The cover is a solid green color. On the left side, there is a vertical illustration of a tall, lattice-structured tower. At the bottom of the cover, there is a dark blue silhouette of a building with a flat roof and a few windows. The text is printed in white, bold, sans-serif capital letters.

**THE
PAMPANGA
RIVER BASIN
FLOOD
FORECASTING
AND
WARNING
PROJECT**

The cover is a light yellow or cream color. It features a prominent black rectangular border with rounded corners. The text is centered within this border and is printed in black, bold, sans-serif capital letters.

**THE
PAMPANGA RIVER
BASIN FLOOD
FORECASTING
AND WARNING
PROJECT**



FERDINAND E. MARCOS
President/Republic of the Philippines



MESSAGE

Let me extend my warmest greetings to those who have jointly contributed to the setting up of the Pampanga River Basin Pilot Flood Forecasting and Warning System. On behalf of the Filipino who will be greatly benefited by this project, may I convey to you their profound gratitude, especially to the Japanese people without whose generous assistance the project would not have been realized.

Our two peoples have shown that the seeds of friendship can still grow out the rubble of war. Today, there thrives between our nations a continuing exchange in the field of trade, culture and diplomacy.

A handwritten signature in dark ink, appearing to read "F. E. Marcos". The signature is stylized and fluid.

FERDINAND E. MARCOS
President
Republic of the Philippines



MESSAGE

It is a great pleasure for me to learn that the Philippine's First Flood Forecasting and Warning System installed in the Pampanga river basin has now started its operation.

Upon the request of the Philippine Government, the Government of Japan sent two survey teams, one in 1969 and another in 1972, to make study as to the feasibilities of putting up such a system in the Philippines. Based on the studies thus made, the Japanese Government has extended to the Philippine Government, a grant up to the amount of eighty million Yen, equivalent to approximately, P2,000,000 for the procurement by the latter of necessary equipment and services of Japanese engineers for the establishment of the system in the Pampanga river basin.

The Philippine Government, in particular the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), formerly the Weather Bureau, and the Bureau of Public Works have been making great efforts to complete the installation of the system in the river basin at the earliest possible time.

This system connects ten (10) rainfall and seven (7) water level gauging stations in the Pampanga river basin with the Flood Forecasting Center in Quezon City, by automatic telemetry equipment. I am convinced that this system's flood forecasting and warning function will minimize the sufferings and destruction of human lives and properties. It might be needless to add that the system will relieve the residents of the Pampanga River Basin from unwarranted anxieties and fears of flood too.

TOSHIO URABE
Ambassador of Japan



MESSAGE

The need for a flood forecasting service for the Pampanga River Basin provided the opportunity for close cooperation and collaboration between the Bureau of Public Works and the PAGASA (Weather Bureau) during the first phase and establishment of the flood warning project.

It is hoped that the continued collaboration between these two agencies during the operational phase of the project will substantially help minimize the losses caused by floods in the Pampanga River Basin. It must also be mentioned that the cooperation and support of other agencies and authorities concerned with emergency flood protection work and dissemination of warnings are indispensable to the effectiveness of the flood warning system. The Bureau of Public Works and the PAGASA (Weather Bureau) look forward to such cooperation and support since the success of the project will, in no small measure, redound to the benefit of our people under the New Society.

Finally we take this opportunity to acknowledge the assistance of the Government of Japan and the role of the ECAFE/WMO Typhoon Committee in making the project a reality.

DESIDERIO ANOLIN
Director, Bureau of Public Works

ROMAN L. KINTANAR
Administrator, PAGASA (Weather Bureau)

BACKGROUND INFORMATION

The Pampanga river is one of the two major systems draining the Central Luzon plains which is often times referred to as the granary of the Philippines. The area unfortunately suffers considerable flood damage almost every year. According to a recent survey of flood damage statistics in the ECAFE region, the average annual flood damage in the Philippines during the period 1961-1970 amounts to 26.6 million US dollars. It is noteworthy that about one fourth of the total flood damage in the Philippines may be attributed to the Pampanga river basin. The disastrous flood that occurred in Central Luzon in July 1972 is the most destructive of the Philippine floods in living memory. It inflicted a total damage of about 300 million US dollars in the Central Luzon area. Most of this unprecedented damage were in the Pampanga river basin.

The Pampanga basin is densely populated and various development programmes are currently in progress in this area. With the rapid economic development the average flood damage is likely to increase correspondingly. In recent years, with a view to reducing flood damage, the need for establishing a flood forecasting system and flood protection measures has been engaging the attention of the Weather Bureau and the Bureau of Public Works.

The Preparatory Survey mission on typhoons (1966-67) sponsored jointly by ECAFE and WMO recommended development of comprehensive plans for pilot flood forecasting and warning system for the Pampanga river basin along with similar recommendations for the other countries affected by typhoons in the ECAFE region. The inaugural session of the inter-governmental Typhoon Committee (December 1968) accepted the recommendation of the Preparatory mission as a part of the Committee's action programme. The Government of the Philippines confirmed the selection of the Pampanga river basin for pilot flood forecasting in consideration of its importance to the economy of the country and the fact that effective and timely flood warnings could help in reducing the losses caused by the recurring floods in this area.

It is gratifying that the Government of Japan, with a view to promoting technical cooperation between the Philippines and Japan and taking into account the action programme decided upon by the ECAFE/WMO Typhoon Committee in which both Governments participate, decided to assist the Government of the Philippines in the proposed

flood forecasting project. A team of Japanese experts carried out a survey of the Pampanga river basin in November-December 1969. The data collected by the team were analyzed in Japan and a detailed report was submitted to the Government of the Philippines in March 1970.

By early 1971 the Weather Bureau and the Bureau of Public Works formalized a Memorandum of Agreement for the establishment and operation of the proposed flood forecasting system. A flood forecasting center was established in the Weather Bureau in September 1971 in cooperation with the Bureau of Public Works. Trial computation was undertaken by the Center on the basis of the Japanese Survey team's report and with the assistance of the Typhoon Committee Secretariat.

In April 1971, the Diet of Japan approved the appropriation of a sum of US \$260,000 for the provision of equipment and training of personnel for the Pampanga flood forecasting system. The Bureau of Public Works allocated P500,000 for the construction of housing and other facilities that were needed for the installation of the equipment. A second survey team from Japan comprising of Telecommunication experts completed site selection and communication tests and submitted a report to the Philippine Government in September 1972. The report contained detailed design of the system and specifications for the equipment.

Following exchange of official communications between the Governments of Japan and the Philippines, an agreement was reached with Japan Radio Co., Ltd. (JRC) for the supply and installation of equipment for the flood forecasting system. The equipment were received from Japan in May-June 1973, by which time a good part of the station housings, towers and other facilities was completed by the Bureau of Public Works. The Engineers of JRC carried out the installation work during June-August 1973 with cooperation from the Weather Bureau, Bureau of Public Works and the Typhoon Committee Secretariat. The Government of Japan also sent three experts, one Hydrologist and two Telecommunication experts, to supervise the installation works and to provide technical advice and on-the-job training to the local technicians. Information was also received that additional equipment worth US \$20,000 comprising of a vehicle equipped with wireless communication, a motor boat and an electronic table computer would be donated by the Government of Japan as part of this technical assistance program.

THE TELEMETERING SYSTEM

The pilot flood forecasting system involved the establishment of a telemetering network of rainfall/water level gauging stations as shown in page 14. The network consists of 7 rainfall and water level gauging stations, 2 rainfall stations and 1 repeater station and 1 combined repeater and rainfall station strategically located within the Pampanga River Basin, which includes the provinces of Pampanga, Bulacan and Nueva Ecija. The Terminal Telemetry Station serving as the nerve center of data collection is located at the Flood Forecasting Center in the PAGASA (Weather Bureau) Central Office in Quezon City and the Monitor Station is located at the Main Office of the Bureau of Public Works. The PAGASA (Weather Bureau) constructed a new Weather Station building inside the Na-

tional Grains Authority Compound in Cabanatuan to house one of the two relay stations in the system.

All rainfall and water level gauging equipment in the station network are fully automatic. Depths of rainfall and water level of rivers at the stations are transmitted by the telemetering system at a specified time interval, say every hour, via the repeater station at Cabanatuan and San Rafael to the Terminal Telemetry Station at the PAGASA (Weather Bureau), Quezon City. All these data automatically appear on a specially designed display panel provided at the Terminal Telemetry Station. Rainfall and water level data transmitted by the telemetering system will also be received by the Monitor Station at the Bureau of Public Works, Manila. All data received are automatically recorded by teleprinter.

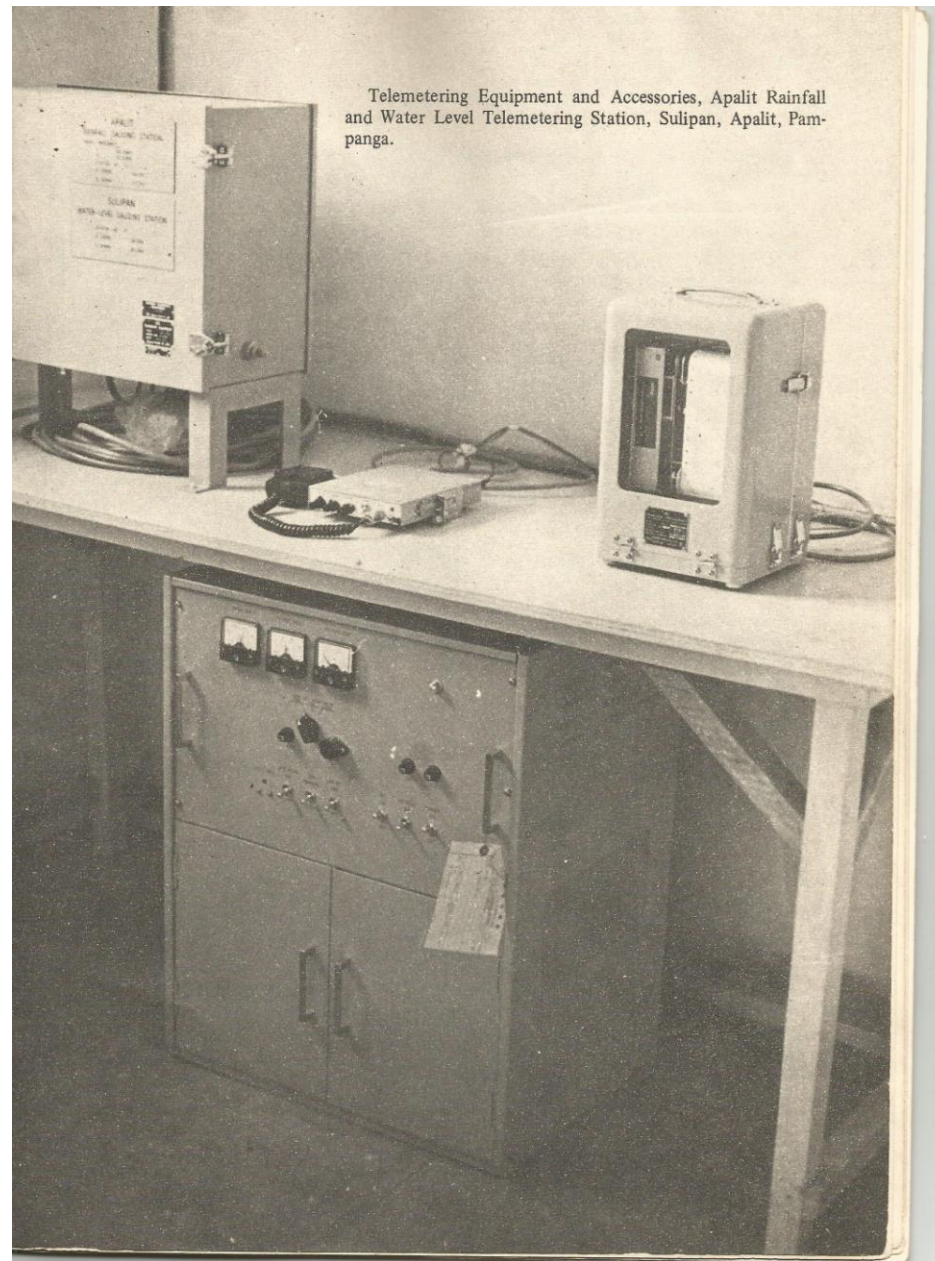
The Principal advantage of the telemetering system over other telecommunication systems is the rapidity of data collection. The observation stations can operate unmanned and it is possible to collect data from any or all these stations at any time desired by the control station. It will take less than 5 minutes for all 10 stations in the network to transmit a set of water level and/or rainfall data to the Terminal Telemetry Station. Data will normally be transmitted at 12-hour intervals during the dry season and at 3-hour intervals during the wet season. The stations can be made to transmit data for shorter intervals, say every 30 minutes, such as when Luzon is threatened by typhoons or other tropical disturbances.

The system is expected to be operational the year round since data collected from the network of observation stations will be useful not only for flood forecasting but also for engineering and agricultural purposes in the area.

FLOOD FORECASTING:

The Flood Forecasting and Warning System in the Pampanga river basin envisages forecasting the flood level at vulnerable places in the lower reaches of the river one day, and if possible two days, in advance. Forecasts of water stages will be prepared with reference to Arayat, Candaba and Sulipan. However, forecast values will also be interpolated for other locations, such as towns and barrios around Candaba Swamp and in Pampanga delta, areas adjoining Arnedo dike, Arayat-Cabiao ring level and Apalit-Masantol dike.

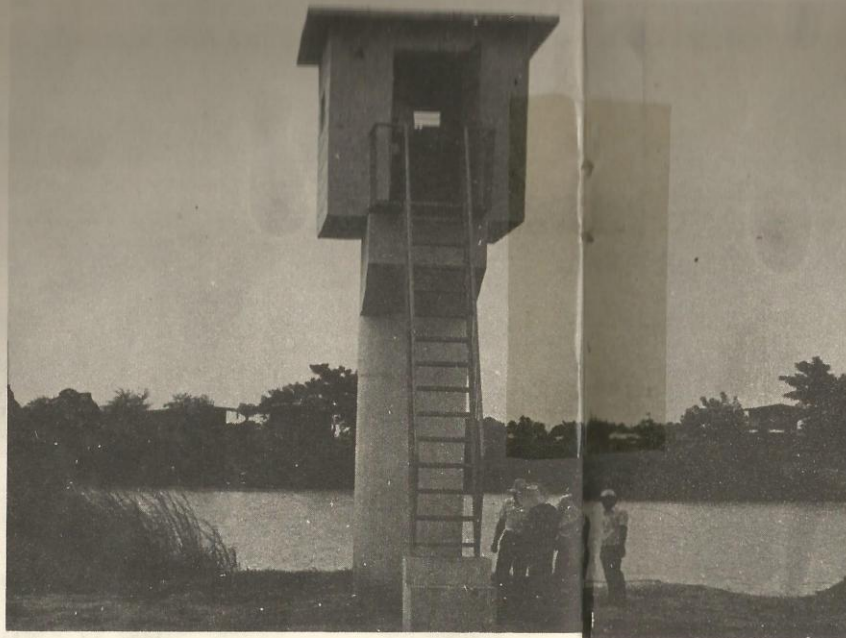
The technique for flood forecasting involves estimation of the basin rainfall, runoff computation, estimation of the flood wave propagation by means of flood routing, etc. Application of empirical correlation and computation of various parameters with the help of electronic computer form a major part of the operational procedure. It may be mentioned that in line with common practices in flood forecasting, the results obtained from the operation of the system will be kept under continued review so that in the light of the experience gained, improvements can be carried out whenever appropriate, both in the network of reporting stations as well as in the technical procedure.



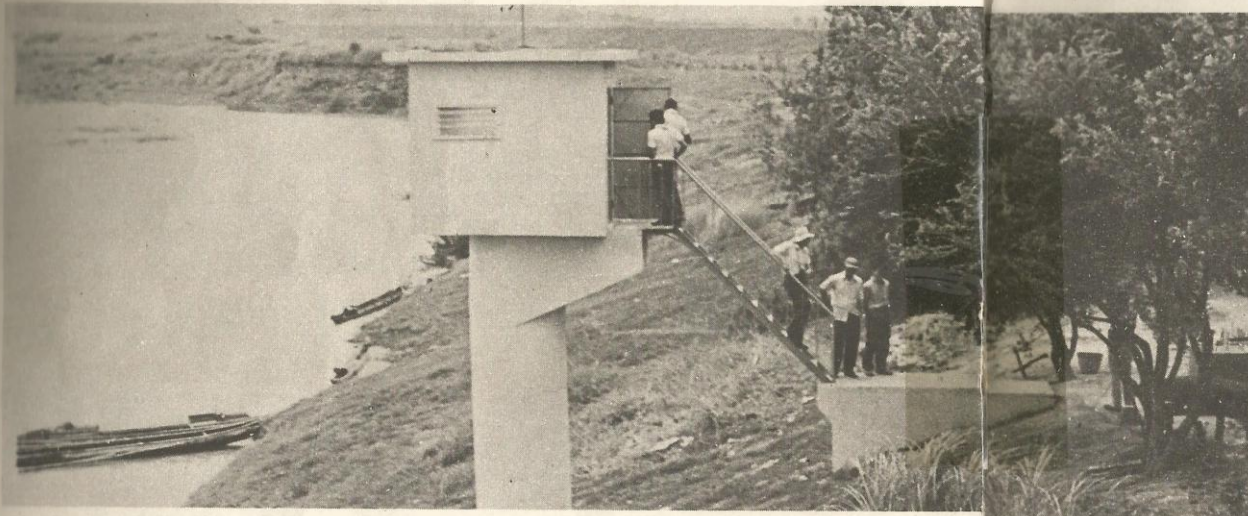
Telemetering Equipment and Accessories, Apalit Rainfall and Water Level Telemetering Station, Sulipan, Apalit, Pampanga.

Water Gauging Station, Sulipan, Apalit, Pampanga

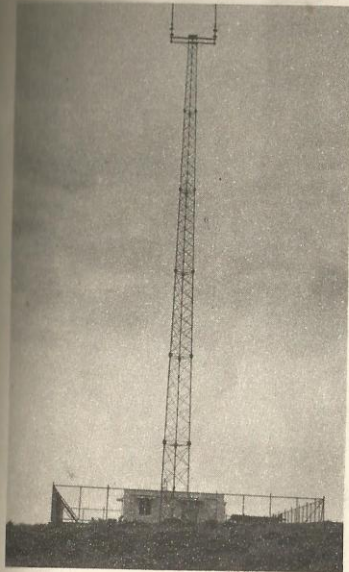
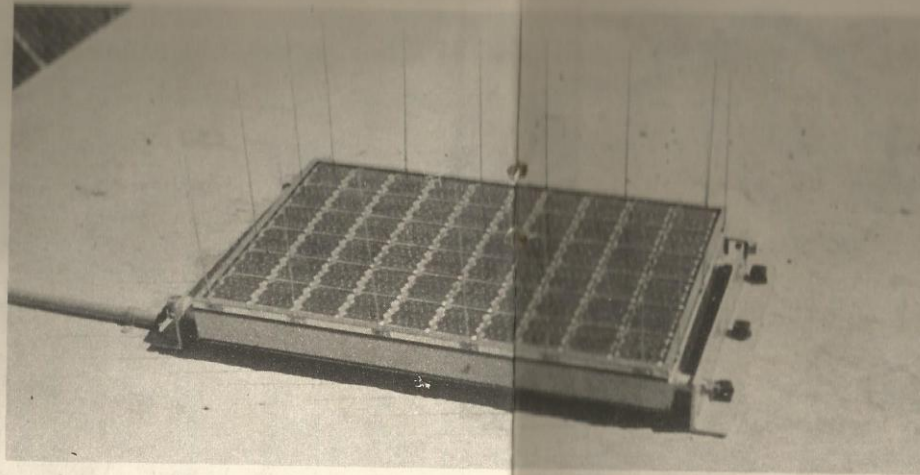
Arayat Rainfall and Water Level Telemetering Station, San Agustin, Arayat, Pampanga.



Water Level Recorder, Sulipan, Apalit, Pan



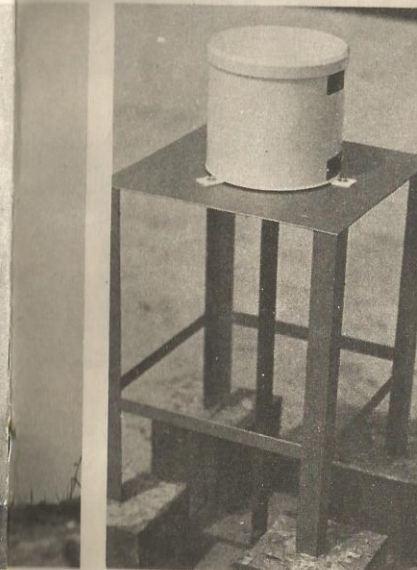
Solar Cells (main source of electric power) installed at San Rafael Relay and Rainfall Telemetering Station, Talaksan, San Rafael, Negros Occidental.



San Rafael Relay and Rainfall Station



Sensing Pole Support, San Isidro Rainfall and Water Level Telemetering Station, San Isidro, Nueva Ecija.

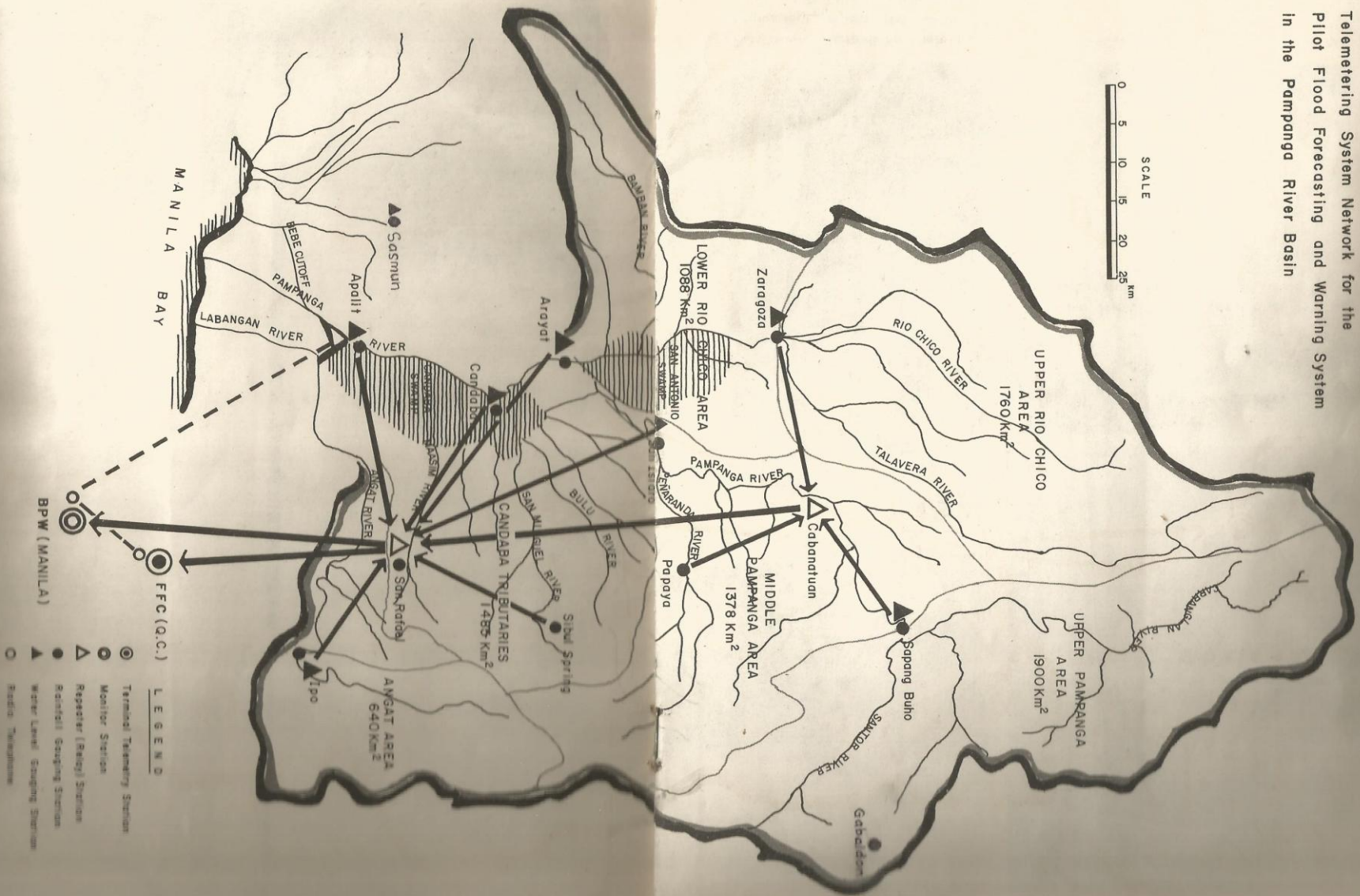
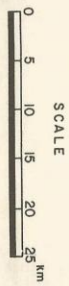


Part of the Rainfall Telemetering Equipment, Apalit Rainfall and Water Level Telemetering Station.



Cabanatuan Relay Station located at PAGASA Office, Cabanatuan City.

Telemetry System Network for the
Pilot Flood Forecasting and Warning System
in the Pampanga River Basin

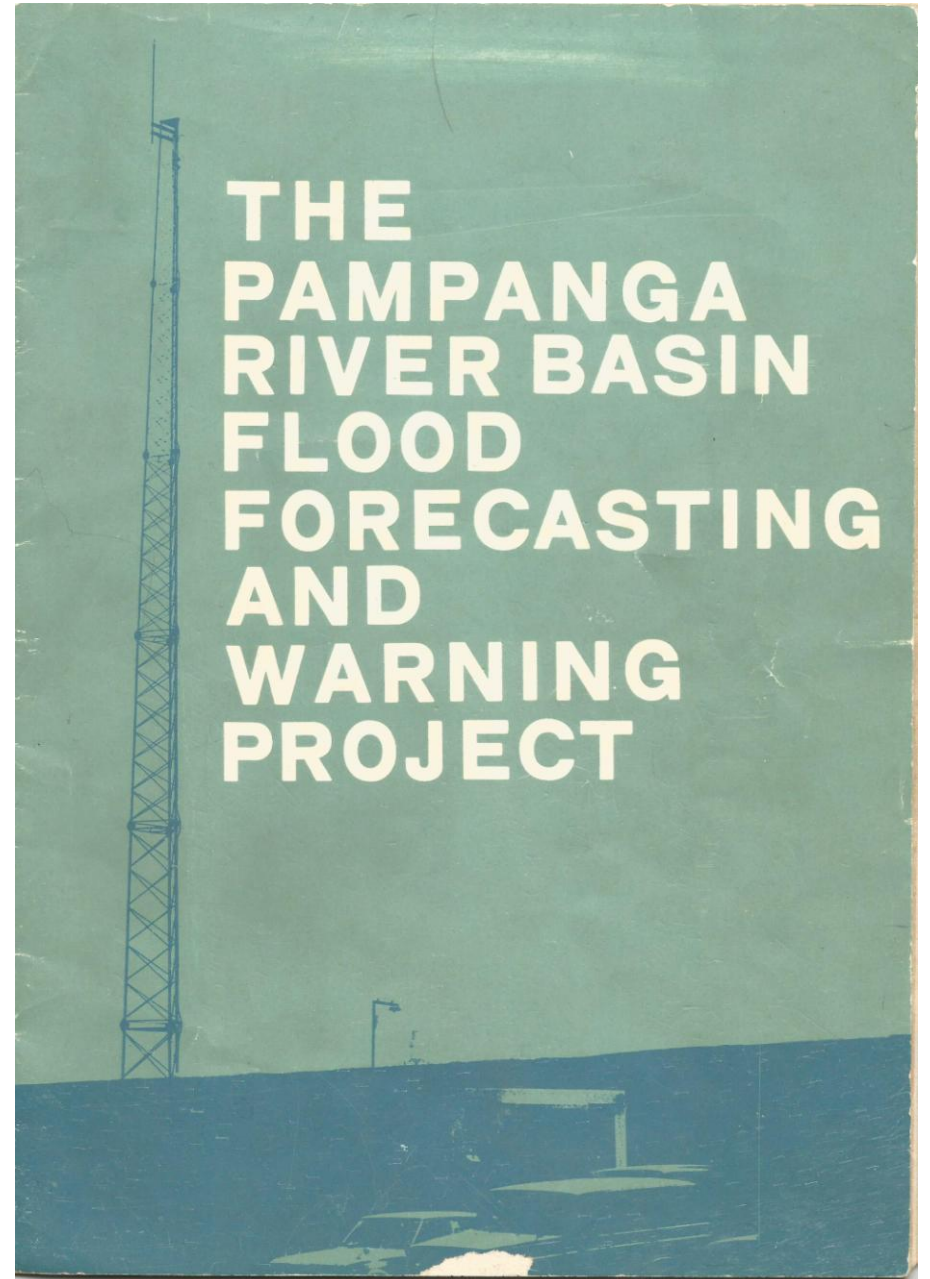


- LEGEND**
- FFC (C.C.)
 - Terminal Telemetry Station
 - Monitor Station
 - Δ Repeater (Relay) Station
 - ▲ Radio Level Gauging Station
 - ▲ Water Level Gauging Station
 - Radio Telemetry Station



San Isidro Rainfall and Water Level Gauging Station.

THE PAMPANGA RIVER BASIN FLOOD FORECASTING AND WARNING PROJECT



Brochure No. 1 (1973)