4. 基礎資料の賦存状況等

マニラ首都圏域洪水対策事業計画作成に関する資料の賦存状況等は以下に整理されるとおりである。

(1) 質問状及び回答

(2) 情報提供者一覧表

(3) 洪水防御，排水その他関連事業計画調査報告書一覧表(1)～(4)

(4) 関連情報一覧表

(5) 購入，借用可能な地形図，航空写真のリスト

(6) マニラ首都圏地図作成業務対象地域（ＪＩＣＡ実施中）

(7) 降雨観測記録

(8) 水位，流量観測記録

(9) 河川断面図

(10) 橋梁一覧表

(11) 現存の排水機場

(1) 質問状及び回答

THE STUDY ON RIVER SYSTEM PLAN FOR FLOOD CONTROL IN THE PASIG-MARIKINA-LAGUNA LAKE BASIN

QUESTIONNAIRE (SPECIFIC)

1 GENERAL

1-1 National development plan (existing long-term plan or five year plan)

1-2 National census

1-3 Socio-economic condition in and around Metro-Manila (Metro-Manila, Risal and Laguna)

a. Administrative district(province,municipality,city,township and barangai)
b. Population and household
c. Land use
d. Infrastructure
-Road condition
-Transportation
-Electricity
-Tele-communication/postal service
-Potable water supply
-Education facility
-Health and social welfare development
e. Industry
f. GDP and GRP

1-4 Budget in recent five years

a. National budget
b. Flood control/inundation prevention (whole country)
c. - ditto - (Metro-Manila area)
d. Maintenance cost for road,flood control facility and infrastructure

1-5 Agencies and their main duties and territories in planning, implementing and operating flood control, river improvement, and inundation prevention projects

1-6 Information regarding the completed / ongoing flood control and other projects covering project name, title and contents of project reports

a. Flood control, drainage,river improvement,flood prediction/ warning and inundation prevention project
b. Urban development and regional development project
c. Hydro-power generation and irrigation project
d. Infrastructure improvement project, including water supply, sewerage and waste disposal
e. Ground water development project

2 TOPOGRAPHY AND GEOLOGY

2-1 Topographic maps covering Metro-Manila, Risal and Laguna

a. Key map and area covered by the above maps
b. Scale and contour line interval
c. Agency and administrative office

2-2 Aerophotographs(the latest and old photos)

a. Area covered by the above photos
b. Scale and photographing year
c. Agency and administration
d. Permission for the Team to take them out of the Philippines to Japan

2-3 Geological maps covering the same area as given in 2-1

2-4 Soil-machanical data at major river structures

3 CLIMATIC AND HYDROLOGIC DATA

3-1 Location map of climatological and hydrologic observatories covering the area defined in 2-1

a. Climatological station
b. Hydrological gauging stations (water level and discharge), including those installed along the coast of and on rivers entering into the Laguna Lake
c. Tidal observatories

3-2 List of observatories showing;

a. Station name
b. Location/address
c. Classification of observatory or code no., if any
d. Observation items indicating equipment in use
e. Period of observation
f. Authority concerned

3-3 General climatic conditions in terms of monthly averages at major climatological stations, to be compiled in an attached Form-1

3-4 Specific climatic condition ever recorded at major stations, to be compiled in an attached Form-2

3-5 Hyetograph of storm which caused major historical floods in the subject area

a. Hourly distribution of storm rainfall at major stations
b. Probable rainfall intensities for the following duration;
   60, 120, 180 minutes
   4, 6, 12, 18, 24 hours
c. Isohyetal maps

3-6 Water levels and discharges

a. Monthly average discharges at major non-tidal river gauging stations
b. Annual maximum water level and discharge, together with the date of occurrence, recorded at major stations in recent 10 years
c. Water level and discharge hydrographs observed during major flood in the past
d. Authorized drainage areas at major points of flood control
e. Equation/curve showing relationship between water level and discharge (water level to discharge conversion)

QUESTIONNAIRE
ON
METRO-MANILA FLOOD CONTROL PLAN

(GENERAL)

1. Background of the request
2. Counterpart agency to JICA Study
3. What is the present situation in the project area?
   Is the number of flooding increasing recently?
   If so,what is the major reason?
   -change of land use
   -increase of inhabitant area
   -ground subsidence, etc
   Where does the ground subsidence occur?
4. What is your basic idea to determine the priority order of flood control projects?
   and where do you want to protect urgently?
5. Progress of the relevant past and on-going flood control plans and studies
   Progress of the existing flood control works including under construction
6. Total progress of the Master plan study in 1952 including the idea of proposed Marikina dam
7. Arrangement and layout of existing flood control facilities including flood forecasting and warning system

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
M A N I L A

PASIG-MARIKINA-LAGUNA BAY RIVER BASIN FLOOD CONTROL MASTER PLAN STUDY

PLANNING SERVICE

MARCH 1987

ANSWER TO GENERAL QUESTIONS

ANSWER TO QUESTION 1

1) BACKGROUND

In June 1985, a series of depressions and typhoons came one after another in rapid succession culminated by Typhoon Daling in June 27 and 28 accompanied by heavy monsoon rains. Almost all esteros, creeks, and rivers including the Pasig-Marikina River swelled and overflowed low portions of their banks. Flood damage spread out over the Metro Manila area, property losses were huge and socio-economic chaos laster for a long time.

Notwithstanding continuous efforts and quite big investments on flood control works in the Metro Manila area, flood damage still take place in every rainy season. Moreover, several development projects and the rapid urbanization achieved in the past years have worsened flooding conditions; increased assets brought tremendous losses once inundated, and urbanization/transportation developements made it more difficult to improve flood/drainage conditions.

The flood control plan of the Pasig-Marikina River including the Metro Manila area was firstly formulated with the Marikina River Multipurpose Project, which was executed in 1954 by the Marikina Project Coordinating Committee, National Economic Council, Government of the Republic of the Philippines. Following this study, several studies on flood control of the Pasig-Marikina-Laguna Lake Basin were carried out; a floodway to direct flood discharge into the Laguna Lake was proposed in 1970; a feasibility study on the Mangahan Floodway and the Parañaque Spillway was conducted in 1975. Resultingly, the construction of Mangahan Floodway was commenced in May 1980 and is still underway but expected to be claimed to be completed in 1987. Furthermore, there are many studies related to flood control although their implementation has not been started yet.

With regard to the urban drainage of the Metro Manila area, BPW prepared a drainage master plan in 1952, and the program for constructing 10 pumping stations was accomplished. However, they are not adequate to totally mitigate flood damage especially in the low-lying areas. To update the drainage plan in Metro Manila area, a master plan study was commenced in 1983, but the study remains suspended until now. The interim results submitted are compiled in the Preliminary Alternative Master Plan Strategy Report.

As enumerated above, many studies were executed and a few of the results/recommendations were implemented; but these were only made rather separately and/or independently. Since the flood control of river and the drainage system of the underlying lowlands cannot be separately undertaken, it is imperative for an efficient and complete flood mitigation to integrate all the plans of both flood control and drainage. It is mentioned, in this connection, that the basic scheme of flood control in the Pasig-Laguna Lake Basin has neither been reviewed nor updated since 1954 despite the fact that urban development has been widely achieved thereat.

2) Study Area

The study area covers Metro Manila, the Pasig-Marikina river basin and the w/ eastern shores areas of Laguna Lake. It is within the Pasig-Marikina-Laguna Lake Basin which lies between 14°10' and 14°55' north latitude and 120°50' east longitude.

The Pasig River, which flows from east to west through the center of Metro Manila, extends about 17.0 km from the confluence of the Markina River and the Napidan Channel to the Manila Bay. It has a fairly direct course, except for its double-loop meander at the Punta-Santa Ana area. One of its principal tributaries is the San Juan River, which enters the Pasig River at the lower river meander about 6.0 km upstream of the river mouth.

Upstream from the junction with the Napidan Channel, the Pasig River is named the Marikina River which originates in the western side of the Sierra Madre Mountain about 35.0 km northeast of Manila. At the town of Montalban, the river emerges from the foothills of the mountain range, turning and flowing southward through the Marikina Valley until it become the Pasig River. The catchment areas of Pasig, Marikina and San Juan rivers are 130 km^2, 50 km^2 and 90 km^2, respectively.

This study area includes small foreshore tributary areas in Malabon, Navotas and Valenzuela (MANABA). Immediately inland from the Manila Metropolitan area, the Laguna Lake exists as a shallow lake with the catchment of approximately 3,200 km^2. The lake's only outlet is via the Napindan Channel and the Pasig River. The Napindan Channel normally flows from the Laguna Lake to the Pasig, but it can and does flow in either direction, depending upon river and lake levels.

Manila, the national capital of the Republic of the Philippines, is the center of economic, political, social and cultural activities of the nation. Located in Central Luzon, it spreads along the eastern shore of Manila Bay from the mouth of the Pasig River. Manila is bisected by the river and has been popularly referred to as the Greater Manila Area.

The Greater Manila Area has expanded to encoumpass four (4) cities and thirteen (13) municipalities. Now known as the Metropolitan Manila Area comprising the National Capital Region, it has an area of 636 square kilometers and its population already exceeded 6.0 million in 1980. Metropolitan Manila (Metro Manila) is still developing rapidly towards the north, the east and the south where the country's largest lake, the Laguna Lake, is restraining its southward expansion.

3) Flood Control and Drainage Works Undertaken and the Problems to be solved

The Mangahan Floodway is the first and major flood control works offered in the course of the flood control plan. Its construction was started in 1980 and is still going on. The floodway aims at diverting the flood discharge of 2,400 m^3 /s out of 3,300 m^3 /s corresponding to a 100-year frequency discharge from the Upper Marikina River. However, the hydraulic model test conducted in 1983 revealed that the said discharge cannot bifurcate toward the Laguna Lake without the Marikina Control Gate Structure (MCGS).

With the Mangahan Floodway, the degree of flood control capability of the Pasig-Marikina is evaluated. Compared with the design flood of 100-year return probability, the flow capacity of the whole reach of Pasig-Marikina River corresponding to a discharge of less than 2-year frequency, is very small, especially the Upper Marikina River which is quite poor for the conveyance of flood.

In line with the flood control scheme which defines the role of Mangahan Floodway, the improvement plan for the Pasig River was formulated and successively implemented since the early 197-'s. Improvement works mainly consisted of the construction of river walls and the dredging around the Pasig river mouth. Until now, the improvement works have not been completed and some portions of the wall have already been damaged resulting in a poor flow capacity of only around 600 m^3 /s

The construction of the Napindan Hydraulic Control Structure (NHCS) was completed in 1982, to control the water stage of the Laguna Lake as well as prevent the instrusion of saline and polluted water from the Pasig River. Since the Napindan Channel is the only waterway aside from the on-going Mangahan Floodway, this structure is also given an operational function to release a part of the flood discharge of the Pasig River to the Laguna Lake, and vice versa, to avoid the inundation of coastal/shore areas around the Lake.

However, no firm operation rule is fixed, nor the flow capacity of the channel is planned to assure a certain flood mitigation effect.

Tributaries have played as drainage mains for urban storm runoff in recent years. These tributaries, however, have remained unimproved and flooding along them has worsened in proportion to the urban development in basin. Aside from the San Juan River, the other tributaries like Nangka, Ampid and Burgos that join the Upper Marikina River have been suffering from overbanking around their confluences and neither study nor plan for flood control has been conducted.

Urban storm drainage in the Metro Manila area has always been a serious matter to promote further urban development for a more comfortable and safer living environment for its increasing population. The drainage program was started in 1974 and totally, 10 pumping stations have been constructed in low-lying areas. These stations cover approximately 4,300 ha of drainage area and may drain the 10-year frequency storm runoff in 12 hours. However, a significant portion of drainage mains and laterals can carry only 10 to 30% of the runoff discharge and the full coordination of their operation with the flood control plan of the Pasig-Marikina River where the storm runoff is to be drained has to be considered.

In addition to the above works, there have been several studies to formulate a plan for flood control and drainage system in the Pasig-Marikina-Laguna Lake Basin. In 1982, the study on an effective flood control operation and telemetering system in the Basin was undertaken and its detailed design was carried out from 1985 to early 1986. The system is to materialize the effective operation of both the Rosario and the Napindan hydraulic control structures with a real time base information by means of telecommunication. The construction of the system is scheduled to commence soon and it is expected to be operational by the time the Mangahan Floodway will be available.

In 1983, a study on an urban drainage plan for Metro Manila was commenced to review/evaluate the drainage improvement works being carried since 1974. This study will be completed with formulation of an integrated drainage plan, but was suspended after the submittal of a proposal for the execution of an Immediate Action Plan. A design work for the Marikina control Gate Structure and the Upper Marikina River Improvement was also carried out in 1985, but the reasons to justify the plan was not studied.

Judging from the foregoing studies, it becomes clear that there has been no comprehensive and long-ranged plan that includes aspects of the Basin.

ANSWER TO QUESTION 2

The executing agency for the project will be the Department of Public Works and Highways (DPWH). The DPWH will assign counterparts from the DPWH National Capital Region, other units of the Department and participating involved local governments.

ANSWER TO QUESTION 3

1) Present Situation

The rapid population growth and magnification of economic activities and hence urban expansion made it unavoidable for people to emigrate to the flood-prone areas. Flooding problems have been getting more serious to the maximum extent.

As described, the present flood control scheme that the greater part of flood discharge from the Upper Marikina River Basin be diverted into the Laguna Lake was firstly indicated in 1954 and finally formulated into the project in 1975. One of the main components of the scheme, the Mangahan Floodway, is now under construction.

This basic scheme has only aimed at protecting the old Metro Manila area from the overbanking flood of the Pasig River. Wider urban expansion than before has brought the effectiveness of the scheme to its limit and caused new flood problems in the tributaries basins.

A long time has passed since the basic plan of flood control was formulated. Moreover, there are remaining works which are still to be implemented, while only a preliminary study on the overall drainage system for the Metro Manila area was commenced in 1983 with world bank assistance to solve the aggravated drainage problem in the area but the Master Plan has not been pursued. In the future, more rapid urban expansion and socio-economic development is anticipated in the Basin including the Metro Manila Area. To assure flood-free urbanization and promote development, it is indispensable that the overall flood control works be undertaken.

Since the Basin holds the national capital where various development plans have been contemplated and carried out, the flood control and drainage measures shall be formulated on the basis of long-term and wide-viewed strategic plan. A Master Plan Study should, therefore, be carried out in the earliest time.

2) Flooding Condition

Flooding in the subject area is mainly caused by the two reasons, i,e; 1) Overflow/reverseflow of flood water from the Pasig-Marikina River to the inland area, and 2) Inundation of inland storm water because of the capacity shortage of the drainage facilities and/or the high tide effect along the coastal low land area (Refer to Fig.-1) The frequency of former occurrence is less comparing the latter, but the damage potentially deems far bigger than the later.

The flooding area surveyed by the Bureau of Public Works (BPW) from 1943 to 1970 is as shown below,

Place	INUNDATION AREA (Ha)				
	1943	1947	1948	1956	1970
Marikina	1,290	530	730	570	550
Pasig-Taytay	3,200	1,300	1,820	1,430	3,100
Pateros-Taguig	1,800	880	1,120	960	1,500
Total	6,290	2,710	3,670	2,960	5,151
Manila (South)	2,900	2,360	2,660	2,210	1,620
Manila (North)	1,760	1,350	1,480	1,330	2,700
Total	4,660	3,710	4,140	3,540	4,320
GRAND TOTAL	10,950	6,420	7,810	6,500	9,480

Sources: Feasibility Study on Mangahan Floodway, DMJM, 1975

In addition to the above, Flooding has occurred in 1966, 1967, 1977 and 1978. (Flood damage from 1970 to 1980 is as shown in Table -1). The number of flooding is actually increasing, the interval of occurrence also become short and the damage amount become big in accordance with the recent urbanization to suburban area, especially to the southern (Taguig, Parañaque, Muntinglupa) and north-eastern area (Valenzuela, Marikina area).

3) Land Use/Population Increase

Metro Manila presently exhibits a highly mixed urban land use. Commercial, residential, industrial and institutional uses are found within the same district/block. This pattern is most commonly seen in the urban core in Metro Manila, in the areas bordering Manila Bay. However, outside of the core, the development pattern is suburban with a highly segregated land use pattern, where different areas tend to be exclusively commercial, residential, industrial or institutional. Areas like Quezon City, Makati and the developing towns of Parañaque and Las Piñas exhibit this characteristic.

The existing residential area covers the largest portion of urban land in Metro Manila, comprising about 30% percent of the total area. High density residential area are concentrated in the slum or blighted areas in the Navotas-Malabon area and in the city of Manila. About 55% percent of the land area in these districts is residential with a density in the range of 300-500 persons/ha. Midium density residential areas occur in the west of Quezon city and in the Mandaluyong-San Juan area.

About 3% percent of the total area is used for commercial purposes. Commercial organizations are concentrated in the central business districts around Escolta and Rizal Avenue and along major roads and highways. At present, Makati is developing into a major business center. Navotas and Pasay City are the most commercialized districts in term of land use having about 30 and 20% percent respectively of their areas in such use.

About 5% percent of the total area is in industrial use. Industrial areas are located in Manila and the Port area, the Pasig River corridor, Caloocan, Marikina and Pasig, Valenzuela and along the South Expressway through Parañaque. New industries are being set up west of Quezon City and, to a lesser degree, in Mandaluyong and San Juan, resulting in conversion from residential to mixed land use.

Population in Metro Manila area reaches at 6,026,000 (1980), and population growth from 1975 to 1980 is about 3.6 percent in average. This is far bigger than the national average at about 2.7% percent.

Population growth in Metro Manila area is as shown in Fig. 2. The figure shows that Valenzuela, Las Piñas, Taguig areas are the higher growth. The number of household also increases from 826,000 in 1975 to 1,104,000 in 1980

Above land use development and population increase resulting contribute to the expansion of the flood prone area and also to the increase of the flood damage amount, accordingly.

As for the land subidence, it is often said that the land subsidence in the lowland area, especially in the coastal lowland area, causes the flood inundation but no investigation is done and the effect of land subsidence could not be suggested herein. (According to the one of the recent study, change of the datum is reported).

ANSWER TO QUESTION 4

To establish the flood control plan in the subject area, there are the following fundamental viewpoints;

1) To formulate the flood control plan of the river system from both long-term/overall and short-term/emergent viewpoints to remove the overflow/reverse flow into the inland.

2) In correspondence with the above, to formulate the storm drainage plan of Metro Manila area from both longterm/overall and short-term/emergent viewpoints, considering the high tide effect in the coastal lowland area.

The above are closely related each together and the staged combined improvement plan shall be considered, and the feasibility study may have to be undertaken to cope the urgent requirement. In this case, a highly developed/density populated area which is practically faced to the serious flooding problems shall be selected with a highest priority.

The recommended area for the above would be suggested as follows on the actual flooding condition, but this should be finally determined based on the Mastern Plan Study.

1) Metro Manila Core Area
2) Malabon-Navotas-Valenzuela Area
3) Taguig-Taytay Area
4) San Juan Area
5) Marikina Area

ANSWER TO QUESTION 5

Several flood control measures are considered to solve the flooding problems in the subject area. They are generally suggested as follows:

a) River Improvement

a-1. channel improvement by means of banking, excavation/dredging, cut-off channel, etc.

a-2. flood flow control by means of control gate structure and/or other riparian structure.

a-3. flood regulation by the impound reservior and/or retanting basin.

a-4. High tide protection levee in the estuary

a-5. countermeasures to remote the sedimendation in the view mouth.

a-6. others.

b) Urban Drainage

b-1. Improvement and/or establishment of drainage facilities such as pumping station, flood gate, sluice, etc.

b-2. Improvement and/or establishment of drainage channel considering not to cause the secondary inundation.

b-3. Construction of high tide protection levee and/or ring levee in the coastal low land area.

b-4. Improvement of the secondary and tirtially drainage channels as well as their well maintenance.

b-5. Land use regulation in the low land area, and regulation of ground water use when the land subsidence is worried.

b-6. Others (Ex. facilities to increase the storage capacity of the inland area considering the retarding effects)

The optimum measures and scale are need to be determined not only from technical viewpoints but also from the viewpoint of economical justification based on the comparative studies of the some alternative plans by the conbination of the above measures.

ANSWER TO QUESTION 6

Although there are so many studies related to flood control and drainage, the main plan/studies are listed as below;

a) (1967-70) T. Ingledow & Associate Ltd.; "Feasibility Survey of Napindan Hydraulic Control Structure and Other Related Development" they recommended:

a-1 Construction of Mangahan Floodway to divert 3000 cumecs from the Marikina river into Laguna de Bay to free Metro Manila from floods.

a-2 Construction of Napindan Hydraulic Control structure and navigation lock to prevent influx of salt and polluted water in to Laguna de Bay through Napindan river and to regulate outflows from the lake through the Napindan river into the Pasig River.

a-3 The Parañaque Spillway was not found to be economically feasible in view of the limited benefits that would accrue.

b) (1971-74) Hydrotechnic Corporation. "Irrigated Agriculture Development for Land Surrounding Laguna de Bay" they recommended.

b-1 Construction of Napindan River Hydraulic Control Structures to reduce pollution of Laguna de Bay.

b-2 Construction of some pump canals and gravity canals around the lake.

b-3 Reclamation of area in the lake for rice polders or fishery.

c) (1972-74) SOGREAH "Laguna de Bay Water Resources Study"

The main recommendations were;

c-1 Mangahan Floodway will definitely suppress flooding in Manila by giving full control of the discharge going into Pasig river.

c-2 Hydraulic Control Structure across the Napindan Channel will permit stoppage of intrusion of saline water into Laguna de Bay, and would reduce N inflow by about 22 percent. It will permit reduction of maximum flood level of the lake. (control structure was completed in 1981)

c-3 Laguna de Bay is critically polluted, is eutrophic, as evidence by massive algal blooms which occur between April and November each year. This results in fish kill and water quality deterioration. This pollution is caused by waster and N flow from domestic, industrial and agricultural resources around the lake.

c-4 Parañaque spillway is too expensive to be recommended as a flood control measure. Rather the following alternatives were recommended to be studied:

a) Additional sluice gate on the overflow weir of the Managahan Floodway.
b) Improving the Napindan Channel.
c) Cutting the Sta. Ana member on the Pasig River.

c-5 Water supply for Metro Manila could be obtained from Kaliwa river and by transbain transfer. Construction of a 2000 m $3m^3/d$ water treatment plant was recommended.

d) (1975) Daniel, Mann, Johnson & Mendehall (DMJM)

"Feasibility Study of Mangahan Floodway". They proposed construction of the Mangahan Floodway consisting of Marikina river control structure, Rosario weir and Mangahan Spillway Channel. This scheme would divert 2400 cumecs of Marikina river flood peak into Laguna de Bay. The 100-year flood of Marikina river was estimated as 3300 cumecs, and the balance of 900 cumecs was proposed to be passed down the Pasig river after raising river walls and after improvement of the city drainage system with installation of pumping plants.

Periodically silt removal at the mouth of the channel would be required. They found that after construction of Napindan Control Structure more water than at present will be discharged from Laguna Lake ot the Manila Bay via Pasig river and better regulation of the lake will be achieved so that the highest stage of Laguna Lake will be reduced, while the lake level will be raised in these years when it would be naturally low, thus providing lake storage for irrigation or municipal use (Floodway is now under construction)

e) (1975) Daniel, Mann, Johnson & Mendehall (DMJM)

"Feasibility Study of Parañaque Spillway and Pasig River cut-off". They proposed construction of Parañaque spillway as an addition outlet channle for Laguna de Bay to reduce flooding along the shoreline of Laguna de Bay. It would consist of a waterway cut through the narrow reach of the land which separates Laguna de Bay from Manila Bay along with control structure to regulate the flow of water. The channel was designed for a maximum discharge of 350 cumecs. It was 8.3 kilometers long with an arched tunnel under the South Super Highway, a gated control structure and two bridges Channel cuts were to average approximately 20 m in depth macimum being 31 m. They estimated its cost at Pesos 160.6 million including a foreign exchange component of Pesos 51 million. They also proposed construction of a cutoff at Sta. Ana on the Pasig river to increase the discharging capacity of the river consequently to reduce the flood damage around Laguna de Bay. The cost was estimated at Pesos 43.5 million.

f) (1975-78) LLDA, UNDP, ADB, WHO " Comprehensive Water Quality Management Study" The study revealed that during periodsoof backflow from the Pasig river the average chloride concentration of the lake waters increases to more than 1000 mg/liter making it unsuitable as a source of water supply or irrigation. In addition, environmental factors are present which enhance algal growth. Also present in the lake water are pesticides,

toxic metals and oil pollution. They recommend that water quality monitoring should continue and suggested several waste reduction measures as well as implementing demonstration projects to educate the local population about waste disposal procedures.

g) (1981-82) (TI Engineering Coy Ltd. (CTIE)

Technical Feasibility Study on an Effective Flood Control Operation System in Pasig-Marikina-Laguna Lake Basin" was conducted and now it is in the detailed design phase (Phase I). The system is to materialize the effective flood control operation at both the Rosario and Napindan hydraulic control structure with a real time base information by means of telecommunication network The construction of the system is scheduled to commence soon and it is expected to be operational by the time when the Mangahan Floodway will be available.

h) (1984) Engineering Science Inc. (ESI)

"Final Alternative Master Plan Strategy Report for the Metro Manila Integrated Flood Control Master Plan" was done in 1984 and they considered six strategies from relieving flooding in Metro Manila and recommended strategies. This includes and recommended strategy No. 5 (deferred maintenance and non structural measures) on the basis of benefits-cost ratio. This includes dredging of creeks and esteros, construction of walls along esteros, and installation of additional pump stations. They proposed that in Part 2 of their studies they would.

h-1 Prepare designs and tender documents and drawings for first phase programs worksnot included in the Immediate Action Program.

h-2 Determine 100-year and other frequency peak floods Marikina river based on 20 years data from 1958 to 1977.

h-3 Caliberate the HEC-1 hydrograph mathematical model with field data to determine rainfall-run-off relationships for Marikina and other rivers.

h-4 Develop a hydrologic model of the Mangahan Floodway, Marikina River Control Structures, and study the effects of proposed improvements in the Pasig, Marikina and Napindan rivers.

h-5 Determine hydrologic equation for Laguna Lake and to develop rule curves for the same.

h-6 Calibrate the Dynamic Wave Operation (DWOPER) to include tidal effects, coordinated operation of the Managahan Floodway and Control structure complex and proposed improvements of Pasig and San Juan rivers.

h-7 Calibrate the Manila Urban Drainage Model (MUDMUD) to determine the hydrology of main drainages within Metro Manila

As enumerated above, many studies, including the other studies not mentioned in the above, were executed and a few of the results/recommendations were implemented, but these were only made rather separately and/or independently. Since the flood control of the river and drainage system of the underlying lowlands are closed interrelated, it is imperative for an efficient and complete flood mitigation to integrate all the plans, not only from emergent short-term viewpoints but also from overall/long-term viewpoints, of both flood control and drainage. It is mentioned, in this connection, that the basic scheme of flood control in Pasig-Laguna Lake Basin has neither been reviewed nor updated since 1954 despite the fact that the urban development has been widely achieved thereat.

ANSWER TO QUESTION 7

Flood control plan of Pasig-Marikina River including the Metro Manila area was firstly formulated with Marikina River Multipurpose Project, which was executed in 1954 by Marikina Project Coordinating Committee, National Economic Council. Following this study, several studies on flood control of the Pasig-Marikina-Laguna Lake Basin were carried out as before mentioned; a floodway to direct flood discharge into the Laguna Lake was proposed in 1967-1970; a feasibility study on the Mangahan Floodway and the Paranaque Spillway was done in 1975. Resulting, the construction of Mangahan Floodway was commenced in May 1980 and is still underway but expected to be completed in 1987.

With regard to the urban drainage at Metro Manila area, BPW prepared a drainage master plan in 1952, and the program for constructing ten (10) pumping stations was accomplished. However, they are not adequate to totally mitigate flood damage especially in the low-lying areas. To update the drainage plan in Metro Manila area, a master plan study was commenced in 1983, but the study remains suspended until now.

Total progress of the Mater Plan Study in 1952 is described as follows:

In 1973, following the recommendations of the 1952 Master Plan, extensive construction work started on the initial four-year phase of a ten-year program. The works built over the period of 1973-1976 are estimated to represent about 90 percent of all flood control works built in Manila and Suburbs since 1943 and represents about 20 percent of the works called for by the 1952 plan. Between the period 1978 until 1982, nine pumping stations were constructed. Presently ten pumping stations have already been installed with the completion in 1984 of another one station .

ANSWER TO QUESTION 8

1) Mangahan Floodway and Associated Works

The Mangahan Floodway is a 9.0-km. long trapezoidal channel designed to divert flows from the Marikina River into Laguna Lake, thereby using the lake as a large detention basin to reduce the peak flows in the Pasig River. The operation of the Mangahan Floodway will be coordinated with the operation of the Napindan Hydraulic Control Structure in order to provide protection against overbank flooding along the Pasig River. Designs have been completed for the floodway and for the hydraulic-control structure at the Floodway entrance near Rosario which will control the flow into the Floodway. The hydraulic-control structure will consist of eigth vertical roller gates. Construction of the Mangahan Floodway and the control structure is in progress and is expected to be completed in June 1984.

Previous recommendations for the control structures at the entrance to the floodway were based on a fixed weir (SOGREAH 1974), or a fixed weir with an auxiliary gated sluiceway to allow reverse flow from Laguna Lake to the Marikina River at certain times (Daniel,Mann, Johnson,& Mendenhall 1975a). The concept of a fixed weir, called the Rosario Weir, was changed in the final design of the control structure prepared by CTI Engineering Co., Ltd. (CTIE, 1979) to the one described in the previous paragraph incorporating eight movable gates. As the fixed weir will not built, it is no longer appropriate to refer to the structure at the entrance of the Mangahan Floodway as the Rosario Weir, and in this report the structure is referred to as the Rosario Hydraulic Control Structure.

The original design concepts for the Mangahan Floodway (SOGREAH 1974; Daniel,Mann, Johnson, & Mendenhall 1975a) comprised the construction of a control structure on the Marikina River downstream from the diversion for the Mangahan Floodway. The Marikina River Control Structure would have the following major functions:

- To control discharges to the Marikina River (and thence to the Pasig River) to within the design capacity of the river channel. At present, the river walls and dikes along the Pasig River can accommodate (without overbanking) flows resulting in stages of no more than 13.0 m (or a flow of about 600 cu m/s) at the confluence of the Pasig and Marikina Rivers. It has been proposed to improve the river walls and dikes such that a stage of 14.5 m (or a flow of 900 cu m/s) can occur at the confluence without overbanking on the Pasig River (Danie, Mann, Johnson, & Mendenhall 1975a).
- To allow diversion of low flows in the Marikina River to Laguna Lake when the lake stage was below the rule curve.
- To increase the water level on the Marikina River and provide sufficient head to permit the diversion of the full design flow (2400 cu m/s) through the floodway.

In the studies on the redesign of the Mangahan Floodway and Rosario weir (CTIE 1979), CTIE concluded that a gated control structure at the entrance to the Mangahan Floodway could alone control the diversion of flood flows in the Marikina River until such time that the Marikina River was improved upstream to enable it to carry the 100-year return period flood of 330 cu m/s. The existing capacity of the lower reach of the Marikina River had been estimated at 2000 cu m/s (Daniel, Mann, Johnson, & Mendenhall 1975a), hence the CTIE recommendation was to defer construction of the Marikina River Control Structure.

The results of recent model studies carried out at the National Hydraulic Research Center and supported by an Adviser from CTIE confirmed CTIE's earlier conclusions (CTIE 1983; National Hydraulic Research Center 1983). The studies that:

- A maximum Marikina River discharge of 2000 cu m/s at the Mangahan Floodway diversion can be accomodated (with less than 900 cu m/s passed down the Pasig River and the remainder through the Floodway) without the Marikina River Control Structure.
- For the design, 100-year return period flood of 3300 cu m/s, the Marikina River Control Structure is necessary to limit the flow downstream to less than 900 cu m/s, this being the capacity of Pasig River after the proposed

dike and river wall improvements have been made.

2. Napindan Hydraulic Control Structure

The Napindan Hydraulic Control Structure is located on the Napindan River near its confluence with the Marikina and Pasig Rivers (see Figure 3.2) and was commissioned in the second quarter of 1983. The control structure, a large spillway dam, is equipped with four vertical roller gates to control the flow in the Napindan Channel. The control structure and associated navigation lock have the following major functions:

- To control the water level in Laguna lake by controlling inflows and outflows at the Pasig River. This control will permit the development of the lake as a dependable water source.
- To prevent the flow of saline, polluted Pasig River water into Laguna Lake when the lake level is low relative to the Pasig River.
- To help lower the water level in Laguna Lake at times when both the lake stage exceeds the Pasig River stage at the control structure and the Pasig River flow is within the design capacity.

The Napindan Hydraulic Control Structure will be operated in conjunction with the Mangahan Floodway and in accordance with an operating rule curve. Various rule curves have been developed in previous studies (SOGREAH 1974; T Ingledow 1970) and a rule curve will be developed during Part 3 of this overall master plan study.

The operation of the Napindan Hydraulic Control Structure will be as follows:

- When the lake level is below the level given by the rule curve for a given date, the Napindan Hydraulic Control Structure will be closed and flows in the Marikina River diverted through the Mangahan Floodway into Laguna Lake. (The diversion will be facilitated by the closure of the Marikina River Control Structure.)

- When the lake level is above the rule curve for a given date, the diversion of Marikina River flows through the Mangahan Floodway will be stopped (provided that this can be accomplished without causing overbank flooding along the Pasig River) and the control structure will be opened (provided that the Lake stage is higher than the Pasig River stage at the control structure).

3. Pumping Station

Nine drainage pump sections have been commissioned in Manila and its environs under the Manila and Suburbs Flood Control and Drainage Project. The MPWH has budgeted for the construction of an additional pump station to serve the Binondo Area, thus completing the implementation of the Bureau of Public Works (BPW) pumping scheme. This pumping scheme was derived from the drainage master plan that the BPW completed in 1952 (BPW-1952). Changes to the original plan included the addition of the Libertad, Estero Tripa de Gallina, and Binondo Pump Stations, consolidation of two pump stations in the Pandacan Watershed, and the revision of flow estimates and required pump capacities.

The areas served, the numbers of pumps, and the station capacities for this scheme are as summarized in the table. Figure 4 illustrates the drainage areas for the ten pump stations and identifies areas where gravity drainage systems would be employed under the most recent BPW scheme. The pump stations have been designed to discharge over a 12-hour period the runoff from the 10-year return period, 12-hour duration storm for each drainage area. Where the adoption of this capacity would otherwise have resulted in flooding of more than 0.2 m, increased pump capacities were selected to limit flooding to 0.2 m.

MANILA DRAINAGE PUMP STATIONS

Pump Station	Drainage Area (ha)	No. of Pumps	Impeller Diameter (mm)	Station Capacity (cu m/s)	Discharge to
Valencia	246	4	1000	10.5	Pasig River
Quiapo	195	4	1000	9.5	Pasig River
Pandacan	180	2	1000	4.4	Pasig River
Aviles-Sampaloc	356	4	1200	14.1	Pasig River
Paco	182	3	1000	7.6	Pasig River
Sta. Clara	116	2	1000	5.3	Pasig River
Tripa de Gallina	1769	8[a]	1650	56.0	Estero Tripa de Gallina
Libertad	779	6	1650	42.0	Libertad Channel
Makati	151	2	1200	7.0	Pasig River
Binondo [b]	279	4	110	13.2	Pasig River

a: Six units are now in operation and two additional units have been proposed

b: Planned

As shown on Figure 3,4 the latest BPW drainage plan calls for the construction of control gates on the esteros to isolate the various catchment areas. These control gates have not been built, nor have the gates have been purchased. In the absence of the control gates, the catchment boundaries indicated on Figure 3 are incorrect. These boundaries are, in fact, not fixed, but vary in response to the hydraulic gradients established by rainfall patterns, inflows to the esteros, and the operation of drainage pump stations. The effects of not providing the control gates are to extend the drainage period and to increase flood levels in the watershed, but at the same time to improve drainage conditions in adjacent watersheds. For at least one drainage pump station (Binondo), and Vitas Flood Gates) be closed during storms until the drainage pumps had lowered the level of flood waters in the design catchment area. The gates would then be opened, allowing flood waters in adjacent catchment areas to be drawn into the design catchment area and then be pumped out.

The three proposed flood gates in the South Manila area would separate the Paco-Pandacan system from the lower Tripa de Gallina system (while the gates are closed) with the area in between draining directly to the sea. If there was to be spare pumping capacity, the gravity area could be connected to either or both systems of pumps to hasten the drainage process. Without the gates there would be more flexibility of operation but more flow to handle. If the Pedro Gil, Quirino and other outfalls are to be connected directly to the sea, the gates should be installed or other measures taken to prevent backflow from the sea to the estero system.

4. Other Current and Planned Projects

The only major flood control and drainage project now under construction in the Study Area is the Mangahan Floodway. Smaller-scale improvement projects with drainage components that are now underway include the Program to Reduce and Eliminate Sewage from Streets (PROGRESS); projects of the Metropolitan Waterworks and Sewerage System (MWSS); the Metro-Manila Infrastructure Utilities and Engineering Program (MMINUTE); various projects of the MPWH and MMC; the Zonal Improvement Project (ZIP) of the MMC, NHA, and local governments. (The scope of these projects is described in the Immediate Action Report and Supplement to the Immediate Action Report) The National Capital Region of the MPWH, the local governments and private developers also undertake small-scale drainage projects.

The following works are planned for implementation in 1984 (MPWH 1983b):

- Construction of the Binondo Pump Station
- Completion of the Epifanio de los Santos Avenue (EDSA) Outfall (provided that funding can be arranged)
- The Immediate Action Program defined in this Project, including channel improvements on the San Juan River, provision of drainage facilities in the San Andres Bukid area, rehabilitation of existing drainage mains, and river and estero dredging.
- The completion of the flood warning telemetry network (through PAGASA)

The MPWH has also prepared plans for the construction of other major-drainage improvements. These major improvements have either been deferred pending the availability fo funds and conclusions of this study or have been postponed indefinetely. Among the major works that have been proposed and are described in the Review Report are the:

- San Juan River Watershed Improvements (BASICTEAM 1979)
- Paranaque Spillway
- Estero improvements

The Marikina River Control Structure has also been recommended for implementation (CTIE 1983) subject to further physical model tests to finalize design parameters. Several other major flood control and drainage projects have been planned by the MPWH. Construction of all these projects have been deferred These projects will be reviewed for possible inclusion in the flood control and drainage master plan. Among these projects are the following:

- Quirino Boulevard Outfall
- Pedro Gil Outfall
- Balete-P. Burgos Outfall
- Tennessee Outfall
- Gallego Court Outfall
- Vito Cruz OUtfall
- De la Reina (Moriones) Outfall
- Batangas Main
- Alvares Main
- Simoun Main
- San Luis Main
- United Nations Main
- Polo Road Main
- Sanches-Figueras Main
- Tupas-William Main
- Salud Menlo Main
- Race Track-Roxas Main

- Medel Main
- Tejeron Main
- Lamayan Main
- Echague Main
- Del Pan Main
- Misericordia Main
- Tayabas Main
- Tayuman Main
- Paranaque River Improvements
- Napindan River improvements
- Pasig River improvements

In addition to these works, the MPWH (now DPWH) has planned to dredge the esteros, creeks, and rivers in the Study Area.

TABLES AND FIGURES

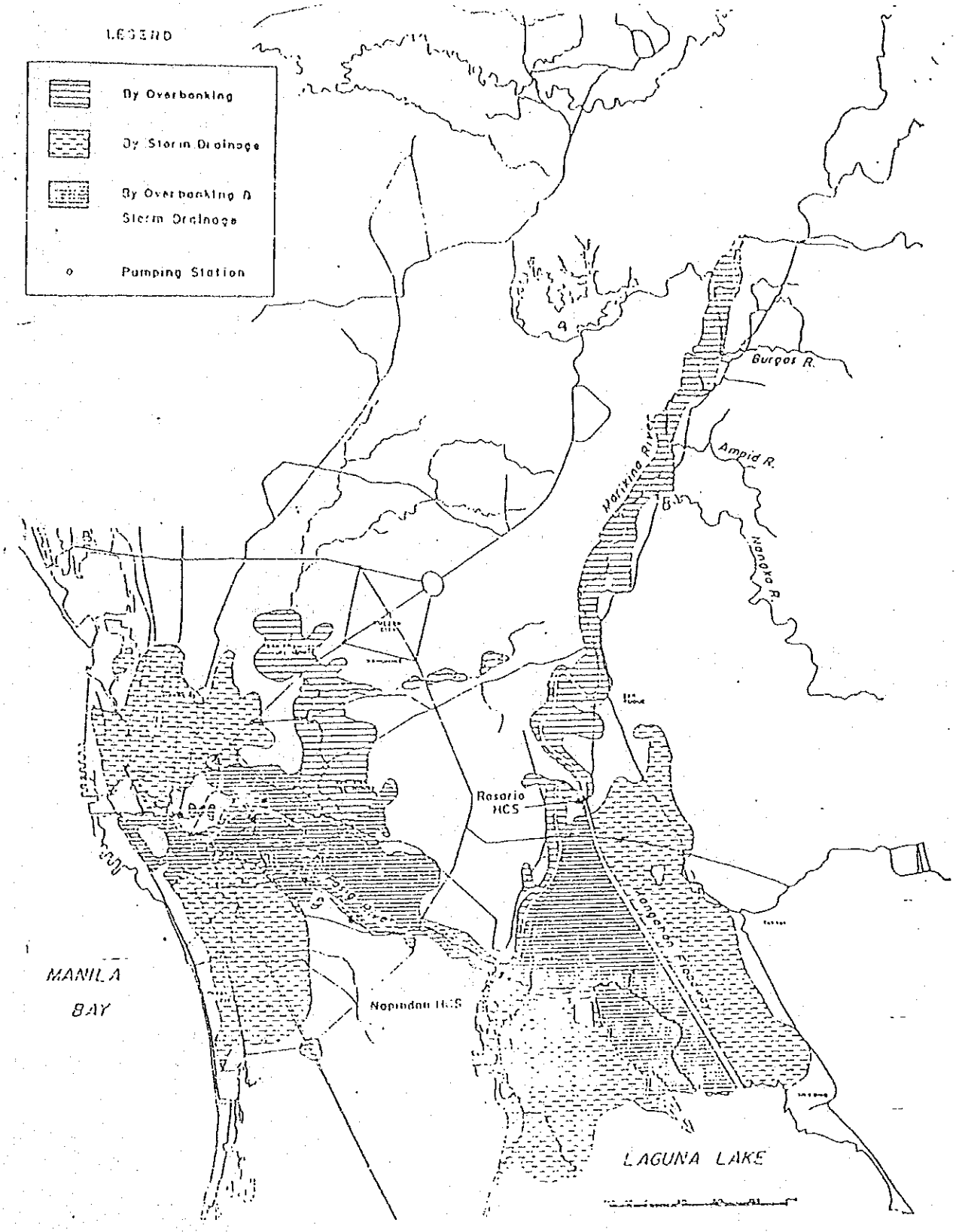


Fig. 1 - EXPECTED FLOODING AREA OF 100-YEAR FLOOD

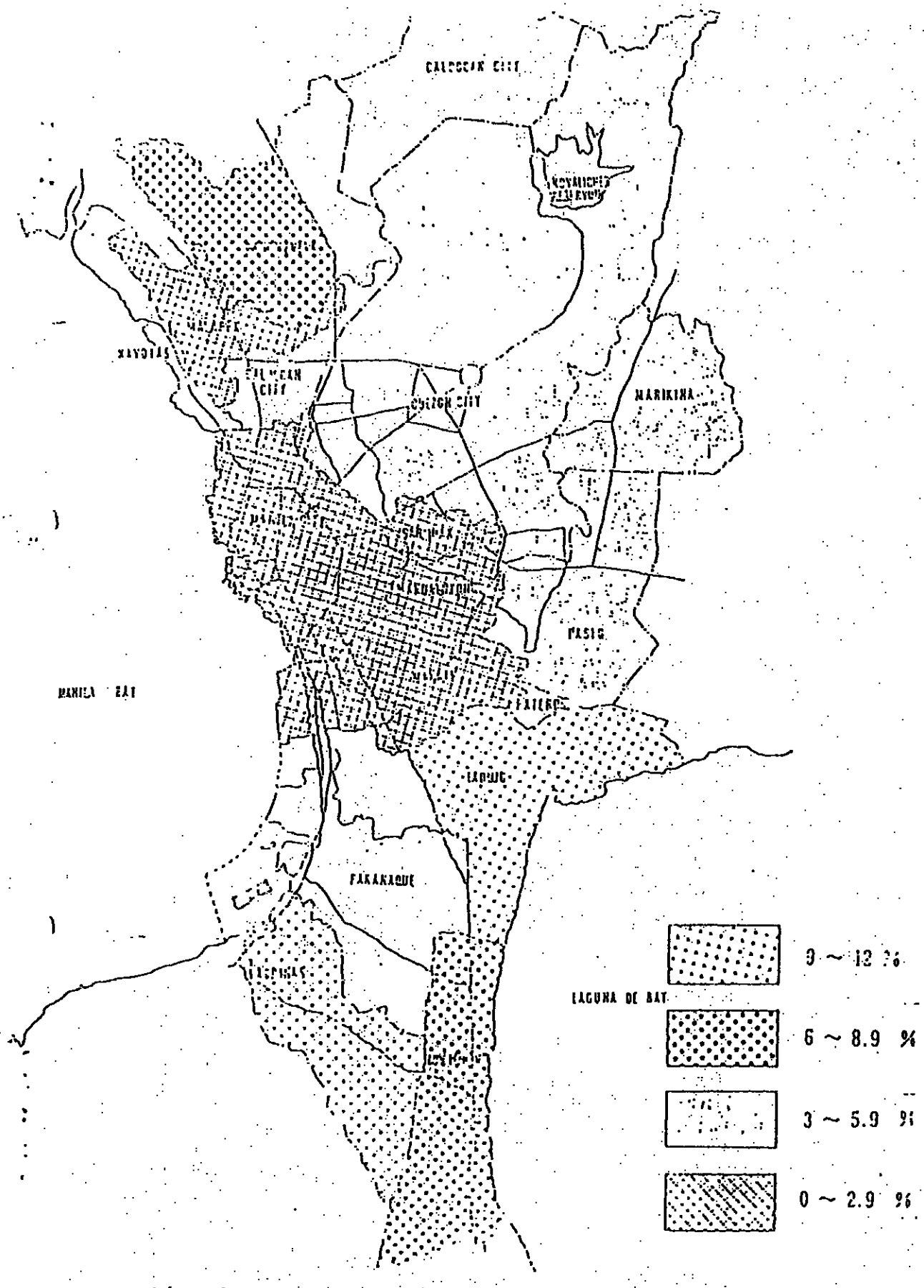


Fig. 2 - POPULATION GROWTH RATE OF METRO MANILA

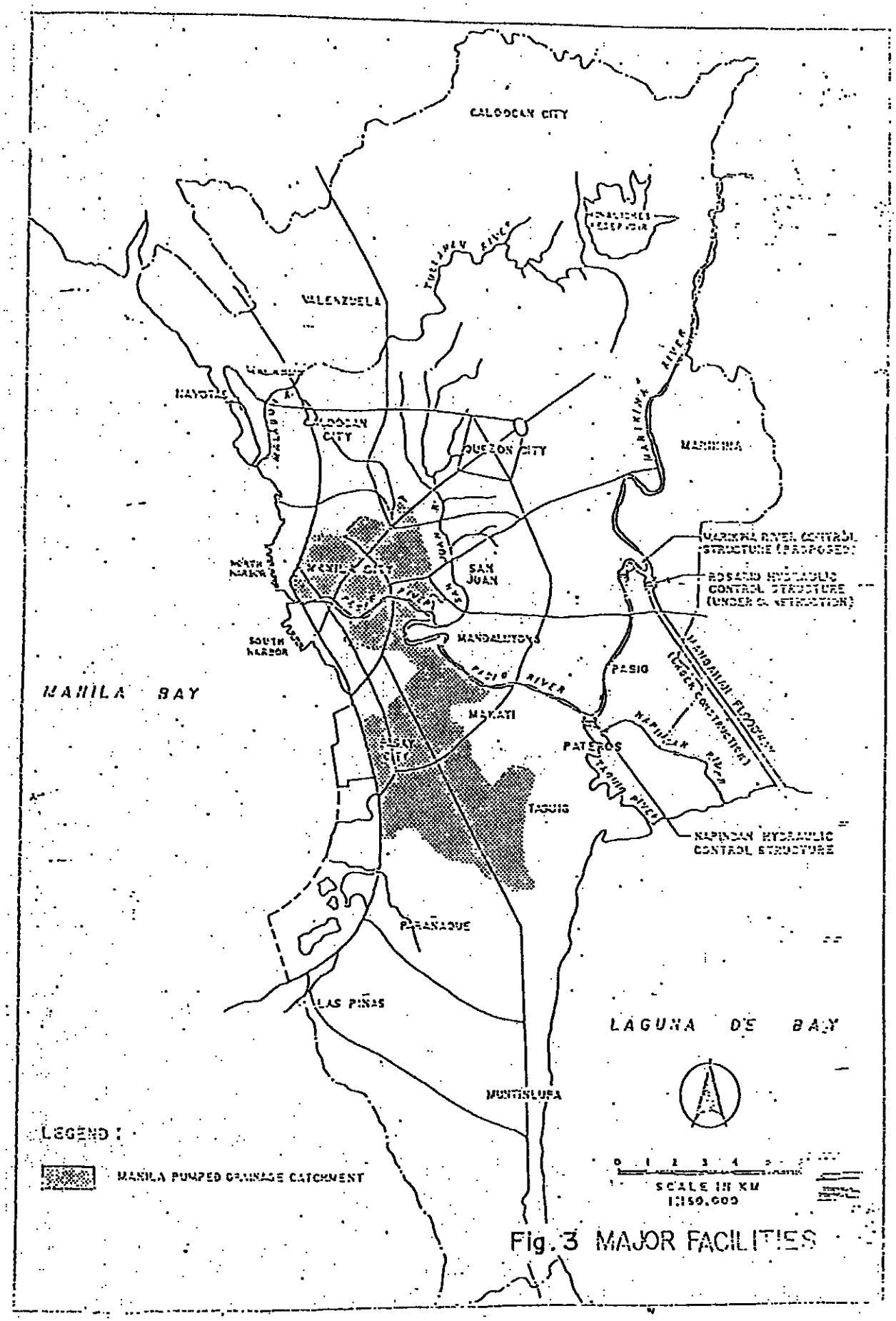


Fig. 3 MAJOR FACILITIES

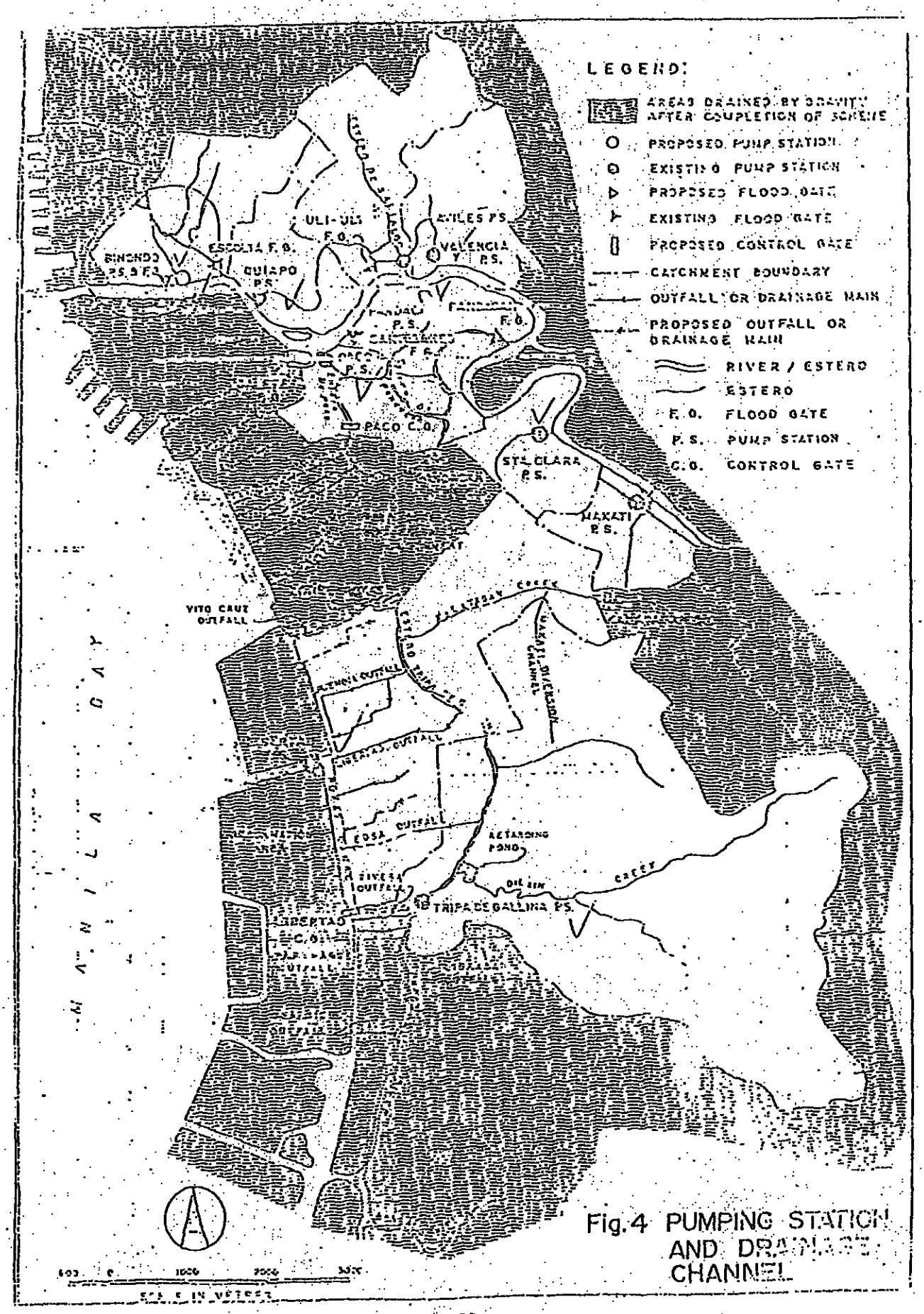


Fig.4 PUMPING STATION AND DRAINAGE CHANNEL

ATTACHED FORM-1 GENERAL CLIMATIC CONDITION

Station :

Location :

Observation Period: 19 ~19 (Years)

General Climatic Condition	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Mean Air Temperature	° C													
Precipitation	mm													
No. of Rainy Days	day													
Mean Relative Humidity	%													
Pan Evaporation	mm													
Sunshine Hours	hour													
or Cloudiness	Oktas/Tenth													
Mean Wind Speed	Knot													
Representative Wind Direction	-													
Frequency of Typhoon	-													

ATTACHED FORM-2 SPECIFIC CLIMATIC CONDITION

Station :

Location :

Observation Period: 19 ~19 (Years)

Specific Climatic Condition	Unit	1st		2nd		3rd		4th		5th	
		Record	Date	Record	Date	Record	Date	Record	Date	Record	Date
Maximum Daily Rainfall	mm/day										
Max. 2-day Consecutive Rainfall	mm/2days										
Max. 3-day Consecutive Rainfall	mm/3days										
Max. Hourly Rainfall	mm/hour										
Max. Successive Rainfall	mm										
Max. Successive No-rain Days	days										
Max. Wind Speed	knot										
Wind Direction at above Occasion	-										

ATTACHED FORM-3 Tidal Observation

Station :

Location :

Observation Period: 19 ~19 (Years)

Items of Observation	Highest High Water Level	High Water Level	Lower High Water Level	Mean Sea Level	Higher Low Water Level	Low Water Level	Lowest Low Water Level	Remarks
Observation								
(Date of Occurrence)	( )	—					( )	

ATTACHED FORM-4 RIVER, DRAINAGE CANAL AND CREEKS

River Canal Creek	Drainage Basin (sqkm)	Commanding Area (sqkm)	Length (km)	Typical Cross-section			Longitudinal Slope	Discharge Capacity (cum/sec)	Type or Structure	Major Facilities
				Bottom Width	Depth	Side Slope				

ATTACHED FORM-5 LIST OF AVAILABLE DRAWINGS (PLAN, PROFILE AND CROSS-SECTION)

River Canal Creek	Plan					Profiles					Cross-sections				
	Drawings		Survey			Drawings		Survey			Drawings		Survey		
	Size(mm x mm)	Nos.	Date	Authority	Accuracy	Size(mm x mm)	Nos.	Date	Authority	Accuracy	Size(mm x mm)	Nos.	Date	Authority	Accuracy

ATTACHED FORM-6 LIST OF SLUICEWAYS AND OTHER IMPORTANT STRUCTURES

Name	Location	Name of Drainage River	Highest Water Levels		Drainage Basin (sqkm)	Commanding Area (sqkm)	Discharge Capacity (cum/sec)	Dimension of Gate				Type or Structure	Date of Installation
			External	Internal				Hight(m)	Width(m)	Sill(m)	Nos. of Gate		

ATTACHED FORM-7 LIST OF DRAINAGE PUMPS

Name	Location	Name of Drainage River	Highest Water Levels		Drainage Basin (sqkm)	Commanding Area (sqkm)	Pump			Motor/Engine			Actual Head (m)	Design Discharge (cum/sec)	Operation Hours (hrs)
			External	Internal			Type	Dia. (mm)	Nos.	Type	Output	Nos.			

(2) 情報提供者一覧表

関連官庁	名前	部署、役職名
MPWH	Jose C. Guanzon	Chief Civil Engineer, Project Evaluation Div.
	Rogelio A. Flores	Project Manager III, PMO-Major Flood Control Project
	Pete Tersinio	Survey & Investigation Div.,Bureau of Design
	Rebeca Garsuta	Supervising Civil Engineer II, PED
	Nancy M. Ramos	Civil Engineer, PED
	Napoleon Famadico	Civil Engineer, PED
	川上俊器	JICA Consultant
	Library	--
PAGASA	Epifanio G. Sadang	Weather Specialist, Hydormeteorological Analysis & Investigation Center, National Flood Forecast Office
	Romulo G. Paculan	Supervising Meteorologist, NFFO
	Cipriano Ferraris	Director, NFFO
NWRC	Luis M. Sosa	Deputy Executive Director
	Melchor O. Baltazan	Chief Water Resources Staff Officer
BCGS	岡田 貢	JICA Consultant
MMC	Von Einsiedel	Commissioner for Planning, Planning Office
	Ferisita de Leon	Senior Planning Officer
MWSS	Leovigildo Veroy	Project Manager V, MWSP II
	Edwardo Del Fierro	Deputy Administrator for Engineering
	Arsenio Macaspac	Project Manager, Manila Water Supply III
	Bienrenido Reyes	Project Manager IV, MWSP III
	Jose Seludo	Project Manager, Metro-Manila Sewerage Project
	Jesus R. Dela Cruz	Technical Assistant Staff, MWSSP
LLDA	Asuncion S. Alvir	Chief, Personnel Section
NIA	Library	--

(3) 洪水防御，排水その他関連事業計画調査報告書一覧表(1)～(4)

洪水防御，排水その他関連事業計画報告書一覧表(1)

報告書名	報告書提出	コンサルタンツ	調査実施機関	摘要
◎ 1. Plan for the Drainage of Manila and Suburbs Drainage Scheme for South Manila & for North Manila	1952	—	River Control Section, BPW	COPY全文
◎ 2. REPORT ON MARIKINA RIVER MULTI-PURPOSE PROJECT PROPOSED DEVELOPMENT PLAN AND EVELUATION	1954 June	—	Marikina Project Coordinating C.	COPY全文
◎ 3. Preliminary Report on Manila Drainage Project	1963.11	CAMP, DRESSER & MCKEE	FCDD/BPW	COPY抜粋
4. MASTER PLAN FOR A SEWERAGE SYSTEM FOR THE MANILA METROPOLITAN	1969.12	BLACK & VEATCH ICE	NWSA/WHO	COPY抜粋
◎ 5. REPORT ON THE SURVEY AND EVALUATION OF FLOOD DAMMAGES CAUSED BY LOCAL STORM RUNOFF AND THE OVERBANK FLOW OF THE PASIG AND MARIKINA RIVER	1970	?	?	COPY全文
6. IRRIGATED AGRICULTURE DEVELOPMENT FOR LANDS SURROUNDING LAGUNA DE BAY : A FEASIBILITY STUDY	1974.3	HYDROTECHNIC	LLDA	COPY抜粋
7. LAGUNA DE BAY Water resources development VOLUME 1	1974.4	SOGREAH(france)	UNDP/ADB	COPY抜粋
◎ 8. THE MANGAHAN FLOODWAY - A FEASIBILITY STUDY	1975.2	DHJM	DPWTC	COPY抜粋
◎ 9. PARANAQUE SPILLWAY - A FEASIBILITY STUDY	1975.2	DHJM	DPWTC	COPY抜粋
10. LAGUNA IRRIGATION DEVELOPMENT PROJECT SUMMARY REPORT	1975		UNDP/FAO	COPY全文
◎11. A PRE-FEASIBILITY STUDY : MARIKINA MULTI-PURPOSE PROJECT	1976.7		TASK Force/FCRA	COPY抜粋
◎12. STAFF REVIEW ON THE PARANAQUE SPILLWAY	1977.10		NWRC	COPY全文
◎13. MARIKINA RIVER MULTIPURPOSE PROJECT - FEASIBILITY STUDY REVIEW AND EVALUATION REPORT : APPENDICES	1978.5	ELECTROWATT & OTHERS	PICOREM	COPY抜粋
◎14. APPENDIX 1 : HYDROLOGY	1978.5	ELECTROWATT & OTHERS	PICOREM	COPY抜粋
15. FINAL REPORT COMPREHENSIVE WATER QUALITY MANAGEMENT PROGRAM LAGUNA DE BAY VOLUME 1 SUMMARY REPORT	1978.5		LLDA/WHO/UNDP	COPY抜粋

洪水防御、排水その他関連事業計画調査報告書一覧表　（２）

報告書名	報告書提出	コンサルタンツ	調査実施機関	摘要
16. LAGUNA DE BAY VOLUME 3 SUMMARY REPORT	1978.5		LLDA/WHO/UNDP	COPY抜粋
17. LAND USE PLAN LAGUNA DE BAY WATERSHED VOLUME 1 SUMMARY	1978.6		LLDA	COPY抜粋
◎18. FINAL REPORT ON PASIG RIVER WALLS CHECKING	1978.10	—	NWRC	COPY全文
◎19. TECHNICAL REPORT NO.3 ON ENGINEERING DESIGN FOR DRAINAGE PUMPING STATIONS AND FLOOD CONTROL STRUCTURE(3rd Phase) Vol.1	1978.10	PCI & BASIC	FCDD/BPW	COPY抜粋
◎20. TECHNICAL REPORT NO.3 ON ENGINEERING DESIGN FOR DRAINAGE PUMPING STATIONS AND FLOOD CONTROL STRUCTURE(3rd Phase) Vol.2	1978.10	PCI & BASIC	FCDD/BPW	COPY抜粋
21. SEWERAGE AND SANITATION MASTER PLAN FOR METRO MANILA	1979.6	JAMES M.MONTGOMERY	MWSS	
22. -do- EXECUTIVE SYNOPSIS				COPY全文
23. -do- MAIN REPORT VOLUME 1				COPY抜粋
24. -do- MAIN REPORT VOLUME 2				COPY抜粋
◎25. FLOOD CONTROL AND DRAINAGE STUDY ON THE SAN JUAN RIVER WATERSHED - FINAL REPORT	1979.8	BASIC	TFFCRA/MPWTC	COPY抜粋
26. MANILA WATER SUPPLY III PROJECT ALTERNATIVE SOURCES STUDY 28	1979.12	ELECTROWATT & OTHERS	PICOREM	COPY抜粋
27. GROUNDWATER DEVELOPMENT MANILA WATER SUPPLY PROJECT II	1981.8	ELECTROWATT & OTHERS	MWSS	COPY抜粋
◎28. FINAL REPORT ON THE STUDY OF AN EFFECTIVE FLOOD CONTROL OPERATION SYSTEH INCLUDING TELEMETERING AND FLOOD WARNING SYSTEH IN THE PASIG-MARIKINA-LAGUNA LAKE COMPLEX	1981.2	CTI ENGINEERING/DTCI	MPWH	COPY抜粋
29. METRO MANILA SOLID WASTE MANAGEMENT STUDY D/F VOL.1	1982.7	JOINT COOPERATION	AD HOC COMMITTEE	COPY抜粋
30. METRO MANILA SOLID WASTE MANAGEMENT STUDY D/F VOL.2	1982.7	JOINT COOPERATION	AD HOC COMMITTEE	COPY抜粋

洪水防御、排水その他関連事業計画調査報告書一覧表　（３）

報告書名	報告書提出	コンサルタンツ	調査実施機関	摘要
◎31. IMMEDIATE ACTION REPORT FOR THE MATRO MANILA INTEGRATED URBAN DRAINAGE AND FLOOD CONTROL MASTER PLAN	1983.1	ES/BASIC	MPWH	COPY全文
◎32. REVIEW REPORT FOR THE METRO MANILA INTEGRATED URBAN DRAINAGE AND FLOOD CONTROL MASTER PLAN	1983.4	ES/BASIC	MPWH	COPY全文
◎33. DRAFT FINAL REPORT - MANGAHAN FLOODWAY PROJECT 1:50 MODEL Hydraulic Model Investigations	1983.4	NHRC	BOD/MPWH	COPY抜粋
◎34. FINAL REPORT ON THE HYDRAULIC MODEL TEST OF THE MANGAHAN FLOODWAY PROJECT	1983.5	CTI/NHRC	MPWH	COPY抜粋
◎35. FINAL REPORT OF THE ENGAGEMENT OF THE SERVICES OF A HYDRAULIC MODEL ADVISER FOR THE HYDRAULIC MODEL TEST MANGAHAN FLOODWAY PROJECT	1983.5	CTI Engineering	MPWH	COPY抜粋
◎36. FINAL ALTERNATIVE MASTER PLAN STRATEGY REPORT FOR THE METRO MANILA INTEGRATED URBAN DRAINAGE AND FLOOD CONTROL MASTER PLAN	1984.3	ES/BASIC	MPWH	COPY抜粋
◎37. Prefeasibility Study - METRO MANILA INTEGRATED URBAN DRAINAGE & FLOOD CONTROL FINAL MASTER PLAN AND LAGUNA DE BAY FLOOD CONTROL STUDY : A Complimentary Service	1984.7	GDDD Inc.	MPWH	COPY抜粋
◎38. CONSULTING SERVICES FOR THE DETAILED ENGINEERING DESIGN OF MARIKINA CONTROL STRUCTURE AND UPPER MARIKINA RIVER IMPROVEMENT PROJECT : DRAFT FINAL REPORT MATHEMATICAL MODELING	1985.1	BASIC	MPWH	COPY抜粋
◎39. FINAL REPORT ON CONSULTING SERVICES FOR MANGAHAN FLOODWAY PRJT	1985.2	CTI/DTCI	MPWH	COPY抜粋
◎40. DESIGN REPORT: CONSULTING ENGINEERING SERVICES FOR NATIONWIDE FLOOD CONTROL AND DREDGING PROJECT : PART B. AN EFFECTIVE FLOOD CONTROL OPERATION SYSTEM INCLUDING TELEMETERING AND FLOOD WARNING SYSTEM IN THE PASIG-MARIKINA-LAGUNA LAKE COMPLEX	1985.10	CTI/BASIC	MPWH	COPY抜粋

洪水防御、排水その他関連事業計画調査報告書一覧表　（４）

報告書名	報告書提出	コンサルタンツ	調査実施機関	摘要
◎41. FINAL REPORT : SUBSURFACE INVESTIGATION FOR MARIKINA FLOODGATE SITES UPPER MARIKINA RIVER FLOOD CONTROL PROJECT	1985.10	BASIC	MPWH	COPY全文
◎42. フィリピン共和国ラグーナ湖地域総合開発情報収集調査報告書	1986.2	国際建設技術協会		
◎43. フィリピン共和国パシッグ河総合開発計画調査報告書	1986.3	国際建設技術協会		
◎44. PRELIMINARY SURVEY REPORT ON PASIG-MARIKINA RIVER INTEGRATED DEVELOPMENT PROJECT （同上報告書の英文版）				
◎45. METRO MANILA DRAINAGE SYSTEM REHABILITATION PROJECT(PH-66) DRAINAGE IMPROVEMENT PLANS OF ESTERO DE VITAS AND OTHER CATCHMENT AREAS : FINAL REPORT	1986.3	PCI/BASIC	MPWH	COPY全文

(4) 関連情報一覧表

情報名	出版等日付	情報出版機関等	情報入手機関	摘要
1. Philippine Economic Indicators		NEDA	NEDA	
2. COMPENDIUM OF PHILIPPINE SOCIAL STATISTICS	1986	NEDA	NEDA	出版物
3. GLOSSARY OF TERMS OF STATISTICS	1985	NEDA	NEDA	出版物
4. MEDIUM TERM PHILIPPINE DEVELOPMENT PLAN 1987-1992	1986		NEDA	出版物
5. MEDIUM TERM(1987-1992) PUBLIC INVESTMENT PROGRAM	1986	MOEP/NEDA	NEDA	出版物
6. 1986 PHILIPPINE STATISTICAL YEARBOOK	1986	NEDA	NEDA	出版物
7. Philippine Development(Clearing The Lake)	1984.2		NEDA	雑誌
8. -do- (URBAN DEVELOPMENT)	1985.11		NEDA	雑誌
9. Metropolitan Manila Capital Investment Folio : TOWARDS AN INVESTMENT STRATEGY FOR METRO MANILA	1984.12	MMC	MMC	抜粋
10. PHILIPPINE WATER RESOURCES SUMMARY DATA VOLUME 1	1980.1	NWRC	NWRC	出版物
11. Rainfall-Intensity-DUration-Frequency data of the Philippines	1981	PAGASA	PAGASA	
12. MAXIMUM RAINFALL AMOUNTS FOR DIFFERENT DURATIONS VOL.1		WEATHER BUREAU	PAGASA	抜粋
13. -do- VOL.2	1979	PAGASA	PAGASA	全体
14. 1986 TROPICAL CYCLONE SUMMARY	1986	NSTA/PAGASA	PAGASA	COPY
15. 1984 WATER QUALITY DATA ON THE LAGUNA DE BAY AND THE TRIBUTARY RIVERS	1985.3	LLDA	NIA	全体
16. SYMPOSIUM On Laguna Lake Development Projects	1981.7		NIA	COPY
17. TIDE AND CURRENT TABLES PHILIPPINES 1987	1986.10	BCGS	BCGS	出版物
18. CY 1986 INFRASTRUCTURE PROGRAM		MPWH	MPWH	COPY
19. PROFILE OF MPWH MAJOR INFRASTRUCTURE PROJECTS CY 1985-1989	1985.12	MPWH	MPWH	抜粋
20. ORGANIZATION MANUAL 1984		MPWH	MPWH	COPY
21. METRO MANILA Street Directory CY 1987-1989		PHILIPPINE MAP CO.		出版物

(5) 購入、借用可能な地形図・航空写真のリスト

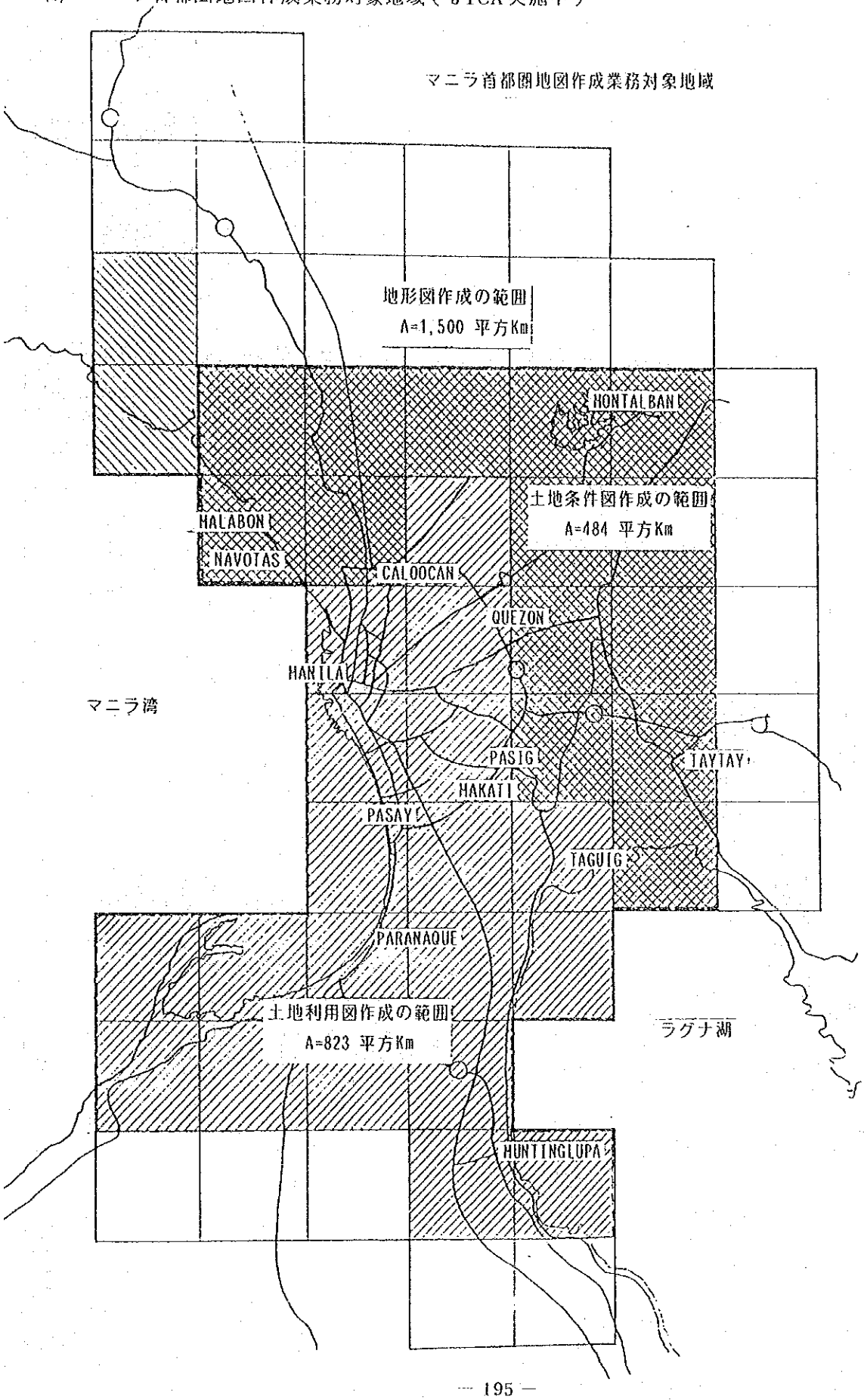
地形図及び航空写真	図化範囲	縮尺	等高	発行機関	摘要
1．地形図					
1）地形図	マニラ首都圏	1:10,000	2m	BCGS	注1
2）土地利用図	マニラ首都圏	1:25,000	2m	Planning Service (Drafting Pool)	
3）地形図	マニラ首都圏、リサール、ラグナ	1:50,000	20m	NAFP Mapping C.	印刷1982-1984(1962測量) 補助コンター10m
4）地形図	ブラカン～バタンガス	1:250,000	100m	BCGS	
5）地形図	マニラ首都圏	1:50,000	20m	BCGS	白図のみ 補助コンター5 ～10m
6）マニラ洪水対策事業計画図	マニラ首都圏	1:10,000	-	NCR(Planning)	
2．航空写真					
1）航空写真	マニラ首都圏、リサール、ラグナ	1:60,000	-	NAFP	プリント1980-1981
1）航空写真	マニラ首都圏、リサール、ラグナ		-	BCGS	注2

注1： "REVIEW REPORT for the Metro-Manila Integrated Urban Drainage and Flood Control Master Plan, April 1983, by ES/BASIC" states: The most detailed topographic information available for Metro-Manila is a set of 1:10,000 scale maps based on the 1966 aerial photography and published by the BCGS. The maps show topographic contours at 2-m intervals and provide isolated spot levels. Contours below 4-m elevation are not indicated on these maps, thus there are no contours in the low-lying zone along the bay shore in Metro-Manila and inland for approximately 5 km.

注2： "The above report" also states: Aerial photographs taken in 1982 were borrowed from the BCGS; new roads and other major topographic modifications(e.g., esteros which have been filled, bay-shore reclamation, the Mangahan Floodway, etc.) built since 1966 were identified and marked on a set of reproducible copies of the 1:10,000 scale, 1966 topographic maps.

注3： These maps can be purchased from the New Armed Forces of the Philippines(NAFP), mapping Center, Camp Aguinaldo, Quezon City.

(6) マニラ首都圏地図作成業務対象地域（ＪICA実施中）



(7) 降雨観測記録

観測所位置	北　緯	東　経	標高	観測期間	観測記録	摘要
San Lazalo, Manila	14:37	120:59	15	8/75- 8/76	A	
Quezon Institute, Quezon	14:37	121:01	30	9/71-	A	
Novaliches, Quezon	14:43	121:02	30	9/75- 3/79	A	
Balintawak, Caloocan	14:40	121:01	30	9/75-12/79	A	信頼性が薄い
Science Garden, Quezon	14:39	121:03	45	4/61-	A, B	
U.P., Quezon	14:39	121:04	178	4/74- 3/78	A	
Balara, Quezon	14:39	121:05	80	1/56- 7/65	A	
Pasig	14:34	121:05	80	3/75-	A	
Concepcion Elem. Sch., Marikina	14:40	121:05	90	9/75-	A	信頼性が薄い
Macabud, Montalban, Rizal	14:47	121:11	150	6/74-11/77	A	
Antipolo, Rizal	14:35	121:12	250	1/72-	A	信頼性が薄い
Bosoboso, Antipolo, Rizal	14:38	121:14	110	4/72-	A	信頼性が薄い
B.S., Cuyambay, Tanay, Rizal	14:35	121:21	40	1/70-12/80	A	
Santa Maria, Laguna	14:28	121:25	520	4/75-10/81	A, C, D	
Lumot, Cavinti, Laguna	14:15	121:30	282	9/68-12/80	A	欠測多数含む
Paowin, Cavinti, Laguna	14:16	121:30	150	11/74-11/76	A	
Santa Cruz, Laguna	14:17	121:25	200	4/66-	A	
Liliw, Laguna	14:08	121:26	10	4/76-	A, C, D	
Los Banos, Laguna	14:10	121:15	21	1/67-12/76	A	
Calamba, Laguna	14:14	121:10	50	5/76-	A, C, D	
San Pedro, Laguna	14:22	121:03	10	12/71-	A	
Muntinlupa	14:23	121:03	10	10/66- 7/71	A	
Bagumbayan, Taguig	14:29	121:04	5	9/75-	A	
Tipaz, Taguig	14:32	121:05	2	8/75-	A	
Las Pinas	14:29	120:59	10	8/75- 7/80	A	
MIA, Pasay	14:31	121:00	10	3/49-	A, B, D	
Port Area, Manila	14:35	120:58	6	3/49-	A, B, D	
Catid, Santa Cruz, Laguna	14:17	121:27	2	3/49-	D	
Ambulong, Batangas	14:05	121:03	100	3/76-	A, B, D	
Apalit, Pampanga	14:58	120:46	2	1/75-	A, C, D	
Bagong Sicat, Plaridel, Bulacan	14:52	120:52	2	7/75- 4/78	A, C, D	
Balucoc, Apalit, Pampanga	14:58	120:50	2	6/75- 4/78	A, C, D	
Baccor, Cavite	14:27	120:56	2	7/75-	A, D	
Malvar, Batangas	14:03	121:07	100	3/76-	A, C, D	
Sabang Baliwag, Bulacan	14:58	120:55	2	1/75- 3/77	A, C, D	
Tagaytay	14:05	120:50	500	11/76-12/80	A, C, D	
Talacsan, San Rafael, Bulacan	14:58	120:59	2	2/75- 5/78	A, C, D	
Tanauan, Batangas	14:06	121:09	150	4/75-	A, C, D	
Tayabas, Quezon	14:02	121:35	320	1/75-12/81	A, C, D	
Camarin, Caloocan	14:45	121:01	40	3/74-	A	
San Jose, Batangas	13:52	121:04	300	4/76- 8/81	A, D	
Angono, Rizal	14:35	121:10	200	1/75-	A, B, D	

注：　A：日雨量観測値
　　B：6時間毎累加雨量
　　C：一日二回観測
　　D：時間雨量

(8) 水位、流量観測記録

河川	観測位置	観測期間	観測法	摘要
Pasig	Del Pan Bridge	1961-1963, 1969-1970	スタッフゲージ	A；B；C
	Beata, Pandacan	1945-1980	スタッフゲージ	A；B
	San Jose, Makati	1946-1973	自記水位計	A；C
	Pineda, Pasig	1946-1980	スタッフゲージ	A；B
	Mckinley, Makati	1959-1975, 1978-1979	スタッフゲージ	A；B
	Napindan, Taguig	1946-1977	自記水位計	A
Marikina	Ugong Norte, Pasig	1959-1977	スタッフゲージ	A；B
	Mangahan, Pasig	1959-1965	自記水位計	A；C
	Santo Nino	1958-1979	自記水位計	
	San Rafael, Montalbon	1956-1978	スタッフゲージ	D
Nangka	Nangka, Marikina	1959-1979	スタッフゲージ	A；B
Laguna Lake	Tayuman, Binangonan	1959-1980	スタッフゲージ	A；B
	Poblacion, Muntinlupa	1960-1979	スタッフゲージ	A；B
	Los Banos	1946-1970	自記水位計	
	Halang, Lumban	1964-1969	スタッフゲージ	D

注： 1971年までのデータはNWRCにて出版済み。 1972年以降は未出版。
A： 水位記録のみ
B： 水位読み取り 3回／日
C： 観測所は既に廃止されている
D： 水位読み取り 2回／日

(9) 河川断面図

河川名	測点始点	測点終点	横断点数	測量年	データ保有機関
パッシグ河	0+000	1+811	12	1974	PRDP
	1+811	3+896	14	1967	LBDP
	3+896	5+055	6	1973	PRDP
	5+055	10+543	27	1974	PRDP
	10+543	12+508	50	1974	PRDP
	12+508	15+210	10	1973	PRDP
	15+210	16+640	7	1967	LBDP
サンファン河	0+000	10+203	55	1979	BASICTEAM
ナピンダン河	0+000	8+100	163	1981	NCR
マリキナ河	0+000	6+040	34	1967	LBDP
	6+040	27+591	216	1981	NCR
マンガハン放水路	0+000	9+000	Construction Drawing		CTI
ナボタスCutoff水路	0+000	0+450	9	1983	ES/BASIC
Bangkulasi川	0+450	1+030	14	1983	ES/BASIC
マラボン川	1+030	3+905	57	1983	ES/BASIC
Tinajeros 川	3+905	5+325	28	1983	ES/BASIC
Paranaque 川	0+000	3+550	73	1983	ES/BASIC
S.Paranaque 川	0+000	2+865	27	1978	MSFCDP
San Dionisio川	0+000	1+680	18	1978	MSFCDP
Estero Tripa de Gallina	0+000	6+062	129	1983	ES/BASIC

注： 出典：REVIEW REPORT by ES/BASIC 、 April 1983 、その他
PRDP：Pasig River Development Project
LBDP：Laguna de Bay Development Project
BASICTEAM:BASIC Technology and Management Corporation
CTI:CTI Engineering Co.,Ltd.
MSFCDP：Manila and Suburbs Flood Control and Drainage Project

(10) 橋梁一覧表

河川	橋梁名	橋梁位置（測点:m）
パッシグ河	Del Pan	0+729
	Jones	1+811
	MacArthur	2+166
	Quezon	2+416
	Ayala	3+116
	Nagtahan	5+065
	Pandacan	6+284
	Lambingan	9+720
	Guadalupe	13+934
サンファン河	Railroad	1+338
	Kalentong	1+507
	N.Domingo	2+486
	Aurora Boulevard	3+569
	E.Rodriguez	5+114
	Quezon Boulevard	6+924
	Del Monte	8+241
	Del Pilar	10+065
マリキナ河	Vargas	1+114
	Rosario	3+968
	Marcos Highway	9+861
	Santo Nino	12+927
マラボン川	Tonsuya	1+513
	Lambingan	2+730
Tinajeros 川	Tinajeros	4+024
	National Railroad	5+325
Paranaque 川	Paranaque	0+150
	Santo Nino	0+400
	MIA	1+900
	Airport	3+100
S.Paranaque 川	Imelda	0+300
San Dionisic川	Kayboboy	1+000
Estero Tripa de Gallina	Aurola Boulevard	0+379
	Maricaban	0+950
	EDSA	1+229
	Dolores	2+789
	Buendia	3+685
	Vito Cruz	4+825
	Estrada	5+033
	Zapanta	5+271
	San Andres	5+834
	S.Superhighway	5+956
	National Railway	6+012

(1) 現存の排水機場

機場名称	排水面積(ha)	ポンプ台数	口径(mm)	排水能力(m3/s)	排水河川
Valencia	246	4	1000	10.5	パッシグ河
Quiapo	195	4	1000	9.5	〃
Pandacan	180	2	1000	4.4	〃
Aviles-Sampaloc	356	4	1200	14.1	〃
Paco	182	3	1000	7.6	〃
Sta. Clara	116	2	1000	5.3	〃
Tripa de Gallina	1769	8	1650	56.0	Estero Tripa de Gallina
Libertad	779	6	1650	42.0	Libertad Channel
Makati	151	2	1200	7.0	パッシグ河
Binondo	279	4	1100	11.4	〃

5. 面談者リスト

比側関係者

DEPERTMENT OF PUBLIC WORKS AND HIGHWAYS

1.	Mr. Teodoro T. Encarnacion	Undersecretary
2.	Mr. Manuel M. Bonoan	Assistant Secretary

Planning Service

1.	Mr. Jose C. Guanzon	Chief Civil Engineer
2.	Mr. Napoleon Famadeco	Secretary Civil Engineer

Bureau of Design

1.	Mr. Pedro P. Tercino	Chief Civil Engineer
2.	Mr. Bienvennido C. Leuterio	Chief Civil Engineer

National Capital Region (NCR)

1.	Mr. Pio A. Teston	Head Civil Engineer
2.	Mr. Nonito F. Fano	Chief Civil Engineer
3.	Mr. Flancisco R. Imperial	Chief Civil Engineer

PMO-Major Flood Control Projects

1.	Mr. Antonio A. Alpasan	Project Manager Ⅳ
2.	Mr. Rogelio A. Flores	Project Manager Ⅱ

Mangahan Floodway Project

1.	Mr. Fernando Lagman	Project Manager V
2.	Mr. Patrick Gatan	

City Engineers Offica Manila

1.	Mr. Gonzalo Banuelos	Sup' g. Civil Engineer Ⅱ

Laguna Lake Development Authority (LLDA)

1.	Mr. Julian D. Centeno	

MANABA Flood Control and Drainage Project

1. Ms. Ismaela O. Peneyra

Metro Manila Commission (MMC)

1. オマール　レガスピン

日本側関係者

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川上　俊器	ＪＩＣＡ派遣専門家（ＤＰＷＨ所属）
宮本　守也	ＪＩＣＡマニラ事務所
大島　勝彦	ＪＩＣＡマニラ事務所
岡崎　有二	ＪＩＣＡマニラ事務所
小沢　勝彦	ＪＩＣＡマニラ事務所
加藤	海外技術協力基金マニラ駐在員