NOTICE

ENERGY RESOURCES CONSERVATION BOARD

OIL SANDS

TAR ISLAND AREA

APPLICATION NO. 780318

NOTICE OF HEARING

TAKE NOTICE that the Energy Resources Conservation Board will hold a public hearing at the MacDonald Island Pavilion, 151 MacDonald Drive, Fort McMurray, Alberta, on Tuesday, 30 January 1979, at the hour of 9:00 a.m., for the purpose of hearing representations respecting an application by Great Canadian Oil Sands Limited to amend Approval No. 1944 for a scheme to recover oil or a crude bitumen hydrocarbon product from oil sands.

The applicant requests permission to expand existing facilities in order to increase synthetic crude oil production in 12 321 cubic metres (77 500 barrels) per calendar day from the authorized maximum 10 334 cubic metres (65 000 barrels) per calendar day.

The proposed expansion would include a third mining train, additional bitumen extraction facilities, expansion of the delayed coking process capacity addition of a gas-fired boiler and attendant water treatment facilities, addition of a third stage reactor to the sulphur plant, additional product storage and water cooling facilities and purchase of offsite electric power.

Copies of the application and information and particulars filed in support thereof may be obtained by interested persons from the applicant, Great Canadian Oil Sands Limited, (Attention: Mr. W. L. Oliver, Vice President, Corporate Affairs), P. O. Box 4001, Fort McMurray, Alberta, T9H 3E3, or Great Canadian Oil Sands Limited, (Attention: Mr. W. L. Oliver, Vice President, Corporate Affairs), 2900 Alberta Telephone Tower, Edmonton, Alberta, T5J 1X2, and will be available for public viewing at the Records Centre of the Board at 603 - 6 Avenue S.W., Calgary, Alberta, T2P 0T4, during normal office hours.

Any person intending to intervene with respect to the application, either by making a written submission or for the purpose of questioning the applicant, shall file on or before 19 January 1979, ten copies of the intervention with the Board at its above address and two copies of the intervention with the applicant at its above address.

The applicant will be required to respond to all interventions supported by written submission by filing on or before 24 January 1979, ten copies of the response with the Board at its above address and two copies with the intervener.

DATED at Calgary, Alberta on 11 December 1978.

ENERGY RESOURCES CONSERVATION BOARD

A. L. McLarty, Board Solicitor
603 - 6 Avenue S.W.
Calgary, Alberta
T2P 0T4

DETAILS OF ~~XXXXXXXXX~~ NOTICE OF HEARING

~~XXXXXXXXX~~ NOTICE OF HEARING RE: Tar Island Area APPLICATION NO. 780318

TIME AND DATE OF HEARING ~~XXXXXXXXXXXXXXXXX~~: Tuesday, 30 January 1979, 9:00 a.m.

RESERVATIONS: BOARD ROOM _____ COURT ROOM _____ OTHER MacDonald Island Pavilion - Fort ~~McMurray~~

BOARD REPORTER _____ COURT REPORTER XX(Edm)

DATE NOTICE ISSUED: 11 December 1978

NOTICE SENT TO: Assistant Deputy Minister of Energy and Natural Resources
Operators in the Oil Sands Fields

(Specify operators or other interested parties) Great Canadian Oil Sands Limited

DATE ADVERTISED IN:

	The Albertan	14 December 1978
	The Calgary Herald	14 December 1978
	The Edmonton Journal	15 December 1978
Other Newspapers	The Edmonton Sun	15 December 1978
	The Fort McMurray Today	15 December 1978

ADVERTISING COSTS CHARGED TO:

Great Canadian Oil Sands Limited
P. O. Box 4001
Fort McMurray, Alberta
T9H 3E3

Attention: Mr. W. L. Oliver, Vice President, Corporate Affairs

EXAMINERS APPOINTED:

ADVERTISING CHECKED BY: _____

DISTRIBUTION:

Original
Copy 1 Hearing Reporter
Copy 2 Record Center
Copy 3 Solicitor's File
Copy 4 Accounting Dept.

DEPARTMENT: OIL SANDS ATTENTION: B. Stadnyk

AD-8-1-79

780318

ENERGY RESOURCES CONSERVATION BOARD

OIL SANDS

TAR ISLAND AREA

APPLICATION NO. 780318

AMENDED NOTICE OF HEARING

TAKE NOTICE that the Energy Resources Conservation Board will hold a public hearing at the MacDonald Island Pavilion, 151 MacDonald Drive, Fort McMurray, Alberta, on Tuesday, 30 January 1979, at the hour of 9:00 a.m., for the purpose of hearing representations respecting an application by Great Canadian Oil Sands Limited to amend Approval No. 1944 for a scheme to recover oil or a crude bitumen hydrocarbon product from oil sands.

The applicant requests permission to expand existing facilities in order to increase the authorized synthetic crude oil production to 3 772.275 cubic metres (23 725 000 barrels) of synthetic crude oil per year.

The proposed expansion would include a third mining train, additional bitumen extraction facilities, expansion of the delayed coking process capacity addition of a gas-fired boiler and attendant water treatment facilities, addition of a third stage reactor to the sulphur plant, additional product storage and water cooling facilities and purchase of offsite electric power.

Copies of the application and information and particulars filed in support thereof may be obtained by interested persons from the applicant, Great Canadian Oil Sands Limited, (Attention: Mr. W. L. Oliver, Vice President, Corporate Affairs), P. O. Box 4001, Fort McMurray, Alberta, T9H 3E3, or Great Canadian Oil Sands Limited, (Attention: Mr. W. L. Oliver, Vice President, Corporate Affairs), 2900 Alberta Telephone Tower, Edmonton, Alberta, T5J 1X2, and will be available for public viewing at the Records Centre of the Board at 603 - 6 Avenue S.W., Calgary, Alberta, T2P 0T4, during normal office hours.

Any person intending to intervene with respect to the application, either by making a written submission or for the purpose of questioning the applicant, shall file on or before 19 January 1979, ten copies of the intervention with the Board at its above address and two copies of the intervention with the applicant at its above address.

The applicant will be required to respond to all interventions supported by written submission by filing on or before 24 January 1979, ten copies of the response with the Board at its above address and two copies with the intervener.

DATED at Calgary, Alberta on 13 December 1978.

ENERGY RESOURCES CONSERVATION BOARD

A. L. McLarty, Board Solicitor
603 - 6 Avenue S.W.
Calgary, Alberta
T2P 0T4

APPLICATION

Application
~~SUBMISSION~~ RE
APPLICATION No. 780318
DATE 78 06 06

GREAT CANADIAN OIL SANDS LIMITED

E.R.C.B. APPLICATION

MAY 1978

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

Great Canadian Oil Sands Limited is the holder of E.R.C.B. Approval No. 1944A issued in 1973, permitting the production of 23,725,000 barrels of synthetic crude oil per year (65,000 barrels per calendar day).

Permission is hereby requested to make the following plant and equipment modifications considered necessary to achieve the increased production rate.

The new expansion facilities will upgrade the crude bitumen to synthetic crude oil by a hydrovisbreaking process or alternately by a delayed coking process.

Proposed expansion areas are highlighted on site plan drawings number 55E-A-507, 55E-A-520.

SITE PLAN DRAWINGS 55E-A-507 and 55E-A-520 ARE NOT AVAILABLE.

2. EXPANSION DETAILS

2.1 MINING OPERATION

A 3-bench mining system will be adopted, requiring the purchase of a new bucketwheel and supporting conveyor system, similar to those in present use.

The tailings disposal system will be updated to accommodate the increase in tailings generation resulting from the increased mining rate.

Tailing dyke heights and locations are shown on drawing number 55D-A-233. Typical mining equipment required for the expansion is shown on drawing number 55D-A-207.

2.2 PRIMARY EXTRACTION OPERATION

A fifth extraction line will be added having a nominal rating of 2000 TPH of tar sands.

Supporting facilities will consist of a rotary drum to slurry the tar sands, screen, separation cell, secondary (scavenger) recovery circuit and a five stage tailings pumping line.

2. EXPANSION DETAILS (continued)

Fifth line expansion details are shown on drawing numbers 55D-A-308, 55E-A-321, 55E-A-322.

It is anticipated that the proposed expansion will improve the extraction plant recovery to around 92% over the present figure of 89%.

2.3 FINAL EXTRACTION OPERATION

The existing plant has a maximum capacity equivalent to 78,000 BPSD synthetic crude. This is sufficient to permit an average production rate of 54,500 BPCD of synthetic crude which is about 5,000 BPCD over present plant throughput. The available space in the existing Final Extraction building will be utilized to accommodate 2 Bird Centrifuges, 2 Cuno filters and 4 Westfalia Centrifuges. These new facilities will increase Final Extraction capability by the equivalent of 12,000 BPSD synthetic crude, sufficient to meet the future production rate. The expansion of support facilities such as header and pumping systems will be minimal.

2.4 NEW UPGRADING OPERATION

The new process facilities will be constructed in a new area, selected to minimize interference with existing plant operations.

2. EXPANSION DETAILS (continued)

HYDROVISBREAKER EXPANSION

The new equipment to be installed will have a processing capacity of 18,000 BPSD and will be capable of being expanded at some later date to 25,000 BPSD of bitumen.

The new process complex will consist of diluent recovery, hydrovisbreaker reaction circuit, atmospheric distillation, gas plant, amine treating plant, cold box, and third stage reactor in sulphur plant.

Upgrading details are shown in drawing numbers 55E-A-007, 55E-A-502, 55E-A-507, 55B-A-523, 55B-A-524, 55B-A-525.

Hydrovisbreaker technology will improve the synthetic crude yield from tar sand over the present day delayed coker operation.

Table 2-1 shows the percentage by weight and by volume of synthetic crude recovered from bitumen fed to the upgrading area.

TABLE 2-1

SYNTHETIC CRUDE YIELDS

PRESENT	65 wt. %	76.5 vol. %
FUTURE	68 wt. %	79.5 vol. %

DRAWING NO. 55E-A-007, 55E-A-502, 55E-A-507, 55B-A-523, 55B-A-524 AND 55B-A-525 ARE NOT AVAILABLE.

2. EXPANSION DETAILS (continued)

DELAYED COKER EXPANSION

The new equipment to be installed will have a processing capacity of 24,000 BPSD of bitumen.

The new process complex will consist of diluent recovery, delayed coker unit, fractionation system, gas plant, new gas-oil hydrotreating plant, amine treating plant, and third stage reactor in the sulphur plant.

Upgrading details are shown in drawing numbers 55E-A-027, 55E-A-510, 55E-A-520.

The delayed coker expansion will give the same synthetic crude yield from tar sand as the present day operation.

2. EXPANSION DETAILS (continued)

NATURAL GAS

It is estimated that the average natural gas requirements will increase from the present figure of approximately 15 MMSCFD to 35-40 MMSCFD at the increased production rate.

COKE

Approximate quantities of coke stockpiled in the expansion cases are -- Hydrovisbreaking 15% of 2600 STPD produced --Delayed coking 25% of 3000 STPD produced. The coke consumption by the boilers increases by only 13% since additional steam will be produced by the addition of a gas fired boiler (capable of firing oil on an emergency basis).

SULPHUR

The recovery efficiency of the sulphur plant will increase from the present figure of 94% to 96% due to the addition of a third stage reactor. This is in compliance with the E.R.C.B. guidelines on sulphur recovery efficiency for a favourable feed gas.

Sulphur balances for present and expanded (Hydrovisbreaker case) are shown on Figures 2-1 and 2-2. The hydrovisbreaker case is the worst case since it produces more sulphur oxides but still remains within the emission standards.

GREAT CANADIAN OIL SANDS LIMITED

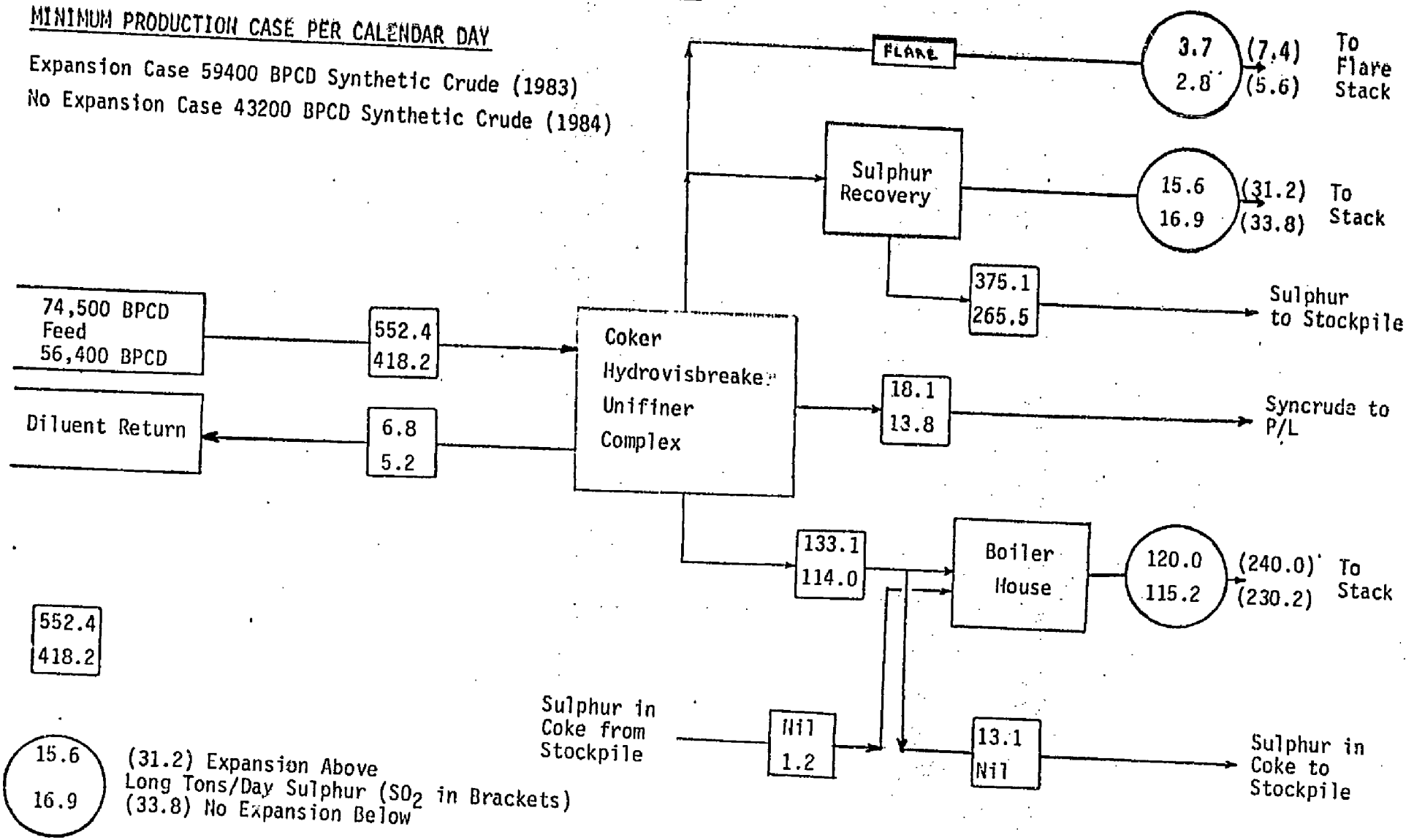
SULPHUR BALANCE

EXPANSION CASE

FIGURE 2-1

MINIMUM PRODUCTION CASE PER CALENDAR DAY

Expansion Case 59400 BPCD Synthetic Crude (1983)
No Expansion Case 43200 BPCD Synthetic Crude (1984)



GREAT CANADIAN OIL SANDS LIMITED

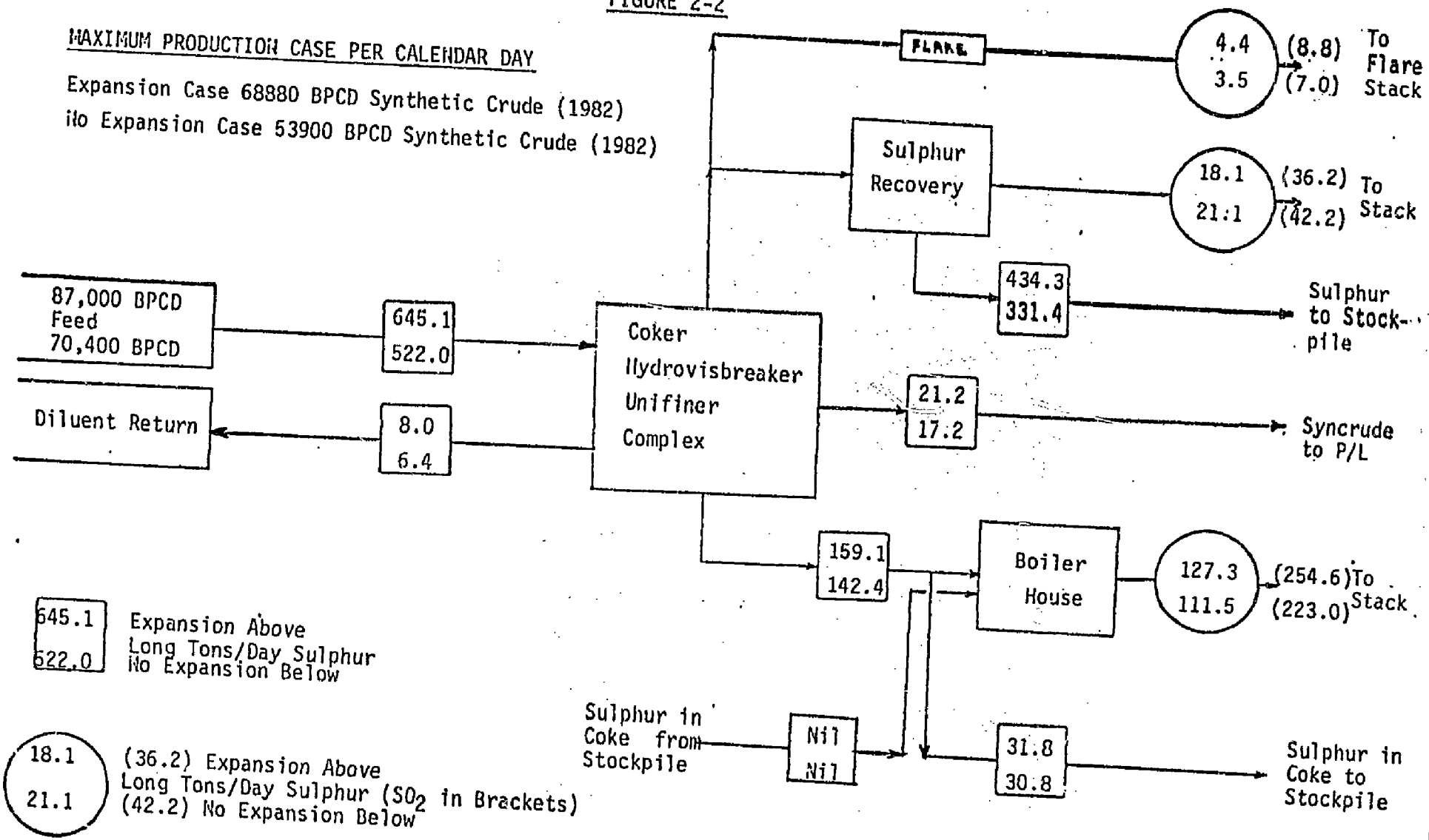
SULPHUR BALANCE

EXPANSION CASE

FIGURE 2-2

MAXIMUM PRODUCTION CASE PER CALENDAR DAY

Expansion Case 68880 BPCD Synthetic Crude (1982)
ito Expansion Case 53900 BPCD Synthetic Crude (1982)



2. EXPANSION DETAILS (continued)

The Environmental-Energy Diagram Drawing Number 55B-A-028 shows the stream quantities on a calendar day basis averaged over a 7 year period for the proposed hydrovisbreaker expansion.

TABLE 2-2

RECOVERY EFFICIENCIES - WT. %
(Based on Total Bitumen in Place)

STEP	RECOVERY % 1973	RECOVERY % 1981/87	DESCRIPTION	CUMULATIVE RECOVERY % 1973	CUMULATIVE RECOVERY % 1981/87
MINING	80	80	Plant Feed	80	80
PRIMARY & FINAL EXTRACTION	90	92	Crude Bitumen	72	73.6
UPGRADING (HYDROVISBREAKING)	65	68	Synthetic Crude Oil	47	50.05
UPGRADING (DELAYED COKING)	65	65.7	Synthetic Crude Oil	47	48.36

DRAWING NO. 55B-A-028 IS NOT AVAILABLE.

2. EXPANSION DETAILS (continued)

TABLE 2-3

RECOVERY EFFICIENCIES - VOL. %
(Based on Total Bitumen in Place)

STEP	RECOVERY % 1973	RECOVERY % 1981/87	DESCRIPTION	CUMULATIVE RECOVERY % 1973	CUMULATIVE RECOVERY % 1981/87
MINING	80	80	Plant Feed	80	80
PRIMARY & FINAL EXTRACTION	90	92	Crude Bitumen	72	73.6
UPGRADING (HYDROVISBREAKING)	78	79.4	Synthetic Crude Oil	56(1)	58.4(2)
UPGRADING (DELAYED COKING)	78	77.2	Synthetic Crude Oil	56	56.82(3)

(1) Gravity of Synthetic Crude Oil 34° API.

(2) Gravity of Synthetic Crude Oil 32.5° API.

(3) Gravity of Synthetic Crude Oil 32.9° API.

2.5 UTILITIES OPERATION

A 750,000 lbs/hr. gas fired steam generator will be required to satisfy the increased steam demand of the Extraction Plant. The increased electrical power demand will be satisfied by purchasing additional power from A.P.L.

The water treatment facilities will be expanded to meet the increased boiler feed water and utility water demands. The selection of a gas fired steam generator was made for the following two major reasons:

2.0 EXPANSION DETAILS (continued)

a) The current license limits on emissions of SO_2 to the atmosphere will not permit continuous operating of all units on coke. Some fuel oil or natural gas must be burned in order to maintain emissions below the allowable limit of 348 LTPD SO_2. As a coke fired unit would result in considerably higher emissions than the present mode of operation it was decided to install a gas fired boiler to maintain emissions well below the license limit and as close as possible to the existing emissions level.

b) For the same generating capacity, the capital cost of a gas/oil fired unit was found to be less than that of a coke fired unit ($20MM compared with $45MM).

TABLE 2-4

STEAM, WATER AND POWER

	PRESENT	FUTURE
STEAM		
820 PSIG Steam Generating Capacity (MLBS/HR)	2250	3000
425 PSIG Steam Generating Capacity (MLBS/HR)	270	270
ELECTRIC POWER		
In House Generating Capacity (MW)	68	68
APL-Interruptible Supply Line Capacity (MW)	17	20
APL-Firm Supply Line Capacity (MW)	--	14
WATER		
River Water Requirements (Acres ft/yr)	25,000	30,000

2. EXPANSION DETAILS (continued)

PURCHASED ELECTRICAL POWER

An external electric power supply from A.P.L. was selected in preference to the addition of more turbine generator capacity or uprating of the existing generators. This approach was taken in order to minimize capital cost and eliminate the risk of extended shut-down time and operational problems associated with extensive modifications to the existing turbine generators.

TABLE 2-5

IMPACT OF POWER GENERATION ON GAS PURCHASE

	PRESENT	FUTURE W/34 MW ELEC. PURCHASE	FUTURE W/O 34 MW ELEC. PURHCASE
PURCHASED POWER	5 MW	34 MW	0
NATURAL GAS	15 MMSCFD	35-40 MMSCFD	50-55 MMSCFD

Having the facility to purchase back-up power is good insurance against failure of the in-house turbine generators.

2.6 OFFSITES/PIPELINE OPERATION

The cooling water system will require extensive modifications to the existing pumps in the river water pumphouse and the installation of new supply and return lines to and from the new process area.

2. EXPANSION DETAILS (continued)

To satisfy the requirement of storing increased synthetic crude production, an additional gas oil product storage tank of 85,000 barrels capacity and an additional off specification product tank of the same capacity will be installed.

Extensive interconnecting facilities will be added to accommodate the increase in overall production capacity throughout the plant. Improvements and additions to the sewers, site and fire system will also be necessary.

PRODUCTS PIPELINE

To meet the proposed increase in the current production rate the following modifications and additions to the existing products pipeline will be required.

a) Installation of a new pumping station at Mile Post 90.

b) Equipment and layout modifications to the Fort McMurray (Mile Post 0) and Boyle(Mile Post 180) pumping stations.

3. ENVIRONMENTAL

3.1 ATMOSPHERE

The principal effects of the operation of the plant on the atmosphere are associated with the discharge of sulphur dioxide and particulate matter from the power plant stack and sulphur dioxide from the sulphur plant incinerator stack.

As was pointed out earlier, a performance factor of 96% will be achieved in the sulphur recovery plant with the installation of a third stage reactor. The proposed expansion will result in increased sulphur dioxide emission rates of between 10 and 30 long tons per day.

The average sulphur content of the coke used for fuel in the power plant will be 6.1% and an average consumption of 2260 STPCD of coke burned daily.

As the new boiler addition is gas fired there will be minimal increase in sulphur emissions from the power house stack. Levels of sulphur dioxide and hydrogen sulphide measured at the continuous monitoring stations have consistently met the department guidelines and this will continue.

3. ENVIRONMENTAL (continued)

G.C.O.S. is proceeding with substantial capital investment to meet the Provincial requirements of 0.2 pounds per 1000 pounds of flue gas for particulate emissions.

3.2 WATER

The only increase in hot water flow to the Athabasca River will result from the installation of a once through cooling water system for the new upgrading facilities.

3.3 LAND

The land reclamation plan for the proposed expansion will be essentially the same as the plan currently being followed with some updating to provide for the faster mining rate. A formulated long term reclamation plan for the lease was submitted to the Development and Reclamation Committee on April 14, 1978.

4. FINANCIAL DETAILS

4.1 CAPITAL COSTS

The estimated capital costs for the proposed expansion are broken out as follows.

TABLE 4-1

CAPITAL COSTS - $ X 1000 AS SPENT

O/B & MOBILE EQUIPMENT	$ 9,100
MINE	$ 47,600
PRIMARY & FINAL EXTRACTION	$ 36,900
UPGRADING	$ 69,900
UTILITIES	$ 19,400
OFFSITES/PIPELINE	$ 19,600
TOTAL	$ 202,500

(Similar for both expansions)

4.2 OPERATING COSTS

The estimated operating costs in the Summary Table represent average as spent dollars over the period 1981-1987. These figures exclude product royalties and depreciation.

4. FINANCIAL DETAILS (continued)

TABLE 4-2

OPERATING COSTS - $ x MILLION AS SPENT ANNUALLY

	PRESENT	FUTURE
O/B & MINE	$121	$144.1
EXTRACTION	$ 25	$ 32.8
UPGRADING	$ 43.6	$ 59.3
TOTAL	$189.6	$236.2

4.3 SUMMARY

The following summary table shows the synthetic crude production, average tar sand mined and other pertinent data for the present and expanded facilities.

TABLE 4-3

SUMMARY

	FUTURE NO EXPANSION	FUTURE EXPANSION
TAR SANDS MINED (MMTPA)	37.2	47.9
SYNTHETIC CRUDE (BPCD) (Average 1981-1987)	47.5	62.5-64.0
GAS CONSUMED (MMSCFD)	15	35-40

(continued on next page)

4. FINANCIAL (continued)

TABLE 4-3
(continued)

	NO FUTURE EXPANSION	FUTURE EXPANSION
ELECTRIC POWER PURCHASED (MW)	3.0	5.6
COKE STOCKPILE (ST)1987	2.34MM	3.99MM-2.66MM
SULPHUR STOCKPILE (LT) 1987	1.52MM	1.80MM-1.77MM
WATER TAKEN FROM RIVER (Acres ft/yr)	25,000	30,000
WATER RETURNED TO RIVER (Acres ft/yr) (at 10°C above normal river temperature)	9,200	14,700

APPENDIX A

LIST OF TABLES AND FIGURES

TABLE

FIGURE

APPENDIX B

LICENSES

1. CLEAN AIR LICENSE (and Amendment)

2. CELAN WATER LICENSE (and Amendment)

3. CLEAN WATER LICENSE APPLICATION

4. *CLEAN AIR LICENSE APPLICATION

   *STATUS

   Now being prepared.

   Deadline for D.O.E. July 1, 1978

   Due Date for New License - October 1, 1978

1. CLEAN AIR LICENSE (and Amendment)

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENCE NO. 73-AL-114A(75)

PERMIT NO. .....

FILE NO. 75-SA-014

TO Great Canadian Oil Sands Limited
P.O. Box 450
FORT McMURRAY, Alberta

Pursuant to section 4.1 of The Clean Air Act, a licence to operate or use

the oil sands recovery plant for the production of synthetic crude oil and associated by-products from the Alberta oil sands subsequent to the above company's submission dated December 11, 1974

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton June 12, 1975

AL 379

Director of Standards and Approvals

LICENCE NO.
73-AL-114A(75)

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(1) Department of the Environment Licence No. 73-AL-114 is hereby amended.

(2) Clause 1.4 is amended by striking out the numeral "1.0" and substituting the numeral "1.2".

(3) Clause 1.5 is amended

(a) by striking out the numeral "9,400" and substituting the numeral "16,000" and,

(b) by striking out the numeral "7,500" and substituting the numeral "13,000".

(4) Clause 1.7 is amended by striking out the numeral "6.3" and substituting the numeral "7.0".

(5) Clause 1.8 is amended

(a) by striking out the numeral "4,100" and substituting the numeral "4,700", and

(b) by striking out the numeral "3,300" and substituting the numeral "3,800".

(6) Clause 1.9 is amended by striking out the numeral "550" and substituting the numeral "450".

(7) Clause 1.16 is amended

(a) as to sub-clause (a) by striking out the date "October 31, 1974" and substituting the date "May 31, 1975", and

(b) as to sub-clause (b) by striking out the date "August 31, 1978" and substituting the date "July 31, 1979".

(8) Sub-clause (h) of clause 3.1 is struck out and the following is substituted:

(h) The additional monitoring facilities as detailed in sub-clauses (b), (f) and (g) shall be installed and operational by

i) May 31, 1975 for the hydrocarbon monitor,

ii) June 30, 1976 for the continuous ambient monitors, and

iii) December 31, 1975 for the power plant stack continuous particulate and sulphur dioxide monitors.

LICENCE NO.
73-AL-114A(75)

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(9) Clause 3.4 is struck out.

June 12, 1975

J. DEFIR, DIRECTOR

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENCE NO. 73-AL-114

PERMIT NO. .....

FILE NO. 73-SA-131

TO Great Canadian Oil Sands Limited
P.O. Box 450
FORT McMURRAY, Alberta

Pursuant to section 4.1 of The Clean Air Act, a licence to operate or use

the oil sands recovery plant for the production of synthetic crude oil and associated by-products from the Alberta oil sands

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton October 18, 1973

AL 133

Director of Standards & Approvals

Amended by hand as per cover letter, June 12, 1975.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION ONE: DESIGN AND EMISSION STANDARDS

1.1 Provincial Board of Health Final Air Pollution Approval No. 365-P-508 is hereby cancelled and the terms, conditions and requirements of this licence take precedence.

1.2 The plant referred to herein includes those buildings, structures, operating and storage facilities and land located within the SE 1/4 of Section 24, Township 92, Range 10, West of the 4th Meridian and Bituminous Sands Lease No. 86.

1.3 The plant may be operated up to a maximum processing capacity of 93,000 barrels per stream day of bitumen feed to upgrading.

1.4 The emission of sulphur dioxide to the atmosphere from the sulphur plant incinerator stack shall not exceed 48 long tons per day ~~or 1.0 long ton~~ in any half hour period.

1.5 The concentration of sulphur dioxide in the flue gases being exhausted to the atmosphere from the sulphur plant incinerator stack shall not exceed a one-half hour average level of 9,400 parts per million by volume or a 24 hour average level of 7,500 parts per million by volume.

1.6 The sulphur plant incinerator stack shall be a minimum of 350 feet in height and the minimum flue gas emission temperature shall be 1000 degrees Fahrenheit. Stack sampling facilities including access ladders to sampling platforms, sample ports and 110 volt electrical outlets at the platforms shall be provided.

1.7 The emission of sulphur dioxide to the atmosphere from the power plant stack shall not exceed 300 long tons per day or 6.3 long tons in any half-hour period.

1.8 The concentration of sulphur dioxide in the flue gases being exhausted to the atmosphere from the power plant stack shall not exceed a one-half hour average level of 4,700 parts per million by volume or a 24 hour average level of 3,800 parts per million by volume.

1.9 The power plant stack shall be a minimum of 350 feet in height and the minimum flue gas emission temperature shall be 550 degrees Fahrenheit. Sampling facilities including access ladders to sampling platforms, sample ports and 110 volt electrical outlets at the platforms shall be provided on the breeching from each of the three boilers.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

1.10 The sour gas flare stack shall be a minimum of 250 feet in height and shall be equipped with a continuously burning pilot and an automatic flame ignitor.

1.11 In the event of an emergency necessitating the flaring of sour gas, a sufficient quantity of residue gas shall be added to the sour gas upstream of the flare to maintain

(a) the gross heating value of the combined residue gas and sour gas stream to the flare equal to or greater than 250 BTU's per cubic foot (at 14.65 pounds per square inch absolute and 60 degrees Fahrenheit), and

(b) the cumulative maximum calculated ground level concentration of sulphur dioxide below 0.20 parts per million by volume.

1.12 The hydrocarbon flare stack shall be a minimum of 325 feet in height and shall be equipped with a continuously burning pilot and an automatic flame ignitor.

1.13 The operation of the plant shall be such that the release of sulphur dioxide to the atmosphere does not result in an ambient one hour average concentration exceeding 450 micrograms per cubic metre (approximately 0.17 parts per million by volume) or an ambient one-half hour average concentration exceeding 525 micrograms per cubic metre (approximately 0.20 parts per million by volume) of sulphur dioxide at ground level or at any other point of impingement.

1.14 The operation of the plant shall be such that the release of nitrogen oxides to the atmosphere does not result in an ambient one hour average concentration exceeding 400 micrograms per cubic metre (approximately 0.20 parts per million by volume) expressed as nitrogen dioxide at ground level or at any other point of impingement.

1.15 The emission of particulates to the atmosphere from the power plant stack shall not exceed 0.85 pounds per 1000 pounds of gaseous effluent adjusted to 50 percent excess air for products of combustion.

1.16 With respect to compliance with a particulate emission concentration from the power plant stack not to exceed 0.20 pounds per 1000 pounds of effluent adjusted to 50 percent excess air, the company shall

(a) on or before ~~October 31, 1974~~ May 31/75, submit an initial proposal outlining the particulate control technique to be implemented, and

(b) on or before ~~August 31, 1978~~ July 31/79, design, construct and commence the operation of the particulate control facilities.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

1.17 Prior to the expiry date of this licence, a proposal shall be submitted to the Department detailing the steps which the company plans to implement to comply with a maximum calculated ground level sulphur dioxide concentration of 0.06 parts per million by volume with respect to emissions from the plant under all operating conditions.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION TWO: GENERAL

2.1 The oil sands recovery plant shall be operated in accordance with the company's submissions of May 17, July 3, and August 1, 1973 relating to Application No. 73-SA-191 under The Clean Air Act for an amendment of a licence to permit production to be increased to 23,725,000 barrels of synthetic crude oil per year.

2.2 All materials causing odors are to be confined at the source of potential emission. Spills of odorous material must be cleaned up in a manner satisfactory to the Director of Pollution Control.

2.3 Should strong or offensive odors be detected frequently outside the plant, the Director of Standards and Approvals may require the company to carry out an odor survey, determine the possible sources of the odor and report the findings to the Director for assessment. Such a survey must be initiated by the company and carried out in a manner satisfactory to the Director at the company's own expense.

2.4 Smoke emission from flaring and other process operations must be adequately controlled to meet the requirements outlined in The Clean Air (Maximum Levels) Regulations.

2.5 The operation of the plant shall be such that a minimum of unburned hydrocarbons are released to the atmosphere.

2.6 Any future expansion of the plant or change in the mode of operation must be reported to the Director of Standards and Approvals and will necessitate a review of this licence.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION THREE: MONITORING AND RETURNS

3.1 Monitoring - In a manner satisfactory to the Director of Standards and Approvals

(a) The flue gases in the sulphur plant incinerator stack shall be:

I) Automatically monitored on a continuous basis for sulphur dioxide, volume flow rate and exit temperature.

II) Stack surveyed four times per year and the following determinations made:

- the rate of flow of sulphur dioxide, other sulphur gases, carbon dioxide, nitrogen, oxygen and water vapor;
- the flue gas volume flow rate and temperature.

(b) The flue gases in the power plant stack shall be:

I) Automatically monitored on a continuous basis for sulphur dioxide, particulates, volume flow rate and exit temperature.
Add by Dec 31/75

II) Stack surveyed eight times per year and the following determinations made:

- the rate of flow of sulphur dioxide, oxides of nitrogen, particulates, carbon dioxide, nitrogen, oxygen and water vapor;
- the flue gas volume flow rate and temperature.

(c) A minimum network of forty static exposure cylinder stations for the detection of hydrogen sulphide and total sulphation shall be maintained at suitable locations around the plant.

(d) A minimum network of eight sulphur dustfall stations shall be maintained at suitable locations around the sulphur storage area.

(e) Representative samples of both coke used for firing and particulate matter being exhausted from the power plant stack shall be analyzed for total heavy metals content at approximately three month intervals for a one year period and in subsequent years at a frequency to be determined by the Director.

(f) A five-station ambient air quality monitoring system for the purpose of determining the concentrations of sulphur dioxide and hydrogen sulphide, wind speed and wind direction shall be maintained and operated on a continuous basis.

(g) An ambient air quality monitoring survey for the purpose of determining the concentrations of total hydrocarbons shall be maintained and operated on a continuous basis.

(h) The additional monitoring facilities as detailed in subclauses (a) to (g) shall be installed and operational by August 31, 1974.

3.2 Returns - The monitoring information referred to in clause 3.1 shall be tabulated and summarized in the form of a monthly report and forwarded to the Director of Pollution Control by the end of the month following the month for which the observations were made. The monthly report shall contain any significant information related to the emission of contaminants including the following items:

(a) The daily maximum half hour average and the daily average values for the concentration of sulphur dioxide in the power plant stack and the incinerator stack.

(b) The daily average and the daily minimum values for the flue gas emission temperature for the power plant stack and the incinerator stack.

(c) The daily maximum and the daily average bolometer readings and the corresponding estimated concentration of particulates in the flue gases being exhausted from the power plant stack.

(d) The daily average and the maximum half hour average of the number of long tons of sulphur dioxide emitted to the atmosphere from the power plant stack and the incinerator stack.

(e) The daily amount, in tons, of tar sands processed.

(f) The daily amount, in barrels, of bitumen feed to upgrading.

(g) The daily amount, in tons, of coke produced, the daily amount in tons of coke burned in the power plant and the sulphur content of the coke.

(h) The daily amount, in barrels, of liquid hydrocarbon products.

(i) The daily sulphur production, in tons, and the sulphur recovery efficiencies.

(j) The results of the stack surveys carried out during the month.

(k) The sulphation levels as detected by the exposure cylinder stations.

(l) The ambient sulphur levels as collected by the dustfall stations.

(m) The results of the continuous ambient monitoring surveys for sulphur dioxide, hydrogen sulphide and hydrocarbons.

(n) Remarks relative to the performance of the air pollution control program including an interpretation of significant variations.

3.3 All uncontrolled releases of air contaminants from the plant and any occurrences of non-compliance with any condition of this licence shall be reported immediately to the Director of Pollution Control and confirmed in writing within 72 hours.

3.4 With respect to the contaminant concentration and emission rate requirements outlined in clauses 1.4, 1.5, 1.7, 1.8 and 1.15, the company shall report to the Director of Pollution Control within 24 hours all daily variations greater than 20 percent occurring within the range of 50 percent to 100 percent of the maximum allowable limits.

3.5 A materials balance statement shall be prepared and submitted to the Director of Pollution Control on a monthly basis. This report shall indicate the quantity and character of incoming process chemicals and raw materials to the plant and their disposition as related to air, water or land.

3.6 An annual summary and evaluation report of the performance of the air pollution control facilities and systems, together with the related quality and quantity of air contaminants released to the atmosphere shall be prepared and forwarded to the Director of Pollution Control by February 14 of the year following the year in question. This annual report shall include remarks pertaining to minor extensions and alterations, and photographs or 35 millimeter slides of the air pollution control facilities.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION FOUR: STOP ORDERS AND EXPIRY DATE

4.1 (a) Pursuant to and in accordance with the provisions of The Clean Air Act, the Minister of the Environment may issue a stop order to the company or any person where the provisions of the Act, regulations and orders thereunder, or the conditions of this licence have been contravened, or where the Minister considers any plant, structure or thing to be a source of air pollution representing an immediate danger to human life or property or both.

(b) In a stop order, the Minister may require that the person to whom it is directed

I) cease the contravention specified in the order, and

II) stop any operations or shut down or stop the operation of any plant, equipment, structure or thing either permanently or for a specified period.

4.2 This licence is granted on the basis of current knowledge, technology, and circumstances and, if deemed necessary by the Director of Standards and Approvals, the terms, conditions and requirements may be revised, amended or revoked at any time. In any event, this licence shall expire October 1, 1978.

October 18, 1973

H. L. HOGGE, DIRECTOR

2. CLEAN WATER LICENSE (and Amendment)

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENCE NO. 73-WL-041A

PERMIT NO. ....

FILE NO. 75-SA-358
73-SA-191

TO Great Canadian Oil Sands Limited
P.O. Box 4001
FORT McMURRAY, Alberta
T9H 3E3

Pursuant to section 4.1 of The Clean Water Act, a licence to operate or use

the tar sands recovery plant for the production of synthetic crude oil and associated by-products from the Athabasca tar sands

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton .... June 5, 19 75

WL 377

S. L. Dabbs
For Director of Standards

LICENCE NO.
73-WL-041A

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(1) Water Licence 73-WL-041 is hereby amended.

(2) Clause 1.4 is deleted and the following new clause 1.4 is substituted:

1.4 The company shall with respect to the disposal of tar sands extraction tailings from the extraction plant

(a) direct these tailings only to

(i) Tar Island tailings pond, and

(ii) the worked-out Mine;

(b) submit a report to the Director of Standards and Approvals by January 1, 1976 and by each January 1st thereafter. The report shall contain:

(i) an outline of the tar sands extraction tailings management program for the coming year,

(ii) an identification of proposed new disposal sites or alterations to existing sites,

(iii) description of the alterations or additions referred to in subclause (ii) above as well as resultant revised liquid and solid waste material balances for the overall disposal system,

(iv) a summary review and assessment of the previous year's tailings waste management program,

and any other information as may from time to time be requested in writing by the Director of Standards and Approvals; and

(c) notify the Director of Standards and Approvals in writing 60 days in advance of any subsequent proposed modifications to the yearly program referred to in subclause (b)(i) and forward supporting documentation to allow review prior to any possible implementation.

Date of Issue: June 5, 1975

for J.DEFIR, DIRECTOR

Alberta

ENVIRONMENT

LICENCE TO OPERATE OR USE

LICENCE NO. 73-WL-041

PERMIT NO. .....

FILE NO. 73-SA-191

TO Great Canadian Oil Sands Limited
P.O. Box 450
FORT MCMURRAY, Alberta

Pursuant to section 4.1 of The Clean Water Act, a licence to operate or use

the tar sands recovery plant for the production of synthetic crude oil and associated by-products from the Athabasca tar sands

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton, May 31, 19 73

WL 069

Director of Standards and Approvals

LICENCE NO.

73-WL-041

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION ONE: GENERAL

1.1 The plant referred to herein includes those buildings, structures, operating and storage facilities and land located in S.E. 1/4 of Section 24, Township 92, Range 10, West of the 4th Meridian and bituminous sands lease 86.

1.2 The "reference bitumen charge rate" is defined as the projected maximum design amount of bitumen feed stock in barrels per stream day that can be charged to the delayed coking unit.

1.3 The plant may be operated up to a process rate of ten percent over the reference bitumen charge rate of 93,000 barrels per stream day of bitumen feed.

1.4 Tar sands extraction waste water from the extraction plant shall be directed only to the existing tailings pond.

1.5 Waste water originating from surface run-off and precipitation from the plant process area and from the working area of the mine pit shall be adequately controlled for the purposes of precipitating settleable solids and recovery of floatable and emulsified liquid hydrocarbons.

1.6 The disposal of any heterogeneous solid waste material shall be conducted in a manner that minimizes potential ground water contamination.

1.7 The company shall at all times conduct and control their operations in such a manner as not to create a hazard to the public and shall take all reasonable precautions to protect and safeguard the lives and property of the public and adjacent property owners.

1.8 The tar sands recovery plant shall be operated in accordance with the company's submission of April 9, 1973, relating to application under The Clean Water Act for a licence to operate facilities to permit production to be increased to 23,725,000 barrels of synthetic crude oil per year.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION TWO: DESIGN AND EMISSION STANDARDS

2.1 Sanitary sewage contained in the sewage lagoons shall be retained for a minimum period of 12 months. The controlled release of effluent from the sanitary lagoons to the surrounding watershed area shall be permitted during the period of spring run-off. However, the company shall notify the Director of the Division of Pollution Control in writing at least three weeks prior to the expected commencement of discharge and shall provide information relating to section 3.2 (f).

2.2 (a) For the purposes of the concentration standards specified in Column 3 in sections 2.3 and 2.4, the nominal average design flow rate of liquid effluent released from the waste water storage pond to the Athabasca River is considered to be 7.5 million Canadian gallons per day and equivalent to 56 Canadian gallons per minute per one thousand barrels of bitumen feed based on the reference bitumen charge rate. Since the nominal average flow rate represents statistical data which reflects the 1972 operating performance of the waste water management program, variance of the concentration standards may be permitted to allow for future re-routing of contaminated streams to the tailings pond and re-cycling of clean streams for re-use as cooling or process water.

(b) The extent of variance from the concentration standards shall be based upon the application of a numerical factor to the levels specified in Column 3 and as determined in sub-sections (c) and (d).

(c) Should the actual flow rate of liquid effluent be less than the nominal average design flow rate specified in sub-section (a) and occurs as a direct result of process adjustments or modifications to the operation of the waste water management system relating to recycling of waste waters, then the standards will be multiplied by a numerical factor greater than one to obtain the effective concentration standard that prevails. The numerical factor shall be equal to the number obtained by dividing the nominal average flow rate by the actual flow rate occurring over one 24-hour period.

(d) Should the actual flow rate of liquid effluent be more than the nominal average design flow rate specified in sub-section (a) and occurs as a direct result of process adjustments or the necessity to release treated storm water or spring run-off water from the extraction and process area of the plant, then the concentration standards will be multiplied by a numerical factor less than one to obtain the effective concentration standard that prevails. The numerical factor shall be equal to the number obtained by dividing the nominal average flow rate by the actual flow rate occurring over one 24-hour period.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(e) The method of determination of the extent of permissible variance described in sub-sections (c) and (d) may be revised or replaced upon written notification from the Director of Standards and Approvals to the company should the Director of the Division of Standards and Approvals deem it necessary.

2.3 Effective July 1, 1975, the emission rates of release and concentration of water contaminants contained in treated liquid effluent which is discharged from the waste water storage pond to the Athabasca River shall be controlled so that the following absolute levels of water contaminants are not exceeded:

Water Contaminant or Constituent	Emission Rate (lbs/MBCD)		Concentration (mg/l)
	Column 1	Column 2	Column 3
Chemical Oxygen Demand	150	100	150
Biochemical Oxygen Demand	50	35	50
Total Suspended Solids	25 (100)	10 (25)	25 (100)
Total Sulfides	0.3	0.2	0.3
Ammonia Nitrogen	10	5	10
Oil and Grease	15	10	15
Phenolics	0.3	0.2	0.3
Threshold Odor Number	1000 units	200 units	1000 units
pH	6.5 - 9.5	6.5 - 9.5	6.5 - 9.5

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

2.4 Effective July 1, 1975, the emission rates of release and concentration of water contaminants contained in treated liquid effluent which is discharged from the waste water storage pond to the Athabasca River shall be controlled so that the following absolute levels of water contaminants are not exceeded:

Water Contaminant or Constituent	Emission Rate (lbs/MBCD)	Concentration (mg/l)	
	Column 1	Column 2	Column 3
Chemical Oxygen Demand	150	100	150
Biochemical Oxygen Demand	50	35	50
Total Suspended Solids	25 (35)	10 (20)	25 (35)
Total Sulfides	0.3	0.2	0.3
Ammonia Nitrogen	10	5	10
Oil and Grease	10	5	10
Phenolics	0.3	0.2	0.3
Threshold Odor Number	500 units	300 units	500 units
pH	6.5 - 9.5	6.5 - 9.5	6.5 - 9.5

2.5 For the purposes of sections 2.3 and 2.4, explanatory notes are as follows:

Notes 1. (lbs/MBCD) - pounds of water contaminant per one thousand barrels of bitumen feed per calendar day based on the reference bitumen charge rate.

2. (mg/l) - milligrams of water contaminants per liter of liquid effluent discharged from the waste water storage pond to the Athabasca River.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

3. Column 1 - emission standards not to be exceeded based on any one 24-hour composite sample and the reference bitumen charge rate.

4. Column 2 - statistical emission design levels based on the monthly average of daily 24-hour composite samples and the reference bitumen charge rate.

5. Column 3 - concentration standards not to be exceeded on any one 24-hour composite sample and subject to variance as permitted under section 2.2.

6. Those values in parentheses shall be prescribed limitations for total suspended solids in Column 1, 2, and 3 during the period of March 1 to September 30 in each year.

7. The emission standards prescribed for suspended solids in Column 1 and Column 3 for the winter period (October 1 to February 28) may only be exceeded by that incremental amount of suspended solids contained in the raw water intake supply that is obtained from the Athabasca River.

2.5 Should the company undertake proposals to increase the throughput of the existing bitumen upgrading facilities by the construction, installation and operation of additional units which will subsequently result in the bitumen feed rate being increased by more than ten percent over the reference bitumen charge rate, the emission rates of release of water contaminants (with the exception of pH) that are associated with the expansion and contained in the treated liquid effluent that is discharged to the Athabasca River shall be controlled so that fifty percent of the absolute levels specified in Column 1 and Column 2 of section 2.4 are not exceeded.

2.7 Ambient levels of suspended matter contained in the Athabasca River raw water supply which is used for the operation of the plant may be directly returned from the pre-treatment facilities to the river during the period of March 1 to September 30.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION THREE: MONITORING AND RETURNS

3.1 Compliance with the numerical standards of water contaminants shall be determined on the basis of a 24-hour composite sample of liquid effluent as follows:

(a) A composite sample consisting of not less than twelve portions proportioned in volume according to the flow rate shall be collected at equal time intervals over a 24-hour period.

(b) The emission rates, values and concentrations shall be based on the analytical results of the composite sample and determined from the flow volume for that 24-hour period during which the composite sample was collected.

(c) In accordance with section 2.2, no water contaminant as determined by an analysis of a representative grab sample collected at any time shall exceed 1.5 times the numerical effective standard of concentration prescribed in this licence. The range of pH limitation is not subject to variance and must be met at all times.

(d) Analysis of the composite sample shall be conducted:

I) In the manner described in the publication "Standard Methods for the Examination of Water and Wastewater", 13th Edition (1971) or the most recent edition, published jointly by the American Public Health Association, American Water Works Association and the Water Pollution Control Federation; or

II) By any other equivalent method, approved in writing by the Director of the Division of Standards and Approvals, the results of which can be confirmed by the methods referred to in sub-section (i) above.

3.2 In a manner satisfactory to the Director of the Division of Standards and Approvals and effective July 1, 1973:

(a) The effluent discharged from the waste water storage pond to the Athabasca River shall be:

I) Monitored for volume flow rate in terms of Canadian gallons per day.

II) Subject to analyses of a 24-hour composite sample and analyzed for water contaminants according to the following schedule:

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

Daily - pH, total suspended solids, phenolics, threshold odor number, ammonia nitrogen, chemical oxygen demand, and oil and grease.

Weekly - total sulfides, biochemical oxygen demand, total organic carbon.

Monthly - total heavy metals including arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, tin, zinc.

(iii) Subject to a monthly fish toxicity bioassay procedure in the manner described in the publication "Standard Methods for the Examination of Water and Wastewater". A 24-hour composite sample of one hundred percent liquid effluent shall be subjected to a 96-hour continuous bioassay. Dilution of the liquid effluent bioassay sample prior to testing with water used for holding fish stocks may be permitted only if the actual rate of discharge of liquid effluent during the period when the bioassay sample was taken is less than the nominal average design flow rate specified in section 2.2. and provided that the volume of diluant plus the bioassay sample does not exceed the equivalent of the nominal average design flow rate. The liquid effluent shall be designated as acutely toxic if the mortality of fish exposed to the test solution is greater than 20 percent. Should the bioassay test show toxicity, the test shall be repeated. If the toxicity is confirmed, the company shall initiate studies to determine the toxic components and take appropriate measures to eliminate the toxic material from the liquid effluent which is discharged to the Athabasca River.

(iv) For the purposes of sub-section (i) and (ii), if the quality of the liquid effluent discharged to the Athabasca River has been demonstrated to continuously meet the requirements of sections 2.3 and 2.4 a simplified schedule of sampling, testing, recording and reporting may be adopted, provided that the revised schedule is approved in writing by the Director of Standards and Approvals.

(b) Four representative grab samples of waste water from the geometric center of the tailings pond shall be collected at four sampling points ranging from the pond surface to the bottom. The samples shall be collected and analyzed for the same water contaminants specified in sub-section 3.2 (a) (ii) during the month of April and September of each year.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(c) The concentration of ambient levels of oil and grease and total suspended solids contained in the Athabasca River which is used as a raw water supply for the operation of the plant shall be monitored daily. A 24-hour composite sample shall be collected and the analytical data shall be summarized and related to the absolute levels of actual emissions of oil and grease and total suspended solids which are contained in the liquid effluent released to the Athabasca River. The extent of pre-treatment of raw river water during the period of high natural river turbidity (March 1 to September 30) with respect to removal of ambient levels of suspended solids and oil and grease in river water shall be noted.

(d) The daily recycle rates and solids content composition of tailings pond water that is returned to the extraction plant shall be monitored.

(e) The company shall:

I) review the nature of seepage entering the Athabasca River from the tailings pond;

II) review the potential for occurrences of seepage from that area of the mining pit which shall be utilized for tailings disposal; and

III) submit a report relating to the matters specified in sub-sections (I) and (II) to the Director of Standards and Approvals by April 1, 1974.

(f) A representative grab sample of treated sanitary wastes contained in any sewage lagoon prior to release to the surrounding watershed area shall be analyzed for phenolics, total residue, total suspended solids, oil and grease, chemical oxygen demand, ammonia nitrogen, total phosphates, threshold odor number, total sulfides, and pH. The volume of liquid effluent released from any sewage lagoon shall be monitored in terms of Canadian gallons per day.

(g) The crude bitumen feed stock that is charged to the upgrading plant shall be analyzed for heavy metals (total) on a monthly basis.

(h) The temperature of the effluent discharged from the waste water storage pond to the Athabasca River shall be monitored on a daily basis in terms of degrees Fahrenheit.

3.3 All uncontrolled releases of water contaminants from the plant, accidental spills of water contaminants to the adjacent watershed area and significant occurrences of non-compliance with any condition of this licence shall be reported to the Director of the Division of Pollution Control within 24 hours of discovery. The company shall initiate contingency procedures to prohibit water pollution or any other environmental hazard as soon as is practically possible.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

3.4 The company shall report or confirm to the Director of Pollution Control any awareness of the occurrence of non-compliance with any condition of this licence in writing within 72 hours of their becoming aware of such contravention.

3.5 A monthly report shall be submitted within twenty days of the end of the month for which the observations were made to the Director of Pollution Control and shall contain information related to the following, effective August 20, 1973:

(a) the results of the analytical determinations, volume flow rates, and monitoring information specified in paragraphs 3.1 and 3.2;

(b) the daily production of synthetic crude oil in terms of barrels per calendar day as well as associated by-products in appropriate units of production;

(c) the daily rate of bitumen feed stock charged to the coking unit of the upgrading section of the plant in terms of barrels per calendar day and the highest average daily rate of bitumen feed stock charged to the coking unit based on five consecutive stream days;

(d) the daily rate of discharge of waste waters from the extraction plant to the tailings pond in terms of Canadian gallons per day;

(e) the daily recycle rate of tailings pond water returned to the extraction plant in terms of Canadian gallons per day;

(f) the daily average solids content composition of the recycle water returned from the tailings pond to the extraction plant and the general quality of the waste water in the tailings pond;

(g) the daily rate of feed of tar sands charged to the extraction plant in terms of tons per day;

(h) remarks relative to the local intensity and duration of precipitation;

(i) remarks relative to the compliance of the waste water management and control program;

(j) the quantity of waste water contained in any waste water treatment pond including any sewage lagoons, retention ponds, or tailings pond during the first day of each month and expressed in terms of Canadian gallons and in terms of the percentage capacity occupied to the total volume of each respective pond;

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

(k) a materials balance statement which shall indicate the quantity and character of incoming raw materials, chemical additives, process and water treatment chemicals to the plant and their disposition as related to air, water, or land.

3.6 An annual summary and evaluation report of the performance of all waste water treatment facilities and control systems shall be prepared and forwarded to the Director of Pollution Control by February 14, 1974. The annual report shall include remarks on extensions and alterations, and photographs, or 35 mm. slides of all waste water treatment facilities. Thereafter, an annual report shall be submitted by February 14 of each subsequent year.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

SECTION FOUR: EXPIRY DATE OF LICENCE

4.1 Notwithstanding the terms and conditions of this licence, the company shall comply with any other requirements by ordinance relative to all waste water treatment facilities.

4.2 The monitoring requirements prescribed under Clauses 3, 4, 5, 6, 7, and 8 of Provincial Board of Health Approval No. 40-S-1967 shall remain in effect until June 30, 1973. The emission standards prescribed under Clauses 1 and 2 of Provincial Board of Health Approval No. 40-S-1967 shall remain in effect until July 1, 1975. Thereafter, Provincial Board of Health Approval No. 40-S-1967 is rescinded.

4.3 Pursuant to and in accordance with the provisions of The Clean Water Act, no person shall alter, add to or in any other manner change a plant, structure or thing that is the subject of a permit or licence unless a permit to alter, add to or otherwise change the plant, structure or thing is issued by the Director of Standards and Approvals.

4.4 Pursuant to and in accordance with the provisions of The Clean Water Act, the Minister of the Environment may issue a stop order to the company or any person where the provisions of the Act, regulations and orders thereunder or the conditions of this licence have been contravened, or where the Minister considers any structure or thing to be a source of water pollution representing an immediate danger to human life or property or both.

In a stop order, the Minister may require that the person to whom it is directed:

I) cease the contravention specified in the order, and

II) stop any operations or shut down or stop the operation of any plant, structure, equipment or thing either permanently or for a specified period.

4.5 The requirements specified in this licence shall be effective the date of this licence or as otherwise noted in the relevant sections relating to emission standards, reporting of monitoring information, and general plant operation or such other dates as approved in writing by the Director of Standards and Approvals.

TERMS, CONDITIONS AND REQUIREMENTS ATTACHED TO LICENCE

4.6 This licence is granted on the basis of current knowledge, technology, circumstances and the conditions and requirements or any of them may be revised, amended or revoked if deemed necessary by the Director of Standards and Approvals. In any event, this licence shall expire on or before June 1, 1978.

Date: May 31, 1973

H. L. HOGGE, DIRECTOR

3. CLEAN WATER LICENSE APPLICATION

THE CLEAN WATER ACT, 1972

APPLICATION FOR A PERMIT OR LICENCE

Application No.	
Date Received	
Reviewed by	
Approval No.	
Date Approved	

For Office Use Only

Section One: General Information

1.0 Date of Application: May 30/78

1.1 Name of Applicant: Great Canadian Oil Sands Limited
(Company or Corporation)

(Owner or Agent)

1.2 Name of Plant or Facility: Fort McMurray

1.3 Address of Applicant:

a) Box 4001, FORT MCMURRAY, Alberta T9H 3E3
Street, Avenue, Road, R.R., Box etc. City, Town, Village Postal Code

1.4 Telephone Number: 743 - 6411

1.5 Location of Facility:

a) _____
Street, Avenue, Road, R.R., Box etc. City, Town, Village Postal Code

or b) ___ 1/4, SE 1/4, Sec. 24, Twp. 92, Rge. 10, W4 Meridian.

1.6 Application For:

(1) A Permit [ ] (2) Permit Amendment [ ]

(3) A license [X] (4) License Ammendment [ ]

1.7 Summary of Project Mining of oil sands, extraction of bitumen and upgrading to synthetic crude oil. Production of steam and power from coke burning powerhouse.

1.8.0 Duration of the Project: AD 2000

Construction Commencement Date: 1964

Construction Completion Date: Complete 1967

1.8.1 Project Costs

	Capital Cost Construction & Equipment ($)	Annual Operating Cost ($)
Water Pollution Abatement Equipment	$5,500,000 (estimated)	2,823,000*
Air Pollution Abatement Equipment	$12,000,000 (estimated)	2,682,000*
Expansion Water Air	$4,000,000 $28,000,000	
TOTAL	$49,500,000	$5,505,000

* From W.L. Cary to W.L. Oliver, April 25/77 re: 1976 Environmental Expenditures.

1.9.0 Previous approvals issued for the applied project:

.1 Department of the Environment, Water Approval No. _____

.2 Department of the Environment, Water Permit No. _____

.3 Department of the Environment, Water License No. 73-WL-041A

.4 Provincial Board of Health, Final Water Pollution Approval No. _____

.5 Other approvals E.R.C.B. Approval 1944A

SECTION TWO: DESIGN AND EMISSION INFORMATION

2.1.0 Scale designs of the plans and the surrounding area is submitted as follows:

2.1.1 Topography of the area - See Appendix No. 1

2.1.2 Property boundaries - See Appendix No. 1

Land use of the area is wildlife habitat. The projected land use of the reclaimed plant and mine area is wildlife habitat.

2.1.3 Location and types of buildings - See Appendix No. 2

2.1.4 Location and name of all equipment used in manufacturing, processing or storage and other units - See Appendix No. 3.

2.1.5 Location and name of all equipment used in control, treatment and disposal of waste water - See Appendix No. 2.

2.1.6 Location of all sewer lines - See Appendices No. 10

2.1.7 Location of all discharge points - See Appendix No. 2.
- See 1973 License Application

2.1.8 Location of the plantsite - See Appendix No. 1

Legal description - SE ¼ Sec. 24 TWP 92 Rge 10 W4

2.2.0 Flow diagram of the operations involved - See 1973 License Application.

Flow diagram of waste water treatment facilities - See Appendix No. 4

Narrative description of operations involved - See 1973 License Application.

Narrative description of waste water treatment facilities - See Appendix No. 5

2.2.1 Water contaminants - concentrations and emission rates - See Section 2.7.0

2.2.2 Water contaminants - chemical composition - See Section 2.7.0

2.2.3 Disposal of solid waste - See Appendix No. 7

2.2.4 Identification of toxic materials, compounds producing taste, odor and colored materials - See Section 2.7.0

2.2.5 Size and capacity of equipment - See 1973 License Application.

2.3.0 List the unit products resulting from the processing operations.

Products	Units of Products per Ave. Operating Day
Naphtha	14,707 BPCD
Kerosene	12,500 BPCD
Gas Oil	38,192 BPCD
Coke	3,500 STPCD
Sulphur	388 LTPCD

2.4.0 List the raw materials required for the manufacturing process or operation.

Type of Raw Materials	Average Quantity per Day (tons/day)
Tar Sand	138,000 STPCD
Bitumen	83,300 BPCD
Natural Gas	19.05 MMSCFD

2.5.0 List the chemicals required for production, the manufacturing process or operation.

Type of Chemicals	Average Quantity per Day (tons/day)(gallons/day)
Caustic	5.29 STCD
Alchem D197 Demulsifier	134 IGCD
Catacarb Inhibitor	0.07 STCD
Silicone	0.10 STCD
Potassium Carbonate	0.14 STCD
Corrosion Inhibitor (EST-800)	0.01 STCD
Sodium Nitrite	0.07 STCD
DEA	1.00 STCD
Methanol	0.06 STCD
Petromeen	0.04 STCD
Soda Ash	0.03 STCD
Disodium Phosphate	0.07 STCD
Sodium Chloride	6.42 STCD
Lime	4.00 STCD
Alum	0.77 STCD
Filming Amine	0.38 STCD
Sodium Sulphite	0.22 STCD
Chlorine	0.01 STCD
Alpha Floc	0.04 STCD

NOTE: Material Balance in regard to Sections 2.3.0, 2.4.0 and 2.5.0 - See 1973 License Application

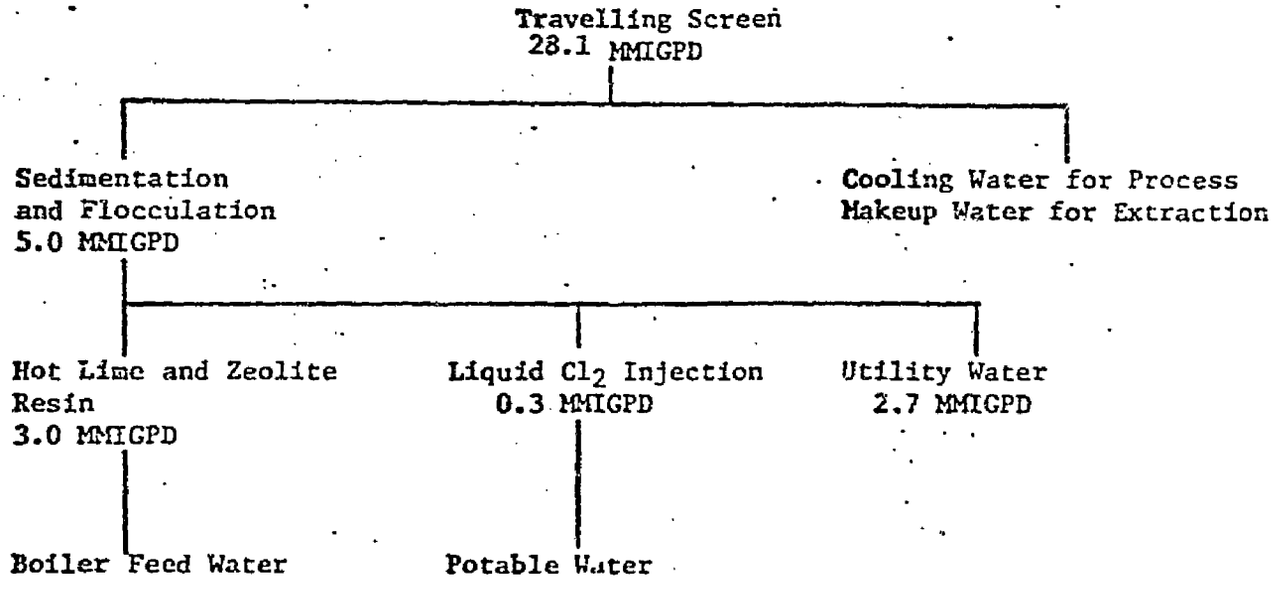
2.6.0 Water Supply: List the source of water supply, it's purpose and quantities.

Type of Operation	Source of Water	Total Consumption (Gal/day)	Amount Consumed into Products (Gal/day)	Amount Discharged (Gal/day)
Process and cooling	Athabasca R.	28.1 MM	8.1 MM	20.0 MM

Water Flow Balance - See Appendix No. 6

2.6.1 Water Treatment Before Consumed

All intake water passes through the fresh water pond where initial settling of river mud takes place. Following this, treatment is approximately as shown below.



2.7.0 Waste Effluents: Identification of Water contaminants

Process Waste Water

Water Contaminant	Concentration (mg/l)	Emission Rate		Continuous Discharge or Intermittent	Frequency (if intermittent)
		lbs/day	lbs/unit production*		
COD	150	13,950	150	Continuous	
BOD	50	4,650	50	Continuous	
TSS	25	2,325	25	Continuous	
	(35)	(3,255)	(35)	Continuous	
Total Sulphides	0.3	27.9	0.3	Continuous	
NH_3 Nitrogen	10	930	10	Continuous	
Oil & Grease	10	930	10	Continuous	
Phenolics	0.3	27.9	0.3	Continuous	
TON	500 Units		500 Units	Continuous	
pH	6.5-9.5		6.5-9.5	Continuous	
Cadmium	10 ppb	1	0.01	Continuous	
Chromium	15 "	1.5	0.02	Continuous	
Cobalt	20 "	2.0	0.02	Continuous	
Copper	500 "	50	0.54	Continuous	
Lead	40 "	4.0	0.04	Continuous	
Manganese	90 "	9.0	0.09	Continuous	
Nickel	50 "	5.0	0.05	Continuous	
Tin	50 "	5.0	0.05	Continuous	
Zinc	80 "	8.0	0.08	Continuous	
Selenium	120 "	12.0	0.13	Continuous	
Mercury	0.2 "	0.2	0.0002	Continuous	
Arsenic	Nil	Nil	Nil	Continuous	
Vanadium	1000 "	100	1.0	Continuous	

* lbs/MBCD bitumen feed to plant

Muskeg Drainage
(See Section 3.1)

Not sampled or measured

Mine Drainage
(See Section 3.1)

COD	20-160	Flow rates are extremely variable and are not measured. Flow depends on rainfall intensity and duration plus pumping capacities. No flow during winter months. Analyses shown are 1976 and 1977 ranges on monthly samples taken during summer months.
TSS	Nil-700	
Total Sulphides	Nil	
NH_3 Nitrogen	Nil	
Oil & Grease	Nil-6.9	
Phenolics	Nil-1.8	
pH	7.18-8.64	

Auxiliary Area Drainage
(See Section 3.1) Same comments as per Mine Drainage

Water Contaminant	Concentration (mg/l)
COD	30-740
TSS	2-1438
Total Sulphides	Nil
NH_3 Nitrogen	Nil
Oil & Grease	2.1-40.0
Phenolics	Nil-3.5
pH	7.78-9.10

2.7.1 Process Waste Water - the process waste waters from the upgrading plant and the Utilities plant are handled in conjunction with the cooling water from the upgrading plant and discharged through the outfall from the waste water pond (see Appendix No. 4). The analyses of the combined streams is given in Section 2.7.0 and the flows are given in Section 2.7.2.

2.7.2 Cooling Water

System	Flow Rate MMIGPD	Water Temperature Intake	Discharge	
Once-through	28.1	22	27	Summer
		1	5	Winter

No conditioning agents are added to the cooling water.

2.7.3 Water Treating Waste Water:

(a) Filter Backwash [x]

(b) Boiler Blowdown [x]

(c) Ion Exchange Resin Regineration [x]

(d) Removal of sludge, deposition, corrosive materials [x]

(e) Other, please give details: [x]
Clarifier Blowdown.

(f) Volume of water required for the above-stated operation
2.2 MMIGPD gal/day (m^3/d in metric system)

(g) Source of water Athabasca River

(h) Method of disposal Waste Water Pond

2.7.4 Sanitary Sewage Effluent

(a) Number of personnel: 1,600

(b) Volume of water discharged: 45,000 gals/day (estimated)

(c) Method of Disposal of sanitary sewage

Anaerobic decomposition followed by aerobic decomposition in five lagoons. Winter sewage is accumulated and after treatment, is discharged to river during the summer following permission from Alberta Environment.

2.8.0 Surface Drainage

A diagram for surface water drainage system from the plant area is required plus the following information: See Appendix No. 9.

2.8.1 Storm run-off can be estimated by the Rational Formula:

Q = ClA, where

Q is the flow in cfs (m^3/s)

C is the run-off coefficient (see attached sheet)

1 is the rainfall intensity in inches/hour (m/hr.)

A is the contributing area in acres (m^2)

2.8.2 The process and mine area (A) 2000 acres (m^2)

2.8.3 The run-off volume from a 3-inch rainfall (per day)(or 0.1 m rain/day)

(A 1) 135 MM Imperial Gallons (m^3)= 250 cfs

2.8.4 Estimate the run-off coefficient (C) 0.65

2.8.5 Calculate the maximum storm run-off (Q) 163 cfs (m^3/s)

2.8.6 Spring Run-off

(a) Average snowfall in the locality 140 cm per year (1961 - 71 Average)

(b) Average number of centimeters of snow on the ground on March 22
130 cm (Average of 1975, 76, and 77.)

(c) Is there any possibility of spilling any raw materials and/or any final products which may cause pollution?

Yes [x] No [ ]

If yes, what are the raw materials and/or final products?

Hydrocarbons ranging from bitumen to naphtha.

(d) Frequency of spilling Rare

(e) Is there any pollution control if the above-stated spill may occur?

Yes [x] No [ ]

If yes, how? All discharge streams to the river pass through sedimentation basins with decant overflows so that oil is contained. (See Section 3.1) The process waste waters, where the possibility of spills is the greatest, has a comprehensive series of containment basins as shown in Appendix No. 4. Continuous monitoring of this system (See Section 3.2) plus the ability to close off discharge to the river ensures that final control can be implemented using standard oil spill techniques.

(f) When does the spring run-off occur?

From April 1 to April 15.

(g) If the pollutants are carried away by spring run-off, is it collected and treated before discharge?

Yes [x] No [ ]

If yes, how? Ditches lead to waste water pond where sedimentation and skimming take place.

2.9.0 Waste Water Treatment Facilities - See Appendix No. 5

2.9.6 Solid Waste Disposal

1. Slag and ash collected from the flue gas of the powerhouse boilers is discharged to the ash pond using a hydraulic system. The ash is accumulated in the pond. The water overflows to the waste water pond. In 1977 part of the accumulated ash was pumped to the tailings pond to provide more space in the ash pond.

2. Spent catalyst - See Appendix No. 7

3. Refuse - At present being dumped into a modified land fill site on the South side of pond 1A. Plans are to start a new site on Waste Dump No. 8 at the North East corner of the lease. An application for a permit has been submitted to the Provincial Board of Health.

2.9.7 Water Uptake and Discharge Points - See 1973 License Application

Structure of the Outfall - See 1973 License Application

SECTION THREE: STATEMENTS

3.1 Describe the different processes or operations that may cause different rates of contamination. Describe and show how they will be different.

Possible contamination of the water environment can only occur from four sources in the G.C.O.S. Operation. All other sources are recycled or contained in the tailings pond. The four sources are:

(a) Muskeg Drainage,

(b) Overburden and Mine Drainage,

(c) Upgrading Plant Waste Water and

(d) Auxiliary Area Drainage.

(a) Muskeg Drainage - After tree removal, the muskeg is partially drained by cutting trenches during Winter so that water seeps out during summer. Over approximately two years the water is drained off to a ditch in the North section of the lease. A collection ditch leads the water through a sedimentation basin with a decant overflow so that any sediment and oil is contained before depositing to the river.

(b) Overburden and Mine Drainage - The water collected from rainfall on Overburden and Mine Areas is collected in sumps in low areas and then pumped to ditches and handled in the same manner used for muskeg drainage. The sedimentation basin is cleaned out periodically of solids and oil accumulation as required.

(c) Upgrading Plant Waste Water

See Appendix No. 2
See Appendix No. 4
See Appendix No. 5

(d) Auxiliary Area Drainage

The Top Shop Maintenance area, the trailer housing area and the conveyor areas close to the plant are drained to a ditch which skirts the North boundary of the plant area. The water is passed through a sedimentation basin with a decant overflow for oil removal before passing to the river.

3.2 Describe the potential for accidents and emergencies and the contingency procedures to minimize the potential damage.

The potential for accidents and emergencies in the muskeg drainage and Overburden/Mine drainage systems is negligible. Small amounts of oil will be collected by the decant overflow. There is no potential for large oil spills in these areas. No chemicals are used in these areas.

3.2 continued....

The potential for accidents and emergencies leading to oil and chemical entry into the upgrading plant waste water system is present but is relatively low. Numerous measures are taken to minimize the potential for emergencies and reduce the impact if an emergency occurs. Among these are:

(a) Alarms for critical operating conditions such as level, temperature, pressure etc. on pressure equipment.

(b) Dykes around each storage tank capable of holding the entire contents of the tank in accordance with API specifications.

(c) The gate at the outfall can be closed to allow conditions in this large pond to normalize.

(d) The retention pond and flare ponds are routinely monitored and sampled seven days per week so that any abnormal contamination entering the waste water pond can be detected early.

(e) The API's and retention pond systems are treated as operating equipment and receive the same attention.

3.3 Proposed method and frequency for monitoring waste water, volume flow rates, and concentrations of water contaminants.

The current method for monitoring the waste water is by a Pro-Tech 24 hour composite sampler that takes a sample every five minutes. The flow is split proportionately, the smallest portion going into a 1 qt. bottle with $CuSO_4$ to preserve the phenols, and the larger portion going into a 2 gallon plastic container. Phenols are run on the 1 qt. sample and total analysis on the 1 gallon sample, once every 24 hours. Flow is taken by means of a 24 hour flow recorder operating on an overflow weir.

3.4 A statement assessing the impact of the operation or manufacturing process on the surrounding environment. This statement should not be limited. It should be drawn up in such a manner as to indicate to the Department the company's awareness of it's interaction with the ecosystem and indicate all the measures that have or will be taken to minimize this interaction.

G.C.O.S. policy for Protection and Conservation of Air, Water, and Land Resources requires the company to comply with all environmental conservation laws and regulations and to adopt reasonable measures for the protection and conservation of these resources. This policy has been implemented and will continue to be implemented every day by G.C.O.S. personnel using equipment and procedures designed to control or to minimize air, water or other emissions.

In addition to the direct involvement in every day environmental conservation activities by operating personnel there is substantial support staff devoted in whole or in part to environmental conservation.

3.4 continued.....

These include the following:

(a) A six man Environmental Control group devoted full time to monitoring and reporting of G.C.O.S. environmental impact on air and water resources.

(b) A five man Environmental Affairs Department reporting directly to the Vice-President, Corporate Affairs. The Department includes Land, Water and Air Sections. The major function of the Department is to identify, assess, monitor and communicate environmental concerns to G.C.O.S. personnel and management.

(c) A substantial committment of Engineering Department manpower on environmental capital projects. In particular, the Process Engineering section which is also responsible for research commits a major portion of it's time to environmental problems.

G.C.O.S. awareness of it's impact on the environment has resulted in numerous programs and projects during the last license period which had as their aim better measurement of or improvement of environmental impact. Those which refer specifically to water are:

(a) Reduction of oil-free water load on the API retention pond system in 1975. This resulted in a noticeable improvement in performance of this system.

(b) An improved waste water control procedure initiated in 1977. These internal procedures provided for improved analyses, communication, and action in water management.

(c) Collection of dyke filter drainage from the Tar Island Dyke in 1977 and return of this flow to the tailings pond.

(d) Temporary containment of sulphur pile drainage in 1977 and disposal to the waste water where its impact can be measured. Long term disposal is being addressed.

(e) Revision to collection of coker warm-up condensate and removal of oil before disposition to the API-retention pond system is being examined.

(f) Possible collection of high oil bearing streams from pump seals etc., and disposition to the front end of the process is being examined.

(g) A consultant has been retained to examine the G.C.O.S. water management system and to recommend the changes needed to meet further requirements. A report is expected in 1978.

3.4 continued.....

G.C.O.S. awareness of it's impact on the environment has also resulted in large committments to environmental research. The water research projects include:

(a) A survey study done by Chemical and Geological Laboratories Ltd. in 1976 which included a benthic study of the area downstream of the waste water outfall. The results as shown in Appendix No. 8 indicate no evidence of change in the benthic community due to the discharge of waste water.

(b) Basic research on the tailings pond "sludge" problem by McGill University. This work and associated studies cost G.C.O.S. in the range of $500,000 per year.

(c) Bacteriological studies by Dr. Costerton of the University of Calgary on the tailings pond water with the objective of developing means of cleaning up this water prior to final abandonment of the lease. Dr. Costerton's work also includes waste water, dyke drainage water and sour water biological treatment.

G.C.O.S. has also provided assistance to the Alberta Oil Sands Environmental Research Program (AOSERP) in it's aquatic and hydrology based research by providing information, samples etc. The results of this research to date have indicated that G.C.O.S. has had no impact on the water environment in it's ten years of operations.

(1) The AOSERP report "Survey of Baseline Levels of Contaminants in the Aquatic Biota of the AOSERP Study Area" by Dr. A. Lutz and M. Hendzel, June, 1977 concludes that the baseline levels of heavy metals in the AOSERP area are similar to the levels in other unpolluted areas.

(2) The draft AOSERP report "Heavy Metals Dynamics in the Athabasca River: Sedimentation Concentrations Prior to Major Alberta Oil Sands Development" by R. T. Allan and T.A. Jackson, September, 1977 concludes that there is no evidence of cultural contamination of drainage sediments by heavy metals.

Research done by Syncrude Canada Limited on the Athabasca River has also corroborated the AOSERP studies. In their Monograph 1977-2 "Baseline Studies of Aquatic Environments in the Athabasca River near Lease 17" the researchers found that:

(a) Total Carbon in the river rose sharply in the west side of the river just downstream of the G.C.O.S. pumphouse but it was just a local concentration and did not persist downtstream.

(b) The periphyton (attached Algae) community in the river is a function of river discharge, velocity and related parameters rather than any presently occuring industrial activity.

3.4 continued....

(c) The diversity of the benthic macroinvertebrate communities in the river is not changed by G.C.O.S. discharge of waste water.

In conclusion therefore, it can be stated that G.C.O.S. has lived up to it's environmental responsibilities as stated in it's own policy and also to those responsibilities required by Alberta laws and regulations. Furthermore, G.C.O.S. intends to continue carrying out these responsibilities and improve on them in those areas deemed necessary for protection of the environment.

Section Four

4.0 This application is submitted in accordance with The Clean Water Act, 1972, and that it is understood that the Director of the Division of Standards and Approvals may require the applicant to submit any additional information that the Director of the Division of Standards and Approvals considers necessary regarding the proposed water facility.

An application for a Permit or Licence shall not be deemed to be filed until the Division has received, at the designated address, all the information, documents, and authorization in the application form or additional information requested by the Director of the Division of Standards and Approvals.

_____

(Date)

_____

(Signature)

_____

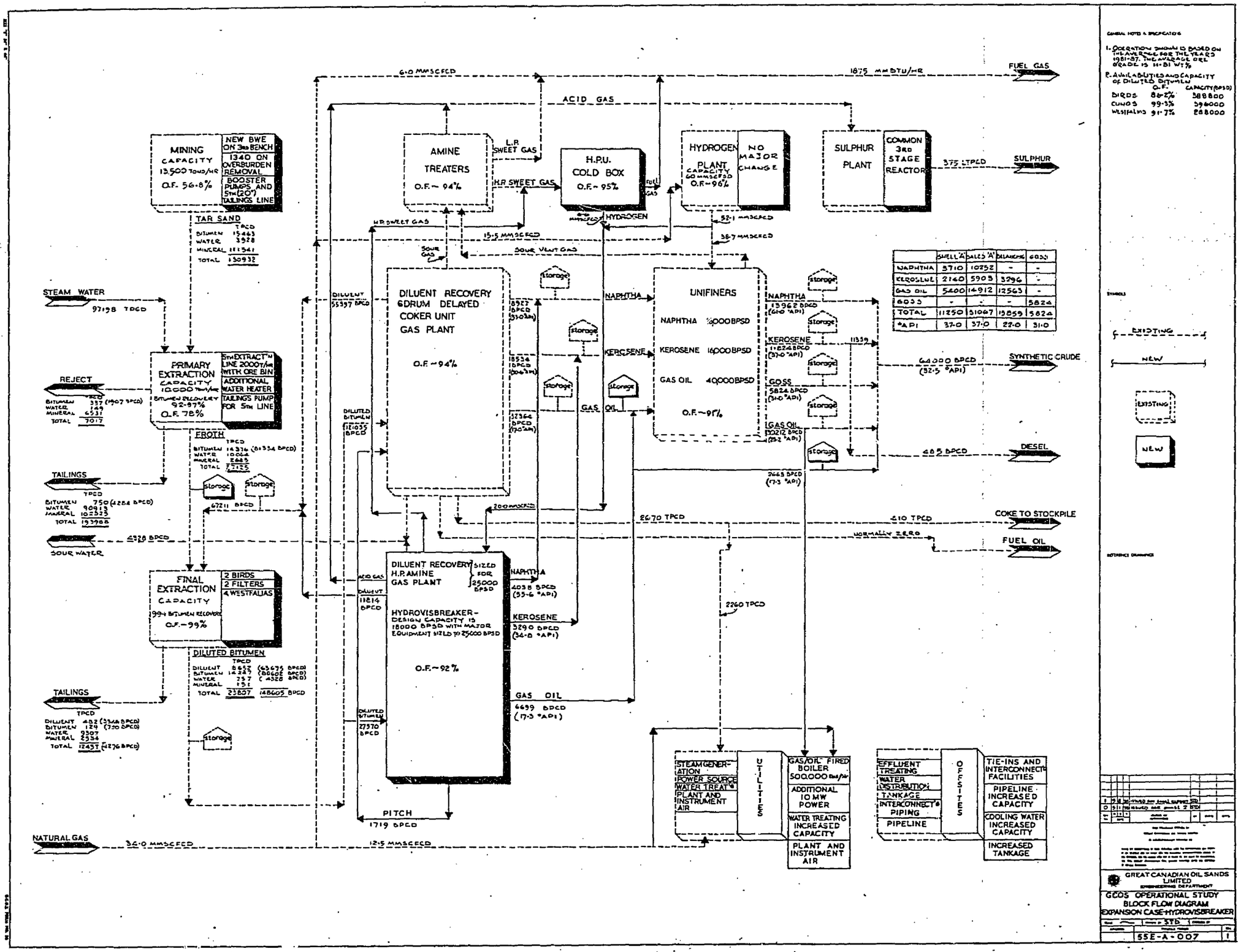
(Title of Signature)

* The application must be signed by the owner or his agent.

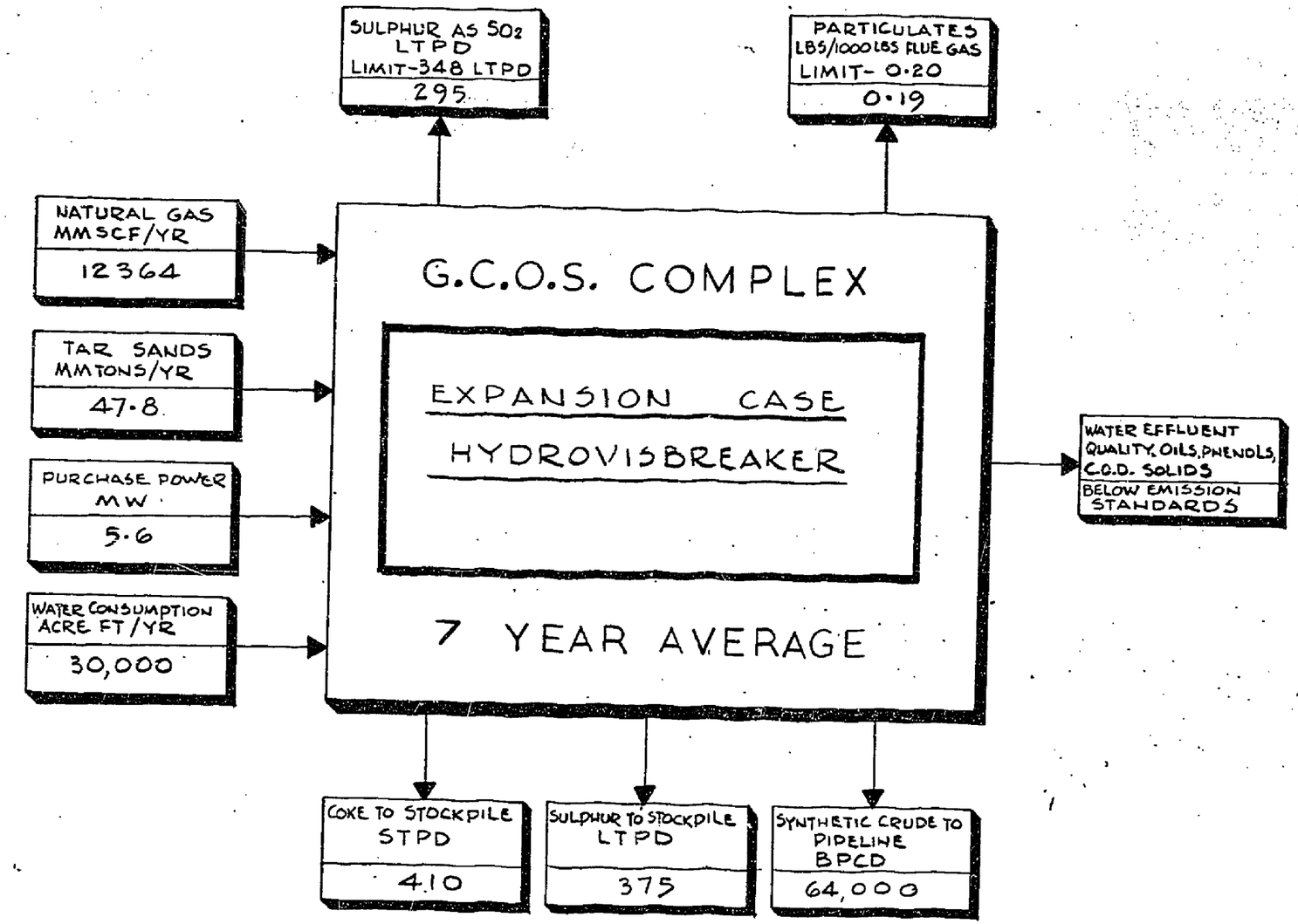
APPENDIX C

LIST OF DRAWINGS

55E-A-007	BLOCK FLOW DIAGRAM
55B-A-028	ENVIRONMENTAL-ENERGY DIAGRAM
55E-A-207	FLOWSHEET MINING EQUIPMENT
55E-A-233	MINING PLAN - 1985
55D-A-308	PROCESS P & I DIAGRAM
55E-A-321	GENERAL ARRANGEMENT - PLAN
55E-A-322	GENERAL ARRANGEMENT - SECTIONS
55E-A-502	PROCESS FLOW DIAGRAM
55E-A-507	SITE PLAN
55B-A-523	P.F.D. - AMINE PLANT
55B-A-524	P.F.D. - COLD BOX
55B-A-525	P.F.D. - GAS PLANT


6·0 MMSCFCD
1875 MMBTU/HR
FUEL GAS
ACID GAS
MINING
CAPACITY 13,500 TONS/HR
O.F. 56·8%
NEW BWE ON 3rd BENCH
1340 ON OVERBURDEN REMOVAL
BOOSTER PUMPS AND STM (20") TAILINGS LINE
TAR SAND
TPCD
BITUMEN 15463
WATER 3528
MINERAL 111541
TOTAL 130932
AMINE TREATERS
O.F. ~ 94%
L.P. SWEET GAS
H.P. SWEET GAS
H.P.U. COLD BOX
O.F. ~ 95%
HYDROGEN PLANT
CAPACITY 60 MMSCFSD
O.F. ~ 96%
NO MAJOR CHANGE
SULPHUR PLANT
COMMON 3RD STAGE REACTOR
375 LTPD
SULPHUR
HYDROGEN
52·1 MMSCFD
38·7 MMSCFD
15·5 MMSCFD
SOUR GAS
SOUR VENT GAS
STEAM WATER
97198 TPCD
PRIMARY EXTRACTION
CAPACITY 10,000 TONS/HR
BITUMEN RECOVERY 92-97%
O.F. 78%
STM EXTRACTN LINE 2000T/HR WITH ORE BIN
ADDITIONAL WATER HEATER
TAILINGS PUMP FOR STM LINE
REJECT
TPCD
BITUMEN 337 (1907 BPCD)
WATER 149
MINERAL 6531
TOTAL 7017
TAILINGS
TPCD
BITUMEN 750 (4284 BPCD)
WATER 90913
MINERAL 102325
TOTAL 193988
FROTH
TPCD
BITUMEN 14374 (81334 BPCD)
WATER 10026
MINERAL 2665
TOTAL 27125
67211 BPCD
4328 BPCD
SOUR WATER
DILUENT 55397 BPCD
DILUTED BITUMEN 121055 BPCD
DILUENT RECOVERY 6DRUM DELAYED COKER UNIT GAS PLANT
O.F. ~ 94%
8927 BPCD (51·0 API)
18534 BPCD (30·4 API)
32366 BPCD (17·0 API)
NAPHTHA
KEROSENE
GAS OIL
UNIFINERS
NAPHTHA 45000 BPSD
KEROSENE 16000 BPSD
GAS OIL 40000 BPSD
O.F. ~ 91%
NAPHTHA 13962 BPCD (61·0 °API)
KEROSENE 11624 BPCD (37·0 °API)
11359
GOSS 5824 BPCD (31·0 °API)
GAS OIL 30212 BPCD (23·2 °API)
2665 BPCD (17·3 °API)
64000 BPCD (32·5 °API)
SYNTHETIC CRUDE
485 BPCD
DIESEL
200 MMSCFD
2670 TPCD
510 TPCD
COKE TO STOCKPILE
NORMALLY ZERO
FUEL OIL
2260 TPCD
FINAL EXTRACTION
CAPACITY
99% BITUMEN RECOVERY
O.F. ~ 99%
2 BIRDS
2 FILTERS
4 WESTFALIAS
DILUTED BITUMEN
TPCD
DILUENT 8657 (63695 BPCD)
BITUMEN 12225 (80602 BPCD)
WATER 757 (4328 BPCD)
MINERAL 151
TOTAL 23807 148605 BPCD
TAILINGS
TPCD
DILUENT 482 (3548 BPCD)
BITUMEN 124 (730 BPCD)
WATER 9307
MINERAL 2534
TOTAL 12457 (14276 BPCD)
DILUENT RECOVERY H.P. AMINE GAS PLANT
SIZED FOR 25000 BPSD
HYDROVISBREAKER – DESIGN CAPACITY IS 18000 BPSD WITH MAJOR EQUIPMENT SIZED TO 25000 BPSD
O.F. ~ 92%
NAPHTHA 4038 BPCD (55·6 °API)
KEROSENE 3290 BPCD (34·0 °API)
GAS OIL 4699 BPCD (17·3 °API)
H2S GAS
DILUENT 11814 BPCD
DILUTED BITUMEN 27570 BPCD
PITCH 1719 BPCD
NATURAL GAS
36·0 MMSCFCD
12·5 MMSCFCD
UTILITIES
STEAM GENERATION
POWER SOURCE
WATER TREAT
PLANT AND INSTRUMENT AIR
GAS/OIL FIRED BOILER 500,000 lbs/hr
ADDITIONAL 10 MW POWER
WATER TREATING INCREASED CAPACITY
PLANT AND INSTRUMENT AIR
OFFSITES
EFFLUENT TREATING
WATER DISTRIBUTION
TANKAGE
INTERCONNECT PIPING
PIPELINE
TIE-INS AND INTERCONNECT FACILITIES
PIPELINE INCREASED CAPACITY
COOLING WATER INCREASED CAPACITY
INCREASED TANKAGE
SHELL 'A' | SALES 'A' | BLENDING | GOSS
NAPHTHA | 3710 | 10752 | - | -
KEROSENE | 2140 | 5903 | 3296 | -
GAS OIL | 5400 | 14912 | 12563 | -
GOSS | - | - | - | 5824
TOTAL | 11250 | 31067 | 15859 | 5824
°API | 37·0 | 37·0 | 22·0 | 31·0
GENERAL NOTES & SPECIFICATIONS
1. OPERATION SHOWN IS BASED ON THE AVERAGE FOR THE YEARS 1981-87. THE AVERAGE FEE GRADE IS 11·81 WT%
2. AVAILABILITIES AND CAPACITY OF DILUTED BITUMEN
O.F. | CAPACITY (BPSD)
BIRDS 86·2% | 388800
CUNOS 99·5% | 396000
WESTFALIAS 91·7% | 288000
SYMBOLS
EXISTING
NEW
EXISTING
NEW
REFERENCE DRAWINGS
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT
GCOS OPERATIONAL STUDY
BLOCK FLOW DIAGRAM
EXPANSION CASE-HYDROVISBREAKER
55E-A-007
1

SIZE "B" 11" X 22"



NO.	DATE	REVISIONS	BY	CHK	ENGR	APPD
2	5/10/78	ISSUED FOR FINAL REPORT	STD			
1	4/12/76	ISSUED FOR PHASE 2	STD			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

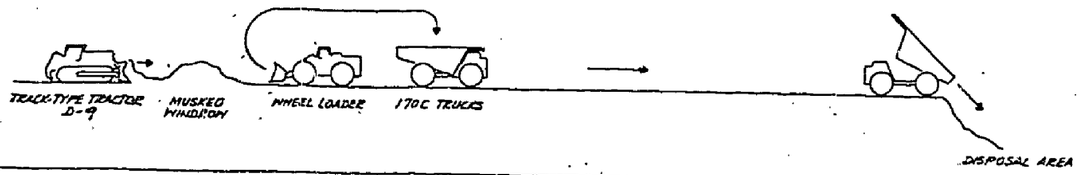
G.C.O.S. OPERATIONAL STUDY
ENVIRONMENTAL-ENERGY DIAGRAM EXPANSION CASE-HYDROVISBREAKER

SCALE	DRAWN BY	CHECKED BY	
	DRAWING NUMBER	SHEET NO.	REV.
	55B-A-028		2

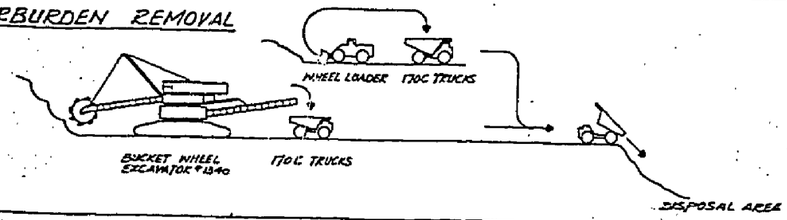
Form 55A Rev. 1 Edmonton Printers Co. Ltd.

MUSKEG REMOVAL

WINTER OPERATION ONLY:

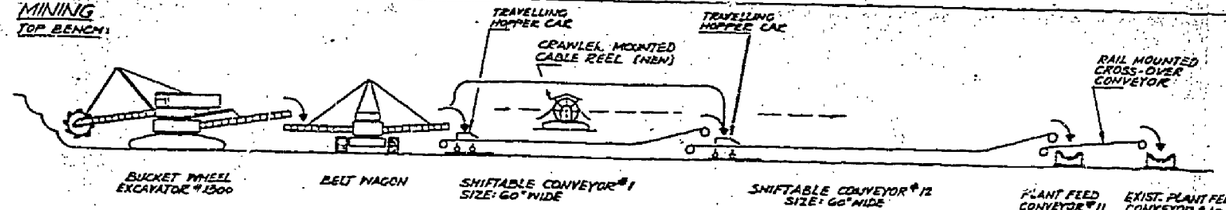


OVERBURDEN REMOVAL



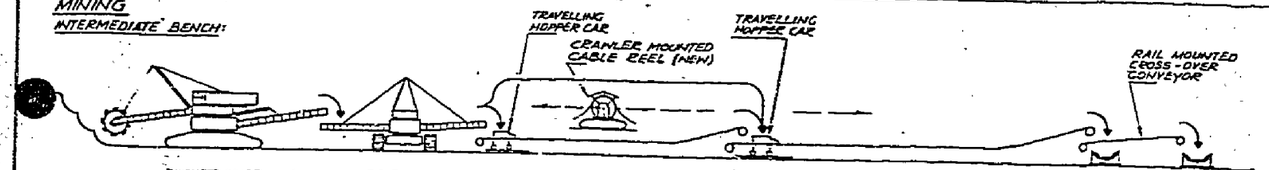
MINING

TOP BENCH:



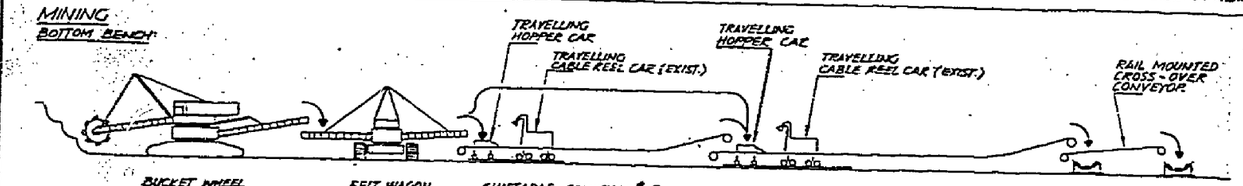
MINING

INTERMEDIATE BENCH:



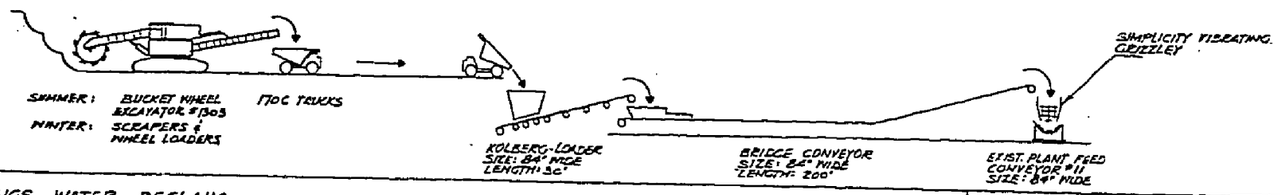
MINING

BOTTOM BENCH:



AUXILIARY MINING & MISC. EQUIPMENT

AUXILIARY MINING:



NOTE:

MINE CLEAN-UP WITH SCRAPERS, WHEEL LOADERS, DOZERS & TRUCKS

TAILINGS WATER RECLAIM

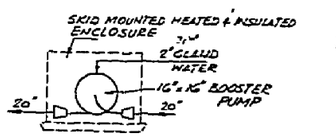
BARGE #3 (RAFT)
4 GEORGIA IRON WORKS PUMPS 2 IN SERIES - 10,000 USGPM EACH FAIR 350 HP EACH @ 4160V (UNDER CONSTRUCTION IN 1978 INCLUDING SWITCH GEAR)

BARGE #2
3 WATER PUMPS (2 IN PARALLEL, 1 SPARE) 1500 HP EACH, 4160 V (EXISTING)

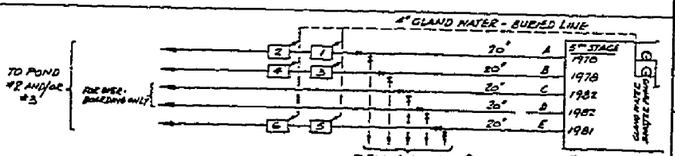
BARGE #4
2 WATER PUMPS MIN. REQ'MT: 6500 USGPM 700 HP EACH, 6900V (NEW - REQ'D IN 1981)

BARGE #1
4 WATER PUMPS TOTAL CAP: 20,000 USGPM 700 HP EACH, 6900V (EXISTING) (MOVE TO POND #3 IN 1985)

TAILINGS DISPOSAL



TYP BOOSTER STATION - 10,000 USGPM
600 HP EACH, 2300V



NOTE: BOOSTER STATIONS #1 & 3 REQ'D IN 1979
BOOSTER STATION #5 REQ'D IN 1982
BOOSTER STATIONS #2, 4 & 6 REQ'D IN 1985

NOTE:

1. CONVEYORS AS SHOWN REPRESENT LAYOUT IN 1983. FOR LAYOUTS BEFORE AND AFTER 1983 SEE DWG. # 55D-A-215.
2. TRENCH RECLAIMER AND PLANT FEED CONVEYOR #8 TO BE INSTALLED BY G.C.O.S. IN 1978.

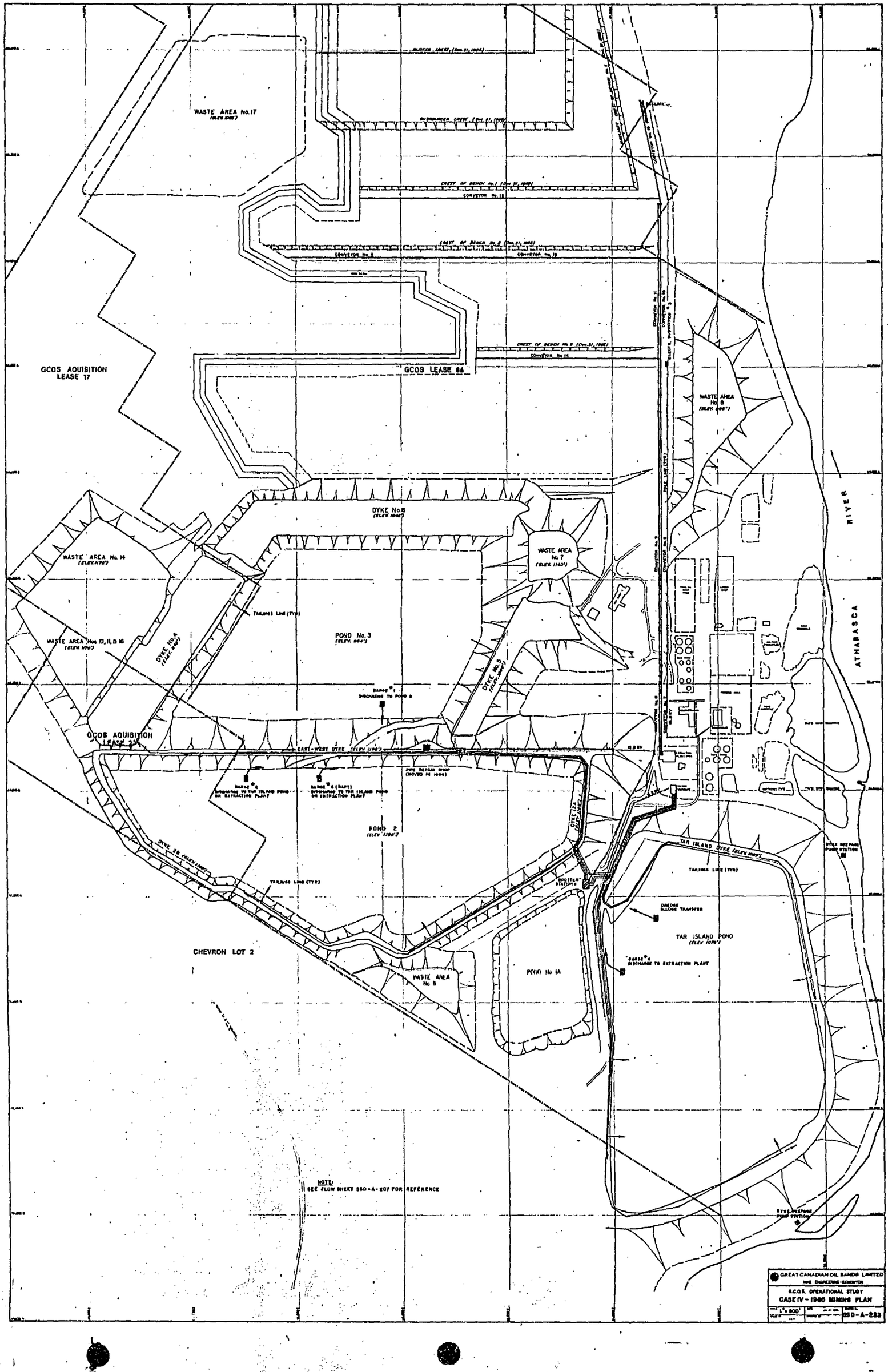
REV No.	M	D	Y	DATE	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
1	4	25	78		ISSUED FOR PHASE 2			
0	11	10	77		ISSUED FOR 1ST PHASE			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

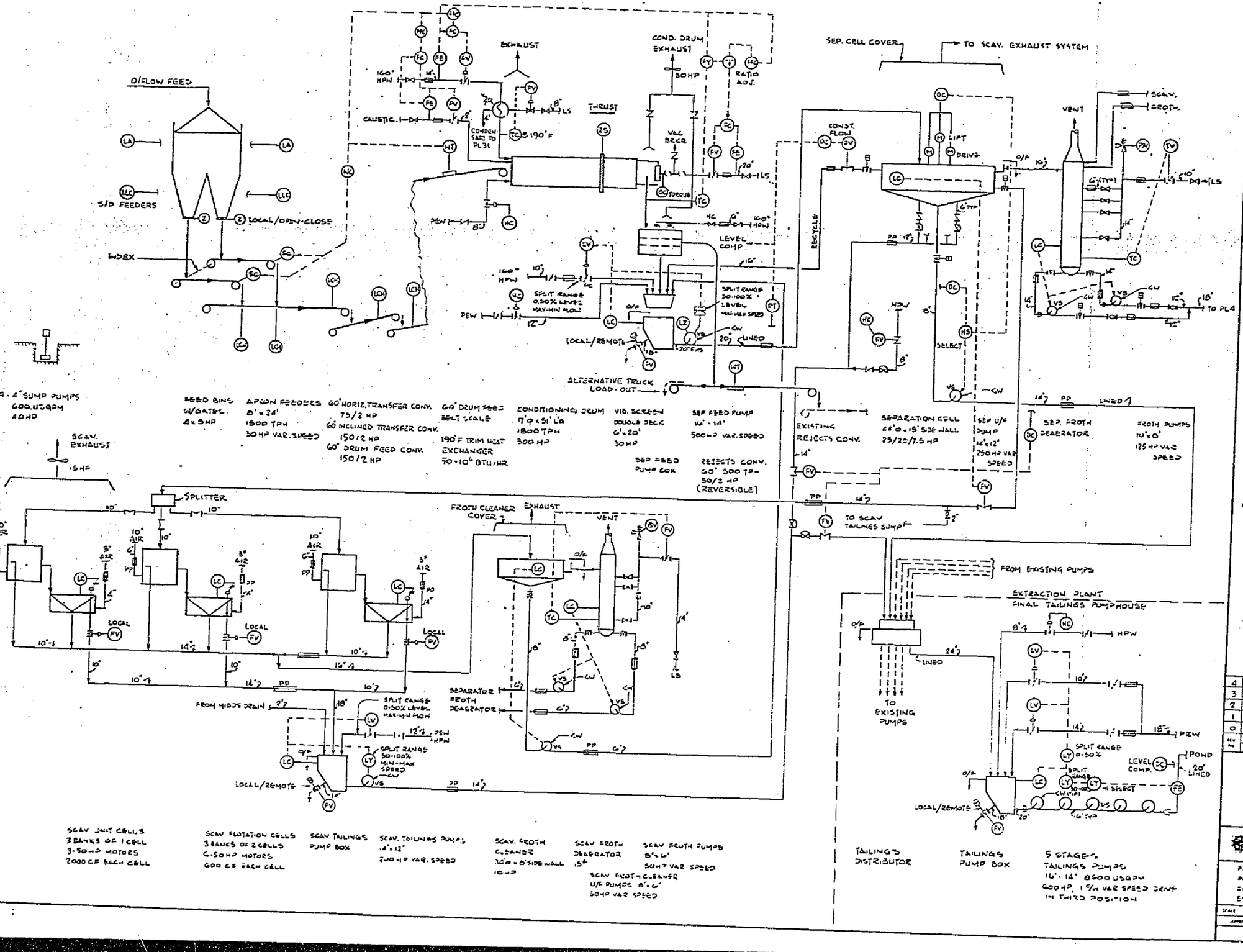
G.C.O.S. OPERATIONAL STUDY

FLOW SHEET
MINING - EQUIPMENT ARRANGEMENT EXPANDED CASE (CASE IV)

SCALE	DRAWN BY	CHECKED BY
APPROVED	DRAWING NUMBER	REV.
	55D-A-207	1


WASTE AREA No.17
(ELEV. 1080')
GCOS AQUISITION LEASE 17
GCOS LEASE 86
WASTE AREA No. 8
(ELEV. 1040')
DYKE No.5
(ELEV. 1040')
WASTE AREA No. 14
(ELEV. 1170')
WASTE AREA No. 7
(ELEV. 1160')
RIVER
ATHABASCA
TAILINGS LINE (TYP.)
POND No. 3
(ELEV. 1041')
WASTE AREA Nos. 10, 11 & 15
(ELEV. 1170')
DYKE No. 4
(ELEV. 1040')
DYKE No. 3
(ELEV. 1040')
BARGE #1
DISCHARGE TO POND 3
GCOS AQUISITION LEASE 23
EAST - WEST DYKE (ELEV. 1100')
PIPE REPAIR SHOP
(MOVED IN 1984)
BARGE #2
DISCHARGE TO TAR ISLAND POND
BARGE #2 (BARGE)
DISCHARGE TO TAR ISLAND POND
POND 2
(ELEV. 1150')
DYKE 2A (ELEV. 1150')
TAILINGS LINE (TYP.)
TAR ISLAND DYKE (ELEV. 1090')
TAILINGS LINE (TYP.)
BOOSTER STATION
DREDGE SLURRY TRANSFER
TAR ISLAND POND
(ELEV. 1070')
BARGE #3
DISCHARGE TO EXTRACTION PLANT
POND No 1A
WASTE AREA No. 9
CHEVRON LOT 2
NOTE:
SEE FLOW SHEET 550-A-207 FOR REFERENCE
GREAT CANADIAN OIL SANDS LIMITED
MINE ENGINEERING - EDMONTON
G.C.O.S. OPERATIONAL STUDY
CASE IV - 1986 MINING PLAN
1" = 800'
550-A-233

SIZE "D" 22" X 34"



GENERAL NOTES & SPECIFICATIONS

SYMBOLS

REFERENCE DRAWINGS

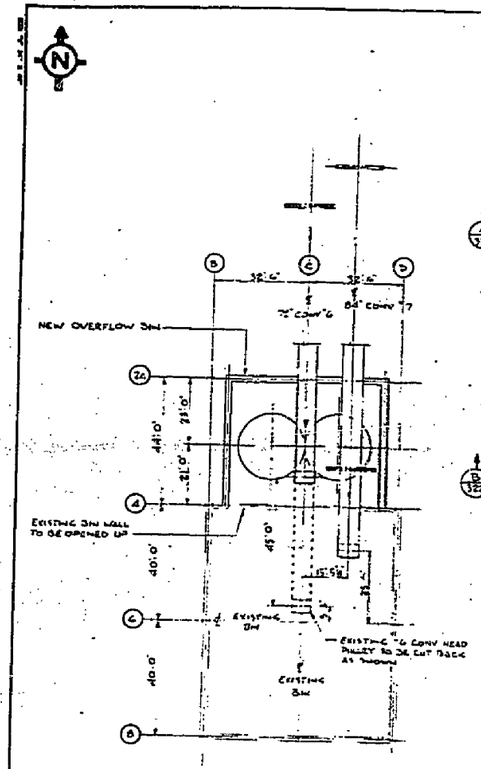
REV No.	DATE	RECORD OF ALTERATIONS	BY	CHKD	APPD
4	4 11 78	GENERAL REVISION	JMC		
3	4 4 78	UPDATED	JMC		
2	3 28 78	UPDATED GENERALLY	JMC		
1	2 28 78	UPDATED FOR 2ND PHASE	JMC		
0	11 1 77	ISSUED FOR 1ST PHASE	JMC		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

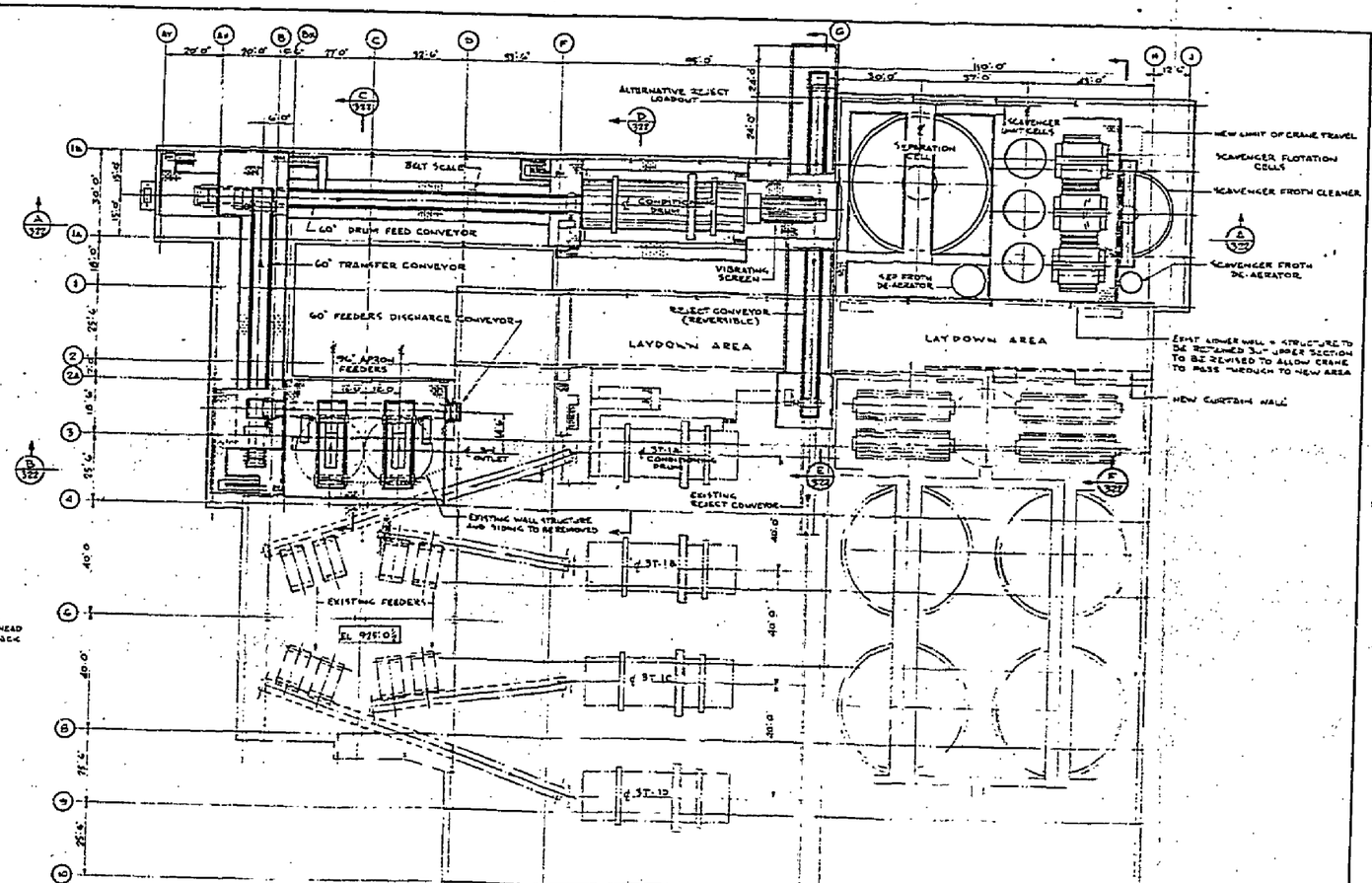
PRIMARY EXTRACTION PLANT
PROCESS P & I DIAGRAM
DIRTY LINE EXPANSION

SCALE — | DRAWN BY JMC | CHECKED BY
APPROVED | DRAWING NUMBER 550-A-308 | REV 4

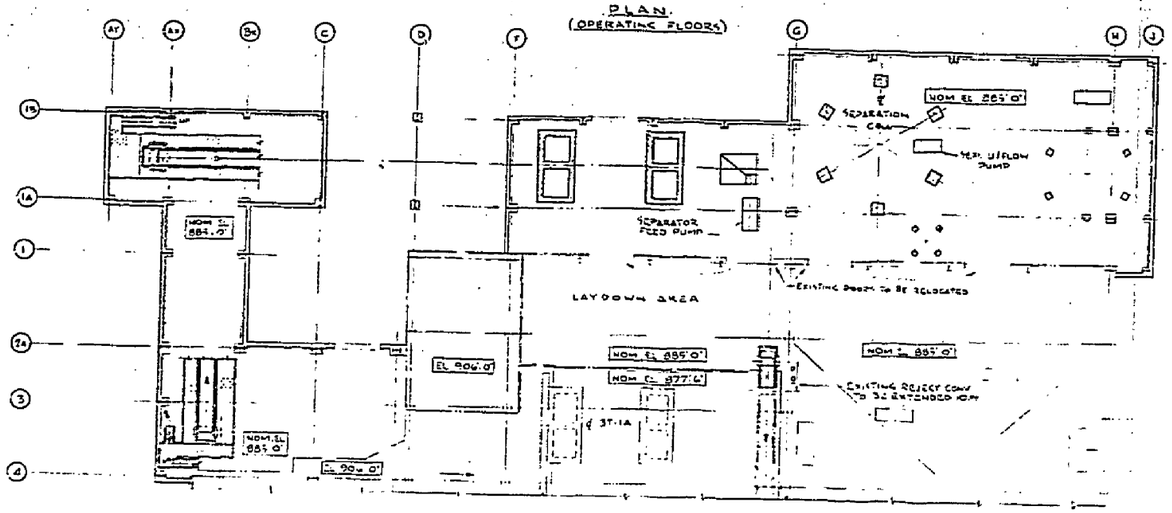
G.C.O.S. FORM NO. 57



PLAN
(TOP OF BINS)



PLAN.
(OPERATING FLOORS)



PLAN
(GROUND FLOOR)

GENERAL NOTES & SPECIFICATION

LEGEND

EXISTING EQUIP
NEW EQUIPMENT

SYMBOLS

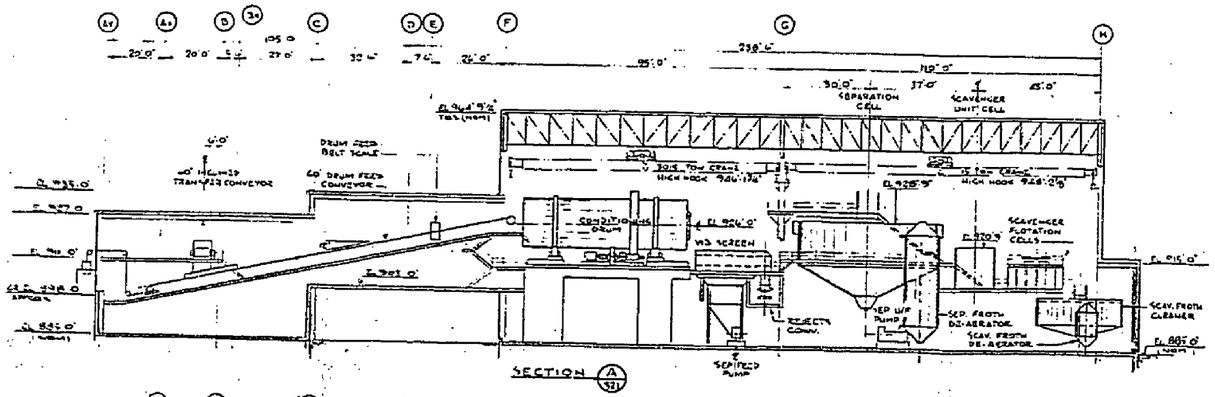
REFERENCE DRAWINGS

GENERAL ARRGT - SECTIONS
DWG # 55 E - A - 322

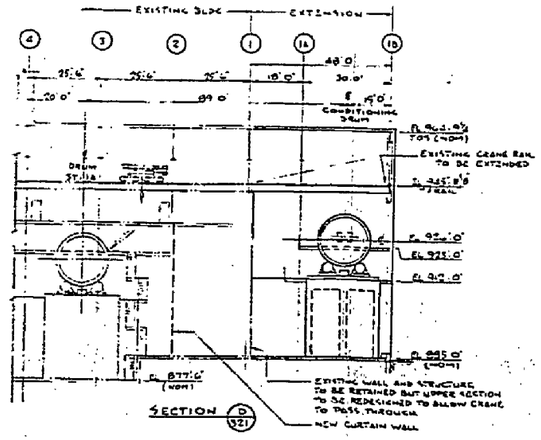
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
5TH LINE EXPANSION
GENERAL ARRANGEMENT - PLANS

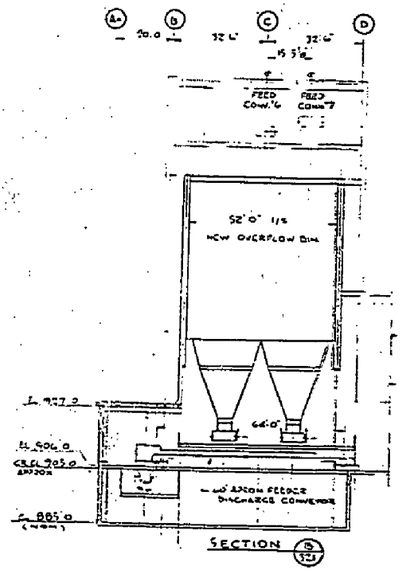
55 E - A - 321



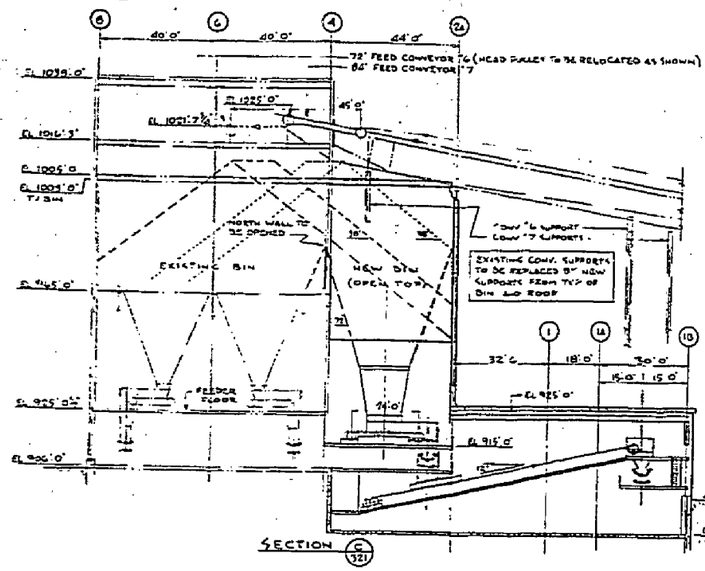
SECTION (A) 321



SECTION (D) 321



SECTION (G) 321



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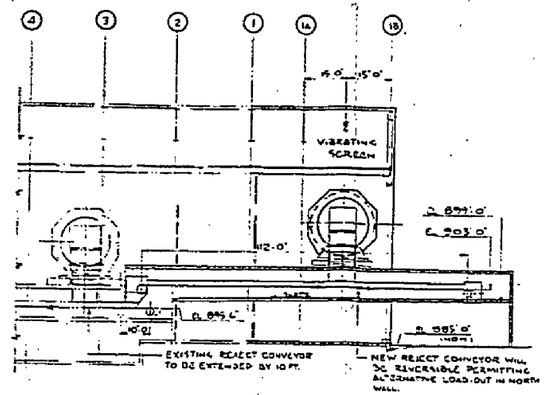
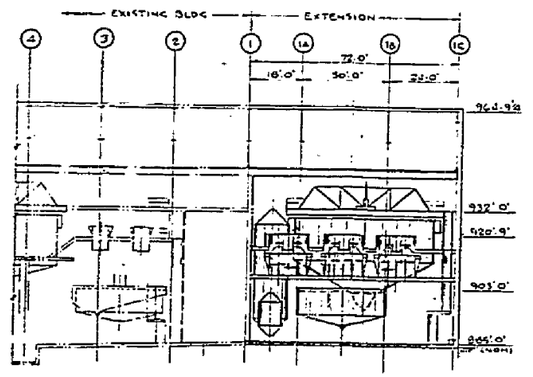


SECTION (E) 321



SECTION (F) 321

GENERAL NOTES & SPECIFICATIONS

LEGEND:-

EXISTING EQUIP.

NEW EQUIPMENT

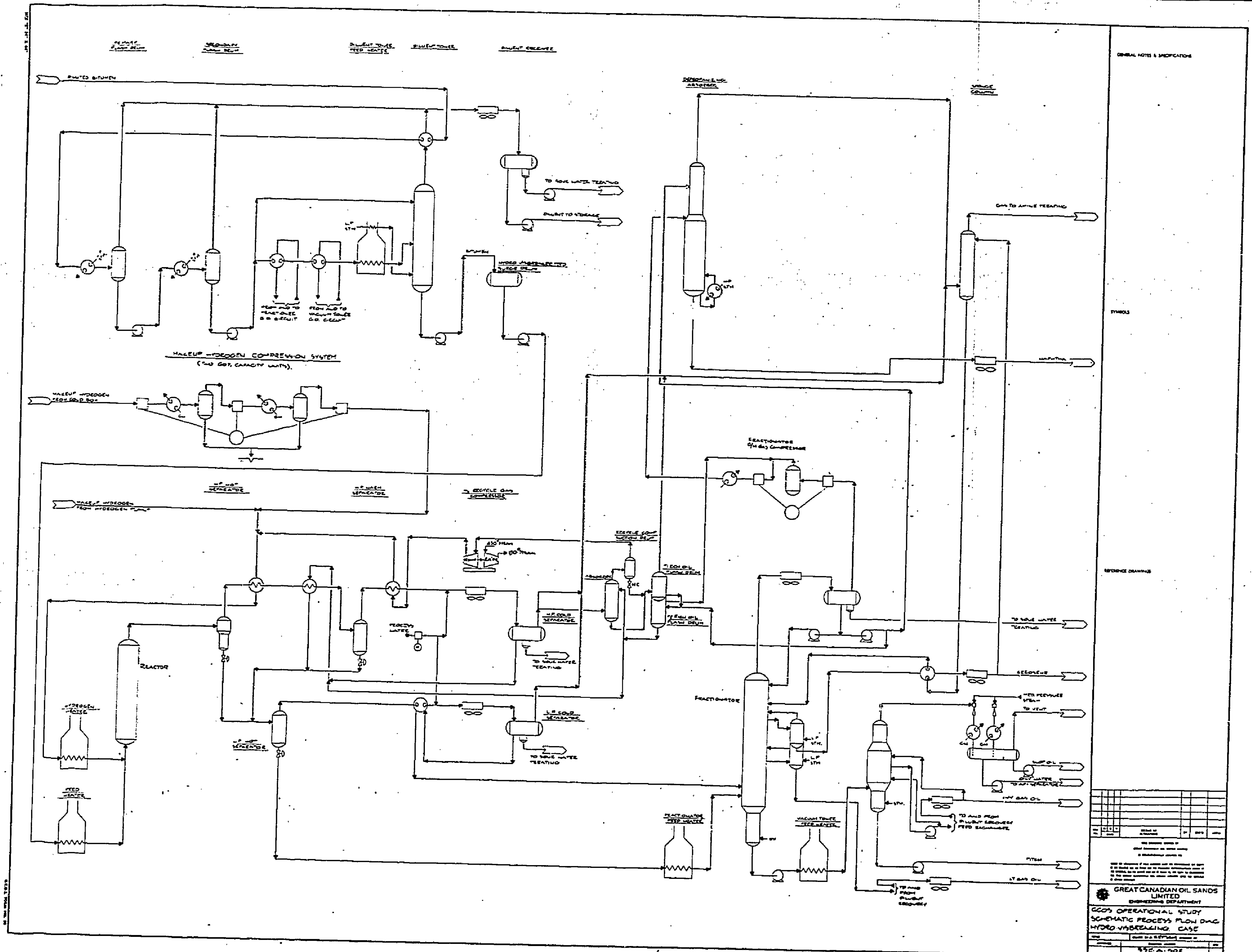
REFERENCE DRAWINGS

GENERAL ARRGT. - PLANS
DWG # 55-E-A-321

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
5TH. LINE EXPANSION
GENERAL ARRANGEMENT - SECTIONS

55-E-A-322


MAKEUP HYDROGEN COMPRESSION SYSTEM
REACTOR
FRACTIONATOR
HYDROGEN HEATER
FEED HEATER
GAS TO AMINE TREATING
NAPHTHA
KEROSENE
TO VENT
PITCH
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT
GCOS OPERATIONAL STUDY
SCHEMATIC PROCESS FLOW DIAG
HYDRO-VISBREAKING CASE
55C-A-508

MINING AREA

REFERENCE DRAWINGS :- 550-A-203 THRU 211

REFENCE DRAWINGS :- 55 D-A-305 THRU 315 FOR EXTRACTION AREA

PRIMARY EXTRACTN PLANT 3

TAILINGS POND AREA

STORAGE SHED

ADMIN

MACHINE SHOP

ENG & SERVICES

LAB & SAFETY

PIPEWAY

200-1 200-2 200-3 200-4 200-5 200-6 200-7 200-8 200-9 200-10 200-11 200-12 200-13 200-14 200-15 200-30 200-32 200-34

BITUMEN STORAGE

COGENERATION BUILDING

COKE STOCKPILE

SULPHUR STORAGE

ASH POND

EMERGENCY POND

WASTE WATER STORAGE POND

FRESH WATER RESERVOIR

E 4500 E 5000 E 5500 E 6000 E 6500 E 7000 E 7500

N 3500 N 4000 N 4500 N 5000 N 5500 N 6000 N 6500 N 7000

GENERAL NOTES & SPECIFICATIONS

1 ALL ADDITIONAL PLANT UNITS, BUILDINGS, ROADS ETC. ARE SHOWN INDICATED THUS: - - -

SYMBOLS

GREAT CANADIAN OIL SANDS LIMITED

G.C.O.S. OPERATIONAL STUDY

SITE PLAN EXPANSION CASE-HYDROCYCLONE BREAKER

55E-A-307

SIZE "B" 11" X 22"

HIGH PRESSURE CONTACTOR
4'-6"ø x 22 TRAYS
55C-08101

AMINE REGENERATOR
5'-6"ø x 20 TRAYS
55C-08103

AMINE REGENERATOR CONDENSER - 19.48 MMBTU/HR
55E-08107

TRIM COOLER
55E-08107t

TO FUEL GAS OR HYDROGEN PLANT FEED

CONDENSATE COOLER
0.15 MM BTU/HR
55E-08109

H.P CONDENSATE PUMPS 1.5GPM
2 REQD
55G-08108 A/B

110°F

#22

CONDENSATE

CW

140psig

PECO FILTER SEPARATOR
18"ø x 8'-0" LG
55T-08108

#1

H.P KNOCK OUT DRUM
3'-0"ø x 8'-0"
55C-08109

SOUR GAS FROM HYDROVISBREAKER

TO SOUR WATER STRIPPER

AMINE COOLER
11.13 MM BTU/HR
55E-08101

AMINE FILTER
50 GPM
55V-08102

FEED BOTTOMS EXCHANGER
18.78 MM BTU/HR
55E-08102

#20

#18

#1

CW

ACID GAS TO SULPHUR PLANT

7psig 100°F

AMINE REGENERATOR REFLUX DRUM
3'-6"ø x 8'-0"
55C-08104

AMINE REGENERATOR REFLUX PUMPS (20GPM
2 REQD
55G-08103 A/B

40# STEAM (DIRTY)

AMINE REGENERATOR REBOILERS
2 REQUIRED
15.64 MM BTU/HR EACH
55E-08106 A/B

REGENERATOR BOTTOMS PUMPS
500 GPM
2 REQD
55G-08107 A/B

REGENERATOR REBOILER CONDENSATE DRUM
3'-0"ø x 6'-0"
55C-08111

DIRTY CONDENSATE TO EXISTING 10C-11

REGENERATOR CONDENSATE PUMPS
80 GPM
2 REQUIRED
55G-08110 A/B

H.P AMINE FEED PUMPS
500 GPM
2 REQD
55G-08102 A/B

AMINE STORAGE
10'-0"ø x 17'-0"
55D-08101

NOTES!

1. THIS AMINE PLANT IS SIZED TO HANDLE THE SOUR GAS FROM A 25,000 BPSD HYDROVISBREAKER ONLY.

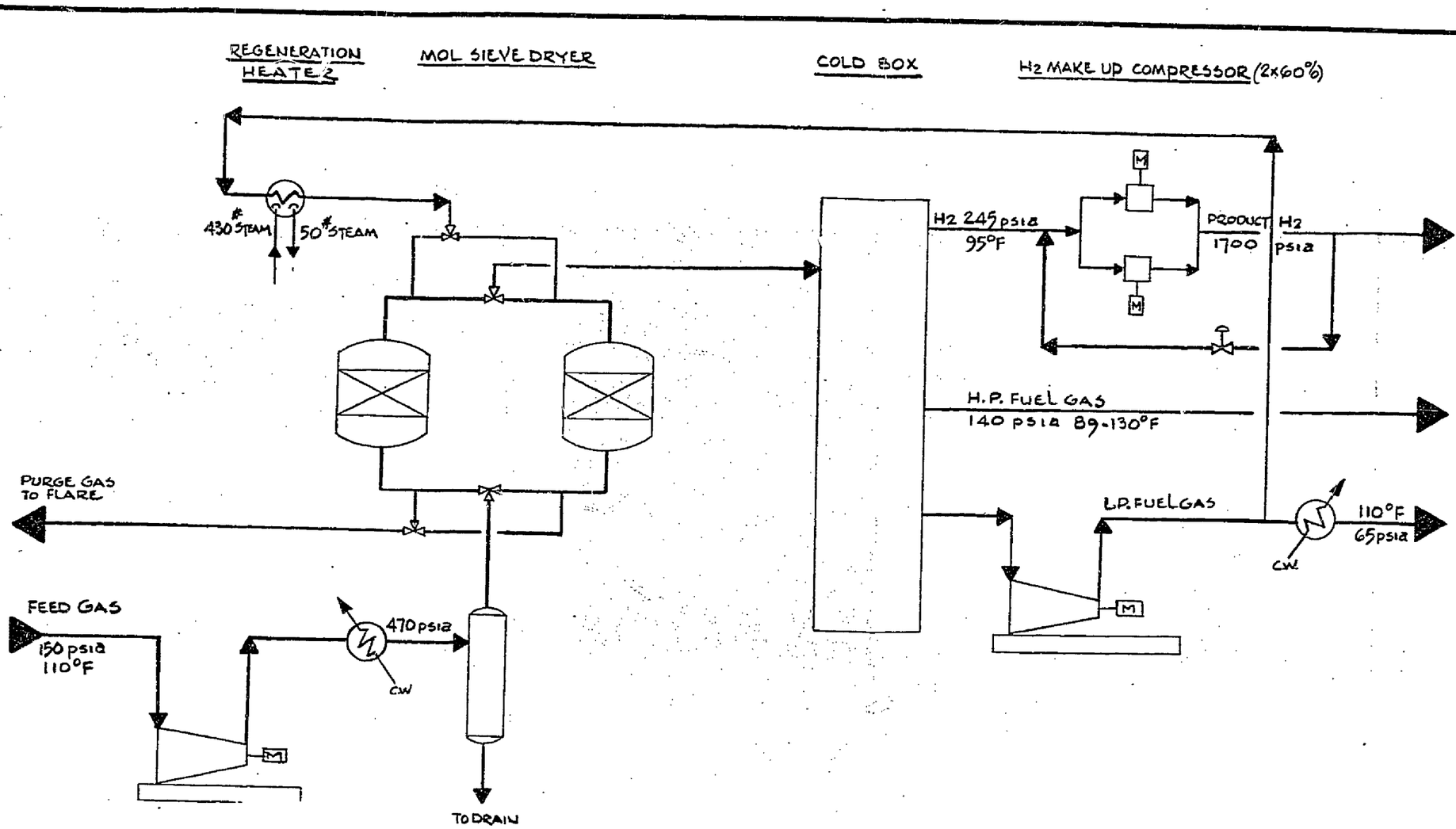
NO.	DATE	REVISIONS	BY	CHECKED	APPD
0	4/5/78	ISSUED FOR PHASE 2	STD		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S OPERATIONAL STUDY
PROCESS FLOW DIAGRAM - AMINE PLANT EXPANSION CASE - HYDROVISBREAKER

SCALE	DRAWN BY	CHECKED BY
	STD	

DRAWING NUMBER	SHEET NO.	REV.
55B-A-523		0



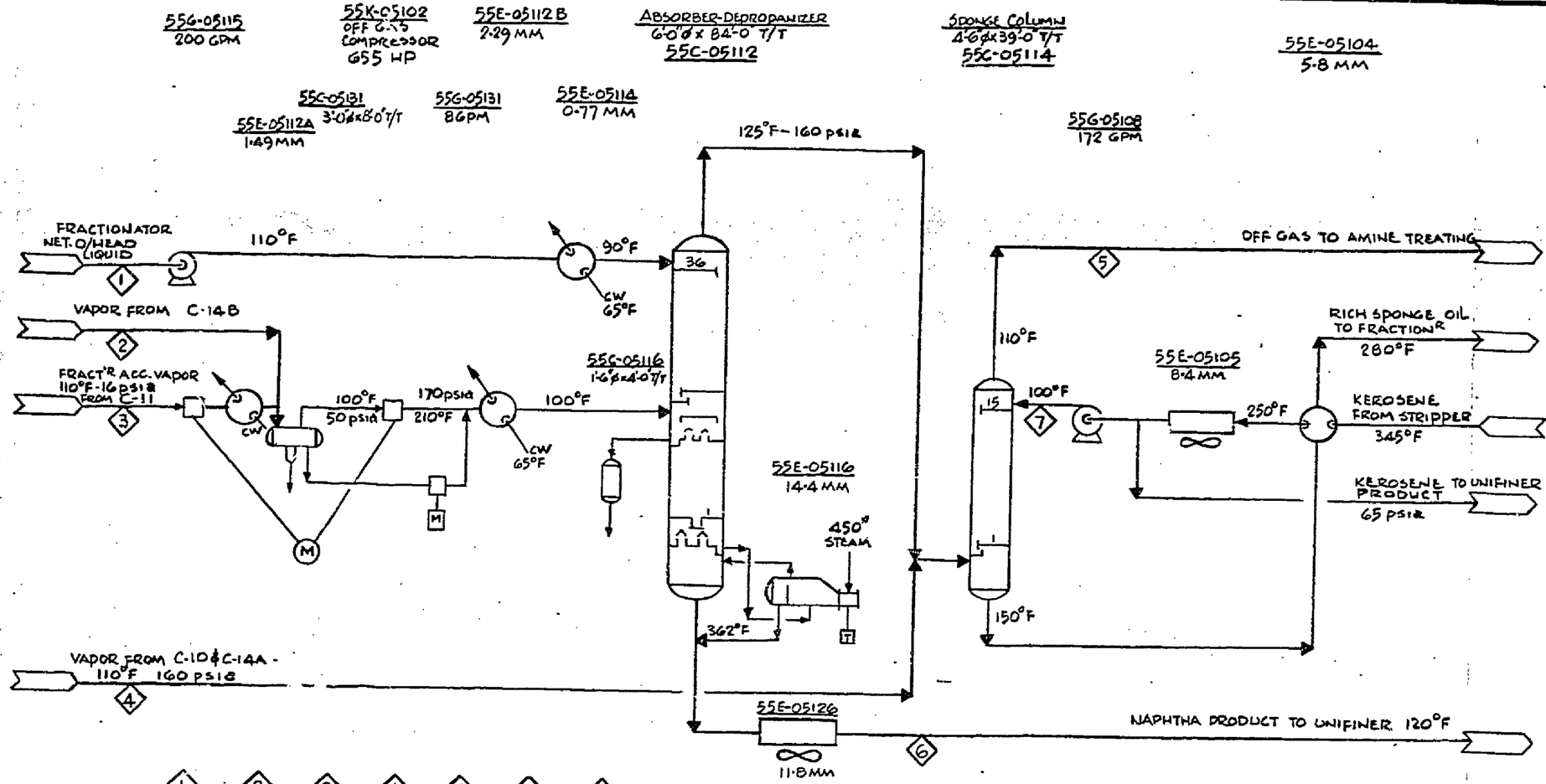
NO.	DATE	REVISIONS	BY	CHK	ENGR	APP'D
0	4/25/78	ISSUED FOR PHASE 2	STD			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
PROCESS FLOW DIAGRAM COLD BOX EXPANSION CASE—HYDROVISBREAKER

SCALE	DRAWN BY	CHECKED BY
~	S.T.D	

DRAWING NUMBER	SHEET NO.	REV.
55 B-A-524		0



	1	2	3	4	5	6	7
BPSD	6680					7668	5760
°API	54.4					58.2	33.4
MMSCFSD		2.43	3.3	11.95	15.35		
MW	109.9	29.77	44.06	17.89	19.24	104.3	180
LB/HR	74,090	7,940	15,940	23,475	32,415	83,324	72,000

NOTES

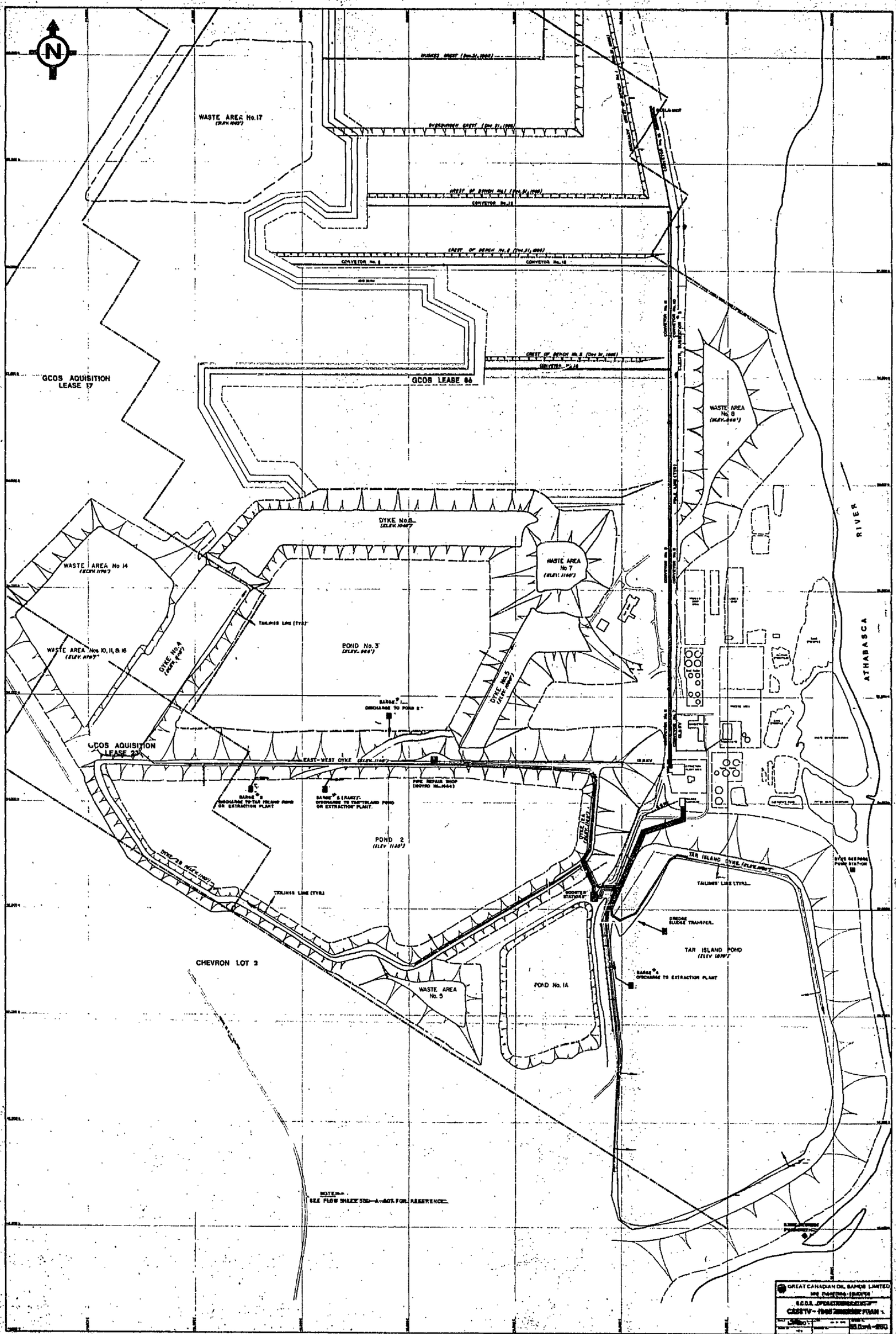
1. MM = 10^6 BTU/HR
2. PUMP GPM ARE NORMAL FLOW RATES
3. ALL QUANTITIES ARE BASED ON 25000 BPSD BITUMEN CHARGE TO THE HYDROVISBREAKER ONLY

NO.	DATE	REVISIONS	BY	CHK	ENG	APPD
0	4/25/78	ISSUED FOR PHASE 2	STD			

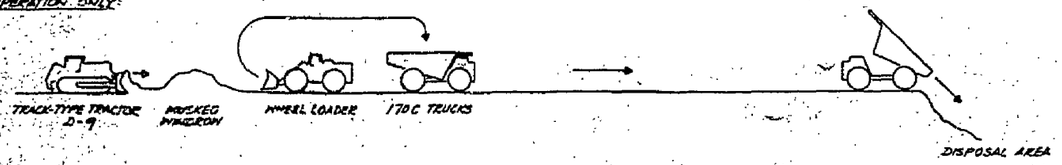
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
PROCESS FLOW DIAGRAM-GAS PLANT EXPANSION CASE-HYDROVISBREAKER

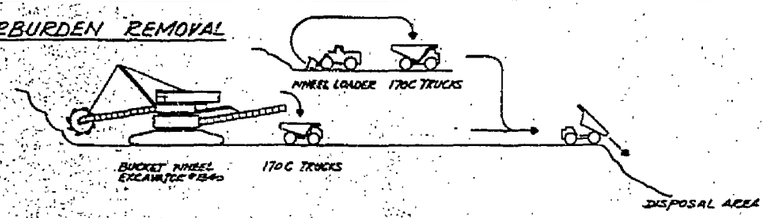
SCALE ~	DRAWN BY STD	CHECKED BY	
DRAWING NUMBER		SHEET NO.	REV.
55B-A-525			0


WASTE AREA No.17
GCOS AQUISITION LEASE 17
GCOS LEASE 86
WASTE AREA No. 8
DYKE No.8
WASTE AREA No 14
WASTE AREA No 7
POND No. 3
WASTE AREA Nos. 10, 11, & 16
DYKE No.4
DYKE No.5
ATHABASCA RIVER
GCOS AQUISITION LEASE 23
EAST-WEST DYKE
POND 2
TAR ISLAND DYKE
TAILINGS LINE (TYP.)
DREDGE SLUDGE TRANSFER
TAR ISLAND POND
CHEVRON LOT 2
WASTE AREA No. 5
POND No. 1A
NOTE:
SEE FLOW SHEET 530-A-607 FOR REFERENCE
GREAT CANADIAN OIL SANDS LIMITED

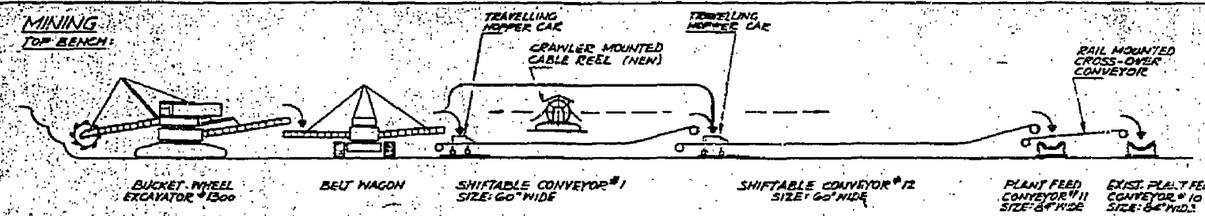
MUSKEG REMOVAL
WINTER OPERATION ONLY:



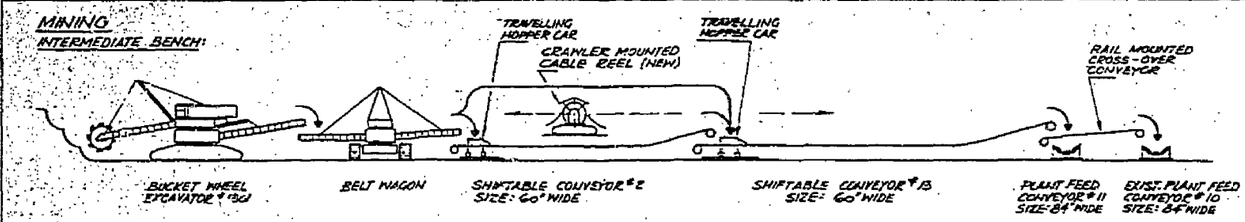
OVERBURDEN REMOVAL



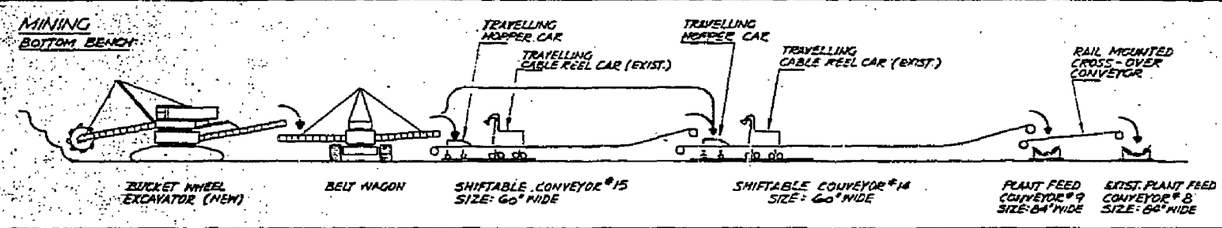
MINING
TOP BENCH:



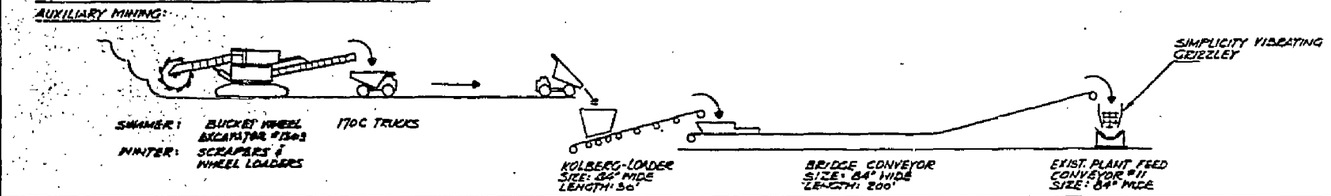
MINING
INTERMEDIATE BENCH:



MINING
BOTTOM BENCH:

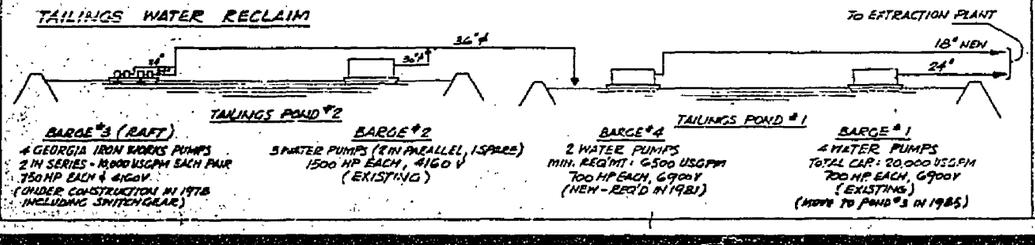


AUXILIARY MINING & MISC. EQUIPMENT
AUXILIARY MINING:

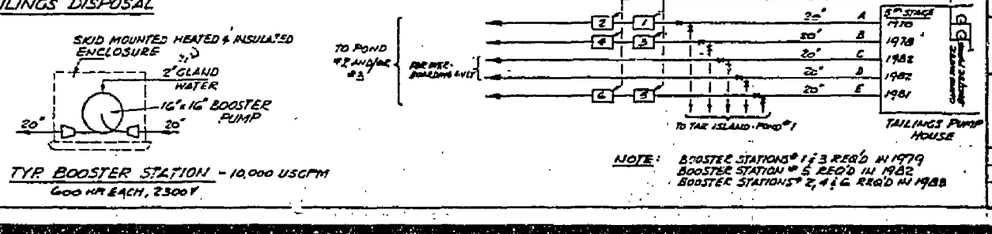


NOTE:
MINE CLEAN-UP WITH SCRAPERS, WHEEL LOADERS, DOZERS & TRUCKS.

TAILINGS WATER RECLAIM



TAILINGS DISPOSAL



NOTE: BOOSTER STATIONS #1, 3 REQ'D IN 1979
BOOSTER STATION #5 REQ'D IN 1982
BOOSTER STATIONS #2, 4 & 6 REQ'D IN 1988

NOTE:
1. CONVEYORS AS SHOWN REPRESENT LAYOUT IN 1983. FOR LAYOUTS BEFORE AND AFTER 1983 SEE DWG.# 55D-A-215.
2. TRENCH RECLAIMER AND PLANT FEED CONVEYOR #8 TO BE INSTALLED BY G.C.O.S. IN 1978.

REV. No.	DATE D	M	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
3	5	09	78	ISSUED FOR ANNUAL REPORT	STD		
2	05	19	78	ISSUED AS ESTIMATE BASIS	K.J.		
1	4	25	78	ISSUED FOR PHASE I	AF		
0	11	10	77	ISSUED FOR 1ST PHASE	AF		

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GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY

FLOW SHEET
MINING - EQUIPMENT ARRANGEMENT
EXPANDED CASE (CASE IV)

SCALE: -"- | DRAWN BY: AF | CHECKED BY:
APPROVED | DRAWING NUMBER: 55D-A-207 | REV. 3

DRAWING

APPLICATION: 78-0318

DRAWING

ATTACHED TO APPLICATION

AREA COVERED:	TAR ISLAND
DRAWING TITLE:	PRIMARY EXTRACTION PLANT PROCESS P & I DIAGRAM FIFTH LINE EXPANSION
DATE:	NO DATE GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 1 of 11

DRAWING

APPLICATION: 78-0318

DRAWING

ATTACHED TO APPLICATION

AREA COVERED: TAR ISLAND

DRAWING TITLE: G.C.O.S. OPERATIONAL STUDY
SIMPLIFIED FLOW DIAGRAM
COOKING UNIT EXPANSION

DATE: NO DATE GIVEN

SCALE: NONE

INDEX: DOCUMENT 2 of 11

PLAN

APPLICATION: /8-0318

PLAN

ATTACHED TO APPLICATION

AREA COVERED:	TAR ISLAND
PLAN TITLE:	G.C.O.S. OPERATIONAL STUDY SITE PLAN EXPANSION CASE-DELAYED COKER
DATE:	NOT GIVEN
SCALE:	1"=100'
INDEX:	DOCUMENT 3 of 11

GOVERNMENT OF THE PROVINCE OF ALBERTA

OIL AND GAS

CONSERVATION BOARD

SUPPLEMENTAL

REPORT TO

THE LIEUTENANT GOVERNOR IN COUNCIL

WITH RESPECT TO THE APPLICATION OF

GREAT CANADIAN OIL SANDS LIMITED

UNDER PART VIA OF

THE OIL AND GAS CONSERVATION ACT

September, 1962

THE APPLICATION OF

GREAT CANADIAN OIL SANDS LIMITED

UNDER PART VIA OF

THE OIL AND GAS CONSERVATION ACT

SUPPLEMENTAL REPORT

Table of Contents

Appendix

List of Tables

List of Figures

THE APPLICATION OF

GREAT CANADIAN OIL SANDS LIMITED

UNDER PART VIA OF

THE OIL AND GAS CONSERVATION ACT

SUPPLEMENTAL REPORT

I. INTRODUCTION

1. Initial Application

The initial application of Great Canadian Oil Sands Limited was heard by the Board in Calgary on June 8, 9 and 10 and July 7, 8 and 9, 1960. The applicant asked approval of a scheme to produce 11,500,000 barrels per year of synthetic crude oil from the oil sands in Bituminous Sands Lease No. 4. Subsequently to the hearing, the Board issued its report entitled "Report to the Lieutenant Governor in Council with Respect to the Application of Great Canadian Oil Sands Limited under part VIA of The Oil and Gas Conservation Act" and dated November, 1960.

In the report the Board concluded that it would not be in the best interests of Alberta to grant approval of the scheme at that time and decided, subject to the approval of the Lieutenant Governor in Council, to defer its final disposition of the application and continue the application to June 30, 1962. It was stipulated that the Board would be prepared to entertain a request made by the applicant at any time after January 1, 1962, and before June 30, 1962, for the reconsideration of the application, if the

applicant was able to offer substantial new evidence of the technical feasibility, economic feasibility, and financibility of the proposal and its effect on the market for conventionally produced crude oil.

The findings of the Board as set forth in its report of November, 1960, are summarized as follows:

(a) With respect to Conservation and Recovery -
The proposal would result in a satisfactory conservation and recovery of crude hydrocarbon.

(b) With respect to Disposition of Waste -
Subject to certain technical difficulties, the method of disposition of solid and liquid wastes appeared to be reasonably well conceived. The proposal for the disposition of gaseous wastes was not considered satisfactory.

(c) With respect to Technical Feasibility -
It was difficult for the Board to give an absolute ruling on the technical feasibility of the process. "Proof" of feasibility had been based on a combination of established processes, which have been successful in similar but not identical applications, laboratory tests, limited field tests, and/or contractor's guarantees. The Board noted a number of technical difficulties which in its opinion were not adequately resolved.

The Board took the position that while the process may well be feasible in a general sense, its feasibility in a detailed technical sense was not yet fully proven. While it did not hold that only a process which it considered completely proven could be approved, it indicated that the degree to which the process was proven as technically feasible must be given weight in deciding on such an approval.

(d) With respect to Economic Feasibility -

Based on its estimated six to eight year payout of debt capital, the Board had serious doubts as to the financibility of the project and, therefore, as to its economic feasibility. (In the Board's assessment, it had been assumed that the proposal could be considered technically feasible and cost increases consistent with certain technical deficiencies had been estimated.)

(e) With respect to the Impact on the Market for Conventionally Produced Crude Oil -

The market proposed by the applicant, the Sarnia refineries of Sun Oil Company and Canadian Oil Companies Limited, would otherwise be supplied largely by conventionally produced Alberta crude oil. Although the scale of the operation was probably as small for its type as could be

considered economically feasible, the effect from the last half of 1963 to 1965 (as estimated by the Board) would have been a decrease in total demand for conventionally produced Alberta crude oil of 5 per cent, and a decrease in the pro-ratable demand of 20 to 30 per cent.

New evidence was submitted by the applicant, Great Canadian Oil Sands Limited, relating to items (a), (b), (c), (d) and (e) above. The Board has reviewed this new evidence and the representations of the interveners respecting it.

2. The Applicant and the Applications

The background of Great Canadian was detailed in the report of November, 1960. A change in the organization of the company since that time has been the issue of a stock purchase option to Canadian Pacific Oil and Gas Limited and the exercise of part of this option. Shares were subsequently purchased from Canadian Pacific Oil and Gas Limited by Sun Oil Company and Canadian Oil Companies Limited.

The new application was made on April 23, 1962. Although there are numerous changes in detail, the overall proposal is unchanged. The applicant asks approval of a scheme to produce 11,500,000 barrels per year of synthetic crude oil and other by-products derived from oil sands to be taken from Bituminous Sands Lease No. 4. The synthetic crude oil would be delivered by pipe line to Edmonton.

The application was heard in Calgary on June 6, 7 and 8 and on July 3 and 5, 1962.

3. Interveners

The following registered as interested parties at the hearing:

	Representing
E. J. Chambers, Q.C.	Cities Service Athabasca, Inc. Imperial Oil Limited Richfield Oil Corporation Royalite Oil Company, Limited
J. E. Prothroe	Can-Amera Oil Sands Limited
J. R. Lacey	Triad Oil Company
The Rev. Peter Harris	The Town of McMurray and its Chamber of Commerce
D. S. Pasternack	Research Council of Alberta
W. E. Richards	Dome Petroleum Limited
F. D. Milne	Dome Petroleum Limited

The Cities Service group hold bituminous sands leases in the McMurray-Ells Lake area and is engaged in an extensive research program on Lease No. 17, immediately north of the applicant's Lease No. 4. The group was highly critical of a number of the technical aspects of the applicant's proposal.

Can-Amera Oil Sands Limited owns a process for the separation of the oil from the sands by the use of centrifugal force. This company presented no witnesses, but in its concluding statement supported the application by Great Canadian Oil Sands.

Triad Oil Company and the Research Council of Alberta made no submissions and presented no witnesses.

The Town of McMurray and its Chamber of Commerce supported the Great Canadian Oil Sand's application, pointing out the benefits to be derived by the Town from oil sand development.

Dome Petroleum Limited was concerned primarily with the impact of the proposed synthetic crude oil production on the market for conventionally produced crude oil. It opposed the application on the grounds that oil sands development at this time is premature in view of the market situation. Dome was supported in its submission by the Calgary and Edmonton Corporation Ltd., Canadian Devonian Petroleums Ltd., and Western Decalta Petroleums Limited.

II. DETAILS OF THE NEW PROPOSAL

The modifications contained in the new proposal, as compared with the original described in the Board's report of November, 1960, are discussed briefly in the following sections.

Complete details may be found in the exhibits presented during the hearing, and in the transcript of the hearing.

1. Mining and Conveying of the Oil Sands

Plans for mining and conveying of oil sands to the separation units are unchanged except that the applicant is more definite on plans for selection of rich sands and discarding of lean. The applicant proposes to process all material containing ten weight per cent oil and higher and to reject at the mining site lean sands containing less than ten weight per cent oil.

2. Separation of the Oil from the Oil Sands

The "Hot Water Separation Process", originally developed by Dr. K. A. Clark of the Research Council of Alberta, was described in the previous report. The new proposal is identical as to overall capacity, conditioning of the oil sand, separation of the oil, and in conditioning of the oil froth for preliminary refining. The processing and the method of transporting water and sand from the separation cell has been revised. A schematic flow sheet, marked as Exhibit T at the hearing commencing on June 6,

1962, showing the material balance of the hot water separation process as presently proposed by Great Canadian is reproduced and shown in Figure 1.

Clay, sand, water and traces of oil from the bottom of the separation cell would be pumped to rotary horizontal filters, rather than to classifiers as originally proposed. The filters would reduce the water content of the sand tailings to 6 per cent so that the tailings could be moved to the disposal area by means of conveyor belts rather than by a wet sluicing system. The filtrate or recycle water from the filters, carrying 0.4 per cent solids, would be returned to the hot water circulating system.

Excess water and "fines" drawn off the separation cell would enter the thickener which replaces the surge tank and wet cyclone in the original proposal. Clean filtrate from the disc filters and effluent from the thickener, the latter containing some 1.2 per cent mineral, would be returned to the hot water circulating system. A slurry of fines and water from the thickener would be pumped to disc filters which would reduce the water content of the filter cake to 15 per cent. The filter cake from the disc filters would then join the sand tailings from the rotary horizontal filters.

3. Preliminary Refining of the Oil to Yield a Synthetic Crude Oil

Preliminary refining of the diluted dehydrated oil is proposed for recovery of diluent and for the upgrading of

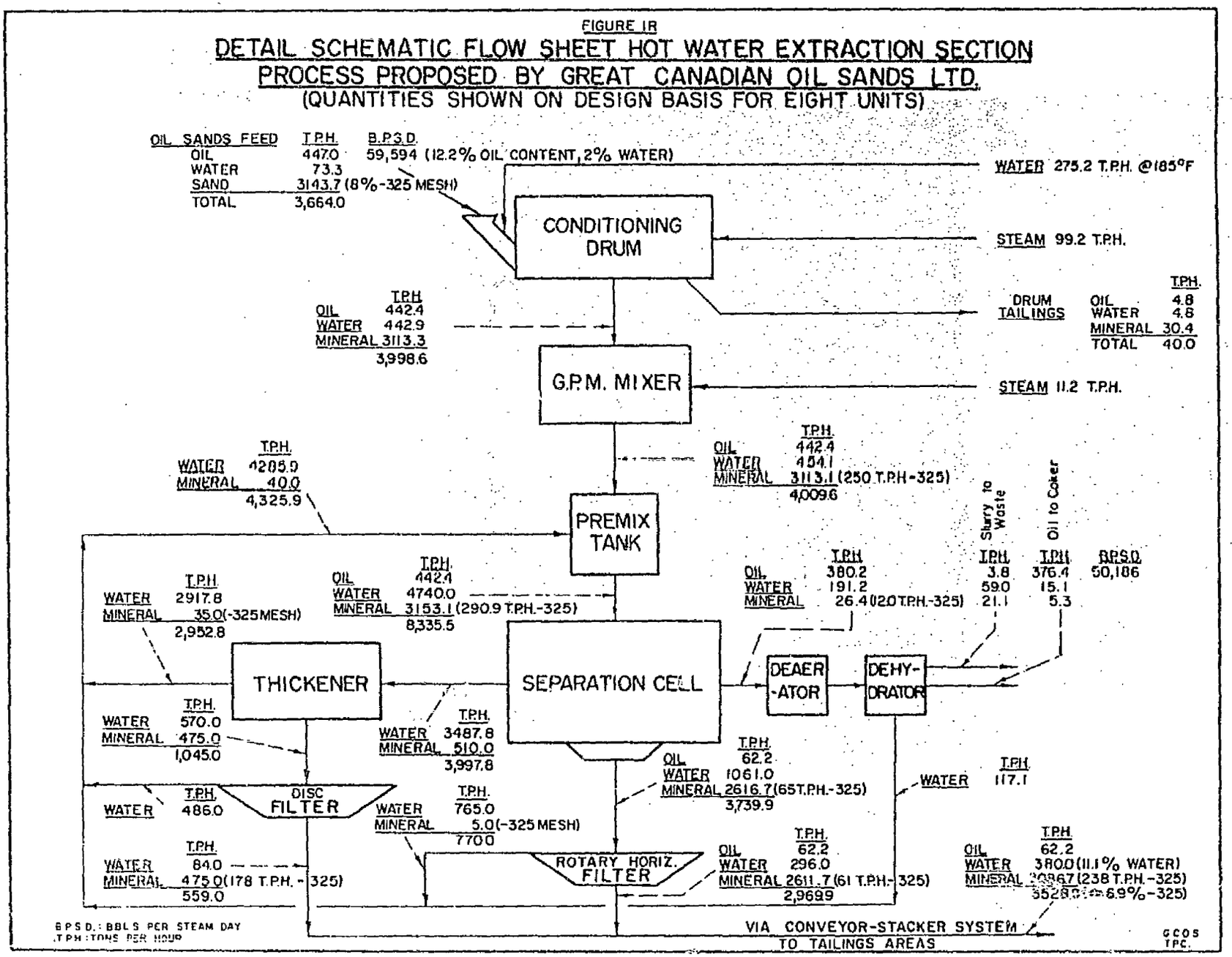


FIGURE I

OIL AND GAS CONSERVATION BOARD

(REPRODUCTION OF EXHIBIT T FILED AT THE HEARING COMMENCING JUNE 6, 1962)

the separated oil (reduction of viscosity, improvement of gravity and removal of sulphur). The refining processes proposed have not been changed, but the operating pressure of the gas-oil and kerosene hydrogenation operation has been increased from 800 pounds per square inch to 1500 pounds per square inch, thus improving the quality of the product and requiring an increase in the size of the hydrogen unit from 31 to 58.8 million cubic feet per day.

4. Waste Disposal

(a) Solid Wastes

(i) Mining Wastes.

No new methods were proposed for disposal of overburden and rejected low oil content material.

(ii) Tailings.

In the revised proposal the hydraulic system for handling solid wastes has been abandoned in favour of a belt conveyor system. The two major solid waste streams, from the rotary horizontal filters and the disc filters, would consist of dewatered sand and clay. These would be moved on 10,600 feet of 54 inch wide belt conveyors, to a stacker located on the river flats south of the plant. It is anticipated by the applicant that when stacked with a slope of 30 degrees from the horizontal, the dewatered sand would form a stable pile with a "factor of safety against a slide failure of about three". With some compaction of the pile or the use of matting, the sand disposal equipment would be able to move over the tailings piles. After a

period of approximately five years the conveyor system and stacker would be moved to return the sand tailings to the mined out area.

(iii) Coke.

Coke not used for fuel in the plant would be moved by conveyor belts and a stacker to stock piles adjacent to the plant site.

(b) Water Wastes

No changes were proposed for disposal of water waste. The applicant has confirmed that it will meet with and satisfy any requirements of the Department of Public Health with regard to any fluid waste entering the Athabasca River.

(c) Gaseous Wastes

It is now proposed to recover 240 tons per day of elemental sulphur, rather than incinerate the hydrogen sulphide recovered in the processing. The remaining sulphur, that not recovered in the sulphur plant (and that contained in the coke burned in the power plant), would be dispersed to the atmosphere from the top of a 300-foot high incinerator stack. Expected ground level concentrations of hydrogen sulphide and sulphur dioxide are nil and 0.25 parts per million respectively.

5. Pipe Line Transportation of the Synthetic Crude Oil to Edmonton

No changes were made to the original proposal for a 16-inch diameter, 290-mile line from the plant site to Edmonton.

The estimated initial capacity would be 36,000 barrels of synthetic crude oil per day without any intermediate pumping stations.

6. Marketing of the Synthetic Crude Oil

A new draft agreement has been agreed upon in general terms by Great Canadian, Sun Oil Company, Abasand Oils Limited and Canadian Oil Companies Limited. The contracted average daily delivery of synthetic crude oil at Edmonton remains unchanged, 23,700 barrels to Sun and 7,800 barrels to Canadian Oil, but a new formula has been introduced to determine the price of the synthetic crude oil.

The basis of the new formula is the selection of a conventional crude oil or crude oil mixture which could be delivered and which would result in the most favourable profit margin to Sun Oil Company. This crude oil is termed the "base price crude". The quantity of synthetic crude oil which would supply the same amount of gasoline is determined and refinery costs for running both crudes are calculated. The price of the synthetic crude oil would then be established as that which would result in Sun Oil Company receiving a 20 cent per barrel advantage after operating cost as compared with the base price crude. The applicant estimates that this will result in a price at Edmonton of $2.713 per barrel. (This estimate was made prior to the $0.10 per barrel general increase in Alberta crude oil prices of May 10, 1962.)

This formula would be in effect for two years of sales, with the price adjusted according to the formula each six months. After the initial two-year period the method would be re-examined and a new five-year agreement adopted which would satisfy the objective of maintaining the 20 cent per barrel advantage to Sun's Sarnia refinery.

6a. Marketing of By-Products

Both sulphur and coke would be stockpiled at the plant site. No agreements have been entered into for the sale of either by-product, but estimates of potential sale prices were presented and the applicant expressed optimism concerning their future marketing. A sulphur price of $10.00 per ton and a coke price of $6.00 per ton, both being net prices to Great Canadian with all handling and transportation charges to the account of the purchaser, were used by the applicant in some economic projections.

7. Method of Financing

The applicant proposes that its revised capital requirements totalling $124,340,000 would be raised by sale of first mortgage bonds, debentures with common shares as a "package", and common shares. Fry and Company, who would be responsible for completing financing arrangements, estimates the financing cost to be of the order of one per cent. First mortgage bonds would be placed primarily with institutional investors, and the debentures and common share package with "sophisticated investors". The remain-

ing common shares would likely be placed with Canadian Pacific Oil and Gas, Sun and Canadian Oil Companies, who, under the terms of the agreements, could eventually control Great Canadian.

On November 20, 1961, Great Canadian and Canadian Pacific Oil and Gas Limited signed an agreement permitting Canadian Pacific to purchase up to 51 per cent of the common shares of Great Canadian. The agreement was in the form of four options with each successive option being contingent on the degree of participation elected in the preceding one.

Canadian Pacific has exercised its full rights under the first option and has purchased 39,999 shares at $2.25 per share. Sun Oil Company and Canadian Oil Companies have each acquired 13,333 shares from Canadian Pacific. The second option to Canadian Pacific does not expire until January 1, 1963, or 30 days after the Board approves the Great Canadian application, whichever is the earlier.

8. Impact on Conventional Market

The applicant stated that approval of the application at this time would enable production to start late in 1965 with full production by mid-1966. A report submitted by McDaniel Consultants Ltd. on behalf of Great Canadian suggests that by 1968 the life index for Alberta's conventional crude oil reserves will have declined to about 15 years. Mr. McDaniel postulated that the market demand

would then level out at 635,000 barrels per day, because no further pipe line capacity would be constructed. Should this be the case, Mr. McDaniel stated, then production of 31,500 barrels per day of synthetic crude oil, which presumably would warrant expansion of pipe line capacity, could be marketed without any real reduction of the market which would otherwise have been available to conventionally produced Alberta crude oil.

III. APPRAISAL OF THE AMENDED PROPOSAL

1. Recovery and Conservation

(a) Oil Sands:

The Board remains satisfied with the recovery proposed by the applicant of oil in the sands actually to be processed, but is concerned with the present proposal concerning the rejection of mined sands containing less than ten weight per cent oil. The Board believes that the maximum practical amount of the mined sand should be subject to processing. This amount will have to be determined by experience.

(b) By-Products:

The Board believes that the applicant's proposal to stockpile the coke produced in excess of the fuel requirements is satisfactory.

The Board considers the applicant's proposal for a sulphur recovery plant to be highly desirable as a conservation measure and necessary from an air pollution standpoint.

2. Technical Feasibility

During the hearing of the application, the interveners, the Board staff and the Board raised questions concerning the technical feasibility of certain phases of the proposed amended process. These matters are discussed in the following.

(a) Mining and Conveying:

Representatives for Cities Service Athabasca, Inc. stated that extensive field tests run in conjunction with manufacturers of mining wheels have convinced Cities Service that it is feasible to use a mining wheel to mine the sand. Consulting Engineer Dr. R. M. Hardy, who was retained by Cities Service, stated that tests conducted at Mildred Lake indicated a general reduction of shearing strength of the oil sands with depth. He expressed the opinion that the reduction of strength is caused by escape of gas upon the release of stress. He concluded that additional information on the effect of stress release on shearing strength is necessary before the stability of benches and slopes could properly be evaluated for design purposes.

Mr. G. Reynolds of Dames & Moore, a consulting engineer appearing for Great Canadian, replied in rebuttal to Dr. Hardy's testimony that their tests indicated there would be no stability problem even at depths of 240 feet. He contended that there may be some sloughing at the face where the oil sands had been cut but the failure of a large mass would be unlikely.

The Board recognizes that there are some uncertainties concerning shearing and bearing strength of the oil sands but still believes that the equipment and method of mining can be designed to overcome this problem.

Representatives of Cities Service reiterated the stand taken at the previous hearing that rock is present in the oil sands and is a complicating factor in the mining and conveying processes.

Dr. K. A. Clark, appearing for Great Canadian, contended that the oil sands on Lease No. 4 are of excellent quality and will not create any problems which cannot easily be overcome. His testimony was illustrated by a peg model which showed various strata in the oil sands on Lease No. 4 and on a part of Lease No. 17.

The Board believes that the oil sands on Lease No. 4 are of exceptional quality and can be mined without causing an interruption in the feed to the plant.

The applicant, in response to questioning by the interveners and the Board's staff, stated that the two digging machines will provide ample flexibility to mine the oil sands selectively. Thick lenses of clay and large deposits of lean sands would be eliminated from the plant feed by selective rejection at a transfer conveyor station.

The Board foresees that such a method will not provide for the rejection of some of the smaller seams of clay and that retaining them in the feed to the separation plant will have a detrimental effect on the extraction process.

(b) Oil Sands Processing:

Mr. A. F. Frame, President of Cities Service Athabasca, Inc., maintained that the oil sands contain appreciable

quantities of rock and that the applicant has made no provisions for the removal of lumps or rocks smaller than one inch in size from the conditioning drums. He contended that these rocks would eventually find their way to the horizontal filters where they would tear the filter cloth rendering the filters inoperative.

The Board feels that this is not a serious problem and that the rocks could be removed by the installation of appropriate screening equipment.

Commenting on the fines present in the oil sands, Mr. Frame stated that Great Canadian did not take into account the fines in the interspersed clay seams. Cities Service's interpretation of the analyses of the Federal Government cores shows that there are extensive areas in the first five-year mining area where the material to be mined will contain substantially more than 16 per cent fines. The capacity of the thickener, disc filters and horizontal filters would have to be considerably increased to handle the increased concentration of fines. Mr. Frame was of the opinion that the horizontal filters would blind and be inadequate. He also contended that build up of fines in the recycle water would adversely affect the yield of oil in the extraction system. Mr. Eugene S. Allen, Chief Project Engineer for Utah Construction & Mining Co., called by Cities Service, testified that his experience with thickeners indicated that the thickener size should be four times as large as proposed for the Great Canadian plant by Dorr-Oliver-Long.

Dr. K. A. Clark contended that there would not be a serious build-up of fines in the system. Instead, the concentration of fines would reach an equilibrium value which would have little effect in the yield. He indicated that the earlier plants at Clearwater and Bitumount employed essentially the same extraction process as that proposed by Great Canadian and that the accumulation of fines was never a serious problem. He further stated that there is a correlation between fines content and oil content which applies to the oil sand deposit as a whole. His evidence was that the correlation indicated that the average oil sand to be processed by Great Canadian would contain approximately 13.4 per cent oil and 8 per cent fines. (The Board's interpretation of Dr. Clark's correlations suggests that 13.4 per cent material would contain approximately 10 per cent fines.) Dr. Clark's correlation, however, did not take account of the fines present in the clay seams excluded by the Federal Government.

The Board staff has carried out detailed calculations of the fines content of the material in the first and the probable second five-year mining areas taking into account the fines present in the oil sands and in the interspersed clay seams. This study shows that the fines concentrations in the first and the probable second five-year mining areas are some 9-10 per cent and 14-15 per cent respectively.

The Board requested the applicant to clarify several points raised at the hearing concerning the thickeners and filters proposed to be supplied by Dorr-Oliver-Long. On July 20, 1962, the Board received a letter from Mr. T. P. Clarke and a letter from Dorr-Oliver-Long discussing the basis for the design of this equipment. The applicant supplied copies of this correspondence to the interveners. The Board then received a letter dated August 7, 1962, from Mr. Lee Haugen of Cities Service commenting on the new evidence submitted by the applicant.

As a result of its own analyses and the further information submitted by letter, the Board believes that the applicant has seriously underestimated the magnitude of the problem associated with the fines in the oil sands. The Board recognizes, however, that this problem can likely be overcome during the finalization of engineering design and through the addition of appropriate equipment.

Mr. A. P. Frame testified that electrostatic dehydrators tested by Cities Service in conjunction with Howe-Baker did not operate satisfactorily. Equilibrium conditions could not be achieved and the underflow contained a large amount of oil. He stated that the performance of this equipment should be satisfactorily demonstrated on a continuous basis using froth from a continuous extraction pilot plant before the Howe-Baker guarantee could be considered valid.

Since the hearing, Howe-Baker, after being confronted with the Cities Service contention, has stated: "Regarding our previous proposal to G.C.O.S., we have no reason to believe at this time that any changes would be required."

The Board originally accepted the views of Howe-Baker but in the light of the experience of Cities Service, is less satisfied that the dehydrators will function as proposed. The Board believes that further development will be required in conjunction with final design of the equipment for the solution of this problem.

(c) Waste Disposal:

Dr. R. M. Hardy stated that disposing of the sand tailings as proposed by Great Canadian in the initial disposal area would constitute a public hazard in the use of the river for navigation and a hazard to operators in Lease No. 17. He estimated that as much as 10 million cubic yards of sand could suddenly move into the Athabasca River when the toe of the sand tailings pile is inundated by the river at high water. Surface erosion could wash about half a million cubic yards into the river and might also be a problem when the sand tailings are deposited in the mined out area.

In rebuttal to Dr. Hardy's testimony, Mr. G. Reynolds stated that the tailings pile would be stable and that a disastrous slide would not occur under the circumstances outlined by Dr. Hardy. He agreed there would be some surface erosion but stated that it could be satisfactorily

handled by constructing a dam with material cleared from the tailings pile site. Mr. Reynolds stated that the sand tailings would be quite permeable and that much of the rainfall would penetrate through the tailings pile rather than cause erosion.

The Board recognizes that the toe of the sand tailings pile could become inundated during periods of high water, and that a hazard could develop. The Board believes, however, that a careful reconsideration of the limits of the disposal area and of the need for diking, compacting, the use of rip rap or the use of stabilizers as previously suggested by the applicant would prevent any of these problems arising.

With respect to the disposal of sulphur wastes, the Board staff in conjunction with the Department of Public Health has carried out stack height calculations based on the preliminary data available. These studies show that the ground level concentration of sulphur dioxide should be within acceptable limits. These findings should be confirmed when final details are available.

With respect to the disposal of liquid wastes, the Department of Public Health and the Board believe that the method of disposing of liquid wastes appears adequate, but final approval from the Department of Public Health will be necessary.

3. Economic Feasibility

In Tables 1 and 2 the Board has outlined the data and economic appraisals presented by the applicant at the 1960 and 1962 hearings, together with the Board's appraisal of the economics of the proposal. The applicant has presented twelve cases, the most conservative of which is Case 1b involving the sale of 11,500,000 barrels per year of synthetic crude oil at $2.713 per barrel and assuming no sale of sulphur or coke. Table 1 shows the capital requirement breakdown and Table 2 presents the financial structure and the expected income and operating costs which have been used in a cash flow analysis to predict the payout period for the project.

(a) Capital Requirement Breakdown:

As indicated in Table 1, the applicant has shown, since the 1960 hearing, an increase in the capital required from $100,700,000 to $109,856,000. This increase includes $4,500,000 to modify the refining section to produce a higher quality product, $528,000 to change the tailings and recirculating water processing systems, $1,000,000 for the construction of a sulphur recovery plant and $3,125,000 for new equipment to convey and stack the tailings in the initial disposal area. The applicant submitted letters from the major contractors to show that the Mannix Co. Ltd.'s estimate for the pipe line, bridge and road, and Link-Belt's proposal for the mining and conveying units had not changed since the last hearing, and that Canadian Kellogg's estimated costs for the power station, tankage, extraction and refining sections

would not be significantly changed. On the basis of these letters the applicant concluded that it was not necessary to make any allowance for escalation of plant costs. The Board agrees that economic conditions do not seem to indicate any appreciable plant cost escalation at the present time.

In its own analysis of the capital requirements, the Board has added to the capital requirement the sum of $83,000 which the applicant indicated to be the extra cost of using bigger disc filters than originally proposed. A contingency fund of one per cent of the total capital requirement also has been added because the Board believes that further revision to the plant will be necessary to improve such processes as the removal of fines, the dehydration of the raw oil, and the diking and compaction of the initial tailings pile.

In the revised application, the amount of working capital has been increased from $11,434,000 to $13,227,000, due mostly to an increase in the interest payments during the construction period.

The applicants also has included a cost of $1,237,000 for payment of financing charges which represents a cost of one per cent of the total cash requirement. In its previous report, the Board estimated these charges as $5,000,000, but acknowledges that under present circumstances this estimate would be too high. On the other hand, the Board believes that the one per cent financing charge estimated by the applicant represents a minimum and has included in its appraisal the sum of $2,000,000 or 1½ per cent for this expense.

A contingency item of 5 per cent of the working capital, excluding interest charges, also has been provided in the Board's analysis.

The Board has used 6½ per cent as the interest rate and has assumed, as in its previous report, that a six-month start-up period after plant completion would be realistic. It has assumed that the plant would produce at half capacity during the last three months of this period and has credited the operation with the income from production in excess of that required for pipe line fill.

(b) Economic Analysis:

(i) Financial Structure -

As indicated in Table 2, the applicant proposes that of the total capital requirements of some $124,000,000, approximately 16.1 per cent or $20,000,000 would be raised by the sale of equity shares. The Board has used the same ratio in its analysis.

The applicant explained that there was a likelihood of a considerable sum being raised from Canadian Pacific Oil and Gas Limited, Sun Oil Company and Canadian Oil Companies who have acquired 39,999 shares of Great Canadian stock under part of a stock purchase option. The Board believes that its observations in the initial report regarding the high ratio of debt to equity still are valid, although the participation by Canadian Pacific Oil and Gas, Sun Oil and Canadian Oil would make financing easier.

GREAT CANADIAN OIL SANDS APPLICATION

TABLE I

CAPITAL REQUIREMENT BREAKDOWN

	G.C.O.S. 1960	Board 1960	Case 1B G.C.O.S. 1962	Board 1962
CAPITAL REQUIREMENT				
Pipe line, bridge and road	26,000,000	26,000,000	26,000,000	26,000,000
Power station, tankage, etc.	20,700,000	20,700,000	20,700,000	20,700,000
Mining, conveying, extraction and refining	54,000,000	54,000,000	54,000,000	54,000,000
Sand tailings disposal		2,500,000	3,125,000	3,125,000
Sulphur recovery plant		2,000,000	1,000,000	1,000,000
1962 modifications			5,031,000	5,114,000
Escalation		3,021,000 (3%)		
Contingency		2,014,000 (2%)		1,100,000
TOTAL CAPITAL	100,700,000	110,235,000	109,856,000	111,039,000
WORKING CAPITAL				
Site	12,000	12,000	12,000	12,000
Initial inventories	1,720,000	1,720,000	1,735,000	1,735,000
Start-up operating expenses (salaries only)	750,000	1,200,000	750,000	1,200,000
Training program	250,000	250,000	250,000	250,000
Insurance and pension	500,000	680,000	500,000	680,000
Interest during construction and start-up time	4,572,000 (6%)	6,894,000 (7%)	6,350,000 (6%)	6,845,000* (6½%)
Pipe line fill		550,000		
Working capital contingency (5% excluding interest charges)		448,000		395,000
Preproduction expenses	3,630,000	4,002,000	3,630,000	4,002,000
TOTAL WORKING CAPITAL	11,484,000	15,756,000	13,227,000	15,119,000
CASH REQUIREMENT				
Capital requirement	100,700,000	110,235,000	109,856,000	111,039,000
Working capital	11,434,000	15,756,000	13,227,000	15,119,000
Financing charges		5,000,000 (3.8%)	1,237,000 (1%)	2,000,000 (1½%)
TOTAL CASH REQUIREMENT	112,134,000	130,991,000	124,320,000	128,158,000

*Interest less revenue from 15,000 barrels per day production during additional three month start-up period.

GREAT CANADIAN OIL SANDS APPLICATION

TABLE 2

FINANCIAL STRUCTURE AND ECONOMIC ANALYSIS

		CASE 1A			CASE 1B		
		G.C.O.S. 1960	BOARD 1960		G.C.O.S. 1962	BOARD 1962	
FINANCIAL STRUCTURE							
EQUITY STOCK		20,408,000	23,840,000		20,000,000	20,700,000	
DEBT CAPITAL		91,726,000	107,151,000		104,940,000	107,450,000	
OPERATING COSTS							
PROJECT		8,082,000	8,082,000		8,137,000	8,137,000	
SULPHUR PLANT		---	250,000		---	---	
INCREMENTAL ROYALTY TO SUN		---	---		325,000	571,000	
ADDED COST OF 16 2/3% CROWN ROYALTY ON SYNTHETIC CRUDE OIL		---	---		---	3,874,000	
TAXES		---	---		---	500,000	
CONTINGENCY (10% OF COSTS)		---	557,000		500,000	557,000	
TOTAL OPERATING COSTS		8,082,000	8,889,000		8,962,000	13,639,000	
INTEREST FOR FIRST YEAR AFTER START-UP TIME		5,400,000	7,502,000		6,260,000	6,980,000	
TOTAL INTEREST AND OPERATING COSTS (FIRST YEAR)		13,482,000	16,391,000		15,222,000	20,619,000	
DEPRECIATION (FIRST YEAR)							
	TOTAL PLANT COSTS						
(A) PIPE LINE, BRIDGE AND ROAD	26,000,000	1,300,000 (5%)	2,451,000 (5%)		1,560,000 (6%)	1,300,000 (5%)	
(B) POWER STATION AND TANKAGE	20,700,000	1,035,000 (5%)			6,200,000 (30%)	2,070,000 (10%)	
(C) MINING, CONVEYING, EXTRACTION	26,200,000	5,400,000 (10%)	6,119,000 (10%)		7,850,800 (30%)	7,860,000 (30%)	
(D) REFINING AND SULPHUR PLANT	37,000,000				11,106,000 (30%)	7,400,000 (20%)	
(1) TOTAL DEPRECIATION AT MAXIMUM RATES		7,735,000	8,570,000		26,716,000	18,630,000	
GROSS INCOME PER YEAR AFTER START-UP TIME		30,300,000	30,046,000		31,200,000	31,600,000	
VALUE OF PRODUCT $/BBL.		2.637	2.6127		2.713	2.75	
INCOME TAX RATE		47%	50%		50%	50%	
YEAR AFTER START-UP TIME AT WHICH PAYOUT ACHIEVED (2)		5.4	7.7		5.8	7.9	

(1) TOTAL MAXIMUM DEPRECIATION ALLOWED IN THE FIRST YEAR UNDER DEPARTMENT OF NATIONAL REVENUE REGULATIONS.

(2) THIS PAYOUT PERIOD ASSUMES NO SALE OF SULPHUR OR COKE.

(ii) Operating Costs -

The applicant has shown an increase in the interest and operating costs for the first year after starting up from $13,482,000 to $15,220,000. The increase is comprised of $860,000 for the increased costs of servicing the higher initial debt, $55,000 for the operation of the sulphur plant, a $500,000 contingency item and $325,000 for the payment of an incremental royalty to Sun Oil Company, Abasand Oils and Canadian Oil. This royalty is required under the applicant's agreement with these companies and amounts to 25 per cent of the excess over $2.60 per barrel of the selling price at Edmonton of the synthetic crude oil. The Board agrees that this item, which was not included in previous estimates, should be included. The Board believes, however, that the applicant's interpretation of the royalty is not consistent with a strict reading of the agreement. The Board has used its own interpretation of the agreement for its appraisal, which, coupled with the higher selling price assumed by the Board of $2.75 per barrel, increases the amount of the incremental royalty to $571,000.

The applicant also indicated that it had been advised that a municipal tax of some $500,000 per year would be levied on the plant and pipe line, but did not include this in its estimates. The Board has added this item to the operating costs.

With respect to Crown royalty, the applicant has allowed for 10 per cent payable on the value of the bitumen

estimated to be $0.70 per barrel. The Board notes, however, that Lease No. 4 expires June 1, 1966, and that its renewal will be under the provisions of The Mines and Minerals Act, 1962, and the Bituminous Sands Regulations, 1962, made thereunder. The 1962 Act introduced amendments affecting both the definition of the products upon which the royalty is payable and, for the first term of any lease granted after the 31st day of August, 1956, the maximum rate of royalty. The Act provides for a royalty on each of the products derived from oil sands not to exceed 1/6 of the products and spells out that the products include any products derived from the oil sands. Within these provisions the actual royalty rate and the products to which it shall apply are matters to be prescribed by the Lieutenant Governor in Council.

The Board is advised that when Lease No. 4 is renewed the royalty will be no less than that which would apply to new leases which might be issued at the same time and for which the royalty would be 1/6 of the synthetic crude oil. Presumably the synthetic crude oil would be valued at its selling price in Edmonton less transporation costs from the plant. Depending upon the manner in which depreciation, interest and other charges are handled, the Board estimates the transportation costs by the proposed Great Canadian pipe line to be in the range of 15 to 20 cents per barrel. Taking an arbitrary figure of 17½ cents per barrel and the Board's estimate of the value of the

synthetic crude oil in Edmonton of $2.75 per barrel, a value of the synthetic crude oil at the plant of $2.575 results. Accordingly, the Board has carried out its own economic evaluation on the basis of a royalty payment of 1/6 of $2.575 on each barrel of synthetic crude oil to be produced.

(iii) Income -

The applicant uses two possible prices for the value of the synthetic crude oil at Edmonton, $2.713 and $2.9067 per barrel. These values are based on various comparisons between the synthetic crude oil and Leduc crude oil at Edmonton. The Board has considered the problem of pricing the synthetic crude oil and concludes that $2.75 per barrel is a reasonable price for estimating the economic feasibility of the project.

The Board does not believe that it is yet possible to assign any income from the sale of sulphur or coke. Sales may well be possible in the future, however.

(iv) Depreciation -

The applicant has assumed maximum depreciation rates to be 6 per cent for the pipe line, bridge and road, and 30 per cent for the rest of the plant and equipment. Information available to the Board indicates that lower rates may apply to the power station and tankage (10 per cent) and to the sulphur plant and refining sections (20 per cent). The Board has used these rates in its analysis. (If the higher rates are found to be applicable, the payout

time would be reduced in the Board's calculation by about 0.2 years.)

(v) Evaluation -

The payout period calculated by the applicant is 5.8 years based on the sale of 11,500,000 barrels per year of synthetic crude oil at a price of $2.713 per barrel, with no income realized from the sale of sulphur or coke. The most favourable of the other economic projections submitted by the applicant, which included the sale of sulphur and coke, and the sale of 14,050,000 barrels per year of synthetic crude oil (an increase of 2,550,000 barrels above the amount applied for), at a price of $2.9067 per barrel, indicated a payout of 3.6 years.

The Board's projection was made assuming the sale of 11,500,000 barrels per year of synthetic crude oil at a price of $2.75 per barrel with no income realized from the sale of sulphur or coke. The payout period is indicated to be 7.9 years on this basis.

Mr. J. D. Wilkins, a director of Great Canadian, a partner of Fry & Company Limited, and the financial witness for Great Canadian, stated that a payout of about 6 years would not be an impediment to the financing of the project. A payout period approaching 8 years, as indicated above, suggests to the Board that there could be serious difficulties in financing. The applicant contended that the active participation of Canadian Pacific Oil and Gas, Sun Oil and Canadian Oil "advance the prospects of Great Canadian....

from a financing point of view" and "we have no more problems with regard to financing". Such participation might offset the difficulties suggested by the estimated longer payout period.

4. Impact on the Market

The Board received two submissions concerning the impact of the Great Canadian proposal on the market for conventional crude oil. The first of these, a study made by McDaniel Consultants Ltd., was filed by the applicant and presented in direct evidence by R. R. McDaniel. The second was made by Dome Petroleum Limited, and was presented by C. S. Dunkley, Vice-President of that company. Concurrently, and during its consideration of the application, the Board reviewed its own forecasts of conventional crude oil reserves, capacity and production.

The historical data and the forecasts of virgin recoverable and remaining recoverable crude oil reserves, productive capacity, and demand made by Dome, McDaniel and the Board are summarized in comparative graphs shown in Figures 2 and 3. All of the forecasts assume no production from the oil sands. It will be noted that there is considerable variation in the forecasts, especially beyond 1965.

The Board's forecasts show that virgin reserves will approximate some 7.3 billion barrels by 1970, at which time the remaining reserves will total 4.1 billion barrels, productive capacity 1,240,000 barrels per day, and demand for crude oil will reach 700,000 barrels per day. Extension of the Board's estimates to 1975, about ten years after the proposed commencement date of

oil sand production, was made on the basis that virgin reserves, productive capacity and demand are expected to follow trends similar to those of the prior ten years. In each of the forecasts condensate and heavy crude oil have been accounted for and excluded.

Reserves were forecast by the Board taking account of historical trends, a geological estimate of ultimate virgin recoverable reserves, the trends in wildcat drilling and various exploration and development incentives.

The forecast of productive capacity resulted from the anticipated rate of depletion of existing pools and from applying to future reserves the historical trend in the ratio of capacity to remaining reserves. A similar method was used for estimating the future level of the economic allowance, with account also being taken of increasing average well depth and the trend to wider well spacing.

Prediction of the demand for Alberta crude oil was based on a composite of anticipated growth in the Canadian and export markets. Alberta, considered a residual supply area, is expected to produce the deficiency between total demand for Canadian-produced oil and production from other Canadian provinces.

In the McDaniel study two cases are presented, referred to as Case "A" and Case "B". While presenting the McDaniel report, Mr. McDaniel stated in oral testimony that, of the two cases presented, he judged Case B to best represent his views. McDaniel concluded that should the market demand level off in accordance with his forecast Case B then "it would be possible

to market the proposed volumes of light gravity oil from the Tar Sands without infringing on the markets" for conventional crude oil production in Alberta. Dome Petroleum Limited, was the only intervener to present views in conflict with the McDaniel conclusions, although the Cities Service group indicated in cross examination that it disagreed as to certain details with the results obtained. The Board is inclined to give little weight to the McDaniel forecast, for two reasons. First, the basis of forecasting both productive capacity and reserves is arbitrary and the two appear inconsistent with one another. Secondly, the McDaniel thesis that a pipe line to a major remote market cannot be justified with a fifteen-year supply of oil and about 500,000 barrels per day of shut-in capacity does not seem reasonable when considered in the light of recent experience in Western Canada and the United States.

Dome Petroleum Limited opposed the application on the ground that there is no foreseeable need for the development of a crude oil source in the oil sands. It contended that experience has shown that more than adequate crude oil reserves and producing capacity can be maintained by conventional crude oil well drilling. The Dome forecast was in two parts presented graphically as Cases I and II and described as "conservative" and "realistic", respectively.

With respect to remaining recoverable reserves, Dome's Case II suggests a growth well above that of the Board (5.0 billion barrels in 1970 versus 4.1 billion barrels) while its Case I closely approximates the Board's by 1970, the final year

of the Dome forecast. The Dome forecast of productive capacity, Case II, lies well above the Board's, while its Case I is well below. Dome submitted only one forecast of market demand. It shows a rapid growth from 1967 to 1970, reaching 870,000 barrels per day as compared with the Board's 700,000 for the same year. The Board considers the demand estimate in the Dome submission to be overly optimistic when viewed in the light of the present import policy of the United States, and the prospects for future oil development in British Columbia, the Northwest Territories, and the Yukon.

After having assessed the forecasts submitted by Great Canadian and Dome, it appears to the Board that its own independent reserve and market forecasts provide a reasonable compromise in most respects of the divergent views of the others. The Board has therefore concluded that there is no good reason to alter its own forecast and has adopted it for the purpose of this report.

A comparison between the Board's present and its previous assessment of the impact of the proposed Great Canadian production on the market for conventional crude oil is given in Table 3.

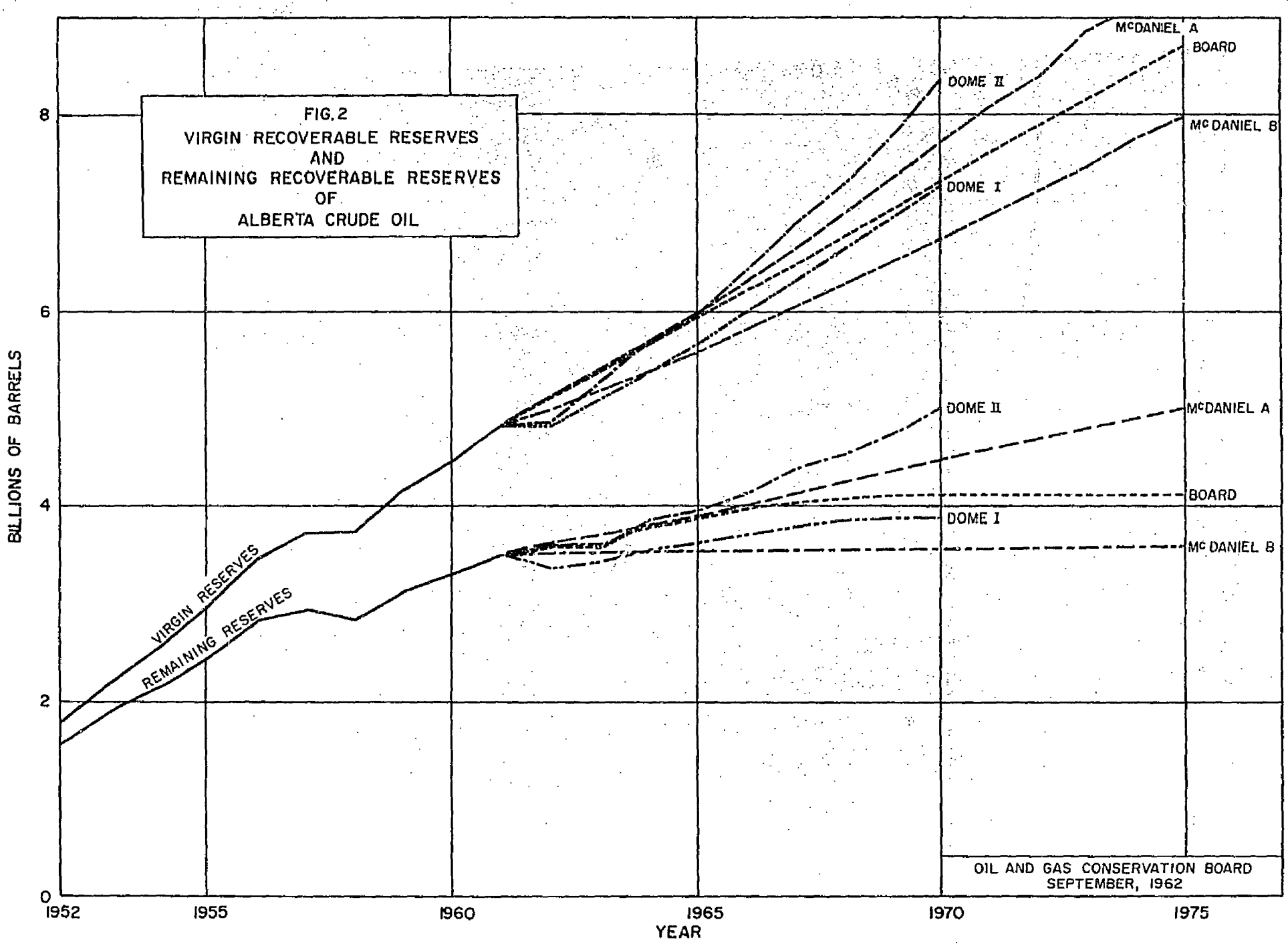


FIG. 2
VIRGIN RECOVERABLE RESERVES
AND
REMAINING RECOVERABLE RESERVES
OF
ALBERTA CRUDE OIL
McDANIEL A
BOARD
DOME II
McDANIEL B
DOME I
DOME II
McDANIEL A
BOARD
DOME I
McDANIEL B
VIRGIN RESERVES
REMAINING RESERVES
BILLIONS OF BARRELS
0
2
4
6
8
1952
1955
1960
1965
1970
1975
YEAR
OIL AND GAS CONSERVATION BOARD
SEPTEMBER, 1962

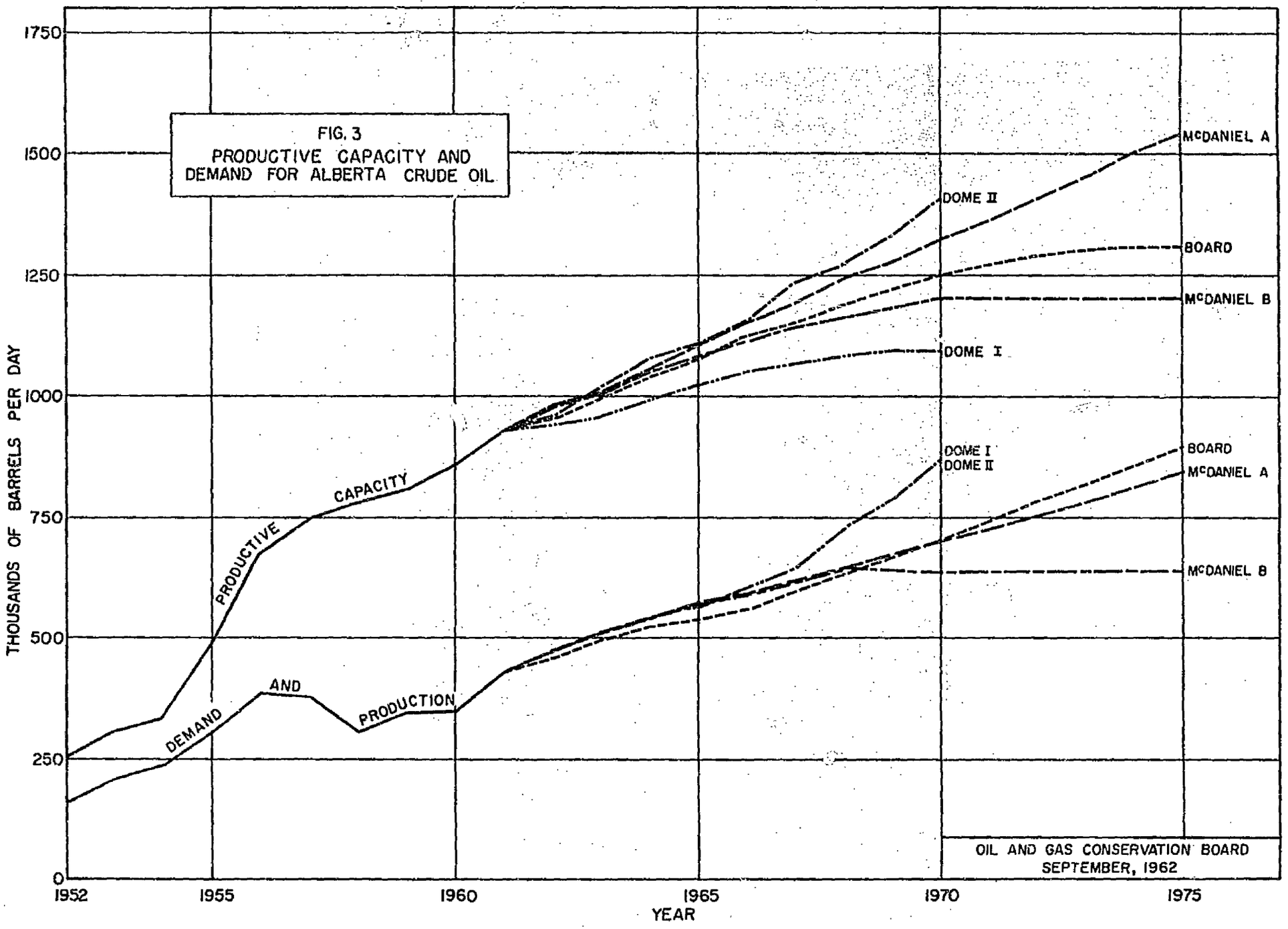


FIG. 3
PRODUCTIVE CAPACITY AND
DEMAND FOR ALBERTA CRUDE OIL
THOUSANDS OF BARRELS PER DAY
YEAR
1750
1500
1250
1000
750
500
250
0
1952
1955
1960
1965
1970
1975
McDANIEL A
DOME II
BOARD
McDANIEL B
DOME I
DOME I
DOME II
BOARD
McDANIEL A
McDANIEL B
CAPACITY
PRODUCTIVE
DEMAND
AND
PRODUCTION
OIL AND GAS CONSERVATION BOARD
SEPTEMBER, 1962

TABLE 3

ESTIMATED EFFECT OF THE GREAT CANADIAN OIL SANDS LIMITED PROPOSAL
ON THE TOTAL AND PRORATABLE MARKET FOR CONVENTIONALLY
PRODUCED ALBERTA CRUDE OIL

Operating Year	Previous Report (1) Year	Total Market Bbls/D	Proratable Market Bbls/D	Per Cent Effect On Total Market	Per Cent Effect On Proratable Market	Present Report (2) Year	Total Market Bbls/D	Proratable Market Bbls/D	Per Cent Effect On Total Market	Per Cent Effect On Proratable Market
First	1963	455,000	85,000	5.5	29.6	1966	559,000	180,000	5.6	17.5
Second	1964	490,000	95,000	5.1	26.6	1967	592,000	193,000	5.3	16.3
Third	1965	580,000	120,000	4.7	21.0	1968	629,000	218,000	5.0	14.4
Fifth	-	-	-	-	-	1970	703,000	263,000	4.5	12.0
Tenth	-	-	-	-	-	1975	896,000	419,000	3.5	7.5

(1) Assumes 25,000 barrels per day impact on Alberta.

(2) Assumes 31,500 barrels per day impact on Alberta.

The table shows that the impact on the total market is actually slightly greater than previously forecast (because it is now assumed that the entire effect will be borne by Alberta). On the other hand the effect on the proratable share of the market is significantly less.

In addition to the direct effect on conventional crude oil production, the Board considers that there are three useful criteria which aid in assessing the impact of oil sands production on the conventional crude oil producing industry of the Province. These are the ratio of actual production to productive capacity, the life index (representing the number of years current reserves would support current production) and the proration allocation factor. The allocation factor is the fraction of the excess of productive capacity over the economic allowance which a well or pool is permitted to produce in addition to its economic allowance.

Like the other two criteria it is one measure of incentive for future oil exploration and development.

The historical trends for these three criteria, and the Board's forecasts of them derived from its forecasts of productive capacity and market demand, are presented in Figure 4. Also shown is the effect on each of the curves should 31,500 barrels per day of synthetic crude oil be placed on the market commencing in 1966. It is to be noted that in the absence of oil sand production, the ratio of production to productive capacity is expected to increase slowly from its present level of about 48 per cent to 50 per cent in 1966 and thereafter at an increasing rate, reaching some 69 per cent by 1975. The effect of 31,500 barrels per day of synthetic crude oil production on this ratio would be to decrease it to about 47 per cent in 1966 and 66 per cent in 1975.

The life index, currently some 22 years, is expected to fall to about 19 years by 1966 and thereafter to decline quite uniformly to some 12 years by 1975. The effect of the proposed production from the oil sands would be to increase the life index for conventional crude oil from the 19 years figure in 1966 to 21 years and the 12 years figure in 1975 to 13 years.

Referring to the trend in the allocation factor, the Board anticipates this factor will remain near its 1962 level of 0.20 until about 1966 and that it will increase quite rapidly thereafter, reaching a level of some 0.46 by 1975. The effect of the proposed oil sand production would be to decrease the factor in 1966 to about 0.18 and to decrease the factor in 1975 to about 0.41.

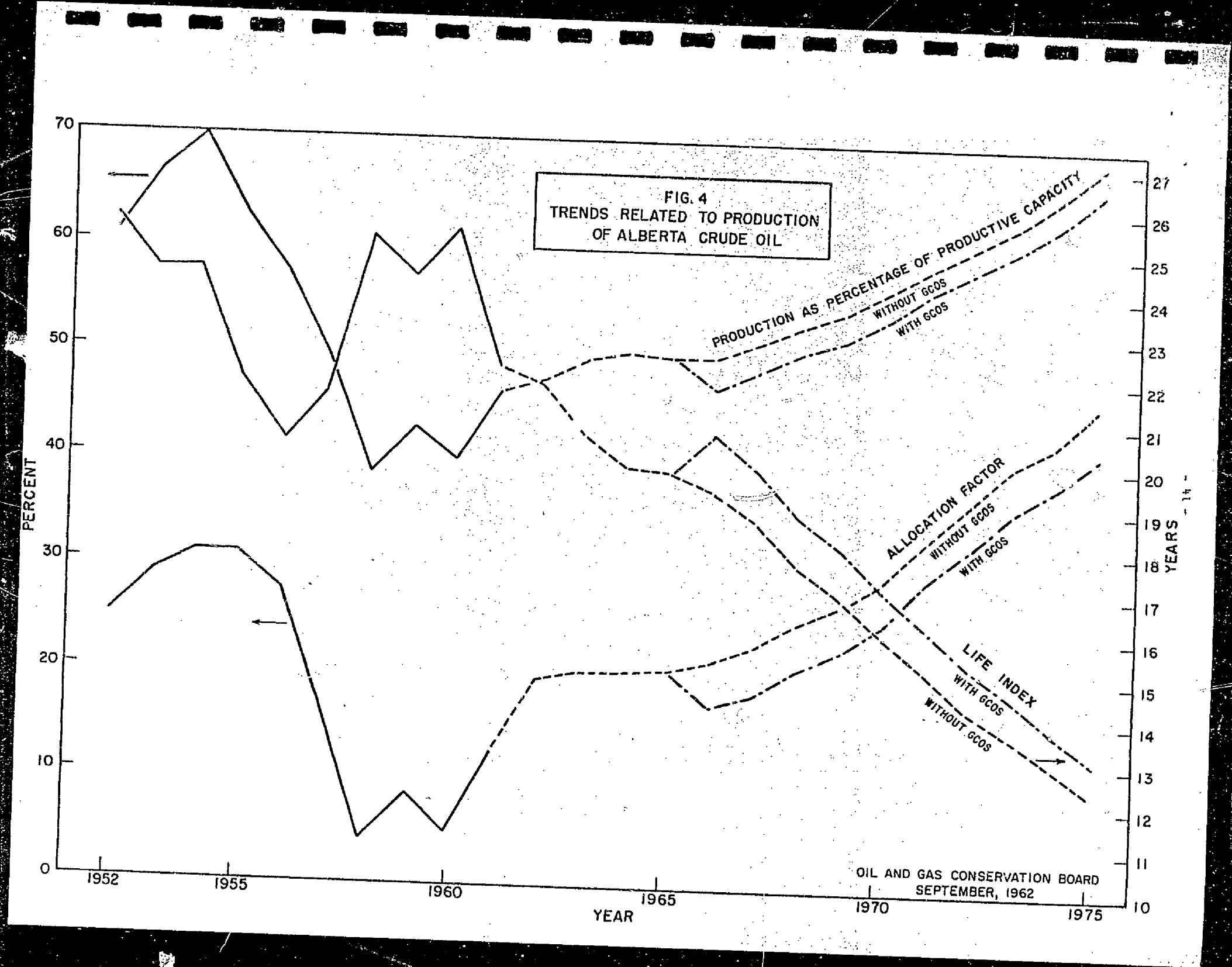


FIG. 4
TRENDS RELATED TO PRODUCTION
OF ALBERTA CRUDE OIL
PRODUCTION AS PERCENTAGE OF PRODUCTIVE CAPACITY
WITHOUT GCOS
WITH GCOS
ALLOCATION FACTOR
WITHOUT GCOS
WITH GCOS
LIFE INDEX
WITH GCOS
WITHOUT GCOS
PERCENT
YEARS
YEAR
70
60
50
40
30
20
10
0
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
1952
1955
1960
1965
1970
1975
OIL AND GAS CONSERVATION BOARD
SEPTEMBER, 1962

The Board believes it would not be in the public interest for the life index to fall to or below the level of 12 to 13 years which is predicted by the Board for 1975. This means, assuming the projection is reasonably good, that some supplement to conventional crude oil production appears desirable before 1975 and perhaps not later than 1970. The effect of the Great Canadian proposal on the life index, particularly after 1970, is in the desirable direction. In addition, the Board does not consider that the impact of the Great Canadian proposal on the market for conventionally produced Alberta crude oil, on the allocation factor, and on the ratio of actual production to productive capacity, sufficient to have any serious detrimental affect on the conventional crude oil industry.

All things considered the Board believes that the impact of the proposed production of oil from oil sands on the conventional crude oil producing industry is within the range which would be in the public interest.

IV. FINDINGS

The Board and its staff have reviewed the previous and the new evidence of the applicant and the interveners on the questions of

(a) conservation and recovery of the crude hydrocarbon present in the oil sands,

(b) disposition of waste products and atmospheric and water pollution,

(c) technical feasibility of the process,

(d) economic feasibility of the process, and

(e) impact on the market for conventionally produced crude oil.

As a result of these considerations, discussed in this and the previous report of the Board, the Board finds as follows:

(a) WITH RESPECT TO THE CONSERVATION AND RECOVERY ASPECTS OF THE PROPOSAL

The present proposal of the applicant is for a sequence of mining, separating and refining operations which, subject to certain conditions related to the discarding of intermediate grade oil sands, would result in a satisfactory conservation and recovery of the crude hydrocarbon present in the oil sands.

(b) WITH RESPECT TO THE DISPOSITION OF WASTE PRODUCTS AND ATMOSPHERIC AND WATER POLLUTION

The applicant's scheme for the disposal of the liquid wastes and its amended scheme for the disposal of the solid wastes of the process appear satisfactory, subject in the

latter case to appropriate precautions being taken to insure stability of the tailings pile.

With respect to the disposition of separated sulphur compounds, the new proposal of the applicant for the recovery of elemental sulphur from the hydrogen sulphide generated in the refining operation and its original plan for the discharge of other sulphur bearing gases at height appear satisfactory.

(c) WITH RESPECT TO THE TECHNICAL FEASIBILITY OF THE PROPOSED PROCESS

Certain changes involving equipment modifications and additions have been made in the applicant's process. In the Board's opinion these have resulted in an improvement in the process. On the other hand, the Board still cannot consider the process as fully proven in a technical sense. In particular the Board believes that problems remain to be solved in connection with the removal of "fines" from the separation process water, the dehydration of the oil froth, and the integration of the various steps of the operation. The Board, however, continues in its view that a process should not have to be completely proven and final engineering designs completed before an applicant could be given approval under Part VIA of The Oil and Gas Conservation Act. The Board considers the revised process as proposed by Great Canadian to be sufficiently developed that process technicalities should not further stand in the way of Board or Government approval to proceed.

(d) WITH RESPECT TO THE ECONOMIC FEASIBILITY OF THE PROPOSAL

The Board has reassessed the economic feasibility of the process - again on the assumption that it is technically feasible. The applicant itself has indicated a substantial increase in total capital cost as compared with the original proposal and due largely to modifications proposed to overcome certain of the technical deficiencies earlier suggested by the Board. In addition, and somewhat related to this, are increases in operating costs. In the light of The Mines and Minerals Act, 1962, the Board believes that the Crown royalty will be at the rate of 1/6 on the value of the synthetic crude oil at the plant rather than at the rate of 1/10 on the value of the bitumen as assumed by the applicant. This results in a decrease in the net income from the proposal.

Offsetting these adverse factors to some extent, however, are a new arrangement with Sun Oil Company and Canadian Oil Companies Limited for the purchase of an upgraded synthetic crude oil and a general improvement in crude oil prices.

Largely because of the difference in Crown royalty assumed by the Board and by the applicant, the Board cannot fully agree with the applicant's assessment of the economic feasibility of the project. The Board believes the payout period will be between 7 and 8 years as compared with the applicant's estimate of 5 or 6 years. (Sale of coke or sulphur would decrease the period.) Even the longer payout period, however, considered along with the life of the project and the revenugs beyond the payout period may leave

the project within the range of economic feasibility. The Board still is uncertain as to the financibility of the project but agrees that the active participation of Canadian Pacific Oil and Gas and its associates would add to the prospects for financing. All things considered, the Board believes the revised proposal of Great Canadian to be sufficiently close to or within the range of being economically feasible and financible, that economic feasibility considerations should not prevent Board or Government approval.

(e) WITH RESPECT TO THE IMPACT ON THE MARKET FOR CONVENTIONALLY PRODUCED CRUDE OIL

The improved market outlook for Alberta crude oil since the last report has reduced the relative impact of the 31,500 barrels per day of synthetic crude oil proposed by the applicant. On the other hand, it now appears to the Board that all of the impact would fall on Alberta, whereas in its earlier report the Board stated that about 20 per cent of the reduction would be in production outside Alberta. In the first five years of the proposed operation (1966-1970), the Board estimates, there would be a decrease of some five per cent in the total market for conventionally produced Alberta crude oil and of fifteen per cent in the proratable demand. The former effect is quite similar to that estimated in the last report but the latter effect is substantially lower.

Consideration of the ratio of production to productive capacity and the allocation factor suggests that the impact of the Great Canadian project on conventional crude oil production would not be serious. Consideration of the trend in the life index makes it clear that at some time in the future production from the oil sands will be desirable or necessary to augment that obtained by conventional methods. While the Board does not believe that this need will be critical during the next ten years, it recognizes the desirability of a gradual build-up of production from the oil sands.

Having regard to all of these factors the Board believes that the impact on the conventional crude oil market is not sufficiently serious to warrant denial of the application.

(f) WITH RESPECT TO THAT PART OF THE APPLICATION DEALING WITH THE PIPE LINE

The Board has made reference to the pipe line proposed by the applicant in this and the previous report and has included the costs of the pipe line in its appraisal. The Board, however, has not given detailed consideration to the pipe line phase of the project since under the provisions of The Pipe Line Act, 1958, it would be subject to separate application for a permit under that Act.

(g) WITH RESPECT TO THE DISPOSITION OF THE APPLICATION

The Board believes it is in the interests of the Province that some commercial development of the oil sands take place in the near future and having considered the various aspects of the proposal believes the applicant should be given an opportunity to proceed.

Accordingly, therefore, subject to the approval of the Lieutenant Governor in Council, the Board is prepared to approve the scheme proposed in the application of Great Canadian Oil Sands Limited. The approval would be subject to certain terms and conditions as indicated in the form of approval attached as Appendix A.

Respectfully submitted,

G. W. Govier, P. Eng.,
Chairman.

A. F. Manyluk, P. Eng.,
Deputy Chairman.

V. Millard,
Member.

Dated at Calgary, Alberta,
this 19th day of September, 1962.

APPENDIX A

THE PROVINCE OF ALBERTA

THE OIL AND GAS CONSERVATION ACT

OIL AND GAS CONSERVATION BOARD

IN THE MATTER of a scheme of Great Canadian Oil Sands Limited for the recovery of oil or a crude hydrocarbon product from oil sands pursuant to the Oil and Gas Conservation Act, being chapter 63 of the Statutes of Alberta, 1957, and

APPROVAL NO.

WHEREAS Part VIA of The Oil and Gas Conservation Act, being chapter 63 of the Statutes of Alberta, 1957, provides, inter alia, that no scheme or operation for the recovery of oil or a crude hydrocarbon product from oil sands shall be proceeded with unless the Board upon application and by order, has approved the scheme or operation in accordance with the said Part VIA; and

WHEREAS the Oil and Gas Conservation Board, on June 8, 9 and 10 and July 7, 8 and 9, 1960, at a public hearing, heard an application by Great Canadian Oil Sands Limited (hereinafter called "Great Canadian") for approval of a scheme for the recovery of oil or crude hydrocarbon product from oil sands, and subsequently to the hearing and with the concurrence of the Lieutenant Governor in Council, decided to defer its final disposition of the application and to continue the application to June 30, 1962; and

WHEREAS the Board, on June 6, 7, 8 and July 3 and 5, 1962, at a public hearing heard the revised application by Great Canadian Oil Sands Limited for approval of the said scheme and it appears proper and desirable to the Board that the approval herein contained be granted.

THEREFORE, the Oil and Gas Conservation Board, pursuant to the provisions of The Oil and Gas Conservation Act, being chapter 63 of the Statutes of Alberta, 1957, and with the approval of the Lieutenant Governor in Council numbered O.C. dated , 1962, hereby orders as follows:

1. (1) The scheme of Great Canadian for the recovery of synthetic crude oil from oil sands, as such scheme is described in an application dated March 14, 1960, together with descriptive material accompanying or supporting the application, marked as exhibits at the said hearings, is approved, subject to the terms and conditions herein contained.

(2) Subclause (1) does not preclude alterations in design or equipment compatible with the outlines of the scheme and made for the better operation of the scheme.

2. This approval applies to the recovery of 11.500,000 barrels per year of synthetic crude oil.

3. Great Canadian shall satisfy the Board prior to September 30, 1963, that arrangements have been completed for financing the construction of the facilities required for the scheme.

4. Great Canadian shall satisfy the Board prior to January 1, 1964, that construction of the facilities required for the scheme has commenced.

5. Upon completion of the final engineering design of the facilities required for the scheme, and prior to September 30, 1966, Great Canadian shall file details of the design with the Board.

6. The effective commencement of the recovery operations pursuant to the scheme shall be on or before September 30, 1966, unless upon application by Great Canadian a later date is stipulated by the Board.

7. Great Canadian shall measure oil sands mined, oil sands processed and synthetic crude oil recovered by a method and in a manner satisfactory to the Board.

8. Great Canadian shall furnish to the Board, in such detail and at such times as may be set by the Board, monthly reports of the quantity and assay of oil sand mined and the quantity and disposition of all products recovered therefrom.

9. There shall be no flaring or waste of liquid hydrocarbons produced except in cases of emergency, unless authorized in writing by the Board.

10. Great Canadian shall carry out the mining operation to the satisfaction of the Board and in a manner that

(a) does not preclude or render more difficult the recovery of other oil sands recoverable by practical and reasonable operations,

(b) results in the mining of the practical maximum of all oil bearing material within the area being mined, and

(c) results in the processing for the recovery of oil of the practical maximum of all oil bearing material that is mined.

11. Great Canadian shall carry out the solids disposal operations to the satisfaction of the Board, on lands to be approved by the Board, and in a manner that insures the stability of any tailings piles.

12. Great Canadian shall dispose of any liquid wastes in a manner satisfactory to the Department of Public Health and the Board and in a manner that insures that no oily or contaminative materials flow over the land or into any body of water.

13. Great Canadian shall convert any gaseous sulphur compounds, not converted to elemental sulphur, to sulphur dioxide and shall discharge them from stacks satisfactory to the Department of Public Health and the Board.

14. This approval does not convey permission to construct or to operate a pipe line.

15. Great Canadian, in operations pursuant to the scheme, shall comply with the provisions of any applicable Act or regulation of the Province of Alberta now enacted or made, or that at any time hereafter may be enacted or made.

16. Where it appears to the Board that there has been a failure to comply with any term or condition of the approval, the Board may, in addition to any other remedy or proceeding to which it may resort, require the suspension of any operation carried on pursuant to the scheme.

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 1962.

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,
Chairman.

SUBMISSION

SUBMISSION RE
APPLICATION No. 780318
DATE OCT 31 1978

S. A. Cowtan
President

GREAT CANADIAN OIL SANDS LIMITED 2900 ALBERTA TELEPHONE TOWER, EDMONTON, ALBERTA T5J 1X2

October 27, 1978

E.R.C.B.
603 - 6 Ave. S.W.
Calgary, Alberta
T2P 0T4

Attention: Mr. Norman Strom

SUBJECT: Great Canadian Oil Sands E.R.C.B. approval No. 1944A and May 1978 application for expansion.

Dear Sir:

As requested by W. L. Oliver this letter outlines the more significant features of the revised application for the expansion that G.C.O.S. plan to submit in the near future. The expansion will be of lesser scope than previously planned and will consist of the following elements:

1.0 The mine will be equipped with a third BWE as previously proposed.

2.0 Extraction will be essentially the same as before except that the fifth line will be the same size as the existing lines and all lines will have improved recovery.

3.0 Final extraction will be reduced to addition of only one each Bird and Westphalia centrifuges.

4.0 The refinery will be debottlenecked rather than expanded by addition of parallel units. This will result in a delayed co-

ker comprized of 8 coke drums and a debottlenecked diluent recovery unit, fractionation section and gas plant. The amine unit and gas oil unifiner will be debottlenecked as well. The sulphur plant expansion will remain as previously proposed.

5.0 Only one gas oil tank is to be added.

6.0 Cooling water facility charges will be limited to upgrading the pumps.

7.0 The pipeline will be expanded to a lesser degree.

8.0 The utility plant will include a smaller but still gas fired boiler.

This expansion of lower capital investment, will yield an increment of approximately 12,000 BPCD synthetic crude oil as compared to the 15,000 BPCD previously envisaged.

Please note that we are still considering a Hydrovisbraker alternative and, depending on risk and economic factors, may follows this route.

We expect to be able to deliver a revised application to you in the week of November 6, 1978 but stand ready to discuss the proposal as soon as you receive this letter.

Very truly yours,

M. A. Supple

MS/dlt

cc: S. A. Cowtan
W. L. Oliver
H. M. Lewis

Exhibit 1 (pt. of)

S. A. COWTAN
President

GREAT CANADIAN OIL SANDS LIMITED 2900 ALBERTA TELEPHONE TOWER, EDMONTON, ALBERTA T5J 1X2

November 8, 1978

Mr. Norman Strom
Manager, Oil Sands Department
Energy Resources Conservation Board
603 - Sixth Avenue S.W.
Calgary, Alberta T2P 0T4

SUBMISSION RE
APPLICATION No. 780318
DATE NOV 10 1978

Dear Mr. Strom;

Re: Proposed GCOS Expansion Application 780318

Further to recent discussions with Mr. M.A. Supple and the writer, we are enclosing a revision to our Application of May, 1978 to make plant and equipment modifications necessary to achieve higher production rates under Approval No. 1944A issued in 1973 which permits production of 23,725,000 barrels of synthetic crude oil per year. This revision outlines the plant and equipment modifications as well as supplying much of the additional information requested in your letter of September 20, 1978.

You will note that the modifications to our Mining and Extraction Operations are almost the same as those outlined in our May, 1978 application but those in Upgrading and Utilities are considerably reduced in magnitude. The proposal modifications will result in increased production slightly lower than the May, 1978 proposed modifications; the resulting maximum annual production should be approximately 22,630,000 barrels and the average annual production should be approximately 20,841,000 barrels, but these volumes might be exceeded as a result of statistical availability of production systems.

Some of the additional information you requested in your letter of September 20, 1978 is not available at the present time and we are continuing work to develop it.

I have, at your suggestion, left three copies of this revision with Mr. John Defir of Alberta Environment. I trust this is satisfactory.

Yours truly,

W.L. Oliver, Vice-president
Corporate Affairs

WLO/tt

GREAT CANADIAN OIL SANDS LIMITED

REVISION OF MAY 1978

E.R.C.B. APPLICATION

NOVEMBER 1978

TABLE OF CONTENTS

SECTION

APPENDICES

APPENDIX A — LIST OF TABLES AND FIGURES

APPENDIX B — DRAWINGS

1. INTRODUCTION

Great Canadian Oil Sands Limited is the holder of E.R.C.B. Approval No. 1944A issued in 1973, permitting the production of 23,725,000 barrels of synthetic crude oil per year (65,000 barrels per calendar day).

Under Approval 1944A, permission is hereby requested to make the modifications to the existing plant necessary to increase production to a maximum of 22,630,000 barrels per year (which is an average of 62,000 barrels per day) with an average production of approximately 20,841,500 barrels per year (which is an average of 57,100 barrels per day). There is a possibility that the production will exceed this maximum production figure during years of high ore grade because of statistical availability and interaction of production systems.

The new expansion facilities will upgrade the crude bitumen to synthetic crude oil by a delayed coking process, similar to the present plant.

Proposed expansion areas are highlighted on site plan drawing # 55E-A-536.

...2/

2. EXPANSION DETAILS

2.1 MINING OPERATION

A 3-bench mining system will be adopted, requiring the purchase of a new bucketwheel and supporting conveyor system, similar to those in present use.

The tailings disposal system will be updated to accommodate the increase in tailings generation resulting from the increased mining rate.

Tailing dyke heights and locations are shown on drawing number 55D-A-233. Typical mining equipment required for the expansion is shown on drawing number 55D-A-207.

2.1 PRIMARY EXTRACTION OPERATION

A fifth extraction line will be added having a nominal rating of 2000 TPH of tar sands.

Supporting facilities will consist of a rotary drum to slurry the tar sands, screen, separation cell, secondary (scavenger) recovery circuit and five stage tailings pumping line.

...3/

2. EXPANSION DETAILS (continued)

Fifth line expansion details are shown on drawing numbers 55D-A-308, 55E-A-321, 55E-A-322.

It is anticipated that the proposed expansion will improve the extraction plant recovery to around 92% over the present figure of 89%. This improvement in recovery will be achieved by operating at higher temperatures in the separation stage and improvements to the scavenger circuit.

2.3 FINAL EXTRACTION OPERATION

The existing plant can nearly process the diluted froth for the expanded synthetic crude production. Consequently, the available space in the existing Final Extraction building will be utilized to accommodated a new Bird Centrifuge and a new Westfalia Centrifuge, which will provide the needed additional capacity. The expansion of support facilities such as heater and pumping systems will be minimal.

2.4 UPGRADING OPERATION

The existing delayed coking facilities will be expanded by the

....4/

2.4 UPGRADING OPERATION (continued)

addition of two coke drums and a coker heater.

In order to process the additional production from the expanded delayed coker facilities, the following additional upgrading plant modifications will be completed;

- extensive debottlenecking of the diluent recovery plant by installation of additional fired heater, heat exchangers and pumps.
- debottlenecking of the gas recovery plant by the installation of an additional separator and pump.
- extensive debottlenecking of the Gas Oil Unifiner to a total capacity of 42,000 BPSD, by the installation of additional fired heater, heat exchanger, pump and re-traying of the fractionator.

A new unit will be installed for the recovery of naphtha from the tailings. This unit will recover approximately 500 BPCD of naphtha.

The expanded facilities will have a total processing capacity of 94,000 BPSD of bitumen.

Upgrading details are shown in drawing numbers 55E-A-027 & 55E-A-536.

The delayed coker expansion will give the same synthetic crude yield from tar sand as the present day operation.

....5/

NATURAL GAS

It is estimated that the average natural gas requirements will increase from the present figure of approximately 15MMSCFD to 25 - 30 MMSCFD at the increased production rate.

COKE

The approximate quantity of coke consumed in boilers in 1976, a typical year, was 2200 tons per day. The average coke consumption by the boilers increases to 2400 tons per day after the expansion because the existing coke-fired boilers will be more fully utilized as a result of improved interaction of production systems.

SULPHUR

The recovery efficiency of the sulphur plant will increase from the present figure of 94% to 98% due to the addition of a third stage reactor. This is in compliance with the E.R.C.B. guidelines on sulphur recovery efficiency for a favourable feed gas.

Sulphur balances for present and expanded cases are shown on Figures 2-1 and 2-2, (calendar day basis) and Figure 2-3 (stream day basis).

The Environmental Energy Diagram Drawing Number 55B-A-029 shows the stream quantities on a calendar day basis averaged over a 6-year period for the proposed expansion.

...6/

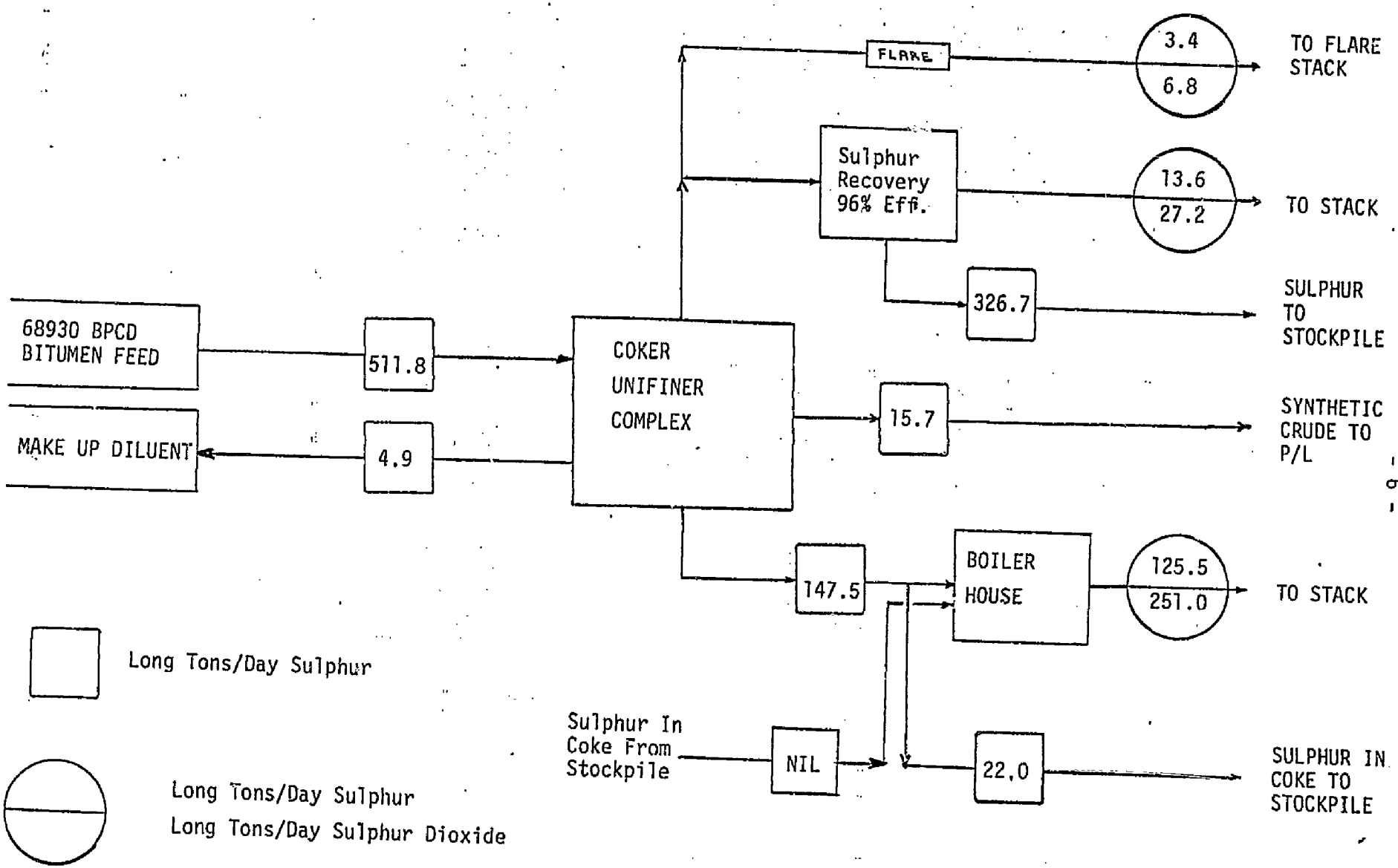
GREAT CANADIAN OIL SANDS LIMITED

SULPHUR BALANCE

EXPANSION CASE

FIG. 2-1

MINIMUM PRODUCTION CASE PER CALENDAR DAY
Expansion Case 53300 BPCD Synthetic Crude (1983)



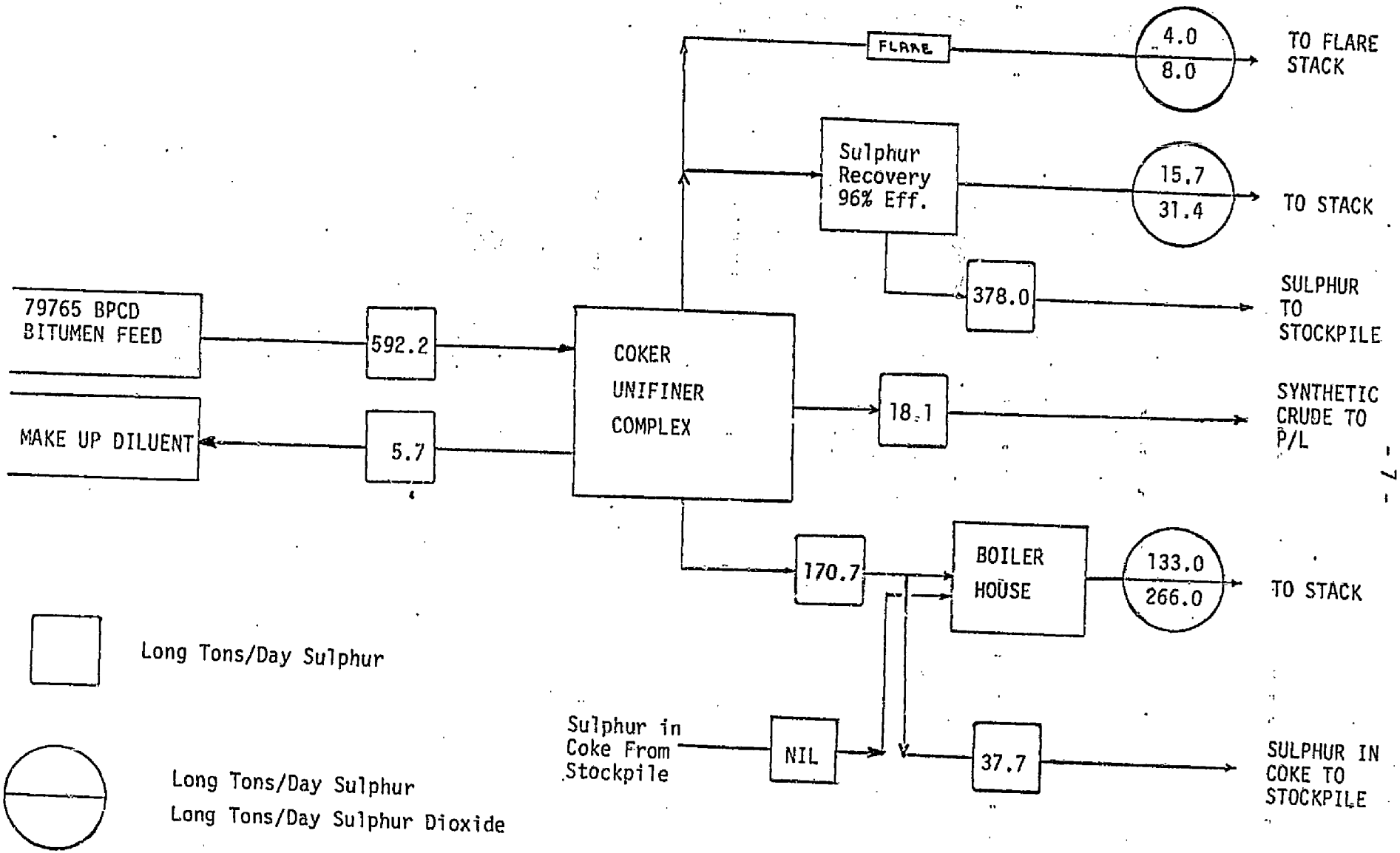
GREAT CANADIAN OIL SANDS LIMITED

SULPHUR BALANCE

EXPANSION CASE

FIG. 2-2

MAXIMUM PRODUCTION CASE PER CALENDAR DAY
Expansion Case 61600 BPCD Synthetic Crude (1982)



/8...

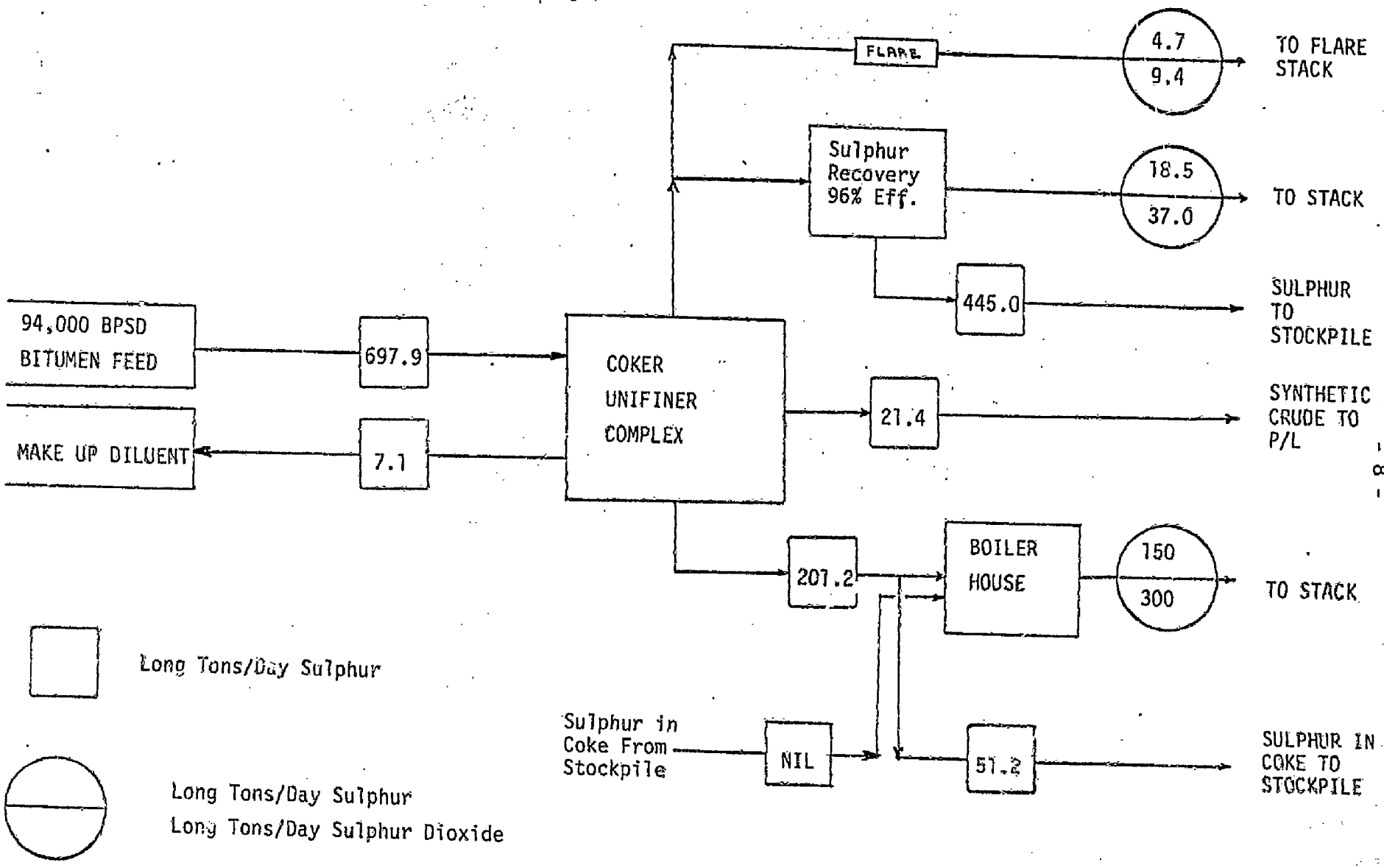
GREAT CANADIAN OIL SANDS LIMITED

SULPHUR BALANCE

EXPANSION CASE

FIG. 2-3

MAXIMUM PRODUCTION CASE (DESIGN) PER STREAM DAY
Expansion Case 71800 BPSD Synthetic Crude (Design)



/6...

TABLE 2-1

RECOVERY EFFICIENCES - WT. %
(Based on Total Bitumen in Place)

STEP	RECOVERY % 1973	RECOVERY % 1982/87	DESCRIPTION	CUMULATIVE RECOVERY % 1973	CUMULATIVE RECOVERY % 1982/87
MINING	80	80	Plant Feed	80	80
PRIMARY & FINAL EXTRACTION	90	92	Crude Bitumen	72	73.6
UPGRADING (DELAYED COKING)	65	65.7	Synthetic Crude Oil	47	48.36

TABLE 2-2

RECOVERY EFFICIENCIES - VOL. %
(Based on Total Bitumen in Place)

STEP	RECOVERY % 1973	RECOVERY % 1982/87	DESCRIPTION	CUMULATIVE RECOVERY % 1973	CUMULATIVE RECOVERY % 1982/87
MINING	80	80	Plant Feed	80	80
PRIMARY & FINAL EXTRACTION	90	92	Crude Bitumen	72	73.6
UPGRADING (DELAYED COKING)	78	77.2	Synthetic Crude Oil	56(1)	56.8 (2)

(1) Gravity of Synthetic Crude Oil 34° API.

(2) Gravity of Synthetic Crude Oil 33.1° API.

2.5 UTILITIES OPERATION

A 250,000 lbs/hr. gas fired steam generator will be installed to satisfy the increased steam demand of the Extraction Plant. The increased electrical power demand will be satisfied by expanding the APL supply facilities to a total capacity of 34 MW.

....10/

2.5 UTILITIES OPERATION (continued)

The water treatment facilities will be expanded to meet the increased boiler feed water and utility water demands.

TABLE 2-3

STEAM, WATER and POWER

	PRESENT	FUTURE
STEAM		
820 PSIG Steam Generating Capacity (MLBS/HR)	2250	2500
425 PSIG Steam Generating Capacity (MLBS/HR)	260	260
ELECTRIC POWER		
In House Generating Capacity (MW)	68	68
APL - Interruptible Supply Line Capacity (MW)	17	20
APL - Firm Supply Line Capacity (MW)	--	14
WATER		
River Water Requirements (MMIG/yr.)	5900	7400

Before selection of a new gas fired boiler was made, due consideration was given to the installation of a new coke fired boiler. The current license limits on emmissions of SO_2 to the atmosphere will not permit continuous operation of a new boiler and the existing boilers on coke, without the installation of a flue gas desulphurization unit. Three desulphurization processes were studied, a lime slurry process, a magnesium oxide slurry process and a sodium sulphite process. The most economical solution (lime slurry) creates a waste calcium sulphite sludge and results in handling and disposal problems, e.g., the full desulphurization process will produce about 1000 STPD of solids. The wet lime slurry process reduces the temperature of the flue gases to 200°F thereby reducing their lift. This reduced lift negates the advantage received from the reduction of sulphur emissions.

...11/

The flue gas would have to be reheated with natural gas in order to reestablish the lift required for adequate dispersion.

The addition of a new gas fired boiler will maintain the emissions below the license limit and close to the existing emissions level.

TABLE 2-4

ADDITIONAL BOILER COSTS

	CAPITAL COST $MM As Spent	OPERATING COST. $MM As Spent Annually
Gas Fired Boiler Addition	9.7	2.0
Coke Fired Boiler & ESP Addition	21.8	--
Coke Fired Boiler & ESP Addition with Partial Desulphurization		
Lime Slurry	31.3	0.9
Magnesium Oxide Slurry	48.2	1.3
Sodium Sulphite	44.3	0.9
Coke Fired Boiler & ESP Addition with Full Desulphurization		
Lime Slurry	58.2	6.6
Magnesium Oxide Slurry	113.8	9.7
Sodium Sulphite	100.3	6.9

Consideration was given to the following methods of supplying the additional electrical power requirements;

- installation of an additional turbine generator,
- modification of the existing turbine generators to hydrogen cooling.

The first alternative was rejected on the basis of excessive capital cost and increased high pressure steam requirements well beyond the capacity of the new boiler (the existing two generators require the full output of all three of the existing boilers for maximum power output). If sufficient high pressure steam capacity is added, the resulting low pressure steam will exceed the requirements of the

...12/

upgrading and extraction facilities and result in increased venting from the low pressure system to the atmosphere.

The second alternative was rejected on the basis of potential operating problems and reduced reliability. Another factor is that both these alternatives still require the expansion of the APL system in order to cope with the power demand during outages of one or more of the existing boilers.

2.6 OFFSITES/PIPELINE OPERATION

The cooling water system will require extensive modifications to the existing pumps in the river water pumphouse.

To satisfy the requirement of storing increased synthetic crude production, an additional gas oil intermediate/product storage tank of 85,000 barrels capacity will be installed.

Additional interconnecting facilities will be added to accomodate the increase in overall production capacity throughout the plant. Improvements and additions to the sewers, site and fire system will also be necessary.

To meet the proposed increase in the production rate the following modifications and additions to the existing products pipeline will be required;

- installation of a new pumping station at Mile Post 90,
- equipment and layout modifications to the Fort McMurray (Mile Post 0) pumping station.

...13/

3. ENVIRONMENTAL

3.1 ATMOSPHERE

The principal effects of the operation of the plant on the atmosphere are associated with the discharge of sulphur dioxide and particulate matter from the power plant stack and sulphur dioxide from the sulphur plant incinerator stack.

As was pointed out earlier, a performance factor of 96% will be achieved in the sulphur recovery plant with the installation of a third stage reactor. The proposed expansion will result in increased sulphur dioxide emission rates of between 5 and 30 long tons per calendar day.

The average sulphur content of the coke used for fuel in the power plant will be 6.1% and a 6 year average consumption of 2410 STPCD of coke burned daily.

As the new boiler addition is gas fired, there will be minimal increase in sulphur emissions from the power house stack on a calendar day basis. Peak levels of sulphur dioxide emissions will not increase.

Levels of sulphur dioxide and hydrogen sulphide measured at the continuous monitoring stations will not exceed the levels presently experienced.

...14/

G.C.O.S. is proceeding with substantial capital investment to meet the Provincial requirements of 0.2 pounds per 1000 pounds of flue gas for particulate emissions.

3.2 WATER

The only increase in hot water flow to the Athabasca River will result from the installation of a once through cooling water system for the expanded upgrading facilities.

3.3 LAND

The land reclamation plan for the proposed expansion will be essentially the same as the plan currently being followed with some updating to provide for the faster mining rate. A formulated long term reclamation plan for the lease area was submitted to the Development and Reclamation Committee on April 14, 1978.

The coke and sulphur stockpiled for both the expansion case and the existing operation will be disposed of by burial prior to lease end if disposal by sales is not possible. This procedure will be re-submitted for Development and Reclamation Approval based on the draft conditions issued.

....15/

4. OPERATING SUMMARY

The following summary table shows the synthetic crude production, average tar sand mined and other pertinent data for the present and expanded facilities.

TABLE 4-1

SUMMARY

	FUTURE NO EXPANSION	FUTURE EXPANSION
Overburden Removed (MMTPY) (Average 1982-1987)	20.6	28.2
Tar Sand Mined (MMTPY) (Average 1982-1987)	36.1	45.0
Synthetic Crude (MBPCD) (Average 1982-1987)	44.8	57.1
Gas Consumed (MMSCFD)	15	25-30
Electric Power Purchased (MW) (Average 1982-1987)	5.8	9.2
Coke Stockpile (MMST) 1987	2.36	2.73
Sulphur Stockpile (MMLT) 1987	1.25	1.70
Water Taken From River (MMIG/YR.)	5,600	7,400
Water Returned to River (MMIG/YR.) (at 10^{0}C above normal river temp.)	3,100	3,700

APPENDIX A

LIST OF TABLES AND FIGURES

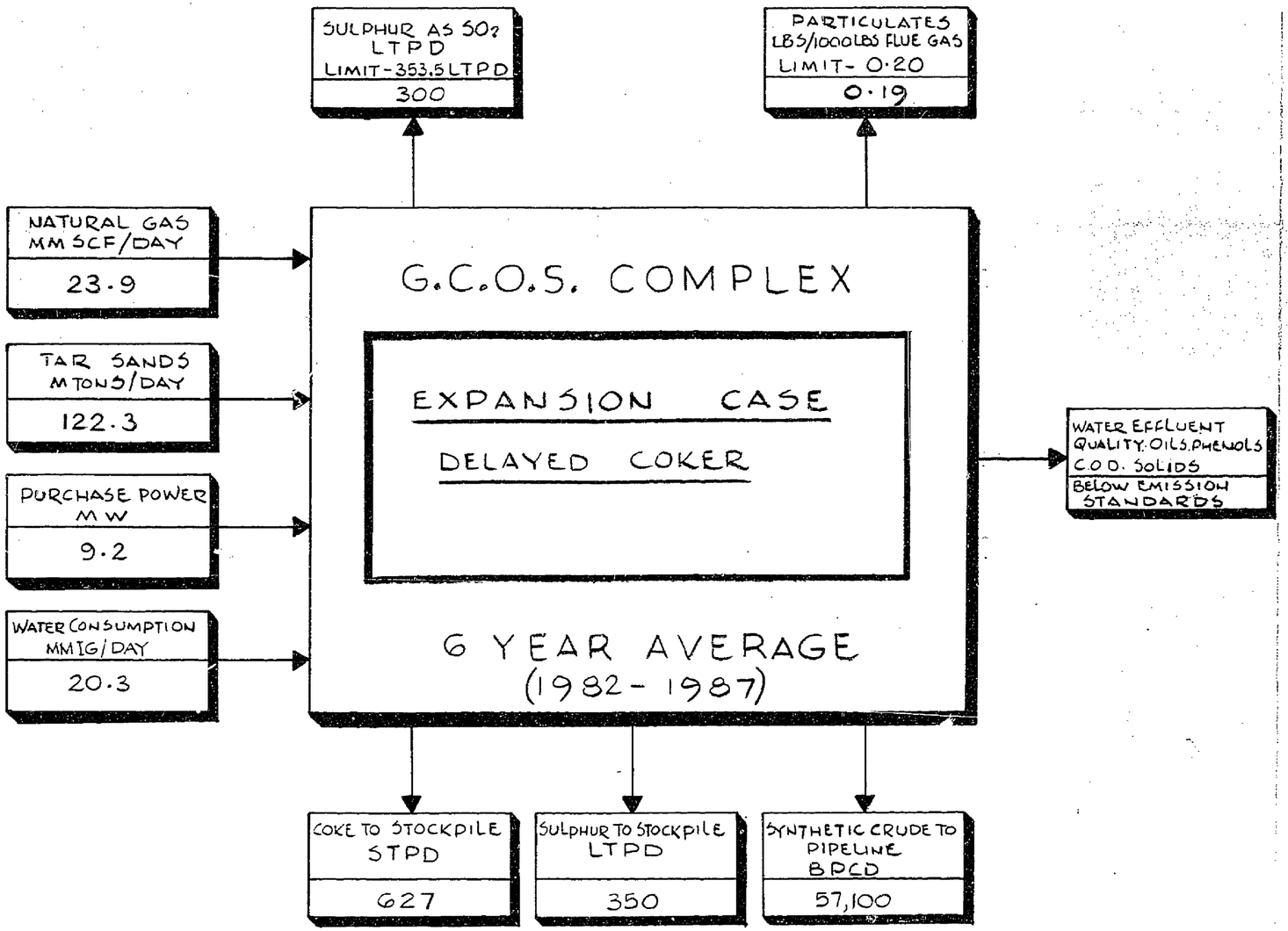
TABLE

FIGURE

APPENDIX B

LIST OF DRAWINGS

55B-A-029	ENVIRONMENTAL-ENERGY DIAGRAM
55D-A-207	FLOWSHEET MINING EQUIPMENT
55D-A-233	MINING PLAN - 1985
55D-A-308	PRIMARY EXTRACTION PLANT, PROCESS P & I DIAGRAM
55E-A-321	PRIMARY EXTRACTION PLANT, GENERAL ARRANGEMENT - PLAN
55E-A-322	PRIMARY EXTRACTION PLANT, GENERAL ARRANGEMENT - SECTIONS
55E-A-027	BLOCK FLOW DIAGRAM - DELAYED COKING
55E-A-536	SITE PLAN - EXPANSION



NO	DATE	REVISIONS	BY	CHK	ENG'R	M'G'R
1	11/2/78	ISSUED FOR ERCB SUBMISSION	OSB			
0	3/29/78	ISSUED FOR FINAL REPORT	STD			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
ENVIRONMENTAL-ENERGY DIAGRAM
EXPANSION CASE-DELAYED COKER

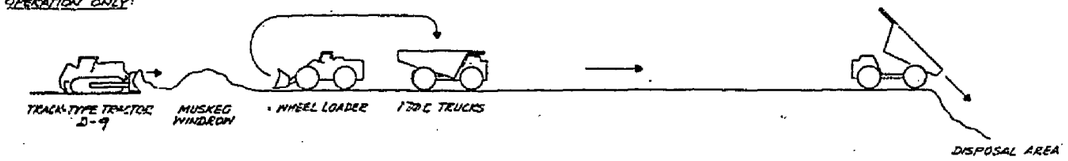
SCALE	DRAWN BY	CHECKED BY	
DRAWING NUMBER		SHEET NO.	REV.
55B-A-029			1

SIZE "B" 11" X 22"

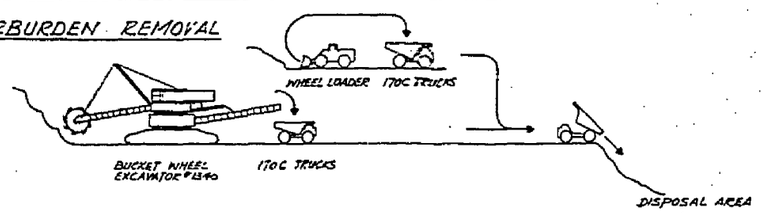
Form 55A Rev. 1 Edmonton Printers

MUSKEG REMOVAL

WINTER OPERATION ONLY:

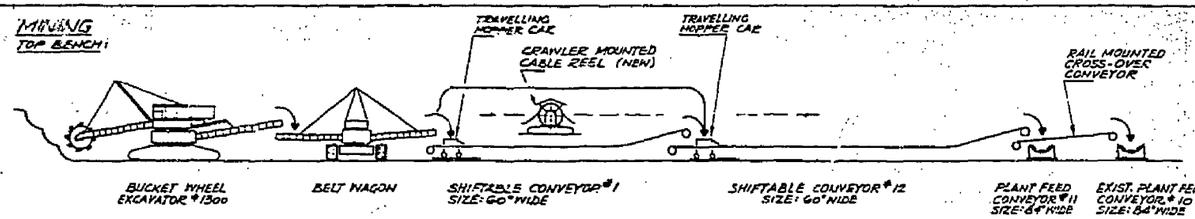


OVERBURDEN REMOVAL



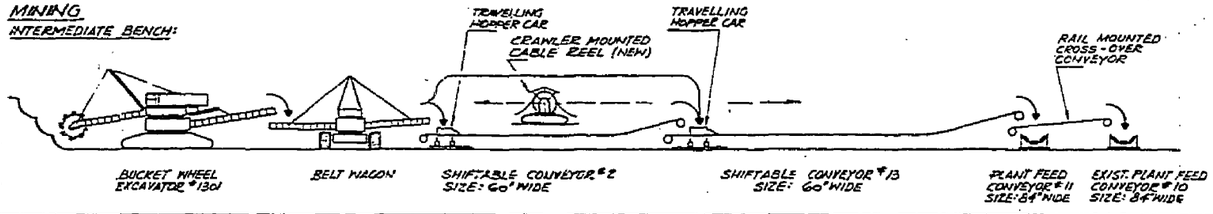
MINING

TOP BENCH:



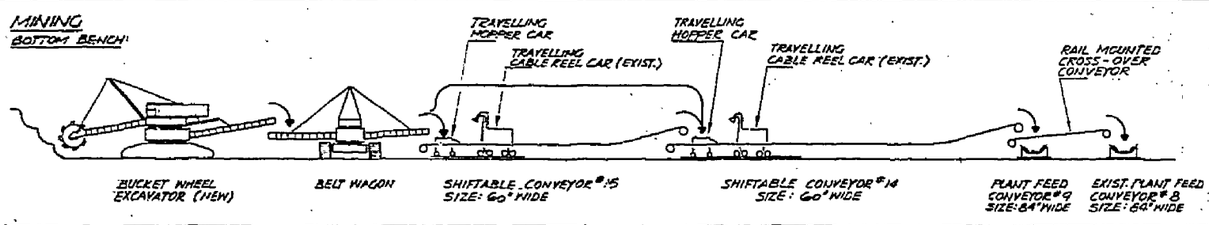
MINING

INTERMEDIATE BENCH:



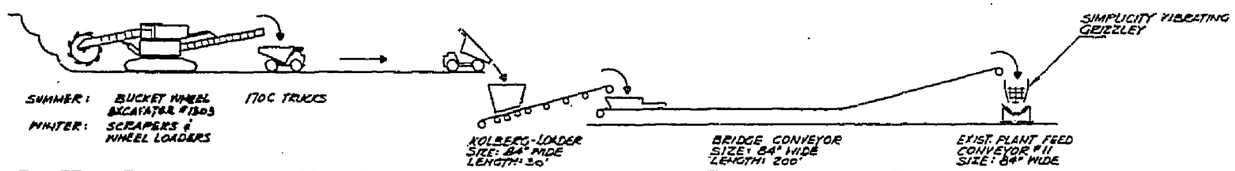
MINING

BOTTOM BENCH:



AUXILIARY MINING & MISC. EQUIPMENT

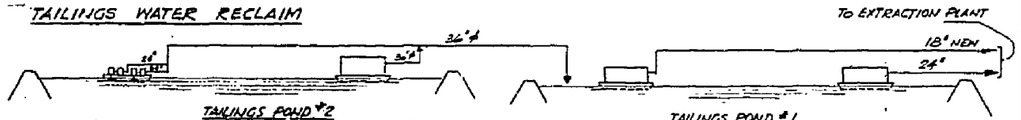
AUXILIARY MINING:



NOTE:

MINE CLEAN-UP WITH SCRAPERS, WHEEL LOADERS, DOZERS & TRUCKS

TAILINGS WATER RECLAIM



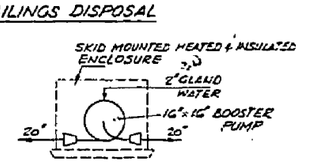
BARGE #3 (RAFT)
4 GEORGIA IRON WORKS PUMPS
2 IN SERIES - 10,000 USGPM EACH PAIR
750 HP EACH @ 4160V
(UNDER CONSTRUCTION IN 1978 INCLUDING SWITCHGEAR)

BARGE #2
3 WATER PUMPS (2 IN PARALLEL, 1 SPARE)
1500 HP EACH, 4160 V
(EXISTING)

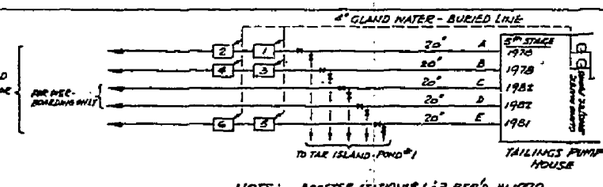
BARGE #4
2 WATER PUMPS
MIN. REQ'MT: 6500 USGPM
700 HP EACH, 6900V
(NEW - REQ'D IN 1981)

BARGE #1
4 WATER PUMPS
TOTAL CAP: 20,000 USGPM
700 HP EACH, 6900V
(EXISTING)
(MOVE TO POND #3 IN 1985)

TAILINGS DISPOSAL



TYP BOOSTER STATION - 10,000 USGPM
600 HP EACH, 2300V



NOTE: BOOSTER STATIONS #1, 3 REQ'D IN 1979
BOOSTER STATION #5 REQ'D IN 1982
BOOSTER STATIONS #2, 4 & 6 REQ'D IN 1985

NOTE:

1. CONVEYORS AS SHOWN REPRESENT LAYOUT IN 1985. FOR LAYOUTS BEFORE AND AFTER 1985 SEE DWG. # 55D-A-215.
2. TRENCH RECLAIMER AND PLANT FEED CONVEYOR #8 TO BE INSTALLED BY G.C.O.S. IN 1978.

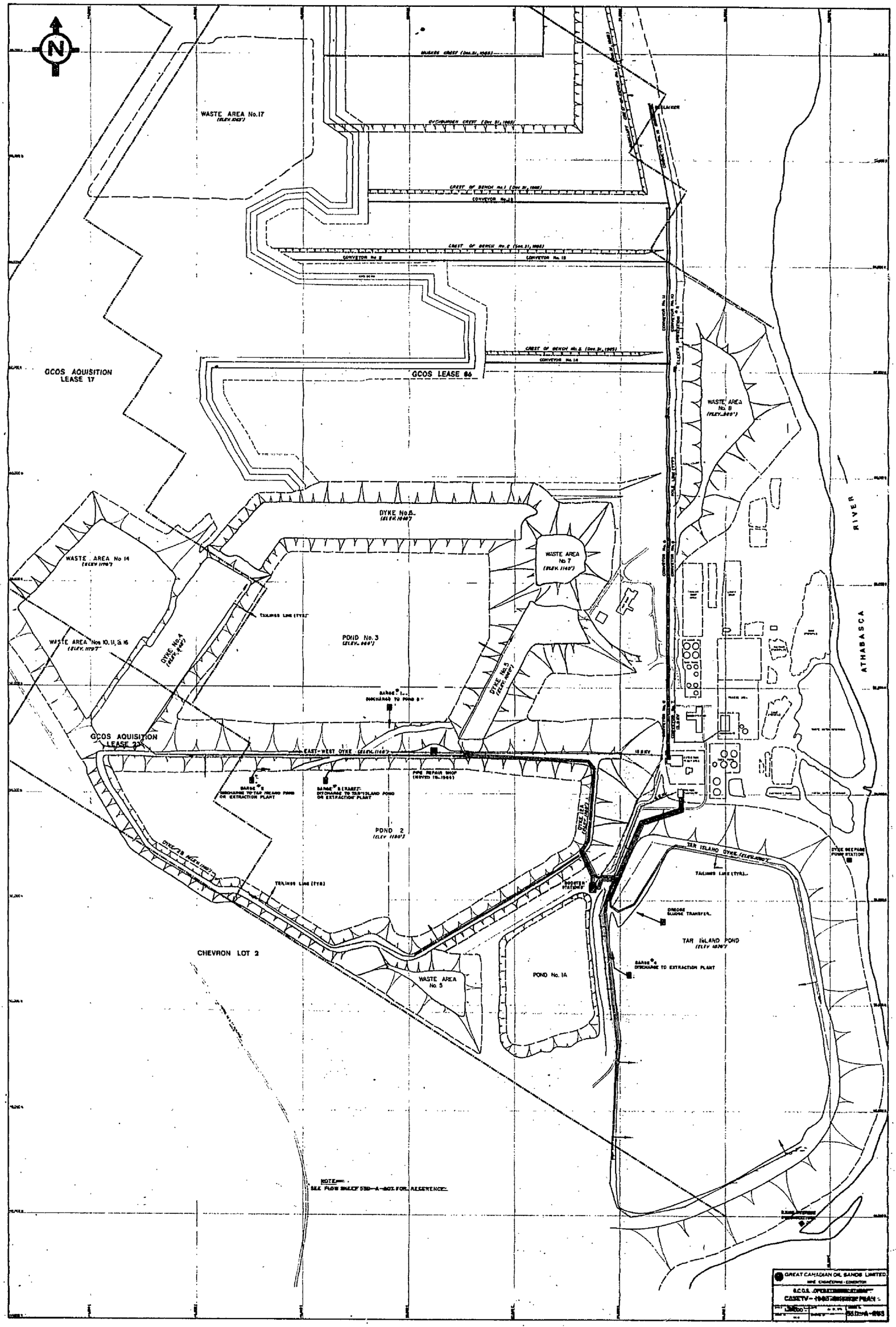
REV. NO	DATE	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
3	5 29 78	ISSUED FOR FINAL REPORT	GTO		
2	05 19 78	ISSUED AS ESTIMATE BASIS	K.J.		
1	04 25 78	ISSUED FOR PHASE II	AP		
0	11 10 77	ISSUED FOR 1ST PHASE	AP		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY

FLOW SHEET
MINING - EQUIPMENT ARRANGEMENT
EXPANDED CASE (CASE IV)

SCALE	DRAWN BY	CHECKED BY
APPROVED	DRAWING NUMBER	REV.
	55D-A-207	3


WASTE AREA No.17
(ELEV. 1065')
GCOS AQUISITION LEASE 17
GCOS LEASE 86
WASTE AREA No. 8
(ELEV. 1100')
DYKE No.6
(ELEV. 1140')
WASTE AREA No 14
(ELEV 1170')
WASTE AREA No 7
(ELEV. 1140')
WASTE AREA Nos 10, 11, & 16
(ELEV. 1170')
DYKE No.4
(ELEV. 1140')
POND No. 3
(ELEV. 1100')
DYKE No.5
(ELEV. 1140')
RIVER
ATHABASCA
GCOS AQUISITION LEASE 23
EAST-WEST DYKE (ELEV. 1160')
POND 2
(ELEV 1130')
TAR ISLAND DYKE (ELEV. 1090')
TAR ISLAND POND
(ELEV 1070')
CHEVRON LOT 2
WASTE AREA No. 5
POND No. 1A
NOTE:
SEE FLOW SHEET 530-A-801 FOR LEGENDS.
GREAT CANADIAN OIL SANDS LIMITED

DRAWING

APPLICATION: 78-0318

DRAWING

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
DRAWING TITLE:	PRIMARY EXTRACTION PLANT PROCESS P & I DIAGRAM FIFTH LINE EXPANSION
DATE:	NOT GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 4 of 11

PLAN

APPLICATION: 78-0318

PLAN

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
PLAN TITLE:	PRIMARY EXTRACTION PLANT 5TH LINE EXPANSION GENERAL ARRANGEMENT-PLANS
DATE:	FEBRUARY 15, 1978
SCALE:	1/16" = 1'-0"
INDEX:	DOCUMENT 5 of 11

DRAWING

APPLICATION: 78-0318

DRAWING

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
DRAWING TITLE:	PRIMARY EXTRACTION PLANT 5TH LINE EXPANSION GENERAL ARRANGEMENT-SECTIONS
DATE:	FEBRUARY 15, 1978
SCALE:	1/16 = 1'-0"
INDEX:	DOCUMENT 6 of 11

CHART

APPLICATION: 78-0318

CHART

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
CHART TITLE:	G.C.O.S. OPERATIONAL STUDY BLOCK FLOW DIAGRAM EXPANSION CASE-DELAYED COKER
DATE:	NOT GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 7 of 11

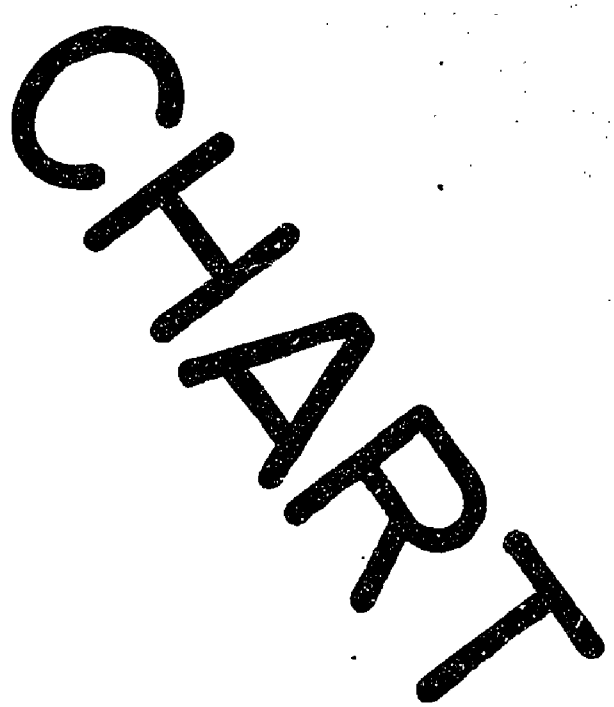
CHART

APPLICATION: 78-0318

CHART

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
CHART TITLE:	G.C.O.S. OPERATIONAL STUDY BLOCK FLOW DIAGRAM EXPANSION CASE-DELAYED COKER
DATE:	NOT GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 8 of 11



CHART

APPLICATION: 78-0318

CHART

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
CHART TITLE:	G.C.O.S. OPERATIONAL STUDY BLOCK FLOW DIAGRAM EXPANSION CASE-DELAYED COKER
DATE:	NOT GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 9 of 11

PLAN

APPLICATION: 78-0318

PLAN

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
PLAN TITLE:	G.C.O.S. OPERATIONAL STUDY SITE PLAN EXPANSION
DATE:	NOT GIVEN
SCALE:	1" = 100'
INDEX:	DOCUMENT 10 of 11

INTER-OFFICE CORRESPONDENCE SHEET

GREAT CANADIAN OIL SANDS LIMITED

SUBJECT: ERCB APPLICATION FOR THE PROPOSED EXPANSION DATE: November 22, 1978

FROM: W. L. Cary OFFICE: Environmental Affairs

c.c.: W. L. Oliver
H. Kaethler (Proj. Office)

TO: M. A. Supple

This is in answer to your inquiry received November 17, 1978, regarding assistance in supplying information to the ERCB for the proposed expansion. Our answers to Question 6 and 7 are given below. The answer to Question 9 is being assembled now and should be ready by November 27, using the new DOE calculation method.

QUESTION 6

COKE HANDLING AND STORAGE

Present Case

The coke produced in the batch delayed coker facilities is cut out of the cokers by means of high pressure water jets and falls into a pit in the form of lumps of varying size. The coke is then moved to a short term stockpile using frontend loaders complete with enclosed cabs supplied with filtered air. Approximately four-fifths of the coke is drawn off the bottom of the stockpile via conveyor as fuel for the powerhouse. Periodically the remaining coke is moved to a more permanent stockpile to the north of the plant using earth movers from the Overburden Operations.

Dusting of this type of coke is only a problem when it is being moved. Precautions are taken using ventilated cabs and face masks to protect the personnel at these times.

Expansion Case

The coke handling and storage will be handled in the same manner with the expanded facilities. Approximately one-fifth (627TPCD out of 3043 TPCD) of the coke will be permanently stockpiled. (see dwgs. 55E-A-027 and 55E-A-536).

In the long term if the coke remains unsold it is planned to move the stockpiled coke to the bottom of the mine pit at elevation approximately 900 a.s.l. There it will be covered in impervious overburden members to a depth of 150 to 200 feet.

.../2

QUESTION 7

SULPHUR HANDLING AND STORAGE

Present Case

At the present time 40% of produced sulphur is sold in the liquid form and shipped out by tanker truck. Prospects of increased sales are favourable. Any unsold sulphur is poured in block form in the storage area to the north and east of the plant site.

Drainage water off the sulphur piles is collected in a ditch along the river edge and pumped into the waste water pond periodically for discharge through the controlled outfall facilities.

Expansion Case

No change is anticipated in the above handling and storage for sulphur under the expansion case.

In the longer term unsold sulphur will be broken up and disposed of at the bottom of the mine pit at elevation approximately 900 a.s.l. There it will be covered in impervious overburden members to a depth of 150 to 200 feet.

W. L. Cary
Manager, Environmental Affairs

/kp

INTER-OFFICE CORRESPONDENCE SHEET

GREAT CANADIAN OIL SANDS LIMITED

SUBJECT: E.R.C.B. APPLICATION - SUPPLEMENTARY INFORMATION DATE: November 24, 1978

FROM: M. A. Supple OFFICE: G.C.O.S. Project Office

TO: W. L. Oliver File: 111

Further to the deficiency letter from the Energy Resources Conservation Board dated 20 September 1978, we can supply the following additional data. The clause numbers correlate with the numbers in the E.R.C.B. letter.

1. This cannot be answered at the present, as further studies are being completed.

Items 2, 3, 5(a) and 5(b) are adequately covered by the November revision of the E.R.C.B. application.

Revised balances are enclosed as follows:

55B-A-518 revision 3, Fuel Balance
55D-A-3119 revision 5, Steam Balance
55B-A-3207 revision 1, Water Balance

In addition the overall block flow diagram 55E-A-027 has been updated to reflect revised natural gas consumption in the process units. Revision 4 is enclosed.

Manager, Environmental Affairs

5(c) The difference in cost is equivalent to the fuel gas cost (cost of coke is neligible), i.e., $2.35/MMBtu (projected for 1982). For the expansion case considered this is equivalent to approximately $3MM in 1982.

6&7 This has been covered by W. L. Cary in his letter to M. A. Supple dated 22 November 1978, a copy of which is enclosed.

8(a) A detailed analysis of upgrading the sulphur recovery facilities to an efficiency of 99% has not been attempted. The facilities included in the expansion are aimed at satisfying the current clean air license requirements for SO_2 limitations (equivalent to a recovery efficiency of 95%). However, "curve costs" for a tail gas clean up unit to match the sulphur recover unit capacity are $9 MM installed capital cost and $1MM per year operating costs.

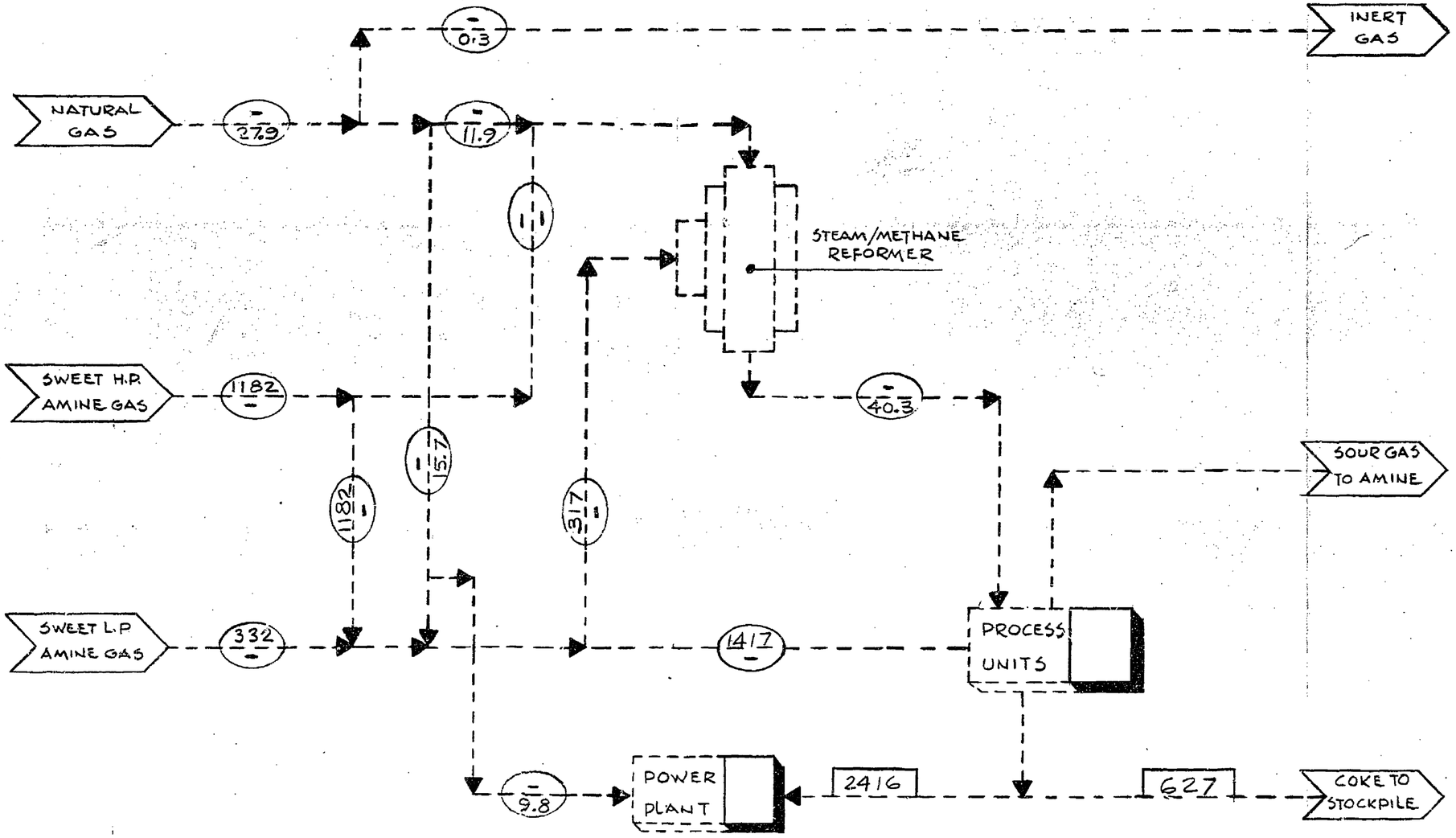
...2

8(b) Such a reduction in SO_2 emission levels is well beyond the scope considered in the operational study. This is equivalent to an emission level of 37 long tons per calendar day for the revised expansion case and will require tail gas removal facilities for the existing powerhouse stack and the sulphur recovery plant.

9. The SO_2 dispersion calculations are being completed by K. Rashid.

M. A. SUPPLE

PM/dm
Attach.
cc: H. Kaethler
P. Mott



LEGEND

EXISTING

NEW

STCD

M^3BTU/HR
M^3SCFCD

NOTE! ALL FLOWS ARE ON DRY BASIS

6 YEAR AVERAGE
(1982-1987)

NO.	DATE	REVISIONS	BY	CHK	ENGR	APPD
3	11/24/88	REVISED & ISSUED FOR ERCB	[illegible]			
2	5/29/88	ISSUED FOR FINAL REPORT	STD			
1	5/19/88	ISSUED AS ESTIMATE BASIS	KJ			
0	5/3/88	ISSUED FOR PHASE 1	KJ			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
H2/FUEL GAS/COKE BALANCE
EXPANSION CASE-DELAYED COKER

SCALE	DRAWN BY	CHECKED BY
~	STD	

DRAWING NUMBER	SHEET NO.	REV.
55B-A-518		3

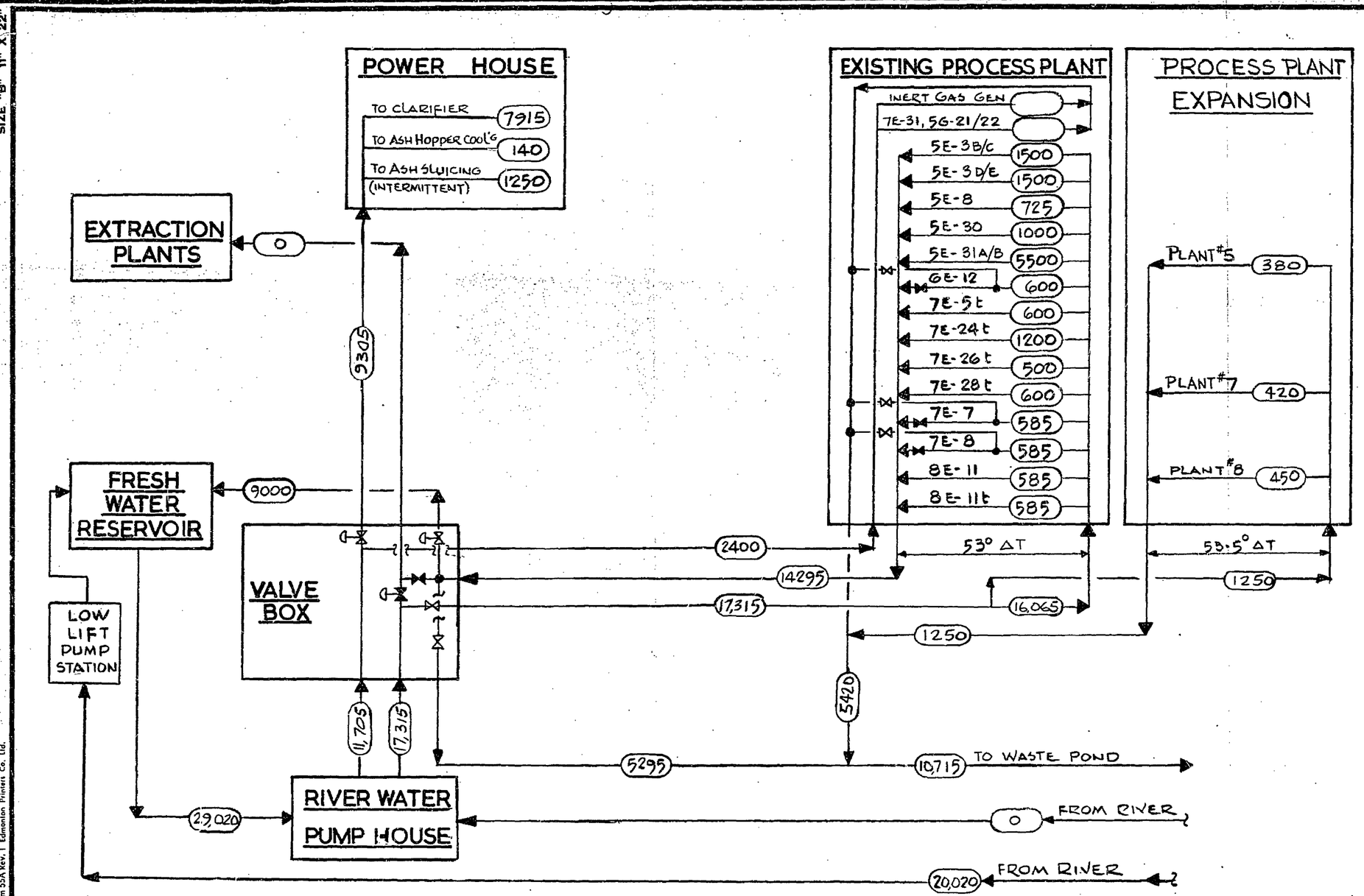
DRAWING

APPLICATION: 78-0318

DRAWING

ATTACHED TO SUBMISSION

AREA COVERED:	TAR ISLAND
DRAWING TITLE:	G.C.O.S. OPERATIONAL STUDY STEAM & B.F.W. BALANCE (WINTER) EXPANSION CASE-DELAYED COKER
DATE:	NOT GIVEN
SCALE:	NONE
INDEX:	DOCUMENT 11 of 11



NOTES

1. 94,000 BPSD EXPANDED DELAYED COKER
2. ALL FLOWS IN USGPM

NO.	DATE	REVISIONS	BY	CHK	ENG	APPD
1	11/24/78	REVISED & ISSUED FOR E.R.C.B.				
0	78/11/78	ISSUED FOR FINAL REPORT	STD			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
OVERALL WATER BALANCE EXPANSION CASE-DELAYED COKER

SCALE ~	DRAWN BY STD	CHECKED BY	
DRAWING NUMBER		SHEET NO.	REV.
55B-A-3207			1

INTER-OFFICE CORRESPONDENCE SHEET

GREAT CANADIAN OIL SANDS LIMITED

SUBJECT: DISPERSION OF SO_2

DATE: November 29, 1978

FROM: Roy Wood

OFFICE: Environmental Affairs

TO: M. Supple

C.C.: K. Rashid
W. L. Cary
R. L. Oliver

Calculations of maximum ground level SO2 were performed using the Alberta Environment programs "Stacks" and "Flares".

The programs were run in an East SouthEast direction headed towards our FINA monitor. This direction was chosen because FINA gives the greatest frequency of deviations, it lies in the prevailing wind direction and it has the most significant topographical feature. These conditions correspond to Alberta Environment recommendations. The concentrations were calculated at a tree top height of 5 metres.

I believe from earlier runs that similar results would be obtained with other directions and tree top heights.

The results are printed out with maximum concentrations with the corresponding distance and wind speed. The program also calculates stack height required to get below 0.2 ppm. The computer also prints out the results for flat terrain.

RESULTS

	CALENDAR DAY	
	No Expansion	Expansion
Production Rate	45,000	61,000
Incinerator SO2	19.6 LTSO2	31.4 LTSO2
Powerhouse SO2	186 LTSO2	266.0 LTSO2
Max. GLC (with elevations)	0.288 at 3500 and 7.5m/s	0.336 at 3500 M and 9m/s
Stack height required	N/A	165 m
Flat terrain max GLC	0.189 at 3630m and 9.0m/s	0.221 at 3630 and 11.5m/s
Stack height required	N/A	116 m

	STREAM DAY	
	No Expansion	Expansion
Production Rate	60,000	71,800 *
Incinerator SO2	23.5 LTSO2	37 LTSO2
Powerhouse SO2	248 LTSO2	300 LTSO2
Max GLC	0.379 at 3500 and 9 m/s	0.354 at 3500 and 10 m/s
Stack height required (with elevation)	157 m	167 m
Flat Terrain Max GLC	0.21 at 3630m and 11m/s	0.233 at 3630m and 12m/s
Stack height required	112 m	120 m

* In this case Nat.Gas fired boiler assumed not operating.

Calculation of GLC due to Flare

Only 1 run of the Flare program was run taking the expansion stream day case. The results were:

Max GLC = 0.023 at 3500 m and 4.5 m/s

From this result I expect that interaction with the main plumes will be insignificant at the conditions for maximum ground levels which require wind speeds of 9 - 12 m/s.

Discussion of Program Limitations

The program stacks takes a near worst case for the dispersion calculations. The spread (sigma) values are the same as for Neutral Stability but the diffusion is taken in a limited mixing case under a capping inversion. There is no estimate of frequency or duration of events such as these and only the peak concentration with corresponding distance and wind speed is printed.

.../3

In addition a situation like GCOS with uneven terrain is taken as if the stack were on a flat plain with the plume meeting a hill downstream. This treatment gives values up to twice the peak values predicted for flat terrain.

However GCOS is situated in the Athabasca Valley and the valley effect and wind shear with altitude have been shown to give better dispersion than predicted by the above methods (see reference 1,2 and 3).

The frequency of a capping inversion is believed to be low in summer and very low in winter. Spring and fall give the highest frequency, but when combined with the concurant high wind speed required, it is not surprising that our experience of ground level concentrations over 0.2 ppm is less than 1% of the time.

The program calculates the stack height required to achieve 0.2 ppm under the specified dispersion conditions but it is strongly recommended that a site specific model be developed before engineering commitment to any new stack height.

References

1. A Study of the Dispersion Charateristics of the GCOS Plume P. R. Slawson et al - March 1978 - Syncrude Publication

2. A predictive study of the dispersion of emissions from the Syncrude Mildred Lake Plant. KEP Company - Syncrude Publication

3. The behaviour of buoyant plumes from an oil sands refinery complex. Whaley and Lee - Canadian Combustion Research Laboratory - 1977.

Roy Wood

/kp

Exhibit 1 (pt. of)

S. A. CONTIN
President

GREAT CANADIAN OIL SANDS LIMITED 2900 ALBERTA TELEPHONE TOWER, EDMONTON, ALBERTA T5J 1X2

November 30, 1978

Mr. Norman Strom
Manager, Oil Sands Department
Energy Resources Conservation Board
603 - Sixth Avenue S.W.
Calgary, Alberta
T2P 0T4

Dear Mr. Strom:

RE: Proposed GCOS Expansion Application 780318

Further to the ERCB--DOE meeting on November 27, 1978 and the letter dated September 20, 1978 from the ERCB outlining deficiencies in our May 1978 ERCB Application 780318, we can offer the following information. The clause numbers below relate to the clause numbers in your deficiency letter. We attach our interoffice memos, W.L. Cary to M.A. Supple dated November 22, 1978 and M.A. Supple to W.L. Oliver dated November 24, 1978 dealing with the deficiency letter clauses.

1) Delayed coking has been selected as the process scheme for expansion. We are continuing a limited study on a hydro-visbreaking alternative but do not expect the results for several months and give this alternative a low probability of success.

2) A revised overall energy balance was enclosed with the November 1978 issue of the application and was accepted as adequate during this week's meeting.

3) Sulphur balances showing calendar day conditions and maximum stream day conditions were enclosed with the November 1978 issue of the application and were accepted as adequate during this week's meeting.

..../2

4) Ten copies of the following revised drawings were handed over at the meeting on November 27, 1978:

55B-A-518, Revision 3, Fuel Balance
55D-A-3119, Revision 4, Steam Balance
55B-A-3207, Revision 1, Water Balance
55E-A-027, Revision 4, Block Flow Diagram

These were also accepted as adequate during the meeting.

5(a) Installation of a flue gas desulphurization unit on a coke fired boiler is feasible. However, the capital and annual operating costs of such a unit are prohibitive and significantly impact the viability of the expansion project. The $25MM cost difference quoted in the May 1978 Application did not include flue gas desulphurization. It included only boiler, particulate removal and auxiliary facilities.

5(b) Table 2-4 in the November revision of the ERCB Application shows the capital and operating costs associated with different degrees and schemes of boiler flue gas treatment. The capital costs shown are stand-alone numbers. For example, a coke fired boiler with ESP addition and partial desulphurization based on a lime slurry process we estimate would cost $31.3 million. Partial desulphurization in this context means that only the new added boiler would have flue gas treatment.

Full desulphurization with lime slurry would cost $58.2 million including boiler and ESP.

We wish to point out that the capital and operating costs were estimated based on a conceptual study only and hence the costs do not include for specific site conditions that would exist at our plant. When actual site conditions are considered, we would expect the capital costs to be 10 - 50% higher.

5(c) The difference in fuel cost is equivalent to the cost of gas because the cost of coke is negligible in comparison (i.e. coke handling cost only). At a gas cost of $2.35/MMBtu, projected for 1982, the total cost difference per year is $2.9MM.

6. Present Case

The coke produced in the batch delayed coker facilities is cut out of the cokers by means of high pressure water jets and falls into a pit in the form of lumps of varying size. The coke is

..../3

then moved to a short term stockpile using front end loaders complete with enclosed cabs supplied with filtered air. Approximately four-fifths of the coke is drawn off the bottom of the stockpile via conveyor as fuel for the powerhouse. Periodically, the remaining coke is moved to a more permanent stockpile to the north of the plant using earth movers from the Overburden Operations.

Drainage water off the coke piles is collected and directed to the waste water pond via the flare pond. From the waste water pond, the water is discharged through controlled outfall facilities.

Dusting of this type of coke is only a problem when it is being moved. Precautions are taken using ventilated cabs and face masks to protect the personnel at these times.

Expansion Case

The coke handling and storage will be handled in the same manner with the expanded facilities. Approximately one-fifth of the coke will be permanently stockpiled.

In the long term, if the coke remains unsold, it is planned to move the stockpiled coke to the bottom of the mine pit at elevation approximately 900 feet a.s.l. There it will be covered in impervious overburden members to a depth of 150 to 200 feet.

7. Present Case

At the present time, 40% of produced sulphur is sold in the liquid form and shipped out by tanker truck. Prospects of increased sales are favourable. Any unsold sulphur is poured in block form in the storage area to the north and east of the plant site.

Drainage water off the sulphur piles is collected in a ditch along the river edge and pumped into the waste water pond periodically for discharge through the controlled outfall facilities.

Expansion Case

No change is anticipated in the above handling and storage for sulphur under the expansion case.

In the long term, unsold sulphur will be broken up and disposed of at the bottom of the mine pit at elevation approximately 900 feet a.s.l. There it will be covered in impervious overburden members to a depth of 150 to 200 feet.

8(a) A detailed analysis of upgrading the sulphur recovery facilities to an efficiency of 99% has not been attempted. The facilities included in the expansion are aimed at satisfying the current clean air license requirements for SO_2 limitations (equivalent to a recovery efficiency of 96%). However, "curve costs" for a tail gas clean up unit to match the sulphur recovery unit capacity are $9MM installed capital cost and $1MM per year operating costs.

8(b) Reduction of sulphur dioxide emission levels, for the overall plant, to 0.5 long tons per 1000 barrels of bitumen can be achieved by the following alternative procedures.

- Burn natural gas in the boiler plant. This will require boiler modifications and will result in an additional gas consumption of 70 MMSCF per calendar day. This will be equivalent to $53MM per year additional operating costs.

- Coke desulphurization. This cannot be achieved economically with currently available technology.

- Coke gasification. A battery limits plant (Koppers-Tozek) including sulphur removal facilities will cost about $170MM installed. Due to the low heating value of the resulting flue gas, extensive heater, boiler and gas distribution modifications will be required. The above mentioned costs will result in a non-viable plant.

- Flue Gas desulphurization. A battery limits plant (lime slurry) will cost about $38MM installed and will result in additional operating costs of about $7.2MM per year. The operating costs include an increased gas consumption of 1.2 MMSCF per calendar day or 1.6 MMSCF per stream day due to reheating requirements. The above mentioned costs will result in a non-viable plant.

Please note that all these costs are based on conceptual studies and do not include for specific site conditions that would substantially increase costs (10 - 50%).

9. We have attached an interoffice memo, Roy Wood to M. Supple dated November 29, 1978 which discusses in detail the SO_2 dispersion calculations for the plant. We wish to emphasize that although the computer model indicates that peak stream day productions will result in 0.354 maximum GLC where 0.2 is permitted, the frequency of simultaneous occurence of both temperature inversion and peak production is low. Also, the computer model is generalized and

..../5

does not accurately represent the plant. We are well underway in the development of a computer model more reflective of actual topographical conditions. The model is expected to be completed in about six months.

We trust the above has answered all of the points in your letter of September 20, 1978 as well as the items brought up in the meeting of November 27, 1978, and ask that you schedule the hearings at the earliest possible time.

Yours very truly,

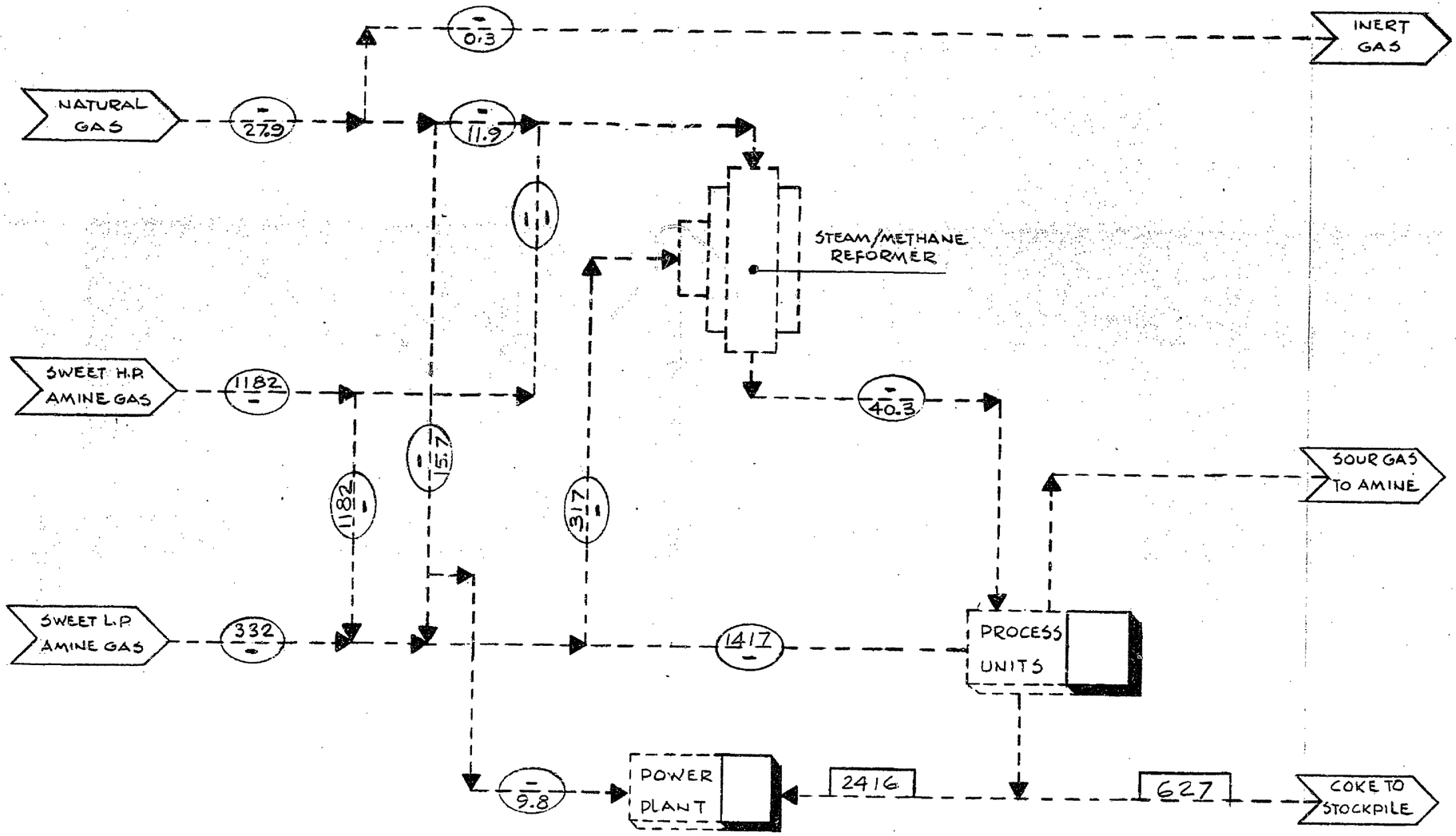
M.A. Supple
Chief Process Engineer

MAS/jb

Attach.

cc: W.L. Oliver
W. Cary
H.M. Lewis

DRAWINGS NO. 55D-A-3119 REVISION 4 AND 55E-A-027 REVISION 4 NOT AVAILABLE.



LEGEND

EXISTING

NEW

STCD

M³BTU/HR
M³SCFCD

NOTE! ALL FLOWS ARE ON DRY BASIS

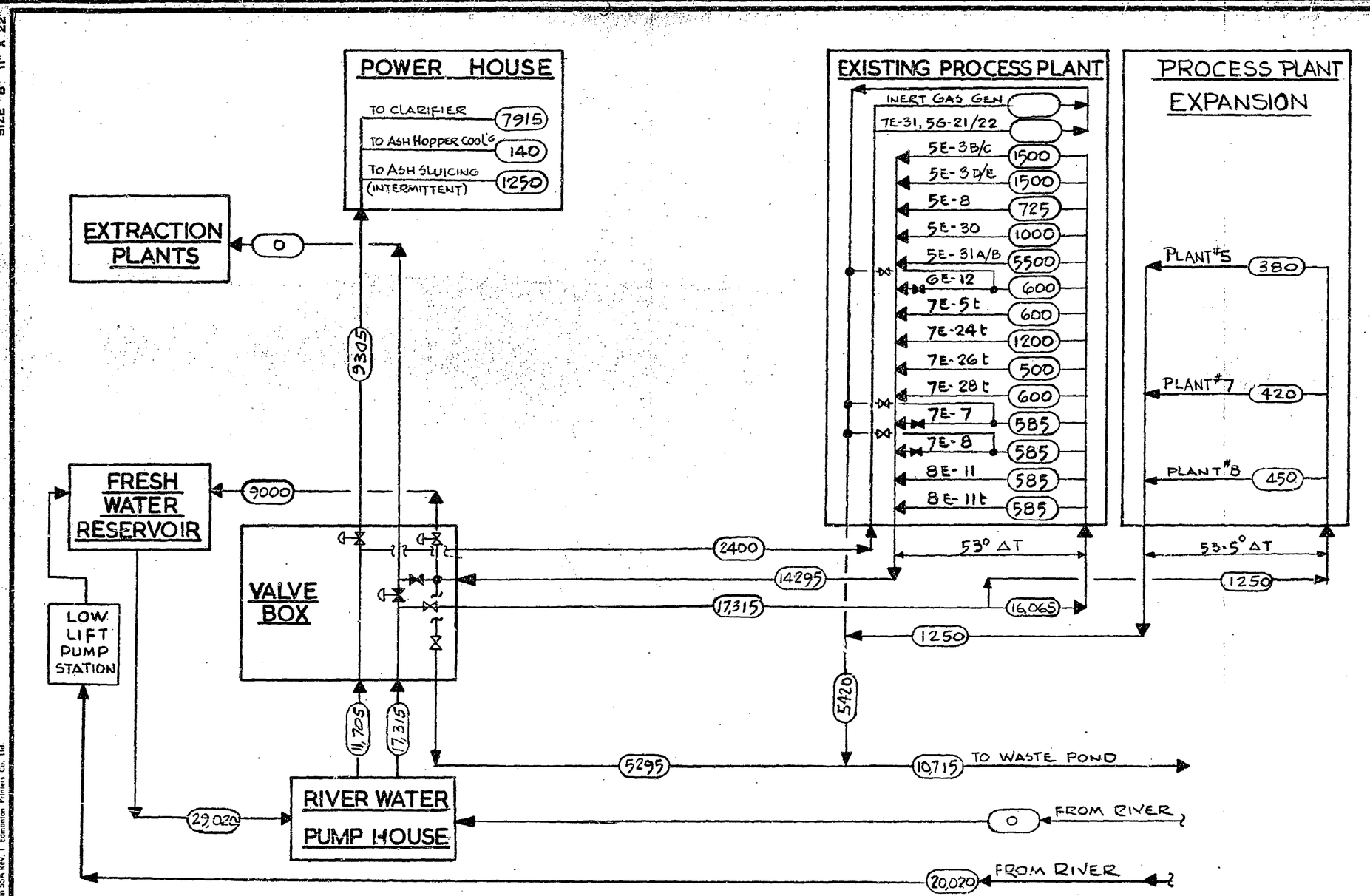
6 YEAR AVERAGE
(1982-1987)

NO.	DATE	REVISIONS	BY	CHK	ENGR	APPD
3	11/24/78	REVISED & ISSUED FOR ERCB	STD			
2	5/29/78	ISSUED FOR FINAL REPORT	STD			
1	5/10/78	ISSUED AS ESTIMATE BASIS	KJ			
0	5/3/78	ISSUED FOR PHASE 1	KJ			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
H2/FUEL GAS/COKE BALANCE
EXPANSION CASE-DELAYED COKER

SCALE	DRAWN BY	CHECKED BY	
~	STD		
DRAWING NUMBER		SHEET NO.	REV.
55B-A-518			3



NOTES

1. 94,000 BPSD EXPANDED DELAYED COKER
2. ALL FLOWS IN USGPM

NO.	DATE	REVISIONS	BY	CHK	ENGR	APPD
1	11/24/78	REVISED & ISSUED FOR ERCB.				
0	2/9/78	ISSUED FOR FINAL REPORT	STD			

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
OVERALL WATER BALANCE EXPANSION CASE-DELAYED COKER

SCALE	DRAWN BY	CHECKED BY	
	STD		
DRAWING NUMBER		SHEET NO.	REV.
55B-A-3207			1

Exhibit 1 (pt. of)

ALBERTA DEPARTMENT OF THE ENVIRONMENT, PRESCRIBED METHOD FOR STACK DESIGN

SUBMISSION RE
APPLICATION No. 780318
DATE DEC 11 1978

RUN NO 6 NOV 28/78 EXPANSION 71800 BPSD FINA ELEV 00000070

PARAMETERS FOR STACK NUMBER 1

STACK HEIGHT -	106.7	M
STACK DIAMETER -	1.803	M
GAS EXIT SPEED -	28.	M/S
GAS TEMPERATURE -	593.	C
EMISSION RATE -	0.164000	M**3/S AT REFERENCE TEMPERATURE AND 101.325 KPA
REFERENCE TEMPERATURE -	21.1	C
STACK DISTANCE -	0.	M FROM ORIGIN

PARAMETERS FOR STACK NUMBER 2

STACK HEIGHT -	106.7	M
STACK DIAMETER -	5.791	M
GAS EXIT SPEED -	31.	M/S
GAS TEMPERATURE -	260.	C
EMISSION RATE -	1.330000	M**3/S AT REFERENCE TEMPERATURE AND 101.325 KPA
REFERENCE TEMPERATURE -	21.1	C
STACK DISTANCE -	46.	M FROM ORIGIN

AMBIENT TEMPERATURE - 10. C

DIFFUSION WITHIN A MIXING LAYER BENEATH AN ELEVATED INVERSION
INVERSION BASE AT LEVEL OF HIGHEST PLUME OR 100. M, WHICHEVER IS LARGER

TEN-METRE WINDSPEEDS BETWEEN 1.0 AND 20.0 M/S IN INCREMENTS OF 0.5 M/S ARE EXAMINED

DISTANCE FROM ORIGIN IN METRES	ELEVATION ABOVE ORIGIN IN METRES
500.	0.
1000.	0.
1500.	0.
2000.	0.
2500.	0.
3000.	36.
3500.	63.
4000.	75.
4500.	80.
5000.	82.
5500.	85.
6000.	86.
6500.	88.
7000.	92.
7500.	96.
8000.	98.
8500.	101.
9000.	102.
9500.	103.

10000. 107.

HEIGHT OF TREE CANOPY = 5. M
DISTANCE TO TREE CANOPY - 2000. M FROM ORIGIN

OVERALL MAXIMUM TREETOP CONCENTRATION - 0.354 PPM AS A 0.50 HOUR AVERAGE
DISTANCE OF OCCURRENCE - 3500. M
CRITICAL TEN-METRE WINDSPEED - 10.0 M/S

MAXIMUM PERMISSIBLE CONCENTRATION = 0.200 PPM AS A 0.50 HOUR AVERAGE

STACK NUMBER	EFFECTIVE STACK HEIGHT -M-	CONTRIBUTION TO OVERALL MAXIMUM -PPM-
1	96.	0.040
2	150.	0.314

***** TALLER STACK-S- NECESSARY *****

STACK NUMBER	REQUIRED STACK HEIGHT -M-	EFFECTIVE STACK HEIGHT -M-	CONTRIBUTION TO OVERALL MAXIMUM -PPM-
1	167.2	146.	0.023
2	167.2	220.	0.177

DISTANCE TO MAXIMUM - 5000. M
CRITICAL TEN-METRE WINDSPEED - 7.5 M/S

***** TALLER STACK-S NECESSARY *****

STACK NUMBER	REQUIRED STACK HEIGHT -M-	EFFECTIVE STACK HEIGHT -M-	CONTRIBUTION TO OVERALL MAXIMUM -PPM-
1	120.2	142.	0.024
2	120.2	207.	0.174

DISTANCE TO MAXIMUM = 4365. M

CRITICAL TOP-HEIGHT WINDSPEED = 10.5 M/S

ALBERTA DEPARTMENT OF THE ENVIRONMENT, PRESCRIBED METHOD FOR STACK DESIGN

RUN NO 6 NOV 28/78 EXPANSTON 71800 BPSD FINA ELEV 00000070

PARAMETERS FOR STACK NUMBER 1

STACK HEIGHT -	106.7	M
STACK DIAMETER -	1.803	M
GAS EXIT SPEED -	28.	M/S
GAS TEMPERATURE -	593.	C
EMISSION RATE -	0.164000	M**3/S AT REFERENCE TEMPERATURE AND 101.325 KPA
REFERENCE TEMPERATURE -	21.1	C
STACK DISTANCE -	0.	M FROM ORIGIN

PARAMETERS FOR STACK NUMBER 2

STACK HEIGHT -	106.7	M
STACK DIAMETER -	5.791	M
GAS EXIT SPEED -	31.	M/S
GAS TEMPERATURE -	260.	C
EMISSION RATE -	1.330000	M**3/S AT REFERENCE TEMPERATURE AND 101.325 KPA
REFERENCE TEMPERATURE -	21.1	C
STACK DISTANCE -	46.	M FROM ORIGIN

AMBIENT TEMPERATURE 10. C

DIFFUSION WITHIN A MIXING LAYER BENEATH AN ELEVATED INVERSION
INVERSION BASE AT LEVEL OF HIGHEST PLUME OR 100. M, WHICHEVER IS LARGER

TEN-METRE WINDSPEEDS BETWEEN 1.0 AND 20.0 M/S IN INCREMENTS OF 0.5 M/S ARE EXAMINED

FLAT, ROUGH TERRAIN
SEARCH IS PERFORMED USING EQUAL LOGARITHMIC INCREMENTS OF DISTANCE

HEIGHT OF TREE CANOPY - 5. M
DISTANCE TO TREE CANOPY - 2000. M FROM ORIGIN

OVERALL MAXIMUM TREETOP CONCENTRATION - 0.233 PPM AS A 0.50 HOUR AVERAGE
DISTANCE OF OCCURRENCE - 3631. M
CRITICAL TEN-METRE WINDSPEED - 12.0 M/S

MAXIMUM PERMISSIBLE CONCENTRATION - 0.200 PPM AS A 0.50 HOUR AVERAGE

STACK NUMBER	EFFECTIVE STACK HEIGHT -M-	CONTRIBUTION TO OVERALL MAXIMUM -PPM-
1	126.	0.029
2	185.	0.204

GREAT CANADIAN OIL SANDS LIMITED

10123 99TH STREET, EDMONTON, ALBERTA T5J 3H9 (403) 426-7440 TELEX: 037-2160

January 22, 1979

Mr. A.P. Scott
Gulf Canada Resources Inc.
P.O. Box 130
707 - 7th Avenue, S.W.
Calgary, Alta. T2P 2H7

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 26 1979

Dear Mr. Scott;

We acknowledge receipt of your letter of intervention dated January 15th, 1979.

If you wish any further information please contact the writer. We trust this is satisfactory.

Yours very truly,

J. Thompson

for W.L. Oliver, Vice-president
Corporate Affairs

WLO/tt

S. A. COWAN
President

GREAT CANADIAN OIL SANDS LIMITED

10123 99TH STREET, EDMONTON, ALBERTA T5J 3H9 (403) 426-7442 TELEX: 037-2160

January 22, 1979

Mr. Jean Poulin
S.T.O.P.
Box 1633
Edmonton, Alta.
T5J 2N9

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 26 1979

Dear Mr. Poulin;

We acknowledge receipt of your letter of intervention dated January 16, 1979. Following your telephone request we forwarded to you on January 18, 1979 copies of the November 8, 1979 Application and November 30 letter to the ERCB complete with drawings.

If you wish any further information please contact the writer. We trust this is satisfactory.

Yours very truly,

J. Thompson

for W.L. Oliver, Vice-president
Corporate Affairs

WLO/tt

S. A. CONRAN
President

GREAT CANADIAN OIL SANDS LIMITED

10123 99TH STREET, EDMONTON, ALBERTA T5J 3H9 (403) 426-7440 TELEX: 037-2160

January 23, 1979

Mr. W.E. Mason
Chairman, Board of Administrators
New Town of Fort McMurray
Fort McMurray, Alberta

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 26 1979

Gentlemen:

We received three copies of your letter dated January 17, 1979, addressed to the Energy Resources Conservation Board and the accompanying brief. We look forward to your presence at the hearing on January 30th, 1979.

Confirming the information I gave to Messrs. Bruce Otterdahl, Peter Van Belle and Gerry Beussieres during our discussions we are hopeful that construction can start on the alterations to our plant in mid-1979 and that the alterations will be substantially complete in early 1981. We expect the construction force to peak in late 1980 at possibly up to 750 people. We are building new camp facilities and expect the entire construction force to be domiciled in the camp. We think that relatively few people from this construction force will choose to live in Fort McMurray for the relatively short time they are at GCOS.

We expect to hire 175 new permanent employees to staff our plant subsequent to the completion of our alterations. We plan on hiring the first 25 people during the last quarter of 1979 and 25 per quarter after that, until we attain 175. We plan to house all of these employees in facilities provided by Athabasca Realty. The attached letter forwarded to me by Mr. John Marsh, President of Athabasca Realty, addresses some of the concerns you voiced in your brief regarding housing units required as a result of our proposed alteration and how we plan to supply these units.

GCOS is concerned about your municipality's fiscal position and supports an equitable sharing with the New Town of Fort McMurray of the taxes paid by GCOS to the Improvement District. We would be pleased to meet with you and explore ways in which this could be done.

...2

GCOS has frequently reviewed the possibility of establishing offices for some of their personnel in Fort McMurray and in fact the employees of Athabasca Realty work out of offices located in Fort McMurray. This matter will continue to be reviewed as opportunities present themselves.

We would be pleased to discuss the proposed alterations of our plant and the possible impact on Fort McMurray further at your convenience.

Yours very truly,

W.L. Oliver, Vice-president
Corporate Affairs

WLO/tt
c.c. W.E. Mason, 3 copies
B. Stadnyk, ERCB, 10 copies

S A CONTAS
President

GREAT CANADIAN OIL SANDS LIMITED

10123 99TH STREET, EDMONTON, ALBERTA T5J 3H9 (403) 426-7440 TELEX: 037-2162

January 23, 1979

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 26 1979

The Fort MacKay Community Committee
c/o Mr. Gary Shantz
9401A Franklin Avenue
Fort McMurray, Alberta

Gentlemen:

We received three copies of the Interventions filed by the Fort MacKay Community Committee dated January 19, 1979. On January 22, 1979 Mr. Blair Stadnyk of the Energy Resources Conservation Board advised me to address our reply in care of Mr. Gary Shantz and we are so doing.

In the short time available between January 22nd and January 24th we are unable to address all of the points raised in your brief but will address the four points listed on page 4 and hopefully many of the questions posed throughout the remainder of the text.

Environmental Points:

GCOS assures that the proposed alteratin to the GCOS operation will not lead to detrimental effects upon the natural environment.

The stream day SO2 emissions will not be increased and will continue to be well within the limits of the GCOS Clean Air License.

The frequency of upset conditions has been reduced during the past years by tighter operating controls and additions of environmental equipment such as the construction of a second back-up sulphur recovery plant completed in 1978 at a cost of approximately $7 million. We believe upset conditions will be lower now that the back-up sulphur unit is operable.

The level of emissions et in the regulations and in the GCOS Clean Air License are well below the level at which there are negative cumulative effects upon individuals and the GCOS emissions are well below these limits.

The studies that GCOS is aware of indicate there is no problem with particulate matter settling in Fort McMurray. During 1979 GCOS will be completing installation of Electrostatic Precipitators at a cost of approximately $26 million which will reduce the particulate emissions to below the levels established by the new Clean Air License.

Emissions from the GCOS plant are not having any negative effect upon wildlife or fish.

The water taken from the Athabasca River is high in sediment and naturally occuring materials leached out of the tar sand on its banks. GCOS settles the sediments, uses the water for cooling and returns the water to the river. Any water used in the process is not returned to the river.

The volume and amounts of water, chemicals, etc. returned to the River are reported monthly to the Department of Environment and are within the limits set by the GCOS Clean Water License. All studies done to date indicate that there are no adverse chemical and biological effects on the biota of the Athabasca River beyond the immediate vicinity of the plant.

We understand that the reason the Athabasca River water is not used for drinking water at Fort MacKay is because of the high coliform levels caused by upstream pollution from communities such as Hinton and Fort McMurray. It is for that reason Fort McMurray, GCOS and Syncrude filter and chlorine treat the water to be used for drinking.

Social and Economic Point:

There will be 600 to 750 jobs created during the construction period of the alterations between mid-1979 and early 1981. Most of these people will be hired by the contractors and will be provided accommodations in the camp.

After the alterations are complete GCOS will require approximately 175 new people to run the operation. We will commence hiring approximately 25 people per quarter commencing the last quarter of 1979.

Speaking to point (b) on page 4 of your brief, a formal program of training recruitment and employment for the native people of Alberta has been in place since 1971. Last year the program was temporarily suspended when the Union objected in November, 1977 to GCOS placing native people in positions without first posting these positions for Union members. We have been discussing this in detail with the Union and expect the matter to be resolved in the near future so that the program can be reactivated. As in the past this program will be offered to the residents of Fort MacKay. In the past this program has been quite successful with a total of 205 Native People having been employed by GCOS. Of this number:

44 are still employed averaging 56 months of service.
43 had 18 months or more of service.
23 had 12 to 17 months of service.
29 had 6 to 11 months of service.
9 had 3 to 6 months of service.
57 had 3 months or less of service.

...3

The above figures do not include the native people employed by our contractors. We estimate that 35 to 40 people from Fort MacKay have been employed by GCOS or its contractor.

Addressing point (c) on page 4 of the brief, GCOS intends to co-operate and communicate with the Fort MacKay Community Committee regarding all matters of mutual concern and has established initial contact with the Committee through the offices of the Commissioner of the Northeast Alberta Region. Contrary to several references in your brief, GCOS has not ignored the community of Fort MacKay but has had many contacts with various people at different times. However, in the past GCOS has been unable to establish a contact in the community with whom our people can maintain easy and regular access. For many years we attempted to keep in touch through Native Outreach and visits to the community by GCOS personnel.

Addressing (d) on page 4, GCOS is willing to provide at its expense transportation for its employees and for the employees of contractors working for GCOS who reside in Fort MacKay if there are sufficient numbers of employees. From 1967 until 1976 GCOS did provide free transportation to and from Fort MacKay. However the number of GCOS employees living in Fort MacKay decreased drastically in 1976 as they apparently sought employment elsewhere, and only one employee was left.

We trust this addresses some of the issues raised in your brief. We would be pleased to discuss the proposed alterations of our plant further at your convenience.

Yours very truly,

W.L. Oliver, Vice-president
Corporate Affairs

WLO/tt

c.c. G. Shantz, 3 copies
B. Stadnyk, ERCB, 10 copies

GREAT CANADIAN OIL SANDS LIMITED 10123 99TH STREET, EDMONTON, ALBERTA T5J 3H9 (403) 425-2443 TELEX: 037-2150

February 2, 1979

Energy Resources Conservation Board
603 - 6th Avenue S.W.
CALGARY, Alberta
T2P 0T4

Dear Mr. Boeheme:

The following is the outstanding information requested of G.C.O.S. at "The Hearing" on January 30th and 31st.

A. To questions of Mr. Poulin (STOP)

(1) Ash Pond Dimensions (Average)

600 ft x 365 ft x 10 ft deep

Capacity - 54,000 short tons (approx.)

(2) Analysis of G.C.O.S. Flyash

	Range % w/w
SiO_2	28.9 - 38.3
Al_2O_3	18.8 - 25.9
Fe_2O_3	5.52- 7.1
V_2O_5	3.7 - 5.8
Sulphur (as SO_4)	1.5 - 2.7
CaO	1.2 - 2.6
Na_2O	0.4 - 0.6
MoO_3	0.16- 0.24
NiO	1.1 - 1.6
TiO_2	3.0 - 3.8
MnO_2	0.15- 0.21
[illegible]$_2O$	1.5 - 2.0
M_2O	1.1 - 1.3

....../2

	Range % w/w
P_2O_5	0.12 - 0.18
Loss on Ignition	11.4 - 39.0

Other Elements - Typical Values

	ppm
Zn	370
Cu	<25
As	2.2
Ba	<240
Cd	<20
Cr	150
Co	<40
Pb	<20
Hg	0.97

(3) No infringements of the guideline of 16,000 ppm, for our sulphur plant incinerator stack, have been experienced.

(4) The coke burn in the calculations results supplied to DOE in our November 30, 1978 letter, item 9 is 2700 t/d.

B. To questions of Ft. MacKay Representative (Mr. Boucher):

(1) Analysis of GCOS Wastewater

Averages for 200 samples in 1978 -

Total Suspended Solids	22.7 mg/l
Oil and Grease	5.3 mg/l
Threshold Odor No.	83 mg/l
Chemical Oxygen Demand	73.4 mg/l
Phenols	0.05mg/l
Ammonia as nitrogen	nil

Cont'd.

pH	8.15 mg/l
Suphides	nil
Biochemical Oxygen Demand	40.4 mg/l
Total Organic Cabon	61.6 mg/l
Temperature ^{o}C	13.1

(2) We will indeed discuss AOSERP & GCOS environmental reports with the Ft. Mac Kay community representatives.

(3) Our Mr. D.G. Smith and Mr. A. Schuster will provide the community relations interface with Ft. MacKay. They will meet with the Fort MacKay Community Committee and discuss the manner in which transportation will be provided and the minimum number of employees residing in Fort MacKay to justify free transportation to and from the GCOS plantsite.

(4) We have just received the C & G report on the impact on the river of our waste water and will send this to you after review in a few days.

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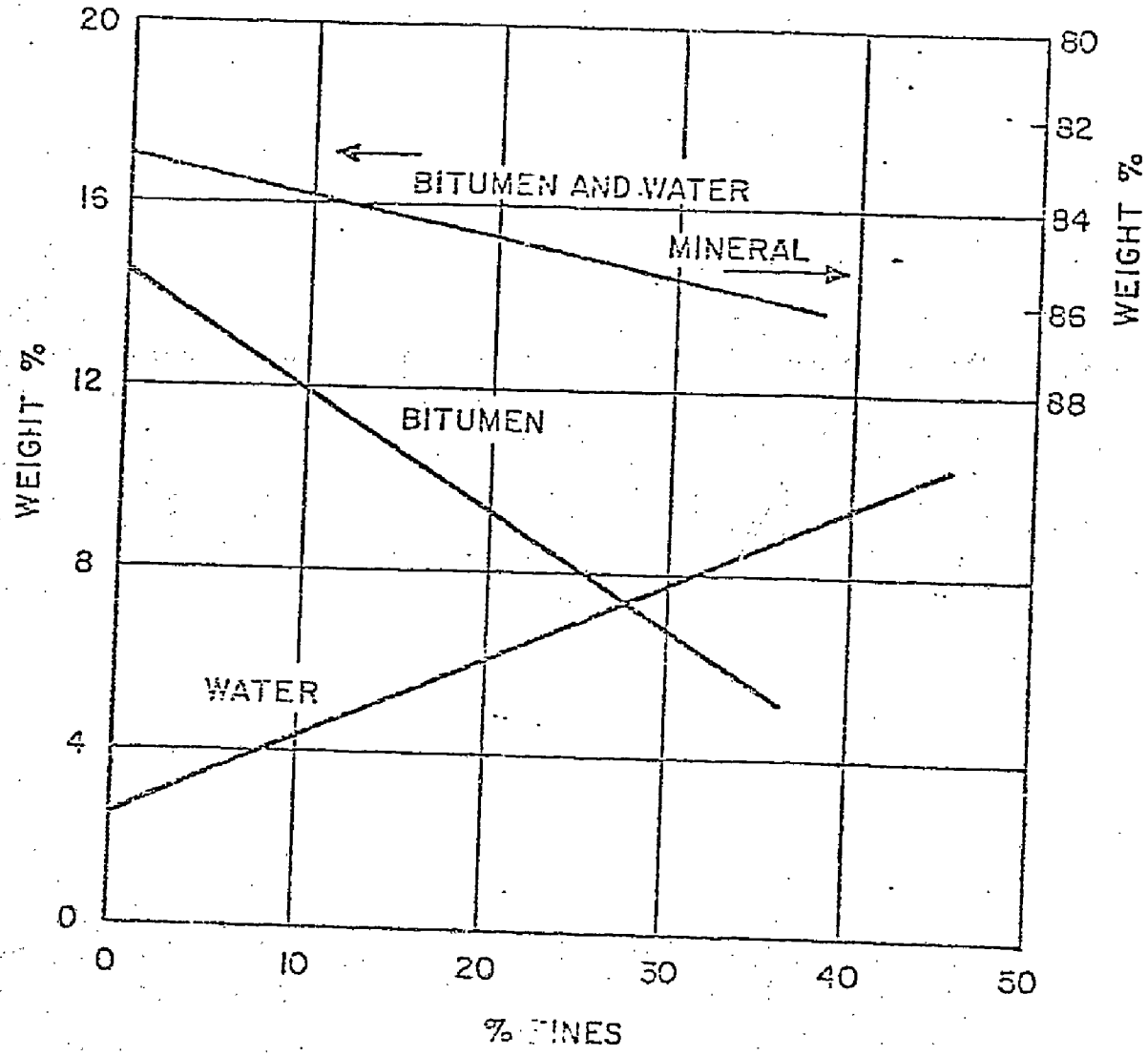

RELATIONSHIP OF BITUMEN, WATER & FINES CONTENT

FIGURE 3

SOURCE: REF 4

C. To questions of E.R.C.B. staff:

(1) Relationship between bitumen and fines is attached (Figure 3).

(2) Maximum design major flow rates for Extraction Plant per each of the five lines are:

Feed	2000 TPH Tar Sand
Tar Sand Feed	2000 TPH
Total Recycle Water	1654 TPH
Oversize	80 TPH
Primary Extraction Tails	3213 TPH
Diluted Bitumen	622 TPH

(3) The detailed analysis of the new kerosene and gas oil streamers are:

Product Specifications

		KEROSENE	GAS-OIL
Boiling Range ASTM D 86	0%	423 (300 min)	513 (425)
	10%	440	594
	50%	485 (460 max)	698
	90%	551	850 (900 max)
End Point	EPI	590	910 (950 min)
Gravity	API	36.5 (35-45)	23 (20-30)
Sulphur	S	25 ppm	2300 ppm (3300)
Nitrogen	N	1 ppm	550 ppm (600)
Aromatics		20% vol.	45 wt %(45 vol)
Smoke Point		20 mm (min)	

(4) Recovery of diluent naphtha from the plant 4 tails by the steam stripping process is greater than 90%.

(5) Extraction Process steam requirements are:

Winter 0.14 lbs steam/ lb tar sand

Summer 0.12 lbs steam/ lb tar sand

The steam availability limits the extraction plant 60% of the time in winter and 10% in summer.

(6) A 350 t/d coke feed boiler would be required to replace the gas fired one. At 6% sulphur this would release 42 tons/day of sulphur dioxide.

(7) Capital cost breakdown for expansion is:

	YEAR					
Facility	1978	1979	1980	1981	1982	Total
Overburden/Mine		2.0	18.2	6.1	9.5	35.8
Extraction	0.1	6.5	27.9	23.0		57.5
Upgrading		4.7	20.0	16.5		41.2
Offsites		2.0	6.4	5.3		13.7
Utilities		2.1	6.4	5.3		13.8
ARCL & GCOS		5.0	10.0	8.0		23.0
	0.1	22.3	88.9	64.2	9.5	185.0

...../7

(8) Pro-rated Estimated Operating Costs for the Altered Facilities to Produce the Additional 13,000 BPCD

		$MM/Year	
Mine	Maintenance	1.4	
	Op. Labor	1.0	
	Other	1.6	
			4.0
Extraction	Maintenance	1.6	
	Op. Labor	0.5	
	Other	0.1	
			2.2
Upgrading	Maintenance	1.0	
	Op. Labor	0.7	
	Fuel Gas	1.8	
	Other	0.3	
			3.8
Utilities	Maintenance	0.5	
	Op. Labor	0.3	
	Fuel Gas	2.2	
	Other	0.4	
			3.4
M.E. Maintenance			2.1
Central Maintenance			0.9
Engineering			0.5
Admin- Plant			1.1
Admin- F&P etc			1.1
Shutdown			1.2
Electricity Purchase			2.5
			25.5

Overburden Unit Cost $1.6/bcy not forecast to change as a result of alterations. However annual volumes to increase to allow faster mining rate.

D. To questions of D.O.E.:

(1) Peak Synthetic Crude Production with Present Facilities

Capacity Test Period - September 16-18, 1972

September 16 - 66,601 bbls/d (off units)

Normal Operating Period Maximum

October 13, 1975 - 71,454 bbls/d

(2) Present peak SO_2 emission is 342 t/day.

Please telephone us if this requires further clarification.

Yours very truly,

W. L. Oliver

MAS/cmo
Attachments

INTERVENTION

LIST OF INTERVENTIONS

1. LETTER FROM GULF CANADA RESOURCES INC.
   DATED JANUARY 12, 1979

2. LETTER FROM JEAN POULIN
   DATED JANUARY 16, 1979

3. SUBMISSION FROM NEW TOWN OF FORT McMURRAY
   DATED JANUARY 17, 1979 (ALSO EXHIBIT NO. 4)

4. SUBMISSION AND LETTER FROM THE FORT MACKAY COMMUNITY COMMITTEE
   DATED JANUARY 19, 1979 (ALSO EXHIBIT NO. 5)AND FEBRUARY 12, 1979

ENERGY RESOURCES CONSERVATION BOARD

IN THE MATTER of the Oil and Gas Conservation Act being Chapter 267 of the Revised Statutes of Alberta 1970 and amendments thereto;

and

IN THE MATTER of Application No. 780318 by Great Canadian Oil Sands Limited for a permit to amend Approval No. 1944 for a scheme to recover oil or a crude bitumen hydrocarbon product from oil sands.

STATEMENT OF INTERVENTION

of

GULF CANADA RESOURCES INC.

Gulf Canada Resources Inc., a corporation incorporated under the laws of Canada, being a major producer of oil and gas in the Province of Alberta, and therefore an interested party in the subject Application, hereby indicates its intention to appear at the hearing to be held at the MacDonald Island Pavilion, 151 MacDonald Drive, Fort McMurray, Alberta, on Tuesday, January 30, 1979, for the purpose of cross examination of witnesses and presentation of argument with respect to evidence adduced and issues raised in connection with the subject Application. Gulf Canada Resources Inc. further wishes to reserve its right to adduce such evidence as deemed appropriate with respect to any and all aspects of the subject Application.

Dated at the City of Calgary, in the Province of Alberta, this 12th day of January, 1979.

Respectfully submitted,

A. P. Scott,
Solicitor for
Gulf Canada Resources Inc.

All communications with respect to this statement of intervention should be directed to:

Gulf Canada Resources Inc.,
P. O. Box 130,
707 - 7th Avenue S. W.,
Calgary, Alberta T2P 2H7

Attention: A. P. Scott

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 19 1979

January 26, 1979

Mr. A. McLarty
E.R.C.B.
603 6th Avenue S.W.
Calgary, Alberta
T2P 0T4.

Dear Sir,

As an interested party in the orderly and proper development of Alberta's energy resources, S.T.O.P. will appear at the Board's hearing into the application by Great Canadian Oil Sands Ltd. to expand their operations.

Our questions will relate to the need for this expansion as well as to its environmental impact.

Yours truly,

per Jean Poulin
S.T.O.P.

cc. Mr. Wm. Oliver
G.C.O.S.

encl./9

STOP: Box 1633 Edmonton T5J 2N9
SAVE TOMORROW/OPPOSE POLLUTION

Exhibit 4

New Town Of Fort McMurray

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 22 1979

OFFICE OF THE CHAIRMAN

42 RIEDEL STREET
FORT McMURRAY, ALBERTA
CANADA T9H 3E1
PHONE (403) 743-1000

January 17, 1979

The Chairman and Members of the
Energy Resources Conservation Board,
603 - 6th Avenue S.W.,
Calgary, Alberta

Gentlemen:

With reference to the planned expansion of the Great Canadian Oil Sands Plant in the area of Fort McMurray, Alberta, I wish to express to your office the unqualified support of the Municipal Council in Fort McMurray for this development.

We consider Great Canadian Oil Sands an excellent corporate citizen in our community and in our area, and have enjoyed a very satisfactory working relationship for over a decade.

Further to our statement of support, we would hope that this project would be encouraged by the E.R.C.B., and that no delays will result in either the approvals or development schedules for this project.

I have had my staff review the project plans, and their comments are attached for your information. We would hope that we would be able to make a presentation along these lines on January 30, 1979, when we expect you to be present in Fort McMurray.

On behalf of the Board of Administrators of the New Town of Fort McMurray, I remain,

Yours sincerely,

W.E.MASON,
Chairman,
Board of Administrators

/vec

Attach.: Staff analysis and report on expansion impact.

NEW TOWN OF FORT MCMURRAY
BRIEF ON G.C.O.S. EXPANSION
PREPARED FOR THE ENERGY RESOURCE CONSERVATION BOARD HEARING
JANUARY 30, 1979

Background

Great Canadian Oil Sands Ltd. made application in May 1978 to the Energy Conservation Board of Alberta for approval to expand their oil mining project located north of Fort McMurray. This application was substantially modified, by letter, to the E.R.C.B. dated November 8, 1978.

A hearing by the E.R.C.B. has been scheduled for January 30, 1979, in Fort McMurray.

All of the personnel employed by G.C.O.S. and it's sub-contractors at the plant are housed in Fort McMurray. The New Town of Fort McMurray has therefore a direct interest in the expansion of G.C.O.S.

The Proposal

The prime elements of the G.C.O.S. expansion as understood, are:

- cost 185 million dollars.
- production to rise from 45,000 barrels to 58,000 barrels per day, average.
- ore body lifetime reduced from 22 years to 17 years.
- peak construction work force 750 in the Fall of 1980.
- construction start up - Summer of 1979.
- completion - mechanical - December 1980.
- completion - bucketwheel - mid 1981.
- labour force increase: 175 permanent employees.

The lifetime of the plant can be extended beyond the 1997/2001 depletion date by mining and/or upgrading bitumen from nearby leases, some of which are held by a sister corporation.

The expansion consists mainly of plant elements maintained by G.C.O.S. work forces. Therefore the increase in sub-contractors maintenance crews is anticipated to be minimal.

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General Impact

The timing of the G.C.O.S. expansion is very appropriate since it falls between the completion of the Syncrude project and future development of Alsands and an anticipated Syncrude expansion. This will even out the extraordinary growth rate of the municipality. It will also increase the likelihood that the construction work force will elect to live in Fort McMurray with their families.

The magnitude of the expansion is small compared to the recent project completed in 1978. The municipal infrastructure will complement this expansion.

All of the G.C.O.S. employees at the plant are citizens of Fort McMurray. The Municipality therefore, has an interest in the economic viability of the G.C.O.S. operation.

It is for the above reasons that the New Town of Fort McMurray supports G.C.O.S. in it's application before the E.R.C.B.

Lifetime of the Ore Body

One area of major concern is the duration of the operation. The lifetime of the ore body will be reduced by about 25%, from 21 years to 17 years. This is a significant reduction.

The Municipality has entered into debentures of 25 years or more to supply services. The proposed expansion will add to the need for further debentures of equal term. A number of families have assumed mortgages of 25 years or more and many new families moving to Fort McMurray will likely do the same.

A shorter life span of the G.C.O.S. operation is therefore of concern to the Municipality. We recognize that no iron clad guarantees can be given that the operation will continue beyond 1997. We raise this issue at this time for two reasons. One, in future hearings of the E.R.C.B. this issue be given full consideration; two, to urge G.C.O.S. to keep the Municipality informed of efforts to extend the ore body that can be mined and/or upgraded at the plant.

The latter is particularly significant since the Municipality intends to attract ancillary industry needed to diversify it's economic base.

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Short Term Fiscal Impact

No estimates have been prepared by G.C.O.S. to show the impact of it's expansion on the population growth of Fort McMurray.

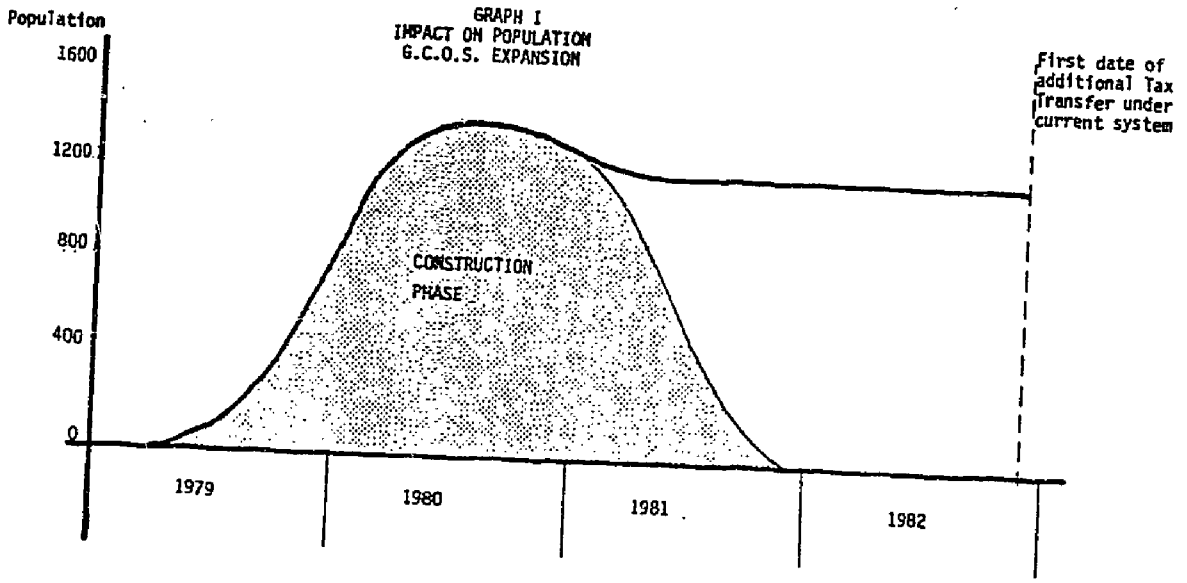
The construction labour force in past projects has largely been located in accommodations at the site. Nevertheless, even during the peak of the Syncrude construction, with a housing shortage in Fort McMurray, 16% ± of the work force lived in Town, including 750 families (Syncrude Construction Force November 1977 p.6 Alberta Municipal Affairs).

With Fort McMurray providing a much broader range of services and a more adequate supply of housing, it is likely that a large proportion of the construction work force will elect to live in Town with their families. The shorter construction period, i.e. 18 months, could be offset by the likelihood of further oil sands development anticipated beyond 1980.

In Table I, we have assumed that 50% of 600 construction employees will elect to live in Town.

The permanent work force addition of 175 people will all live in Fort McMurray. As shown in Table I, this will generate an additional population of say, 1200 permanent residents.

The graph below, which includes induced growth, based on Table I, shows that combining the construction and permanent work forces with expansion of the service sector, the major impact will occur during 1980 with a small decline during 1981.



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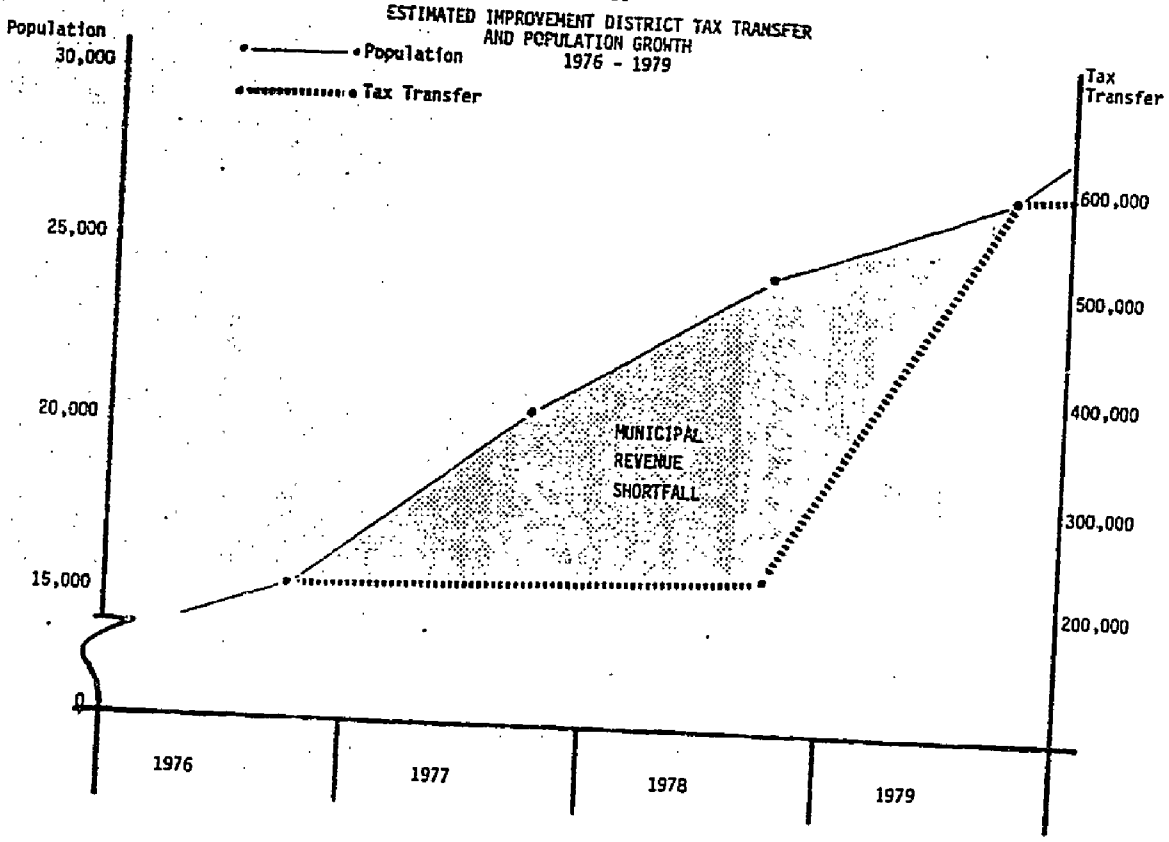
Under the current fiscal arrangement, Improvement District 18 transfers $50.00 per capita for every resident of Fort McMurray and his dependents employed in a tax paying industrial plant located outside the Town.

With this revenue system the first I.D. Transfer generated by the G.C.O.S. expansion will occur by late 1982 so that the Municipal services have been provided for almost 3 years.

This is similar to what occurred during the period 1976-1979 as shown by Graph II.

GRAPH II
ESTIMATED IMPROVEMENT DISTRICT TAX TRANSFER AND POPULATION GROWTH 1976 - 1979



Long Term Fiscal Impact

Of greater concern is the long term fiscal impact on Fort McMurray under the present financial arrangement. During 1978 every employee (including part-time)

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working in a tax paying industry in Town will contribute ± $340.00 through the 59.3 mills tax levied on those commercial/industrial projects.

In 1978, the amount received per employee of the industry located in the Improvement District was $146.00, @ $50.00 per capita.

The Municipality has experienced fiscal difficulty related to growth as evidenced by a 107% increase in mill rate over the four year period 1975-1978. The [illegible] fee of $50.00 per qualified capita has not kept pace with inflation and the expanded demand for services. If indexed to the Municipal mill rate over the last 4 years, the 1978 per capita transfer should have been over $100.00.

The G.C.O.S. expansion of 175 workers in itself is very minimal. However, it will add to the present imbalance and if this imbalance continues then the Municipality will not be in a position to continue operating.

When the short term impact and the long term impact are combined, an impossible situation evolves.

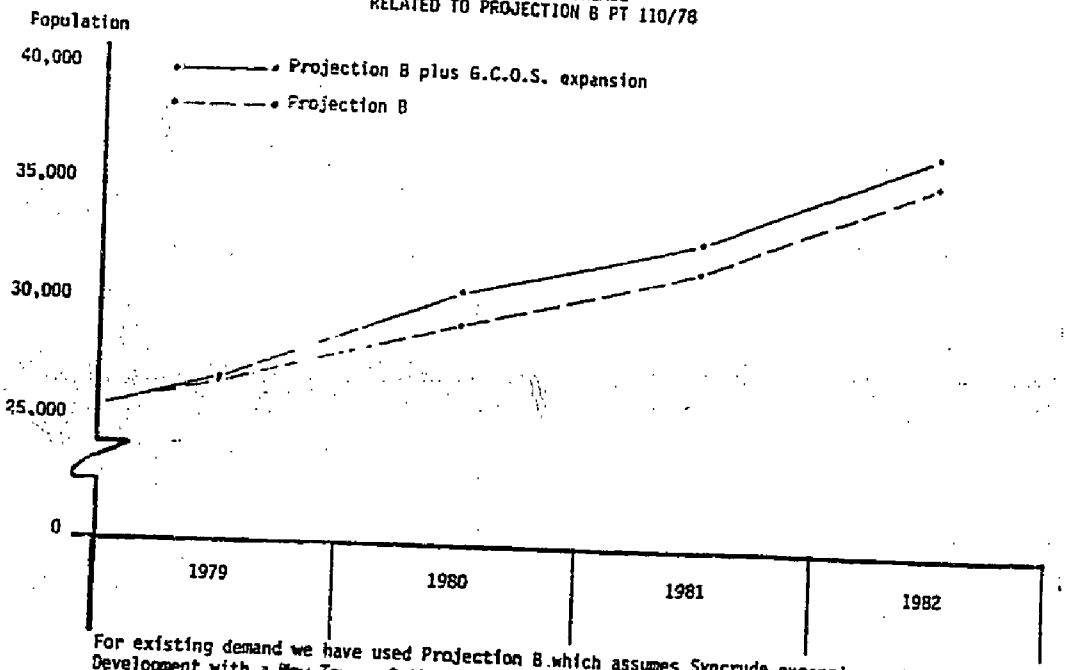
In a conventional setting the initial tax revenue of a plant such as G.C.O.S. is substantially higher, offsetting the upfront operating deficit accumulated before new construction is placed on the assessment roll. As the assessed value of the plant decreases, revenue deceases over time.

Housing Impact

The magnitude of the impact of the G.C.O.S. expansion on population is relatively small. The graph below illustrates the population impact related to projection B of PT 110/78.

6/.....

GRAPH III
POPULATION INCREASE
RELATED TO PROJECTION B PT 110/78



For existing demand we have used Projection B which assumes Syncrude expansion and Alsands Development with a New Town. Both of these projects beginning to impact on the Town by 1981 (PT 110/78)

Of greater concern however, is the impact on housing demand. Table III shows the demand for dwelling units generated by the expansion. It shows that G.C.O.S. will need about 120 additional units for it's new employees. However, at peak of construction, about 410 new dwelling units will be required for the service sector and construction employees.

Athabasca Realty has about 150 vacant lots available and some sites for town-houses and apartment dwellings which may be used for link housing or zero lot line units in Thickwood Heights. Furthermore, Grayling Terrace will contain approximately 100 link housing or zero lot line housing units. All of these are in various stages of development and have received the required approvals. In addition, it is anticipated that Athabasca Realty will be requesting approval of a project to re-develop Ptarmigan Park in Waterways. At this time the number of units involved is not known.

It is our understanding that Athabasca Realty requires approximately 100 new dwelling units per year to allow for replacement of units occupied by former

7/.....

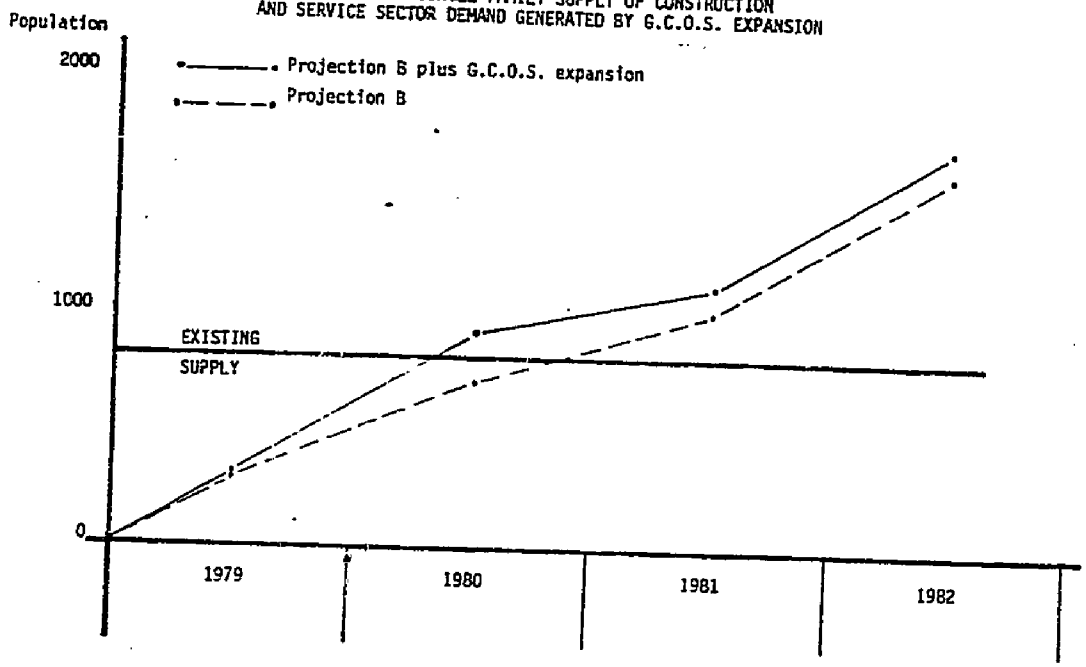
employees who have fulfilled the conditions of the agreement for sale and purchase.

Assuming this to be the case - it would appear that Athabasca Realty, for G.C.O.S. employees, would have an adequate amount of land available for developing dwelling units to allow for this expansion. Over the long term, of course, Athabasca Realty will require new areas for development.

Housing accommodation for the service sector employees, generated by both the construction employment and the permanent employment, could be a problem. At the present time there is an adequate supply of vacant apartment units and sites for additional multi-family dwellings. However, in the area of single and two family dwellings, this will become a problem in the very near future. Using the Impact Assessment previously prepared (PT 110/78), the following graph shows the effect of the G.C.O.S. expansion on housing demand in single family dwellings.

The graph below shows that the major demand for new single family dwellings will occur during 1980. That is also the point where we expect to run out of single family lots in Thickwood. The net effect of the G.C.O.S. expansion may be to require a fast tracking of the Timberlea development.

GRAPH IV
IMPACT ON SINGLE FAMILY SUPPLY OF CONSTRUCTION
AND SERVICE SECTOR DEMAND GENERATED BY G.C.O.S. EXPANSION



8/.....

It is virtually impossible to predict accurately the increased demand on single family dwellings because of the many variables and the small number involved. The assumptions used to prepare Table III and Graph IV take neither the greatest or the least impact. It is based on the recent experience and reasonable expectation of what will happen.

Suggested Methods for Ameliorating the Impact on Fort McMurray

It is agreed and understood that the expansion of G.C.O.S. in itself is relatively small in terms of the impact on Fort McMurray. However, even this small impact will have a detrimental effect on the Municipality's fiscal position. We feel obliged therefore to recommend, at this time, methods for reducing the impact of the G.C.O.S. expansion on the fiscal stability of the New Town of Fort McMurray. The following items are submitted :

a) Municipal Boundary

It is suggested that G.C.O.S. apply to the Local Authorities Board for annexation of their plant to the New Town of Fort McMurray. The exact boundaries to be determined in consultation between the Town and G.C.O.S. Taxation from the G.C.O.S. operation would then accrue directly to the Municipality in a manner similar to the current School Board position. This would allow the Municipality a broader tax base and allow it to apply a tax rate on G.C.O.S. as is applied to commercial operators located within the community.

In the event that annexation does not occur, a formula will have to be devised which has the same effect without the G.C.O.S. operation being within the Town limits of Fort McMurray.

b) G.C.O.S. Offices

It is also suggested that G.C.O.S. develop and operate a substantial office facility within the Central Business District in Fort McMurray. The Provincial and Municipal Governments are showing leadership in this regard by the development of a 130 thousand sq. ft. office building to be located on the Civic Centre Site. Similarly, Alberta Power is building a 40 thousand sq. ft. office facility within Fort McMurray's C.B.D. It is entirely appropriate that G.C.O.S. operate a similar office in Fort McMurray, perhaps locating it's Engineering and/or Personnel division there.

The direct benefit to the community would be to broaden the potential for community leadership within the Municipality. It will also diversify the

9/.....

labour force. The Municipal tax revenue of such an office facility can assist the Municipality in creating a more stable revenue base. It would strengthen the commercial infrastructure, thus providing a wider range of services.

c) Participation in Timberlea

The G.C.O.S. expansion may result in the accelerated need for the development of Timberlea. The initial off-site costs to bring the needed infrastructure to Timberlea has been estimated at $16,650,000.00. The Municipality will be required to debenture these costs over a period of time before revenue from the sale of these lots would retire this debt. As such, the Municipality requires participation committment from G.C.O.S. in the development of Timberlea.

Conclusion

In examining the proposed expansion, there is no doubt that this is a very positive event for our Province, our Country and one of Fort McMurray's best regarded corporate citizens. The economic activity and creation of needed regional employment is most significant. We therefore share in supporting the application of G.C.O.S. for expansion of their facilities.

Our primary interests and dedication is to Fort McMurray's best interest on a broad scale. While generally the impact will be positive, this in no way should compromise arduous efforts to abate negative effects.

This submission is provided to the E.R.C.B. in the full confidence that the ameliorating conditions recommended above will be given fair consideration and implementation. The New Town of Fort McMurray can then continue to provide a town for the employees of G.C.O.S. with a high level of service and at a reasonable cost.

Respectfully submitted,

G.E. Bussieres
Municipal Secretary

Bruce Otterdahl
Director of Finance

Peter Van Belle
Senior Planner

TABLE I

POPULATION IMPACT

G.C.O.S. EXPANSION

	JUNE 1979	FALL 1980	JUNE 1981	JUNE 1982
Construction Workforce	50	600	50	00
50% Living In Town	25	300	25	00
Multiplied 2 x	50	600	50	00
Crude Labour Participation Rate 44%	100	1400	100	00
Net Change	+100	+1300	-1300	-100
Permanent Workforce				
100% in Town	0	0	160	15
Multiplied 3 X	0	0	500	45
Crude Labour Participation Rate 44%	0	0	1100	100
Total Net Population Change	+100	+1300	- 200	00

Although the peak construction work force is estimated at 750, the peak longer term construction work force is assumed to be 600 only.

NOTE: ALL FIGURES HAVE BEEN ROUNDED TO THE NEAREST 100.

TABLE II

Total Commercial Industrial Assessment 1978		$ 18,000,000
Municipal Tax Revenue 59.3 mills say 60 mills		
Total Revenue		$ 1,080,000

Census 1978

Employees in Part-time and Full-time	
Manufacturing	50
Transportation	442
Wholesale Trade	218
Retail Trade	916
Finance Insurance etc.	528
Accommodation Food Service	408
Other Commercial Business & Personal Service	633
	3195

Revenue per employee: 3195 ÷ $ 338.16 say $340.00

1978 ID Transfer

Total Revenue $50 per capita	$232,250	
Number of Employees	1,588	
Revenue per Employee		$ 146.00

TABLE III

G.C.O.S. EXPANSION

IMPACT ON DWELLING DEMAND

	G.C.O.S. EMPLOYEES 1 NEW DWELLING UNITS	50% SF	CONSTRUCTION AND SERVICE SECTOR NEW DWELLING UNITS	50% SF
JUNE 1979			30	15
JUNE 1980			380	190
JUNE 1981	90	45	-150	-75
JUNE 1982	30	15	- 30	-15
NET CHANGE	+120	+60	+230	115

1. Using 3.42 persons per dwelling unit 1978 Census.
2. Does not include new units normally required by G.C.O.S. each ye[illegible] to replace units lost to attrition.
3. Assumes that G.C.O.S. will not provide housing in Fort McMurray for construction employees. They may elect to do so in part.

Exhibit 5

SUBMISSION RE
APPLICATION No. 780318
DATE JAN 16 1979

I N T E R V E N T I O N

filed with

THE ENERGY RESOURCES CONSERVATION BOARD

by

THE FORT MACKAY COMMUNTIY COMMITTEE

in relation to the

PROPOSED GCOS EXPANSION APPLICATION 780318

January 19, 1979

Received
Jan 17/79
Solicitor's Office

Introduction

Before 1960, Fort MacKay was a relatively isolated settlement having little contact with the "outside world". The building of the Great Canadian Oil Sands plant in the 1960s marked the beginning of the encroachment of major resource development upon the settlement. The plant was constructed on the site of traditional hunting and trapping grounds - an area which also provided summer residence for many families from Fort MacKay. The construction of the plant provided the first major conflict between the traditional lifestyle of the community and an industrialized way of life.

In such a conflict, the "old way" can not win. A giant like GCOS has not changed its way because of Fort MacKay. But certainly our community has had to turn "upside down" for GCOS and other specific resource developments.

We can no longer live as we once did even though some people in our settlement would still like to live the "old way". We have had no choice but to try to change in order to survive. But to acquire the knowledge, skills and standard of living needed to participate in an industrialized way of life has been, and still is, very difficult for people in Fort MacKay.

When the present plant was first proposed, we did not know what to expect. But now we have had several years of experience living closer to the plant than has any other community. As GCOS has appeared consistently to ignore any ongoing liaison with us to help us adapt to the new way of life, we are prepared now to initiate this cooperation ourselves. As a result, this intervention briefly outlines a number of our concerns pertaining to the GCOS application for expansion. We request an opportunity at the scheduled hearings to expand upon these issues in the context of questioning and cross-examination of the applicant.

Environmental Issues

The following environmental issues are of concern to the residents of Fort MacKay.

(1) Since the construction of GCOS, the quality of the air in Fort MacKay appears to have decreased significantly. We are concerned that:

   (a) the expansion of the plant will compound the problem of sulphur dixoide emissions, not in terms of percentages, but in absolute terms;

   (b) The frequency of upset conditions in the past is unclear to us. What would be the projected frequency if the proposed expansion takes place?

   (c) There may be a negative cumulative effect upon individuals who are exposed to sulphur dixoide and particulate matter over a long period of time;

. . . 2

(d) There are a number of people in Fort MacKay who melt snow for drinking water. There may be a long term health hazard due to the settling of particulate matter on the snow;

(e) Emissions from GCOS plant are having a negative effect upon wildlife and fish;

(f) GCOS has not made any attempt to explain to the residents of Fort MacKay the results of environmental monitoring by the company and by the Alberta Oil Sands Environmental Research Program. The people in our community do not have the facts concerning the positive or negative significance of company emissions into the air and water.

(2) We are also concerned that the quality of the water in the Athabasca River appears to have detoriated significantly since the construction of the GCOS plant.

(a) How much chemical or effluent is released into the river water at the present time? We are concerned that the proposed expansion will raise these levels. We would also like to know the specific components of waste released into the river.

(b) Why were water-tanks installed in Fort MacKay so that water now has to be hauled into the community if river and snow water is safe to drink?

(c) We believe that GCOS has a responsibility to ensure safe drinking water for Fort MacKay.

Social and Economic Issues

The fact that the GCOS application does not address social and economic issues appears to demonstrate that the company will continue to ignore these points. We suggest that the company has definite responsibility to work with Fort MacKay to ensure that negative social and economic impacts are minimized and that these problems are resolved.

(1) We are curious concerning the effect which the proposed plant expansion will have on employment levels during the construction period and during the time of ongoing operation.

(a) How many jobs will be created during the construction period and during the operational phase?

. . . 3

(b) To date, neither GCOS nor its contractors apparently have deemed it their responsibility to engage in programs of recruitment, training and employment for the people of Fort MacKay. Will the proposed expansion provide more employment opportunity for the residents of Fort MacKay?

(c) To date, GCOS and its contractors have provided transportation to and from the job site for employees who live in Fort McMurray, a round trip of approximately 60 miles. The lack of such transportation for the community of Fort MacKay has greatly limited the ability of residents to participate in employment opportunities on the GCOS site. As late as December, 1978, GCOS and its contractors turned down a formal request from Fort MacKay for provision of transportation for onsite employees. We deem this to be unjust.

(2) GCOS consistently has oriented its community involvement toward Fort McMurray with no recognition of Fort MacKay in spite of the fact that Fort MacKay is closer to the plant, and the impact of the operation upon the community is at least of equal significance. We would like to know if this stance is going to continue if the license for expansion is granted.

(3) The necessity of belonging to unions makes getting jobs at the GCOS site very difficult for residents of Fort MacKay.

(4) GCOS has had an immense social and economic impact upon the community of Fort MacKay. We are concerned that these impacts will be compounded by the proposed expansion.

(a) As far as we know, GCOS has never bothered to determine the nature of the social and economic impacts which the plant has had on Fort MacKay. The application implies that the company has no greater concerns about these issues at the present time than they did at the time of initial construction of the plant.

(b) Before another phase of the plant is added, we suggest that GCOS has a responsibility to ensure that residents of Fort MacKay have a realistic opportunity to participate in an industrialized lifestyle.

(c) We do not believe that the company has ever assumed responsibility for compensating individuals whose traplines have been destoryed or debilitated by the project. What effect will the proposed expansion have upon traplines?

Conclusions

The Fort MacKay Community Committee is concerned that in the present application for expansion, GCOS appears to once again adopt the stance that environmental, social and economic impacts upon the settlement of Fort MacKay are not the responsibility of the company, and consequently are not relevent to company interests. Yet this company was the first to change our way of life.

. . . 4

We can not go back to the old way of life which has been destroyed. We are trying to adapt to the new. We ask only for a realistic and equal opportunity to participate. We are not asking for "hand outs". We suggest only that the company has some responsibility to work with us to ensure that residents of our community have a real opportunity to participate in an industrialized lifestyle.

Accordingly, we are prepared to support the GCOS application if the following are accepted as formal, written conditions for license approval:

(a) That GCOS provide assurance that the proposed expansion will not lead to increased detrimental effects upon the natural environment;

(b) That GCOS on its own behalf as well as on behalf of its onsite contractors be required to initiate a company sponsored program of recruitment, training and employment of residents of Fort MacKay;

(c) That GCOS cooperate in serious, ongoing communication and liaison with the Fort MacKay Community Committee regarding all matters of mutual concern;

(d) That GCOS assume responsibility for providing company employees from Fort MacKay with transportation to and from the job site at no cost to the employees as is the case with the employees housed in Fort McMurray, and further to ensure that all contractors working on the GCOS site do the same.

Copies sent to - E. Kupchanko
- R. Evans
- V. Bohme
- File
19 Feb 79

Fort MacKay Community Committee
c/o 9401A Franklin Avenue
FORT MCMURRAY, Alberta
T9H 2J5

SUBMISSION RE
APPLICATION No. 780318
DATE FEB 20 1979

February 12, 1979

Mr. V.E. Bohme
Board Member
Energy Resources Conservation Board
#603, 6 Avenue S.W.
CALGARY, Alberta
T2P OT4

Dear Mr. Bohme:

Near the conclusion of the recent G.C.O.S. hearings, the Board requested a statement from the Fort MacKay Community Committee related to the question of support for the proposed expansion in light of the commitments made to Fort MacKay by G.C.O.S. Accordingly, our Committee has discussed this issue.

While we feel that to the present time both government and industry have tended to downplay the problems faced by Fort MacKay in relation to the impact of resource development, we have been encouraged by the recent G.C.O.S. hearings. We deeply appreciate the commitments made by the company and intend to follow them up carefully and responsibly. Therefore, in light of company assurances and promises, we wish to lend our support to the proposed expansion.

Yours very truly,

Dorothy McDonald
Marcel Ahyasou
Ernie Lacorde
Clara Shott
Rod. Hyde.

Fort MacKay Community Committee

EXHIBIT

LIST OF EXHIBITS

EXHIBIT NO. 1

PROPOSED GREAT CANADIAN OIL SANDS APPLICATION THREE ITEMS: SUPPLEMENTARY SUBMISSION, LETTER AND COMPUTER PRINT-OUT
DATED NOVEMBER 8, 1978, NOVEMBER 30,1978 AND DECEMBER 11, 1978

EXHIBIT NO. 2

ENERGY RESOURCES CONSERVATION BOARD APPROVALS AND CLEAN AIR LICENCE AND CLEAN WATER LICENCE
DATE NOT GIVEN (NOT AVAILABLE)

EXHIBIT NO. 3

SUMMARY OF COST ESTIMATES FOR THE GAS-FIRED VERSUS COKE-FIRED BOILER
DATE NOT GIVEN (NOT AVAILABLE)

EXHIBIT NO. 4

SUBMISSION BY MR. MASON FOR NEW TOWN OF FORT McMURRAY
DATED JANUARY 17, 1979 (ALSO INTERVENTION)

EXHIBIT NO. 5

SUBMISSION BY THE FORT MACKAY COMMUNITY COMMITTEE
DATED JANUARY 19, 1979 (ALSO INTERVENTION)

DECISION

THE PROVINCE OF ALBERTA

THE OIL AND GAS CONSERVATION ACT

ENERGY RESOURCES CONSERVATION BOARD

IN THE MATTER of a scheme of Great Canadian Oil Sands Limited for the recovery of synthetic crude oil from oil sands

APPROVAL NO. 2821

WHEREAS the Energy Resources Conservation Board, by Approval No. 1944, dated 10 December 1973, and as amended from time to time, approved a scheme of Great Canadian Oil Sands Limited for the recovery of oil sands, crude bitumen or products derived therefrom; and

WHEREAS Great Canadian Oil Sands Limited has applied for amendment of the said approval and it is proper and desirable that a new approval be issued superseding Approval No. 1944; and

WHEREAS the Energy Resources Conservation Board is prepared to grant the application by Great Canadian Oil Sands Limited, subject to the conditions herein contained and the Minister of the Environment and the Minister of Energy and Natural Resources have given their approval, hereto attached, insofar as the application affects matters of the environment.

THEREFORE, the Energy Resources Conservation Board, pursuant to The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970, and with the approval of the Lieutenant Governor in Council, numbered O.C. 237/79 and dated 20 March 1979, hereby orders as follows:

1. (1) The scheme of Great Canadian Oil Sands Limited (hereinafter called "Great Canadian") for the recovery of synthetic crude oil from oil sands taken from the area shown

outlined on the attachment hereto, marked Appendix I to this approval, as such scheme is described in

(a) an application dated 14 March 1960, together with descriptive material accompanying or supporting the application, marked as exhibits at the said hearing,

(b) an application to permit amendment of the scheme, dated 25 September 1963, and descriptive material accompanying or supporting such application, marked as exhibits at the hearing of such application,

(c) an application to permit amendment of the scheme, dated 12 May 1967, and descriptive material accompanying or supporting such application, marked as exhibits at the hearing of such application,

(d) submissions to the Department of Health dated 17 May 1965, 26 May 1967 and 6 September 1966,

(e) an application dated 1 September 1972 and supporting material marked as exhibits and evidence adduced at the hearing of the application,

(f) an application dated 7 November 1975, together with supporting material marked as exhibits, and evidence adduced at the hearing of the application, and

(g) an application dated 8 November 1978, together with supporting material marked as exhibits, and evidence adduced at the hearing of the application,

is approved, subject to the terms and conditions herein contained.

(2) Subclause (1) does not preclude minor alterations in design or equipment compatible with the outlines of the scheme and made for the better operation of the scheme.

(3) Great Canadian shall inform the Board upon completion of any alterations referred to in subclause (2).

2. This approval applies to the recovery of 3 730 000 cubic metres per year of synthetic crude oil.

3. Great Canadian shall measure or otherwise determine the quantity of oil sands mined, oil sands processed, crude bitumen recovered, and synthetic crude oil produced and any other products including coke and sulphur by a method and in a manner satisfactory to the Board.

4. Great Canadian shall furnish to the Board, in such detail and at such times as may be set by the Board

(a) monthly reports of the quantity and assay of oil sands mined, crude bitumen recovered, and the quantity and disposition of all products produced or recovered therefrom, and

(b) monthly sulphur balance reports for the overall plant, the sulphur recovery plant and the power plant.

5. There shall be no flaring or waste of liquid or gaseous hydrocarbons produced, except in cases of emergency, unless authorized in writing by the Board.

6. Great Canadian shall carry out its operations to the satisfaction of the Board and in a manner that

(a) does not preclude or render more difficult the recovery of other oil sands recoverable by practical and reasonable operations,

(b) results in the mining of the practical maximum of all oil sands within the area being mined,

(c) results in the processing for the recovery of synthetic crude oil of the practical maximum of all oil sands that are mined,

(d) results in recovery of not less than 91.4 weight per cent of the crude bitumen contained in the oil sands processed by the extraction plant,

(e) results in the recovery of the practical maximum of synthetic crude oil from the crude bitumen processed,

(f) results in the production of the practical minimum amount of coke in excess of the fuel requirements of the operations,

(g) results in the utilization of the practical minimum of natural gas for steam and power production by maximizing coke boiler firing and minimizing auxiliary boiler firing,

(h) results in the recovery in the form of elemental sulphur of;

(i) from the date of this approval, not less than 94 per cent of the sulphur contained in the gas delivered to the sulphur recovery plant during each three-month period beginning 1 January, 1 April, 1 July or 1 October, and

(ii) from 1 January 1982, or such other date as the Board may stipulate, not less than 96 per cent of the sulphur contained in the gas delivered to the sulphur recovery plant during each three-month period beginning 1 January, 1 April, 1 July or 1 October.

7. Great Canadian shall study the possibility of recovering additional crude bitumen from the extraction plant oversize reject stream and shall report the results of the study to the Board by 1 June 1983, or such later date as the Board may stipulate.

8. Prior to commencement of operations to dispose of solid or liquid materials, Great Canadian shall submit to the Board for its approval, detailed plans for the disposal of such materials.

9. (1) Three months after start of construction of the facilities described in the application dated 8 November 1978, and thereafter on a quarterly basis until completion of construction, Great Canadian shall report the progress of construction to the Board.

(2) Great Canadian shall obtain the approval of the Board prior to making any changes in the scheme described in the application dated 8 November 1978.

(3) Upon completion of the construction of the facilities and prior to 1 June 1982, or such later date as the Board may stipulate, Great Canadian shall file with the Board the following details of the project design and operating procedures

(i) process and instrument diagrams for all sections of the plant,

(ii) detailed material balances for all sections of the plant,

(iii) operating and equipment schedules, and

(iv) other details as the Board may require.

(4) Upon satisfactory operation of the facilities and prior to 1 June 1983 or such later date as the Board may stipulate, Great Canadian shall file with the Board complete details of any modifications made to the process design and operating conditions in the same detail as required by subclause (3).

10. (1) Great Canadian, by 30 September of each year, shall submit to the Board for its approval detailed mining and overburden removal plans for the following year's operation.

(2) Great Canadian shall include with the mining plans required by subclause (1) an economic evaluation of all mining limits supported, to the satisfaction of the Board, by unit costs in sufficient detail to permit calculation of the break-even stripping ratio.

(3) Great Canadian, by 28 February of each year, shall submit to the Board plans showing mine status as of 31 December of the previous calendar year.

(4) Great Canadian shall advise the Board of any significant modification of the mining plans and obtain its approval prior to effecting such modification.

11. Should a failure or collapse occur in the slope of the pit wall or discard pile, Great Canadian shall report it

expeditiously to the Board and shall submit, as soon as possible, a complete geotechnical analysis of the failure or collapse, including a desc 'ption of any remedial action: taken or planned.

12. (1) The emission of sulphur dioxide and the sulphur dioxide equivalent of other sulphur compounds to the atmosphere from the plant incinerator stack shall not exceed 49 tonnes per day or 1.0 tonne in any half-hour period.

(2) The incinerator stack flue gas emission temperature shall be a minimum of 540°C.

13. (1) The emission of sulphur dioxide and the sulphur dioxide equivalent of other sulphur compounds to the atmosphere from the power plant stack shall not exceed 305 tonnes per day or 6.4 tonnes in any half-hour period.

(2) The power plant stack flue gas emission temperature shall be a minimum of 290°C.

14. (1) Great Canadian shall conduct five stack surveys per year of the incinerator stack and six stack surveys per year of the power plant stack inlet ducts for the determination of the volume rate of flow, composition and temperature of the effluent gases.

(2) At least one of the stack sampling tests required by subclause (1) shall be made when the plant is operating at not less than 90 per cent of its maximum daily production rate and at least three other of the stack sampling surveys shall be made when the plant is operating at not less than 75 per cent of its maximum daily production rate.

(3) Great Canadian shall summarize the results of all power plant and incinerator stack surveys and forward them to the Board as soon as they are available.

15. Great Canadian, in operations pursuant to the scheme, shall comply with the provisions of any applicable Act or regulation of the Province of Alberta now enacted or made, or that at any time hereafter may be enacted or made.

16. This approval, as it affects matters of the environment, is subject to the approval of the Minister of the Environment, set out in Appendix II hereto attached, and to the terms and conditions therein contained.

17. This approval, as it affects matters of the environment, is subject to the approval of the Minister of Energy and Natural Resources, set out in Appendix III hereto attached, and to the terms and conditions therein contained.

18. Where it appears to the Board that there has been a failure to comply with any terms or conditions of this approval, the Board may, in addition to any other remedy or proceeding to which it may resort, require the suspension of any operation carried on pursuant to the scheme.

19. The Operator shall comply with the attached Clean Air Act Licence No. 73-AL-234, dated 24 September 1978, and The Clean Water Act Licence No. 73-WL-080, dated 22 June 1978, issued by the Department of the Environment.

20. Board Approval No. 1944 is rescinded.

MADE at the City of Calgary, in the Province of Alberta, this 29th day of March, 1979.

ENERGY RESOURCES CONSERVATION BOARD

V. E. Bohme
Board Member

APPENDIX B TO APPROVAL NO. 2821

Department of the Environment

MINISTERIAL APPROVAL

No. 79-45 ERCB

Edmonton, Alberta
March 27, 1979

Pursuant to Part 8 of The Oil and Gas Conservation Act, I, W. Solodzuk, Deputy Minister of the Environment, hereby approve Application No. 780318, from Great Canadian Oil Sands Limited to the Energy Resources Conservation Board, in respect of the operations of an oil sands processing plant and related facilities near Tar Island, appropriate permits to construct must be obtained under The Clean Air Act and The Clean Water Act, insofar as it affects matters of the environment, such application to be granted by the Board's Approval No. 2821.

DEPUTY MINISTER OF THE ENVIRONMENT

APPENDIX C TO APPROVAL 2821

Department of Energy and Natural Resources

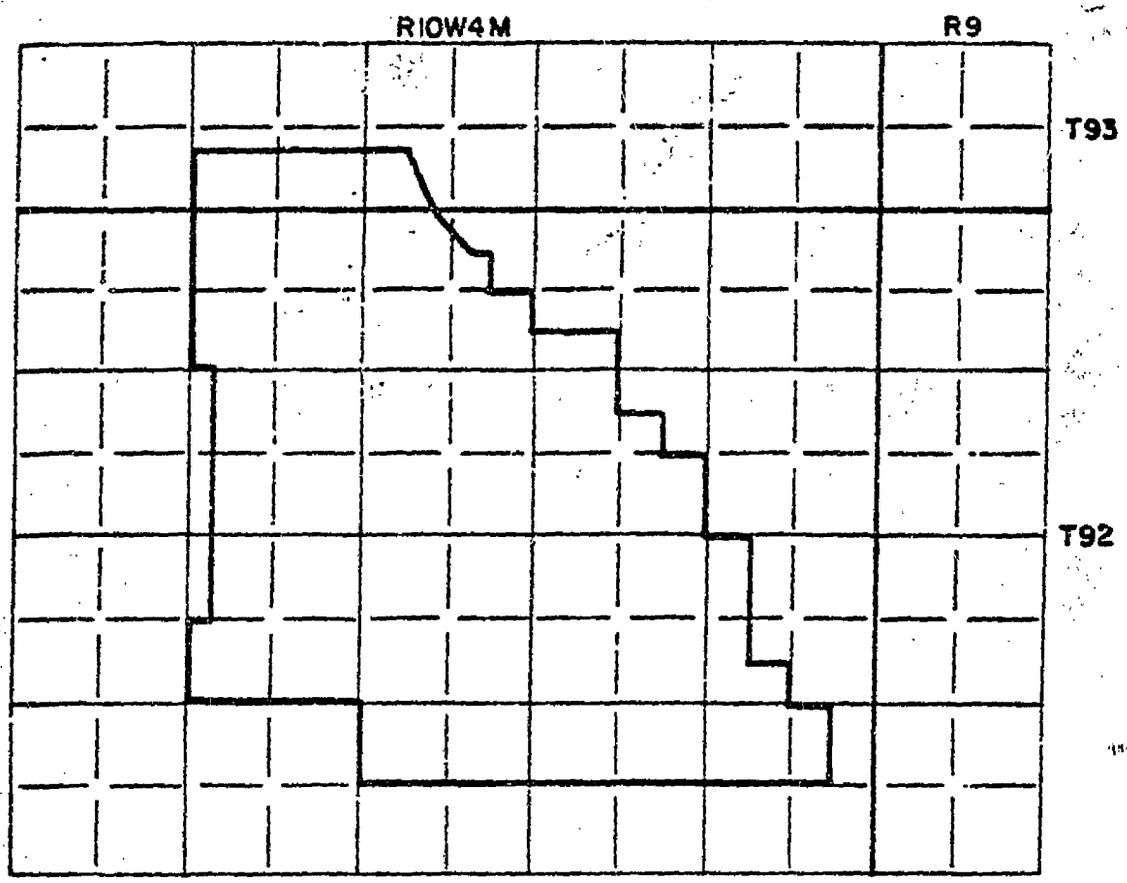
MINISTERIAL APPROVAL

NO. ERCB

Edmonton, Alberta
March 8, 1979

Pursuant to Part 8 of The Oil and Gas Conservation Act, I, F. W. McDougall, Deputy Minister of Renewable Resources, representing the Minister of Energy and Natural Resources, hereby approve Application No. 780318 from Great Canadian Oil Sands Limited to the Energy Resources Conservation Board, in respect of the operations of an oil sands processing plant and related facilities near Tar Island, insofar as it affects matters of the environment, such application to be granted by the Board's Approval No. 2821.

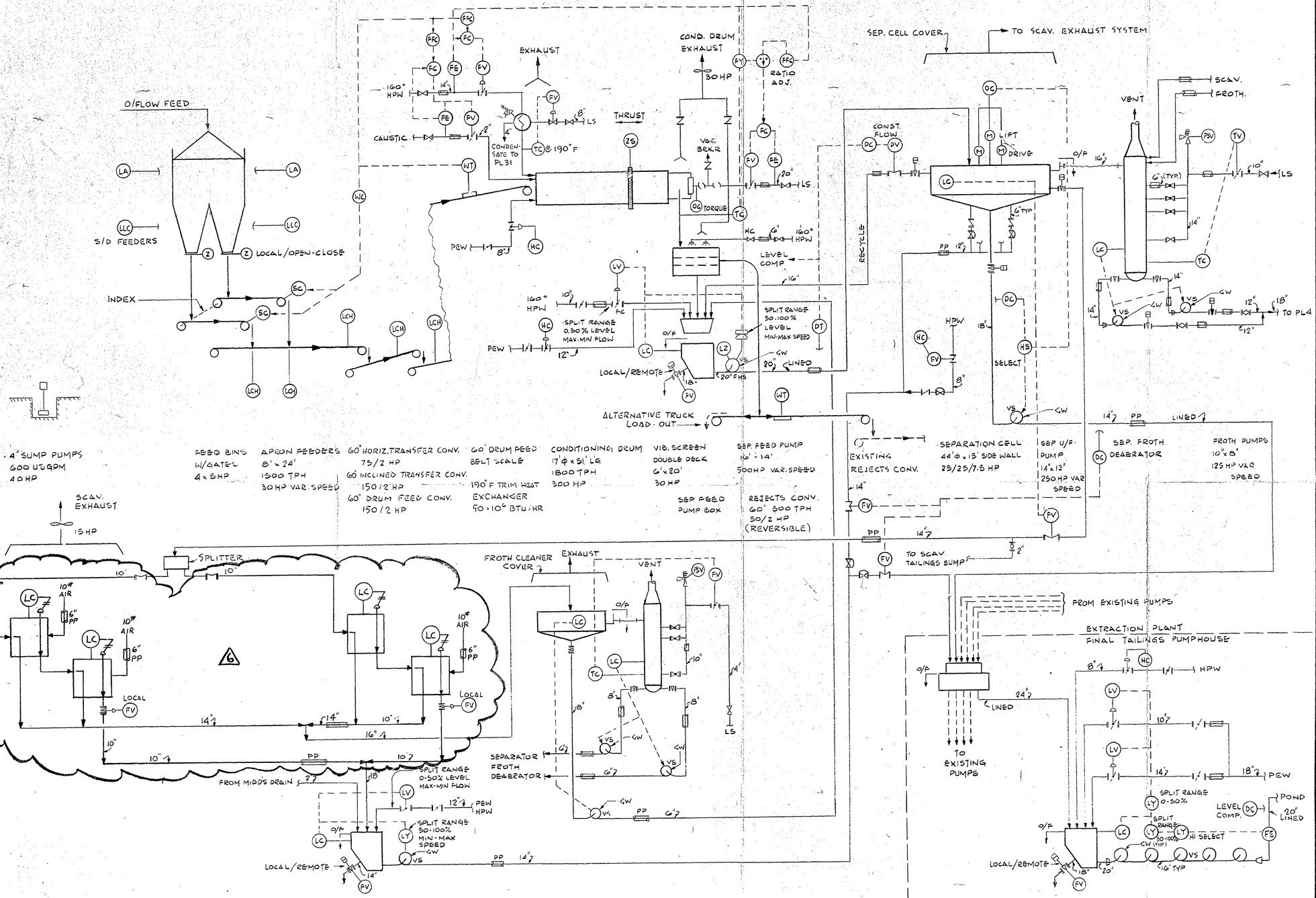
DEPUTY MINISTER OF RENEWABLE RESOURCES



APPENDIX I TO APPROVAL NO. 2821

ENERGY RESOURCES CONSERVATION BOARD
CALGARY, ALBERTA

SIZE "D" 22" X 34"



4 - 4" SUMP PUMPS
600 USGPM
40 HP

FEED BINS
W/GATES
4 x 5HP

APRON FEEDERS
8' x 24'
1500 TPH
30 HP VAR. SPEED

60" HORIZ. TRANSFER CONV.
75/2 HP
60 INCLINED TRANSFER CONV.
150/2 HP
60" DRUM FEED CONV.
150/2 HP

60' DRUM FEED BELT SCALE

190°F TRIM HEAT EXCHANGER
50 x 10^6 BTU/HR

CONDITIONING DRUM
17'ϕ x 51' LG
1800 TPH
300 HP

VIB. SCREEN
DOUBLE DECK
6' x 20'
30 HP

SEP FEED PUMP BOX

SEP. FEED PUMP
16" x 14"
500 HP VAR. SPEED

REJECTS CONV.
60" 500 TPH
50/2 HP
(REVERSIBLE)

SEPARATION CELL
44'ϕ x 15' SIDE WALL
25/25/7.5 HP

SEP U/F PUMP
14" x 12"
250 HP VAR SPEED

SEP. FROTH DEAERATOR

FROTH PUMPS
10" x 8"
125 HP VAR SPEED

SCAV. UNIT CELLS
2 BANKS OF 2 CELLS
4-50 HP MOTORS
2000 CF EACH CELL

SCAV. TAILINGS PUMP BOX

SCAV. TAILINGS PUMPS
14" x 12"
200 HP VAR. SPEED

SCAV. FROTH CLEANER
30'ϕ x 8' SIDE WALL
10 HP

SCAV. FROTH DEAERATOR
15'ϕ

SCAV FROTH PUMPS
8" x 6"
50 HP VAR SPEED

SCAV FROTH CLEANER U/F PUMPS 8" x 6"
50 HP VAR SPEED

5 STAGE
TAILINGS PUMPS
16" x 14" 8600 USGPM
600 HP, 1 C/W VAR SPEED DRIVE
IN THIRD POSITION

GENERAL NOTES & SPECIFICATIONS

SYMBOLS

REFERENCE DRAWINGS

Application: 78-0318
Document 1 of 11

REV. No.	DATE (M D Y)	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
6	10 31 78	SCAV. CELLS REVISED	AJR		
5	05 19 78	ISSUED AS ESTIMATE BASIS	K.J.		
4	4 11 78	GENERAL REVISION	J.M.C.		
3	4 4 78	UPDATED	J.M.C.		
2	3 28 78	UPDATED GENERALLY	J.M.C.		
1	2 28 78	UPDATED FOR 2ND PHASE	J.M.C.		
0	11 1 77	ISSUED FOR 1ST PHASE	J.M.C.		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
PROCESS PFD DIAGRAM
FIFTH LINE EXPANSION

SCALE	DRAWN BY	CHECKED BY
—	J.M.C.	

APPROVED	DRAWING NUMBER	REV.
	55D-A-308	6

G.C.O.S. FORM NO. 57

BITUMEN FROM STORAGE
50# STM
55E-05023A/B
55C-05027A PRIMARY FLASH DRUM
55C-05027B SECONDARY FLASH DRUM
CONDENSATE FROM 55C-05025
TO CONDENSATE HEADER
55G-05030A/B
55E-05024
55G-05026A/B
55G-05001A/B/C
55F-05001 DILUENT TOWER FEED HEATER
50# STEAM
55E-05006
55G-05002A/B
55E-05022 A/B
55C-05001 DILUENT TOWER
55C-05002 DILUENT SURGE DRUM
55E-05031A/B
C.W.
SPLIT TO 55C-05010
55E-05030
DILUENT TO STORAGE
DILUENT TO PLANT N°4
TO SOUR WATER SURGE TANK
55G-05003A/B
55G-05004A/B
GAS OIL TO UNIFINER
GAS OIL TO STORAGE
55E-05027
55E-05033
WILD NAPHTHA
55C-05014 SPONGE COLUMN
55E-05018
55C-05015 DEPENTANIZER ϕ ACCUMULATOR
55G-05016A/B
55C-05013 DEPENTANIZER
55C-05012 DEBUTANIZING ABSORBER
55C-05016 WATER DRAW OFF POT
450# STEAM
55E-05014
55G-05015A/B
55E-05017
55E-05016
STM
55E-05019
COND
55C-05030 CONDENSATE DRUM (G.P.)
TO CONDENSATE HEADER
55E-05003A
55E-05003B/C
C.W.
55K-05001 PACKAGE UNIT
55C-05010 COKER FRACTIONATOR ϕ ACCUMULATOR
55G-05011A/B
55G-05010A/B
55G-05039
TO SOUR WATER SURGE TANK
55E-05013
TO FLARE
TO SOUR WATER SURGE TANK
55C-05018 WATER SEPARATOR DRUM
55G-05017A/B
55G-05018A/B
QUENCH WATER (INTERMITTENT)
55G-05021
EXISTING COKE DRUMS
55C-05003 COKE DRUM
55C-05004 COKE DRUM
SPONGE OIL STRIPPER
55C-05011
55C-05009 COKER FRACTIONATOR
55G-05009
55E-05004
55E-05005
55G-05008A/B
55G-05007A/B
55C-05017 COKER STEAM OUT DRUM
55G-05014A/B
GAS OIL MAKE-UP (INTERMITTENT)
EXCESS GAS-OIL TO DILUTED BITUMEN STORAGE (INTERMITTENT)
EXISTING HEATER
55E-05002 COKER FEED HEATER
55E-05007A/B
STM
CON
C.W.
55E-05008
55C-05021 CONDENSATE DRUM
55G-05006A/B
55C-05029 COKER FEED SURGE DRUM
55G-05005A/B
COKE DRUM HEAT UP CONDENSATE (INTERMITTENT)
55G-05031
55E-05026
NAPHTHA TO UNIFINER
55E-05014
NAPHTHA TO STORAGE
55E-05028
KEROSENE TO STORAGE
KEROSENE TO UNIFINER
FUEL OIL

GENERAL NOTES & SPECIFICATIONS

SYMBOLS

REFERENCE DRAWINGS

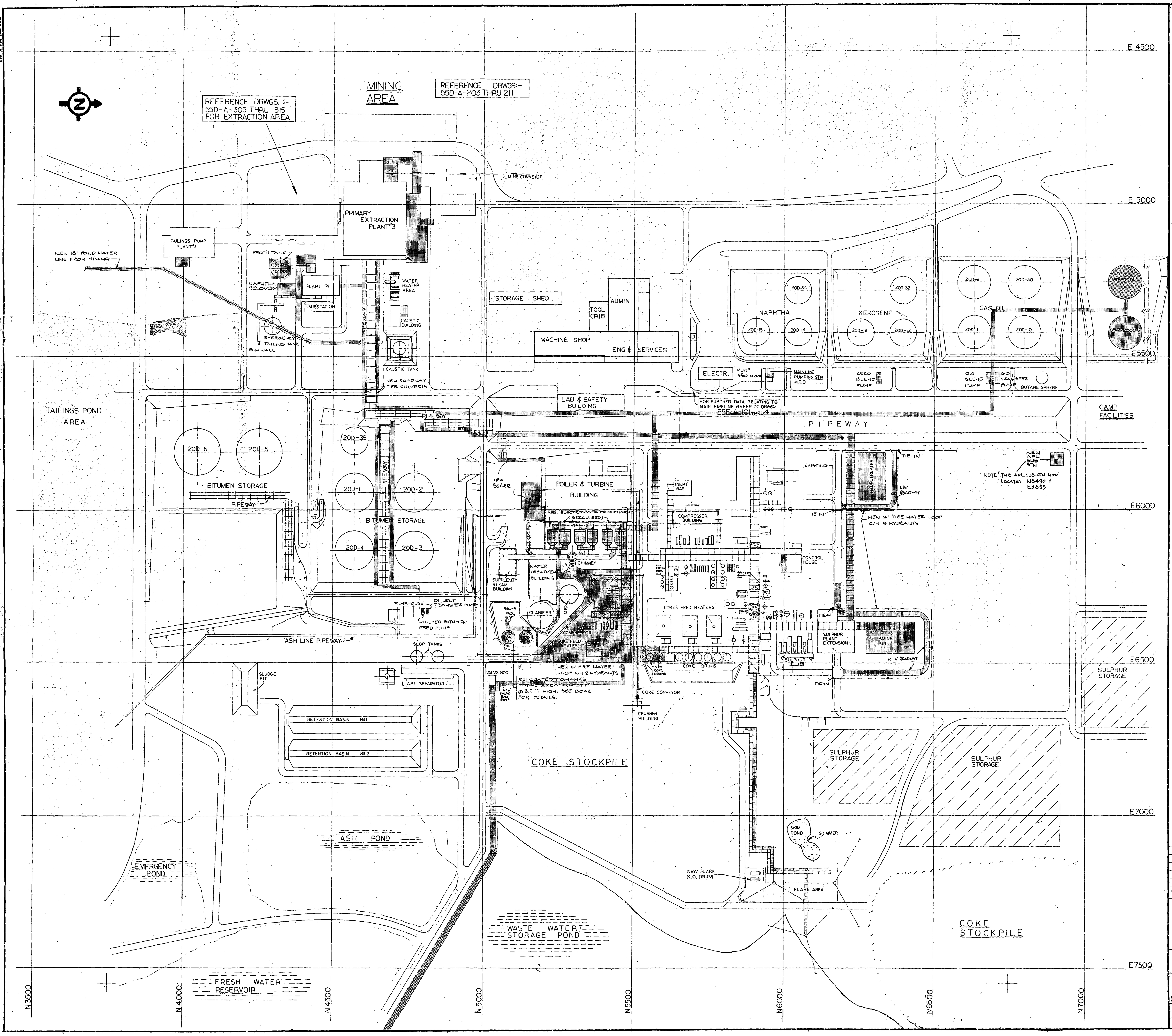
Application: 78-03/8
Document 24.11

REV. No.	DATE	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
1	06 19 78	ISSUED AS ESTIMATE BASIS	K.J.		
0	04 78	ISSUED FOR PHASE II	MWE		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
SIMPLIFIED FLOW DIAGRAM
COKING UNIT EXPANSION

SCALE NONE	DRAWN BY MWE/ADEAN	CHECKED BY	
APPROVED	DRAWING NUMBER		REV.
	55-E-A-510		1



GENERAL NOTES & SPECIFICATIONS

1. ALL ADDITIONAL PLANT UNITS, BUILDINGS, ROADS ETC. ARE SHOWN INDICATED THUS:-

SYMBOLS

REFERENCE DRAWINGS

Application 78-0318
Document 3 of 11

REV. No.	M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
1	05	19	78	ISSUED AS ESTIMATE BASIS	K.J.		
0	5	1	78	ISSUED FOR FINAL REPORT	STD		

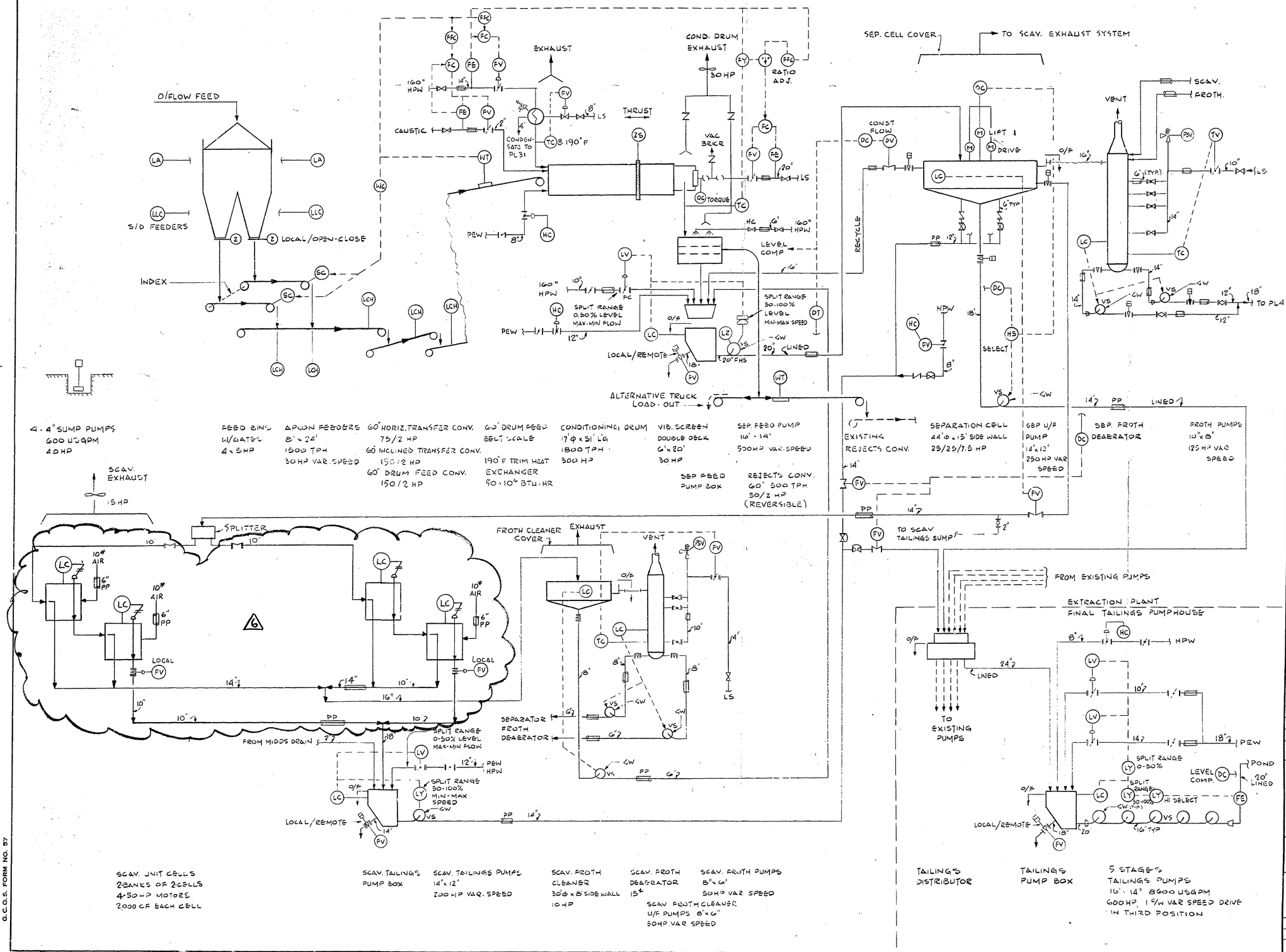
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY SITE PLAN EXPANSION CASE-DELAYED COKER

SCALE 1" = 100' | DRAWN BY HBE | CHECKED BY

APPROVED | DRAWING NUMBER 55E - A - 520 | REV. 1

SIZE "D" 22" X 34"



4-4" SUMP PUMPS
600 USGPM
40 HP

FEED BINS W/GATES 4 x 5HP

APRON FEEDERS 8' x 24' 1500 TPH 30HP VAR. SPEED

60" HORIZ. TRANSFER CONV. 75/2 HP
60 INCLINED TRANSFER CONV. 150/2 HP
60" DRUM FEED CONV. 150/2 HP

60" DRUM FEED BELT SCALE

190°F TRIM HEAT EXCHANGER 50 x 10^6 BTU/HR

CONDITIONING DRUM 17'Φ x 51' LG 1800 TPH 300 HP

VIB. SCREEN DOUBLE DECK 6' x 20' 30 HP

SEP FEED PUMP 16" - 14" 500HP VAR. SPEED

SEP FEED PUMP BOX

REJECTS CONV. 60" 500 TPH 50/2 HP (REVERSIBLE)

SCAV. UNIT CELLS
2-BANKS OF 2-CELLS
4-50 HP MOTORS
2000 CF EACH CELL

SCAV. TAILINGS PUMP BOX

SCAV. TAILINGS PUMPS 14"x12" 250 HP VAR. SPEED

SCAV. FROTH CLEANER 30'Φ x 8' SIDE WALL 10 HP

SCAV. FROTH DEAERATOR 15'

SCAV. FROTH PUMPS 8"x6" 50HP VAR SPEED

SCAV FROTH CLEANER U/F PUMPS 8"x6" 50HP VAR SPEED

TAILINGS DISTRIBUTOR

TAILINGS PUMP BOX

5 STAGE TAILINGS PUMPS 16" - 14" 8600 USGPM 600HP, 1 S/W VAR SPEED DRIVE IN THIRD POSITION

G.C.O.S. FORM NO. 57

GENERAL NOTES & SPECIFICATIONS

SYMBOLS

REFERENCE DRAWINGS

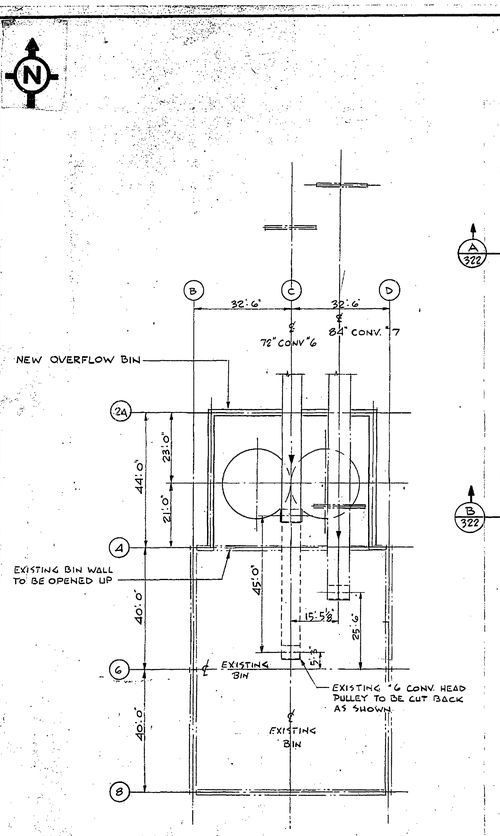
Application: 78-0318
Document 4 of 11

REV. No.	DATE M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
6	10	31	78	SCAV. CELLS REVISED	AJR		
5	05	19	78	ISSUED AS ESTIMATE BASIS	K.J.		
4	4	11	78	GENERAL REVISION	JM'C		
3	4	4	78	UPDATED	JM'C		
2	3	28	78	UPDATED GENERALLY	JM'C		
1	2	28	78	UPDATED FOR 2ND PHASE	JM'C		
0	11	1	77	ISSUED FOR 1ST PHASE	JM'C		

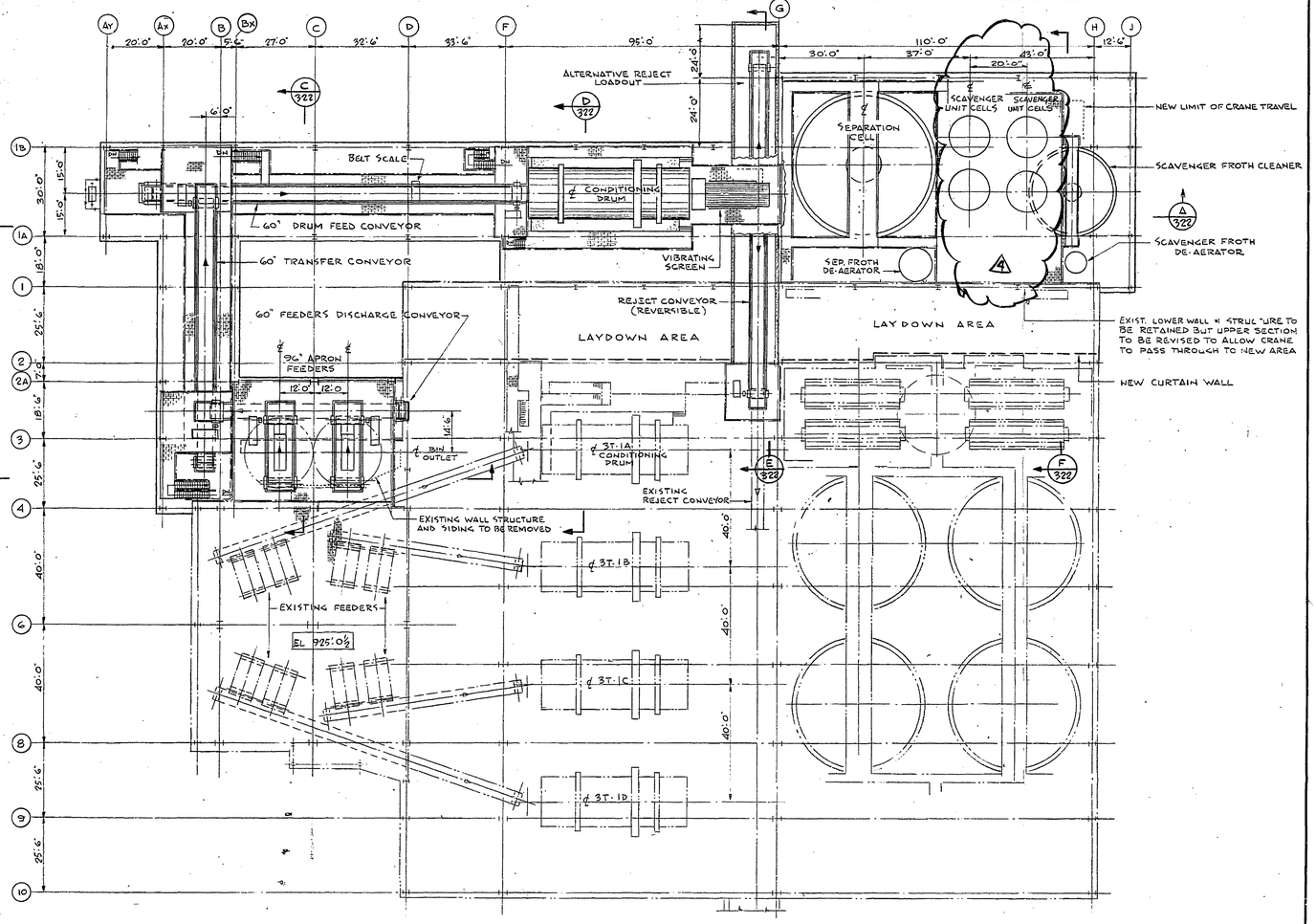
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
PROCESS P & I DIAGRAM
FIFTH LINE EXPANSION

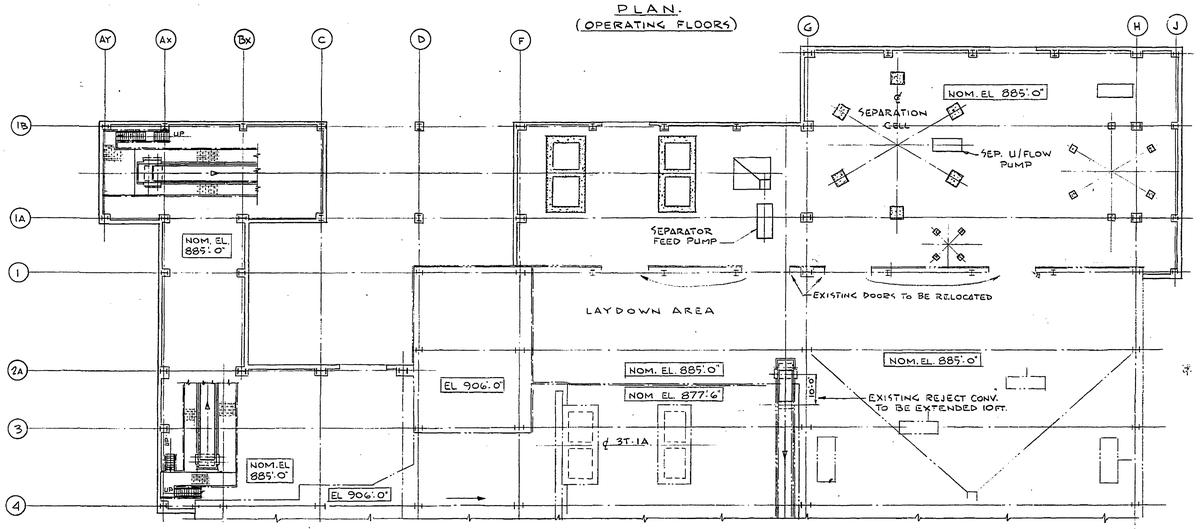
SCALE	—	DRAWN BY	JM'C	CHECKED BY	
APPROVED		DRAWING NUMBER			REV
		550-A-308			6



PLAN
(TOP OF BINS)



PLAN.
(OPERATING FLOORS)



PLAN
(GROUND FLOOR)

GENERAL NOTES & SPECIFICATIONS

LEGEND :

——·——·—— EXISTING EQUIP.

———— NEW EQUIPMENT

SYMBOLS

REFERENCE DRAWINGS

GENERAL ARRGT - SECTIONS
DWG # 55 E - A - 322

Application : 78-0318
Document 3 of 11

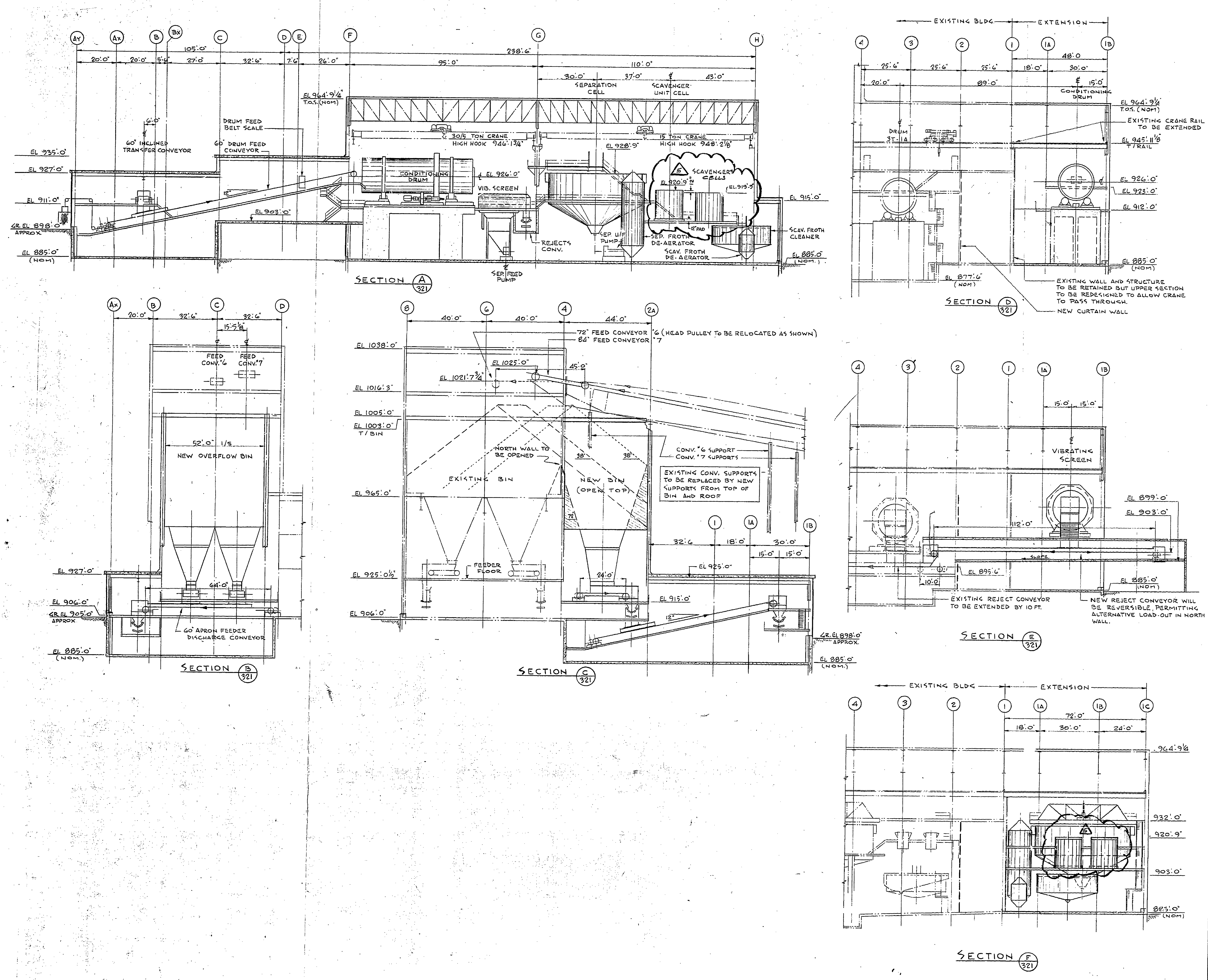
REV. No.	MO	DAY	YR	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
4	10	31	79	SCAV. CELLS REVISED	GTZ		
3	5	29	79	ISSUED FOR FINAL REPORT	STO		
2	05	19	78	ISSUED AS ESTIMATE BASIS	K.J.		
1	5	15	78	REVISED & REISSUED TO EST	J.M.L.		
0	3	8	78	ISSUED FOR ESTIMATE	J.M.L.		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
5TH. LINE EXPANSION
GENERAL ARRANGEMENT - PLANS

SCALE 1/16" : 1'-0"	DRAWN BY J.M.L. FEB 15/78	CHECKED BY
APPROVED	DRAWING NUMBER > 55 E - A - 321	REV. 4

GCOS. FORM NO. 28



GENERAL NOTES & SPECIFICATIONS

LEGEND:

EXISTING EQUIP.

NEW EQUIPMENT.

SYMBOLS

REFERENCE DRAWINGS

GENERAL ARRGT. - PLANS DWG # 55E-A-321

Application: 78-0318
Document 6 of 11

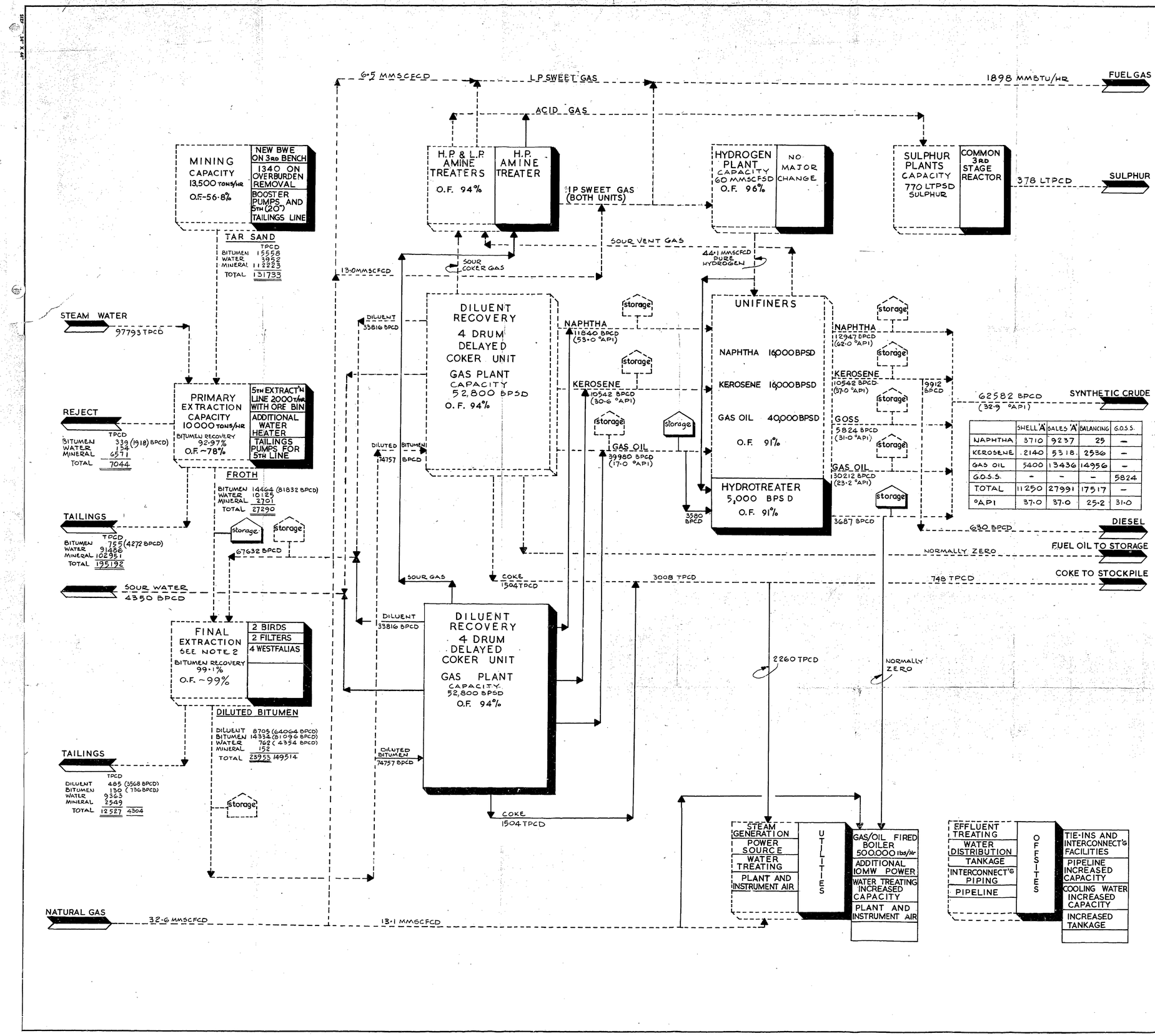
REV. No.	M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
5	10	31	78	SCAV. CELLS REVISED	AJR		
4	5	29	78	ISSUED FOR FINAL REPORT	STD		
3	05	15	78	ISSUED AS ESTIMATE BASIS	K.L.		
2	3	20	78	NOTE RE CONV. SUPPTS ON SECT C. AMENDED	JMC		
1	3	15	78	REVISED & REISSUED TO EST.	JMC		
0	3	8	78	ISSUED FOR ESTIMATE	JMC		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

PRIMARY EXTRACTION PLANT
5TH. LINE EXPANSION
GENERAL ARRANGEMENT - SECTIONS

SCALE 1/16" = 1'-0" | DRAWN BY JMC FEB 15/78 | CHECKED
APPROVED | DRAWING NUMBER 55 E - A - 322 | REV. 5

G.C.O.S. FORM NO. 58



	SHELL 'A'	SALES 'A'	BALANCING	G.O.S.S.
NAPHTHA	3710	9237	25	–
KEROSENE	.2140	5318.	2536	–
GAS OIL	5400	13436	14956	–
G.O.S.S.	–	–	–	5824
TOTAL	11250	27991	17517	–
°API	37·0	37·0	25·2	31·0

GENERAL NOTES & SPECIFICATIONS

1. OPERATION SHOWN IS BASED ON THE AVERAGE FOR THE YEARS 1981-87. THE AVERAGE ORE GRADE IS 11·81 WT%
2. AVAILABILITIES AND CAPACITY OF DILUTED BITUMEN

	O.F.	CAPACITY (BPSD)
BIRDS	86·2%	388800
CUNOS	99·5%	396000
WESTFALIAS	91·7%	288000

SYMBOLS

EXISTING

NEW

EXISTING

NEW

REFERENCE DRAWINGS

Application: 78-0318
Document 7911

REV. No.	DATE D	M	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
1	05	10	78	ISSUED AS ESTIMATE BASIS	K.J.		
0	5	1	78	ISSUED FOR PHASE 2	STD		

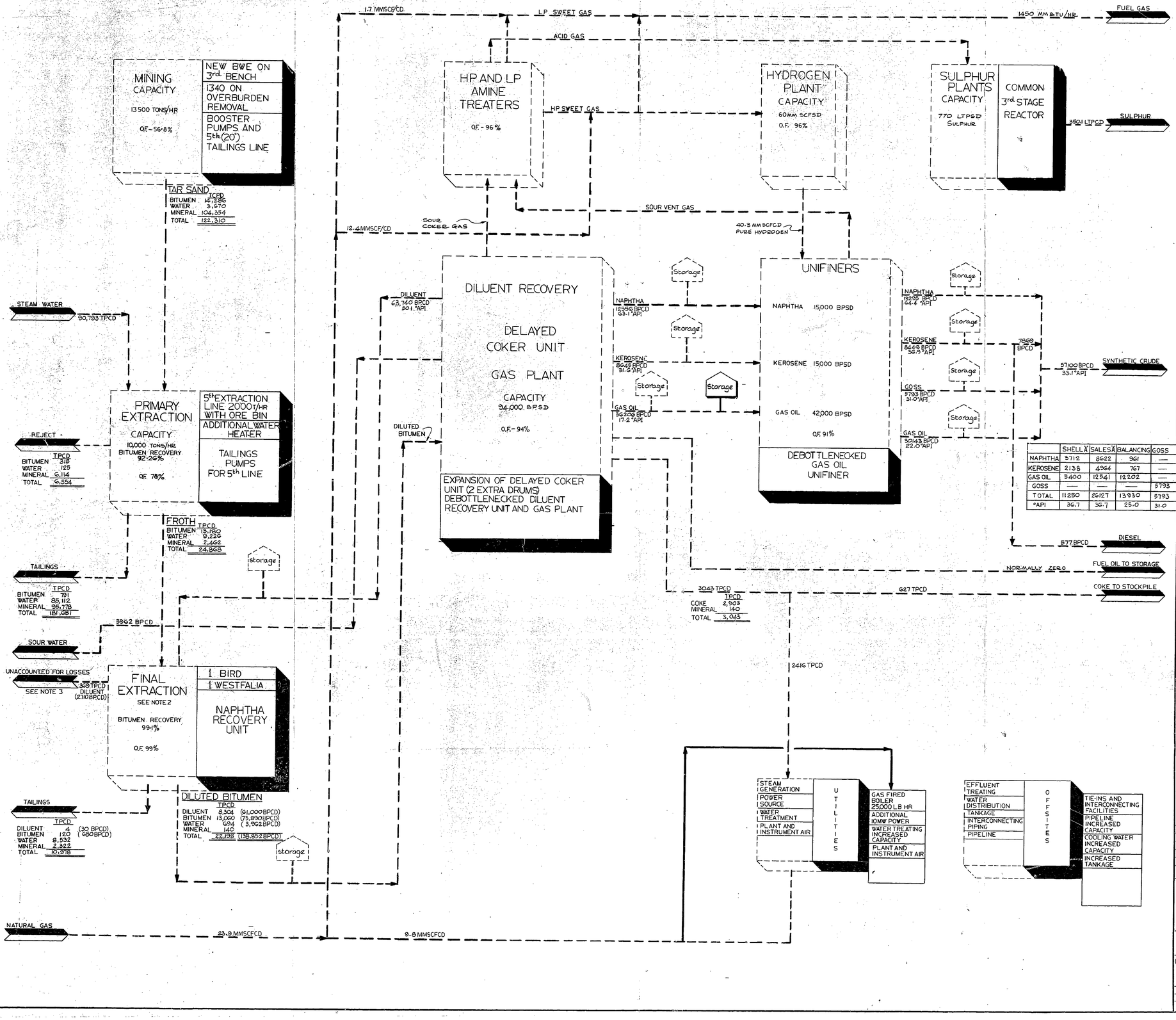
GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
BLOCK FLOW DIAGRAM
EXPANSION CASE-DELAYED COKER

SCALE ~ DRAWN BY STD CHECKED BY

APPROVED

DRAWING NUMBER 55E-A-027 REV. 1



	SHELL A	SALES A	BALANCING	GOSS
NAPHTHA	3712	8622	961	—
KEROSENE	2138	4964	767	—
GAS OIL	5400	12541	12202	—
GOSS	—	—	—	5793
TOTAL	11250	26127	13930	5793
°API	36.7	36.7	25.0	31.0

GENERAL NOTES & SPECIFICATIONS

1. OPERATION SHOWN IS BASED ON THE AVERAGE FOR THE YEARS 1982–87 THE AVERAGE OBS GRADE IS 11.68 WT%
2. AVAILABILITIES AND CAPACITY OF DILUTED BITUMEN

	O.F	CAPACITY
BIRDS	86.2%	388800
CUNOS	99.3%	396000
WESTFALIAS	91.7%	288000

3. UNACCOUNTED FOR LOSSES ARE VENTS DRAINS FROM DILUTED BITUMEN TANKS, FINAL EXTRACTION ETC.

SYMBOLS

EXISTING

NEW

EXISTING

NEW

REFERENCE DRAWINGS

Application: 78-0318
Document 8 of 47

REV. No.	M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
3	11	2	78	RE-DRAWN	HWE		
2	5	29	78	ISSUED FOR FINAL REPORT	STD		
1	5	19	78	ISSUED AS ESTIMATE BASIS	KJ		
0	5	1	78	ISSUED FOR PHASE 2	STD		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

GCOS OPERATIONAL STUDY. BLOCK FLOW DIAGRAM EXPANSION CASE-DELAYED COKER

SCALE NONE | DRAWN BY HWE 78 JAN | CHECKED BY

APPROVED | DRAWING NUMBER 55E-A-027 | REV. 3

GCOS FORM NO. 88

MINING
CAPACITY
13500 TONS/HR
O.F.-56·8%

NEW BWE ON 3rd BENCH
1340 ON OVERBURDEN REMOVAL
BOOSTER PUMPS AND 5th(20') TAILINGS LINE

TAR SAND

	TCPD
BITUMEN	14,286
WATER	3,670
MINERAL	104,354
TOTAL	122,310

STEAM WATER
30,783 TPCD

PRIMARY EXTRACTION
CAPACITY
10,000 TONS/HR
BITUMEN RECOVERY
92·26%
O.F. 78%

5th EXTRACTION LINE 2000T/HR WITH ORE BIN
ADDITIONAL WATER HEATER
TAILINGS PUMPS FOR 5th LINE

REJECT

	TPCD
BITUMEN	315
WATER	125
MINERAL	6,114
TOTAL	6,554

FROTH

	TPCD
BITUMEN	15,180
WATER	9,226
MINERAL	2,462
TOTAL	24,868

storage

TAILINGS

	TPCD
BITUMEN	781
WATER	85,112
MINERAL	95,778
TOTAL	181,681

3962 BPCD

SOUR WATER

UNACCOUNTED FOR LOSSES
303 TPCD DILUENT (2710BPCD)
SEE NOTE 3

FINAL EXTRACTION
SEE NOTE 2
BITUMEN RECOVERY 99·1%
O.F. 99%

1 BIRD
1 WESTFALIA
NAPHTHA RECOVERY UNIT

TAILINGS

	TPCD	
DILUENT	4	(30 BPCD)
BITUMEN	120	(680 BPCD)
WATER	8,532	
MINERAL	2,322	
TOTAL	10,978	

DILUTED BITUMEN

	TPCD	
DILUENT	3,304	(61,000 BPCD)
BITUMEN	13,060	(73,890 BPCD)
WATER	694	(3,962 BPCD)
MINERAL	140	
TOTAL	22,198	(138,852 BPCD)

storage

NATURAL GAS
27·9 MMSCFD

5.9 MMSCF/CD
LP SWEET GAS
1734 MM BTU/HR
FUEL GAS
ACID GAS
HP AND LP AMINE TREATERS
O.F.-96%
HP SWEET GAS
HYDROGEN PLANT
CAPACITY
60MM SCFSD
O.F. 96%
SULPHUR PLANTS
CAPACITY
770 LTPSD SULPHUR
COMMON 3rd STAGE REACTOR
350.1 LTPD
SULPHUR
SOUR VENT GAS
11·9 MMSCF/CD
SOUR COKER GAS
40·3 MM SCFCD PURE HYDROGEN

DILUENT RECOVERY
DELAYED COKER UNIT
GAS PLANT
CAPACITY
94,000 BPSD
O.F.-94%

EXPANSION OF DELAYED COKER UNIT (2 EXTRA DRUMS) DEBOTTLENECKED DILUENT RECOVERY UNIT AND GAS PLANT

DILUENT
63,740 BPCD
30·1 °API

DILUTED BITUMEN

Storage

NAPHTHA
12556 BPCD
63·1 °API

KEROSENE
8645 BPCD
31·6 °API

GAS OIL
36206 BPCD
17·2 °API

UNIFINERS
NAPHTHA 15,000 BPSD
KEROSENE 15,000 BPSD
GAS OIL 42,000 BPSD
O.F. 91%
DEBOTTLENECKED GAS OIL UNIFINER

NAPHTHA
13695 BPCD
64·4 °API

KEROSENE
8446 BPCD
36·9 °API

7660 BPCD

97100 BPCD
33.1°API
SYNTHETIC CRUDE

GOSS
3793 BPCD
31·0°API

GAS OIL
30143 BPCD
22.0°API

	SHELL A	SALES A	BALANCING	GOSS
NAPHTHA	3712	8622	961	—
KEROSENE	2138	4964	767	—
GAS OIL	3400	12541	12202	—
GOSS	—	—	—	5793
TOTAL	11250	26127	13930	5793
°API	36.7	36.7	25.0	31.0

577 BPCD
DIESEL

NORMALLY ZERO
FUEL OIL TO STORAGE

627 TPCD
COKE TO STOCKPILE

3043 TPCD

	TPCD
COKE	2,903
MINERAL	140
TOTAL	3,043

2416 TPCD

UTILITIES
- STEAM GENERATION
- POWER SOURCE
- WATER TREATMENT
- PLANT AND INSTRUMENT AIR
- INERT GAS GENERATION

GAS FIRED BOILER 25,000 LB HR
ADDITIONAL 10MW POWER
WATER TREATING INCREASED CAPACITY
PLANT AND INSTRUMENT AIR

OFFSITES
- EFFLUENT TREATING
- WATER DISTRIBUTION
- TANKAGE
- INTERCONNECTING PIPING
- PIPELINE

TIE-INS AND INTERCONNECTING FACILITIES
PIPELINE INCREASED CAPACITY
COOLING WATER INCREASED CAPACITY
INCREASED TANKAGE

10·1 MMSCFCD

GENERAL NOTES & SPECIFICATIONS

1. OPERATION SHOWN IS BASED ON THE AVERAGE FOR THE3 YEARS 1982-87 THE AVERAGE OBS GRADE IS 11.68 WT%
2. AVAILABILITIES AND CAPACITY OF DILUTED BITUMEN

	O.F.	CAPACITY
BIRDS	86·2%	388800
CUNOS	99·3%	336000
WESTFALIAS	91·7%	288000

3. UNACCOUNTED FOR LOSSES ARE VENTS DRAINS FROM DILUTED BITUMEN TANKS, FINAL EXTRACTION ETC.

SYMBOLS

EXISTING
NEW

EXISTING
NEW

REFERENCE DRAWINGS

Application: 78-0318
Document 9 of 11

REV. NO.	IN	D	M	DATE	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
4	11	24	78		MAT GAS & FUEL GAS FLOWS CORRECTED	SSE		
3	11	2	78		RE-DRAWN	MWE		
2	5	29	78		ISSUED FOR FINAL Report	STD		
1	5	9	78		ISSUED AS ESTIMATE BASIS	KJ		
0	5	1	78		ISSUED FOR PHASE 2	STD		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

GCOS OPERATIONAL STUDY. BLOCK FLOW DIAGRAM EXPANSION CASE-DELAYED COKER

SCALE	DRAWN BY	CHECKED BY	APPROVED	DRAWING NUMBER	REV.
NONE	MWC-22JAN			55E-A-027	4

GCOS FORM NO. 38

GENERAL NOTES & SPECIFICATIONS

1. ALL ADDITIONAL PLANT UNITS, BUILDINGS, ROADS ETC. ARE SHOWN INDICATED THUS:- ▆

SYMBOLS

REFERENCE DRAWINGS

Application 78-0318
Document 10 of 11

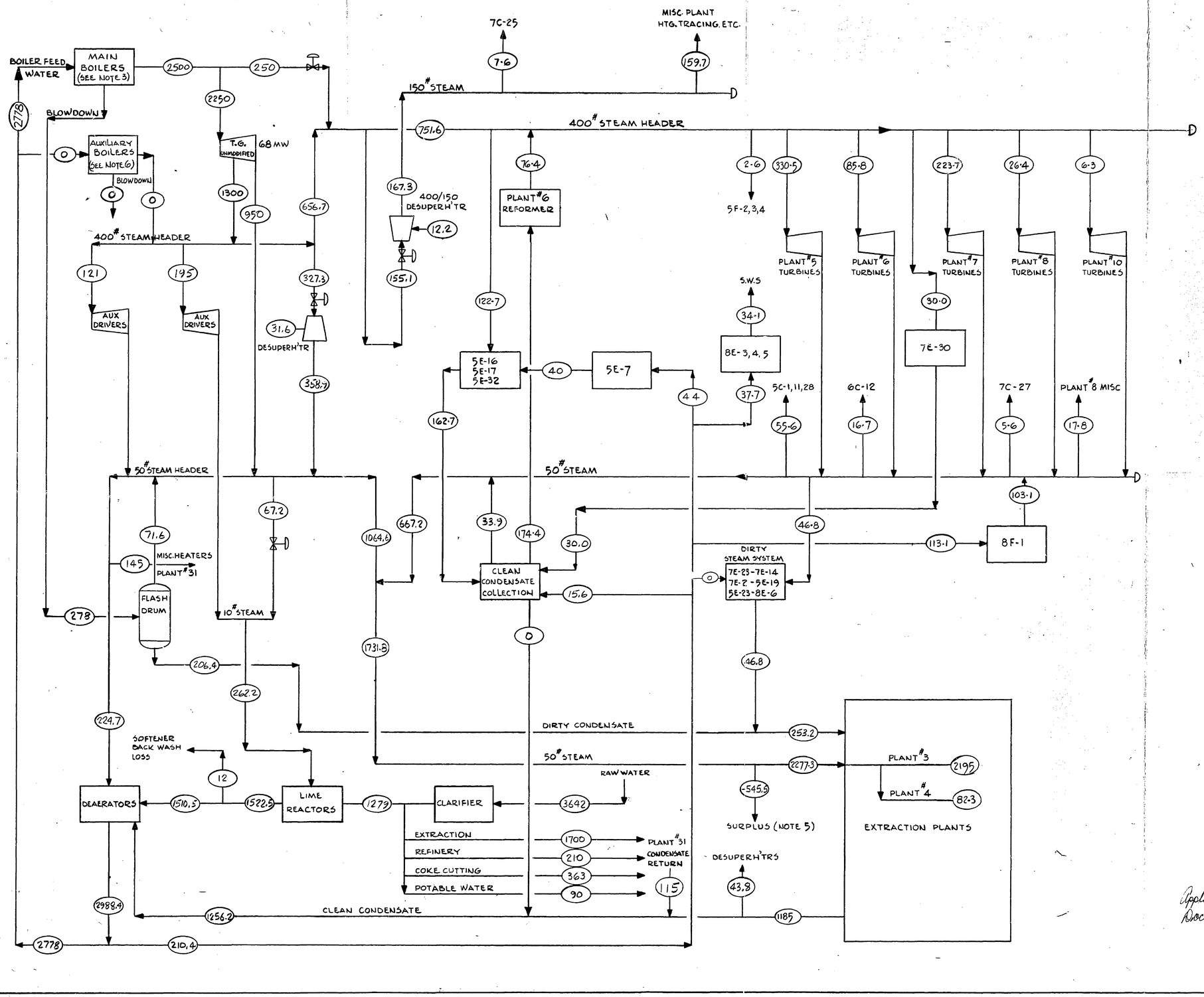
REV. No.	DATE M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
0	11	2	78	ISSUED FOR SCOPE DEFINITION	AK		

GREAT CANADIAN OIL SANDS
LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
SITE PLAN
EXPANSION

SCALE 1" = 100'
DRAWN BY HBE.
CHECKED BY
APPROVED
DRAWING NUMBER 55E-A-536
REV. 0

SIZE "D"—22" X 34"



NOTES

1. 94000 BPSD EXPANDED DELAYED COKER.
2. 4 EXTRACTION LINES OPERATING
3. 3 MAIN BOILERS AT 750 MIDS/HR (COKE FIRED) 1 MAIN BOILER AT 250 M IDS/HR (GAS FIRED)
4. ALL FLOWS IN MIDS/HR.
5. SHORTAGE OF STEAM MUST BE BALANCED BY A REDUCTION OF STEAM TO EXTRACTION PLANT
6. AUXILIARY BOILERS USED AS STAND-BY MODE ONLY.

REV. No.	M	D	Y	RECORD OF ALTERATIONS	BY	CHK'D	APP'D
5	11	20	78	REVISED DELAYED COKER EXPANSION ISSUED FOR ERCB			
4	5	31	78	AUXILIARY BOILER OPERATION CHANGED-ISSUED FOR FINAL REPORT	STD	PJM	PJM
3	05	19	78	ISSUED AS ESTIMATE BASIS	K.J.		
2	4	11	78	REVISED & ISSUED FOR PHASE 2 REPORT	STD	PJM	
1	2	14	78	EXTRACTION PLANT REVISED UNITRINERS DELETED	STD	PJM	
0	2	2	78	ISSUED FOR VACUUM UNIT PLUS EXPANDED DELAYED COKER	STD		

GREAT CANADIAN OIL SANDS LIMITED
ENGINEERING DEPARTMENT

G.C.O.S. OPERATIONAL STUDY
STEAM & BFW BALANCE (WINTER)
EXPANSION CASE - DELAYED COKER

SCALE NONE	DRAWN BY S.T.D.	CHECKED BY
APPROVED	DRAWING NUMBER	REV.
	55D-A-3119	5

Application: 78-0318
Document 11 of 11

G.C.O.S. FORM NO. 57