PRESENTATION ON AMAILA HYDROELECTRIC RESERVOIR CAPACITY

BY

MR. MAURICE VEECOCK

SENIOR LECTURER, DEPARTMENT OF CIVIL ENGINEERING
FACULTY OF TECHNOLOGY

AMAILA HYDROELECTRIC RESERVOIR CAPACITY

INTRODUCTION

The object of this note is to suggest a solution to ensure a continuous flow of water into the Amaila reservoir so as to enhance the supply of continual average generation of electric power to the users.

BACKGROUND

A pre-feasibility study completed during the United Nations Development Programme (UNDP) Hydroelectric Power Survey (1974-1976) recommended an installation of 195mw (3-65mw Turbines) with an energy capability of average 131 Megawatts.

PRESENT SITUATION AND PHYSICAL SETTING

The present position is to size larger turbines of 50 megawatts as against the proposal made in 1997 by Synergy Holdings Inc of 4-Francis type turbines.

Nominal discharge for each unit 8.38 m^3/sec for some 25 MW each.

The ***Amaila Hydroelectric Project*** is located on the Kuribrong River in West Central Guyana and about 250 kilometers southwest of Georgetown. The dam site is at the confluence of the Amaila and Kuribrong Rivers.

PRESENT SITUATION AND PHYSICAL SETTING (CONT'D)

The project includes a small storage reservoir created by two small dams constructed at the confluence of the Amaila and Kuribrong Rivers at the top of Amaila Falls.

Some of the salient features of Hydrological aspects are listed below:

Drainage area	**648km^2**
Length of record period (1950-1991)	**41 yrs**
Average flow approximately	**64.0m^3/sec**

RESERVOIR

F.S.L.	**462.0m**
L.S.L.	**452.5m**
Active storage volume	**146mcm**
Surface area at F.S.L.	**26.7km²**
Surface area at L.S.L.	**5.35km²**
Gross head (maximum)	**365m**

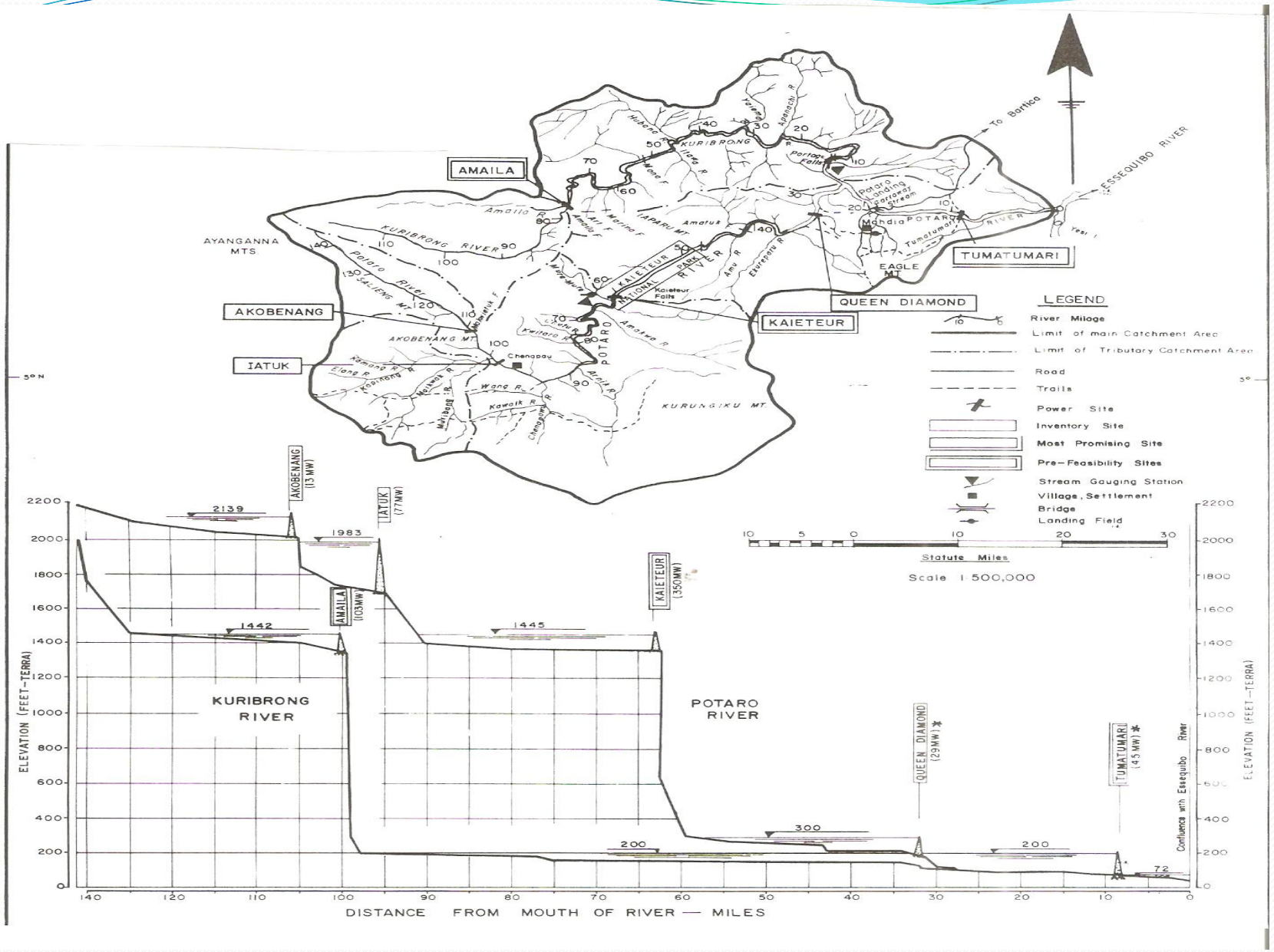
In order to generate flows for the Amaila project, the flows at Kaieteur Falls on the Potaro river were used.

RESERVOIR (CONT'D)

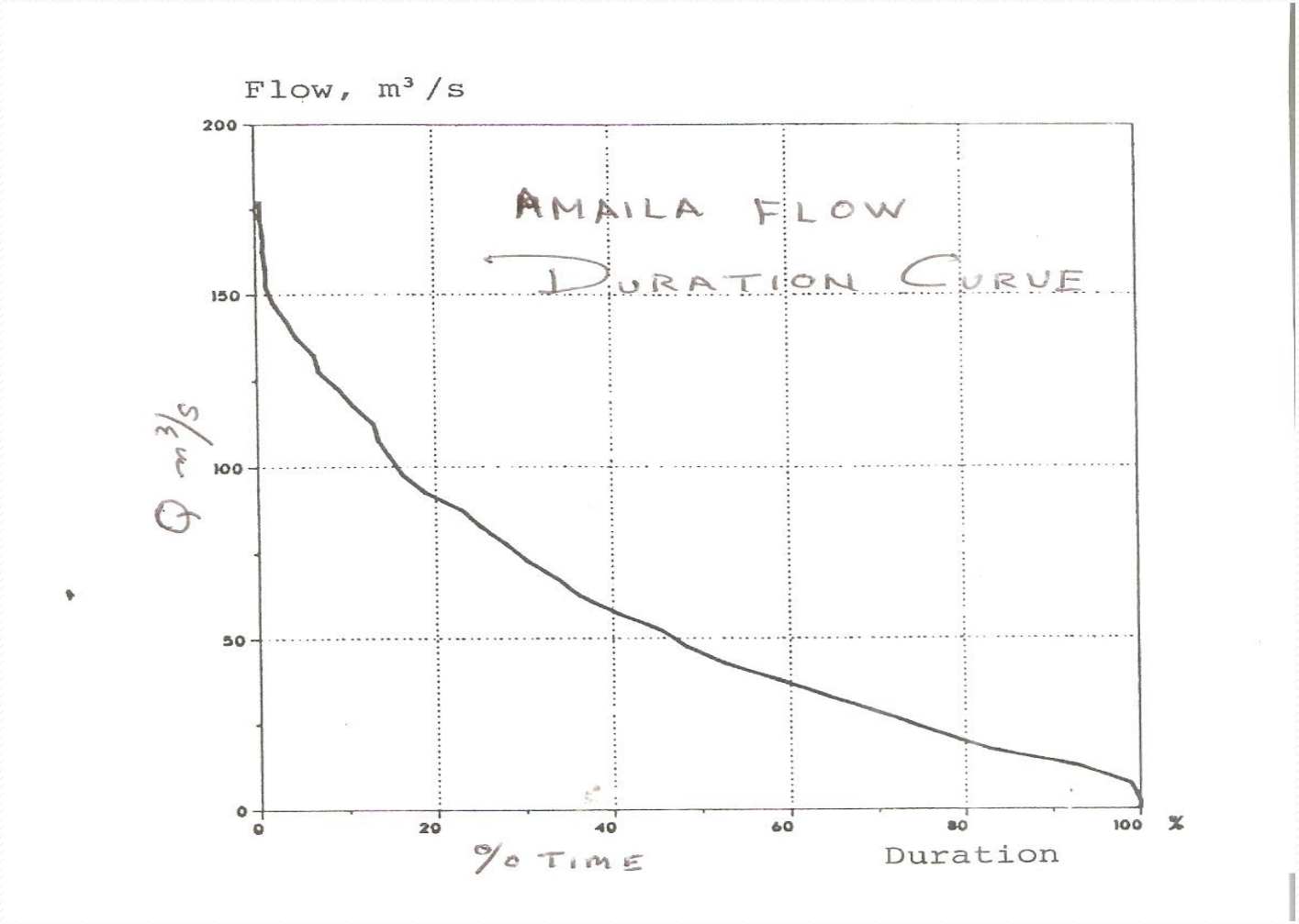
The terrain and climate of the Kuribrong and Potaro basins are similar and on the basis of the ratio of drainage basin with adjustment for average precipitation and utilization some actual discharge measurement at/near Amaila Falls, these formulae were adapted.

$$Q_{AM} = 0.26Q_{KAi}$$ **(MONECO)**

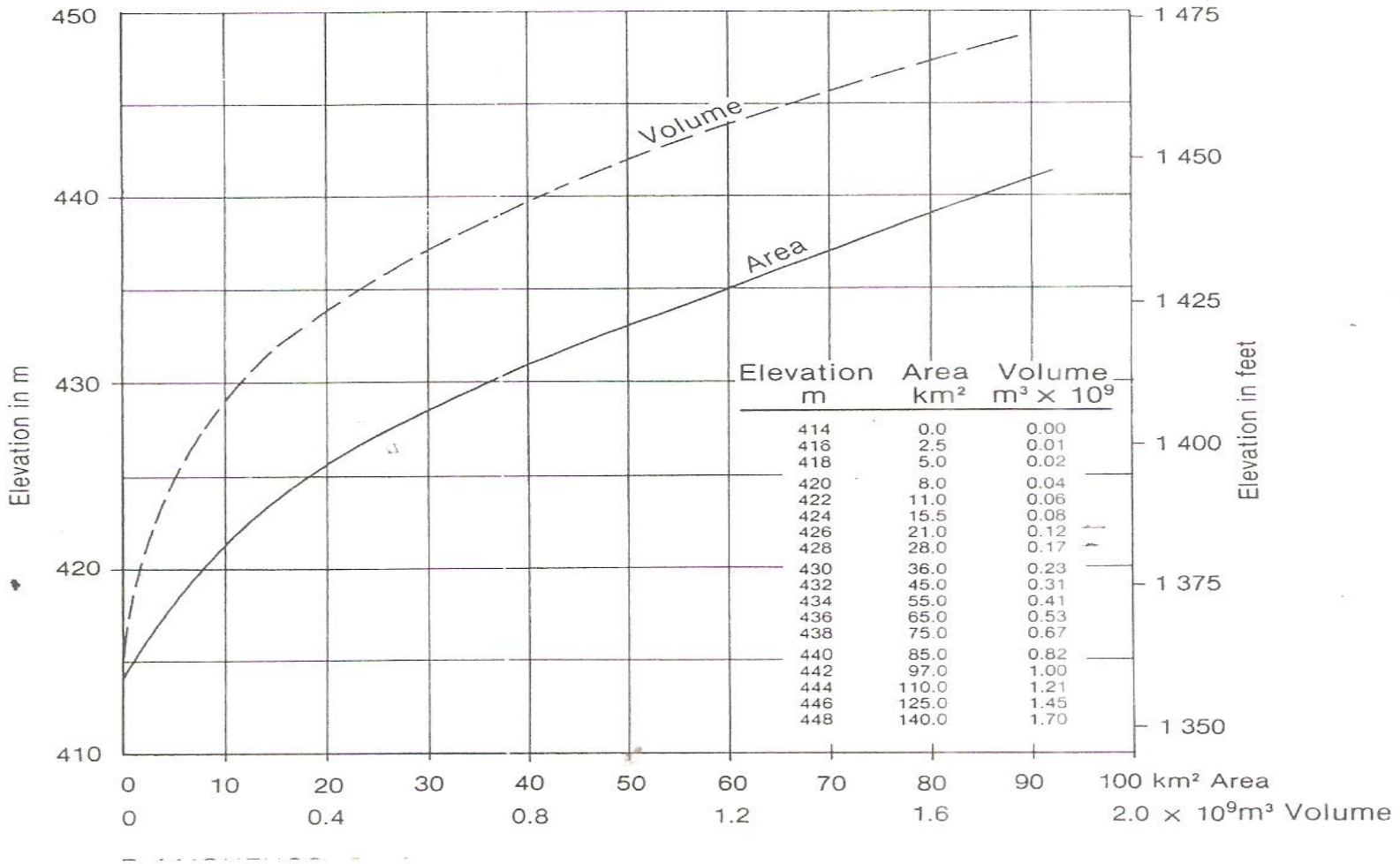
$$Q_{AM} = 0.30Q_{KAi}$$ **(Synergy Holding Inc.)**


AMAILA
AKOBENANG
IATUK
KAIETEUR
QUEEN DIAMOND
TUMATUMARI
AYANGANNA MTS
EAGLE MT
KURIBRONG RIVER
POTARO RIVER
ESSEQUIBO RIVER
To Bartica
KURUNGIKU MT
LEGEND
River Mileage
Limit of main Catchment Area
Limit of Tributary Catchment Area
Road
Trails
Power Site
Inventory Site
Most Promising Site
Pre-Feasibility Sites
Stream Gauging Station
Village, Settlement
Bridge
Landing Field
Statute Miles
Scale 1 500,000
AKOBENANG (13 MW)
IATUK (77MW)
AMAILA (103MW)
KAIETEUR (350MW)
QUEEN DIAMOND (29MW)
TUMATUMARI (45 MW)
2139
1983
1442
1445
300
200
200
72
KURIBRONG RIVER
POTARO RIVER
ELEVATION (FEET-TERRA)
DISTANCE FROM MOUTH OF RIVER — MILES
Confluence with Essequibo River

AMAILA FLOW DURATION CURVE



Amaila reservoir



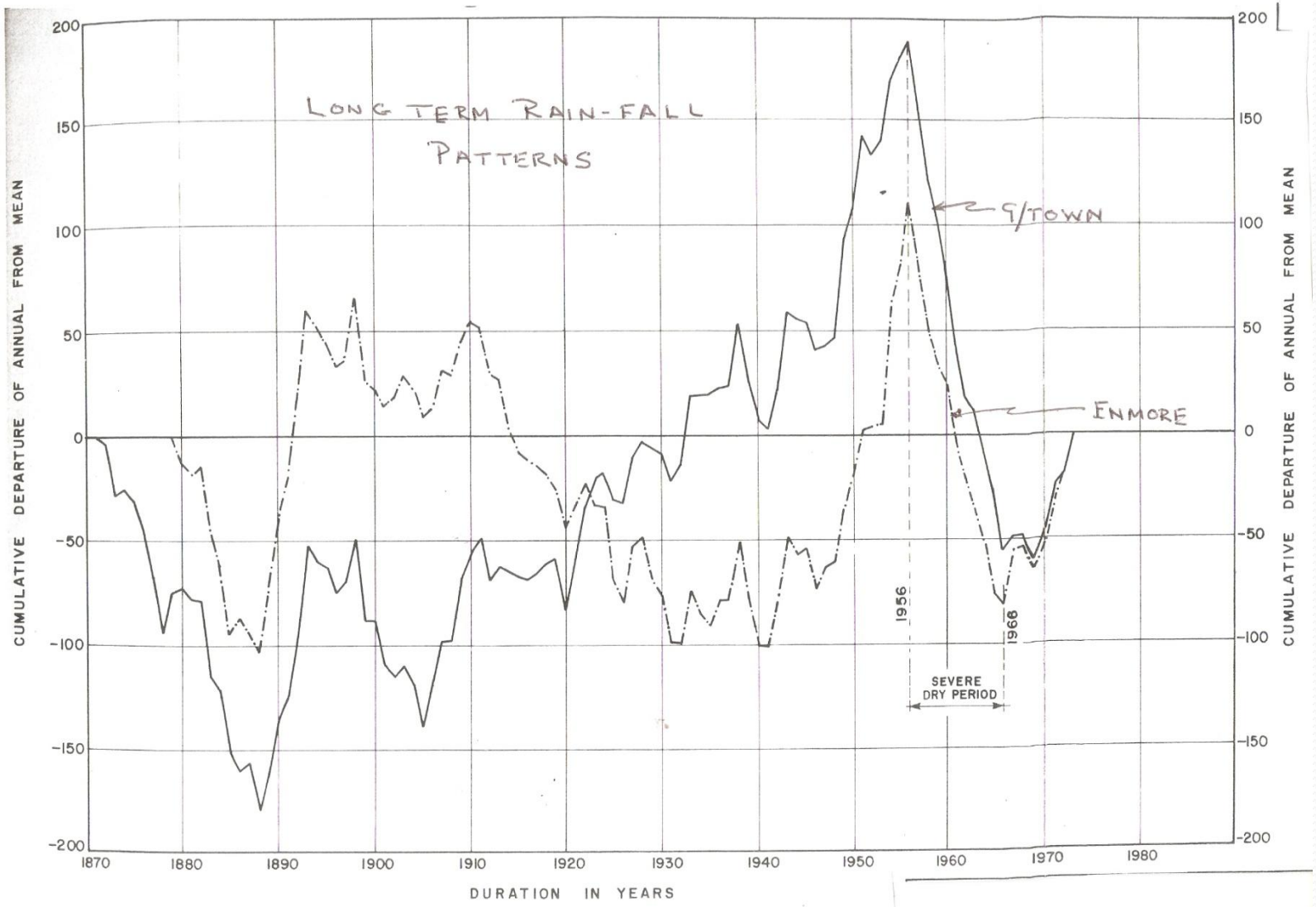
Elevation m	Area km²	Volume m³ × 10⁹
414	0.0	0.00
416	2.5	0.01
418	5.0	0.02
420	8.0	0.04
422	11.0	0.06
424	15.5	0.08
426	21.0	0.12
428	28.0	0.17
430	36.0	0.23
432	45.0	0.31
434	55.0	0.41
436	65.0	0.53
438	75.0	0.67
440	85.0	0.82
442	97.0	1.00
444	110.0	1.21
446	125.0	1.45
448	140.0	1.70

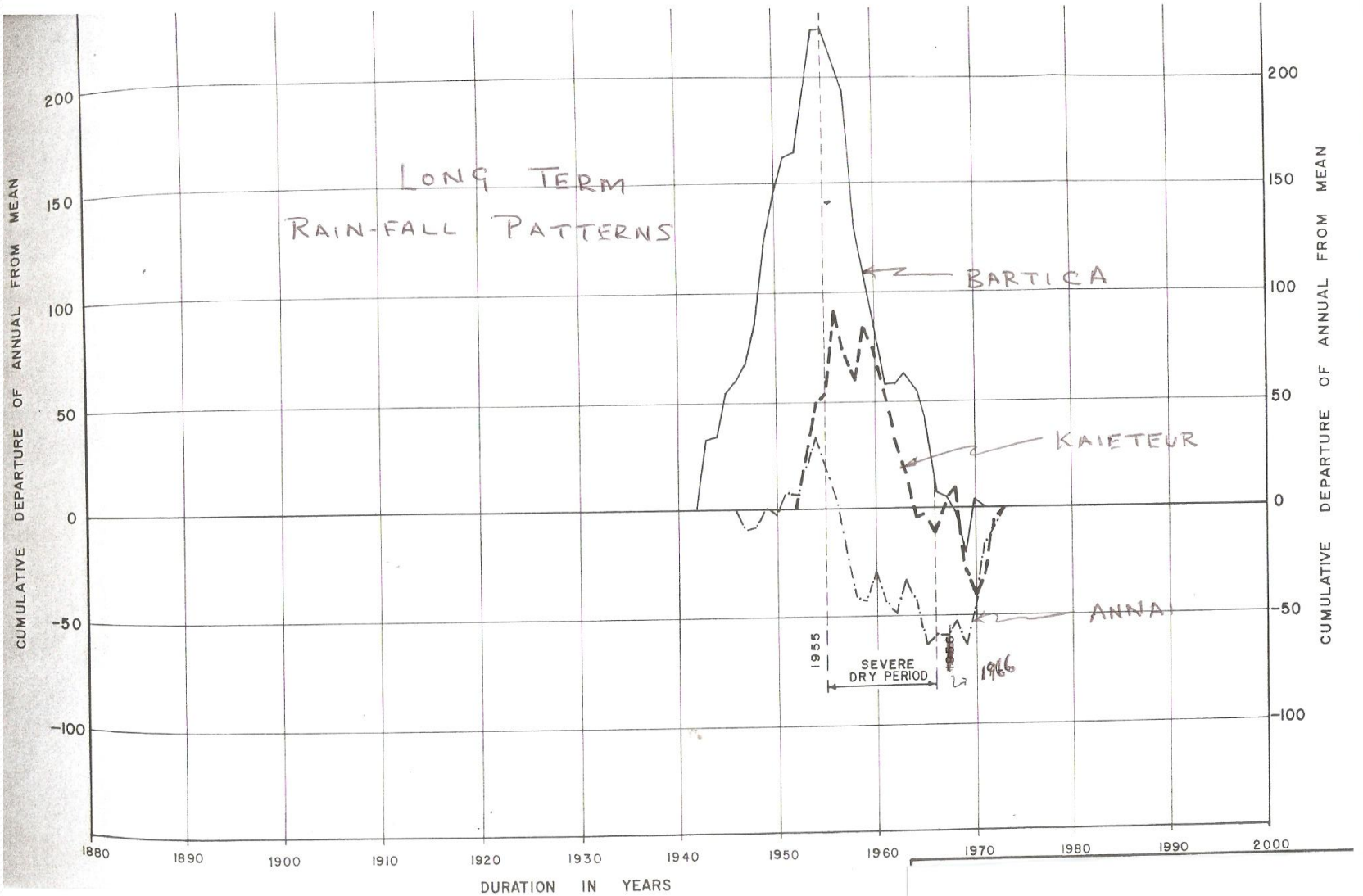
Inspection of the data from a flow duration curve shows that 40% of the time the flows on the Amaila project area at the dam site is less or equal to 35 m^3/sec.

The stream flow data show a cyclic trend with low flows occurring in early 1960s and early 1980s. Low flows were observed in the years 1952, 1961-1962, 1964-1965, 1969, and 1986.

Utilizing annual precipitation data for Georgetown Botanical Gardens (1870-1973), Enmore Front (1880-1973), Bartica Potaro Road (1943-1970), Kaieteur (1955-1973) and Annai (1945-1973); the long term precipitation patterns indicated a severe dry period (1950-1966).

The stream flow and precipitation data show the need to consider additional storage capacity so as to supplement the Amaila reservoir during the drier periods.


LONG TERM RAIN-FALL
PATTERNS
Q/TOWN
ENMORE
1956
1966
SEVERE
DRY PERIOD
CUMULATIVE DEPARTURE OF ANNUAL FROM MEAN
CUMULATIVE DEPARTURE OF ANNUAL FROM MEAN
DURATION IN YEARS
200
150
100
50
0
-50
-100
-150
-200
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980


LONG TERM
RAIN-FALL PATTERNS
BARTICA
KAIETEUR
ANNAI
1955
SEVERE
DRY PERIOD
1966
CUMULATIVE DEPARTURE OF ANNUAL FROM MEAN
CUMULATIVE DEPARTURE OF ANNUAL FROM MEAN
200
150
100
50
0
-50
-100
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
DURATION IN YEARS

The minimum flow recorded at Kaieteur is 11.24 m^3/sec during the year 1961 on the 16^{th} to 18^{th} and 3^{rd} May. This flow extrapolated to the Amaila project will be 2.92 m^3/sec to 3.37 m^3/sec. Such low discharges sounds a warning and reinforces the need to plan further storage.

RIVER BASINS FOR POWER DEVELOPMENT IN GUYANA

There are many river basins in Guyana that contain many suitable sites for power development. However, the three main rivers that offer suitable power sites for Guyana's domestic and industrial developments are:

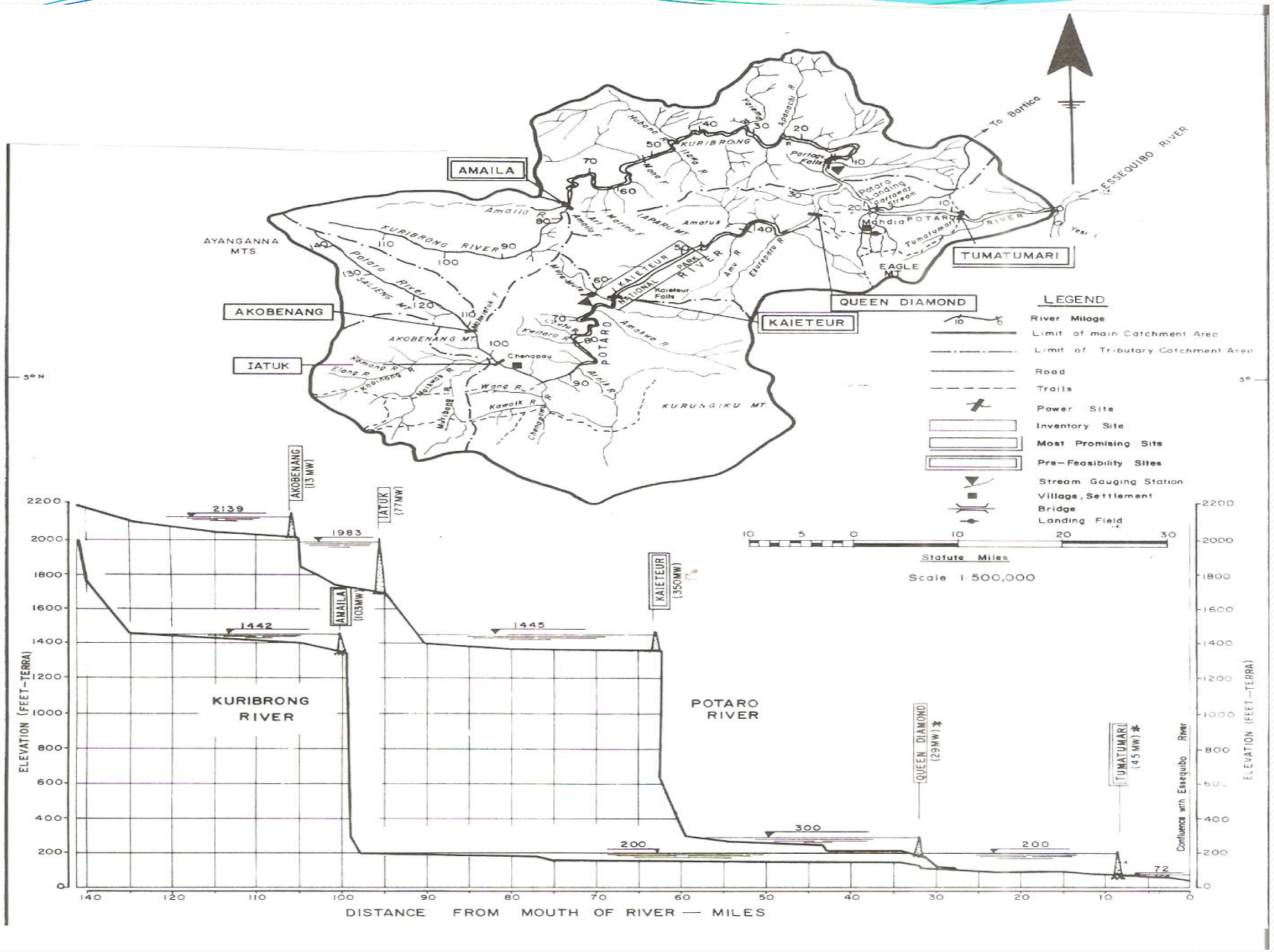
- Cuyuni
- Mazaruni
- Potaro

Cuyuni basin places third since most of catchment lies in the area of our neighbour to the West.

Mazaruni basin has the largest power potential and perhaps the cheapest mill-rate; however the Potaro basin offers the best potential to satisfy Guyana's needs for now and for the foreseeable future.

There are many possible hydropower sites in the Potaro basin that can be developed. These include:

- Tumatumari
- Amaila
- Kaieteur (at the falls)
- Queen Diamond
- Iatuk
- Akobenang
- Chi-Chi Diversion


AMAILA
AKOBENANG
IATUK
KAIETEUR
QUEEN DIAMOND
TUMATUMARI
AYANGANNA MTS
EAGLE MT
KURIBRONG RIVER
POTARO RIVER
ESSEQUIBO RIVER
To Bartica
KURUNGIKU MT
LEGEND
River Mileage
Limit of main Catchment Area
Limit of Tributary Catchment Area
Road
Trails
Power Site
Inventory Site
Most Promising Site
Pre-Feasibility Sites
Stream Gauging Station
Village, Settlement
Bridge
Landing Field
Statute Miles
Scale 1 500,000
AKOBENANG (13 MW)
IATUK (77MW)
AMAILA (103MW)
KAIETEUR (350MW)
QUEEN DIAMOND (29MW)
TUMATUMARI (45 MW)
2139
1983
1442
1445
300
200
200
72
KURIBRONG RIVER
POTARO RIVER
ELEVATION (FEET-TERRA)
DISTANCE FROM MOUTH OF RIVER — MILES
Confluence with Essequibo River

CONCLUSION

I will conclude with the following points:

1. Develop Amaila to provide at-site power (100–150) MW.
2. Construct a dam upstream of the Kaieteur Falls and divert the flow of the Potaro River into the Amaila reservoir through a saddle between the two watersheds so as to supplement the low flow conditions.
3. Release water over the Kaieteur falls so as to preserve its beauty.

CONCLUSION (CONT'D)

4. Construct the Tumatumari Power station.
5. Investigate and construct if feasible the Chi-Chi diversion.

THANK YOU FOR LISTENING!