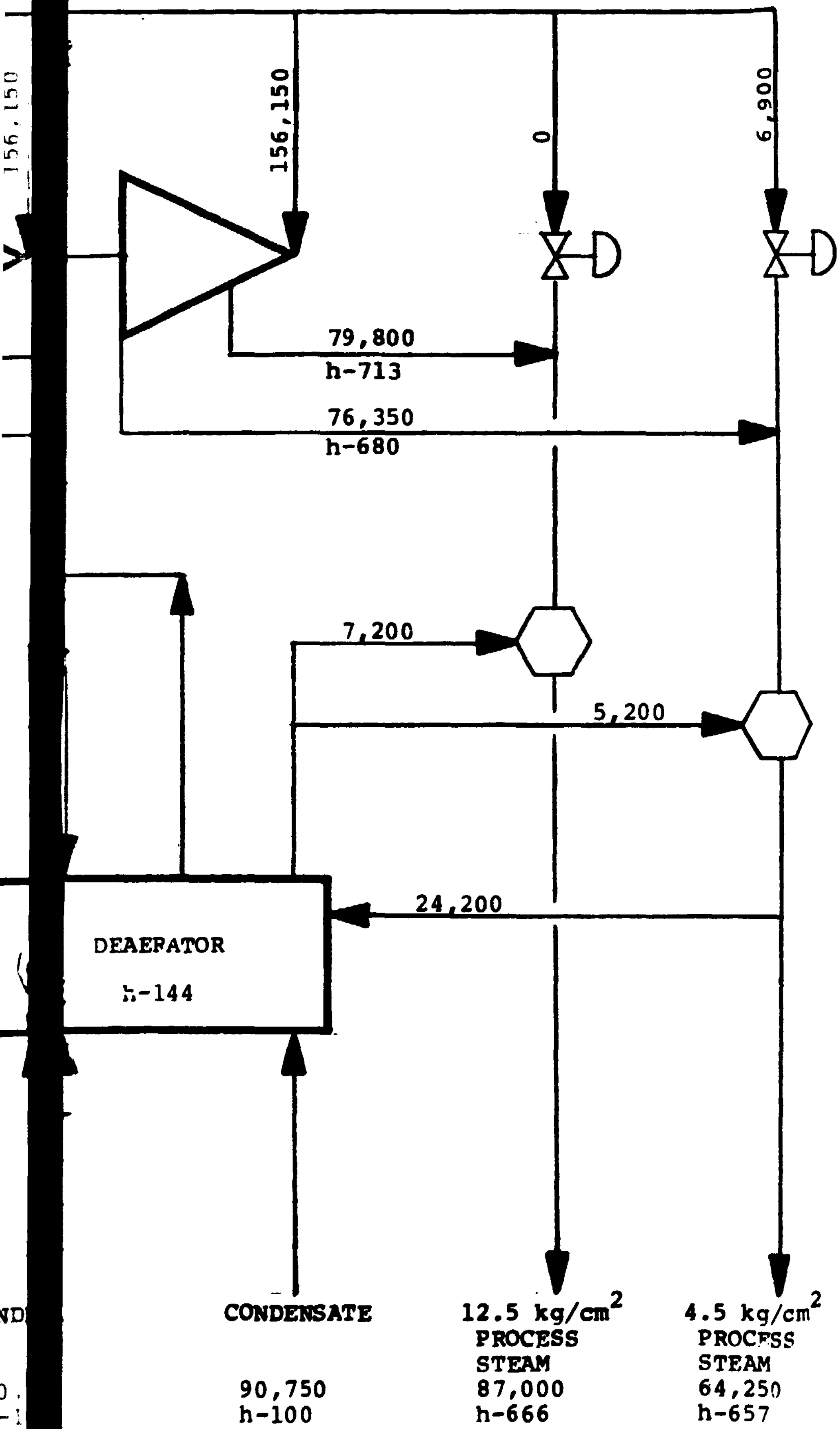
15/01/80 | A.G.H.

SECTION 2



10,000
163,050
h-790
64 kg/cm2
455oC
126,500
46,550
156,150
REC.
BOILER
POWER
BOILER
16,250 kW
3,000
1,000
47,550
129,500
1,200
h-654
4,000
h-294
DEAERATOR
h-144
MAKE-UP
73,300
h-14
BLOWDOWN
2,800
h-67

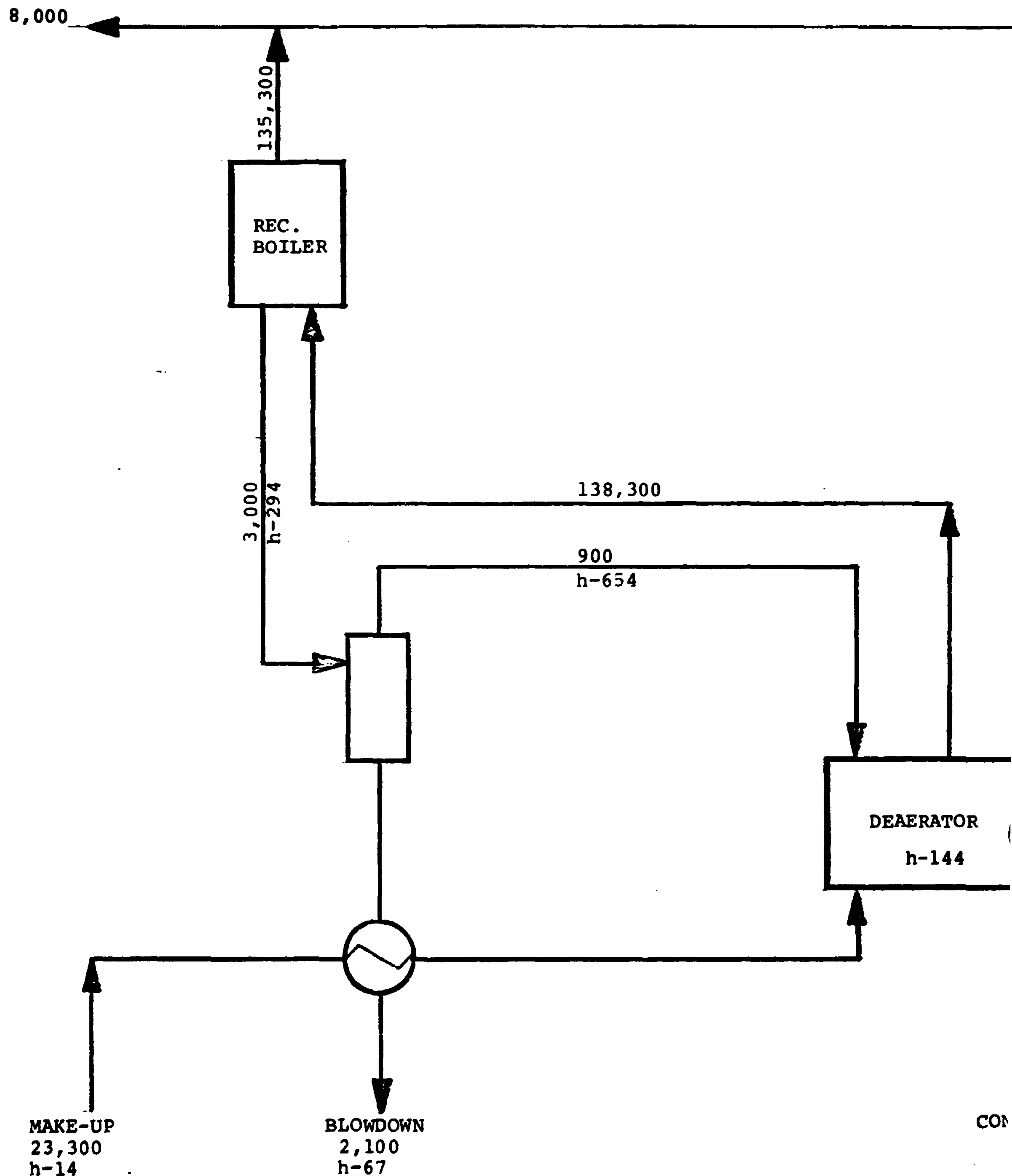
SECTION 1



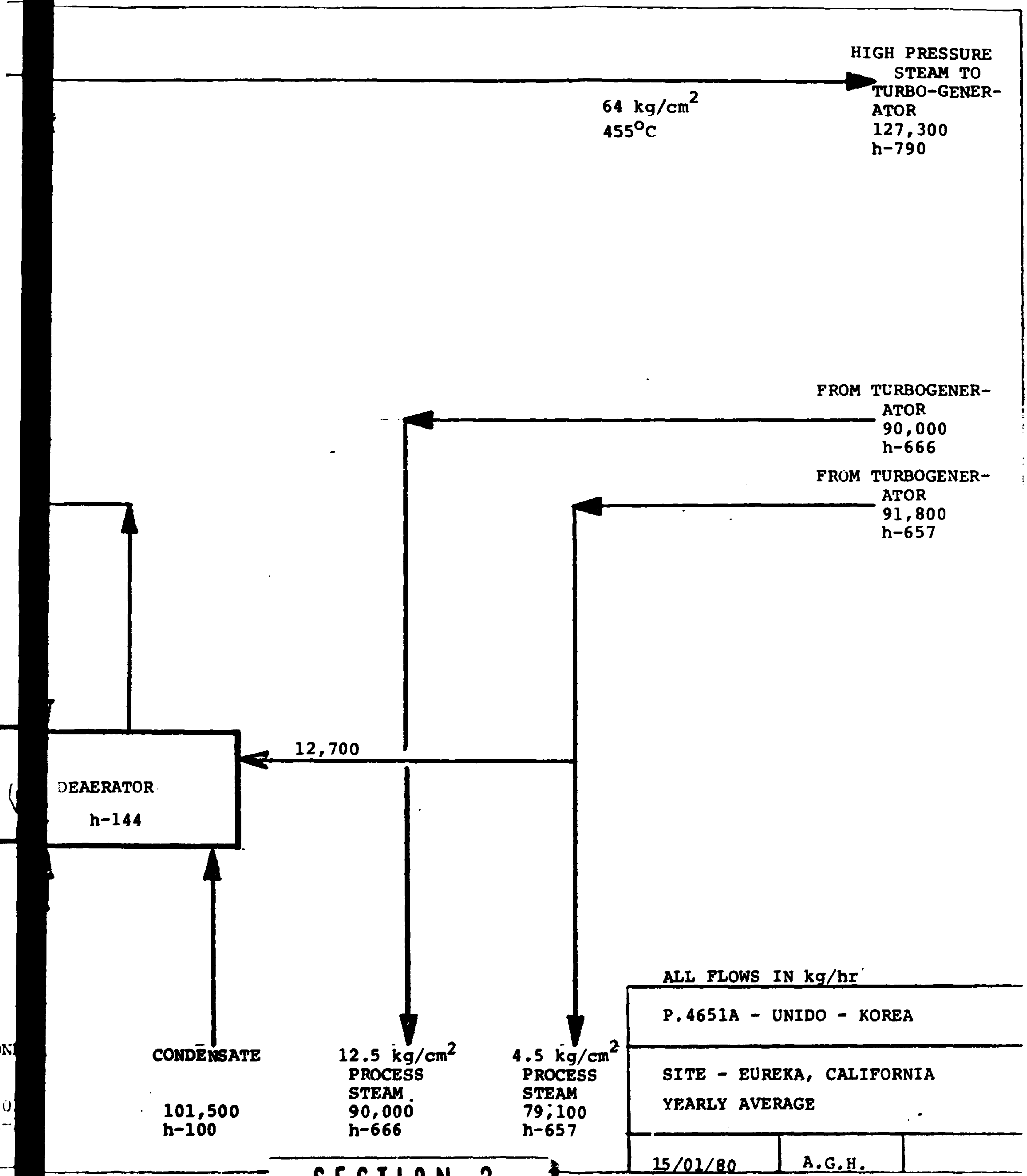
ALL FLOWS IN kg/hr

P.4651A - UNIDO - KOREA
SITE - QUEENSLAND YEARLY AVERAGE
15/01/80	A.G.H.	

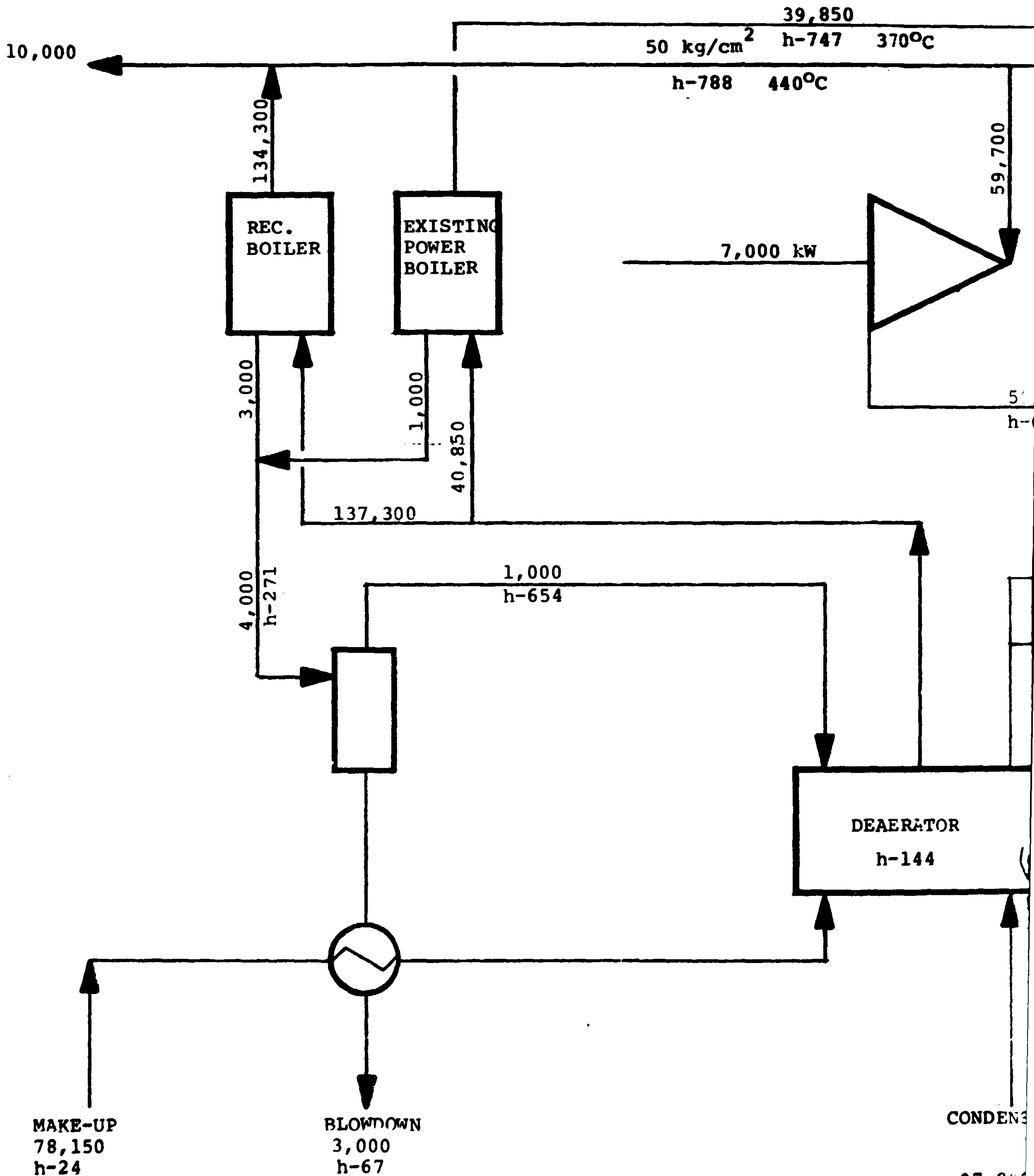
SECTION 2


8,000
135,300
REC.
BOILER
3,000
h-294
138,300
900
h-654
DEAERATOR
h-144
MAKE-UP
23,300
h-14
BLOWDOWN
2,100
h-67

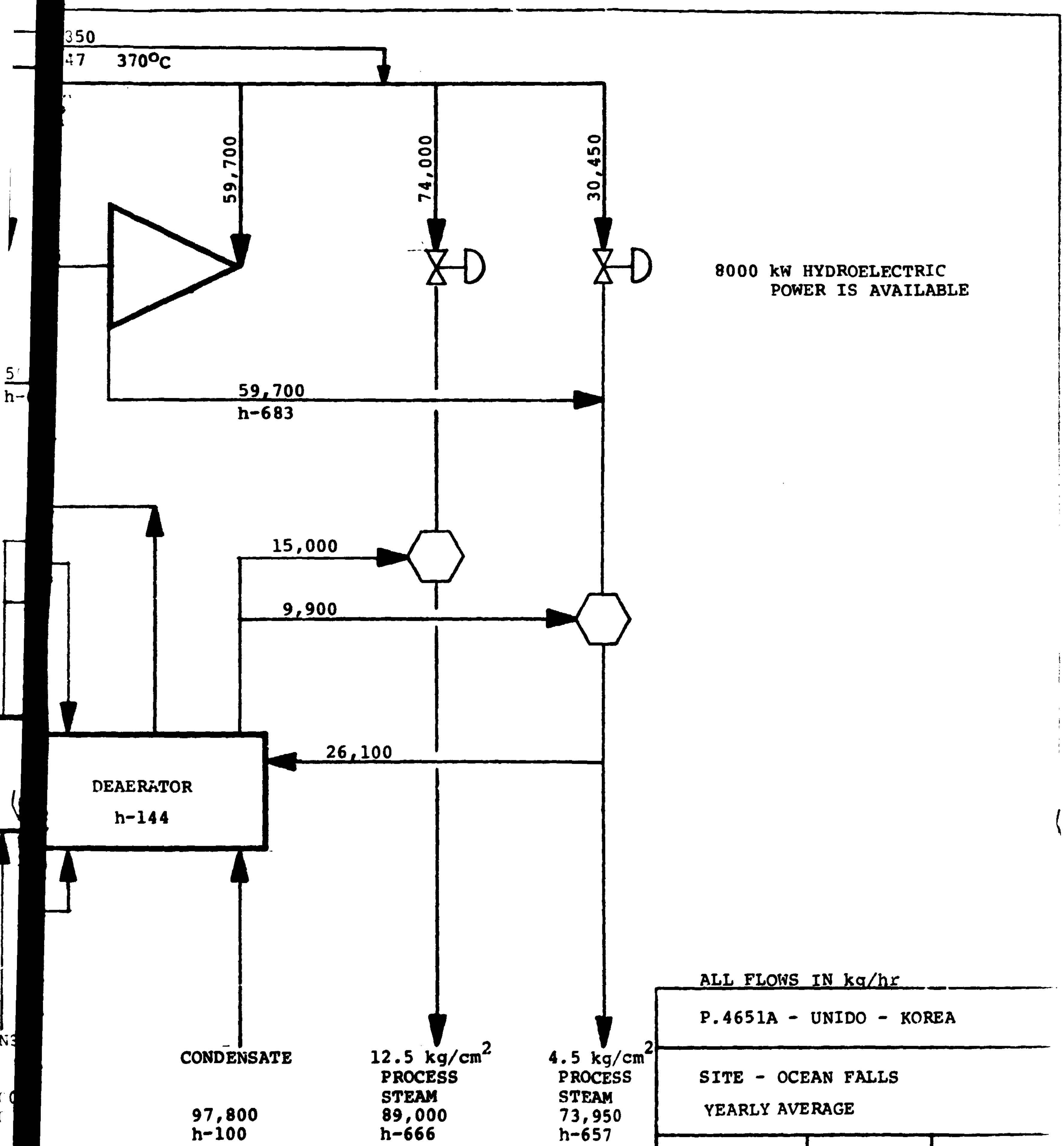
SECTION 1


HIGH PRESSURE STEAM TO TURBO-GENERATOR
127,300
h-790
64 kg/cm²
455°C
FROM TURBOGENERATOR
90,000
h-666
FROM TURBOGENERATOR
91,800
h-657
12,700
DEAERATOR
h-144
CONDENSATE
101,500
h-100
12.5 kg/cm² PROCESS STEAM
90,000
h-666
4.5 kg/cm² PROCESS STEAM
79,100
h-657
ALL FLOWS IN kg/hr
P.4651A - UNIDO - KOREA
SITE - EUREKA, CALIFORNIA
YEARLY AVERAGE
15/01/80
A.G.H.

SECTION 2


39,850
10,000
50 kg/cm2
h-747
370°C
h-788
440°C
134,300
59,700
REC. BOILER
EXISTING POWER BOILER
7,000 kW
3,000
1,000
40,850
137,300
1,000
h-654
4,000
h-271
DEAERATOR
h-144
MAKE-UP
78,150
h-24
BLOWDOWN
3,000
h-67
CONDEN
97,8
h-10

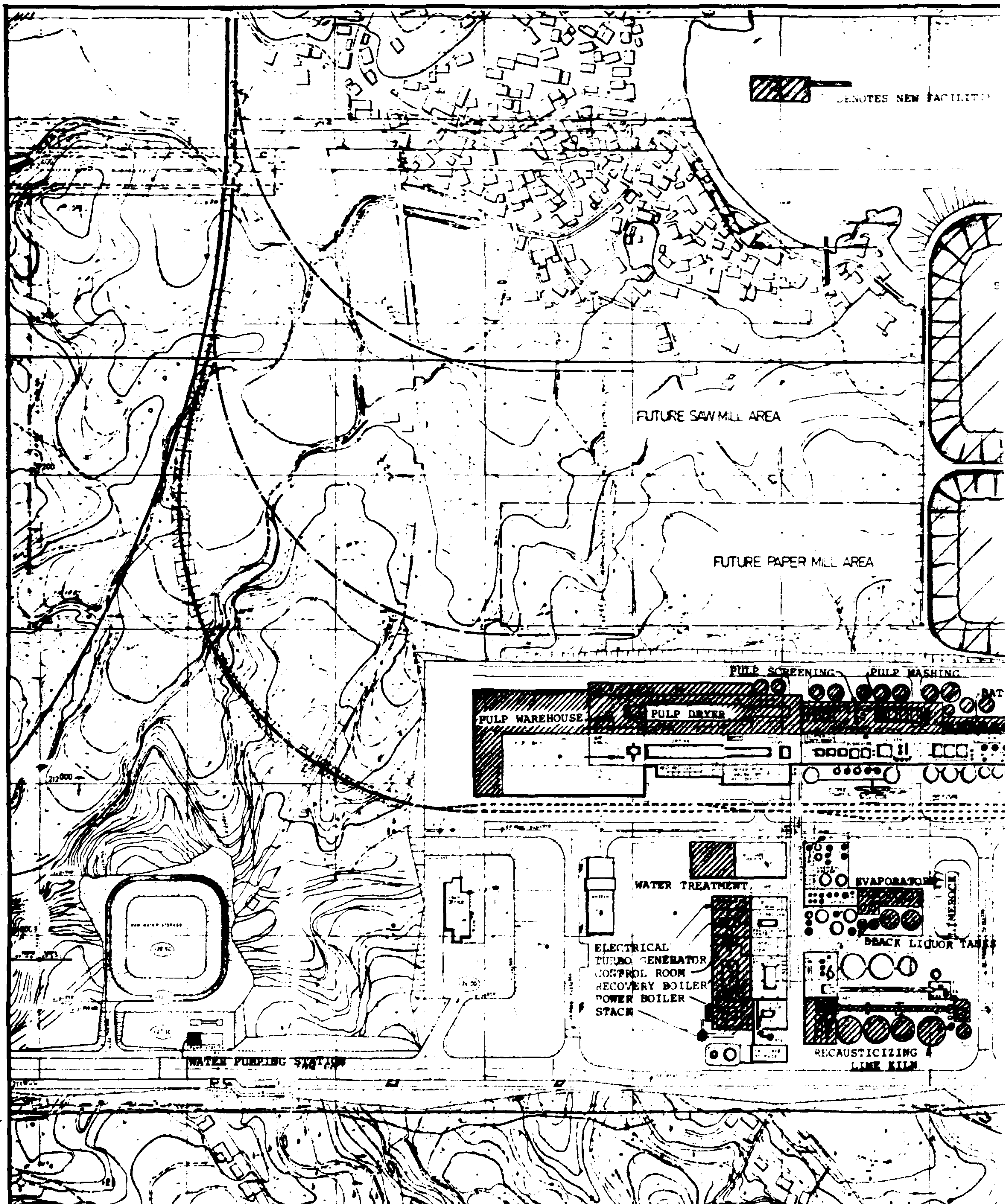
SECTION 1


350
47 370°C
59,700
74,000
30,450
8000 kW HYDROELECTRIC POWER IS AVAILABLE
59,700
h-683
15,000
9,900
26,100
DEAERATOR
h-144
CONDENSATE
97,800
h-100
12.5 kg/cm2 PROCESS STEAM
89,000
h-666
4.5 kg/cm2 PROCESS STEAM
73,950
h-657
ALL FLOWS IN kg/hr
P.4651A - UNIDO - KOREA
SITE - OCEAN FALLS
YEARLY AVERAGE
15/01/80
A.G.H.

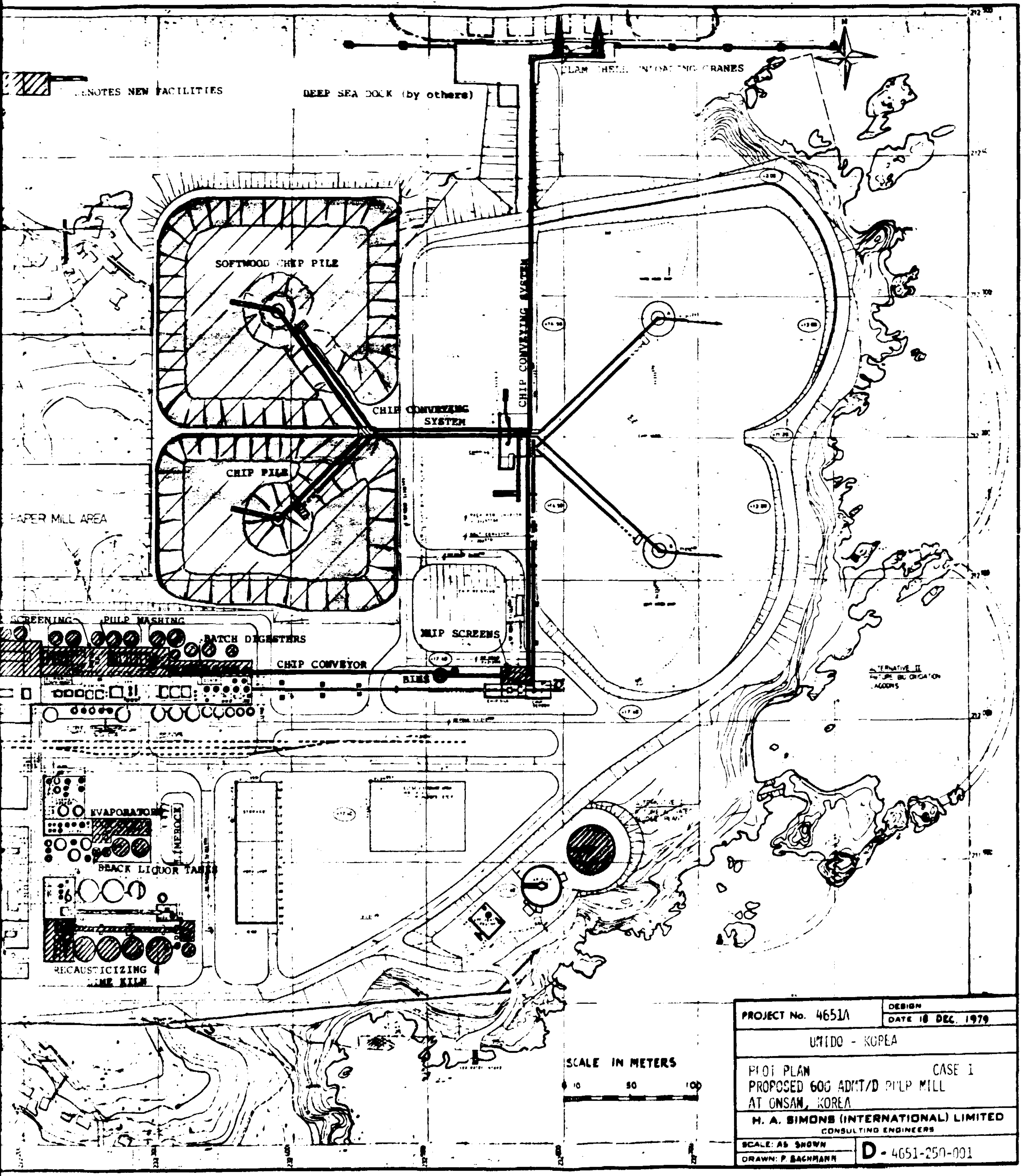
SECTION 2

APPENDIX 3

FLOWSHEETS AND LAYOUTS


FUTURE SAW MILL AREA
FUTURE PAPER MILL AREA
PULP SCREENING
PULP WASHING
PULP WAREHOUSE
PULP DRYER
WATER TREATMENT
EVAPORATORS
ELECTRICAL
TURBO GENERATOR
CONTROL ROOM
RECOVERY BOILER
POWER BOILER
STACK
RECAUSTICIZING &
LIME KILN
WATER PUMPING STATION

SECTION 1



DENOTES NEW FACILITIES
DEEP SEA DOCK (by others)
CLAM SHELL UNLOADING CRANES
SOFTWOOD CHIP PILE
CHIP CONVEYING SYSTEM
CHIP PILE
PAPER MILL AREA
SCREENING
PULP WASHING
BATCH DIGESTERS
CHIP CONVEYOR
CHIP SCREENS
BINS
EVAPORATORS
LIMEROCK
BLACK LIQUOR TANKS
RECAUSTICIZING & LIME KILN
ALTERNATIVE II FUTURE BIO OXIDATION LAGOONS
SCALE IN METERS
10
50
100
PROJECT No. 4651A
DESIGN
DATE 18 DEC. 1979
UNIDO - KOREA
PLOT PLAN CASE I
PROPOSED 600 ADMT/D PULP MILL
AT ONSAN, KOREA
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
SCALE: AS SHOWN
DRAWN: P. BACHMANN
D - 4651-250-001

SECTION 2

LEGEND:

WOOD YARD:
1) LOG STORAGE (FOR EMERGENCY)
2) RAIL CAR UNLOADING
3) LOG DECKS
4) TRUCK UNLOADING
5) SLASHER TO 3 METER LENGTH
6) SHORT LOG CONVEYOR
7) BARKING DRUM 12'-6" DIA X 100
8) DROP CHIPPER
9) CHIP SCREEN
10) CHIP CONVEYOR TO AND FROM CHIP STORAGE
11) CHIP STORAGE PILE
12) CHIP TRUCK UNLOADING
13) HAMMER HOG
14) HOG FUEL PILE
15) CONVEYORS TO DIGESTING & BARK BOILER

PULPING:
16) CONTINUOUS DIGESTER (2) VESSEL WITH DIFFUSION WASHING
17) DIFFUSION WASHING & STORAGE
18) PULP SCREENING & REWASHING
19) PULP CLEANING & DE-WATERING
20) PULP DRYER
21) BALE FINISHING
22) WAREHOUSE & RAIL CAR LOADING
23) CONDENSATE STRIPPING
24) TURPENTINE RECOVERY
25) TALL OIL PLANT
26) CONTROL ROOM (ELEVATED)
29) RAIL CAR LOADING/UNLOADING (#2 TURP. TALL OIL, H_2SO_4)

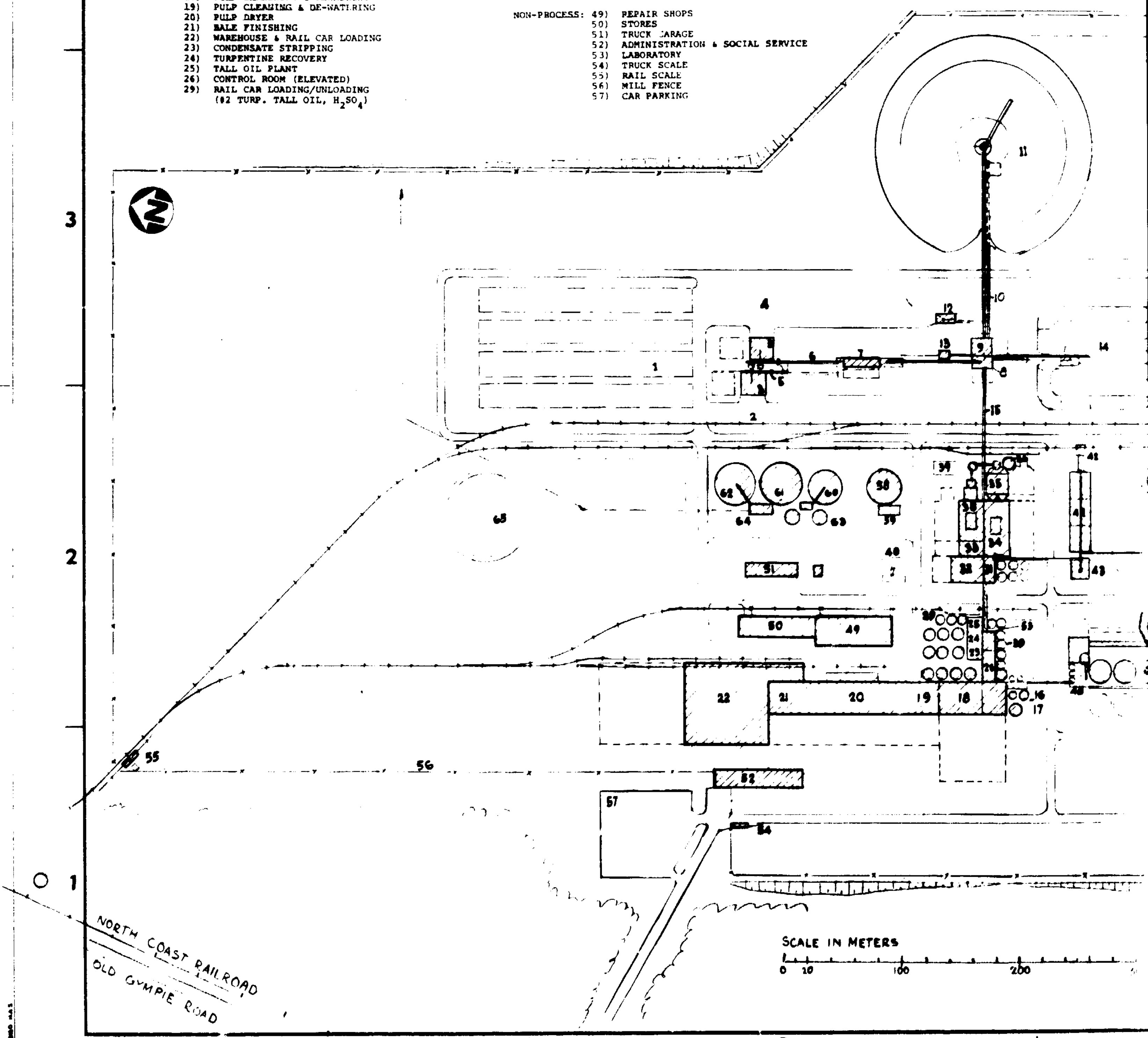
POWER GROUP:
30) EVAPORATORS
31) CONTROL ROOM
32) TURBO GENERATOR
33) FEED WATER TREATMENT
34) RECOVERY BOILER - LO ODOUR
35) PRECIPITATOR
37) SALT CAKE SILO
38) POWER BOILER
39) ASH HANDLING
40) TRANSFORMER STATION
41) COAL BUNKERS
42) COAL CAR UNLOADING - SKIP HOIST
43) GAS PRODUCER (FOR LIME KILN)
44) STAND-BY OIL STORAGE

RECAUSTICIZING:
45) LIME ROCK STORAGE
46) LIME KILN
47) LIQUOR CLARIFIERS & STORAGE
48) SLAKER & CAUSTICIZERS

NON-PROCESS:
49) REPAIR SHOPS
50) STORES
51) TRUCK GARAGE
52) ADMINISTRATION & SOCIAL SERVICE
53) LABORATORY
54) TRUCK SCALE
55) RAIL SCALE
56) MILL FENCE
57) CAR PARKING

WATER & EFFLUENT TREATMENT:
58) MILL WATER STORAGE
59) WATER PUMPING & FI
60) PRIMARY EFFL. CLA
61) HI RATE BOD TREATM
62) SECONDARY CLARIFI
63) SLUDGE THICKENING
64) EFFLUENT PUMPING &
65) SPILL POND

NOTE: PROVISIONS ARE MADE FOR FUTURE EXPANSION WITH BLEACHING

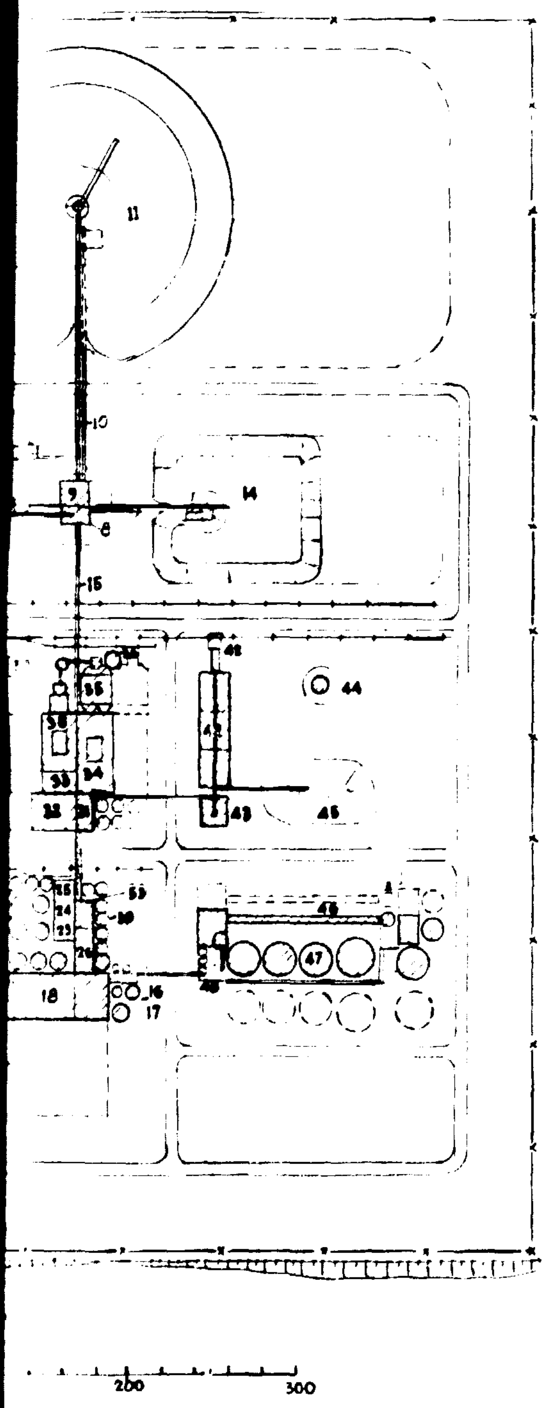


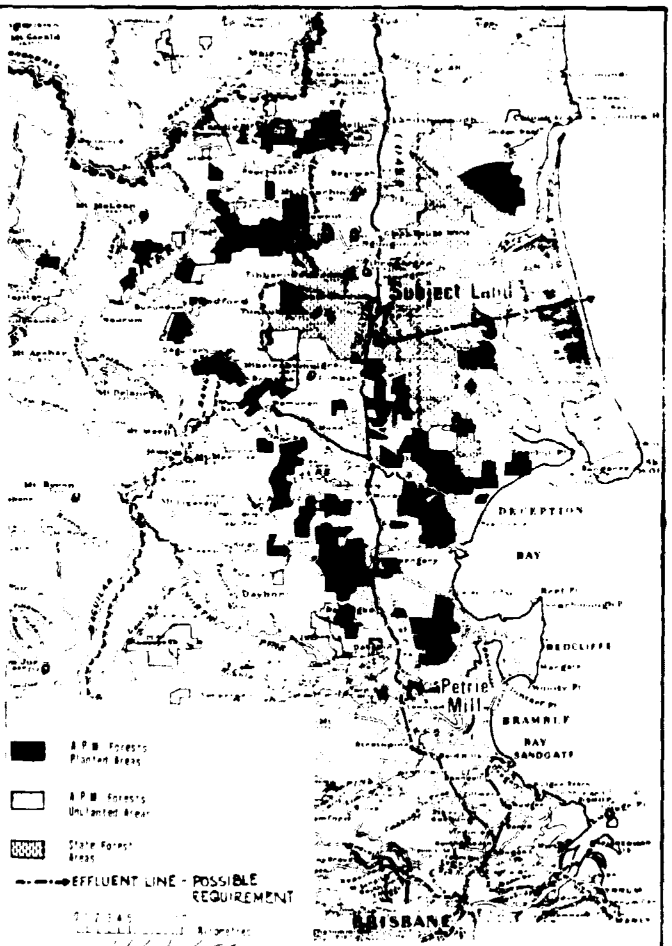
SECTION 1

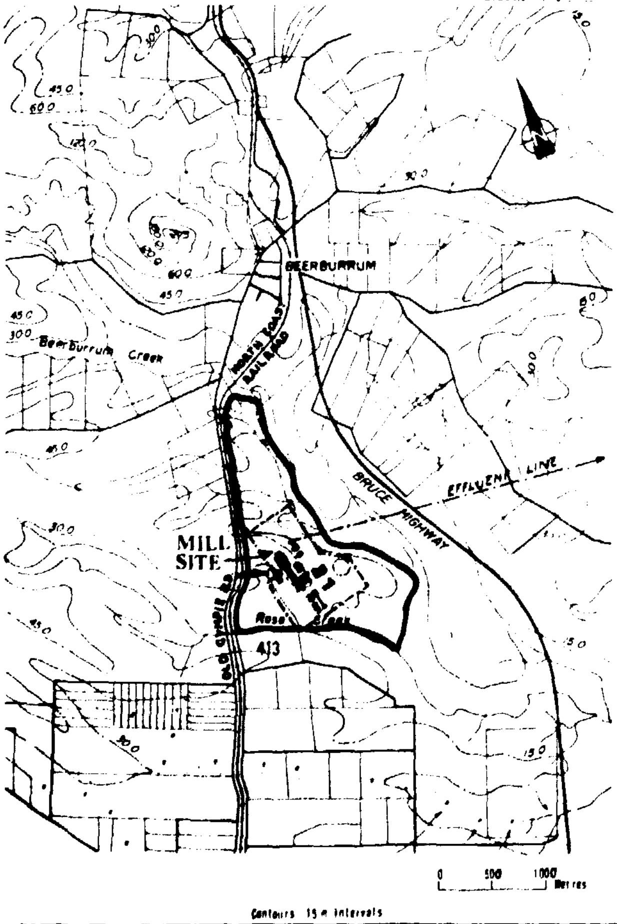
EFFLUENT TREATMENT:

58 MILL WATER STORAGE & FIRE TANK
59 WATER PUMPING & FILTERS
60 PRIMARY EFFL. CLARIFIER
61 HI RATE BOD TREATMENT
62 SECONDARY CLARIFIER
63 SLUDGE THICKENING
64 EFFLUENT PUMPING & EFFL. LINE
65 SPILL POND

PROVISIONS ARE MADE FOR FUTURE MILL EXPANSION WITH BLEACHING







PROJECT No. 4651A	DATE JANUARY 7 1980
UNIDO - KOREA	
PLOT PLAN CASE 2 600 ADMT/ DAY UNBL. KRAFT MILL BEERBURRUM, QUEENSLAND, AUSTA	
H. A. SIMONS (INTERNATIONAL) LIMITED CONSULTING ENGINEERS	
SCALE: AS SHOWN DRAWN: P. BACHMANN	D-4651-250-002

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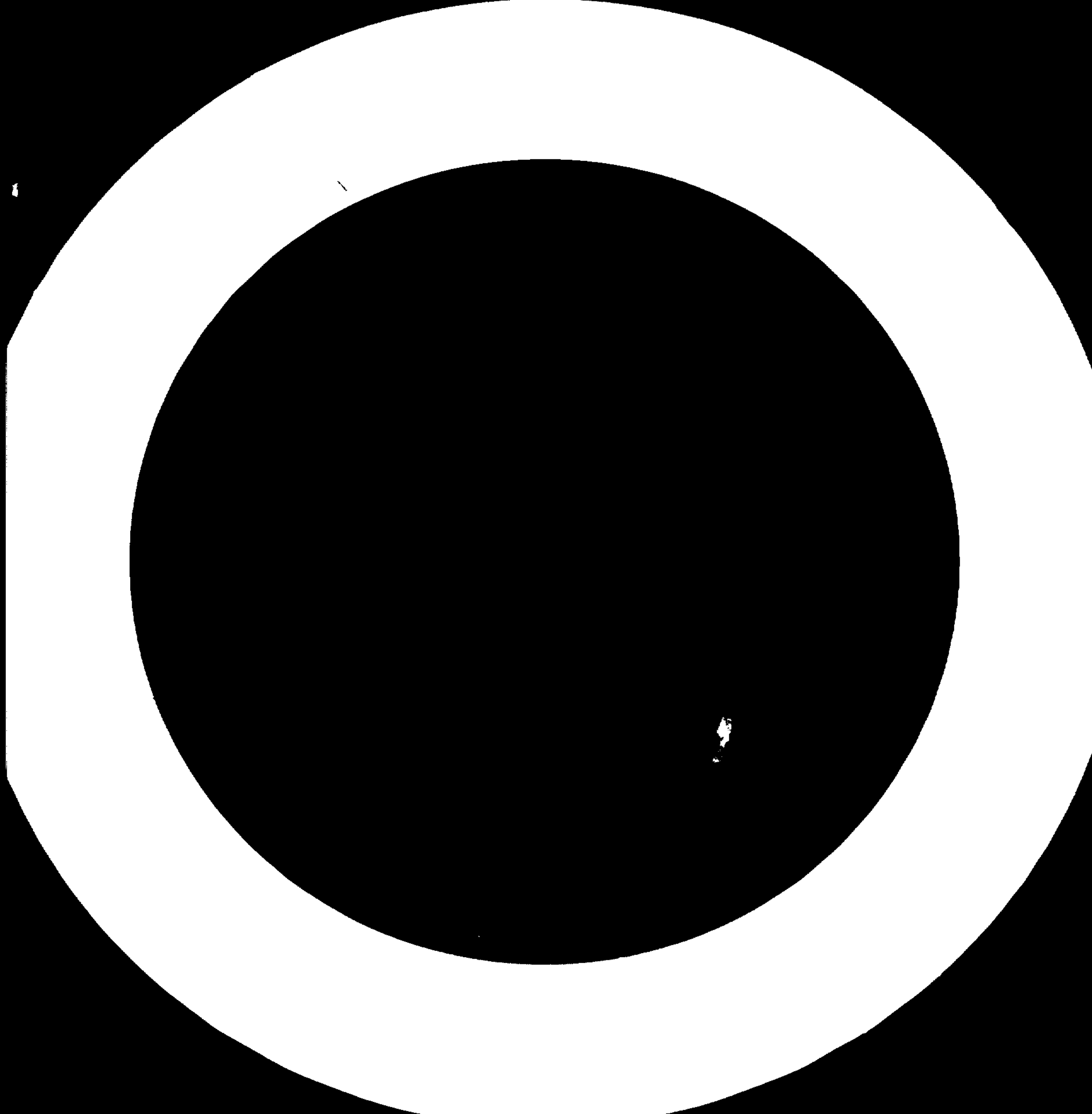
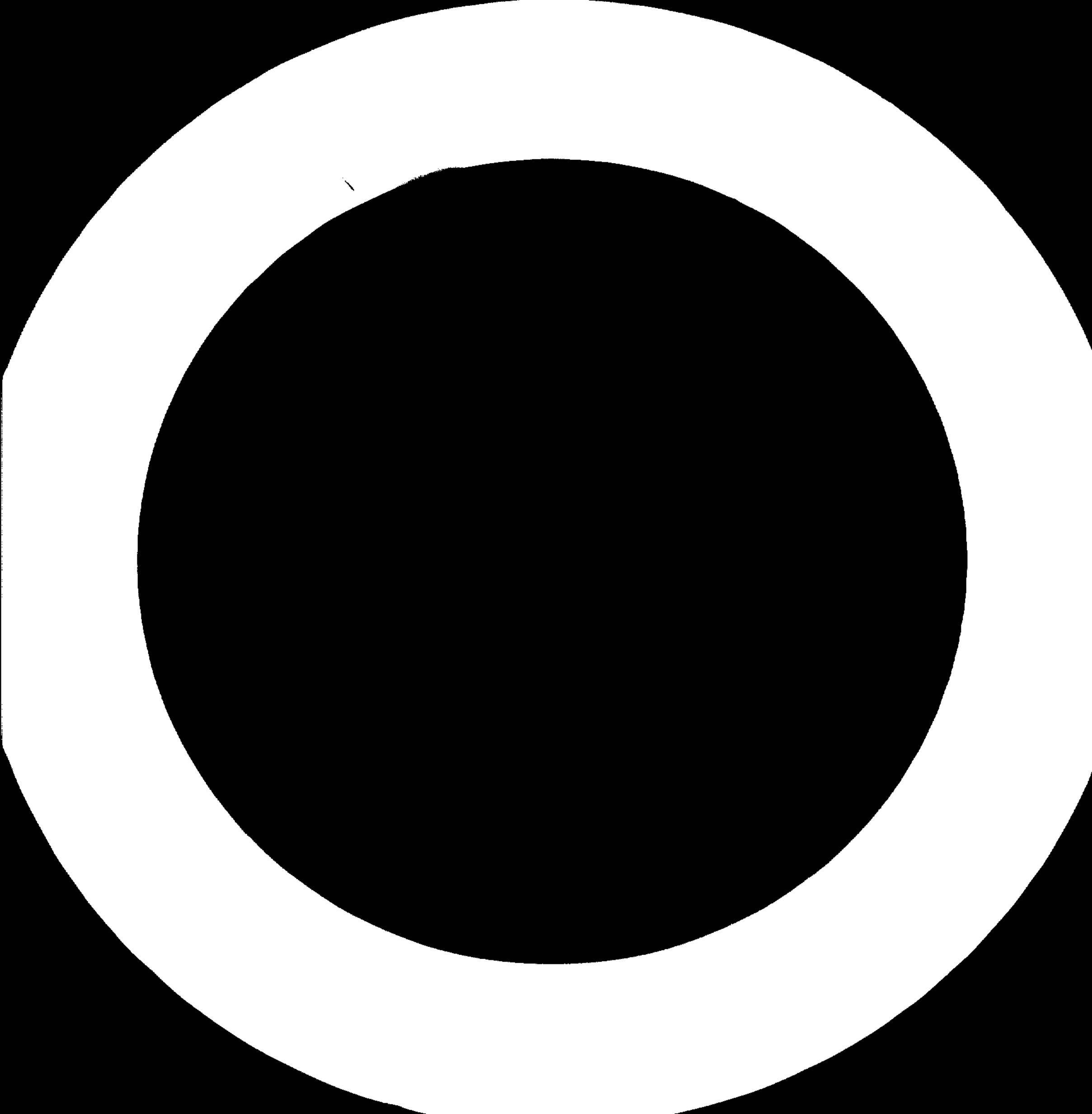
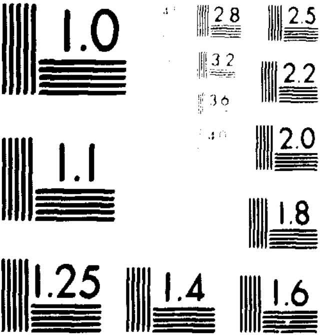
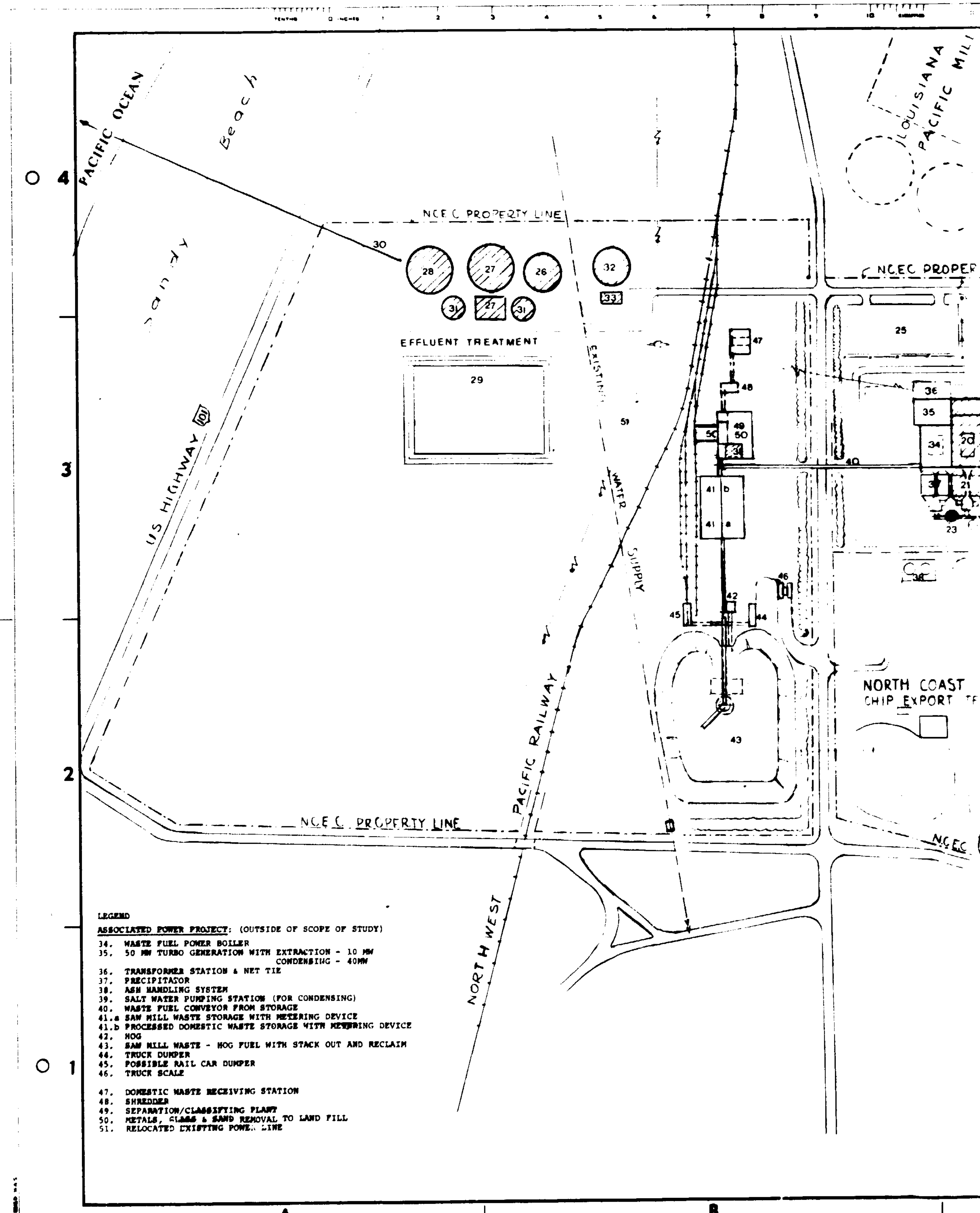
SECTION 2





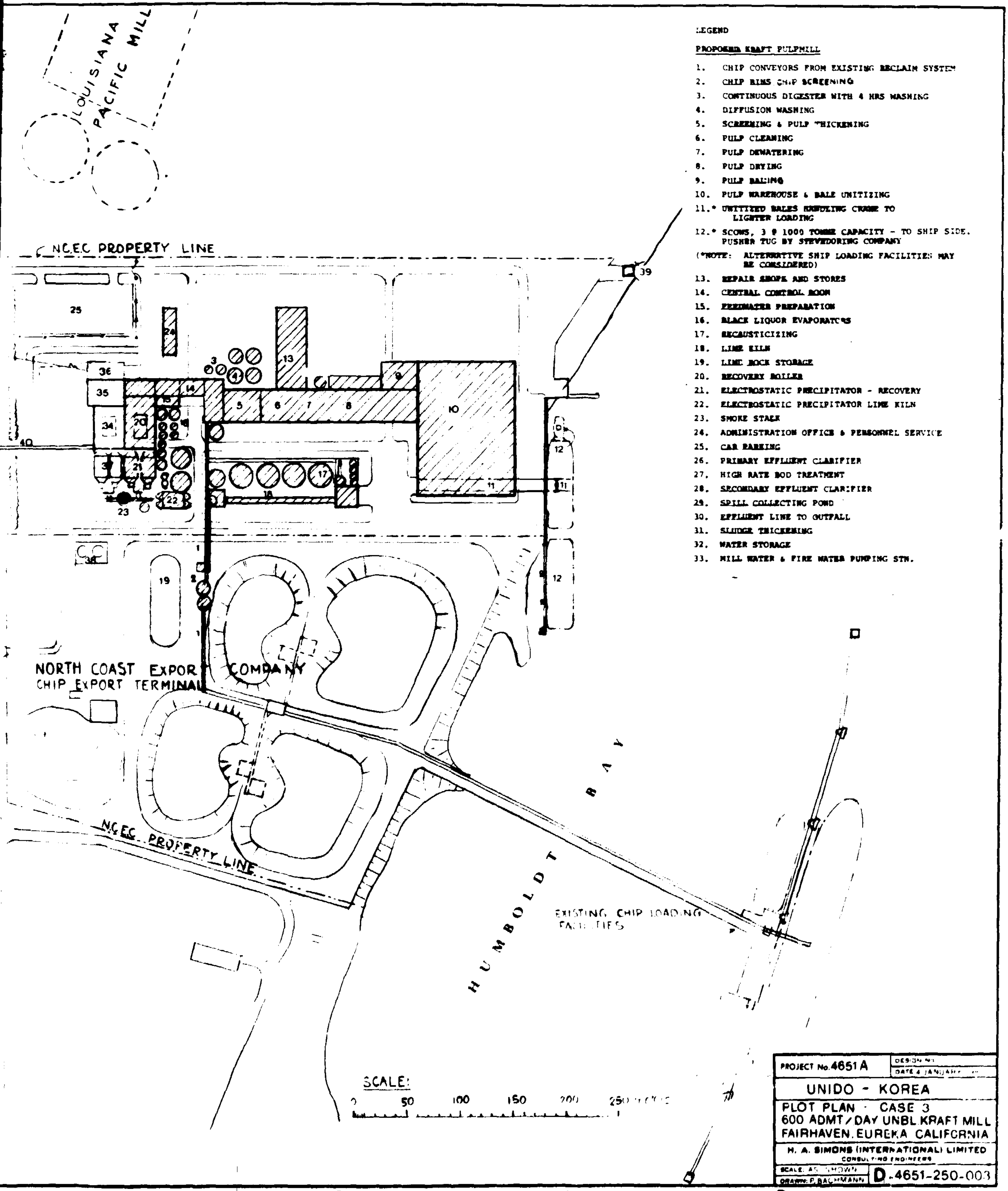


MICROCOPY RESOLUTION TEST CHART



PACIFIC OCEAN
Beach
Sandy
NCEC PROPERTY LINE
EFFLUENT TREATMENT
EXISTING WATER SUPPLY
US HIGHWAY 101
PACIFIC RAILWAY
NORTH WEST
LOUISIANA PACIFIC MILL
NCEC PROPERTY
NORTH COAST CHIP EXPORT
NCEC
LEGEND
ASSOCIATED POWER PROJECT: (OUTSIDE OF SCOPE OF STUDY)
34. WASTE FUEL POWER BOILER
35. 50 MW TURBO GENERATION WITH EXTRACTION - 10 MW CONDENSING - 40MW
36. TRANSFORMER STATION & NET TIE
37. PRECIPITATOR
38. ASH HANDLING SYSTEM
39. SALT WATER PUMPING STATION (FOR CONDENSING)
40. WASTE FUEL CONVEYOR FROM STORAGE
41.a SAW MILL WASTE STORAGE WITH METERING DEVICE
41.b PROCESSED DOMESTIC WASTE STORAGE WITH METERING DEVICE
42. HOG
43. SAW MILL WASTE - HOG FUEL WITH STACK OUT AND RECLAIM
44. TRUCK DUMPER
45. POSSIBLE RAIL CAR DUMPER
46. TRUCK SCALE
47. DOMESTIC WASTE RECEIVING STATION
48. SHREDDER
49. SEPARATION/CLASSIFYING PLANT
50. METALS, GLASS & SAND REMOVAL TO LAND FILL
51. RELOCATED EXISTING POWER LINE

SECTION 1


LEGEND
PROPOSED KRAFT PULPMILL
1. CHIP CONVEYORS FROM EXISTING RECLAIM SYSTEM
2. CHIP BINS CHIP SCREENING
3. CONTINUOUS DIGESTER WITH 4 HRS WASHING
4. DIFFUSION WASHING
5. SCREENING & PULP THICKENING
6. PULP CLEANING
7. PULP DEWATERING
8. PULP DRYING
9. PULP BALING
10. PULP WAREHOUSE & BALE UNITIZING
11.* UNITIZED BALES HANDLING CRANE TO LIGHTER LOADING
12.* SCOWS, 3 @ 1000 TONNE CAPACITY - TO SHIP SIDE. PUSHER TUG BY STEVEDORING COMPANY
(*NOTE: ALTERNATIVE SHIP LOADING FACILITIES MAY BE CONSIDERED)
13. REPAIR SHOPS AND STORES
14. CENTRAL CONTROL ROOM
15. FEEDWATER PREPARATION
16. BLACK LIQUOR EVAPORATORS
17. RECAUSTICIZING
18. LIME KILN
19. LIME ROCK STORAGE
20. RECOVERY BOILER
21. ELECTROSTATIC PRECIPITATOR - RECOVERY
22. ELECTROSTATIC PRECIPITATOR LIME KILN
23. SMOKE STACK
24. ADMINISTRATION OFFICE & PERSONNEL SERVICE
25. CAR PARKING
26. PRIMARY EFFLUENT CLARIFIER
27. HIGH RATE BOD TREATMENT
28. SECONDARY EFFLUENT CLARIFIER
29. SPILL COLLECTING POND
30. EFFLUENT LINE TO OUTFALL
31. SLUDGE THICKENING
32. WATER STORAGE
33. MILL WATER & FIRE WATER PUMPING STN.
LOUISIANA PACIFIC MILL
N.C.E.C PROPERTY LINE
NORTH COAST EXPORT COMPANY
CHIP EXPORT TERMINAL
N.C.E.C. PROPERTY LINE
HUMBOLDT BAY
EXISTING CHIP LOADING FACILITIES
SCALE:
0 50 100 150 200 250
PROJECT No. 4651 A
UNIDO - KOREA
PLOT PLAN · CASE 3
600 ADMT / DAY UNBL KRAFT MILL
FAIRHAVEN, EUREKA CALIFORNIA
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
DRAWN: P. BACHMANN
D-4651-250-003

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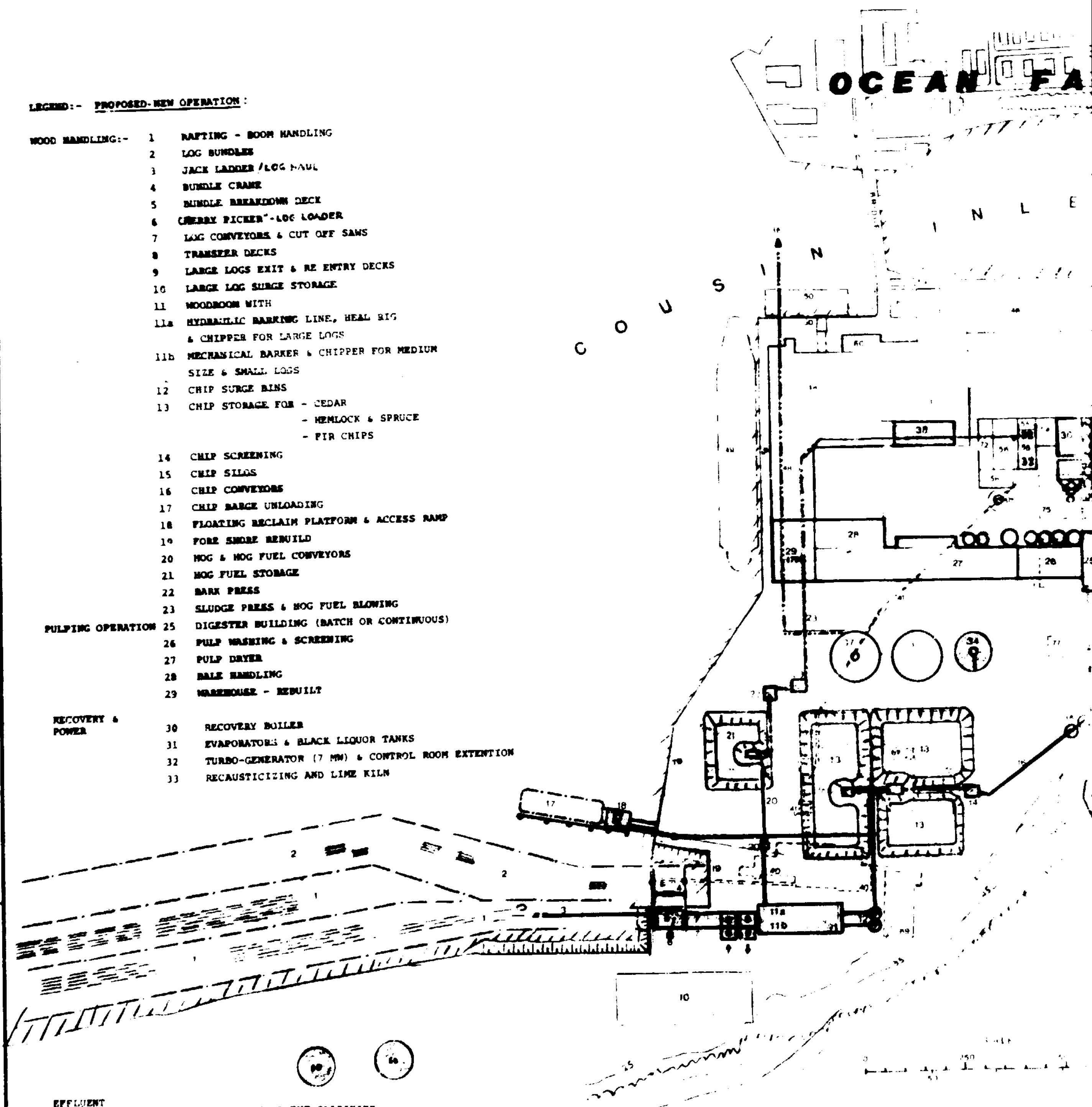


LEGEND:- PROPOSED-NEW OPERATION:

WOOD HANDLING:-
1 RAFTING - BOOM HANDLING
2 LOG BUNDLES
3 JACK LADDER /LOG HAUL
4 BUNDLE CRANE
5 BUNDLE BREAKDOWN DECK
6 "CHERRY PICKER"-LOG LOADER
7 LOG CONVEYORS & CUT OFF SAWS
8 TRANSFER DECKS
9 LARGE LOGS EXIT & RE ENTRY DECKS
10 LARGE LOG SURGE STORAGE
11 WOODROOM WITH
11a HYDRAULIC BARKING LINE, HEAL RIG & CHIPPER FOR LARGE LOGS
11b MECHANICAL BARKER & CHIPPER FOR MEDIUM SIZE & SMALL LOGS
12 CHIP SURGE BINS
13 CHIP STORAGE FOR - CEDAR
- HEMLOCK & SPRUCE
- FIR CHIPS
14 CHIP SCREENING
15 CHIP SILOS
16 CHIP CONVEYORS
17 CHIP BARGE UNLOADING
18 FLOATING RECLAIM PLATFORM & ACCESS RAMP
19 FORE SHORE REBUILD
20 HOG & HOG FUEL CONVEYORS
21 HOG FUEL STORAGE
22 BARK PRESS
23 SLUDGE PRESS & HOG FUEL BLOWING

PULPING OPERATION
25 DIGESTER BUILDING (BATCH OR CONTINUOUS)
26 PULP WASHING & SCREENING
27 PULP DRYER
28 BALE HANDLING
29 WAREHOUSE - REBUILT

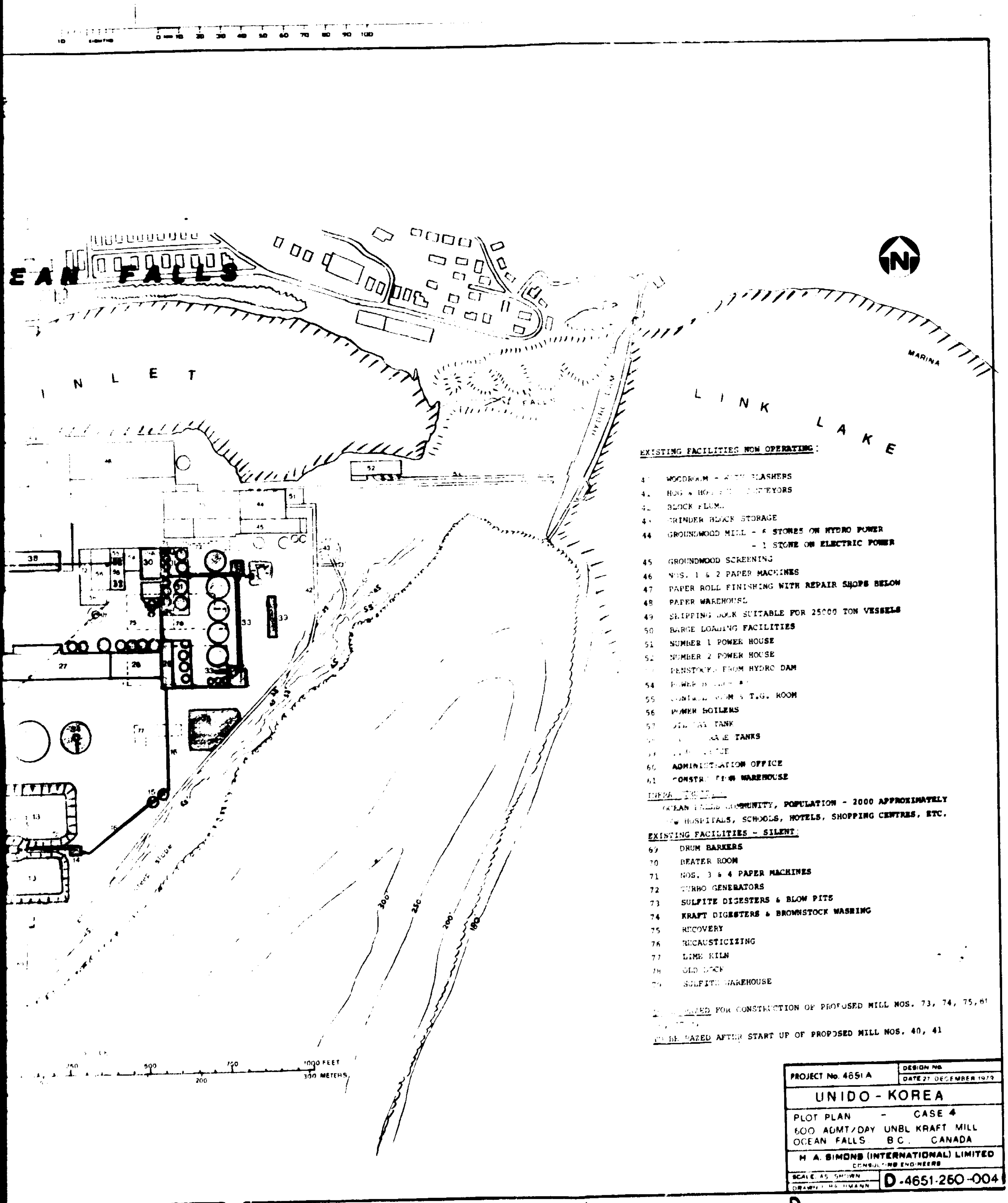
RECOVERY & POWER
30 RECOVERY BOILER
31 EVAPORATORS & BLACK LIQUOR TANKS
32 TURBO-GENERATOR (7 MW) & CONTROL ROOM EXTENTION
33 RECAUSTICIZING AND LIME KILN

EFFLUENT TREATMENT
34 PRIMARY EFFLUENT CLARIFIER
35 DUMP POND
36 EFFLUENT OUTFALL
37 FUTURE B.O.D. TREATMENT & SECONDARY CLARIFIER

NON PROCESS FACILITIES
38 REPAIR SHOP EXTENSION & LABORATORY
39 FIRE HALL AND TRUCK GARAGE

A B

SECTION 1



OCEAN FALLS
INLET
LINK LAKE
MARINA
N
EXISTING FACILITIES NOW OPERATING:
44 GROUNDWOOD MILL - 6 STONES ON HYDRO POWER
- 1 STONE ON ELECTRIC POWER
45 GROUNDWOOD SCREENING
46 NOS. 1 & 2 PAPER MACHINES
47 PAPER ROLL FINISHING WITH REPAIR SHOPS BELOW
48 PAPER WAREHOUSE
49 SHIPPING DOCK SUITABLE FOR 25000 TON VESSELS
50 BARGE LOADING FACILITIES
51 NUMBER 1 POWER HOUSE
52 NUMBER 2 POWER HOUSE
PENSTOCKS FROM HYDRO DAM
55 T.G. ROOM
56 POWER BOILERS
57 TANK
TANKS
60 ADMINISTRATION OFFICE
61 CONSTRUCTION WAREHOUSE
OCEAN FALLS COMMUNITY, POPULATION - 2000 APPROXIMATELY
HOSPITALS, SCHOOLS, HOTELS, SHOPPING CENTRES, ETC.
EXISTING FACILITIES - SILENT:
69 DRUM BARKERS
70 BEATER ROOM
71 NOS. 3 & 4 PAPER MACHINES
72 TURBO GENERATORS
73 SULFITE DIGESTERS & BLOW PITS
74 KRAFT DIGESTERS & BROWNSTOCK WASHING
75 RECOVERY
76 RECAUSTICIZING
77 LIME KILN
78 OLD DOCK
79 SULFITE WAREHOUSE
FOR CONSTRUCTION OF PROPOSED MILL NOS. 73, 74, 75, 61
TO BE RAZED AFTER START UP OF PROPOSED MILL NOS. 40, 41
0 250 500 750 1000 FEET
200 300 METERS
PROJECT No. 4651 A
DESIGN NO.
DATE 27 DECEMBER 1979
UNIDO - KOREA
PLOT PLAN - CASE 4
600 ADMT/DAY UNBL KRAFT MILL
OCEAN FALLS B.C. CANADA
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
SCALE AS SHOWN
D-4651-260-004

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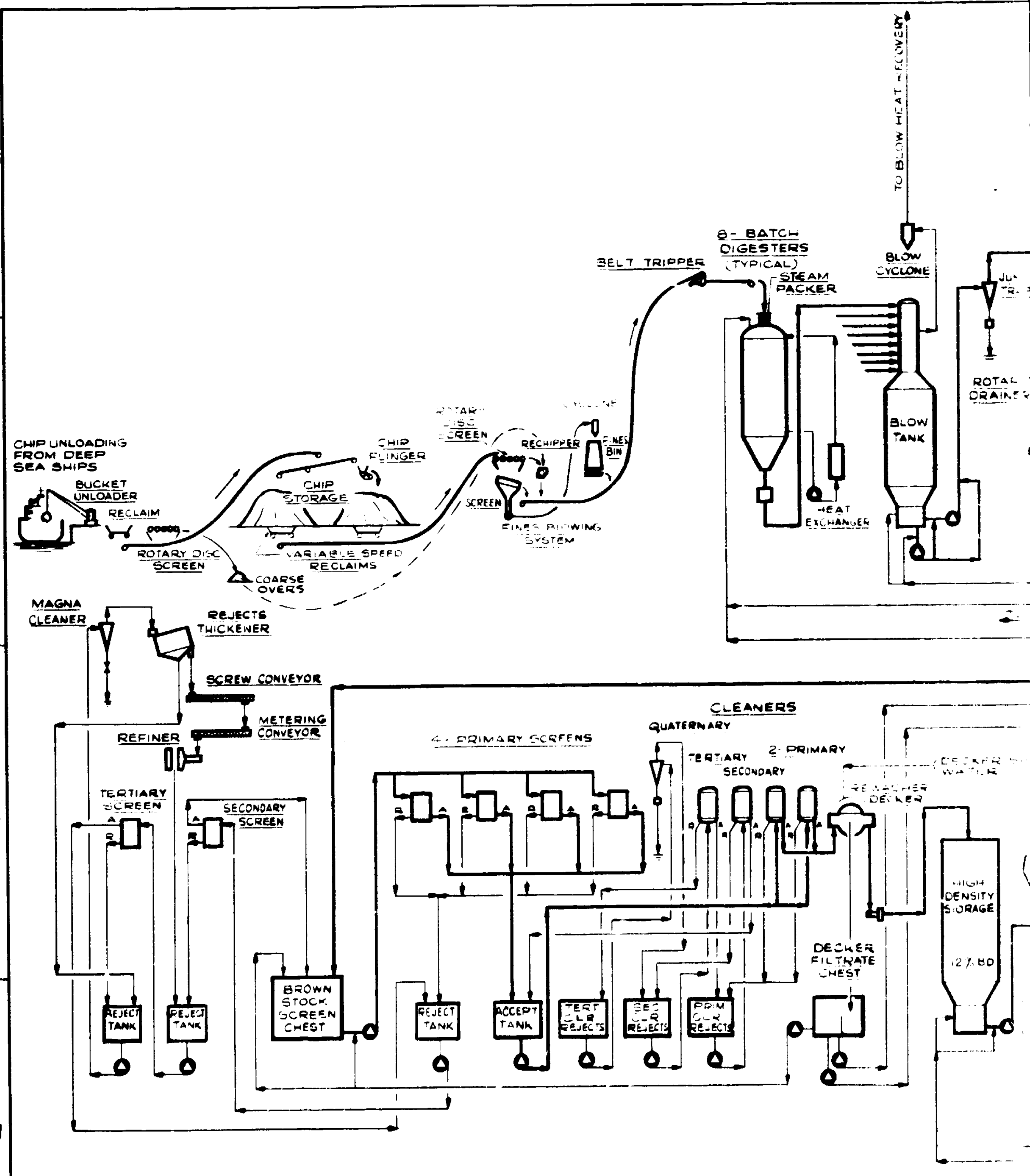
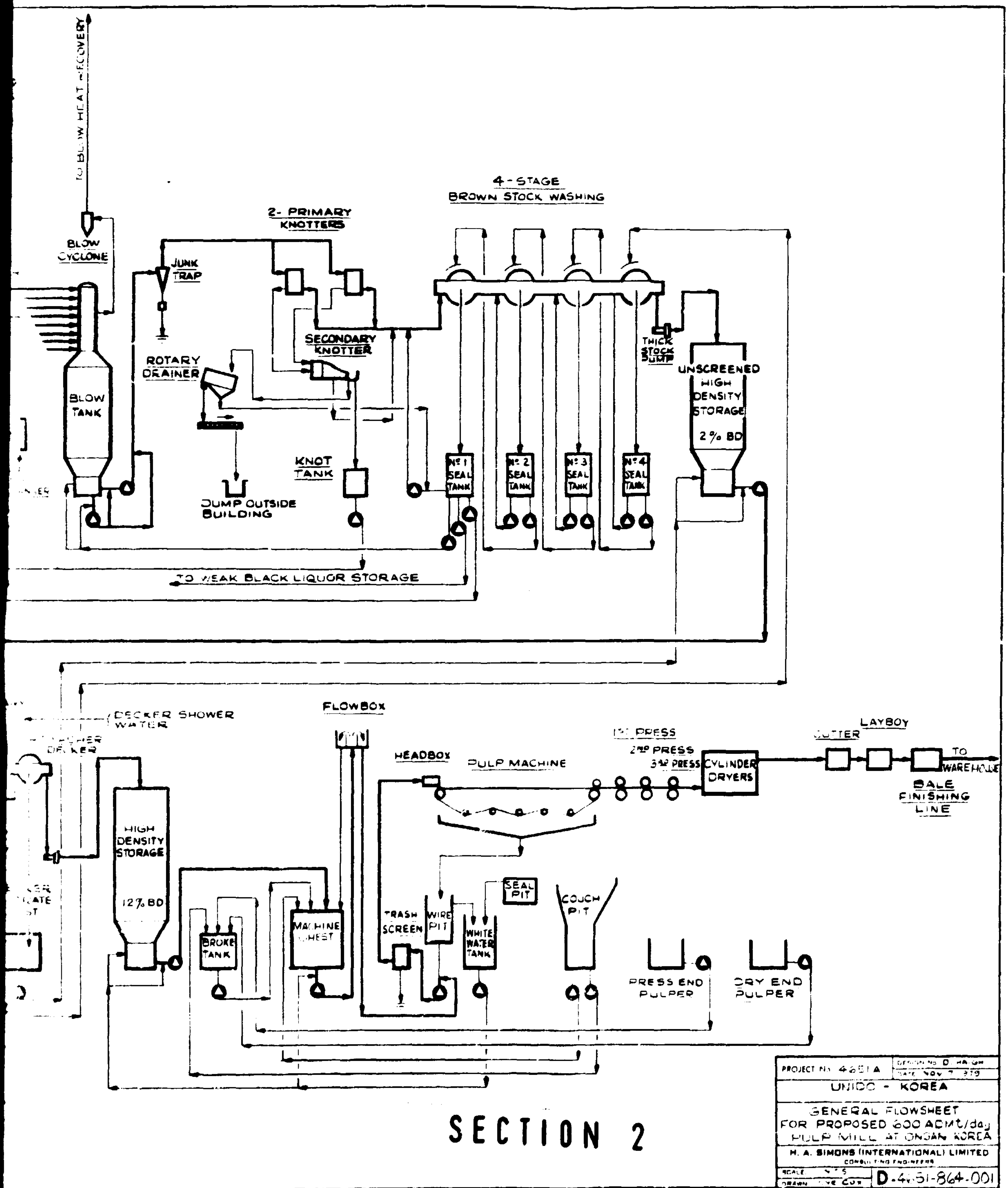
SECTION 2


TO BLOW HEAT RECOVERY
8- BATCH DIGESTERS (TYPICAL)
BELT TRIPPER
STEAM PACKER
BLOW CYCLONE
BLOW TANK
HEAT EXCHANGER
CHIP UNLOADING FROM DEEP SEA SHIPS
BUCKET UNLOADER
RECLAIM
ROTARY DISC SCREEN
COARSE OVERS
CHIP STORAGE
CHIP FLINGER
VARIABLE SPEED RECLAIMS
ROTARY DISC SCREEN
RECHIPPER
FINES BIN
SCREEN
FINES BLOWING SYSTEM
MAGNA CLEANER
REJECTS THICKENER
SCREW CONVEYOR
METERING CONVEYOR
REFINER
TERTIARY SCREEN
SECONDARY SCREEN
4 - PRIMARY SCREENS
CLEANERS
QUATERNARY
TERTIARY
SECONDARY
2- PRIMARY
DECKER
HIGH DENSITY STORAGE
DECKER FILTRATE CHEST
REJECT TANK
REJECT TANK
BROWN STOCK SCREEN CHEST
REJECT TANK
ACCEPT TANK
TERT CLR REJECTS
SEC CLR REJECTS
PRIM CLR REJECTS

SECTION 2


TO BLOW HEAT RECOVERY
BLOW CYCLONE
BLOW TANK
JUNK TRAP
2- PRIMARY KNOTTERS
SECONDARY KNOTTER
ROTARY DRAINER
DUMP OUTSIDE BUILDING
KNOT TANK
4 - STAGE BROWN STOCK WASHING
No 1 SEAL TANK
No 2 SEAL TANK
No 3 SEAL TANK
No 4 SEAL TANK
THICK STOCK PUMP
UNSCREENED HIGH DENSITY STORAGE
2% BD
TO WEAK BLACK LIQUOR STORAGE
DECKER SHOWER WATER
FLOWBOX
HEADBOX
PULP MACHINE
1ST PRESS
2ND PRESS
3RD PRESS
CYLINDER DRYERS
CUTTER
LAYBOY
TO WAREHOUSE
BALE FINISHING LINE
HIGH DENSITY STORAGE
12% BD
BROKE TANK
MACHINE CHEST
TRASH SCREEN
WIRE PIT
WHITE WATER TANK
SEAL PIT
COUCH PIT
PRESS END PULPER
DRY END PULPER
PROJECT No 4651 A
DESIGNED D. HAIGH
UNIDO - KOREA
GENERAL FLOWSHEET FOR PROPOSED 600 ADMt/day PULP MILL AT ONSAN KOREA
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
D-4651-864-001
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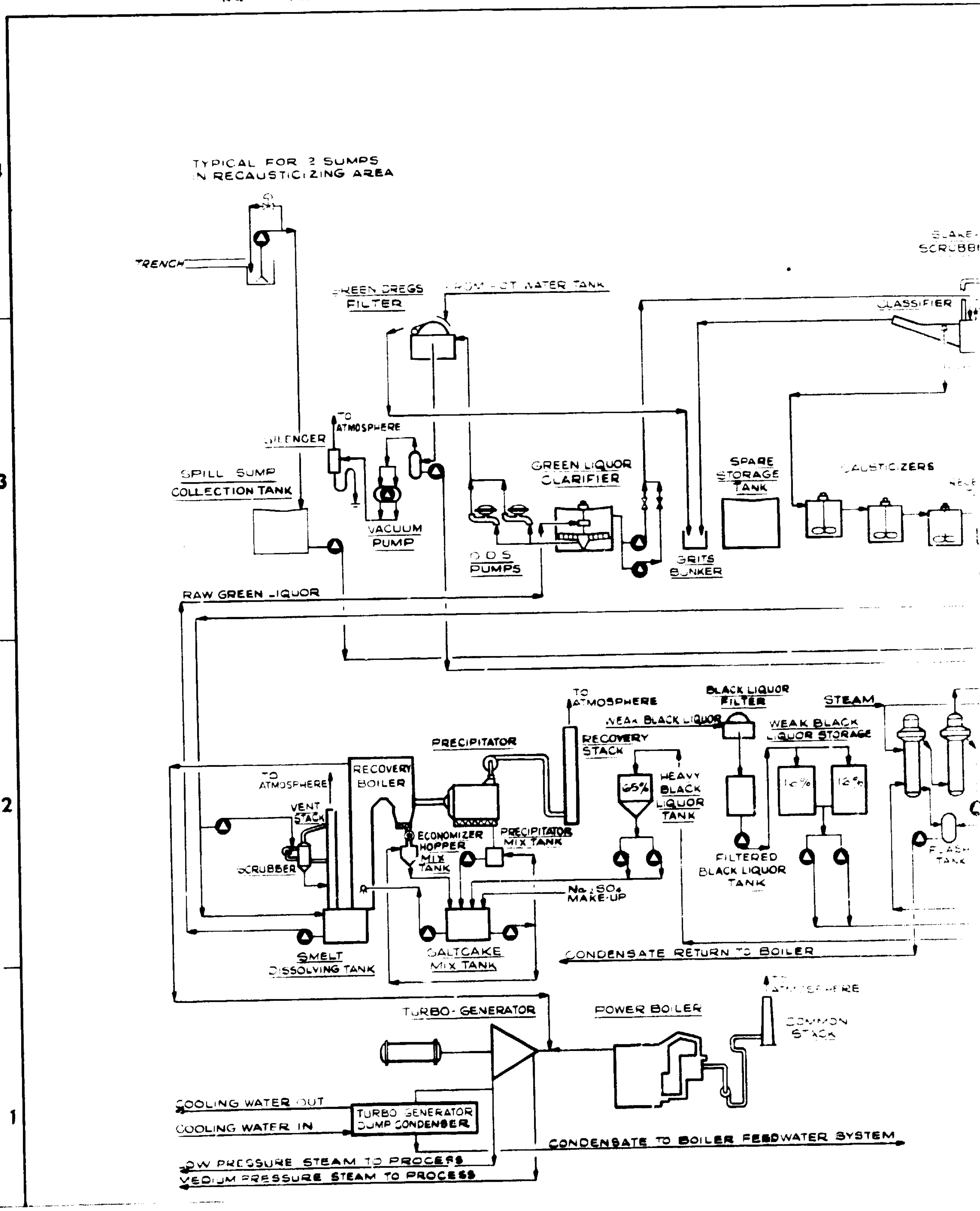
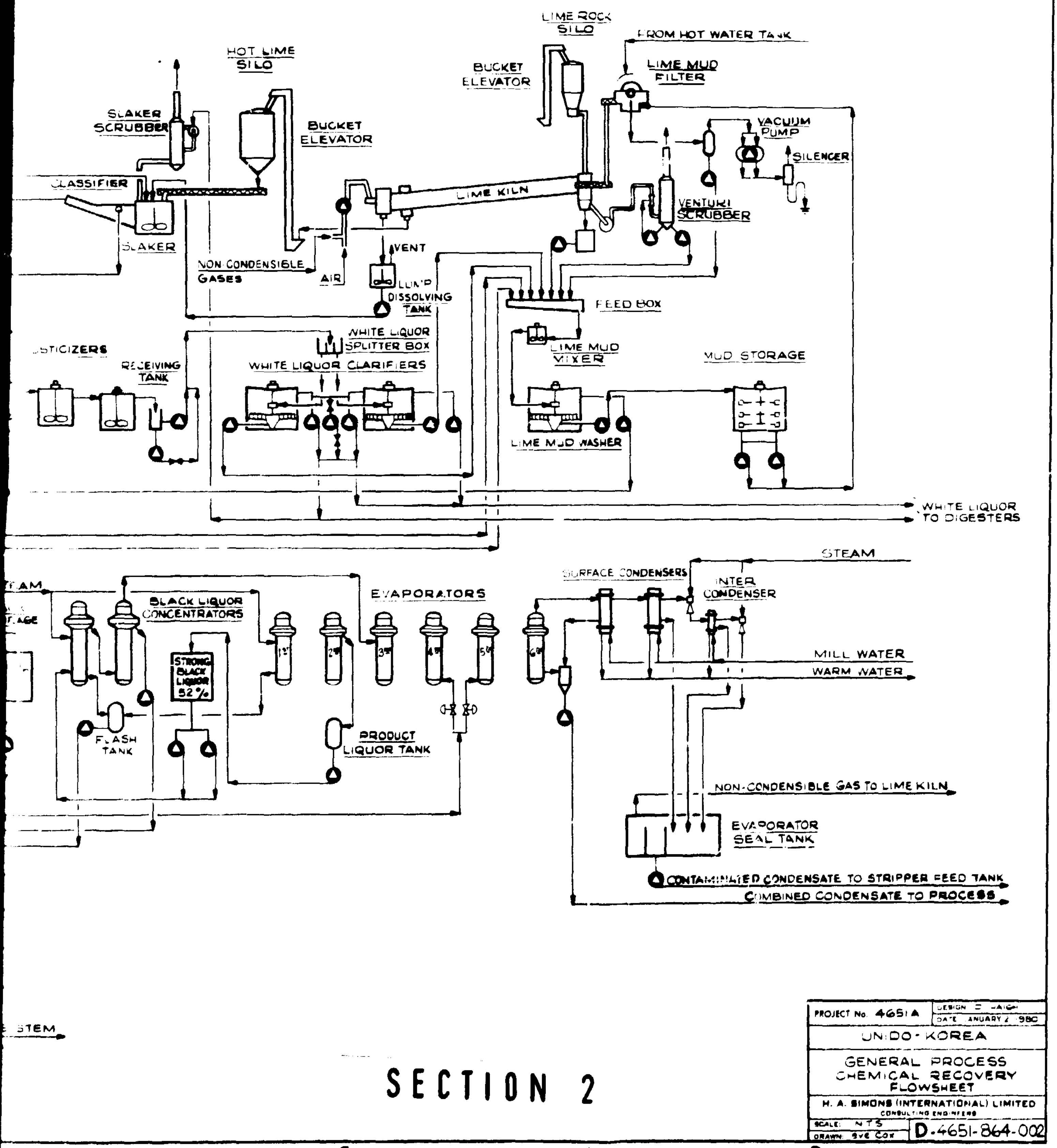
SECTION 2



TYPICAL FOR 2 SUMPS IN RECAUSTICIZING AREA
TRENCH
GREEN DREGS FILTER
CLASSIFIER
SILENCER
TO ATMOSPHERE
SPILL SUMP COLLECTION TANK
VACUUM PUMP
GREEN LIQUOR CLARIFIER
PUMPS
SPARE STORAGE TANK
GRITS BUNKER
RAW GREEN LIQUOR
TO ATMOSPHERE
BLACK LIQUOR FILTER
STEAM
WEAK BLACK LIQUOR
WEAK BLACK LIQUOR STORAGE
PRECIPITATOR
RECOVERY STACK
RECOVERY BOILER
VENT STACK
65%
HEAVY BLACK LIQUOR TANK
ECONOMIZER HOPPER
PRECIPITATOR MIX TANK
MIX TANK
SCRUBBER
FILTERED BLACK LIQUOR TANK
Na2SO4 MAKE-UP
SMELT DISSOLVING TANK
SALTCAKE MIX TANK
CONDENSATE RETURN TO BOILER
TURBO-GENERATOR
POWER BOILER
COMMON STACK
COOLING WATER OUT
COOLING WATER IN
TURBO GENERATOR DUMP CONDENSER
CONDENSATE TO BOILER FEEDWATER SYSTEM
LOW PRESSURE STEAM TO PROCESS
MEDIUM PRESSURE STEAM TO PROCESS

SECTION 1


LIME ROCK SILO
FROM HOT WATER TANK
HOT LIME SILO
BUCKET ELEVATOR
LIME MUD FILTER
SLAKER SCRUBBER
BUCKET ELEVATOR
VACUUM PUMP
SILENCER
CLASSIFIER
LIME KILN
VENTURI SCRUBBER
SLAKER
NON CONDENSIBLE GASES
AIR
VENT
DISSOLVING TANK
FEED BOX
WHITE LIQUOR SPLITTER BOX
LIME MUD MIXER
RECEIVING TANK
WHITE LIQUOR CLARIFIERS
MUD STORAGE
LIME MUD WASHER
WHITE LIQUOR TO DIGESTERS
STEAM
SURFACE CONDENSERS
INTER CONDENSER
BLACK LIQUOR CONCENTRATORS
EVAPORATORS
STRONG BLACK LIQUOR 52%
MILL WATER
WARM WATER
FLASH TANK
PRODUCT LIQUOR TANK
NON-CONDENSIBLE GAS TO LIME KILN
EVAPORATOR SEAL TANK
COMBINED CONDENSATE TO PROCESS
PROJECT No. 4651 A
UNIDO - KOREA
GENERAL PROCESS CHEMICAL RECOVERY FLOWSHEET
H. A. SIMONS (INTERNATIONAL) LIMITED
CONSULTING ENGINEERS
SCALE: NTS
D-4651-864-002
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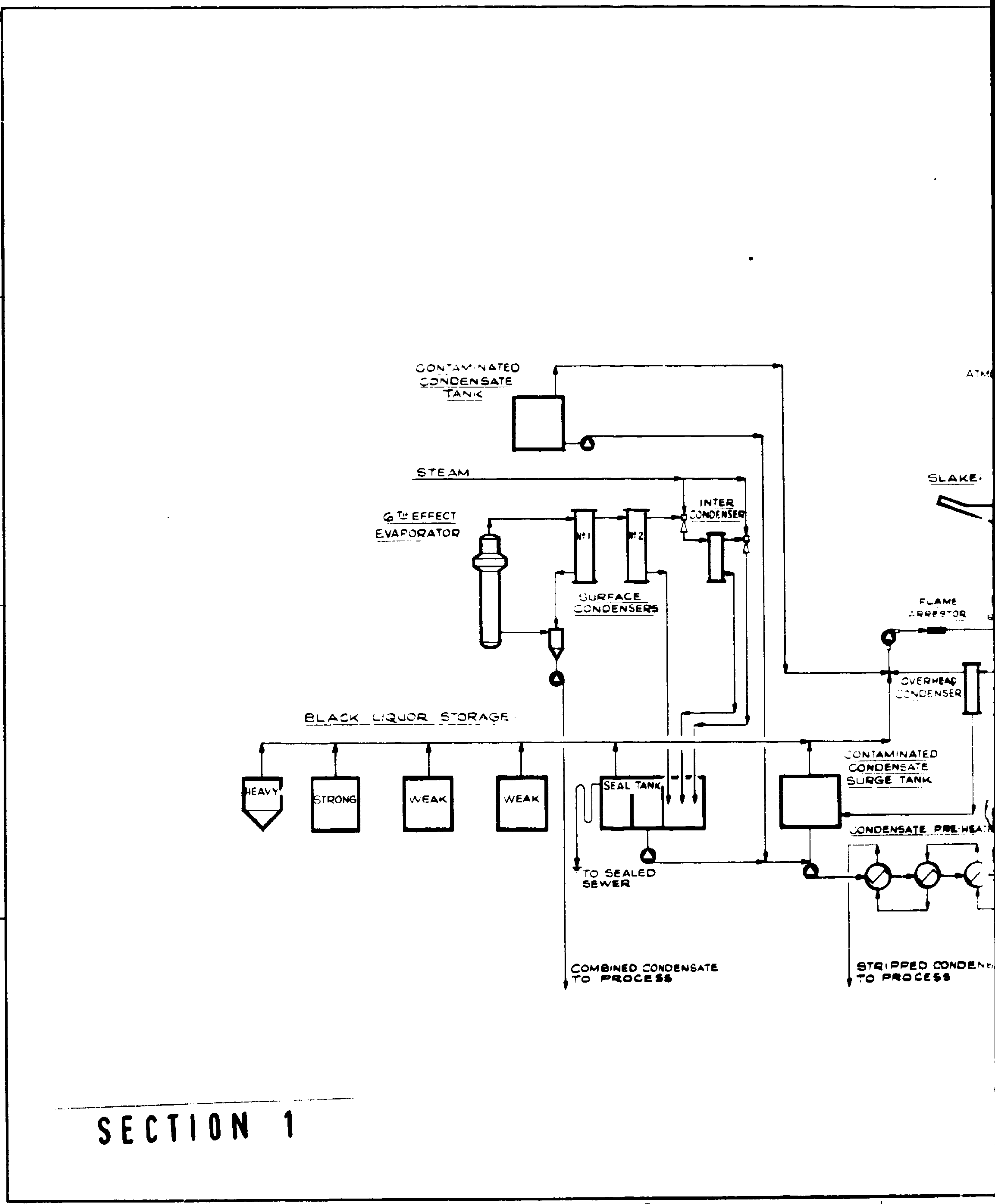
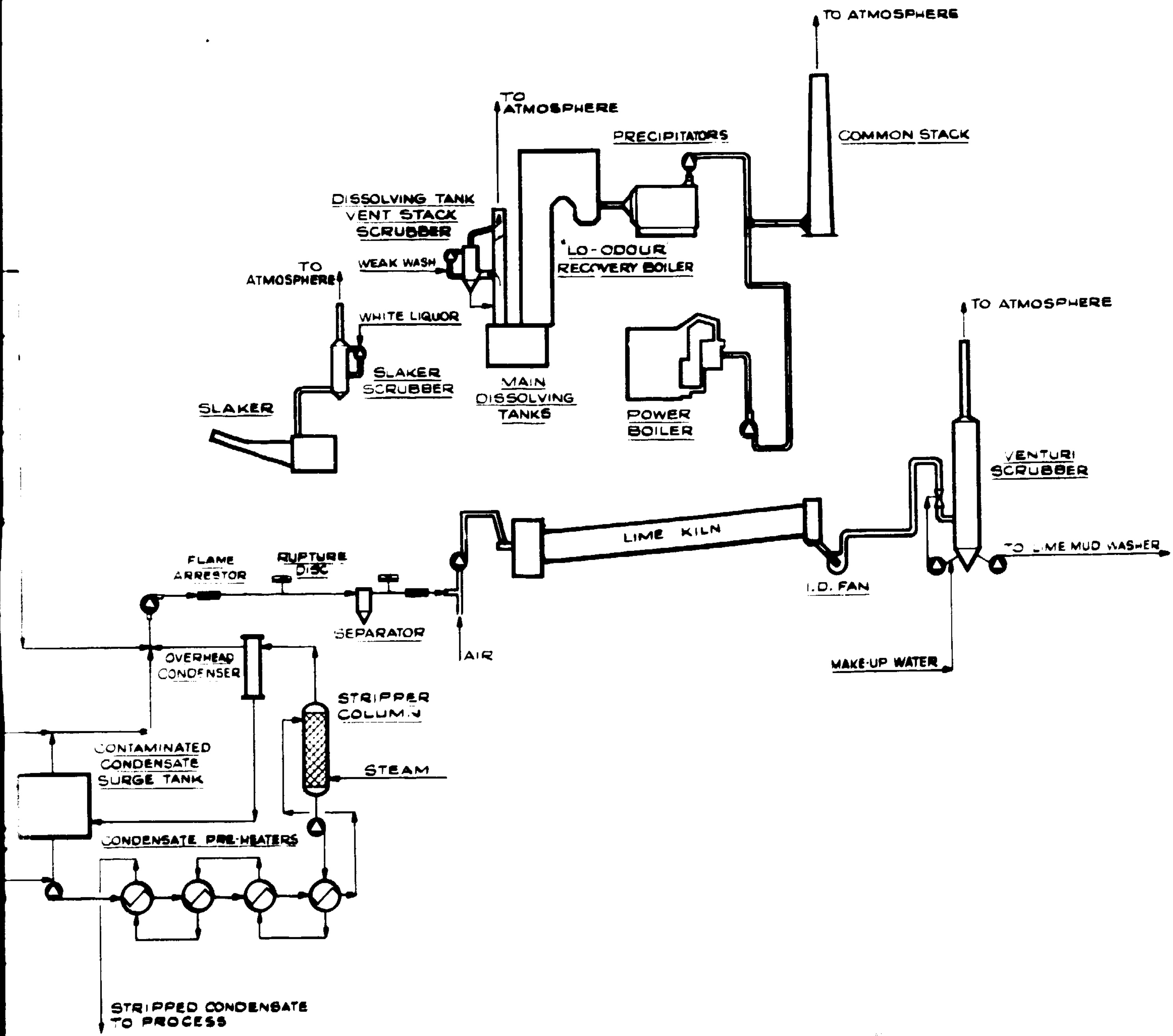
SECTION 2


CONTAMINATED CONDENSATE TANK
STEAM
INTER CONDENSER
6TH EFFECT EVAPORATOR
Nº1
Nº2
SURFACE CONDENSERS
BLACK LIQUOR STORAGE
HEAVY
STRONG
WEAK
WEAK
SEAL TANK
TO SEALED SEWER
COMBINED CONDENSATE TO PROCESS
CONTAMINATED CONDENSATE SURGE TANK
CONDENSATE PRE-HEAT
STRIPPED CONDEN
TO PROCESS
FLAME ARRESTOR
OVERHEAD CONDENSER
SLAKE
ATM
A
B
1
2
3
4

SECTION 1



SECTION 2

PROJECT No. 4651 A	DESIGN D. HAIGH
UNIDO - KOREA	
GENERAL PROCESS KRAFT MILL ODOUR CONTROL FLOWSHEET	
H. A. SIMONS (INTERNATIONAL) LIMITED CONSULTING ENGINEERS	
SCALE: N.T.S.	D-465-864-003

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APPENDIX 4

PROPOSED CONSTRUCTION SCHEDULE
- ONSAN MILL

simons
H.A. SIMONS (INTERNATIONAL) LTD.

CLIENT - UNIDO

ITEM No.			DESCRIPTION	1	2
1				EFFECT DATE O CONTRA	
2			SITE & SERVICES		
3					
4			POWER DISTRIBUTION		
5					
6			MILL WATER SUPPLY & TREATMENT		
7					
8			EFFLUENT TREATMENT & DISPOSAL		
9					
10					
11			PURCHASED CHIP HANDLING & STORAGE		
12					
13					
14			DIGESTING		
15			STRUCT. ALL IN BROWN STOCK		□
16			BROWN STOCK		
17					□
18					
19			PULP MACHINE		
20					
21			BALE FINISHING		
22					

SCHED.	ACTUAL	ACTIVITY
▽	▼	P.I. OR TENDER ISSUED
E	Ⓔ	BID EVALUATION
◇	◆	CLIENTS DECISION OR APPROVAL
▭	▬	P.O. OR CONTRACT AWARDED
⌶	█	INITIAL VENDOR INFORMATION
X	⧗	CERTIFIED VENDOR INFORMATION
↓	↓	EQUIPMENT SHIPPED
○	●	EQUIPMENT DELIVERED ON SITE

	ACTIVITY
- - - - - -	ENGINEERING - PRELIM. & TAIL OFF
————	ENGINEERING — MAIN PHASE
\\\\\\\\	PREPARE BID INFORMATION
—/—/—→	BID PERIOD & CLOSING DATE
///////	CONSTRUCT FOUNDATIONS
—◆—◆—◆—	ERECT MAIN STRUCTURAL FRAME
XXX	ESSENTIAL COMPLETION OF BUILDING
✱✱✱✱✱✱	INSTALLATIONS — MECHANICAL & ALLIED

BCIL 6884 - H.A.S.I.

H.A.S. 76 168 02

SECTION 1

NIDO

PROJECT - 600 ADT/D UNBLEACHED KRAFT PULP MILL
ONSAN KOREA

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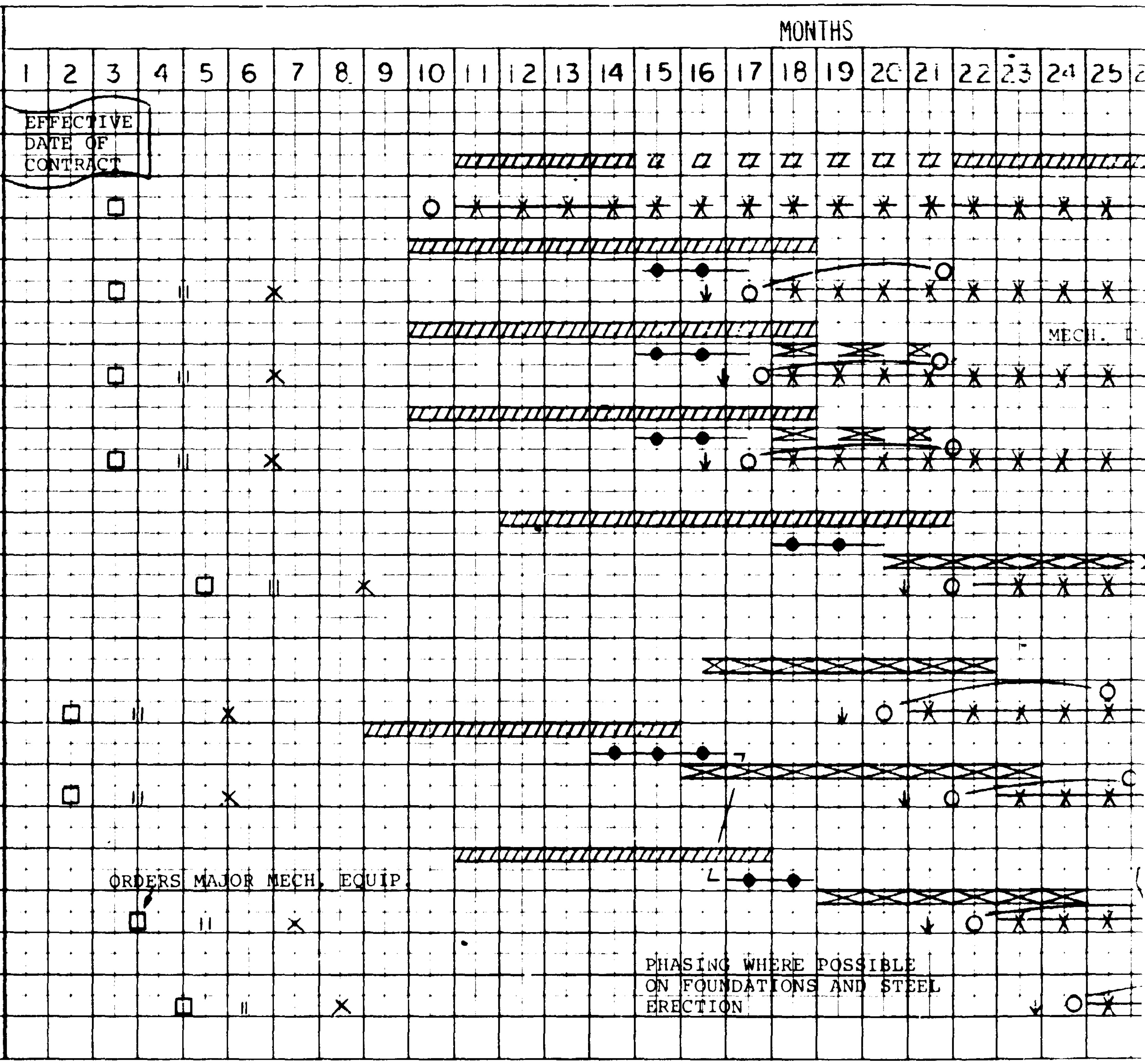
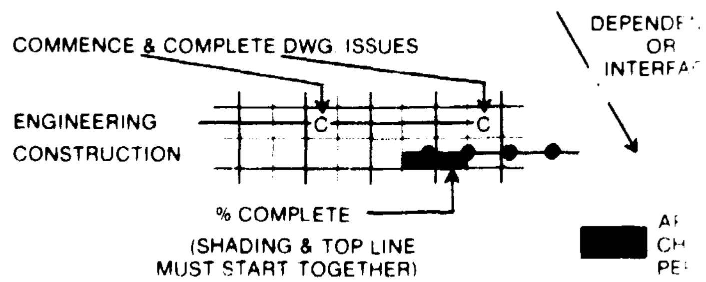


SCHED	ACTUAL	ACTIVITY
MO	MO	MILL ORDER — STRUCTURAL STEEL
M	M	MECHANICAL DEPT. INPUT
PC	PC	ISSUE P&C DIAGRAMS
P	P	INFORMATION FOR PROCUREMENT
C	C	ISSUE CERTIFIED DRAWINGS
A	A	DRAWING APPROVALS
*	*	HIGHLIGHT
⊢	⊣	START OR COMPLETION DEADLINE



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SECTION 2

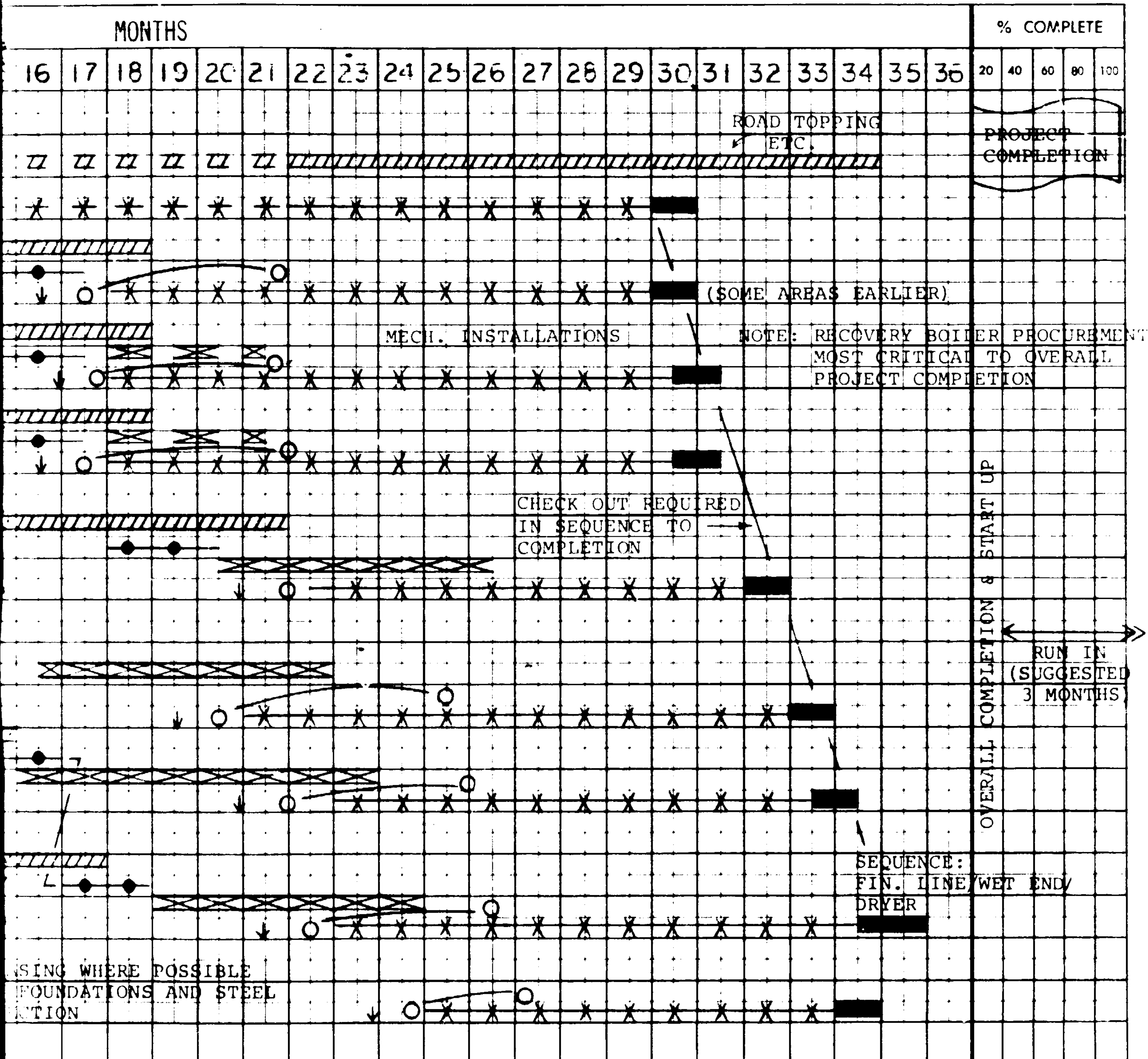
PULP MILL

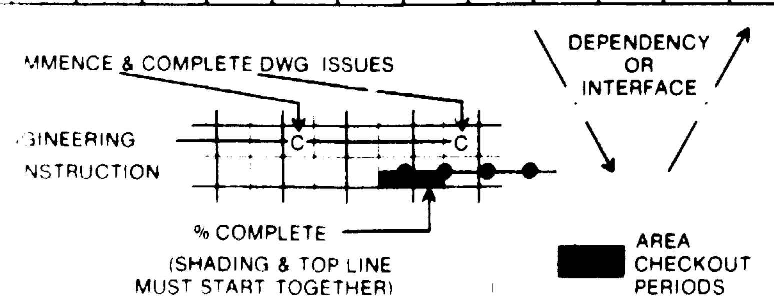
ENGINEERING AND CONSTRUCTION SCHEDULE

TITLE - OVERALL CONCEPT

SHEET - 1 OF 2 . PROJECT No. 4651A .

PREPARED BY SCHEDULING DEPT.- DATE - MAR. 25, 1980





ISSUE	DATE	REMARKS
01	3-25-80	FOR FEASIBILITY STUDY

SECTION 3

simons
H.A. SIMONS (INTERNATIONAL) LTD

CLIENT - UNIDO

ITEM No.			DESCRIPTION	1	2	3
1						
2			EVAPORATORS	EF	FECT	IVE
				DA	TE OF	
				CO	NTRACT	
3						
4			RECOVERY BOILER ⎫	O	RDER	MA
5			⎬ STRUCT. ALL IN RECOVERY BOILER			
6			PRECIPITATORS ⎭			
7						
8						
9			POWER BOILER			
10						
11			POWER GENERATION			
12						
13			RECAUSTICIZING AND LIME KILN			
14						
15						
16			FINISHED PRODUCTS WAREHOUSE			
17						
18			NON PROCESS BUILDINGS			
19						
20			TEMPORARY FACILITIES			
21						
22						

SCHED	ACTUAL	ACTIVITY
▽	▼	P I OR TENDER ISSUED
E	Ⓔ	BID EVALUATION
◇	◆	CLIENTS DECISION OR APPROVAL
▭	▬	P O OR CONTRACT AWARDED
▯	▮	INITIAL VENDOR INFORMATION
X	⧗	CERTIFIED VENDOR INFORMATION
↓	↓	EQUIPMENT SHIPPED
○	●	EQUIPMENT DELIVERED ON SITE

	ACTIVITY
- - - - - -	ENGINEERING - PRELIM & TAIL OFF
———	ENGINEERING — MAIN PHASE
\\\\\\\\\\\\\\\\	PREPARE BID INFORMATION
—/—/—→	BID PERIOD & CLOSING DATE
///////	CONSTRUCT FOUNDATIONS
—◆—◆—◆—	ERECT MAIN STRUCTURAL FRAME
XXX	ESSENTIAL COMPLETION OF BUILDING
✱✱✱✱✱✱	INSTALLATIONS - MECHANICAL & ALLIED

BCIL 6884 HASI

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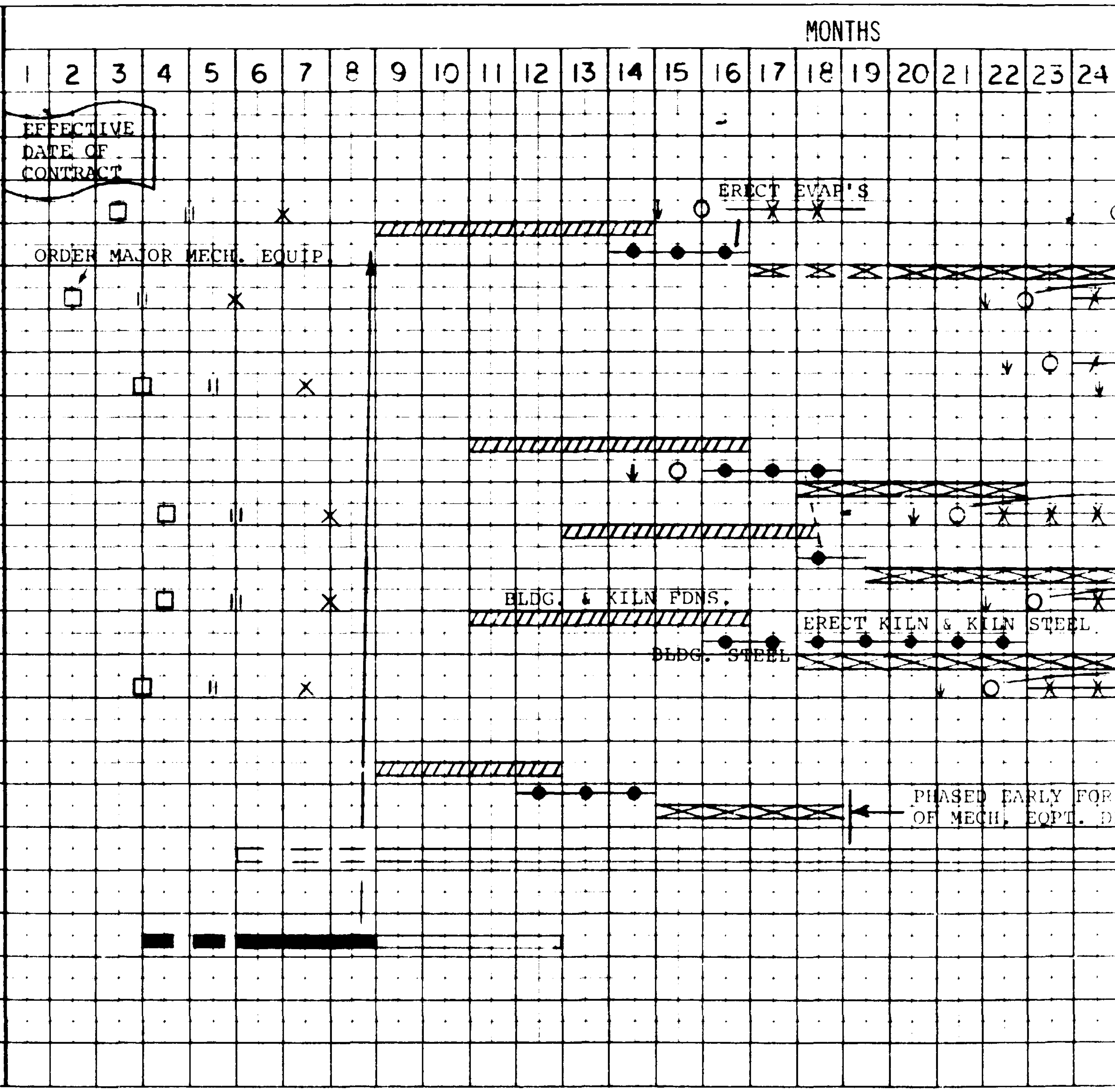
SECTION 1

UNIDO **PROJECT -** 600 ADT/D UNBLEACHED KRAFT PULP MILL
ONSAN KOREA



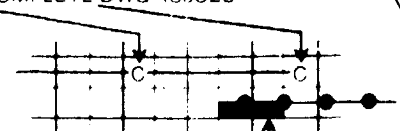
SCHED	ACTUAL	ACTIVITY
MO	MO	MILL ORDER — STRUCTURAL STEEL
M	M	MECHANICAL DEPT INPUT
PC	PC	ISSUE P&C DIAGRAMS
P	P	INFORMATION FOR PROCUREMENT
C	C	ISSUE CERTIFIED DRAWINGS
A	A	DRAWING APPROVALS
*	*	HIGHLIGHT
|←	→|	START OR COMPLETION DEADLINE

ALLIED

COMMENCE & COMPLETE DWG ISSUES

ENGINEERING

CONSTRUCTION



% COMPLETE

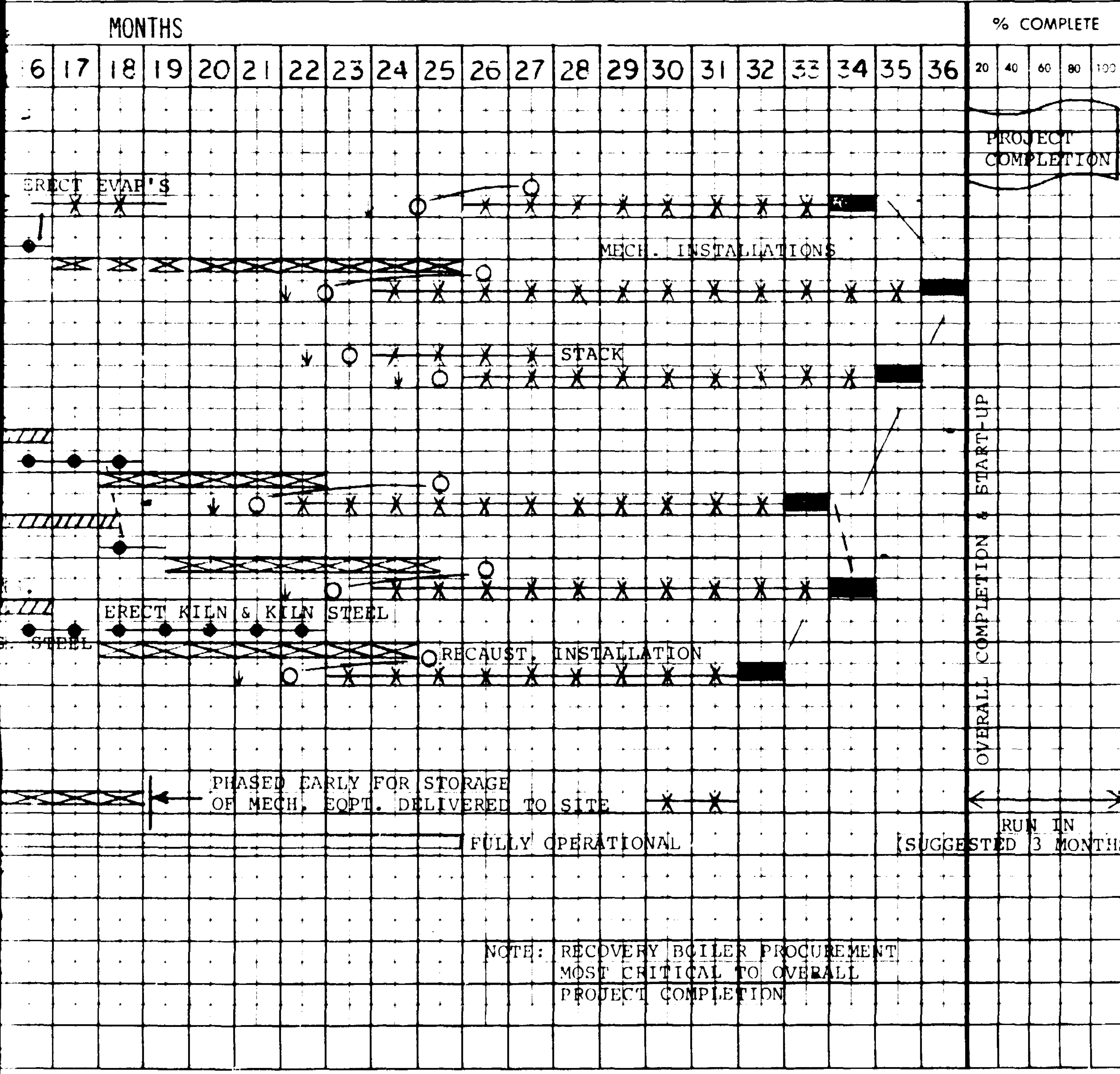
(SHADING & TOP LINE MUST START TOGETHER)

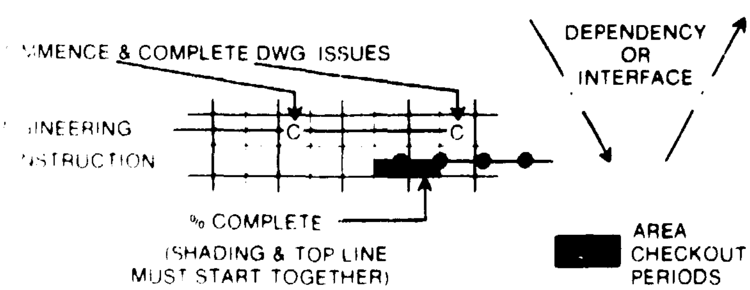
SECTION 2

PULP MILL

ENGINEERING AND CONSTRUCTION SCHEDULE

TITLE - OVERALL CONCEPT
SHEET - 2 OF 2 . PROJECT No. 4651A .
PREPARED BY SCHEDULING DEPT.- DATE - MAR. 25, 1980





ISSUE	DATE	REMARKS
01	3-25-80	FOR FEASIBILITY STUDY

SECTION 3

APPENDIX 5

FINANCIAL STATEMENTS

simons

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	-	-	-	78278	93933	104370	104370	104370	104370	104370	104370	104370	104370	104370	104370
OPERATING COSTS	-	-	-	61851	73360	81033	81033	81033	81033	81033	81033	81033	81033	81033	81033
GROSS PROFIT	-	-	-	16427	20573	23337	23337	23337	23337	23337	23337	23337	23337	23337	23337
REVENUE DEDUCTIONS															
DEPRECIATION	-	-	-	10878	10878	10878	10878	10628	10628	10628	10628	10628	10628	10628	10628
INTEREST ON DEBT	-	-	-	22325	25168	27443	29587	31811	34311	37398	41209	45915	51724	58897	67752
AMORT. OF DEF.CHARGES	-	-	-	1160	1160	1160	1160	1160	-	-	-	-	-	-	-
AMORT. CONST.INTEREST	-	-	-	1892	1892	1892	1892	1892	1892	1892	1892	1892	1892	-	-
TOTAL DEDUCTIONS	-	-	-	36256	39098	41373	43517	45492	46832	49919	53730	58435	64244	69525	78380
EARNINGS BEFORE TAX	-	-	-	-19829	-18525	-18036	-20180	-22154	-23494	-26581	-30392	-35098	-40907	-46187	-55043
INCOME TAXES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NET EARNINGS	-	-	-	-19829	-18525	-18036	-20180	-22154	-23494	-26581	-30392	-35098	-40907	-46187	-55043

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	-	-	-	-19829	-18525	-18036	-20180	-22154	-23494	-26581	-30392	-35098	-40907	-46187	-55043
TAX DEFERRAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEPRECIATION & AMORT.	-	-	-	13930	13930	13930	13930	13680	12520	12520	12520	12520	12520	10628	10628
SALE OF COMMON SHARES	21900	33461	-	-	-	-	-	-	-	-	-	-	-	-	-
LONG TERM LOAN	-	43574	83788	-	-	-	-	-	-	-	-	-	-	-	-
SHORT TERM BANK LOANS	-	-	-	5899	21173	19284	19928	20052	22552	25639	29450	34156	39965	47138	55993
DECR. IN WORKING CAP.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DECR. IN SURPLUS CASH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	21900	77035	83788	-	16578	15178	13678	11578	11578	11578	11578	11578	11578	11578	11578
APPLICATION OF FUNDS															
FIXED ASSETS	21900	73000	51100	-	-	-	-	-	-	-	-	-	-	-	-
CONSTRUCTION INTEREST	-	4035	14888	-	-	-	-	-	-	-	-	-	-	-	-
TERM DEBT REPAYMENTS	-	-	-	-	11578	11578	11578	11578	11578	11578	11578	11578	11578	11578	11578
DEFERRED CHARGES	-	-	5800	-	-	-	-	-	-	-	-	-	-	-	-
SHORT TERM BANK LOANS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIVIDENDS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INCR. IN WORKING CAP.	-	-	12000	-	5000	3600	2100	-	-	-	-	-	-	-	-
INCR. IN SURPLUS CASH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	21900	77035	83788	-	16578	15178	13678	11578	11578	11578	11578	11578	11578	11578	11578

UNIDO-KOREA CASE 1 KOREA MILL JAN 1980 - 7/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ'D	-	-	12000	12000	17000	20600	22700	22700	22700	22700	22700	22700	22700	22700	22700
CASH SURPLUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FIXED ASSETS	21900	94900	145000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000
- ACCUM. DEPRECIATION	-	-	-	10878	21756	32634	43512	54140	64768	75395	86024	96652	107280	117908	128536
DEPRECIATED PLANT	21900	94900	145000	135122	124244	113366	102488	91860	81232	70604	59976	49348	38720	28092	17464
NET CONSTR. INTEREST	-	4035	18924	17031	15139	13246	11354	9462	7569	5677	3785	1892	-	-	-
NET DEFERRED CHARGES	-	-	5800	4640	3480	2320	1160	-	-	-	-	-	-	-	-
TOTAL	21900	98935	1827[illegible]4	168793	159863	149532	137702	124022	111501	98981	86461	73940	61420	50792	40164
LIABILITIES AND EQUITY															
SHORT TERM LOANS	-	-	-	5899	27072	46356	66283	86335	108888	134527	163977	198133	238098	285236	341229
LONG TERM LOANS	-	43574	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362
- PRINCIPAL RETIRED	-	-	-	-	11578	23157	34735	46313	57892	69470	81049	92627	104205	115784	127362
NET LONG TERM DEBT	-	43574	127362	127362	115784	104205	92627	81049	69470	57892	46313	34735	23157	11578	-
DEFERRED TAXES	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL LIABILITIES	-	43574	127362	133261	142856	150561	158910	167384	178358	192419	210291	232868	261255	296814	341229
SHARE CAPITAL	21900	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361
RETAINED EARNINGS	-	-	-	-19829	-38354	-56390	-76570	-98724	-122218	-148799	-179192	-214290	-255197	-301384	-356427
SHAREHOLDER EQUITY	21900	55361	55361	35532	17007	-1029	-21208	-43362	-66857	-93438	-123830	-158928	-199835	-246023	-301066
TOTAL	21900	98935	182723	168793	159863	149532	137702	124022	111501	98981	86460	73940	61420	50792	40164

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	54574	65489	72765	72765	72765	72765	72765	72765	72765	72765	72765	72765
OPERATING COSTS	0	0	0	33943	39027	42416	42416	42416	42416	42415	42416	42416	42416	42416	42416
GROSS PROFIT	0	0	0	20631	26462	30349	30349	30349	30349	30349	30349	30349	30349	30349	30349
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967
INTEREST ON DEBT	0	0	0	20318	21327	20596	19421	18026	16453	14709	12833	10731	8376	5740	2786
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1849	1849	1849	1849	1849	1849	1849	1849	1849	1849	0	0
TOTAL DEDUCTIONS	0	0	0	38934	39943	39212	38037	36642	34269	32525	30649	28547	26192	21707	18754
EARNINGS BEFORE TAX	0	0	0	-18304	-13481	-8863	-7688	-6293	-3919	-2175	-299	1802	4157	8642	11595
INCOME TAXES	0	0	0	0	0	0	0	0	0	0	0	829	1912	3975	5334
NET EARNINGS	0	0	0	-18304	-13481	-8863	-7688	-6293	-3919	-2176	-299	973	2245	4667	6261

UNIDO-KOREA CASE 2 AUSTRALIA MILL JAN.1980 BASE CASE 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	3300	8800	10400	11500	11500	11500	11500	11500	11500	11500	11500	11500	11500
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4113
FIXED ASSETS	31800	138400	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900
- ACCUM. DEPRECIATION	0	0	0	15967	31935	47902	63870	79837	95805	111772	127740	143707	159675	175642	191610
DEPRECIATED PLANT	31800	138400	212900	196933	180965	164998	149030	133063	117095	101128	85160	69193	53225	37258	21290
NET CONSTR. INTEREST	0	4241	18485	16637	14788	12940	11091	9243	7394	5545	3697	1849	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	31800	142641	238685	225569	208553	191037	172421	153805	135989	118173	100357	82541	64725	48758	36903
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	5188	16810	23313	27542	30376	31636	31153	28794	24332	17516	8064	0
LONG TERM LOANS	0	70682	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727
- PRINCIPAL RETIRED	0	0	0	0	15157	30314	45471	60628	75785	90942	106099	121256	136413	151570	166727
NET LONG TERM DEBT	0	70682	166727	166727	151570	136413	121256	106099	90942	75785	60628	45471	30314	15157	0
DEFERRED TAXES	0	0	0	0	0	0	0	0	0	0	0	829	2741	6717	11821
TOTAL LIABILITIES	0	70682	166727	171914	168379	159726	148798	136474	122578	106938	89421	70632	50571	29937	11821
SHARE CAPITAL	31800	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959
RETAINED EARNINGS	0	0	0	-18304	-31785	-40648	-48335	-54628	-58548	-60724	-61023	-60050	-57805	-53139	-46877
SHAREHOLDER EQUITY	31800	71959	71959	53655	40174	31311	23624	17331	13411	11235	10936	11909	14154	18820	25082
TOTAL	31800	142641	238685	225569	208553	191037	172421	153805	135989	118173	100357	82541	64725	48757	36903

UNIDO-KOREA CASE 2. AUSTRALIA MILL JAN.1980 *BASE CASE* 08/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-18304	-13481	-8863	-7688	-6293	-3919	-2176	-299	973	2245	4667	6261
TAX DEFERRAL	0	0	0	0	0	0	0	0	0	0	0	829	1912	3975	5105
DEPRECIATION _ AMORT.	0	0	0	18616	18616	18616	18616	18616	17816	17816	17816	17816	17816	15967	15967
SALE OF COMMON SHARES	31800	40159	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	70682	96045	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	5188	11622	6504	4229	2834	1260	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	31800	110841	96045	5500	16757	16257	15157	15157	15157	15640	17517	19619	21973	24609	27333
APPLICATION OF FUNDS															
FIXED ASSETS	31800	106600	74500	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	4241	14245	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	15157	15157	15157	15157	15157	15157	15157	15157	15157	15157	15157
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	483	2360	4462	6816	9453	8064
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3300	5500	1600	1100	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4113
TOTAL	31800	110841	96045	5500	16757	16257	15157	15157	15157	15640	17517	19619	21973	24609	27333

UNIDO-KOREA CASE 3 CALIFORNIA MILL JAN.1980 *BASE CASE* 13/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	55991	67190	74655	74655	74655	74655	74655	74655	74655	74655	74655	74655
OPERATING COSTS	0	0	0	42797	49067	53248	53248	53248	53248	53249	53248	53248	53248	53248	53248
GROSS PROFIT	0	0	0	13194	18122	21407	21407	21407	21407	21407	21407	21407	21407	21407	21407
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	25181	12759	12759	12759	12759	12759	12759	12759	12759	6716	673	673
INTEREST ON DEBT	0	0	0	15419	16659	16441	15820	15107	14303	13396	12373	11219	9930	8552	7010
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1366	1366	1366	1366	1366	1366	1365	1366	1366	1366	0	0
TOTAL DEDUCTIONS	0	0	0	42766	31584	31366	30745	30032	28427	27520	26497	25344	18011	9226	7683
EARNINGS BEFORE TAX	0	0	0	-29572	-13462	-9959	-9337	-8624	-7020	-6113	-5090	-3937	3396	12182	13724
INCOME TAXES	0	0	0	0	0	0	0	0	0	0	0	0	1868	6700	7548
NET EARNINGS	0	0	0	-29572	-13462	-9959	-9337	-8624	-7020	-6113	-5090	-3937	1528	5482	6176

UNIDO-KOREA CASE 3 CALIFORNIA MILL JAN.1980 BASE CASE 13/02/80

CASH FLOW STATEMENT

FISCAL YEAR	1 1980	2 1981	3 1982	4 1983	5 1984	6 1985	7 1986	8 1987	9 1988	10 1989	11 1990	12 1991	13 1992	14 1993	15 1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-29572	-13462	-9959	-9337	-8624	-7020	-6113	-5090	-3937	1528	5482	6176
TAX DEFERRAL	0	0	0	0	0	0	0	0	0	0	0	0	1868	6700	7548
DEPRECIATION _ AMORT.	0	0	0	27347	14925	14925	14925	14925	14125	14125	14125	14125	8082	673	673
SALE OF COMMON SHARES	23600	30078	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	51619	72760	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	8225	12444	6541	5720	5007	4202	3295	2272	1119	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	23600	81697	72760	6000	13907	11507	11307	11307	11307	11307	11307	11307	11478	12855	14398
APPLICATION OF FUNDS															
FIXED ASSETS	23600	78600	55000	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3097	10560	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	11307	11307	11307	11307	11307	11307	11307	11307	11307	11307	11307
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	171	1548	3091
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3200	6000	2600	200	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	23600	81697	72760	6000	13907	11507	11307	11307	11307	11307	11307	11307	11478	12855	14398

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	3200	9200	11800	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIXED ASSETS	23600	102200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200
- ACCUM. DEPRECIATION	0	0	0	25181	37940	50700	63459	76218	88977	101736	114495	127254	133970	134643	135317
DEPRECIATED PLANT	23600	102200	157200	132019	119260	106500	93741	80982	68223	55464	42705	29946	23230	22557	21883
NET CONSTR. INTEREST	0	97	13657	12291	10926	9560	8194	6829	5463	4097	2731	1366	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	23600	105297	178057	156710	144385	129660	114736	99811	85686	71561	57437	43312	35230	34557	33883
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	8225	20669	27210	32930	37936	42139	45434	47706	48825	48655	47107	44016
LONG TERM LOANS	0	51619	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379
- PRINCIPAL RETIRED	0	0	0	0	11307	22614	33922	45229	56536	67843	79150	90457	101765	113072	124379
NET LONG TERM DEBT	0	51619	124379	124379	113072	101765	90457	79150	67843	56536	45229	33922	22614	11307	0
DEFERRED TAXES	0	0	0	0	0	0	0	0	0	0	0	0	1868	8568	16116
TOTAL LIABILITIES	0	51619	124379	132604	133740	128974	123387	117086	109982	101970	92935	82747	73137	66982	60132
SHARE CAPITAL	23600	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678
RETAINED EARNINGS	0	0	0	-29572	-43033	-52992	-62330	-70954	-77974	-84086	-89176	-93113	-91585	-86103	-79927
SHAREHOLDER EQUITY	23600	53678	53678	24106	10645	686	-8651	-17276	-24295	-30408	-35498	-39435	-37907	-32425	-26249
TOTAL	23600	105297	178057	156710	144385	129660	114736	99811	85686	71561	57437	43312	35230	34557	33883

UNIDO-KOREA CASE # B.C. HILL JAN.1980 *BASE CASE* 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	55991	67190	74655	74655	74655	74655	74655	74655	74655	74655	74655	74655
OPERATING COSTS	0	0	0	35873	40840	44152	44152	44152	44152	44152	44152	44152	44152	44152	44152
GROSS PROFIT	0	0	0	20119	26349	30503	30503	30503	30503	30503	30503	30503	30503	30503	30503
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	15915	15915	15915	15915	15915	15715	15715	15715	15715	15715	1565	1565
INTEREST ON DEBT	0	0	0	16551	17016	15865	14114	12148	10455	8961	7468	5974	4481	2987	1494
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1510	1510	1510	1510	1510	1510	1510	1510	1510	1510	0	0
TOTAL DEDUCTIONS	0	0	0	34776	35240	34090	32339	30373	27680	26186	24692	23199	21705	4552	3059
EARNINGS BEFORE TAX	0	0	0	-14657	-8891	-3587	-1836	130	2823	4317	5811	7304	8798	25951	27444
INCOME TAXES	0	0	0	0	0	0	0	59	1271	1943	5923	9891	10587	11960	12654
NET EARNINGS	0	0	0	-14657	-8891	-3587	-1836	72	1553	2374	-112	-2587	-1789	13990	14791

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-14657	-8891	-3587	-1836	72	1553	2374	-112	-2587	-1789	13990	14791
TAX DEFERRAL	0	0	0	0	0	0	0	59	1271	1943	-3272	0	0	0	0
DEPRECIATION & AMORT.	0	0	0	18225	18225	18225	18225	18225	17225	17225	17225	17225	17225	1565	1565
SALE OF COMMON SHARES	26100	32988	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	57354	79556	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	2033	5713	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	26100	90341	79556	5600	15046	14638	16389	18355	20048	21542	13841	14637	15435	15555	16356
APPLICATION OF FUNDS															
FIXED ASSETS	26100	86900	60800	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3441	11656	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	12446	12446	12446	12446	12446	12446	12446	12446	12446	12446	12446
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	2142	3942	1662	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3100	5600	2600	50	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	4247	7602	9095	1394	2191	2989	3109	3909
TOTAL	26100	90341	79556	5600	15046	14638	16389	18355	20048	21542	13841	14637	15435	15555	16356

UNIDO-KOREA CASE # B.C. MILL JAN.1980 *BASE CASE* 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ'D	0	0	3100	8700	11300	11350	11350	11350	11350	11350	11350	11350	11350	11350	11350
CASH SURPLUS	0	0	0	0	0	0	0	4247	11849	20945	22339	24530	27519	30628	34538
FIXED ASSETS	26100	113000	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800
- ACCUM. DEPRECIATION	0	0	0	15915	31830	47745	63660	79575	95290	111005	126720	142435	158150	159715	161280
DEPRECIATED PLANT	26100	113000	173800	157885	141970	126055	110140	94225	78510	62795	47080	31365	15650	14085	12520
NET CONSTR. INTEREST	0	3441	15097	13587	12078	10568	9058	7548	6039	4529	3019	1510	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	26100	116441	195997	183372	167748	149573	131348	117371	107748	99619	83788	68755	54519	56063	58408
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	2033	7745	5604	1662	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	57354	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909
- PRINCIPAL RETIRED	0	0	0	0	12446	24893	37339	49785	62232	74678	87124	99570	112017	124463	136909
NET LONG TERM DEBT	0	57354	136909	136909	124463	112017	99570	87124	74678	62232	49785	37339	24893	12446	0
DEFERRED TAXES	0	0	0	0	0	0	0	59	1329	3272	0	0	0	0	0
TOTAL LIABILITIES	0	57354	136909	138942	132208	117620	101232	87183	76007	65503	49785	37339	24893	12446	0
SHARE CAPITAL	26100	59088	59088	59088	59088	59088	59089	59088	59088	59089	59088	59088	59088	59088	59088
RETAINED EARNINGS	0	0	0	-14657	-23549	-27135	-28971	-28900	-27347	-24972	-25085	-27672	-29461	-15471	-680
SHAREHOLDER EQUITY	26100	59088	59088	44430	35539	31952	30116	30188	31741	34115	34003	31416	29626	43617	58408
TOTAL	26100	116441	195997	183372	167748	149573	131349	117371	107748	99619	83788	68754	54519	56063	58408

UNIDO-KOREA CASE 11 KOREA MILL JAN 1980 (800 TPD) 07/02/80

STATEMENT OF EARNINGS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	104370	125244	139160	139160	139160	139160	139160	139160	139160	139160	139160	139160
OPERATING COSTS	0	0	0	81533	96878	107109	107109	107109	107109	107109	107109	107109	107109	107109	107109
GROSS PROFIT	0	0	0	22837	28366	32051	32051	32051	32051	32051	32051	32051	32051	32051	32051
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	12773	12773	12773	12773	12448	12448	12448	12448	12448	12448	12448	12448
INTEREST ON DEBT	0	0	0	26245	29299	30576	31203	31625	32147	32791	33586	34568	35780	37277	39125
AMORT. OF DEF.CHARGES	0	0	0	1200	1200	1200	1200	1200	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618	1618
TOTAL DEDUCTIONS	0	0	0	41836	44891	46167	46794	46892	46214	46858	47653	48635	49847	51343	53191
EARNINGS BEFORE TAX	0	0	0	-18999	-16525	-14116	-14743	-14841	-14162	-14806	-15601	-16583	-17795	-19292	-21140
INCOME TAXES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NET EARNINGS	0	0	0	-18999	-16525	-14116	-14743	-14841	-14162	-14806	-15601	-16583	-17795	-19292	-21140

UNIDO-KOREA CASE 11 KOREA MILL JAN 1980 (800 TPD) 07/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-18999	-16525	-14116	-14743	-14841	-14162	-14806	-15601	-16583	-17795	-19292	-21140
TAX DEFERRAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEPRECIATION - AMORT.	0	0	0	15591	15591	15591	15591	15266	14066	14065	14066	14066	14056	14066	14066
SALE OF COMMON SHARES	26000	32420	5577	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	57000	92015	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	10208	18880	15071	12698	13121	13643	14287	15082	16064	17276	18772	20620
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	26000	89420	97592	6800	17947	16547	13547	13547	13547	13547	13547	13547	13547	13547	13547
APPLICATION OF FUNDS															
FIXED ASSETS	26000	86000	60085	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3420	16007	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	13547	13547	13547	13547	13547	13547	13547	13547	13547	13547	13547
DEFERRED CHARGES	0	0	6000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	15500	6800	4400	3000	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	26000	89420	97592	6800	17947	16547	13547	13547	13547	13547	13547	13547	13547	13547	13547

UNIDO-KOREA CASE 11 KOREA MILL JAN 1980 (800 TPD) 07/02/80

PRO-FORMA BALANCE SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	15500	22300	26700	29700	29700	29700	29700	29700	29700	29700	29700	29700	29700
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIXED ASSETS	26000	112000	172085	172085	172085	172085	172085	172085	172085	172085	172085	172085	172085	172085	172085
- ACCUM. DEPRECIATION	0	0	0	12773	25546	38320	51093	63541	75989	88438	100886	113334	125782	138231	150679
DEPRECIATED PLANT	26000	112000	172085	159312	146539	133765	120992	108544	96096	83647	71199	58751	46303	33854	21406
NET CONSTR. INTEREST	0	3420	19427	17808	16190	14572	12954	11335	9717	8099	6481	4862	3244	1626	8
NET DEFERRED CHARGES	0	0	6000	4800	3600	2400	1200	0	0	0	0	0	0	0	0
TOTAL	26000	115420	213012	204220	193029	180437	164846	149579	135513	121446	107380	93313	79247	65180	51114
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	10208	29088	44159	56857	69978	83620	97907	112989	129053	146328	165101	185721
LONG TERM LOANS	0	57000	149015	149015	149015	149015	149015	149015	149015	149015	149015	149015	149015	149015	149015
- PRINCIPAL RETIRED	0	0	0	0	13547	27094	40640	54187	67734	81281	94828	108375	121921	135468	149015
NET LONG TERM DEBT	0	57000	149015	149015	135468	121921	108375	94828	81281	67734	54187	40640	27094	13547	0
DEFERRED TAXES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LIABILITIES	0	57000	149015	159223	164556	166080	165232	164806	164901	165641	167176	169693	173422	178648	185721
SHARE CAPITAL	26000	58420	63997	63997	63997	63997	63997	63997	63997	63997	63997	63997	63997	63997	63997
RETAINED EARNINGS	0	0	0	-18999	-35524	-49640	-64383	-79223	-93385	-108192	-123793	-140376	-158172	-177464	-198604
SHAREHOLDER EQUITY	26000	58420	63997	44997	28473	14357	-386	-15227	-29389	-44195	-59797	-76380	-94175	-113467	-134607
TOTAL	26000	115420	213012	204220	193029	180437	164846	149579	135513	121446	107380	93313	79247	65180	51114

UNIDO-KOREA CASE 22 AUSTRALIA MILL JAN.1980 (800 TPD) 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	71715	86058	95620	95620	95620	95620	95620	95620	95620	95620	95620	95620
OPERATING COSTS	0	0	0	42516	49294	53813	53813	53813	53813	53813	53813	53813	53813	53813	53813
GROSS PROFIT	0	0	0	29199	36764	41807	41807	41807	41807	41807	41807	41807	41807	41807	41807
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	18838	18838	18838	18838	18838	18838	18839	18838	18838	18838	18838	18838
INTEREST ON DEBT	0	0	0	23535	23939	22203	19999	17382	14977	12837	10698	8558	6419	4279	2140
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1816	1816	1816	1816	1816	1816	1815	1816	1816	1816	1816	1816
TOTAL DEDUCTIONS	0	0	0	44989	45393	43657	41453	38836	35631	33491	31352	29212	27073	24933	22793
EARNINGS BEFORE TAX	0	0	0	-15790	-8629	-1850	353	2970	6176	8316	10455	12595	14734	16874	19013
INCOME TAXES	0	0	0	0	0	0	163	1366	2841	3825	4809	5794	6778	7762	8746
NET EARNINGS	0	0	0	-15790	-8629	-1850	191	1604	3335	4490	5646	6801	7956	9112	10267

08/02/80

UNIDO-KOREA CASE 22 AUSTRALIA MILL JAN.1980 (800 TPD)

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-15790	-8629	-1850	191	1604	3335	4490	5646	6801	7956	9112	10267
TAX DEFERRAL	0	0	0	0	0	0	163	1366	2841	3825	4809	5794	6778	-4369	-9665
DEPRECIATION - AMORT.	0	0	0	21454	21454	21454	21454	21454	20654	20654	20654	20654	20654	20654	20654
SALE OF COMMON SHARES	37675	46974	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	83629	112495	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	6730	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	164	0	0	0	0	0	0	0	0	0	0
TOTAL	37675	130603	112495	5664	19719	19604	21807	24424	26830	28970	31109	33249	35388	25397	22256

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
APPLICATION OF FUNDS															
FIXED ASSETS	37675	125585	87910	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	5018	15785	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	17829	17829	17829	17829	17829	17829	17829	17829	17829	17829	17829
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	534	3978	2218	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3800	5500	1890	1240	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	164	0	0	0	4377	9001	11140	13280	15419	17559	7568	4426
TOTAL	37675	130603	112495	5664	19719	19604	21807	24424	26830	28970	31109	33249	35388	25397	22256

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ'D	0	0	3800	9300	11190	12430	12430	12430	12430	12430	12430	12430	12430	12430	12430
CASH SURPLUS	0	0	0	164	0	0	0	4377	13377	24517	37797	53216	70775	78342	82769
FIXED ASSETS	37675	163260	251170	251170	251170	251170	251170	251170	251170	251170	251170	251170	251170	251170	251170
- ACCUM. DEPRECIATION	0	0	0	18838	37675	56513	75351	94189	113026	131864	150702	169540	188377	207215	226053
DEPRECIATED PLANT	37675	163260	251170	232332	213495	194657	175819	156981	138144	119305	100468	81630	62793	43955	25117
NET CONSTR. INTEREST	0	5018	21803	19987	18171	16354	14538	12722	10906	9090	7273	5457	3641	1825	9
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	37675	168278	280773	264983	245255	225041	203587	186510	174857	165343	157968	152734	149638	136552	120324
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	6730	6196	2218	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	83629	196124	196124	196124	196124	196124	196124	196124	196124	196124	196124	196124	196124	196124
- PRINCIPAL RETIRED	0	0	0	0	17829	35659	53488	71318	89147	106977	124806	142636	160465	178295	196124
NET LONG TERM DEBT	0	83629	196124	196124	178295	160465	142636	124806	106977	89147	71318	53488	35659	17829	0
DEFERRED TAXES	0	0	0	0	0	0	163	1529	4370	8195	13005	18798	25576	21207	12542
TOTAL LIABILITIES	0	83629	196124	196124	185025	166661	145017	126335	111347	97343	84323	72287	61235	39037	12542
SHARE CAPITAL	37675	84649	84649	84649	84649	84649	84649	84649	84649	84649	84649	84649	84649	84649	84649
RETAINED EARNINGS	0	0	0	-15790	-24419	-26269	-26078	-24474	-21139	-16648	-11003	-4202	3755	12867	23134
SHAREHOLDER EQUITY	37675	84649	84649	68859	60230	58380	58571	60175	63510	68000	73646	80447	88404	97515	107783
TOTAL	37675	168278	280773	264983	245255	225041	203587	186510	174857	165343	157968	152734	149638	136552	120324

UNIDO-KOREA CASE 33 CALIFORNIA MILL JAN.1980 (800 TPD) 13/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	74655	89586	99540	99540	99540	99540	99540	99540	99540	99540	99540	99540
OPERATING COSTS	0	0	0	54048	62408	67982	67982	67982	67982	67982	67982	67982	67982	67982	67982
GROSS PROFIT	0	0	0	20607	27178	31558	31558	31558	31558	31558	31558	31558	31558	31558	31558
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	29716	15056	15056	15056	15056	15056	15056	15056	15056	7923	791	791
INTEREST ON DEBT	0	0	0	17722	18266	17055	15463	13532	11368	9579	7982	6385	4789	3193	1596
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1341	1341	1341	1341	1341	1341	1341	1341	1341	1341	1341	1341
TOTAL DEDUCTIONS	0	0	0	49580	35463	34252	32660	30729	27765	25975	24379	22782	14054	5325	3729
EARNINGS BEFORE TAX	0	0	0	-28972	-8285	-2693	-1102	830	3793	5583	7180	8776	17505	26233	27830
INCOME TAXES	0	0	0	0	0	0	0	456	2086	3071	3949	4827	9628	14428	15306
NET EARNINGS	0	0	0	-28972	-8285	-2693	-1102	373	1707	2512	3231	3949	7877	11805	12523

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-28972	-8285	-2693	-1102	373	1707	2512	3231	3949	7877	11805	12523
TAX DEFERRAL	0	0	0	0	0	0	0	456	2086	3071	3949	4827	2083	58	0
DEPRECIATION & AMORT.	0	0	0	31857	17197	17197	17197	17197	16397	16397	16397	16397	9265	2132	2132
SALE OF COMMON SHARES	27800	35352	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	61009	85320	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	2715	6340	79	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	27800	96360	85320	5600	15253	14583	16095	18027	20190	21980	23577	25173	19225	13995	14656
APPLICATION OF FUNDS															
FIXED ASSETS	27800	92700	64880	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3661	12440	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	13303	13303	13303	13303	13303	13303	13303	13303	13303	13303	13303
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	2793	4724	1617	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	4000	5600	1950	1280	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	5270	8678	10274	11870	5923	693	1353
TOTAL	27800	96361	85320	5600	15253	14583	16095	18027	20190	21980	23577	25173	19225	13995	14656

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	4000	9600	11550	12830	12830	12830	12830	12830	12830	12830	12830	12830	12830
CASH SURPLUS	0	0	0	0	0	0	0	0	5270	13947	24222	36092	42014	42707	44060
FIXED ASSETS	27800	120500	185380	185380	185380	185380	185380	185380	185380	185380	185380	185380	185380	185380	185380
- ACCUM. DEPRECIATION	0	0	0	29716	44772	59828	74884	89940	104996	120051	135107	150163	158087	158878	159669
DEPRECIATED PLANT	27800	120500	185380	155664	140608	125552	110496	95440	80384	65329	50273	35217	27293	26502	25711
NET CONSTR. INTEREST	0	3661	16101	14760	13418	12077	10736	9395	8054	6712	5371	4030	2689	1348	6
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	27800	124161	209481	183223	167976	152059	134862	117665	106538	98819	92695	88169	84827	83387	82608
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	2715	9055	9134	6342	1617	0	0	0	0	0	0	0
LONG TERM LOANS	0	61009	146329	146329	146329	146329	146329	146329	146329	146329	146329	146329	146329	146329	146329
- PRINCIPAL RETIRED	0	0	0	0	13303	26605	39908	53210	66513	79816	93118	106421	119724	133026	146329
NET LONG TERM DEBT	0	61009	146329	146329	133026	119724	106421	93118	79816	66513	53210	39908	26605	13303	0
DEFERRED TAXES	0	0	0	0	0	0	0	456	2542	5613	9562	14389	16472	16530	16530
TOTAL LIABILITIES	0	61009	146329	149044	142081	128858	112763	95192	82358	72126	62772	54297	43077	29833	16530
SHARE CAPITAL	27800	63152	63152	63152	63152	63152	63152	63152	63152	63152	63152	63152	63152	63152	63152
RETAINED EARNINGS	0	0	0	-28972	-37257	-39951	-41052	-40679	-38972	-36460	-33229	-29280	-21403	-9598	2926
SHAREHOLDER EQUITY	27800	63152	63152	34180	25895	23201	22100	22473	24180	26692	29923	33872	41749	53554	66077
TOTAL	27800	124160	209481	183223	167976	152059	134862	117665	106538	98818	92695	88169	84827	83387	82608

UNIDO-KOREA CASE ## B.C. MILL JAN.1980 (800 TPD) 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	74655	89586	99540	99540	99540	99540	99540	99540	99540	99540	99540	99540
OPERATING COSTS	0	0	0	44952	51575	55991	55991	55991	55991	55991	55991	55991	55991	55991	55991
GROSS PROFIT	0	0	0	29703	38011	43549	43549	43549	43549	43549	43549	43549	43549	43549	43549
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	18718	18718	18718	18718	18718	18458	18458	18458	18458	18458	1930	1930
INTEREST ON DEBT	0	0	0	19286	19286	17533	15780	14026	12273	10520	8766	7013	5260	3507	1753
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484	1484
TOTAL DEDUCTIONS	0	0	0	40288	40288	38535	36781	35028	32215	30461	28708	26955	25202	6920	5167
EARNINGS BEFORE TAX	0	0	0	-10585	-2277	5014	6768	8521	11334	13088	14841	16594	18347	36629	38382
INCOME TAXES	0	0	0	0	0	2256	3045	3834	5100	5889	6678	7467	11319	16831	17646
NET EARNINGS	0	0	0	-10585	-2277	2758	3722	4687	6234	7199	8162	9127	7029	19797	20736

UNIDO-KOREA CASE 4 R.C. MILL JAN.1980 (800 TPD) 08/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-10585	-2277	2758	3722	4687	6234	7198	8162	9127	7029	19797	20736
TAX DEFERRAL	0	0	0	0	0	2256	3045	3834	5100	5889	-7700	-7730	-4697	0	0
DEPRECIATION _ AMORT.	0	0	0	21002	21002	21002	21002	21002	19942	19942	19942	19942	19942	3414	3414
SALE OF COMMON SHARES	30800	38566	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	68015	92704	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	30800	106581	92704	10417	18724	26016	27769	29523	31276	33029	20405	21339	22274	23211	24149
APPLICATION OF FUNDS															
FIXED ASSETS	30800	102500	71980	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	4081	13724	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	14611	14611	14611	14611	14611	14611	14611	14611	14611	14611	14611
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3100	5600	2600	50	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	4817	1513	11355	13158	14912	16665	18418	5794	6728	7663	8600	9538
TOTAL	30800	106581	92704	10417	18724	26016	27769	29523	31276	33029	20405	21339	22274	23211	24149

UNIDO-KOREA CASE ## R.C. MILL JAN.1980 (800 TPD) 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	3100	8700	11300	11350	11350	11350	11350	11350	11350	11350	11350	11350	11350
CASH SUPPLUS	0	0	0	4817	6330	17685	30844	45756	62421	80839	86633	93360	101024	109624	119162
FIXED ASSETS	30800	133300	205180	205180	205180	205180	205180	205180	205180	205180	205180	205180	205180	205180	205180
- ACCUM. DEPRECIATION	0	0	0	18718	37436	56154	74872	93590	112048	130506	148964	167422	185880	187810	189740
DEPRECIATED PLANT	30800	133300	205180	186462	167744	149026	130308	111590	93132	74674	56216	37758	19300	17370	15440
NET CONSTR. INTEREST	0	4081	17805	16321	14838	13354	11870	10387	8903	7419	5935	4452	2968	1484	1
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	30800	137381	230085	219500	202612	193015	185172	179082	175806	174282	160134	146920	134642	139828	145953
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	68015	160719	160719	160719	160719	160719	160719	160719	160719	150719	160719	160719	160719	160719
- PRINCIPAL RETIRED	0	0	0	0	14611	29222	43832	58443	73054	87665	102276	116887	131497	146108	160719
NET LONG TERM DEBT	0	68015	160719	160719	146108	131497	116887	102276	87665	73054	58443	43832	29222	14611	0
DEFERRED TAXES	0	0	0	0	0	2256	5302	9136	14237	20126	12426	4697	0	0	0
TOTAL LIABILITIES	0	68015	160719	160719	146108	133754	122189	111412	101902	93180	70870	48529	29222	14611	0
SHARE CAPITAL	30800	69366	69366	69366	69366	69366	69366	69366	69366	69366	69366	69366	69366	69366	69366
RETAINED EARNINGS	0	0	0	-10585	-12862	-10104	-6382	-1696	4538	11736	19899	29025	36054	55852	76587
SHAREHOLDER EQUITY	30800	69366	69366	58781	56503	59261	62983	67670	73904	81102	89264	98391	105420	125217	145953
TOTAL	30800	137381	230085	219500	202612	193015	185172	179082	175805	174282	160134	146920	134642	139828	145953

UNIDO-KOREA CASE 10 KOREA MILL JAN 1980 (PRICE +%50) 07/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	86153	103383	114870	114870	114870	114870	114870	114870	114870	114870	114870	114870
OPERATING COSTS	0	0	0	61851	73360	81033	81033	81033	81033	81033	81033	81033	81033	81033	81033
GROSS PROFIT	0	0	0	24302	30023	33837	33837	33837	33837	33837	33837	33837	33837	33837	33837
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	10878	10878	10878	10878	10628	10628	10628	10628	10628	10628	10628	10628
INTEREST ON DEBT	0	0	0	21706	22371	21344	19653	17573	14616	11840	9866	7893	5920	3947	1973
AMORT. OF DEF.CHARGES	0	0	0	1160	1160	1160	1160	1160	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1892	1892	1892	1892	1892	1892	1892	1892	1892	1892	0	0
TOTAL DEDUCTIONS	0	0	0	35636	36301	35274	33583	31253	27136	24360	22387	20413	18440	14575	12601
EARNINGS BEFORE TAX	0	0	0	-11335	-6278	-1437	254	2584	6701	9477	11451	13424	15397	19263	21236
INCOME TAXES	0	0	0	0	0	0	135	1369	3552	5023	6069	7115	8160	10209	11255
NET EARNINGS	0	0	0	-11335	-6278	-1437	119	1214	3150	4454	5382	6309	7237	9053	9981

UNIDO-KOREA CASE 10 KOREA MILL JAN 1980 (PRICE +$50) 07/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-11335	-6278	-1437	119	1214	3150	4454	5382	6309	7237	9053	9981
TAX DEFERRAL	0	0	0	0	0	0	135	1369	3552	4089	0	0	0	0	0
DEPRECIATION _ AMORT.	0	0	0	13930	13930	13930	13930	13680	12520	12520	12520	12520	12520	10628	10628
SALE OF COMMON SHARES	21900	33461	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	43574	83788	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	6330	2685	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	2596	0	0	0	0	0	0	0	0	0	0
TOTAL	21900	77035	83788	2596	16578	15178	14185	16264	19221	21064	17902	18830	19757	19681	20609
APPLICATION OF FUNDS															
FIXED ASSETS	21900	73000	51100	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	4035	14888	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	11578	11578	11578	11578	11578	11579	11578	11578	11578	11578	11578
DEFERRED CHARGES	0	0	5800	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	506	4686	3823	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	12000	0	5000	3600	2100	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	2596	0	0	0	0	3820	9485	6324	7251	8179	8103	9031
TOTAL	21900	77035	83788	2596	16578	15178	14185	16264	19221	21064	17902	18830	19757	19681	20609

UNIDO-KOREA CASE 10 KOREA MILL JAN 1980 (PRICE +$50) 07/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	12000	12000	17000	20600	22700	22700	22700	22700	22700	22700	22700	22700	22700
CASH SURPLUS	0	0	0	2596	0	0	0	0	3820	13305	19629	26880	35059	43162	52192
FIXED ASSETS	21900	94900	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000	146000
- ACCUM. DEPRECIATION	0	0	0	10878	21756	32634	43512	54140	64768	75396	86024	96652	107280	117908	128536
DEPRECIATED PLANT	21900	94900	146000	135122	124244	113366	102488	91860	81232	70604	59976	49348	38720	28092	17464
NET CONSTR. INTEREST	0	4035	18924	17031	15139	13246	11354	9462	7569	5677	3785	1892	0	0	0
NET DEFERRED CHARGES	0	0	5800	4640	3480	2320	1160	0	0	0	0	0	0	0	0
TOTAL	21900	98935	182724	171389	159863	149532	137702	124022	115321	112286	106089	100820	96479	93954	92356
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	6330	9015	8509	3823	0	0	0	0	0	0	0
LONG TERM LOANS	0	43574	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362	127362
- PRINCIPAL RETIRED	0	0	0	0	11578	23157	34735	46313	57892	69470	81049	92627	104205	115784	127362
NET LONG TERM DEBT	0	43574	127362	127362	115784	104205	92627	81049	69470	57892	46313	34735	23157	11578	0
DEFERRED TAXES	0	0	0	0	0	0	135	1504	5056	9145	9145	9145	9145	9145	9145
TOTAL LIABILITIES	0	43574	127362	127362	122114	113221	101271	86376	74526	67037	55458	43880	32301	20723	9145
SHARE CAPITAL	21900	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361	55361
RETAINED EARNINGS	0	0	0	-11335	-17613	-19050	-18930	-17716	-14566	-10112	-4730	1579	8816	17869	27850
SHAREHOLDER EQUITY	21900	55361	55361	44027	37749	36312	36431	37645	40795	45249	50631	56940	64177	73230	83211
TOTAL	21900	98935	182723	171389	159863	149532	137702	124022	115321	112286	106089	100820	96478	93954	92356

UNIDO-KOREA CASE 80 AUSTRALIA MILL JAN.1990 (PRICE +$50) 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	62449	74939	83265	83265	83265	83265	83265	83265	83265	83265	83265	83265
OPERATING COSTS	0	0	0	33943	39027	42416	42416	42416	42416	42415	42416	42416	42416	42416	42416
GROSS PROFIT	0	0	0	28506	35912	40849	40849	40849	40849	40849	40849	40849	40849	40849	40849
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967	15967
INTEREST ON DEBT	0	0	0	20007	20007	18188	16370	14551	12732	10913	9094	7275	5457	3638	1819
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1849	1849	1849	1849	1849	1849	1849	1849	1849	1849	0	0
TOTAL DEDUCTIONS	0	0	0	38623	38623	36804	34986	33167	30548	28729	26910	25091	23273	19605	17786
EARNINGS BEFORE TAX	0	0	0	-10117	-2711	4045	5864	7682	10301	12120	13939	15758	17577	21244	23063
INCOME TAXES	0	0	0	0	0	1861	2697	3534	4739	5575	6412	7249	8085	9772	10609
NET EARNINGS	0	0	0	-10117	-2711	2184	3166	4148	5563	6545	7527	8509	9491	11472	12454

UNIDO-KOREA CASE 20 AUSTRALIA MILL JAN.1980 (PRICE +$50) 08/02/80

CASH FLOW STATEMENT

FISCAL YEAR	1 1980	2 1981	3 1982	4 1983	5 1984	6 1985	7 1986	8 1987	9 1988	10 1989	11 1990	12 1991	13 1992	14 1993	15 1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-10117	-2711	2164	3166	4148	5563	6545	7527	8509	9491	11472	12454
TAX DEFFERAL	0	0	0	0	0	1861	2697	3534	4739	5575	6412	4497	2448	-7345	-7345
DEPRECIATION AMORT.	0	0	0	18616	18616	18616	18616	18615	17816	17816	17816	17816	17816	15967	15967
SALE OF COMMON SHARES	31800	40159	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	70682	96045	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	852	0	0	0	0	0	0	0	0	0	0
TOTAL	31800	110841	96045	8499	16757	22661	24480	26298	28117	29936	31755	30822	29756	20094	21076
APPLICATION OF FUNDS															
FIXED ASSETS	31800	106600	74500	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	4241	14245	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	15157	15157	15157	15157	15157	15157	15157	15157	15157	15157	15157
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3300	5500	1600	1100	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	2999	0	6404	9323	11141	12960	14779	16598	15665	14599	4937	5919
TOTAL	31800	110841	96045	8499	16757	22661	24480	26298	28117	29936	31755	30822	29756	20094	21076

UNIDO-KOREA CASE 10 AUSTRALIA MILL JAN.1980 (PRICE +$50) 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ'D	0	0	3300	6800	10400	11500	11500	11500	11500	11500	11500	11500	11500	11500	11500
CASH SURPLUS	0	0	0	2999	2146	8550	17873	29014	41975	56754	73352	89016	103615	108552	114472
FIXED ASSETS	31800	138400	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900	212900
- ACCUM. DEPRECIATION	0	0	0	15967	31935	47902	63870	79837	95805	111772	127740	143707	159675	175642	191610
DEPRECIATED PLANT	31800	138400	212900	196933	180965	164998	149030	133063	117095	101128	85160	69193	53225	37258	21290
NET CONSTR. INTEREST	0	4241	18485	16637	14788	12940	11091	9243	7394	5546	3697	1849	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	31800	142641	238685	228568	210700	199587	190294	182819	177964	174927	173709	171558	168340	157310	147262
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	70682	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727	166727
- PRINCIPAL RETIRED	0	0	0	0	15157	30314	45471	60628	75785	90942	106099	121256	136413	151570	166727
NET LONG TERM DEBT	0	70682	166727	166727	151570	136413	121256	106099	90942	75785	60628	45471	30314	15157	0
DEFERRED TAXES	0	0	0	0	0	1861	4558	8092	12830	18405	24817	29314	31762	24417	17072
TOTAL LIABILITIES	0	70682	166727	166727	151570	138273	125813	114190	103772	94190	85445	74785	62076	39574	17072
SHARE CAPITAL	31800	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959	71959
RETAINED EARNINGS	0	0	0	-10117	-12829	-10645	-7478	-3330	2233	8779	16305	24814	34305	45777	58231
SHAREHOLDER EQUITY	31800	71959	71959	61842	59130	61314	64481	68629	74192	80737	88264	96773	106264	117736	130190
TOTAL	31800	142641	238685	228568	210700	199587	190294	182819	177964	174927	173709	171557	168340	157310	147262

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	63866	76640	85155	85155	85155	85155	85155	85155	85155	85155	85155	85155
OPERATING COSTS	0	0	0	42797	49067	53248	53248	53248	53248	53248	53248	53248	53248	53248	53248
GROSS PROFIT	0	0	0	21069	27572	31907	31907	31907	31907	31907	31907	31907	31907	31907	31907
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	25181	12759	12759	12759	12759	12759	12759	12759	12759	6716	673	673
INTEREST ON DEBT	0	0	0	14925	14997	13711	12212	10855	9498	8141	6784	5427	4071	2714	1357
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1366	1366	1366	1366	1366	1366	1366	1366	1366	1366	0	0
TOTAL DEDUCTIONS	0	0	0	42273	29921	28636	27136	25780	23623	22265	20909	19552	12152	3387	2030
EARNINGS BEFORE TAX	0	0	0	-21203	-2349	3272	4771	6128	8285	9641	10998	12355	19755	28520	29877
INCOME TAXES	0	0	0	0	0	1799	2624	3370	4557	5303	6049	6795	10865	15686	16432
NET EARNINGS	0	0	0	-21203	-2349	1472	2147	2757	3728	4339	4949	5560	8890	12834	13445

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-21203	-2349	1472	2147	2757	3728	4339	4949	5560	8890	12834	13445
TAX DEFERRAL	0	0	0	0	0	1799	2624	3370	4557	2632	0	135	0	0	0
DEPRECIATION & AMORT.	0	0	0	27347	14925	14925	14925	14925	14125	14125	14125	14125	8082	673	673
SALE OF COMMON SHARES	23600	30078	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	51619	72760	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	1188	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	144	0	0	0	0	0	0	0	0	0	0
TOTAL	23600	81697	72760	6144	13907	18196	19696	21053	22409	21095	19074	19820	16972	13507	14118
APPLICATION OF FUNDS															
FIXED ASSETS	23600	78600	55000	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3097	10560	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	-0	0	0	11307	11307	11307	11307	11307	11307	11307	11307	11307	11307	11307
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	1188	0	0	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3200	6000	2600	200	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	144	0	5501	8388	9745	11102	9788	7767	8513	5664	2200	2811
TOTAL	23600	81697	72760	6144	13907	18196	19696	21053	22409	21095	19074	19820	16972	13507	14118

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	3200	9200	11800	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
CASH SURPLUS	0	0	0	144	0	5501	13890	23635	34737	44525	52292	60805	66469	68670	71480
FIXED ASSETS	23600	102200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200	157200
- ACCUM. DEPRECIATION	0	0	0	25181	37940	50700	63459	76218	88977	101736	114495	127254	133970	134643	135317
DEPRECIATED PLANT	23600	102200	157200	132019	119260	106500	93741	80982	68223	55464	42705	29946	23230	22557	21883
NET CONSTR. INTEREST	0	3097	13657	12291	10926	9560	8194	6829	5463	4097	2731	1366	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	23600	105297	178057	156854	144385	135162	128625	123446	120423	116087	109729	104117	101699	103226	105364
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	1188	0	0	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	51619	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379	124379
- PRINCIPAL RETIRED	0	0	0	0	11307	22614	33922	45229	56536	67843	79150	90457	101765	113072	124379
NET LONG TERM DEBT	0	51619	124379	124379	113072	101765	90457	79150	67843	56536	45229	33922	22614	11307	0
DEFERRED TAXES	0	0	0	0	0	1799	4423	7794	12350	14982	14982	15117	15117	15117	15117
TOTAL LIABILITIES	0	51619	124379	124379	114260	103564	94881	86944	80193	71518	60211	49039	37732	26424	15117
SHARE CAPITAL	23600	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678	53678
RETAINED EARNINGS	0	0	0	-21203	-23553	-22080	-19934	-17176	-13448	-9109	-4160	1400	10290	23124	36568
SHAREHOLDER EQUITY	23600	53678	53678	32475	30125	31598	33745	36502	40230	44569	49518	55078	63968	76802	90247
TOTAL	23600	105297	178057	156854	144385	135162	128625	123446	120423	116087	109729	104117	101699	103226	105364

UNIDO-KOREA CASE 40 B.C. MILL JAN.1980 (PRICE +$50) 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	63866	76640	85155	85155	85155	85155	85155	85155	85155	85155	85155	85155
OPERATING COSTS	0	0	0	35873	40840	44152	44152	44152	44152	44152	44152	44152	44152	44152	44152
GROSS PROFIT	0	0	0	27994	35799	41003	41003	41003	41003	41003	41003	41003	41003	41003	41003
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	15915	15915	15915	15915	15915	15715	15715	15715	15715	15715	1565	1565
INTEREST ON DEBT	0	0	0	16429	16429	14936	13442	11948	10455	8961	7468	5974	4481	2987	1494
AMORT. OF DFF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1510	1510	1510	1510	1510	1510	1510	1510	1510	1510	0	0
TOTAL DEDUCTIONS	0	0	0	34654	34654	33160	31667	30173	27680	26185	24692	23199	21705	4552	3059
EARNINGS BEFORE TAX	0	0	0	-6660	1145	7843	9336	10830	13323	14817	16311	17804	19298	36451	37944
INCOME TAXES	0	0	0	0	515	3529	4201	4873	5996	6668	7340	8012	8684	16403	17075
NET EARNINGS	0	0	0	-6660	630	4314	5135	5956	7328	8149	8971	9792	10614	20048	20869

UNIDO-KOREA CASE 40 B.C. MILL JAN.1980 (PRICE +$50) 08/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-6660	630	4314	5135	5956	7328	8149	8971	9792	10614	20048	20869
TAX DEFFRRAL	0	0	0	0	515	3529	4201	4873	5996	2304	-6580	-6605	-6628	-283	-304
DEPRECIATION & AMORT.	0	0	0	18225	18225	18225	18225	18225	17225	17225	17225	17225	17225	1565	1565
SALE OF COMMON SHARES	26100	32988	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	57354	79556	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	26100	90341	79556	11564	19370	26067	27561	29055	30548	27678	19616	20412	21210	21330	22131
APPLICATION OF FUNDS															
FIXED ASSETS	26100	86900	60800	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3441	11656	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	12446	12446	12446	12446	12446	12445	12446	12446	12446	12446	12446
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3100	5600	2600	50	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	5964	4324	13571	15115	16608	18102	15232	7169	7966	8764	8884	9684
TOTAL	26100	90341	79556	11564	19370	26067	27561	29055	30548	27678	19616	20412	21210	21330	22131

UNIDO-KOREA CASE [illegible] B.C. MILL JAN.1980 (PRICE *$50) 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ"D	0	0	3100	8700	11300	11350	11350	11350	11350	11350	11350	11350	11350	11350	11350
CASH SURPLUS	0	0	0	5964	10288	23859	38974	55582	73684	88915	96085	104051	112815	121699	131384
FIXED ASSETS	26100	113000	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800	173800
- ACCUM. DEPRECIATION	0	0	0	15915	31830	47745	63660	79575	95290	111005	126720	142435	158150	159715	161280
DEPRECIATED PLANT	26100	113000	173800	157885	141970	126055	110140	94225	78510	62795	47080	31365	15650	14085	12520
NET CONSTR. INTEREST	0	3441	15097	13587	12078	10568	9058	7549	6039	4529	3019	1510	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	26100	116441	195997	189337	178036	173432	170322	168706	169583	167590	157534	148276	139815	147134	155254
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOANS	0	57354	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909	136909
- PRINCIPAL RETIRED	0	0	0	0	12446	24893	37339	49785	62232	74678	87124	99570	112017	124463	136909
NET LONG TERM DEBT	0	57354	136909	136909	124463	112017	99570	87124	74678	62232	49785	37339	24893	12446	0
DEFERRED TAXES	0	0	0	0	515	4045	8246	13119	19115	21419	14839	8234	1606	1324	1020
TOTAL LIABILITIES	0	57354	136909	136909	124978	116061	107816	100244	93793	83650	64624	45573	26499	13770	1020
SHARE CAPITAL	26100	59088	59088	59088	59088	59088	59088	59088	59088	59088	59088	59088	59088	59088	59088
RETAINED EARNINGS	0	0	0	-6660	-6030	-1717	3418	9375	16702	24852	33823	43615	54228	74276	95146
SHAREHOLDER EQUITY	26100	59088	59088	52427	53057	57371	62506	68462	75790	83939	92910	102702	113316	133364	154234
TOTAL	26100	116441	195997	189337	178035	173432	170322	168706	169583	167590	157534	148276	139815	147134	155254

UNIDO-KOREA CASE X AUSTRALIA MILL JAN.1980 (-$20 MILLION) 08/02/80

STATEMENT OF EARNINGS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
REVENUE FROM SALES	0	0	0	54574	65489	72765	72765	72765	72765	72765	72765	72765	72765	72765	72765
OPERATING COSTS	0	0	0	33943	39027	42416	42416	42416	42416	42415	42416	42416	42416	42416	42416
GROSS PROFIT	0	0	0	20631	26462	30349	30349	30349	30349	30349	30349	30349	30349	30349	30349
REVENUE DEDUCTIONS															
DEPRECIATION	0	0	0	14467	14467	14467	14467	14467	14467	14467	14467	14467	14467	14467	14467
INTEREST ON DEBT	0	0	0	19380	19054	18032	16532	14874	13017	10939	8608	6613	4960	3306	1653
AMORT. OF DEF.CHARGES	0	0	0	800	800	800	800	800	0	0	0	0	0	0	0
AMORT. CONST.INTEREST	0	0	0	1675	1675	1675	1675	1675	1675	1675	1675	1675	1675	0	0
TOTAL DEDUCTIONS	0	0	0	35323	35996	34975	33475	31817	29160	27080	24751	22756	21102	17774	16121
EARNINGS BEFORE TAX	0	0	0	-14692	-9534	-4626	-3126	-1468	1189	3269	5598	7594	9247	12575	14228
INCOME TAXES	0	0	0	0	0	0	0	0	547	1504	2575	3493	4254	5785	6545
NET EARNINGS	0	0	0	-14692	-9534	-4626	-3126	-1468	642	1765	3023	4101	4993	6791	7683

UNIDO-KOREA CASE X AUSTRALIA MILL JAN.1980 (-$20 MILLION) 08/02/80

PRO-FORMA BALANCE SHEET

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
ASSETS															
WORKING CAPITAL REQ'D	0	0	3300	8800	10400	11500	11500	11500	11500	11500	11500	11500	11500	11500	11500
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	5113	15072	21774	25694	30197
FIXED ASSETS	28950	125400	192900	192900	192900	192900	192900	192900	192900	192900	192900	192900	192900	192900	192900
- ACCUM. DEPRECIATION	0	0	0	14467	28935	43402	57870	72337	86805	101272	115740	130207	144675	159142	173610
DEPRECIATED PLANT	28950	125400	192900	178433	163965	149498	135030	120563	106095	91628	77160	62693	48225	33758	19290
NET CONSTR. INTEREST	0	3829	16752	15076	13401	11726	10051	8376	6701	5025	3350	1675	0	0	0
NET DEFERRED CHARGES	0	0	4000	3200	2400	1600	800	0	0	0	0	0	0	0	0
TOTAL	28950	129229	216952	205509	190166	174324	157381	140438	124296	108153	97123	90939	81499	70951	60987
LIABILITIES AND EQUITY															
SHORT TERM LOANS	0	0	0	3250	11218	13778	13738	12041	8486	2851	0	0	0	0	0
LONG TERM LOANS	0	63824	151546	151546	151546	151546	151546	151546	151546	151546	151546	151546	151546	151546	151546
- PRINCIPAL RETIRED	0	0	0	0	13777	27554	41331	55108	68885	82661	96438	110215	123992	137769	151546
NET LONG TERM DEBT	0	63824	151546	151546	137769	123992	110215	96438	82661	68885	55108	41331	27554	13777	0
DEFERRED TAXES	0	0	0	0	0	0	0	0	547	2051	4626	8119	7461	3900	30
TOTAL LIABILITIES	0	63824	151546	154796	148987	137770	123954	108479	91694	73786	59733	49449	35015	17677	30
SHARE CAPITAL	28950	65406	65406	65406	65406	65406	65406	65406	65406	65406	65406	65406	65406	65406	65406
RETAINED EARNINGS	0	0	0	-14692	-24227	-28852	-31978	-33446	-32804	-31039	-28016	-23916	-18922	-12132	-4449
SHAREHOLDER EQUITY	28950	65406	65406	50713	41179	36553	33427	31959	32601	34365	37389	41490	46483	53274	60957
TOTAL	28950	129229	216952	205509	190166	174323	157381	140438	124296	108153	97123	90939	81498	70951	60987

UNIDO-KOREA CASE X AUSTRALIA MILL JAN.1980 (-$20 MILLION) 08/02/80

CASH FLOW STATEMENT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FISCAL YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
SOURCE OF FUNDS															
NET EARNINGS	0	0	0	-14692	-9534	-4626	-3126	-1468	642	1765	3023	4101	4993	6791	7683
TAX DEFERRAL	0	0	0	0	0	0	0	0	547	1504	2575	3493	-657	-3561	-3870
DEPRECIATION AMORT.	0	0	0	16943	16943	16943	16943	16943	16143	16143	16143	16143	16143	14467	14467
SALE OF COMMON SHARES	28950	36456	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG TERM LOAN	0	63824	87722	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	3250	7969	2560	0	0	0	0	0	0	0	0	0
DECR. IN WORKING CAP.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DECR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	28950	100279	87722	5500	15377	14877	13817	15475	17332	19411	21741	23736	20479	17697	18280
APPLICATION OF FUNDS															
FIXED ASSETS	28950	96450	67500	0	0	0	0	0	0	0	0	0	0	0	0
CONSTRUCTION INTEREST	0	3829	12922	0	0	0	0	0	0	0	0	0	0	0	0
TERM DEBT REPAYMENTS	0	0	0	0	13777	13777	13777	13777	13777	13777	13777	13777	13777	13777	13777
DEFERRED CHARGES	0	0	4000	0	0	0	0	0	0	0	0	0	0	0	0
SHORT TERM BANK LOANS	0	0	0	0	0	0	40	1698	3555	5635	2851	0	0	0	0
DIVIDENDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INCR. IN WORKING CAP.	0	0	3300	5500	1600	1100	0	0	0	0	0	0	0	0	0
INCR. IN SURPLUS CASH	0	0	0	0	0	0	0	0	0	0	5113	9959	6702	3920	4503
TOTAL	28950	100279	87722	5500	15377	14877	13817	15475	17332	19411	21741	23736	20479	17697	18280