(3) construction of navigation lock including excavation, earth embankment, rip-rap, revetment, mass and reinforced concretes, steel sheet piling, steel gates and bascule bridge.

The construction planning for the major work items is executed in accordance with the construction methods described above.

River Improvement of Pasig-Marikina River

The major work items of the River Improvement of the Pasig-Marikina River are (1) river improvement of Pasig-Marikina including excavation of riverbed, embankment, parapet walls/river walls, revetment, steel sheet piling and concrete bridge; and, (2) construction of Marikina Control Gate Structure including coffering with steel sheet piles, excavation, foundation treatment, embankment, concrete revetment, gabion and gates.

The construction planning for the major work items is executed in accordance with the construction methods described above.

2.4 Construction Time Schedule

Based on the Master Plan Study, the construction works of the selected priority projects are scheduled to be completed within 4 years starting from 1991 for the East and West of Mangahan Drainage Improvement Project and the Malabon-Navotas Drainage Improvement Project, and within 5 years starting from 1991 for the Pasig-Marikina River Improvement Project.

The construction time schedules for the above projects are presented in Fig. 6-2-2, 6-2-3 and 6-2-4, respectively.

3. COST ESTIMATES

3.1 Conditions for Cost Estimates

The construction cost for the projects is estimated on the basis of the design, the construction plan and the following assumptions and conditions.

(1) Price Level

The construction cost for the project is estimated on the price level of October 1988.

(2) Exchange Rate

The foreign currency conversion rates between US$, Philippine Peso and Japanese Yen are as follows:

US$1.00 : ₱21.30 : ¥132

(3) Currency of Cost Estimate

The construction cost is estimated in foreign currency component and local currency component.

The currency for estimated costs is expressed in Philippine Peso for both local and foreign currency components.

(4) Labor Wages

Labor wages of foreman, operator/driver, mechanic, concrete worker, carpenter, barbender and common laborer are estimated in consideration with the Labor Code of the Philippines and the prevailing labor wages for technicians of general contractors in Metro Manila. The daily wages including overtime of 1 hour is shown in Table 6-3-1.

(5) Material Costs

The unit prices of construction materials were canvassed in Metro Manila and the major steel materials were adjusted in consideration with the prevailing market prices in Japan. The unit price list and hourly rental cost of the materials are shown in Tables 6-3-2 and 6-3-3, respectively.

(6) Equipment Cost

The hourly equipment cost consists of depreciation cost, maintenance and repair cost, and other annual administration cost. The hourly cost is calculated in consideration with ACEL price in the

Philippines, CIF purchase cost, economic life of equipment and rates of maintenance and repair cost in Japan. The hourly equipment and material (POL) costs are shown in Table 6-3-3.

(7) Contractor's Indirect Cost

The contractor's indirect cost such as overhead, tax and duty, profit, etc., is assumed to be 25 percent of the direct cost of both local and foreign currency components.

(8) Land Acquisition and Compensation Cost

The unit price of compensation consisting of land acquisition, house evacuation and temporary use of land is estimated as follows by the data so far collected.

Area for Land Acquisition Including Compensation	Unit	Unit Price (Peso)
Congested Area 1 (Manila, Quezon City, Makati, Pasay City)	m^2	3,000
Congested Area 2 (Residential Area, except above four areas)	m^2	1,200
Open Space (Other than Residential Area)	m^2	300

(9) Government Administration Cost

Government administration expense is assumed to be 5% of the total construction cost of civil works including preparatory works for local currency portion to cover the cost of management of the Project.

(10) Engineering Services Cost

An international consultancy firm will be selected for carrying out the detailed design and supervision of the construction works. The engineering services cost is assumed to be 15% of the total construction cost of civil works for local and foreign currency portions.

(11) Contingencies

Physical contingency is estimated at 10% of the foreign and local currency costs, while price contingency is considered only for the local currency at the annual escalation rate of 6%.

3.2 Unit Cost of Construction Works

The direct construction cost is estimated on the unit cost basis multiplying the unit cost of work items by the corresponding work quantities.

Unit cost is estimated based on the construction methods in this report. The unit price for each work item consists of the direct costs of labor, equipment and materials, and the contractor's indirect cost.

Revetment works will require coffering for the work site because of dewatering. The cost of coffering is different in accordance with the water depth of the construction site. Therefore, the coffering is classified into three types and the cost for each type is estimated as follows.

Calculation of Cost for Coffering

(1) In case of water depth more than 5 m

Sta. 5+605, water depth = 6.4 m (average)

- Unit cost of preparatory works for both banks (coffering with steel sheet pile for revetment) : ₱69,284/m
- Unit direct cost of construction (excavation, revetment, river wall, parapet, etc.) : ₱88,520/m

The percentage of cost of preparatory works against the direct cost of construction is approximately 80%.

(2) In case of water depth of 3 to 5 m

Sta. 12+495, water depth = 3.8 m

- Unit cost of preparatory works for both banks (coffering with steel sheet pile for revetment : ₱42,844/m
- Unit direct cost of construction (excavation, revetment, river wall, parapet, etc. : ₱89,000/m

The percentage of cost of preparatory works against the direct cost of construction is approximately 50%.

(3) In case of water depth less than 3 m

Sta. 2+710, water depth = 2.8 m

- Unit cost of preparatory works for both banks (coffering with steel sheet pile for revetment : ₱17,208/m
- Unit direct cost of construction (excavation, revetment, river wall, parapet, etc. : ₱51,700/m

The percentage of cost of preparatory works against the direct cost of construction is approximately 30%. (Refer to Fig. 6-3-1.)

The breakdowns of unit costs are shown in Table 6-3-4 and the attached sheets.

3.3 Foreign and Local Currencies

The unit cost of the major work items is estimated on the basis of the conditions mentioned in Tables 6-3-1, 6-3-2 and 6-3-3.

The unit cost of each item is estimated by dividing it into two currency components after examining its contents. As shown in the Breakdown of Unit Cost, the foreign currency components formed in each unit cost vary in percentage from 70 to 100%. Based on these results of

calculation, the estimated percentage allocation on each unit cost for major items is presented in Table 6-3-5.

3.4 Construction Cost of the Project

The construction cost consists of the direct and the indirect costs, the latter of which includes land acquisition, administration, engineering services, physical contingency and price contingencyt. Cost estimates are made at the price level of October, 1988.

The construction costs for the Phase I Project is estimated as follows.

		(in Million) F/C (US$)	L/C (Peso)	Total (Peso)
(1)	Construction Cost for East and West of Mangahan Drainage Improvement Project	96.6 (₱2,058)	754 (US$35.4	2,812 (US$132.0)
(2)	Construction Cost for Malabon-Navotas Drainage Improvement Project	35.8 (₱762)	353 (US$16.6)	1,115 (US$52.4)
(3)	Construction Cost for Pasig-Marikina River Improvement Project	43.6 (₱927)	474 (US$22.2)	1,401 (US$65.8)
	Total	176.0 (₱3,747)	1,581 (US$74.2)	5,328 (US$250.2)

The breakdown of each project is shown in Tables 6-3-6, 6-3-7 and 6-3-8, respectively.

3.5 Annual Disbursement Schedule

The annual disbursement schedules for the projects are prepared in accordance with the implementation schedules and presented in Tables 6-3-9, 6-3-10 and 6-3-11, respectively.

3.6 Operation, Maintenance and Replacement Cost

The operation and maintenance cost is estimated on the basis of the rate involved in the direct construction cost which consists of the cost for major civil works and the cost for preparatory works. The rates of operation cost and maintenance cost will depend on the employed structures and facilities, as follows.

- Common Civil Works : 0.3%
- Steel Gate : 1.0%
- Pump : 1.5%

As for the replacement cost, the durable life of structures and facilities is set as follows.

- Common Civil Works : 40 years
- Steel Gate : 30 years
- Pump : 15 years

The annual operation, maintenance and replacement cost for the proposed plan is estimated as shown in Table 6-3-12.

TABLES

Table 6-2-1(1/4) REQUIRED WORKS FOR THE FRAMEWORK PLAN

PASIG-MARIKINA RIVER IMPROVEMENT (100-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
River Mouth/San Juan C.	Sta. 0+000/ 8+735	8,735	1150	2,334	0	40	3	0	1	20	646	60	706
San Juan C./Napindan C.	Sta. 8+735/18+495	9,760	500	300	0	60	10	0	0	15	212	45	257
Napindan C./M.C.G.S.	Sta.18+495/ 5+425	5,580	500	100	10	10	1	0	0	8	39	24	63
M.C.G.S. /Mangahan C.	Sta. 5+425/ 6+635	1,210	500	100	0	2	1	0	0	15	24	18	42
Mangahan C./Sta.7+425	Sta. 6+635/ 7+425	790	2900	50	5	2	2	0	0	10	26	12	38
M.C.G.S.			500	30	6	0	22	300	0	1	183	1	184
San Juan River	Sta. 0+000/10+653	10,653	900	1,820	0	175	43	0	4	50	580	177	757
	Sub-Total	36,728		4,734	21	289	82	300	5	119	1,710	337	2,047
Sta.7+425 /Nangka C.	Sta. 7+425/18+620	11,195	2900	2,493	555	109	46	0	0	950	497	334	831
Nangka C. /Rodorigez B.	Sta.18+620/27+200	8,580	2600	1,596	692	0	0	0	0	1,753	218	517	735
Marikina Dam (Qcut=600m3/s)			2100	40	0	0	120	0	0	2,500	675	125	800
	Sub-Total	19,775		4,129	1,246	109	166	0	0	5,203	1,390	976	2,366
	Total	56,503		8,863	1,267	398	248	300	5	5,322	3,100	1,313	4,413
Paranaque Spillway(C. Bottom Width : 60m)		9,000		7,600	45	30	50	590	5	580	3,476	524	4,000
	G.Total	56,503		16,463	1,312	428	298	890	10	5,902	6,576	1,837	8,413

Table 6-2-1(2/4) REQUIRED WORKS FOR THE FRAMEWORK PLAN

BAHO BULI MAHABA RIVER IMPROVEMENT (100-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Mahaba River	Sta. 0+000/ 5+000	5,000	190	475	43	0	0	0	6	210	78	159	237
	Sta. 5+000/ 6+000	1,000	190	12	0	0	0	0	0	3	1	3	4
	Sub-Total	6,000		487	43	0	0	0	6	213	79	162	241
Baho River	Sta. 0+000/ 5+500	5,500	335	682	37	0	0	0	7	209	112	146	258
	Sta.A0+000/A2+000	2,000	280	231	4	0	0	0	3	63	35	19	54
	Sta.A2+000/A3+000	1,000	280	49	0	0	0	0	0	10	5	3	8
	Sub-Total	8,500		962	41	0	0	0	10	282	152	168	320
Buli River	Sta. 0+000/6A+200	3,100	330	292	44	0	0	0	4	98	82	86	168
	Sta.6A+200/8A+200	2,000	280	304	6	0	0	0	3	73	45	22	67
	Sta.8A+200/9A+830	1,630	280	207	16	0	0	0	1	74	40	22	62
	Sta.9A+830/10+480	650	280	85	7	0	0	0	1	32	14	38	52
	Sta.10+480/14+000	2,520	200	317	20	0	0	0	3	113	57	135	192
	Sta.14+000/15+000	1,000	200	73	0	0	0	0	1	19	21	23	44
	Sub-Total	10,900		1,278	93	0	0	0	13	409	259	326	585
Tributary-B	Sta. 0+000/ 5+000	5,000	110	414	13	0	0	0	3	144	70	43	113
	Sta. 5+000/ 6+000	1,000	110	24	2	0	0	0	2	14	7	4	11
	Sub-Total	6,000		438	15	0	0	0	5	158	77	47	124
Tributary-C	Sta. 0+000/ 4+000	4,000	80	170	4	0	0	0	3	60	30	52	82
	Sta. 4+000/ 5+000	1,000	80	183	0	0	0	0	0	5	2	2	4
	Sub-Total	5,000		353	4	0	0	0	3	65	32	54	86
Mangahan Diversion	Sta. 6+800/ 6+100	700	570	1,059	18	0	0	0	0	219	159	65	224
	Sta. 6+100/ 4+500	1,600	520	1,023	0	0	0	0	0	170	156	51	207
	Sta. 4+500/ 3+000	1,500	340	499	29	0	0	0	0	114	56	34	90
	Sub-Total	3,800		2,581	47	0	0	0	0	503	371	150	521
	Total	40,200		6,100	242	0	0	0	37	1,630	970	907	1,877

Table 6-2-1(3/4) REQUIRED WORKS FOR THE FRAMEWORK PLAN

MALABON-TULLAHAN RIVER IMPROVEMENT (100-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Malabon River	Sta. 0+000/ 2+835	2,835	570	1,132	140	68	0	0	3	75	156	90	246
	Sta. 2+835/ 4+377	1,542	550	198	59	20	0	0	0	42	36	50	87
	Sta. 4+377/ 5+427	1,050	520	77	91	11	0	0	3	15	94	18	112
	Sub-Total	5,427		1,407	289	99	0	0	6	132	287	158	445
Tullahan River	Sta. 0+000/ 4+800	4,800	480	452	160	0	0	0	0	87	280	104	384
	Sta. 4+800/18+000	13,200	330	23	0	0	0	0	0	26	47	31	78
	Sta.18+000/20+500	2,500	240	11	24	0	0	0	0	7	16	8	24
	Sta.20+500/21+500	1,000	240	11	0	0	0	0	0	2	5	2	7
	Sub-Total	21,500		497	184	0	0	0	0	122	347	146	493
	Total	26,927		1,904	473	99	0	0	6	254	634	305	938

SOUTH PARANAQUE LAS PINAS RIVER IMPROVEMENT (100-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Las Pinas River	Sta. 0+000/ 1+780	1,780	250	227	100	3	0	0	2	32	132	38	171
	Sta. 1+780/ 6+395	4,615	220	624	118	25	0	0	2	135	151	162	313
	Sta. 6+395/ 7+395	1,000	130	38	0	7	0	0	0	4	15	5	20
	Sub-Total	7,395		889	218	35	0	0	4	171	298	205	503
South Paranaque River	Sta. 0+000/ 0+560	560	630	95	12	4	0	0	0	5	26	6	32
	Sta.D0+000/D0+400	400	630	95	24	0	0	0	0	2	64	2	67
	Sta.D0+400/S0+000	400	430	113	18	0	0	0	0	11	14	13	27
	Sta.S0+000/S1+200	1,200	430	302	86	0	0	0	0	46	45	37	82
	Sta.S1+200/S2+600	1,400	370	340	39	0	0	0	0	72	53	58	110
	Sta.S2+600/S3+600	1,000	370	113	3	0	0	0	0	20	13	16	29
	Sub-Total	4,960		1,060	183	4	0	0	0	156	214	132	346
Dongalo River	Sta. 0+000/ 2+600	2,600	200	265	48	16	0	0	0	30	80	24	104
	Sta. 2+600/ 3+600	1,000	200	38	2	7	0	0	0	8	16	6	23
	Sub-Total	3,600		302	50	23	0	0	0	38	97	30	127
	Total	15,955		2,251	451	62	0	0	4	365	609	368	977

Table 6-2-1(4/4) REQUIRED WORKS FOR THE FRAMEWORK PLAN

DRAINAGE IMPROVEMENT(10-Yr)

Drainage Area	Area	Required Works												Construction Cost		
		Pump Station		Gate		Channel Impvt.	Open Cha. Const.	Closed Cha. Const.	Ring Dike/ Lake Dike	Regulation Pond		Reconst. Bridge	Land Acq.	Civil Works	L.A./Compen.	Total
	(km2)	(site)	(m3/s)	(site)	(ton)	(m)	(m)	(m)	(m)	(site)	(1000m3)	(place)	(1000m2)	(mil.Peso)	(mil.Peso)	(mil.Peso)
North Manila & Suburbs	28.6	3	15.5	1	15	7,950	0	5,750	0	0	0	1	6	1,496	17	1,513
South Manila & Suburbs	43.1	1	5.3	2	25	7,750	0	0	0	0	0	3	3	909	9	918
Sub-Total	71.7	4	20.8	3	40	15,700	0	5,750	0	0	0	4	9	2,405	26	2,431
Malabon-Navotas	24.9	8	76.1	16	420	5,100	5,600	800	22,000	0	0	11	119	1,246	48	1,294
East of Mangahan	8.8	4	31.1	4	90	1,100	7,300	0	1,800	2	60	2	57	251	35	286
West of Mangahan	38.1	5	147.6	10	350	34,100	11,000	1,450	8,900	4	776	26	372	2,066	260	2,327
Sub-Total	71.8	17	254.8	30	860	40,300	23,900	2,250	32,700	6	836	39	548	3,563	344	3,906
San Juan	12.7	9	52.7	13	128	1,300	0	12,300	3,400	0	0	8	7	1,197	2	1,199
Mandaluyong Pasig	15.9	3	23.0	3	47	2,500	0	8,800	0	0	0	5	9	847	9	856
Marikina	13.0	0	0.0	1	10	0	1,000	2,600	0	0	0	2	23	179	9	188
Paranaque Laspinas	15.4	2	19.8	8	195	4,800	650	0	0	0	0	3	47	723	18	741
Valenzuela	18.4	3	10.9	1	15	12,900	500	0	8,000	0	0	4	38	318	15	333
Sub-Total	75.4	17	106.4	26	396	21,500	2,150	23,700	11,400	0	0	22	124	3,263	54	3,317
Total	218.9	38	382.0	59	1,296	77,500	26,050	31,700	44,100	6	836	65	681	9,231	424	9,655

Table 6-2-2(1/4) REQUIRED WORKS FOR THE MASTER PLAN

PASIG-MARIKINA RIVER IMPROVEMENT (100-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
River Mouth/San Juan C.	Sta. 0+000/ 8+735	8,735	1150	2,334	0	40	3	0	1	20	646	60	706
San Juan C./Napindan C.	Sta. 8+735/18+495	9,760	500	300	0	60	10	0	0	15	212	45	257
Napindan C./M.C.G.S.	Sta.18+495/ 5+425	5,580	500	100	10	10	1	0	0	8	39	24	63
M.C.G.S. /Mangahan C.	Sta. 5+425/ 6+635	1,210	500	100	5	2	1	0	0	15	24	18	42
Mangahan C./Sta.7+425	Sta. 6+635/ 7+425	790	2900	50	5	2	2	0	0	10	26	12	38
M.C.G.S.			500	30	6	0	22	300	0	1	183	1	184
San Juan River	Sta. 0+000/10+653	10,653	900	1,820	0	175	43	0	4	50	580	177	757
	Sub-Total	36,728		4,734	26	289	82	300	5	119	1,710	337	2,047
Mangahan C./Nangka C.	Sta. 7+425/18+620	11,195	2900	2,493	555	109	46	0	0	950	497	334	831
Nangka C. /Rodorigez B.	Sta.18+620/27+200	8,580	2600	1,596	692	0	0	0	0	1,753	218	517	735
Marikina Dam (Qcut=600m3/s)			2100	40	0	0	120	0	0	2,500	675	125	800
	Sub-Total	19,775		4,129	1,246	109	166	0	0	5,203	1,390	976	2,366
	Total	56,503		8,863	1,272	398	248	300	5	5,322	3,100	1,313	4,413

Table 6-2-2(2/4) REQUIRED WORKS FOR THE MASTER PLAN

BAHO BULI MAHABA RIVER IMPROVEMENT (30-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works							Construction Cost		
				Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Mahaba River	Sta. 0+000/ 5+000	5,000	160	390	35	0	0	0	6	173	64	130	194
	Sta. 5+000/ 6+000	1,000	160	10	0	0	0	0	0	3	1	3	4
	Sub-Total	6,000		400	35	0	0	0	6	176	65	133	198
Baho River	Sta. 0+000/ 5+500	5,500	275	560	30	0	0	0	7	172	92	120	212
	Sta.A0+000/A2+000	2,000	230	190	3	0	0	0	3	52	29	16	45
	Sta.A2+000/A3+000	1,000	230	40	0	0	0	0	0	9	4	3	7
	Sub-Total	8,500		790	33	0	0	0	10	233	125	139	264
Buli River	Sta. 0+000/6A+200	3,100	270	240	36	0	0	0	4	81	67	71	138
	Sta.6A+200/8A+200	2,000	230	250	5	0	0	0	3	60	37	18	55
	Sta.8A+200/9A+830	1,630	230	170	13	0	0	0	1	61	32	18	51
	Sta.9A+830/10+480	650	230	70	6	0	0	0	1	26	12	31	43
	Sta.10+480/14+000	2,520	180	260	16	0	0	0	3	93	46	111	158
	Sta.14+000/15+000	1,000	180	60	0	0	0	0	1	16	18	19	36
	Sub-Total	10,900		1,050	76	0	0	0	13	337	212	269	480
Tributary-B	Sta. 0+000/ 5+000	5,000	95	340	11	0	0	0	3	118	57	35	92
	Sta. 5+000/ 6+000	1,000	95	20	2	0	0	0	2	12	5	3	9
	Sub-Total	6,000		360	13	0	0	0	5	130	62	39	101
Tributary-C	Sta. 0+000/ 4+000	4,000	50	140	3	0	0	0	3	49	25	43	67
	Sta. 4+000/ 5+000	1,000	50	150	0	0	0	0	0	5	1	2	3
	Sub-Total	5,000		290	3	0	0	0	3	54	26	45	71
Mangahan Diversion	Sta. 6+800/ 6+100	700	470	870	15	0	0	0	0	180	131	53	184
	Sta. 6+100/ 4+500	1,600	435	840	0	0	0	0	0	140	128	42	170
	Sta. 4+500/ 3+000	1,500	280	410	24	0	0	0	0	93	47	28	75
	Sub-Total	3,800		2,120	39	0	0	0	0	413	306	123	429
	Total	40,200		5,010	199	0	0	0	37	1,343	796	747	1,542

Table 6-2-2(3/4) REQUIRED WORKS FOR THE MASTER PLAN

MALABON-TULLAHAN RIVER IMPROVEMENT (30-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works: Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Construction Cost: Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Malabon River	Sta. 0+000/ 2+835	2,835	500	970	112	68	0	0	3	64	122	77	199
	Sta. 2+835/ 4+377	1,542	480	170	55	20	0	0	0	33	37	40	77
	Sta. 4+377/ 5+427	1,050	450	70	82	10	0	0	3	13	40	16	56
	Sub-Total	5,427		1,210	250	98	0	0	6	110	199	133	332
Tullahan River	Sta. 0+000/ 4+800	4,800	420	400	141	0	0	0	0	80	163	96	259
	Sta. 4+800/18+000	13,200	290	20	0	0	0	0	0	19	23	23	46
	Sta.18+000/20+500	2,500	210	10	21	0	0	0	0	5	8	6	14
	Sta.20+500/21+500	1,000	210	10	0	0	0	0	0	1	3	1	4
	Sub-Total	21,500		440	163	0	0	0	0	105	197	126	323
	Total	26,927		1,650	413	98	0	0	6	215	397	259	655

SOUTH PARANAQUE LAS PINAS RIVER IMPROVEMENT (30-Yr)

River	Stretch	Length (M)	Design Discharge (m3/s)	Required Works: Exca. (1000m3)	Embank. (1000m3)	Revet. (1000m2)	Concrete (1000m3)	Gate (ton)	Re.Bridge (place)	Land Acq. (1000m2)	Construction Cost: Civil Works (mil.Peso)	L.A./Compen. (mil.Peso)	Total (mil.Peso)
Las Pinas River	Sta. 0+000/ 1+780	1,780	210	181	80	3	0	0	2	21	111	25	136
	Sta. 1+780/ 6+395	4,615	180	498	94	20	0	0	2	86	149	104	253
	Sta. 6+395/ 7+395	1,000	110	30	0	5	0	0	0	3	11	4	15
	Sub-Total	7,395		710	173	28	0	0	4	110	271	133	404
South Paranaque River	Sta. 0+000/ 0+560	560	520	76	10	3	0	0	0	4	21	5	26
	Sta.D0+000/D0+400	400	520	76	19	0	0	0	0	2	51	2	53
	Sta.D0+400/S0+000	400	350	91	14	0	0	0	0	9	10	11	21
	Sta.S0+000/S1+200	1,200	350	242	68	0	0	0	0	37	20	44	65
	Sta.S1+200/S2+600	1,400	300	272	31	0	0	0	0	46	32	55	88
	Sta.S2+600/S3+600	1,000	300	91	2	0	0	0	0	16	3	19	23
	Sub-Total	4,960		846	144	3	0	0	0	114	138	137	275
Dongalo River	Sta. 0+000/ 2+600	2,600	170	211	38	13	0	0	0	24	54	29	83
	Sta. 2+600/ 3+600	1,000	170	30	1	5	0	0	0	6	11	7	18
	Sub-Total	3,600		242	39	18	0	0	0	30	65	36	101
	Total	15,955		1,797	357	49	0	0	4	254	475	305	780

Table 6-2-2(4/4) REQUIRED WORKS FOR THE MASTER PLAN

DRAINAGE IMPROVEMENT

Drainage Area	Area	Required Works												Construction Cost		
		Pump Station		Gate		Channel Impvt.	Open Cha. Const.	Closed Cha. Const.	Ring Dike/ Lake Dike	Regulating Pond		Reconst. Bridge	Land Acq.	Civil Works	L.A./Compen.	Total
	(km2)	(site)	(m3/s)	(site)	(ton)	(m)	(m)	(m)	(m)	(site)	(1000m3)	(place)	(1000m2)	(mil.Peso)	(mil.Peso)	(mil.Peso)
Project Scale (5-Yr)																
Malabon-Navotas	24.9	8	62.1	16	405	5,100	5,600	800	22,000	0	0	11	106	1,108	43	1,151
East of Mangahan	8.8	4	27.0	4	84	1,100	7,300	0	1,800	2	51	2	62	211	38	249
West of Mangahan	38.1	5	129.3	10	342	34,100	11,000	1,450	8,900	4	642	26	237	1,910	166	2,076
Sub-Total	71.8	17	218.4	30	831	40,300	23,900	2,250	32,700	6	693	39	405	3,229	247	3,476
Project Scale (3-Yr)																
San Juan	12.7	9	31.0	13	103	1,300	0	12,300	3,400	0	0	8	6	960	2	962
Mandaluyong Pasig	15.9	3	14.5	3	40	2,500	0	8,800	0	0	0	5	8	713	8	721
Marikina	13.0	0	0.0	1	7	0	1,000	2,600	0	0	0	2	20	169	15	184
Paranaque Laspinas	15.4	2	12.5	8	175	4,800	650	0	0	0	0	3	36	559	14	573
Valenzuela	18.4	0	0.0	1	10	12,900	500	0	8,000	0	0	4	29	205	12	217
Sub-Total	75.4	14	58.0	26	335	21,500	2,150	23,700	11,400	0	0	22	99	2,606	51	2,657
Total	147.2	31	276.4	56	1,166	61,800	26,050	25,950	44,100	6	693	61	504	5,835	298	6,133

Table 6-2-3 WORK ITEM AND QUANTITY OF DRAINAGE IMPROVEMENT IN EAST AND WEST OF MANGAHAN

Work Item	Feature	Unit	Quantity
1 Lakeshore Dike			
Preparatory Works *1)		l/s	1
Earth dike w/ sheet pile	L=10,700m H=4m	cu.m	872,000
Sluice Gate		ton	240
Box culvert type	2.5m*2.9m*3no.	ton	20
Box culvert type	3.0m*4.4m*4no.	ton	40
Box culvert type	3.0m*4.7m*5no.	ton	50
Open channel type	6.5m*15.2m*2no.	ton	100
Box culvert type	3.0m*4.8m*3no.	ton	30
Maintenance bridge			
Napindan channel	130m*9.1m	sq.m	1,170
Mangahan floodway	250m*9.1m	sq.m	2,250
Mangahan diversion	60m*9.1m	sq.m	540
Lower bicutan	30m*9.1m	sq.m	270
2 River Channel Works			
Preparatory Works *1)		l/s	1
Napindan River			
Excavation		cu.m	583,200
Parapet wall	L=2495m	cu.m	1,200
Embankment	L=2747m	cu.m	98,500
Revetment		sq.m	5,000
Buli River	L=1600m		
Embankment		cu.m	14,700
Re-con bridge	2 bridges	sq.m	960
Baho River	L=1800m		
Embankment		cu.m	14,700
Mahaba River	L=2400m		
Embankment		cu.m	14,600
Re-con bridge	2 bridges	sq.m	444
Mangahan Diversion	L=3900m		
Excavation		cu.m	723,900
Embankment		cu.m	37,500
Lower Bicutan	L=800m		
Excavation		cu.m	4,000
Embankment		cu.m	41,300
3 Drainage System			
Preparatory Works *1)		l/s	1
Regulaton Pond	6sites	cu.m	693,000
Channel Works			
Drainage channel impvt.	L=35200m	l/s	1
Const. of open channel	L=18300m	l/s	1
Const. of closed channel	L=1450m	l/s	1
Sluice Gate	9sites	ton	186
Box culvert type	2.5m*4.2m*3no.	ton	24
Box culvert type	2.5m*4.4m*3no.	ton	25
Box culvert type	2.5m*3.8m*2no.	ton	15
Open channel type	5.6m*13.m*2no.	ton	90
Open channel type	2.0m*2.0m	ton	3
Box culvert type	2.0m*2.0m	ton	3
Box culvert type	2.0m*2.0m	ton	3
Open channel type	2.0m*2.0m	ton	3
Open channel type	4.7m*10.m	ton	20
Pump Station	9sites	cu.ms	111
		cu.ms	8
		cu.ms	8
		cu.ms	5
		cu.ms	2
		cu.ms	32
		cu.ms	7
		cu.ms	14
		cu.ms	31
		cu.ms	4
Lateral		m	114,500

Table 6-2-4 WORK ITEM AND QUANTITY OF DRAINAGE IMPROVEMENT IN MALABON-NAVOTAS

Work Item	Feature	Unit	Quantity
1 North of Malabon River			
Preparatory Works *1)		l/s	1
Ring Dike		m	15,900
Coastal Dike(w/ revetment)	EL.13.5m/H=2.5m	m	5,700
River Dike(w/ revetment)	Raising H=1m	m	3,500
Ring Dike(w/o revetment)	Raising H=1m	m	6,700
Embankment		cu.m	184,500
Revetment		sq.m	34,200
Channel Works			1,600
Drainage channel impvt.		m	600
Const. of open channel		m	1,000
Lateral		m	31,200
Pump	3sites	cu.ms	25
		cu.ms	2
		cu.ms	3
		cu.ms	20
Sluice Gate	7sites	ton	159
Box culvert type	2.5m*3.3m*2no.	ton	14
Open channel type	5.1m*10.m	ton	30
Open channel type	4.0m*10.m	ton	20
Open channel type	4.0m*10.m	ton	20
Open channel type	4.5m*10.m	ton	25
Open channel type	4.0m*10.m	ton	20
Open channel type	5.0m*10.m	ton	30
2 Navigation Lock			
Preparatory Works *1)		l/s	1
Excavation		cu.m	9,000
Backfill		cu.m	250,000
Riprap		sq.m	900
RC-pile		m	3,950
Revetment		sq.m	3,800
Mass concrete		cu.m	340
Reinforced concrete		cu.m	9,800
Steel sheet pile		sq.m	1,000
Gate		ton	180
3 South of Malabon River			
Preparatory Works *1)		l/s	1
Ring Dike		m	13,200
Coastal Dike(w/ revetment)	EL.13.5m/H=2.5m	m	1,100
River Dike(w/ revetment)	Raising H=1m	m	3,600
Parapet Wall,reinforced conc.		m	8,500
Embankment		cu.m	133,200
Revetment		sq.m	14,300
Reinforced concrete		cu.m	11,900
Channel Works		m	2,400
Drainage channel impvt.		m	700
Const. of open channel		m	900
Const. of closed channel		m	800
Lateral		m	5,900
Pump	3sites	cu.ms	10
		cu.ms	4
		cu.ms	2
		cu.ms	4
Sluice Gate	5sites	ton	55
Box culvert type	2.5m*4.2m*3no.	ton	24
Box culvert type	4.5m*4.0m	ton	12
Box culvert type	2.0m*2.0m	ton	3
Box culvert type	2.0m*4.0m*2no.	ton	12
Box culvert type	2.0m*3.0m	ton	4

Table 6-2-5 WRK ITEM AND QUANTITY OF IMPROVEMENT OF PASIG-MARIKINA RIVER

Work Item	Feature	Unit	Quantity
1 River Improvement			
River Mouth/San Juan C.	L=8735m		
Preparatory Works		l/s	1
Excavation		cu.m	2,334,000
Parapet wall/River wall		cu.m	3,000
Revetment		sq.m	40,000
Steel sheet		sq.m	5,000
Reconst. Pandacan bridge	L=140m	sq.m	840
San Juan C./Napindan C.	L=9760m		
Preparatory Works		l/s	1
Excavation		cu.m	300,000
Parapet wall/River wall		cu.m	10,000
Revetment		sq.m	60,000
Steel sheet		sq.m	3,000
Napindan C./M.C.G.S.	L=5580m		
Preparatory Works		l/s	1
Excavation		cu.m	100,000
Embankment		cu.m	10,000
Parapet wall/River wall		cu.m	1,000
Revetment		sq.m	10,000
Steel sheet		sq.m	1,000
M.C.G.S. /Mangahan C.	L=1210m		
Preparatory Works		l/s	1
Excavation		cu.m	100,000
Parapet wall/River wall		cu.m	1,000
Revetment		sq.m	2,000
Steel sheet		sq.m	1,000
Mangahan C./STA.7+425	L=790m		
Preparatory Works		l/s	1
Excavation		cu.m	50,000
Embankment		cu.m	5,000
Parapet wall/River wall		cu.m	2,000
Revetment		sq.m	2,000
Steel sheet		sq.m	1,000
2 Marikina Control Gate Structure			
Preparatory Works		l/s	1
Excavation		cu.m	30,000
Embankment		cu.m	6,000
Concrete		cu.m	22,000
Gate (10.1m*17.5m*2no.)		ton	300

Table 6-3-1 LABOR WAGES IN METRO MANILA

1.	Foreman Civil, mechanical, electrical	P110
2.	Technician, T-1 Operator for dredger, tug boat, etc. (Special equipment)	P90
3.	Technician, T-2 Operator for heavy equipment and assist. for the above Electrician, welder, rigger, etc.	P85
4.	Technician, T-3 Operator for small size heavy equipment and assist. for the above. Mason, plasterer, etc.	P80
5.	Technician, T-4 Operator for roller, miscellaneous equipment and assist. operator Driver for dump truck 6 - 8 t Carpenter, etc.	P75
6.	Technician, T-5 Operator for compressor, pump, generator, etc. Driver for light truck, etc. Bar-bender, form worker, traffic controller	P70
7.	Technician T-6 Operator for tamper, concrete vibrator, etc. Concrete worker, etc.	P65
8.	Common labor Common labor for civil works	P60
9.	Foreign Specialist	

Table 6-3-2(1) PURCHASE COST OF CONSTRUCTION MATERIALS

(US$=P 21.3=Y132) 1

NO.	DESCRIPTIONS	UNIT	PURCHASE COST AT THE SITE (P)	ALLOCATION OF COST			
				L.C. PORTION		F.C. PORTION	
				%	COST (P)	%	COST (Y)
	Cement & stone						
	Portland cement, ordinary type (P 58/40kg bag)	t	1,450	50	725	50	4,490
	Portland cement, high early strength type (P 58/40kg bag)	t	1,450	50	725	50	4,490
	Concrete aggregate, Coarse(crushed) 80-5 mm (P 130/m3)	t	85	100	85	-	
	Concrete aggregate, Fine(manufactured) (P 75/m3)	t	50	100	50	-	
	Concrete aggregate, Fine(washed sand) (P 85/m3)	t	55	100	55	-	
	Sand and gravel, -50 mm	m3	100	100	100	-	
	Boulder	m3	220	100	220	-	
	Concrete						
	Ready mixed concrete,-40mm,90kg/cm2(strength),240kg/m3(cement)	m3	820	30	246	70	3,560
	Ready mixed concrete,-40mm,125kg/cm2(strength),280kg/m3(cement)	m3	875	30	263	70	3,795
	Ready mixed concrete,-40mm,175kg/cm2(strength),320kg/m3(cement)	m3	930	30	279	70	4,035
	Ready mixed concrete,-40mm,210kg/cm2(strength),360kg/m3(cement)	m3	990	30	297	70	4,295
	Ready mixed concrete,-40mm,245kg/cm2(strength),400kg/m3(cement)	m3	1,045	30	314	70	4,530
	Ready mixed concrete,-40mm,280kg/cm2(strength),470kg/m3(cement)	m3	1,145	30	344	70	4,970
	Ready mixed concrete,-40mm,350kg/cm2(strength),600kg/m3(cement)	m3	1,325	30	398	70	5,750
	Wooden materials						
	Wooden materials, square (P 9.00/bd ft)	m3	3,810	100	3,810	-	
	Wooden materials, plank (P 9.00/bd ft)	m3	3,810	100	3,810	-	

NO.	DESCRIPTIONS	UNIT	PURCHASE COST AT THE SITE (P)	ALLOCATION OF COST			
				L.C. PORTION		F.C. PORTION	
				%	COST (P)	%	COST (Y)
	Wooden materials, plywood, water-proof, 12 x 900 x 1,800 mm	sheet	320	100	320	-	
	Wooden materials, plywood, ordinary, 12 x 900 x 1,800 mm	sheet	150	100	150	-	
	* 1 bd ft = 2.363 x 10-3 m3 (423.2 bd ft = 1 m3)						
	Steel materials						
	Reinforcement steel bar, round plain (o12-o25 mm)	t	8,500	35	2,975	65	34,200
	Reinforcement steel bar, round deformed (o10-o36 mm)	t	8,500	35	2,975	65	34,200
	Steel shapes, H-beam, H 200 - H 300	t	12,500	-		100	77,500
	Steel shapes, channel,[100 - [200	t	10,700	-		100	66,300
	Steel shapes, Angel, L 50x50 - 100x100	t	9,630	-		100	59,700
	Steel plate, t = 2.3 mm to 9 mm	t	12,600	-		100	78,100
	Steel plate, t = 12 - 25 mm	t	12,400	-		100	76,800
	Steel plate, checked/floor plate t = 1.6 mm	t	16,200	-		100	100,000
	Steel pipe, galvanized w/threads o 50 - o 100 mm (P 1,090/20)	t	20,700	-		100	128,000
	Steel pipe, galvanized w/flanges o 125 - o 250 mm (P 1,510/20)	t	22,300	-		100	138,000
	Steel pipe pile, o 500 x 9 (P 21,500/t)	m	2,350	-		100	146,000
	Steel pipe pile, o 600 x 12 (P 21,500/t)	m	3,740	-		100	23,000
	Steel pile, type U II (P 20,500/t) 48kg/m	m	985	-		100	6,100
	Steel pile, type U III (P 20,500/t) 60kg/m	m	1,230	-		100	7,600
	Steel pile, type U IV (P 20,500/t) 76.1kg/m	m	1,560	-		100	9,600
	Steel pipe sheet pile, o 500 x 12 (P 22,600/t)	m	3,620	-		100	22,400
	Steel pipe sheet pile, o 600 x 12 (P 22,800/t)	m	4,330	-		100	26,800
	Steel pipe sheet pile, o 700 x 12 (P 23,000)	m	5,060	-		100	31,300

NO.	DESCRIPTIONS	UNIT	PURCHASE COST AT THE SITE (₱)	ALLOCATION OF COST			
				L.C. PORTION		F.C. PORTION	
				%	COST (₱)	%	COST (¥)
	Steel road mat, 500 x 1,200 (10.2kg/m2)	pc	1,980	-		100	12,300
	Steel road mat, 500 x 1,500 (12.3kg/m2)	pc	2,380	-		100	14,700
	Steel wire, annealed (bind wire)	kg	18	-		100	110
	Steel wire, galvanized, barbed wire (25 kg/roll)	roll	500	-		100	3,100
	Nails	kg	18	-		100	110
	Fuel & lubricants						
	Fuel, diesel oil (light oil)	l	5.25	50		50	
	Fuel, gasoline, regular	l	6.75	50		50	
	Oil,engine	l	30	50		50	
	Oil, gear	l	30	50		50	
	Brake fluid	l	35	50		50	
	Grease MP	kg	50	50		50	
	Electric charge	kWh	10	50		50	
	Support/scaffold						
	Plywood form, 12 x 900 x 1,800 mm	sheet	350	100	350	-	
	Metal form with accessories	m2	8,330	-		100	51,600
	Agent	l	65	-		100	400
	Form tie and cone	pc	12	-		100	75
	Separator, 9 ø x 200	pc	3	-		100	20
	Separator, 9 ø x 400	pc	5	-		100	30
	Separator, 9 ø x 500	pc	7	-		100	45

NO.	DESCRIPTIONS	UNIT	PURCHASE COST AT THE SITE (₱)	ALLOCATION OF COST			
				L.C. PORTION		F.C. PORTION	
				%	COST (₱)	%	COST (¥)
	Separator, 9 ø x 1,000	pc	13	-		100	80
	Separator, 9 ø x 1,500	pc	20	-		100	125
	Steel pipe scaffold w/clamps ø 48.6 mm x 3 m	m	100	-		100	620
	Steel pipe supports, 1,680 to 3,045 mm	pc	420	-		100	2,600
	Miscellaneous						
	Water stop, PVC center bulb type, 230 x 6 (₱ 160/10)	m	54	50	27	50	170
	Water stop, PVC center bulb type, 300 x 9 (₱ 190/10)	m	64	50	32	50	200
	Weep hole, PVC pipe, ø 50 (2"ø) (VU) (₱ 80/10)	m	27	50	14	50	85
	Weep hole, PVC pipe, ø 80 (3"ø) (VU)	m	55	50	28	50	170
	Weep hole, PVC pipe, ø 100 (4"ø) (VU)	m	83	50	42	50	260

Table 6-3-2(2) HOURLY RENTAL COST OF MATERIALS FOR CONSTRUCTION WORKS

(US$ = P21.3 = ¥132)

1

Item No.	Descriptions	Life (day)	Purchase Cost CIF at Site (P)	Daily Cost (Hourly Cost) (P)	Remarks
1.	Steel sheet pile, U-II	1,100	985 /m	0.90 /m.day	
2.	- do - U-III	1,100	1,230 /m	1.12 /m.day	
3.	- do - U-IV	1,100	1,560 /m	1.42 /m.day	
4.	Steel pipe-sheet pile, ø500 x 12	1,500	3,620 /m	2.41 /m.day	
5.	- do - ø600 x 12	1,500	4,330 /m	2.89 /m.day	
6.	- do - ø700 x 12	1,500	5,060 /m	3.37 /m.day	
7.	Steel shapes, H-beam H200 - 300	1,100	12,500 /t	11.36 /t.day	
8.	- do - Channel, Angle, etc.	900	10,700 /t	11.89 /t.day	
9.	Steel plate	700	12,600 /t	18.00 /t.day	
10.	Steel road mats, 500 x 1,200	1,100	1,980 /pc	1.80 /pc.day	
11.	- do - 500 x 1,500	1,100	2,380 /pc	2.16 /pc.day	
12.	Metal form, 100 x 1,800 mm		1,130 /m2		
13.	- do - 300 x 1,800 mm		1,130 /m2		
14.	Plywood form, 12 x 900 x 1,800 mm (water-proof)		350 /sht		
15.	Form tie and cone		12 /pc		
16.	Steel pipe scaffolding w/clamps, ø48.6 x 3,000		100 /m		
17.	Steel pipe support, 1,680 to 3,045		420 /pc		

Item No.	Descriptions			(Unit Price) (P)	Life (day)	Purchase Cost CIF at Site (P)	Daily Cost (Hourly Cost) (P)	Remarks
18.	Floater pipe,ø350 (for 100 m)				800	1,618,880	2,020 /day	
	Consists of:	pipe, 6 m	16 pcs	(13,760)	(4 X 200)		(253 /hr)	
		flexible hose 0.9 m	16 pcs	(23,450)				
		floater ø0.7m x 4.5m	16 sets	(63,970)				
19.	Floater pipe, ø200 (for 100 m)				800	1,252,050	1,570 /day	
	Consists of:	pipe, 5.5 m	17 pcs	(8,140)	(4 X 200)		(196 /hr)	
		flexible hose 0.9 m	17 pcs	(12,210)				
		floater ø0.43m x 4.5m	17 sets	(53,300)				
20.	Shore pipe, ø350 (for 100 m)				800	324,160	405 /day	
					(4 x 200)		(50 /hr)	
	Consists of:	pipe, 6 m	17 pcs	(13,760)				
		valve	1 pcs	(68,040)				
		bend	2 pcs	(8,340)				
		branch	1/2 pc	(11,040)				
21.	Shore pipe, ø200 (for 100 m)				800	224,740	280 /day	
					(4 x 200)		(35 /hr)	
	Consists of:	pipe, 5.5 m	19 pcs	(8,140)				
		valve	1 pc	(59,120)				
		bend	2 pcs	(4,260)				
		branch	1/2 pc	(4,840)				

Item No.	Descriptions		(Unit Price) (P)	Life (day)	Purchase Cost CIF at Site (P)	Daily Cost (Hourly Cost) (P)	Remarks
22.	Wooden supports for pipes			150	3,770	25 /day	
	Consists of: Square	20 pcs	(3,772)				
	(0.15 x 0.15 x 2 m)	(0.9 m3)					
	Miscallaneous	10%					
23.	Fence for spoil bank (40 m x 120 m)			150	92,820	620 /day	
	Consists of: log	134 pcs					
	(0.15 x 0.15 x 2.5 m)	(5.9 m3)					
	Square	410 pcs					
	(0.1 x 0.1 x 3.5 m)	(14.4 m3)					
	Bamboo mat	720 m2					

Table 6-3-3(1/2) HOURLY EQUIPMENT AND MATERIAL (P.O.L) COST

(US$ = P 21.30 = Y 132)

No.	Descriptions	Output of prime mover PS,(kW)	Total weight of EQPT (t)	Purchase cost (CIF site) incl. tax & duty (Y 1000)	Salvage value (%)	Life of EQPT (hr)	Hourly depre-ciation cost (Y/hr)	Hourly maintenance and repairing cost					Total hourly equipment cost			Hourly material (P.O.L) cost						
								Foreign currency		Local currency		Total	FC	LC	Total	Fuels D:P 5.25/l G:P 6.75/l E:P 10/kwh		Oils P 30/l		Grease P 50/kg		Total (r+t+v)
								rate x10-3	Y(h x i)	rate x10-5	P(h x k)	P	Y	P	P	QTY	AMT	QTY	AMT	QTY	AMT	P
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)
1	Bulldozer,25t	220	25.00	32,000	5	12,000	2,533	468	1,186	1,892	48	239	3,719	48	648	23	120.8	0.50	15.0	0.04	2.0	137.8
2	Bulldozer,18t	170	18.00	24,000	5	12,000	1,900	468	889	1,892	36	179	2,789	36	486	19	99.8	0.40	12.0	0.03	1.5	113.3
3	Bulldozer,12t	120	12.00	15,500	5	10,000	1,473	468	689	1,892	28	139	2,162	28	377	14	73.5	0.20	6.0	0.02	1.0	80.5
4	Swampdozer,14t	120	14.00	21,700	5	10,000	2,062	504	1,039	2,037	42	210	3,100	42	542	14	73.5	0.20	6.0	0.02	1.0	80.5
5	Swampdozer,10t	90	10.00	13,000	5	10,000	1,235	504	622	2,037	25	126	1,857	25	325	10	52.5	0.20	6.0	0.02	1.0	59.5
6	Hydraulic backhoe,1.2m3	180	30.00	35,500	5	12,000	2,810	432	1,214	1,746	49	245	4,025	49	698	21	110.3	0.50	15.0	0.10	5.0	130.3
7	Hydraulic backhoe,0.9m3	160	25.00	27,500	5	12,000	2,177	432	941	1,746	38	190	3,118	38	541	19	99.8	0.50	15.0	0.10	5.0	119.8
8	Hydraulic backhoe,0.7m3 long arm	180	35.00	36,000	5	12,000	2,850	432	1,231	1,746	50	248	4,081	50	708	21	110.3	0.50	15.0	0.10	5.0	130.3
9	Hydraulic backhoe,0.7m3	120	20.00	21,000	5	12,000	1,663	396	658	1,601	27	133	2,321	27	401	13	68.3	0.40	12.0	0.10	5.0	85.3
10	Hydraulic backhoe,0.55m3	90	15.00	15,500	5	10,000	1,473	396	583	1,601	24	118	2,056	24	355	11	57.8	0.30	9.0	0.06	3.0	69.8
11	Crawler crane w/grab bucket,1.0m3	120	40.00	48,500	5	12,000	3,840	468	1,797	1,892	73	363	5,637	73	982	15	78.8	0.40	12.0	0.15	7.5	98.3
12	Crawler crane w/grab bucket,0.8m3	120	35.00	42,100	5	12,000	3,333	432	1,440	1,746	58	291	4,773	58	828	14	73.5	0.40	12.0	0.12	6.0	91.5
13	Crawler crane w/grab bucket,0.6m3	105	27.00	29,000	5	12,000	2,296	432	992	1,746	40	200	3,288	40	571	12	63.0	0.30	9.0	0.12	6.0	78.0
14	Crawler loader,1.5m3	120	14.00	15,300	5	10,000	1,454	504	733	2,037	30	148	2,186	30	382	13	68.3	0.40	12.0	0.02	1.0	81.3
15	Wheel loader,2.7m3	160	15.00	22,000	5	12,000	1,742	540	941	2,183	38	190	2,682	38	471	13	68.3	0.50	15.0	0.07	3.5	86.8
16	Wheel loader,1.7m3	110	10.00	13,300	5	10,000	1,264	468	591	1,892	24	119	1,855	24	323	9	47.3	0.40	12.0	0.06	3.0	62.3
17	Dump truck,11t	300	9.0	9,200	5	10,000	874	576	503	2,328	20	102	1,377	20	243	10	52.5	0.40	12.0	0.05	2.5	67.0
18	Dump truck,8t	240	7.0	6,600	5	8,000	784	576	451	2,328	18	91	1,235	18	218	8	42.0	0.30	9.0	0.03	1.5	52.5
19	Dump truck,6t	170	6.0	4,900	5	8,000	582	576	335	2,328	14	68	917	14	162	6	31.5	0.30	9.0	0.03	1.5	42.0
20	Cargo truck,11t	290	8.5	8,200	5	10,000	779	576	449	2,328	18	91	1,228	18	216	9	47.3	0.40	12.0	0.05	2.5	61.8
21	Cargo truck,8t w/crane 3t	230	7.5	7,700	5	8,000	914	540	494	2,183	20	100	1,408	20	247	7	36.8	0.30	9.0	0.03	1.5	47.3
22	Tractor and trailer,30t	300	30.0	18,200	5	12,000	1,441	576	830	2,328	34	167	2,271	34	400	12	63.0	0.40	12.0	0.05	2.5	77.5
23	Water tanker,6m3	180	5.5	5,200	5	8,000	618	540	333	2,183	13	67	951	13	167	6	31.5	0.30	9.0	0.03	1.5	42.0
24	Agitator truck,4.5m3	280	10.0	10,800	5	8,000	1,283	576	739	2,328	30	149	2,021	30	356	10	52.5	0.40	12.0	0.05	2.5	67.0
25	Agitator truck,3.0m3	220	7.5	7,900	5	8,000	938	576	540	2,328	22	109	1,478	22	260	9	47.3	0.30	9.0	0.03	1.5	57.8
26	Crawler crane,40t	120	40.0	48,500	5	12,000	3,840	396	1,520	1,601	61	307	5,360	61	926	15	78.8	0.40	12.0	0.15	7.5	98.3
27	Crawler crane,25t	100	30.0	29,000	5	12,000	2,296	396	909	1,601	37	183	3,205	37	554	14	73.5	0.40	12.0	0.12	6.0	91.5
28	Truck crane,35t	300	35.0	41,500	5	12,000	3,285	360	1,183	1,455	48	239	4,468	48	769	13	68.3	0.55	16.5	0.08	4.0	88.8
29	Truck crane,20t	230	22.0	27,300	5	12,000	2,161	360	778	1,455	31	157	2,939	31	506	10	52.5	0.55	16.5	0.07	3.5	72.5
30	Truck crane,10t	230	16.0	13,000	5	10,000	1,235	360	445	1,455	18	90	1,680	18	289	8	42.0	0.55	16.5	0.06	3.0	61.5
31	Motor grader,12t	135	12.0	14,900	5	12,000	1,180	576	679	2,328	27	137	1,859	27	327	9	47.3	0.40	12.0	0.04	2.0	61.3
32	Compactor dozer,20t	210	20.0	29,000	5	12,000	2,296	468	1,074	1,892	43	217	3,370	43	587	22	115.5	0.50	15.0	0.04	2.0	132.5
33	Road roller,8/10t	60	8.0	6,800	5	12,000	538	360	194	1,455	8	39	732	8	126	4	21.0	0.20	6.0	0.02	1.0	28.0
34	Self-prop tire roller,8/20t	90	8.5	7,400	5	10,000	703	468	329	1,892	13	66	1,032	13	180	6	31.5	0.20	6.0	0.02	1.0	38.5
35	Vibration roller,4t	25	4	4,700	5	6,000	744	360	268	1,455	11	54	1,012	11	174	3	15.8	0.10	3.0	0.01	0.5	19.3

Table 6-3-3(2/2) HOURLY EQUIPMENT AND MATERIAL (P.O.L) COST

(US$ = P 21.30 = Y 132)

No.	Descriptions	Output of prime mover PS,(kW)	Total weight of EQPT (t)	Purchase cost (CIF site) incl. tax & duty (Y 1000)	Salvage value (%)	Life of EQPT (hr)	Hourly depre-ciation cost (Y/hr)	Hourly maintenance and repairing cost: Foreign currency rate x10-3	Foreign currency Y(h x i)	Local currency rate x10-5	Local currency P(h x k)	Total (j + l)	Total hourly equipment cost: F.C (h + j)	L.C (l)	Total (n + o)	Hourly material (P.O.L) cost: Fuels D:P 5.25/l G:P 6.75/l E:P 10/kwh QTY	Fuels AMT	Oils P 30/l QTY	Oils AMT	Grease P 50/kg QTY	Grease AMT	Total (r+t+v)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)
36	Vibration roller,0.6t	6	0.6	1,150	5	3,000	364	360	131	1,455	5	26	495	5	85	1	5.3	0.10	3.0	0.01	0.5	8.8
37	Compactor/tamper,0.1t	6	0.10	300	5	3,000	95	324	31	1,310	1	6	125	1	22	1	6.8	0.05	1.5	0.00	0.0	8.3
38	Portable concrete mixer,0.2m3	(2.2)	1.50	1,800	5	4,000	428	504	215	2,037	9	43	643	9	112	1.5	15.0	0.05	1.5	0.01	0.5	17.0
39	Concrete bucket,1.5m3	-	0.90	1,500	5	2,000	713	396	282	1,601	11	57	995	11	172	-		-		-		0.0
40	Concrete bucket,1.0m3	-	0.70	1,150	5	2,000	546	396	216	1,601	9	44	763	9	132	-		-		-		0.0
41	Concrete bucket,0.5m3	-	0.50	750	5	1,500	475	396	188	1,601	8	38	663	8	115	-		-		-		0.0
42	Concrete vibrator,60mm	(0.97)	0.03	330	5	1,500	209	252	53	1,019	2	11	262	2	44	0.5	5.0	-		-		5.0
43	Concrete vibrator,30mm	(0.75)	0.03	170	5	1,500	108	252	27	1,019	1	5	135	1	23	0.2	2.0	-		-		2.0
44	Concrete pump car w/boom,45m3/h	175	7.5	26,000	5	10,000	2,470	504	1,245	2,037	50	251	3,715	50	650	12	63.0	0.55	16.5	0.05	2.5	82.0
45	Pile hammer unit,3.5t D.P.H(3-points)	120	61.0	60,000	5	12,000	4,750	432	2,052	1,746	83	414	6,802	83	1,181	15	78.8	1.80	54.0	0.05	2.5	135.3
46	Pile hammer unit,2.5t D.P.H(w/boom)	100	58.0	9,900	5	12,000	784	432	339	1,746	14	68	1,122	14	195	10	52.5	1.50	45.0			97.5
47	Vibro-hammer,90kW(200kVA D.G)	-	7.0	12,500	5	8,000	1,484	432	641	1,746	26	129	2,126	26	369	-		0.20	6.0	0.02	1.0	7.0
48	Vibro-hammer,60kW(125kVA D.G)	-	5.0	10,000	5	8,000	1,188	432	513	1,746	21	104	1,701	21	295	-		0.15	4.5	0.01	0.5	5.0
49	Vibro-hammer,40kW(100kVA D.G)	-	3.5	7,000	5	8,000	831	432	359	1,746	15	72	1,190	15	207	-		0.10	3.0	0.01	0.5	3.5
50	Diesel generator,200kVA	245	4.0	5,000	5	12,000	396	288	114	1,164	5	23	510	5	87	30	157.5	0.40	12.0	-		169.5
51	Diesel generator,125kVA	155	2.7	3,200	5	12,000	253	252	64	1,019	3	13	317	3	54	19	99.8	0.30	9.0	-		108.8
52	Diesel generator,75kVA	90	1.5	2,500	5	10,000	238	252	60	1,019	2	12	297	2	50	19	99.8	0.20	6.0	-		105.8
53	Diesel generator,35kVA	50	1.3	1,500	5	8,000	178	252	45	1,019	2	9	223	2	38	6	31.5	0.10	3.0	-		34.5
54	Sub-pump,200(H=15,Q=4.0)	(15)	0.25	420	5	6,000	67	792	53	3,201	2	11	119	2	21	9	90.0	-		-		90.0
55	Sub-pump,150(H=15,Q=2.0)	(11)	0.16	300	5	6,000	48	792	38	3,201	2	8	85	2	15	6.5	65.0	-		-		65.0
56	Sub-pump,100(H=15,Q=1.0)	(5.5)	0.06	240	5	6,000	38	792	30	3,201	1	6	68	1	12	5	50.0	-		-		50.0
57	Sub-pump,80(H=15,Q=0.5)	(2.2)	0.03	130	5	5,000	25	792	20	3,201	1	4	44	1	8	3.5	35.0	-		-		35.0
58	Cutter suction dradger,400 o	1,100	-	233,300	5	20,000	11,082	468	5,186	1,892	210	1,047	16,268	210	2,835	130	682.5	2.50	75.0	0.15	7.5	765.0
59	Cutter suction dradger,200 o	300	-	65,000	5	20,000	3,088	468	1,445	1,892	58	292	4,532	58	790	35	183.8	0.70	21.0	0.05	2.5	207.3
60	Floating pontoon,300t	-	-	28,900	5	15,000	1,830	792	1,450	3,201	59	293	3,280	59	588	-		-		-		0.0
61	Floating pontoon,200t	-	-	21,200	5	15,000	1,343	792	1,063	3,201	43	215	2,406	43	431	-		-		-		0.0
62	Floating pontoon,100t	-	-	11,200	5	15,000	709	792	562	3,201	23	113	1,271	23	228	-		-		-		0.0
63	Tug boat,300PS	300	-	71,100	5	30,000	2,252	972	2,188	3,929	88	442	4,440	88	805	35	183.8	0.70	21.0	0.04	2.0	206.8
64	Tug boat,200PS	200	-	49,700	5	30,000	1,574	972	1,530	3,929	62	309	3,104	62	563	24	126.0	0.60	18.0	0.03	1.5	145.5
65	Dredge tender,60PS(3t)	60	-	37,000	5	25,000	1,406	1,044	1,468	4,220	59	296	2,874	59	523	8	42.0	0.20	6.0	0.01	0.5	48.5
66	Service boat	15	-	4,000	5	10,000	380	468	178	1,892	7	36	558	7	97	2.5	13.1	0.05	1.5	-		14.6
67	Dumping scow,500m3(by 300PS)	-	-	90,000	5	25,000	3,420	792	2,709	3,201	109	547	6,129	109	1,098	-		-		-		0.0
68	Dumping scow,300m3(by 300PS)	-	-	60,000	5	25,000	2,280	792	1,806	3,201	73	364	4,086	73	732	-		-		-		0.0
69	Dumping scow,200m3(by 200PS)	-	-	47,700	5	25,000	1,813	792	1,436	3,201	58	290	3,248	58	582	-		-		-		0.0
70	Dumping scow,100m3(by 200PS)	-	-	26,000	5	25,000	988	792	782	3,201	32	158	1,770	32	317	-		-		-		0.0

Table 6-3-4 LIST OF BREAKDOWN OF UNIT COST

1.	Excavation A		P50/m^3
2.	Excavation B		P30
3.	Excavation C		P30
4.	Excavation by pump dredger A		P170/m^3
5.	Excavation by pump dredger B		P140
6.	Excavation by pump dredger C		P50
7.	Excavation by clamshell A		P200/m^3
8.	Excavation by clamshell B		P160
9.	Excavation by clamshell C		P70
10.	Backfill, (A, B & C)		P30/m^3
11.	Embankment (A, B & C)		P40/m^3
12.	Rip-rap		P100/m^2
13.	Revetment, concrete block		P600/m^2
14.	Mass concrete		P1,500/m^3
15.	Parapet wall, reinforced concrete		P3,000
16.	River wall, rubble concrete		P1,200
17.	River wall, reinforced concrete		P4,000
18.	River wall, steel sheet pile		P3,500
19.	Bridge		P8,000/m^2
20.	Preparatory works (coffering)	H > 5 m	(80%)
21.	- do -	3 m < H < 5 m	(50 %)
22.	- do -	H < 3 m	(30 %)

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(1)

Work Site :

Work : Excavation A

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Excavation by using bulldozer and wheel loader Item No. 8.3 - 4 (101)	0.6 m3	4.0	2.0	100	50
2	Excavation by using grab bucket excavator Item No. 8.3 - 4 (103)	0.5 m3	5.0	2.5	177	89
3	Transportation by using dump truck (120 m3) Item No. 8.3 - 4 (108)	1.0 m3	4.4	4.4	110	110
4						
5						
	Total :			8.9		249 (P 40.2)

Remarks : 82%

Total:P 49.1

P 50/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(2)

Work Site :

Work : Excavation B & C

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Excavation by using bulldozer and wheel loader Item No. 8.3 - 4 ( )	0.4 m3	4.0	1.6	100	40
2	Transportation by using dump truck (180 m3) Item No. 8.3 - 4 ( )	0.4 m3	2.9	1.2	73	29
3	Excavation by using backhoe Item No. 8.3 - 4 ( )	0.3 m3	3.0	0.9	72	22
4	Excavation by using grab bucket excavator Item No. 8.3 - 4 ( )	0.3 m3	5.0	1.5	177	53
5						
Total :				5.2		144 (P 23.2)

Remarks : 82%

Total:P 28.4

P 30/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(3)

Work Site :

Work : Excavation by pump dredger A

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Excavation by using cutter suction dredger with pipeline Item No. 8.3 - 4 (104)	1.0 m3	7.0	7.0	266	266
2	Loader (grab bucket) to dumping scow at T.S. bank Item No. 8.3 - 4 (103)	1.0 m3	5.0	5.0	177	177
3	Hauling by using dumping scow Item No. 8.3 - 4 (500)	1.0 m3	6.4	6.4	206	206
4	Unloader (grab bucket) to spoil bank Item No. 8.3 - 4 ( )	1.0 m3	5.0	5.0	177	177
5	Miscellaneous equipment : 10 % of the above			2.3		83
	Total :			25.7		909 (P 146.6)

Remarks : 85%

Total:P 172.3

P 170/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(4)

Work Site :

Work : Excavation by pump dredger B

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Excavation by using cutter suction dredger with pipeline Item No. 8.3 - 4 (104)	1.0 m3	7.0	7.0	266	266
2	Loader (grab bucket) to dumping scow at T.S. bank Item No. 8.3 - 4 (103)	1.0 m3	5.0	5.0	177	177
3	Hauling by using dumping scow Item No. 8.3 - 4 (109) (600)	1.0 m3	5.3	5.3	171	171
4	Unloader (grab bucket) to spoil bank (50%) Item No. 8.3 - 4 (103)	0.5 m3	5.0	2.5	177	89
5	Miscellaneous equipment : 5 % of the above			1.0		35
	Total :			20.8		738 (P 119)

Remarks :

82%

Total:P 139.9

P 140/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(5)

Work Site :

Work : Excavation by pump dredger C

Conditions : Direct trasportation to spoil bank through pipeline

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Excavation by using cutter suction dredger with floating pipe and shore pipe	1.0 m3	7.0	7.0	266	266
2	Item No. 8.3 - 4 (104)					
3						
4						
5						
	Total :			7.0		266 (P 43)

Remarks : 86%

Total:P 50

P 50/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(6)

Work Site :

Work : Excavation by clamshell A

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Clamshell (grab bucket) on pontoon 1.0 m3 Item No. 8.3 - 4 (105)	1.0 m3	12.0	12.0	395	395
2	Dumping scow, 100 m3 Item No. 8.3 - 4 (110)	1.0 m3	19.8	19.8	483	483
3	Unloader (grab bucket) 1.0 m3 Item No. 8.3 - 4 (103)	0.5 m3	5.0	2.5	177	89
4	Miscellaneous equipment	5%		1.7		48
5						
	Total :			36.0		1,015 (P 163.8)

Remarks : 82%

Total:P 199.8

P 200/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(7)

Work Site :

Work : Excavation by clamshell B

Conditions :

NO.	DESCRIPTIONS	Q'TY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Clamshell (grab bucket) on pontoon 1.0 m3 Item No. 8.3 - 4 (105)	1.0 m3	12.0	12.0	395	395
2	Dumping scow, 100 m3 Item No. 8.3 - 4 (110)	1.0 m3	12.4	12.4	302	302
3	Unloader (grab bucket) 1.0 m3 Item No. 8.3 - 4 (103)	0.5 m3	5.0	2.5	177	89
4	Miscellaneous equipment	5%		1.3		39
5						
	Total :			28.2		825 (P 133.1)

Remarks : 83%

Total:P 161.3

P 160/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(8)

Work Site :

Work : Excavation by clamshell C

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Clamshell (grab bucket) 1.0 m3 Item No. 8.3 - 4 ( )	0.75 m3	5.0	3.8	177	133
2	Dump truck, 8 t Item No. 8.3 - 4 ( )	0.75 m3	5.2	3.9	132	99
3	Clamshell on pontoon Item No. 8.3 - 4 ( )	3%		0.3		10
4	Miscellaneous equipment Item No. 8.3 - 4 ( )	0.25 m3	12.0	3.0	395	99
5						
	Total :			11.0		341 (P 55.0)

Remarks : 83%

Total:P 66

P 70/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(9)

Work Site :

Work : Backfill A, B & C

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Bulldozer & wheel loader	0.75 m3	4.0	3.0	100	75
2	Backhoe	0.25 m3	3.0	0.8	72	18
3	Dump truck	0.5 m3	3.5	1.8	88	44
4	Miscellaneous equipment (compactor, etc.)	5%		0.3		7
5						
	Total :			5.9		144 (P 23.2)

Remarks : 96%

Total:P 29.1

P 30/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(10)

Work Site :

Work : Embankment, A, B & C

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Backhoe, 0.9 m3	1.0 m3	3.0	3.0	72	72
2	Dump truck, 8 t (very short distance only)	0.5 m3	3.5	1.8	88	44
3	Bulldozer, wheel loader, etc.	1.0 m3	2.0	2.0	50	50
4	Compactor, etc.	1.0 m3	0.8	0.8	26	26
5						
	Total :			7.6		192 (P 30.9)

Remarks : 96%

Total:P 38.5

P 40/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(11)

Work Site :

Work : Rip - rap (t = 0.15 m)

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Rip - rap materials, boulder t = 0.15 m	0.15 m3	200.0	30.0	-	-
2	Rip - rap materials, sand and gravel	0.1 m3	100.0	10.0	-	-
3	Spreading by using dump truck, dumping scow and others	0.25 m3	33.0	8.3	1,160	290
4						
5						
	Total :			48.3		290 (P 46.8)

Remarks : 50%

Total:P 95.1

P 100/m2

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(12)

Work Site :

Work : Revetment, concrete block (t = 0.4 m)

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Concrete block t = 0.2 m	1.0 m2	55.8	55.8	807	807
2	Sand & gravel	0.15 m3	100.0	15.0	-	-
3	Leveling concrete	0.1 m3	246.0	24.6	3,560	356
4	Placing and curing	1.0 m2	41.0	41.0	1,400	1,400
5						
	Total :			136.4		2,563 (P 413.6)

Remarks : 75%

Total:P 550

P 600/m2

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(13)

Work Site :

Work : Mass concrete

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Concrete	1.0 m3	263.0	263.0	3,795	3,795
2	Concrete form	1.1 m2	20.0	22.0	200	220
3	Pouring and curing	1.0 m3	80.0	80.0	2,897	2,897
4						
5						
	Total :			365.0		6,912 (P 1,115)

Remarks : 74%

Total:P 1,480

P 1,500/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(14)

Work Site :

Work : Parapet wall, reinforced concrete

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Concrete	1.0 m3	314.0	314.0	4,530	4,530
2	reinforced bar	60 kg	3.0	180.0	34	2,040
3	Concrete form	4 m2	25.0	100.0	250	1,000
4	Pouring and curing	1.0 m3	193.0	193.0	6,769	6,769
5						
Total :				787.0		14,339 (P 2,313.7)

Remarks : 75%

Total:P 3,100.7

P 3,000/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(15)

Work Site :

Work : River wall, rubble concrete

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Rubble	1.0 m3	220.0	220.0	-	-
2	Concrete	0.4 m3	246.0	98.4	3,560	1,424
3	Placing and curing	1.0 m3	252.0	252.0	2,343	2,343
4						
5						
	Total :			570.4		3,767 (P 607.8)

Remarks :

87%

Total:P 1,178.2

P 1,200/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(16)

Work Site :

Work : River wall, reinforced concrete

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Concrete	1.0 m3	314.0	314.0	4,530	4,530
2	reinforced bar	60 kg	3.0	180.0	34	2,040
3	Concrete form	5 m2	32.5	162.5	325	1,625
4	Pouring and curing	1.0 m3	277.5	277.5	9,745	9,745
5						
	Total :			934.0		17,940 (P 2,894.8)

Remarks : 95%

Total:P 3,829

P 4,000/m3

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(17)

Work Site :

Work : River wall , steel sheet pile

Conditions : Sheet pile type U III
Sheet pile driving = by using vibro - hammer

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1	Steel sheet pile U III	1.0 m2	-	-	19,060	19,060
2	Sheet pile driving by using vibro - hammer and diesel generator	1.0 m3	69.0	69.0	2,420	2,420
3						
4						
5						
	Total :			69.0		21,480 (P 3,466)

Remarks : 98%

Total:P 3,535
P 3,500/m2

BREAKDOWN OF UNIT COST

ITEM NO. : 6-3-4(18)

Work Site :

Work : Construction of bridge

Conditions :

NO.	DESCRIPTIONS	QTY	PESO CURRENCY		YEN CURRENCY	
			UNIT	AMOUNT	UNIT	AMOUNT
1						
2						
3						
4						
5						
Total :						

Remarks :

Total:P
P 8,000/m2

Table 6-3-5 ESTIMATED PERCENTAGE ALLOCATION ON EACH UNIT COST

ITEMS	UNIT	L/C PORTION		F/C PORTION		F. ALLOCATE	
		PESO	%	PESO	%	L/C (%)	L/C (%)
1.Excavation, commom	cu.m	8.9	18	40.2	82	15	85
2.Excavation, pump dredger	cu.m	25.7	15	147	85	15	85
3.Excavation, clamshell	cu.m	28.2	17	133	83	15	85
4.Backfill	cu.m	5.9	20	23.2	80	15	85
5.Embankment	cu.m	7.6	20	30.9	80	15	85
6.Riprap	sq.m	48.3	50	46.8	50	50	50
7.Revetment, block concrete	sq.m	136	25	414	75	25	75
8.Mass concrete	cu.m	365	26	1,115	74	25	75
9.Parapet wall,R.C.	cu.m	787	25	2,314	75	30	70
10.River wall, rubble concrete	cu.m	570	48	608	52	45	55
11.River wall, R.C.	sq.m	934	24	2,894	76	30	70
12.River wall, sheel sheet pile	sq.m	69	2	3,466	98	-	100

Table 6-3-6 COST BREAKDOWN OF THE OPTIMUM DRAINGE SYSTEM FOR EAST AND WEST OF MANGAHAN DRAINAGE IMPROVEMENT PROJECT

1US$=132Yen=21.3Peso

Work Item	Feature	Unit	Quantity	Total (1000P)	Foreign Currency (1000P)	Local Currency (1000P)
1 Lakeshore Dike				587,652	499,105	88,547
Preparatory Works *1)		l/s	1	97,942	83,184	14,758
Earth dike w/ sheet pile	L=10,700m H=4m	cu.m	872,000	299,090	269,181	29,909
Sluice Gate		ton	240	110,880	90,922	19,958
Box culvert type	2.5m*2.9m*3no.	ton	20	9,240	7,577	1,663
Box culvert type	3.0m*4.4m*4no.	ton	40	18,480	15,154	3,326
Box culvert type	3.0m*4.7m*5no.	ton	50	23,100	18,942	4,158
Open channel type	6.5m*15.2m*2no.	ton	100	46,200	37,884	8,316
Box culvert type	3.0m*4.8m*3no.	ton	30	13,860	11,365	2,495
Maintenance bridge				79,740	55,818	23,922
Napindan channel	130m*9.1m	sq.m	1,170	23,400	16,380	7,020
Mangahan floodway	250m*9.1m	sq.m	2,250	45,000	31,500	13,500
Mangahan diversion	60m*9.1m	sq.m	540	7,560	5,292	2,268
Lower bicutan	30m*9.1m	sq.m	270	3,780	2,646	1,134
2 River Channel Works				163,396	136,865	26,531
Preparatory Works *1)		l/s	1	27,233	22,811	4,422
Napindan River				70,162	59,638	10,524
Dredging		cu.m	583,200	59,483	50,561	8,922
Parapet wall	L=2495m	cu.m	1,200	3,743	3,182	561
Embankment	L=2747m	cu.m	98,500	3,942	3,351	591
Revetment		sq.m	5,000	2,994	2,545	449
Buli River	L=1600m			8,520	6,090	2,430
Embankment		cu.m	14,700	840	714	126
Re-con bridge	2 bridges	sq.m	960	7,680	5,376	2,304
Baho River	L=1800m			587	499	88
Embankment		cu.m	14,700	587	499	88
Mahaba River	L=2400m			4,138	2,985	1,154
Embankment		cu.m	14,600	586	498	88
Re-con bridge	2 bridges	sq.m	444	3,552	2,486	1,066
Mangahan Diversion	L=3900m			50,828	43,204	7,624
Excavation		cu.m	723,900	49,327	41,928	7,399
Embankment		cu.m	37,500	1,501	1,276	225
Lower Bicutan River	L=800m			1,928	1,639	289
Dredging		cu.m	4,000	276	235	41
Embankment		cu.m	41,300	1,652	1,404	248
3 Drainage System				1,280,678	1,142,491	138,187
Preparatory Works *1)		l/s	1	213,446	190,415	23,031
Regulaton Pond	6sites	cu.m	693,000	95,600	78,392	17,208
				219,100	178,545	40,555
Drainage channel impvt.	L=35200m	l/s	1	65,300	55,505	9,795
Const. of open channel	L=18300m	l/s	1	131,100	104,880	26,220
Const. of closed channel	L=1450m	l/s	1	22,700	18,160	4,540
Sluice Gate	9sites	ton	186	85,932	70,464	15,468
Pump station	9sites	cu.ms	111	609,300	578,835	30,465
Lateral		m	114,500	57,300	45,840	11,460
Sub-Total(1+2+3)				2,031,726	1,778,461	253,265
4 Administration *2)		l/s	1	101,586	0	101,586
5 Engineering Services		l/s	1	102,240	92,016	10,224
6 Physical Contingency *3)		l/s	1	223,555	187,048	36,508
7 Land Acquisition & Compensation		ha	91	185,434	0	185,434
Total(1+2+3+4+5+6+7)				2,644,542	2,057,524	587,017
8 Price Contingency *4)				167,013	0	167,013
9 Grand total				2,811,555	2,057,524	754,030

Notes:
1);20% of main civil works
2); 5% of main civil works(1+2+3)
3);10% of (1+2+3+4+5)
4); 0% for foreign currency and 6% for local currency

Table 6-3-7 COST BREAKDOWN OF THE OPTIMUM DRAINAGE SYSTEM FOR MALABON-NAVOTAS DRAINAGE IMPROVEMENT PROJECT

1US$=132Yen=21.3Peso

Work Item	Feature	Unit	Quantity	Total (1000P)	Foreign Currency (1000P)	Local Currency (1000P)
1 North of Malabon River				340,714	296,995	43,719
Preparatory Works *1)		l/s	1	56,786	49,499	7,286
Ring Dike		m	15,900	27,918	23,730	4,188
Coastal Dike(w/ revetment)	EL.13.5m/H=2.5m	m	5,700			
River Dike(w/ revetment)	Raising H=1m	m	3,500			
Ring Dike(w/o revetment)	Raising H=1m	m	6,700			
Embankment		cu.m	184,500	7,380	6,273	1,107
Revetment		sq.m	34,200	20,538	17,457	3,081
Channel Works				7,952		
Drainage channel impvt.		m	600	852	724	128
Const. of open channel		m	1,000	7,100	5,680	1,420
Lateral		m	31,200	15,600	12,480	3,120
Pump	3sites	cu.ms	25	159,000	151,050	7,950
Sluice Gate	7sites	ton	159	73,458	60,236	13,222
2 Navigation Lock				98,650	83,374	15,276
Preparatory Works *1)		l/s	1	16,442	13,896	2,546
Excavation		cu.m	9,000	495	421	74
Backfill		cu.m	250,000	10,000	8,500	1,500
Riprap		sq.m	900	90	77	14
RC-pile		m	3,950	1,185	1,007	178
Revetment		sq.m	3,800	2,280	1,938	342
Mass concrete		cu.m	340	510	434	77
Reinforced concrete		cu.m	9,800	39,200	33,320	5,880
Steel sheet pile		sq.m	1,000	3,500	3,325	175
Gate		ton	180	24,948	20,457	4,491
3 South of Malabon River				283,950	235,916	48,034
Preparatory Works *1)		l/s	1	47,325	39,319	8,006
Ring Dike		m	13,200	61,506	49,900	11,606
Coastal Dike(w/ revetment)	EL.13.5m/H=2.5m	m	1,100			
River Dike(w/ revetment)	Raising H=1m	m	3,600			
Parapet Wall,reinforced conc.		m	8,500			
Embankment		cu.m	133,200	5,328	4,529	799
Revetment		sq.m	14,300	8,578	7,291	
Reinforced concrete		cu.m	11,900	47,600	38,080	1,287
Channel Works		m	2,400	16,759		
Drainage channel impvt.		m	700	1,274	1,083	191
Const. of open channel		m	900	5,085	4,068	1,017
Const. of closed channel		m	800	10,400	8,320	2,080
Lateral		m	5,900	2,950	2,360	590
Pump	3sites	cu.ms	10	130,000	123,500	6,500
Sluice Gate	5sites	ton	55	25,410	20,836	4,574
Sub-Total(1+2+3)				723,313	616,285	107,029
4 Administration *2)		l/s	1	36,166	0	36,166
5 Engineering Services		l/s	1	85,200	76,680	8,520
6 Physical Contingency *3)		l/s	1	84,468	69,296	15,171
7 Land Acquisition & Compensation		ha	28	109,200	0	109,200
Total(1+2+3+4+5+6+7)				1,038,347	762,261	276,086
8 Price Contingency *4)				76,936	0	76,936
9 Grand Total				1,115,282	762,261	353,021

Notes:
1);20% of main civil works
2); 5% of main civil works(1+2+3)
3);10% of (1+2+3+4+5)
4); 0% for foreign currency and 6% for local currency

Table 6-3-8 COST BREAKDOWN OF THE OPTIMUM PLAN FOR PASIG-MARIKINA RIVER IMPROVEMENT PROJECT

1US$=132Yen=21.3Peso

Work Item	Feature	Unit	Quantity	Total (1000P)	Foreign Currency (1000P)	Local Currency (1000P)
1 River Improvement				718,313	611,645	106,668
River Mouth/San Juan C.	L=8735m			494,093	418,307	75,786
Preparatory Works		l/s	1	117,679	99,629	18,050
Excavation		cu.m	2,334,000	305,754	259,891	45,863
Parapet wall/River wall		cu.m	3,000	9,000	7,650	1,350
Revetment		sq.m	40,000	24,000	20,400	3,600
Steel sheet		sq.m	5,000	17,500	16,625	875
Reconst. Pandacan bridge	L=140m	sq.m	840	20,160	14,112	6,048
San Juan C./Napindan C.	L=9760m			159,750	137,259	22,491
Preparatory Works		l/s	1	45,750	39,309	6,441
Excavation		cu.m	300,000	37,500	31,875	5,625
Parapet wall/River wall		cu.m	10,000	30,000	25,500	4,500
Revetment		sq.m	60,000	36,000	30,600	5,400
Steel sheet		sq.m	3,000	10,500	9,975	525
Napindan C./M.C.G.S.	L=5580m			28,170	24,385	3,785
Preparatory Works		l/s	1	5,770	4,995	775
Excavation		cu.m	100,000	9,500	8,075	1,425
Embankment		cu.m	10,000	400	340	60
Parapet wall/River wall		cu.m	1,000	3,000	2,550	450
Revetment		sq.m	10,000	6,000	5,100	900
Steel sheet		sq.m	1,000	3,500	3,325	175
M.C.G.S. /Mangahan C.	L=1210m			17,520	15,312	2,208
Preparatory Works		l/s	1	2,920	2,552	368
Excavation		cu.m	100,000	6,900	5,865	1,035
Parapet wall/River wall		cu.m	1,000	3,000	2,550	450
Revetment		sq.m	2,000	1,200	1,020	180
Steel sheet		sq.m	1,000	3,500	3,325	175
Mangahan C./STA.7+425	L=790m			18,780	16,383	2,397
Preparatory Works		l/s	1	3,130	2,731	400
Excavation		cu.m	50,000	4,750	4,038	713
Embankment		cu.m	5,000	200	170	30
Parapet wall/River wall		cu.m	2,000	6,000	5,100	900
Revetment		sq.m	2,000	1,200	1,020	180
Steel sheet		sq.m	1,000	3,500	3,325	175
2 Marikina Control Gate Structure				138,600	116,147	22,453
Preparatory Works		l/s	1	23,100	19,358	3,742
Excavation		cu.m	30,000	7,000	5,950	1,050
Embankment		cu.m	6,000	300	255	45
Concrete		cu.m	22,000	62,000	52,700	9,300
Gate (10.1m*17.5m*2no.)		ton	300	46,200	37,884	8,316
Sub-Total(1+2)				856,913	727,792	129,121
3 Administration *1)		l/s	1	42,846	0	42,846
4 Engineering Services		l/s	1	127,800	115,020	12,780
5 Physical Cotingency *2)		l/s	1	102,756	84,281	18,475
6 Land Acquisition & Compensation		ha	7	160,000	0	160,000
Total(1+2+3+4+5+6)				1,290,315	927,093	363,222
7 Price Cotingency *3)				110,675	0	110,675
8 Grand Total				1,400,990	927,093	473,896

Notes:
1); 5% of main civil works(1+2)
2);10% of (1+2+3+4)
3); 0% for foreign currecy and 6% for local currency

Table 6-3-9 DISBURSEMENT SCHEDULE FOR EAST AND WEST OF MANGAHAN DRAINAGE IMPROVEMENT PROJECT

UNIT : THOUSAND US$

	WORK ITEM	TOTAL			1991		1992		1993		1994	
		TOTAL	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1.	PREPARATORY WORKS	15,898	13,916	1,982	4,976	900	8,940	1,081	0	0	0	0
2.	CONSTRUCTION WORKS	79,488	69,580	9,908	4,882	866	21,566	3,014	21,566	3,014	21,566	3,014
	2.1 LAKESHORE DIKE	22,991	19,527	3,464	4,882	866	4,882	866	4,882	866	4,882	866
	2.2 RIVER CHANNEL WORKS	6,392	5,355	1,037	0	0	1,785	346	1,785	346	1,785	346
	2.3 DRAINAGE SYSTEM	50,105	44,698	5,407	0	0	14,899	1,802	14,899	1,802	14,899	1,802
	TOTAL OF 1.+2.	95,386	83,496	11,890	9,858	1,766	30,506	4,095	21,566	3,014	21,566	3,014
3.	ADMINISTRATION	4,769	0	4,769	0	581	0	1,730	0	1,229	0	1,229
4.	ENGINEERING SERVICES	4,800	4,320	480	1,080	120	1,080	120	1,080	120	1,080	120
	TOTAL OF 1. TO 4.	104,955	87,816	17,139	10,938	2,467	31,586	5,945	22,646	4,363	22,646	4,363
5.	PHYSICAL CONTINGENCY (10% of the above total)	10,496	8,782	1,714	1,094	247	3,159	595	2,265	436	2,265	436
6.	LAND ACQUISISTION & COMPENSATION	8,706	0	8,706	0	4,353	0	4,353	0	0	0	0
	TOTAL OF 1. TO 6.	124,157	96,598	27,559	12,032	7,067	34,744	10,893	24,911	4,799	24,911	4,799
7.	PRICE CONTINGENCY (F.C.:0% L.C.:6%)	7,841	0	7,841	0	1,350	0	2,859	0	1,623	0	2,009
	GRAND TOTAL	131,997	96,598	35,400	12,032	8,417	34,744	13,752	24,911	6,423	24,911	6,808

NOTE : Figures may not add up to totals due to rounding.
Currency conversion rates are 1.00 US$ = 132 Yen = 21.30 Peso.

Table 6-3-10 DISBURSEMENT SCHEDULE FOR MALABON-NAVOTAS DRAINAGE IMPROVEMENT PROJECT

UNIT : THOUSAND US$

	WORK ITEM	TOTAL			1991		1992		1993		1994	
		TOTAL	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1.	PREPARATORY WORKS	5,660	4,822	838	930	137	3,196	598	697	103	0	0
2.	CONSTRUCTION WORKS	28,298	24,111	4,187	2,905	428	7,069	1,253	7,069	1,253	7,069	1,253
	2.1 NORTH OF MALABON RIVER	13,330	11,619	1,711	2,905	428	2,905	428	2,905	428	2,905	428
	2.2 NAVIGATION LOCK	3,859	3,262	597	0	0	1,087	199	1,087	199	1,087	199
	2.3 SOUTH OF MALABON RIVER	11,109	9,230	1,879	0	0	3,077	626	3,077	626	3,077	626
	TOTAL OF 1.+2.	33,958	28,933	5,025	3,834	565	10,264	1,851	7,766	1,356	7,069	1,253
3.	ADMINISTRATION	1,698	0	1,698	0	220	0	606	0	456	0	416
4.	ENGINEERING SERVICES	4,000	3,600	400	900	100	900	100	900	100	900	100
	TOTAL OF 1. TO 4.	39,656	32,533	7,123	4,734	885	11,164	2,557	8,666	1,912	7,969	1,769
5.	PHYSICAL CONTINGENCY (10% of the above total)	3,966	3,253	712	473	88	1,116	256	867	191	797	177
6.	LAND ACQUISISTION & COMPENSATION	5,127	0	5,127	0	2,564	0	2,564	0	0	0	0
	TOTAL OF 1. TO 6.	48,748	35,786	12,962	5,208	3,537	12,281	5,376	9,532	2,103	8,766	1,946
7.	PRICE CONTINGENCY (F.C.:0% L.C.:6%)	3,612	0	3,612	0	676	0	1,411	0	711	0	814
	GRAND TOTAL	52,360	35,787	16,574	5,208	4,212	12,281	6,787	9,532	2,814	8,766	2,761

NOTE : Figures may not add up to totals due to rounding.
Currency conversion rates are 1.00 US$ = 132 Yen = 21.30 Peso.

Table 6-3-11 DISBURSEMENT SCHEDULE FOR PASIG-MARIKINA RIVER IMPROVEMENT PROJECT

UNIT : THOUSAND US$

WORK ITEM	TOTAL			1991		1992		1993		1994		1995	
	TOTAL	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1. PREPARATORY WORKS	9,310	7,913	1,397	3,041	548	2,339	424	2,300	390	234	36	0	0
2. RIVER IMPROVEMENT WORKS	30,919	26,256	4,663	620	91	8,010	1,431	7,390	1,340	5,118	901	5,118	901
2.1 LOWER MARIKINA R. IMPVT.(M.C.G.S/STA.7+425)	1,421	1,240	181	620	91	620	91	0	0	0	0	0	0
2.2 CONST. OF MARIKINA CONTROL GATE STRUCTURE	5,422	4,544	878	0	0	2,272	439	2,272	439	0	0	0	0
2.3 PASIG R. IMPVT.(RIVER MOUTH/M.C.G.S.)	24,076	20,472	3,604	0	0	5,118	901	5,118	901	5,118	901	5,118	901
TOTAL OF 1.+2.	40,229	34,169	6,060	3,661	638	10,349	1,854	9,690	1,730	5,352	937	5,118	901
3. ADMINISTRATION	2,011	0	2,011	0	215	0	610	0	571	0	314	0	301
4. ENGINEERING SERVICES	6,000	5,400	600	1,080	120	1,080	120	1,080	120	1,080	120	1,080	120
TOTAL OF 1. TO 4.	48,240	39,569	8,671	4,741	973	11,429	2,584	10,770	2,421	6,432	1,371	6,198	1,322
5. PHYSICAL CONTINGENCY (10% of the above total)	4,824	3,957	867	474	97	1,143	258	1,077	242	643	137	620	132
6. LAND ACQUISISTION & COMPENSATION	7,512	0	7,512	0	2,504	0	2,504	0	2,504	0	0	0	0
TOTAL OF 1. TO 6.	60,576	43,526	17,051	5,215	3,574	12,571	5,347	11,846	5,167	7,075	1,509	6,818	1,454
7. PRICE CONTINGENCY (F.C.:0% L.C.:6%)	5,197	0	5,197	0	683	0	1,403	0	1,748	0	631	0	732
GRAND TOTAL	65,774	43,526	22,248	5,215	4,257	12,571	6,750	11,846	6,915	7,075	2,140	6,818	2,186

NOTE : Figures may not add up to totals due to rounding.
Currency conversion rates are 1.00 US$ = 132 Yen = 21.30 Peso.

Table 6-3-1 SUMMARY OF ANNUAL OPERATION, MAINTENANCE AND REPLACEMENT COST

UNIT : MIL. PESO

RIVER IMPROVEMENT SCHEME	OPERATION, MAINTENANCE AND REPLACEMENT COST	PROJECT SCALE
1. PASIG RIVER	7.6	100-Yr
2. MARIKINA RIVER	3.2	100-Yr
3. BAHO BULI MAHABA RIVERS	2.1	30-Yr
4. MALABON TULLAHAN RIVERS	1.1	30-Yr
5. SOUTH PARANAQUE LAS PINAS RIVERS	1.5	30-Yr
TOTAL	15.5	

UNIT : MIL. PESO

DRAINAGE IMPROVEMENT SCHEME	OPERATION, MAINTENANCE AND REPLACEMENT COST	PROJECT SCALE
1. MALABON NAVOTAS	9.7	5-Yr
2. EAST OF MANGAHAN	3.1	5-Yr
3. WEST OF MANGAHAN	36.0	5-Yr
4. MALABON NAVOTAS (REMAINING)	1.7	5-Yr
5. SAN JUAN	7.5	3-Yr
6. MANDALUYONG PASIG	3.7	3-Yr
7. MARIKINA	3.4	3-Yr
8. PARANAQUE LAS PINAS	3.4	3-Yr
9. VALENZUELA	0.7	3-Yr
TOTAL	69.2	

FIGURES

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

JAPAN INTERNATIONAL COOPERATION AGENCY

EXCAVATION/DREDGING METHOD AND COMBINATION OF CONSTRUCTION EQUIPMENT

Fig.6-2-1

WORK ITEM	QUANTITY	UNIT
1. LAKESHORE DIKE		
PREPARATORY WORKS	1	L/S
EXCAVATION	145,000	m^3
EMBANKMENT	872,000	m^3
REVETMENT	80,000	m^2
SLUICE GATE	5	Site
MAINTENANCE BRIDGE	4	Site
2. RIVER CHANNEL IMPROVEMENT		
PREPARATORY WORKS	1	L/S
NAPINDAN RIVER	5,242	m
MANGAHAN DIVERSION	3,900	m
BULI, BAHO, MAHABA RIVERS	5,800	m
LOWER BICUTAN RIVER	800	m
3. DRAINAGE IMPROVEMENT		
PREPARATORY WORKS	1	L/S
CHANNEL WORKS	55,000	m
SLUICE GATE	9	Site
REGULATION POND	6	Site
PUMP STATION	9	Site
LATERAL	114,500	m

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

JAPAN INTERNATIONAL COOPERATION AGENCY

WORK SCHEDULE FOR EAST AND WEST OF MANGAHAN DRAINAGE IMPROVEMENT PROJECT

Fig.6-2-2

WORK ITEM	QUANTITY	UNIT
1. NORTH OF MALABON RIVER		
PREPARATORY WORKS	1	L/S
RING DIKE	15,900	m
CHANNEL WORKS	1,600	m
GATE	7	Site
PUMP STATION	3	Site
LATERAL	31,200	m
2. NAVIGATION LOCK		
PREPARATORY WORKS	1	L/S
EARTHWORKS	1	L/S
CONCRETE WORKS	1	L/S
GATE/EQUIPMENT	1	L/S
3. SOUTH OF MALABON RIVER		
PREPARATORY WORKS	1	L/S
RING DIKE	13,200	m
CHANNEL WORKS	2,400	m
GATE	5	Site
PUMP STATION	3	Site
LATERAL	5,900	m

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

JAPAN INTERNATIONAL COOPERATION AGENCY

WORK SCHEDULE FOR MALABON-NAVOTAS DRAINAGE IMPROVEMENT PROJECT

Fig.6-2-3

WORK ITEM	QUANTITY	UNIT
1. LOWER MARIKINA RIVER IMPROVEMENT		
PREPARATORY WORKS	1	L/S
MCGS/MANGAHAN CONFLUENCE	1,210	m
MANGAHAN CONFLUENCE/STA.7+425	790	m
2. MARIKINA CONTROL GATE STRUCTURE		
PREPARATORY WORKS	1	L/S
EARTHWORKS	1	L/S
CONCRETE WORKS	1	L/S
GATE	1	L/S
3. PASIG RIVER IMPROVEMENT		
PREPARATORY WORKS	8,735	m
RIVERMOUTH/SAN JUAN CONFL	9,760	m
SN JUAN CONFL/NAPINDAN CONFL	5,580	m
NAPINDAN CONFL/MCGS		

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

JAPAN INTERNATIONAL COOPERATION AGENCY

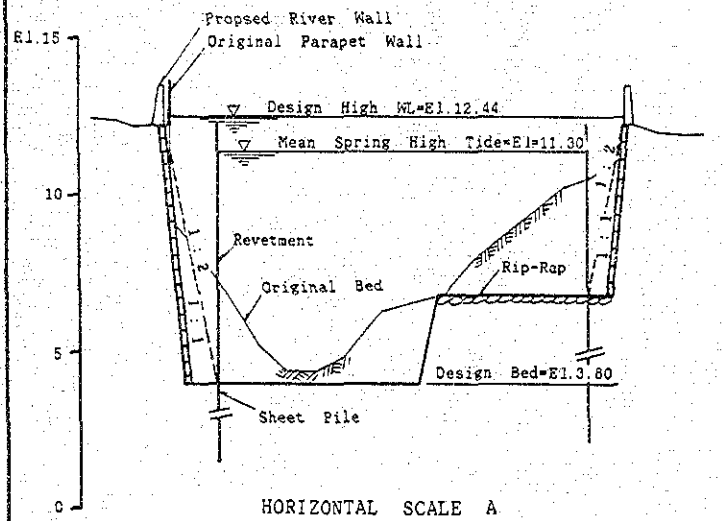
WORK SCHEDULE FOR PASIG-MARIKINA RIVER IMPROVEMENT PROJECT

Fig.6-2-4

TYPICAL MODEL FOR CALCULATION OF COST FOR PREPARATORY WORKS

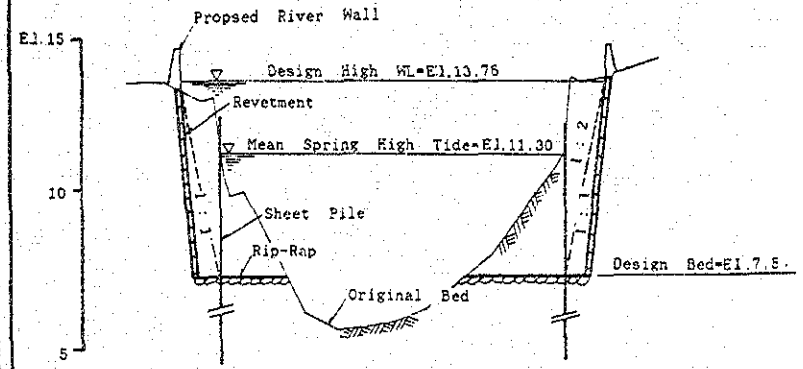
Fig.6-3-1

Pasing River Sta. 5+605 (Q 1,300m³/s)



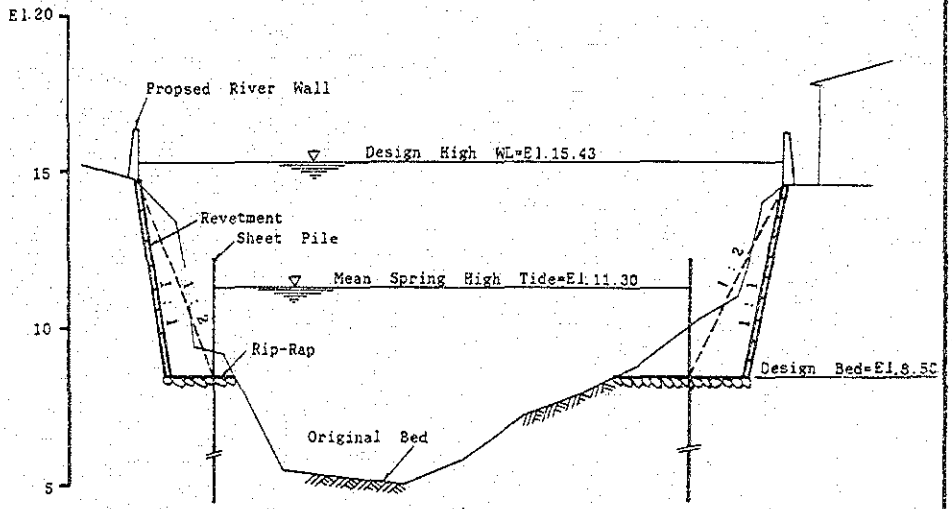
HORIZONTAL SCALE A

Pasing River Sta.12+495 (Q=800m³/s)



HORIZONTAL SCALE A

Lower Marikina River Sta.2+650 (Q=650m³/s)



HORIZONTAL SCALE B

1.Unit Direct Construction Cost

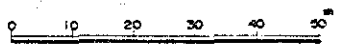
Item	Unit	Unit Cost (P)	Sta.5+605		Sta.12+495		Sta.2+710	
			Quantity	Cost(P/m)	Quantity	Cost(P/m)	Quantity	Cost(P/m)
Excavation dredger	m³	200	310	62,000	300	60,000	120	24,000
Revetment	m²	600	30	18,000	32	19,200	32	19,200
River Wall	m³	1200	2.1	2,520	2.3	2,800	4.0	4,800
Rip-rap	m²	100	60	6,000	70	7,000	37	3,700
Total				88,520		89,000		51,700

2.Water Depth for Construction (H)

Sta. 5+605 : H=11.30-(3.80+6.00)/2=6.40m
Sta.12+495 : H=11.30-7.50=3.80m
Sta. 2+710 : H=11.30-8.50=2.80m

Horizontal Scale A

Horizontal Scale B



VII. ADMINISTRATIVE ORGANIZATION

SUPPORTING REPORT

VII. ADMINISTRATIVE ORGANIZATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. GENERAL

The study on an administrative organization that can successfully implement the proposed flood control and drainage project in Metro Manila is herein discussed according to the following order:

(1) A brief description and analysis of existing organizational setup regarding flood control and drainage including flood defense and solid waste management which are closely related to flood control and drainage matter.

(2) A description of the proposed flood control and drainage system, dealing with the study on the responsible agencies and the formulation of the required organization for planning, construction, operation and maintenance.

2. EXISTING ORGANIZATION SETUP

2.1 Legal and Administrative Framework

The existing legal and administrative framework of flood control and drainage systems, including flood defense and solid waste management, are briefly described hereinafter (refer to Table 7-2-1).

(1) Flood Control and Drainage

Regulations on flood control are basically provided under the Water Code of the Philippines (P.D. No. 1067) dated December 1976. The Code has empowered the then Secretary of Public Works, Transportation and Communications (now, the Department of Public Works and Highways) to declare flood control areas and to promulgate regulations for governing flood plain management plans in these areas.

The most recent regulations on flood control are found in Executive Order (E.O.) No. 124, as amended by E.O. No. 124-A of July 22, 1987, which was issued by the incumbent President of the Philippines on January 30, 1987 and which is otherwise known as the Reorganization Act of the Ministry of Public Works and Highways (MPWH). The ministry is presently called the Department of Public Works and Highways (DPWH).

According to E.O. 124, the DPWH is mandated to provide technical services for planning, design, construction and maintenance of flood control and drainage facilities nationwide including the Metro Manila area. It is noted in this connection that before the issuance of E.O. No. 124, E.O. No. 52 was issued in October 1986 to transfer the responsibility for flood control and drainage projects in Metro Manila from MPWH (presently called DPWH) to the Metropolitan Manila Commission (MMC). Practically, however, these duties were not transferred to the MMC.

Under E.O. No. 124-B, also dated July 22, 1987, the Metropolitan Manila Flood Control and Drainage Council was attached to the DPWH. The powers and functions of the Council include among others, the coordination of policies, plans and programs of related agencies, cities and municipalities for the flood control and drainage in Metro Manila, including the identification of project priorities. However, the Council has not been exercising this function since it was reorganized in July 1987.

(2) Flood Defense

According to P.D. 78, as amended by P.D. 1149 dated June 1977, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) shall coordinate its flood forecasting activities in major river basins with DPWH.

The fundamental law on disaster management is P.D. 1566 dated June 1978. Entitled "Strengthening the Philippine Disaster Control Capability and Establishing the National Program on Community Disaster Preparedness", P.D. 1566 stipulates the policy on disaster management and the composition of the National Disaster Coordinating Council (NDCC). The secretary of the Department of National Defense (DND) is the Chairman of the NDCC. Under the decree, the Office of Civil Defense (OCD) under the DND is responsible for coordinating the activities of various agencies relative to disaster management and the preparation and dissemination of disaster control guidelines.

In accordance with P.D. 1566, the OCD prepared the "Calamities and Disaster Preparedness Plan" in August 1987. This plan was intended to

save lives, prevent needless suffering, protect property and minimize damages during disasters and calamities such as floods, typhoons, fires and earthquakes. It presents the organization for disaster preparedness and the tasks of related agencies under the national and local governments.

The OCD also published the Barangay Disaster Manual in 1988 to provide barangays with the general instructions on the organization and implementation of disaster preparedness measures.

(3) Solid Waste Management

The Environmental Sanitation Center (ESC) was established in the MMC in July 1976 by E.O. No. 5, to develop and directly manage an integrated environmental sanitation program covering the cleanliness and beautification of streets, sidewalks, and waterways; refuse collection and disposal and measures to prevent pollution in land areas and waterways.

Another basic legislation regarding solid waste management is P.D. 825, dated November 1975, providing a penalty for improper disposal of garbage. Any person who throws garbage or other waste matters in public places shall suffer an imprisonment of not less than 5 days nor more than one year, or a fine of not less than ₱100 nor more than ₱2,000, or both, such fine and imprisonment at the discretion of the Court, without prejudice to the imposition of a higher penalty under any other law or decree.

The Presidential Task Force created by virtue of Memorandum Circular No. 30 dated November 1987 to enhance the improvement of the present waste management system is composed of representatives from several agencies, and the MMC is authorized as the leading agency. However, the Task Force has not started functioning yet.

2.2 Flood Control and Drainage Activity in Practice

The planning, construction, operation and maintenance of flood control and drainage facilities in Metro Manila is the responsibility of the DPWH as stated before. The activities for the study area are

practically executed under the jurisdiction of the National Capital Region (NCR) and some project management offices (PMOs) under the DPWH. The PMO for Major Flood Control Projects who is concurrently responsible for the EFCOS Project, and the PMO for Mangahan Floodway Project have just been merged into the PMO for Flood Control and Dredging Projects. The PMO for Metro Manila Infrastructure Utilities and Engineering MMINUTE) funded by the World Bank executes small scale drainage projects for the depressed urban areas in Metro Manila. The organizational chart of the DPWH is presented in Fig. 7-2-1.

The yearly fund allocations of the DPWH for flood control in Metro Manila from 1987 to 1989 are presented in Table 7-2-2. In 1987, around 50% or 230 million pesos was allocated to the NCR out of the total funds of around 410 million pesos. The remaining amount was allocated to the PMOs.

With assistance from the DPWH, minor drainage activities are undertaken by local government units (LGUs) such as the MMC and the city/municipal governments and private entities. The administrative setup for waterways in Metro Manila is presented in Fig. 7-2-2. The infrastructure projects involving drainage and declogging programs executed by the Engineering Operations Center (EOC) under the MMC from 1985 to 1988 are presented in Table 7-2-3, together with the fund allocations for the related projects. The total funds for these projects in four years is around 4.6 million pesos, which is too small compared with the 410 million pesos allocated in 1987 for the Metro Manila flood control fund of the DPWH.

There is no clear delineation of duties and responsibilities in the administration of flood control facilities among the NCR and the PMOs under the DPWH, the MMC and the cities/municipalities. Supplemental or complemental functions can be provided, but there is the potential that conflicts and inefficiencies in formulating a project will arise. The structural and solid waste problems regarding the operation and maintenance (O&M) of flood control facilities are enumerated in Table 7-2-4.

The organizational setup of the related offices under the DPWH and the LGUs is described hereinafter.

Department of Public Works and Highways (DPWH)

(1) National Capital Region (NCR)

The NCR with around 1,800 personnel provides technical services for the planning, designing, construction, maintenance and/or operation of infrastructure facilities in Metro Manila such as the facilities in rivers and esteros, drainage mains, laterals, pumping stations, etc., as well as bridges, roads and buildings. The organizational chart of the NCR is presented in Fig. 7-2-3.

On flood control and drainage projects, the Planning and Design Division, the Flood Control and Drainage Division, the Pumping Stations and Floodgates Division and the Materials Control and Hydrology Division execute their assigned tasks independently. Their respective functions are presented in Table 7-2-5.

The important flood control facilities such as the Napindan Hydraulic Control Structure, Rosario Weir, pumping stations and the flood gates are administered separately by the Flood Control and Drainage Division and the Pumping Stations and Floodgates Division of the NCR and the PMO for the Mangahan Floodway Project. This setup causes inefficiency in executing, among others, emergency flood control activities. (Refer to Fig. 7-2-4.)

The NCR has six (6) engineering district offices, located in different areas of Metro Manila (refer to Fig. 7-2-5). Each district office has a section corresponding to the general divisions mentioned above.

The NCR also has the Regional Equipment Service (RES) which provides equipment support and services for the rehabilitation of infrastructure projects. The RES provides the equipment for flood control and drainage such as dredgers, sewer jet pumps and dump trucks. The servicing of equipment is far from satisfactory, and many equipment are awaiting repair, as shown in Table 7-2-6.

In the related offices under the NCR, technical personnel are not enough to form an organized crew to implement infrastructure programs and conduct operation/maintenance work on flood control facilities. Some projects are executed through the hiring of casual employees and "pakyaw" workers under negotiated contracts between authorized section workers and the various contractors.

(2) PMO for Mangahan Floodway Project

The Mangahan Floodway which runs from the Marikina River to the Laguna Lake, and the other project components such as the Ortigas Bridge, the Daang-Pasig Bridge and the Rosario Weir are operated and maintained by the PMO for the Mangahan Floodway Project. This PMO is headed by a Project Manager and is composed of 14 engineers and 38 other staff. The PMO has been supported by funds from the OECF, but it is now purely funded by local funds.

(3) PMO for Major Flood Control Projects

This Project Management Office implements the flood control projects in major river basins nationwide such as the Pasig-Marikina, Agno, Pampanga, Cagayan, Bicol, Cotabato and Parang. It is headed by a Project Director and is composed of 15 engineers and 20 other staff.

For the flood control programs in Metro Manila, this office has started to implement the Effective Flood Control Operation System (EFCOS) including the installation of flood warning and telemetering devices for the Pasig-Marikina-Laguna Lake Complex. The survey on siltation at drainage mains in Metro Manila which is a very important step for the planning of drainage projects, is also being undertaken by this office to give assistance to the NCR.

(4) PMO for Metro Manila Infrastructure Utilities and Engineering (MMINUTE)

The function of MMINUTE which is funded by the World Bank is to provide basic barangay-based infrastructure facilities in the depressed urban areas in Metro Manila. This PMO implements the projects concerned with barangay sanitation, the construction of small communal water

supply, the improvement of city or municipal level roads including minor drainage, and the rehabilitation of public buildings. Minor projects regarding drainage laterals for small scale drainage systems are executed by this office in cooperation with the city or municipal engineer's office.

This PMO is headed by a Project Manager and is composed of 18 engineers and 32 other staff.

Local Government Units (LGUs)

(1) Metropolitan Manila Commission (MMC)

MMC was created by virtue of P.D. 824 dated November 1975 to integrate public service activities in the Metro Manila Area. P.D. 824 and the issuance of E.O. 2-77 in May 1977 marked the creation of the Engineering Operations Center (EOC) in the MMC. The organization chart of the MMC is presented in Fig. 7-2-6.

The EOC was organized to coordinate and monitor all engineering operations and activities in Metro Manila. Regarding flood control and drainage, EOC implements some programs for minor drainage facilities as a part of the maintenance activities for roads such as the drainage laterals attached to local level structures and/or secondary and tertiary roads. Presently, the EOC has around 90 personnel composed of 20 engineers and architects, and other staff including casual employees.

The Environmental Sanitation Center (ESC) under the MMC is responsible for solid waste management in Metro Manila. The objective of the ESC is to manage an integrated program of cleanliness through streetsweeping and garbage collection including the beautification of streets, sidewalks and waterways in the metropolitan area.

The ESC which is headed by an Executive Director has a central office and five (5) sector offices, namely the North, East, South, West and Quezon City, to undertake the integrated and efficient environmental sanitation services.

In 1987, the ESC has a total of 12,000 personnel, 90% of which are involved in operations, while the remaining 10% are office staff.

Around 6,800 personnel or 50% of the total manpower are assigned in streetsweeping. Garbage collection and other operations of cleanliness comprise 40% or around 4,600 personnel.

The budget of ESC for 1987 and 1988 is presented as follows. Around 70% of the budget is allotted for personal services, while the remaining is for operation and maintenance.

Unit: million pesos

Items	1987	1988
Personal Services	240	290
Operation and Maintenance	110	100
Total	350	390

The major problems of the ESC are the squatters along the esteros who indiscriminately throw garbage into the esteros, residents who do not use the right containers and give additional laborious work to collectors, narrow streets that prevent dump trucks from going into them to collect garbage, and aged dump trucks which obviously require replacement.

(2) City/Municipal Government

City or municipal governments have engineer's offices that issue permits, monitor and inspect the construction of buildings and factories, and execute minor activities on drainage in their respective administrative areas of judrisdiction.

City or municipal engineer's offices have little staff and capability in terms of engineering activity and drainage works. For example, the engineer's office of Caloocan City has 15 engineers and architects and 52 other staff, and the engineer's office of Navotas has 4 engineers and 33 other staff. Therefore, they usually turn for assistance from the NCR and MMINUTE offices under DPWH, and the ESC of MMC.

3. ORGANIZATION SETUP OF THE PROPOSED FLOOD CONTROL AND DRAINAGE PROJECT

3.1 Organizational Setup in the Formulation of the Master Plan

The flood control and drainage projects nationwide including the Metro Manila area are presently executed by the Department of Public Works and Highways (DPWH), under Executive Order No. 124 of January 1987. The minor drainage laterals in Metro Manila are maintained by the local governments such as the Metropolitan Manila Commission (MMC) and city/municipality.

Aside from the DPWH, other concerned agencies are also involved in the planning of flood control and drainage projects in Metro Manila such as the National Economic and Development Authority (NEDA) and the Laguna Lake Development Authority (LLDA). The NEDA is related to the fund allocation of the flood control and drainage projects and other infrastructure programs. The LLDA undertakes the execution and coordination of the development programs of Laguna Lake and adjoining areas.

In view of the above situation, there are many agencies related to the flood control and drainage program, and it is recommended that an integrated institution, like a Committee for decision making, be created to ensure the effective and smooth implementation of proposed projects (refer to Table 7-3-1). A Technical Working Group (TWG) will be established to serve as the technical subagency of the Committee (refer to Table 7-3-2). The PAGASA and the Office of Civil Defense (OCD) will also be joined in the TWG for the purpose of flood forecasting and flood defense.

The practical implementation for the proposed project will be undertaken by DPWH and local governments according to the existing activities on flood control and drainage. The proposed organizational diagram of flood control and drainage projects is shown in Fig. 7-3-1.

The planning, construction and operation and maintenance of the proposed flood control and drainage facilities such as rivers, esteros, drainage mains/outfalls and major drainage laterals will be under the

jurisdiction of the DPWH from the existing function, while the maintenance of minor drainage laterals and street gutters connected to local government structures and/or secondary/tertiary roads would be tasked to local governments such as the MMC and the city/municipality concerned. (Refer to Table 7-3-3.)

The implementation of flood control and drainage projects in Metro Manila is presently undertaken by the DPWH through the NCR and the PMOs such as the PMO for Flood Control and Dredging Projects and the PMO for Metro Manila Infrastructure Utilities and Engineering (MMINUTE). The PMO for Major Flood Control Projects who is currently responsible for the EFCOS Project, and the PMO for Mangahan Floodway Project have just been merged into the PMO for Flood Control and Dredging Project.

The PMO for Flood Control and Dredging Projects will undertake the planning, design and construction of major proposed projects in view of the project scale. The DPWH-NCR will be able to execute the planning, design, and construction of ordinary flood control and drainage projects, as well as the operation and maintenance (O&M) of proposed projects from the present function. The PMO for MMINUTE can execute the provision of technical assistance to the local governments as it presently undertakes.

Furthermore, it is recommended that a Flood Control and Drainage Office be established in DPWH-NCR to execute the integrated flood control and drainage projects, after the merger and acquisition of the Flood Control and Drainage Division, the Pumping Stations and Floodgates Division, and a part of the flood control and drainage activities of the Planning and Design Division and the Materials Quality Control and Hydrology Division. The proposed office may allot the functions concerned to the Planning and Design Division, the Construction Division and the Operation and Maintenance Division (refer to Fig. 7-3-2). Information/data on the O&M of flood control and drainage facilities will be exchanged between the Operation and Maintenance Division and other related agencies as mentioned in Table 7-3-4.

Street gutters connected with national roads should be maintained by the Maintenance Division of DPWH-NCR, which is presently responsible

for the maintenance of roads and bridges, because street gutters are parts of the road.

3.2 Organizational Setup in the Feasibility Study of the Priority Project

3.2.1 Drainage Improvement in East and West of Mangahan

In accordance with the proposed organizational setup of the master plan, as shown in Fig. 7-3-1, the design and construction will be executed by the DPWH-NCR or the PMO for Flood Control and Dredging Projects under DPWH. The DPWH-NCR will undertake the operation and maintenance (O&M) of the proposed project, excluding the one of the minor drainage laterals which is in charge of local government units such as MMC and city/municipality.

Design and Construction

To execute the design and construction work, the consulting engineers and a private company with high technical expertise will be hired or contracted, and the DPWH-NCR or the PMO mentioned above will undertake the supervision of this work.

The main required staff for desing and construction of the proposed project will be composed of the following staff. The staffing of the required assistant such as draftsman, typist, driver, messenger, etc. would be decided at the stage of detail design of the proposed project. The details of staffing and required activity is described in Table Table 7-3-5.

Position	Staffing for Design and Construction
Project Manager	1
Design and Construction Staff	7
Administrative Staff	2
Total	10

Operation and Maintenance (O&M)

The proposed O&M Division of DPWH-NCR in the master plan will execute the operation of the related facilities for the proposed project, including the comprehensive management of maintenance work concerned and training of the related staff, for the purpose of the integrated and comprehensive operation of the related facilities.

The Engineering District Office of DPWH-NCR will undertake the practical and close maintenance activities for the proposed project under the management of the O&M Division mentioned above, including the O&M of pump stations and gates.

The staffing of main officers for the related O&M activities are summarized in the following table. The details of staffing and required activity is presented in Table 7-3-6. The staffing of the required assistant such as labourer, typist, driver, messenger, etc., will be decided at the stage of detail design of the proposed project.

Position	Number of Staff
(Operation and Maintenance Division)	
Chief Supervising Engineer	1
Flood/Drainage Control Staff	9
Administrative Staff	2
Sub-total	12
(Engineering District Office)	
Maintenance Staff	5
- Pump Station -	
Operation and Maintenance Staff (9 stations x 2 staff = 18 staff)	18
- Flood Gate -	
Operation and Maintenance Staff (14 gates x 1 staff = 14 staff)	14
Sub-total	37
Total	49

3.2.2 Drainage Improvement in Malabon-Navotas

The DPWH-NCR or the PMO for Flood Control and Dredging Projects of DPWH may execute the supervision of the design and construction work. The DPWH-NCR will execute the O&M of the proposed project, excluding the one of the minor drainage laterals managed by local governments (refer to Fig. 8-3-1 and Section 3.2.1).

Design and Construction

The consulting engineers and a private company with high technical expertise will be contracted to execute the design and construction work, and the DPWH-NCR or the PMO mentioned above will execute the supervision of this work.

The main required staffing is the same as the one of the East and West Areas of Mangahan Floodway as shown in Section 3.2.1. The details of staffing and required acticity is explained in Table 7-3-5.

Operation and Maintenance (O&M)

The proposed O&M Division in the master plan will undertake the operation for the proposed projects, including the comprehensive management of related maintenance work, as explained in Section 3.2.1. The Engineering District Office of DPWH-NCR will undertake the practical and close maintenance activities for the proposed project, including the O&M of pump stations and flood gates, under the management of the O&M Division.

The staffing of main officers for the related O&M activities are summarized in the following table. The details of staffing are required activity is presented in Table 7-3-6 (refer to Section 3.2.1).

Position	Number of Staff
(Operation and Maintenance Division)	
Chief Supervising Engineer	1
Flood/Drainage Control Staff	9
Administrative Staff	2
Sub-total	12
(Engineering District Office)	
Maintenance Staff	5
- Pump Station -	
Operation and Maintenance Staff (6 stations x 2 staff = 12 staff)	12
- Flood Gate/Navigation Lock -	
Operation and Maintenance Staff (13 gates x 1 staff = 13 staff)	13
Sub-total	30
Total	42

3.2.3 Pasig-Marikina River

The DPWH-NCR or the PMO for Flood Control and Dredging Projects of DPWH may undertake the supervision of the design and construction work. The DPWH-NCR will undertake the O&M of the proposed project, excluding the one of the minor drainage laterals managed by local governments (refer to Fig. 7-3-1 and Section 3.2.1).

Design and Construction

The consulting engineers and a private company with high technical expertise will be contracted to execute the design and construction work, and the DPWH-NCR or the PMO abovementioned will execute the supervision of this work.

The main required staffing is the same as the one of the East and West Areas of Mangahan Floodway as shown in Section 3.2.1. The details of staffing and required acticity is presented in Table 7-3-5.

Operation and Maintenance (O&M)

The proposed O&M Division in the master plan will undertake the operation of related facilities for the proposed projects, including the comprehensive management of related maintenance work, as shown in Section 3.2.1. The Engineering District Office of DPWH-NCR will undertake the practical and close maintenance activities for the proposed project, including the O&M of pump stations and flood gates, under the management of the O&M Division.

The staffing of main officers are summarized in the following table. The details of staffing and required activity is presented in Table 7-3-6 (refer to Section 3.2.1).

Position	Number of Staff
(Operation and Maintenance Division)	
Chief Supervising Engineer	1
Flood/Drainage Control Staff	9
Administrative Staff	2
Sub-total	12
(Engineering District Office)	
Operation and Maintenance Staff	5
- MCGS -	
Operation and Maintenance Staff (1 station x 4 staff = 4 staff)	4
Sub-total	9
Total	21