

PRAIRIE PROVINCES WATER BOARD

Memorandum #1

MEMORANDUM ON COMMERCIAL POWER POTENTIAL
OF SOUTH SASKATCHEWAN RIVER PROJECT

413 Post Office Building
Regina, Saskatchewan
January 22, 1951

Prepared for the use of Sask.
Power Corporation by the Prairie
Provinces Water Board Staff

HYD.

RAIRIE PROVINCES WATER BOARD

Memorandum #1

MEMORANDUM ON COMMERCIAL POWER POTENTIAL

OF SOUTH SASKATCHEWAN RIVER PROJECT

413 Post Office Building
Regina, Saskatchewan
January 22, 1951

Prepared for the use of Sask.
Power Corporation by the Prairie
Provinces Water Board Staff

150.4

MEMORANDUM ON COMMERCIAL POWER POTENTIAL
OF SOUTH SASKATCHEWAN RIVER PROJECT

Prepared for the use of Saskatchewan
Power Corporation by the Prairie
Provinces Water Board staff -
413 Post Office Bldg.,
Regina, Sask.,
January 22, 1951.

General

The South Saskatchewan River Project is a combined irrigation and power project proposed by the Province of Saskatchewan and the Prairie Farm Rehabilitation Administration (Canada). Figure A indicates the location of this project and its relation to other projected hydro-electric power sites that will be directly affected by its construction and operations.

The following notes set out the commercial power possibilities of this project and indicate the future benefits which will accrue to the downstream hydro developments due to its operations.

All figures contained herein, although they are close estimates, are subject to correction and change.

South Saskatchewan River Project

Assumptions

The natural flow of the river had been previously reconstructed by the Water Board. From this flow certain deductions were made to arrive at the flow available for commercial power production. The deductions, and other pertinent assumptions, follow:

Period of years investigated = 1923-48

Area irrigated in Alberta = 1,710,000 acres

This includes the proposed Red Deer Project with some water diverted over from the Clearwater River.

Area irrigated in Swift Current Project = 21,000 acres

Area irrigated in S. Sask. River Project = 430,900 acres

Water required for this = 738,500 acre-feet

Qu'Appelle diversion = 200 c.f.s. for 7 months =

84,000 acre-feet

Seepage loss @ 100 c.f.s. continuously = 72,000 acre-feet

Evaporation loss @ 24 inches from reservoir surface.

Allowable reservoir drawdown = 1825 - 1785 = 40 feet

Available reservoir storage = 4,000,000 acre-feet

Water allowed annually for power for irrigation

pumping = 305,000 - 450,000 acre-feet

depending on elevation of reservoir.

Turbine-generator efficiency = 80%

Distribution of commercial energy production by months:

Jan. - 13.0%	July - 4.5%
Feb. - 9.0	Aug. - 7.0
Mar. - 7.0	Sept. - 8.0
Apr. - 5.0	Oct. - 11.0
May - 5.0	Nov. - 12.0
June - 4.5	Dec. - 14.0

Results

Using the above assumptions, it is possible to obtain from this project every year a commercial energy output of 325,000,000 kwh distributed by months as follows (Note - a more uniform monthly distribution would increase the annual energy production):

Jan. - 42,400,000 kwh	July - 14,700,000 kwh
Feb. - 29,400,000	Aug. - 22,900,000
Mar. - 22,900,000	Sept. - 26,100,000
Apr. - 16,300,000	Oct. - 35,900,000
May - 16,300,000	Nov. - 39,100,000
June - 14,700,000	Dec. - 45,700,000

The possible average annual secondary energy production (with 155,500 KW capacity) = 70,000,000 kwh.

Then, if the plant capacity was 155,500 KW,

if maximum allowable winter discharge was 12,500 c.f.s.,
and if firm capacity is defined as the available capacity in
December 100% of the time,
then, firm capacity of this plant would be 127,000 KW

- this is with lowest reservoir elevation (yr 1901)
With highest reservoir elevation (see Figure B), the capacity
would be 156,000 KW.

If the Fort a la Corne hydro plant were built, it would be both feasible and desirable to use its low-value summer power for pumping irrigation water; this would permit the present allowance for pumping-power water to be used for the production of firm energy. Such an arrangement would increase the output of firm commercial energy at the South Saskatchewan River Project plant to 375,000,000 kwh annually.

The following table summarizes these results:

Production of Commercial Power in K.W.H.

<u>Condition</u>	<u>Annual Firm (100%)</u>	<u>December Firm (100%)</u>	<u>Av. annual Secondary</u>
Without Fort a la Corne	326,000,000	45,700,000	70,000,000
With Fort a la Corne	375,000,000	52,500,000	70,000,000

Hydro Plants Below Saskatoon

It is thought that in the stretch of the river between Saskatoon and The Forks there are suitable sites for four fifty-foot hydro plants, see Figure A. The river regulation afforded by the operation of the South Saskatchewan River Project plant (Coteau Dam) would tend to increase the firm power production of these plants. In this case, the South Saskatchewan River Project should be credited, to some extent, with this increased firm production.

Figure C gives monthly flows below Saskatoon available 90% (firm) and 50% (average) of the time for three different conditions:

1. Flow available after Alberta's development up to the extent now approved by the Water Board.
2. Flow available after South Saskatchewan River Project is constructed and developed.
3. Flow available with both the South Saskatchewan River Project and Fort a la Corne plant operating.

Assuming that these four hydro developments have a combined capacity of 100,000 KW, then the annual power production for the three above conditions is:

Energy Production in K.W.H.

Condition	Annual firm (90%)	December Firm (90%)	Av. annual Secondary (50%)
1	365,000,000	25,000,000	240,000,000
2	430,000,000	52,000,000	33,000,000
3	430,000,000	60,500,000	33,000,000

Fort a la Corne Hydro Plant

It will be noticed from Figure A that this plant is located just downstream from the junction of the North and South Saskatchewan Rivers.

The operation of the South Saskatchewan River Project will tend to increase the firm power production at the Fort a la Corne plant. Such increased production should be credited, to some extent, to the S. Saskatchewan River Project.

Figure D gives monthly flows below The Forks available 90% and 50% of the time for the following two conditions:

1. Flow available after Alberta's development up to the extent now approved by the Water Board.
2. Flow available after South Saskatchewan River Project is constructed and developed.

After adjusting these flows for reservoir storage (230,000 acre-feet), the energy available from the above conditions, assuming an installation of 135,000 KW, is:

Energy Production in K.W.H.			
Condition	Annual firm (90%)	December firm (90%)	Av. annual Secondary (50%)
1	550,000,000	22,000,000	200,000,000
2	560,000,000	35,000,000	110,000,000
3	560,000,000	39,500,000	110,000,000

By using the low-value summer power for pumping irrigation water in the South Saskatchewan River Project, the winter power production would be increased as shown in condition 3 in the above table.

Conclusions

The following table indicates the commercial power possibilities of the South Saskatchewan River Project and its incremental effect on proposed downstream hydro developments.

Commercial Energy Production - K.w.H.			
Item	Annual Firm	December Firm	Average annual Secondary
<u>With no Fort a la Corne exchange</u>			
S. Sask. River Project	326,000,000	45,700,000	70,000,000
Four hydro plants	65,000,000	27,000,000	-207,000,000
Fort a la Corne	10,000,000	13,000,000	- 90,000,000
<u>With Fort a la Corne exchange</u>			
S. Sask. River Project	375,000,000	52,500,000	70,000,000
Four hydro plants	65,000,000	35,000,000	-207,000,000
Fort a la Corne	-39,000,000	17,500,000	- 90,000,000


There is another hydro site downstream from the Fort a la Corne site near Nipawin, Sask., that will be aided by the regulation of the S. Sask. River Project. The increased energy production to be gained at this site would be approximately equal to that at Fort a la Corne.

It should be borne in mind in assessing the commercial power possibilities of this project, that, while power produced at the main site should be credited in full (first line in the above table), the incremental power values produced at Fort a la Corne would not be realized for some time, while the incremental power values produced at the four projected plants below Saskatoon would not be realized for a long, long time.

It should also be emphasized that all energy production figures are based on the assumption that all the irrigation projects mentioned are fully developed. This will not be the case for many years, and in the meantime, more water could be available for the production of commercial energy. For example, if this project were in operation by 1965, at least 450,000,000 k.w.h. of firm power could be produced.

LOCATION MAP
OF
SOUTH SASK. RIVER PROJECT
AND
PROPOSED DOWNSTREAM HYDRO DEVELOPMENTS

— LEGEND —

Proposed Reservoirs 

SCALE
MILES 20 0 20 40 60 80 100 MILES

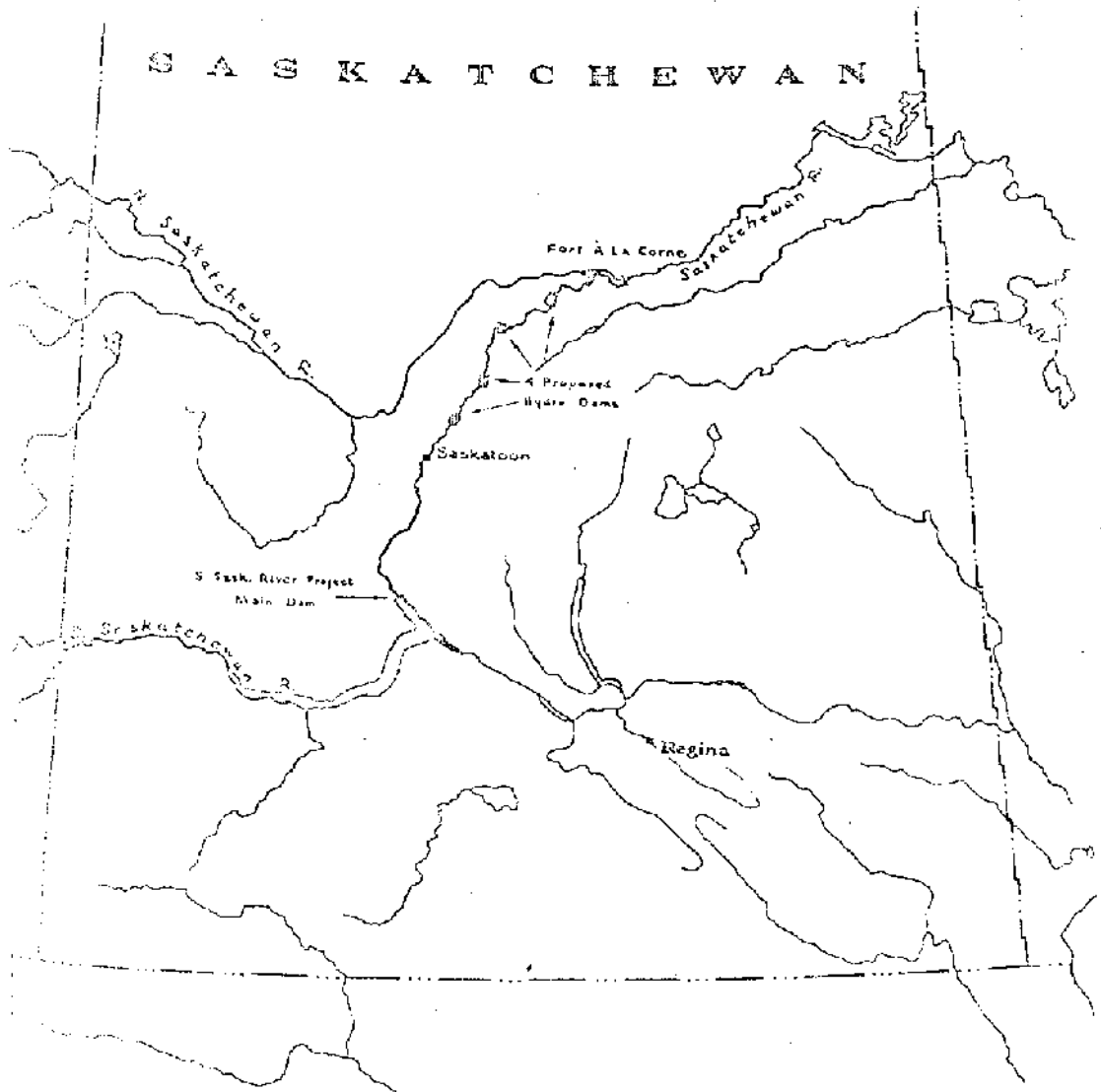
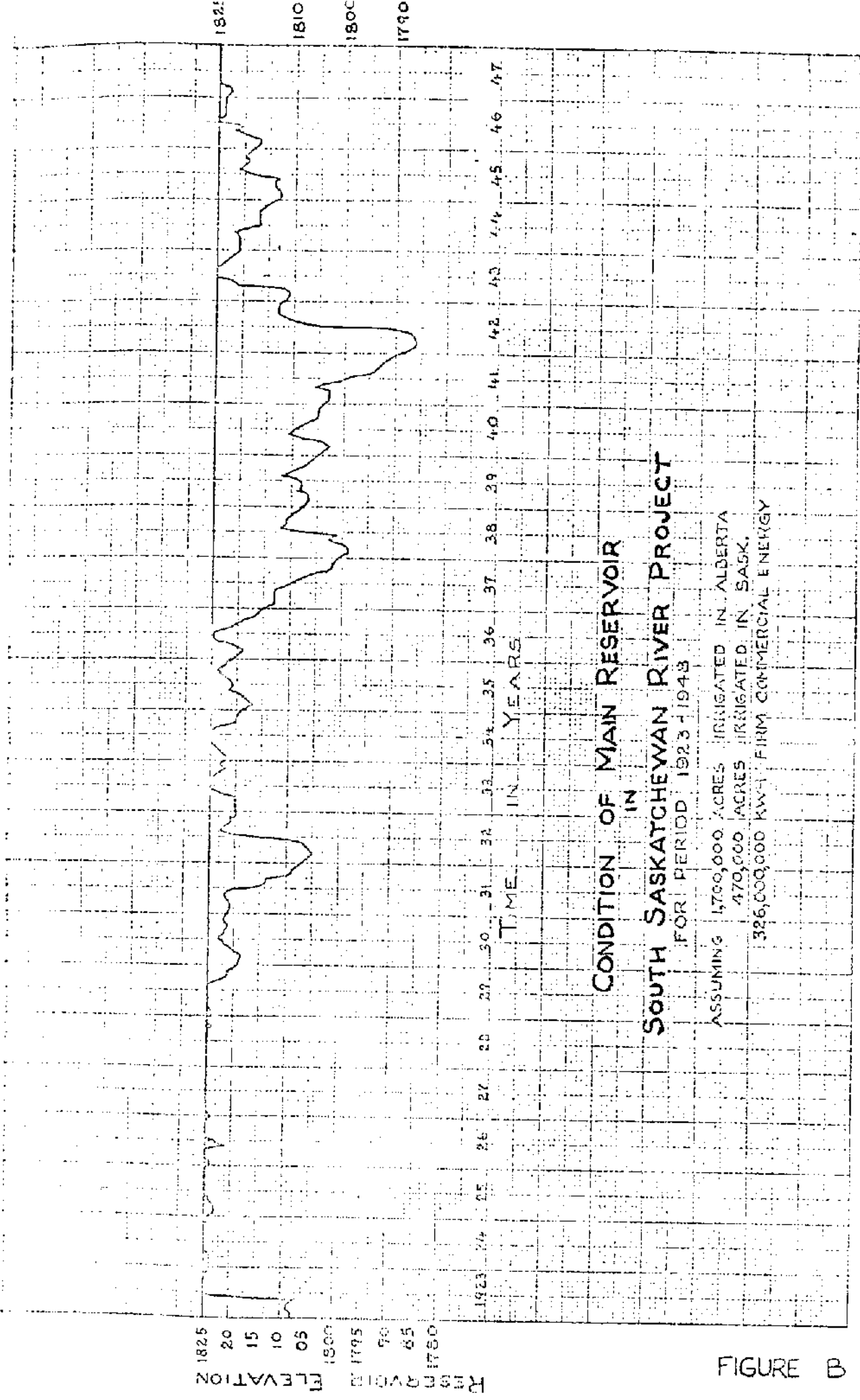


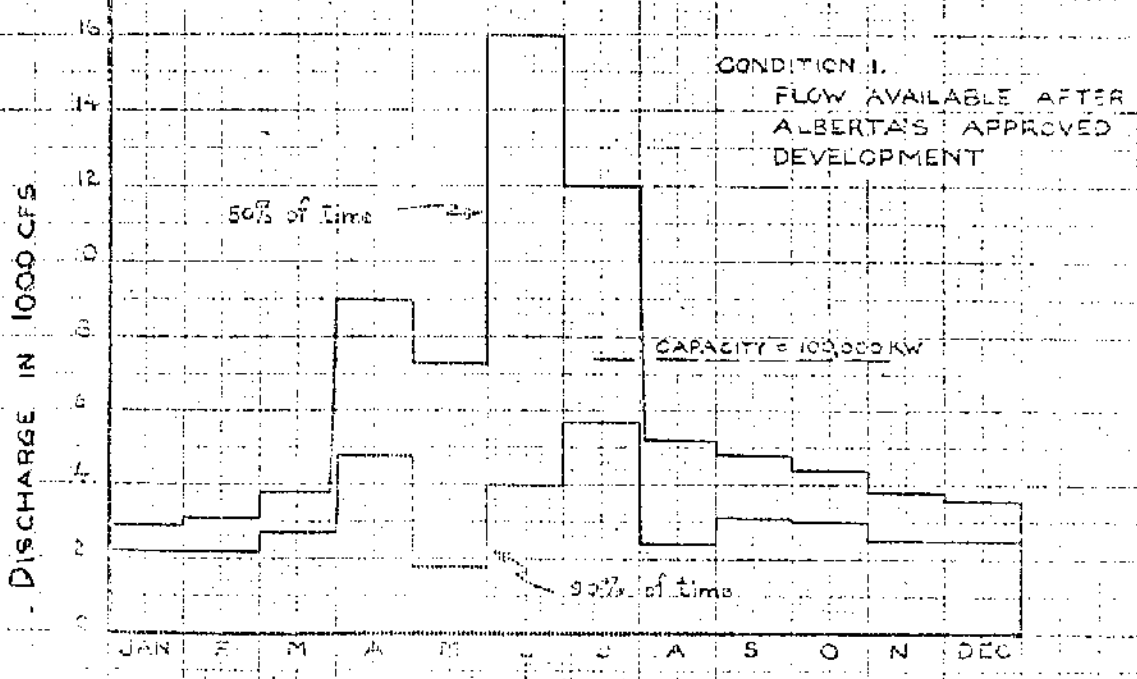
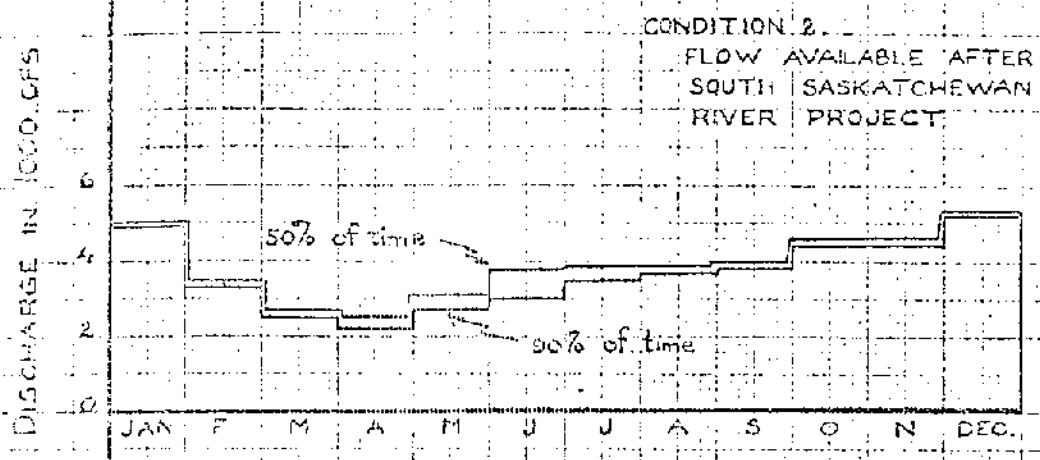
Figure A.



**CONDITION OF MAIN RESERVOIR
IN
SOUTH SASKATCHEWAN RIVER PROJECT
FOR PERIOD 1923-1943**

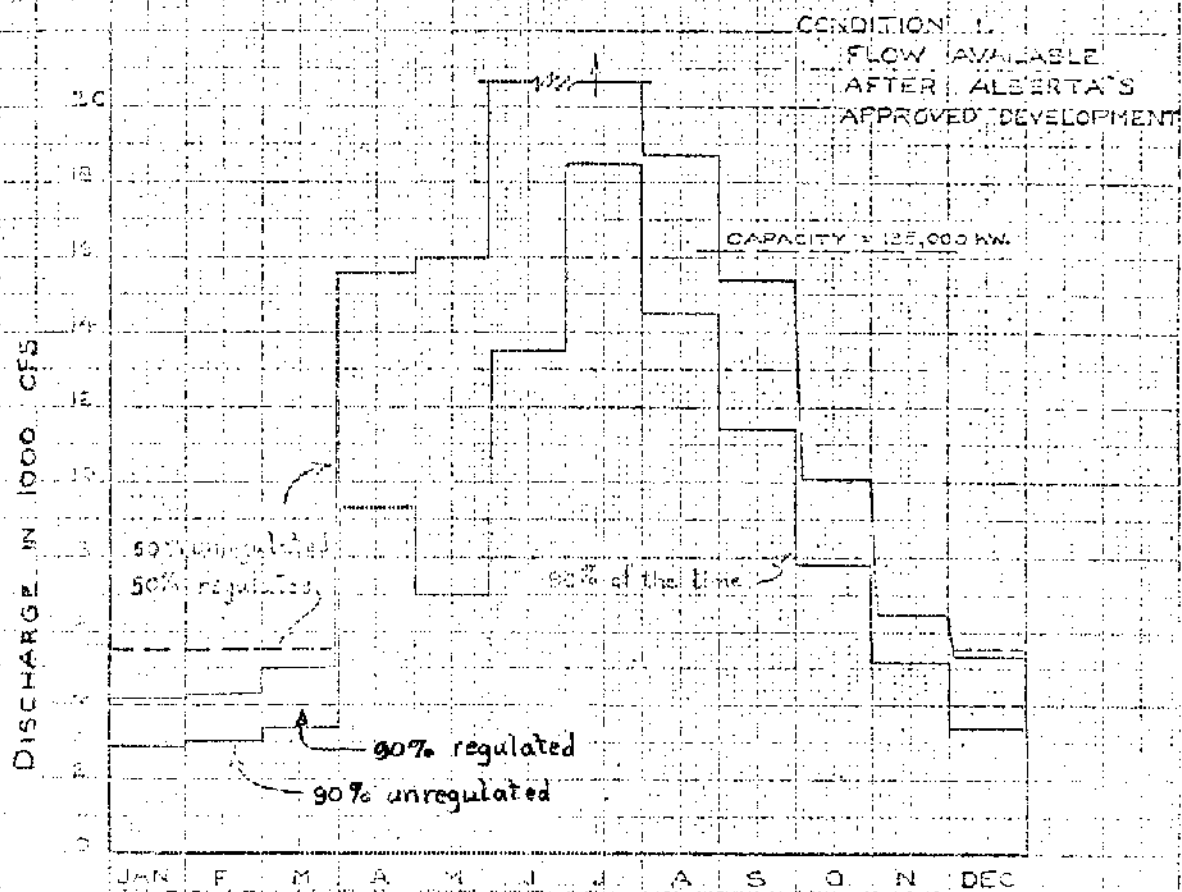
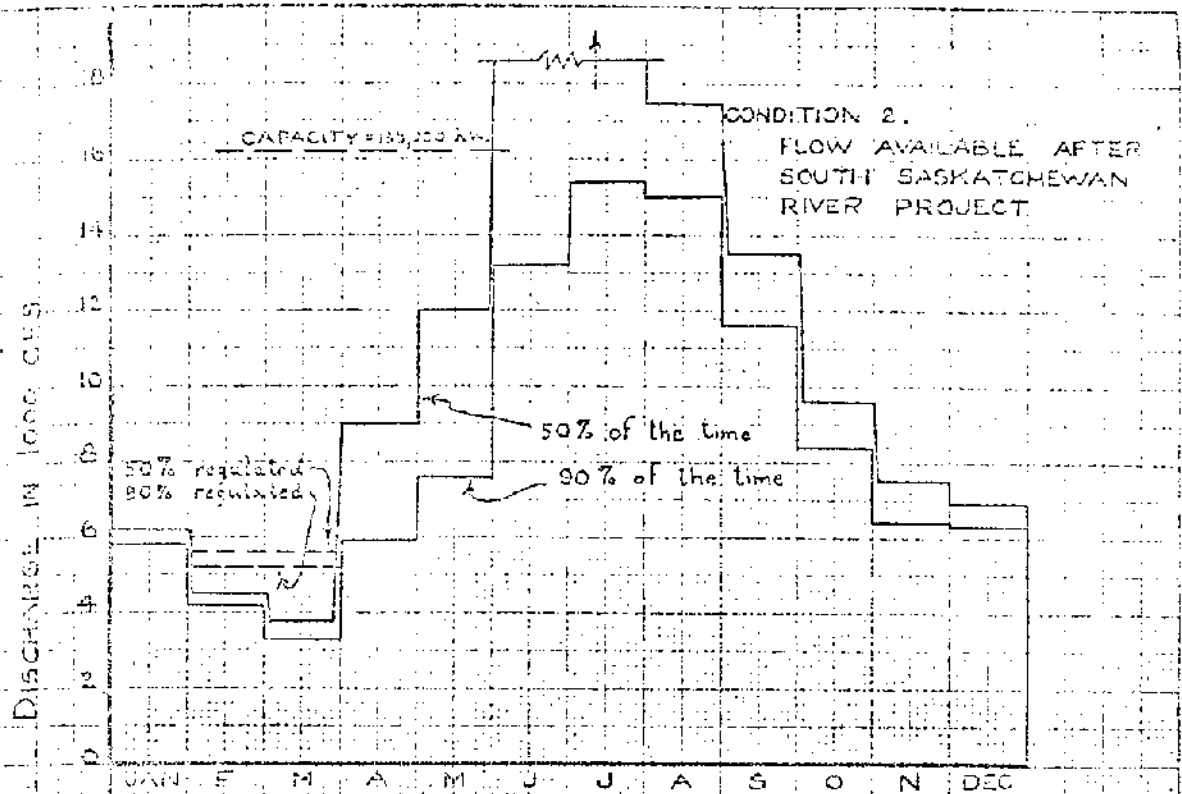
ASSUMING 1,700,000 ACRES IRRIGATED IN ALBERTA
 470,000 ACRES IRRIGATED IN SASK.
 326,000,000 KW-H FIRM COMMERCIAL ENERGY

FIGURE B



MONTHLY FLOW-DURATION CURVES
SOUTH SASKATCHEWAN RIVER BELOW SASKATOON

FIGURE C



MONTHLY FLOW-DURATION CURVES
SASKATCHEWAN RIVER BELOW THE FORKS

FIGURE D