6. PRELIMINARY STRUCTURAL DESIGN

6.1 Major Structures for Drainage Improvement in Priority Area

East and West of Mangahan area and Malabon-Navotas area are selected as the priority area of drainage improvement for the feasibility study. In this section, preliminary structural design for the following major structures is described for each priority area.

East and West of Mangahan

- Lakeshore Dike
- Backwater Dike
- Drainage Channel
- Pump Station
- Regulation Pond
- Sluice Gate
- Bridge

Malabon-Navotas

- Ring Dike
- Drainage Channel
- Pump Station
- Sluice Gate
- Navigation Lock

6.2 East and West of Mangahan

Preliminary design of major structures is made based on the least construction cost method.

Lakeshore Dike

The optimum shape of the lakeshore dike is determined by the following procedure.

- Examination of the wave effect of the Laguna Lake to the top elevation of the dike with various bank slope;

- Examination of the shape of the dike with various embankment material and method;

- Determination of the optimum shape of the dike by construction cost comparison; and

- Study of the consolidation settlement of the foundation.

(1) Crest Elevation

The crest elevation of the lakeshore dike was determined by the following equation:

$$EL = HWL + H' + 0.5 \text{ m}$$

where, EL : crest elevation of the dike
HWL : design high water level of Laguna Lake (EL 13.8 m)
H' : Wave setup to the dike
0.5 : allowance

To define the design wave, the Bretschneider's method is applied under the following condition:

Water Depth of Laguna Lake	:	2.3 m
Wind Velocity	:	20 m/s
Fetch Length	:	20 km

Then, the following characteristics of the wave are obtained.

Wave Height (H)	:	0.78 m
Wave Length (L)	:	9.89 m
Wave Period (T)	:	2.7 sec

A wave setup to the dike can be calculated by the Savielle's diagram which is a function of dike slope and a ratio of (H/L).

As a result, crest elevation of lakeshore dike was calculated from the above-mentioned equation, as follows:

Dike Slope	HWL	H'	Crest (EL)
1:2	EL 13.8	1.2	EL 15.5
1:3	EL 13.8	0.8	EL 15.1
1:4	EL 13.8	0.6	EL 14.9
1:5	EL 13.8	0.5	EL 14.8
1:10	EL 13.8	0.3	EL 14.6

(2) Alternative Shape of Lakeshore Dike

The following five alternative shapes of the dike were considered by means of different material and construction method.

Case 1: Embankment by dredged materials from the bottom or lakeshore of the Laguna Lake.

Case 2: Embankment by mixed soil of dredged materials with borrowed materials.

Case 3: Embankment by dredged materials for the center part and borrowed materials for the outer part.

Case 4: Embankment by borrowed materials.

Case 5: Embankment by mixed soil of dredged materials with cement or lime powder.

The stable shape of each of the above cases was determined from the stability analysis of slip circle method based on the following foundation condition and material properties.

Foundation Condition

Depth		Soil Properties A = sα (t/m³)	c' (t/m²)	η' (°)	N-Value
GL - EL 6.90 m	Clay	1.64	1.10	22.0	10
EL 9.0 - EL 6.5 m	Sand	1.75	1.80	36.0	5
EL 6.5 - EL -5.5 m	Clay	1.50	1.90	20.0	5
EL -5.5 - EL-10.5 m	Clay	1.70	3.20	18.5	20-50

where, A : wet unit weight
s : saturated unit weight
c' : cohesion
η' : angle of internal friction

Embankment Material

Case	Material	Soil Properties A = s (t/m³)	c' (t/m²)	η' (°)
1	Dredged Material	1.60	0.90	11.0
2	Mixed Clay	1.60	1.10	22.0
3	Borrowed Material	1.70	3.00	22.0
	Dredged Material	1.60	0.90	11.0
4	Borrowed Material	1.70	3.00	22.0
5	Soil Material	1.70	3.00	22.0

Typical shapes of the lakeshore dike for the above five alternatives are presented in Fig. 5-6-1.

(3) Optimum Shape of Lakeshore Dike

The optimum shape of lakeshore dike was determined by comparing the construction costs for the foregoing five alternatives as tabulated in Table 5-6-1. The summary of construction cost is presented in the following table.

Case	Bank Slope	Crest Elevation	Construction Cost (in 1000 peso/m)
1	1:10	EL 14.6	35
2	1:3	EL 15.1	22
3	1:4	EL 14.9	21
4	1:2	EL 15.5	18
5	1:2	EL 15.5	29

Consequently, Case 4 of embankment with borrowed material is considered as the optimum case because it is the most economical with a simple construction method.

(4) Consolidation Settlement

Consolidation settlement of the foundation of the lakeshore dike under Case 4 was calculated using the mode shown in Fig. 5-6-2. In this calculation, it was assumed that consolidation settlement does not occur for the dike itself because compaction was provided.

From the soil mechanics analysis, the total quantity of settlement was calculated at 0.7 m and consolidation time of 70% and 80% of the foundation results in about 1.5 and 2.8 years, respectively. The detailed calculation procedure is compiles in the Data Book (Volume 1).

Backwater Dike

As a connected dike to the lakeshore dike, backwater dikes are provided for Napindan Channel, the Buli, Baho, Mahaba and Lower Bicutan rivers. (Refer to Fig. 5-6-3.)

For the Napindan Channel, earth dike and parapet wall are provided for the lakeside stretch and for the landside stretch, respectively. In desiging the earth dike, a similar shape of the lakeshore dike is basically adopted. However, revetment is not provided at the water side and its dike crest is set at EL 14.6 m, only considering a freeboard of 0.8 m derived from the planning criteria by design discharge, since effect of wave setup by the lake water is not considered.

An R.C. parapet wall is proposed in the urbanized area for the landside river stretch, where a revetted channel cross section having a 1:1 side slope is provided to protect from foundation failure of the wall.

Along the river courses of the Buli, Baho, Mahaba and Lower Bicutan, the same type of diking of the earth dike of the Napindan Channel is proposed at present, since river improvement plans in their upper reaches are not concreted.

Typical cross sections of backwater dike are shown in Fig. 5-6-4.

Drainage Channel

Since there are relatively lots of open space in East and West of Mangahan, trapezoidal type of cross section with a side slope of 1:2 without revetment is adopted for improvement of existing drainage channels and construction of drainage channels. Basically, excavated channel method without diking is proposed, providing a design water depth of 2 to 3 m. As for closed channel, R.C. box culvert with two or three rectangular cross sectional areas is adopted considering a design water depth of connected drainage channel. Main features and design condition of drainage channels are summarized in Table 5-6-2. The proposed longitudinal profile and typical cross sections are shown in Figs. 5-6-5 and 5-6-6, respectively.

Pump Station

A submersible type pump is applied for the pump equipment which can be operated by diesel generator through the economical comparison study between the conventional type and the submersible type (refer to ANNEX). In addition to the said power supply equipment, garbage removal equipment such as mechanical rake, belt conveyor and hopper, and concrete structures such as sand basin, surge tank and operation house are provided, accordingly. The general layout of the pump station is presented in Fig. 5-6-7.

Regulation Pond

Six regulation ponds are provided beside the pump stations along the lakeshore dike. Each pond is designed to be excavated at a 3 m depth with a cut slope of 1:2 from the ground level. At the boundary of drainage channel and pond, an overflow section of concrete structure is placed to control the inflow water from drainage channel. The general layout of the regulation pond is shown in Fig. 5-6-8. The schematic profile of the regulation pond, pump station and sluice gate is shown in Fig. 5-6-9.

Sluice Gate

The proposed sluice gates are classified into four types as follows:

Type	Site
Open channel type/appurtenant to pump station	2
Box culvert type/appurtenant to pump station	7
Open channel type/independent	3
Box culvert type/independent	2

A cross sectional area of sluice gate is determined based on 1 m/s of flow velocity at sluice inside and considering the relation of the connecting drainage channel to the width.

Sluice gates mainly consist of concrete structure and steel roller gate. Open channel type sluice gate is adopted in the case that a large cross section area for sluiceway is required from the design discharge and/or navigation of vessel. While, a box culvert type sluice gate is installed when a relatively small size gate is required.

The main dimensions of fourteen sluice gates are tabulated in Table 5-6-3. Fig. 5-6-10 shows a typical layout of a sluice gate.

Bridges

Four bridges are planned to be constructed along the lakeshore dike as follows:

- Napindan Channel Bridge
- Mangahan Floodway Bridge
- Mangahan Diversion Bridge
- Lower Bicutan River Bridge

The design of bridges was carried out in consideration of Philippine and Japanese standards, especially the following items:

(a) Vertical Clearance

Vertical clearance between the superstructure of the bridge and the HWL of the river is set at 1.50 m.

(b) Span between Piers

Span between piers is set to reduce the obstruction rate of the piers to the flow area at less than 4.0%.

(c) Type of Superstructure

Common and economical type of superstructure is used. In principle, the type of superstructure in relation to the span is set as follows in the Philippines.

Type	Span
Reinforced Concrete Bridge	
- Reinforced Concrete Precast Slab or Reinforced Flat Slab	6.00 m
- Reinforced Concrete Deck Girder	8.00 - 21.00 m
- Reinforced Concrete Box Girder	22.00 - 30.00 m
Prestressed Concrete Bridge	
- Channel Beams	11.00 - 13.40 m
- T-Beams	15.80 - 18.90 m
- Box Girders	Over 30.00 m
Steel Bridge	
- Composite I-Beam	15.00 - 30.00 m
- Steel Plate Girder	20.00 - 50.00 m
- Railway Bridge	9.00 - 30.00 m
- Steel Truss	36.50 - 128.00 m

(1) Bridge Across Napindan Channel (Napindan Bridge)

Napindan Bridge is designed as follows considering the above design criteria (refer to Fig. 5-6-11):

Length : 129.50 m

Width of Roadway : 9.10 m

Type : Prestressed Post-Tensioned Composite I-Beam

Span : 3 spans (42.50 m each)

Prestressed post-tensioned composte I-beam bridge is the most economical compared with steel plate girder and steel truss bridges. Steel pile foundation of about 20 m in length is adopted to reach the

stiff layer of C3 of the weathered Guadalupe Formation which has enough bearing capacity of N-value 20-50.

(2) Bridge Across Mangahan Floodway (Mangahan Floodway Bridge)

Mangahan Floodway Bridge is designed as follows (refer to Fig. 5-6-11):

Length	:	248.00 m
Width of Roadway	:	9.10 m
Type	:	Prestressed Post-Tensioned Composite I-Beam
Span	:	6 spans (41.00 m each)

The above type was determined for the same reason as the Napindan Bridge. Steel pile foundation of about 20 m in length is also provided.

(3) Bridge Across Mangahan Diversion Channel

The Mangahan Diversion Channel Bridge is designed as follows:

Length	:	60.00 m
Width of Roadway	:	9.10 m
Type	:	Reinforced Concrete
Span	:	2 spans (30.0 m each)

(4) Bridge Across Lower Bicutan River

Length	:	30.00 m
Width of Roadway	:	9.10 m
Type	:	Reinforced Concrete
Span	:	1 span

6.3 Malabon-Navotas

Major structures in Malabon-Navotas are designed preliminarily based on the least construction cost method. Locations of proposed structures are illustrated in Fig. 5-6-12.

Ring Dike

Ring dike in the north bank of the Malabon River consists of a coastal dike with a length of 5,700 m, Malabon River dike with a length of 3,500 m and a ring dike with a length of 6,700 m against high tide.

Coastal dike is provided along the seashore line of Navotas Island and its crest is set at EL 13.5 m, which is derived from hydraulic analysis and empirical DPWH standards. Malahon River dike is designed considering the Master Plan of the Malabon River and existing condition of river structures. Therefore, freeboard of Malabon River dike is determined by the design discharge of the river.

Coastal dike and Malabon River dike, providing their crest widths of 3 m, are made of borrowed earth material with a revetted slope of 1:2 at the waterside and a slope of 1:2 without revetment at the landside. As for the ring dike against high tide, which is drawn on the north drainage boundary, reinforcing work for existing tide dike is provided. The dike is designed to be earth dike with a slope of 1:2 at both sides and its crest with a 3.0 m wide is set at EL 12.5 m.

In the south bank of the Malabon River, a river dike 3,600 m long along the Malabon River and a coastal dike 1,100 m long along the seashore line and the river course near estuary of the Malabon River are proposed, providing the same shapes as in the north bank of the Malabon River. Since there is inadequate open space for diking along the Navotas River and Estero de Marala, a parapet wall with 8,500 m of total length is provided at both sides of the water courses. Top elevation of the parapet wall is set at EL 13.5 m of the same level that the coastal dike is set. A shape of parapet wall is mostly the same as that of the landside backwater dike along the Napindan Channel.

Typical cross sections of dike and rivers are presented in Figs. 5-6-13 and 5-6-14.

Drainage Channel

Design concept of drainage channel in Malabon-Navotas is basically the same as that in East and West of Mangahan. Principal features and design condition of proposed drainage channel are described in Table 5-6-4. The longitudinal profiles and typical cross sections of the channels are shown in Figs. 5-6-15 and 5-6-16, respectively.

Pump Station

Most components of the pump station in malabon-Navotas are the same as in East and West of Mangahan. Submersible pumps are also applied. A general feature is illustrated in Fig. 5-6-17.

Sluice Gate

Proposed sluice gates in Malabon-Navotas are classified into four types as follows:

Type	Site
Open channel type/appurtenant to pump station	1
Box culvert type/appurtenant to pump station	4
Open channel type/independent	5
Box culvert type/independent	2

Basic design concept is the same in East and West of Mangahan. Main features and design condition are summarized in Table 5-6-5. Typical drawings are shown in Fig. 5-6-18.

Navotas Navigation Lock

A navigation lock is planned to be constructed at the estuary of the Navotas River near Tanza. This structure is designed assuming that one thousand dead weight ton class vessel can pass. Main features of the lock are described below:

Lock chamber : 20 m wide and 120 m long

Gate chamber : 32 m wide and 30 m long (seaside)
32 m wide and 27 m long (river side)

Miter gate : 10.0 m (W) x 6.6 m (H) x 2 units (seaside)
10.0 m (W) x 6.0 m (H) x 2 units (river side)

Bascule bridge: 10.0 m (L) x 1.5 m (W) x 2 units

For the foundation works, reinforced concrete piles of 20 m long are provided to reach the stiff layer with adequate bearing capacity of N-value over 50, namely the Guadalupe Formation. Fig. 5-6-19 shows the general drawing of the Navotas navigation lock.

TABLES

Table 5-2-1 MAIN FEATURES OF PUMPING STATIONS EXISTING IN MANILA AND SUBURBS

Pumping Station	Drainage Area (ha)	Pump Diameter & Units (mm)	Pump Capacity (m^3/s)	Pump Starting Water Level (m)	Peak Discharge (m^3/s)	Point of Discharge
North						
(1) Valencia	277	1000x4	10.5	10.50	38.8	Pasig River
(2) Aviles-Sampaloc	345	1200x4	14.1	10.50	47.9	-do-
(3) Quiapo	212	1000x4	9.5	10.50	33.5	-do-
(4) Binondo	304	1000x4	11.4	10.00	30.5	-do-
Sub-Total	1,138		45.5			
South						
(1) Makati	142	1200x2	7.0	11.30	24.1	Pasig River
(2) Sta. Clara	150	1000x2	5.3	11.00	20.1	-do-
(3) Pandacan	104	1000x2	4.4	10.50	22.1	-do-
(4) Paco	178	1000x3	7.6	10.50	23.6	-do-
(5) Libertad	755	1650x6	48.0	9.60	130.0	Manila Bay
(6) Tripa de Gallina	1,725	1650x8	56.0	9.90	165.0	Parañaque River
Sub-Total	3,054		128.3			
Total	4,192		173.8			

Table 5-2-2 FEATURES OF MAJOR ESTEROS IN MANILA AND SUBURBS

No. Estero	Total Length (km)	Section No.	Width Max. (m)	Width Min. (m)	Width Ave. (m)	Point of Discharge
NORTH						
1. Vitas	1.84	0+000 - 1+365	73.0	37.5	52.6	Manila Bay
		1+365 - 1+835	49.7	33.1	40.3	
2. La Reina	1.31	2+861 - 1+548	20.0	11.0	15.8	Est. Vitas
	1.55	0+000 - 1+548	48.2	12.3	23.1	Pasig
3. Binondo	0.90	0+000 - 0+889	35.0	16.0	22.3	Pasig (Binondo P.S.)
4. Quiapo	0.96	0+000 - 0+958	70.0	10.0	25.6	Pasig (Quiapo P.S.)
5. San Miguel	1.32	2+497 - 1+178	30.0	10.0	18.7	Est. Quiapo
	1.18	0+000 - 1+178	11.0	6.8	9.0	Pasig
SOUTH						
1. Sta. Clara	1.34	0+000 - 1+338	10.0	4.0	6.2	Pasig (Sta. Clara P.S.)
2. Pandacan	1.78	0+000 - 1+775	27.5	7.5	18.1	Pasig (Pandacan P.S.)
	2.43	4+200 - 1+775	17.5	7.0	11.3	Pasig
3. Paco	1.6	0+000 - 0+600	39.5	20.0	26.4	Pasig
		0+600 - 1+400	27.0	15.0	20.4	
		1+400 - 1+600	15.0	15.0	15.0	
4. Tripa de Gallina	2.00	0+000 - 2+000	22.5	4.0	12.7	Est. Pandacan
	3.00	2+000 - 2+623	15.0	7.0	10.3	Manila Bay (Libertad P.S.)
		2+623 - 5+000	21.0	8.0	12.3	
(Parañaque)	1.79	3+615 - 4+944	42.0	14.5	26.6	Manila Bay
		4+944 - 5+400	20.0	15.5	18.3	(Tripa de Gallina P.S.)

Table 5-2-3(1/4) FEATURES OF EXISTING DRAINAGE MAINS AND OUTFALLS IN MANILA AND SUBURBS (NORTH)

No.	Name	Total Length (m)	Sec. No.	No. of Bays	Width (m)	Depth (m)	Gradient (1/1000)	Point of Discharge
1.	Blumentritt Interceptor	2,973.3	1	2	2.57	2.57	0.300	Estero de Maypajo
			2	2	2.57	2.57	0.350	
			3	2	2.46	2.46	0.350	
			4	2	2.38	2.38	1.130	
			5	2	2.20	2.20	1.130	
			6	2	1.69	1.69	0.593	
2.	Kanlaon-Piy Margal Main	650.0	1	1	2.00	1.40	n.a.	Blumentritt Interceptor
			2	1	1.52	(dia.)	n.a.	
3.	Solis-Tecson Main	1,475.0	1	2	2.20	1.50	1.000	Estero de Sunog-Apog
			2	2	1.60	1.40	1.000	
			3	1	2.00	1.40	1.000	
			4	1	1.07	(dia.)	2.500	
4.	South Antipolo Main	1,415.5	1	1	4.40	3.30	0.320	South Antipolo Open Channel
			2	1	4.40	2.60	0.360	
			3	1	3.00	2.50	0.350	
			4	1	2.00	2.40	0.430	
5.	Tayuman Main	1,605.0	1	1	2.40	1.40	n.a.	Estero de Vitas
			2	1	2.00	1.20	n.a.	
			3	1	1.00	0.80	n.a.	
6.	Zurbaran Main	705.0	1	2	2.15	1.50	0.700	Estero de San Lazaro
			2	1	2.95	1.50	0.700	

n.a. : Not available

Table 5-2-3(2/4) FEATURES OF EXISTING DRAINAGE MAINS AND OUTFALLS IN MANILA AND SUBURBS (NORTH)

No.	Name	Total Length (m)	Sec. No.	No. of Bays	Width (m)	Depth (m)	Gradient (1/1000)	Point of Discharge
7.	Visayas Main	668.0	1	2	2.05	2.05	0.966	Estero de Valencia
			2	2	1.69	1.69	0.854	
			3	1	2.94	1.57	0.854	
8.	Washington-Piy Margal Main	361.0	1	1	2.40	2.10	0.720	Estero de Bamo Bamo
			2	1	1.37	(dia.)	1.200	
9.	Economia Main	586.0	1	2	2.20	1.50	15.652	Josefina-Lepanto Main
			2	1	4.40	2.10	0.423	
			3	1	3.20	1.80	0.420	
			4	1	2.20	1.60	0.365	
10.	Lepanto-Josefina Main	1,156.1	1	1	4.22	2.40	1.010	Lepanto-Gov. Forbes Mains
			2	1	4.10	2.70	1.040	
			3	1	3.20	3.20	0.667	
11.	Lepanto-Gov. Forbes Main	1,057.0	1	3	3.60	2.80	1.107	Estero de Sampaloc
12.	Severino Reyes Main	536.0	1	1	3.20	1.60	1.500	Estero de Quiapo
13.	Pacheco Main	1,108.0	1	1	4.28	1.90	0.800	Manila Bay
			2	1	2.94	1.50	0.600	
14.	Lakandula Main	876.2	1	1	3.84	2.02	0.400	Manila Bay
			2	1	2.94	1.57	0.508	
			3	1	2.70	1.45	0.540	
			4	1	2.20	1.20	0.620	

Table 5-2-3(3/4) FEATURES OF EXISTING DRAINAGE MAINS AND OUTFALLS IN MANILA AND SUBURBS (SOUTH)

No.	Name	Total Length (m)	Sec. No.	No. of Bays	Width (m)	Depth (m)	Gradient (1/1000)	Point of Discharge
1.	Makati Headrace No.1	410.0	1	1	2.60	2.00	2.500	Makati P.S.
			2	1	2.60	2.00	0.500	
2.	Makati Headrace No.2	625.0	1	1	5.00	2.50	0.500	Makati P.S.
			2	1	4.00	2.00	0.500	
3.	Estrada Main	592.0	1	1	2.94	1.57	n.a.	Tripa de Gallina
			2	1	1.52	(dia.)	n.a.	
			3	1	1.22	(dia.)	n.a.	
			4	1	0.91	(dia.)	n.a.	
4.	Vito Cruz Outfall	1,324.8	1	1	2.05	2.05	0.370	Manila Bay
5.	Zobel-Roxas Main	1,016.0	1	1	4.40	2.10	0.676	Tripa de Gallina
			2	1	2.80	1.60	0.575	
			3	1	1.37	(dia.)	0.900	
6.	Buendia-Roxas Outfall	1,956.0	1	3	4.60	3.20	0.500	Libertad P.S.
			2	3	3.80	3.20	0.500	
			3	3	3.60	3.20	0.500	
			4	3	3.60	3.20	0.500	

n.a. : Not available

Table 5-2-3(4/4) FEATURES OF EXISTING DRAINAGE MAINS AND OUTFALLS IN MANILA AND SUBURBS (SOUTH)

No.	Name	Total Length (m)	Sec. No.	No. of Bays	Width (m)	Depth (m)	Gradient (1/1000)	Point of Discharge
7.	Libertad Outfall	1,800.0	1	1	4.70	3.20	0.300	Libertad P.S.
			2	1	3.50	4.00	0.340	
			3	1	2.75	3.003)	0.319	
8.	EDSA Outfall	1,733.0	1	2	4.30	2.50	0.552	Libertad P.S.
9.	Padre Faura Main	1,157.0	1	1	3.20	2.88	1.750	Manila Bay
			2	1	2.20	1.80	1.300	
10.	Remedios Main	1,338.0	1	1	4.40	3.00	0.367	Manila Bay
			2	1	3.35	2.80	0.454	
			3	1	2.80	2.40	0.932	
			4	1	1.37	(dia.)	0.874	
11.	Zobel Orbit Outfall	1,170.0	1	1	5.00	3.00	0.500	Pasig River
			2	1	5.00	3.00	11.100	
			3	1	5.00	3.00	1.000	

Table 5-2-4(1/2) DRAINAGE DISTRICTS AND DRAINAGE METHODS

Drainage District	Area (ha)	Drainage Method
North Manila and Suburbs		
1. Sunog Apog	802	Gravity drainage through Estero de Sunog Apog and Estero de Vitas to Manila Bay.
2. Vitas	573	Gravity drainage through Estero de Vitas and Estero dela Reina to Manila Bay. A pumping stations will be constructed.
3. Balut	36	Gravity flow to Manila Bay. A pumping station will be constructed.
4. Northeast Pasig	72	Gravity drainage to Pasig River.
5. Valencia P.S.	277	Pump drainage to Pasig River.
6. Aviles-Sampaloc P.S.	345	-do-
7. Quiapo P.S.	212	-do-
8. Binondo P.S.	304	-do-
9. Northwest Pasig	69	Gravity drainage to Pasig River.
10. North Manila Bay	168	Gravity drainage to Manila Bay.
Sub-Total	2,858	

Table 5-2-4(2/2) DRAINAGE DISTRICTS AND DRAINAGE METHODS

Drainage District	Area (ha)	Drainage Method
South Manila and Suburbs		
1. Makati Slope	307	Gravity drainage to Pasig River.
2. Makati P.S.	142	Pump drainage to Pasig River.
3. Sta. Clara P.S.	150	-do-
4. San Andres	339	Pump drainage to Pasig River. A pumping station will be constructed.
5. Pandacan P.S.	104	Pump drainage to Pasig River.
6. Paco P.S.	178	-do-
7. Balete	85	Gravity drainage to Manila Bay.
8. Southwest Pasig	141	Gravity drainage to Pasig River.
9. South Manila Bay	388	Gravity drainage to Manila Bay.
10. Libertad P.S.	755	Pump drainage to Manila Bay.
11. Tripa de Gallina P.S.	1,725	-do-
Sub-Total	4,314	
Total	7,172	

Table 5-2-5 SCOPE OF WORK FOR METRO MANILA FLOOD CONTROL PROJECT

Financial Source	Drainage Area	Scope of Work
Financial Assistance from Overseas Economic Cooperation Fund (OECF), Japan	Vitas	1. Construction of Vitas Pumping Station
		2. Construction of Balut Pumping Station
		3. Improvement of Estero de Vitas, Estero de la Reina, Estero Sunog Apog and Estero Maypajo
		4. Extension of Solis-Tecson Drainage Main
	San Andres	1. Construction of San Andres Pumping Station
		2. Improvement of Estero de Pandacan and Estero Tripa de Gallina
Local Funds	Vitas	1. Dredging of Estero de Vitas and Estero Sunog Apog
		2. Construction of New Kabulusan Outfall
		3. Improvement of Blumentritt Interceptor
		4. Improvement of Laterals
	San Andres	1. Dredging of Estero de Pandacan and Estero Tripa de Gallina
		2. Improvement of Laterals

Table 5-2-6 FEATURES OF EXISTING DRAINAGE CHANNELS (DRAINS) IN DAGAT-DAGATAN

No.	Name	Total Length (m)	Section No.	Width (m)	Gradient (1/1000)	Point of Discharge
1	Spine Drain	2,000	1	5.0	0.50	Bangkulasi River
			2	4.5	0.85	
2	Saluysoy Drain	1,700	1	4.5	0.30	Bangkulasi River
			2	2.5	0.55	
3	Northern Drain	1,100	1	4.0	0.48	Estero North Sunog Apog
			2	3.5	0.48	
			3	3.0	0.76	
			4	2.0	1.0	
4	Southern Drain	800	1	3.0	0.66	Estero North Sunog Apog
			2	2.0	0.90	

Table 5-2-7 FEATURES OF EXISTING OUTFALLS IN PARAÑAQUE-LAS PIÑAS

Item No.	Name	Total Length (m)	Section No.	No. of Bays	Width (m)	Depth (m)	Gradient (1/1000)	Point of Discharge
1	Rivera Outfall	782.0	1	1	4.00	3.00	2.580	Manila Bay
2	Librada Outfall	545.0	1	1	5.40	3.55	2.760	Manila Bay
			2	1	4.40	2.75	4.460	
3	Seaside Outfall	518.0	1	1	5.40	4.15	1.350	Manila Bay
			2	1	5.40	4.00	1.320	

Table 5-2-8. COMPARISON OF PUMP CAPACITY, FLOW CAPACITY, 10-YEAR AND 5-YEAR RETURN PERIOD FLOOD IN MANILA AND SUBURBS

Drainage District	Existing Pump Capacity (m^3/s)	Pump Capacity for 10-Year Return Period Flood (m^3/s)	Pump Capacity for 5-Year Return Period Flood (m^3/s)	Drainage Channel	Flow Capacity (m^3/s)	10-Year Return Period Flood (m^3/s)	5-Year Return Period Flood (m^3/s)
North Manila and Suburbs							
Sunog Apog	-	-	-	Estero de Vitas	*	161	144
				Estero de Sunog Apog	56	108	97
				Estero de Maypajo	35	91	73
				Blumentritt Interceptor	20	37	32
Vitas	(31.8)	31.8	25.2	Estero de Vitas	50	67	60
				Estero dela Reina	20	29	26
Balut	(2.0)	2.0	1.4				
Northeast Pasig	-	5.5	4.4				
Valencia P.S.	10.5	18.0	14.4	Estero de Valencia	30	59	53
				Visayas Main	18	19	17
Aviles-Sampaloc P.S.	14.1	18.3	14.6	Estero de Sampaloc	40	48	43
				Lepanto-Gov. Forbes Main	50	48	43
				Economia Main	10	21	19
				Lepanto-Josefina Main	20	35	32
				Estero de San Miguel	5	19	17
Quiapo P.S.	9.5	11.2	9.0	Estero de Quiapo	40	37	33
				Estero de San Miguel	20	18	16
				Severino Reyes Main	7	15	13
Binondo P.S.	11.4	17.2	13.7	Estero de Binondo	40	50	45
				Estero dela Reina	5	49	44
Northwest Pasig	-	-	-	-	-	-	-
North Manila Bay	-	-	-	Pacheco Main	8	13	12
				Lakandula Main	10	9	8
South Manila and Suburbs							
Makati Slope	-	-	-	Zobel Orbit Outfall	40	40	36
Makati P.S.	7.0	7.0	5.6	Pond	-	25	22
				Makati Headrace No. 1	13	13	10
				Makati Headrace No. 2	17	16	13
Sta. Clara P.S.	5.3	9.6	8.0	Estero de Sta. Clara	5	32	29
San Andres	(17.4)	17.4	13.6	Estero de Pandacan	3	58	51
				Estero Tripa de Gallina	5	26	23
Pandacan P.S.	4.4	7.1	5.7	Estero de Pandacan	15	26	24
Paco P.S.	7.6	9.7	7.9	Estero de Paco	50	36	32
				Estero de Paco/1	20	28	25
Balete	-	5.3	4.4				
Southwest Pasig	-	-	-	-	-	-	-
South Manila Bay	-	-	-	Padre Faura Main	20	19	17
				Remedios Main	17	17	16
Libertad P.S.	48.0	54.2	43.8	Pond	-	122	110
				Buendia-Roxas Outfall	50	50	45
				Libertad Outfall	8	8	7
				EDSA	25	25	23
				Estero Tripa de Gallina/2	10	45	41
				Zobel-Roxas Main	18	19	17
Tripa de Gallina P.S.	56.0	58.8	46.6	Tripa de Gallina/3	100	132	117
				-do- /4	60	49	43
				-do- /5	20	65	59

Note: Figures in parentheses indicate the planned pump capacity in the project assisted by the Government of Japan.

* Bank of channel is lower than the Design Tide Level (EL 11.80 m).
/1 Upper reaches of Estero dela Concordia
/2 The reaches between Zobel-Roxas Main and Buendia-Roxas Outfall
/3 The reaches between the pumping station and Dilain Creek
/4 The reaches between Dilain Creek and EDSA
/5 Upper reach from EDSA

Table 5-2-9 CLASSIFICATION OF DRAINAGE DISTRICTS BY FLOW CAPACITY OF MAIN DRAINAGE CHANNELS

Area	Category I	Category II	Category III	Category IV
North Manila and Suburbs	° Quiapo P.S.		° Sunog Apog*	° Northwest Pasig
			° Vitas*	
			° Valencia P.S.**	
			° Aviles-Sampaloc P.S.**	
			° Binondo P.S.**	
			° North Manila Bay**	
South Manila and Suburbs	° Makati Slope		° Sta. Clara P.S.	
	° Makati P.S.		° San Andres*	
	° Paco P.S.		° Pandacan P.S.**	
	° South Manila Bay		° Tripa de Gallina P.S.	
	° Libertad P.S.			

[Note]

Category I : Drainage districts where the flow capacity of lower reaches of main drainage channel is more than 10-year return period.

Category II : Drainage districts where it is between those of 10-year and 5-year return period.

Category III: Drainage districts where it is less than 5-year return period.

Category IV : Drainage districts where main drainage channel(s) needs to be constructed.

* Indicates the drainage district where channels will be constructed and/or improved soon by Metro Manila Flood Control Project.

** Indicates drainage districts where dredging of main drainage channels will be undertaken soon by the Project for Retrieval of Flood Prone Areas in Metro Manila.

Table 5-2-10 CLASSIFICATION OF DRAINAGE DISTRICTS BY PUMP CAPACITY

Area	Category I	Category II	Category III	Category IV
North Manila and Suburbs	-	° Aviles-Sampaloc P.S. ° Quiapo P.S.	° Valencia P.S. ° Binondo P.S.	° Vitas* ° Balut* ° Northeast Pasig
South Manila and Suburbs	° Makati P.S.	° Libertad P.S. ° Tripa de Gallina	° Sta. Clara P.S. ° Pandacan P.S. ° Paco P.S.	° San Andres* ° Balete

[Note]

Category I : Drainage districts where the pump capacity is almost equal to that for 10-year return period.

Category II : Drainage districts where it is between those of 10-year and 5-year return period.

Category III: Drainage districts where it is less than 5-year return period.

Category IV : Drainage districts where pump stations need to be constructed.

* Indicates the drainage district where pump station will be constructed soon.

Table 5-4-1(1/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANILA & SUBURBS : NORTH 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond	
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
NM-1	1681.0	1-a	304.0	5.8				1-h	68.0	15.0	I-OCR	1500			
								1-i	140.0	30.0	I-OCR	1750			
								1-j	208.0	39.0	I-OCR	900			
Sub-total	1681.0			5.8							I-OCR	4150			
NM-3	906.0	3-a	72.0	5.5	3-a	70.0	19.0	3-b	277.0	59.0	I-OCR	850			
		3-b*	277.0	7.5				3-c*	139.0	15.0	C-BC	1150			
		3-c	345.0	4.2				3-d*	65.0	10.0	C-BC	600			
		3-d*	212.0	1.7				3-e	275.0	48.0	I-OCR	650			
								3-f	70.0	19.0	I-OCR	1200			
								3-g*	74.0	9.0	C-BC	550			
Sub-total	906.0		906.0	18.9		70.0			I-OCR	2700.0	C-BC	2300			
NM-4	69.0		69.0					4-a	37.0	11.0	C-BC	750			
								4-b	32.0	11.0	C-BC	400			
Sub-total	69.0		69.0								C-BC	1150			
NM-5	168.0							5-a	45.0	12.0	C-BC	600			
								5-b*	59.0	5.0	C-BC	1100			
								5-c	32.0	9.0	C-BC	600			
Sub-total	168.0										C-BC	2300			
Total	2824.0		975.0	24.7		70.0			I-OCR	6850.0	C-BC	5750			
											Total	12600			

Note: *in pump station indicates the extention of the existing pump station.
*in drainage channels indicates the extention of the existing box culvert (drainage main)
I-OCR:Open channel improvement with rectangular section
C-BC:Box culvert construction.

Table 5-4-1(2/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANILA & SUBURBS : SOUTH 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond	
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
SM-1	599.0	1-a*	150.0	4.3				1-d	49.0	12.0	I-OCR	950			
								1-e	150.0	32.0	I-OCR	1350			
Sub-total	599.0		150.0	4.3							I-OCR	2300			
SM-2	706.0	2-a*	104.0	2.7	2-a			2-e	104.0	26.0	I-OCR	950			
		2-b*	178.0	2.3				2-f	62.0	13.0	I-OCR	850			
		2-c	85.0	5.3				2-g	115.0	28.0	I-OCR	1000			
Sub-total	706.0		367.0	10.3							I-OCR	2800			
SM-3	141.0														
Sub-total	141.0														
SM-4	388.0														
Sub-total	388.0														
SM-5	2480.0	5-a*	755.0	6.2	5-a			5-b	284.0	45.0	I-OCR	1000			
		5-b*	1725.0	2.8	5-b			5-f	509.0	65.0	I-OCR	1050			
								5-h	1725.0	132.0	I-OCR	600			
Sub-total	2480.0		2480.0	9.0							I-OCR	2650			
	4314.0		2997.0	23.6							I-OCR	7750			
											Total	7750			

Note: *in pump station indicates the extention of the existing pump station.
*in drainage channels indicates the extention of the existing box culvert (drainage main)
I-OCR:Open channel improvement with rectangular section

Table 5-4-1(3/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MALABON - NAVOTAS 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
MT-4-1	411.0	4-1-a	411.0	15.9	4-1-a			4-1-a	227.0	38.0	C-OCT	2000			
					4-1-b	411.0	68.0	4-1-b	184.0	33.0	I-OCT	1600			
Sub-total	411.0		411.0	15.9					C-OCT	2000	I-OCT	1600			
MT-4-2	218.0				4-2-a	218.0	39.0	4-2-a	218.0	39.0	C-OCT	1700			
Sub-total	218.0										C-OCT	1700			
MA-1-A	113.0	1-a	113.0	3.6	1-a	113.0	15.0	1-a	113.0	15.0	I-OCT	600			
								1-b	113.0	15.0	C-OCT	1000			
Sub-total	113.0		113.0	3.6					C-OCT	1000	I-OCT	600			
MA-1-B	164.0	2-a	164.0	4.3	2-a	164.0	21.0								
MA-2-A					2-b										
Sub-total	164.0		164.0	4.3											
MA-2-B	614.0	3-a	614.0	26.5	3-a										
MA-3					3-b										
MA-4					3-c										
MA-5					3-d										
					3-e										
Sub-total	614.0		614.0	26.5											
MA-6	134.0	6-a	134.0	7.4	6-a	134.0	28.0	6-a	134.0	28.0	I-OCT	700			
								6-b	34.0	7.0	C-OCT	400			
								6-c	34.0	7.0	C-OCT	500			
Sub-total	134.0		134.0	7.4					C-OCT	900	I-OCT	700			
MA-7	240.0	7-a	240.0	12.1	7-a	240.0	41.0	7-a	240.0	41.0	I-OCT	2200			
Sub-total	240.0		240.0	12.1							I-OCT	2200			
MA-8	376.0				8-a	160.0	27.0								
Sub-total	376.0														
MA-9	30.0	9-a	30.0	2.2	9-a	30.0									
Sub-total	30.0		30.0	2.2											
MA-10	91.0														
Sub-total	91.0														
MA-11	69.0	11-a	69.0	4.1	11-a	69.0	14.0	11-a	69.0	14.0	C-BC	800			
Sub-total	69.0		69.0	4.1							C-BC	800			
MA-12	32.0														
Sub-total	32.0														
	2492.0		1775.0	76.1					C-OCT=	5600	I-OCT=	5100			
									C-BC=	800	Total=	11500			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:Box culvert construction.

Table 5-4-1(4/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MALABON - NAVOTAS 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
MT-4-1	411.0	4-1-a	411.0	11.7	4-1-a			4-1-a	227.0	34.0	C-OCT	2000			
					4-1-b	411.0	61.0	4-1-b	184.0	30.0	I-OCT	1600			
Sub-total	411.0		411.0	11.7					C-OCT	2000	I-OCT	1600			
MT-4-2	218.0				4-2-a	218.0	35.0	4-2-a	218.0	35.0	C-OCT	1700			
Sub-total	218.0										C-OCT	1700			
MA-1-A	113.0	1-a	113.0	3.0	1-a	113.0	13.0	1-a	113.0	13.0	I-OCT	600			
								1-b	113.0	13.0	C-OCT	1000			
Sub-total	113.0		113.0	3.0					C-OCT	1000	I-OCT	600			
MA-1-B	164.0	2-a	164.0	4.0	2-a	164.0	19.0								
MA-2-A					2-b										
Sub-total	164.0		164.0	4.0											
MA-2-B	614.0	3-a	614.0	22.0	3-a										
MA-3					3-b										
MA-4					3-c										
MA-5					3-d										
					3-e										
Sub-total	614.0		614.0	22.0											
MA-6	134.0	6-a	134.0	6.0	6-a	134.0	2.5	6-a	134.0	25.0	I-OCT	700			
								6-b	34.0	7.0	C-OCT	400			
								6-c	34.0	7.0	C-OCT	500			
Sub-total	134.0		134.0	6.0					C-OCT	900	I-OCT	700			
MA-7	240.0	7-a	240.0	9.4	7-a	240.0	37.0	7-a	240.0	37.0	I-OCT	2200			
Sub-total	240.0		240.0	9.4							I-OCT	2200			
MA-8	376.0				8-a	160.0	27.0								
Sub-total	376.0														
MA-9	30.0	9-a	30.0	2.0	9-a	30.0									
Sub-total	30.0		30.0	2.0											
MA-10	91.0														
Sub-total	91.0														
MA-11	69.0	11-a	69.0	4.0	11-a	69.0	12.0	11-a	69.0	12.0	C-BC	800			
Sub-total	69.0		69.0	4.0							C-BC	800			
MA-12	32.0														
Sub-total	32.0														
	2492.0		1775.0	62.1					C-OCT=	5600	I-OCT=	5100			
									C-BC=	800	Total=	11500			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:Box culvert construction.

Table 5-4-1(5/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MALABON - NAVOTAS 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
MT-4-1	411.0	4-1-a	411.0	7.8	4-1-a			4-1-a	227.0	30.0	C-OCT	2000			
					4-1-b	411.0	55.0	4-1-b	184.0	27.0	I-OCT	1600			
Sub-total	411.0		411.0	7.8					C-OCT	2000	I-OCT	1600			
MT-4-2	218.0				4-2-a	218.0	31.0	4-2-a	218.0	31.0	C-OCT	1700			
Sub-total	218.0					218.0					C-OCT	1700			
MA-1-A	113.0	1-a	113.0	2.0	1-a	113.0	12.0	1-a	113.0	12.0	I-OCT	600			
								1-b	113.0	12.0	C-OCT	1000			
Sub-total	113.0		113.0	2.0					C-OCT	1000	I-OCT	600			
MA-1-B MA-2-A	164.0	2-a	164.0	2.3	2-a 2-b	164.0	17.0								
Sub-total	164.0		164.0	2.3											
MA-2-B MA-3 MA-4 MA-5	614.0	3-a	614.0	15.8	3-a 3-b 3-c 3-d 3-e										
Sub-total	614.0		614.0	15.8											
MA-6	134.0	6-a	134.0	4.6	6-a			6-a	134.0	23.0	I-OCT	700			
								6-b	34.0	6.0	C-OCT	400			
								6-c	34.0	6.0	C-OCT	500			
Sub-total	134.0		134.0	4.6					C-OCT	900	I-OCT	700			
MA-7	240.0	7-a	240.0	7.2	7-a	240.0	33.0	7-a	240.0	33.0	I-OCT	2200			
Sub-total	240.0		240.0	7.2							I-OCT	2200			
MA-8	376.0				8-a	160.0	27.0								
Sub-total	376.0														
MA-9	30.0	9-a	30.0	1.0	9-a	30.0									
Sub-total	30.0		30.0	1.0											
MA-10	91.0														
Sub-total	91.0														
MA-11	69.0	11-a	69.0	2.7	11-a	69.0	11.0	11-a	69.0	11.0	C-BC	800			
Sub-total	69.0		69.0	2.7							C-BC	800			
MA-12	32.0														
Sub-total	32.0														
	2492.0		1775.0	43.4					C-OCT=	5600	I-OCT=	5100			
									C-BC=	800	Total=	11500			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:Box culvert construction.

Table 5-4-1(6/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MALABON - NAVOTAS 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
MT-4-1	411.0	4-1-a	411.0	4.8	4-1-a			4-1-a	227.0	27.0	C-OCT	2000			
					4-1-b	411.0	49.0	4-1-b	184.0	24.0	I-OCT	1600			
Sub-total	411.0		411.0	4.8					C-OCT	2000	I-OCT	1600			
MT-4-2	218.0				4-2-a	218.0	28.0	4-2-a	218.0	28.0	C-OCT	1700			
Sub-total	218.0										C-OCT	1700			
MA-1-A	113.0	1-a	113.0	1.4	1-a	113.0	11.0	1-a		11.0	I-OCT	600			
								1-b		11.0	C-OCT	1000			
Sub-total	113.0		113.0	1.4					C-OCT	1000	I-OCT	600			
MA-1-B	164.0	2-a	164.0	1.6	2-a	164.0	16.0								
MA-2-A					2-b										
Sub-total	164.0		164.0	1.6											
MA-2-B	614.0	3-a	614.0	11.5	3-a										
MA-3					3-b										
MA-4					3-c										
MA-5					3-d										
					3-e										
Sub-total	614.0		614.0	11.5											
MA-6	134.0	6-a	134.0	3.4	6-a	134.0	21.0	6-a	134.0	21.0	I-OCT	700			
								6-b	34.0	6.0	C-OCT	400			
								6-c	34.0	6.0	C-OCT	500			
Sub-total	134.0		134.0	3.4					C-OCT	900	I-OCT	700			
MA-7	240.0	7-a	240.0	5.2	7-a	240.0	30.0	7-a	240.0	30.0	I-OCT	2200			
Sub-total	240.0		240.0	5.2							I-OCT	2200			
MA-8	376.0				8-a	160.0	27.0								
Sub-total	376.0														
MA-9	30.0	9-a	30.0	0.8	9-a	30.0									
Sub-total	30.0		30.0	0.8											
MA-10	91.0														
Sub-total	91.0														
MA-11	69.0	11-a	69.0	2.2	11-a	69.0	10.0	11-a	69.0	10.0	C-BC	800			
Sub-total	69.0		69.0	2.2							C-BC	800			
MA-12	32.0														
Sub-total	32.0														
	2492.0		1775.0	30.9					C-OCT=	5600	I-OCT=	5100			
									C-BC=	800	Total=	11500			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:Box culvert construction.

Table 5-4-1(7/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(EAST OF MANGAHAN 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station		Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
EM-1	166.6	1-a	166.6	10.0	1-a	166.6	28.0	1-a	83.6	14.0	C-OCT	1100			
								1-b	83.0	17.0	C-OCT	700			
Sub-total	166.6		166.6	10.0							C-OCT	1800			
EM-2	241.7	2-a	241.7	13.0	2-a	241.7	29.0	2-a-1	11.0	11.0	C-OCT	750			
								2-a-2	15.0	15.0	C-OCT	550			
								2-a-3	20.0	20.0	C-OCT	700			
								2-b	74.3	13.0	C-OCT	800			
Sub-total	241.7		241.7	13.0							C-OCT	2800			
EM-3	272.2	3-a	272.2	5.1	3-a	272.2	17.0	3-a-1	85.2	6.0	C-OCT	600	3-a	21300	7100
								3-a-2	150.8	10.0	C-OCT	500			
								3-a-3	191.7	12.0	C-OCT	900			
								3-b	80.5	8.0	C-OCT	700			
Sub-total	272.2		272.2	5.1							C-OCT	2700		21300	7100
EM-4	195.0	4-a	195.0	3.0	4-a	195.0	18.0	4-a-1	95.7	9.0	I-OCT	350	4-a	39000	13000
								4-a-2	141.5	13.0	I-OCT	350			
								4-a-3	195.0	18.0	I-OCT	400			
Sub-total	195.0		195.0	3.0							I-OCT	1100		39000	13000
Total	875.5		875.5	31.1							C-OCT	7300.0		60300	20100
											I-OCT	1100.0			

Note: C-OCT:open channel construction with trapezoidal section.
I-OCT:open channel improvement with trapezoidal section.

Table 5-4-1(8/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(EAST OF MANGAHAN 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station		Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
EM-1	166.6	1-a	166.6	9.0	1-a	166.6	27.5	1-a	83.6	13.0	C-OCT	1100			
								1-b	83.0	15.0	C-OCT	700			
Sub-total	166.6		166.6	9.0							C-OCT	1800			
EM-2	241.7	2-a	241.7	11.0	2-a	241.7	28.1	2-a-1	11.0	10.0	C-OCT	750			
								2-a-2	15.0	14.0	C-OCT	550			
								2-a-3	20.0	18.0	C-OCT	700			
								2-b	74.3	11.0	C-OCT	800			
Sub-total	241.7		241.7	11.0							C-OCT	2800			
EM-3	272.2	3-a	272.2	5.0	3-a	272.2	16.5	3-a-1	85.2	5.0	C-OCT	600	3-a	18000	6000
								3-a-2	150.8	9.0	C-OCT	500			
								3-a-3	191.7	11.0	C-OCT	900			
								3-b	80.5	7.0	C-OCT	700			
Sub-total	272.2		272.2	5.0							C-OCT	2700		18000	6000
EM-4	195.0	4-a	195.0	2.0	4-a	195.0	17.9	4-a-1	95.7	9.0	I-OCT	350	4-a	33000	11000
								4-a-2	141.5	13.0	I-OCT	350			
								4-a-3	195.0	17.0	I-OCT	400			
Sub-total	195.0		195.0	2.0							I-OCT	1100		33000	11000
Total	875.5		875.5	27.0							C-OCT	7300.0		51000	17000
											I-OCT	1100.0			

Note: C-OCT:open channel construction with trapezoidal section.
I-OCT:open channel improvement with trapezoidal section.

Table 5-4-1(9/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(EAST OF MANGAHAN 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
EM-1	166.6	1-a	166.6	6.6	1-a	166.6	23.0	1-a	83.6	11.0	C-OCT	1100			
								1-b	83.0	13.0	C-OCT	700			
Sub-total	166.6		166.6	6.6							C-OCT	1800			
EM-2	241.7	2-a	241.7	9.0	2-a	241.7	23.0	2-a-1	11.0	9.0	C-OCT	750			
								2-a-2	15.0	12.0	C-OCT	550			
								2-a-3	20.0	16.0	C-OCT	700			
								2-b	74.3	10.0	C-OCT	800			
Sub-total	241.7		241.7	9.0							C-OCT	2800			
EM-3	272.2	3-a	272.2	3.5	3-a	272.2	14.0	3-a-1	85.2	5.0	C-OCT	600	3-a	17100	5700
								3-a-2	150.8	8.0	C-OCT	500			
								3-a-3	191.7	10.0	C-OCT	900			
								3-b	80.5	6.0	C-OCT	700			
Sub-total	272.2		272.2	3.5							C-OCT	2700		17100	5700
EM-4	195.0	4-a	195.0	1.5	4-a	195.0	15.0	4-a-1	95.7	8.0	I-OCT	350	4-a	30600	10200
								4-a-2	141.5	11.0	I-OCT	350			
								4-a-3	195.0	15.0	I-OCT	400			
Sub-total	195.0		195.0	1.5							I-OCT	1100		30600	10200
Total	875.5		875.5	20.6							C-OCT	7300.0		47700	15900
											I-OCT	1100.0			

Note: C-OCT:open channel construction with trapezoidal section.
I-OCT:open channel improvement with trapezoidal section.

Table 5-4-1(10/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(EAST OF MANGAHAN 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
EM-1	166.6	1-a	166.6	5.3	1-a	166.6	21.0	1-a	83.6	10.0	C-OCT	1100			
								1-b	83.0	12.0	C-OCT	700			
Sub-total	166.6		166.6	5.3							C-OCT	1800			
EM-2	241.7	2-a	241.7	7.3	2-a	241.7	21.0	2-a-1	11.0	8.0	C-OCT	750			
								2-a-2	15.0	11.0	C-OCT	550			
								2-a-3	20.0	15.0	C-OCT	700			
								2-b	74.3	9.0	C-OCT	800			
Sub-total	241.7		241.7	7.3							C-OCT	2800			
EM-3	272.2	3-a	272.2	2.7	3-a	272.2	12.0	3-a-1	85.2	4.0	C-OCT	600	3-a	16500	5500
								3-a-2	150.8	7.0	C-OCT	500			
								3-a-3	191.7	9.0	C-OCT	900			
								3-b	80.5	6.0	C-OCT	700			
Sub-total	272.2		272.2	2.7							C-OCT	2700		16500	5500
EM-4	195.0	4-a	195.0	1.0	4-a	195.0	14.0	4-a-1	95.7	7.0	I-OCT	350	4-a	28800	9600
								4-a-2	141.5	10.0	I-OCT	350			
								4-a-3	195.0	14.0	I-OCT	400			
Sub-total	195.0		195.0	1.0							I-OCT	1100		28800	9600
Total	875.5		875.5	16.3							C-OCT	7300.0		45300	15100
											I-OCT	1100.0			

Note: C-OCT:open channel construction with trapezoidal section.
I-OCT:open channel improvement with trapezoidal section.

Table 5-4-1(11/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES

(WEST OF MANGAHAN 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
WM-1	912.1	1-a	912.1	53.8	1-a	912.1	87.0	1-a-1	71.1	10.0	C-OCT	500			
								1-a-2	107.4	14.0	C-OCT	250			
								1-a-3	107.4	14.0	I-OCT	250			
								1-a-4	157.7	21.0	I-OCT	700			
								1-a-5	237.4	31.0	I-OCT	1000			
								1-b-1	638.6	61.0	I-OCT	900			
								1-b-2	744.4	71.0	I-OCT	1650			
								1-c-1	92.0	18.0	I-OCT	500			
								1-c-2	114.3	22.0	I-OCT	450			
								1-d-1	85.4	15.0	I-OCT	600			
								1-d-2	131.5	22.0	I-OCT	800			
								1-e	268.0	39.0	I-OCT	600			
								1-f-1	81.5	14.0	C-OCT	450			
								1-f-2	32.8	22.0	C-OCT	450			
								1-f-3	167.7	27.0	C-OCT	600			
	912.1		912.1	53.8		912.1			I-OCT	7450	C-OCT	2250			
									C-BC	0	Total	9700			
WM-2	514.4	2-a	514.4	13.4	2-a	-	-	2-a-1	82.7	10.0	I-OCT	900	2-a	156000	52000
					2-b	514.4	49.0	2-a-2	162.2	19.0	I-OCT	1000			
								2-b	307.0	30.0	I-OCT	1000			
								2-c	55.8	9.0	I-OCT	850			
								2-d-1	99.5	11.0	C-OCT	500			
								2-d-2	151.4	17.0	C-OCT	550			
								2-d-3	207.4	23.0	C-OCT	1100			
	514.4		514.4	13.4					I-OCT	3750.0	C-OCT	2150		156000	52000
									C-BC	0	Total	5900			
WM-3	683.2	3-a	683.2	23.2	3-a	-	-	3-a-1	80.4	11.0	I-OCT	750	3-a	209100	69700
					3-b	-	-	3-a-2	120.0	17.0	I-OCT	1000			
					3-c	683.2	65.0	3-a-3	147.4	20.0	I-OCT	300			
								3-b	249.8	32.0	I-OCT	300			
								3-c	456.5	44.0	I-OCT	2350			
								3-d-1	76.1	14.0	I-OCT	300			
								3-d-2	96.0	17.0	I-OCT	800			
								3-e-1	88.8	15.0	C-OCT	600			
								3-e-2	124.4	21.0	I-OCT	550			
								3-f-1	89.8	14.0	C-OCT	400			
								3-f-2	110.4	17.0	C-OCT	550			
								3-f-3	140.2	22.0	C-OCT	550			
								3-g-1	57.2	11.0	C-OCT	400			
								3-g-2	86.5	16.0	C-OCT	600			
	683.2		683.2	23.2					I-OCT	6350.0	C-OCT	3100		209100	69700
									C-BC	0	Total	9450			
WM-4	1427.6	4-a	1427.6	50.0	4-a	-	-	4-a-1	51.2	5.0	I-OCT	350	4-a	330900	110300
					4-b	-	-	4-a-2	100.5	10.0	I-OCT	900			
					4-c	1427.6	102.0	4-a-3	146.1	14.0	I-OCT	800			
								4-a-4	177.2	17.0	I-OCT	500			
								4-a-5	241.7	24.0	I-OCT	1300			
								4-b	346.7	32.0	I-OCT	400			
								4-c	927.3	75.0	I-OCT	1450			
								4-d	1233.7	92.0	I-OCT	1000			
								4-e	1427.6	102.0	I-OCT	800			
								4-f-1	73.5	13.0	C-OCT	400			
								4-f-2	92.8	16.0	C-OCT	600			
								4-g-1	102.1	17.0	I-OCT	500			
								4-g-2	114.5	19.0	I-OCT	500			
								4-h-1	80.7	13.0	C-BC	600			
								4-h-2	136.3	21.0	C-BC	600			
								4-i-1	136.3	21.0	C-BC	250			
								4-i-2	164.2	21.0	I-OCT	200			
								4-i-3	224.4	28.0	I-OCT	1350			
								4-i-4	272.3	34.0	I-OCT	500			
								4-j	441.9	47.0	I-OCT	900			
								4-k	128.4	23.0	I-OCT	800			
								4-l-1	97.1	19.0	I-OCT	250			
								4-l-2	139.8	28.0	I-OCT	350			
								4-m	62.1	12.0	C-OCT	600			
								4-n	92.2	19.0	C-OCT	550			
								4-o-1	67.4	8.0	I-OCT	900			
								4-o-2	126.2	14.0	I-OCT	1900			
Sub-total	1427.6		1427.6	50.0					I-OCT	15650	C-OCT	2150		330900	110300
									C-BC	1450	Total	19250			
WM-5	277.3	5-a	277.3	7.2	5-a	277.3	40.0	a-1	78.3	14.0	C-OCT	400	5-a	79500	26500
								a-2	101.9	19.0	C-OCT	400			
								b-1	101.5	17.0	I-OCT	550			
								b-2	142.4	23.0	I-OCT	550			
								c	277.3	40.0	I-OCT	350			
Sub-total	277.3		277.3	7.2					I-OCT	900	C-OCT	1350		79500	26500
									C-BC	0	Total	2250			
Total	3814.6		3814.6	147.6					I-OCT	34100	C-OCT	11000		775500	258500
									C-BC	1450	Total	46550			

Note: I-OCT:open channel improvement with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(12/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(WEST OF MANGAHAN 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A (ha)	Qp (m3/s)	Code	D.A (ha)	Qp (m3/s)	Code	D.A (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
WM-1	912.1	1-a	912.1	46.0	1-a	912.1	78.0	1-a-1	71.1	9.0	C-OCT	500			
								1-a-2	107.4	13.0	C-OCT	250			
								1-a-3	107.4	13.0	I-OCT	250			
								1-a-4	157.7	18.0	I-OCT	700			
								1-a-5	237.4	27.0	I-OCT	1000			
								1-b-1	638.6	55.0	I-OCT	900			
								1-b-2	744.4	64.0	I-OCT	1650			
								1-c-1	92.0	17.0	I-OCT	500			
								1-c-2	114.3	20.0	I-OCT	450			
								1-d-1	85.4	13.0	I-OCT	600			
								1-d-2	131.5	20.0	I-OCT	800			
								1-e	268.0	35.0	I-OCT	600			
								1-f-1	81.5	13.0	C-OCT	450			
								1-f-2	32.8	20.0	C-OCT	450			
								1-f-3	167.7	25.0	C-OCT	600			
	912.1		912.1	46.0		912.1				I-OCT	7450	C-OCT	2250			
										C-BC	0	Total	9700			
WM-2	514.4	2-a	514.4	12.0	2-a	-	-	2-a-1	82.7	9.0	I-OCT	900	2-a	138000	46000
					2-b	514.4	44.0	2-a-2	162.2	17.0	I-OCT	1000			
								2-b	307.0	27.0	I-OCT	1000			
								2-c	55.8	8.0	I-OCT	850			
								2-d-1	99.5	11.0	C-OCT	500			
								2-d-2	151.4	16.0	C-OCT	550			
								2-d-3	207.4	21.0	C-OCT	1100			
	514.4		514.4	12.0						I-OCT	3750.0	C-OCT	2150		138000	46000
										C-BC	0	Total	5900			
WM-3	683.2	3-a	683.2	20.0	3-a	-	-	3-a-1	80.4	10.0	I-OCT	750	3-a	183000	61000
					3-b	-	-	3-a-2	120.0	15.0	I-OCT	1000			
					3-c	683.2	58.0	3-a-3	147.4	18.0	I-OCT	300			
								3-b	249.8	29.0	I-OCT	300			
								3-c	456.5	39.0	I-OCT	2350			
								3-d-1	76.1	12.0	I-OCT	300			
								3-d-2	96.0	15.0	I-OCT	800			
								3-e-1	88.8	14.0	C-OCT	600			
								3-e-2	124.4	19.0	I-OCT	550			
								3-f-1	89.8	13.0	C-OCT	400			
								3-f-2	110.4	16.0	C-OCT	550			
								3-f-3	140.2	20.0	C-OCT	550			
								3-g-1	57.2	10.0	C-OCT	400			
								3-g-2	86.5	14.0	C-OCT	600			
	683.2		683.2	20.0						I-OCT	6350.0	C-OCT	3100		183000	61000
										C-BC	0	Total	9450			
WM-4	1427.6	4-a	1427.6	45.0	4-a	-	-	4-a-1	51.2	5.0	I-OCT	350	4-a	258000	86000
					4-b	-	-	4-a-2	100.5	9.0	I-OCT	900			
					4-c	1427.6	91.0	4-a-3	146.1	13.0	I-OCT	800			
								4-a-4	177.2	16.0	I-OCT	500			
								4-a-5	241.7	21.0	I-OCT	1300			
								4-b	346.7	29.0	I-OCT	400			
								4-c	927.3	67.0	I-OCT	1450			
								4-d	1233.7	83.0	I-OCT	1000			
								4-e	1427.6	91.0	I-OCT	800			
								4-f-1	73.5	12.0	C-OCT	400			
								4-f-2	92.8	14.0	C-OCT	600			
								4-g-1	102.1	16.0	I-OCT	500			
								4-g-2	114.5	17.0	I-OCT	500			
								4-h-1	80.7	12.0	C-BC	600			
								4-h-2	136.3	19.0	C-BC	600			
								4-i-1	136.3	19.0	C-BC	250			
								4-i-2	164.2	19.0	I-OCT	200			
								4-i-3	224.4	25.0	I-OCT	1350			
								4-i-4	272.3	30.0	I-OCT	500			
								4-j	441.9	42.0	I-OCT	900			
								4-k	128.4	21.0	I-OCT	800			
								4-l-1	97.1	18.0	I-OCT	250			
								4-l-2	139.8	25.0	I-OCT	350			
								4-m	62.1	11.0	C-OCT	600			
								4-n	92.2	17.0	C-OCT	550			
								4-o-1	67.4	7.0	I-OCT	900			
								4-o-2	126.2	13.0	I-OCT	1900			
Sub-total	1427.6		1427.6	45.0						I-OCT	15650	C-OCT	2150		258000	86000
										C-BC	1450	Total	19250			
WM-5	277.3	5-a	277.3	6.0	5-a	277.3	36.0	a-1	78.3	14.0	C-OCT	400	5-a	63000	21000
								a-2	101.9	17.0	C-OCT	400			
								b-1	101.5	15.0	C-OCT	550			
								b-2	142.4	21.0	I-OCT	550			
								c	277.3	36.0	I-OCT	350			
Sub-total	277.3		277.3	6.0						I-OCT	900	C-OCT	1350		63000	21000
										C-BC	0	Total	2250			
Total	3814.6		3814.6	129.0						I-OCT	34100	C-OCT	11000		642000	214000
										C-BC	1450	Total	46550			

Note: I-OCT:open channel improvement with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(13/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES

(WEST OF MANGAHAN 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
WM-1	912.1	1-a	912.1	38.5	1-a	912.1	70.0	1-a-1	71.1	8.0	C-OCT	500			
								1-a-2	107.4	11.0	C-OCT	250			
								1-a-3	107.4	11.0	I-OCT	250			
								1-a-4	157.7	17.0	I-OCT	700			
								1-a-5	237.4	25.0	I-OCT	1000			
								1-b-1	638.6	49.0	I-OCT	900			
								1-b-2	744.4	57.0	I-OCT	1650			
								1-c-1	92.0	15.0	I-OCT	500			
								1-c-2	114.3	18.0	I-OCT	450			
								1-d-1	85.4	12.0	I-OCT	600			
								1-d-2	131.5	18.0	I-OCT	800			
								1-e	268.0	31.0	I-OCT	600			
								1-f-1	81.5	11.0	C-OCT	450			
								1-f-2	32.8	18.0	C-OCT	450			
								1-f-3	167.7	22.0	C-OCT	600			
	912.1		912.1	38.5		912.1			I-OCT	7450	C-OCT	2250			
									C-BC	0	Total	9700			
WM-2	514.4	2-a	514.4	10.3	2-a	-	-	2-a-1	82.7	8.0	I-OCT	900	2-a	110100	36700
					2-b	514.4	40.0	2-a-2	162.2	15.0	I-OCT	1000			
								2-b	307.0	24.0	I-OCT	1000			
								2-c	55.8	7.0	I-OCT	850			
								2-d-1	99.5	9.0	C-OCT	500			
								2-d-2	151.4	14.0	C-OCT	550			
								2-d-3	207.4	18.0	C-OCT	1100			
	514.4		514.4	10.3					I-OCT	3750.0	C-OCT	2150		110100	36700
									C-BC	0	Total	5900			
WM-3	683.2	3-a	683.2	17.1	3-a	-	-	3-a-1	80.4	9.0	I-OCT	750	3-a	145200	48400
					3-b	-	-	3-a-2	120.0	14.0	I-OCT	1000			
					3-c	683.2	52.0	3-a-3	147.4	16.0	I-OCT	300			
								3-b	249.8	26.0	I-OCT	300			
								3-c	456.5	35.0	I-OCT	2350			
								3-d-1	76.1	11.0	I-OCT	300			
								3-d-2	96.0	14.0	I-OCT	800			
								3-e-1	88.8	13.0	C-OCT	600			
								3-e-2	124.4	17.0	I-OCT	550			
								3-f-1	89.8	12.0	C-OCT	400			
								3-f-2	110.4	14.0	C-OCT	550			
								3-f-3	140.2	18.0	C-OCT	550			
								3-g-1	57.2	9.0	C-OCT	400			
								3-g-2	86.5	13.0	C-OCT	600			
	683.2		683.2	17.1					I-OCT	6350.0	C-OCT	3100		145200	48400
									C-BC	0	Total	9450			
WM-4	1427.6	4-a	1427.6	40.0	4-a	-	-	4-a-1	51.2	4.0	I-OCT	350	4-a	188100	62700
					4-b	-	-	4-a-2	100.5	8.0	I-OCT	900			
					4-c	1427.6	82.0	4-a-3	146.1	12.0	I-OCT	800			
								4-a-4	177.2	14.0	I-OCT	500			
								4-a-5	241.7	19.0	I-OCT	1300			
								4-b	346.7	26.0	I-OCT	400			
								4-c	927.3	60.0	I-OCT	1450			
								4-d	1233.7	74.0	I-OCT	1000			
								4-e	1427.6	82.0	I-OCT	800			
								4-f-1	73.5	10.0	C-OCT	400			
								4-f-2	92.8	13.0	C-OCT	600			
								4-g-1	102.1	14.0	I-OCT	500			
								4-g-2	114.5	16.0	I-OCT	500			
								4-h-1	80.7	11.0	C-BC	600			
								4-h-2	136.3	17.0	C-BC	600			
								4-i-1	136.3	17.0	C-BC	250			
								4-i-2	164.2	17.0	I-OCT	200			
								4-i-3	224.4	23.0	I-OCT	1350			
								4-i-4	272.3	27.0	I-OCT	500			
								4-j	441.9	38.0	I-OCT	900			
								4-k	128.4	19.0	I-OCT	800			
								4-l-1	97.1	16.0	I-OCT	250			
								4-l-2	139.8	22.0	I-OCT	350			
								4-m	62.1	10.0	C-OCT	600			
								4-n	92.2	15.0	C-OCT	550			
								4-o-1	67.4	6.0	I-OCT	900			
								4-o-2	126.2	12.0	I-OCT	1900			
Sub-total	1427.6		1427.6	40.0					I-OCT	15650	C-OCT	2150		188100	62700
									C-BC	1450	Total	19250			
WM-5	277.3	5-a	277.3	4.6	5-a	277.3	32.0	a-1	78.3	12.0	C-OCT	400	5-a	57900	19300
								a-2	101.9	15.0	C-OCT	400			
								b-1	101.5	13.0	C-OCT	550			
								b-2	142.4	19.0	I-OCT	550			
								c	277.3	32.0	I-OCT	350			
Sub-total	277.3		277.3	4.6					I-OCT	900	C-OCT	1350		57900	19300
									C-BC	0	Total	2250			
Total	3814.6		3814.6	110.5					I-OCT	34100	C-OCT	11000		501300	167100
									C-BC	1450	Total	46550			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(14/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(WEST OF MANGAHAN 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
WM-1	912.1	1-a	912.1	32.0	1-a	912.1	62.0	1-a-1	71.1	7.0	C-OCT	500			
								1-a-2	107.4	10.0	C-OCT	250			
								1-a-3	107.4	10.0	I-OCT	250			
								1-a-4	157.7	15.0	I-OCT	700			
								1-a-5	237.4	22.0	I-OCT	1000			
								1-b-1	638.6	44.0	I-OCT	900			
								1-b-2	744.4	51.0	I-OCT	1650			
								1-c-1	92.0	13.0	I-OCT	500			
								1-c-2	114.3	16.0	I-OCT	450			
								1-d-1	85.4	11.0	I-OCT	600			
								1-d-2	131.5	16.0	I-OCT	800			
								1-e	268.0	28.0	I-OCT	600			
								1-f-1	81.5	10.0	C-OCT	450			
								1-f-2	32.8	16.0	C-OCT	450			
								1-f-3	167.7	20.0	C-OCT	600			
	912.1		912.1	32.0		912.1			I-OCT	7450	C-OCT	2250			
									C-BC	0	Total	9700			
WM-2	514.4	2-a	514.4	8.2	2-a	-	-	2-a-1	82.7	7.0	I-OCT	900	2-a	101100	33700
					2-b	514.4	36.0	2-a-2	162.2	14.0	I-OCT	1000			
								2-b	307.0	22.0	I-OCT	1000			
								2-c	55.8	7.0	I-OCT	850			
								2-d-1	99.5	8.0	C-OCT	500			
								2-d-2	151.4	12.0	C-OCT	550			
								2-d-3	207.4	17.0	C-OCT	1100			
	514.4		514.4	8.2					I-OCT	3750.0	C-OCT	2150		101100	33700
									C-BC	0	Total	5900			
WM-3	683.2	3-a	683.2	15.0	3-a	-	-	3-a-1	80.4	8.0	I-OCT	750	3-a	114000	38000
					3-b	-	-	3-a-2	120.0	12.0	I-OCT	1000			
					3-c	683.2	47.0	3-a-3	147.4	15.0	I-OCT	300			
								3-b	249.8	24.0	I-OCT	300			
								3-c	456.5	31.0	I-OCT	2350			
								3-d-1	76.1	10.0	I-OCT	300			
								3-d-2	96.0	12.0	I-OCT	800			
								3-e-1	88.8	11.0	C-OCT	600			
								3-e-2	124.4	16.0	I-OCT	550			
								3-f-1	89.8	10.0	C-OCT	400			
								3-f-2	110.4	13.0	C-OCT	550			
								3-f-3	140.2	16.0	C-OCT	550			
								3-g-1	57.2	8.0	C-OCT	400			
								3-g-2	86.5	12.0	C-OCT	600			
	683.2		683.2	15.0					I-OCT	6350.0	C-OCT	3100		114000	38000
									C-BC	0	Total	9450			
WM-4	1427.6	4-a	1427.6	34.3	4-a	-	-	4-a-1	51.2	4.0	I-OCT	350	4-a	156300	52100
					4-b	-	-	4-a-2	100.5	7.0	I-OCT	900			
					4-c	1427.6	72.0	4-a-3	146.1	11.0	I-OCT	800			
								4-a-4	177.2	13.0	I-OCT	500			
								4-a-5	241.7	17.0	I-OCT	1300			
								4-b	346.7	23.0	I-OCT	400			
								4-c	927.3	54.0	I-OCT	1450			
								4-d	1233.7	66.0	I-OCT	1000			
								4-e	1427.6	72.0	I-OCT	800			
								4-f-1	73.5	9.0	C-OCT	400			
								4-f-2	92.8	12.0	C-OCT	600			
								4-g-1	102.1	13.0	I-OCT	500			
								4-g-2	114.5	14.0	I-OCT	500			
								4-h-1	80.7	10.0	C-BC	600			
								4-h-2	136.3	16.0	C-BC	600			
								4-i-1	136.3	16.0	C-BC	250			
								4-i-2	164.2	16.0	I-OCT	200			
								4-i-3	224.4	20.0	I-OCT	1350			
								4-i-4	272.3	24.0	I-OCT	500			
								4-j	441.9	34.0	I-OCT	900			
								4-k	128.4	17.0	I-OCT	800			
								4-l-1	97.1	14.0	I-OCT	250			
								4-l-2	139.8	20.0	I-OCT	350			
								4-m	62.1	9.0	C-OCT	600			
								4-n	92.2	14.0	C-OCT	550			
								4-o-1	67.4	6.0	I-OCT	900			
								4-o-2	126.2	10.0	I-OCT	1900			
Sub-total	1427.6		1427.6	34.3					I-OCT	15650	C-OCT	2150		156300	52100
									C-BC	1450	Total	19250			
WM-5	277.3	5-a	277.3	3.3	5-a	277.3	29.0	a-1	78.3	11.0	C-OCT	400	5-a	53100	17700
								a-2	101.9	14.0	C-OCT	400			
								b-1	101.5	12.0	C-OCT	550			
								b-2	142.4	17.0	I-OCT	550			
								c	277.3	29.0	I-OCT	350			
Sub-total	277.3		277.3	3.3					I-OCT	900	C-OCT	1350		53100	17700
									C-BC	0	Total	2250			
Total	3814.6		3814.6	92.8					I-OCT	34100	C-OCT	11000		424500	141500
									C-BC	1450	Total	46550			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(15/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(SAN JUAN 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
SJ-5-1	283.0				5-1-a	283.0	44.0	5-1-a	283.0	44.0	C-BC	2050			
Sub-total	283.0					283.0					C-BC	2050			
SJ-5-2	31.0				5-2-b	31.0	7.0	5-2-a	31.0	7.0	C-BC	800			
Sub-total	31.0					31.0						800			
SJ-7-1	256.0	7-1-a	137.0	8.2	7-1-a	137.0	28.0	7-1-a	137.0	28.0	C-BC	1000			
		7-1-b	119.0	7.6	7-1-b	119.0	26.0	7-1-b	119.0	26.0	C-BC	800			
Sub-total	256.0		256.0	15.8		256.0						1800			
SJ-7-2	92.0	7-2-a	50.0	4.1	7-2-a	50.0	11.0	7-2-a	50.0	11.0	C-BC	800			
		7-2-b	42.0	3.9	7-2-b	42.0	11.0	7-2-b	42.0	11.0	C-BC	500			
Sub-total	92.0		92.0	8.0		92.0					C-BC	1300			
SJ-8-1	87.0	8-1-a	87.0	6.8	8-1-a	87.0	17.0	8-1-a	87.0	17.0	C-BC	1000			
Sub-total	87.0		87.0	6.8		87.0					C-BC	1000			
SJ-8-2	59.0	8-2-a	59.0	4.2	8-2-a	59.0	11.0	8-2-a	59.0	11.0	C-BC	1100			
Sub-total	59.0		59.0	4.2		59.0					C-BC	1100			
SJ-9-1	94.0				9-1-a	79.0	15.0	9-1-a	79.0	15.0	C-BC	1400			
					9-1-b	15.0									
Sub-total	94.0					94.0					C-BC	1400			
SJ-9-2	187.0	9-2-a	187.0	9.5	9-2-a	187.0	40.0	9-2-a	95.0	20.0	C-BC	1000			
								9-2-b	92.0	20.0	C-BC	1000			
Sub-total	187.0		187.0	9.5		187.0					C-BC	2000			
SJ-9-3	62.0	9-3-a	62.0	3.5	9-3-a	62.0	14.0	9-3-a	62.0	14.0	C-BC	850			
Sub-total	62.0		62.0	3.5		62.0					C-BC	850			
SJ-10	109.0	10-a	109.0	4.9	10-a	109.0	21.0	10-a	109.0	21.0	I-OCR	1300			
Sub-total	109.0		109.0	4.9		109.0					I-OCR	1300			
Total	1260.0		852.0	52.7		1260.0			I-OCR	1300	C-BC	12300			
											Total	13600			

Note: I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(16/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(SAN JUAN 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
SJ-5-1	283.0				5-1-a	283.0	40.0	5-1-a	283.0	40.0	C-BC	2050			
Sub-total	283.0					283.0					C-BC	2050			
SJ-5-2	31.0				5-2-b	31.0	6.0	5-2-a	31.0	6.0	C-BC	800			
Sub-total	31.0					31.0						800			
SJ-7-1	256.0	7-1-a	137.0	6.5	7-1-a	137.0	25.0	7-1-a	137.0	25.0	C-BC	1000			
		7-1-b	119.0	6.1	7-1-b	119.0	24.0	7-1-b	119.0	24.0	C-BC	800			
Sub-total	256.0		256.0	12.6		256.0						1800			
SJ-7-2	92.0	7-2-a	50.0	3.3	7-2-a	50.0	10.0	7-2-a	50.0	10.0	C-BC	800			
		7-2-b	42.0	3.1	7-2-b	42.0	10.0	7-2-b	42.0	10.0	C-BC	500			
Sub-total	92.0		92.0	6.4		92.0					C-BC	1300			
SJ-8-1	87.0	8-1-a	87.0	5.4	8-1-a	87.0	15.0	8-1-a	87.0	15.0	C-BC	1000			
Sub-total	87.0		87.0	5.4		87.0					C-BC	1000			
SJ-8-2	59.0	8-2-a	59.0	3.4	8-2-a	59.0	10.0	8-2-a	59.0	10.0	C-BC	1100			
Sub-total	59.0		59.0	3.4		59.0					C-BC	1100			
SJ-9-1	94.0				9-1-a	79.0	14.0	9-1-a	79.0	14.0	C-BC	1400			
					9-1-b	15.0									
Sub-total	94.0					94.0					C-BC	1400			
SJ-9-2	187.0	9-2-a	187.0	7.3	9-2-a	187.0	36.0	9-2-a	95.0	18.0	C-BC	1000			
								9-2-b	92.0	18.0	C-BC	1000			
Sub-total	187.0		187.0	7.3		187.0					C-BC	2000.0			
SJ-9-3	62.0	9-3-a	62.0	2.8	9-3-a	62.0	13.0	9-3-a	62.0	13.0	C-BC	850			
Sub-total	62.0		62.0	2.8		62.0					C-BC	850			
SJ-10	109.0	10-a	109.0	3.2	10-a	109.0	19.0	10-a	109.0	19.0	I-OCR	1300			
Sub-total	109.0		109.0	3.2		109.0					I-OCR	1300			
Total	1260.0		852.0	41.1		1260.0			I-OCR	1300	C-BC	12300			
											Total	13600			

Note: I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(17/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(SAN JUAN 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
SJ-5-1	283.0				5-1-a	283.0	36.0	5-1-a	283.0	36.0	C-BC	2050			
Sub-total	283.0					283.0					C-BC	2050			
SJ-5-2	31.0				5-2-b	31.0	6.0	5-2-a	31.0	6.0	C-BC	800			
Sub-total	31.0					31.0						800			
SJ-7-1	256.0	7-1-a	137.0	5.3	7-1-a	137.0	23.0	7-1-a	137.0	23.0	C-BC	1000			
		7-1-b	119.0	5.0	7-1-b	119.0	21.0	7-1-b	119.0	21.0	C-BC	800			
Sub-total	256.0		256.0	10.3		256.0						1800			
SJ-7-2	92.0	7-2-a	50.0	2.7	7-2-a	50.0	9.0	7-2-a	50.0	9.0	C-BC	800			
		7-2-b	42.0	2.6	7-2-b	42.0	9.0	7-2-b	42.0	9.0	C-BC	500			
Sub-total	92.0		92.0	5.3		92.0					C-BC	1300			
SJ-8-1	87.0	8-1-a	87.0	4.5	8-1-a	87.0	14.0	8-1-a	87.0	14.0	C-BC	1000			
Sub-total	87.0		87.0	4.5		87.0					C-BC	1000			
SJ-8-2	59.0	8-2-a	59.0	2.7	8-2-a	59.0	9.0	8-2-a	59.0	9.0	C-BC	1100			
Sub-total	59.0		59.0	2.7		59.0					C-BC	1100			
SJ-9-1	94.0				9-1-a	79.0	12.0	9-1-a	79.0	12.0	C-BC	1400			
					9-1-b	15.0									
Sub-total	94.0					94.0					C-BC	1400			
SJ-9-2	187.0	9-2-a	187.0	4.0	9-2-a	187.0	32.0	9-2-a	95.0	16.0	C-BC	1000			
								9-2-b	92.0	16.0	C-BC	1000			
Sub-total	187.0		187.0	4.0		187.0					C-BC	2000			
SJ-9-3	62.0	9-3-a	62.0	1.9	9-3-a	62.0	11.0	9-3-a	62.0	11.0	C-BC	850			
Sub-total	62.0		62.0	1.9		62.0					C-BC	850			
SJ-10	109.0	10-a	109.0	2.3	10-a	109.0	17.0	10-a	109.0	17.0	I-OCR	1300			
Sub-total	109.0		109.0	2.3		109.0					I-OCR	1300			
Total	1260.0		852.0	31.0		1260.0			I-OCR	1300	C-BC	12300			
											Total	13600			

Note: I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(18/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(SAN JUAN 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
SJ-5-1	283.0				5-1-a	283.0	32.0	5-1-a	283.0	32.0	C-BC	2050			
Sub-total	283.0					283.0					C-BC	2050			
SJ-5-2	31.0				5-2-b	31.0	5.0	5-2-a	31.0	5.0	C-BC	800			
Sub-total	31.0					31.0						800			
SJ-7-1	256.0	7-1-a	137.0	4.2	7-1-a	137.0	21.0	7-1-a	137.0	21.0	C-BC	1000			
		7-1-b	119.0	4.0	7-1-b	119.0	19.0	7-1-b	119.0	19.0	C-BC	800			
Sub-total	256.0		256.0	8.2		256.0						1800			
SJ-7-2	92.0	7-2-a	50.0	2.1	7-2-a	50.0	8.0	7-2-a	50.0	8.0	C-BC	800			
		7-2-b	42.0	2.1	7-2-b	42.0	8.0	7-2-b	42.0	8.0	C-BC	500			
Sub-total	92.0		92.0	4.2		92.0					C-BC	1300			
SJ-8-1	87.0	8-1-a	87.0	3.6	8-1-a	87.0	13.0	8-1-a	87.0	13.0	C-BC	1000			
Sub-total	87.0		87.0	3.6		87.0					C-BC	1000			
SJ-8-2	59.0	8-2-a	59.0	2.2	8-2-a	59.0	8.0	8-2-a	59.0	8.0	C-BC	1100			
Sub-total	59.0		59.0	2.2		59.0					C-BC	1100			
SJ-9-1	94.0				9-1-a	79.0	11.0	9-1-a	79.0	11.0	C-BC	1400			
					9-1-b	15.0									
Sub-total	94.0					94.0					C-BC	1400			
SJ-9-2	187.0	9-2-a	187.0	2.5	9-2-a	187.0	29.0	9-2-a	95.0	15.0	C-BC	1000			
								9-2-b	92.0	14.0	C-BC	1000			
Sub-total	187.0		187.0	2.5		187.0					C-BC	2000			
SJ-9-3	62.0	9-3-a	62.0	1.0	9-3-a	62.0	10.0	9-3-a	62.0	10.0	C-BC	850			
Sub-total	62.0		62.0	1.0		62.0					C-BC	850			
SJ-10	109.0	10-a	109.0	1.2	10-a	109.0	16.0	10-a	109.0	16.0	I-OCR	1300			
Sub-total	109.0		109.0	1.2		109.0					I-OCR	1300			
Total	1260.0		852.0	22.9		1260.0			I-OCR	1300	C-BC	12300			
											Total	13600			

Note: I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(19/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANDALUYONG-PASIG 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM5-1	929.0							5-1-a	187.0	45.0	I-OCR	900			
								5-1-b	188.0	24.0	C-BC	2500			
								5-1-c	425.0	78.0	I-OCR	1000			
								5-1-d	129.0	21.0	C-BC	1400			
Sub-total	929.0								I-OCR	1900	C-BC	3900			
PM-5-2	138.0							5-2-a	68.0	12.0	C-BC	1200			
Sub-total	138.0										C-BC	1200			
PM-7	458.0	7-a	352.0	16.2	7-a	352.0	61.0	7-a	126.0	22.0	C-BC	1700			
		7-b	62.0	4.1	7-b	62.0	16.0	7-b	195.0	48.0	I-OCT	600			
		7-c	44.0	2.7	7-c	44.0	10.0	7-c	31.0	8.0	C-BC	600			
								7-d	62.0	16.0	C-BC	600			
								7-e	44.0	10.0	C-BC	800			
Sub-total	458.0			23.0					I-OCT	600	C-BC	3700			
	1525.0			23.0					I-OCT	600	C-BC	8800			
									I-OCR	1900	Total	11300			

Note: I-OCT:open channel improvement with trapezoidal section.
I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(20/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANDALUYONG-PASIG 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM5-1	929.0							5-1-a	187.0	41.0	I-OCR	900			
								5-1-b	188.0	22.0	C-BC	2500			
								5-1-c	425.0	70.0	I-OCR	1000			
								5-1-d	129.0	19.0	C-BC	1400			
Sub-total	929.0								I-OCR	1900	C-BC	3900			
PM-5-2	138.0							5-2-a	68.0	11.0	C-BC	1200			
Sub-total	138.0										C-BC	1200			
PM-7	458.0	7-a	352.0	13.0	7-a	352.0	55.0	7-a	126.0	20.0	C-BC	1700			
		7-b	62.0	3.3	7-b	62.0	14.0	7-b	195.0	43.0	I-OCT	600			
		7-c	44.0	2.1	7-c	44.0	9.0	7-c	31.0	7.0	C-BC	600			
								7-d	62.0	14.0	C-BC	600			
								7-e	44.0	9.0	C-BC	800			
Sub-total	458.0			18.4					I-OCT	600	C-BC	3700			
	1525.0			18.4					I-OCT	600	C-BC	8800			
									I-OCR	1900	Total	11300			

Note: I-OCT:open channel improvement with trapezoidal section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(21/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANDALUYONG-PASIG 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM5-1	929.0							5-1-a	187.0	37.0	I-OCR	900			
								5-1-b	188.0	19.0	C-BC	2500			
								5-1-c	425.0	63.0	I-OCR	1000			
								5-1-d	129.0	17.0	C-BC	1400			
Sub-total	929.0									I-OCR 1900	C-BC	3900			
PM-5-2	138.0							5-2-a	68.0	10.0	C-BC	1200			
Sub-total	138.0										C-BC	1200			
PM-7	458.0	7-a	352.0	10.2	7-a	352.0	49.0	7-a	126.0	18.0	C-BC	1700			
		7-b	62.0	2.6	7-b	62.0	13.0	7-b	195.0	39.0	I-OCT	600			
		7-c	44.0	1.7	7-c	44.0	8.0	7-c	31.0	7.0	C-BC	600			
								7-d	62.0	13.0	C-BC	600			
								7-e	44.0	8.0	C-BC	800			
Sub-total	458.0			14.5						I-OCT 600	C-BC	3700			
	1525.0			14.5						I-OCT 600	C-BC	8800			
										C-OCR 1900	Total	11300			

Note: I-OCT:open channel improvement with trapezoidal section.
I-OCR:open channel improvement with rectangular section.
C-BC:box culvert construction.

Table 5-4-1(22/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MANDALUYONG-PASIG 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM5-1	929.0							5-1-a	187.0	34.0	I-OCR	900			
								5-1-b	188.0	17.0	C-BC	2500			
								5-1-c	425.0	57.0	I-OCR	1000			
								5-1-d	129.0	15.0	C-BC	1400			
Sub-total	929.0									I-OCR 1900	C-BC	3900			
PM-5-2	138.0							5-2-a	68.0	9.0	C-BC	1200			
Sub-total	138.0										C-BC	1200			
PM-7	458.0	7-a	352.0	7.7	7-a	352.0	44.0	7-a	126.0	16.0	C-BC	1700			
		7-b	62.0	1.9	7-b	62.0	12.0	7-b	195.0	35.0	I-OCT	600			
		7-c	44.0	1.3	7-c	44.0	8.0	7-c	31.0	6.0	C-BC	600			
								7-d	62.0	12.0	C-BC	600			
								7-e	44.0	8.0	C-BC	800			
Sub-total	458.0			10.9						I-OCT 600.0	C-BC	3700			
	1525.0			10.9						I-OCT 600	C-BC	8800			
										I-OCR 1900	Total	11300			

Note: I-OCT:open channel improvement with trapezoidal section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(23/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MARIKINA 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM-3-1	32.0														
Sub-total	32.0														
PM-3-2	42.0														
Sub-total	42.0														
PM-3-3	149.0														
Sub-total	149.0														
PM-3-4	193.0							3-4-a	193.0	29.0	C-BC	1600			
Sub-total	193.0								193.0		C-BC	1600			
PM-3-5	76.0				3-5-a	76.0	14.0	3-5-a	76.0	14.0	C-OCT	1000			
Sub-total	76.0										C-OCT	1000			
PM-3-6	125.0														
Sub-total	125.0														
PM-4-1	344.0							4-1-a	89.0	16.0	C-BC	1000			
Sub-total	344.0										C-BC	1000			
PM-4-2	207.0														
Sub-total	207.0														
Total	1168.0								C-OCT	1000.0	C-BC	2600			
											Total	3600			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(24/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MARIKINA 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM-3-1	32.0														
Sub-total	32.0														
PM-3-2	42.0														
Sub-total	42.0														
PM-3-3	149.0														
Sub-total	149.0														
PM-3-4	193.0							3-4-a	193.0	26.0	C-BC	1600			
Sub-total	193.0								193.0		C-BC	1600			
PM-3-5	76.0				3-5-a	76.0	12.0	3-5-a	76.0	12.0	C-OCT	1000			
Sub-total	76.0										C-OCT	1000			
PM-3-6	125.0														
Sub-total	125.0														
PM-4-1	344.0							4-1-a	89.0	15.0	C-BC	1000			
Sub-total	344.0										C-BC	1000			
PM-4-2	207.0														
Sub-total	207.0														
Total	1168.0								C-OCT	1000.0	C-BC	2600			
											Total	3600			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(25/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MARIKINA 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM-3-1	32.0														
Sub-total	32.0														
PM-3-2	42.0														
Sub-total	42.0														
PM-3-3	149.0														
Sub-total	149.0														
PM-3-4	193.0							3-4-a	193.0	23.0	C-BC	1600			
Sub-total	193.0								193.0		C-BC	1600			
PM-3-5	76.0				3-5-a	76.0	11.0	3-5-a	76.0	11.0	C-OCT	1000			
Sub-total	76.0										C-OCT	1000			
PM-3-6	125.0														
Sub-total	125.0														
PM-4-1	344.0							4-1-a	89.0	13.0	C-BC	1000			
Sub-total	344.0										C-BC	1000			
PM-4-2	207.0														
Sub-total	207.0														
Total	1168.0								C-OCT	1000.0	C-BC	2600			
											Total	3600			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(26/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(MARIKINA 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PM-3-1	32.0														
Sub-total	32.0														
PM-3-2	42.0														
Sub-total	42.0														
PM-3-3	149.0														
Sub-total	149.0														
PM-3-4	193.0							3-4-a	193.0	21.0	C-BC	1600			
Sub-total	193.0								193.0		C-BC	1600			
PM-3-5	76.0				3-5-a	76.0	11.0	3-5-a	76.0	10.0	C-OCT	1000			
Sub-total	76.0										C-OCT	1000			
PM-3-6	125.0														
Sub-total	125.0														
PM-4-1	344.0							4-1-a	89.0	12.0	C-BC	1000			
Sub-total	344.0										C-BC	1000			
PM-4-2	207.0														
Sub-total	207.0														
Total	1168.0								C-OCT	1000.0	C-BC	2600			
											Total	3600			

Note: C-OCT:open channel construction with trapezoidal section.
C-BC:box culvert construction.

Table 5-4-1(27/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(PARANAQUE-LAS PINAS 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PA-1	882.0				1-a			1-a	1725.0	132.0	C-OCR	500			
					1-b			1-b	213.0	60.0	I-OCR	2000			
					1-c										
					1-d										
Sub-total	882.0								C-OCR	500.0	I-OCR	2000			
PA-2	242.0	2-a	242.0	8.9	2-a			2-a	242.0	24.0	I-OCR	1650			
					2-b										
Sub-total	242.0										I-OCR	1650			
PA-3	154.0														
Sub-total	154.0														
PA-4	265.0	4-a	265.0	10.9	4-a			4-a-1	238.0	39.0	I-OCR	1150			
					4-b			4-a-2	238.0	39.0	C-OCR	150			
Sub-total	265.0			10.9					C-OCR	150.0	I-OCR	1150			
	1543.0			19.8					C-OCR=	650.0	I-OCR=	4800			
											Total=	5450			

Note: C-OCR:open channel construction with rectangular section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(28/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(PARANAQUE-LAS PINAS 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PA-1	882.0				1-a			1-a	1725.0	132.0	C-OCR	500			
					1-b			1-b	213.0	54.0	I-OCR	2000			
					1-c										
					1-d										
Sub-total									C-OCR	500.0	I-OCR	2000			
PA-2	242.0	2-a	242.0	7.0	2-a			2-a	242.0	21.0	I-OCR	1650			
Sub-total					2-b						I-OCR	1650			
PA-3	154.0														
Sub-total															
PA-4	265.0	4-a	265.0	8.0	4-a			4-a-1	238.0	35.0	I-OCR	1150			
					4-b			4-a-2	238.0	35.0	C-OCR	150			
Sub-total				8.0					C-OCR	150.0	I-OCR	1150			
				15.0					C-OCR=	650.0	I-OCR=	4800			
											Total=	5450			

Note: C-OCR:open channel construction with rectangular section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(29/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(PARANAQUE-LAS PINAS 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PA-1	882.0				1-a			1-a	1725.0	132.0	C-OCR	500			
					1-b			1-b	213.0	48.0	I-OCR	2000			
					1-c										
					1-d										
Sub-total									C-OCR	500.0	I-OCR	2000			
PA-2	242.0	2-a	242.0	5.5	2-a			2-a	242.0	19.0	I-OCR	1650			
					2-b										
Sub-total											I-OCR	1650			
PA-3	154.0														
Sub-total															
PA-4	265.0	4-a	265.0	7.0	4-a			4-a-1	238.0	31.0	I-OCR	1150			
					4-b			4-a-2	238.0	31.0	C-OCR	150			
Sub-total				7.0					C-OCR	150.0	I-OCR	1150			
				12.5					C-OCR=	650.0	I-OCR=	4800			
											Total=	5450			

Note: C-OCR:open channel construction with rectangular section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(30/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(PARANAQUE-LAS PINAS 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel					Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
PA-1	882.0				1-a			1-a	1725.0	132.0	C-OCR	500			
					1-b			1-b	213.0	44.0	I-OCR	2000			
					1-c										
					1-d										
Sub-total									C-OCR	500.0	I-OCR	2000			
PA-2	242.0	2-a	242.0	4.0	2-a			2-a	242.0	17.0	I-OCR	1650			
					2-b										
Sub-total				4.0							I-OCR	1650			
PA-3	154.0														
Sub-total															
PA-4	265.0	4-a	265.0	5.0	4-a			4-a-1	238.0	28.0	I-OCR	1150			
					4-b			4-a-2	238.0	28.0	C-OCR	150			
Sub-total				5.0					C-OCR	150.0	I-OCR	1150			
				12.0					C-OCR=	650.0	I-OCR=	4800			
											Total=	5450			

Note: C-OCR:open channel construction with rectangular section.
I-OCR:open channel improvement with rectangular section.

Table 5-4-1(31/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(VALENZUELA 10-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
ME-9	1842.0	9-a	562.0	3.3	9-a	562.0	51.8	9-a	562.0	52.0	I-OCT	2500			
		9-b	995.0	5.9				9-b-1	576.0	36.0	I-OCT	2400			
		9-c	285.0	1.7				9-b-2	210.0	14.0	I-OCT	3200			
								9-b-3	210.0	2.0	C-OCT	500			
								9-c	285.0	20.0	I-OCT	4800			
Total	1842.0		1842.0	10.9		554.0				C-OCT	500	I-OCT	12900		
												Total	13400		

Note: I-OCT:open channel improvement with trapezoidal section. C-OCT:open channel construction with trapezoidal section.

Table 5-4-1(32/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(VALENZUELA 5-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
ME-9	1842.0	9-a	562.0	1.3	9-a	562.0	46.4	9-a	562.0	47.0	I-OCT	2500			
		9-b	995.0	2.3				9-b-1	576.0	32.0	I-OCT	2400			
		9-c	285.0	0.7				9-b-2	210.0	12.0	I-OCT	3200			
								9-b-3	210.0	2.0	C-OCT	500			
								9-c	285.0	18.0	I-OCT	4800			
Total	1842.0		1842.0	4.3		562.0				C-OCT	500	I-OCT	12900		
												Total	13400		

Note: I-OCT:open channel improvement with trapezoidal section. C-OCT:open channel construction with trapezoidal section.

Table 5-4-1(33/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(VALENZUELA 3-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
ME-9	1842.0	9-a	562.0	0.0	9-a	562.0	41.6	9-a	562.0	42.0	I-OCT	2500			
		9-b	995.0	0.0				9-b-1	576.0	29.0	I-OCT	2400			
		9-c	285.0	0.0				9-b-2	210.0	11.0	I-OCT	3200			
								9-b-3	210.0	0.0	C-OCT	0			
								9-c	285.0	16.0	I-OCT	4800			
Total	1842.0		1842.0	0.0		562.0				C-OCT	0	I-OCT	12400		
												Total	12400		

Note: I-OCT:open channel improvement with trapezoidal section. C-OCT:open channel construction with trapezoidal section.

Table 5-4-1(34/34) DESIGN DISCHARGE FOR DRAINAGE FACILITIES
(VALENZUELA 2-YR. RETURN PERIOD)

Subdrainage area		Pump Station			Gate			Drainage Channel				Regulation Pond		
Code	Area (ha)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Qp (m3/s)	Code	D.A. (ha)	Q (m3/s)	Type	Length (m)	Code	Volume (m3)	Area (m2)
ME-9	1842.0	9-a	562.0	0.0	9-a	562.0	37.4	9-a	562.0	38.0	I-OCT	2500			
		9-b	995.0	0.0				9-b-1	576.0	26.0	I-OCT	2400			
		9-c	285.0					9-b-2	210.0	10.0	I-OCT	3200			
								9-b-3	210.0	0.0	C-OCT	0			
								9-c	285.0	15.0	I-OCT	4800			
Total	1842.0		1842.0	0.0		562.0				C-OCT	0	I-OCT	12900		
												Total	12900		

Note: I-OCT:open channel improvement with trapezoidal section. C-OCT:open channel construction with trapezoidal section.

Table 5-4-2(1/5) INLAND INUNDATION WATER STAGE

Pond Name	Scale of Facilities	2-Yr Rainfall		3-Yr Rainfall		5-Yr Rainfall		10-Yr Rainfall		30-Yr Rainfall		50-Yr Rainfall		100-Yr Rainfall	
		Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)
MANILA AND SUBURBS (NORTH MANILA)															
NN-1	Existing	12.50	2.15	12.56	2.79	12.63	3.68	12.72	4.83	12.93	7.46	13.03	8.03	13.14	8.27
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.33	1.26	12.36	1.34	12.38	1.39
NN-2	Existing	11.97	0.20	11.99	0.20	12.01	0.21	12.05	0.21	12.14	0.22	12.19	0.23	12.28	0.24
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	11.97	0.20	11.97	0.20	11.97	0.20
NN-3	Existing	12.20	1.39	12.28	1.78	12.38	2.34	12.51	2.98	12.69	3.89	12.80	4.44	12.94	5.14
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.17	1.25	12.18	1.26	12.19	1.35
NN-4	Existing	12.30	0.13	12.38	0.16	12.47	0.20	12.53	0.24	12.67	0.34	12.76	0.41	12.87	0.49
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	11.98	0.01	11.99	0.01	11.99	0.01
NN-5	Existing	12.54	0.56	12.56	0.60	12.59	0.64	12.64	0.71	12.77	0.88	12.86	1.00	12.96	1.14
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.49	0.51	12.50	0.52	12.51	0.53
MANILA AND SUBURBS (SOUTH MANILA)															
SN-1	Existing	12.39	0.76	12.47	0.90	12.52	0.99	12.61	1.16	12.83	1.57	12.98	1.81	13.13	1.86
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.25	0.51	12.29	0.59	12.39	0.76
SN-2	Existing	12.03	1.10	12.06	1.32	12.10	1.64	12.19	2.26	12.41	3.75	12.49	4.33	12.57	4.76
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.05	1.29	12.08	1.46	12.12	1.78
SN-3	Existing	12.06	0.12	12.08	0.15	12.10	0.18	12.15	0.24	12.24	0.37	12.32	0.47	12.45	0.64
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	11.97	0.01	11.97	0.01	11.97	0.02
SN-4	Existing	12.07	0.73	12.09	0.85	12.12	1.00	12.19	1.31	12.35	2.03	12.46	2.56	12.52	2.73
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	11.96	0.25	11.97	0.28	11.98	0.31
SN-5	Existing	12.20	1.61	12.31	2.09	12.45	2.66	12.53	3.41	12.72	5.09	12.86	6.39	13.03	7.52
	2-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5-Yr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10-Yr	-	-	-	-	-	-	-	-	12.35	2.24	12.44	2.66	12.51	3.22
MALABON-NAVOTAS															
MT-4-1	Existing	12.51	0.76	12.59	0.82	12.71	0.92	12.92	1.08	13.27	1.36	13.46	1.51	13.63	1.54
	2-Yr	-	-	12.20	0.48	12.24	0.51	12.27	0.54	12.31	0.58	12.32	0.60	12.36	0.63
	3-Yr	-	-	-	-	12.20	0.48	12.24	0.52	12.28	0.55	12.30	0.57	12.33	0.60
	5-Yr	-	-	-	-	-	-	12.20	0.48	12.25	0.53	12.27	0.55	12.29	0.57
	10-Yr	-	-	-	-	-	-	-	-	12.22	0.50	12.23	0.51	12.27	0.54
MT-4-2	Existing	12.59	0.33	12.66	0.37	12.77	0.42	13.01	0.52	13.41	0.70	13.56	0.75	13.72	0.80
	2-Yr	-	-	12.10	0.10	12.11	0.10	12.15	0.12	12.23	0.16	12.25	0.18	12.31	0.21
	3-Yr	-	-	-	-	12.10	0.10	12.12	0.11	12.17	0.14	12.20	0.15	12.26	0.18
	5-Yr	-	-	-	-	-	-	12.10	0.10	12.14	0.12	12.15	0.13	12.21	0.15
	10-Yr	-	-	-	-	-	-	-	-	12.11	0.11	12.12	0.11	12.15	0.13

Table 5-4-2(2/5) INLAND INUNDATION WATER STAGE

Pond Name	Scale of Facilities	2-Yr Rainfall		3-Yr Rainfall		5-Yr Rainfall		10-Yr Rainfall		30-Yr Rainfall		50-Yr Rainfall		100-Yr Rainfall	
		Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)	Max. Water Level (El. m)	Max. Flooded Area (km^2)
MALABON-NAVOTAS															
MA-1	Existing	10.98	0.47	11.03	0.58	11.07	0.73	11.14	0.96	11.25	1.33	11.31	1.53	11.39	1.79
	2-Yr	-	-	10.73	0.37	10.78	0.39	10.89	0.44	11.03	0.59	11.07	0.72	11.11	0.85
	3-Yr	-	-	-	-	10.73	0.37	10.80	0.40	10.95	0.46	11.02	0.55	11.06	0.68
	5-Yr	-	-	-	-	-	-	10.74	0.38	10.83	0.41	10.91	0.44	11.01	0.51
	10-Yr	-	-	-	-	-	-	-	-	10.75	0.38	10.79	0.40	10.86	0.42
MA-2	Existing	10.79	0.64	10.85	0.67	10.93	0.71	11.03	0.81	11.12	1.05	11.17	1.19	11.24	1.36
	2-Yr	-	-	10.78	0.63	10.83	0.66	10.93	0.71	11.05	0.87	11.09	0.98	11.14	1.11
	3-Yr	-	-	-	-	10.78	0.63	10.84	0.66	10.98	0.73	11.04	0.84	11.09	0.98
	5-Yr	-	-	-	-	-	-	10.79	0.64	10.88	0.68	10.95	0.72	11.03	0.82
	10-Yr	-	-	-	-	-	-	-	-	10.81	0.65	10.84	0.66	10.92	0.70
MA-3	Existing	11.06	1.36	11.11	1.43	11.16	1.51	11.25	1.64	11.38	1.83	11.45	1.93	11.53	2.01
	2-Yr	-	-	10.83	0.55	10.88	0.77	10.97	1.15	11.07	1.38	11.12	1.45	11.18	1.54
	3-Yr	-	-	-	-	10.83	0.55	10.89	0.81	11.01	1.29	11.05	1.35	11.11	1.43
	5-Yr	-	-	-	-	-	-	10.84	0.60	10.93	0.98	10.99	1.24	11.04	1.34
	10-Yr	-	-	-	-	-	-	-	-	10.86	0.68	10.89	0.81	10.96	1.11
MA-4	Existing	11.06	0.19	11.09	0.21	11.13	0.23	11.19	0.27	11.29	0.33	11.35	0.36	11.42	0.40
	2-Yr	-	-	10.83	0.07	10.88	0.09	10.97	0.14	11.07	0.20	11.12	0.23	11.18	0.26
	3-Yr	-	-	-	-	10.83	0.07	10.89	0.10	11.01	0.16	11.05	0.18	11.11	0.22
	5-Yr	-	-	-	-	-	-	10.84	0.07	10.93	0.12	10.99	0.15	11.04	0.18
	10-Yr	-	-	-	-	-	-	-	-	10.86	0.08	10.89	0.10	10.96	0.13
MA-5	Existing	11.17	0.72	11.24	0.74	11.33	0.76	11.48	0.79	11.62	1.02	11.70	1.16	11.79	1.34
	2-Yr	-	-	10.83	0.10	10.88	0.28	10.97	0.59	11.07	0.70	11.12	0.71	11.18	0.73
	3-Yr	-	-	-	-	10.83	0.10	10.89	0.31	11.01	0.69	11.05	0.70	11.11	0.71
	5-Yr	-	-	-	-	-	-	10.84	0.14	10.93	0.45	10.99	0.66	11.04	0.70
	10-Yr	-	-	-	-	-	-	-	-	10.86	0.21	10.89	0.31	10.96	0.55
MA-6	Existing	11.04	0.75	11.08	0.78	11.13	0.83	11.22	0.91	11.35	1.04	11.43	1.10	11.52	1.18
	2-Yr	-	-	10.92	0.51	10.94	0.57	10.98	0.67	11.05	0.76	11.09	0.79	11.14	0.84
	3-Yr	-	-	-	-	10.92	0.51	10.94	0.58	11.00	0.71	11.03	0.74	11.08	0.78
	5-Yr	-	-	-	-	-	-	10.92	0.52	10.96	0.62	10.99	0.68	11.02	0.73
	10-Yr	-	-	-	-	-	-	-	-	10.93	0.54	10.94	0.57	10.97	0.64
MA-7	Existing	11.40	0.80	11.50	0.90	11.59	0.91	11.76	0.92	12.02	0.93	12.16	0.93	12.33	0.94
	2-Yr	-	-	11.23	0.62	11.27	0.66	11.35	0.75	11.49	0.90	11.55	0.91	11.61	0.91
	3-Yr	-	-	-	-	11.23	0.62	11.28	0.67	11.40	0.80	11.47	0.87	11.54	0.91
	5-Yr	-	-	-	-	-	-	11.24	0.63	11.31	0.71	11.36	0.76	11.45	0.85
	10-Yr	-	-	-	-	-	-	-	-	11.25	0.64	11.28	0.67	11.34	0.73
MA-8	Existing	13.10	0.75	13.12	0.85	13.16	1.01	13.22	1.30	13.38	2.01	13.49	2.51	13.57	2.58
	2-Yr	-	-	13.00	0.30	13.01	0.32	13.01	0.36	13.03	0.42	13.03	0.45	13.05	0.50
	3-Yr	-	-	-	-	13.00	0.30	13.01	0.33	13.02	0.38	13.02	0.40	13.04	0.45
	5-Yr	-	-	-	-	-	-	13.00	0.30	13.01	0.34	13.02	0.36	13.02	0.40
	10-Yr	-	-	-	-	-	-	-	-	13.00	0.31	13.01	0.32	13.01	0.36
MA-9	Existing	11.29	0.12	11.32	0.17	11.37	0.17	11.45	0.21	11.56	0.24	11.60	0.24	11.67	0.25
	2-Yr	-	-	11.21	0.09	11.22	0.09	11.24	0.10	11.29	0.13	11.32	0.14	11.36	0.16
	3-Yr	-	-	-	-	11.21	0.09	11.23	0.09	11.26	0.11	11.28	0.12	11.32	0.14
	5-Yr	-	-	-	-	-	-	11.21	0.09	11.23	0.10	11.25	0.10	11.27	0.12
	10-Yr	-	-	-	-	-	-	-	-	11.21	0.08	11.22	0.09	11.23	0.09
MA-10	Existing	12.21	0.13	12.26	0.17	12.32	0.21	12.45	0.29	12.57	0.40	12.62	0.47	12.70	0.56
	2-Yr	-	-	12.00	0.00	12.01	0.01	12.02	0.02	12.05	0.03	12.06	0.04	12.08	0.05
	3-Yr	-	-	-	-	12.00	0.00	12.01	0.01	12.04	0.02	12.05	0.03	12.07	0.04
	5-Yr	-	-	-	-	-	-	12.00	0.00	12.02	0.01	12.03	0.02	12.05	0.03
	10-Yr	-	-	-	-	-	-	-	-	12.01	0.00	12.01	0.01	12.03	0.02
MA-11	Existing	11.11	0.23	11.17	0.24	11.24	0.25	11.37	0.28	11.53	0.32	11.59	0.37	11.66	0.42
	2-Yr	-	-	10.92	0.15	10.94	0.17	10.97	0.19	11.02	0.21	11.05	0.22	11.10	0.23
	3-Yr	-	-	-	-	10.92	0.15	10.94	0.17	10.99	0.20	11.01	0.21	11.04	0.22
	5-Yr	-	-	-	-	-	-	10.92	0.15	10.95	0.18	10.96	0.19	11.00	0.21
	10-Yr	-	-	-	-	-	-	-	-	10.93	0.16	10.94	0.17	10.96	0.18
MA-12	Existing	13.05	0.05	13.13	0.06	13.25	0.07	13.46	0.08	13.63	0.10	13.72	0.11	13.83	0.12
	2-Yr	-	-	12.50	0.00	12.51	0.00	12.53	0.00	12.57	0.01	12.59	0.01	12.62	0.01
	3-Yr	-	-	-	-	12.50	0.00	12.52	0.00	12.55	0.00	12.56	0.01	12.60	0.01
	5-Yr	-	-	-	-	-	-	12.50	0.00	12.53	0.00	12.54	0.00	12.57	0.01
	10-Yr	-	-	-	-	-	-	-	-	12.51	0.00	12.52	0.00	12.54	0.00

Table 5-4-2(3/5) INLAND INUNDATION WATER STAGE

Pond Name	Scale of Facilities	2-Yr Rainfall		3-Yr Rainfall		5-Yr Rainfall		10-Yr Rainfall		30-Yr Rainfall		50-Yr Rainfall		100-Yr Rainfall	
		Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)
EAST OF MANGAHAN															
EM-1	Existing	13.45	0.20	13.58	0.23	13.75	0.29	14.10	0.38	14.44	0.41	14.54	0.43	14.61	0.44
	2-Yr	-	-	13.00	0.13	13.07	0.15	13.33	0.19	13.44	0.20	14.54	0.43	14.61	0.44
	3-Yr	-	-	-	-	13.05	0.15	13.28	0.19	13.35	0.20	14.54	0.43	14.61	0.44
	5-Yr	-	-	-	-	-	-	13.24	0.19	13.29	0.19	14.54	0.43	14.61	0.44
	10-Yr	-	-	-	-	-	-	-	-	13.25	0.19	14.54	0.43	14.61	0.44
EM-2	Existing	12.94	0.24	13.14	0.39	13.32	0.59	13.53	0.81	13.79	1.09	13.89	1.12	14.08	1.24
	2-Yr	-	-	12.73	0.23	12.77	0.23	12.82	0.23	12.92	0.24	13.89	1.12	14.08	1.24
	3-Yr	-	-	-	-	12.73	0.23	12.77	0.23	12.84	0.23	13.89	1.12	14.08	1.24
	5-Yr	-	-	-	-	-	-	12.74	0.23	12.79	0.23	13.89	1.12	14.08	1.24
	10-Yr	-	-	-	-	-	-	-	-	12.75	0.23	13.89	1.12	14.08	1.24
EM-3	Existing	12.80	0.24	13.01	0.40	13.16	0.63	13.25	0.77	13.65	1.32	13.86	1.56	14.08	1.80
	2-Yr	-	-	12.73	0.19	12.76	0.21	12.82	0.25	12.95	0.34	13.86	1.56	14.08	1.80
	3-Yr	-	-	-	-	12.73	0.19	12.77	0.22	12.86	0.28	13.86	1.56	14.08	1.80
	5-Yr	-	-	-	-	-	-	12.73	0.19	12.80	0.24	13.86	1.56	14.08	1.80
	10-Yr	-	-	-	-	-	-	-	-	12.75	0.20	13.86	1.56	14.08	1.80
EM-4	Existing	12.45	0.29	12.63	0.41	12.85	0.58	13.22	0.75	13.65	0.86	13.86	0.92	14.08	1.01
	2-Yr	-	-	12.25	0.19	12.33	0.23	12.49	0.31	12.63	0.41	13.86	0.92	14.08	1.01
	3-Yr	-	-	-	-	12.25	0.19	12.35	0.24	12.54	0.34	13.86	0.92	14.08	1.01
	5-Yr	-	-	-	-	-	-	12.27	0.20	12.43	0.28	13.86	0.92	14.08	1.01
	10-Yr	-	-	-	-	-	-	-	-	12.31	0.22	13.86	0.92	14.08	1.01
WEST OF MANGAHAN															
WM-1	Existing	12.58	1.73	12.65	2.10	12.85	3.16	13.22	4.73	13.65	5.84	13.86	6.02	14.08	6.30
	2-Yr	-	-	12.24	0.95	12.29	1.01	12.36	1.11	12.48	1.27	13.86	6.02	14.08	6.30
	3-Yr	-	-	-	-	12.24	0.95	12.30	1.03	12.40	1.16	13.86	6.02	14.08	6.30
	5-Yr	-	-	-	-	-	-	12.25	0.96	12.34	1.08	13.86	6.02	14.08	6.30
	10-Yr	-	-	-	-	-	-	-	-	12.27	0.99	13.86	6.02	14.08	6.30
WM-2	Existing	12.15	1.11	12.50	2.64	12.85	3.68	13.22	4.32	13.65	4.69	13.86	4.87	14.08	5.01
	2-Yr	-	-	11.77	0.33	11.85	0.38	12.00	0.46	12.08	0.81	13.86	4.87	14.08	5.01
	3-Yr	-	-	-	-	11.77	0.33	11.88	0.39	12.03	0.59	13.86	4.87	14.08	5.01
	5-Yr	-	-	-	-	-	-	11.80	0.35	12.01	0.50	13.86	4.87	14.08	5.01
	10-Yr	-	-	-	-	-	-	-	-	11.87	0.39	13.86	4.87	14.08	5.01
WM-3	Existing	12.17	1.54	12.50	2.96	12.85	4.51	13.22	5.28	13.65	5.54	13.86	5.70	14.08	5.87
	2-Yr	-	-	11.76	0.60	11.83	0.66	11.95	0.77	12.06	1.07	13.86	5.70	14.08	5.87
	3-Yr	-	-	-	-	11.76	0.60	11.87	0.70	12.02	0.90	13.86	5.70	14.08	5.87
	5-Yr	-	-	-	-	-	-	11.79	0.63	11.97	0.78	13.86	5.70	14.08	5.87
	10-Yr	-	-	-	-	-	-	-	-	11.84	0.67	13.86	5.70	14.08	5.87
WM-4	Existing	12.54	2.59	12.63	3.00	12.85	3.85	13.22	5.19	13.65	6.24	13.86	6.43	14.08	6.67
	2-Yr	-	-	12.00	0.91	12.05	0.97	12.12	1.04	12.26	1.70	13.86	6.43	14.08	6.67
	3-Yr	-	-	-	-	12.00	0.91	12.07	0.99	12.18	1.46	13.86	6.43	14.08	6.67
	5-Yr	-	-	-	-	-	-	12.01	0.94	12.11	1.24	13.86	6.43	14.08	6.67
	10-Yr	-	-	-	-	-	-	-	-	12.05	1.06	13.86	6.43	14.08	6.67
WM-5	Existing	12.18	0.68	12.50	0.89	12.85	1.35	13.22	1.69	13.65	1.94	13.86	2.04	14.08	2.14
	2-Yr	-	-	11.94	0.54	11.99	0.56	12.07	0.61	12.21	0.70	13.86	2.04	14.08	2.14
	3-Yr	-	-	-	-	11.94	0.54	12.01	0.57	12.11	0.63	13.86	2.04	14.08	2.14
	5-Yr	-	-	-	-	-	-	11.95	0.54	12.04	0.59	13.86	2.04	14.08	2.14
	10-Yr	-	-	-	-	-	-	-	-	11.98	0.55	13.86	2.04	14.08	2.14
SAN JUAN															
SJ-5-1	Existing	16.19	0.26	16.47	0.27	16.68	0.31	17.03	0.36	17.60	0.45	17.91	0.50	18.29	0.56
	2-Yr	-	-	15.64	0.24	15.66	0.24	15.68	0.24	15.72	0.24	15.75	0.24	15.78	0.24
	3-Yr	-	-	-	-	15.66	0.24	15.67	0.24	15.71	0.24	15.73	0.24	15.76	0.24
	5-Yr	-	-	-	-	-	-	15.67	0.24	15.70	0.24	15.72	0.24	15.74	0.24
	10-Yr	-	-	-	-	-	-	-	-	15.69	0.24	15.71	0.24	15.72	0.24
SJ-5-2	Existing	15.80	0.06	15.93	0.06	16.09	0.06	16.36	0.07	16.59	0.08	16.69	0.09	16.81	0.10
	2-Yr	-	-	15.57	0.05	15.58	0.05	15.59	0.05	15.61	0.05	15.62	0.05	15.64	0.05
	3-Yr	-	-	-	-	15.58	0.05	15.59	0.05	15.61	0.05	15.62	0.05	15.64	0.05
	5-Yr	-	-	-	-	-	-	15.59	0.05	15.61	0.05	15.61	0.05	15.63	0.05
	10-Yr	-	-	-	-	-	-	-	-	15.60	0.05	15.61	0.05	15.63	0.05
SJ-7-1	Existing	14.01	0.33	14.21	0.37	14.46	0.42	14.64	0.48	14.93	0.58	15.09	0.63	15.29	0.70
	2-Yr	-	-	13.71	0.27	13.76	0.28	13.82	0.29	13.90	0.31	13.93	0.31	13.98	0.32
	3-Yr	-	-	-	-	13.71	0.27	13.77	0.28	13.85	0.30	13.89	0.31	13.94	0.32
	5-Yr	-	-	-	-	-	-	13.72	0.27	13.80	0.29	13.83	0.29	13.89	0.31
	10-Yr	-	-	-	-	-	-	-	-	13.73	0.27	13.76	0.28	13.81	0.29

Table 5-4-2(4/5) INLAND INUNDATION WATER STAGE

Pond Name	Scale of Facilities	2-Yr Rainfall Max. Water Level (EL. m)	2-Yr Rainfall Max. Flooded Area (km^2)	3-Yr Rainfall Max. Water Level (EL. m)	3-Yr Rainfall Max. Flooded Area (km^2)	5-Yr Rainfall Max. Water Level (EL. m)	5-Yr Rainfall Max. Flooded Area (km^2)	10-Yr Rainfall Max. Water Level (EL. m)	10-Yr Rainfall Max. Flooded Area (km^2)	30-Yr Rainfall Max. Water Level (EL. m)	30-Yr Rainfall Max. Flooded Area (km^2)	50-Yr Rainfall Max. Water Level (EL. m)	50-Yr Rainfall Max. Flooded Area (km^2)	100-Yr Rainfall Max. Water Level (EL. m)	100-Yr Rainfall Max. Flooded Area (km^2)
SAN JUAN															
SJ-7-2	Existing	14.25	0.09	14.50	0.10	14.67	0.11	14.97	0.13	15.45	0.16	15.71	0.18	16.04	0.20
	2-Yr	-	-	13.72	0.07	13.78	0.07	13.86	0.08	13.97	0.08	14.02	0.08	14.08	0.08
	3-Yr	-	-	-	-	13.71	0.07	13.77	0.07	13.88	0.08	13.92	0.08	13.99	0.08
	5-Yr	-	-	-	-	-	-	13.72	0.07	13.80	0.07	13.84	0.08	13.90	0.08
	10-Yr	-	-	-	-	-	-	-	-	13.73	0.07	13.76	0.07	13.81	0.07
SJ-8-1	Existing	14.19	0.09	14.45	0.10	14.64	0.11	14.93	0.12	15.41	0.14	15.68	0.16	16.02	0.17
	2-Yr	-	-	13.70	0.06	13.76	0.06	13.82	0.07	13.91	0.07	13.94	0.07	13.99	0.08
	3-Yr	-	-	-	-	13.71	0.06	13.76	0.07	13.85	0.07	13.88	0.07	13.94	0.07
	5-Yr	-	-	-	-	-	-	13.72	0.06	13.79	0.07	13.82	0.07	13.88	0.07
	10-Yr	-	-	-	-	-	-	-	-	13.73	0.06	13.75	0.06	13.81	0.07
SJ-8-2	Existing	14.13	0.06	14.38	0.07	14.59	0.07	14.87	0.08	15.35	0.10	15.61	0.10	15.94	0.11
	2-Yr	-	-	13.70	0.05	13.75	0.05	13.81	0.05	13.90	0.05	13.93	0.05	13.97	0.06
	3-Yr	-	-	-	-	13.71	0.05	13.76	0.05	13.85	0.05	13.88	0.05	13.93	0.05
	5-Yr	-	-	-	-	-	-	13.71	0.05	13.78	0.05	13.81	0.05	13.87	0.05
	10-Yr	-	-	-	-	-	-	-	-	13.73	0.05	13.75	0.05	13.80	0.05
SJ-9-1	Existing	12.77	0.13	12.89	0.18	13.03	0.24	13.28	0.34	13.55	0.44	13.64	0.45	13.75	0.47
	2-Yr	-	-	12.62	0.07	12.63	0.07	12.65	0.08	12.67	0.09	12.67	0.09	12.69	0.09
	3-Yr	-	-	-	-	12.63	0.07	12.65	0.08	12.67	0.09	12.67	0.09	12.68	0.09
	5-Yr	-	-	-	-	-	-	12.65	0.08	12.67	0.09	12.67	0.09	12.68	0.09
	10-Yr	-	-	-	-	-	-	-	-	12.66	0.09	12.67	0.09	12.68	0.09
SJ-9-2	Existing	12.98	0.26	13.18	0.31	13.43	0.39	13.66	0.43	14.02	0.48	14.21	0.51	14.45	0.55
	2-Yr	-	-	12.68	0.16	12.70	0.17	12.72	0.18	12.74	0.18	12.75	0.19	12.77	0.19
	3-Yr	-	-	-	-	12.69	0.17	12.71	0.17	12.73	0.18	12.74	0.19	12.76	0.19
	5-Yr	-	-	-	-	-	-	12.68	0.17	12.71	0.18	12.72	0.18	12.74	0.19
	10-Yr	-	-	-	-	-	-	-	-	12.70	0.17	12.71	0.18	12.73	0.18
SJ-9-3	Existing	13.00	0.08	13.20	0.11	13.46	0.14	13.67	0.15	14.01	0.17	14.19	0.18	14.42	0.19
	2-Yr	-	-	12.68	0.05	12.69	0.05	12.71	0.05	12.74	0.05	12.75	0.05	12.77	0.06
	3-Yr	-	-	-	-	12.68	0.05	12.70	0.05	12.72	0.05	12.73	0.05	12.75	0.05
	5-Yr	-	-	-	-	-	-	12.68	0.05	12.71	0.05	12.72	0.05	12.73	0.05
	10-Yr	-	-	-	-	-	-	-	-	12.70	0.05	12.70	0.05	12.72	0.05
SJ-10	Existing	12.89	0.26	12.99	0.31	13.07	0.37	13.20	0.47	13.41	0.62	13.50	0.66	13.60	0.67
	2-Yr	-	-	12.68	0.17	12.70	0.18	12.72	0.19	12.75	0.20	12.77	0.20	12.78	0.21
	3-Yr	-	-	-	-	12.68	0.17	12.71	0.18	12.74	0.19	12.75	0.20	12.77	0.21
	5-Yr	-	-	-	-	-	-	12.69	0.17	12.73	0.19	12.74	0.19	12.76	0.20
	10-Yr	-	-	-	-	-	-	-	-	12.70	0.17	12.71	0.18	12.73	0.19
MANDALUYONG-PASIG															
PM-5-1	Existing	16.94	0.67	17.13	0.80	17.38	0.98	17.77	1.26	18.44	1.73	18.61	1.85	18.81	1.99
	2-Yr	-	-	16.46	0.33	16.47	0.34	16.49	0.35	16.52	0.37	16.54	0.38	16.57	0.40
	3-Yr	-	-	-	-	16.46	0.33	16.48	0.34	16.50	0.36	16.52	0.37	16.54	0.39
	5-Yr	-	-	-	-	-	-	16.46	0.33	16.48	0.35	16.49	0.35	16.52	0.37
	10-Yr	-	-	-	-	-	-	-	-	16.47	0.34	16.48	0.34	16.49	0.35
PM-5-2	Existing	14.72	0.12	14.82	0.14	14.95	0.17	15.16	0.22	15.52	0.30	15.72	0.35	15.96	0.41
	2-Yr	-	-	14.46	0.06	14.47	0.06	14.47	0.06	14.49	0.07	14.49	0.07	14.51	0.07
	3-Yr	-	-	-	-	14.46	0.06	14.47	0.06	14.48	0.06	14.48	0.07	14.50	0.07
	5-Yr	-	-	-	-	-	-	14.46	0.06	14.47	0.06	14.48	0.06	14.49	0.07
	10-Yr	-	-	-	-	-	-	-	-	14.46	0.06	14.47	0.06	14.48	0.06
PM-7	Existing	13.46	1.46	13.53	1.49	13.62	1.52	13.77	1.58	14.01	1.68	14.13	1.73	14.30	1.79
	2-Yr	-	-	13.20	0.70	13.26	0.87	13.36	1.17	13.49	1.47	13.52	1.48	13.55	1.49
	3-Yr	-	-	-	-	13.20	0.70	13.27	0.91	13.42	1.34	13.48	1.47	13.52	1.48
	5-Yr	-	-	-	-	-	-	13.21	0.73	13.31	1.02	13.38	1.21	13.47	1.46
	10-Yr	-	-	-	-	-	-	-	-	13.23	0.79	13.27	0.90	13.35	1.13
MARIKINA															
PM-3-1	Existing	22.89	0.01	22.97	0.01	23.07	0.01	23.25	0.02	23.67	0.03	23.98	0.04	24.50	0.05
	2-Yr	-	-	22.50	0.00	22.51	0.00	22.53	0.00	22.57	0.00	22.59	0.00	22.63	0.00
	3-Yr	-	-	-	-	22.50	0.00	22.52	0.00	22.55	0.00	22.57	0.00	22.60	0.00
	5-Yr	-	-	-	-	-	-	22.50	0.00	22.53	0.00	22.54	0.00	22.57	0.00
	10-Yr	-	-	-	-	-	-	-	-	22.51	0.00	22.52	0.00	22.54	0.00
PM-3-2	Existing	22.71	0.01	22.75	0.01	22.81	0.02	22.91	0.02	23.16	0.04	23.34	0.05	23.65	0.06
	2-Yr	-	-	22.50	0.00	22.51	0.00	22.52	0.00	22.54	0.00	22.55	0.00	22.57	0.00
	3-Yr	-	-	-	-	22.50	0.00	22.51	0.00	22.53	0.00	22.54	0.00	22.55	0.00
	5-Yr	-	-	-	-	-	-	22.50	0.00	22.51	0.00	22.52	0.00	22.54	0.00
	10-Yr	-	-	-	-	-	-	-	-	22.51	0.00	22.51	0.00	22.52	0.00

Table 5-4-2(5/5) INLAND INUNDATION WATER STAGE

Pond Name	Scale of Facilities	2-Yr Rainfall		3-Yr Rainfall		5-Yr Rainfall		10-Yr Rainfall		30-Yr Rainfall		50-Yr Rainfall		100-Yr Rainfall	
		Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)	Max. Water Level (EL. m)	Max. Flooded Area (km^2)
MARIKINA															
PM-3-3	Existing	21.51	0.04	21.73	0.05	22.01	0.06	22.51	0.08	22.77	0.11	22.97	0.13	23.31	0.16
	2-Yr	-	-	20.51	0.00	20.55	0.00	20.62	0.00	20.75	0.01	20.81	0.01	20.92	0.02
	3-Yr	-	-	-	-	20.52	0.00	20.56	0.00	20.68	0.01	20.73	0.01	20.83	0.01
	5-Yr	-	-	-	-	-	-	20.52	0.00	20.59	0.00	20.64	0.01	20.73	0.01
	10-Yr	-	-	-	-	-	-	-	-	20.53	0.00	20.56	0.00	20.64	0.01
PM-3-4	Existing	19.94	0.10	20.04	0.12	20.16	0.15	20.40	0.21	20.62	0.25	20.73	0.27	20.91	0.31
	2-Yr	-	-	19.51	0.00	19.53	0.01	19.56	0.01	19.63	0.03	19.66	0.04	19.71	0.05
	3-Yr	-	-	-	-	19.51	0.00	19.53	0.01	19.59	0.02	19.61	0.03	19.66	0.04
	5-Yr	-	-	-	-	-	-	19.51	0.00	19.55	0.01	19.57	0.02	19.61	0.03
	10-Yr	-	-	-	-	-	-	-	-	19.52	0.00	19.53	0.01	19.56	0.01
PM-3-5	Existing	20.74	0.03	20.77	0.04	20.81	0.04	20.89	0.05	21.05	0.07	21.15	0.08	21.38	0.11
	2-Yr	-	-	20.72	0.03	20.73	0.03	20.74	0.03	20.76	0.03	20.77	0.03	20.78	0.04
	3-Yr	-	-	-	-	20.73	0.03	20.74	0.03	20.75	0.03	20.76	0.03	20.77	0.04
	5-Yr	-	-	-	-	-	-	20.74	0.03	20.74	0.03	20.74	0.03	20.76	0.03
	10-Yr	-	-	-	-	-	-	-	-	20.73	0.03	20.74	0.03	20.75	0.03
PM-3-6	Existing	20.62	0.03	20.64	0.04	20.68	0.05	20.74	0.07	20.87	0.11	20.98	0.14	21.15	0.19
	2-Yr	-	-	20.50	0.00	20.51	0.00	20.52	0.00	20.53	0.01	20.54	0.01	20.55	0.02
	3-Yr	-	-	-	-	20.50	0.00	20.51	0.00	20.52	0.01	20.53	0.01	20.54	0.01
	5-Yr	-	-	-	-	-	-	20.50	0.00	20.51	0.00	20.52	0.01	20.53	0.01
	10-Yr	-	-	-	-	-	-	-	-	20.50	0.00	20.51	0.00	20.52	0.00
PM-4-1	Existing	18.21	0.18	18.26	0.23	18.32	0.28	18.44	0.39	18.57	0.53	18.63	0.61	18.74	0.76
	2-Yr	-	-	18.00	0.00	18.01	0.01	18.03	0.03	18.06	0.05	18.07	0.06	18.09	0.08
	3-Yr	-	-	-	-	18.00	0.00	18.01	0.01	18.04	0.04	18.05	0.04	18.07	0.06
	5-Yr	-	-	-	-	-	-	18.01	0.01	18.02	0.02	18.03	0.03	18.05	0.04
	10-Yr	-	-	-	-	-	-	-	-	18.00	0.00	18.01	0.01	18.03	0.03
PM-4-2	Existing	18.26	0.11	18.32	0.14	18.39	0.17	18.51	0.23	18.57	0.29	18.62	0.34	18.70	0.42
	2-Yr	-	-	18.00	0.00	18.01	0.00	18.03	0.01	18.07	0.03	18.08	0.03	18.11	0.05
	3-Yr	-	-	-	-	18.00	0.00	18.02	0.01	18.05	0.02	18.06	0.03	18.09	0.04
	5-Yr	-	-	-	-	-	-	18.00	0.00	18.02	0.01	18.02	0.03	18.06	0.03
	10-Yr	-	-	-	-	-	-	-	-	18.01	0.00	18.02	0.01	18.03	0.01
PARAÑAQUE-LAS PIÑAS															
PA-1	Existing	12.86	2.80	13.00	3.31	13.14	3.50	13.42	3.89	13.69	3.99	13.79	4.02	13.91	4.05
	2-Yr	-	-	12.17	0.55	12.20	0.58	12.23	0.62	12.28	0.69	12.31	0.73	12.37	0.80
	3-Yr	-	-	-	-	12.18	0.56	12.20	0.59	12.25	0.65	12.27	0.68	12.32	0.73
	5-Yr	-	-	-	-	-	-	12.18	0.57	12.22	0.61	12.23	0.63	12.27	0.67
	10-Yr	-	-	-	-	-	-	-	-	12.19	0.57	12.20	0.59	12.21	0.61
PA-2	Existing	12.02	0.59	12.05	0.69	12.09	0.84	12.17	1.14	12.30	1.63	12.37	1.90	12.46	2.25
	2-Yr	-	-	11.96	0.35	11.97	0.37	11.97	0.39	11.98	0.41	11.98	0.42	11.99	0.44
	3-Yr	-	-	-	-	11.96	0.35	11.97	0.38	11.98	0.40	11.98	0.41	11.98	0.42
	5-Yr	-	-	-	-	-	-	11.96	0.35	11.97	0.39	11.97	0.39	11.98	0.41
	10-Yr	-	-	-	-	-	-	-	-	11.97	0.36	11.97	0.38	11.97	0.39
PA-3	Existing	12.13	0.30	12.20	0.42	12.29	0.58	12.44	0.83	12.54	0.98	12.59	1.04	12.65	1.13
	2-Yr	-	-	11.96	0.00	11.96	0.01	11.97	0.01	11.98	0.03	11.98	0.04	11.99	0.05
	3-Yr.	-	-	-	-	11.96	0.00	11.96	0.01	11.97	0.02	11.98	0.03	11.98	0.04
	5-Yr	-	-	-	-	-	-	11.96	0.00	11.97	0.01	11.97	0.02	11.98	0.03
	10-Yr	-	-	-	-	-	-	-	-	11.96	0.00	11.96	0.00	11.96	0.01
PA-4	Existing	12.06	0.62	12.11	0.74	12.18	0.94	12.30	1.26	12.49	1.68	12.55	1.69	12.63	1.70
	2-Yr	-	-	11.97	0.38	11.99	0.42	12.02	0.50	12.06	0.61	12.07	0.63	12.08	0.66
	3-Yr	-	-	-	-	11.97	0.38	11.99	0.43	12.03	0.53	12.06	0.60	12.07	0.63
	5-Yr	-	-	-	-	-	-	11.98	0.39	12.01	0.47	12.03	0.52	12.06	0.60
	10-Yr	-	-	-	-	-	-	-	-	11.99	0.41	12.00	0.45	12.02	0.50
VALENZUELA															
ME-9	Existing	12.11	2.95	12.16	3.52	12.23	4.27	12.37	5.66	12.51	7.58	12.55	8.48	12.61	9.65
	2-Yr	-	-	12.13	3.22	12.19	3.85	12.25	4.43	12.32	5.16	12.35	5.47	12.39	5.87
	3-Yr	-	-	-	-	12.19	3.85	12.25	4.43	12.32	5.16	12.35	5.47	12.39	5.87
	5-Yr	-	-	-	-	-	-	12.23	4.18	12.30	4.95	12.33	5.26	12.37	5.70
	10-Yr	-	-	-	-	-	-	-	-	12.27	4.60	12.30	4.95	12.34	5.39

Table 5-5-1 OPTIMUM DIMENSIONS OF PUMPS AND REGULATION PONDS FOR EAST AND WEST OF MANGAHAN

Subdrainage Area	Objective Discharge* For Land Use at 2020		Optimum Dimensions of Pump and Regulation Pond							Dimensions of Pump For Land Use at 2000	
			Pump Station		Regulation Pond						
	Discharge (m^3/s)	Specific Discharge ($m^3/s/km^2$)	Design Capacity (m^3/s)	Specific Discharge ($m^3/s/km^2$)	High Water Level EL (m)	Bottom Height EL (m)	Water Depth (m)	Area (m^2)	Volume (m^3)	Design Capacity (m^3/s)	Specific Discharge ($m^3/s/km^2$)
EM-1	8.1	4.9	9	5.4	13.0	-	-	-	-	8	4.8
2	10.8	4.5	11	4.5	12.5	-	-	-	-	8	3.3
3	6.7	2.5	5	1.8	12.5	9.5	3.0	6,000	18,000	5	1.8
4	5.1	2.6	2	1.0	12.0	9.0	3.0	11,000	33,000	2	1.0
WM-1	45.3	5.0	46	5.0	12.0	-	-	-	-	32	3.5
2	26.3	5.1	12	2.3	12.0	9.0	3.0	46,000	138,000	7	1.4
3	35.2	5.2	20	2.9	12.0	9.0	3.0	61,000	183,000	14	2.0
4	66.1	4.6	45	3.2	12.0	9.0	3.0	86,000	258,000	31	2.2
5	12.4	4.5	6	2.2	12.0	9.0	3.0	21,000	63,000	4	1.4

* Objective Discharge is the required pump capacity without the regulation pond.

Table 5-5-2 INUNDATION WATER LEVEL WITH AND WITHOUT PROJECT FOR EAST AND WEST OF MANGAHAN

Name of Sub-drainage Area	W/ or W/O Project	Maximum Inundation Water Level (E.L.m) 2-Yr. Return Period	3-Yr. Return Period	5-Yr. Return Period	10-Yr. Return Period	30-Yr. Return Period	50-Yr. Return Period	100-Yr. Return Period
EAST OF MANGAHAN								
EM-1	W/O	13.40	13.52	13.68	14.02	14.32	14.48	14.56
	W/	-	-	-	13.23	13.29	14.48	14.56
EM-2	W/O	12.78	13.00	13.12	13.39	13.65	13.86	14.08
	W/	-	-	-	12.73	12.79	13.86	14.08
EM-3	W/O	12.80	13.01	13.16	13.25	13.65	13.86	14.08
	W/	-	-	-	12.73	12.78	13.86	14.08
EM-4	W/O	12.40	12.57	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	12.26	12.38	13.86	14.08
WEST OF MANGAHAN								
WM-1	W/O	12.55	12.60	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	12.24	12.31	13.86	14.08
WM-2	W/O	12.15	12.50	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	11.79	12.00	13.86	14.08
WM-3	W/O	12.15	12.50	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	11.77	11.92	13.86	14.08
WM-4	W/O	12.35	12.50	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	12.00	12.08	13.86	14.08
WM-5	W/O	12.15	12.50	12.85	13.22	13.65	13.86	14.08
	W/	-	-	-	11.96	12.06	13.86	14.08

Table 5-5-3 DEVELOPED AREA AFFECTED BY 1986 FLOOD IN MALABON-NAVOTAS

Drainage District	(A) Total Draina Area (km^2)	(B) Developed Area at Prese (km^2)	(C) Flooded Area in 1986 (km^2)	(D) Developed Area at Present within (C) (km^2)	(E) (D)/(A) (%)	(F) Developed Area in 2020 within (C) (km^2)	(G) (F)/(A) (%)
MA-11	0.69	0.66	0.69	0.66	95.65	0.69	100.00
MA-3	2.21	1.88	1.94	1.71	77.38	1.77	80.09
MA-6	1.34	0.71	1.09	0.71	52.99	1.09	81.34
MA-4	0.50	0.26	0.50	0.26	52.00	0.3 9	78.00
MA-2	2.05	0.92	2.05	0.92	44.88	1. 28	62.44
MA-5	1.89	1.76	0.78	0.78	41.27	0.78	41.27
MA-9	0.30	0.30	0.12	0.12	40.00	0.12	40.00
MA-1	2.26	0.72	1.81	0.38	16.81	1.82	80.53
MT-4-1	4.11	3.19	0.90	0.34	8.27	0.68	16.55
MT-4-2	2.18	1.87	0.80	0.15	6.88	0.32	14.68
MA-7	2.40	1.60	0.34	0.05	2.08	0.34	14.17
MA-12	0.32	0.00	0.00	0.00	0.00	0.00	0.00

Table 5-5-4 ECONOMIC COMPARISON ON DRAINAGE SYSTEM FOR NORTH OF MALABON RIVER

Alternative Case	Integration of Subdrainage Areas for Ring Dike	Project Cost incl. O/M Cost* (million pesos)	Land Acquisition (1,000 m^2)
1	MA-1, MA-2, MA-3, MA-4, MA-5	1,398	402
2	(MA-1+MA-2), MA-3, MA-4, MA-5	1,369	341
3	(MA-1+MA-2), (MA-3+MA-4), MA-4	1,273	325
4	(MA-1+MA-2), (MA-3+MA-5), MA-4	1,257	277
5	(MA-1+MA-2), MA-3, (MA-4+MA-5)	1,662	326
6	(MA-1+MA-2), (MA-3+MA-4+MA-5)	1,070	242
7	MA-1, (MA-2+MA-3), MA-4, MA-5	1,251	347
8	MA-1, (MA-2+MA-3), (MA-4+MA-5)	1,509	332
9	MA-1, MA-2, (MA-3+MA-4), MA-5	1,302	386
10	MA-1, MA-2, (MA-3+MA-5), MA-4	1,308	346
11	MA-1, MA-2, MA-3, (MA-4+MA-5)	1,690	387
12	(MA-1+MA-2+MA-3), MA-4, MA-5	1,245	310
13	(MA-1+MA-2+MA-3), (MA-4+MA-5)	1,537	295
14	MA-1, (MA-2+MA-3+MA-4+MA-5)	1,168	306
15	MA-1, (MA-2+MA-3+MA-5), MA-4	1,239	280
16	MA-1, MA-2, (MA-3+MA-4+MA-5)	1,087	290
17	(MA-1+MA-2+MA-3+MA-4), MA-5	1,158	266
18	(MA-1+MA-2+MA-3+MA-5), MA-4	1,226	243
19	MA-1, (MA-2+MA-3,MA-4+MA-5)	1,001	222
20**	(MA-1+MA-2+MA-3+MA-4+MA-5)	984	185

[Note]

* Including the pump cost estimated under the land use conditions of 2020.
** Optimum drainage system for the north bank of Malabon River.

Table 5-5-5 INUNDATION WATER LEVEL WITH AND WITHOUT PROJECT
FOR MALABON - NAVOTAS

Name of Sub-drainage Area	W/ or W/O Project	Maximum Inundation Water Level (E.L.m) 2-Yr. Return Period	3-Yr. Return Period	5-Yr. Return Period	10-Yr. Return Period	30-Yr. Return Period	50-Yr. Return Period	100-Yr. Return Period
MA-1	W/O	10.77	10.82	10.88	10.98	11.05	11.07	11.11
	W/	-	-	-	10.74	10.84	10.90	10.97
MA-2	W/O	10.73	10.77	10.83	10.92	11.03	11.07	11.11
	W/	-	-	-	10.77	10.87	10.92	10.99
MA-3	W/O	11.04	11.08	11.13	11.21	11.33	11.39	11.47
	W/	-	-	-	10.82	10.91	10.97	11.03
MA-4	W/O	11.05	11.08	11.12	11.19	11.28	11.34	11.41
	W/	-	-	-	10.82	10.91	10.97	11.03
MA-5	W/O	11.14	11.20	11.28	11.41	11.56	11.63	11.71
	W/	-	-	-	10.82	10.91	10.97	11.03
MA-6	W/O	10.99	11.02	11.05	11.11	11.23	11.25	11.31
	W/	-	-	-	10.92	10.98	11.02	11.05
MA-9	W/O	11.29	11.32	11.37	11.45	11.56	11.60	11.67
	W/	-	-	-	11.21	11.23	11.24	11.26
MA-11	W/O	11.11	11.17	11.24	11.37	11.53	11.59	11.66
	W/	-	-	-	10.92	10.95	10.97	11.00

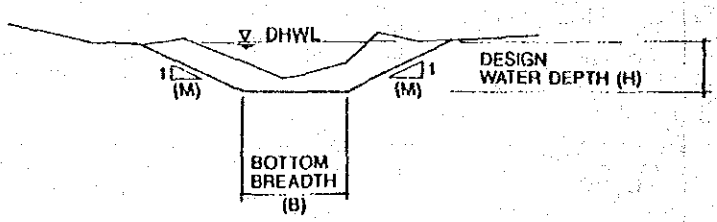
Table 5-6-1 COST COMPARISON OF EMBANKMENT METHOD OF LAKESHORE DIKE (Per Unit Length)

(unit ;P/m)

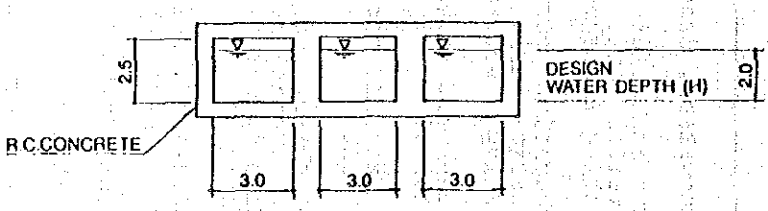
Work Item	Unit	Unit Cost (P)	Case 1		Case 2		Case 3		Case 4		Case 5	
			Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
1. Excavation, dredger	m^3	50	149	7,450	57	2,850	61	3,050	-	-	91	4,550
2. Excavation, dredged material incl. loading hauling & spreading	m^3	30	-	-	57	1,710	-	-	-	-	-	-
3. Excavation, borrowed material incl. loading hauling & spreading	m^3	100	-	-	37	3,700	41	4,100	91	9,100	-	-
4. Embankment, dredged material	m^3	40	149	5,960	-	-	61	2,440	-	-	-	-
5. Compacting, borrowed material	m^3	5	-	-	-	-	41	210	91	460	-	-
6. Embankment, mixed soil with dredged material & borrowed material incl. mixing	m^3	40	-	-	94	3,760	-	-	-	-	-	-
7. Embankment, soil cement incl. mixing	m^3	45	-	-	-	-	-	-	-	-	91	4,100
8. Cement (0.08 t/m^3)	ton	1,450	-	-	-	-	-	-	-	-	7.3	10,590
9. Revetment	m^2	600	26.1	15,660	10.4	6,240	12.8	7,680	8.5	5,100	8.5	5,100
10. Preparatory works (20%)	L.S.			5,810		3,650		3,500		2,930		4,870
Total				34,880		21,910		20,980		17,590		29,210

Table 5-6-2(1/2) FEATURES OF PROPOSED DRAINAGE CHANNEL FOR EAST AND WEST OF MANGAHAN

Sub-D.Area	Drainage Area (ha)	Design Discharge (m3/s)	Channel Gradient (1/1)	Roghness Co-efficient	Length Const. (m)	Length Impvt. (m)	Bottom Breadth (B:m)	Design W.Depth (H:m)	Type	Side Slope (M)	Channel Code	Remarks
EM-1	83.0	15	5000	0.030	700		8.6	2.0	Trape.	2.0	b	
	83.6	13	5000	0.030	1,100		7.1	2.0		2.0	a	
S-total	166.6				1,800							
EM-2	74.3	11	5000	0.030	800		5.7	2.0	Trape.	2.0	b	
	39.9	18	5000	0.030	700		10.7	2.0	Trape.	2.0	a-3	
	39.7	14	5000	0.030	550		7.9	2.0	Trape.	2.0	a-2	
	87.8	10	5000	0.030	750		5.0	2.0	Trape.	2.0	a-1	
S-total	241.7				2,800							
EM-3	80.5	7	5000	0.030	700		2.8	2.0	Trape.	2.0	b	
	40.9	11	5000	0.030	900		5.7	2.0	Trape.	2.0	a-3	
	65.6	9	5000	0.030	500		4.3	2.0	Trape.	2.0	a-2	
	85.2	5	5000	0.030	600		1.3	2.0	Trape.	2.0	a-1	
S-total	272.2				2,700							
EM-4	53.5	17	5000	0.030		400	10.0	2.0	Trape.	2.0	a-3	
	45.8	13	5000	0.030		350	7.1	2.0	Trape.	2.0	a-2	
	95.7	9	5000	0.030		350	4.3	2.0	Trape.	2.0	a-1	
S-total	195.0					1,100						
Total	875.5				7,300	1,100						



TYPICAL CROSS SECTION OF TRAPEZOIDAL CHANNEL

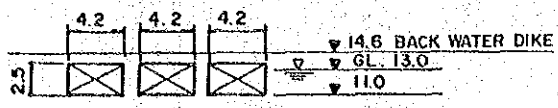
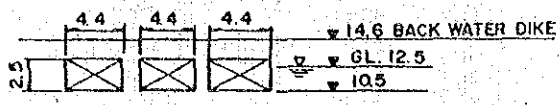
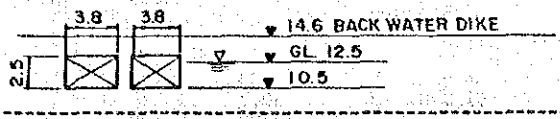
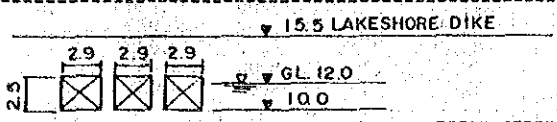
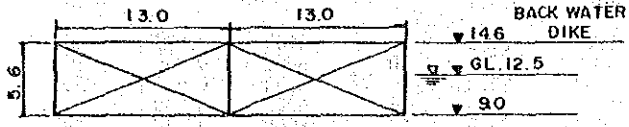
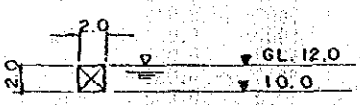
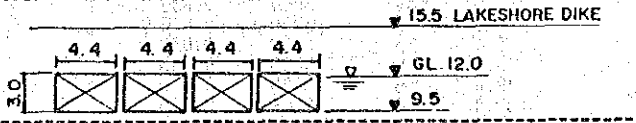
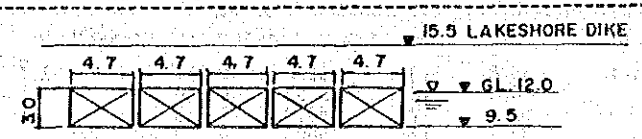
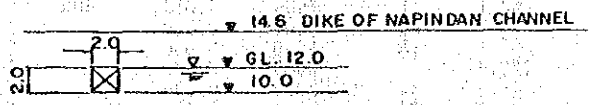
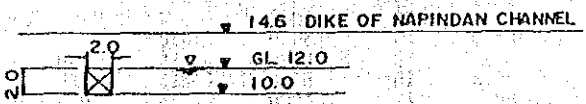
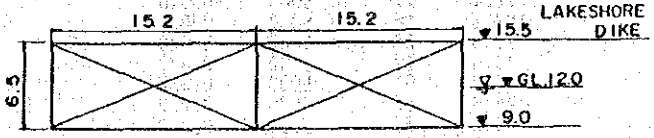
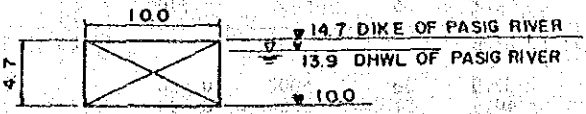
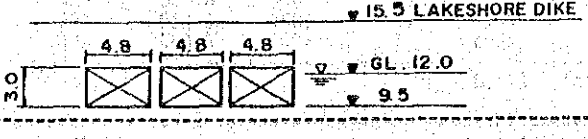


TYPICAL CROSS SECTION OF CLOSED CHANNEL
(THREE UNITS BOX CULVERT)

Table 5-6-2(2/2) FEATURES OF PROPOSED DRAINAGE CHANNEL FOR EAST AND WEST OF MANGAHAN

Sub-D.Area	Drainage Area (ha)	Design Discharge (m3/s)	Channel Gradient (1/I)	Roghness Co-efficient	Length Const. (m)	Length Impvt. (m)	Bottom Breadth (B:m)	Design W.Depth (H:m)	Type	Side Slope (M)	Channel Code	Remarks
WM-1	34.9	25	5000	0.030	600		15.5	2.0	Trape.	2.0	f-3	
	51.3	20	5000	0.030	450		12.0	2.0	Trape.	2.0	f-2	
	81.5	13	5000	0.030	450		7.1	2.0	Trape.	2.0	f-1	
	22.2	35	1500	0.030		600	16.0	1.7	Trape.	2.0	e	
	46.1	20	1500	0.030		800	10.0	1.6	Trape.	2.0	d-2	
	85.4	13	1500	0.030		600	10.0	1.2	Trape.	2.0	d-1	
	22.3	20	1500	0.030		450	17.0	1.2	Trape.	2.0	c-2	
	92.0	17	1500	0.030		500	14.0	1.2	Trape.	2.0	c-1	
	50.0	64	2000	0.030		800	13.0	2.9	Trape.	2.0	b-2	
	55.8	64	2000	0.030		850	20.0	2.3	Trape.	2.0	b-2	
	133.2	55	2000	0.030		900	23.0	2.0	Trape.	2.0	b-1	
	79.7	27	1500	0.030		1,000	12.0	1.7	Trape.	2.0	a-5	
	50.3	18	1500	0.030		700	21.0	1.0	Trape.	2.0	a-4	
	36.3	13	1500	0.030		250	15.0	1.0	Trape.	2.0	a-3	
	0.0	13	1500	0.030	250		15.0	1.0	Trape.	2.0	a-2	
	71.1	9	1500	0.030	500		10.0	1.0	Trape.	2.0	a-1	
S-total	912.1				2,250	7,450						
WM-2	56.0	21	5000	0.030	1,100		12.7	2.0	Trape.	2.0	d-3	
	51.9	16	5000	0.030	550		9.3	2.0	Trape.	2.0	d-2	
	99.5	11	5000	0.030	500		5.7	2.0	Trape.	2.0	d-1	
	55.8	8	5000	0.030		850	8.0	1.5	Trape.	2.0	c	
	89.0	27	5000	0.030		1,000	17.0	2.0	Trape.	2.0	b	Antipolo
	79.5	17	5000	0.030		1,000	10.0	2.0	Trape.	2.0	a-2	
	82.7	9	5000	0.030		900	7.0	1.7	Trape.	2.0	a-1	S.Baho
S-total	514.4				2,150	3,750						
WM-3	29.3	14	5000	0.030	600		7.9	2.0	Trape.	2.0	g-2	
	57.2	10	5000	0.030	400		5.0	2.0	Trape.	2.0	g-1	
	29.8	20	5000	0.030	550		12.0	2.0	Trape.	2.0	f-3	
	20.6	16	5000	0.030	550		9.3	2.0	Trape.	2.0	f-2	
	89.8	13	5000	0.030	400		7.1	2.0	Trape.	2.0	f-1	
	35.6	19	5000	0.030		550	11.3	2.0	Trape.	2.0	e-2	
	88.8	14	5000	0.030	600		7.9	2.0	Trape.	2.0	e-1	
	19.9	15	5000	0.030		800	8.6	2.0	Trape.	2.0	d-2	
	76.1	12	5000	0.030		300	6.4	2.0	Trape.	2.0	d-1	
	22.3	39	3000	0.030		550	20.0	2.0	Trape.	2.0	c	
	25.0	39	3000	0.030		800	16.0	2.2	Trape.	2.0	c	
	35.0	39	3000	0.030		1,000	16.0	2.4	Trape.	2.0	c	
	6.4	29	5000	0.030		300	20.0	1.9	Trape.	2.0	b	
	27.4	18	5000	0.030		300	10.7	2.0	Trape.	2.0	a-3	
	39.6	15	5000	0.030		1,000	8.6	2.0	Trape.	2.0	a-2	
	80.4	10	5000	0.030		750	5.0	2.0	Trape.	2.0	a-1	
S-total	683.2				3,100	6,350						
WM-4	38.8	13	5000	0.030		1,400	11.0	1.7	Trape.	2.0	o-2	Tipas
	20.0	13	5000	0.030		500	8.0	1.9	Trape.	2.0	o-2	Tipas
	67.4	7	5000	0.030		900	2.8	2.0	Trape.	2.0	o-1	Tipas
	92.2	17	5000	0.030	550		10.0	2.0	Trape.	2.0	n	
	62.1	11	5000	0.030	600		5.7	2.0	Trape.	2.0	m	
	42.7	25	5000	0.030		350	15.5	2.0	Trape.	2.0	l-2	
	97.1	18	5000	0.030		250	10.7	2.0	Trape.	2.0	l-1	
	128.4	21	5000	0.030		800	12.7	2.0	Trape.	2.0	k	Ususan
	41.2	42	2000	0.030		900	17.0	2.0	Trape.	2.0	j	Ususan
	47.9	30	500	0.030		500	2.0	2.5	Trape.	2.0	i-4	Ususan
	60.2	25	5000	0.030		1,350	15.5	2.0	Trape.	2.0	i-3	Ususan
	27.9	19	5000	0.030		200	11.3	2.0	Trape.	2.0	i-2	Ususan
	0.0	19	5000	0.015	250		9.0	2.0	B.Culvert	0.0	i-1	B=3.0m*3units
	55.6	19	5000	0.015	600		9.0	2.0	B.Culvert	0.0	h-2	B=3.0m*3units
	80.7	12	5000	0.015	600		6.0	2.0	B.Culvert	0.0	h-1	B=3.0m*2units
	12.4	17	5000	0.030		500	10.0	2.0	Trape.	2.0	g-2	
	102.1	16	5000	0.030		500	9.3	2.0	Trape.	2.0	g-1	
	19.3	14	5000	0.030	600		7.9	2.0	Trape.	2.0	f-2	
	73.5	12	5000	0.030	400		6.4	2.0	Trape.	2.0	f-1	
	67.7	91	5000	0.030		800	30.0	3.0	Trape.	2.0	e	Taguig
	12.3	83	5000	0.030		1,000	30.0	2.8	Trape.	2.0	d	Taguig
	24.2	67	5000	0.030		1,450	27.0	2.7	Trape.	2.0	c	Taguig
	12.2	29	5000	0.030		400	11.0	2.6	Trape.	2.0	b	Taguig
	64.5	21	5000	0.030		1,300	8.0	2.5	Trape.	2.0	a-5	Taguig
	31.1	16	5000	0.030		500	6.0	2.4	Trape.	2.0	a-4	Taguig
	45.6	13	5000	0.030		800	5.0	2.4	Trape.	2.0	a-3	Taguig
	49.3	9	5000	0.030		900	2.0	2.4	Trape.	2.0	a-2	Taguig
	51.2	5	5000	0.030		350	1.0	2.4	Trape.	2.0	a-1	Taguig
S-total	1,427.6				3,600	15,650						
WM-5	33.0	36	5000	0.030		350	15.0	2.5	Trape.	2.0	c	
	40.9	21	5000	0.030		550	12.7	2.0	Trape.	2.0	b-2	
	101.5	15	5000	0.030	550		8.6	2.0	Trape.	2.0	b-1	
	23.6	17	5000	0.030	400		10.0	2.0	Trape.	2.0	a-2	
	78.3	14	5000	0.030	400		7.9	2.0	Trape.	2.0	a-1	
S-total	277.3				1,350	900						
Total	3,814.6				12,450	34,100						

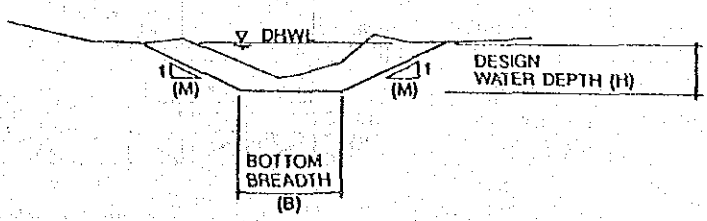
Table 5-6-3 FEATURES OF PROPOSED SLUICE GATE FOR EAST AND WEST OF MANGAHAN

DRAINAGE AREA	LOCATION	DESIGN DISCHARGE (M3/S)	TYPE	CROSS SECTION
EM-1	Buli River STA.0+000	25	Box culvert/Sluice appurtenant to Pump Station	
EM-2	Baho River STA.0+000	26	Box culvert/Sluice appurtenant to Pump Station	
EM-3	Mahaba River STA.0+000	15	Box culvert/Sluice appurtenant to Pump Station	
EM-4	Lakeshore Dike	17	Box culvert/Sluice appurtenant to Pump Station	
WM-1	Napindan R. Lower Buli R.	78	Open channel/Sluice appurtenant to Pump Station	
	Antipolo R. STA.0+800	*	Open channel/Sluice	
WM-2	Lakeshore Dike Anti Polo R. STA.3+100	44	Box culvert/Sluice appurtenant to Pump Station	
WM-3	Lakeshore Dike Labsan R. STA.1+800	58	Box culvert/Sluice appurtenant to Pump Station	
	Napindan C. STA.1+628	*	Box culvert/Sluice	
	Napindan C. STA.3+906	*	Box culvert/Sluice	
WM-4	Lakeshore Dike Taguig R. STA.7+970	91	Open channel/Sluice appurtenant to Pump Station	
	Tipas R. STA.2+010	*	Open channel/Sluice	
	Taguig R. STA.0+000	Navi.	Open channel/Sluice	
WM-5	Lakeshore Dike Bicutan R.	36	Box culvert/Sluice appurtenant to Pump Station	

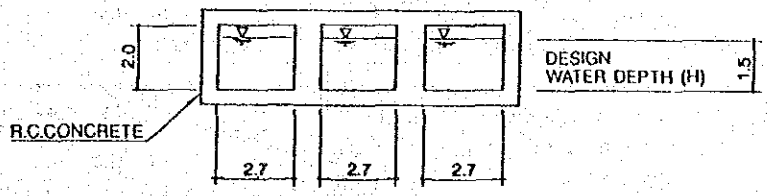
NOTE: Design discharge of "*" presents that the gate size is determined from its maintenance function.

Table 5-6-4 FEATURES OF PROPOSED DRAINAGE CHANNEL FOR MALABON-NAVOTAS

Sub-D.Area	Drainage Area (ha)	Design Discharge (m3/s)	Channel Gradient (1/I)	Roghness Co-efficient	Length Const. (m)	Length Impvt. (m)	Bottom Breadth (B:m)	Design W.Depth (H:m)	Type	Side Slope (M)	Remarks
MA-1-A	53.0	13	1500	0.030		600	4.0	2.0	Trape.	2.0	Panghulo
	60.0	13	1500	0.030	1,000		4.0	2.0	Trape.	2.0	
S-total	113.0				1,000	600					
MA-6	64.0	25	2000	0.030		300	10.0	2.0	Trape.	2.0	Catmon
	70.0	25	2000	0.030		400	15.0	1.6	Trape.	2.0	Catmon
	34.0	7	5000	0.030	400		6.5	1.5	Trape.	2.0	
	34.0	7	5000	0.030	500		6.5	1.5	Trape.	2.0	
S-total	202.0				900	700					
MA-11	69.0	12	5000	0:015	800		8.1	1.5	B.Culvert	0.0	B=2.7m*3units
S-total	69.0				800						
Total	384.0				2,700	1,300					

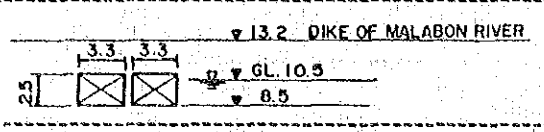
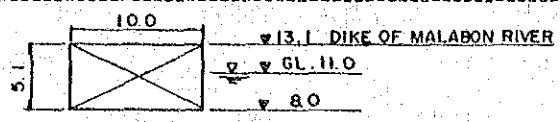
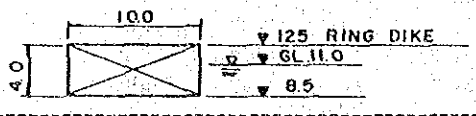
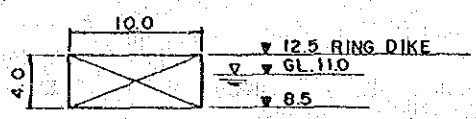
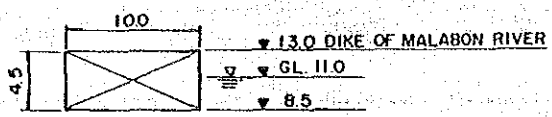
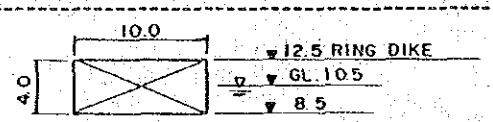
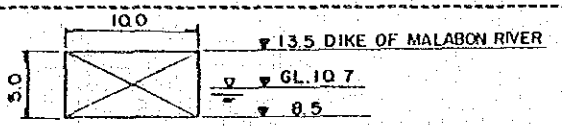
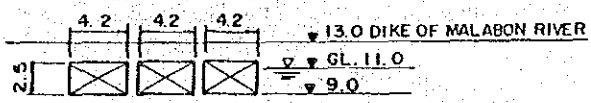
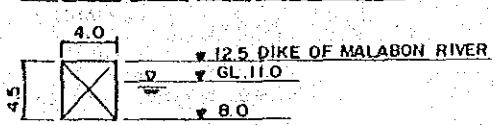
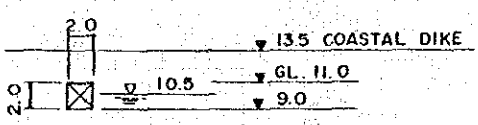
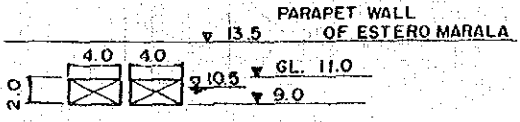
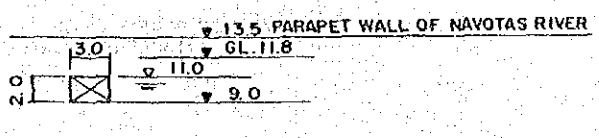


TYPICAL CROSS SECTION OF TRAPEZOIDAL CHANNEL



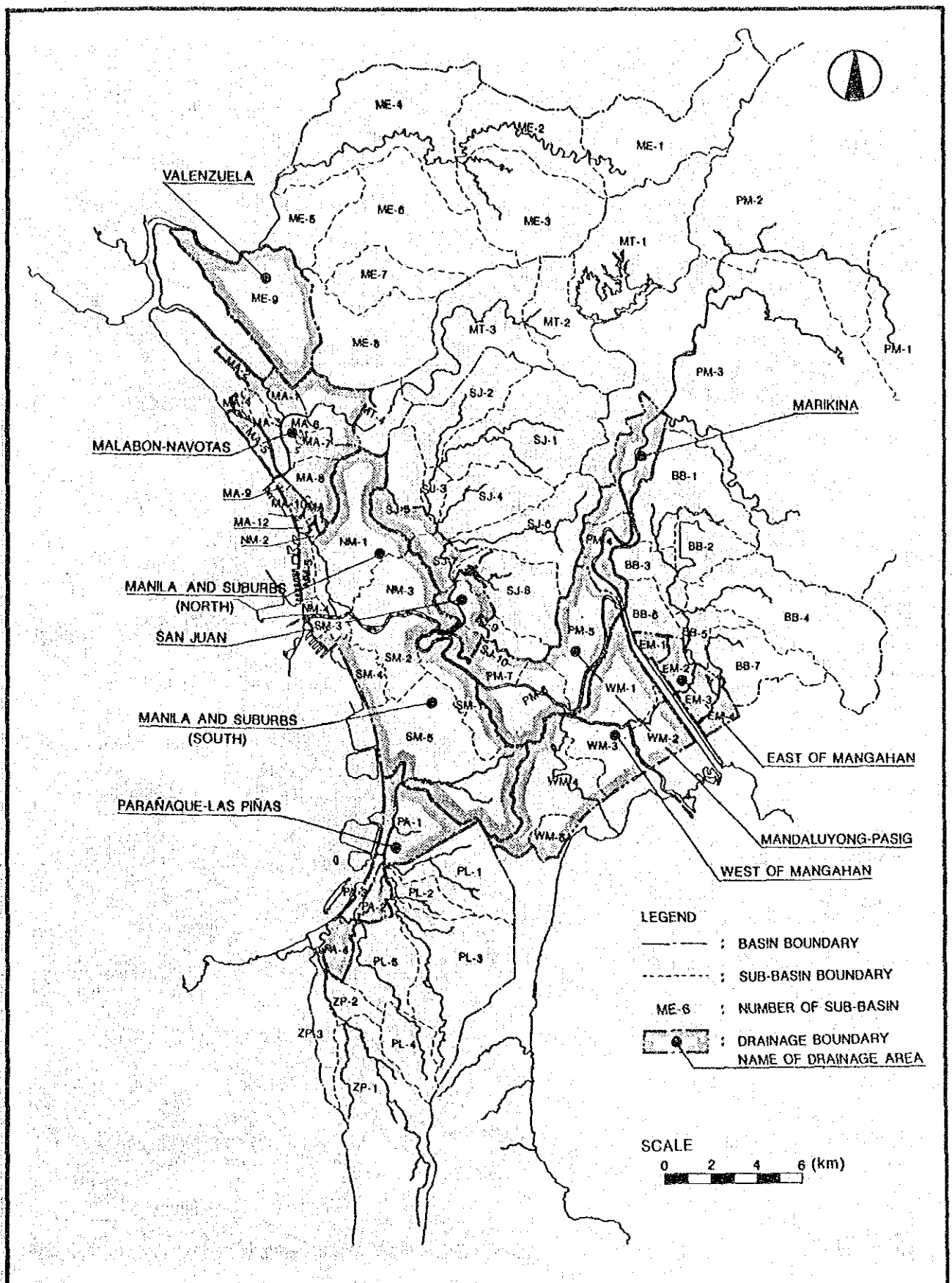
TYPICAL CROSS SECTION OF CLOSED CHANNEL
(THREE UNITS BOX CULVERT)

Table 5-6-5 FEATURES OF PROPOSED SLUICE GATE FOR MALABON-NAVOTAS

DRAINAGE AREA	LOCATION	DESIGN DISCHARGE (M3/S)	TYPE	CROSS SECTION
MA-1-A	Saltolan R. STA.0+000	13	Box culvert/Sluice appurtenant to Pump Station	
MA-1-B	Pinagkabalian STA.0+000	Navi.	Open channel/Sluice appurtenant to Pump Station	
	Pinagkabalian STA.2+200	Navi.	Open channel/Sluice	
MA-2-B	Dampalit R. STA.5+400	Navi.	Open channel/Sluice	
	Dampalit R. STA.0+000	Navi.	Open channel/Sluice	
MA-3	Dampalit R. STA.2+200	Navi.	Open channel/Sluice	
MA-5	Navotas R. STA.2+865	Navi.	Open channel/Sluice	
MA-6	Catmon Creek STA.0+000	25	Box culvert/Sluice appurtenant to Pump Station	
	Longos Creek STA.0+000	*	Box culvert/Sluice	
MA-9	Coastal Dike	2	Box culvert/Sluice appurtenant to Pump Station	
MA-11	Estero Marala STA.0+950	12	Box culvert/Sluice appurtenant to Pump Station	
	Dagat Dagatan Navotas R. STA.2+250	*	Box culvert/Sluice	

NOTE: Design discharge of "*" presents that the gate size is determined from its maintenance function.
Design discharge of "Navi." presents that the gate size is determined considering navigatin of vessels.

FIGURES



THE STUDY ON FLOOD CONTROL AND DRAINAGE PROJECT IN METRO MANILA, PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

DRAINAGE AREAS IN THE STUDY AREA
Fig.5-2-1